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SECTION 011000 – SUMMARY OF WORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Work under Owner's separate contracts.
4. Owner-furnished/Contractor-installed (OFCI) products.
5. Contractor's use of site and premises.
6. Coordination with occupants.
7. Work restrictions.
8. Specification and Drawing conventions.

1.2 PROJECT INFORMATION

A. Project Identification: Caesars Lane Wastewater Treatment Plant Expansion Phase 1

1. Project Location: 145 Caesars Ln., New Windsor, NY 12553

B. Owner: Town of New Windsor

555 Union Avenue, New Windsor, NY 12553

1. Owner's Representative: Stephen A. Bedetti, Town Supervisor

C. Engineer: MHE Engineering, DPC

33 Airport Center Dr., Suite 202, New Windsor, NY 12553

1. Engineer's Representative: Michael W. Weeks, P.E., Engineer for the Town

D. Engineer's Consultants: Engineer has retained the following design professionals, who have prepared designated portions of the Contract Documents:

1. Mechanical Engineering: Jade Stone Engineering

2. Electrical Engineering: Jade Stone Engineering

3. Plumbing Engineering: Jade Stone Engineering

4. Owner and Contractor, according to a separate contract between Owner and Construction Manager.

5. Construction Manager for this Project is Project's constructor. The terms "Construction Manager" and "Contractor" are synonymous.

E. Hazardous Material Consultant: Quality Environmental Solutions & Technologies, Inc. (QuES&T)

1.3 WORK COVERED BY CONTRACT DOCUMENTS

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

1. General Construction Contract: General construction contractor shall perform all layout required for work of this contract including final record (as-built) drawings. General Construction Contractor work shall also include permits and fees, all dumpsters, and removal of debris for all trades. Hazardous material removal and disposal shall be in accordance with the Hazardous material consultant's requirements. General construction contractor shall provide temporary facilities, including workplace toilet facilities (porta-jons), temporary heat and water. General construction contractor shall provide all demolition, including abatement, (also including all abatement of hazardous materials on MEP components), layout, new construction, including walls, floors, windows, doors, finishes, and all site work, etc. Work will include any other work normally considered general construction contract work in nature to comprise a complete project in accordance with the project plans and specifications.

2. Mechanical Construction Contract: Mechanical Construction Contractor shall perform installation work, including, but not limited to, installation of two (2) furnaces, with associated ductwork systems; two (2) air cooled condensing units, with associated refrigerant piping systems; two (2) in-line exhaust fans, with associated ductwork systems; three (3) ceiling mounted exhaust fans, with associated ductwork systems and wall discharge; five (5) wall louvers with associated motorized dampers; three (3) electric unit heaters installed within the electrical, mechanical, and storage rooms; temporary heat and any other work necessary for a complete project as defined in the plans and specifications and other Work indicated in the Contract Documents.

3. Electrical Construction Contract: Electrical Construction Contractor shall perform demolition work within the existing De-Watering Building as shown and specified on the Contract Drawings. Where items are indicated for removal, the Electrical Construction Contractor shall be responsible for removing all power and control circuitry (conduit and conductors) back to source, junctions boxes, pull boxes, conduit fittings and bodies, disconnects, starters, controls, devices, interlocks, and all associated mounting hardware, backets, unistrut, clamps, pads, etc. Electrical Construction Contractor shall be responsible for patching and repairing affected surfaces to match adjacent finished surfaces. Electrical Construction Contractor shall perform installation work, including, but not limited to, all temporary electric, and lighting as required to facilitate construction, new electrical distribution equipment (panels, transformers, starters, disconnects, etc.), new LED lighting systems, including emergency / egress, exit signs, and controls (switches, occupancy sensors, photocells, time clocks, etc.), new wiring devices and receptacles, including weather-proof, GFI, and specialty devices where shown on the Electrical Contract Drawings, new power and control circuitry (conduit and conductors), interlocks, and controls to all new Process, Mechanical, HVAC, and

Plumbing equipment, new lightning protection systems, new grounding systems, new firestopping systems, new data, fire alarm, security camera, and access control circuitry (conduit and conductors), new underground electrical infrastructure, including duct banks, hand holes, conduit and conductors as shown on the Electrical Contract Drawings, all required permitting, inspections, start-ups, submittals, as-builts, operation and maintenance materials, and training as specified, and any other ancillary work necessary including all mounting hardware, brackets, accessories, etc., installation, and labeling for a complete project as defined in the plans and specifications and other Work indicated in the Contract Documents.

4. Plumbing Construction Contract: Plumbing construction contractor shall perform installation work, including, but not limited to installation of new plumbing equipment to include gas fired water heater and recirculation pump; installation of new water service entrance; installation of new plumbing fixtures and installation of new plumbing piping to include sanitary, vent, CW, HW and HWR and all associated equipment, piping, hangers and supports; gas piping, hangers and support (coordinate propane supply with local propane supplier and owner); and any other work necessary for a complete project as defined in the plans and specifications and other Work indicated in the Contract Documents.

B. Type of Contract:

Project will be constructed under multiple prime contracts

1. Contract 1G: General Construction Contract
2. Contract 1M: Mechanical Construction Contract
3. Contract 1E: Electrical Construction Contract
4. Contract 1P: Plumbing Construction Contract

1.4 WORK UNDER SEPARATE CONTRACTS

A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying Work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts

B. Concurrent Work: Owner will award separate contract(s) for the following construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract.

1. Caesars Lane WWTP Expansion Project: Phase 2

1.5 CONTRACTOR'S USE OF SITE AND PREMISES

C. Restricted Use of Site: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section. Additional limitations are based on Phase 2 work scope.

D. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by

construction operations. The dewatering building to be renovated will remain in operation during Phase 1 work.

E. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

1.5 COORDINATION WITH OCCUPANTS

A. Full Owner Occupancy: Owner will occupy site and building(s) during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits, unless otherwise indicated. **The WWTP will remain in operation throughout the duration of the Phase 1and Phase 2 projects.**

1.6 WORK RESTRICTIONS

A. Comply with restrictions on construction operations.

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

B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 7:00 am to 5:00p.m., Monday through Friday, unless otherwise indicated.

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:

1. Obtain Owner’s written permission before proceeding with utility interruptions.

D. Noise, Vibration, Dust, and Odors: Coordinate operations that may result in high levels of noise and vibration, dust, odors, or other disruption to Owner occupancy with Owner.

1. Notify Engineer and Owner not less than 2 days in advance of proposed disruptive operations.
2. Obtain Owner’s written permission before proceeding with disruptive operations.

E. Smoking and Controlled Substance Restrictions: Use of tobacco products, alcoholic beverages, and other controlled substances on Project site is not permitted.

F. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.

G. Employee Screening: Comply with Owner's requirements for background screening of Contractor personnel working on Project site.

1.7 SPECIFICATION AND DRAWING CONVENTIONS

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

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Text Color: Text used in the Specifications, including units of measure, manufacturer and product names, and other text may appear in multiple colors or underlined as part of a hyperlink; no emphasis is implied by text with these characteristics.
3. Hypertext: Text used in the Specifications may contain hyperlinks. Hyperlinks may allow for access to linked information that is not residing in the Specifications. Unless otherwise indicated, linked information is not part of the Contract Documents.
4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 00 Contracting Requirements: General provisions of the Contract, including General and Supplementary Conditions, apply to all Sections of the Specifications.

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

END OF SECTION 011000

SECTION 013233 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

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

1. Preconstruction photographs.
2. Concealed Work photographs.
3. Periodic construction photographs.
4. Final completion construction photographs.

B. Related Requirements:

1. Section 017700 "Closeout Procedures" for submitting photographic documentation as Project Record Documents at Project closeout.
2. Section 024116 "Structure Demolition" for photographic documentation before building demolition operations commence.
3. Section 024119 "Selective Demolition" for photographic documentation before selective demolition operations commence.
4. Section 311000 "Site Clearing" for photographic documentation before site clearing operations commence.

1.2 INFORMATIONAL SUBMITTALS

A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.

B. Digital Photographs: Submit image files within 7 days of taking photographs.

1. Submit photos on a thumb-drive or by uploading to web-based Project management software site. Include copy of key plan indicating each photograph's location and direction.
2. Identification: Provide the following information with each image description in file metadata tag in web-based Project management software site, as applicable:

a. Name of Project.
b. Name and contact information for photographer.
c. Name of Architect.
d. Name of Contractor.
e. Date photograph was taken.
f. Description of location, vantage point, and direction.
g. Unique sequential identifier keyed to accompanying key plan.

1.3 FORMATS AND MEDIA

A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of 12 megapixels, and at an image resolution of not less than 3200 by 2400 pixels.

B. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

C. Metadata: Record accurate date and time and GPS location data from camera.

D. File Names: Name media files with date and Project area and sequential numbering suffix.

1.4 CONSTRUCTION PHOTOGRAPHS

A. Photographer: Engage a qualified photographer to take construction photographs.

B. General: Take photographs with maximum depth of field and in focus.

1. Maintain key plan with each set of construction photographs that identifies each photographic location.

C. Preconstruction Photographs: Before commencement of the Work, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.

1. Flag construction limits before taking construction photographs.
2. Take photographs to show existing conditions adjacent to property before starting the Work.
3. Take photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.

D. Concealed Work Photographs: Before proceeding with installing work that will conceal other work, take photographs sufficient in number, with annotated descriptions, to record nature and location of concealed Work, including, but not limited to, the following:

1. Underground utilities.
2. Underslab services.
3. Piping.
4. Electrical conduit.
5. Waterproofing and weather-resistant barriers.
6. Work to be located within walls or other locations to be covered by finish materials.

E. Periodic Construction Photographs: Take photographs weekly coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

F. Final Completion Construction Photographs: Take photographs after date of Substantial Completion for submission as Project Record Documents. Architect will inform photographer of desired vantage points.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013233

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Submittal schedule requirements.
2. Administrative and procedural requirements for submittals.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

1.3 SUBMITTAL SCHEDULE

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

1.4 SUBMITTAL FORMATS

A. Submittal Information: Include the following information in each submittal:

1. Project name.
2. Date.
3. Name of Architect.
4. Name of Contractor.
5. Name of firm or entity that prepared submittal.
6. Names of subcontractor, manufacturer, and supplier.
7. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier; and alphanumeric suffix for resubmittals.
8. Category and type of submittal.
9. Submittal purpose and description.

10. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
11. Drawing number and detail references, as appropriate.
12. Indication of full or partial submittal.
13. Location(s) where product is to be installed, as appropriate.
14. Other necessary identification.
15. Remarks.
16. Signature of transmitter.

B. Options: Identify options requiring selection by Architect.

C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.

D. Paper Submittals:

1. Place a permanent label or title block on each submittal item for identification; include name of firm or entity that prepared submittal.
2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
3. Action Submittals: Submit 6 (six) paper copies of each submittal unless otherwise indicated. Architect will return a minimum of two copies.
4. Informational Submittals: Submit 6 (six) paper copies of each submittal unless otherwise indicated. Architect will not return copies.
5. Transmittal for Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using AIA Document G810 or similar transmittal form.

E. Electronic Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.

F. Submittals for Utilizing Web-Based Project Management Software: Prepare submittals as PDF files, or other format indicated by Project management software.

1.5 SUBMITTAL PROCEDURES

A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Email: Prepare submittals as PDF package, and transmit to Architect by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Architect.
2. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project management software website. Enter required data in web-based software site to fully identify submittal.
3. Paper: Prepare submittals in paper form, and deliver to Architect.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 10 business days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Resubmittal Review: Allow 10 days for review of each resubmittal.

D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

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

1.6 SUBMITTAL REQUIREMENTS

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

1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

    a. Manufacturer's catalog cuts.
    b. Manufacturer's product specifications.
    c. Standard color charts.
    d. Statement of compliance with specified referenced standards.
    e. Testing by recognized testing agency.
    f. Application of testing agency labels and seals.
    g. Notation of coordination requirements.
    h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

a. Wiring diagrams that show factory-installed wiring.
b. Printed performance curves.
c. Operational range diagrams.
d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before Shop Drawings, and before or concurrent with Samples.

B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data unless submittal based on Architect's digital data drawing files is otherwise permitted.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

a. Identification of products.
b. Schedules.
c. Compliance with specified standards.
d. Notation of coordination requirements.
e. Notation of dimensions established by field measurement.
f. Relationship and attachment to adjoining construction clearly indicated.
g. Seal and signature of professional engineer if specified.

2. Paper Sheet Size: Except for templates, patterns, and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.

a. Six opaque (bond) copies of each submittal. Architect will return a minimum of two copies.

C. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other materials.

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

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

3. Email Transmittal: Provide PDF transmittal. Include digital image file illustrating Sample characteristics, and identification information for record.
4. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
5. Paper Transmittal: Include paper transmittal including complete submittal information indicated.

6. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

    a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
    b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

7. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

    a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

8. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

    a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record Sample.

        1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
        2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

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

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

F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.

G. Certificates:

1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
2. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
4. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
5. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

H. Test and Research Reports:

1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for substrate preparation and primers required.
2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

    a. Name of evaluation organization.
    b. Date of evaluation.
    c. Time period when report is in effect.
    d. Product and manufacturers' names.
    e. Description of product.
    f. Test procedures and results.
    g. Limitations of use.

1.7 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file and three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

1.8 CONTRACTOR'S REVIEW

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

B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp or indication in web-based Project management software. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval.

1.9 ARCHITECT'S REVIEW

A. Action Submittals: Architect will review each submittal, indicate corrections or revisions required, and return it.

1. PDF Submittals: Architect will indicate, via markup on each submittal, the appropriate action.

2. Paper Submittals: Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

3. Submittals by Web-Based Project Management Software: Architect will indicate, on Project management software website, the appropriate action.

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

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Architect will return without review or discard submittals received from sources other than Contractor.

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013300

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
2. Requirements for Contractor to provide quality-assurance and quality-control services required by Architect, Owner, Commissioning Authority, or authorities having jurisdiction are not limited by provisions of this Section.

1.2 DEFINITIONS

A. Experienced: When used with an entity or individual, "experienced" unless otherwise further described means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

B. Field Quality-Control Tests and Inspections: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.

1. Use of trade-specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).

D. Mockups: Full-size physical assemblies that are constructed on-site either as freestanding temporary built elements or as part of permanent construction. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

1. Laboratory Mockups: Full-size physical assemblies constructed and tested at testing facility to verify performance characteristics.

2. Integrated Exterior Mockups: Mockups of the exterior envelope constructed on-site as freestanding temporary built elements or as indicated in-place portions of permanent construction if approved by Architect, consisting of multiple products, assemblies, and subassemblies, with cutaways enabling inspection of concealed portions of the Work.

    a. Include each system, assembly, component, and part of the exterior wall and roof to be constructed for the Project. Colors of components shall be those selected by the Architect for use in the Project.

3. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes; doors; windows; millwork; casework; specialties; furnishings and equipment; and lighting.
4. Product Mockups: Mockups that may include multiple products, materials, or systems specified in a single Section.
5. In-Place Mockups: Mockups constructed on-site in their actual final location as part of permanent construction.

E. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria. Unless otherwise indicated, copies of reports of tests or inspections performed for other than the Project do not meet this definition.

F. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

G. Source Quality-Control Tests and Inspections: Tests and inspections that are performed at the source; for example, plant, mill, factory, or shop.

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall have the same meaning as testing agency.

I. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

J. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Architect.

1.3 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Statement: Submit a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.4 CONFLICTING REQUIREMENTS

A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements is specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, inform the Architect regarding the conflict and obtain clarification prior to proceeding with the Work. Refer conflicting requirements that are different, but apparently equal, to Architect for clarification before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 ACTION SUBMITTALS

A. Mockup Shop Drawings: For integrated exterior mockups.

1. Include plans, sections, elevations, and details, indicating materials and size of mockup construction.
2. Indicate manufacturer and model number of individual components.
3. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.6 INFORMATIONAL SUBMITTALS

A. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility submitted to authorities having jurisdiction before starting work on the following systems:

1. Seismic-force-resisting system, designated seismic system, or component listed in the Statement of Special Inspections.
2. Main wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.

B. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

C. Permits, Licenses, and Certificates: For Owner's record, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the Work.

1.7 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, telephone number, and email address of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspection.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Statement on condition of substrates and their acceptability for installation of product.
2. Statement that products at Project site comply with requirements.
3. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
4. Results of operational and other tests and a statement of whether observed performance complies with requirements.
5. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Statement that equipment complies with requirements.
2. Results of operational and other tests and a statement of whether observed performance complies with requirements.
3. Other required items indicated in individual Specification Sections.

1.8 QUALITY ASSURANCE

A. Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.

F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

G. Testing and Inspecting Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented according to ASTM E329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

1. Contractor responsibilities include the following:

a. Provide test specimens representative of proposed products and construction.

b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
c. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
d. When testing is complete, remove test specimens and test assemblies, and mockups; do not reuse products on Project.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect and Commissioning Authority, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups of size indicated.
2. Build mockups in location indicated or, if not indicated, as directed by Architect.
3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
4. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed to perform same tasks during the construction at Project.
5. Demonstrate the proposed range of aesthetic effects and workmanship.
6. Obtain Architect's approval of mockups before starting corresponding work, fabrication, or construction.

a. Allow seven days for initial review and each re-review of each mockup.

7. Promptly correct unsatisfactory conditions noted by Architect's preliminary review, to the satisfaction of the Architect, before completion of final mockup.
8. Approval of mockups by the Architect does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
9. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
10. Demolish and remove mockups when directed unless otherwise indicated.

K. Integrated Exterior Mockups: Construct integrated exterior mockup according to approved Shop Drawings. Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials. Comply with requirements in "Mockups" Paragraph.

1. Coordinate construction of the mockup to allow observation of air barrier installation, flashings, air barrier integration with fenestration systems, and other portions of the building air/moisture barrier and drainage assemblies, prior to installation of veneer, cladding elements, and other components that will obscure the work.

L. Room Mockups: Construct room mockups according to approved Shop Drawings, incorporating required materials and assemblies, finished according to requirements. Provide required lighting

and additional lighting where required to enable Architect to evaluate quality of the Work. Comply with requirements in "Mockups" Paragraph.

1. Provide room mockups in locations indicated on the drawings.

1.9 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspection they are engaged to perform.
2. Costs for retesting and reinspecting construction that replaces or is necessitated by Work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.

1. Engage a qualified testing agency to perform quality-control services.

    a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspection will be performed.
3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
4. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

D. Testing Agency Responsibilities: Cooperate with Architect, Commissioning Authority and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect, Commissioning Authority, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the locations from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected Work complies with or deviates from requirements.

4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform duties of Contractor.

E. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."

F. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

G. Contractor's Associated Requirements and Services: Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Preliminary design mix proposed for use for material mixes that require control by testing agency.
6. Security and protection for samples and for testing and inspection equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.10 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified testing agency or special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, as indicated in the Statement of Special Inspections attached to this Section, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect, Commissioning Authority, and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.

3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect and Commissioning Authority with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected Work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's, Commissioning Authority's, authorities' having jurisdiction reference during normal working hours.

1. Submit log at Project closeout as part of Project Record Documents.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspection, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

SECTION 014535 – CODE-REQUIRED SPECIAL INSPECTIONS AND PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for special inspections and procedures required by the 2020 Building Code of New York Sate (2020 BCNYS), National Electrical Code, and local Town codes.

B. A Special Inspections preconstruction meeting should be held at least 7 days prior to the initial planned date for start of construction.
   1. Discussion shall include review of specifications and Schedule of Special Inspections for work requiring Special Inspections; responsibilities of Contractor, Owner, Testing Agency, Special Inspector, and Engineer; notification procedures; and reporting procedures.
   2. Attendees shall include the Contractor, Owner's Representative, Testing Agency, Special Inspector, and Engineers for Structural Engineering and for Architecture.

1.3 RELATED SECTIONS

A. Related Sections include the following:

   1. Division 1 Section "Allowances" for testing and inspecting allowances.
   2. Divisions 2 through 46 Sections for non-building code related test and inspection requirements.

1.4 DEFINITIONS

A. Engineer or Design Engineer: The licensed Professional Engineer or Registered Architect whose seal appears on the Construction Drawings. Unless noted otherwise, references to the Engineer in this section refer to the appropriate Engineer for the design as defined in Division 1 "Summary".

B. Code Enforcement Official: The Officer or other designated authority charged with administration and enforcement of the 2020 BCNYS.

C. Testing/Inspecting Agency: An agent retained by the Special Inspector or by the Owner and coordinated by the Special Inspector, to perform some of the inspection services on behalf of the Special Inspector. A Geotechnical Engineer is an example of an Inspecting Agency.

D. Special Inspection: Inspection required by code of materials, installation, fabrication, erection, or placement of components and connections requiring special expertise to ensure compliance with approved Contract Plans, details, and the standards referenced above.

E. Special Inspector: A qualified person employed or retained by an approved agency and approved by the building official as having the competence necessary to inspect a particular type of construction requiring special inspection.

F. Special Inspection Coordinator: Is responsible for managing, updating, and maintaining the inspection database. They are also responsible for coordinating the scheduling of inspections and are responsible for completing all associated inspections and electronic paperwork.

G. Statement of Special Inspections: A document prepared by the Engineer and filed with and approved by the Code Enforcement Official that includes the Schedule of Special Inspections listing the materials and work requiring Special Inspections. This document includes the inspections and verifications required for the project.

H. Continuous Special Inspection: The full-time observation of work requiring Special Inspections by the Special Inspector who is present in the area where the work is being performed.

I. Periodic Special Inspections: The part-time or intermittent observation of work requiring Special Inspections by the Special Inspector who is present in the area where the work has been or is being performed and at the completion of the work.

1.5 QUALIFICATIONS

A. The Special Inspector shall be a Professional Engineer licensed in the State of New York who is accepted by the design engineer and by the Code Enforcement Official.

B. The Testing/Inspecting Agency shall be accepted by the design engineer and by the Town's Code Enforcement Officer.

C. Special Inspections shall be performed by inspectors who are either Professional Engineers (P.E.) or Engineers-In-Training (EIT) certified in the State that matches the project location and with an education and background in structural engineering, except as indicated below:

1. Special Inspections of soils and foundations may be performed by inspectors who are either Professional Engineers (P.E.) or Engineers-In-Training (EIT) with an education and background in geotechnical engineering.
2. Technicians performing tests of concrete shall be ACI Certified Concrete Field Technicians - Grade 1 or higher.
3. Inspectors performing inspections of concrete work may be ACI Certified Concrete Construction Inspectors or other qualified individuals with experience inspecting concrete work, designated and supervised by the Special Inspector.
4. Inspectors performing inspections of other work such as masonry, wood framing, and steel framing may be qualified individuals with experience inspecting such work, designated and supervised by the Special Inspector.
5. Technicians performing tests or inspections of welds shall be AWS Certified Welding Inspectors. Technicians performing ultrasonic testing shall also be certified as an ASNTTC Level II or Level III technician.

6. Technicians performing standard tests described by specific ASTM standards shall have training in the performance of such tests and must be able to demonstrate either by oral or written examination competence for the test to be performed. They shall not be permitted to independently evaluate test results.
7. Technicians of Testing/Inspecting Agencies for smoke control shall have expertise in fire-protection engineering and mechanical engineering and shall have certification as air balancers.

1.6 SUBMITTALS

A. The Special Inspector and Testing/Inspecting Agency shall submit to the design engineer and Code Enforcement Official a copy of their qualifications for review, including the names and qualifications of each of the individual inspectors and technicians who will be performing inspections or tests.

B. The Special Inspector and Testing/Inspecting Agency shall disclose past or present business relationship or potential conflict of interest with the Contractor or Subcontractors whose work will be inspected or tested.

1.7 PAYMENT

A. Special inspections shall be an independent third party engaged by Owner to perform said inspections and is paid by Owner.

B. Contractor shall be responsible for the cost of re-testing and/or re-inspecting of work failing to comply with the requirements of the Contract Documents or above referenced standards.

1.8 OWNER RESPONSIBILITIES

A. The Owner will provide the Special Inspector(s) with a complete set of Contract Documents sealed by the Engineer and approved by the Code Enforcement Official as applicable.

B. Owner shall engage the services of special inspectors and shall ensure inspectors are ready to perform when Contractors need them to.

1.9 CONTRACTOR RESPONSIBILITIES

A. Contractor shall coordinate with special inspectors to ensure inspections are performed in a timely manner with little or no delay and without hindrance.

B. Delays resulting from inadequate coordination shall not be justification for contract time extensions. Failure of the inspector to be able to perform inspections when Contractor is prepared for them is a justifiable cause for contract time extensions.

C. Contractor shall notify the Special Inspector or Testing/Inspecting Agency at least 48 hours in advance of a required inspection or test.

D. Contractor shall provide incidental labor and facilities to provide access to the work to be inspected or tested, to obtain and handle samples at the site or at source of products to be tested, to facilitate tests and inspections, and for storage and curing of test samples.

E. If Special Inspections or testing require the use of Contractor's scaffolding to access work areas, Contractor shall provide a competent person to perform a daily evaluation of the scaffolding to verify that it is safe to use. The contractor shall notify the Special Inspector and Testing Agent of this review before each use. The contractor is responsible for the safe assembly and stability of the scaffolding.

F. All work requiring special inspection shall remain accessible and exposed until it has been observed by the Special Inspector.

G. The contractor shall keep the latest set of Construction Drawings, field sketches, accepted shop drawings, and specifications at the project site for field use by the Inspectors and Testing Technicians.

H. The Special Inspection program shall not relieve Contractor of his obligation to perform work in accordance with the requirements of the Contract Documents or from implementing an effective Quality Control program.

I. The contractor shall be solely responsible for construction site safety.

J. If applicable to the project, each Contractor responsible for the construction of a seismic-force-resisting system listed in the Quality Assurance Plan for Seismic Resistance and indicated in the drawings shall submit a written Contractor's Statement of Responsibility to the Code Enforcement Official, Special Inspector, Engineer, and Owner prior to the commencement of work on the system or component. The Contractor's Statement of Responsibility shall contain the following:

1. Acknowledgment of awareness of the special requirements contained in the Quality Assurance Plan.
2. Acknowledgment that control will be exercised to obtain conformance with the Construction Documents approved by the Code Enforcement Official.
3. Procedures for exercising control within the Contractor's organization, the method and frequency of reporting, and the distribution of the reports.
4. Identification and qualifications of each person exercising such control and his position in the organization.

1.10 DUTIES OF THE SPECIAL INSPECTOR

A. The Special Inspector shall review all work listed below for conformance with the approved construction plans and specifications for the 2020 BCNYS.

B. The Special Inspector shall furnish special inspection reports to the EOR, Contractor, Owner, and Building Official on a weekly basis, or more frequently as required by the Building Official. All items not in compliance shall be brought to the immediate attention of the Contractor for correction, and if uncorrected, to the EOR and Building Official.

C. Once corrections have been made by the Contractor, the Special Inspector shall submit a final signed report to the Building Official and EOR stating that the work requiring special inspection

was, to the best of the Special Inspector's knowledge, in conformance with the approved construction plans and specifications as well as the applicable workmanship provisions of the 2020 BCNYS.

1.11 LIMITS ON AUTHORITY

A. The Special Inspector or Testing/Inspecting Agency shall not release, revoke, alter, or enlarge on the requirements of the Contract Documents.

B. The Special Inspector or Testing/Inspecting Agency shall not have control over the Contractor's means and methods of construction.

C. The Special Inspector or Testing/Inspecting Agency shall not be responsible for construction site safety.

D. The Special Inspector or Testing/Inspecting Agency shall not have the authority to stop the work.

1.12 STATEMENT OF SPECIAL INSPECTIONS

A. The Statement of Special Inspections and the Schedule of Special Inspections have been prepared by the Engineer.

B. The Special Inspector shall provide or coordinate inspection and testing requirements as necessary in accordance with the provisions of the 2020 BCNYS, these specifications, the Statement of Special Inspections, and the Quality Assurance Plan for Seismic Resistance.

C. Required inspections and tests are described in the Schedule of Special Inspections included in the drawings and in the attached individual specification sections for the items to be inspected or tested.

D. The Statement of Special Inspections and, if applicable, the Quality Assurance Plan for Seismic Resistance shall be submitted with the Application for Building Permit.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Detailed reports shall be prepared of each test or inspection. Reports shall include:
   1. Date of test or inspection.
   2. Name of Testing Agency or Inspecting Agency.
   3. Name of technician or inspector.
   4. Locations of specific areas tested or inspected.
   5. Description of test or inspection and results.
   6. Reference to applicable ASTM standard.

7. Weather conditions.

B. The Testing/Inspecting Agency shall immediately notify the Contractor, Special Inspector, and Engineer by telephone or fax of test results failing to comply with the requirements of the Contract Documents.

C. The Special Inspector shall immediately notify the Contractor of discrepancies from the Contract Documents found during a Special Inspection. If discrepancies are not corrected before the Special Inspector leaves the site, the Special Inspector shall notify the Engineer within 24 hours (one business day) and issue a non-conformance report. If discrepancies are not corrected by the time of substantial completion or other appropriate time, the Special Inspector shall notify the Code Enforcement Official.

D. The Testing/Inspecting Agency shall submit reports to the Special Inspector and the Engineer within 7 days of the inspection or test. Legible handwritten reports may be submitted if final typed copies are not available.

E. At the completion of work requiring Special Inspections, each Testing/Inspecting Agency shall provide an Agent's Final Report of Special Inspections to the Special Inspector stating that work was completed in substantial conformance with the Contract Documents and that appropriate inspections and tests were performed.

F. The Special Inspector shall submit reports to the Engineer within 7 days of the inspections. Legible handwritten reports may be submitted if final typed copies are not available. In addition, the Special Inspector shall submit interim reports at intervals noted in the Statement of Special Inspection, including reports for inspections and tests performed since the previous interim report or since the beginning of construction for the first interim report.

G. Interim reports shall be addressed to the Code Enforcement Official with copies sent to the Engineers (Structural Engineer and Architect) and Contractor.

H. Interim reports shall be signed and stamped by a Professional Engineer.

3.2 FINAL REPORT OF SPECIAL INSPECTIONS

A. The Final Report of Special Inspections shall be completed by the Special Inspector and submitted to the Engineer and Code Enforcement Official prior to issuance of a Certificate of Use and Occupancy.

B. CASE Form 102-2001 or other similar form shall be used for the Final Report of Special Inspections.

END OF SECTION 01 45 35

Statement of Special Inspections

Project: *Caesars Lane WWTP Expansion Phase 1*

Location: *145 Caesars Lane, New Windsor, New York 12553*

Owner: *Town of New Windsor*

Design Professional in Responsible Charge: *MHE Engineering, D.P.C.*

This *Statement of Special Inspections* is submitted as a condition for permit issuance in accordance with the Special Inspection and Structural Testing requirements of the Building Code. It includes a schedule of Special Inspection services applicable to this project. This *Statement of Special Inspections* encompass the following disciplines:

☒ Structural ☐ Mechanical/Electrical/Plumbing

☒ Architectural ☐ Other: _____

Discovered discrepancies shall be brought to the immediate attention of the Contractor for correction. If such discrepancies are not corrected, the discrepancies shall be brought to the attention of the Building Official and the Registered Design Professional in Responsible Charge. The Special Inspection program does not relieve the Contractor of his or her responsibilities.

A *Final Report of Special Inspections* documenting completion of all required Special Inspections, testing and correction of any discrepancies noted in the inspections shall be submitted prior to issuance of a Certificate of Use and Occupancy.

Job site safety and means and methods of construction are solely the responsibility of the Contractor.

As the Registered Design Professional(s) in Responsible Charge for this project, I/we certify this Statement of Special Inspections includes a complete list of materials and work that require special inspection and testing, and the minimum qualifications of the Special Inspectors / testing agencies required to be considered for conducting the inspections and testing. This represents the complete extent of special inspections and testing required during the construction of this project and complies with the 2020 New York State Uniform Fire Prevention and Building Code.

Affix Professional Seal	**Affix Professional Seal**	**Affix Professional Seal**
 02/28/2025	 10/31/2025	
Structural Engineer	**Architect**	**Mechanical Engineer**
Joseph Sinsabaugh 11/20/2024	Andrew Warren 11/20/2024	
Print name/date	**Print name/date**	**Print name/date**
(Signature)	**(Signature)**	**(Signature)**

SCHEDULE OF SPECIAL INSPECTIONS

Reference Specification 01 45 35 for all requirements not noted as part of this schedule.

INSPECTION DEFINITIONS:

PERFORM: Perform these tasks for each weld, fastener or bolted connection, and noted verification.

OBSERVE: Observe these items randomly during the course of each work day to insure that applicable requirements are being met. Operations need not be delayed pending these inspections at contractor's risk.

DOCUMENT: Document, with a report, that the work has been performed in accordance with the contract documents. This is in addition to any other reports required in the Special Inspections guide specification.

CONTINUOUS: Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

The Seismic Design Category for this project is: ☐ A, ☒ B, ☒ C, ☐ D, ☐ E, ☐ F (check appropriate box)

STRUCTURAL - STEEL – WELDING SECTION

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☒

STEEL INSPECTION PRIOR TO WELDING – VERIFY THE FOLLOWING ARE IN COMPLIANCE 2018 IBC 1705.2.1, AISC 360-16: Table C-N5.4-1		
TASK	INSPECTION TYPE[1]	DESCRIPTION
1. Verify that the welding procedures specification (WPS) is available	**PERFORM**	
2. Verify manufacturer certifications for welding consumables are available	**PERFORM**	
3. Verify material identification	**PERFORM**	Type and grade.
4. Welder Identification System	**PERFORM**	The fabricator or erector, as applicable, shall maintain a system by which a welder who has welded a joint or member can be identified. Stamps, if used, shall be the low-stress type.
5. Fit-up of groove welds (including joint geometry)	OBSERVE	✓ Joint preparation ✓ Dimensions (alignment, root opening, root face, bevel) ✓ Cleanliness (condition of steel surfaces) ✓ Tacking (tack weld quality and location) ✓ Backing type and fit (if applicable)
6. Configuration and finish of access holes	OBSERVE	
7. Fit-up of fillet welds	OBSERVE	✓ Dimensions (alignment, gaps at root) ✓ Cleanliness (condition of steel surfaces) ✓ Tacking (tack weld quality and location)
STEEL INSPECTION DURING WELDING – VERIFY THE FOLLOWING ARE IN COMPLIANCE 2018 IBC 1705.2.1, AISC 360-16: Table C-N5.4-2		
TASK	INSPECTION TYPE	DESCRIPTION
8. Use of qualified welders	**PERFORM**	Welding by welders, welding operators, and tack welders who are qualified in conformance with requirements.
9. Control and handling of welding consumables	OBSERVE	✓ Packaging ✓ Electrode atmospheric exposure control
10. No welding over cracked tack welds	OBSERVE	
11. Environmental conditions	OBSERVE	✓ Wind speed within limits ✓ Precipitation and temperature
12. Welding Procedures Specification followed	OBSERVE	✓ Settings on welding equipment ✓ Travel speed ✓ Selected welding materials ✓ Shielding gas type/flow rate ✓ Preheat applied ✓ Interpass temperature maintained (min./max.) ✓ Proper position (F, V, H, OH) ✓ Intermix of filler metals avoided
13. Welding techniques	OBSERVE	✓ Interpass and final cleaning ✓ Each pass within profile limitations ✓ Each pass meets quality requirements

[1] **PERFORM**: Perform these tasks for each weld, fastener or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

STRUCTURAL - STEEL – WELDING SECTION (CONTINUED)

STEEL INSPECTION AFTER WELDING – VERIFY THE FOLLOWING ARE IN COMPLIANCE 2018 IBC 1705.2.1, AISC 360-16: Table C-N5.4-3		
TASK	INSPECTION TYPE [1]	DESCRIPTION
14. Welds cleaned	OBSERVE	
15. Size, length, and location of all welds	**PERFORM**	Size, length, and location of all welds conform to the requirements of the detail drawings.
16. Welds meet visual acceptance criteria	**PERFORM AND DOCUMENT**	✓ Crack prohibition ✓ Weld/base-metal fusion ✓ Crater cross section ✓ Weld profiles ✓ Weld size ✓ Undercut ✓ Porosity
17. Arc strikes	**PERFORM**	
18. k-area	**PERFORM**	When welding of doubler plates, continuity plates or stiffeners has been performed in the k-area, visually inspect the web k-area for cracks.
19. Backing removed, weld tabs removed and finished, and fillet welds added where required	**PERFORM**	
20. Repair activities	**PERFORM AND DOCUMENT**	
21. Document acceptance or rejection of welded joint or member	**PERFORM**	

END SECTION

[1] **PERFORM**: Perform these tasks for each weld, fastener or bolted connection, and required verification.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.

STRUCTURAL - STEEL – BOLTING SECTION

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☒

STEEL INSPECTION TASKS PRIOR TO BOLTING – VERIFY THE FOLLOWING ARE IN COMPLIANCE 2018 IBC 1705.2.1, AISC 360-16: Table C-N5.6-1		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Manufacture's certifications available for fastener materials	**PERFORM**	
2. Fasteners marked in accordance with ASTM requirements	OBSERVE	
3. Proper fasteners selected for joint detail (grade, type, bolt length if threads are to be excluded from shear plane)	OBSERVE	
4. Proper bolting procedure selected for joint detail	OBSERVE	
5. Connecting elements, including appropriate faying surface condition and hole preparation, if specified, meet applicable requirements	OBSERVE	
6. Proper storage provided for bolts, nuts, washers, and other fastener components	OBSERVE	
STEEL INSPECTION TASKS DURING BOLTING – VERIFY THE FOLLOWING ARE IN COMPLIANCE 2018 IBC 1705.2.1, AISC 360-16: Table C-N5.6-2		
TASK	INSPECTION TYPE [1]	DESCRIPTION
7. Fastener assemblies of suitable condition, placed in all holes and washers (if required) are positioned as required	OBSERVE	
8. Joint brought to the snug-tight condition prior to pretensioning operation	OBSERVE	
9. Fastener component not turned by the wrench prevented from rotating	OBSERVE	
10. Bolts are pretensioned in accordance with RCSC Specification, progressing systematically from the most rigid point toward the free edges	OBSERVE	
STEEL INSPECTION TASKS AFTER BOLTING – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.2.1, AISC 360-10: Table C-N5.6-3		
TASK	INSPECTION TYPE [1]	DESCRIPTION
11. Document acceptance or rejection of all bolted connections	**DOCUMENT**	

END SECTION

[1] **PERFORM**: Perform these tasks for each weld, fastener or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.

STRUCTURAL - STEEL - NON DESTRUCTIVE TESTING SECTION

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

NONDESTRUCTIVE TESTING OF WELDED JOINTS – VERIFY THE FOLLOWING ARE IN COMPLIANCE 2018 IBC 1705.2.1, AISC 360-16: Section N5.5		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Use of qualified nondestructive testing personnel	**PERFORM**	Visual weld inspection and nondestructive testing (NDT) shall be conducted by personnel qualified in accordance with AWS D1.8 clause 7.2
2. CJP groove welds	OBSERVE	Dye penetrant testing (DT) and ultrasonic testing (UT) shall be performed on 20% of CJP groove welds for materials greater than 5/16" (8mm) thick. Testing rate must be increased to 100% if greater than 5% of welds tested have unacceptable defects.
3. Welded joints subject to fatigue	OBSERVE	Dye penetrant testing (DT) and Ultrasonic testing (UT) shall be performed on 100% of welded joints identified on contract drawings as being subject to fatigue.
4. Weld tab removal sites	OBSERVE	At the end of welds where weld tabs have been removed, magnetic particle testing shall be performed on the same beam-to-column joints receiving UT

END SECTION

[1] **PERFORM**: Perform these tasks for each weld, fastener or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

STRUCTURAL - STEEL – AISC 341 REQUIREMENTS (SEISMIC PROVISIONS) SECTION

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

NONDESTRUCTIVE TESTING OF WELDED JOINTS – VERIFY THE FOLLOWING ARE IN COMPLIANCE 2018 IBC 1705.2.1, AISC 341-16: Section J6.2		
TASK	INSPECTION TYPE [1]	DESCRIPTION
5. CJP groove welds	OBSERVE	Dye penetrant testing (DT) and ultrasonic testing (UT) shall be performed on 100% of CJP groove welds for materials greater than 5/16" thick (8mm).
6. Beam cope and access hole.	OBSERVE	At welded splices and connections, thermally cut surfaces of beam copes and access holes shall be tested using magnetic particle testing (MT) or dye penetrant testing (DT), when the flange thickness exceeds 1 1/2 in. for rolled shapes, or when the web thickness exceeds 1 1/2 in. for built-up shapes.
7. K-area NDT (AISC 341)	**PERFORM**	Where welding of doubler plates, continuity plates or stiffeners has been performed in the k-area, the web shall be tested for cracks using magnetic particle testing (MT). The MT inspection area shall include the k-area base metal within 3-inches of the weld. The MT shall be performed no sooner than 48 hours following completion of the welding.
8. Placement of reinforcing or contouring fillet welds	**DOCUMENT**	

END SECTION

[1] **PERFORM**: Perform these tasks for each weld, fastener or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.

STRUCTURAL - STEEL - COMPOSITE CONSTRUCTION [1]

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

COMPOSITE CONSTRUCTION PRIOR TO PLACING CONCRETE – VERIFY THE FOLLOWING ARE IN COMPLIANCE 2018 IBC 1705.2.1, AISC 360-16: Table N6.1, AISC 341-16: Table J9.1		
TASK	INSPECTION TYPE [2]	DESCRIPTION
1. Placement and installation of steel headed stud anchors	**PERFORM**	
2. Material identification of reinforcing steel (Type/Grade)	OBSERVE	
3. Determination of carbon equivalent for reinforcing steel other than ASTM A706	OBSERVE	
4. Proper reinforcing steel size, spacing, clearances, support, and orientation	OBSERVE	
5. Reinforcing steel has not been re-bent in the field	OBSERVE	
6. Reinforcing clearances have been provided	OBSERVE	
7. Reinforcing steel has been tied and supported as required	OBSERVE	
8. Composite member has required size	OBSERVE	

END SECTION

STRUCTURAL - STEEL - OTHER INSPECTIONS

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☒

OTHER STEEL INSPECTIONS – VERIFY THE FOLLOWING ARE IN COMPLIANCE 2018 IBC 1705.2.1, AISC 341-16: Tables J8.1 & J10.1		
TASK	INSPECTION TYPE [2]	DESCRIPTION
1. Anchor rods and other embedments supporting structural steel	**PERFORM**	Verify the diameter, grade, type, and length of the anchor rod or embedded item, and the extent or depth of embedment prior to placement of concrete.
2. Fabricated steel or erected steel frame	OBSERVE	Verify compliance with the details shown on the construction documents, such as braces, stiffeners, member locations and proper application of joint details at each connection.
3. Reduced beam sections (RBS) where/if occurs	**DOCUMENT**	✓ Contour and finish ✓ Dimensional tolerances
4. Protected zones	**DOCUMENT**	No holes or unapproved attachments made by fabricator or erector
5. H-piles where/if occurs	**DOCUMENT**	No holes or unapproved attachments made by the responsible contractor

END SECTION

[1] See Concrete Construction Section for all concrete related inspection of composite steel construction.

[2] **PERFORM**: Perform these tasks for each weld, fastener or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.

STRUCTURAL - COLD-FORMED METAL DECK - PLACEMENT SECTION

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☒

METAL DECK INSPECTION PRIOR TO DECK PLACEMENT – VERIFY THE FOLLOWING ARE IN COMPLIANCE SDI QA/QC-2011, Appendix 1, Table 1.1		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Verify compliance of materials (deck and all deck accessories) with construction documents, including profiles, material properties, and base metal thickness	**PERFORM**	
2. Document acceptance or rejection of deck and deck accessories	**DOCUMENT**	
METAL DECK INSPECTION DURING DECK PLACEMENT – VERIFY THE FOLLOWING ARE IN COMPLIANCE SDI QA/QC-2011, Appendix 1, Table 1.2		
TASK	INSPECTION TYPE [1]	DESCRIPTION
3. Verify compliance of deck and all deck accessories installation with construction documents	**PERFORM**	
4. Verify deck materials are represented by the mill certifications that comply with the construction documents	**PERFORM**	
5. Document acceptance or rejection of installation of deck and deck accessories	**DOCUMENT**	
METAL DECK INSPECTION AFTER DECK PLACEMENT – VERIFY THE FOLLOWING ARE IN COMPLIANCE SDI QA/QC-2011, Appendix 1, Table 1.3		
TASK	INSPECTION TYPE [1]	DESCRIPTION
6. Welding procedure specification (WPS) available	**PERFORM**	
7. Manufactures certifications for welding consumables available	OBSERVE	
8. Material identification (type/grade)	OBSERVE	
9. Check welding equipment	OBSERVE	

END SECTION

[1] **PERFORM**: Perform these tasks for each weld, fastener or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.

STRUCTURAL - COLD-FORMED METAL DECK – WELDING SECTION

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☒

METAL DECK INSPECTION DURING WELDING – VERIFY THE FOLLOWING ARE IN COMPLIANCE SDI QA/QC-2011, Appendix 1, Table 1.4		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Use of qualified welders	OBSERVE	
2. Control and handling of welding consumables	OBSERVE	
3. Environmental conditions (wind speed, moisture, temperature)	OBSERVE	
4. WPS followed	OBSERVE	
METAL DECK INSPECTION AFTER WELDING – VERIFY THE FOLLOWING ARE IN COMPLIANCE SDI QA/QC-2011, Appendix 1, Table 1.5		
TASK	INSPECTION TYPE [1]	DESCRIPTION
5. Verify size and location of welds, including support, sidelap, and perimeter welds.	**PERFORM**	
6. Welds meet visual acceptance criteria	**PERFORM**	
7. Verify repair activities	**PERFORM**	
8. Document acceptance or rejection of welds	**DOCUMENT**	

END SECTION

[1] **PERFORM**: Perform these tasks for each weld, fastener or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.

STRUCTURAL - COLD-FORMED METAL DECK – FASTENING SECTION

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☒

METAL DECK INSPECTION BEFORE MECHANICAL FASTENING – VERIFY THE FOLLOWING ARE IN COMPLIANCE SDI QA/QC-2011, Appendix 1, Table 1.6		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Manufacturer installation instructions available for mechanical fasteners	OBSERVE	
2. Proper tools available for fastener installation	OBSERVE	
METAL DECK INSPECTION DURING MECHANICAL FASTENING – VERIFY THE FOLLOWING ARE IN COMPLIANCE SDI QA/QC-2011, Appendix 1, Table 1.7		
TASK	INSPECTION TYPE [1]	DESCRIPTION
3. Fasteners are positioned as required	OBSERVE	
4. Fasteners are installed in accordance with manufacturer's instructions	OBSERVE	
METAL DECK INSPECTION AFTER MECHANICAL FASTENING – VERIFY THE FOLLOWING ARE IN COMPLIANCE SDI QA/QC-2011, Appendix 1, Table 1.8		
TASK	INSPECTION TYPE [1]	DESCRIPTION
5. Check spacing, type, and installation of support fasteners	**PERFORM**	
6. Check spacing, type, and installation of sidelap fasteners	**PERFORM**	
7. Check spacing, type, and installation of perimeter fasteners	**PERFORM**	
8. Verify repair activities	**PERFORM**	
9. Document acceptance or rejection of mechanical fasteners	**DOCUMENT**	

END SECTION

[1] **PERFORM**: Perform these tasks for each weld, fastener or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.

STRUCTURAL - LIGHT GAUGE STEEL FRAMING AND/OR LIGHT GAUGE TRUSSES SECTION

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☒

LIGHT GAUGE STEEL CONSTRUCTION AND CONNECTIONS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.2.2, 1705.11.2, 1705.11.3, UFC 4 023 03		
TASK	INSPECTION TYPE[1]	DESCRIPTION
1. Trusses spanning 60-feet or greater where/if applies	**PERFORM**	Verify that temporary and permanent truss restraint/bracing is installed in accordance with approved truss submittal package.
2. Welded connections (seismic and/or wind resisting system)	OBSERVE	Visually inspect all welds composing part of the main wind or seismic force resisting system, including shearwalls, braces, collectors (drag struts), and hold-downs.
3. Connections (seismic and/or wind resisting system)	OBSERVE	Visually inspect all screw attachment, bolting, anchoring and other fastening of components within the main wind or seismic force resisting system, including roof deck, roof framing, exterior wall covering, wall to roof/floor connections, braces, collectors (drag struts) and hold-downs.
4. Cold-formed steel (progressive collapse resisting system where/if applies)	OBSERVE	Verify proper welding operations, screw attachment, bolting, anchoring and other fastening of components within the progressive collapse resisting system, including horizontal tie force elements, vertical tie force elements and bridging elements (UFC 4 023 03).

END SECTION

STRUCTURAL - OPEN-WEB STEEL JOISTS SECTION

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☒

OPEN-WEB STEEL JOISTS AND JOIST GIRDERS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC TABLE 1705.2.3		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Installation of open-web steel joists and joist girders	OBSERVE	✓ End connections – welded or bolted ✓ Bridging – horizontal and diagonal

END SECTION

[1] **PERFORM**: Perform these tasks for each weld, fastener or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

STRUCTURAL - CONCRETE CONSTRUCTION SECTION

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☒

CONCRETE CONSTRUCTION, INCLUDING COMPOSITE DECK – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC TABLE 1705.3 (ACI 318 REFERENCES NOTED IN IBC TABLE)		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Inspect reinforcement, including prestressing tendons, and verify placement.	OBSERVE	Verify prior to placing concrete that reinforcing is of specified type, grade and size; that it is free of oil, dirt and unacceptable rust; that it is located and spaced properly; that hooks, bends, ties, stirrups and supplemental reinforcement are placed correctly; that lap lengths, stagger and offsets are provided; and that all mechanical connections are installed per the manufacturer's instructions and/or evaluation report.
2. Reinforcing bar welding	OBSERVE	✓ Verify weldability of reinforcing bars other than ASTM A 706 ✓ Inspect single-pass fillet welds, maximum 5/16" in accordance with AWS D1.4
3. All other welding	**CONTINUOUS**	Visually inspect all welds in accordance with AWS D1.4
4. Cast in place anchors and post installed drilled anchors (downward inclined)	OBSERVE	Verify prior to placing concrete that cast in place anchors and post installed drilled anchors have proper embedment, spacing and edge distance.
5. Post-installed adhesive anchors in horizontal or upward inclined orientations	**CONTINUOUS AND DOCUMENT**	✓ Inspect as required per approved ICC-ES report ✓ Verify that installer is certified for installation of horizontal and overhead installation applications ✓ Inspect proof loading as required by the contract documents
6. Verify use of required mix design	OBSERVE	Verify that all mixes used comply with the approved construction documents
7. Prior to concrete placement, fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete	**CONTINUOUS**	At the time fresh concrete is sampled to fabricate specimens for strength test verify these tests are performed by qualified technicians.
8. Inspect concrete and/or shotcrete placement for proper application techniques	**CONTINUOUS**	Verify proper application techniques are used during concrete conveyance and depositing avoids segregation or contamination. Verify that concrete is properly consolidated.
9. Verify maintenance of specified curing temperature and technique	OBSERVE	Inspect curing, cold weather protection, and hot weather protection procedures.
10. Pre-stressed concrete	**CONTINUOUS**	Verify application of prestressing forces and grouting of bonded prestressing tendons.

CONTINUED ON FOLLOWING PAGE

[1] **OBSERVE**: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.
CONTINUOUS: Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

STRUCTURAL - CONCRETE CONSTRUCTION (CONTINUED)

CONCRETE CONSTRUCTION, INCLUDING COMPOSITE DECK – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC TABLE 1705.3 (ACI 318 REFERENCES NOTED IN IBC TABLE)		
TASK	INSPECTION TYPE [1]	DESCRIPTION
11. Inspect erection of precast concrete members	OBSERVE	
12. Verify in-situ concrete strength, prior to stressing of tendons in post-tensioned concrete and prior to removal of shores and forms from beams and structural slabs.	OBSERVE	
13. Inspect formwork for shape, location and dimensions of the concrete member being formed.	OBSERVE	

END SECTION

[1] **OBSERVE**: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.
CONTINUOUS: Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

STRUCTURAL - MASONRY CONSTRUCTION SECTION (ALL RISK CATEGORIES)

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☒

MASONRY CONSTRUCTION – VERIFY THE FOLLOWING ARE IN COMPLIANCE AT START OF CONSTRUCTION IBC 1705.4 (ACI 530-13 TABLE 3.1.2 & 3.1.3)		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Compliance with approved submittals prior to start	OBSERVE	
2. Proportions of site-mixed mortar.	OBSERVE	
3. Grade and type of reinforcement, anchor bolts, and prestressing tendons and anchorages	OBSERVE	
4. Prestressing technique	OBSERVE	
5. Properties of thin bed mortar for AAC masonry	OBSERVE	
MASONRY CONSTRUCTION – VERIFY THE FOLLOWING ARE IN COMPLIANCE PRIOR TO GROUTING IBC 1705.4 (ACI 530-13 TABLE 3.1.2 & 3.1.3)		
TASK	INSPECTION TYPE [1]	DESCRIPTION
6. Grout space	OBSERVE **CONTINUOUS**	
7. Proportions of site-prepared grout and prestressing grout for bonded tendons	OBSERVE	
8. Proportions of site-mixed grout and prestressing grout for bonded tendons	OBSERVE	
9. Placement of masonry units and mortar joints	OBSERVE	
10. Welding of reinforcement	**CONTINUOUS**	
MASONRY CONSTRUCTION – VERIFY THE FOLLOWING ARE IN COMPLIANCE DURING CONSTRUCTION IBC 1705.4 (ACI 530-13 TABLE 3.1.2 & 3.1.3)		
TASK	INSPECTION TYPE [1]	DESCRIPTION
11. Size and location of structural elements is in compliance	OBSERVE	
12. Preparation, construction, and protection of masonry during cold weather (temperature below 40°F (4.4°c) or hot weather (temp above 90°F (32.2°C))	OBSERVE	
13. Application and measurement of prestressing force	**CONTINUOUS**	
14. Placement of grout and prestressing grout for bonded tendons	**CONTINUOUS**	
15. Placement of AAC masonry units and construction of thin bed mortar joints	**CONTINUOUS**	Continuous for first 5000 square feet only (465 square meters).
16. Observe preparation of grout specimens, mortar specimens, and/or prisms	OBSERVE	
17. Type, size and placement of reinforcement, connectors, anchor bolts and prestressing tendons and anchorages, including details of anchorage of masonry to structural members, frames, or other construction	OBSERVE **CONTINUOUS**	

END SECTION

[1] **OBSERVE**: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

CONTINUOUS: Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

STRUCTURAL - WOOD CONSTRUCTION – SPECIALTY ITEMS SECTION

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

WOOD CONSTRUCTION – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.5		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. High-load diaphragms where applicable	OBSERVE	Verify thickness and grade of sheathing, size of framing members at panel edges, nail diameters and length, and the number of fastener lines and that fastener spacing is per approved contract documents.
2. Metal-plate connected wood trusses spanning 60 feet or greater	OBSERVE	Verify that the temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package

END SECTION

STRUCTURAL - WOOD CONSTRUCTION - SEISMIC & WIND SECTION

THIS SECTION IS APPLICABLE IF BOX IS CHECKED: ☐

WOOD CONSTRUCTION SEISMIC AND WIND – VERIFY THE FOLLOWING ARE IN COMPLIANCE 2018 IBC 1705.11 & 1705.12.2		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Nailing, bolting, anchoring and other fastening of elements of the main wind/seismic force-resisting system	OBSERVE (CONTINUOUS FOR GLUING)	Includes connectors for: shearwall sheathing, roof/floor sheathing, drag struts/collectors (double top plates), braces, hold downs, roof connections to exterior walls.

END SECTION

STRUCTURAL – ISOLATION AND ENERGY DISSIPATION SYSTEMS SECTION

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

ISOLATION AND ENERGY DISSIPATION SYSTEMS – VERIFY THE FOLLOWING ARE IN COMPLIANCE 2018 IBC TABLE 1705.12.8		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Fabrication and installation	OBSERVE	Verify that fabrication and installation of isolator units and energy dissipation devices conform to manufacturer's recommendations and approved construction documents
2. Testing of seismic isolation Systems in seismically isolated structures		Seismic Isolation Systems in seismically isolated structures shall be tested accordance with ASCE 7, Section 17.8

END SECTION

[1] **OBSERVE**: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

GEOTECHNICAL - SOILS INSPECTION SECTION

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☒

SOILS INSPECTION – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.6		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Materials below shallow foundations are adequate to achieve the design bearing capacity.	OBSERVE	
2. Excavations are extended to proper depth and have reached proper material	OBSERVE	
3. Perform classification and testing of compacted fill materials	**OBSERVE**	
4. Verify use of proper materials, densities and lift thicknesses during placement and compaction of compacted fill	**CONTINUOUS**	
5. Prior to placement of compacted fill, inspect subgrade and verify that site has been prepared properly.	OBSERVE	During fill placement, the special inspector shall verify that proper materials and procedures are used in accordance with the provisions of the approved geotechnical report

END SECTION

GEOTECHNICAL - DRIVEN DEEP FOUNDATION ELEMENTS SECTION

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

DEEP DRIVEN FOUNDATION CONSTRUCTION – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.7		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Verify element materials, sizes and lengths comply with requirements	**CONTINUOUS**	
2. Inspect driving operations and maintain complete and accurate records for each element	**CONTINUOUS**	
3. Verify placement locations and plumbness, confirm type and size of hammer, record number of blows per foot of penetration, determine required penetrations to achiever design capacity, record tip and butt elevations and document any damage to foundation element	**CONTINUOUS**	
4. Determine capacities of test elements and conduct additional load tests if required.	**CONTINUOUS**	
5. For steel or concrete elements, perform additional special inspections in accordance with the Steel and Concrete sections in this schedule		

END SECTION

[1] **OBSERVE**: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.
CONTINUOUS: Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

GEOTECHNICAL - HELICAL PILE FOUNDATIONS SECTION

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

HELICAL PILE FOUNDATIONS – VERIFY THE FOLLOWING ARE IN COMPLIANCE 2018 IBC 1705.9		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Record installation equipment used, pile dimensions, tip elevations, final depth, final installation torque and other pertinent installation data as required. The approved geotechnical report and the contract documents shall be used to determine compliance	**CONTINUOUS**	

END SECTION

GEOTECHNICAL - CAST IN PLACE DEEP FOUNDATION ELEMENTS SECTION

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

CAST IN PLACE DEEP FOUNDATION ELEMENTS – VERIFY THE FOLLOWING ARE IN COMPLIANCE 2018 IBC 1705.8		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Inspect drilling operations and maintain complete and accurate records for each element.	**CONTINUOUS**	
2. Verify placement locations and plumbness, confirm element diameters, bell diameters (if applicable), lengths, embedment into bedrock (if applicable) and adequate end-bearing strata capacity. Record concrete or grout volumes	**CONTINUOUS**	For concrete elements, perform additional special inspections in accordance with the Concrete section in this schedule

END SECTION

[1] **CONTINUOUS:** Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

FIRE PROTECTION - SPRAYED FIRE-RESISTANT MATERIALS SECTION

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

SPRAYED FIRE RESISTANT MATERIALS (SFRM) – VERIFY THE FOLLOWING ARE IN COMPLIANCE 2018 IBC 1705.14		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Substrate condition	OBSERVE	Prior to application, confirm that surfaces have been prepared according to the approved fire-resistance design and manufacturer's instructions.
2. Material thickness	OBSERVE	Verify SFRM thickness according to 2018 IBC 1705.14.4
3. Material density	OBSERVE	Verify SFRM density according to 2018 IBC 1705.14.5
4. Bond strength	OBSERVE	Verify bond strength of cured SFRM according to IBC 1705.14.6

END SECTION

FIRE PROTECTION - MASTIC AND INTUMESCENT COATINGS SECTION

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

MASTIC AND INTUMESCENT FIRE-RESISTANT COATINGS – VERIFY THE FOLLOWING ARE IN COMPLIANCE 2018 IBC 1705.15		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Inspect according to AWCI 12-B and the contract documents	OBSERVE	Inspections shall be performed in accordance with AWCI 12-B, Standard Practice for the Testing and Inspection of Field Applied Thin Film Intumescent Fire-Resistive Materials.

END SECTION

FIRE PROTECTION – FIRE RESISTANT PENETRATIONS AND JOINTS SECTION

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

FIRE RESISTANT PENETRATIONS AND JOINTS – VERIFY THE FOLLOWING ARE IN COMPLIANCE 2018 IBC 1705.17		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Inspections of penetration firestop systems conducted in accordance with ASTM E 2174.	OBSERVE	
2. Inspections of fire-resistant joint systems conducted in accordance with ASTM E 2393	OBSERVE	

END SECTION

[1] **OBSERVE**: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

FIRE PROTECTION – SMOKE CONTROL SECTION

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

SMOKE CONTROL – VERIFY THE FOLLOWING ARE IN COMPLIANCE 2018 IBC 1705.18		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Verify device locations and perform leakage testing	OBSERVE	Perform during erection of ductwork and prior to concealment
2. Pressure difference testing, flow measurements and detection and control verification	OBSERVE	Perform prior to occupancy and after sufficient completion

END SECTION

[1] **OBSERVE**: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

ARCHITECTURAL - EXTERIOR INSULATION AND FINISH SYSTEMS SECTION

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☒

EXTERIOR INSULATION AND FINISH SYSTEMS (EIFS) – VERIFY THE FOLLOWING ARE IN COMPLIANCE 2018 IBC 1705.16		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Water resistive barrier coating applied over a sheathing substrate.	OBSERVE	Verify that water resistive barrier coating complies with ASTM E 2570.

END SECTION

ARCHITECTURAL – ARCHITECTURAL COMPONENTS

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

ARCHITECTURAL COMPONENTS – VERIFY THE FOLLOWING ARE IN COMPLIANCE 2018 IBC 1705.12.5, 1705.12.7		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Erection and fastening of exterior cladding and interior and exterior veneer.	OBSERVE	Verify appropriate materials, fasteners and attachment at commencement of work and at completion. **Inspector Note: Inspection not required if height is less than 30 feet or weight is less than 5psf**
2. Interior and exterior non-load bearing walls	OBSERVE	Verify appropriate materials, fasteners and attachment at commencement of work and at completion. **Inspector Note: Inspection not required if interior non-load bearing walls weigh less than 15psf**
3. Access floors	OBSERVE	Verify that anchorage complies with approved construction documents.
4. Storage racks	OBSERVE	Verify that anchorage complies with approved construction documents. Inspection of post-installed anchors shall comply with approved ICC-ES report. **Inspector Note: Not required for racks less than 8 feet in height**

END SECTION

[1] **OBSERVE**: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

PLUMBING/MECHANICAL/ELECTRICAL DESIGNATED SEISMIC SYSTEMS SECTION

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☐

PLUMBING, MECHANICAL AND ELECTRICAL IBC 1705.12.6		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Anchorage of electrical equipment for emergency and standby power systems	OBSERVE	✓ Check for general conformance
2. Anchorage of all other electrical equipment in Seismic Design Categories E and F only (See first page of this schedule for Seismic Design Category)	OBSERVE	✓ Check for general conformance
3. Installation and anchorage of piping designed to carry hazardous materials and their associated mechanical units.	OBSERVE	✓ Check for general conformance
4. Installation and anchorage of vibration isolation systems where the construction documents require a nominal clearance of ¼" or less between support framing and restraint.	OBSERVE	✓ Check for general conformance
5. Verification of clearance between fire sprinkler piping and surrounding mechanical and electrical equipment, including ductwork, piping and their structural supports.	OBSERVE	✓ Check for minimum clearances noted in ASCE7 13.2.3 or a nominal clearance of not less than 3 inches

END SECTION

[1] **OBSERVE**: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

1.2 USE CHARGES

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

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

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

1.3 INFORMATIONAL SUBMITTALS

A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.

B. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, typestyles, graphic elements, and message content. See Supplementary Conditions, Article 18.

C. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of SWPPP, attached hereto.

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

E. Moisture- and Mold-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage and mold. Describe delivery, handling, storage, installation, and protection provisions for materials subject to water absorption or water damage.

1. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and requirements for replacing water-damaged Work.
2. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
3. Indicate methods to be used to avoid trapping water in finished work.

1.4 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

C. Accessible Temporary Egress: Comply with applicable provisions in the United States Access Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.5 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 TEMPORARY FACILITIES

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

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

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

5. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.

2.2 EQUIPMENT

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

B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating, Cooling, and Dehumidifying Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Section 017700 "Closeout Procedures."

C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 TEMPORARY FACILITIES, GENERAL

A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

3.2 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

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

3.3 TEMPORARY UTILITY INSTALLATION

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

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

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

1. Connect temporary sewers to municipal system or private system indicated as directed by authorities having jurisdiction.

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

D. Sanitary Facilities: Provide temporary toilets, wash facilities, safety shower and eyewash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

E. Temporary Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

1. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.

F. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.

G. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

1. Install electric power service overhead unless otherwise indicated.

H. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

I. Electronic Communication Service: Provide secure WiFi wireless connection to internet with provisions for access by Architect and Owner.

J. Project IT: Provide IT equipment in primary field office as follows:

1. Printer: "All-in-one" unit equipped with printer server, combining color printing, photocopying, scanning, and faxing, or separate units for each of these three functions.
2. Internet Service: Broadband modem, router, and ISP, equipped with hardware firewall, providing minimum 20.0 -Mbps upload and 100.0 -Mbps download speeds at each computer.

3.4 SUPPORT FACILITIES INSTALLATION

A. Comply with the following:

1. Provide construction for temporary field offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E136. Comply with NFPA 241.
2. Utilize designated area within existing building for temporary field offices.
3. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas as indicated on Drawings.

1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

C. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

D. Parking: Provide temporary offsite or use designated areas as shown on the site plans.

E. Storage and Staging: Provide temporary offsite area or use designated areas of Project site for storage and staging needs.

F. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

G. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.

1. Identification Signs: Provide Project identification signs as indicated on Drawings or specifications.
2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.

    a. Provide temporary, directional signs for construction personnel and visitors.

3. Maintain and touch up signs so they are legible at all times.

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

I. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 017300 "Execution."

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

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

K. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

L. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.

1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.

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

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

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

1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

C. Temporary Erosion and Sedimentation Control: Comply with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent and requirements specified in Section 311000 "Site Clearing."

D. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings, requirements of the SWPPP or authorities having jurisdiction, whichever is more stringent.

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

2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

E. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

F. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

G. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using materials approved by authorities having jurisdiction.

H. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people from easily entering site except by entrance gates.

1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations or as indicated on Drawings.
2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.

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

J. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

K. Temporary Egress: Provide temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction. Provide signage directing occupants to temporary egress.

L. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

M. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner and tenants from fumes and noise.

1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.
2. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
3. Provide walk-off mats at each entrance through temporary partition.

N. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.

1. Prohibit smoking in construction areas. Comply with additional limits on smoking specified in other Sections.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.6 MOISTURE AND MOLD CONTROL

A. Moisture and Mold Protection: Protect stored materials and installed Work in accordance with Moisture and Mold Protection Plan.

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

1. Protect porous materials from water damage.
2. Protect stored and installed material from flowing or standing water.
3. Keep porous and organic materials from coming into prolonged contact with concrete.
4. Remove standing water from decks.
5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Period: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.
4. Discard or replace water-damaged material.
5. Do not install material that is wet.
6. Discard and replace stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.

D. Controlled Construction Period: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:

1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Use temporary or permanent HVAC system to control humidity within ranges specified for installed and stored materials.
3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

3.7 OPERATION, TERMINATION, AND REMOVAL

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

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

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

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

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION 015000

015500 - MAINTENANCE AND PROTECTION OF TRAFFIC (NY)

PART 1 – GENERAL

1.1 WORK INCLUDED:

A. Maintain traffic and protect the public from damage to person and property within limits of and for duration of the Contract.

B. Provide all such signs, flag-persons, delineation and/or other methods as necessary so that a person who has no knowledge of conditions can safely and with a minimum of discomfort and inconvenience, ride, drive or walk over all or any portion of the street under construction where traffic is to be maintained.

C. Maintain a reasonably smooth traveled way, acceptable to the Engineer, for movement of traffic.

D. Maintain, at all times, access to all properties for emergency vehicles and services.

E. Control dust and keep the traveled way free from materials spilled from hauling equipment. This shall also apply to dust control and spilled material resulting from the Contractor's operations in areas outside the contract limits.

F. Insure conformance with this Section for all work performed by this Contractor and/or any Subcontractor thereof.

1.2 EXISTING CONDITIONS:

A. It shall be the Contractor's responsibility to investigate all site conditions that may affect his work.

B. It shall be the Contractor's responsibility to notify all appropriate jurisdictions, make any and all applications and comply with all requirements involved with the Maintenance and Protection of Traffic in compliance with all State and/or Local codes or requirements.

1.3 NECESSITY AND IMPORTANCE:

A. The Contractor is placed on notice that Maintenance and Protection of Traffic over any street, road, highway or accessway during construction is to be considered as important and necessary an item of work as is the actual construction itself. The Contractor shall at all times conduct his operation in a manner to insure the safety of not only the public and motorists, but also pedestrians and his own employees.

B. The Contractor shall protect the user from damage to person and property by reason of any construction operation (for example excavation, paving, tree work, demolition, etc.) by such

protective screens, devices, signs, or methods.

1.4 REFERENCES:

A. All layouts, devices, signs, methods and procedures for all work under this Section shall comply with the requirements referenced in the National Manual on Uniform Traffic Control (MUTCD) and the New York State Supplement to the National MUTCD, years of latest revision.

PART 2 - MATERIALS

2.1 SIGNS:

A. All temporary signs, delineators, barricades, warnings, lights and other warning and guiding devices shall comply with the requirements of the National MUTCD and the New York State Supplement to the National MUTCD, except as otherwise specified, and shall remain the property of the Contractor.

B. All temporary signs, delineators and other warning and guiding devices shall conform to the requirements of the Agency having jurisdiction on the roadway(s) wherein the contract work is being performed.

PART 3 - CONSTRUCTION DETAILS

3.1 GENERAL:

A. Contractor shall generally provide a travel way suitable for one or more lanes of traffic. The way of travel shall be kept well drained and reasonably smooth and hard at all times and free of the potholes, bumps, irregularities and depressions that hold or retain water. The Contractor shall conduct his operations to insure a minimum of delay to the traffic. Stopping traffic for more than approximately five (5) minutes is considered unsatisfactory. Necessary equipment and personnel to attain and maintain a satisfactory riding surface shall be available and used as needed at all times, both when the work is under way and when the work is temporarily suspended for any period of time. Special attention shall be given to maintenance of a satisfactory way of travel over weekends, holidays and during the winter season, if applicable.

B. Contractor shall keep the travel way free of foreign objects such as rocks, timber and other items that may fall from the transporting vehicles. Spillage of material carried by or dropped from the undercarriage of any carrying vehicle resulting from the Contractor's hauling operations along or across any public traveled way shall be removed immediately and such travel way, both within and outside of the contract limits shall be kept free of such spillage by the Contractor. The Contractor shall also provide a sufficient number of competent flag-persons in areas where traffic is congested, particularly where construction equipment is operating.

C. Contractor shall maintain all elements of the street beginning on the date of execution of the contract and ending on the date the contract is accepted by the Owner. He shall provide an adequate travel way as specified. He shall devote particular attention to all the drainage facilities, keeping them fully operative at all times. Contractor will be required to plow snow or control ice on the travel way.

D. He shall be responsible for the moving of any plowed snow that may be necessary to adequately maintain any element of the street, and he will be responsible for the moving of any plowed snow from in front of driveways or entrances. Any damage to any portion of the work occasioned by lack of adequate maintenance shall be repaired by the Contractor at his own expense.

E. Contractor shall provide and maintain at all times a safe and adequate ingress and egress to and from intersecting streets, homes, businesses and commercial establishments at existing or at new access points.

F. Contractor shall furnish and erect reflectorized signs for the information of the motorist and to adequately and legally post the street under construction as to its status in compliance with the National MUTCD and the New York State Supplement to the National MUTCD.

G. All signs shall be kept clean, mounted at the approved height and placed so as to be effective both day and night. Signs, warnings, delineators and barricades shall be used to adequately inform the motorist of any unusual or unsafe conditions and to safely and clearly guide him through the contract area. Such signs, warnings, or devices shall be placed so as to give timely warning and permit the motorist to take the necessary action to traverse the area safely.

H. Shall maintain free access to every utility manhole and/ or box, fire hydrant or alarm box, valve box, valve chamber, etc.

I. Dusty conditions resulting from the Contractor's operation, in the opinion of the Engineer, Owner or Agency responsible for the roadway, shall be corrected with application of water and broomed. Water used as a dust palliative shall be distributed uniformly over a minimum width of eight feet by the use of suitable spray heads or spray bars. The brooms shall be of sufficient force to effectively remove any foreign material on the wetted surface, without spraying or splashing the material onto adjacent structures, automobiles, buildings, pedestrians, etc. The Contractor may not use public or private water systems for these purposes without permission and/or payment to the system owner.

3.2 MAINTENANCE:

A. Contractor is to maintain existing traffic control devices such as signs, etc.

B. If temporary removal during construction is necessary, temporary signs should be installed to maintain traffic control in a like manner.

C. Traffic control devices shall be replaced, if damaged during the construction operations; removal, storage or replacement of the item shall be by the Contractor at his own expense.

PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT:

A. Unless otherwise specified in the Proposal or on the Plans, the Contractor shall, under this item, be responsible for the maintenance within the limits of the Contract of the entire pavement, drainage facilities and other street elements both old and new beginning on the date the Contract is executed and ending on the date the Contract is officially finally accepted.

4.2 FAILURE TO COMPLY:

A. In the event that, in the judgement of the Owner and/or Engineer, traffic is not adequately maintained on any part of the contract, on any day, no payment for maintenance and protection of traffic will be made for that day. The amount of such daily non-payment will be determined by dividing the lump sum amount bid for this item by the number of calendar days between the date of award and the date of completion as designated in the proposal without regard to any extension of time. These amounts may be deducted from any monies due to the Contractor on this Contract.

B. If the Contractor fails to maintain and protect traffic adequately and safely for a period of 24 hours, the Owner may correct the adverse conditions by the use of Municipal Forces, augmented if necessary, by other equipment and personnel as it may be necessary to hire, and the entire cost of this work by such forces shall be deducted from any monies due the Contractor on this contract. The cost of this work shall be in addition to daily non-payment deductions listed above, and shall not be limited to the lump sum bid amount for this item.

4.3 PAYMENT:

A. Maintenance and Protection of Traffic shall be paid for on a lump sum basis; at the price bid for this item, less any deductions for the unsatisfactory accomplishment, as determined above. The price bid shall include the cost of furnishing all labor, materials and equipment necessary to satisfactorily complete the work and comply with all requirements herein.

B. If no separate Payment Item is provided in the Proposal for Maintenance and Protection of Traffic, then all work required under this Section shall be deemed included under the other payment items of the Proposal.

C. Price bid shall also include the cost of any detour, temporary pavement or temporary structure not shown on the plans or in the proposal. Payments will be made for this item in

proportion to the total amount of work completed, less any amounts deducted for unsatisfactory accomplishment.

D. In view of the difficulty of accurately ascertaining the cost to the Owner in indirect impacts as caused by the Contractor's failure to properly accomplish this item of work, any monies deducted for unsatisfactory accomplishment shall not be refundable to the Contractor in any case.

E. The amount of actual costs incurred by the Owner (and reimbursement thereof) to properly maintain and protect traffic upon the failure of the Contractor to do so shall not be limited to the amount bid by the Contractor in the Proposal.

END OF SECTION 015500 (NY)

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

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

B. Related Requirements:

1. Section 012500 "Substitution Procedures" for requests for substitutions.

1.2 DEFINITIONS

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

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

B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.

1. Evaluation of Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification. Manufacturer's published attributes and characteristics of basis-of-design product also establish salient characteristics of products for purposes of evaluating comparable products.

C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.

D. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:

1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
2. Data indicating compliance with the requirements specified in Part 2 "Comparable Products" Article.

E. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Section 013300 "Submittal Procedures."

F. Substitution: Refer to Section 012500 "Substitution Procedures" for definition and limitations on substitutions.

1.3 QUALITY ASSURANCE

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

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products, using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

1.5 PRODUCT WARRANTIES

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

1. Manufacturer's Warranty: Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of the Owner or endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of the Owner or endorsed by manufacturer to Owner.

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

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included in the Project Manual, prepare a written document, using indicated form properly executed.
3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

B. Product Selection Procedures:

1. Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

    a. Sole product may be indicated by the phrase "Subject to compliance with requirements, provide the following."

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

    a. Sole manufacturer/source may be indicated by the phrase "Subject to compliance with requirements, provide products by the following."

3. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with

requirements. Comparable products or substitutions for Contractor's convenience will be considered.

a. Limited list of products may be indicated by the phrase "Subject to compliance with requirements, provide one of the following."

4. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed or an unnamed product that complies with requirements.

a. Non-limited list of products is indicated by the phrase "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following."
b. Provision of an unnamed product is not considered a substitution, if the product complies with requirements.

5. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered.

a. Limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, provide products by one of the following."

6. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed or a product by an unnamed manufacturer that complies with requirements.

a. Non-limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following."
b. Provision of products of an unnamed manufacturer is not considered a substitution, if the product complies with requirements.

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

a. For approval of products by unnamed manufacturers, comply with requirements in Section 012500 "Substitution Procedures" for substitutions for convenience.

C. Visual Matching Specification: Where Specifications require the phrase "match Architect's sample," provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or a similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

E. Sustainable Product Selection: Where Specifications require product to meet sustainable product characteristics, select products complying with indicated requirements. Comply with requirements in Division 01 sustainability requirements Section and individual Specification Sections.

1. Select products for which sustainable design documentation submittals are available from manufacturer.

2.2 COMPARABLE PRODUCTS

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

1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those of the named basis-of-design product. Significant product qualities include attributes, such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects, with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

B. Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional information or documentation for evaluation, as specified in Section 013300 "Submittal Procedures."

1. Form of Approval of Submittal: As specified in Section 013300 "Submittal Procedures."
2. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

C. Submittal Requirements, Two-Step Process: Approval by the Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.

D. Submittal Requirements, Single-Step Process: When acceptable to Architect, incorporate specified submittal requirements of individual Specification Section in combined submittal for

comparable products. Approval by the Architect of Contractor's request for use of comparable product and of individual submittal requirements will also satisfy other submittal requirements.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017419 - 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 011200 "Multiple Contract Summary" for coordination of responsibilities for waste management.
2. Section 042000 "Unit Masonry" for disposal requirements for masonry waste.
3. Section 044313.13 "Anchored Stone Masonry Veneer" for disposal requirements for excess stone and stone waste.
4. Section 044313.16 "Adhered Stone Masonry Veneer" for disposal requirements for excess stone and stone waste.
5. Section 311000 "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.2 DEFINITIONS

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

B. Demolition Waste: Building, structure, and site improvement materials resulting from demolition operations.

C. Disposal: Removal of demolition or construction waste and subsequent salvage, sale, recycling, or deposit in landfill, incinerator acceptable to authorities having jurisdiction, or designated spoil areas on Owner’s property.

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

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

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

1.3 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within 30 days of date established for the Notice to Proceed.

1.4 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 in 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.

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.

1.5 QUALITY ASSURANCE

A. Waste Management Coordination shall be the responsibility of the general construction contractor or Contract 1G.

1.6 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Distinguish between demolition and construction waste. 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.
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: The general contractor, Contract 1G, shall act as the waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.

C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.

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 and recycled.
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. Comply with requirements in Section 024119 "Selective Demolition" for salvaging demolition waste.

B. Salvaged Items for Reuse in the Work:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
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.

C. Salvaged Items for Sale and Donation: Not permitted on Project site.

D. Salvaged Items for Owner's Use:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
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.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

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

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.

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

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

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

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

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

3.4 RECYCLING DEMOLITION WASTE

A. Asphalt Paving: Grind asphalt to maximum 1-1/2-inch size.

B. Asphalt Paving: Break up and transport paving to asphalt-recycling facility.

C. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.

1. Pulverize concrete to maximum 1-1/2-inch size.

D. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.

1. Pulverize masonry to maximum 3/4-inch size.
2. Clean and stack undamaged, whole masonry units on wood pallets.

E. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.

F. 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.

G. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.

H. 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.

I. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.

J. Metal Suspension System: Separate metal members, including trim and other metals from acoustical panels and tile, and sort with other metals.

K. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.

1. Store clean, dry carpet and pad in a closed container or trailer provided by carpet reclamation agency or carpet recycler.

L. 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.

M. Piping: Reduce piping to straight lengths and store by material and size. Separate supports, hangers, valves, sprinklers, and other components by material and size.

N. Conduit: Reduce conduit to straight lengths and store by material and size.

O. Lamps: Separate lamps by type and store according to requirements in 40 CFR 273.

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.

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.

D. Paint: Seal containers and store by type.

3.6 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged or recycled, 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. General: Except for items or materials to be salvaged or recycled, remove waste materials and legally dispose of at designated spoil areas on Owner’s property.

C. Burning: Do not burn waste materials.

D. Burning: Burning of waste materials is permitted only at designated areas on Owner's property, provided required permits are obtained. Provide full-time monitoring for burning materials until fires are extinguished.

3.7 ATTACHMENTS

END OF SECTION 017419

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

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

1. Substantial Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.

B. Related Requirements:

1. Section 017823 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
2. Section 017839 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
3. Section 017900 "Demonstration and Training" for requirements to train the Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of cleaning agent.

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

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

1.3 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest-control inspection.

1.4 SUBSTANTIAL COMPLETION PROCEDURES

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

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

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction, permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number.
5. Submit testing, adjusting, and balancing records.
6. Submit sustainable design submittals not previously submitted.
7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

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

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
6. Advise Owner of changeover in utility services.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements.
10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1.5 FINAL COMPLETION PROCEDURES

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

1. Submit a final Application for Payment in accordance with Section 012900 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1.6 LIST OF INCOMPLETE ITEMS

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

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

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

4. Submit list of incomplete items in the following format:

    a. MS Excel Electronic File: Architect will return annotated file.
    b. PDF Electronic File: Architect will return annotated file.
    c. Web-Based Project Software Upload: Utilize software feature for creating and updating list of incomplete items (punch list).
    d. Three Paper Copies: Architect will return two copies.

1.7 SUBMITTAL OF PROJECT WARRANTIES

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

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

C. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

1. Submit on digital media acceptable to Architect by uploading to web-based project software site when available, or by email to Architect.

D. Warranties in Paper Form:

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.

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

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

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

PART 3 - EXECUTION

3.1 FINAL CLEANING

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

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

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

    a. Clean Project site of rubbish, waste material, litter, and other foreign substances.
    b. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
    c. Remove debris and surface dust from limited-access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
    d. Clean flooring, removing debris, dirt, and staining; clean according to manufacturer's recommendations.
    e. Vacuum and mop concrete.
    f. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
    g. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
    h. Remove labels that are not permanent.
    i. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
    j. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
    k. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
    l. Clean ducts, blowers, and coils.

    m. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
    n. Clean strainers.
    o. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.

D. Construction Waste Disposal: Comply with waste-disposal requirements in Section 015000 "Temporary Facilities and Controls" and/or Section 017419 "Construction Waste Management and Disposal."

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations required by Section 017300 "Execution" before requesting inspection for determination of Substantial Completion.

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

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

1. Operation and maintenance documentation directory manuals.
2. Emergency manuals.
3. Systems and equipment operation manuals.
4. Systems and equipment maintenance manuals.
5. Product maintenance manuals.

1.2 CLOSEOUT SUBMITTALS

A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

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

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

1. Submit on digital media acceptable to Architect or by uploading to web-based project software site. Enable reviewer comments on draft submittals.
2. Submit three paper copies. Architect will return two copies.

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

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

D. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.3 FORMAT OF OPERATION AND MAINTENANCE MANUALS

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

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

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

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

    a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
    b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

1.4 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

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

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

B. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Construction Manager.
7. Name and contact information for Architect.
8. Name and contact information for Commissioning Authority.

9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
10. Cross-reference to related systems in other operation and maintenance manuals.

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

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

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

1.5 EMERGENCY MANUALS

A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

B. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

C. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

E. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.

3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

1.6 SYSTEMS AND EQUIPMENT OPERATION MANUALS

A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.

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

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

C. Descriptions: Include the following:

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

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

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

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

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

1.7 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.

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

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

1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

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

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

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

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

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

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

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

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

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

1.8 PRODUCT MAINTENANCE MANUALS

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

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

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

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

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

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

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

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 017823

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Instruction in operation and maintenance of systems, subsystems, and equipment.
2. Demonstration and training video recordings.

1.2 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

1.3 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.

1. At completion of training, submit complete training manual(s) for Owner's use prepared in same paper and PDF file format required for operation and maintenance manuals specified in Section 017823 "Operation and Maintenance Data."

1.4 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.

1.5 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Architect.

1.6 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

    a. System, subsystem, and equipment descriptions.
    b. Performance and design criteria if Contractor is delegated design responsibility.
    c. Operating standards.
    d. Regulatory requirements.
    e. Equipment function.
    f. Operating characteristics.
    g. Limiting conditions.
    h. Performance curves.

2. Documentation: Review the following items in detail:

    a. Emergency manuals.
    b. Systems and equipment operation manuals.
    c. Systems and equipment maintenance manuals.
    d. Product maintenance manuals.
    e. Project Record Documents.
    f. Identification systems.
    g. Warranties and bonds.
    h. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

    a. Instructions on meaning of warnings, trouble indications, and error messages.
    b. Instructions on stopping.
    c. Shutdown instructions for each type of emergency.

d. Operating instructions for conditions outside of normal operating limits.
e. Sequences for electric or electronic systems.
f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

a. Startup procedures.
b. Equipment or system break-in procedures.
c. Routine and normal operating instructions.
d. Regulation and control procedures.
e. Control sequences.
f. Safety procedures.
g. Instructions on stopping.
h. Normal shutdown instructions.
i. Operating procedures for emergencies.
j. Operating procedures for system, subsystem, or equipment failure.
k. Seasonal and weekend operating instructions.
l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

5. Adjustments: Include the following:

a. Alignments.
b. Checking adjustments.
c. Noise and vibration adjustments.
d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

a. Diagnostic instructions.
b. Test and inspection procedures.

7. Maintenance: Include the following:

a. Inspection procedures.
b. Types of cleaning agents to be used and methods of cleaning.
c. List of cleaning agents and methods of cleaning detrimental to product.
d. Procedures for routine cleaning.
e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.

8. Repairs: Include the following:

a. Diagnosis instructions.
b. Repair instructions.
c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
d. Instructions for identifying parts and components.
e. Review of spare parts needed for operation and maintenance.

1.7 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

1.8 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

C. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner, through Architect, or, through Construction Manager, with at least seven days' advance notice.

D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.

F. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

1.9 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. Record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of 12 megapixels and capable of recording in full HD modewith vibration reduction technology.

1. Submit video recordings on CD-ROM or thumb drive and by uploading to web-based Project software site.

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.

D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.

E. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION 017900

SECTION 024119 - 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.

1.2 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.3 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1.4 INFORMATIONAL SUBMITTALS

A. DELETED

B. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.

C. Schedule of selective demolition activities with starting and ending dates for each activity.

D. Predemolition photographs or video.

1.5 CLOSEOUT SUBMITTALS

A. Inventory of items that have been removed and salvaged.

1.6 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Engineer of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: Owner has engaged a qualified testing agency to take samples throughout existing building and perform tests for hazardous materials. Hazardous materials were present in the building and can be found in “PRE-DEMOLITION/PRE-RENOVATION INSPECTION FOR ASBESTOS-CONTAINING MATERIALS (ACM)” as prepared by Quality Environmental Solutions & Technologies, Inc. as found within this contract.
   1. Contractor is responsible for engaging a qualified abatement contractor.

   2. If suspected hazardous materials are encountered, do not disturb; immediately notify the hazardous material consultant, Owner and Engineer..

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.

G. Arrange selective demolition schedule so as not to interfere with Owner's operations.

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 and using approved contractors 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 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.

B. Engage a professional engineer to 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.

C. Inventory and record the condition of items to be removed and salvaged.

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 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. 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.
3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings 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 and leave in place.
    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.
    f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
    g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.3 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

B. Temporary Shoring: Design, 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.

C. Remove temporary barricades and protections where hazards no longer exist.

3.4 SELECTIVE DEMOLITION

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. 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 portable fire-suppression devices during flame-cutting operations.
4. Maintain fire watch during and for at least a half hour after flame-cutting operations.
5. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
6. Dispose of demolished items and materials promptly. Comply with requirements in Section 017419 "Construction Waste Management and Disposal."

B. 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.

C. 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.

D. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
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.

E. 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 cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 CLEANING

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction. and recycle or dispose of them according to Section 017419 "Construction Waste Management and Disposal."

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. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

C. 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 024119

SECTION 031000 - CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Form-facing material for cast-in-place concrete.
2. Shoring, bracing, and anchoring.

1.2 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each of the following:

1. Exposed surface form-facing material.
2. Concealed surface form-facing material.
3. Form ties.
4. Waterstops.
5. Form-release agent.

B. Shop Drawings: Prepared by, and signed and sealed by, a qualified professional engineer responsible for their preparation, detailing fabrication, assembly, and support of forms.

1. For exposed vertical concrete walls, indicate dimensions and form tie locations.
2. Indicate dimension and locations of construction and movement joints required to construct the structure in accordance with ACI 301.

a. Location of construction joints is subject to approval of the Engineer.

3. Indicate location of waterstops.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Minutes of pre-installation conference.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Concrete Formwork: Design, engineer, erect, shore, brace, and maintain formwork, shores, and reshores in accordance with ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.

1. Design wood panel forms in accordance with APA's "Concrete Forming Design/Construction Guide."
2. Design formwork to limit deflection of form-facing material to L/240 of center-to-center spacing of supports.

2.2 FORM-FACING MATERIALS

A. As-Cast Surface Form-Facing Material:

1. Provide continuous, true, and smooth concrete surfaces.
2. Furnish in largest practicable sizes to minimize number of joints.
3. Acceptable Materials: As required to comply with Surface Finish designations specified in Section 033000 "Cast-In-Place Concrete, and as follows:

    a. Plywood, metal, or other approved panel materials.
    b. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:

        1) APA HDO (high-density overlay).
        2) APA MDO (medium-density overlay); mill-release agent treated and edge sealed.
        3) APA Structural 1 Plyform, B-B or better; mill oiled and edge sealed.
        4) APA Plyform Class I, B-B or better; mill oiled and edge sealed.

B. Concealed Surface Form-Facing Material: Lumber, plywood, metal, plastic, or another approved material.

1. Provide lumber dressed on at least two edges and one side for tight fit.

2.3 WATERSTOPS

A. Flexible PVC Waterstops: U.S. Army Corps of Engineers CRD-C 572, for embedding in concrete to prevent passage of fluids through joints, with factory fabricate corners, intersections, and directional changes.
1. Profile: Ribbed with center bulb.
2. Dimensions: 6 inches by 3/8 inch thick; nontapered; unless otherwise noted on the plans.

B. 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.

C. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer-modified chloroprene rubber, for adhesive bonding to concrete, 3/8 by 3/4 inch.

2.4 RELATED MATERIALS

A. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

B. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

C. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

D. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
2. Form release agent for form liners shall be acceptable to form liner manufacturer.

E. Form Ties: Factory-fabricated, removable or snap-off, glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

PART 3 - EXECUTION

3.1 INSTALLATION OF FORMWORK

A. Comply with ACI 301.

B. Construct formwork, so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 and to comply with the Surface Finish designations specified in Section 033000 "Cast-In-Place Concrete" for as-cast finishes.

C. Limit concrete surface irregularities as follows:
1. Surface Finish-3.0: ACI 117 Class A, 1/8 inch.

D. Construct forms tight enough to prevent loss of concrete mortar.

1. Minimize joints.
2. Exposed Concrete: Symmetrically align joints in forms.

E. Construct removable forms for easy removal without hammering or prying against concrete surfaces.

1. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces.
2. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

3. Install keyways, reglets, recesses, and other accessories, for easy removal.

F. Do not use rust-stained, steel, form-facing material.

G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces.

1. Provide and secure units to support screed strips.
2. Use strike-off templates or compacting-type screeds.

H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible.

1. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar.
2. Locate temporary openings in forms at inconspicuous locations.

I. Chamfer exterior corners and edges of permanently exposed concrete.

J. At construction joints, overlap forms onto previously placed concrete not less than 12 inches.

K. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work.

1. Determine sizes and locations from trades providing such items.
2. Obtain written approval of Engineer prior to forming openings not indicated on Drawings.

L. Construction and Movement Joints:

1. Construct joints true to line with faces perpendicular to surface plane of concrete.
2. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer.
3. Place joints perpendicular to main reinforcement.
4. Locate joints for beams, slabs, joists, and girders in the middle third of spans.

    a. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.

5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
6. Space vertical joints in walls as specified in Section 033000 "Cast-In-Place Concrete.".

    a. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.

M. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection.

1. Locate ports and openings in bottom of vertical forms, in inconspicuous location, to allow flushing water to drain.

2. Close temporary ports and openings with tight-fitting panels, flush with inside face of form, and neatly fitted, so joints will not be apparent in exposed concrete surfaces.

N. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

O. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

P. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 INSTALLATION OF 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.

1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
3. 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.
4. Install dovetail anchor slots in concrete structures, as indicated on Drawings.
5. Clean embedded items immediately prior to concrete placement.

3.3 INSTALLATION OF WATERSTOPS

A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm.

1. Install in longest lengths practicable.
2. Locate waterstops in center of joint unless otherwise indicated on Drawings.
3. Allow clearance between waterstop and reinforcing steel of not less than 2 times the largest concrete aggregate size specified in Section 033000 "Cast-In-Place Concrete."
4. Secure waterstops in correct position at 12 inches on center.
5. Field fabricate joints in accordance with manufacturer's instructions using heat welding.

    a. Miter corners, intersections, and directional changes in waterstops.
    b. Align center bulbs.

6. Clean waterstops immediately prior to placement of concrete.
7. Support and protect exposed waterstops during progress of the Work.

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

1. Install in longest lengths practicable.
2. Locate waterstops in center of joint unless otherwise indicated on Drawings.
3. Protect exposed waterstops during progress of the Work.

3.4 SHORING AND RESHORING INSTALLATION

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

1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.

B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.

C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

1. Where Special Inspections are required and listed on the plans, the owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.
2. Where Special Inspections are not required, the contractor shall engage a qualified testing and inspecting agency, at contractor’s expense, to perform tests and inspections and to submit reports as outlined in section 3.12.B of Section 033000 Cast-in-Place Concrete.

B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

C. Inspections:

1. Inspect formwork for shape, location, and dimensions of the concrete member being formed.
2. Inspect insulating concrete forms for shape, location, and dimensions of the concrete member being formed.

END OF SECTION 031000

SECTION 032000 - CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel reinforcement bars.
2. Welded-wire reinforcement.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Each type of steel reinforcement.
2. Bar supports.
3. Mechanical splice couplers.

B. Shop Drawings: Comply with ACI SP-066:

1. Include placing drawings that detail fabrication, bending, and placement.
2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.

C. Construction Joint Layout: Indicate proposed construction joints required to build the structure.

1. Location of construction joints is subject to approval of the Engineer.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1. Reinforcement to Be Welded: Welding procedure specification in accordance with AWS D1.4/D1.4M

B. Material Certificates: For each of the following, signed by manufacturers:

1. Epoxy-Coated Reinforcement: CRSI's "Epoxy Coating Plant Certification."

C. Material Test Reports: For the following, from a qualified testing agency:

1. Steel Reinforcement:

a. For reinforcement to be welded, mill test analysis for chemical composition and carbon equivalent of the steel in accordance with ASTM A706/A706M.

2. Mechanical splice couplers.

D. Field quality-control reports.

E. Minutes of preinstallation conference.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.4/D 1.4M.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.

B. Epoxy-Coated Reinforcing Bars:

1. Steel Bars: ASTM A615/A615M, Grade 60, deformed bars.
2. Epoxy Coating: ASTM A775/A775M or ASTM A934/A934M with less than 2 percent damaged coating in each 12-inch bar length.

C. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.

D. Deformed-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, flat sheet.

E. Galvanized-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from galvanized-steel wire into flat sheets.

F. Epoxy-Coated Welded-Wire Reinforcement: ASTM A884/A884M, Class A coated, Type 1, deformed steel.

2.2 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.

1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

    a. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.
    b. For epoxy-coated reinforcement, use CRSI Class 1A epoxy-coated or other dielectric-polymer-coated wire bar supports.
    c. For dual-coated reinforcement, use CRSI Class 1A epoxy-coated or other dielectric-polymer-coated wire bar supports.
    d. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.
    e. For stainless steel reinforcement, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.

B. Mechanical Splice Couplers: ACI 318 Type 1, same material of reinforcing bar being spliced;.

C. Steel Tie Wire: ASTM A1064/A1064M, annealed steel, not less than 0.0508 inch in diameter.

2.3 FABRICATING REINFORCEMENT

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

PART 3 - EXECUTION

3.1 PREPARATION

A. Protection of In-Place Conditions:

1. Do not cut or puncture vapor retarder.
2. 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 reduce bond to concrete.

3.2 INSTALLATION OF STEEL REINFORCEMENT

A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.

B. Accurately position, support, and secure reinforcement against displacement.

1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
2. Do not tack weld crossing reinforcing bars.

C. Preserve clearance between bars of not less than 1 inch, not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.

D. Provide concrete coverage in accordance with ACI 318.

E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

F. Splices: Lap splices as indicated on Drawings.

1. Bars indicated to be continuous, and all vertical bars shall be lapped not less than 36 bar diameters at splices, or 24 inches, whichever is greater.
2. Stagger splices in accordance with ACI 318.
3. Mechanical Splice Couplers: Install in accordance with manufacturer's instructions.

G. Install welded-wire reinforcement in longest practicable lengths.

1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice."

a. For reinforcement less than W4.0 or D4.0, continuous support spacing shall not exceed 12 inches.

2. Lap edges and ends of adjoining sheets at least one wire spacing plus 2 inches for plain wire and 8 inches for deformed wire.
3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
4. Lace overlaps with wire.

3.3 JOINTS

A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer.

1. Place joints perpendicular to main reinforcement.
2. Continue reinforcement across construction joints unless otherwise indicated.
3. Do not continue reinforcement through sides of strip placements of floors and slabs.

3.4 INSTALLATION TOLERANCES

A. Comply with ACI 117.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

1. Where Special Inspections are required and listed on the plans, the owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.
2. Where Special Inspections are not required, the contractor shall engage a qualified testing and inspecting agency, at contractor’s expense, to perform tests and inspections and to submit reports as outlined in section 3.12.B

B. Testing Agency: 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 mechanical splice couplers.
3. Steel-reinforcement welding.

END OF SECTION 032000

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.

B. Related Requirements:

1. Section 031000 “Concrete Forming and Accessories” for form-facing materials, form liner, insulating concrete forms, and waterstops.
2. Section 032000 “Concrete Reinforcing” for steel reinforcing bars and welded-sire reinforcement.

1.2 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, and other pozzolans materials subject to compliance with requirements.

B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each of the following, where applicable.

1. Portland cement.
2. Fly ash.
3. Slag cement.
4. Blended hydraulic cement.
5. Aggregates.
6. Admixtures:

a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, and temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.

7. Vapor retarders.
8. Liquid floor treatments.
9. Curing materials.
10. Joint fillers.

B. Design Mixtures: For each concrete mixture, include the following:

1. Mixture identification.
2. Minimum 28-day compressive strength.
3. Durability exposure class.
4. Maximum w/cm.
5. Calculated equilibrium unit weight, for lightweight concrete.
6. Slump limit.
7. Air content.
8. Nominal maximum aggregate size.
9. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.
10. Intended placement method.

C. Cold Weather Submittals

1. In addition to the requirements of 1.4.B, contractor shall submit alternate design mixtures for use during cold weather periods.
2. Concrete Temperature Log: Contractor shall record and maintain a log of the concrete temperature for the duration of the cold weather protection period.
    a. Temperature readings should be recorded on an hourly basis during work hours and every 3 hours during non-work hours.
    b. This log should be kept on the job site and be always accessible to inspection personnel during work hours.
    c. The temperature log shall be submitted to the engineer for inclusion in project records upon completion of the monitoring period.

D. Shop Drawings:

1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

    a. Location of construction joints is subject to approval of the Engineer.

E. Concrete Schedule: For each location of each Class of concrete indicated in "Concrete Mixtures" Article, including the following:

1. Concrete Class designation.
2. Location within Project.
3. Exposure Class designation.
4. Formed Surface Finish designation and final finish.
5. Final finish for floors.
6. Curing process.
7. Floor treatment if any.

1.5 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Curing compounds.
4. Vapor retarders.
5. Joint-filler strips.

B. Material Test Reports: For the following, from a qualified testing agency:

1. Portland cement.
2. Fly ash.
3. Slag cement.
4. Blended hydraulic cement.
5. Aggregates.
6. Admixtures:
    a. Research Reports: For concrete admixtures in accordance with ICC's Acceptance Criteria AC198.

C. Preconstruction Test Reports: For each mix design.

D. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products that complies with ASTM C94/C94M requirements for production facilities and equipment.

1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

B. Mockups: Full-size physical assemblies that are constructed on-site either as freestanding temporary built elements or as part of permanent construction. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

1. Laboratory Mockups: Full-size physical assemblies constructed and tested at testing facility to verify performance characteristics.

2. Integrated Exterior Mockups: Mockups of the exterior envelope constructed on-site as freestanding temporary built elements or as indicated in-place portions of permanent construction if approved by Engineer, consisting of multiple products, assemblies, and subassemblies, with cutaways enabling inspection of concealed portions of the Work.

a. Include each system, assembly, component, and part of the exterior wall and roof to be constructed for the Project. Colors of components shall be those selected by the Engineer for use in the Project.

3. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes; doors; windows; millwork; casework; specialties; furnishings and equipment; and lighting.

4. Product Mockups: Mockups that may include multiple products, materials, or systems specified in a single Section.

5. In-Place Mockups: Mockups constructed on-site in their actual final location as part of permanent construction.

C. Mockups for SF-2.0 are not required unless opted otherwise. Mockups for SF-3.0 are required.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Testing: Concrete mixture design submissions shall include laboratory trial testing data for each concrete mixture.

1. Include the following information in each test report:

a. Admixture dosage rates.
b. Slump.
c. Air content.
d. Seven-day compressive strength.
e. 28-day compressive strength.

B. Pre-Installation Conference for Concrete Construction: Pre-installation conference shall be required for any pour in excess of 100 cu. yds.

1. Contractor shall be responsible for planning and coordination of meeting agenda and notification of participants. Meeting shall be scheduled a minimum of 5 days in advance of the planned concrete pour.
2. Personnel to Attend: Contractor's project manager, owner's representative, concrete subcontractor, architect, engineer, testing lab supervisor, pumping contractor, concrete producer's quality control director, inspection agency personnel, and construction manager, if applicable, and anyone else with the need to know.
3. Suggested Agenda Items shall include but are not limited to: Project Information and Participants, Construction Sequence and Process, Base/Subbase preparation and acceptance, Site Access, Formwork and Removal, Placing Concrete – equipment and procedures, Consolidation, Finishing, Jointing, Curing and Sealing, Protection of Concrete, Hot and Cold Weather precautions, QA/QC, Inspection and Testing, Special Inspections, etc.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94/C94M and ACI 301.

1.9 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1.

B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 unless modified by requirements in the Contract Documents.

2.2 CONCRETE MATERIALS

A. Cementitious Materials:

1. Portland Cement: ASTM C150/C150M, Type I/II, gray.
2. Fly Ash: ASTM C618, Class C or F.
3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.

B. Normal-Weight Aggregates: ASTM C33/C33M, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size:

Sieve Size	% Passing by Weight
2½”	-
2"	-
1½”	100
1"	93-100
½”	27- 58
¼”	0-8

2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

Sieve Size	% Passing by Weight
3/8”	100
No. 4	90-100
8	75-100
16	50-85
30	25-60
50	10-30
100	1-10
200	0-3

C. Lightweight Aggregate: ASTM C330/C330M, 3/4-inch nominal maximum aggregate size.

D. Air-Entraining Admixture: ASTM C260/C260M.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do 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 C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

F. Water and Water Used to Make Ice: ASTM C94/C94M, potable.

G. Waterproofing Admixture: For use in liquid-tight and water storage tank structure.

2.3 VAPOR RETARDERS

A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A; not less than 10 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.

2.4 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. BASF Corporation.
b. Euclid Chemical Company (The); an RPM company.

2.5 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

B. Moisture-Retaining Cover: ASTM C171, polyethylene film burlap-polyethylene sheet.

1. Color:

a. Ambient Temperature Below 50 deg F: Black.
b. Ambient Temperature between 50 deg F and 85 deg F: Any color.
c. Ambient Temperature Above 85 deg F: White.

C. Curing Paper: Eight-feet-wide paper, consisting of two layers of fibered kraft paper laminated with double coating of asphalt.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Fortifiber Building Systems Group.

D. Water: Potable or complying with ASTM C1602/C1602M.

E. Clear, Waterborne, Membrane-Forming, Dissipating Curing Compound: ASTM C309, Type 1, Class B.

F. Clear, Waterborne, Membrane-Forming, Nondissipating Curing Compound: ASTM C309, Type 1, Class B, certified by curing compound manufacturer to not interfere with bonding of floor covering.

G. Clear, Waterborne, Membrane-Forming, Curing and Sealing Compound: ASTM C1315, Type 1, Class A.

2.6 RELATED MATERIALS

A. Expansion and Isolation Joint Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber or ASTM D1752, cork or self-expanding cork.

B. Floor Slab Protective Covering: Eight-feet-wide cellulose fabric.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. McTech Group, Inc.

2.7 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301.

1. Use a qualified 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 or Other Pozzolans: 25 percent by mass.
2. Slag Cement: 50 percent by mass.
3. Total of Fly Ash or Other Pozzolans, Slag Cement: 50 percent by mass, with fly ash or pozzolans not exceeding 25 percent by mass.
4. Total of Fly Ash or Other Pozzolans: 35 percent by mass with fly ash or pozzolans not exceeding 25 percent by mass.

C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.

1. Use high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

2.8 CONCRETE MIXTURES

A. Class A: Structural Normal-weight concrete used for footings, frost walls, grade beams, and tie beams, not exposed or above grade.

1. Exposure Class: ACI 318 F1.
2. Minimum Compressive Strength: 4000 psi at 28 days.
3. Maximum w/cm: 0.50.
4. Slump Limit: 3 inches, plus or minus 1 inch.
5. Air Content: 5.0 percent, plus or minus 1.5 percent at point of delivery.
6. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.

B. Class B: Structural Normal-weight concrete used for above grade walls, exposed foundation walls, retaining walls and tank walls.

1. Exposure Class: ACI 318 F2.
2. Minimum Compressive Strength: 4500 psi at 28 days.
3. Maximum w/cm: 0.45.
4. Slump Limit: 3 inches, plus or minus 1 inch.
5. Air Content: 6.0 percent, plus or minus 1.5 percent at point of delivery
6. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.

C. Class C: Structural Normal-weight concrete used for interior slabs-on-ground.

1. Exposure Class: ACI 318 F0
2. Minimum Compressive Strength: 4000 psi at 28 days.
3. Maximum w/cm: 0.48.
4. Minimum Cementitious Materials Content: 540lb/cu. yd.
5. Slump Limit: 4 inches, plus or minus 1 inch, or 8 inches, plus or minus 1 inch for concrete with verified slump of 3 inches plus or minus 1 inch before adding high-range water-reducing admixture or plasticizing admixture.
6. Air Content:
   a. Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished floors.
7. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.

D. Class D: Structural Normal-weight concrete used for exterior slabs, mat foundations, parking garages and concrete paving.
1. Exposure Class: ACI 318 F3
2. Minimum Compressive Strength: 5000 psi at 28 days.

3. Maximum w/cm: 0.40.
4. Minimum Cementitious Materials Content: 540lb/cu. yd.
5. Slump Limit: 4 inches, plus or minus 1 inch, or 8 inches, plus or minus 1 inch for concrete with verified slump of 3 inches plus or minus 1 inch before adding high-range water-reducing admixture or plasticizing admixture.
6. Air Content: 6.0 percent, plus or minus 1.5 percent at point of delivery.
7. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.

E. Class E: Structural Normal-weight concrete used for interior suspended slabs.

1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum w/cm: 0.48.
3. Minimum Cementitious Materials Content: 610 lb/cu. yd.
4. Slump Limit: 4 inches, plus or minus 1 inch, or 8 inches, plus or minus 1 inch for concrete with verified slump of 3 inches plus or minus 1 inch before adding high-range water-reducing admixture or plasticizing admixture.
5. Air Content:
   a. Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished floors.
6. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.

F. Class F: Structural lightweight concrete used for interior suspended slabs.

1. Minimum Compressive Strength: 4000 psi at 28 days or as indicated.
2. Calculated Equilibrium Unit Weight: 115 lb/cu. ft., plus or minus 3 lb/cu. ft. as determined by ASTM C567/C567M.
3. Slump Limit: 4 inches, plus or minus 1 inch.
4. Air Content:
   a. Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished floors.
5. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.

G. Class G: Normal-weight concrete used for interior concrete toppings and overlays.

1. Minimum Compressive Strength: 5000 psi at 28 days.
2. Minimum Cementitious Materials Content: 610 lb/cu. yd.
3. Maximum w/cm: 0.45
4. Slump Limit: 3 inches, plus or minus 1 inch, or 6 inches, plus or minus 1 inch for concrete with verified slump of 2 inches plus or minus 1 inch before adding high-range water-reducing admixture or plasticizing admixture.
5. Air Content:
   a. Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished toppings.
6. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.
7. Aggregate for thin toppings and overlays (<2'') shall be 3/8'' nominal.

H. Class H: Normal-weight concrete used for exterior site improvements (aprons, landing, equipment pads, tank pads generator pads, sidewalks, etc.).

1. Minimum Compressive Strength: 3500 psi at 28 days.
2. Maximum w/cm: 0.55.
3. Minimum Cementitious Materials Content: 564 lb/cu. yd.
4. Slump Limit: 4 inches, plus or minus 1 inch.
5. Air Content: 6.0 percent, plus or minus 1.5 percent at point of delivery.

2.9 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M and furnish batch ticket information.

PART 3 - EXECUTION

3.1 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining Work that are attached to or supported by cast-in-place concrete.

1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.
3. 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.

3.2 INSTALLATION OF VAPOR RETARDER

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.

1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
2. Face laps away from exposed direction of concrete pour.
3. Lap vapor retarder over footings and grade beams not less than 6 inches, sealing vapor retarder to concrete.
4. Lap joints 6 inches and seal with manufacturer’s recommended tape.
5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
7. Protect vapor retarder during placement of reinforcement and concrete.

    a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches on all sides, and sealing to vapor retarder.

3.3 JOINTS

A. Construct joints true to line, with faces perpendicular to surface plane of concrete.

B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.

1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Engineer.
2. Place joints perpendicular to main reinforcement.

    a. Continue reinforcement across construction joints unless otherwise indicated.
    b. Do not continue reinforcement through sides of strip placements of floors and slabs.

3. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
4. Locate joints for beams, slabs, joists, and girders at third points of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
6. Space vertical joints in walls not more than thirty (30') feet apart in straight runs, unless otherwise indicated on Drawings. Locate vertical joints beside piers integral with walls, near corners, and in concealed locations where possible.

C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.

D. Isolation Joints in Slabs-on-Ground: 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. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface, where joint sealants are indicated.
2. 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:

1. Install dowel bars and support assemblies at joints where indicated on Drawings.
2. Lubricate or asphalt coat one-half of dowel bar length to prevent concrete bonding to one side of joint.

3.4 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.

1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.

B. Notify Engineer and testing and inspection agencies 24 hours prior to commencement of concrete placement.

C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Engineer in writing, but not to exceed the amount indicated on the concrete delivery ticket.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301, but not to exceed the amount indicated on the concrete delivery ticket.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

E. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.

1. If a section cannot be placed continuously, provide construction joints as indicated.
2. Deposit concrete to avoid segregation.
3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.

a. Do not use vibrators to transport concrete inside forms.
b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
d. 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.

F. 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. Do not place concrete floors and slabs in a checkerboard sequence.
2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.

3. Maintain reinforcement in position on chairs during concrete placement.
4. Screed slab surfaces with a straightedge and strike off to correct elevations.
5. Level concrete, cut high areas, and fill low areas.
6. Slope surfaces uniformly to drains where required.
7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
8. Do not further disturb slab surfaces before starting finishing operations.

3.5 FINISHING FORMED SURFACES

A. As-Cast Surface Finishes:

1. ACI 301 Surface Finish SF-1.0: As-cast concrete texture imparted by form-facing material.

    a. Patch voids larger than 1-1/2 inches wide or 1/2 inch deep.
    b. Remove projections larger than 1 inch.
    c. Tie holes do not require patching.
    d. Surface Tolerance: ACI 117 Class D.
    e. Apply to concrete surfaces not exposed to public view.

2. ACI 301Surface Finish SF-2.0: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams.

    a. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
    b. Remove projections larger than 1/4 inch.
    c. Patch tie holes.
    d. Surface Tolerance: ACI 117 Class B.
    e. Locations: Apply to concrete surfaces exposed to public view.

3. ACI 301 Surface Finish SF-3.0:

    a. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
    b. Remove projections larger than 1/8 inch.
    c. Patch tie holes.
    d. Surface Tolerance: ACI 117 Class A.
    e. Locations: Apply to concrete surfaces to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.

B. Rubbed Finishes: Remove forms as early as permitted by Article 3.9 Removal of Forms and perform necessary repairs and patches.
    1. Smooth Rubbed Finish – If specified, produced smooth-rubbed finish no later than the day following form-work removal. Wet the surface and rub it with an abrasive such as carborundum brick until uniform color and texture are produced. If insufficient cement paste can be drawn from the concrete itself by the rubbing process, use a grout made with cementitious materials from the same sources as used for in-place concrete.

    2. Grout-Cleaned Rubbed Finish – If grout-cleaned rubbed finish is specified, begin cleaning operations after contiguous surfaces are completed and accessible. Do not clean surfaces as Work progresses. Wet the surface and, unless otherwise specified, apply grout

consisting of 1 part by volume portland cement and 1-1/2 parts of sand meeting the requirements of ASTM C144 or ASTM C404, with sufficient water to produce a consistency of thick paint. Scrub grout into voids and remove excess grout.

3. Cork-Floated Finish – if cork-floated finish is specified, remove ties, burrs, and fins. Wet the surface and, unless otherwise specified, apply stiff grout of 1 part portland cement and 1 part sand meeting the requirements of ASTM C144 or ASTM C404 to fill voids. Use sufficient water to produce a stiff consistency. Compress grout into voids. Produce the final finish with cork float, using a swirling motion.

C. Final Concrete Finish: Concrete

D. Related Unformed Surfaces:

1. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a color and texture matching adjacent formed surfaces.
2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.6 FINISHING FLOORS AND SLABS

A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish:

1. While still plastic, texture concrete surface that has been screeded and bull-floated or darbied.
2. Use stiff brushes, brooms, or rakes to produce a profile depth of 1/4 inch in one direction.
3. Apply scratch finish to surfaces to receive concrete floor toppings or to receive mortar setting beds for bonded cementitious floor finishes.

C. Float Finish:

1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.
2. Repeat float passes and re-straightening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 tolerances for conventional concrete.
3. Apply float finish to surfaces to receive trowel finish, to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

D. Trowel Finish:

1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.

3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
4. Do not add water to concrete surface.
5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
6. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic, or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
7. Finish and measure surface, so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces. While concrete is still plastic, slightly scarify surface with a fine broom perpendicular to main traffic route.

1. Coordinate required final finish with Engineer before application.
2. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, pads, and locations indicated on Drawings.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
2. Coordinate required final finish with Engineer before application.

G. Slip-Resistive Finish: Before final floating, apply slip-resistive aggregate or aluminum granule finish to concrete stair treads, platforms, ramps as indicated on Drawings.

1. Apply in accordance with manufacturer's written instructions and as follows:

a. Uniformly spread 25 lb/100 sq. ft. of dampened slip-resistive aggregate or aluminum granules over surface in one or two applications.
b. Tamp aggregate flush with surface, but do not force below surface.
c. After broadcasting and tamping, apply float finish.
d. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive aggregate or aluminum granules.

3.7 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling In:

1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
3. 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:

1. Coordinate sizes and locations of concrete bases with actual equipment provided.
2. Construct concrete bases 4 inches high unless otherwise indicated on Drawings and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated on Drawings, or unless required for seismic anchor support.
3. Minimum Compressive Strength: 4000 psi at 28 days.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
6. Prior to pouring concrete, place and secure anchorage devices.

    a. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
    b. Cast anchor-bolt insert into bases.
    c. Install anchor bolts to elevations required for proper attachment to supported equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items.

1. Cast-in inserts and accessories, as shown on Drawings.
2. Screed, tamp, and trowel finish concrete surfaces.

3.8 CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Comply with ACI 301 and ACI 306.1 for cold weather protection during curing.
    a. Concrete curing protection period when cold weather concreting is in effect shall be a minimum of 3 days.
2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
3. Maintain moisture loss of no more than 0.2 lb/sq. ft. x h before and during finishing operations.

B. Curing Formed Surfaces: Comply with ACI 308.1 as follows:

1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
2. Cure concrete containing color pigments in accordance with color pigment manufacturer's instructions.
3. If forms remain during curing period, moist cure after loosening forms.
4. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:

    a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
    b. Continuous Sprinkling: Maintain concrete surface continuously wet.

c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.

1) Recoat areas subject to heavy rainfall within three hours after initial application.
2) Maintain continuity of coating and repair damage during curing period.

C. Curing Unformed Surfaces: Comply with ACI 308.1 as follows:

1. Begin curing immediately after finishing concrete.
2. Interior Concrete Floors:

a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:

1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.

a) Lap edges and ends of absorptive cover not less than 12-inches.
b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.

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, and sealed by waterproof tape or adhesive.

a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
b) Cure for not less than seven days.

3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:

a) Water.
b) Continuous water-fog spray.

b. Floors to Receive Penetrating Liquid Floor Treatments: Contractor has option of the following:

1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.

a) Lap edges and ends of absorptive cover not less than 12 inches.
b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.

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, and sealed by waterproof tape or adhesive.

a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
b) Cure for not less than seven days.

3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:

a) Water.
b) Continuous water-fog spray.

c. Floors to Receive Polished Finish: Contractor has option of the following:

1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.

a) Lap edges and ends of absorptive cover not less than 12 inches.
b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.

2) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:

a) Water.
b) Continuous water-fog spray.

d. Floors to Receive Chemical Stain:

1) As soon as concrete has sufficient set to permit application without marring concrete surface, install curing paper over entire area of floor.
2) Install curing paper square to building lines, without wrinkles, and in a single length without end joints.
3) Butt sides of curing paper tight; do not overlap sides of curing paper.
4) Leave curing paper in place for duration of curing period, but not less than 28 days.

e. Floors to Receive Urethane Flooring:

1) As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.

2) Rewet absorptive cover and cover immediately with polyethylene moisture-retaining cover with edges lapped 6 inches and sealed in place.
3) Secure polyethylene moisture-retaining cover in place to prohibit air from circulating under polyethylene moisture-retaining cover.
4) Leave absorptive cover and polyethylene moisture-retaining cover in place for duration of curing period, but not less than 28 days.

f. Floors to Receive Curing Compound:

1) Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
2) Recoat areas subjected to heavy rainfall within three hours after initial application.
3) Maintain continuity of coating, and repair damage during curing period.
4) Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.

g. Floors to Receive Curing and Sealing Compound:

1) Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller in accordance with manufacturer's written instructions.
2) Recoat areas subjected to heavy rainfall within three hours after initial application.
3) Repeat the process 24 hours later and apply a second coat. Maintain continuity of coating, and repair damage during curing period.

3.9 REMOVAL OF FORMS

A. The forms shall be removed in such a manner as to ensure the complete safety of the structure or improvements.

B. Forms shall not be disturbed until the concrete has sufficiently hardened and acquired sufficient strength to support its own weight and the load upon it.

C. Form removal shall comply with the following schedule:

Structural Element	Atmospheric Temperature	
	Above 60°F	Between 60°F and 40°F
Walls, column and beam sides	3 Days	4 Days
Suspended Slab Bottoms	5 Days	6 Days
Beam and Girder Bottoms	7 Days	10 Days

D. No backfilling or imposing of other forces or loads shall be permitted before the concrete has attained its design strength.

E. After the removal of forms where concrete is exposed to view, the entire surface shall be rubbed to provide a homogeneous surface and defective surfaces shall be repaired and patched to meet the minimum surface finish class specified in section 3.5.

F. Metal ties shall be cut back at least three-quarters (¾") inch and spaces filled. Patches shall be properly cured, color matched, and otherwise treated to obtain as near a permanent homogeneous surface as practicable.

3.10 TOLERANCES

A. Conform to ACI 117.

3.11 APPLICATION OF LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment in accordance with manufacturer's written instructions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Do not apply to concrete that is less than seven days old.
3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing.
4. Rinse with water; remove excess material until surface is dry.
5. Apply a second coat in a similar manner if the surface is rough or porous.

B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller in accordance with manufacturer's written instructions.

3.12 FIELD QUALITY CONTROL

A. Special Inspections:
1. Where Special Inspections are required and listed on the plans, the owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.
2. Where Special Inspections are not required, the contractor shall engage a qualified testing and inspecting agency, at contractor's expense, to perform tests and inspections and to submit reports as outlined in section 3.12.B.

B. Testing Agency:

1. Testing agency shall be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.

2. Testing agency shall immediately report to Engineer, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
3. Testing agency shall report results of tests and inspections, in writing, to Owner, Engineer, Contractor, and concrete manufacturer within 48 hours of inspections and tests.

    a. Test reports shall include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:

        1) Project name.
        2) Name of testing agency.
        3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
        4) Name of concrete manufacturer.
        5) Date and time of inspection, sampling, and field testing.
        6) Date and time of concrete placement.
        7) Location in Work of concrete represented by samples.
        8) Date and time sample was obtained.
        9) Truck and batch ticket numbers.
        10) Design compressive strength at 28 days.
        11) Concrete mixture designation, proportions, and materials.
        12) Field test results.
        13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
        14) Type of fracture and compressive break strengths at seven days and 28 days.

C. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.

D. Inspections: Required inspections to be performed by qualified testing agency. Project specific special inspections required are listed on the contract plans.

1. Headed bolts and studs.
2. Verification of use of required design mixture.
3. Concrete placement, including conveying and depositing.
4. Curing procedures and maintenance of curing temperature.
5. Verification of concrete strength before removal of shores and forms from beams and slabs.

E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C172/C172M shall be performed in accordance with the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.

2. Slump: ASTM C143/C143M:

a. 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.
b. Perform additional tests when concrete consistency appears to change.

3. Slump Flow: ASTM C1611/C1611M:

   a. 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.
   b. Perform additional tests when concrete consistency appears to change.

4. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete; ASTM C173/C173M volumetric method, for structural lightweight concrete.

   a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

5. Concrete Temperature: ASTM C1064/C1064M:

   a. One test hourly when air temperature is above 40 deg F and below or 80 deg F and above, and one test for each composite sample.

6. Unit Weight: ASTM C567/C567M fresh unit weight of structural lightweight concrete.

   a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

7. Compression Test Specimens: ASTM C31/C31M:

   a. Cast, initial cure in field for 3 days, then laboratory cure one set of four (4) 6-inch by 12-inch cylinder specimens for each composite sample.
      1) Where maximum coarse aggregate size does not exceed 1¼ inches, five (5) 4-inch by 8-inch cylinder specimens for each composite sample may be cast in-lieu of 6-inch by 12-inch specimens.

8. Compressive-Strength Tests: ASTM C39/C39M.

   a. For each set, test one (1) specimen at seven days, two (2) specimens at 28 days, and hold one (1) specimen in reserve for later testing if required.
      1) Where 4-inch by 8-inch cylinders are cast, test three (3) specimens at 28 days.

9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

10. Test results shall be reported in writing to Engineer, 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 inspection 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 each test performed.

11. Additional Tests:

    a. 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 Engineer.
    b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Engineer.

        1) Acceptance criteria for concrete strength shall be in accordance with ACI 301 section 1.6.6.3.

12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

13. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

F. Measure floor and slab flatness and levelness in accordance with ASTM E1155 within 24 hours of completion of floor finishing and promptly report test results to Engineer.

3.13 PROTECTION

A. Protect concrete surfaces as follows:

1. Protect from petroleum stains.
2. Diaper hydraulic equipment used over concrete surfaces.
3. Prohibit vehicles from interior concrete slabs.
4. Prohibit use of pipe-cutting machinery over concrete surfaces.
5. Prohibit placement of steel items on concrete surfaces.
6. Prohibit use of acids or acidic detergents over concrete surfaces.
7. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.
8. Protect concrete surfaces scheduled to receive surface hardener or polished concrete finish using Floor Slab Protective Covering.

END OF SECTION 033000

SECTION 040110 - MASONRY CLEANING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes cleaning the following:

1. Unit masonry surfaces.
2. Stone surfaces.

1.2 DEFINITIONS

A. Low-Pressure Spray: 100 to 400 psi; 4 to 6 gpm

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at a location to be determined.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 QUALITY ASSURANCE

A. Mockups: Prepare mockups of cleaning on existing surfaces to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Cleaning: Clean an area approximately 25 sq. ft. for each type of masonry and surface condition.

a. Test cleaners and methods on samples of adjacent materials for possible adverse reactions. Do not test cleaners and methods known to have deleterious effect.
b. Allow a waiting period of not less than seven days after completion of sample cleaning to permit a study of sample panels for negative reactions.

PART 2 - PRODUCTS

2.1 CLEANING MATERIALS

A. Water: Potable.

B. Hot Water: Water heated to a temperature of 140 to 160 deg F.

C. Detergent Solution, Job Mixed: Solution prepared by mixing 2 cups of tetrasodium pyrophosphate (TSPP), 1/2 cup of laundry detergent, and 20 quarts of hot water for every 5 gal. of solution required.

D. Mold, Mildew, and Algae Remover, Job Mixed: Solution prepared by mixing 2 cups of tetrasodium pyrophosphate (TSPP), 5 quarts of 5 percent sodium hypochlorite (bleach), and 15 quarts of hot water for every 5 gal. of solution required.

E. Mild-Acid Cleaner: Manufacturer's standard mild-acid cleaner containing no muriatic (hydrochloric), hydrofluoric, or sulfuric acid; or ammonium bifluoride or chlorine bleaches.

1. Prosoco,Inc., Sure Klean 600 or approved equal

2.2 CHEMICAL CLEANING SOLUTIONS

A. Dilute chemical cleaners with water to produce solutions not exceeding concentration recommended in writing by chemical-cleaner manufacturer.

B. Acidic Cleaner Solution for Nonglazed Masonry and Unpolished Stone: Dilute acidic cleaner with water to produce hydrofluoric acid content of 3 percent or less, but not greater than that recommended in writing by chemical-cleaner manufacturer.

1. Stones: Use only on unpolished granite, unpolished dolomite marble, and siliceous sandstone.

C. Acidic Cleaner for Glazed Masonry and Polished Stone: Dilute acidic cleaner with water to concentration demonstrated by testing that does not etch or otherwise damage glazed or polished surface, but not greater than that recommended in writing by chemical-cleaner manufacturer.

1. Stones: Use only on polished granite and polished dolomite marble.

PART 3 - EXECUTION

3.1 PROTECTION

A. Comply with each manufacturer's written instructions for protecting building and other surfaces against damage from exposure to its products. Prevent paint removers and chemical cleaning solutions from coming into contact with people, motor vehicles, landscaping, buildings, and other surfaces that could be harmed by such contact.

1. Cover adjacent surfaces with materials that are proven to resist paint removers and chemical cleaners used unless products being used will not damage adjacent surfaces. Use protective materials that are waterproof and UV resistant. Apply masking agents according to manufacturer's written instructions. Do not apply liquid strippable masking agent to painted or porous surfaces. When no longer needed, promptly remove masking to prevent adhesive staining.

3.2 CLEANING MASONRY, GENERAL

A. Cleaning Appearance Standard: Cleaned surfaces are to have a uniform appearance as viewed from 20 feet away by Architect.

B. Proceed with cleaning in an orderly manner; work from top to bottom of each scaffold width and from one end of each elevation to the other. Ensure that dirty residues and rinse water do not wash over dry, cleaned surfaces.

C. Use only those cleaning methods indicated for each masonry material and location.

1. Brushes: Do not use wire brushes or brushes that are not resistant to chemical cleaner being used.
2. Spray Equipment: Use spray equipment that provides controlled application at volume and pressure indicated, measured at nozzle. Adjust pressure and volume to ensure that cleaning methods do not damage surfaces, including joints.

    a. Equip units with pressure gages.
    b. For chemical-cleaner spray application, use low-pressure tank or chemical pump suitable for chemical cleaner indicated, equipped with nozzle having a cone-shaped spray.
    c. For water-spray application, use fan-shaped spray that disperses water at an angle of 25 to 50 degrees.
    d. For heated water-spray application, use equipment capable of maintaining temperature between 140 and 160 deg F at flow rates indicated.

D. Perform each cleaning method indicated in a manner that results in uniform coverage of all surfaces, including corners, moldings, and interstices, and that produces an even effect without streaking or damaging masonry surfaces. Keep wall wet below area being cleaned to prevent streaking from runoff.

E. Perform additional general cleaning, paint and stain removal, and spot cleaning of small areas that are noticeably different when viewed according to the "Cleaning Appearance Standard" Paragraph, so that cleaned surfaces blend smoothly into surrounding areas.

F. Water-Spray Application Method: Unless otherwise indicated, hold spray nozzle at least 6 inches from masonry surface and apply water in horizontal back-and-forth sweeping motion, overlapping previous strokes to produce uniform coverage.

G. Chemical-Cleaner Application Methods: Apply chemical cleaners to masonry surfaces according to chemical-cleaner manufacturer's written instructions; use brush or spray application. Do not spray apply at pressures exceeding 50 psi. Do not allow chemicals to remain on surface for periods longer than those indicated or recommended in writing by manufacturer.

H. Rinse off chemical residue and soil by working upward from bottom to top of each treated area at each stage or scaffold setting. Periodically during each rinse, test pH of rinse water running off of cleaned area to determine that chemical cleaner is completely removed.

1. Apply neutralizing agent and repeat rinse if necessary to produce tested pH of between 6.7 and 7.5.

3.3 PRELIMINARY CLEANING

A. Removing Plant Growth: Completely remove visible plant, moss, and shrub growth from masonry surfaces. Carefully remove plants, creepers, and vegetation by cutting at roots and allowing remaining growth to dry as long as possible before removal. Remove loose soil and plant debris from open joints to whatever depth they occur.

B. Preliminary Cleaning: Before beginning general cleaning, remove extraneous substances that are resistant to planned cleaning methods. Extraneous substances include paint, calking, asphalt, and tar.

1. Carefully remove heavy accumulations of rigid materials from masonry surface with sharp chisel. Do not scratch or chip masonry surface.
2. Remove paint and calking with alkaline paint remover.

    a. Comply with requirements in "Paint Removal" Article.
    b. Repeat application up to two times if needed.

3. Remove asphalt and tar with solvent-type paste paint remover.

    a. Comply with requirements in "Paint Removal" Article.
    b. Apply paint remover only to asphalt and tar by brush without prewetting.
    c. Allow paint remover to remain on surface for 10 to 30 minutes.
    d. Repeat application if needed.

3.4 CLEANING MASONRY

A. Detergent Cleaning:

1. Wet surface with hot water applied by low-pressure spray.
2. Scrub surface with detergent solution using medium-soft brushes until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from mortar joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that surface remains wet.
3. Rinse with hot water applied by low-pressure spray to remove detergent solution and soil.
4. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.

B. Mold, Mildew, and Algae Removal:

1. Wet surface with hot water applied by low-pressure spray.
2. Apply mold, mildew, and algae remover by brush or low-pressure spray.
3. Scrub surface with medium-soft brushes until mold, mildew, and algae are thoroughly dislodged and can be removed by rinsing. Use small brushes for mortar joints and crevices. Dip brush in mold, mildew, and algae remover often to ensure that adequate fresh cleaner is used and that surface remains wet.
4. Rinse with hot water applied by low-pressure spray to remove mold, mildew, and algae remover and soil.
5. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.

C. Mild-Acid Chemical Cleaning:

1. Wet surface with cold water applied by low-pressure spray.
2. Apply cleaner to surface in two applications by brush or low-pressure spray.
3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer.
4. Rinse with cold water applied by low-pressure spray to remove chemicals and soil.
5. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.

END OF SECTION 040110

SECTION 040120.64 – BRICK AND UNIT MASONRY REPOINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes repointing joints with mortar.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Sullivan School District 777 south st, Laporte, PA 18626

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified.

1.4 INFORMATIONAL SUBMITTALS

A. Quality-control program.

1.5 QUALITY ASSURANCE

A. Brick Masonry Repointing Specialist Qualifications: Engage an experienced brick masonry-repointing firm to perform work of this Section. Firm shall have completed work similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance. Experience in only installing masonry is insufficient experience for masonry repointing work.

B. Quality-Control Program: Prepare a written quality-control program for this Project to systematically demonstrate the ability of personnel to properly follow methods and use materials and tools without damaging masonry. Include provisions for supervising performance and preventing damage.

C. Mockups: Prepare mockups of brick masonry repointing to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Repointing: Rake out joints in two separate areas, each approximately 36 inches high by 48 inches wide, unless otherwise indicated, for each type of repointing required, and repoint one of the areas.

PART 2 - PRODUCTS

2.1 MORTAR MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or Type II, except Type III may be used for cold-weather construction; gray where required for color matching of mortar.

1. Provide cement containing not more than 0.60 percent total alkali when tested according to ASTM C114.

B. Hydrated Lime: ASTM C207, Type S.

C. Masonry Cement: ASTM C91/C91M.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Cemex S.A.B. de C.V.
b. Essroc.
c. Hanson Brick and Tile;Lehigh Hanson.
d. Holcim (US) Inc.
e. Lafarge North America Inc.
f. QUIKRETE.

D. Mortar Cement: ASTM C1329/C1329M.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Lafarge North America Inc.

E. Mortar Sand: ASTM C144.

1. Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several sands if necessary to achieve suitable match.
2. Color: Provide natural sand or ground marble, granite, or other sound stone of color necessary to produce required mortar color.

F. Mortar Pigments: ASTM C979/C979M, compounded for use in mortar mixes, and having a record of satisfactory performance in masonry mortars.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Davis Colors.
b. LANXESS Corporation.
c. Solomon Colors, Inc.

G. Water: Potable.

2.2 MORTAR MIXES

A. Measurement and Mixing: Measure cementitious materials and sand in a dry condition by volume or equivalent weight. Do not measure by shovel; use known measure. Mix materials in a clean, mechanical batch mixer.

1. Mixing Pointing Mortar: Thoroughly mix cementitious materials and sand together before adding any water. Then mix again, adding only enough water to produce a damp, unworkable mix that retains its form when pressed into a ball. Maintain mortar in this dampened condition for 15 to 30 minutes. Add remaining water in small portions until mortar reaches desired consistency. Use mortar within one hour of final mixing; do not retemper or use partially hardened material.

B. Colored Mortar: Produce mortar of color required by using specified ingredients. Do not alter specified proportions without Architect's approval.

1. Mortar Pigments: Where mortar pigments are indicated, do not add pigment exceeding 10 percent by weight of the cementitious or binder materials, except for carbon black, which is limited to 2 percent.

C. Do not use admixtures in mortar unless otherwise indicated.

D. Mixes: Mix mortar materials in the following proportions:

1. Pointing Mortar by Volume: ASTM C270, Proportion Specification, 1 part Portland cement, 1 part lime, and 6 parts sand.
2. Pointing Mortar by Property: ASTM C270, Property Specification, Type N unless otherwise indicated; with cementitious material limited to Portland cement and lime

PART 3 - EXECUTION

3.1 REPOINTING

A. Rake out and repoint joints to the following extent:

1. All joints in areas indicated.
2. Joints indicated as sealant-filled joints. Seal joints according to Section 079200 "Joint Sealants."
3. Joints at locations of the following defects:

a. Holes and missing mortar.
b. Cracks that can be penetrated 1/4 inch or more by a knife blade 0.027 inch thick.
c. Cracks 1/16 inch or more in width and of any depth.
d. Hollow-sounding joints when tapped by metal object.
e. Eroded surfaces 1/4 inch or more deep.
f. Deterioration to point that mortar can be easily removed by hand, without tools.
g. Joints filled with substances other than mortar.

B. Do not rake out and repoint joints where not required.

C. Rake out joints as follows, according to procedures demonstrated in approved mockup:

1. Remove mortar from joints to depth of not less than 1 inch and not less than that required to expose sound, unweathered mortar. Do not remove unsound mortar more than 2 inches deep; consult Architect for direction.
2. Remove mortar from brick and other masonry surfaces within raked-out joints to provide reveals with square backs and to expose masonry for contact with pointing mortar. Brush, vacuum, or flush joints to remove dirt and loose debris.
3. Do not spall edges of brick or other masonry units or widen joints. Replace or patch damaged brick or other masonry units as directed by Architect.

D. Notify Architect of unforeseen detrimental conditions including voids in mortar joints, cracks, loose masonry units, rotted wood, rusted metal, and other deteriorated items.

E. Pointing with Mortar:

1. Rinse joint surfaces with water to remove dust and mortar particles. Time rinsing application so, at time of pointing, joint surfaces are damp but free of standing water. If rinse water dries, dampen joint surfaces before pointing.
2. Apply pointing mortar first to areas where existing mortar was removed to depths greater than surrounding areas. Apply in layers not greater than 3/8 inch until a uniform depth is formed. Fully compact each layer, and allow it to become thumbprint hard before applying next layer.
3. After deep areas have been filled to same depth as remaining joints, point joints by placing mortar in layers not greater than 3/8 inch. Fully compact each layer and allow to become thumbprint hard before applying next layer. Where existing masonry units have worn or rounded edges, slightly recess finished mortar surface below face of masonry to avoid widened joint faces. Take care not to spread mortar beyond joint edges onto exposed masonry surfaces or to featheredge the mortar.
4. When mortar is thumbprint hard, tool joints to match original appearance of joints as demonstrated in approved mockup. Remove excess mortar from edge of joint by brushing.
5. Cure mortar by maintaining in thoroughly damp condition for at least 72 consecutive hours, including weekends and holidays.
6. Hairline cracking within mortar or mortar separation at edge of a joint is unacceptable. Completely remove such mortar and repoint.

F. Where repointing work precedes cleaning of existing masonry, allow mortar to harden at least 30 days before beginning cleaning work.

3.2 FINAL CLEANING

A. After mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water, applied by low pressure spray.

1. Do not use metal scrapers or brushes.
2. Do not use acidic or alkaline cleaners.

END OF SECTION 040120.64

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Brick.
2. Concrete face brick.
3. Mortar materials.
4. Ties and anchors.
5. Embedded flashing.
6. Accessories.
7. Mortar mixes.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each type and color of brick mortar.

1.3 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each type and size of product.

1.4 MOCKUPS

A. Sample Panels: Build sample panels to verify selections made under Sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 014000 "Quality Requirements" for mockups.

1. Build sample panels for typical exterior and interior walls in sizes approximately 48 inches long by 36 inches high by full thickness.

1.5 FIELD CONDITIONS

A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602.

B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602.

PART 2 - PRODUCTS

2.1 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602, except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects will be exposed in the completed Work and will be within 20 ft. vertically and horizontally of a walking surface.

2.2 BRICK

A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units.

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
2. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

TYPE “A” Basis of Design:

B. Clay Face Brick: Facing brick complying with ASTM C216 or hollow brick complying with ASTM C652, Class H40V (void areas between 25 and 40 percent of gross cross-sectional area).

1. Manufacturer: Glen – Gery
2. Series: Tuscan, Tawney Beige
3. Color: Cream
4. Grade: SW
5. Type: HBS Facebrick
6. Style – Extruded
7. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested according to ASTM C67.
8. Efflorescence: Provide brick that has been tested according to ASTM C67 and is rated "not effloresced."
9. Surface Coating: Brick with colors or textures produced by application of coatings shall withstand 50 cycles of freezing and thawing according to ASTM C67 with no observable difference in the applied finish when viewed from 10 feet or shall have a history of successful use in Project's area.
10. Size (Actual Dimensions): 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.

TYPE “B” Basis of Design:

A. Clay Face Brick: Facing brick complying with ASTM C216 or hollow brick complying with ASTM C652, Class H40V (void areas between 25 and 40 percent of gross cross-sectional area).

1. Manufacturer: Glen – Gery
2. Series: La Paloma, International Collection, Romero
3. Color: Black
4. Grade: SW
5. Type: HBS Facebrick
6. Style – Extruded
7. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested according to ASTM C67.
8. Efflorescence: Provide brick that has been tested according to ASTM C67 and is rated "not effloresced."
9. Surface Coating: Brick with colors or textures produced by application of coatings shall withstand 50 cycles of freezing and thawing according to ASTM C67 with no observable difference in the applied finish when viewed from 10 feet or shall have a history of successful use in Project's area.
10. Size (Actual Dimensions): 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.

2.3 MORTAR MATERIALS

A. Masonry Cement: ASTM C91/C91M.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
      a. Lehigh Northeast Cement Co.
      b. Lafarge Building Materials, Inc
      c. Quikrete, a Custom Building Products Co.

B. Preblended Dry Mortar Mix: Packaged blend made from masonry cement, sand, and admixtures and complying with ASTM C1714/C1714M.

   1. Preblended Dry Masonry Cement Mortar Mix:
      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) Lehigh Northeast Cement Co.
         2) Lafarge Building Materials, Inc
         3) Quikrete, a Custom Building Products Co.

C. Aggregate for Mortar: ASTM C144.

   1. White-Mortar Aggregates: Natural white sand or crushed white stone.
   2. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

D. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C and recommended by manufacturer for use in masonry mortar of composition indicated.
      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) Lehigh Northeast Cement Co.

2) Lafarge Building Materials, Inc
3) Quikrete, a Custom Building Products Co.

E. Water: Potable.

2.4 TIES AND ANCHORS

A. General: Ties and anchors extend at least 1-1/2 inches into veneer but with at least a 5/8-inch cover on outside face.

B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A1064/A1064M, with ASTM A153/A153M, Class B-2 coating.
2. Steel Sheet, Galvanized after Fabrication: ASTM A1008/A1008M, Commercial Steel, with ASTM A153/A153M, Class B coating.

C. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch diameter, hot-dip galvanized steel wire.
2. Tie Section: Triangular-shaped wire tie made from 0.25-inch diameter, hot-dip galvanized steel wire.

D. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Connector Section: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 0.060-inch thick, steel sheet, galvanized after fabrication 0.109-inch thick, stainless steel sheet.
2. Tie Section: Triangular-shaped wire tie made from 0.187-inch- diameter, hot-dip galvanized steel wire. Mill-galvanized wire may be used at interior walls unless otherwise indicated.

E. Adjustable Masonry-Veneer Anchors:

1. General: Provide anchors that allow vertical adjustment but resist a 100 lbf load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of 1/16 inch.

2. Masonry-Veneer Anchors; Double-Pintle Type: Hot dipped galvanized with 6” standard hook section to be tied into eyewire attached to welded wire truss reinforcing in CMU back up wall , projecting horizontal leg with slots for vertical legs of double pintle wire tie.
   a. Hohmann & Barnard, Inc.

   b. Wire Bond Company

2.5 EMBEDDED FLASHING

A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:

1. Fabricate metal drip edges from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
2. Fabricate metal sealant stops from stainless steel. Extend at least 3 inches into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch and down into joint 1/4 inch to form a stop for retaining sealant backer rod.

B. Flexible Flashing: Where concealed flashing is required, use the following unless otherwise indicated:
1. EPDM Flashing: Sheet flashing product made from ethylene-propylene-diene terpolymer, complying with ASTM D4637/D4637M, 40 mil thick.

C. Solder and Sealants for Sheet Metal Flashings: As specified in Section 076200 "Sheet Metal Flashing and Trim."

D. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

E. Termination Bars for Flexible Flashing, Flanged: Stainless steel sheet 0.019 inch by 1-1/2 inches with a 3/8-inch flange at top and bottom.

2.6 ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene

B. Weep/Vent Products: Use the following unless otherwise indicated:

1. Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth 1/8 inch less than depth of outer wythe; in color selected from manufacturer's standard.

a. Hohmann & Barnard, Inc.

b. Wire Bond Company

C. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

1. Mortar Deflector: Strips, full depth of cavity 1-1/2 inches thick 2 inches and 10 inches high, with dovetail-shaped notches that prevent clogging with mortar droppings.

a. Mortar Net Solutions

b. Mason Pro, Inc.

2.7 MORTAR MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Use masonry cement mortar unless otherwise indicated.
3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification. Use Type N unless another type is indicated.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

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

C. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in per minute when tested in accordance with ASTM C67/C67M. Allow units to absorb water so they are damp but not wet at time of laying.

3.2 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/4 inch.
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 ft., or 1/2-inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 ft., 1/4 inch in 20 ft., or 1/2-inch maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 ft. maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 ft., or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 ft, or 1/2-inch maximum.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.

3.3 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in Flemish bond at every 6th course; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

C. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

3.4 MORTAR BEDDING AND JOINTING

A. Lay masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.5 ANCHORED MASONRY VENEERS

A. Anchor masonry veneers to concrete and masonry backup with seismic masonry-veneer anchors to comply with the following requirements:

1. Fasten screw-attached anchors through sheathing to wall framing and to concrete and masonry backup with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
2. Embed tie sections, connector sections and continuous wire in masonry joints.
3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
4. Space anchors as indicated, but not more than 18 inches o.c. vertically and horizontally. Install additional anchors within 12 inches of openings and at intervals, not exceeding 24 inches, around perimeter.

B. Provide not less than 2 inches of airspace between back of masonry veneer and face of insulation.

3.6 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete to comply with the following:

1. Provide an open space not less than 1/2 inch wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.7 FLASHING, WEEP HOLES, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. Extend flashing through veneer, across airspace behind veneer, and up face of sheathing at least 8 inches; with upper edge tucked under water-resistive barrier, lapping at least 4 inches.
3. At lintels and shelf angles, extend flashing 6 inches minimum, to edge of next full unit at each end. At heads and sills, extend flashing 6 inches minimum, to edge of next full unit and turn ends up not less than 2 inches to form end dams.
4. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal drip edge.

C. Install weep holes in veneers in head joints of first course of masonry immediately above embedded flashing.

1. Use specified weep/cavity vent products to form weep holes.
2. Space weep holes 24 inches o.c. unless otherwise indicated.

D. Place cavity drainage material in airspace behind veneers to comply with configuration requirements for cavity drainage material in "Accessories" Article.

E. Install vents in head joints in exterior wythes at spacing indicated. Use specified weep/cavity vent products to form vents.

1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements will be at Contractor's expense.

B. Inspections: Special inspections in accordance with Level 2 in TMS 402.

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.

C. Testing Prior to Construction: One set of tests.

D. Clay Masonry Unit Test: For each type of unit provided, in accordance with ASTM C67/C67M for compressive strength.

E. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, in accordance with ASTM C780.

3.9 CLEANING

A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
2. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

3.10 MASONRY WASTE DISPOSAL

A. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042613

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural steel.
2. Shrinkage-resistant grout.

1.2 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Structural-steel materials.
2. High-strength, bolt-nut-washer assemblies.
3. Anchor rods.
4. Threaded rods.
5. Shop primer.
6. Galvanized-steel primer.
7. Etching cleaner.
8. Galvanized repair paint.
9. Shrinkage-resistant grout.

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

C. Delegated-Design Submittal: For structural-steel connections indicated on Drawings to comply with design loads, include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Mill test reports for structural-steel materials, including chemical and physical properties.

C. Source quality-control reports.

D. Field quality-control reports.

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 BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172).

B. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

1. ANSI/AISC 303.
2. ANSI/AISC 360.
3. RCSC's "Specification for Structural Joints Using High-Strength Bolts."

B. Connection Design Information:
1. Option 2: Fabricator's experienced steel detailer shall select or complete connections in accordance with ANSI/AISC 303.

a. Select and complete connections using schematic details indicated and ANSI/AISC 360.
b. Use Allowable Strength Design; data are given at service-load level.

2. Option 3 and 3A: Design connections in accordance with ANSI/AISC 303 by fabricator's qualified professional engineer. Member reinforcement at connections is indicated on Drawings.

a. Use Allowable Strength Design; data are given at service-load level.

3. Option 3 and 3B: Design connections and final configuration of member reinforcement at connections in accordance with ANSI/AISC 303 by fabricator's qualified professional engineer.

a. Use Allowable Strength Design; data are given at service-load level.

C. Moment Connections: Type FR, fully restrained.

2.2 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A992/A992M.

B. Channels, Angles, M-Shapes, S-Shapes: ASTM A36/A36M.

C. Plate and Bar: ASTM A36/A36M.

D. Hollow Structural Sections: ASTM A500/A500M, Grade C structural tubing.
   1. Rectangular HSS: FY=50 KSI; FU=62 KSI
   2. Round HSS: FY=46 KSI; FU= 62 KSI

E. Steel Pipe: ASTM A53/A53M, Type E or Type S, Grade B.

F. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS AND CONNECTORS

A. High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.

   1. Direct-Tension Indicators: ASTM F959/F959M, Type 325-1, compressible-washer type with plain finish.

B. High-Strength A490 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A490, Type 1, heavy-hex steel structural bolts or Grade F2280 tension-control, bolt-nut-washer assemblies with splined ends; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.

   1. Direct-Tension Indicators: ASTM F959/F959M, Type 490-1, compressible-washer type with plain finish.

C. Zinc-Coated High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.

   1. Finish: Hot-dip or mechanically deposited zinc coating.
   2. Direct-Tension Indicators: ASTM F959/F959M, Type 325-1, compressible-washer type with mechanically deposited zinc coating, baked epoxy-coated finish.

D. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F3125/F3125M, Grade F1852, Type 1, heavy-hex head assemblies, consisting of steel structural bolts with splined ends; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.

   1. Finish: Mechanically deposited zinc coating.

E. Shear Stud Connectors: ASTM A108, AISI C-1015 through C-1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

2.4 RODS

A. Unheaded Anchor Rods: ASTM F1554, Grade 36.

1. Configuration: Hooked.
2. Finish: Hot-dip zinc coating, ASTM A153/A153M, Class C.

B. Headed Anchor Rods: ASTM F1554, Grade 36, straight.

1. Finish: Hot-dip zinc coating, ASTM A153/A153M, Class C.

C. Threaded Rods: ASTM A36/A36M.

1. Finish: Hot-dip zinc coating, ASTM A153/A153M, Class C.

2.5 FORGED-STEEL STRUCTURAL HARDWARE

A. Clevises and Turnbuckles: Made from cold-finished carbon-steel bars, ASTM A108, AISI C-1035.

2.6 SHRINKAGE-RESISTANT GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.7 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.

B. Shear Stud Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld using automatic end welding of headed-stud shear connectors in accordance with AWS D1.1/D1.1M and manufacturer's written instructions.

2.8 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength 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 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

2.9 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel in accordance with ASTM A123/A123M.

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

2.10 SHOP PRIMING

A. Shop prime steel surfaces, except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
2. Surfaces to be field welded.
3. Surfaces of high-strength bolted, slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
5. Galvanized surfaces unless indicated to be painted.
6. Surfaces enclosed in interior construction.

B. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces in accordance with the following specifications and standards. Coordinate minimum surface-preparation requirements with selection of primers, paint, and coating systems:

1. SSPC-SP 2.
2. SSPC-SP 3.
3. SSPC-SP 7 (WAB)/NACE WAB-4.
4. SSPC-SP 6 (WAB)/NACE WAB-3.

C. Surface Preparation of Galvanized Steel: If galvanized steel is indicated to be painted, prepare galvanized-steel surfaces for shop priming by thoroughly cleaning steel of grease, dirt, oil, flux, and other foreign matter, and treating with etching cleaner or in accordance with SSPC-SP 16.

D. Priming: Immediately after surface preparation, apply primer in accordance with manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.11 SOURCE QUALITY CONTROL

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

1. Allow testing agency access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
2. Bolted Connections: Inspect and test shop-bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
3. Welded Connections: Visually inspect shop-welded connections in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

    a. Liquid Penetrant Inspection: ASTM E165/E165M.
    b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
    c. Ultrasonic Inspection: ASTM E164.

d. Radiographic Inspection: ASTM E94/E94M.

4. In addition to visual inspection, test and inspect shop-welded shear stud connectors in accordance with requirements in AWS D1.1/D1.1M.
5. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedded items for compliance with requirements.

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

3.2 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.

B. Baseplates, Bearing Plates, and 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 shrinkage-resistant 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 grouting.

C. Maintain erection tolerances of structural steel within ANSI/AISC 303.

3.3 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.

1. Joint Type: Snug tightened.

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

1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform the following special inspections:

1. Verify structural-steel materials and inspect steel frame joint details.
2. Verify weld materials and inspect welds.
3. Verify connection materials and inspect high-strength bolted connections.

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

1. Bolted Connections: Inspect and test bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
2. Welded Connections: Visually inspect field welds in accordance with AWS D1.1/D1.1M.

    a. In addition to visual inspection, test and inspect field welds in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

        1) Liquid Penetrant Inspection: ASTM E165/E165M.
        2) Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
        3) Ultrasonic Inspection: ASTM E164.
        4) Radiographic Inspection: ASTM E94/E94M.

END OF SECTION 051200

SECTION 052100 - STEEL JOIST FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. K-series steel joists.
2. K-series steel joist substitutes.
3. LH-series long-span steel joists.
4. DLH-series long-span steel joists.
5. Steel joist girders.
6. Steel joist accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of joist, accessory, and product.

B. Shop Drawings:

1. Include layout, designation, number, type, location, and spacing of joists.
2. Include joining and anchorage details; bracing, bridging, and joist accessories; splice and connection locations and details; and attachments to other construction.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Manufacturer certificates.

C. Mill Certificates: For each type of bolt.

D. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables in SJI's "Specifications."

1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.

B. Welding Qualifications: Qualify field-welding procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Canam Steel Corporation; Canam Group, Inc.
2. New Millennium Building Systems, LLC.
3. Vulcraft; Nucor Vulcraft Group.

2.2 STEEL JOISTS

A. K-Series Steel Joist: Manufactured steel joists of type indicated according to "Standard Specification 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. 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.

B. Long-Span Steel Joist: Manufactured steel joists according to "Standard Specification for Longspan Steel Joists, LH-Series and Deep Longspan Steel Joists, DLH-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members; of joist type and end and top-chord arrangements as indicated on Drawings.

2.3 STEEL JOIST GIRDERS

A. Manufactured joist girders according to "Standard Specification for Joist Girders" in SJI's "Specifications," with steel-angle top- and bottom-chord members; with end and top-chord arrangements as indicated.

2.4 PRIMERS

A. Primer:

1. SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.

2.5 STEEL JOIST ACCESSORIES

A. Bridging:

1. 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.

B. Furnish ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction.

1. Extend ends to within 1/2 inch of finished wall surface unless otherwise indicated on Drawings.

C. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.

1. Finish:
   a. Interior: Plain
   b. Exterior: Hot-dip zinc coating, ASTM A153/A153M, Class C

D. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.

2.6 CLEANING AND SHOP PAINTING

A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories.

B. Apply one coat of shop primer to joists and joist accessories.

PART 3 - EXECUTION

3.1 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 instructions, 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.

C. Field weld joists to supporting steel bearing plates and 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 A325 or ASTM A490 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.

3.2 FIELD QUALITY CONTROL

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

B. Visually inspect field welds according to AWS D1.1/D1.1M.

C. Visually inspect bolted connections.

D. Prepare test and inspection reports.

END OF SECTION 052100

SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof deck.
2. Composite floor deck.
3. Noncomposite form deck.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Roof deck.
2. Composite floor deck.
3. Noncomposite form deck.

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.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product Certificates: For each type of steel deck.

C. Research reports.

D. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

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. Canam Steel Corporation; Canam Group, Inc.
2. New Millennium Building Systems, LLC.
3. Nucor Corp.

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 A1008/A1008M, Structural Steel (SS), Grade 33 minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.

a. Color: Manufacturer's standard.

2. Galvanized-Steel Sheet: ASTM A653/A653M, Structural Steel (SS), G90 zinc coating.
3. Galvanized and Shop-Primed Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 33, G60 zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.

a. Color: Manufacturer's standard.

4. Deck Profile: As indicated.
5. Profile Depth: As indicated.
6. Design Uncoated-Steel Thickness: 0.0295 inch minimum, or as indicated.

2.3 NONCOMPOSITE FORM 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. Canam Steel Corporation; Canam Group, Inc.
2. New Millennium Building Systems, LLC.
3. Nucor Corp.

B. Noncomposite Form Deck: Fabricate ribbed-steel sheet noncomposite form-deck panels to comply with "SDI Specifications and Commentary for Noncomposite Steel Form Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:

1. Uncoated Steel Sheet: ASTM A1008/A1008M, Structural Steel (SS), Grade 33 minimum.
2. Prime-Painted Steel Sheet: ASTM A1008/A1008M, Structural Steel (SS), Grade 33 minimum, with underside surface shop primed with manufacturer's standard baked-on, rust-inhibitive primer.

    a. Color: Manufacturer's standard.

3. Galvanized-Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 33, G90 zinc coating.
4. Galvanized and Shop-Primed Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 33, G60 zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.

    a. Color: Manufacturer's standard.

5. Profile Depth: 9/16 inch, or as indicated.
6. Design Uncoated-Steel Thickness: 0.0474 inch.

2.4 ACCESSORIES

A. Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.

G. Galvanizing Repair Paint: SSPC-Paint 20 or MIL-P-21035B, with dry film containing a minimum of 94 percent zinc dust by weight.

H. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 INSTALLATION

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. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

C. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

D. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

E. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

F. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

G. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld flanges to top of deck. Space welds not more than 12 inches apart with at least one weld at each corner.

1. Install reinforcing channels or zees in ribs to span between supports and weld or mechanically fasten.

H. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or 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.

I. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.

J. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.2 REPAIR

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.

3.3 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. Prepare test and inspection reports.

END OF SECTION 053100

SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Load-bearing wall framing.
2. Exterior non-load-bearing wall framing.
3. Interior non-load-bearing wall framing.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Cold-formed steel framing materials.
2. Load-bearing wall framing.
3. Exterior non-load-bearing wall framing.
4. Interior non-load-bearing wall framing.
5. Vertical deflection clips.
6. Single deflection track.
7. Double deflection track.
8. Drift clips.
9. Post-installed anchors.
10. Power-actuated anchors.

B. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product certificates.

C. Product test reports.

D. Research Reports:

1. For post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

B. Product Tests: Mill certificates or data from a qualified independent testing agency.

C. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

D. Comply with AISI S230 "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. ClarkDietrich.
2. MarinoWARE.
3. MBA Building Supplies.

2.2 PERFORMANCE REQUIREMENTS

A. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing shall comply with AISI S100, AISI S200, and the following:

1. Wall Studs: AISI S211.
2. Headers: AISI S212.
3. Lateral Design: AISI S213.

B. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

2.3 COLD-FORMED STEEL FRAMING MATERIALS

A. Steel Sheet: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:

1. Grade: As required by structural performance.

2. Coating: G60, A60, AZ50, or GF30.

B. Steel Sheet for Vertical Deflection Clips: ASTM A653/A653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: As required by structural performance.
2. Coating: G60.

2.4 LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: per project plans.
2. Flange Width: per project plans.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and matching minimum base-metal thickness of steel studs.

C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, unpunched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: per project plans.
2. Flange Width: per project plans.

2.5 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: per project plans.
2. Flange Width: per project plans.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and matching minimum base-metal thickness of steel studs.

C. Vertical Deflection Clips: Manufacturer's standard clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ClarkDietrich.
b. MarinoWARE.
c. Simpson Strong-Tie Co., Inc.

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

E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.

F. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.6 INTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: per project plans.
2. Flange Width: per project plans.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and matching minimum base-metal thickness of steel studs.

C. Vertical Deflection Clips: Manufacturer's standard clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ClarkDietrich.
b. MarinoWARE.
c. Simpson Strong-Tie Co., Inc.

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

E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.

F. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.7 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from ASTM A1003/A1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated.

2.8 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process according to ASTM A123/A123M.

B. Anchor Bolts: ASTM F1554, Grade 36, threaded carbon-steel carbon-steel nuts, and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A153/A153M, Class C.

C. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC193, ICC-ES AC58, or ICC-ES AC308 as appropriate for the substrate.

1. Uses: Securing cold-formed steel framing to structure.
2. Type: Torque-controlled expansion anchor or adhesive anchor.
3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
4. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

D. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

E. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.

1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.

2.9 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A780/A780M or SSPC-Paint 20.

B. Cement Grout: Portland cement, ASTM C150/C150M, Type I; and clean, natural sand, ASTM C404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C1107/C1107M, and with a fluid consistency and 30-minute working time.

D. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.

E. Sill Sealer Gasket: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that required to obtain fire-resistance ratings indicated. Protect remaining fire-resistive materials from damage.

C. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.

D. Install sill sealer gasket at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.2 INSTALLATION, GENERAL

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

B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.

C. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

D. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

E. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

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

G. Install insulation in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work, as directed on the project plans.

H. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.3 INSTALLATION OF LOAD-BEARING WALL FRAMING

A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:

1. Anchor Spacing: As shown on the Drawings.

B. Squarely seat studs against top and bottom tracks, with gap not exceeding 1/8 inch between the end of wall-framing member and the web of track.

1. Fasten both flanges of studs to top and bottom tracks.
2. Space studs as follows:

a. Stud Spacing: As indicated on Drawings.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.

D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.

E. Align floor and roof framing over studs according to AISI S200, Section C1. Where framing cannot be aligned, continuously reinforce track to transfer loads.

F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure.

G. Install headers over wall openings wider than stud spacing. Locate headers above openings. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.

1. Frame wall openings with not less than a double stud at each jamb of frame. Fasten jamb members together to uniformly distribute loads.
2. Install tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.

H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.

1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.

I. Install horizontal bridging in stud system, spaced vertically as indicated on Shop Drawings Insert dimension. Fasten at each stud intersection.

1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of two screws into each flange of the clip angle for framing members up to 6 inches deep.

2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges, and secure solid blocking to stud webs or flanges.
3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

J. Install steel sheet diagonal bracing straps to both stud flanges; terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.

K. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.4 INSTALLATION OF EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:

1. Stud Spacing: As indicated on Drawings.

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

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single deep-leg deflection tracks and anchor to building structure.
2. Install double deep-leg deflection tracks and anchor outer track to building structure.
3. Connect vertical deflection clips to studs and anchor to building structure.
4. Connect drift clips to cold-formed steel framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.

1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

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

3.5 INSTALLATION OF INTERIOR NON-LOAD-BEARING WALL FRAMING

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

B. Fasten both flanges of studs to bottom track unless otherwise indicated. Space studs as follows:

1. Stud Spacing: As indicated on Drawings.

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

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single deep-leg deflection tracks and anchor to building structure.
2. Install double deep-leg deflection tracks and anchor outer track to building structure.
3. Connect vertical deflection clips to studs and anchor to building structure.
4. Connect drift clips to cold-formed steel metal framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.

1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

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

3.6 INSTALLATION TOLERANCES

A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.7 REPAIRS

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

3.8 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

END OF SECTION 054000

SECTION 054400 - COLD-FORMED METAL TRUSSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof trusses.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Cold-formed steel truss materials.
2. Anchor bolts.
3. Post-installed anchors.
4. Power-actuated fasteners.
5. Mechanical fasteners.

B. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel trusses; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

C. Delegated-Design Submittal: For cold-formed steel trusses.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product test reports.

C. Research Reports: For post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

D. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

B. Product Tests: Mill certificates or data from a qualified independent testing agency.

C. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Aegis Metal Framing.
2. MarinoWARE.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer to design cold-formed steel trusses.

B. Structural Performance: Provide cold-formed steel trusses capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As indicated on Drawings.
2. Deflection Limits: Design trusses to withstand design loads without deflections greater than the following:

a. Floor Trusses: Vertical deflection of 1/480 for live loads and l/360 for total loads of the span.
b. Roof Trusses: Vertical deflection of 1/240 of the span.

3. Design trusses to provide for movement of truss members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.

C. Cold-Formed Steel Truss Standards: Unless more stringent requirements are indicated, trusses shall comply with the following:

1. Floor and Roof Systems: AISI S210.
2. Lateral Design: AISI S213.
3. Roof Trusses: AISI S214.

D. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

2.3 COLD-FORMED STEEL TRUSS MATERIALS

A. Steel Sheet: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:

1. Grade: ST50H.
2. Coating: G60, A60, AZ50, or GF30.

2.4 ROOF TRUSSES

A. Roof Truss Members: Manufacturer's standard steel sections.

1. Connecting Flange Width: 1-5/8 inches, minimum at top and bottom chords connecting to sheathing or other directly fastened construction.
2. Minimum Base-Metal Thickness: 0.0329 inch.

2.5 TRUSS ACCESSORIES

A. Fabricate steel-truss accessories from steel sheet, ASTM A1003/A1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for truss members.

B. Provide accessories of manufacturer's standard thickness and configuration unless otherwise indicated.

2.6 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process according to ASTM A123/A123M.

B. Anchor Bolts: ASTM F1554, Grade 36, threaded carbon-steel, carbon-steel nuts, and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A153/A153M, Class C.

C. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC193, ICC-ES AC58, or ICC-ES AC308 as appropriate for the substrate.

1. Uses: Securing cold-formed steel trusses to structure.
2. Type: Torque-controlled expansion anchor or adhesive anchor.
3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
4. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

D. Power-Actuated Fasteners: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

E. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.

1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.

2.7 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A780/A780M or SSPC-Paint 20.

B. Shims: Load-bearing, high-density multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as truss members supported by shims.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install bridge, and brace cold-formed steel trusses according to AISI S200, AISI S202, AISI S214, and manufacturer's written instructions unless more stringent requirements are indicated.

1. Coordinate with wall framing to align webs of bottom chords and load-bearing studs or continuously reinforce track to transfer loads to structure.
2. Install continuous bridging and permanently brace trusses as indicated on Shop Drawings and designed according to CFSEI's Technical Note 551e, "Design Guide: Permanent Bracing of Cold-Formed Steel Trusses."

B. Install cold-formed steel trusses and accessories true to line and location, and with connections securely fastened.

C. Install temporary bracing and supports to secure trusses and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to trusses are secured.

D. Truss Spacing: As indicated on Drawings.

3.2 ERECTION TOLERANCES

A. Install cold-formed steel trusses level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual trusses no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.3 REPAIR

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel trusses with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform inspections.

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

C. Cold-formed metal trusses will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 054400

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Miscellaneous steel framing and supports.
2. Shelf angles.
3. Metal ladders.
4. Metal Ships ladders.
5. Metal floor plate and supports.
6. Structural-steel door frames.
7. Miscellaneous steel trim.
8. Metal bollards.
9. Loose bearing and leveling plates.

B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Paint products.
2. Grout.

B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

C. Delegated-Design Submittal: For ladders, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design ladders and stair cases.

B. Structural Performance of Aluminum Ladders: Aluminum ladders, including landings, shall withstand the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. Stainless-Steel Bars and Shapes: ASTM A276, Type 304.

D. Rolled-Steel Floor Plate: ASTM A786/A786M, rolled from plate complying with ASTM A36/A36M or ASTM A283/A283M, Grade C or D.

E. Rolled-Stainless-Steel Floor Plate: ASTM A793.

F. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.

G. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.

H. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.

1. Size of Channels: 1-5/8 by 1-5/8 inches, or as indicated on the plans.
2. Material: Galvanized steel, ASTM A653/A653M, structural steel, Grade 33, with G90 coating; 0.079-inch nominal thickness.
3. Material: Cold-rolled steel, ASTM A1008/A1008M, structural steel, Grade 33; 0.0677-inch minimum thickness; coated with rust-inhibitive, baked-on, acrylic enamel, or hot-dip galvanized after fabrication.

I. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.

J. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.

K. Aluminum-Alloy Rolled Tread Plate: ASTM B632/B632M, Alloy 6061-T6.

L. Aluminum Castings: ASTM B26/B26M, Alloy 443.0-F.

M. Nickel Silver Castings: ASTM B584, Alloy UNS No. C97600 (20 percent leaded nickel bronze).

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

1. Provide stainless-steel fasteners for fastening aluminum.
2. Provide stainless-steel fasteners for fastening stainless steel.
3. Provide stainless-steel fasteners for fastening nickel silver.
4. Provide bronze fasteners for fastening bronze.

B. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329.

C. Post-Installed Anchors: Torque-controlled expansion anchors or epoxy anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

D. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

A. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting," Section 099123 Interior Painting,"

B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

C. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

G. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi.

2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Use connections that maintain structural value of joined pieces.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.

C. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended.

D. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Locate joints where least conspicuous.

E. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

F. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors not less than 8 inches from ends and corners of units and 24 inches o.c.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

C. Fabricate steel girders for wood frame construction from continuous steel shapes of sizes indicated.

1. Where wood nailers are attached to girders with bolts or lag screws, drill or punch holes at 16 inches o.c.

D. Fabricate steel pipe columns for supporting wood frame construction from steel pipe with steel baseplates and top plates as indicated. Drill or punch baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness unless otherwise indicated.

2.7 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

C. Galvanize and prime shelf angles located in exterior walls.

D. Prime shelf angles located in exterior walls with primer specified in Section 099113 “Exterior Painting.”

E. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.8 METAL LADDERS

A. General:

1. Comply with ANSI A14.3, except for elevator pit ladders.

B. Steel Ladders:

1. Space siderails 18 inches apart unless otherwise indicated.
2. Siderails: Continuous, 1/2-by-2-1/2-inch steel flat bars, with eased edges.
3. Rungs: 3/4-inch-diameter or 3/4-inch-square steel bars.
4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
5. Provide nonslip surfaces on top of each rung.
6. Galvanize and prime exterior ladders, including brackets.
7. Primeladders, including brackets and fasteners, with primer specified in Section 099113 “Exterior Painting.”

2.9 METAL SHIPS LADDERS

A. General:

1. Comply with IBC Section 1011.15.

B. Steel Ship’s Ladders:

1. Treads to have a minimum depth of 5”
2. Risers to have a minimum height of 9 ½”
3. Handrails to be provided on both sides
4. The minimum clear width at handrails shall be 20”
5. Provide nonslip surfaces on all treads and platforms
6. Galvanize and prime exterior ladders, including brackets.
7. Primeladders, including brackets and fasteners, with primer specified in Section 099113 “Exterior Painting.”

2.10 METAL FLOOR PLATE

A. Fabricate from rolled-steel floor plate of thickness indicated below:

1. Thickness: 1/8 inch.

B. Provide steel angle supports as indicated.

C. Provide flush steel bar drop handles for lifting removable sections, one at each end of each section.

2.11 STRUCTURAL-STEEL DOOR FRAMES

A. Fabricate structural-steel door frames from steel shapes, plates, and bars of size and to dimensions indicated, fully welded together, with 5/8-by-1-1/2-inch steel channel stops. Plug-weld built-up members and continuously weld exposed joints. Reinforce frames and drill and tap as necessary to accept finish hardware.

1. Provide with integrally welded steel strap anchors for securing door frames into adjoining concrete or masonry.

B. Galvanize exterior steel frames.

C. Prime steel frames with primer specified in Section 099113 “Exterior Painting.”

2.12 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

C. Galvanize exterior miscellaneous steel trim.

D. Prime miscellaneous steel trim with primer specified in Section 099113 “Exterior Painting.”

2.13 METAL BOLLARDS

A. Fabricate metal bollards from Schedule 40 steel pipe or steel shapes, as indicated on plans.

1. If bollards are not indicated to be concrete filled, cap bollards with 1/4-inch-thick steel plate.

B. Fabricate sleeves for bollard anchorage from steel pipe or tubing with 1/4-inch-thick steel plate welded to bottom of sleeve.

C. Prime bollards with primer specified in Section 099113 “Exterior Painting.”

2.14 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

2.15 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.

B. Galvanize loose steel lintels located in exterior walls.

C. Prime loose steel lintels located in exterior walls with primer specified in Section 099113 “Exterior Painting.”

2.16 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.17 FINISHES, GENERAL

A. Finish metal fabrications after assembly.

2.18 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

B. Shop prime iron and steel items unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

1. Shop prime with primers specified in Section 099113 "Exterior Painting" primers or specified in Section 099123 "Interior Painting"

C. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:

1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
3. Items Indicated to Receive Primers Specified in Section 099113 “Exterior Painting”: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
4. Other Items: SSPC-SP 3, "Power Tool Cleaning."

D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 INSTALLING METAL BOLLARDS

A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing, unless otherwise indicated.

B. Anchor bollards in concrete with pipe sleeves preset and anchored into concrete. Fill annular space around bollard solidly with nonshrink grout.

C. Anchor bollards in place with concrete footings. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

D. Fill bollards solidly with concrete, mounding top surface to shed water.

3.3 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with nonshrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 055000

SECTION 055213 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel pipe and tube railings.

2. Moveable steel pipe railings.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Manufacturer's product lines of mechanically connected railings.
2. Railing brackets.
3. Grout, anchoring cement, and paint products.

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

C. Samples: For each type of exposed finish required.

D. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For pipe and tube railings, for tests performed by a qualified testing agency, according to ASTM E894 and ASTM E935.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Steel Pipe and Tube Railings:

1. Fabricate all railings using standard weight steel (shapes shown on drawings); use flush type fittings and fully welded connections; provide vertical supports at all ends and at spans to not exceed 5’-0” spacing.

B. Moveable Steel Pipe Railings:

1. Fabricate all moveable railings using standard weight steel (shapes shown on drawings); use flush type fittings and fully welded connections; provide vertical supports at all ends and at spans to not exceed 5’-0” spacing. Securely fasten the railing to the structure as required to meet all code required loads and for proper structural performance. Utilize fittings that allow for the temporary removal and reinstallation of the railing system in order to facilitate the removal and reinstallation of mechanical equipment.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.

B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

   a. Uniform load of 50 lbs./lin. ft. applied in any direction.
   b. Concentrated load of 200 lbs. applied in any direction.
   c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

   a. Concentrated load of 50 lbs. applied horizontally to an area of 1 sq. ft..
   b. Infill load and other loads need not be assumed to act concurrently.

2.3 METALS, GENERAL

A. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

1. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

2. Coordinate type of bracket used in each application with plans.

2.4 STEEL AND IRON

A. Tubing: ASTM A500 (cold formed) or ASTM A513.

B. Pipe: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

1. Provide galvanized finish for exterior installations and where indicated.

C. Plates, Shapes, and Bars: ASTM A36/A36M.

2.5 FASTENERS

A. General: Provide the following:
   1. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A153/A153M or ASTM F2329 for zinc coating.

B. Post-Installed Anchors: Torque-controlled expansion anchors or epoxy anchors capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.
   1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

2.6 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Etching Cleaner for Galvanized Metal: Complying with MPI#25.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

E. Non-shrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.7 FABRICATION

A. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

B. Form work true to line and level with accurate angles and surfaces.

C. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove flux immediately.
   4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

D. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

E. Close exposed ends of railing members with prefabricated end fittings.

F. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated.

G. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

2.8 STEEL AND IRON FINISHES

A. Galvanized Railings:

1. Hot-dip galvanize exterior steel railings, including hardware, after fabrication.
2. Comply with ASTM A123/A123M for hot-dip galvanized railings.
3. Comply with ASTM A153/A153M for hot-dip galvanized hardware.

B. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.

C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

D. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

1. Do not apply primer to galvanized surfaces.

E. High-Performance Coating: Apply epoxy intermediate and polyurethane topcoats to prime-coated surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.

1. Color: As selected by Engineer/Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1. Coat, with a heavy coat of bituminous paint, concealed surfaces of aluminum that are in contact with grout, concrete, masonry, wood, or dissimilar metals.

3.2 ANCHORING POSTS

A. Use metal sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with non-shrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with non-shrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.

C. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members.

3.3 ATTACHING RAILINGS

A. Attach railings to wall with wall brackets, except where end flanges are used. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

B. Secure wall brackets and railing end flanges to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For hollow masonry anchorage, use toggle bolts.
3. For wood stud partitions, use hanger or lag bolts set into studs or wood backing between studs. Coordinate with carpentry work to locate backing members.
4. For steel-framed partitions, use toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

3.4 ADJUSTING AND CLEANING

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

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 055213

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Framing with dimension lumber.
2. Framing with engineered wood products.
3. Shear wall panels.
4. Rooftop equipment bases and support curbs.
5. Wood blocking, cants, and nailers.
6. Wood furring and grounds.
7. Wood sleepers.
8. Plywood backing panels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product.

1.3 INFORMATIONAL SUBMITTALS

A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses as indicated on the plans. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

B. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.
2. Fire-retardant-treated wood.
3. Engineered wood products.
4. Shear panels.
5. Power-driven fasteners.
6. Post-installed anchors.
7. Metal framing anchors.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, omit grade stamp and provide certificates of grade compliance issued by grading agency.
3. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

C. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.

1. Allowable design stresses, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3B for exterior construction not in contact with ground, and Use Category UC4A for items in contact with ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
4. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.

C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent. Kiln-dry plywood after treatment to maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

E. Application: Treat items indicated on Drawings, and the following:

1. Framing for raised platforms.
2. Framing for stages.
3. Concealed blocking.
4. Framing for non-load-bearing partitions.
5. Framing for non-load-bearing exterior walls.
6. Roof construction.
7. Plywood backing panels.

2.4 DIMENSION LUMBER FRAMING

A. Use materials with grades and strengths as indicated on the project plans.

2.5 ENGINEERED WOOD PRODUCTS

A. Laminated-Veneer Lumber: Structural composite lumber made from wood veneers with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D5456 and manufactured with an exterior-type adhesive complying with ASTM D2559.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Weyerhaeuser Company.
b. Georgia-Pacific Gypsum LLC.
c. Boise Cascade Corporation.

2. Extreme Fiber Stress in Bending, Edgewise: 2600 psi for 12-inch nominal-depth members.
3. Modulus of Elasticity, Edgewise: 1,800,000 psi.

2.6 SHEAR WALL PANELS

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. Simpson Strong-Tie Co., Inc.
2. Weyerhaeuser Company.

B. Wood-Framed Shear Wall Panels: Prefabricated assembly consisting of wood perimeter framing, tie downs, and Exposure I, Structural I plywood or OSB sheathing.

C. Steel-Framed Shear Wall Panels: Prefabricated assembly consisting of cold-formed galvanized-steel panel, steel top and bottom plates, and wood studs.

D. Allowable design loads, as published by manufacturer, shall meet or exceed those of products of manufacturers listed. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.7 MISCELLANEOUS LUMBER

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

1. Blocking.
2. Nailers.
3. Rooftop equipment bases and support curbs.
4. Cants.
5. Furring.
6. Grounds.

B. Dimension Lumber Items: Standard, Stud, or No. 3 grade lumber of any species.

C. Concealed Boards: 19 percent maximum moisture content and any of the following species and grades:

1. Mixed southern pine or southern pine; No. 2 grade; SPIB.
2. Eastern softwoods; No. 2 Common grade; NeLMA.
3. Northern species; No. 2 Common grade; NLGA.

2.8 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

2.9 FASTENERS

A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.

B. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

C. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC58, ICC-ES AC193, or ICC-ES AC308 as appropriate for the substrate.

2.10 METAL FRAMING ANCHORS

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. Simpson Strong-Tie Co., Inc.
2. USP Structural Connectors.

B. Allowable design loads, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.

C. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, G60 coating designation.

1. Use for interior locations unless otherwise indicated.

D. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A653/A653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.

1. Use for wood-preservative-treated lumber and where indicated.

2.11 MISCELLANEOUS MATERIALS

A. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch nominal thickness, compressible to 1/32 inch; selected from manufacturer's standard widths to suit width of sill members indicated.

B. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.

C. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

D. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

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

C. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

D. Install shear wall panels to comply with manufacturer's written instructions.

E. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

F. Do not splice structural members between supports unless otherwise indicated.

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

H. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

I. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
2. ICC-ES evaluation report for fastener.

3.2 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet enough that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

SECTION 061600 - SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wall sheathing.
2. Roof sheathing.
3. Parapet sheathing.
4. Composite nail base insulated wall sheathing.
5. Subflooring.
6. Underlayment.
7. Sheathing joint and penetration treatment.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product.

1.3 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated plywood.
2. Fire-retardant-treated plywood.
3. Foam-plastic sheathing.

1.4 QUALITY ASSURANCE

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings: As tested according to ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 PRESERVATIVE-TREATED PLYWOOD

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

C. Application: Treat items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

2.3 FIRE-RETARDANT-TREATED PLYWOOD

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201/D3201M at 92 percent relative humidity. Use where exterior type is not indicated.
3. Design Value Adjustment Factors: Treated lumber plywood shall be tested according to ASTM D5516 and design value adjustment factors shall be calculated according to ASTM D6305. Span ratings after treatment shall be not less than span ratings specified. For roof sheathing and where high-temperature fire-retardant treatment is indicated, span ratings for temperatures up to 170 deg F shall be not less than span ratings specified.

C. Kiln-dry material after treatment to a maximum moisture content of 15 percent.

D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.

2.4 WALL SHEATHING

A. Plywood Sheathing: DOC PS 1, Exposure 1, or Structural I sheathing.

B. Paper-Surfaced Gypsum Sheathing: ASTM C1396/C1396M, gypsum sheathing; with water-resistant-treated core and with water-repellent paper bonded to core's face, back, and long edges.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. American Gypsum.
    b. CertainTeed Gypsum.
    c. Georgia-Pacific Gypsum LLC.
    d. National Gypsum Company.
    e. USG Corporation.

2. Type and Thickness: Type X, 5/8 inch thick.

C. Glass-Mat Gypsum Sheathing: ASTM C1177/C1177M.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. CertainTeed Corporation.
    b. CertainTeed Gypsum.
    c. Continental Building Products, LLC.
    d. Georgia-Pacific Gypsum LLC.
    e. National Gypsum Company.
    f. USG Corporation.

2. Type and Thickness: Type X, 5/8 inch thick.

2.5 ROOF SHEATHING

A. Plywood Sheathing: DOC PS 1, sheathing.

2.6 PARAPET / DORMER SHEATHING

A. Plywood Sheathing: DOC PS 1, sheathing.

B. Glass-Mat Gypsum Sheathing: ASTM C1177/C1177M.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. CertainTeed Corporation.
    b. Georgia-Pacific Gypsum LLC.
    c. National Gypsum Company.
    d. USG Corporation.

2. Type and Thickness: Type X, 5/8 inch thick.

2.7 COMPOSITE NAIL-BASE INSULATED WALL SHEATHING

A. Plywood-Surfaced, Polyisocyanurate-Foam Sheathing: ASTM C1289, Type V with DOC PS 2, Exposure 1 plywood on one face.

1. Basis of Design 1: Composite wall panels shall be Xci Ply as manufactured by Hunter Panels with a total thickness of 1.6 inches, with a thermal value of R=6.6 as per ASTM C518 with a compressive strength of 20 psi min. as per ASTM 1621, moisture vapor permeance of less than 1 perm, water absorption of less than 1% by volume as per ASTM C209, resistance to mold to pass ASTM D3272 and a dimensional stability of 2% linear change as per ASTM D2126. ubject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

2. Basis of Design 2: Composite wall panels shall be Xci Ply as manufactured by Hunter Panels with a total thickness of 2.6 inches, with a thermal value of R=12.7 as per ASTM C518 with a compressive strength of 20 psi min. as per ASTM 1621, moisture vapor permeance of less than 1 perm, water absorption of less than 1% by volume as per ASTM C209, resistance to mold to pass ASTM D3272 and a dimensional stability of 2% linear change as per ASTM D2126. ubject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

3. Additional Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Atlas EPS; a Division of Atlas Roofing Corporation.
    b. Cornell Corporation.
    c. Dow Chemical Company (The).
    d. Johns Manville; a Berkshire Hathaway company.
    e. Rmax, Inc.

4. Polyisocyanurate-Foam Thickness: varies – see description of Basis of Design 1 and Basis of Design 2.
5. Plywood Nominal Thickness: 1/2 inch.

2.8 SUBFLOORING AND UNDERLAYMENT

A. Plywood Combination Subfloor-Underlayment: DOC PS 1, Exposure 1, Structural I, Underlayment single-floor panels.

B. Plywood Subflooring: DOC PS 1, Exposure 1, Structural I single-floor panels or sheathing.

C. Underlayment: Provide underlayment in nominal thicknesses indicated or, if not indicated, not less than 1/4 inch over smooth subfloors and not less than 3/8 inch over board or uneven subfloors.

1. Plywood Underlayment for Resilient Flooring: DOC PS 1, Exterior A-C with fully sanded face.

2. Cement Board Underlayment for Ceramic Tile and recessed floor mat installed over plywood subfloor: ASTM C 1288, Interior, to be ¼ inch nominal thickness.

2.9 FASTENERS

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

1. For roof parapet and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.

2.10 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Glass-Mat Gypsum Sheathing: Elastomeric, medium-modulus, neutral-curing silicone joint sealant compatible with joint substrates formed by gypsum sheathing and other materials, recommended by sheathing manufacturer for application indicated and complying with requirements for elastomeric sealants specified in Section 079200 "Joint Sealants."

B. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.

1. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches wide, 10 by 10 or 10 by 20 threads/inch, of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.

C. Sheathing Tape for Foam-Plastic Sheathing: Pressure-sensitive plastic tape recommended by sheathing manufacturer for sealing joints and penetrations in sheathing.

2.11 MISCELLANEOUS MATERIALS

A. Adhesives for Field Gluing Panels to Wood Framing: Formulation complying with APA AFG-01 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in the ICC's International Residential Code for One- and Two-Family Dwellings.
3. ICC-ES evaluation report for fastener.

D. Coordinate wall parapet and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:

1. Combination Subfloor-Underlayment:

    a. Glue and nail to wood framing.
    b. Screw to cold-formed metal framing.
    c. Space panels 1/8 inch apart at edges and ends.

2. Subflooring:

    a. Glue and nail to wood framing.
    b. Screw to cold-formed metal framing.
    c. Space panels 1/8 inch apart at edges and ends.

3. Wall and Roof Sheathing:

    a. Nail to wood framing. Apply a continuous bead of glue to framing members at edges of wall sheathing panels.
    b. Screw to cold-formed metal framing.
    c. Space panels 1/8 inch apart at edges and ends.

4. Underlayment:

    a. Nail to subflooring.
    b. Space panels 1/32 inch apart at edges and ends.
    c. Fill and sand edge joints of underlayment receiving resilient flooring immediately before installing flooring.

3.3 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.

1. Fasten gypsum sheathing to wood framing with screws.
2. Fasten gypsum sheathing to cold-formed metal framing with screws.
3. Install panels with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
4. Install panels with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Seal sheathing joints according to sheathing manufacturer's written instructions.

1. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

3.4 FOAM-PLASTIC SHEATHING INSTALLATION

A. Comply with manufacturer's written instructions.

B. Foam-Plastic Wall Sheathing: Install vapor-relief strips or equivalent for permitting escape of moisture vapor that otherwise would be trapped in stud cavity behind sheathing.

C. Apply sheathing tape to joints between foam-plastic sheathing panels and at items penetrating sheathing. Apply at upstanding flashing to overlap both flashing and sheathing.

3.5 STRUCTURAL CONCRETE PANEL INSTALLATION

A. Comply with CPA's recommendations and structural concrete panel manufacturer's written instructions for preparing and applying hardboard underlayment.

1. Use fasteners recommended by panel manufacturer.

2. Install the fasteners at recommended spacing and distance from the ends (square cut) and edges (tongue and groove) of the panel.

3. Length of fasteners may be of any length recommended by the manufacturer but shall not be larger unless specified by the structural engineer.

END OF SECTION 061600

SECTION 062023 - INTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior trim, including non-fire-rated interior door and sidelight frames.
2. Shelving and clothes rods.

1.2 DEFINITIONS

A. MDF: Medium-density fiberboard.

B. PVC: Polyvinyl chloride.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product.

B. Samples: For each exposed product and for each color and texture specified.

1.4 QUALITY ASSURANCE

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with applicable rules of any rules-writing agency certified by the American Lumber Standard Committee's (ALSC) Board of Review. Grade lumber by an agency certified by the ALSC's Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by grading agency.

B. Softwood Plywood: DOC PS 1.

C. Hardboard: ANSI A135.4.

D. MDF: ANSI A208.2, Grade 130.

E. Particleboard: ANSI A208.1, Grade M-2.

2.2 INTERIOR TRIM

A. Softwood Lumber Trim for Transparent Finish (Stain or Clear Finish):

1. Species and Grade: Eastern white pine; NeLMA or NLGA Finish or 1 Common. Or equivalent species and grade
2. Maximum Moisture Content: 15 percent with at least 85 percent of shipment at 12 percent or less.
3. Finger Jointing: Allowed only at wood receiving opaque finish.
4. Face Surface: Surfaced (smooth).

B. Hardwood Lumber Trim for Transparent Finish (Stain or Clear Finish):

1. Species and Grade: Red oak or yellow poplar; NHLA Clear.
2. Maximum Moisture Content: 10 percent.
3. Finger Jointing: Not allowed.
4. Gluing for Width: Use for lumber trim wider than 6 inches.
5. Veneered Material: Not allowed.
6. Face Surface: Surfaced (smooth).
7. Matching: Selected for compatible grain and color.

C. Lumber Trim for Opaque Finish (Painted Finish):

1. Species and Grade: Eastern white pine; NeLMA or NLGA Finish or 1 Common. Or equivalent species and grade.
2. Maximum Moisture Content: 15 percent with at least 85 percent of shipment at 12 percent or less.
3. Maximum Moisture Content: 10 percent.
4. Finger Jointing: Allowed.
5. Face Surface: Surfaced (smooth).
6. Optional Material: Primed MDF of same actual dimensions as lumber indicated may be used in lieu of lumber.

D. Softwood Moldings for Transparent Finish (Stain or Clear Finish): MMPA WM 4, N-grade wood moldings. Made to patterns included in MMPA's "WM/Series Softwood Moulding Patterns."

1. Species: Eastern White. Pine; NeLMA or NLGA Finish or 1 common
2. Maximum Moisture Content: 15 percent with at least 85 percent of shipment at 12 percent or less.
3. Finger Jointing: Not allowed.
4. Matching: Selected for compatible grain and color.
5. Base Pattern: WM 623, 9/16-by-3-1/4-inch ogee base.
6. Shoe-Mold Pattern: WM 129, 7/16-by-11/16-inch quarter-round shoe mold.
7. Casing Pattern: WM 324, 11/16-by-2-1/4-inch casing.
8. Mull-Casing Pattern: WM 973, 3/8-by-1-3/4-inch bullnose casing.
9. Stop Pattern: WM 886, 3/8-by-1-3/8-inch bullnose stop.
10. Chair-Rail Pattern: WM 297, 11/16-by-3-inch chair rail.

E. Hardwood Moldings for Transparent Finish (Stain or Clear Finish): MMPA WM 4, N-grade wood moldings made to patterns included in MMPA's "HWM/Series Hardwood Moulding Patterns."

1. Species: Red oak or yellow poplar.
2. Maximum Moisture Content: 9 percent.
3. Finger Jointing: Not allowed.
4. Matching: Selected for compatible grain and color.
5. Optional Material: Kiln-dried softwood or MDF, with exposed surfaces veneered with species indicated, may be used in lieu of solid wood.
6. Base Pattern: HWM 633, 7/16-by-3-1/4-inch ogee base.
7. Shoe-Mold Pattern: HWM 129, 7/16-by-11/16-inch quarter-round shoe mold.
8. Casing Pattern: WM 324, 1/2-by-2-1/4-inch casing.
9. Mull-Casing Pattern: HWM 989, 3/16-by-2-inch square-edge casing.
10. Stop Pattern: HWM 886, 3/8-by-1-3/8-inch bullnose stop.
11. Chair-Rail Pattern: HWM 297, 11/16-by-3-inch chair rail.

F. Moldings for Opaque Finish (Painted Finish): Made to patterns included in MMPA's "WM/Series Softwood Moulding Patterns."

1. Softwood Moldings: MMPA WM 4, P grade.

    a. Species: Eastern white.
    b. Maximum Moisture Content: 15 percent with at least 85 percent of shipment at 12 percent or less.

2. Hardwood Moldings: MMPA WM 4, P-grade.

    a. Species: Yellow poplar.
    b. Maximum Moisture Content: 9 percent.

3. Finger Jointing: Allowed.
4. Optional Material: Primed MDF.
5. Base Pattern: WM 623, 9/16-by-3-1/4-inch ogee base.
6. Shoe-Mold Pattern: WM 129, 7/16-by-11/16-inch quarter-round shoe mold.
7. Casing Pattern: WM 324, 11/16-by-2-1/4-inch casing.
8. Mull-Casing Pattern: WM 973, 3/8-by-1-3/4-inch bullnose casing.
9. Stop Pattern: WM 886, 3/8-by-1-3/8-inch bullnose stop.
10. Chair-Rail Pattern: WM 297, 11/16-by-3-inch chair rail.

2.3 PANELING

A. Hardwood Veneer Plywood Paneling: Manufacturer's stock hardwood plywood panels complying with HPVA HP-1.

1. Face Veneer Species and Cut: Rotary-cut white birch Plain-sliced red oak.
2. Veneer Matching: Selected for similar color and grain.
3. Backing Veneer Species: Same species as face veneer.
4. Construction: Veneer core.
5. Thickness: 1/4 inch.

6. Panel Size: 48 by 96 inches.
7. Glue Bond: Type II (interior).
8. Face Pattern: Manufacturer's standard channel-grooved pattern, with grooves at edges, center, and third points of panels, and at other locations to provide pattern resembling random-width boards.
9. Finish: As selected by Engineer/Architect from manufacturer's full range.

B. Hardboard Paneling: Interior factory-finished hardboard paneling complying with ANSI A135.5.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Georgia-Pacific Gypsum LLC.
   b. Marlite.

2. Thickness: 1/4 inch.
3. Finish: Class I.
4. Surface-Burning Characteristics: As follows, tested according to ASTM E84:

   a. Flame-Spread Index: 25 or less.
   b. Smoke-Developed Index: 450 or less.

5. Colors, Textures, and Patterns: As selected by Engineer/Architect from manufacturer's full range.

C. Board Paneling: Interior wood-board paneling complying with MMPA WM 9.

1. Species: Eastern white pine.
2. Grade: Clear No. 2.
3. Maximum Moisture Content: 15 percent with at least 85 percent of shipment at 12 percent or less.
4. Pattern: V-joint, tongue and groove, PT 82.
5. Net Coverage Width: Not less than 6-3/4 inches.

D. Board Paneling:

1. Species and Grade: Eastern white pine; NeLMA or NLGA Finish or 1 Common.
2. Species and Grade: Idaho white, lodgepole, ponderosa, radiata, or sugar pine; NLGA or WWPA 1 Common (Colonial).
3. Species and Grade: Eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine; NeLMA, NLGA, or WWPA Finish or 1 Common (Colonial).
4. Species and Grade: Southern pine; SPIB B & B Paneling.
5. Species and Grade: Western red cedar; NLGA, WCLIB, or WWPA Clear Heart.
6. Maximum Moisture Content: 15 percent with at least 85 percent of shipment at 12 percent or less.
7. Pattern: V-joint, tongue and groove, NeLMA EWP 4 SPIB SPP 54 or WWPA WP 4.
8. Sizes in "Net Coverage Width" Subparagraph below represent 6-, 8-, and 10-inch (150-, 200-, 254-mm) nominal widths.
9. Net Coverage Width: Not less than 6-3/4 inches.

2.4 SHELVING AND CLOTHES RODS

A. Closet Shelving: Made from one of the following materials, 3/4 inch thick:
   1. MDF with solid-wood front edge.

B. Adjustable Shelf Brackets: BHMA A156.9, B04112; powder-coat-finished steel.

C. Clothes Rods: 1-5/16-inch-diameter, aluminum tubes.

D. Rod Flanges: Aluminum.

2.5 MISCELLANEOUS MATERIALS

A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.

B. Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.

C. Multipurpose Construction Adhesive: Formulation, complying with ASTM D3498, that is recommended for indicated use by adhesive manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

B. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours unless longer conditioning is recommended by manufacturer.

3.2 INSTALLATION, GENERAL

A. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials.

   1. Use concealed shims where necessary for alignment.
   2. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
   3. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.
   4. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining interior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
   5. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.

3.3 STANDING AND RUNNING TRIM INSTALLATION

A. Install trim with minimum number of joints as is practical, using full-length pieces from maximum lengths of lumber available.

1. Do not use pieces less than 24 inches long, except where necessary.
2. Stagger joints in adjacent and related standing and running trim.
3. Miter at returns, miter at outside corners, and cope at inside corners to produce tight-fitting joints with full-surface contact throughout length of joint.
4. Use scarf joints for end-to-end joints.
5. Plane backs of casings to provide uniform thickness across joints where necessary for alignment.
6. Match color and grain pattern of trim for transparent finish (stain or clear finish) across joints.
7. Install trim after gypsum-board joint finishing operations are completed.
8. Install without splitting; drill pilot holes before fastening where necessary to prevent splitting.
9. Fasten to prevent movement or warping.
10. Countersink fastener heads on exposed carpentry work and fill holes.

3.4 SHELVING AND CLOTHES ROD INSTALLATION

A. Cut shelf cleats at ends of shelves about 1/2 inch less than width of shelves and sand exposed ends smooth.

1. Install shelf cleats by fastening to framing or backing with finish nails or trim screws, set below face and filled.
2. Space fasteners not more than 16 inches o.c. Use two fasteners at each framing member or fastener location for cleats 4 inches nominal in width and wider.
3. Apply a bead of multipurpose construction adhesive to back of shelf cleats before installing.
4. Remove adhesive that is squeezed out after fastening shelf cleats in place.

B. Install shelf brackets according to manufacturer's written instructions, spaced not more than 32 inches o.c. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors.

C. Install standards for adjustable shelf supports according to manufacturer's written instructions. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors. Space fasteners not more than 12 inches o.c.

D. Install standards for adjustable shelf brackets according to manufacturer's written instructions, spaced not more than 36 inches o.c. and within 6 inches of ends of shelves. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors.

E. Cut shelves to neatly fit openings with only enough gap to allow shelves to be removed and reinstalled.

1. Install shelves, fully seated on cleats, brackets, and supports.
2. Fasten shelves to cleats with finish nails or trim screws, set flush.

3. Fasten shelves to brackets to comply with bracket manufacturer's written instructions.

F. Install rod flanges for rods as indicated.

1. Fasten to shelf cleats, framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors.
2. Install rods in rod flanges.

END OF SECTION 062023

SECTION 064113 - WOOD-VENEER-FACED ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood-veneer-faced architectural cabinets.
2. Wood furring, blocking, shims, and hanging strips for installing architectural cabinets that are not concealed within other construction.
3. Shop finishing of architectural cabinets.

B. Related Requirements:

1. Section 1264000 "Stone Countertops" for countertops, back-splashes and side-splashes to coordinate with work specified in this section.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Location to be determined.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings: For architectural cabinets.

1. Include plans, elevations, sections, and attachment details.
2. Product catalogue information including finish and color selection options.

C. Samples: For each exposed product and for each color and finish specified.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Research reports.

C. Field quality control reports.

1.5 CLOSEOUT SUBMITTALS

A. Quality Standard Compliance Certificates: KCMA and ANSI A161.1 standards.

1.6 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1. Manufacturer's product quality is fabricated to meet the KCMA and ANSI A161.1 standards.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL CABINET MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. KraftMaid
2. Medallion
3. Diamond
4. Omega

2.2 CABINETS, GENERAL

A. Quality Standard: Unless otherwise indicated, meet or exceed the ANSI A161.1 performance and construction standards and finishes and other requirements for kitchen and vanity cabinets as certified by ICC-ES (International Code Council – Evaluation Service).

2.3 WOOD CABINETS FOR TRANSPARENT FINISH

A. Architectural Woodwork Standards Grade: Premium Custom.

B. Type of Construction: Face frame.

C. Door and Drawer-Front Style: Reveal overlay.

1. Reveal Dimension: 1/2 inch.

D. Wood for Exposed Surfaces: As indicated on Drawings.

1. Species: Red oak
2. Cut: Plain sliced/plain sawn.
3. Grain Direction: Vertically for doors and fixed panels, horizontally for drawer fronts.
4. Matching of Veneer Leaves: Book match.

5. Veneer Matching within Panel Face: Balance match.

E. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.

1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners.

2.4 WOOD CABINETS FOR OPAQUE FINISH

A. Architectural Woodwork Standards Grade: Custom.

B. Type of Construction: Face frame.

C. Door and Drawer-Front Style: Reveal overlay.

1. Reveal Dimension: 1/2 inch.

D. Species for Exposed Lumber Surfaces: Any closed-grain hardwood.

E. Panel Product for Exposed Surfaces: Medium-density overlay.

F. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.

1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners.

2.5 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches wide.
2. Wood Moisture Content: 8 to 13 percent.

B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

2.6 FIRE-RETARDANT-TREATED MATERIALS

A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials that are acceptable to authorities having jurisdiction as determined by testing performed on identical products by a qualified testing agency.

1. Use treated materials that comply with requirements of referenced quality standard. Do not use materials that are warped, discolored, or otherwise defective.

2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.

2.7 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 087100 "Door Hardware."

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Häfele America Co.
b. Blum, Julius & Co., Inc.

B. Butt Hinges: 2-3/4-inch, five-knuckle steel hinges made from 0.095-inch-thick metal, and as follows:

1. Semiconcealed Hinges for Flush Doors: ANSI/BHMA A156.9, B01361.
2. Semiconcealed Hinges for Overlay Doors: ANSI/BHMA A156.9, B01521.

C. Frameless Concealed Hinges (European Type): ANSI/BHMA A156.9, B01602, 100 degrees of opening.

D. Back-Mounted Pulls: ANSI/BHMA A156.9, B02011.

E. Wire Pulls: Back mounted, solid metal, 4 inches long, 5/16 inch in diameter.

F. Catches: Magnetic catches, ANSI/BHMA A156.9, B03141.

G. Adjustable Shelf Standards and Supports: ANSI/BHMA A156.9, B04071; with shelf rests, B04081.

H. Shelf Rests: ANSI/BHMA A156.9, B04013; metal.

I. Drawer Slides: ANSI/BHMA A156.9.

1. Grade 1 and Grade 2: Side mounted and extending under bottom edge of drawer.

a. Type: Partial extension.
b. Material: Zinc-plated steel with polymer rollers.

2. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-extension type; zinc-plated-steel, ball-bearing slides.
3. For drawers not more than 3 inches high and not more than 24 inches wide, provide Grade 1.

4. For drawers more than 3 inches high, but not more than 6 inches high and not more than 24 inches wide, provide Grade 1HD-100.
5. For drawers more than 6 inches high or more than 24 inches wide, provide Grade 1HD-100.
6. For computer keyboard shelves, provide Grade 1HD-100.
7. For trash bins not more than 20 inches high and 16 inches wide, provide Grade 1HD-100.

J. Door Locks: ANSI/BHMA A156.11, E07121.

K. Drawer Locks: ANSI/BHMA A156.11, E07041.

L. Door and Drawer Silencers: ANSI/ BHMA A156.16, L03011.

M. Grommets for Cable Passage: 1-1/4-inch OD, molded-plastic grommets and matching plastic caps with slot for wire passage.

1. Color: To be selected by Architect from Manufacturer’s full range of colors.

N. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with ANSI/BHMA A156.18 for BHMA finish number indicated.

1. Dark, Oxidized, Satin Bronze, Oil Rubbed: ANSI/BHMA 613 for bronze base; ANSI/BHMA 640 for steel base; match Architect's sample.
2. Bright Brass, Clear Coated: ANSI/BHMA 605 for brass base; ANSI/BHMA 632 for steel base.
3. Bright Brass, Vacuum Coated: ANSI/BHMA 723 for brass base; ANSI/BHMA 729 for zinc-coated-steel base.
4. Satin Brass, Blackened, Bright Relieved, Clear Coated: ANSI/BHMA 610 for brass base; ANSI/BHMA 636 for steel base.
5. Satin Chromium Plated: ANSI/BHMA 626 for brass or bronze base; ANSI/BHMA 652 for steel base.
6. Bright Chromium Plated: ANSI/BHMA 625 for brass or bronze base; ANSI/BHMA 651 for steel base.
7. Satin Stainless Steel: ANSI/BHMA 630.

O. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in ANSI/BHMA A156.9.

2.8 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

2.9 FABRICATION

A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

C. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

2.10 SHOP FINISHING

A. General: Finish architectural cabinets at manufacturer's shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

B. General: Shop finish transparent-finished architectural cabinets at manufacturer's shop as specified in this Section. See Section 099123 "Interior Painting" for field finishing of opaque-finished architectural cabinets.

C. General: Drawings indicate items that are required to be shop finished. Finish these items at manufacturer's shop as specified in this Section. See Section 099123 "Interior Painting" for field finishing of architectural cabinets.

D. Shop Priming: Shop apply the prime coat including backpriming, if any, for transparent-finished items specified to be field finished. See Section 099123 "Interior Painting" for material and application requirements.

E. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural cabinets, as applicable to each unit of work.

1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of cabinets.

F. Transparent Finish:

1. Architectural Woodwork Standards Grade: Custom.
2. Finish: System - 8, water-based crosslinking acrylic.
3. Wash Coat for Closed-Grain Woods: Apply wash-coat sealer to cabinets made from closed-grain wood before staining and finishing.
4. Staining: Color to be selected by Architect.
5. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.
6. Filled Finish for Open-Grain Woods: After staining, apply wash-coat sealer and allow to dry. Apply paste wood filler and wipe off excess. Tint filler to match stained wood.
7. Sheen: Satin, 31-45 gloss units measured on 60-degree gloss meter per ASTM D523.

G. Opaque Finish:

1. Architectural Woodwork Standards Grade: Custom.
2. Finish: System - 8, water-based crosslinking acrylic.
3. Color: Color to be selected by Architect.
4. Sheen: Satin, 31-45 gloss units measured on 60-degree gloss meter per ASTM D523.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

B. Architectural Woodwork Standards Grade: Install cabinets to comply with quality standard grade of item to be installed.

C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with cabinet surface.

1. For shop-finished items, use filler matching finish of items being installed.

D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches using concealed shims.

1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
3. Maintain veneer sequence matching of cabinets with transparent finish.
4. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch penetration into wood framing, blocking, or hanging strips.

E. Shop Finishes: Touch up finishing after installation of architectural cabinets. Fill nail holes with matching filler.

F. Field Finishing: See Section 099123 "Interior Painting" for finishing of installed architectural cabinets.

3.2 CLEANING

A. Clean and touch up minor finish damage. Remove and replace components that cannot be successfully cleaned and repaired.

END OF SECTION 064113

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Extruded polystyrene foam-plastic board insulation.
2. Polyisocyanurate foam-plastic board insulation.
3. Glass-fiber blanket insulation.
4. Mineral-wool blanket insulation.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Extruded polystyrene foam-plastic board insulation.
2. Polyisocyanurate foam-plastic board insulation.
3. Glass-fiber blanket insulation.
4. Mineral-wool blanket insulation.

1.3 INFORMATIONAL SUBMITTALS

A. Installer's Certification: Listing type, manufacturer, and R-value of insulation installed in each element of the building thermal envelope.

1. Sign, date, and post the certification in a conspicuous location on Project site.

B. Product test reports.

C. Research reports.

PART 2 - PRODUCTS

2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION

A. Extruded Polystyrene Board Insulation, Type X: ASTM C578, Type X, 15-psi minimum compressive strength; unfaced.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Dow Chemical Company (The).

b. Owens Corning.

2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
3. Smoke-Developed Index: Not more than 450 when tested in accordance with ASTM E84.
4. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
5. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

B. Extruded Polystyrene Board Insulation, Type V: ASTM C578, Type V, 100-psi minimum compressive strength.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Dow Chemical Company (The).
b. Owens Corning.

2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
3. Smoke-Developed Index: Not more than 450 when tested in accordance with ASTM E84.
4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.2 POLYISOCYANURATE FOAM-PLASTIC BOARD INSULATION

A. Polyisocyanurate Board Insulation, Foil Faced: ASTM C1289, foil faced, Type I, Class 1 or 2.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Carlisle Coatings & Waterproofing Inc.
b. Dow Chemical Company (The).
c. Hunter Panels.

2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
3. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.3 GLASS-FIBER BLANKET INSULATION

A. Glass-Fiber Blanket Insulation, Kraft Faced: ASTM C665, Type II (nonreflective faced), Class C (faced surface not rated for flame propagation); Category 1 (membrane is a vapor barrier).

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Owens Corning.

2. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.4 MINERAL-WOOL BLANKET INSULATION – FOR INTERIOR SOUND CONTROL

A. Mineral-Wool Blanket Insulation, Unfaced: ASTM C665, Type I (blankets without membrane facing); consisting of fibers; passing ASTM E136 for combustion characteristics.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Johns Manville; a Berkshire Hathaway company.
b. Rockwool International.
c. Thermafiber, Inc.; an Owens Corning company.

2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
3. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.5 ACCESSORIES

A. Insulation for Miscellaneous Voids:

1. Glass-Fiber Insulation: ASTM C764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E84.
2. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.

B. Insulation Anchors, Spindles, and Standoffs: As recommended by manufacturer.

C. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

D. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide ventilation between insulated attic spaces and vented eaves.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Install insulation with manufacturer's R-value label exposed after insulation is installed.

D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.2 INSTALLATION OF SLAB INSULATION

A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.

1. If not otherwise indicated, extend insulation a minimum of 36 inches below exterior grade line.

B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

1. If not otherwise indicated, extend insulation in 36 inches minimum from exterior walls.

3.3 INSTALLATION OF FOUNDATION WALL INSULATION

A. Butt panels together for tight fit.

B. Anchor Installation: Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors.

C. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing according to manufacturer's written instructions.

3.4 INSTALLATION OF CAVITY-WALL INSULATION

A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face and as recommended by manufacturer.

1. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions, and with faces flush.
2. Press units firmly against inside substrates.
3. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Section 047200 "Cast Stone Masonry."

3.5 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. Attics: Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
5. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
6. For wood-framed construction, install blankets to meet ASTM C1320 and as follows:

    a. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.

7. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.

    a. Exterior Walls: Set units with facing placed toward air space.
    b. Interior Walls: Set units with facing placed toward areas of high humidity if applicable.

B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft..
2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.6 INSTALLATION OF CURTAIN-WALL INSULATION

A. Install board insulation in curtain-wall construction according to curtain-wall manufacturer's written instructions.

1. Hold insulation in place by securing metal clips and straps or integral pockets within window frames, spaced at intervals recommended in writing by insulation manufacturer to hold insulation securely in place without touching spandrel glass. Maintain cavity width of dimension indicated on Drawings between insulation and glass.
2. Install insulation to fit snugly without bowing.

END OF SECTION 072100

SECTION 072119 - FOAMED-IN-PLACE INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Open-cell spray polyurethane foam.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Research reports.

PART 2 - PRODUCTS

2.1 OPEN-CELL SPRAY POLYURETHANE FOAM

A. Open-Cell Spray Polyurethane Foam: Spray-applied polyurethane foam using water as a blowing agent. Minimum density of 0.5 lb/cu. ft. and minimum aged R-value at 1-inch thickness of 3.4 deg F x h x sq. ft./Btu at 75 deg F.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. BASF Corporation.
b. Demilec (USA) LLC.
c. Icynene-Lapolla; Icynene.
d. Johns Manville; a Berkshire Hathaway company.

2. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 450 or less.

3. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Spray insulation to envelop entire area to be insulated and fill voids.

C. Apply in multiple passes to not exceed maximum thicknesses recommended by manufacturer. Do not spray into rising foam.

END OF SECTION 072119

SECTION 072500 - WEATHER BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Building paper.
2. Building wrap.
3. Flexible flashing.
4. Drainage material.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For water-resistive barrier and flexible flashing, from ICC-ES.

PART 2 - PRODUCTS

2.1 WATER-RESISTIVE BARRIER

A. Building Wrap: ASTM E1677, Type I air barrier; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E84; UV stabilized; and acceptable to authorities having jurisdiction.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Dow Chemical Company (The).
b. DuPont Safety and Construction.
c. TYPAR.

2. Water-Vapor Permeance: Not less than 8 perms per ASTM E96/E96M, Desiccant Method (Procedure A).
3. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.

B. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

2.2 FLEXIBLE FLASHING

A. Butyl Rubber Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. DuPont Safety and Construction.
    b. TYPAR.
2. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.

B. Rubberized-Asphalt Flashing: Composite, self-adhesive, flashing product consisting of a pliable, rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Carlisle Coatings & Waterproofing Inc.
    b. TYPAR.
2. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.

2.3 DRAINAGE MATERIAL

A. Drainage Material: Product shall maintain a continuous open space between water-resistive barrier and exterior cladding to create a drainage plane and shall be used under siding.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. DuPont Safety and Construction.
    b. Insulfoam; Carlisle Construction Materials Company.
    c. TYPAR.
2. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.

PART 3 - EXECUTION

3.1 WATER-RESISTIVE BARRIER INSTALLATION

A. Cover sheathing with water-resistive barrier as follows:

1. Cut back barrier 1/2 inch on each side of the break in supporting members at expansion- or control-joint locations.
2. Apply barrier to cover vertical flashing with a minimum 4-inch overlap unless otherwise indicated.

B. Building Paper: Apply horizontally with a 2-inch overlap and a 6-inch end lap; fasten to sheathing with galvanized staples or roofing nails.

C. Building Wrap: Comply with manufacturer's written instructions and warranty requirements.

1. Seal seams, edges, fasteners, and penetrations with tape.
2. Extend into jambs of openings and seal corners with tape.

3.2 FLEXIBLE FLASHING INSTALLATION

A. Apply flexible flashing where indicated to comply with manufacturer's written instructions.

1. Lap seams and junctures with other materials at least 4 inches except that at flashing flanges of other construction, laps need not exceed flange width.
2. Lap flashing over water-resistive barrier at bottom and sides of openings.
3. Lap water-resistive barrier over flashing at heads of openings.

3.3 DRAINAGE MATERIAL INSTALLATION

A. Install drainage material over building wrap and flashing to comply with manufacturer's written instructions.

END OF SECTION 072500

SECTION 072600 - VAPOR RETARDERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Polyethylene vapor retarders.
2. Reinforced-polyethylene vapor retarders.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for under-slab vapor retarders.
2. Section 072100 "Thermal Insulation" for vapor retarders integral with insulation products.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Product test reports.

PART 2 - PRODUCTS

2.1 POLYETHYLENE VAPOR RETARDERS

A. Polyethylene Vapor Retarders: ASTM D4397, 6-mil- thick sheet, with maximum permeance rating of 0.1 perm.

2.2 REINFORCED-POLYETHYLENE VAPOR RETARDERS

A. Reinforced-Polyethylene Vapor Retarders: Sheet with outer layers of polyethylene film laminated to an inner reinforcing layer consisting of either nylon cord or polyester scrim and weighing not less than 42 lb/1000 sq. ft., with maximum permeance rating of 0.1 perm.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. ISI Building Products.
b. Raven Industries, Inc.

c. Reef Industries, Inc.

PART 3 - EXECUTION

3.1 INSTALLATION OF VAPOR RETARDERS ON FRAMING

A. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives, vapor retarder fasteners, or other anchorage system as recommended by manufacturer. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

B. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs and sealing with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Locate all joints over framing members or other solid substrates.

C. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.

D. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

END OF SECTION 072600

SECTION 074113.16 - STANDING-SEAM METAL ROOF PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Standing-seam metal roof panels.

B. Related requirements:
1. Section 077253 “Snow Guards”

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at a location to be determined.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.

C. Samples: For each type of metal panel indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Warranties: Sample of special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of work.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: 20 years from date of Substantial Completion.

C. Special Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Energy Performance: Provide roof panels that are listed on the EPA/DOE's ENERGY STAR "Roof Product List" for low-slope roof products.

B. Energy Performance: Provide roof panels according to one of the following when tested according to CRRC-1:

1. Three-year, aged solar reflectance of not less than 0.55 and emissivity of not less than 0.75.
2. Three-year, aged Solar Reflectance Index of not less than 64 when calculated according to ASTM E1980.

C. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.
3. Deflection Limits: For wind loads, no greater than 1/240 of the span.

D. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E1680 or ASTM E283 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft..

E. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E1646 or ASTM E331 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft..

F. Hydrostatic-Head Resistance: No water penetration when tested according to ASTM E2140.

G. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.

1. Uplift Rating: UL 90.

H. FM Global Listing: Provide metal roof panels and component materials that comply with requirements in FM Global 4471 as part of a panel roofing system and that are listed in FM Global's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.

1. Fire/Windstorm Classification: Class 1A- 90.
2. Hail Resistance: MH.

I. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.2 STANDING-SEAM METAL ROOF PANELS

A. Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.

1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E1514.
2. Aluminum Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E1637.

B. Vertical-Rib, Seamed-Joint, Standing-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and intermediate stiffening ribs symmetrically spaced between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels, engaging opposite edge of adjacent panels, and mechanically seaming panels together.

1. Basis of Design: S2500 metal roof system as manufactured by Englert, Inc. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Berridge Manufacturing Co.

b. McElroy Metal, Inc.

c. MBCI Metal Roof and Wall Systems, Inc.

2. Aluminum Sheet: Coil-coated sheet, ASTM B209, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.

a. Structural Support: Over open framing.
b. Materials: Metallic coated steel
c. Panel Profile: Intermediate stiffening ribs symmetrically spaced between seams
d. Panel Coverage: 16 inches.
e. Panel Height: 2 inches.
f. Thickness: 22 gauge.
g. Exterior Finish: Two-coat fluoropolymer.
h. Color: As selected by Engineer/Architect from manufacturer's full range.

3. Clips: One-piece fixed to accommodate thermal movement.

a. Material: 0.028-inch- nominal thickness, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.

b. Clip Spacing: 36 inches or at purlin spacings. To be coordinated.

2.3 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 30 mils thick, consisting of slip-resistant, polyethylene-film top surface laminated to a layer of butyl or SBS-modified asphalt adhesive, with release-paper backing. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: Stable after testing at 240 deg F; ASTM D1970.
2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F; ASTM D1970.

3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Carlisle WIP Products; a brand of Carlisle Construction Materials.
b. Henry Company.
c. Owens Corning.

B. Felt Underlayment: ASTM D226/D226M, Type II (No. 30), asphalt-saturated organic felts.

C. Slip Sheet: Manufacturer's recommended slip sheet, of type required for application.

2.4 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C645; cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 coating designation or ASTM A792/A792M, Class AZ50 coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fascia, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

D. Gutters and Downspouts: Formed from same material as roof panels according to SMACNA's "Architectural Sheet Metal Manual." Finish to match roof fascia and rake trim.

E. Roof Curbs: Fabricated from same material as roof panels, 0.048-inch nominal thickness; with bottom of skirt profiled to match roof panel profiles and with welded top box and integral full-length cricket. Fabricate curb subframing of 0.060-inch-nominal thickness, angle-, C-, or Z-shaped steel sheet. Fabricate curb and subframing to withstand indicated loads of size and height indicated. Finish roof curbs to match metal roof panels.

F. Panel Fasteners: Self-tapping screws designed to withstand design loads.

G. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing; 1/2 inch wide and 1/8 inch thick.
2. Joint Sealant: ASTM C920; as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

2.5 FABRICATION

A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.

C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

2.6 FINISHES

A. Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat.
2. Concealed Finish: White or light-colored acrylic or polyester backer finish.

PART 3 - EXECUTION

3.1 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.

3.2 INSTALLATION OF UNDERLAYMENT

A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated on Drawings, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.
1. Apply over the roof area indicated below:

a. Roof perimeter for a distance up from eaves of 36 inches beyond interior wall line.
b. Valleys, from lowest point to highest point, for a distance on each side of 18 inches. Overlap ends of sheets not less than 6 inches.
c. Rake edges for a distance of 18 inches.
d. Hips and ridges for a distance on each side of 12 inches.
e. Roof-to-wall intersections for a distance from wall of 18 inches.

f. Around dormers, chimneys, skylights, and other penetrating elements for a distance from element of 18 inches.

B. Slip Sheet: Apply slip sheet over underlayment before installing metal roof panels.

C. Flashings: Install flashings to cover underlayment to comply with requirements specified in Section 076200 "Sheet Metal Flashing and Trim."

3.3 INSTALLATION OF STANDING SEAM METAL ROOF PANELS

A. Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.

1. Install clips to supports with self-tapping fasteners.
2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
4. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.
5. Watertight Installation:

a. Apply a continuous ribbon of sealant or tape to seal joints of metal panels, using sealant or tape as recommend in writing by manufacturer as needed to make panels watertight.
b. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
c. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

B. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

C. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

3.4 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

END OF SECTION 074113.16

SECTION 074213.13 - FORMED METAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concealed-fastener, lap-seam metal wall panels.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project Site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.

C. Samples: For each type of metal panel indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Warranties: Samples of special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of work.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.
3. Deflection Limits: For wind loads, no greater than 1/180 of the span.

B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E283 at the following test-pressure difference:

1. Test-Pressure Difference: 1.57 lbf/sq. ft..

C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E331 at the following test-pressure difference:

1. Test-Pressure Difference: 2.86 lbf/sq. ft..

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

E. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 CONCEALED-FASTENER, LAP-SEAM METAL WALL PANELS

A. Provide factory-formed metal panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps. Include accessories required for weathertight installation.

B. Flush-Profile, Concealed-Fastener Metal Wall Panels: Formed with horizontal panel edges and a flat pan between panel edges; with flush joint between panels.

1. Basis of Design: ATAS International, Int. Opaline 8” wide panels (OPF Profile)

2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. ATAS International, Inc.
   b. Berridge Manufacturing Company.
   c. PAC-CLAD; Petersen Aluminum Corporation; a Carlisle company.

3. Aluminum Sheet: Coil-coated sheet, ASTM B209, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.

   a. Thickness: 0.024 inch.
   b. Surface: Smooth, flat finish.
   c. Exterior Finish: Two-coat fluoropolymer.
   d. Color: As selected by Engineer/Architect from manufacturer's full range.

4. Panel Coverage: 12 inches.
5. Panel Height: 1 inches.

2.3 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 coating designation or ASTM A792/A792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing; 1/2 inch wide and 1/8 inch thick.
2. Joint Sealant: ASTM C920; as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

2.4 FABRICATION

A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.

C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

2.5 FINISHES

A. Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat.
2. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil for primer and 0.8 mil for topcoat.

3. Concealed Finish: White or light-colored acrylic or polyester backer finish.

PART 3 - EXECUTION

3.1 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.

3.2 INSTALLATION

A. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

1. Lap ribbed or fluted sheets one full rib. Apply panels and associated items true to line for neat and weathertight enclosure.
2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
5. Flash and seal panels with weather closures at perimeter of all openings.

B. Watertight Installation:

1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels; and elsewhere as needed to make panels watertight.
2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
3. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

C. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

D. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

3.3 CLEANING

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

END OF SECTION 074213.13

SECTION 074293 - SOFFIT PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes metal soffit panels.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.

C. Samples: For each type of metal panel indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Warranties: Samples of special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.
3. Deflection Limits: For wind loads, no greater than 1/240 of the span.

B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E283 at the following test-pressure difference:

1. Test-Pressure Difference: 1.57 lbf/sq. ft.

C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E331 at the following test-pressure difference:

1. Test-Pressure Difference: 2.86 lbf/sq. ft.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient.

2.2 METAL SOFFIT PANELS

A. General: Provide metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.

B. Metal Soffit Panels: Match profile and material of metal roof panels.

1. Finish: Color to be as selected by Engineer/Architect from manufacturer's full range of colors.
2. Sealant: Factory applied within interlocking joint.

C. V-Groove-Profile Metal Soffit Panels: Perforated panels formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced between panel edges; with a V-groove joint between panels.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. ATAS International, Inc.
b. Berridge Manufacturing Company.
c. Dimensional Metals, Inc.
d. Englert, Inc.
e. Fabral.
f. Innovative Metals Company, Inc.
g. McElroy Metal, Inc.
h. PAC-CLAD; Petersen Aluminum Corporation; a Carlisle company.

2. Material: Same material, finish, and color as metal roof panels.

3. Aluminum Sheet: Coil-coated sheet, ASTM B209, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.

a. Thickness: 0.032 inch.
b. Surface: Smooth, flat finish.
c. Exterior Finish: Two-coat fluoropolymer.
d. Color: As selected by Engineer/Architect from manufacturer's full range.

4. Panel Coverage: 12 inches.
5. Panel Height: 0.375 inch.

2.3 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 coating designation or ASTM A792/A792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Finish flashing and trim with same finish system as adjacent metal panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: Provide sealant types recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing; 1/8 inch thick.
2. Joint Sealant: ASTM C920; as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

2.4 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.

C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

2.5 FINISHES

A. Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Concealed Finish: White or light-colored acrylic or polyester backer finish.

PART 3 - EXECUTION

3.1 PREPARATION

A. Miscellaneous Supports: Install sub-framing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.

1. Soffit Framing: Wire tie or clip furring channels to supports, as required to comply with requirements for assemblies indicated.

3.2 METAL PANEL INSTALLATION

A. Metal Soffit Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

1. Apply panels and associated items true to line for neat and weathertight enclosure.
2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.

3.3 CLEANING

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

END OF SECTION 074293

SECTION 074646 - FIBER-CEMENT SIDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes fiber-cement siding panels and trim boards.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For fiber-cement siding and soffit including related accessories.

1.3 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Product test reports.

C. Research/evaluation reports.

D. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for fabrication and installation.

1. Build mockup of typical wall area as shown on Drawings.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace products that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 25 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 FIBER-CEMENT SIDING

A. General: ASTM C1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E136; with a flame-spread index of 25 or less when tested according to ASTM E84.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. CertainTeed Corporation.
b. GAF.
c. James Hardie Building Products, Inc.
d. Nichiha Fiber Cement.

B. Labeling: Provide fiber-cement siding that is tested and labeled according to ASTM C1186 by a qualified testing agency acceptable to authorities having jurisdiction.

C. Nominal Thickness: Not less than 5/16 inch.

D. Horizontal Pattern: Boards size to be 6-1/4” width for 5” exposure.

1. Texture: Wood grain.

E. Panels: Boards size to be 48” x 96”.

1. Texture: Smooth.

F. Trim Boards: 1x4 or 1x6 smooth boards.

G. Factory Priming: Manufacturer's standard acrylic primer.

H. Factory Finish: manufacturer’s factory finish, applied in a controlled environment with a multi-coat, heat cured finish, in one process by same manufacturer of the fiber cement siding product. Siding shall be packaged & protected from damage and shall include a pre-packaged touch-up kit.

I. Color: As selected by Engineer/Architect from manufacturer's full range of colors.

2.2 ACCESSORIES

A. Siding Accessories, General: Provide starter strips, edge trim, outside and inside corner caps, and other items as recommended by siding manufacturer for building configuration.

B. Flashing: Provide aluminum flashing complying with Section 076200 "Sheet Metal Flashing and Trim" at window and door heads and where indicated.

1. Finish for Aluminum Flashing: Siliconized polyester coating.

C. Fasteners:

1. For fastening to wood, use siding nails of sufficient length to penetrate a minimum of 1 inch into substrate.
2. For fastening to metal, use ribbed bugle-head screws of sufficient length to penetrate a minimum of 1/4 inch, or three screw-threads, into substrate.
3. For fastening fiber cement, use hot-dip galvanized fasteners.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.

1. Install fasteners no more than 24 inches o.c.

B. Install joint sealants as specified in Section 079200 "Joint Sealants" and to produce a weathertight installation.

3.2 ADJUSTING AND CLEANING

A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.

B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION 074646

SECTION 075323 - ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Adhered ethylene-propylene-diene-terpolymer (EPDM) roofing system.
2. Mechanically fastened, ethylene-propylene-diene-terpolymer (EPDM) roofing system.
3. Substrate board.
4. Roof insulation.
5. Cover board.

1.2 PREINSTALLATION MEETINGS

A. Preliminary Conference: Conduct conference at location to be determined.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For insulation and roof system component fasteners, include copy of FM Approvals' RoofNav listing.

B. Shop Drawings: Include roof plans, sections, details, and attachments to other work, including the following:

1. Layout and thickness of insulation.
2. Base flashings and membrane terminations.
3. Flashing details at penetrations.
4. Tapered insulation, thickness, and slopes.
5. Roof plan showing orientation of steel roof deck and orientation of roof membrane and fastening spacings and patterns for mechanically fastened roofing system.
6. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

C. Samples: For the following products:

1. Roof membrane and flashings of color required.
2. Walkway pads or rolls, of color required.

D. Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift performance requirements.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer Certificates:

1. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.

a. Submit evidence of complying with performance requirements.

2. Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.

B. Product Test Reports: For components of roof membrane and insulation, for tests performed by a qualified testing agency, indicating compliance with specified requirements.

C. Research reports.

D. Field Test Reports:
1. Fastener-pullout test results & manufacturer's revised requirements for fastener patterns.

E. Field quality-control reports.

F. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 20 years from Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accelerated Weathering: Roof membrane shall withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.

B. Impact Resistance: Roof membrane shall resist impact damage when tested according to ASTM D3746, ASTM D4272, or the Resistance to Foot Traffic Test in FM Approvals 4470.

C. Wind Uplift Resistance: Design roofing system to resist the following wind uplift pressures when tested according to FM Approvals 4474, UL 580, or UL 1897:

1. Zone 1 (Roof Area Field): 25.15 lbf/sq. ft. .
2. Zone 2 (Roof Area Perimeter): 39.76 lbf/sq. ft. .

    a. Location: From roof edge to 3.9 feet inside roof edge.

3. Zone 3 (Roof Area Corners): 60.51 lbf/sq. ft. .

    a. Location: 3.9 feet in each direction from building corner.

D. FM Approvals' RoofNav Listing: Roof membrane, base flashings, and component materials shall comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and shall be listed in FM Approvals' RoofNav for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals Certification markings.

1. Fire/Windstorm Classification: Class 1A-90.
2. Hail-Resistance Rating: FM Global Property Loss Prevention Data Sheet 1-34 MH.

E. SPRI's Directory of Roof Assemblies Listing: Roof membrane, base flashings, and component materials shall comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and shall be listed in SPRI's Directory of Roof Assemblies for roof assembly identical for that specified for this Project.
1. Wind Uplift Load Capacity: 90 psf.

F. Exterior Fire-Test Exposure: ASTM E108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

G. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

2.2 ETHYLENE-PROPYLENE-DIENE-TERPOLYMER (EPDM) ROOFING

A. Fabric-Backed EPDM Sheet: ASTM D4637/D4637M, Type III, nonreinforced, EPDM sheet, laminated to a nonwoven polyester fabric backing except at selvages with factory-applied seam tape.

1. Basis of design Manufacturer: Subject to compliance with requirements, provide products by one of the following or equal product by other manufacturers:

    a. Carlisle SynTec Incorporated.
2. Composite Thickness: 115 mils, nominal.
3. Exposed Face Color: Black

2.3 AUXILIARY ROOFING MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.

1. Adhesive and Sealants: Comply with VOC limits of authorities having jurisdiction.

B. Sheet Flashing: 60-mil-thick EPDM, partially cured or cured, according to application.

C. Protection Sheet: Epichlorohydrin or neoprene nonreinforced flexible sheet, 55 to 60 mils thick, recommended by EPDM manufacturer for resistance to hydrocarbons, non-aromatic solvents, grease, and oil.

D. Slip Sheet: ASTM D2178/D2178M, Type IV; glass fiber; asphalt-impregnated felt.

E. Slip Sheet: Manufacturer's standard, of thickness required for application.

F. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.

G. Low-Rise, Urethane, Fabric-Backed Membrane Adhesive: Roof system manufacturer's standard spray-applied, low-rise, two-component urethane adhesive formulated for compatibility and use with fabric-backed membrane roofing.

H. Seaming Material: Manufacturer's standard, synthetic-rubber polymer primer and 3-inch-wide minimum, butyl splice tape with release film.

I. Lap Sealant: Manufacturer's standard, single-component sealant, colored to match membrane roofing.

J. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.

K. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.

L. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening components to substrate, and acceptable to roofing system manufacturer.

M. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, molded pipe boot flashings, preformed inside and outside corner sheet flashings, reinforced EPDM securement strips, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.

1. Provide white flashing accessories for white EPDM membrane roofing.

2. Provide black flashing accessories for black EPDM membrane roofing.

2.4 ROOF INSULATION

A. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Carlisle SynTec Incorporated.
    b. Hunter Panels.
    c. Johns Manville; a Berkshire Hathaway company.
2. Size: 48 by 96 inches.
3. Thickness:

    a. Base Layer: 2-1/2".
    b. Upper Layers: 2".

B. Tapered Insulation: Provide factory-tapered insulation boards where required by drawings.

1. Material: Match roof insulation.
2. Minimum Thickness: 1/4 inch.
3. Slope:

    a. Roof Field: 1/4 inch per foot unless otherwise indicated on Drawings.
    b. Saddles and Crickets: 1/2 inch per foot unless otherwise indicated on Drawings.

2.5 INSULATION ACCESSORIES

A. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

B. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:
1. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.

2.6 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads, approximately 3/16 inch thick and acceptable to roofing system manufacturer.

1. Size: Approximately 36 by 60 inches
2. Color: Contrasting with roof membrane.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

3.2 PREPARATION

A. Perform fastener-pullout tests according to roof system manufacturer's written instructions.

1. Submit test result within 24 hours of performing tests.

a. Include manufacturer's requirements for any revision to previously submitted fastener patterns required to achieve specified wind uplift requirements.

3.3 INSTALLATION OF ROOFING, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions, FM Approvals' RoofNav assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.

B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.4 INSTALLATION OF INSULATION

A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.

B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.

C. Installation Over Metal Decking:

1. Install base layer of insulation with end joints staggered not less than 12 inches in adjacent rows and with long joints continuous at right angle to flutes of decking.

a. Locate end joints over crests of decking.
b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
c. Make joints between adjacent insulation boards not more than 1/4 inch in width.
d. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches.

1) Trim insulation so that water flow is unrestricted.

e. Fill gaps exceeding 1/4 inch with insulation.
f. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
g. Loosely lay base layer of insulation units over substrate.
h. Mechanically attach base layer of insulation using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to metal decks.

1) Fasten insulation according to requirements in SPRI's Directory of Roof Assemblies for specified Wind Uplift Load Capacity.

2) Fasten insulation to resist specified uplift pressure at corners, perimeter, and field of roof.

2. Install upper layers of insulation with joints of each layer offset not less than 12 inches from previous layer of insulation.
   a. Install with long joints continuous and with end joints staggered not less than 12 inches in adjacent rows.
   b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
   c. Make joints between adjacent insulation boards not more than 1/4 inch in width.
   d. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches.
   e. Trim insulation so that water flow is unrestricted.
   f. Fill gaps exceeding 1/4 inch with insulation.
   g. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
   h. Loosely lay each layer of insulation units over substrate.
   i. Adhere each layer of insulation to substrate using adhesive according to SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
      1) Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

3.5 ADHERED ROOFING INSTALLATION

A. Adhere roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.

B. Unroll membrane roof membrane and allow to relax before installing.

C. Start installation of roofing in presence of roofing system manufacturer's technical personnel and Owner's testing and inspection agency.

D. Accurately align roof membrane, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

E. Bonding Adhesive: Apply to substrate and underside of roof membrane at rate required by manufacturer, and allow to partially dry before installing roof membrane. Do not apply to splice area of roof membrane.

F. Fabric-Backed Roof Membrane Adhesive: Apply to substrate at rate required by manufacturer, and install fabric-backed roof membrane.

G. In addition to adhering, mechanically fasten roof membrane securely at terminations, penetrations, and perimeters.

H. Apply roof membrane with side laps shingled with slope of roof deck where possible.

I. Adhesive Seam Installation: Clean both faces of splice areas, apply splicing cement.

1. Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
2. Apply lap sealant and seal exposed edges of roofing terminations.
3. Apply a continuous bead of in-seam sealant before closing splice if required by roofing system manufacturer.

J. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape.

1. Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
2. Apply lap sealant and seal exposed edges of roofing terminations.

K. Factory-Applied Seam Tape Installation: Clean and prime surface to receive tape.

1. Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
2. Apply lap sealant and seal exposed edges of roofing terminations.

L. Spread sealant or mastic bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.

M. Adhere protection sheet over roof membrane at locations indicated.

3.6 INSTALLATION OF BASE FLASHING

A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.7 INSTALLATION OF WALKWAYS

A. Flexible Walkways: Install walkway products according to manufacturer's written instructions.

1. Install flexible walkways at the following locations:

a. Perimeter of each rooftop unit.
b. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.

c. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
d. Top and bottom of each roof access ladder.
e. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.
f. Locations indicated on Drawings.
g. As required by roof membrane manufacturer's warranty requirements.

2. Provide 6-inch clearance between adjoining pads.
3. Adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.8 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing system, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 075323

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Formed roof-drainage sheet metal fabrications.
2. Formed steep-slope roof sheet metal fabrications.
3. Formed wall sheet metal fabrications.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at a location to be determined.

1.3 ACTION SUBMITTALS

A. Product Data: For each of the following

1. Underlayment materials.
2. Elastomeric sealant.
3. Butyl sealant.
4. Epoxy seam sealer.

B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled Work.
3. Include identification of material, thickness, weight, and finish for each item and location in Project.
4. Include details for forming, including profiles, shapes, seams, and dimensions.
5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Include details of termination points and assemblies.
7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
8. Include details of roof-penetration flashing.
9. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, flashings, and counterflashings.
10. Include details of special conditions.
11. Include details of connections to adjoining work.

C. Samples: For each exposed product and for each color and texture specified, 12 inches long by actual width.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of coping and roof edge flashing that is ANSI/SPRI/FM 4435/ES-1 tested and FM Approvals approved.

B. Evaluation Reports: For copings and roof edge flashing, from an agency acceptable to authority having jurisdiction showing compliance with ANSI/SPRI/FM 4435/ES-1.

C. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

B. Special warranty.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1. For copings and roof edge flashings that are ANSI/SPRI/FM 4435/ES-1 tested and FM Approvals approved, shop shall be listed as able to fabricate required details as tested and approved.

1.7 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

    a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
    b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
    c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual: Architectural Metal Flashing, Condensation and Air Leakage Control, and Reroofing" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. Sheet Metal Standard for Copper: Comply with CDA's "Copper in Architecture Handbook." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

D. SPRI Wind Design Standard: Manufacture and install copings, roof edge flashings tested in accordance with ANSI/SPRI/FM 4435/ES-1 and capable of resisting the following design pressure:

1. Design Pressure: As indicated on Drawings.

E. FM Approvals Listing: Manufacture and install copings, roof edge flashings that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-90. Identify materials with name of fabricator and design approved by FM Approvals.

F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 SHEET METALS

A. Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Aluminum Sheet: ASTM B209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.
1. Alclad Finish: Metallurgically bonded surfacing alloy on both sides, forming aluminum sheet with reflective luster.
2. Factory Prime Coating: Where painting after installation is required, pretreat metal with white or light-colored, factory-applied, baked-on epoxy primer coat; minimum dry film thickness of 0.2 mil.

3. Clear Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
4. Color Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

    a. Color: As selected by Architect from full range of industry colors and color densities.
    b. Color Range: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

5. Exposed Coil-Coated Finish:

    a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

6. Color: As selected by Architect from manufacturer's full range.
7. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

2.3 MISCELLANEOUS MATERIALS

A. Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

    a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
    b. Blind Fasteners: High-strength aluminum or stainless steel rivets suitable for metal being fastened.
    c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

D. Elastomeric Sealant: ASTM C920, elastomeric polyurethane or silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

F. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

2.4 FABRICATION, GENERAL

A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.

1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances:

1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
2. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard and by FM Global Property Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.

G. Seams:

1. Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
2. Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
3. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.

2.5 ROOF-DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters:

1. Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required.
2. Fabricate in minimum 96-inch-long sections.
3. Furnish flat-stock gutter brackets and flat-stock gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard, but with thickness not less than twice the gutter thickness.
4. Fabricate expansion joints, expansion-joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters. Shop fabricate interior and exterior corners.
5. Accessories: Continuous, removable leaf screen with sheet metal frame and hardware cloth screen.

6. Gutters with Girth 16 to 20 Inches: Fabricate from the following materials:

    a. Aluminum: 0.040 inch thick. Color to match finish of standing seam roofing.

B. Downspouts: Fabricate rectangular downspouts to dimensions indicated on Drawings, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors. Shop fabricate elbows.

1. Hanger Style: rectangular, wrap around hanger.
2. Fabricate from the following materials:
    a. Aluminum: 0.024 inch thick.
    b. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

C. Conductor Heads: Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shape required, complete with outlet tubes, exterior flange trim, and built-in overflows. Fabricate from the following materials:
1. Aluminum: 0.032 inch thick.
2. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

D. Splash Pans: Fabricate to dimensions and shape required and from the following materials:

1. Aluminum: 0.040 inch thick.

2.6 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

A. Apron, Step, Cricket, and Backer Flashing: Fabricate from the following materials:
   1. Aluminum: 0.032 inch thick.

B. Drip Edges: Fabricate from the following materials:
   1. Aluminum: 0.032 inch thick.

C. Eave, Rake, Ridge, and Hip Flashing: Fabricate from the following materials:
   1. Aluminum: 0.032 inch thick.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.

   1. Install fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
   2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, or sealant.
   3. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
   4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
   5. Install continuous cleats with fasteners spaced not more than 12 inches o.c.
   6. Space individual cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
   7. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
   8. Do not field cut sheet metal flashing and trim by torch.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

   1. Coat concealed side of uncoated-aluminum and stainless steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
   2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.

1. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
2. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
3. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction.

1. Use sealant-filled joints unless otherwise indicated.

a. Embed hooked flanges of joint members not less than 1 inch into sealant.
b. Form joints to completely conceal sealant.
c. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way.
d. Adjust setting proportionately for installation at higher ambient temperatures.

1) Do not install sealant-type joints at temperatures below 40 deg F.

2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

G. Rivets: Rivet joints in uncoated aluminum or zinc where necessary for strength.

3.2 INSTALLATION OF ROOF-DRAINAGE SYSTEM

A. Install sheet metal roof-drainage items to produce complete roof-drainage system in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.

B. Hanging Gutters:

1. Join sections with riveted and soldered joints or joints sealed with sealant.
2. Provide for thermal expansion.
3. Attach gutters at eave or fascia to firmly anchor them in position.
4. Provide end closures and seal watertight with sealant.
5. Slope to downspouts.
6. Install gutter with expansion joints at locations indicated on Drawings, but not exceeding, 50 feet apart. Install expansion-joint caps.
7. Install continuous gutter screens on gutters with noncorrosive fasteners, removable for cleaning gutters.

C. Downspouts:

1. Join sections with 1-1/2-inch telescoping joints.
2. Provide hangers with fasteners designed to hold downspouts securely to walls.
3. Locate hangers at top and bottom and at approximately 60 inches o.c.
4. Provide elbows at base of downspout to direct water away from building.
5. Connect downspouts to underground drainage system.

D. Splash Pans:

1. Install where downspouts discharge on low-slope roofs.
2. Set in asphalt roofing cement or elastomeric sealant compatible with the substrate.

E. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated on Drawings. Lap joints minimum of 4 inches in direction of water flow.

3.3 INSTALLATION OF ROOF FLASHINGS

A. Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard.

1. Provide concealed fasteners where possible, and set units true to line, levels, and slopes.
2. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Roof Edge Flashing:

1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.
2. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.
3. Anchor to resist uplift and outward forces in accordance with recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for FM Approvals' listing for required windstorm classification.

C. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches over base flashing. Install stainless steel draw band and tighten.

D. Counterflashing: Coordinate installation of counterflashing with installation of base flashing.

1. Insert counterflashing in reglets or receivers and fit tightly to base flashing.
2. Extend counterflashing 4 inches over base flashing.
3. Lap counterflashing joints minimum of 4 inches.

E. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.4 INSTALLATION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.5 CLEANING

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

3.6 PROTECTION

A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION 076200

SECTION 077253 - SNOW GUARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fence-type, seam-mounted snow guards.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include roof plans showing layouts and attachment details of snow guards.

   1. Include details of fence-type snow guards.

C. Samples:

   1. Fence-Type Snow Guards: Bracket, 12-inch-long rail, and installation hardware.

      a. For units with factory-applied finishes, submit manufacturer's standard color selections.

D. Delegated-Design Submittal: For snow guards, include analysis reports signed and sealed by the qualified professional engineer responsible for their preparation.

   1. Include calculation of number and location of snow guards.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer's experience with providing delegated design engineering services of the kind indicated, including documentation that the engineer is licensed in the state in which the Project is located.

B. Product Test Reports: For each type of snow guard, for tests performed by a qualified testing agency, indicating load at failure of attachment to roof system identical to roof system used on this Project.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design snow guards, including attachment to roofing material and roof deck, applicable for attachment method, based on the following:

1. Roof snow load.
2. Snow drifting
3. Roof slope.
4. Roof type.
5. Roof dimensions.
6. Roofing substrate type and thickness.
7. Snow guard type.
8. Snow guard fastening method and strength.
9. Snow guard spacing.
10. Coefficient of Friction Between Snow and Roof Surface: 0.
11. Factor of Safety: 3.

B. Performance Requirements: Provide snow guards that withstand exposure to weather and resist thermally induced movement without failure, rattling, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

C. Structural Performance: Snow guards shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.

1. Snow Loads: As indicated on Drawings.

2.2 FENCE-TYPE SNOW GUARDS

A. Fence-Type, Seam-Mounted Snow Guards:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Alpine SnowGuards, a division of Vermont Slate & Copper Services, Inc.
   b. Berger Building Products, Inc.
   c. IceBlox Inc.

2. Description: Snow guard fence section to be fabricated from extrusions in manufacturer's standard shape, anchored to brackets and equipped with integral track to accept color-matching inserts of material and finish used for standing seam metal roof.
3. Brackets and Baseplates: ASTM B209 aluminum; mill finish.
4. Fence extrusion: ASTM B221 aluminum; mill finish.

a. Profile: Manufacturer’s standard extrusion crossmember configured to accept a metal color strip of a material and finish to match standing seam metal roof and with snow clips to slow the movement of snow and ice on the roof surface.

5. Seam clamps: ASTM B221 aluminum extrusion or ASTM B85/B85M aluminum casting with stainless steel set screws incorporating round nonpenetrating point; designed for use with applicable roofing system to which clamp is attached.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install snow guards according to manufacturer's written instructions.

1. Space rows as indicated on Shop Drawings.
2. Space rows as recommended by manufacturer.

B. Attachment for Standing-Seam Metal Roofing:

1. Do not use fasteners that will penetrate metal roofing or fastening methods that void metal roofing finish warranty.

2. Fence-Type, Seam-Mounted Snow Guards:

a. Install brackets to vertical ribs in straight rows.
b. Secure with stainless steel set screws, incorporating round nonpenetrating point, on same side of standing seam.
c. Torque set screw according to manufacturer's instructions.
d. Install cross members to brackets.
e. Install snow clips to cross members.

END OF SECTION 077253

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Nonstaining silicone joint sealants.
2. Urethane joint sealants.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at a location to be determined.

1.3 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product.

B. Samples: For each kind and color of joint sealant required.

C. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Preconstruction laboratory test reports.

C. Preconstruction field-adhesion-test reports.

D. Field-adhesion-test reports.

E. Sample warranties.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C1021 to conduct the testing indicated.

1.6 PRECONSTRUCTION TESTING

A. Preconstruction Laboratory Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Adhesion Testing: Use ASTM C794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Compatibility Testing: Use ASTM C1087 to determine sealant compatibility when in contact with glazing and gasket materials.
3. Stain Testing: Use ASTM C1248 to determine stain potential of sealant when in contact with stone or masonry substrates.

B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates. Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.

1.7 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

A. Colors of Exposed Joint Sealants: As selected by Engineer/Architect from manufacturer's full range.

2.2 NONSTAINING SILICONE JOINT SEALANTS

A. Silicone, Nonstaining, S, NS, 100/50, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. May National Associates, Inc.; a subsidiary of Sika Corporation.

b. Pecora Corporation.
c. Sika Corporation; Joint Sealants.
d. Tremco Incorporated.

2.3 URETHANE JOINT SEALANTS

A. Urethane, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Uses T and NT.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Sika Corporation; Joint Sealants.

2.4 JOINT-SEALANT BACKING

A. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Adfast.
b. Alcot Plastics Ltd.
c. BASF Corporation.
d. Construction Foam Products; a division of Nomaco, Inc.

B. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer.

2.5 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove laitance and form-release agents from concrete.
2. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces.

3.2 INSTALLATION OF JOINT SEALANTS

A. General: Comply with ASTM C1193 and joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.

1. Provide concave joint profile per Figure 8A in ASTM C1193 unless otherwise indicated.

3.3 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed and cured sealant joints as follows:

a. Perform 10 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.

2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.

B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.4 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces JS-1.

1. Joint Locations:

a. Construction joints in cast-in-place concrete.
b. Joints between plant-precast architectural concrete units.
c. Control and expansion joints in unit masonry.
d. Joints in dimension stone cladding.
e. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT.
3. Joint-Sealant Color: As selected by Engineer/Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Concealed mastics JS-2.

1. Joint Locations:

a. Aluminum thresholds.
b. Sill plates.
c. Other joints as indicated on Drawings.
d. Gutters.

2. Joint Sealant: Urethane based.
3. Joint-Sealant Color: As selected by Engineer/Architect from manufacturer's full range of colors.

END OF SECTION 079200

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:

1. Interior standard steel doors and frames.
2. Exterior standard steel doors and frames.
3. Interior custom hollow-metal doors and frames.
4. Exterior custom hollow-metal doors and frames.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

C. Shop Drawings: Include the following:

1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.

D. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Field quality control reports.

1.5 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.6 QUALITY ASSURANCE

A. Fire-Rated Door Inspector Qualifications: Inspector for field quality control inspections of fire-rated door assemblies shall meet the qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:

1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

B. Egress Door Inspector Qualifications: Inspector for field quality control inspections of egress door assemblies shall meet the qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:

1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Ceco Door; ASSA ABLOY.
2. Curries Company; ASSA ABLOY.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits indicated on Drawings, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.
2. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.

B. Fire-Rated, Borrowed-Lite Assemblies: Assemblies complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

C. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than 0.48 when tested according to ASTM C518.

2.3 INTERIOR STANDARD STEEL DOORS AND KNOCK DOWN FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Standard-Duty Doors and Knock Down Frames: ANSI/SDI A250.8, Level 1; ANSI/SDI A250.4, Level C. At locations indicated in the Door and Frame Schedule.

1. Doors:

   a. Type: As indicated in the Door and Frame Schedule.
   b. Thickness: 1-3/4 inches or 1-3/8 inches.
   c. Face: Metallic-coated steel sheet, minimum thickness of 0.040 inch.
   d. Edge Construction: Model 1, Full Flush.
   e. Core: Manufacturer's standard.
   f. Fire-Rated Core: Manufacturer's standard laminated mineral board core for fire-rated and temperature-rise-rated doors.

2. Frames:

   a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch.
   b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
   c. Construction: Knocked down.

2.4 HEAVY DUTY DOORS AND WELDED FRAMES

A. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B. At locations indicated in the Door and Frame Schedule.

1. Doors:

   a. Type: As indicated in the Door and Frame Schedule.
   b. Thickness: 1-3/4 inches.
   c. Face: Metallic-coated steel sheet, minimum thickness of 0.040 inch.
   d. Edge Construction: Model 2, Seamless.
   e. Core: Manufacturer's standard.
   f. Fire-Rated Core: Manufacturer's standard laminated mineral board core for fire-rated and temperature-rise-rated doors.

2. Frames:

   a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch.
   b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.

c. Construction: Full profile welded.

2.5 EXTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B. At locations indicated in the Door and Frame Schedule.

1. Doors:

a. Type: As indicated in the Door and Frame Schedule.
b. Thickness: 1-3/4 inches.
c. Face: Metallic-coated steel sheet, minimum thickness of 0.042 inch, with minimum A60 coating.
d. Edge Construction: Model 2, Seamless.
e. Edge Bevel: Bevel lock edge 1/8 inch in 2 inches.
f. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
g. Bottom Edges: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
h. Core: Polyisocyanurate.
i. Fire-Rated Core: Manufacturer's standard laminated mineral board core for fire-rated doors.

2. Frames:

a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A60 coating.
b. Construction: Thermal break frames.

2.6 BORROWED LITES

A. Fabricate of metallic-coated steel sheet, minimum thickness of 0.053 inch.

B. Construction: Full profile welded.

C. Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as metal as frames.

D. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

2.7 FRAME ANCHORS

A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.
3. Postinstalled Expansion Anchor: Minimum 3/8-inch-diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

C. Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at top of underlayment.

D. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized according to ASTM A153/A153M, Class B.

2.8 MATERIALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

C. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

D. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A153/A153M.

F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

G. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.

H. Glazing: Comply with requirements in Section 088000 "Glazing."

2.9 FABRICATION

A. Door Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.

B. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.

1. Sidelite and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by welding, or by rigid mechanical anchors.
2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
3. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.

    a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

C. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to ANSI/SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

D. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Provide stops and moldings flush with face of door, and with square stops unless otherwise indicated.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.
4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
5. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

2.10 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

A. Hollow-Metal Frames: Comply with ANSI/SDI A250.11.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.

    a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
    b. Install frames with removable stops located on secure side of opening.

2. Fire-Rated Openings: Install frames according to NFPA 80.
3. Floor Anchors: Secure with postinstalled expansion anchors.

    a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

4. Solidly pack mineral-fiber insulation inside exterior frames.
5. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.

6. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:

    a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

B. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.

1. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8.
2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors according to NFPA 105.

C. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

A. Inspections:

1. Fire-Rated Door Inspections: Inspect each fire-rated door according to NFPA 80, Section 5.2.
2. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements according to NFPA 101, Section 7.2.1.15.

B. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

C. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

D. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.4 REPAIR

A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

B. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

C. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 081113

SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Five-ply flush wood veneer-faced doors for transparent finish.
2. Factory priming and finishing flush wood doors and frames.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

1. Door core materials and construction.
2. Door edge construction
3. Door face type and characteristics.
4. Door trim for openings.
5. Door frame construction.
6. Factory-machining criteria.
7. Factory-priming and finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:

1. Door schedule indicating door and frame location, type, size, fire protection rating, and swing.
2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
3. Details of frame for each frame type, including dimensions and profile.
4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
5. Dimensions and locations of blocking for hardware attachment.
6. Clearances and undercuts.
7. Requirements for veneer matching.
8. Apply AWI Quality Certification Program label to Shop Drawings.

C. Samples: For factory-finished doors and factory-finished door frames.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For door inspector.

1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, Section 5.2.3.1.

2. Egress Door Inspector: Submit documentation of compliance with NFPA 101, Section 7.2.1.15.4.
3. Submit copy of DHI's Fire and Egress Door Assembly Inspector (FDAI) certificate.

B. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

B. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.5 QUALITY ASSURANCE

A. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.

B. Fire-Rated Door Inspector Qualifications: Inspector for field quality-control inspections of fire-rated door assemblies shall comply with qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:

1. DHI's Fire and Egress Door Assembly Inspector (FDAI) certification.

C. Egress Door Inspector Qualifications: Inspector for field quality-control inspections of egress door assemblies shall comply with qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:

1. DHI's Fire and Egress Door Assembly Inspector (FDAI) certification.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Wood Door and Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings and temperature-rise limits indicated on Drawings, based on testing at positive pressure in accordance with UL 10C or NFPA 252.

1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
2. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.

B. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.

2.2 FLUSH WOOD DOORS AND FRAMES, GENERAL

A. Quality Standard: In addition to requirements specified, comply with ANSI/WDMA I.S. 1A.

1. Provide labels and certificates from AWI WI certification program indicating that doors and frames comply with requirements of grades specified.
   a. Contractor shall register the Work under this Section with the AWI Quality Certification Program at www.awiqcp.org or by calling 855-345-0991.

2.3 SOLID-CORE, FIVE-PLY FLUSH WOOD VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Exterior Doors:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Eggers Industries.
   b. Lambton Doors.
   c. Oshkosh Door Company.
   d. VT Industries Inc.
2. Performance Grade: ANSI/WDMA I.S. 1A Extra Heavy Duty.
3. ANSI/WDMA I.S. 1A Grade: Premium.
4. Faces: Single-ply wood veneer not less than 1/50 inch thick.

   a. Species: Red oak.
   b. Cut: Plain sliced (flat sliced).
   c. Match between Veneer Leaves: Book match.
   d. Assembly of Veneer Leaves on Door Faces: Center-balance match.
   e. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.

5. Exposed Vertical and Top Edges: Same species as faces - Architectural Woodwork Standards edge Type A.
6. Core:
   a. Glued wood stave.
   b. WDMA I.S. 10 structural composite lumber.

      1) Screw Withdrawal, Door Face: 550 lbf.
      2) Screw Withdrawal, Vertical Edge: 550 lbf.

   c. Either glued wood stave or WDMA I.S. 10 structural composite lumber.

7. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

8. Adhesives: Type I in accordance with WDMA T.M. 6.

B. Interior Doors:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Eggers Industries.
    b. Lambton Doors.
    c. Oshkosh Door Company.
    d. VT Industries Inc.
2. Performance Grade: ANSI/WDMA I.S. 1A Extra Heavy Duty.

3. ANSI/WDMA I.S. 1A Grade: Premium.
4. Faces: Single-ply wood veneer not less than 1/50 inch thick.

    a. Species: Red oak.
    b. Cut: Plain sliced (flat sliced).
    c. Match between Veneer Leaves: Book match.
    d. Assembly of Veneer Leaves on Door Faces: Center-balance match.
    e. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
    f. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.
    g. Blueprint Match: Where indicated, provide doors with faces produced from same flitches as adjacent wood paneling and arranged to provide blueprint match with wood paneling. Comply with requirements in Section 062023 "Interior Finish Carpentry."

5. Exposed Vertical and Top Edges: Same species as faces - Architectural Woodwork Standards edge Type A.

    a. Mineral-Core Doors: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

        1) Screw-Holding Capability: 550 lbf in accordance with WDMA T.M. 10.

6. Core for Non-Fire-Rated Doors:

    a. ANSI A208.1, Grade LD-2 particleboard.

        1) Provide doors with glued-wood-stave or WDMA I.S. 10 structural-composite-lumber cores instead of particleboard cores for doors scheduled to receive exit devices in Section 087100 "Door Hardware."

    b. Glued wood stave.
    c. WDMA I.S. 10 structural composite lumber.

        1) Screw Withdrawal, Face: 550 lbf.
        2) Screw Withdrawal, Edge: 550 lbf.

d. Either glued wood stave or WDMA I.S. 10 structural composite lumber.

7. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

2.4 LIGHT FRAMES AND LOUVERS

A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.

1. Wood Species: Same species as door faces.
2. Profile: Flush rectangular beads.
3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.

B. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated on Drawings. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.

C. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch-thick, cold-rolled steel sheet; factory primed for paint with baked-enamel- or powder-coated finish; and approved for use in doors of fire-protection rating indicated on Drawings.

2.5 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated.

1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
2. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied.

1. Locate hardware to comply with DHI-WDHS-3.
2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.
4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.
5. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

C. Openings: Factory cut and trim openings through doors.

1. Light Openings: Trim openings with moldings of material and profile indicated.

2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."
3. Louvers: Factory install louvers in prepared openings.

2.6 FACTORY PRIMING

A. Doors for Opaque Finish: Factory prime faces, all four edges, edges of cutouts, and mortises with one coat of wood primer specified in Section 099113 "Exterior Painting." Or Section 099123" Interior Painting."

2.7 FACTORY FINISHING

A. Comply with referenced quality standard for factory finishing.

1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
2. Finish faces, all four edges, edges of cutouts, and mortises.
3. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.

B. Factory finish doors.

C. Transparent Finish:

1. ANSI/WDMA I.S. 1A Grade: Premium.
2. Finish: Architectural Woodwork Standards System-9, UV Curable, Acrylated Epoxy, Polyester or Urethane.
3. Staining: As selected by Engineer/Architect from manufacturer's full range.
4. Effect: Semifilled finish, produced by applying an additional finish coat to partially fill the wood pores.
5. Sheen: Satin.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Hardware: For installation, see Section 087100 "Door Hardware."

B. Install doors and frames to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

C. Install frames level, plumb, true, and straight.

1. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
2. Anchor frames to anchors or blocking built in or directly attached to substrates.

a. Secure with countersunk, concealed fasteners and blind nailing.

b. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.

1) For factory-finished items, use filler matching finish of items being installed.

3. Install fire-rated doors and frames in accordance with NFPA 80.
4. Install smoke- and draft-control doors in accordance with NFPA 105.

D. Job-Fitted Doors:

1. Align and fit doors in frames with uniform clearances and bevels as indicated below.

a. Do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors.

2. Machine doors for hardware.
3. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
4. Clearances:

a. Provide 1/8 inch at heads, jambs, and between pairs of doors.
b. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated on Drawings.
c. Where threshold is shown or scheduled, provide1/4 inch from bottom of door to top of threshold unless otherwise indicated.
d. Comply with NFPA 80 for fire-rated doors.

5. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
6. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.

E. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

F. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.2 FIELD QUALITY CONTROL

A. Inspections:

1. Provide inspection of installed Work through AWI's Quality Certification Program, certifying that wood doors and frames, including installation, comply with requirements of AWI/AWMCA/WI's "Architectural Woodwork Standards" for the specified grade.
2. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.

B. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

C. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

D. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes access doors and frames for walls and ceilings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each type of access door and frame and for each finish specified.

C. Product Schedule: For access doors and frames.

1.3 CLOSEOUT SUBMITTALS

A. Record Documents: For doors locations, list of applicable room name and number in which access door is located.

1.4 QUALITY ASSURANCE

A. Fire-Rated Door Inspector Qualifications: Inspector for field quality control inspections of fire-rated door assemblies shall meet the qualifications set forth in NFPA 80, section 5.2.3.1 and the following:

1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

PART 2 - PRODUCTS

2.1 ACCESS DOORS AND FRAMES

A. Flush Access Doors with Exposed Flanges:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Babcock-Davis.
b. JL Industries, Inc.; a division of the Activar Construction Products Group.
c. Karp Associates, Inc.
d. Larsens Manufacturing Company.

2. Description: Face of door flush with frame, with exposed flange and concealed hinge.
3. Locations: Wall and ceiling.
4. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch, 16 gage, factory finished.
5. Frame Material: Same material, thickness, and finish as door.
6. Latch and Lock: Cam latch, screwdriver operated with interior release.

B. Flush Access Doors with Concealed Flanges:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Babcock-Davis.
   b. JL Industries, Inc.; a division of the Activar Construction Products Group.
   c. Karp Associates, Inc.
   d. Larsens Manufacturing Company.
2. Description: Face of door flush with frame; with concealed flange for gypsum board installation and concealed hinge.
3. Locations: Wall and ceiling.
4. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch, 16 gage factory finished.
5. Frame Material: Same material and thickness as door.
6. Latch and Lock: Cam latch, screwdriver operated with interior release.

2.2 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879/A879M, with cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS), exposed.

C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.

D. Stainless Steel Plate, Sheet, and Strip: ASTM A240/A240M or ASTM A666, Type 304. Remove tool and die marks and stretch lines, or blend into finish.

E. Stainless Flat Bars: ASTM A666, Type 304. Remove tool and die marks and stretch lines, or blend into finish.

F. Frame Anchors: Same material as door face.

G. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

2.3 FABRICATION

A. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

B. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.

C. Latch and Lock Hardware:

1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
2. Keys: Furnish two keys per lock and key all locks alike.
3. Mortise Cylinder Preparation: Where indicated, prepare door panel to accept cylinder specified in Section 087100 "Door Hardware," in locations that are accessible to public.
4. Flush mounted, keyless paddle latch with finger pull in secured spaces and mechanical rooms.

2.4 FINISHES

A. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.
2. Factory Finished: Apply manufacturer's standard baked-enamel or powder-coat finish immediately after cleaning and pretreating, with minimum dry-film thickness of 1 mil for topcoat.

a. Color: As selected by Engineer/Architect from full range of industry colors.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Adjust doors and hardware, after installation, for proper operation.

3.2 FIELD QUALITY CONTROL

A. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

B. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

END OF SECTION 083113

SECTION 083613 - SECTIONAL DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes manually operated sectional doors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type and size of sectional door and accessory.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

C. Samples: For each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

A. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of sectional doors that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Sectional doors shall comply with performance requirements specified without failure due to defective manufacture, fabrication, installation, or other defects in construction and without requiring temporary installation of reinforcing components.

B. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.

1. Design Wind Load: Uniform pressure (velocity pressure) of 20 lbf/sq. ft., acting inward and outward.
2. Testing: According to ASTM E330 or DASMA 108 for garage doors and complying with the acceptance criteria of DASMA 108.

C. Seismic Performance: Sectional doors shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

2.2 DOOR ASSEMBLY

A. Aluminum Sectional Door: Sectional door formed with hinged sections and fabricated according to DASMA 102 unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Overhead Door Corporation.
b. Raynor Garage Doors.
c. Wayne-Dalton Corp.

B. Operation Cycles: Door components and operators capable of operating for not less than 50,000.

C. Air Infiltration: Maximum rate of 0.4 cfm/sq. ft. at 15 and 25 mph when tested according to ASTM E283.

D. R-Value: 15.0 deg F x h x sq. ft./Btu.

E. Steel Sections: Zinc-coated (galvanized) steel sheet with G60 zinc coating.

1. Section Thickness: 2 inches.
2. Exterior-Face Surface: Paneled.
3. Interior Facing Material: Zinc-coated (galvanized) steel sheet.

F. Aluminum Sections: Solid panels.

G. Track Configuration: Standard-lift & Low-headroom track.

H. Weatherseals: Fitted to bottom and top and around entire perimeter of door. Provide combination bottom weatherseal and sensor edge.

I. Windows: Approximately 24 by 7 inches, with curved corners, and spaced apart the approximate distance as indicated on Drawings; in one row(s) at height indicated on Drawings; installed with insulated glazing of clear float glass.

J. Locking Devices: Equip door with locking device assembly.

1. Locking Device Assembly: Cremone type, both jamb sides, locking bars, operable from inside with thumbturn, outside with cylinder.

K. Door Finish:

1. Aluminum Finish: Anodized color as selected by Engineer/Architect from manufacturer's full range.
2. Baked-Enamel or Powder-Coat Finish: Color and gloss as selected by Engineer/Architect from manufacturer's full range.
3. Factory Prime Finish: Manufacturer's standard color.
4. Finish of Interior Facing Material: Finish as selected by Engineer/Architect from manufacturer's full range.

2.3 STEEL DOOR SECTIONS

A. Exterior Section Faces and Frames: Zinc-coated (galvanized), cold-rolled, commercial steel (CS) sheet.

1. Roll horizontal meeting edges to a continuous, interlocking, keyed, rabbeted, shiplap, or tongue-in-groove weather-resistant seal, with a reinforcing flange return.
2. For insulated doors, provide sections with continuous thermal-break construction, separating the exterior and interior faces of door.

B. Section Ends and Intermediate Stiles: Enclose open ends of sections with channel end stiles formed from galvanized-steel sheet welded to door section. Provide intermediate stiles formed from galvanized-steel sheet, cut to door section profile, and welded in place. Space stiles not more than 48 inches apart.

C. Reinforce bottom section with a continuous channel or angle conforming to bottom-section profile and allowing installation of astragal.

D. Reinforce sections with continuous horizontal and diagonal reinforcement, as required to stiffen door and for wind loading. Provide galvanized-steel bars, struts, trusses, or strip steel, formed to depth and bolted or welded in place. Ensure that reinforcement does not obstruct vision lites.

E. Provide reinforcement for hardware attachment.

F. Thermal Insulation: Insulate interior of steel sections with door manufacturer's standard CFC-free insulation, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E84. Enclose insulation completely within steel sections and the interior facing material, with no exposed insulation.

2.4 ALUMINUM DOOR SECTIONS

A. Sections: Extruded-aluminum stile and rail members with dimensions and profiles as indicated on Drawings; members joined by welding or with concealed, aluminum or nonmagnetic stainless-steel through bolts, full height of door section; and with meeting rails shaped to provide a weather-resistant seal.

1. Reinforce sections with continuous horizontal and diagonal reinforcement, as required to stiffen door and for wind loading. Ensure that reinforcement does not obstruct vision lites.
2. Provide reinforcement for hardware attachment.

B. Solid Panels: Aluminum sheet, set in continuous vinyl channel retained with rigid, snap-in, extruded-vinyl moldings or with rubber or neoprene glazing gasket with aluminum stop.

C. Full-Vision Sections: Manufacturer's standard, tubular, aluminum-framed section fully glazed with 6-mm-thick, clear acrylic glazing set in vinyl, rubber, or neoprene glazing channel and with removable extruded-vinyl or aluminum stops.

2.5 TRACKS, SUPPORTS, AND ACCESSORIES

A. Tracks: Manufacturer's standard, galvanized-steel track system of configuration indicated, sized for door size and weight, designed for lift type indicated and clearances indicated on Drawings, Provide complete system including brackets, bracing, and reinforcement to ensure rigid support of ball-bearing roller guides for required door type, size, weight, and loading.

1. Track Reinforcement and Supports: Galvanized-steel members to support track without sag, sway, and vibration during opening and closing of doors. Slot vertical sections of track spaced 2 inches apart for door-drop safety device.

B. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom and top of sectional door unless otherwise indicated.

C. Windows: Manufacturer's standard window units of type, size, and in arrangement indicated. Provide removable stops of same material as door-section frames.

2.6 HARDWARE

A. General: Heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless-steel, or other corrosion-resistant fasteners, to suit door type.

B. Hinges: Heavy-duty, galvanized-steel hinges at each end stile and at each intermediate stile, according to manufacturer's written recommendations for door size. Attach hinges to door sections through stiles and rails.

C. Rollers: Heavy-duty rollers with steel ball-bearings in case-hardened steel races, mounted with varying projections to suit slope of track. Provide 3-inch-diameter roller tires for 3-inch-wide track and 2-inch-diameter roller tires for 2-inch-wide track.

D. Push/Pull Handles: Equip each push-up operated or emergency-operated door with galvanized-steel lifting handles on each side of door, finished to match door.

2.7 LOCKING DEVICES

A. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on single-jamb side, operable from inside only.

B. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded deadbolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.

1. Lock Cylinders: Cylinders specified in Section 087100 "Door Hardware" and keyed to building keying system.
2. Keys: Three for each cylinder.

C. Chain Lock Keeper: Suitable for padlock.

2.8 COUNTERBALANCE MECHANISM

A. Torsion Spring: Counterbalance mechanism consisting of adjustable-tension torsion springs fabricated from steel-spring wire complying with ASTM A229/A229M, mounted on torsion shaft made of steel tube or solid steel. Provide springs designed for number of operation cycles indicated.

B. Cable Drums and Shaft for Doors: Cast-aluminum or gray-iron casting cable drums mounted on torsion shaft and grooved to receive door-lifting cables as door is raised. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of torsion shaft.

C. Cables: Galvanized-steel, multistrand, lifting cables.

D. Cable Safety Device: Include a spring-loaded steel or spring-loaded bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if either lifting cable breaks.

E. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level the shaft and prevent sag.

F. Bumper: Provide spring bumper at each horizontal track to cushion door at end of opening operation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Tracks: Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.

C. Accessibility: Install sectional doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

D. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

E. Touch-up Painting: Immediately after welding galvanized materials, clean welds and abraded galvanized surfaces and repair galvanizing to comply with ASTM A780/A780M.

3.2 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain sectional doors.

END OF SECTION 083613

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum-framed storefront systems.
2. Aluminum-framed entrance door systems.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at a location to be determined.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
2. Include point-to-point wiring diagrams.

C. Samples: For each type of exposed finish required.

D. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams.

E. Delegated-Design Submittal: For aluminum-framed entrances and storefronts, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Energy Performance Certificates: NFRC-certified energy performance values from manufacturer.

B. Product test reports.

C. Source quality-control reports.

D. Field quality-control reports.

E. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Testing Agency Qualifications: Qualified according to ASTM E699 for testing indicated and accredited by the International Accreditation Service or the International Laboratory Accreditation Cooperation Mutual Recognition Arrangement as complying with ISO/IEC 17025 and acceptable to Owner and Engineer/Architect.

C. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not change intended aesthetic effects, as judged solely by Engineer/Architect, except with Engineer/Architect's approval. If changes are proposed, submit comprehensive explanatory data to Engineer/Architect for review.

1.7 WARRANTY

A. Special Warranty: Manufacturer or Installer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

B. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of baked-enamel, powder-coat, or organic finishes within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

C. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed entrances and storefronts.

B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:

a. Thermal stresses transferring to building structure.
b. Glass breakage.
c. Noise or vibration created by wind and thermal and structural movements.
d. Loosening or weakening of fasteners, attachments, and other components.
e. Failure of operating units.

C. Structural Loads:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.

D. Deflection of Framing Members: At design wind pressure, as follows:

1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding 1/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch.

a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.

3. Cantilever Deflection: Where framing members overhang an anchor point, as follows:

a. Perpendicular to Plane of Wall: No greater than 1/240 of clear span plus 1/4 inch for spans greater than 11 feet 8-1/4 inches or 1/175 times span, for spans of less than 11 feet 8-1/4 inches.

E. Structural: Test according to ASTM E330/E330M as follows:

1. When tested at positive and negative wind-load design pressures, storefront assemblies, including entrance doors, do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, storefront assemblies, including entrance doors and anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

F. Water Penetration under Static Pressure: Test according to ASTM E331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas, including entrance doors, when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.

G. Energy Performance: Certified and labeled by manufacturer for energy performance as follows:

1. Thermal Transmittance (U-factor):

   a. Fixed Glazing and Framing Areas: U-factor for the system of not more than 0.45 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
   b. Entrance Doors: U-factor of not more than 0.68 Btu/sq. ft. x h x deg F as determined according to NFRC 100.

2. Solar Heat-Gain Coefficient (SHGC):

   a. Fixed Glazing and Framing Areas: SHGC for the system of not more than 0.35 as determined according to NFRC 200.
   b. Entrance Doors: SHGC of not more than 0.35 as determined according to NFRC 200.

3. Air Leakage:

   a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than 0.06 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft. when tested according to ASTM E283.
   b. Entrance Doors: Air leakage of not more than 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.

4. Condensation Resistance Factor (CRF):

   a. Fixed Glazing and Framing Areas: CRF for the system of not less than 55 as determined according to AAMA 1503.
   b. Entrance Doors: CRF of not less than 63 as determined according to AAMA 1503.

H. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 STOREFRONT SYSTEMS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. EFCO Corporation.
2. Kawneer North America, an Arconic company.

B. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Exterior Framing Construction: Thermally broken.
2. Interior Vestibule Framing Construction: Nonthermal.
3. Glazing System: Retained mechanically with gaskets on four sides.
4. Finish: Baked-enamel or powder-coat finish.
5. Fabrication Method: Field-fabricated stick system.
6. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
7. Steel Reinforcement: As required by manufacturer.

C. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

2.3 ENTRANCE DOOR SYSTEMS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. EFCO Corporation.
2. Kawneer North America, an Arconic company.

B. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation.

1. Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch- thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.

    a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.

2. Door Design: Wide stile; 5-inch nominal width.
3. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.

    a. Provide nonremovable glazing stops on outside of door.

2.4 ENTRANCE DOOR HARDWARE

A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 087100 "Door Hardware."

B. General: Provide entrance door hardware and entrance door hardware sets indicated in door and frame schedule for each entrance door, to comply with requirements in this Section.

1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products equivalent in function and comparable in quality to named products.
2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
3. Opening-Force Requirements:

    a. Egress Doors: Not more than 15 lbf to release the latch and not more than 30 lbf to set the door in motion and not more than 15 lbf to open the door to its minimum required width.
    b. Accessible Interior Doors: Not more than 5 lbf to fully open door.

C. Designations: Requirements for design, grade, function, finish, quantity, size, and other distinctive qualities of each type of entrance door hardware are indicated in "Entrance Door Hardware Sets" Article. Products are identified by using entrance door hardware designations as follows:

1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in "Entrance Door Hardware Sets" Article.
2. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.

D. Butt Hinges: BHMA A156.1, Grade 1, radius corner.

1. Nonremovable Pins: Provide setscrew in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while entrance door is closed.
2. Exterior Hinges: Stainless steel, with stainless-steel pin.
3. Quantities:

    a. For doors up to 87 inches high, provide three hinges per leaf.
    b. For doors more than 87 and up to 120 inches high, provide four hinges per leaf.

E. Continuous-Gear Hinges: BHMA A156.26.

F. Mortise Auxiliary Locks: BHMA A156.5, Grade 1.

G. Manual Flush Bolts: BHMA A156.16, Grade 1.

H. Automatic and Self-Latching Flush Bolts: BHMA A156.3, Grade 1.

I. Panic Exit Devices: BHMA A156.3, Grade 1, listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.

J. Cylinders:

1. As specified in Section 087100 "Door Hardware."
2. BHMA A156.5, Grade 1.

a. Keying: Master key system. Permanently inscribe each key with a visual key control number and include notation "DO NOT DUPLICATE" to be furnished by Owner.

K. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.

L. Operating Trim: BHMA A156.6.

M. Removable Mullions: BHMA A156.3 extruded aluminum.

1. When used with panic exit devices, provide keyed removable mullions listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305. Use only mullions that have been tested with exit devices to be used.

N. Closers: BHMA A156.4, Grade 1, with accessories required for a complete installation, sized as required by door size, exposure to weather, and anticipated frequency of use; adjustable to comply with field conditions and requirements for opening force.

O. Concealed Overhead Holders and Stops: BHMA A156.8, Grade 1.

P. Door Stops: BHMA A156.16, Grade 1, floor or wall mounted, as appropriate for door location indicated, with integral rubber bumper.

Q. Weather Stripping: Manufacturer's standard replaceable components.

1. Compression Type: Made of ASTM D2000 molded neoprene or ASTM D2287 molded PVC.
2. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

R. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.

S. Thresholds: BHMA A156.21 raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch.

T. Finger Guards: Manufacturer's standard collapsible neoprene or PVC gasket anchored to frame hinge-jamb at center-pivoted doors.

2.5 GLAZING

A. Glazing: Comply with Section 088000 "Glazing."

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

C. Glazing Sealants: As recommended by manufacturer.

2.6 MATERIALS

A. Sheet and Plate: ASTM B209.

B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.

C. Extruded Structural Pipe and Tubes: ASTM B429/B429M.

D. Structural Profiles: ASTM B308/B308M.

E. Steel Reinforcement:

1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.

F. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.

2.7 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from interior for vision glass and exterior for spandrel glazing or metal panels.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

F. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

G. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.8 ALUMINUM FINISHES

A. High-Performance Organic Finish, Two-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat.

1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Color and Gloss: As selected by Engineer/Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Comply with manufacturer's written instructions.

B. Do not install damaged components.

C. Fit joints to produce hairline joints free of burrs and distortion.

D. Rigidly secure nonmovement joints.

E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.

F. Seal perimeter and other joints watertight unless otherwise indicated.

G. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

H. Set continuous sill members and flashing in full sealant bed, as specified in Section 079200 "Joint Sealants," to produce weathertight installation.

I. Install joint filler behind sealant as recommended by sealant manufacturer.

J. Install components plumb and true in alignment with established lines and grades.

3.2 INSTALLATION OF GLAZING

A. Install glazing as specified in Section 088000 "Glazing."

3.3 INSTALLATION OF ALUMINUM-FRAMED ENTRANCE DOORS

A. Install entrance doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.4 FIELD QUALITY CONTROL

A. Field Quality-Control Testing: Perform the following test on representative areas of aluminum-framed entrances and storefronts mockups.

1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Engineer/Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.

    a. Perform a minimum of two tests in areas as directed by Engineer/Architect.

2. Air Leakage: ASTM E783 at 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article but not more than 0.09 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..

    a. Perform a minimum of two tests in areas as directed by Engineer/Architect.

3. Water Penetration: ASTM E1105 at a minimum uniform static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft., and shall not evidence water penetration.

B. Aluminum-framed entrances and storefronts will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 084113

SECTION 085113 - ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes aluminum windows for exterior locations.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at a location to be determined.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.

C. Samples: For each exposed product and for each color specified.

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Sample warranties.

1.5 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.

1. Warranty Period:

a. Window: 10 years from date of Substantial Completion.
b. Glazing Units: 10 years from date of Substantial Completion.
c. Aluminum Finish: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 WINDOW PERFORMANCE REQUIREMENTS

A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

1. Window Certification: AAMA certified with label attached to each window.

B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:

1. Minimum Performance Class: CW.
2. Minimum Performance Grade: 30.

C. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of 0.30 Btu/sq. ft. x h x deg F.

D. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of 0.40.

E. Condensation-Resistance Factor (CRF): Provide aluminum windows tested for thermal performance according to AAMA 1503, showing a CRF of 62.

F. Thermal Movements: Provide aluminum windows, including anchorage, that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F ambient; 180 deg F material surfaces.

2.2 ALUMINUM WINDOWS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. EFCO Corporation.
2. Kawneer North America, an Arconic company.

B. Types: As indicated on Drawings.

C. Frames and Sashes: Aluminum extrusions complying with AAMA/WDMA/CSA 101/I.S.2/A440.

1. Thermally Improved Construction: Fabricate frames, sashes, and muntins with an integral, concealed, low-conductance thermal barrier located between exterior materials and window members exposed on interior side in a manner that eliminates direct metal-to-metal contact.

D. Glass: Clear annealed glass, ASTM C1036, Type 1, Class 1, q3.

1. Kind: Fully tempered where indicated on Drawings.

E. Insulating-Glass Units: ASTM E2190.

1. Glass: ASTM C1036, Type 1, Class 1, q3.

a. Tint: Clear.
b. Kind: Fully tempered where indicated on Drawings.

2. Lites: Two.
3. Filling: Fill space between glass lites with argon.
4. Low-E Coating: Sputtered on second or third surface.

F. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.

G. Hardware, General: Provide manufacturer's standard corrosion-resistant hardware sized to accommodate sash weight and dimensions.

1. Exposed Hardware Color and Finish: As selected by Engineer/Architect from manufacturer's full range.

H. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.

I. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.

1. Exposed Fasteners: Do not use exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

2.3 ACCESSORIES

A. Subsills: Thermally broken, extruded-aluminum subsills in configurations indicated on Drawings.

B. Column Covers: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.

C. Interior Trim: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.

D. Panning Trim: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.

E. Receptor System: Two-piece, snap-together, thermally broken, extruded-aluminum receptor system that anchors windows in place.

2.4 FABRICATION

A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.

B. Glaze aluminum windows in the factory.

C. Weather strip each operable sash to provide weathertight installation.

D. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.

E. Provide water-shed members above side-hinged sashes and similar lines of natural water penetration.

F. Mullions: Provide mullions and cover plates, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections. Provide mullions and cover plates capable of withstanding design wind loads of window units.

G. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

2.5 ALUMINUM FINISHES

A. High-Performance Organic Finish (Two-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.

1. Color and Gloss: As selected by Engineer/Architect from full range of industry colors and color densities.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E2112.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.

C. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

E. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.

F. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

G. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION 085113

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Mechanical door hardware for the following:

a. Swinging doors.
b. Folding doors.

2. Cylinders for door hardware specified in other Sections.
3. Electrified door hardware.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at a location to be determined.

B. Keying Conference: Conduct conference at a location to be determined.

1.3 SUBMITTALS

A. General:
1. Submit in accordance with Conditions of Contract and Division 01 requirements.

2. Highlight, encircle, or otherwise specifically identity on submittals deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the work.

3. Prior to forwarding submittal, comply with procedures for verifying existing door and frame compatibility for new hardware, as specified in PART 3, “Execution” article, herein.

B. Action Submittals:
1. Product Data: Technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.

2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:

a. Wiring Diagrams: For power, signal, and control wiring and including:
1) Details of interface of electrified door hardware and building safety and security systems.
2) Schematic diagram of systems that interface with electrified door hardware.

3) Point-to-point wiring.
4) Risers.

3. Samples for Verification: If requested by Engineer/Architect, submit production sample or sample installations of each type of exposed hardware unit in finish indicated, and tagged with full description for coordination with schedule.

   a. Samples will be returned to supplier. Units that are acceptable to Engineer/Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.

4. Door Hardware Schedule: Submit schedule with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Indicate complete designations of each item required for each door or opening, include:

   a. Door Index; include door number, heading number, and Engineers/Architects hardware set number.
   b. Opening Lock Function Spreadsheet: List locking device and function for each opening.
   c. Quantity, type, style, function, size, and finish of each hardware item.
   d. Name and manufacturer of each item.
   e. Fastenings and other pertinent information.
   f. Location of each hardware set cross-referenced to indications on Drawings.
   g. Explanation of all abbreviations, symbols, and codes contained in schedule.
   h. Mounting locations for hardware.
   i. Door and frame sizes and materials.
   j. Name and phone number for local manufacturer's representative for each product.
   k. Operational Description of openings with any electrified hardware (locks, exits, electromagnetic locks, electric strikes, automatic operators, door position switches, magnetic holders or closer/holder units, and access control components). Operational description should include operational descriptions for: egress, ingress (access), and fire/smoke alarm connections.
      1) Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work that is critical in Project construction schedule.

5. Key Schedule:

   a. After Keying Conference, provide keying schedule listing levels of keying as well as explanation of key system's function, key symbols used and door numbers controlled.
   b. Use ANSI/BHMA A156.28 “Recommended Practices for Keying Systems” as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
   c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
   d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.

e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion.
   1) Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.

6. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.

C. Informational Submittals:

1. Qualification Data: For Supplier, Installer and Architectural Hardware Consultant.
2. Product data for electrified door hardware:
   a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
3. Certificates of Compliance:
   a. UL listings for fire-rated hardware and installation instructions if requested by Engineer/Architect or Authority Having Jurisdiction.
   b. Installer Training Meeting Certification: Letter of compliance, signed by Contractor, attesting to completion of installer training meeting specified in "QUALITY ASSURANCE" article, herein.
   c. Electrified Hardware Coordination Conference Certification: Letter of compliance, signed by Contractor, attesting to completion of electrified hardware coordination conference, specified in "QUALITY ASSURANCE" article, herein.
4. Warranty: Special warranty specified in this Section.

D. Closeout Submittals:

1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:

   a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
   b. Catalog pages for each product.
   c. Factory order acknowledgement numbers (for warranty and service)
   d. Name, address, and phone number of local representative for each manufacturer.
   e. Parts list for each product.
   f. Final approved hardware schedule, edited to reflect conditions as-installed.
   g. Final keying schedule
   h. Copies of floor plans with keying nomenclature
   i. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.
   j. Copy of warranties including appropriate reference numbers for manufacturers to identify project.

1.4 QUALITY ASSURANCE

A. Supplier Qualifications and Responsibilities: Recognized Architectural hardware supplier with record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that provides certified Architectural Hardware Consultant (AHC) available to Owner, Engineer/Architect, and Contractor, at reasonable times during the Work for consultation.

1. Warehousing Facilities: In Project's vicinity.
2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
4. Coordination Responsibility: Assist in coordinating installation of electronic security hardware with Engineer/Architect and electrical engineers and provide installation and technical data to Engineer/Architect and other related subcontractors.
    a. Upon completion of electronic security hardware installation, inspect and verify that all components are working properly.

B. Architectural Hardware Consultant Qualifications: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:

1. For door hardware, DHI-certified, Architectural Hardware Consultant (AHC).
2. Can provide installation and technical data to Engineer/Architect and other related subcontractors.
3. Can inspect and verify components are in working order upon completion of installation.
4. Capable of producing wiring diagrams.
5. Capable of coordinating installation of electrified hardware with Engineer/Architect and electrical engineers.

C. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.

D. Fire-Rated Door Openings: Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed products tested by Underwriters Laboratories, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.

E. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.

F. Accessibility Requirements: For door hardware on doors in an accessible route, comply with governing accessibility regulations cited in “REFERENCES” article, herein.

G. Keying Conference

1. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:

    a. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
    b. Preliminary key system schematic diagram.
    c. Requirements for key control system.

d. Requirements for access control.
e. Address for delivery of keys.

H. Pre-installation Conference

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Inspect and discuss preparatory work performed by other trades.
3. Inspect and discuss electrical roughing-in for electrified door hardware.
4. Review sequence of operation for each type of electrified door hardware.
5. Review required testing, inspecting, and certifying procedures.

I. Coordination Conferences:

1. Installation Coordination Conference: Prior to hardware installation, schedule and hold meeting to review questions or concerns related to proper installation and adjustment of door hardware.
2. Electrified Hardware Coordination Conference: Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Three years from date of Substantial Completion unless otherwise indicated below:

a. Electromagnetic and Delayed-Egress Locks: Five years from date of Substantial Completion.
b. Exit Devices: Two years from date of Substantial Completion.
c. Manual Closers: 10 years from date of Substantial Completion.
d. Concealed Floor Closers: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Door Assemblies: Where fire-rated doors are indicated, provide door hardware complying with NFPA 80 that is listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

B. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that complies with requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.

1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. at the tested pressure differential of 0.3-inch wg of water.

C. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

E. Accessibility Requirements: For door hardware on doors in an accessible route, comply with ICC A117.1.

2.2 HINGES

A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Allegion plc.
b. Bommer Industries, Inc.
c. McKinney Products Company; an ASSA ABLOY Group company.
d. Stanley Commercial Hardware; a division of Stanley Security Solutions.

2.3 CONTINUOUS HINGES

A. Continuous Hinges: BHMA A156.26; minimum 0.120-inch-thick, hinge leaves with minimum overall width of 4 inches; fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.

B. Pin-and-Barrel-Type Hinges:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Allegion plc.
b. McKinney Products Company; an ASSA ABLOY Group company.
c. Stanley Commercial Hardware; a division of Stanley Security Solutions.

C. Continuous, Gear-Type Hinges: Extruded-aluminum, pinless, geared hinge leaves joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Allegion plc.
b. Bommer Industries, Inc.

c. McKinney Products Company; an ASSA ABLOY Group company.
d. Stanley Commercial Hardware; a division of Stanley Security Solutions.
e. Zero International, Inc.

2.4 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: As indicated in door hardware schedule.

B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:

1. Bored Locks: Minimum 1/2-inch latchbolt throw.
2. Mortise Locks: Minimum 3/4-inch latchbolt throw.
3. Deadbolts: Minimum 1-inch bolt throw.

C. Lock Backset: 2-3/4 inches unless otherwise indicated.

D. Lock Trim:

1. Description: K Series.
2. Levers: Cast.

a. Dane.

3. Escutcheons (Roses): Cast.
4. Dummy Trim: Match lever lock trim and escutcheons.

E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.
4. Rabbet Front and Strike: Provide on locksets for rabbeted meeting stiles.

F. Bored Locks: BHMA A156.2; Grade 1; Series 4000.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Allegion plc.
b. Arrow USA; an ASSA ABLOY Group company.
c. Best Access Systems; Stanley Security Solutions, Inc.
d. Corbin Russwin, Inc.; an ASSA ABLOY Group company.
e. SARGENT Manufacturing Company; ASSA ABLOY.
f. Stanley Commercial Hardware; a division of Stanley Security Solutions.
g. Yale Security Inc; an ASSA ABLOY Group company.

G. Mortise Locks: BHMA A156.13; Security Grade 1; stamped steel case with steel or brass parts; Series 1000.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Allegion plc.
b. Best Access Systems; Stanley Security Solutions, Inc.
c. Corbin Russwin, Inc.; an ASSA ABLOY Group company.
d. SARGENT Manufacturing Company; ASSA ABLOY.
e. Stanley Commercial Hardware; a division of Stanley Security Solutions.
f. Yale Security Inc; an ASSA ABLOY Group company.

2.5 AUXILIARY LOCKS

A. Bored Auxiliary Locks: BHMA A156.36: Grade 1; with strike that suits frame.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Allegion plc.
b. Best Access Systems; Stanley Security Solutions, Inc.
c. SARGENT Manufacturing Company; ASSA ABLOY.
d. Stanley Commercial Hardware; a division of Stanley Security Solutions.
e. Yale Security Inc; an ASSA ABLOY Group company.

B. Mortise Auxiliary Locks: BHMA A156.36; Grade 1; with strike that suits frame.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Allegion plc.
b. Best Access Systems; Stanley Security Solutions, Inc.
c. SARGENT Manufacturing Company; ASSA ABLOY.
d. Stanley Commercial Hardware; a division of Stanley Security Solutions.
e. Yale Security Inc; an ASSA ABLOY Group company.

C. Narrow Stile Auxiliary Locks: BHMA A156.36; Grade 1; with strike that suits frame.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Accurate Lock & Hardware Co.
b. Adams Rite Manufacturing Co; an ASSA ABLOY Group company.
c. Kaba Ilco Corp.

D. Push-Button Combination Locks: BHMA A156.36; cylindrical; Grade 1; lock opens by entering a one- to five-digit code by pushing correct buttons in correct sequence; automatically relocks when door is closed; with strike that suits frame.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Kaba Ilco Corp.

2.6 ELECTRIC STRIKES

A. Electric Strikes: BHMA A156.31; Grade 1; with faceplate to suit lock and frame.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Allegion plc.
b. Securitron Magnalock Corporation; an ASSA ABLOY Group company.
c. Stanley Commercial Hardware; a division of Stanley Security Solutions.

2.7 ELECTROMAGNETIC LOCKS

A. Electromagnetic Locks: BHMA A156.23; electrically powered; with electromagnet attached to frame and armature plate attached to door; full-exterior or full-interior type, as required by application indicated.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Allegion plc.
b. Door Controls International, Inc.
c. Securitron Magnalock Corporation; an ASSA ABLOY Group company.
d. Security Door Controls.

2.8 ELECTROMECHANICAL LOCKS

A. Electromechanical Locks: BHMA A156.25; Grade 1; motor or solenoid driven; with strike that suits frame.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allegion plc.
b. Best Access Systems; Stanley Security Solutions, Inc.
c. SARGENT Manufacturing Company; ASSA ABLOY.
d. Security Door Controls.
e. Stanley Commercial Hardware; a division of Stanley Security Solutions.
f. Yale Security Inc; an ASSA ABLOY Group company.

2. Type: Mortise latchbolt.

2.9 SELF-CONTAINED ELECTRONIC LOCKS

A. Self-Contained Electronic Locks: BHMA A156.25, mortise; with internal, battery-powered, self-contained electronic locks; consisting of complete lockset, motor-driven lock mechanism, and actuating device; enclosed in zinc-dichromate-plated, wrought-steel case, and strike that suits frame. Provide key override, low-battery detection and warning, LED status indicators, and ability to program at the lock.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allegion plc.
b. Best Access Systems; Stanley Security Solutions, Inc.
c. SARGENT Manufacturing Company; ASSA ABLOY.
d. Yale Security Inc; an ASSA ABLOY Group company.

2.10 EXIT LOCKS AND EXIT ALARMS

A. Exit Locks and Alarms: BHMA A156.29, Grade 1.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Arrow USA; an ASSA ABLOY Group company.
b. Detex Corporation.
c. Precision Hardware, Inc.; a Stanley company.
d. SARGENT Manufacturing Company; ASSA ABLOY.

2.11 SURFACE BOLTS

A. Surface Bolts: BHMA A156.16.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allegion plc.
b. Burns Manufacturing Incorporated.
c. Door Controls International, Inc.
d. Trimco.

2.12 MANUAL FLUSH BOLTS

A. Manual Flush Bolts: BHMA A156.16; minimum 3/4-inch throw; designed for mortising into door edge.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Adams Rite Manufacturing Co; an ASSA ABLOY Group company.

b. Allegion plc.
c. Burns Manufacturing Incorporated.
d. Door Controls International, Inc.

2.13 EXIT DEVICES AND AUXILIARY ITEMS

A. Exit Devices and Auxiliary Items: BHMA A156.3.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Allegion plc.
b. Arrow USA; an ASSA ABLOY Group company.
c. Corbin Russwin, Inc.; an ASSA ABLOY Group company.
d. Door Controls International, Inc.
e. SARGENT Manufacturing Company; ASSA ABLOY.
f. Stanley Commercial Hardware; a division of Stanley Security Solutions.
g. Yale Security Inc; an ASSA ABLOY Group company.

2.14 LOCK CYLINDERS

A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver. Provide cylinder from same manufacturer of locking devices.

1. Manufacturers: The Basis of design for the lock cylinders shall be Schlage, an Allegion company. Subject to compliance with requirements, other available manufacturers offering products that may be incorporated into the Work will be reviewed if they are compatible with the owner's existing Schlage cores and keying system.

B. Standard Lock Cylinders: BHMA A156.5; Grade 1 permanent cores; face finished to match lockset.

1. Core Type: Removable.

C. High-Security Lock Cylinders: BHMA A156.30; Grade 1 permanent cores that are removable; face finished to match lockset.

1. Type: M, mechanical.

D. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.

E. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

2.15 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, appendix. Provide one extra key blank for each lock. Incorporate decisions made in keying conference.

1. No Master Key System: Only change keys operate cylinders.

    a. Provide three cylinder change keys.

2. Master Key System: Change keys and a master key operate cylinders.

    a. Provide three cylinder change keys and five master keys.

3. Grand Master Key System: Change keys, a master key, and a grand master key operate cylinders.

    a. Provide three cylinder change keys and five each of master and grand master keys.

4. Great-Grand Master Key System: Change keys, a master key, a grand master key, and a great-grand master key operate cylinders.

    a. Provide three cylinder change keys and five each of master, grand master, and great-grand master keys.

5. Existing System:

    a. Master key or grand master key locks to Owner's existing system.

6. Keyed Alike: Key all cylinders to same change key.

B. Keys: Nickel silver.

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:

    a. Notation: "DO NOT DUPLICATE."

2.16 KEY CONTROL SYSTEM

A. Key Control Cabinet: BHMA A156.28; metal cabinet with baked-enamel finish; containing key-holding hooks, labels, two sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers; with key capacity of 150 percent of the number of locks.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. American Key Boxes and Cabinets.
    b. GE Security, Inc.
    c. HPC, Inc.
    d. Lund Equipment Co., Inc.
    e. MMF Industries.
    f. TelKee; Oasis International.

2. Multiple-Drawer Cabinet: Grade 1 cabinet with drawers equipped with key-holding panels and key envelope storage, and progressive-type ball-bearing suspension slides. Include single cylinder lock to lock all drawers.

3. Wall-Mounted Cabinet: Grade 1 cabinet with hinged-panel door equipped with key-holding panels and pin-tumbler cylinder door lock.
4. Portable Cabinet: Grade 1 tray for mounting in file cabinet, equipped with key-holding panels, envelopes, and cross-index system.

2.17 OPERATING TRIM

A. Operating Trim: BHMA A156.6; aluminum unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Allegion plc.
b. Burns Manufacturing Incorporated.
c. Rockwood Manufacturing Company; an ASSA ABLOY Group company.

2.18 ACCESSORIES FOR PAIRS OF DOORS

A. Coordinators: BHMA A156.3; consisting of active-leaf, hold-open lever and inactive-leaf release trigger; fabricated from steel with nylon-coated strike plates; with built-in, adjustable safety release; and with internal override.

B. Carry-Open Bars: BHMA A156.3; prevent the inactive leaf from opening before the active leaf; provide polished brass or bronze carry-open bars with strike plate for inactive leaves of pairs of doors unless automatic or self-latching bolts are used.

C. Astragals: BHMA A156.22.

2.19 SURFACE CLOSERS

A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allegion plc.
b. Arrow USA; an ASSA ABLOY Group company.
c. Corbin Russwin, Inc.; an ASSA ABLOY Group company.
d. Hager Companies.
e. Norton Door Controls; an ASSA ABLOY Group company.
f. Rixson Specialty Door Controls; an ASSA ABLOY Group company.
g. SARGENT Manufacturing Company; ASSA ABLOY.
h. Stanley Commercial Hardware; a division of Stanley Security Solutions.
i. Yale Security Inc; an ASSA ABLOY Group company.

2.20 CONCEALED CLOSERS

A. Concealed Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Allegion plc.
    b. DORMA USA, Inc.
    c. Norton Door Controls; an ASSA ABLOY Group company.
    d. Rixson Specialty Door Controls; an ASSA ABLOY Group company.
    e. SARGENT Manufacturing Company; ASSA ABLOY.

2.21 CLOSER HOLDER RELEASE DEVICES

A. Closer Holder Release Devices: BHMA A156.15; Grade 1; closer connected with separate or integral releasing and fire- or smoke-detecting devices. Door shall become self-closing on interruption of signal to release device. Automatic release is activated by smoke detection system or loss of power.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Allegion plc.
    b. Corbin Russwin, Inc.; an ASSA ABLOY Group company.
    c. DORMA USA, Inc.
    d. Norton Door Controls; an ASSA ABLOY Group company.
    e. Rixson Specialty Door Controls; an ASSA ABLOY Group company.
    f. SARGENT Manufacturing Company; ASSA ABLOY.
    g. Stanley Commercial Hardware; a division of Stanley Security Solutions.

2.22 MECHANICAL STOPS AND HOLDERS

A. Wall- and Floor-Mounted Stops: BHMA A156.16.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Allegion plc.
    b. Architectural Builders Hardware Mfg., Inc.
    c. Baldwin Hardware Corporation.
    d. Burns Manufacturing Incorporated.
    e. Door Controls International, Inc.
    f. Hager Companies.
    g. Rockwood Manufacturing Company; an ASSA ABLOY Group company.

2.23 ELECTROMAGNETIC STOPS AND HOLDERS

A. Electromagnetic Door Holders: BHMA A156.15, Grade 1; wall-mounted electromagnetic single unit with strike plate attached to swinging door; coordinated with fire detectors and interface with fire-alarm system for labeled fire-rated door assemblies.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allegion plc.
b. Architectural Builders Hardware Mfg., Inc.
c. DORMA USA, Inc.
d. Hager Companies.
e. SARGENT Manufacturing Company; ASSA ABLOY.

2.24 OVERHEAD STOPS AND HOLDERS

A. Overhead Stops and Holders: BHMA A156.8.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allegion plc.
b. Architectural Builders Hardware Mfg., Inc.
c. DORMA USA, Inc.
d. Hager Companies.
e. Rixson Specialty Door Controls; an ASSA ABLOY Group company.
f. SARGENT Manufacturing Company; ASSA ABLOY.

2.25 DOOR GASKETING

A. Door Gasketing: BHMA A156.22; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hager Companies.
b. M-D Building Products, Inc.
c. National Guard Products, Inc.
d. Pemko Manufacturing Co.
e. Reese Enterprises, Inc.
f. Sealeze.
g. Zero International, Inc.

B. Maximum Air Leakage: When tested according to ASTM E283 with tested pressure differential of 0.3-inch wg, as follows:

1. Smoke-Rated Gasketing: 0.3 cfm/sq. ft. of door opening.
2. Gasketing on Single Doors: 0.3 cfm/sq. ft. of door opening.
3. Gasketing on Double Doors: 0.50 cfm per foot of door opening.

2.26 THRESHOLDS

A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hager Companies.
b. M-D Building Products, Inc.
c. National Guard Products, Inc.
d. Pemko Manufacturing Co.
e. Reese Enterprises, Inc.
f. Rixson Specialty Door Controls; an ASSA ABLOY Group company.
g. Sealeze.
h. Zero International, Inc.

2.27 SLIDING DOOR HARDWARE

A. Sliding Door Hardware: BHMA A156.14; consisting of complete sets including rails, hangers, supports, bumpers, floor guides, and accessories indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Arthur Cox & Sons, Inc.
b. Hager Companies.
c. Hettich America L.P.
d. Johnson, L. E., Products, Inc.
e. K.N. Crowder Mfg. Inc.
f. PC Henderson Inc.
g. Stanley Commercial Hardware; a division of Stanley Security Solutions.

2.28 FOLDING DOOR HARDWARE

A. General: BHMA A156.14; complete sets including overhead rails, hangers, supports, bumpers, floor guides, and accessories indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Arthur Cox & Sons, Inc.
b. Johnson, L. E., Products, Inc.
c. PC Henderson Inc.
d. Stanley Commercial Hardware; a division of Stanley Security Solutions.

2.29 METAL PROTECTIVE TRIM UNITS

A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch-thick aluminum; with manufacturer's standard machine or self-tapping screw fasteners.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Allegion plc.
    b. Burns Manufacturing Incorporated.
    c. Hager Companies.
    d. Inpro Corporation.
    e. Pawling Corporation.
    f. Rockwood Manufacturing Company; an ASSA ABLOY Group company.

2.30 AUXILIARY DOOR HARDWARE

A. Auxiliary Hardware: BHMA A156.16.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Allegion plc.
    b. Baldwin Hardware Corporation.
    c. Hager Companies.
    d. Rockwood Manufacturing Company; an ASSA ABLOY Group company.

2.31 AUXILIARY ELECTRIFIED DOOR HARDWARE

A. Auxiliary Electrified Door Hardware:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Allegion plc.
    b. Door Controls International, Inc.
    c. DORMA USA, Inc.
    d. DynaLock Corp.
    e. GE Security, Inc.
    f. Hager Companies.
    g. Precision Hardware, Inc.; a Stanley company.
    h. Rutherford Controls Int'l. Corp.
    i. SARGENT Manufacturing Company; ASSA ABLOY.
    j. Securitron Magnalock Corporation; an ASSA ABLOY Group company.
    k. Security Door Controls.

2.32 FINISHES

A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Custom Steel Doors and Frames: HMMA 831.
3. Wood Doors: DHI's "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.

C. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule, but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches of door height greater than 90 inches.

E. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as indicated in keying schedule or directed by Owner.

F. Key Control Cabinet: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

G. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings. Verify location with Engineer/Architect.

1. Configuration: Provide least number of power supplies required to adequately serve doors with electrified door hardware.

H. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."

I. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

J. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

1. Do not notch perimeter gasketing to install other surface-applied hardware.

K. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

L. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.2 ADJUSTING

A. Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.3 DOOR HARDWARE SCHEDULE

A. The following schedule is furnished for whatever assistance it may afford the Contractor; do not consider it as entirely inclusive. Should any particular door or item be omitted in any scheduled hardware heading, provide door or item with hardware same as required for similar purposes.

Hardware supplier is responsible for handing and sizing all products as listed in the hardware heading. Quantities listed are for each pair of doors, or for each single door.

B. Manufacturer's Abbreviations depicting basis of design for these items:

1. SCH – Schlage
2. VON – Von Duprin
3. LCN – Allegion LCN
4. NGP - NGP
5. IVE – Ives
6. FAL – Falcon
7. ISO – Isonas
8. HES – H.E.S. assa abloy
9. GLY – Glynn-Johnson

HARDWARE SETS

QTY	ITEM	MODEL NUMBER	FINISH	MFR
SET # 1	***- 901B***			
1	CONT. HINGE	112HD	628	IVE
1	STORE ROOM LOCK	T581H7DANE	626	FAL
1	SFIC CORE	C607	626	FAL
1	WALL STOP	WS 406/407 CVX	630	IVE
1	ELECTRIC STRIKE	1006 SERIES	630	HES
1	SURFACE CLOSER	1450 PARRALLEL ARM MOUNT	695	LCN
1	DOOR SWEEP	39A	A	ZER
1	THRESHOLD	655A	A	ZER
1	CARD READER	PUREIP RC-04 MCT-W		150
SET # 2	***- 913B***			
1	CONT. HINGE	112 HD	652	IVE
1	CLASSROOM LOCK	T561H7 DANE	626	FAL
1	SFIC CORE	C607	626	FAL
1	WALL STOP	WS 406/407 CVX	630	IVE
1	SURFACE CLOSER	1450 PARALLELARM MOUNT	689	LCN
1	MOUNTING PLATE	1450-18	689	LCN
2	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE
3	SILENCER	SR64	GRY	IVE
SET #3	***- 906, 907, 908***			
3	HINGE	5BB1 4.5 X 4.5	652	IVE
1	CLASSROOM LOCK	T561H7 DANE	626	FAL
1	SFIC CORE	C607	626	FAL
1	SURFACE CLOSER	1450 REG ARM MOUNT	695	LCN
2	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE
1	WALL STOP	WS406/407CVX	630	IVE
3	SILENCER	SR64	GRY	IVE
SET # 4	***- 902B, 903B, 911***			
6	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
2	DUMMY TRIM	DANE W SERIES	626	FAL
2	OH STOP	90S	652	GLY
2	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	SILENCER	SR64	GRY	IVE
SET # 5	***- 912B***			
3	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	CLASSROOM LOCK	T561H7 DANE	626	FAL
1	SFIC CORE	C607	626	FAL
1	SURFACE CLOSER	1450 REG ARM MOUNT	695	LCN
1	OH STOP	90S	652	GLY
2	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE
3	SILENCER	SR64	GRY	IVE

SET # 6 - 912A

1	CONT. HINGE	112 HD	628	IVE
1	CLASSROOM LOCK	T561H7 DANE	626	FAL
2	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE
1	AUTO OPERATOR	9540 – 18 ANCLR75.5		LCN
2	DOOR ACTUATORS	8310-856T(HARD WIRED)		LCN
1	ELECTRIC STRIKE	1006 SERIES	630	HES

SET # 7 - 913A

1	CONT. HINGE	112HD	628	IVE
1	STOREROOM LOCK	T581 H7 DANE	626	FAL
1	SFIC CORE	C607	626	FAL
1	GASKETING	328AA-S	AA	ZER
1	DOOR BOTTOM	355A6	A	ZER
1	AUTO OPERATOR	9540-18 ANCLR75.5		LCN
2	DOOR ACTUATORS	8310-856T(HARD WIRED)		LCN
1	ELECTRIC STRIKE	1006 SERIES		HES
1	DOOR SWEEP	39A	A	ZER
1	THRESHOLD	655A	A	ZER
1	CARD READER	PUREIP RC-04 MCT-W		150

SET #8 - 901A

1	CONT. HINGE	224HD	628	IVE
2	SFIC CORE	C607	626	FAL
1	AUTO OPERATOR	9540 – 18 ANCLR75.5		LCN
1	DOOR BOTTOM	355A6	A	ZER
2	DOOR ACTUATORS	8 310-856T(HARD WIRED)		LCN
1	ELECTRIC STRIKE	1006 SERIES		HES
1	GASKETING	328AA-S	AA	ZER
1	DOOR SWEEP	39A	A	ZER
1	THRESHOLD	655A	A	ZER
1	CARD READER			150

SET # 9 - 902A, 903A

3	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	CLASSROOM LOCK	T561H7 DAN	626	FAL
1	SFIC CORE	C607	626	FAL
1	SURFACE CLOSER	1450 RE ARM MOUNT	689	LCN
2	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE
1	WALL STOP	WS406/407CVX	630	IVE

SET # 10 - 904

3	HINGE	5BB1 4.5 X 4.5	652	IVE
1	CLASSROOM LOCK	T561H7 DAN	626	FAL
1	SFIC CORE	C607	626	FAL
1	SURFACE CLOSER	450 PARALLEL ARM MOUNT	689	LCN

3	SILENCER	SR64	GRY	IVE
2	KICK PLATE	8400 10” X 1 1/2” LDW B-CS	630	IVE

SET # 11 - 909, 905

3	HINGE	5BB1 4.5 X 4.5	652	IVE
1	PASSAGE SET	T101 DAN	626	FAL
1	SURFACE CLOSER	1450 REG ARM MOUNT	695	LCN
1	WALL STOP	WS406/407CVX	630	IVE
3	SILENCER	SR64	GRY	IVE
2	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE

SET # 12 - 915, 916

3	HINGE	5BB1 4.5 X 4.5	652	IVE
1	DOOR PULL, 1" ROUND	8103EZHD 10" O	630-316	IVE
1	PUSH PLATE	8200 3" X 12"	630	IVE
1	SURFACE CLOSER	1450 REG ARM MOUNT	695	LCN
2	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE
3	SILENCER	SR64	GRY	IVE

END OF SECTION 087100

SECTION 087113 - AUTOMATIC DOOR OPERATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Low-energy door operators for swinging doors.
2. Power-assist door operators for swinging doors.

1.2 DEFINITIONS

A. AAADM: American Association of Automatic Door Manufacturers.

B. Double-Egress (Doors): A pair of doors that simultaneously swing, with the two doors moving in opposite directions with no mullion between them.

C. Double-Swing (Doors): A pair of doors that swing, with the two doors moving in opposite directions with a mullion between them; each door functioning as a single-swing door.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at a location to be determined.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For automatic door operators.

1. Include plans, elevations, sections, hardware mounting heights, and attachment details.
2. Include diagrams for power, signal, and control wiring.

C. Samples: For each exposed product and for each color and texture specified.

1.5 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Field quality-control reports.

C. Sample warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer for installation and maintenance of units required for this Project.

B. Certified Inspector Qualifications: Certified by AAADM.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of automatic door operators that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 BASIS OF DESIGN

A. Provide automatic door operator as manufactured by LCN an Allegion Company to be 9540-18 ANCLR 75.5 model with 8310-856T push plate actuator pad.

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Horton Automatics; a division of Overhead Door Corporation.
2. SARGENT Manufacturing Company; ASSA ABLOY.
3. Stanley Access Technologies

2.3 AUTOMATIC DOOR OPERATORS, GENERAL

A. General: Provide operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for occupancy type indicated; and in accordance with UL 325. Coordinate operator mechanisms with door operation, hinges, and activation and safety devices.

1. Emergency Breakaway: Where indicated for center-pivoted doors, provide emergency breakaway feature for reverse swing of doors. Equip system to discontinue power to automatic door operator when door is in emergency breakaway position, to return door to closed position after breakaway, and to automatically reset.

2. Fire-Rated Doors: Provide door operators for fire-rated door assemblies that comply with NFPA 80 for fire-rated door components and are listed and labeled by a qualified testing agency.
3. Wind Load: Provide door operators on exterior doors that will open and close doors and maintain them in fully closed position when subjected to wind load of 15 PSF.

B. Electromechanical Operating System: Self-contained unit powered by permanent-magnet dc motor; with closing speed controlled mechanically by gear train and dynamically by braking action of electric motor, connections for power and activation- and safety-device wiring, and manual operation, including spring closing when power is off.

C. Electrohydraulic Operating System: Self-contained, low-pressure unit; with separate cylinders for power and checking, connections for power and activation- and safety-device wiring, and manual operation, including spring closing when power is off.

D. Housing for Overhead Concealed Operators: Fabricated from minimum 0.125-inch-thick, extruded or formed aluminum and extending full width of door opening, including door jambs, to conceal door operators and controls. Provide hinged or removable access panels for service and adjustment of door operators and controls. Secure panels to prevent unauthorized access.

E. Cover for Surface-Mounted Operators: Fabricated from 0.125-inch-thick, extruded or formed aluminum; manufacturer's standard width; continuous over full width of operator-controlled door opening; with enclosed end caps, provision for maintenance access, and fasteners concealed when door is in closed position.

F. Brackets and Reinforcements: Fabricated from aluminum with nonstaining, nonferrous shims for aligning system components.

G. Fire-Door Package: Consisting of UL-listed latch mechanism, power-reset box, and caution signage for fire-rated doors. Latch mechanism shall allow door to swing free during automatic operation; when fire is detected, latch actuator shall cause exit hardware to latch when door closes. Provide latch actuators with fail-secure design.

H. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.4 LOW-ENERGY DOOR OPERATORS FOR SWINGING DOORS

A. Standard: BHMA A156.19.

B. Performance Requirements:

1. Opening Force if Power Fails: Not more than 15 lbf required to release latch if provided, not more than 30 lbf required to manually set door in motion, and not more than 15 lbf required to fully open door.
2. Entrapment-Prevention Force: Not more than 15 lbf required to prevent stopped door from closing or opening.

C. Configuration: Operator to control single swinging door.

1. Traffic Pattern: Two way.
2. Operator Mounting: Surface.

D. Configuration: Operator to control pair of swinging doors.

1. Traffic Pattern: Two way.
2. Operator Mounting: Surface.

E. Operation: Power opening and power-assisted spring closing. When not in automatic mode, door operator shall function as manual door closer, with or without electrical power.

F. Operating System: Electromechanical.

G. Microprocessor Control Unit: Solid-state controller.

H. Features:

1. Adjustable opening and closing speed.
2. Adjustable opening and closing force.
3. Adjustable backcheck.
4. Adjustable hold-open time from zero to 30 seconds.
5. Adjustable time delay.
6. Adjustable acceleration.
7. Obstruction recycle.
8. On-off/hold-open switch to control electric power to operator; key operated.

I. Activation Device: Push-plate switch on each side of door to activate door operator.

J. Exposed Finish: Finish matching door and frame.

1. Color: As selected by Architect from full range of industry colors and color densities.

2.5 POWER-ASSIST DOOR OPERATORS FOR SWINGING DOORS

A. Standard: BHMA A156.19.

B. Performance Requirements:

1. Opening Force:

a. Opening Force if Power Fails: Not more than 15 lbf required to release latch if provided, not more than 30 lbf required to manually set door in motion, and not more than 15 lbf required to fully open door.
b. Accessible Interior Doors: Not more than 5 lbf to push or pull door to fully open position.

2. Entrapment-Prevention Force: Not more than 15 lbf required to prevent stopped door from closing or opening.

C. Configuration: Operator to control single swinging door.

1. Traffic Pattern: Two way.
2. Operator Mounting: Surface.

D. Configuration: Operator to control pair of swinging doors.

1. Traffic Pattern: Two way.
2. Operator Mounting: Surface.

E. Operation: Power-assisted opening that reduces the force to open door and power-assisted spring closing. Pushing or pulling on door activates operator. When not in automatic mode, door operator shall function as manual door closer, with or without electrical power.

F. Operating System: Electromechanical.

G. Microprocessor Control Unit: Solid-state controller.

H. Features:

1. Adjustable opening and closing speed.
2. Adjustable opening and closing force.
3. Adjustable backcheck.
4. Adjustable hold-open time from zero to 30 seconds.
5. Adjustable time delay.
6. Adjustable acceleration.
7. Obstruction recycle.
8. On-off/hold-open switch to control electric power to operator; key operated.

I. Exposed Finish: Finish matching door and frame.

1. Color: As selected by Architect from full range of industry colors and color densities.

2.6 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Extrusions: ASTM B221.
2. Sheet: ASTM B209.

B. Fasteners and Accessories: Corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

2.7 CONTROLS

A. General: Provide controls in accordance with BHMA standards; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for occupancy type indicated. Coordinate devices with door operation and door operator mechanisms.

B. Push-Plate Switch: Momentary-contact door control switch with flat push-plate actuator with contrasting-colored, engraved message.

1. Configuration: Square push plate with 4-by-4-inch junction box.

a. Mounting: As indicated on Drawings.

2. Push-Plate Material: Stainless steel as selected by Architect from manufacturer's full range.
3. Message: International symbol of accessibility and "Push to Open."

C. Electrical Interlocks: Unless units are equipped with self-protecting devices or circuits, provide electrical interlocks to prevent activation of operator when door is locked, latched, or bolted.

2.8 ACCESSORIES

A. Signage: As required by cited BHMA standard for type of door and its operation.

1. Application Process: Operator manufacturer's standard process.
2. Provide sign materials with instructions for field application when operators are installed.

2.9 FABRICATION

A. Factory fabricate automatic door operators to comply with indicated standards.

B. Fabricate exterior components to drain condensation and water-passing joints within operator enclosure to the exterior.

C. Use concealed fasteners to greatest extent possible. Where exposed fasteners are required, use countersunk Phillips flat-head machine screws, finished to match operator.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install automatic door operators in accordance with manufacturer's written instructions and cited BHMA standard for type of door operation and direction of pedestrian travel, including signage, controls, wiring, remote power units if any, and connection to building's power supply.

B. Verify that full-height finger guards are installed at each door with pivot hinges, where door has a clearance at hinge side greater than 1/4 inch and less than 3/4 inch with door in any position.

C. Controls: Install devices in accordance with manufacturer's written instructions and cited BHMA standard for operator type and direction of pedestrian travel.

D. Signage: Apply on both sides of each door as required by cited BHMA standard for type of door operator and direction of pedestrian travel.

E. Adjusting: Adjust automatic door operators to function smoothly, and lubricate as recommended by manufacturer; comply with requirements of applicable BHMA standards.

1. Adjust operators on exterior doors for tight closure.
2. Readjust automatic door operators and controls after repeated operation of completed installation equivalent to three days' use by normal traffic (100 to 300 cycles).

F. Demonstration: Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain automatic door operators.

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Test and inspect each automatic door operator installation, using AAADM inspection forms, to determine compliance of installed systems with applicable BHMA standards.

B. Automatic door operators will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 087113

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes but is not necessarily limited to:

1. Glass for windows, doors and sidelights.
2. Glazing sealants and accessories.
3. Fire Protection Rated Glazing

1.2 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.

C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

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

1.4 INFORMATIONAL SUBMITTALS

A. Preconstruction adhesion and compatibility test report.

1.5 QUALITY ASSURANCE

A. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

1.6 PRECONSTRUCTION TESTING

A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.

1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.

1.7 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Fire-Rated Glass: Manufacturer agrees to replace fired-rated glass units that deteriorate within specified warranty period. Deterioration of fired-rated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning fired-rated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced fired-rated glass standard.

1. Warranty Period: 10 years from date of Substantial Completion.

C. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Cardinal Glass Industries.
2. Guardian Glass; SunGuard.
3. Pilkington North America.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazing.

B. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the International Building Code and ASTM E1300.

1. Design Wind Pressures: As indicated on Drawings.
2. Design Snow Loads: As indicated on Drawings.
3. Thickness of Patterned Glass: Base design of patterned glass on thickness at thinnest part of the glass.
4. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

C. Windborne-Debris Impact Resistance: Exterior glazing shall pass ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone 1 for basic protection.

1. Large-Missile Test: For glazing located within 30 feet of grade.
2. Small-Missile Test: For glazing located between 30 feet (9.1 m) and 60 feet above grade.

D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

E. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
2. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
3. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR A7, "Sloped Glazing Guidelines."
3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.

E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.

B. Tinted Annealed Float Glass: ASTM C1036, Type I, Class 2 (tinted), Quality-Q3.

C. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

D. Heat-Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

E. Pyrolytic-Coated, Low-Maintenance Glass: Clear float glass with a coating on first surface having both photocatalytic and hydrophilic properties that act to loosen dirt and to cause water to sheet evenly over the glass instead of beading.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Pilkington North America.
b. Saint-Gobain Glass Exprover NA.

F. Silicone-Coated Spandrel Glass: ASTM C1048, Type I, Condition C, Quality-Q3.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. ICD High Performance Coatings.

2.5 FIRE PROTECTION RATED GLASS

A. Fire Protection Rated Glass Basis of Design: SuperClear 45-HS as manufactured by Safety and Fire Technlogy Inc., phone (888) 653-3333, web site http://www.safti.com . Use materials that have a proven record of no tendency to lose physical and mechanical properties after fabrication and installation.

1. Fire-rated glass ceramic clear and wireless glazing material listed for use in non-impact safety-rated locations such as transoms and borrowed lites with fire rating requirements for 45 minutes with required hose stream test.
2. Passes positive pressure test standards UL 10C.
3. Properties:
   a. Thickness: 3/4 inch [19 mm] overall.
   b. Weight: 9 lbs./sq. ft.
   c. Approximate Visible Transmission: 83 percent.
   d. Approximate Visible Reflection: 9 percent.
   e. Fire-rating: 45 minutes with hose stream.
   f. Impact Safety Resistance: ANSI Z97.1 Class A and B and CPSC 16CFR1201 (Cat. I and II).
   g. STC Rating: Approximately 37 dB.
   h. Surface Finish:
   i. Appearance: clear, wireless and tint-free.
   j. Positive Pressure Test: UL 10C; passes.
4. Maximum sheet sizes based on surface finish:
   a. Premium: 48 inches by 96 inches.
   b. Standard: 48 inches by 96 inches.
5. Labeling: Permanently label each piece with a permanent logo including name of product, manufacturer, testing laboratory, fire rating, period and safety glazing standards.
6. Glazing material installed in Hazardous Locations, subject to human impact, shall be certified and permanently labeled as meeting applicable requirements referenced in NFPA 80: a. CPSC 16 CFR 1201, Cat. I or II.

2.6 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E2190.

1. Sealing System: Dual seals.
2. Perimeter Spacer: Manufacturer's standard spacer material and construction.

   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      1) Technoform.
      2) Thermix; a brand of Ensinger USA.

2.7 GLAZING SEALANTS

A. General:

1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As selected by Engineer/Architect from manufacturer's full range.

B. Glazing Sealant:
1. Neutral-curing silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 100/50, Use NT.

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) Sika Corporation.
2) The Dow Chemical Company.

2.8 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.
2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.9 MISCELLANEOUS GLAZING MATERIALS

A. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

B. Setting Blocks:

1. EPDM or Silicone with a Shore A durometer hardness of 85, plus or minus 5.
2. Type recommended by sealant or glass manufacturer.

C. Spacers:

1. Neoprene blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
2. Type recommended by sealant or glass manufacturer.

D. Edge Blocks:

1. EPDM or Silicone with a Shore A durometer hardness per manufacturer's written instructions.
2. Type recommended by sealant or glass manufacturer.

E. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

PART 3 - EXECUTION

3.1 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

3.2 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Apply heel bead of elastomeric sealant.

F. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

G. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.3 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.4 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.5 CLEANING AND PROTECTION

A. Immediately after installation remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

3.6 MONOLITHIC GLASS SCHEDULE

A. Glass Type GL-1: Clear annealed float glass.

1. Minimum Thickness: 6 mm.
2. Safety glazing required.

B. Glass Type GL-2: Ultraclear heat-strengthened float glass.

1. Basis-of-Design Product: PPG Industries, Inc.; Starphire.
2. Minimum Thickness: 6 mm.
3. Safety glazing required.

C. Glass Type GL-#3: Pyrolytic-coated, self-cleaning, low-maintenance, clear fully tempered float glass.

1. Basis-of-Design Product: Cardinal Glass Industries; Neat.
2. Minimum Thickness: 6 mm.
3. Safety glazing required.

3.7 LAMINATED GLASS SCHEDULE

A. Glass Type GL-4: Clear laminated glass with two plies of ultraclear fully tempered float glass.

1. Basis-of-Design Product: Cardinal Glass
2. Minimum Thickness of Each Glass Ply: 6 mm.
3. Interlayer Thickness: 0.060 inch.
4. Safety glazing required.

3.8 INSULATING GLASS SCHEDULE

A. Glass Type GL-5: Pyrolytic-coated, self-cleaning, low-maintenance, low-E coated, clear insulating glass.

1. Basis-of-Design Product: Cardinal Glass Industries; Neat LoE.
2. Overall Unit Thickness: 1 inch.
3. Minimum Thickness of Each Glass Lite: 6 mm.
4. Outdoor Lite: Pyrolytic-coated, self-cleaning, low-maintenance, clear fully tempered float glass.
5. Interspace Content: Argon.
6. Indoor Lite: Fully tempered float glass.
7. Low-E Coating: Pyrolytic or sputtered on second or third surface.
8. Winter Nighttime U-Factor: 0.28 maximum.
9. Summer Daytime U-Factor: 0.25 maximum.
10. Visible Light Transmittance: 72% percent minimum.
11. Solar Heat Gain Coefficient: 0.41 maximum.
12. Safety glazing required.

B. Glass Type GL-6: Pyrolytic-coated, self-cleaning, low-maintenance, low-E coated, clear insulating, tempered safety glass.

1. Basis-of-Design Product: Cardinal Glass Industries; Neat LoE.
2. Overall Unit Thickness: 1 inch.
3. Minimum Thickness of Each Glass Lite: 6 mm.
4. Outdoor Lite: Pyrolytic-coated, self-cleaning, low-maintenance, clear fully tempered float glass.
5. Interspace Content: Argon.
6. Indoor Lite: Fully tempered float glass.
7. Low-E Coating: Pyrolytic or sputtered on second or third surface.
8. Winter Nighttime U-Factor: 0.28 maximum.
9. Summer Daytime U-Factor: 0.25 maximum.
10. Visible Light Transmittance: 72% percent minimum.
11. Solar Heat Gain Coefficient: 0.41 maximum.
12. Safety glazing required.

C. Glass Type GL-7: Silicone-coated, insulating spandrel glass.

1. Basis-of-Design Product: ICD High Performance Coatings, Opaci-Coat 300.
2. Coating Color: As selected by Engineer/Architect from manufacturer's full range.
3. Overall Unit Thickness: 1 inch.
4. Minimum Thickness of Each Glass Lite: 6 mm.
5. Outdoor Lite: fully tempered float glass.
6. Interspace Content: Argon.
7. Indoor Lite: fully tempered float glass.
8. Coating Location: Fourth surface.
9. Winter Nighttime U-Factor: 0.31 maximum.
10. Summer Daytime U-Factor: 0.28 maximum.

D. Glass Type GL-7: Clear Annealed glass.

1. Basis-of-Design Product: ICD High Performance Coatings, Opaci-Coat 300.

2. Coating Color: As selected by Engineer/Architect from manufacturer's full range.
3. Overall Unit Thickness: 1 inch.
4. Minimum Thickness of Each Glass Lite: 6 mm.
5. Outdoor Lite: fully tempered float glass.
6. Interspace Content: Argon.
7. Indoor Lite: fully tempered float glass.
8. Coating Location: Fourth surface.
9. Winter Nighttime U-Factor: 0.31 maximum.
10. Summer Daytime U-Factor: 0.28 maximum.

END OF SECTION 088000

SECTION 089119 - FIXED LOUVERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes fixed extruded-aluminum and formed-metal louvers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

C. Samples: For each type of metal finish required.

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

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on tests performed according to AMCA 500-L.

B. Sample warranties.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.5 WARRANTY

A. Special Finish Warranty: Manufacturer agrees to repair or replace components on which finishes fail in materials or workmanship within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design louvers, including comprehensive engineering analysis by a qualified professional engineer, using structural and seismic performance requirements and design criteria indicated.

B. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.

1. Wind Loads: Determine loads based on pressures as indicated on Drawings.
2. Wind Loads: Determine loads based on a uniform pressure of 20 lbf/sq. ft., acting inward or outward.

C. Seismic Performance: As indicated on drawings.

D. Seismic Performance: Louvers, including attachments to other construction, shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
1. Component Importance Factor: 1.0.

E. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

2.2 FIXED EXTRUDED-ALUMINUM LOUVERS

A. Horizontal Drainable-Blade Louver:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Airolite Company, LLC (The).
    b. Greenheck Fan Corporation.
    c. Ruskin Company.
2. Louver Depth: 6 inches.
3. Frame and Blade Nominal Thickness: Not less than 0.060 inch for blades and 0.080 inch for frames.
4. Mullion Type: Exposed.
5. Louver Performance Ratings:

    a. Free Area: Not less than 8.0 sq. ft for 48-inch-wide by 48-inch-high louver.
    b. Point of Beginning Water Penetration: Not less than 700 fpm.
    c. Air Performance: Not more than 0.10-inch wg static pressure drop at 700-fpm free-area intake velocity.

d. Air Performance: Not more than 0.15-inch wg static pressure drop at 900-fpm free-area exhaust velocity.

6. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.3 LOUVER SCREENS

A. General: Provide screen at louvers indicated.

1. Screen Location for Fixed Louvers: Interior face.
2. Screening Type: Bird screening.

B. Louver Screen Frames: Same type and form of metal as indicated for louver to which screens are attached.

C. Louver Screening for Aluminum Louvers:

1. Bird Screening: Aluminum, 1/2-inch-square mesh, 0.063-inch wire.

2.4 MATERIALS

A. Aluminum Extrusions: ASTM B221, Alloy 6063-T5, T-52, or T6.

B. Aluminum Sheet: ASTM B209, Alloy 3003 or 5005, with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Fasteners: Use types and sizes to suit unit installation conditions.

1. Use tamper-resistant screws for exposed fasteners unless otherwise indicated.
2. For color-finished louvers, use fasteners with heads that match color of louvers.

D. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, fabricated from stainless-steel components, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing according to ASTM E488/E488M conducted by a qualified testing agency.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.5 FABRICATION

A. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

B. Join frame members to each other and to fixed louver blades with fillet welds concealed from view unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.6 ALUMINUM FINISHES

A. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

1. Color: Per architectural plans.

B. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2604 and containing not less than 50 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Color and Gloss: As selected by Engineer/Architect from manufacturer's full range.

2.7 GALVANIZED-STEEL SHEET FINISHES

A. Finish louvers after assembly.

B. Surface Preparation: Clean surfaces with nonpetroleum solvent, so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating compatible with the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas and repair according to ASTM A780/A780M.

C. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 2 mils.

1. Color and Gloss: As selected by Engineer/Architect from manufacturer's full range.

2.8 STAINLESS-STEEL SHEET FINISHES

A. Repair sheet finish by grinding and polishing irregularities, weld spatter, scratches, and forming marks to match surrounding finish.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

D. Protect unpainted galvanized- and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

3.2 ADJUSTING

A. Restore louvers damaged during installation and construction, so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Engineer/Architect, remove damaged units and replace with new units.

END OF SECTION 089119

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Tile backing panels.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Gypsum board, Type X.
2. Mold-resistant gypsum board.
3. Impact-resistant gypsum board.
4. Interior trim.
5. Joint treatment materials.
6. Laminating adhesive.

B. Samples: For each texture finish indicated on same backing indicated for Work.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

B. Gypsum Board, Type X: ASTM C1396/C1396M.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. National Gypsum Company.
    b. USG Corporation.

2. Thickness: 5/8 inch.
3. Long Edges: Tapered and featured (rounded or beveled) for prefilling.

C. Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. National Gypsum Company.
    b. USG Corporation.

2. Core: 5/8 inch, Type X.
3. Long Edges: Tapered.
4. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

D. Impact-Resistant Gypsum Board: ASTM C1396/C1396M gypsum board, tested in accordance with ASTM C1629/C1629M.

    a. National Gypsum Company.
    b. USG Corporation.
2. Core: 5/8 inch Type X.
3. Surface Abrasion: ASTM C1629/C1629M, meets or exceeds Level 2 requirements.
4. Indentation: ASTM C1629/C1629M, meets or exceeds Level 2 requirements.
5. Soft-Body Impact: ASTM C1629/C1629M, meets or exceeds Level 2 requirements.
6. Hard-Body Impact: ASTM C1629/C1629M, meets or exceeds Level 2 requirements in accordance with test in Annex A1.
7. Long Edges: Tapered.
8. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.

2.3 TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Board: ASTM C1178/C1178M, with manufacturer's standard edges.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. National Gypsum Company.
    b. USG Corporation.

2. Core: 5/8 inch, Type X.
3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

B. Cementitious Backer Units: ANSI A118.9 and ASTM C1288 or ASTM C1325, with manufacturer's standard edges.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. National Gypsum Company.
b. USG Corporation.

2. Thickness: 5/8 inch .
3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.4 METAL SUSPENSION SYSTEM

A. Manufacturers: Basis of Design: USG Drywall Suspension Systems. 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. Armstrong World Industries, Inc.
2. National Gypsum Services Company

A. Commercial quality, cold-rolled steel, hot dipped galvanized finish.
   1. Main Tees: Fire-Rated Heavy Duty classification 1.617” high x 144” long, integral reversible splice with knurled face. (DGLW-26 1-1/2” Face and 1.617” high)
      a. Cross Members: Fire-Rated members with knurled face. Cross Tees: DGLW-424 cross tee 1-1/2” high x 48” long with 1-1/2” wide face; DGLW-224 Fire-Rated: 1-1/2” high x 24” long with 1-1/2” face
   2. quick release cross tee ends for positive locking and removability without tools
   3. Accessory Cross Tees: Cross tees must have knurled faces and quick release cross tee ends for positive locking and removability without tools.
      a. DGW-6026DM: 1.617” high x 5’ long with a 1-1/2” face
      b. DGW-7226DM: 1.617” high x 6’ long with a 1-1/2” face
      c. DGW-8426DM: 1.617” high x 7’ long with a 1-1/2” face
      d. DGW-9626DM: 1.617” high x 8’ long with a 1-1/2” face
   4. Wall Moldings: Single web with knurled face
      a. DGWM-24: 1-1/2” x 1” x 144” long wall molding
      b. DGCM-27: 144” x 1-5/8” x 1” x 1” channel molding
      c. DGLC-12: 144” x 1-3/4” x 1” x 1” index channel molding
   5. Accessories
      a. DGSC-180: Splice Clip
      b. DGTC-90: Transition Clip
      c. DGWC: Wall Attachment Clip
      d. DGSP-180: Splice Plate
      e. DGHUB: Dome Hub
      f. CMAC-1: Close Mount Attachment Clip
   6. Wire: Hanger Wire 12 ga., galvanized or as noted on drawings

B. USG Drywall Wall-to-Wall Suspension Systems – Commercial quality, cold-rolled steel, hot dipped galvanized finish for use in corridors and short span applications.
    1. Main Tees: Fire-Rated Heavy Duty classification 1.617" high x [6'] [8'] [10'] [12'] [14'] [Custom] long, integral reversible splice with 1-1/2" knurled face.
    2. Wall Moldings: Single web with knurled face, 1-1/2" x 1" x 12' long, DGWM24
    3. Wall Channel: Single web with knurled face, 1-5/8" x 1" x 12' long, DGCM27
    4. Locking Wall Channel: Single web with knurled face, 1-3/4" x 1" x 12' long, DGLC-12

2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet.
2. Shapes:

    a. Cornerbead.
    b. Bullnose bead.
    c. LC-Bead: J-shaped; exposed long flange receives joint compound.
    d. L-Bead: L-shaped; exposed long flange receives joint compound.
    e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
    f. Expansion (control) joint.
    g. Curved-Edge Cornerbead: With notched or flexible flanges.

2.6 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.

    a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use setting-type, sandable topping compound.
4. Finish Coat: For third coat, use setting-type, sandable topping compound.
5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.

2.7 AUXILIARY MATERIALS

A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.

1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

PART 3 - EXECUTION

3.1 INSTALLATION AND FINISHING OF PANELS

A. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

B. Comply with ASTM C840.

C. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch-wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

D. For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

E. Prefill open joints, rounded or beveled edges, and damaged surface areas.

F. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

G. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:

1. **Level 1**: Used in ceiling plenum areas, concealed areas, areas not open to public view. All joints and interior angles to have tape embedded in joint compound; tape and fastener heads don’t need to be covered with joint compound. Surface to be free of excess joint compound.
2. **Level 2**: Used with setting-type compound where water resistant gypsum backing board is used as substrate for tile. Garage areas, warehouse storage, or similar areas. All joints and interior angles to have tape embedded in joint compound and have a thin coat of

compound. Fastener heads and accessories to be covered with a coat of joint compound. Surface to be free of excess joint compound.

3. **Level 3**: Used in areas where heavy texture finish will be applied before painting, or where commercial grade wallcoverings are applied as final decoration. All joints and interior angles to have tape embedded in joint compound and have a 2 coats of compound. Fastener heads and accessories to be covered with 2 coats of joint compound. All joints to be smooth and free of tool marks and ridges. Prepared surface to be covered with primer prior to final decoration.
4. **Level 4**: Used where residential grade wall coverings, flat paints, light textures will be applied. All joints and interior angles to have tape embedded in joint compound with a thin coat of compound; Additional coats of compound to be applied, 2 coats on all flat joints and 1 coat over interior angles. Fastener heads and accessories to be covered with 3 coats of joint compound. Joints to be smooth and free of tool marks and ridges. Prepared surface to be covered with primer prior to final decoration. Gloss, semi-gloss, and enamel paints are not recommended for this level.
5. **Level 5**: Used in areas where gloss, semi-gloss, and enamel paints, or flat joints on untextured surface are specified. All joints and interior angles to have tape embedded in joint compound with a thin coat of compound; Additional coats of compound to be applied, 2 coats on all flat joints and 1 coat over interior angles. Fastener heads and accessories to be covered with 3 coats of joint compound. A thin skim coat of joint compound to be trowel applied to entire surface. Surface to be smooth and free of tool marks and ridges. Prepared surface to be covered with primer prior to final decoration.

H. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.

I. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.

J. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.2 APPLYING TEXTURE FINISHES

A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.

B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture matching approved mockup and free of starved spots or other evidence of thin application or of application patterns.

3.3 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.

END OF SECTION 092900

SECTION 093013 - CERAMIC TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ceramic mosaic tile.
2. Porcelain tile.
3. Stone thresholds.
4. Tile backing panels.
5. Waterproof membrane for thinset applications.
6. Crack isolation membrane.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples:

1. Each type and composition of tile and for each color and finish required. For ceramic mosaic tile in color blend patterns, provide samples of each color blend.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer is a Five-Star member of the National Tile Contractors Association or a Trowel of Excellence member of the Tile Contractors' Association of America.
2. Installer's supervisor for Project holds the International Masonry Institute's Foreman Certification.

3. Installer employs only Ceramic Tile Education Foundation Certified Installers or installers recognized by the U.S. Department of Labor as Journeyman Tile Layers for Project.
4. Installer employs at least one installer for Project that has completed the Advanced Certification for Tile Installers (ACT) certification for installation of mud floors, mud walls, membranes, shower receptors, gauged porcelain tile/gauged porcelain tile panels and slabs, and large format tile.

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of each type of floor tile installation.
2. Build mockup of each type of wall tile installation.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide Standard-grade tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

2.2 TILE PRODUCTS

A. Ceramic Tile Type CT-1: Factory-mounted unglazed ceramic mosaic tile.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. American Olean; a division of Dal-Tile Corporation.
    b. Daltile.
2. Composition: Vitreous or impervious natural clay or porcelain.
3. Certification: Porcelain tile certified by the Porcelain Tile Certification Agency.
4. Module Size: 2 by 2 inches.
5. Thickness: 1/4 inch.
6. Face: Plain with cushion edges.
7. Surface: Slip resistant, with abrasive admixture.
8. Dynamic Coefficient of Friction: Not less than 0.42.
9. Finish: Mat, opaque glaze.
10. Tile Color and Pattern: As selected by Engineer/Architect from manufacturer's full range.
11. Grout Color: As selected by Engineer/Architect from manufacturer's full range.

12. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:

    a. Base Cove: Cove, module size 2 by 1 inch.
    b. Base Cap: Surface bullnose, module size 2 by 2 inches.
    c. Wainscot Cap: Surface bullnose, module size 2 by 2 inches.
    d. External Corners for Thinset Mortar Installations: Surface bullnose, module size 2 by 2 inches.
    e. Internal Corners: Cove, module size 2 by 1 inch.
    f. Tapered Transition Tile: Shape designed to effect transition between thickness of tile floor and adjoining floor finishes of different thickness, tapered to provide reduction in thickness from 1/2 to 1/4 inch across nominal 4-inch dimension.

B. Ceramic Tile Type CT-2: Glazed porcelain tile.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. American Olean; a division of Dal-Tile Corporation.
    b. Daltile.
2. Certification: Tile certified by the Porcelain Tile Certification Agency.
3. Face Size: 11-13/16 by 11-13/16 inches.
4. Face Size Variation: Rectified.
5. Thickness: 1/4 inch.
6. Face: Plain with square or cushion edges.
7. Dynamic Coefficient of Friction: Not less than 0.42.
8. Tile Color, Glaze, and Pattern: As selected by Architect from manufacturer's full range.
9. Grout Color: As selected by Architect from manufacturer's full range.
10. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:

    a. Base Cap: Surface bullnose, module size same as adjoining flat tile.
    b. Wainscot Cap: Surface bullnose, module size same as adjoining flat tile.
    c. External Corners: Surface bullnose, module size same as adjoining flat tile.
    d. Tapered Transition Tile: Shape designed to effect transition between thickness of tile floor and adjoining floor finishes of different thickness, tapered to provide reduction in thickness from 1/2 to 1/4 inch across nominal 4-inch dimension.

C. Ceramic Tile Type CT-3: Glazed wall tile.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. American Olean; a division of Dal-Tile Corporation.
    b. Daltile.

2. Module Size: 4 by 8 inches.

3. Face Size Variation: Rectified.
4. Thickness: 5/16 inch.
5. Face: Plain with modified square edges or cushion edges.
6. Finish: Bright, clear glaze.
7. Tile Color and Pattern: As selected by Engineer/Architect from manufacturer's full range.
8. Grout Color: As selected by Engineer/Architect from manufacturer's full range.
9. Mounting: Factory, back mounted.
10. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:

    a. Base: Coved, module size 4 by 8 inches.
    b. External Corners: Surface bullnose, same size as adjoining flat tile.
    c. Internal Corners: Field-butted square corners. For coved base and cap use angle pieces designed to fit with stretcher shapes.

2.3 THRESHOLDS

A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.

1. Double Hollywood Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.

B. Marble Thresholds: ASTM C503/C503M, with a minimum abrasion resistance of 10 according to ASTM C1353 or ASTM C241/C241M and with honed finish.

1. Description: Uniform, fine- to medium-grained white stone with gray veining.

2.4 TILE BACKING PANELS - WALLS

A. Cementitious Backer Units: ANSI A118.9 or ASTM C1325, Type A.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. C-Cure.
    b. Custom Building Products.
    c. FinPan, Inc.
    d. Georgia-Pacific Gypsum LLC.
    e. USG Corporation.
2. Thickness: 5/8 inch for use on walls.

B. Fiber-Cement Backer Board: ASTM C1288.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. CertainTeed Corporation.
    b. Custom Building Products.
    c. James Hardie Building Products, Inc.

2. Thickness: 1/4 inch for use over plywood sub-floor.

2.5 WATERPROOF MEMBRANE

A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Composite polypropylene waterproof sheet mat: Polyethylene faced on both sides with fleece webbing; 0.5 mm nominal thickness.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Dural USA, Inc.

2. Basis of Design – FLOORS -: DURABASE WP Waterproof Sealing Mat composite sheet waterproofing membrane to be used behind all floor tile. Install as per all manufacturer's installation requirements with seam tape at all joints, intersections, penetrations, etc., as manufactured by Dural, or approved equal.

2.6 CRACK ISOLATION MEMBRANE

A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.12 for high performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Polypropylene membrane to be 0.5 mm thick sheets with structure of square grid structure of setback cavities and an anchoring fleece laminated to the top and bottom sides.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Dural USA, Inc.

2. Basis of Design – FLOORS -: DURABASE WP Waterproof Sealing Mat composite sheet waterproofing membrane to be used behind all floor tile. Install as per all manufacturer's installation requirements with seam tape at all joints, intersections, penetrations, etc., as manufactured by Dural, or approved equal.

2.7 SETTING MATERIALS

A. Improved Modified Dry-Set Mortar (Thinset): ANSI A118.15.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Bonsal American, an Oldcastle company.
    b. LATICRETE SUPERCAP, LLC.
    c. MAPEI Corporation.
2. Provide prepackaged, dry-mortar mix to which only water must be added at Project site.
3. For wall applications, provide nonsagging mortar.

2.8 GROUT MATERIALS

A. Sand-Portland Cement Grout: ANSI A108.10, consisting of white or gray cement and white or colored aggregate as required to produce color indicated.

B. High-Performance Tile Grout: ANSI A118.7.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Schluter Systems L.P.

    b. Bonsal American, an Oldcastle company.
    c. LATICRETE SUPERCAP, LLC.
    d. MAPEI Corporation.
    e. Dural USA, Inc
2. Polymer Type: Dry, redispersible form, prepackaged with other dry ingredients.

2.9 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Floor Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Bonsal American, an Oldcastle company.
    b. Custom Building Products.
    c. Jamo Inc.
    d. Southern Grouts & Mortars, Inc.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors installed with adhesives bonded mortar bed or thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.

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

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproof membrane by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION

A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
    a. Tile floors in wet areas.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Where accent tile differs in thickness from field tile, vary setting bed thickness so that tiles are flush.

F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:

1. Ceramic Mosaic Tile: 1/8 inch.
2. Quarry Tile: 1/4 inch.
3. Glazed Wall Tile: 1/16 inch.

H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

I. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

J. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.

1. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in improved modified dry-set mortar (thinset).
2. Do not extend cleavage membrane, waterproof membrane or crack isolation membrane under thresholds set in standard dry-set, modified dry-set or improved modified dry-set mortar. Fill joints between such thresholds and adjoining tile set on cleavage membrane, waterproof membrane or crack isolation membrane with elastomeric sealant.

K. Floor Sealer: Apply floor sealer to cementitious grout joints in tile floors according to floor-sealer if cementitious grout utilizes manufacturer's written instructions. As soon as floor sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

L. Install tile backing panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use modified dry-set mortar for bonding material unless otherwise directed in manufacturer's written instructions.

M. Install waterproof membrane to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.

N. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.

3.4 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor:

1. Ceramic Tile Installation CT-1: TCNA F113; thinset mortar.

    a. Ceramic Tile Type: CT-1.
    b. Thinset Mortar: Improved modified dry-set mortar.
    c. Grout: High-performance unsanded grout.

2. Ceramic Tile Installation CT-1: TCNA F125-Partial; thinset mortar on crack isolation membrane or waterproofing membrane.

    a. Ceramic Tile Type: CT-1.
    b. Thinset Mortar: Improved modified dry-set mortar.
    c. Grout: High-performance unsanded grout.

B. Interior Wall Installations, Wood or Metal Studs or Furring:

1. Ceramic Tile Installation CT-3: TCNA W244C or TCNA W244F; thinset mortar on cementitious backer units or fiber-cement backer board over vapor-retarder membrane.

    a. Ceramic Tile Type: CT-3.
    b. Thinset Mortar: Improved modified dry-set mortar.
    c. Grout: High-performance unsanded grout.

END OF SECTION 093013

SECTION 095123 - ACOUSTICAL TILE CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Acoustical tiles for interior ceilings.
2. Fully concealed, direct-hung, suspension systems.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at a location to be determined.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified.

C. Delegated-Design Submittal: For seismic restraints for ceiling systems.

1. Include design calculations for seismic restraints including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, and coordinated with each other, using input from installers of the items involved.

B. Product test reports.

C. Research reports.

D. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design seismic restraints for ceiling systems.

B. Seismic Performance: Suspended ceilings shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

C. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Class A according to ASTM E1264.
2. Smoke-Developed Index: 50 or less.

2.2 ACOUSTICAL TILES

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. Armstrong World Industries, Inc.
2. CertainTeed Corporation.
3. USG Corporation.

B. Acoustical Tile Standard: Manufacturer's standard tiles of configuration indicated that comply with ASTM E1264.

C. Classification: Type III, Form 2, Pattern CD, Item No. 1756 (24x24x7/8” Tile), Item No. 1757 (24x48x7/8” Tile).

D. Color: White.

E. Light Reflectance (LR): 0.86.

F. Ceiling Attenuation Class (CAC): 35.

G. Noise Reduction Coefficient (NRC): 0.75.

H. Articulation Class (AC): 170.

I. Edge/Joint Detail: Angled Tegular.

J. Thickness: 15/16”.

K. Modular Size: As indicated on Drawings.

2.3 ACOUSTICAL TILES

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. Armstrong World Industries, Inc.
2. CertainTeed Corporation.
3. USG Corporation.

B. Basis of Design: Armstrong Lumawash #972

C. Acoustical Tile Standard: Manufacturer's standard tiles of configuration indicated that comply with ASTM E1264.

D. Classification: Type III, Form 2, Pattern CD, Item No. 1756 (24x24x7/8" Tile), Item No. 1757 (24x48x7/8" Tile).

E. Color: White.

F. Light Reflectance (LR): 0.89.

G. Ceiling Attenuation Class (CAC): 33.

H. Noise Reduction Coefficient (NRC): 0.70.

I. Articulation Class (AC): 170.

J. Edge/Joint Detail: Square edge.

K. Thickness: 15/16".

L. Modular Size: As indicated on Drawings.

M. Smooth face texture with superior sag and mold resistance meeting USDA / FSIS

2.4 METAL SUSPENSION SYSTEM

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. Armstrong World Industries, Inc.
2. USG Corporation.

B. Metal Suspension-System Standard: Manufacturer's standard, direct-hung, fully concealed, metal suspension system that complies with applicable requirements in ASTM C635/C635M.

C. Direct-Hung, Double-Web Suspension System: Main and cross runners roll formed from and capped with cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 coating designation.

1. Structural Classification: Intermediate-duty system.

2.5 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

B. Seismic Clips: Manufacturer's standard seismic clips designed to secure acoustical tiles in-place during a seismic event.

2.6 METAL EDGE MOLDINGS AND TRIM

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. Armstrong World Industries, Inc.
2. CertainTeed Corporation.
3. USG Corporation.

B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations complying with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for of suspension-system runners.

PART 3 - EXECUTION

3.1 PREPARATION

A. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders unless otherwise indicated.

B. Layout openings for penetrations centered on the penetrating items.

3.2 INSTALLATION OF SUSPENDED ACOUSTICAL TILE CEILINGS

A. Install suspended acoustical tile ceilings according to ASTM C636/C636M, seismic design requirements, and manufacturer's written instructions.

B. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical tiles.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Do not use exposed fasteners, including pop rivets, on moldings and trim.

C. Arrange directionally patterned acoustical tiles as indicated on reflected ceiling plans.

3.3 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform inspections:

1. Periodic inspection during the installation of suspended ceiling grids according to ASCE/SEI 7 – if required by authority having jurisdiction.

END OF SECTION 095123

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Vinyl base.
   2. Vinyl molding accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

2.2 VINYL BASE

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. Armstrong World Industries, Inc.
   2. Burke Mercer Flooring Products; a division of Burke Industries Inc.
   3. Johnsonite; a Tarkett company.

B. Product Standard: ASTM F1861, Type TV (vinyl, thermoplastic).

   1. Group: I (solid, homogeneous).

   2. Style to be Cove in areas with carpet or with resilient floor coverings.

C. Minimum Thickness: 0.125 inch.

D. Height: 4 inches.

E. Lengths: Coils in manufacturer's standard length.

F. Outside and Inside Corners: Preformed.

G. Colors and Patterns: As selected by Engineer/Architect from manufacturer’s full range.

2.3 VINYL MOLDING ACCESSORY

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. Burke Mercer Flooring Products; a division of Burke Industries Inc.
2. Johnsonite; a Tarkett company.

B. Description: Vinyl transition strips.

C. Profile and Dimensions: As indicated.

D. Locations: Provide vinyl molding accessories in areas indicated.

E. Colors and Patterns: As selected by Engineer/Architect from manufacturer's full range.

2.4 THERMOSET RUBBER BASE

A. Basis of Design: Premium TS Molded Wall Base to be Burke Base by Mannington Commercial.

B. 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. Armstrong World Industries, Inc.
2. Burke Mercer Flooring Products; a division of Burke Industries Inc.
3. Johnsonite; a Tarkett company.

C. Product Standard: ASTM F1861, Type TP, Group 1 thermoplastic rubber.

1. Group: I (solid, homogeneous).
2. Style to be Cove in areas with Rubber athletic floor coverings.

D. Minimum Thickness: 0.125 inch.

E. Height: 4 inches.

F. Lengths: Coils in manufacturer's standard length.

G. Outside and Inside Corners: Preformed.

H. Colors and Patterns: As selected by Engineer/Architect from manufacturer's full range.

2.5 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

C. Floor Polish: Provide protective, liquid floor-polish products recommended by resilient stair-tread manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 10 pH.
4. Moisture Testing: Perform tests so that each test area does not exceed 300 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

    a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient products until materials are the same temperature as space where they are to be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.2 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

H. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 12 inches in length.

    a. Form without producing discoloration (whitening) at bends.

2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 12 inches in length.

    a. Miter corners to minimize open joints.

3.3 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips and or transition stips at edges of floor covering that would otherwise be exposed.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Floor Polish: Remove soil, adhesive, and blemishes from resilient stair treads before applying liquid floor polish.

1. Apply two coat(s).

C. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

SECTION 096519 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vinyl composition floor tile.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and pattern specified.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient floor tile, as determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 VINYL COMPOSITION FLOOR TILE

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. Armstrong World Industries, Inc.
2. Congoleum Corporation.

B. Tile Standard: ASTM F1066, Class 2, through pattern.

C. Wearing Surface: Smooth.

D. Thickness: 0.125 inch.

E. Size: 12 by 12 inches.

F. Colors and Patterns: Color as selected by Engineer/Architect from manufacturer's full range of colors. Patterns designated on drawings.

2.3 RUBBER FLOOR TILE

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. Mannington Commercial

B. Tile Standard: ASTM F1344, Class I-A, Homogeneous Rubber Tile, Solid Color.

C. Wearing Surface: Molded pattern

1. Molded-Pattern Figure: Raised discs or Raised squares.

D. Thickness: 0.125 inch.

E. Size: 18 by 18 inches.

F. Colors and Patterns: Color as selected by Engineer/Architect from manufacturer's full range of colors. Patterns designated on drawings.

2.4 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

C. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 10 pH.
4. Moisture Testing: Perform tests so that each test area does not exceed 300 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

    a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 95 percent relative humidity level measurement.

C. Access Flooring Panels: Remove protective film of oil or other coating using method recommended by access flooring manufacturer.

D. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

E. Do not install floor tiles until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

F. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.2 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles square with room axis.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

1. Lay tiles with grain direction alternating in adjacent tiles.

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

H. Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

I. Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish.

1. Apply two coats immediately after installation to protect during construction.

2. Apply three coats after final cleaning for final floor finish.

END OF SECTION 096519

SECTION 096813 - TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Modular carpet tile.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at a location to be determined.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For carpet tile installation, plans showing the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
2. Carpet tile type, color, and dye lot.
3. Type of subfloor.
4. Type of installation.
5. Pattern of installation.
6. Pattern type, location, and direction.
7. Pile direction.
8. Type, color, and location of insets and borders.
9. Type, color, and location of edge, transition, and other accessory strips.
10. Transition details to other flooring materials.

C. Samples: For each exposed product and for each color and texture required.

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Certified by the International Certified Floorcovering Installers Association at the Commercial II Master II certification level.

1.7 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE

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. Mannington Mills, Inc.
2. Mohawk Group (The); Mohawk Carpet, LLC.
3. Patcraft; a division of Shaw Industries, Inc.
4. Philadelphia Commercial; a division of Shaw Industries, Inc.
5. Shaw Contract Group; a Berkshire Hathaway company.

B. Color: As selected by Architect from manufacturer's full range.

C. Pattern: Match Architect's samples.

D. Fiber Content: 100 percent nylon 6, 6.

E. Fiber Type: Nylon .

F. Pile Characteristic: Level-loop pile.

G. Density: 4286 oz./cu. yd..

H. Pile Thickness: 0.126” for finished carpet tile according to ASTM D6859.

I. Stitches: 10.6 stitches per inch.

J. Gage: 1/10 (39.37 Rows per 10cm) .

K. Surface Pile Weight: 15 oz./sq. yd..

L. Total Weight: 89.98 oz./sq. yd. for finished carpet tile.

M. Primary Backing/Backcoating: Manufacturer's standard composite materials.

N. Size: 24 by 24 inches.

O. Applied Treatments:

1. Soil-Resistance Treatment: Manufacturer's standard treatment.
2. Antimicrobial Treatment: Manufacturer's standard treatment that protects carpet tiles as follows:

a. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria, not less than 1-mm halo of inhibition for gram-negative bacteria, and no fungal growth, according to AATCC 174.

P. Sustainable Design Requirements:

1. Sustainable Product Certification: Gold level certification according to ANSI/NSF 140.

Q. Performance Characteristics:

1. Appearance Retention Rating: Heavy traffic, 3.0 minimum according to ASTM D7330.
2. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm according to NFPA 253.
3. Dry Breaking Strength: Not less than 100 lbf according to ASTM D2646.
4. Tuft Bind: Not less than 6.2 lbf according to ASTM D1335.
5. Noise Reduction Coefficient (NRC):.15 NRC according to ASTM C423.
6. Colorfastness to Crocking: Not less than 4, wet and dry, according to AATCC 165.
7. Colorfastness to Light: Not less than 4 after 40 AFU (AATCC fading units) according to AATCC 16, Option E.
8. Electrostatic Propensity: Less than 3.5 kV according to AATCC 134.

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Concrete Slabs:

1. Moisture Testing: Perform tests so that each test area does not exceed 300 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
b. Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
c. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.

B. Wood Subfloors: Verify that underlayment surface is free of irregularities and substances that may interfere with adhesive bond or show through surface.

C. Metal Subfloors: Verify that underlayment surface is free of irregularities and substances that may interfere with adhesive bond or show through surface.

D. Painted Subfloors: Perform bond test recommended in writing by adhesive manufacturer.

1. Access Flooring Systems: Verify access floor substrate is compatible with carpet tile and adhesive, if any, and underlayment surface is gaps greater than 1/8 inch and protrusions more than 1/32 inch.

3.2 PREPARATION

A. General: Comply with the Carpet and Rug Institute's CRI 104 and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.

C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.

D. Metal Substrates: Clean grease, oil, soil and rust, and prime if recommended in writing by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.

E. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with the Carpet and Rug Institute's CRI 104, Section 10, "Carpet Tile," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: As recommended in writing by carpet tile manufacturer.

C. Maintain dye-lot integrity. Do not mix dye lots in same area.

D. Maintain pile-direction patterns recommended in writing by carpet tile manufacturer.

E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.

H. Install pattern parallel to walls and borders.

I. Access Flooring: Stagger joints of carpet tiles so carpet tile grid is offset from access flooring panel grid. Do not fill seams of access flooring panels with carpet adhesive; keep seams free of adhesive.

J. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

SECTION 098116 – ACOUSTIC BLANKET INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Mineral-wool blanket insulation.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Mineral-wool blanket insulation.

1.3 INFORMATIONAL SUBMITTALS

A. Installer's Certification: Listing type, manufacturer, and Acoustical Performance of insulation installed in each element of the building, ie. walls, ceilings, etc.

   1. Sign, date, and post the certification in a conspicuous location on Project site.

B. Product test reports.

C. Research reports.

PART 2 - PRODUCTS

2.1 MINERAL-WOOL BLANKET INSULATION

A. Mineral-Wool Blanket Insulation, Unfaced: ASTM C665, Type I (blankets without membrane facing); consisting of fibers; passing ASTM E136 for combustion characteristics.

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      a. Johns Manville; a Berkshire Hathaway company.
      b. Rockwool International.
      c. Thermafiber, Inc.; an Owens Corning company.

   2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
   3. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
   4. Labeling: Provide identification of mark indicating Acoustical Performance of each piece of insulation 12 inches and wider in width.
   5. Acoustical Performance: Thickness 3”, 125Hz-0.52, 250Hz-0.96, 500Hz-1.18, 1000Hz-1.07, 2000Hz-1.05, 4000Hz-1.05, NRC-1.05 ASTM C423

2.2 ACCESSORIES

A. Insulation for Miscellaneous Voids:

1. Mineral Fiber Insulation: ASTM C764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E84.

B. Insulation Anchors, Spindles, and Standoffs: As recommended by manufacturer.

C. Adhesive for Bonding Insulation: Product compatible with insulation and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Install insulation delivered to site in manufacturer's labeled packaging indicating Acoustic Performance.

D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve Acoustic Performance.

3.2 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends, with no voids.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. For wood-framed construction, install blankets according to ASTM C1320 and as follows:

a. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.

B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Mineral Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft..

END OF SECTION 072100

SECTION 099113 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following exterior substrates:

1. Concrete.
2. Fiber-cement board.
3. Clay masonry.
4. Concrete masonry units (CMUs).
5. Steel and iron.
6. Aluminum (not anodized or otherwise coated).
7. Wood.
8. Gypsum board.

1.2 DEFINITIONS

A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D523.

B. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.

C. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523.

D. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.

E. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.

F. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.

B. Samples: For each type of paint system and each color and gloss of topcoat.

1.4 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system.

a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
b. Other Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on mockups.

a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Benjamin Moore & Co.
2. Coronado Paint; Benjamin Moore & Co.
3. PPG Paints.
4. Rust-Oleum Corporation; a subsidiary of RPM International, Inc.
5. Sherwin-Williams Company (The).

B. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to products listed in the Exterior Painting Schedule for the paint category indicated.

2.2 PAINT, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

C. Colors: As selected by Architect from manufacturer's full range.

1. Twenty percent of surface area will be painted with deep tones.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Fiber-Cement Board: 12 percent.
3. Masonry (Clay and CMUs): 12 percent.
4. Wood: 15 percent.
5. Portland Cement Plaster: 12 percent.
6. Gypsum Board: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."

B. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 CLEANING AND PROTECTION

A. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

B. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 EXTERIOR PAINTING SCHEDULE

A. Concrete Cementitious Siding, Nontraffic Surfaces:

1. Latex System:

a. Prime Coat: Primer sealer, latex.

1) S-W Loxon Concrete & Masonry Primer Sealer, A24W8300, at 8.0 mils wet, 3.2 mils dry.

b. Prime Coat: Latex, exterior, matching topcoat.
c. Intermediate Coat: Latex, exterior, matching topcoat.
d. Topcoat: Latex, exterior, flat.

1) S-W A-100 Exterior Latex Flat, A6 Series, at 4.0 mils wet, 1.2 mils dry, per coat.

e. Topcoat: Latex, exterior, low sheen.

1) S-W A-100 Exterior Latex Low Sheen, A12 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

f. Topcoat: Latex, exterior, satin.

1) S-W A-100 Exterior Latex Satin, A82 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

g. Topcoat: Latex, exterior, semi-gloss.

1) S-W Solo Acrylic Semi-Gloss, A76 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

h. Topcoat: Latex, exterior, gloss.

1) S-W A-100 Exterior Latex Gloss, A8 Series, at 4.0 mils wet, 1.3 mils dry, per coat.

2. Latex over Latex Aggregate System:

a. Prime Coat: Block Filler, Latex, Interior/Exterior.

1) S-W Loxon Block Surfacer, A24W200, at 50 to 100 sq. ft. per gal. .

b. Topcoat: Latex, exterior flat, coarse texture.

1) S-W UltraCrete Textured Masonry Topcoat, A44-800 Series, 50 to 80 sq. ft. per gal. .

3. Concrete Stain System (Water-based):

a. First Coat: Low-luster opaque finish matching topcoat.
b. Topcoat: Low-luster opaque finish:

1) S-W H&C Colortop Water-Based Solid Color Concrete Stain, at 50 to 250 sq. ft. per gal.

B. Concrete Substrates, Pedestrian Traffic Surfaces:

1. Latex Floor Paint System:

a. First Coat: Floor paint, latex, slip-resistant, matching topcoat.
b. Topcoat: Floor paint, latex, slip-resistant, low gloss.

1) S-W ArmorSeal Tread-Plex, B90 Series, at 1.5 to 2.0 mils dry per coat.

2. Concrete Stain System (Water-based) for Vertical Surfaces:

a. First Coat: Low-luster opaque finish matching top coat.
b. Topcoat: Low-luster opaque finish.

1) S-W H&C Colortop Water-Based Solid Color Concrete Stain, at 50 to 250 sq. ft. per gal. .

C. CMU Substrates:

1. Latex System:

a. Block Filler: Block filler, latex, interior/exterior:

1) S-W PrepRite Block Filler, B25W25, at 75 to 125 sq. ft. per gal..

b. Intermediate Coat: Latex, exterior, matching topcoat.
c. Topcoat: Latex, exterior, flat.

1) S-W A-100 Exterior Latex Flat, A6 Series, at 4.0 mils wet, 1.2 mils dry, per coat.

d. Topcoat: Latex, exterior, low sheen.

1) S-W A-100 Exterior Latex Low Sheen, A12 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

e. Topcoat: Latex, exterior, satin.

1) S-W A-100 Exterior Latex Satin, A82 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

f. Topcoat: Latex, exterior, semi-gloss.

1) S-W Solo Acrylic Semi-Gloss, A76 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

g. Topcoat: Latex, exterior, gloss.

1) S-W A-100 Exterior Latex Gloss, A8 Series, at 4.0 mils wet, 1.3 mils dry, per coat.

2. CMU Stain System (Water-Based):

a. First Coat: Low-luster opaque finish matching topcoat.
b. Topcoat: Low-luster opaque finish.

1) S-W H&C Colortop Water-Based Solid Color Concrete Stain, at 50 to 250 sq. ft. per gal. .

D. Ferrous Metal and Aluminum Substrates:

1. Water-Based Light Industrial Coating System:

a. Prime Coat: Primer, water based.

1) S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series, 5.0 to 10.0 mils wet, 2.0 to 4.0 mils dry.

b. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
c. Topcoat: Light industrial coating, exterior, water based eggshell.

1) S-W Pro Industrial Eg-Shel Acrylic B66-660 Series, at 2.5 to 4.0 mils dry, per coat.

d. Topcoat: Light industrial coating, exterior, water based, semi-gloss.

1) S-W Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series, at 2.5 to 4.0 mils dry, per coat.

e. Topcoat: Light industrial coating, exterior, water based, gloss.

1) S-W Pro Industrial Acrylic Gloss Coating, B66-600 Series, at 2.5 to 4.0 mils dry, per coat.

E. Wood Substrates: Including exposed wood items not indicated to receive shop-applied finish.

1. Latex System:

a. Prime Coat: Primer, latex for exterior wood.

1) S-W Exterior Latex Primer, B42, at 4.0 mils wet, 1.4 mils dry, per coat.

b. Intermediate Coat: Latex, exterior, matching topcoat.
c. Topcoat: Latex, exterior, flat:

1) S-W A-100 Exterior Latex Flat, A6 Series, at 4.0 mils wet, 1.2 mils dry, per coat.

d. Topcoat: Latex, exterior, low-sheen:

1) S-W A-100 Exterior Latex Low Sheen, A12 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

e. Topcoat: Latex, exterior, satin:

1) S-W A-100 Exterior Latex Satin, A82 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

f. Topcoat: Latex, exterior, semi-gloss:

1) S-W Solo Acrylic Semi-Gloss, A76 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

g. Topcoat: Latex, exterior, gloss:

1) S-W A-100 Exterior Latex Gloss, A8 Series, at 4.0 mils wet, 1.3 mils dry, per coat.

F. Wood Substrates, Pedestrian Traffic Surfaces:

1. Latex Floor Paint System:

a. First Coat: Floor paint, latex, slip-resistant, matching topcoat.
b. Topcoat: Floor paint, latex, slip-resistant, low gloss:

1) S-W ArmorSeal Tread-Plex, B90 Series, at 1.5 to 2.0 mils dry per coat.

2. Solid Color Stain System:

a. First Coat: Solid color stain, latex, matching topcoat.
b. Topcoat: Solid color stain, latex, slip-resistant, flat, interior/exterior:

1) S-W SuperDeck Exterior Acrylic Solid Color Deck, SD7-Series, at 200 to 400 sq. ft. per gal..

G. Plastic Trim Fabrication Substrates: Including architectural PVC, plastic, and fiberglass items.

1. Latex System:

a. Prime Coat: Primer, bonding, water-based:

1) S-W PrepRite ProBlock Latex Primer/Sealer, B57-620 Series, at 4.0 mils wet, 1.4 mils dry.

b. Intermediate Coat: Latex, exterior, matching topcoat.

a. Topcoat: Latex, exterior, flat:

1) S-W A-100 Exterior Latex Flat, A6 Series, at 4.0 mils wet, 1.2 mils dry, per coat.

b. Topcoat: Latex, exterior, low-sheen:

1) S-W A-100 Exterior Latex Low Sheen, A12 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

c. Topcoat: Latex, exterior, satin:

1) S-W A-100 Exterior Latex Satin, A82 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

d. Topcoat: Latex, exterior, semi-gloss:

1) S-W Solo Acrylic Semi-Gloss, A76 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

e. Topcoat: Latex, exterior, gloss:

1) S-W A-100 Exterior Latex Gloss, A8 Series, at 4.0 mils wet, 1.3 mils dry, per coat.

H. Exterior Gypsum Board Substrates:

1. Latex System:

a. Prime Coat: Primer bonding, water-based.

1) S-W PrepRite ProBlock Latex Primer/Sealer, B57-620 Series, at 4.0 mils wet, 1.4 mils dry.

b. Intermediate Coat: Latex, exterior, matching topcoat.

c. Topcoat: Latex, exterior, flat.

1) S-W A-100 Exterior Latex Flat, A6 Series, at 4.0 mils wet, 1.2 mils dry, per coat.

d. Topcoat: Latex, exterior, low-sheen.

1) S-W A-100 Exterior Latex Low Sheen, A12 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

e. Topcoat: Latex, exterior, satin:

1) S-W A-100 Exterior Latex Satin, A82 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

f. Topcoat: Latex, exterior, semi-gloss.

1) S-W Solo Acrylic Semi-Gloss, A76 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

g. Topcoat: Latex, exterior, gloss.

1) S-W A-100 Exterior Latex Gloss, A8 Series, at 4.0 mils wet, 1.3 mils dry, per coat.

I. Exterior Insulation Finish Systems (EIFS):

1. Latex System:

a. First Coat: Latex, exterior, matching topcoat.
b. Topcoat: Latex, exterior flat.

1) S-W A-100 Exterior Latex Flat, A6 Series, at 4.0 mils wet, 1.2 mils dry, per coat.

c. Topcoat: Latex, exterior, low-sheen:

1) S-W A-100 Exterior Latex Low Sheen, A12 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

d. Topcoat: Latex, exterior, satin:

1) S-W A-100 Exterior Latex Satin, A82 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

e. Topcoat: Latex, exterior, semi-gloss:

1) S-W Solo Acrylic Semi-Gloss, A76 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

f. Topcoat: Latex, exterior, gloss:

1) S-W A-100 Exterior Latex Gloss, A8 Series, at 4.0 mils wet, 1.3 mils dry, per coat.

END OF SECTION 099113

SECTION 099123 - INTERIOR PAINTING

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 surface preparation and the application of paint systems on the following interior substrates:

1. Concrete.
2. Clay masonry.
3. Concrete masonry units (CMU).
4. Steel.
5. Cast iron.
6. Galvanized metal.
7. Aluminum (not anodized or otherwise coated).
8. Wood.
9. Gypsum board.
10. Plaster.

B. Related Requirements:

1. Section 051200 "Structural Steel Framing" for shop priming of metal substrates with primers specified in this section.
2. Section 099113 "Exterior Painting" for surface preparation and the application of paint systems on exterior substrates.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Indicate VOC content.

B. Sustainable Design Submittals:

1. Product Data for LEED 2009 Credit EQ 4.2: For paints and coatings, showing printed statement of VOC content.
2. Laboratory Test Reports: For paints and coatings, indicating compliance with LEED 2009 Credit EQ 4.2 requirements for low-emitting materials.

C. Samples for Initial Selection: For each type of topcoat product.

D. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.
2. Label each coat of each Sample.
3. Label each Sample for location and application area.

E. Product List: For each product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
2. Indicate VOC content.

1.4 CLOSEOUT SUBMITTALS

1. Coating Maintenance Manual: Provide coating maintenance manual including area summary with finish schedule, area detail designating location where each product/color/finish was used, product data pages, material safety data sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 1 gal. of each material and color applied.

1.6 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.

a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
b. Other Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on mockups.

a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Handling: Deliver products to Project site in an undamaged condition in manufacturer's original sealed containers, complete with labels and instructions for handling, storing, unpacking, protecting, and installing. Packaging shall bear the manufacturer’s label with the following information:

1. Product name and type (description).
2. Batch date.
3. Color number.
4. VOC content.
5. Environmental handling requirements.
6. Surface preparation requirements.
7. Application instructions.

B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

C. Lead Paint: It is not expected that lead paint will be encountered in the Work.

1. If suspected lead paint is encountered, do not disturb; immediately notify Architect and Owner.

D. Lead Paint: Lead paint may be present in buildings and structures to be painted. A report on the presence of lead paint is on file for review and use. Examine report to become aware of locations where lead paint is present.

1. Do not disturb lead paint or items suspected of containing hazardous materials except under procedures specified.
2. Perform preparation for painting of substrates known to include lead paint in accordance with EPA Renovation, Repair and Painting Rule and additional requirements of authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Sherwin-Williams Company (The); products indicated or comparable product from one of, but not necessarily limited to, the following:

1. Benjamin Moore

2. PPG Industries Inc.

B. Comparable Products: Comparable products of approved manufacturers will be considered in accordance with Section 016000 "Product Requirements," and the following:

1. Products are approved by manufacturer in writing for application specified.
2. Products meet performance and physical characteristics of basis of design product including published ratio of solids by volume, plus or minus two percent.

C. Source Limitations: Obtain paint materials from single source from single listed manufacturer.

1. Manufacturer's designations listed on a separate color schedule are for color reference only and do not indicate prior approval.

2.2 PAINT, GENERAL

A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. VOC Content: For field applications that are inside the weatherproofing system, paints and coatings shall provide materials that comply with VOC limits of authorities having jurisdiction and for interior paints and coatings applied at Project site, the following VOC limits exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 150 g/L.
3. Primers, Sealers, and Undercoaters: 200 g/L.
4. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
5. Floor Coatings: 100 g/L.
6. Shellacs, Clear: 730 g/L.
7. Shellacs, Pigmented: 550 g/L.

C. Low-Emitting Materials: Interior paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the

Testing of Volatile Organic Emissions from Various Sources Using Small Scale Environmental Chambers."

D. Colors: As selected by Architect from manufacturer's full range.

1. 20 percent of surface area will be painted with deep tones.

2.3 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers. Where acceptability of substrate conditions is in question, apply samples and perform in-situ testing to verify compatibility, adhesion, and film integrity of new paint application.

1. Report, in writing, conditions that may affect application, appearance, or performance of paint.

B. Substrate Conditions:

1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

a. Concrete: 12 percent.
b. Masonry (Clay and CMU): 12 percent.
c. Wood: 15 percent.
d. Gypsum Board: 12 percent.
e. Plaster: 12 percent.

2. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

3. Plaster Substrates: Verify that plaster is fully cured.
4. Spray-Textured Ceiling Substrates: Verify that surfaces are dry.

C. Proceed with coating application only after unsatisfactory conditions have been corrected; application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

1. Concrete Floors: Remove oil, dust, grease, dirt, and other foreign materials. Comply with SSPC-SP-13/NACE 6 or ICRI 03732.

E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceed that permitted in manufacturer's written instructions.

F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:

1. SSPC-SP 2, "Hand Tool Cleaning."
2. SSPC-SP 3, "Power Tool Cleaning."
3. SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
4. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."

G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

I. Aluminum Substrates: Remove loose surface oxidation.

J. Wood Substrates:

1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Sand surfaces that will be exposed to view, and dust off.
3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

K. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed in equipment rooms:

a. Equipment, including panelboards and switch gear.
b. Uninsulated metal piping.
c. Uninsulated plastic piping.
d. Pipe hangers and supports.
e. Metal conduit.

f. Plastic conduit.
g. Tanks that do not have factory-applied final finishes.
h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.

2. Paint the following work where exposed in occupied spaces:

a. Equipment, including panelboards.
b. Uninsulated metal piping.
c. Uninsulated plastic piping.
d. Pipe hangers and supports.
e. Metal conduit.
f. Plastic conduit.
g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
h. Other items as directed by Architect.

3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR MICROBICIDAL PAINTING SCHEDULE

A. Concrete Substrates, Nontraffic Surfaces and Clay Masonry:

1. Microbicidal Latex Finish System: With topcoat EPA registered No. 64695-1.

    a. Prime Coat: Primer sealer, latex, interior:

        1) S-W Loxon Concrete & Masonry Primer Sealer, A24W8300, at 8.0 mils wet, 3.2 mils dry.

    b. First Coat: Microbicidal Latex, interior, matching topcoat.
    c. Topcoat: Microbicidal Latex, interior, eggshell:

        1) S-W Paint Shield Interior Latex Eg-Shel Microbicidal Paint, D12W51, at 4.0 mils wet, 1.8 mils dry, per coat. Brush and roll application only.

B. CMU Substrates:

1. Microbicidal Latex Finish System: With topcoat EPA registered No. 64695-1.
    a. Block Filler: One or two coats as required: Block filler, latex, interior/exterior:

        1) S-W Loxon Block Surfacer, A24W200, at 10.0 mil wet, 8.0 mils dry, per coat.

    b. First Coat: Microbicidal Latex, interior, matching topcoat.
    c. Topcoat: Microbicidal Latex, interior, eggshell:

        1) S-W Paint Shield Interior Latex Eg-Shel Microbicidal Paint, D12W51, at 4.0 mils wet, 1.6 mils dry, per coat. Brush and roll application only.

C. Wood Substrates: Including exposed wood items not indicated to receive shop-applied finish.

1. Microbicidal Latex Finish System: With topcoat EPA registered No. 64695-1.

    a. Prime Coat: Primer, latex, interior, anti-microbial:

        1) S-W PrepRite ProBlock Interior/Exterior Latex Primer/Sealer, at 4.0 mils wet, 1.5 mils dry.

    b. First Coat: Microbicidal Latex, interior, matching topcoat.
    c. Topcoat: Microbicidal Latex, interior, eggshell:

        1) S-W Paint Shield Interior Latex Eg-Shel Microbicidal Paint, D12W51, at 4.0 mils wet, 1.8 mils dry, per coat. Brush and roll application only.

D. Gypsum Board and Plaster Substrates:

1. Microbicidal Latex Finish System: With topcoat EPA registered No. 64695-1.

    a. Prime Coat: Primer, latex, interior:

        1) S-W ProMar 200 Zero VOC Latex Primer, B28W2600, at 4.0 mils wet, 1.0 mils dry.

    b. First Coat: Microbicidal Latex, interior, matching topcoat.

c. Topcoat: Microbicidal Latex, interior, eggshell:

1) S-W Paint Shield Interior Latex Eg-Shel Microbicidal Paint, D12W51, at 4.0 mils wet, 1.8 mils dry, per coat. Brush and roll application only.

3.7 INTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Nontraffic Surfaces and Clay Masonry:

1. Latex System:

a. Prime Coat: Primer, latex, interior.

1) S-W Loxon Concrete & Masonry Primer Sealer, A24W8300, at 8.0 mils wet, 3.2 mils dry.

b. Intermediate Coat: Latex, interior, matching topcoat.

c. Topcoat: Latex, interior, flat.

1) S-W ProMar 200 Zero VOC Latex Flat, B30-2600 Series, at 4.0 mils wet, 1.6 mils dry, per coat.

d. Topcoat: Latex, interior, low sheen.

1) S-W ProMar 200 Zero VOC Latex Low Sheen Eg-Shel, B24-2600 Series, at 4.0 mils wet, 1.6 mils dry, per coat.

e. Topcoat: Latex, interior, eggshell.

1) S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series, at 4.0 mils wet, 1.7 mils dry, per coat .

f. Topcoat: Latex, interior, semi-gloss.

1) S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series, at 4.0 mils wet, 1.6 mils dry, per coat .

g. Topcoat: Latex, interior, gloss.

1) S-W ProMar 200 Zero VOC Gloss, B21-12650 Series, at 4.0 mils wet, 1.4 mils dry, per coat.

B. Concrete Substrates, Pedestrian Traffic Surfaces:

1. Latex Floor Enamel System:

a. First Coat: Floor paint, latex, slip-resistant, matching topcoat.
b. Topcoat: Floor paint, latex, slip-resistant, low gloss: S-W ArmorSeal Tread-Plex, B90 Series, at 1.5 to 2.0 mils dry per coat.

2. Clear Acrylic System, Gloss Finish:

a. First Coat:

1) S-W H&C Clarishield Water-Based Wet-Look Concrete Sealer, at 100 to 200 sq. ft. per gal.

b. Second Coat:

1) S-W H&C Clarishield Water-Based Wet-Look Concrete Sealer, at 100 to 200 sq. ft. per gal.

3. Concrete Stain System (Water-based):

a. First Coat: Low-luster opaque finish:

1) S-W H&C Colortop Water-Based Solid Color Concrete Stain, at 50 to 300 sq. ft. per gal.

b. Second Coat: Low-luster opaque finish:

1) S-W H&C Colortop Water-Based Solid Color Concrete Stain, at 50 to 300 sq. ft. per gal.

C. CMU Substrates:

1. Latex System:

a. Block Filler: Block filler, latex, interior/exterior:

1) S-W PrepRite Block Filler, B25W25, at 75-125 sq. ft. per gal.

b. Intermediate Coat: Latex, interior, matching topcoat.
c. Topcoat: Latex, interior, flat:

1) S-W ProMar 200 Zero VOC Latex Flat, B30-2600 Series, at 4.0 mils wet, 1.6 mils dry, per coat.

d. Topcoat: Latex, interior, low sheen:

1) S-W ProMar 200 Zero VOC Latex Low Sheen Enamel, B24-2600 Series, at 4.0 mils wet, 1.6 mils dry, per coat.

e. Topcoat: Latex, interior, eggshell:

1) S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series, at 4.0 mils wet, 1.7 mils dry, per coat.

f. Topcoat: Latex, interior, semi-gloss:

1) S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series, at 4.0 mils wet, 1.6 mils dry, per coat.

g. Topcoat: Latex, interior, gloss:

1) S-W ProMar 200 Zero VOC Gloss, B21-12650 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

D. Metal Substrates (Aluminum, Steel, Galvanized Steel):

1. Latex System:

a. Prime Coat: Primer, rust-inhibitive, water based:

1) S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series, at 5.0 to 10 mils wet, 2.0 to 4.0 mils dry.

b. Intermediate Coat: Water-based acrylic, interior, matching topcoat.
c. Topcoat: Water-based acrylic, semi-gloss:

1) S-W Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series, at 2.5 to 4.0 mils dry, per coat.

d. Topcoat: Water-based acrylic, gloss:

1) S-W Pro Industrial Acrylic Gloss Coating, B66-660 Series, at 2.5 to 4.0 mils dry, per coat.

2. Water-Based Dry-Fall System:

a. Top Coat: Dry-fall latex, flat:

1) S-W Pro Industrial Waterborne Acrylic Dryfall Flat, B42-181 Series, at 6.0 mils wet, 1.5 mils dry.

b. Top Coat: Dry-fall latex, eggshell:

1) S-W Pro Industrial Waterborne Acrylic DryFall Eg-Shel, B42-82, at 6.0 mils wet, 1.9 mils dry.

c. Top Coat: Dry-fall latex, semi-gloss:

1) S-W Pro Industrial Waterborne Acrylic DryFall Semi-Gloss, B42-83, at 5.8 mils wet, 2.3 mils dry.

3. Waterbased/Alkyd Urethane System:

a. Prime Coat:

1) S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series, at 5.0 to 10 mils wet, 2.0 to 4.0 mils dry.

b. Intermediate Coat: Water-based acrylic-alkyd, interior, matching topcoat.
c. Topcoat: Water-based alkyd-urethane, semi-gloss, interior:

1) S-W Pro Industrial Waterbased Alkyd Urethane Semi-Gloss, B53-1150 Series, at 4.0 mils wet, 1.4 mils dry, per coat.

d. Topcoat: Water-based alkyd-urethane, gloss, interior:

1) S-W Pro Industrial Waterbased Alkyd Urethane Gloss, B53-1050 Series, at 4.0 mils wet, 1.4 mils dry, per coat.

E. Wood Substrates: Including exposed wood items not indicated to receive shop-applied finish.

1. Latex System:

a. Prime Coat: Primer sealer, latex, interior:

1) S-W PrepRite ProBlock Primer Sealer, B51-620 Series, at 4.0 mils wet, 1.4 mils dry.

b. Intermediate Coat: Latex, interior, matching topcoat.
c. Topcoat: Latex, interior, eggshell:

1) S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series, at 4.0 mils wet, 1.7 mils dry, per coat.

d. Topcoat: Latex, interior, semi-gloss:

1) S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series, at 4.0 mils wet, 1.6 mils dry, per coat.

e. Topcoat: Latex, interior, gloss:

1) S-W ProMar 200 Zero VOC Gloss, B21-12650 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

F. Gypsum Board and Plaster Substrates:

1. Latex System:

a. Prime Coat: Primer, latex, interior:

1) S-W ProMar 200 Zero VOC Latex Primer, B28W2600, at 4.0 mils wet, 1.0 mils dry.

b. Intermediate Coat: Latex, interior, matching topcoat.
c. Topcoat: Latex, interior, flat:

1) S-W ProMar 200 Zero VOC Latex Flat, B30-2600 Series, at 4.0 mils wet, 1.6 mils dry, per coat.

d. Topcoat: Latex, interior, low sheen:

1) S-W ProMar 200 Zero VOC Latex Low Sheen Enamel, B24-2600 Series, at 4.0 mils wet, 1.6 mils dry, per coat.

e. Topcoat: Latex, interior, eggshell:

1) S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series, at 4.0 mils wet, 1.7 mils dry, per coat.

f. Topcoat: Latex, interior, semi-gloss:

1) S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series, at 4.0 mils wet, 1.6 mils dry, per coat.

g. Topcoat: Latex, interior, gloss:

1) S-W ProMar 200 Zero VOC Gloss, B21-12650 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

END OF SECTION 099123

SECTION 101423.16 - ROOM-IDENTIFICATION PANEL SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes room-identification signs that are directly attached to the building.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For room-identification signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.

C. Samples: For each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

A. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in ICC A117.1, included but not limited to raised characters, braille, character height, contrasting colors, and sign location.

2.2 ROOM-IDENTIFICATION SIGNS

A. Room-Identification Sign: Sign system with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Best Sign Systems, Inc.
    b. Inpro Corporation.
    c. Vista System.

2. Laminated-Sheet Sign: Sandblasted polymer face sheet with raised graphics laminated to acrylic backing sheet to produce composite sheet.

    a. Composite-Sheet Thickness: 0.125 inch.
    b. Surface-Applied Graphics: Applied paint.
    c. Color(s): As selected by Engineer/Architect from manufacturer's full range.

3. Sign-Panel Perimeter: Finish edges smooth.

    a. Edge Condition: Square cut.
    b. Corner Condition in Elevation: Square.

4. Mounting: Surface mounted to wall with two-face tape.

2.3 SIGN MATERIALS

A. Acrylic Sheet: ASTM D4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).

B. Vinyl Film: UV-resistant vinyl film with pressure-sensitive, permanent adhesive; die cut to form characters or images as indicated on Drawings and suitable for exterior applications.

2.4 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
3. Exposed Metal-Fastener Components, General:

    a. Fabricated from same basic metal and finish of fastened sign unless otherwise indicated.

4. Sign Mounting Fasteners:

a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material or screwed into back of sign assembly unless otherwise indicated.
b. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, and installed in predrilled holes.

B. Adhesive: As recommended by sign manufacturer.

C. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.

2.5 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
2. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
3. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

B. Subsurface-Applied Graphics: Apply graphics to back face of clear face-sheet material to produce precisely formed image. Image shall be free of rough edges.

C. Subsurface-Etched Graphics: Reverse etch back face of clear face-sheet material. Fill resulting copy with manufacturer's standard enamel. Apply opaque manufacturer's standard background color coating over enamel-filled copy.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.

B. Mounting Methods:

1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embed studs in holes. Temporarily support sign in position until adhesive fully sets.
b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

2. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.
3. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.
4. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position and push to engage tape adhesive.

3.2 SCHEDULE

DESCRIPTION	**QTY**
MEN’S LOCKER ROOM	1
WOMEN’S LOCKER ROOM	1
STORAGE	1
EXIT	4
LAB	2
STAFF ENTRY	1
CHIEF OPERATOR	1
CLERK	1
OFFICE AREA	1
BREAK ROOM	1
ELECTRICAL ROOM	1
MECHANICAL ROOM	1

END OF SECTION 101423.16

SECTION 102113.19 - PLASTIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-plastic toilet compartments configured as toilet enclosures entrance screens and urinal screens.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for supports that attach floor-and-ceiling-anchored compartments and post-to-ceiling screens to overhead structural system.
2. Section 061053 "Miscellaneous Rough Carpentry" for blocking, overhead support of floor-and-ceiling-anchored compartments and overhead support of post-to-ceiling screens.
3. Section 102800 "Toilet, Bath, and Laundry Accessories" for accessories mounted on toilet compartments.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Solid-plastic toilet compartments:

B. Shop Drawings: For solid-plastic toilet compartments.

1. Include plans, elevations, sections, details, and attachment details.

C. Samples: For each type of toilet compartment material indicated.

1. Include Samples of hardware and accessories involving material and color selection.

1.3 INFORMATIONAL SUBMITTALS

A. Certificates:

1. Product Certificates: For each type of toilet compartment by manufacturer.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire Performance: Tested in accordance with, and pass the acceptance criteria of, NFPA 286.

B. Regulatory Requirements: Comply with applicable provisions in ICC A117.1 for toilet compartments designated as accessible.

2.2 SOLID-PLASTIC TOILET COMPARTMENTS

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. AJW Architectural Products.
2. General Partitions Mfg. Corp.
3. Global Partitions Corp., an ASI Group Company.
4. Scranton Products.

B. Toilet-Enclosure Style: Overhead braced Floor anchored.

C. Entrance-Screen Style: Overhead braced Floor anchored.

D. Urinal-Screen Style: Wall hung.

E. Door, Panel, Screen, and Pilaster Construction: Solid, high-density polyethylene (HDPE) panel material, not less than 1 inch thick, seamless, with eased edges, no-sightline system, and with homogenous color and pattern throughout thickness of material.

1. Integral Hinges: Configure doors and pilasters to receive integral hinges.
2. Heat-Sink Strip: Manufacturer's standard continuous, extruded-aluminum or stainless steel strip fastened to exposed bottom edges of solid-plastic components to hinder malicious combustion.
3. Color and Pattern: One color and pattern in each room as selected by Engineer/Architect from manufacturer's full range.

F. Pilaster Shoes and Sleeves (Caps): Manufacturer's standard design; polymer or stainless steel.

1. Polymer Color and Pattern: Matching pilaster.

G. Brackets (Fittings):

1. Stirrup Type: Ear or U-brackets, stainless steel.
2. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel.

a. Polymer Color and Pattern: Matching panel.

2.3 HARDWARE AND ACCESSORIES

A. Hardware and Accessories, Heavy Duty: Manufacturer's heavy-duty operating hardware and accessories.

1. Hinges: Manufacturer's minimum 0.062-inch-thick stainless steel paired, self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees, allowing emergency access by lifting door. Mount with through bolts.
2. Latch and Keeper: Manufacturer's heavy-duty, surface-mounted, cast-stainless steel latch unit, designed to resist damage due to slamming, with combination rubber-faced door strike and keeper, and with provision for emergency access. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible. Mount with through bolts.
3. Coat Hook: Manufacturer's heavy-duty combination cast-stainless steel hook and rubber-tipped bumper, sized to prevent inswinging door from hitting compartment-mounted accessories. Mount with through bolts.
4. Door Bumper: Manufacturer's heavy-duty, rubber-tipped, cast-stainless steel bumper at outswinging doors and entrance-screen doors. Mount with through bolts.
5. Door Pull: Manufacturer's heavy-duty, cast-stainless steel pull at outswinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible. Mount with through bolts.

2.4 MATERIALS

A. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.

B. Stainless Steel Castings: ASTM A743/A743M.

2.5 FABRICATION

A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.

B. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

C. Floor-and-Ceiling-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at tops and bottoms of pilasters. Provide shoes and sleeves (caps) at pilasters to conceal anchorage.

D. Urinal-Screen Posts: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at tops and bottoms of posts. Provide shoes and sleeves (caps) at posts to conceal anchorage.

E. Door Size and Swings: Unless otherwise indicated, provide 24-inch-wide, inswinging doors for standard toilet compartments and 36-inch-wide, outswinging doors with a minimum 32-inch-wide, clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 INSTALLATION OF PLASTIC TOILET COMPARTMENTS

A. General: Comply with manufacturer's written installation instructions. Install units straight, rigid, level & plumb. Secure units in position with manufacturer's recommended anchoring devices.

1. Maximum Clearances:

a. Pilasters and Panels: 1/2 inch.
b. Panels and Walls: 1 inch.

2. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than three brackets attached at midpoint and near top and bottom of panel.

a. Locate wall brackets, so holes for wall anchors occur in masonry or tile joints.
b. Align brackets at pilasters with brackets at walls.

3. Full-Height (Continuous) Brackets: Secure panels to walls and to pilasters with full-height brackets.

a. Locate bracket fasteners, so holes for wall anchors occur in masonry or tile joints.
b. Align brackets at pilasters with brackets at walls.

B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels and adjust, so tops of doors are parallel with overhead brace when doors are in closed position.

C. Floor-and-Ceiling-Anchored Units: Secure pilasters to supporting construction and level, plumb, and tighten. Hang doors and adjust, so doors are level and aligned with panels, when doors are in closed position.

D. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.2 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on inswinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on outswinging doors and doors in entrance screens to return doors to fully closed position.

END OF SECTION 102113.19

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.
2. Public-use shower room accessories.
3. Private-use bathroom accessories.
4. Underlavatory guards.
5. Custodial accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: Full size, for each exposed product and for each finish specified.

1.3 INFORMATIONAL SUBMITTALS

A. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 WARRANTY

A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

A. Toilet Tissue (Roll) Dispenser:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. AJW Architectural Products.
    b. Bobrick Washroom Equipment, Inc.
    c. Bradley Corporation.

2. Description: Double-roll dispenser.
3. Mounting: Surface mounted.
4. Operation: Noncontrol delivery with theft-resistant spindle.
5. Capacity: Designed for 5-inch- diameter tissue rolls.
6. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

B. Liquid-Soap Dispenser:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. AJW Architectural Products.
    b. Bobrick Washroom Equipment, Inc.
    c. Bradley Corporation.

2. Description: Designed for dispensing hands free antibacterial soap in lather form.
3. Mounting: Vertically oriented, surface mounted.
4. Capacity: 40 oz.
5. Lockset: Tumbler type.
6. Refill Indicator: Window type.

C. Grab Bar:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. AJW Architectural Products.
    b. Bobrick Washroom Equipment, Inc.
    c. Bradley Corporation.

2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.

    a. Finish: Smooth, ASTM A480/A480M No. 4 finish (satin) on ends and slip-resistant texture in grip area.

4. Outside Diameter: 1-1/2 inches.

5. Configuration and Length: As indicated on Drawings.

D. Sanitary-Napkin Disposal Unit:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. AJW Architectural Products.
    b. Bobrick Washroom Equipment, Inc.
    c. Bradley Corporation.

2. Mounting: Surface mounted.
3. Door or Cover: Self-closing, disposal-opening cover and hinged face panel with tumbler lockset.
4. Receptacle: Removable.
5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

E. Mirror Unit:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. AJW Architectural Products.
    b. Bobrick Washroom Equipment, Inc.
    c. Bradley Corporation.

2. Frame: Stainless steel angle, 0.05 inch thick.

    a. Corners: Welded and ground smooth.

3. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.

    a. One-piece, galvanized-steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
    b. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.

4. Size: As indicated on Drawings.

F. Coat Hook:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. AJW Architectural Products.
    b. Bobrick Washroom Equipment, Inc.

c. Bradley Corporation.

2. Description: Single-prong unit.
3. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

2.3 PRIVATE-USE BATHROOM ACCESSORIES

A. Toilet Tissue Dispenser:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. AJW Architectural Products.
   b. Bobrick Washroom Equipment, Inc.
   c. Bradley Corporation.

2. Description: Double-roll dispenser with hood.
3. Mounting: Surface mounted.
4. Capacity: Designed for 4-1/2- or 5-inch-diameter tissue rolls.
5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

B. Robe Hook:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. AJW Architectural Products.
   b. Bobrick Washroom Equipment, Inc.
   c. Bradley Corporation.

2. Description: Single-prong unit.
3. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

C. Paper Towel (Roll) Dispenser:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. AJW Architectural Products.
   b. Bobrick Washroom Equipment, Inc.
   c. Bradley Corporation.

2. Description: Unit for dispensing preset length of roll paper towels.
3. Mounting: Wall mounted.
4. Minimum Towel-Dispenser Capacity: 8-inch-wide, 800-foot-long roll.
5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
6. Lockset: Tumbler type for towel dispenser compartment.

2.4 UNDERLAVATORY GUARDS

A. Underlavatory Guard:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Buckaroos, Inc.
    b. Plumberex Specialty Products, Inc.
    c. Truebro by IPS Corporation.

2. Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.
3. Material and Finish: Antimicrobial, molded plastic, white.

2.5 WARM-AIR DRYERS

A. High-Speed Warm-Air Dryer:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Excel Dryer, Inc.
    b. Bobrick Washroom Equipment, Inc.
    c. Bradley Corporation.

B. Basis of Design: XLERATOReco Hand dryer

1. Description: High-speed, adjustable velocity, warm-air hand dryer for rapid hand drying, with adjustable velocity.
2. Mounting: Surface mounted, with low-profile design.
3. Operation: Electronic-sensor activated with operation time of 8 to 20 seconds.
4. Cover Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
5. Electrical Requirements: 110 V, 13 A, 1500 W.
6. Filter Requirements: HEPA filtration
7. Sound Level Requirements: Noise Reduction Nozzle
8. ADA compliance features: to include recess kit (Excel #40502).

2.6 CUSTODIAL ACCESSORIES

A. Utility Shelf:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. AJW Architectural Products.

b. Bobrick Washroom Equipment, Inc.
c. Bradley Corporation.

2. Description: With exposed edges turned down not less than 1/2 inch and supported by two triangular brackets welded to shelf underside.
3. Size: 16 inches long by 6 inches deep.
4. Material and Finish: Not less than nominal 0.05-inch-thick stainless steel, ASTM A480/A480M No. 4 finish (satin).

B. Mop and Broom Holder:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. AJW Architectural Products.
b. Bobrick Washroom Equipment, Inc.
c. Bradley Corporation.

2. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
3. Length: 36 inches.
4. Hooks: Four.
5. Mop/Broom Holders: Three, spring-loaded, rubber hat, cam type.
6. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

a. Shelf: Not less than nominal 0.05-inch-thick stainless steel.
b. Rod: Approximately 1/4-inch-diameter stainless steel.

2.7 FABRICATION

A. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F446.

END OF SECTION 102800

SECTION 104413 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire-protection cabinets for portable fire extinguishers.

1.2 PREINSTALLATION CONFERENCE

A. Preinstallation Conference: Conduct conference at a location to be determined.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For fire-protection cabinets.

C. Samples: For each type of exposed finish required.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E814 for fire-resistance rating of walls where they are installed.

2.2 FIRE-PROTECTION CABINET

A. Cabinet Type: Suitable for fire extinguisher.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Babcock-Davis.
b. JL Industries, Inc.; a division of the Activar Construction Products Group.
c. Larsens Manufacturing Company.
d. Potter Roemer LLC; a Division of Morris Group International.

B. Cabinet Construction: Nonrated.

C. Cabinet Material: Cold-rolled steel sheet.

D. Recessed Cabinet:

1. Exposed Flat Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).

E. Cabinet Trim Material: Same material and finish as door.

F. Door Material: Extruded-aluminum shapes.

G. Door Style: Vertical duo panel with frame.

H. Door Glazing: Tempered float glass (clear).
1. Acrylic Sheet Color: Clear transparent acrylic sheet painted white on unexposed side.

I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

J. Accessories:

1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
2. Lettered Door Handle: One-piece, cast-iron door handle with the word "FIRE" embossed into face.
3. Door Lock: Cylinder lock, keyed alike to other cabinets.
4. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated.

a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."

1) Location: Applied to cabinet glazing.
2) Application Process: Pressure-sensitive vinyl letters.
3) Lettering Color: Red.

4) Orientation: Vertical.

5. Alarm: Manufacturer's standard alarm that actuates when fire-protection cabinet door is opened and that is powered by low voltage, complete with transformer.

K. Materials:

1. Cold-Rolled Steel: ASTM A1008/A1008M, Commercial Steel (CS), Type B.

a. Finish: Baked enamel, TGIC polyester powder coat, HAA polyester powder coat, epoxy powder coat, or polyester/epoxy hybrid powder coat, complying with AAMA 2603.
b. Color: As selected by Engineer/Architect from manufacturer's full range.

2. Tempered Float Glass: ASTM C1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.3 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Prepare recesses for recessed and semi recessed fire-protection cabinets as required by type and size of cabinet and trim style.

B. Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

C. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.

D. Identification: Apply vinyl lettering at locations indicated.

E. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

END OF SECTION 104413

SECTION 104416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at a location to be determined.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Babcock-Davis.
    b. Badger Fire Protection.
    c. Guardian Fire Equipment, Inc.
    d. JL Industries, Inc.; a division of the Activar Construction Products Group.
    e. Kidde Residential and Commercial Division.
    f. Larsens Manufacturing Company.
    g. Potter Roemer LLC; a Division of Morris Group International.

2. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.

B. Multipurpose Dry-Chemical Type: UL-rated 5 lbs nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.

2.3 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or black baked-enamel finish.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Babcock-Davis.
    b. Guardian Fire Equipment, Inc.
    c. JL Industries, Inc.; a division of the Activar Construction Products Group.
    d. Kidde Residential and Commercial Division.
    e. Larsens Manufacturing Company.

f. Potter Roemer LLC; a Division of Morris Group International.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Engineer/Architect.

1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

a. Orientation: Vertical.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

1. Mounting Brackets: Top of fire extinguisher to be at 42 inches above finished floor.

C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

SECTION 105113 - METAL LOCKERS

1.1 SUMMARY

A. Section Includes:

1. Welded corridor lockers.

1.2 PREINSTALLATION MEETINGS

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

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For metal lockers.

1. Include plans, elevations, sections, and attachment details.
2. Include locker identification system and numbering sequence.

C. Samples: For each color specified.

1.4 INFORMATIONAL SUBMITTALS

A. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.

1. Warranty Period for Welded Metal Lockers: **10 years** from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. lockers[**and locker benches**] indicated to be accessible, comply with applicable provisions in **ICC A117.1**

2.2 WELDED CORRIDOR LOCKERS

A. Manufacturers:

1. Penco Products, Inc.
2. Centar Industries, Inc.
3. Lyon LLC

B. Doors: One piece; fabricated from 0.075-inch nominal-thickness steel sheet; formed into channel shape with double bend at vertical edges and with right-angle single bend at horizontal edges.

1. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches wide; welded to inner face of doors.
2. Door Style: **Vented panel as follows:**

a. Louvered Vents: No fewer than **six louver openings at top and bottom for single-tier**

C. Body: Assembled by welding body components together. Fabricate from unperforated steel sheet with thicknesses as follows:

1. Tops, Bottoms, and Sides: 0.060-inch nominal thickness.
2. Backs: 0.048-inch nominal thickness.
3. Shelves: 0.060-inch nominal thickness, with double bend at front and single bend at sides and back.

D. Frames: Channel formed; fabricated from 0.060-inch nominal-thickness steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral, full-height door strikes on vertical main frames.

E. Hinges:

1. Continuous Hinges: Manufacturer's standard, steel, full height.

F. Recessed Door Handle and Latch: Stainless steel cup with integral door pull, recessed so locking device does not protrude beyond door face; pry and vandal resistant.

1. Single-Point Latching: Nonmoving latch hook **with steel padlock loop that projects through recessed cup and is finished to match metal locker body**.

a. Latch Hook: Equip each door with one latch hook.

G. Locks: **Combination padlocks**

H. Identification Plates: Manufacturer's standard, etched, embossed, or stamped **aluminum** plates, with numbers and letters at least 3/8 inch high.

I. Hooks: Manufacturer's standard ball-pointed, aluminum or steel; zinc plated.

J. Coat Rods: Manufacturer's standard.

K. Legs: 6 inches high; formed by extending vertical frame members, or fabricated from 0.075-inch nominal-thickness steel sheet; welded to bottom of locker.

1. Provide closed front and end bases.

L. Filler Panels: Fabricated from 0.048-inch nominal-thickness steel sheet.

M. Finished End Panels: Fabricated from 0.024-inch nominal-thickness steel sheet to cover unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.

N. Materials:

1. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B, suitable for exposed applications.

O. Finish: Baked enamel or powder coat.

1. Color: **As selected by Architect from manufacturer's full range**

2.3 LOCKS

A. Combination Padlock: **Provided by Owner**.

2.4 LOCKER BENCHES

A. Manufacturers:

1. Penco Products, Inc.
2. Centar Industries, Inc.
3. Lyon LLC

B. Provide bench units with overall assembly height of **17-1/2 inches.**

C. Bench Tops: Manufacturer's standard one-piece units, with rounded corners and edges.

1. Size: Minimum 9-1/2 inches wide by 1-1/4 inches thick
2. Laminated clear hardwood with one coat of clear sealer on all surfaces and one coat of clear lacquer on top and sides.

D. Fixed-Bench Pedestals: Manufacturer's standard supports, with predrilled fastener holes for attaching bench top and anchoring to floor, complete with fasteners and anchors.

1. Color: **Match metal lockers**

E. Materials:

1. Stainless Steel Plate, Sheet, and Strip: ASTM A240/A240M or ASTM A666, Type 304.
2. Steel Tube: ASTM A500/A500M, cold rolled.

2.5 FABRICATION

A. Fabricate metal lockers square, rigid, without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.

B. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments.

C. Equipment: Provide each locker with an identification plate and the following equipment:

1. Single-Tier Units: Shelf, one double-prong ceiling hook, and two single-prong wall hooks.

D. Welded Construction: Factory preassemble metal lockers by welding all joints, seams, and connections; with no bolts, nuts, screws, or rivets used in assembly of main locker groups. Factory weld main locker groups into one-piece structures. Grind exposed welds smooth and flush.

E. Accessible Lockers: Fabricate as follows:

1. Locate bottom shelf no lower than 15 inches above the floor.
2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches above the floor.

F. Continuous Zee Base: Fabricated in lengths as long as practical to enclose base and base ends; finished to match lockers.

G. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip-joint filler angle formed to receive filler panel.

H. Boxed End Panels: Fabricated with 1-inch-wide edge dimension, and designed for concealing fasteners and holes at exposed ends of nonrecessed metal lockers; finished to match lockers.

I. Finished End Panels: Fabricated to conceal unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install lockers level, plumb, and true; shim as required, using concealed shims.

1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
2. Anchor single rows of metal lockers to walls near top **and bottom of lockers.**
3. Anchor back-to-back metal lockers to floor.

B. Welded Lockers: Connect groups together with manufacturer's standard fasteners, with no exposed fasteners on face frames.

C. Trim: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.

1. Attach filler panels with concealed fasteners.

D. Fixed Benches: Provide no fewer than two pedestals for each bench, uniformly spaced not more than 72 inches apart.

END OF SECTION 105113

SECTION 114000 - KITCHEN EQUIPMENT

1.1 SUMMARY

A. Section includes equipment for kitchen facilities.

B. Owner-Furnished Equipment: Where indicated, Owner will furnish equipment for installation by Contractor.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For fabricated equipment. Include plans, elevations, sections, roughing-in dimensions, fabrication details, utility service requirements, and attachments to other work.

C. Samples for Initial Selection: For units with factory-applied color finishes.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: For kitchen facilities.

1. Indicate locations of kitchen equipment and connections to utilities.
2. Key equipment using same designations as indicated on Drawings.
3. Include plans and elevations; clearance requirements for equipment access and maintenance; details of equipment supports; and utility service characteristics.
4. Include details of seismic bracing for equipment.

B. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 WARRANTY

A. Refrigeration Compressor Warranty: Manufacturer agrees to repair or replace compressors that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NSF Standards: Provide equipment that bears NSF Certification Mark or UL Classification Mark certifying compliance with applicable NSF standards.

B. UL Certification: Provide electric and fuel-burning equipment and components that are evaluated by UL for fire, electric shock, and casualty hazards according to applicable safety standards, and that are UL certified for compliance and labeled for intended use.

C. Regulatory Requirements: Install equipment to comply with the following:

1. ASHRAE 15, "Safety Code for Mechanical Refrigeration."
2. NFPA 54, "National Fuel Gas Code."
3. NFPA 70, "National Electrical Code."
4. NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operations."

D. Seismic Restraints: Comply with SMACNA's "Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines," Appendix A, "Seismic Restraint Details," unless otherwise indicated.

2.2 KITCHEN EQUIPMENT

A. Microwave:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Maytag
b. Or Approved Equal

2. Basis of Design Description: Microwave Countertop UMC5225GZ Design

a. Capacity:

1) 2.2 cubic feet

a) Finish: Stainless Steel

b. Size:

1) 12-9/16 inches height x 24-7/16” wide x 19-5/8” depth

c. Accessories:

1) LED Display
2) Electronic Display
3) Powder Coat Internal Finish

B. Refrigeration Equipment: Refrigerators.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Fridgaire
b. Or Approved Equal

2. Basis of Design Description: Reach-in type, side by side refrigerator – GRSN2620AF

a. Exterior Finish: Stainless steel.
b. Interior Finish: Stainless steel.
c. Doors: 2 Full length.
d. Accessories:

1) 3 Adjustable glass shelves
2) 2 Drawers
3) 4 Door bins

e. Electrical Service: Equip unit with plug and cord for service indicated on Drawings.

2.3 MISCELLANEOUS MATERIALS

A. Installation Accessories, General: NSF certified for end-use application indicated.

B. Elastomeric Joint Sealant: ASTM C920; silicone. Type S (single component), Grade NS (nonsag), Class 25, Use NT (nontraffic) related to exposure, and Use M, G, A, or O as applicable to joint substrates indicated.

1. Public Health and Safety Requirements:

a. Sealant is certified for compliance with NSF standards for end-use application indicated.
b. Washed and cured sealant complies with the FDA's regulations for use in areas that come in contact with food.

2. Cylindrical Sealant Backing: ASTM C1330, Type C, closed-cell polyethylene, in diameter greater than joint width.

2.4 FINISHES

A. Stainless Steel Finishes: Remove tool and die marks and stretch lines, or blend into finish. Grind and polish surfaces to produce uniform finish, free of cross scratches.

B. Powder-Coat Finishes: Comply with resin manufacturer's written instructions for application, baking, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install kitchen equipment level and plumb, according to manufacturer's written instructions.

1. Connect equipment to utilities.
2. Provide cutouts in equipment, neatly formed, where required to run service lines through equipment to make final connections.

B. Complete equipment assembly where field assembly is required.

1. Provide closed butt and contact joints that do not require a filler.
2. Grind field welds on stainless steel equipment until smooth and polish to match adjacent finish.

C. Install equipment with access and maintenance clearances that comply with manufacturer's written installation instructions and with requirements of authorities having jurisdiction.

D. Install cabinets and similar equipment on bases in a bed of sealant.

E. Install closure-trim strips and similar items requiring fasteners in a bed of sealant.

F. Install joint sealant in joints between equipment and abutting surfaces with continuous joint backing unless otherwise indicated. Produce airtight, watertight, vermin-proof, sanitary joints.

3.2 CLEANING AND PROTECTING

A. After completing installation of equipment, repair damaged finishes.

B. Clean and adjust equipment as required to produce ready-for-use condition.

C. Protect equipment from damage during remainder of the construction period.

3.3 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain kitchen equipment.

END OF SECTION 114000

SECTION 123553.13 - METAL LABORATORY CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal laboratory casework.
2. Utility-space framing at backs of base cabinets.
3. Filler and closure panels.
4. Laboratory countertops.
5. Tables.
6. Shelves.
7. Laboratory sinks.
8. Laboratory accessories.
9. Water, laboratory gas, and electrical service fittings.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For laboratory casework. Include plans, elevations, sections, and attachments to other work including blocking and reinforcements required for installation.

C. Samples: For casework finishes and materials requiring color selection.

D. Delegated-Design Submittal: For laboratory casework indicated to comply with seismic performance requirements, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

PART 2 - PRODUCTS

2.1 METAL LABORATORY CASEWORK

A. Basis of Design manufacturer: Kewaunee Scientific Corporation

B. Manufacturers: Subject to compliance with requirements, other available manufacturers offering products that may be incorporated into the Work. The Laboratory Casework and the Laboratory Fume Hood shall be provided by the same manufacturer and the contractor must coordinate with the M-contract.

C. Product Designations: Drawings indicate sizes and configurations of laboratory casework by referencing designated manufacturer's catalog numbers. Other manufacturers' laboratory casework of similar sizes and similar door and drawer configurations and complying with Specifications may be considered. See Section 016000 "Product Requirements."

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design laboratory casework installation.

B. Seismic Performance: Laboratory casework installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Design earthquake spectral response acceleration, short period (Sds) for Project is indicated on Drawings.
2. Component Importance Factor: 1.0.
3. Base Cabinet Load (Including Countertop and Load on Countertop): 320 lb/ft.
4. Wall Cabinet (Upper Cabinet) Load: 160 lb/ft.

2.3 CASEWORK, GENERAL

A. Casework Product Standard: Comply with SEFA 8 M, "Laboratory Grade Metal Casework."

B. Flammable Liquid Storage: Where cabinets are indicated for solvent or flammable liquid storage, provide units that are listed and labeled as complying with requirements in NFPA 30 by a testing and inspecting agency acceptable to authorities having jurisdiction.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.4 METAL CASEWORK MATERIALS

A. Steel Sheet: Cold-rolled, commercial steel (CS) sheet, complying with ASTM A1008/A1008M; matte finish; suitable for exposed applications.

2.5 AUXILIARY CABINET MATERIALS

A. Acid Storage-Cabinet Lining: 1/4-inch thick, polyethylene, polypropylene, epoxy, or phenolic-composite lining material.

B. Glass for Glazed Doors: Clear tempered glass complying with ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality-Q3; not less than 5.0 mm thick.

2.6 CABINET HARDWARE

A. General: Provide laboratory casework manufacturer's standard, commercial-quality, heavy-duty hardware complying with requirements indicated for each type.

B. Hinges: lol-steel, five-knuckle hinges complying with BHMA A156.9, Grade 1, with antifriction bearings and rounded tips.

C. Hinged-Door and Drawer Pulls: stainless-steel back-mounted pulls.

D. Sliding-Door Pulls: Stainless-steel recessed flush pulls.

E. Door Catches: Nylon-roller spring catches. Provide two catches on doors more than 48 inches high.

F. Drawer Slides: Manufacturer's standard.

G. Locks: Cam or half-mortise type, brass with chrome-plated finish; complying with BHMA A156.11, Type E07261

1. Tumbler: Disc
2. Lock Locations: Provide on drawers and doors
3. Keying: Key locks alike within each room; key each room separately

    a. Masterkey for up to 225 key changes.

4. Key Quantity: Minimum of two keys per lock.
5. Master Key System: Key locks to be operable by master key.

    a. Master Keys: Provide two**.**

H. Sliding-Door Hardware Sets: Laboratory casework manufacturer's standard, to suit type and size of sliding-door units.

2.7 METAL CABINETS AND TABLES

A. Fabrication: Assemble and finish units at point of manufacture. Use precision dies for interchangeability of like-size drawers, doors, and similar parts. Perform assembly on precision jigs to provide units that are square. Reinforce units with angles, gussets, and channels. Except where otherwise specified, integrally frame and weld cabinet bodies to form dirt- and vermin-resistant enclosures. Where applicable, reinforce base cabinets for sink support. Maintain uniform clearance around door and drawer fronts of 1/16 to 3/32 inch.

B. Flush Doors: Outer and inner pans that nest into box formation, with full-height channel reinforcements at center of door. Fill doors with noncombustible, sound-deadening material.

C. Glazed Doors: Hollow-metal stiles and rails of similar construction as flush doors, with glass held in resilient channels or gasket material.

D. Hinged Doors: Mortise for hinges and reinforce with angles welded inside inner pans at hinge edge.

E. Drawers: Fronts made from outer and inner pans that nest into box formation, without raw metal edges at top. Sides, back, and bottom fabricated in one piece with rolled or formed top of sides for stiffening and comfortable grasp for drawer removal. Provide drawers with rubber bumpers, polymer roller slides, and positive stops to prevent metal-to-metal contact or accidental removal.

F. Adjustable Shelves: Front, back, and ends formed down, with edges returned horizontally at front and back to form reinforcing channels.

G. Toe Space: Fully enclosed, 4 inches high by 3 inches deep, with no open gaps or pockets.

H. Tables: Welded tubing legs, not less than 2 inches square with channel stretchers as needed to comply with product standard. Weld or bolt stretchers to legs and cross-stretchers, and bolt legs to table aprons. Provide leveling device welded to bottom of each leg.

1. Leg Shoes: Rubber Satin-finished, stainless-steel, open-bottom, slip-on type.

I. Utilities: Provide space, cutouts, and holes for pipes, conduits, and fittings in cabinet bodies to accommodate utility services and their support-strut assemblies.

1. Provide base cabinets with removable backs for access to utility space.

J. Utility-Space Framing: Steel framing units consisting of two steel slotted channels complying with MFMA-4, not less than 1-5/8 inches square by 0.105-inch nominal thickness, that are connected at top and bottom by U-shaped brackets made from 1-1/4-by-1/4-inch steel flat bars. Framing units may be made by welding channel material into rectangular frames instead of using U-shaped brackets.

K. Filler and Closure Panels: Provide where indicated and as needed to close spaces between casework and walls, ceilings, and equipment. Fabricate from same material and with same finish as casework and with hemmed or flanged edges unless otherwise indicated.

2.8 METAL CABINET FINISH

A. Chemical-Resistant Finish: Finish complies with acceptance levels of cabinet surface finish tests in SEFA 8 M. Acceptance level for chemical spot test shall be no more than for Level 3 conditions.

1. Colors for Metal Laboratory Casework Finish: As selected by Architect from manufacturer's full range.

2.9 COUNTERTOPS, TABLETOPS, SHELVES, TROUGHS, AND SINKS

A. Countertops, General: Provide units with smooth surfaces in uniform plane, free of defects. Make exposed edges and corners straight and uniformly beveled. Provide front and end overhang of 1 inch.

B. Sinks, General: Provide sizes indicated or laboratory casework manufacturer's closest standard size of equal or greater volume, as approved by Architect.

1. Outlets: Provide with strainers and tailpieces, NPS 1-1/2 (DN 40), unless otherwise indicated.
2. Overflows: For each sink except cup sinks, provide overflow of standard beehive or open-top design with separate strainer. Height 2 inches (50 mm) less than sink depth. Provide in same material as strainer.

C. Phenolic-Composite Countertops, Tabletops and Shelves:

1. Countertop Fabrication: Fabricate with cutouts for sinks, holes for service fittings and accessories, and butt joints assembled with epoxy adhesive and concealed metal splines.

    a. Flat Configuration: 1 inch thick with continuous drip groove on underside 1/2 inch from overhang edge and integral coved backsplash.

        1) Edges and Corners: Rounded.

2. Tabletop Fabrication:

    a. Flat Configuration: 1 inch thick with continuous drip groove on underside at perimeter.

        1) Edges and Corners: Rounded.

3. Shelf Configuration: Flat, 3/4 inch thick.

    a. Edges and Corners: Rounded.

D. Stainless-Steel Shelves: Made from stainless-steel sheet, not less than 0.050-inch nominal thickness, with No. 4 satin finish. Weld shop-made joints. Fold down front edge 3/4 inch; fold up back edge 3 inches.

1. Provide integral stiffening brackets, formed by folding up ends 3/4 inch and welding to upturned front and back edges.
2. After fabricating, grind welds smooth and polish to produce uniform, directionally textured finish with no cross scratches or evidence of welds. Passivate and rinse surfaces; remove embedded foreign matter and leave surfaces clean.

E. Stainless-Steel Sinks: Made from stainless-steel sheet, not less than 0.050-inch nominal thickness. Fabricate with corners rounded and coved to at least 5/8-inch radius. Slope sink bottoms to outlet. Provide continuous butt-welded joints.

1. Provide double-wall construction for sink partitions with top edge rounded to at least 1/2-inch diameter.
2. After fabricating and welding, grind surfaces smooth and polish to produce uniform finish with no cross scratches or evidence of welds. Passivate and rinse surfaces; remove embedded foreign matter and leave surfaces clean.
3. Factory punch holes for fittings.
4. Provide with stainless-steel strainers and tailpieces.
5. Provide with integral rims except where located in stainless-steel countertops.
6. Apply 1/8-inch- thick coating of heat-resistant, sound-deadening mastic to undersink surfaces.

F. Cup Sinks: Provide in material indicated, 3-by-9-inch

1. Stainless-Steel Cup Sinks: Provide with stainless-steel strainers and integral tailpieces.

G. Troughs: Provide in material indicated and pitch to drains not less than 1/8 inch/foot. Except where troughs empty into sinks, provide NPS 1-1/2 (DN 40) outlets with strainers and tailpieces.

1. Stainless-Steel Troughs: Made from stainless-steel sheet, not less than 0.062-inch nominal thickness. Fabricate with corners rounded and coved to at least 5/8-inch radius. Provide continuous butt-welded joints. After fabricating and welding, grind surfaces smooth and polish to produce uniform finish with no cross scratches or evidence of welds. Passivate and rinse surfaces; remove embedded foreign matter and leave surfaces clean. Provide stainless-steel strainers and tailpieces.

2.10 LABORATORY ACCESSORIES

A. Reagent Shelves: Provide as indicated, fabricated from same material as adjacent countertop unless otherwise indicated.

B. Burette Rods: Aluminum or stainless-steel rods, 1/2 inch in diameter and 18 inches long, threaded on one end to fit tapered plug adapter for flush socket receptacle. Provide with tapered plug adapter and receptacle.

C. Upright Rod Assembly and Metal Crossbar: Aluminum or stainless steel. Two vertical rods and one horizontal crossbar, 3/4 inch in diameter and 36 inches long unless otherwise indicated; two flush socket receptacles and two crossbar clamps. Ends of vertical rods are tapered to fit receptacles; other rod ends are rounded.

D. Greenlaw Arm Assembly: Aluminum or stainless-steel vertical rod, tapered on one end to fit flush socket receptacle. Adjustable crossbar of hardwood with black, acid-resistant finish, secured to upright with adjustable clamp. Provide with receptacle.

E. Lattice Assembly: Aluminum or stainless-steel, vertical and horizontal rod lattice assembly with 3/4-inch- diameter rods at approximately 12 inches o.c. with two flush socket receptacles for mounting.

1. Size: 36 inches wide by 24 inches high.

F. Pegboards: Polypropylene, epoxy, or phenolic-composite pegboards with removable polypropylene pegs and stainless-steel drip troughs with drain outlet.

G. Pegboards: Stainless-steel pegboards with removable polypropylene pegs and stainless-steel drip troughs with drain outlet.

2.11 WATER AND LABORATORY GAS SERVICE FITTINGS

A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Service Fittings: Provide units that comply with SEFA 7, "Recommended Practices for Fixtures." Provide fittings complete with washers, locknuts, nipples, and other installation accessories. Include wall and deck flanges, escutcheons, handle extension rods, and similar items.

1. Provide units that comply with "Vandal-Resistant Faucets and Fixtures" recommendations in SEFA 7.

C. Materials: Fabricated from cast or forged red brass unless otherwise indicated.

1. Reagent-Grade Water Service Fittings: Polypropylene, PVC, or PVDF for parts in contact with water.

D. Finish: Acid- and solvent-resistant powder coating complying with requirements in SEFA 7 for corrosion-resistant finishes.

1. Provide chemical-resistant powder coating in laboratory casework manufacturer's standard metallic brown, aluminum, white, or other color as approved by Architect.

E. Water Valves and Faucets: Provide units complying with ASME A112.18.1, with renewable seats, designed for working pressure up to 80 psig.

1. Vacuum Breakers: Provide ASSE 1035 vacuum breakers on water fittings with serrated outlets.
2. Aerators: Provide aerators on water fittings that do not have serrated outlets.
3. Self-Closing Valves: Provide self-closing valves where indicated.

F. Ball Valves: Chrome-plated ball and PTFE seals. Handle requires no more than 5 lbf to operate. Provide units designed for working pressure up to 75 psig, with serrated outlets.

1. Locking Safety Handles: Where ball valves are indicated for fuel-gas use, provide handles that must be pushed in before being turned on.

G. Ground-Key Cocks: Tapered core and handle of one-piece forged brass, ground and lapped, and held in place under constant spring pressure. Provide units designed for working pressure up to 40 psig, with serrated outlets.

H. Steam Valves: Stainless-steel seat and PTFE seat disc. Provide units designed for steam working pressure up to 20 psig, with serrated outlets.

I. Needle Valves: Provide units with renewable, self-centering, floating cones and renewable seats of stainless steel or Monel metal, with removable serrated outlets.

1. Provide units designed for working pressure up to **60 psig**.

J. Hand of Fittings: Furnish right-hand fittings unless fitting designation is followed by "L."

K. Remote-Control Valves: Provide needle valves, straight-through or angle type as indicated for fume hoods and where indicated.

L. Handles: Provide three- or four-wing, molded-plastic or powder-coated-metal handles for valves unless otherwise indicated.

1. Provide lever-type handles for ground-key cocks. Lever handle aligns with outlet when valve is closed and is perpendicular to outlet when valve is fully open.
2. Provide lever-type handles for ball valves unless otherwise indicated. Lever handle aligns with outlet when valve is closed and is perpendicular to outlet when valve is fully open.
3. Provide heat-resistant plastic handles for steam valves.
4. Provide knurled, molded-plastic handles for needle valves.

M. Service-Outlet Identification: Provide color-coded plastic discs with embossed identification, secured to each service-fitting handle to be tamper resistant. Comply with SEFA 7 for colors and embossed identification.

2.12 ELECTRICAL AND COMMUNICATION SERVICE FITTINGS

A. Service Fittings, General: Provide units complete with metal housings, receptacles, switches, pilot lights, data communication outlets, cover plates, accessories, and gaskets required for mounting on laboratory casework.

B. Electrical Wiring Devices: Comply with requirements in Section 262726 "Wiring Devices" for receptacles, switches, pilot lights, cover plates, and accessories.

C. Twisted-Pair Copper Data Outlets: Comply with requirements in Section 271513 "Communications Copper Horizontal Cabling."

D. Optical-Fiber Data Outlets: Comply with requirements Section 271523 "Communications Optical Fiber Horizontal Cabling."

E. Electrical Receptacles: General grade. 125 V, 20 A; NEMA WD 6, Configuration 5-20R unless otherwise indicated.

1. GFCI Receptacles: Feed-through type with integral LED indicator light.
2. SPD Receptacles: With LED indicator light and integral SPD in line to ground, line to neutral, and neutral to ground.
3. Color of Receptacles: As selected by Architect unless otherwise indicated or required by NFPA 70.

F. USB Charger Receptacles: Dual Type A, color matching electrical receptacles.

1. Type: Tamper resistant.

G. Switches: Comply with NEMA WD 1, UL 20, and FS W-S-896.

1. Color of Switches: As selected by Architect unless otherwise indicated or required by NFPA 70.

H. Data Communication Outlets: Two RJ-45 jacks for terminating 100-ohm, balanced, four-pair twisted-pair cabling complying with TIA-568-C.1; complying with Category 5e. Comply with UL 1863.

I. Cover Plates: Provide satin-finish, Type 304, stainless-steel cover plates with formed, beveled edges.

J. Cover-Plate Identification: Use 1/4-inch- high letters unless otherwise indicated. For stainless steel or chrome-plated metal, stamp or etch plate and fill in letters with black enamel.

1. Provide at every cover plate.

a. Receptacles other than standard 125-V duplex, grounding type.
b. Switches and thermal-overload switches.
c. Pilot lights when located remotely from associated equipment or switch, where function is not obvious.
d. Receptacles, switches, and other locations indicated.

2. Provide the following information:

a. Voltage and phase for receptacles other than standard 125-V duplex, grounding type.
b. Indicate equipment being controlled by switches and thermal-overload switches.
c. Indicate equipment being controlled for pilot lights when located remotely from associated equipment or switch, where function is not obvious.
d. Number of the breaker in panelboard that controls device.

K. Pedestal-Type Fittings: Cast-aluminum housings with sloped single face or two faces, as indicated, with neoprene gasket under base and with concealed mounting holes in base for attaching to laboratory casework. Provide holes tapped for conduits.

L. Line-Type Fittings: Provide with cast-metal boxes with threaded holes for mounting on rigid steel conduit. Provide cover plates same size as boxes.

M. Recessed-Type Fittings: Provide with galvanized-steel boxes.

N. Finishes for Service-Fitting Components: Provide housings or boxes for pedestal- and line-type fittings with manufacturer's standard baked-on, chemical-resistant enamel in color as selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION OF CABINETS

A. Comply with installation requirements in SEFA 2. Install level, plumb, and true in line; shim as required using concealed shims. Where laboratory casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.

B. Utility-Space Framing: Secure to floor with two fasteners at each frame. Fasten to partition framing, wood blocking, or metal reinforcements in partitions and to base cabinets.

C. Base Cabinets: Fasten cabinets to utility-space framing, partition framing, wood blocking, or reinforcements in partitions, with fasteners spaced not more than 16 inches o.c. Bolt adjacent cabinets together with joints flush, tight, and uniform.

1. Where base cabinets are installed away from walls, fasten to floor at toe space at not more than 24 inches o.c. and at sides of cabinets with not less than two fasteners per side.

D. Wall Cabinets: Fasten to hanging strips, masonry, partition framing, blocking, or reinforcements in partitions. Fasten each cabinet through back, near top, at not less than 16 inches o.c.

E. Install hardware uniformly and precisely.

F. Adjust operating hardware so doors and drawers align and operate smoothly without warp or bind and contact points meet accurately. Lubricate operating hardware as recommended by manufacturer.

3.2 INSTALLATION OF COUNTERTOPS

A. Comply with installation requirements in SEFA 2. Abut top and edge surfaces true in plane with flush hairline joints and with internal supports placed to prevent deflection. Locate joints where indicated on Shop Drawings.

B. Field Jointing: Where possible, make in same manner as shop-made joints, using dowels, splines, fasteners, adhesives, and sealants recommended by manufacturer. Shop prepare edges for field-made joints.

1. Plastic-Laminate Countertops: Secure field-made joints using concealed clamping devices located within 6 inches of front and back edges and at intervals not exceeding 24 inches . Tighten according to manufacturer's written instructions to exert a uniform heavy pressure at joints.

C. Fastening:

1. Secure countertops, except for epoxy countertops, to cabinets with Z-type fasteners or equivalent, using two or more fasteners at each cabinet front, end, and back.
2. Secure epoxy countertops to cabinets with epoxy cement, applied at each corner and along perimeter edges at not more than 48 inches o.c.
3. Where necessary to penetrate countertops with fasteners, countersink heads approximately 1/8 inch and plug hole flush with material equal to countertop in chemical resistance, hardness, and appearance.

D. Provide holes and cutouts required for service fittings.

E. Seal unfinished edges and cutouts in plastic-laminate countertops with heavy coat of polyurethane varnish.

F. Provide scribe moldings for closures at junctures of countertop, curb, and splash with walls as recommended by manufacturer for materials involved. Match materials and finish to adjacent laboratory casework. Use chemical-resistant, permanently elastic sealing compound where recommended by manufacturer.

G. Dress joints smooth, remove surface scratches, and clean entire surface.

3.3 INSTALLATION OF SINKS

A. Comply with installation requirements in SEFA 2.

B. Drop-in Installation of Epoxy Sinks: Rout groove in countertop to receive sink rim if not shop prepared. Set sink in adhesive and fill remainder of groove with sealant or adhesive. Use procedures and products recommended by sink and countertop manufacturers. Remove excess adhesive and sealant while still wet and finish joint for neat appearance.

C. Underside Installation of Epoxy Sinks: Use laboratory casework manufacturer's recommended adjustable support system for table- and cabinet-type installations. Set top edge of sink unit in sink and countertop manufacturers' recommended chemical-resistant sealing compound or adhesive, and firmly secure to produce a tight and fully leakproof joint. Adjust sink and securely support to prevent movement. Remove excess sealant or adhesive while still wet and finish joint for neat appearance.

D. Semiflush Installation of Stainless-Steel Sinks: Before setting, apply sink and countertop manufacturers' recommended sealant under rim lip and along top. Remove excess sealant while still wet and finish joint for neat appearance.

E. Drop-in Installation of [**Epoxy**] [**and**] [**Polypropylene**] Cup Sinks: Rout groove in countertop to receive sink rim if not shop prepared. Set sink in adhesive and fill remainder of groove with sealant or adhesive. Use procedures and products recommended by sink and countertop manufacturers. Remove excess adhesive and sealant while still wet and finish joint for neat appearance.

F. Surface Installation of [**Epoxy**] [**and**] [**Polypropylene**] Cup Sinks: Set sink in sealant or adhesive. Use procedures and products recommended by sink and countertop manufacturers. Remove excess sealant or adhesive while still wet and finish joint for neat appearance.

3.4 INSTALLATION OF LABORATORY ACCESSORIES

A. Install accessories according to Shop Drawings, installation requirements in SEFA 2, and manufacturer's written instructions.

B. Securely fasten adjustable shelving supports, stainless-steel shelves, and pegboards to partition framing, wood blocking, or reinforcements in partitions.

C. Install shelf standards plumb and at heights to align shelf brackets for level shelves. Install shelving level and straight, closely fitted to other work where indicated.

D. Securely fasten pegboards to partition framing, wood blocking, or reinforcements in partitions.

3.5 INSTALLATION OF SERVICE FITTINGS

A. Comply with requirements in other Sections for installing water and laboratory gas service fittings and electrical devices.

B. Install fittings according to Shop Drawings, installation requirements in SEFA 2, and manufacturer's written instructions. Set bases and flanges of sink- and countertop-mounted fittings in sealant recommended by manufacturer of sink or countertop material. Securely anchor fittings to laboratory casework unless otherwise indicated.

3.6 CLEANING AND PROTECTING

A. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

B. Protect countertop surfaces during construction with 6-mil plastic or other suitable water-resistant covering. Tape to underside of countertop at a minimum of 48 inches o.c.

3.7 SERVICE-FITTING SCHEDULE

A. Water Service Fitting, Type WF-1:

1. Fitting Type: Swing-spout mixing faucet.
2. Outlet: [**Aerator**] [**Vacuum breaker and removable serrated outlet**].
3. Mounting: Wall mounted.
4. Additional Requirements: [**Self-closing valves**] [**For reagent-grade water**].

B. Laboratory Gas Service Fitting, Type GF-1:

1. Service: **Air**.
2. Fitting Type: Turret.
3. Outlets: Two, at 180 degrees.
4. Outlet Type: Straight.
5. Valve Type: Ball valve.

C. Laboratory Gas Service Fitting, Type GF-2:

1. Service: Gas (fuel gas).
2. Fitting Type: Turret.
3. Outlets: Two, at 180 degrees.
4. Outlet Type: Straight.
5. Valve Type: Ball valve.

D. Laboratory Gas Service Fitting, Type GF-3:

1. Service: Vacuum.
2. Fitting Type: Turret.
3. Outlets: Two, at 180 degrees.
4. Outlet Type: Straight.
5. Valve Type: Ball valve.

E. Electrical Service Fitting, Type EF-1:

1. Fitting Type: Recessed.
2. Device: Two duplex receptacles .
3. Additional Requirements: GFCI receptacles.

F. Communication Service Fitting, Type CF-1:

1. Fitting Type: Recessed.
2. Device: One duplex communication receptacle.

END OF SECTION 123553.13

SECTION 123640 - STONE COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes stone countertops.

1.2 ACTION SUBMITTALS

A. Product Data: For each variety of stone, stone accessory and manufactured product.

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

C. Samples: For each stone type indicated.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of stone countertops.

1.4 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of construction to receive stone countertops by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Stone: Obtain each variety of stone, regardless of finish, from a single quarry, whether specified in this Section or in another Specification Section, with resources to provide materials of consistent quality in appearance and physical properties.

1. Make stone slabs available for examination by Architect.

2.2 GRANITE

A. Material Standard: Comply with ASTM C615/C615M.

B. Varieties and Sources: Subject to compliance with requirements, provide one of the following available stone varieties that may be incorporated into the Work include, but are not limited to, the following:

1. Provide polished granite countertops from StoneMark Granite, Daltile, or other acceptable granite countertop supplier.

C. Finish: Polished.

2.3 ADHESIVES, GROUT, SEALANTS, AND STONE ACCESSORIES

A. General: Use only adhesives formulated for stone and ceramic tile and that are recommended by their manufacturer for the application indicated.

B. Water-Cleanable Epoxy Adhesive: ANSI A118.3.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   a. Bonsal American, an Oldcastle company.
   b. H.B. Fuller Construction Products Inc. / TEC.
   c. LATICRETE SUPERCAP, LLC.
   d. MAPEI Corporation.
   e. Southern Grouts & Mortars, Inc.
   f. Summitville Tiles, Inc.

C. Water-Cleanable Epoxy Grout: ANSI A118.3, chemical-resistant, water-cleanable, tile-setting and -grouting epoxy.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   a. Bonsal American, an Oldcastle company.
   b. H.B. Fuller Construction Products Inc. / TEC.
   c. LATICRETE SUPERCAP, LLC.
   d. MAPEI Corporation.
   e. Southern Grouts & Mortars, Inc.
   f. Summitville Tiles, Inc.

D. Sealant for Countertops: Manufacturer's standard sealant that complies with applicable requirements in Section 079200 "Joint Sealants" and that will not stain the stone it is applied to.

1. Mildew-Resistant Joint Sealant: Mildew resistant, single component, nonsag, neutral curing, silicone.
2. Color: Clear.

E. Particleboard Subtops: ANSI A208.1, Grade M-2-Exterior Glue.

F. Plywood Subtops: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

G. Stone Sealer: Colorless, stain-resistant sealer that does not affect color or physical properties of stone surfaces, as recommended by stone producer for application indicated.

2.4 STONE FABRICATION, GENERAL

A. Select stone for intended use to prevent fabricated units from containing cracks, seams, and starts that may impair structural integrity, function, or appearance.

B. Fabricate stone countertops in sizes and shapes required to comply with requirements indicated.

1. Dress joints straight and at right angle to face unless otherwise indicated.
2. Fabricate molded edges with machines having abrasive shaping wheels made to reverse contour of edge profile to produce uniform shape throughout entire length of edge and with precisely formed arris slightly eased to prevent snipping, and matched at joints between units. Form corners of molded edges as indicated with outside corners slightly eased unless otherwise indicated.
3. Finish exposed faces of stone to comply with requirements indicated for finish of each stone type required and to match approved Samples and mockups. Provide matching finish on exposed edges of countertops, splashes, and cutouts.

2.5 STONE COUNTERTOPS

A. General: Comply with recommendations in MIA's "Dimension Stone - Design Manual VII."

B. Nominal Thickness: Provide thickness indicated, but not less than 7/8 inch. Gage backs to provide units of identical thickness.

C. Splashes: Provide 3/4-inch thick backsplashes and end splashes unless otherwise indicated.

D. Joints: Fabricate countertops without joints.

E. Joints: Fabricate countertops in sections for joining in field, with joints at locations to be determined.

F. Cutouts and Holes:

1. Undercounter Fixtures: Make cutouts for undercounter fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
2. Counter-Mounted Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
3. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

PART 3 - EXECUTION

3.1 INSTALLATION OF COUNTERTOPS

A. Install countertops over subtops with full spread of water-cleanable epoxy adhesive.

B. Install countertops by adhering to supports with water-cleanable epoxy adhesive.

C. Set stone to comply with requirements indicated. Shim and adjust stone to locations indicated, with uniform joints of widths indicated and with edges and faces aligned according to established relationships.

D. Space joints with 1/16-inch gap for filling with sealant. Use temporary shims to ensure uniform spacing.

1. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.

E. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Use power saws with diamond blades to cut stone. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

F. Install backsplashes and end splashes by adhering to wall with water-cleanable epoxy adhesive. Leave 1/16-inch gap between countertop and splashes for filling with sealant. Use temporary shims to ensure uniform spacing.

G. Grout joints to comply with ANSI A108.10. Remove temporary shims before grouting. Tool grout uniformly and smoothly with plastic tool.

H. Apply sealant to joints and gaps specified for filling with sealant; comply with Section 079200 "Joint Sealants." Remove temporary shims before applying sealant.

3.2 ADJUSTING AND CLEANING

A. In-Progress Cleaning: Clean countertops as work progresses. Remove adhesive, grout, mortar, and sealant smears immediately.

B. Clean stone countertops no fewer than six days after completion of sealant installation, using clean water and soft rags. Do not use wire brushes, acid-type cleaning agents, cleaning compounds with caustic or harsh fillers, or other materials or methods that may damage stone.

C. Sealer Application: Apply stone sealer to comply with stone producer's and sealer manufacturer's written instructions.

END OF SECTION 123640

SECTION 124813 - ENTRANCE FLOOR MATS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roll-up rail mats.
2. Recessed frames.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Items penetrating floor mats and frames, including door control devices.
2. Divisions between mat sections.
3. Perimeter floor moldings and frames.
4. Custom Graphics: Scale drawing indicating colors.

C. Samples: For each exposed product and for each color and texture specified.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance data.

PART 2 - PRODUCTS

2.1 ENTRANCE FLOOR MATS AND FRAMES, GENERAL

A. Accessibility Standard: Comply with applicable provisions in ICC A117.1.

2.2 ROLL-UP RAIL MATS

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. Amarco Products.
2. Babcock-Davis.
3. C/S Group.
4. Kadee Industries, Inc.

B. Hinged Mats: Extruded-aluminum tread rails 1-1/2 inches wide by 3/8 inch thick, sitting on continuous vinyl cushions.

1. Tread Inserts: 1/4-inch-high, 28-oz./sq. yd. weight, level-cut, nylon-pile, fusion-bonded carpet.
2. Colors, Textures, and Patterns of Inserts: As selected by Engineer/Architect from full range of industry colors.
3. Rail Color: As selected by Engineer/Architect from full range of industry colors and color densities.
4. Hinges: Plastic.
5. Mat Size: As indicated.

2.3 FRAMES

A. Recessed Frames: Manufacturer's standard extrusion.

1. Extruded Aluminum: ASTM B221.

a. Color: As selected by Engineer/Architect from full range of industry colors and color densities.

2.4 FABRICATION

A. Floor Mats: Shop fabricate units to greatest extent possible in sizes indicated. Unless otherwise indicated, provide single unit for each mat installation; do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in mats are necessary, space symmetrically and away from normal traffic lanes. Miter corner joints in framing elements with hairline joints or provide prefabricated corner units without joints.

B. Coat concealed surfaces of aluminum frames that contact cementitious material with manufacturer's standard protective coating.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install recessed mat frames and mats to comply with manufacturer's written instructions so that tops of mats will be flush with adjoining finished flooring. Set mats with tops at height recommended by manufacturer for most effective cleaning action; coordinate tops of mat surfaces with bottoms of doors that swing across mats to provide clearance between door and mat.

3.2 PROTECTION

A. After completing frame installation and concrete work, provide temporary filler of plywood or fiberboard in recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near Substantial Completion.

END OF SECTION 124813

SECTION 22 0510 - BASIC PLUMBING REQUIREMENTS

PART 1 GENERAL

1.1 WORK INCLUDED

A. Provide all labor, tools, materials, accessories, parts, transportation, taxes, and related items, essential for installation of the work and necessary to make work, complete, and operational. Provide new equipment and material unless otherwise called for. References to codes, specifications and standards called for in the specification sections and on the drawings mean, the latest edition, amendment and revision of such referenced standard in effect on the date of these contract documents.

1.2 LICENSING

A. The Contractor shall hold a license to perform the work as issued by the local jurisdiction.

B. Plumbing work shall be performed by, or under, the direct supervision of a licensed master plumber if so required by the local jurisdiction.

C. The Contractor shall be responsible for reviewing the local jurisdiction requirements prior to bidding.

1.3 PERMITS

A. Apply for and obtain all required permits and inspections, pay all fees and charges including all service charges.

1.4 CODE COMPLIANCE

A. Provide work in compliance with the following:

1. The Building Code of New York State including The Fire Code; Property Maintenance Code; Plumbing Code, Mechanical Code and Fuel Gas Code; and The Energy Code of New York.

2. New York State Department of Labor Rules and Regulations.

3. Occupational Safety and Health Administration (OSHA).

4. National Fuel Gas Code, NFPA 54.

5. National Electrical Code, NFPA 70.

6. Local Codes and Ordinances.

7. Life Safety Codes, NFPA 101 (2000).

8. New York Board of Fire Underwriters.

1.5 GLOSSARY

A. ACI American Concrete Institute

B. AGA American Gas Association

C. AGCA Associated General Contractors of America, Inc.

D. AIA American Institute of Architects

E. AISC American Institute of Steel Construction

F. AFBMA Anti-Friction Bearing Manufacturer's Association

G. AMCA Air Moving and Conditioning Association, Inc.

H. ANSI American National Standards Institute

I. ARI Air Conditioning and Refrigeration Institute

J. ASHRAE American Society of Heating, Refrigeration, and Air Conditioning Engineers, Inc.

K. ASME American Society of Mechanical Engineers

L. ASPE American Society of Plumbing Engineers

M. ASTM American Society for Testing Materials

N. FM Factory Mutual Insurance Company

O. IBR Institute of Boiler & Radiation Manufacturers

P. IEEE Institute of Electrical and Electronics Engineers

Q. IRI Industrial Risk Insurers

R. NYBFU New York Board of Fire Underwriters

S. NEC National Electrical Code

T. NEMA National Electrical Manufacturer's Association

U. NESC National Electrical Safety Code

V. NFPA National Fire Protection Association

W. NYS/DEC New York State Department of Environmental Conservation

X. SBI Steel Boiler Institute

Y.	SMACNA	Sheet Metal and Air Conditioning Contractors National Association
Z.	UFPO	Underground Facilities Protective Organization
AA.	UL	Underwriter's Laboratories, Inc.
AB.	OSHA	Occupational Safety and Health Administration
AC.	NYS/UFPBC	New York State Uniform Fire Prevention and Building Code

1.6 DEFINITIONS

A.	Acceptance	Owner acceptance of the project from Contractor upon certification by Owner's Representative.
B.	Approval/Approved	Written permission to use a material or system.
C.	As Called For	Materials, equipment including the execution specified/shown in the contract documents.
D.	Code Requirements	Minimum requirements.
E.	Concealed	Work installed in pipe and duct shafts, chases or recesses, inside walls, above ceilings, in slabs or below grade.
F.	Design Equipment Substitutions.	Refer to the article, Equipment Arrangements, and the article,
G.	Design Make Substitutions.	Refer to the articles, Equipment Arrangements, and the article,
H.	Exposed	Work not identified as concealed.
I.	Equal or Equivalent	Equally acceptable as determined by Owner's Representative.
J.	Furnish	Supply and deliver to installed location.
K.	Furnished by Others	Receive delivery at job site or where called for and install.
L.	Inspection	Visual observations by Owner's site Representative.
M.	Install	Mount and connect equipment and associated materials ready for use.
N.	Labeled	Refers to classification by a standards agency.
O.	Make Substitutions.	Refers to the article, Equipment Arrangements, and the article,

P. Or Approved Equal — Approved equal or equivalent as determined by Owner's Representative.

Q. Owner's Representative — The Prime Professional.

R. Prime Professional — Architect or Engineer having a contract directly with the Owner for professional services.

S. Provide — Furnish, install, and connect ready for use.

T. Relocate — Disassemble, disconnect, and transport equipment to new locations, then clean, test, and install ready for use.

U. Replace — Remove and provide new item.

V. Review — A general contractual conformance check of specified products.

W. Roughing — Pipe, duct, conduit, equipment layout and installation.

X. Satisfactory — As specified in contract documents.

Y. Site Representative — Owner's inspector or "Clerk of Works" at the work site.

1.7 SHOP DRAWINGS/PRODUCT DATA/SAMPLES

A. Submit Shop Drawings on all items of equipment and materials to be furnished and installed. Submission of Shop Drawings and samples shall be accompanied by a transmittal letter, stating name of project and contractor, number of drawings, titles, and other pertinent data called for in individual sections. Shop Drawings shall be dated and contain: Name of project; name of prime professional; name of prime contractor; description or names of equipment, materials and items; and complete identification of locations at which materials or equipment are to be installed. Individual piecemeal or incomplete submittals will not be accepted. Similar items, (all types specified) shall be submitted at one time. Number each submittal by trade. Indicate deviations from contract requirements on Letter of Transmittal. Shop Drawings will be given a general review only. Corrections or comments made on the Shop Drawings during the review do not relieve Contractor from compliance with requirements of the drawings and specifications. The Contractor is responsible for: confirming and correcting all quantities; checking electrical characteristics and dimensions; selecting fabrication processes and techniques of construction; coordinating his work with that of all other trades; and performing his work in a safe and satisfactory manner.

1.8 PROTECTION OF PERSONS AND PROPERTY

A. Contractor shall assume responsibility for construction safety at all times and provide, as part of contract, all trench or building shoring, scaffolding, shielding, dust/fume protection, mechanical/electrical protection, special grounding, safety railings, barriers,

and other safety feature required to provide safe conditions for all workmen and site visitors.

1.9 EQUIPMENT ARRANGMENTS

A. The contract documents are prepared on basis of one manufacturer as "design equipment," even though other manufacturer's names are listed as acceptable makes. If Contractor elects to use one of the listed makes other than "design equipment," submit detailed drawings, indicating proposed installation of equipment. Show maintenance arrangement. Make required changes in the work of other trades, at no increase in any contract. Provide larger motors, feeders, breakers, and equipment, additional control devices, valves, fittings and other miscellaneous equipment required for proper operation, and assume responsibility for proper location of roughing and connections by other trades. Remove and replace door frames, access doors, walls, ceilings, or floors required to install other than design make equipment. If revised arrangement submittal is rejected, revise and resubmit specified "design equipment" item which conforms to contract documents.

1.10 UTILITY COMPANY SERVICES

A. Make arrangements with the Owner's Gas supplier for installation of new gas service. Coordinate all activities between the Owner and supplier. The installation of the gas service shall comply with the published standards, including but no limited to NFPA 54 and NFPA 58.

1.11 ROUGHING

A. Due to small scale of Drawings, it is not possible to indicate all offsets, fittings, changes in elevation, interferences, etc. Make necessary changes in contract work, equipment locations, etc., as part of a contract to accommodate work to obstacles and interferences encountered. Before installing, verify exact location and elevations at work site. DO NOT SCALE plans. If field conditions, details, changes in equipment or shop drawing information require an important rearrangement, report same to Owner's Representative for review. Obtain written approval for all major changes before installing.

B. Install work so that items both existing and new are operable and serviceable. Eliminate interference with removal of coils, motors, filters, belt guards and/or operation of doors. Provide easy, safe, and code mandated clearances at controllers, motor starters, valve access, and other equipment requiring maintenance and operation. Where Contractor could not reasonably be expected to find such trade interferences due to concealment in walls, ceiling or floors, such relocations will be done by Change Order, if not, included in contract work. Contractor shall relocate existing work in way of new construction. VISIT SITE BEFORE BIDDING TO DETERMINE SCOPE OF WORK SINCE FEW OF SUCH ITEMS CAN BE SHOWN. Provide new materials, including new piping and insulation for relocated work.

C. Coordinate work with other trades and determine exact route or location of each duct, pipe, conduit, etc., before fabrication and installation. Coordinate with Architectural

Drawings. Obtain from Owner's Representative exact location of all equipment in finished areas, such as thermostat, fixture, and switch mounting heights, and equipment mounting heights. Coordinate all work with the architectural reflected ceiling plans and/or existing Architecture. Mechanical and plumbing drawings show design arrangement only for diffusers, grilles, registers, air terminals, lighting fixtures, speakers, and other items. Do not rough-in contract work without reflected ceiling location plans.

D. Before roughing for equipment furnished by Owner or in other contracts, obtain from Owner and other Contractors, approved roughing drawings giving exact location for each piece of equipment. Do not "rough in" services without final layout drawings approved for construction. Cooperate with other trades to insure proper location and size of connections to insure proper functioning of all systems and equipment. For equipment and connections provided in this contract, prepare roughing drawing as follows:

    1. New equipment: Obtain equipment roughing drawings and dimensions, then prepare roughing-in-drawings. If such information is not available in time, obtain an acknowledgement in writing, then make space arrangements as required with Owner's Representative.

1.12 EQUIPMENT AND MATERIAL INSTALLATION

A. Provide materials that meet the following minimum requirements:

    1. Materials shall have a flame spread rating of 25 or less and smoke developed rating of 50 or less, in accordance with NFPA 255.

    2. All equipment and material for which there is a listing service shall bear a UL label.

    3. Potable water systems and equipment shall be built according to AWWA Standards.

    4. Gas-fired equipment and system shall meet AGA Regulations and shall have AGA label.

    5. Electrical equipment and systems shall meet UL Standards and requirements of the NEC.

1.13 CUTTING AND PATCHING

A. Each trade shall include their required cutting and patching work unless shown as part of the General Construction work on the architectural drawings. Refer to "General Conditions of the Contract for Construction," for additional requirements. Cut and drill from both sides of walls and/or floors to eliminate splaying. Patch any cut or abandoned holes left by removals of equipment, fixtures, etc. Patch adjacent existing work disturbed by installation of new work including insulation, walls and wall covering, ceiling and floor covering, other finished surfaces. Patch openings and damaged areas equal to existing surface finish. Cut openings in prefabricated construction units in accordance with manufacturer's instructions.

1.14 PAINTING

A. Include painting for patchwork with color to match adjacent surfaces. Where color cannot be adequately matched, paint entire surface. Provide one (1) coat of primer and two (2) finish coats or as called for in the Specifications. Refer to Specifications for additional information.

1.15 CONCEALMENT

A. Conceal all contract work above ceilings and in walls, below slabs, and elsewhere throughout building. If concealment is impossible or impractical, notify Owner's Representative before starting that part of the work and install only after his review. In areas with no ceilings, install only after Owner's Representative reviews and comments on arrangement and appearance.

1.16 CHASES

A. New Construction:

1. Certain chases, recessed, openings, shafts, and wall pockets will be provided as part of "General Building Construction Plans and Specifications." Contractor shall provide all other openings required for their contract work.

2. Check Architectural and Structural Design and Shop Drawings to verify correct size and location for all openings, recesses and chases in general building construction work.

3. Assume responsibility for correct and final location and size of such openings.

4. Rectify improperly sized, improperly located or omitted chases or openings due to faulty or late information or failure to check final location.

5. Provide 18 gauge galvanized sleeves and inserts. Extend all sleeves 2" above finished floor. Set sleeves and inserts in place ahead of new construction, securely fastened during concrete pouring. Correct, by drilling, omitted or improperly located sleeves. Assume responsibility for all work and equipment damaged during course of drilling. Firestop all unused sleeves.

6. Provide angle iron frame where openings are required for contract work.

1.17 FLASHING, SEALING, FIRE-STOPPING

A. See Specification Section 22 0515 - Plumbing Firestopping.

1.18 SUPPORTS

A. Provide required supports, beams, angles, hangers, rods, bases, braces, and other items to properly support contract work. Supports shall meet the approval of the Owner's Representative. Modify studs, add studs, add framing, or otherwise reinforce studs in metal stud walls and partitions as required to suit contract work. If necessary, in stud walls, provide special supports from floor to structure above. For Precast Panels/Planks and Metal Decks, support mechanical/electrical work as determined by manufacturer and Owner's Representative. Provide heavy gauge steel mounting plates for mounting contract work. Mounting plates shall span two or more studs. Size, gauge, and strength of mounting plates shall be sufficient for equipment size, weight, and desired rigidity.

1.19 ACCESS PANELS

A. Access panels shall be furnished and installed by the Contractor. Location and size shall be the responsibility of the Contractor. Bear cost of construction changes necessary due to improper information or failure to provide proper information in ample time. Access panels over 324 square inches shall have two cam locks. Contractor shall provide proper frame and door type for various wall or ceiling finishes. Access panels shall be equal to "Milcor" as manufactured by Inland Steel Products Co., Milwaukee, Wisconsin.

1.20 CONCRETE BASES

A. Provide concrete bases for all floor-mounted equipment (unless otherwise noted). Provide 3,000 lb. concrete, chamfer edges, trowel finish, and securely bond to floor by roughening slab and coating with cement grout. Bases 4" high (unless otherwise indicated); shape and size to accommodate equipment. Set anchor bolts in sleeves before pouring and after anchoring and leveling, fill equipment bases with grout.

1.21 PLUMBING EQUIPMENT CONNECTIONS

A. Contractor is responsible for draining, filling, venting, chemically treating and restarting any systems which are affected by work shown on the Contract Documents unless specifically noted otherwise.

B. Provide roughing and final water, waste, vent, propane, etc. connections to all equipment. Provide loose key stops, sanitary "P" traps, tailpiece, adapters, gas cocks, and all necessary piping and fittings from roughing point to equipment. Provide installation of sinks, faucets, traps, tailpiece furnished by others. Provide continuation of piping and connection to equipment that is furnished by others. Provide relief valve discharge piping from equipment relief valves to point(s) of safe discharge.

C. Provide as part of plumbing work valved water outlet adjacent to equipment requiring same. Provide equipment type floor drains, or drain hubs, adjacent to equipment.

D. Install controls and devices furnished by others.

E. Refer to Contract Documents for roughing schedules, and equipment lists indicating scope of connections required.

F. Provide for Owner furnished and Contractor furnished equipment all valves, piping, piping accessories, traps, pressure reducing valves, gauges, relief valves, vents, drains, insulation, sheet metal work, controls, dampers, wiring as required.

G. Refer to Manufacturer drawings and specifications for requirements of kitchen equipment, laboratory equipment and special equipment. Verify connection requirements before bidding.

1.22 STORAGE AND PROTECTION OF MATERIALS

A. Store materials on dry base, at least 6" above-ground or floor. Store so as not to interfere with other work or obstruct access to buildings or facilities. Provide waterproof/windproof covering. Remove and provide special storage for items subject to moisture damage. Protect against theft or damage from any cause. Replace items stolen or damaged, at no cost to Owner.

B. Refer to "General Conditions of the Contract for Construction."

1.23 FREEZING AND WATER DAMAGE

A. Take all necessary precautions with equipment, systems and building to prevent damage due to freezing and/or water damage. Repair or replace, at no charge in contract, any such damage to equipment, systems, and building. Perform first seasons winterizing in presence of Owner's operating staff.

1.24 OWNER INSTRUCTIONS

A. Before final acceptance of the work, furnish necessary skilled labor to operate all systems by seasons. Instruct designated person on proper operation, and care of systems/equipment. Repeat instructions, if necessary. Obtain written acknowledgement from person instructed prior to final payment. Contractor is fully responsible for system until final acceptance, even though operated by Owner's personnel, unless otherwise agreed in writing. List under clear plastic, operating, maintenance, and starting precautions procedures to be followed by Owner for operating systems and equipment.

1.25 MAINTENANCE MANUALS

A. Prepare Instructions and Maintenance Portfolios. Include one copy of each of approved Shop Drawings, wiring diagrams, piping diagrams spare parts lists, as-built drawings and manufacturer's instructions. Include typewritten instructions, describing equipment, starting/operating procedures, emergency operating instructions, summer-winter changeover, freeze protection, precautions and recommended maintenance procedures. Include name, address, and telephone number of supplier manufacturer representative and

service agency for all major equipment items in a three ring binder with name of project on the cover. Deliver to Owner's Representative before request for final acceptance.

1.26 RECORD DRAWINGS

A. The Contractor shall obtain at his expense one (1) set of construction Contract Drawings including non-reproducible black and white prints and one set of reproducible for the purpose of recording record conditions.

B. The Contractor shall perform all survey work required for the location and construction of the work and to record information necessary for completion of the record drawings. Record drawings shall show the actual location of the constructed facilities in the same manner as was shown on the bid drawings. All elevations and dimensions shown on the drawings shall be verified or corrected so as to provide a complete and accurate record of the facilities as constructed.

C. It shall be the responsibility of the Contractor to mark each sheet of the non-reproducible drawings in pencil and to record thereon in a legible manner, any and all approved field changes and conditions as they occur. A complete file of approved field sketches, diagrams, and other changes shall also be maintained. At completion of the work, each sheet of record prints, plus all approved field sketches and diagrams shall be used in preparation of the reproducible record drawings.

D. Completed reproducible drawings shall be certified as reflecting record conditions and submitted to the engineer for approval.

1.27 ADDITIONAL ENGINEERING SERVICES

A. In the event that the Consultant is required to provide additional engineering services as a result of substitution of equivalent materials or equipment by the Contractor, or changes by the Contractor in dimension, weight, power requirements, etc., of the equipment and accessories furnished, or if the Consultant is required to examine and evaluate any changes proposed by the Contractor for the convenience of the Contractor, then the Consultant's expenses in connection with such additional services shall be paid by the Contractor and may be deducted from any monies owed to the Contractor.

1.28 FINAL INSPECTION

A. Upon completion of all punch list items, the Contractor shall provide a copy of the punch list back to the Engineer with each items noted as completed or the current status of the item. Upon receipt, the Engineer will schedule a final inspection.

1.29 ALL TRADES TEMPORARY HEAT

A. Refer to the Standard General Conditions of the contract for Construction and Supplemental General Conditions.

1.30 PLUMBING TEMPORARY FACILITIES

A. Refer to the Standard General Conditions of the Contract for Construction and Supplemental General Conditions.

1.31 CLEANING

A. It is the Contractor's responsibility to keep clean all equipment and fixtures provided under this contract for the duration of the project. Contractor shall keep the premises free from an accumulation of waste material or rubbish caused by his operations. The facilities require an environment of extreme cleanliness, and it is the Contractor's responsibility to adhere to the strict regulations regarding procedures on the existing premises. After all tests are made and installations completed satisfactorily:

B. Thoroughly clean entire installation, both exposed surfaces and interiors.

C. Remove all debris caused by work.

D. Remove tools, surplus, materials, when work is finally accepted.

END OF SECTION

SECTION 22 0515 - PLUMBING FIRESTOPPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Firestopping materials.

B. Firestopping of all penetrations, openings, and interruptions to fire rated assemblies, whether indicated on drawings or not, including but not limited to piping, tubing and similar utilities passing through or penetrating fire rated walls and floor assemblies.

1.2 RELATED SECTIONS

A. Refer to "Code Compliance Drawings" for location of fire rated assemblies. At a minimum all corridor walls and all floors between stories have a 1hour rating.

1.3 REFERENCES

A. ASTM International:

1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

3. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

B. National Fire Protection Association:

1. NFPA 70 - National Electrical Code.

C. Underwriters Laboratories Inc.:

1. UL 263 - Fire Tests of Building Construction and Materials.

2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

3. UL 1479 - Fire Tests of Through-Penetration Firestops.

4. UL - Fire Resistance Directory.

D. Plumbing and Fuel Gas Codes of New York State.

1.4 FIRE-STOP SYSTEM PERFORMANCE REQUIREMENTS

A. General: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration fire-stop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.

1. Fire-resistance-rated walls including fire walls, fire partitions, fire barriers and smoke barriers.

2. Fire-resistance-rated horizontal assemblies including floors and ceiling membranes of roof/ceiling assemblies.

1.5 SUBMITTALS

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

1.6 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs which provide the specified fire ratings when tested in accordance with methods indicated.

1. Listing in the current-year classification or certification books of UL will be considered as constituting an acceptable test report.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation. Maintain minimum temperature before, during, and for 3 days after installation of materials.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Hilti.

B. Nelson Fire Stop Products.

C. Specified Technology.

D. 3M Fire Protection Products.

E. Approved equals meeting UL requirements.

2.2 MATERIALS

A. Sealant Firestopping:

1. Intumescent firestop sealant designed to expand when exposed to fire.
2. Paintable
3. Fire Resistance: Up to 4 hours
4. Curing Time: 14-21 days
5. Elongation: 5%
6. Density: 1.5 g/cm3
7. Product: FS-ONE Intumescent Firestop Sealant manufactured by Hilti USA.
8. Uses: Insulated and uninsulated metal pipes, with or without sleeve and plastic pipes.

B. Silicone Sealant Firestopping:

1. Silicone based firestop sealant that provides maximum movement in fire-rated joint applications and pipe penetrations.
2. Not paintable
3. Fire Resistance: Up to 4 hours
4. Elongation: 25%
5. Product: CP 601S Elastomeric Firestop Sealant manufactured by Hilti USA.
6. Uses: Joints in walls, floor to floor or fire compartments.

C. Safing Insulation:

1. Mineral-wool type insulation.
2. Thickness: 1" to 1-1/2"
3. Density: 4 to 8 pcf
4. Product: THERMAFIBER Safing Insulation

D. Sleeves:

1. Provide sleeves as required by section 1206.4 of the Mechanical Code.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing through-penetration fire-stop systems to comply with fire-stop system manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration fire-stop systems.

2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration fire-stop systems. Remove loose particles remaining from cleaning operation.

3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by through-penetration fire-stop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

A. General

1. Install materials in manner described in UL Detail and in accordance with manufacturer's instructions, completely closing openings.

B. Installation

1. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping and other items, requiring firestopping.

2. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

3. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating, to uniform density and texture.

4. Fire Rated Surface:

a. Seal opening at floor, wall, partition, and roof as follows:

1) Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.

2) Size sleeve allowing minimum of 1 inch void between sleeve and building element.

3) Pack void with backing material.

4) Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.

b. Where plumbing piping penetrates a fire rated surface, install firestopping product in accordance with manufacturer's instructions.

5. Non-Rated Surfaces:

a. Seal opening through non-fire rated wall, floor, ceiling, and roof opening as follows:

1) Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.

2) Size sleeve allowing minimum of 1 inch void between sleeve and building element.

3) Install type of firestopping material recommended by manufacturer.

b. Install floor plates or ceiling plate where piping penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.

c. Exterior wall openings below grade: Assemble rubber links of mechanical seal to size of piping and tighten in place, in accordance with manufacturer's instructions.

C. Identification:

1. Identify through-penetration fire-stop systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of edge of the fire-stop systems so that labels will be visible to anyone seeking to remove penetrating items or fire-stop systems. Use mechanical fasteners for metal labels. For plastic labels, use self-adhering type with adhesives capable of permanently bonding labels to surfaces on which labels are placed and, in combination with label material, will result in partial destruction of label if removal is attempted. Include the following information on labels:

a. The words "Warning - Through-Penetration Fire-Stop System - Do Not Disturb. Notify Building Management of Any Damage."

b. Date of installation.

c. Through-penetration fire-stop system manufacturer's name.

3.4 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration fire-stop system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration fire-stop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration fire-stop systems immediately and install new materials to produce systems complying with specified requirements.

END OF SECTION

SECTION 22 0516 - EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Flexible pipe connectors.

1.2 RELATED REQUIREMENTS

A. Section 22 1005 - Plumbing Piping.

1.3 REFERENCE STANDARDS

A. ASTM A 269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2008.

B. EJMA (STDS) - EJMA Standards; Expansion Joint Manufacturers Association; 2003.

1.4 REGULATORY REQUIREMENTS

A. Conform to UL requirements.

PART 2 PRODUCTS

2.1 FLEXIBLE PIPE CONNECTORS - STEEL PIPING

A. Manufacturers:

1. Mercer Rubber Company: www.mercer-rubber.com.
2. Metraflex Company: www.metraflex.com.
3. Approved Equal.

B. Inner Hose: Carbon Steel.

C. Exterior Sleeve: Single braided, stainless steel.

D. Pressure Rating: 125 psi and 450 degrees F.

E. Joint: Flanged.

F. Size: Use pipe sized units.

G. Maximum offset: 3/4 inch on each side of installed center line.

2.2 FLEXIBLE PIPE CONNECTORS - COPPER PIPING

A. Manufacturer:

1. Mercer Rubber Company: www.mercer-rubber.com.

2. Metraflex Company: www.metraflex.com.

3. Approved Equal.

B. Inner Hose: Bronze.

C. Exterior Sleeve: Braided bronze.

D. Pressure Rating: 125 psi and 450 degrees F.

E. Joint: Flanged.

F. Size: Use pipe sized units.

G. Maximum offset: 3/4 inch on each side of installed center line.

H. Application: Copper piping.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install flexible pipe connectors on pipes connected to vibration isolated equipment. Provide line size flexible connectors.

C. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.

END OF SECTION

SECTION 22 0553 - PLUMBING IDENTIFICATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

B. Pipe Markers.

1.2 RELATED REQUIREMENTS

A. Section 22 1005 - Plumbing Piping.

1.3 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers; 2007.

1.4 SUBMITTALS

A. Product Data: Provide manufacturers catalog literature for each product required.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Seton Identification Products.

B. Brady Corporation

C. Emed Company.

D. Approved Equal.

2.2 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.

1. Letter Color: White.

2. Letter Height: 3/8 inch.

3. Nameplate Height: 3/4 inch.

4. Background Color: Black.

2.3 PIPE MARKERS AND ACCESSORIES

A. Snap-on Marker: One piece wrap around type constructed of precoiled acrylic plastic with clear polyester coating, integral flow arrows, legend printed in alternating directions, 3/4 inch adhesive strip on inside edge, and 360 degree visibility.

B. Strap-on Marker: Strip type constructed of precoiled acrylic plastic polyester coating, integral flow arrows, legend printed in alternating directions, factory applied grommets, and pair of stainless steel spring fasteners.

C. Stick-on Marker: Pressure sensitive adhesive backed type constructed of vinyl with clear polyester coating, and integral flow arrows for applications where flow arrow banding tape is not being used.

D. Pipe Marker Legend:

1. Outside Diameter of Pipe or Insulation 3/4 to 1-1/4 inch:

    a. Letter size: 1/2 inch.

    b. Length of color field: 8 inches.

2. Outside Diameter of Pipe or Insulation 1-1/2 to 2 inches:

    a. Letter size: 3/4 inch.

    b. Length of color field: 8 inches.

3. Outside Diameter of Pipe or Insulation 2-1/2 to 6 inches:

    a. Letter size: 1-1/4 inch.

    b. Length of color field: 12 inches.

E. Color: Conform to ANSI A13.1.

F. Banding Tapes: Pressure sensitive adhesive backed type constructed of vinyl with clear polyester coating.

1. Plain Tape: Unprinted type; color to match pipe marker background.

2. Flow Arrow Tape: Printed type with integral flow arrows; color to match pipe marker background.

2.4 UNDERGROUND PLASTIC PIPE MARKERS

A. Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

PART 3 EXECUTION

3.1 PREPARATION

A. Complete testing, insulation, and finish painting work prior to completing the Work of this Section.

B. Clean pipe and equipment surfaces with cleaning solvents prior to installing piping identification or equipment tags.

C. Remove dust from insulation surfaces with clean clothes prior to installing piping or equipment identification.

3.2 INSTALLATION

A. Install the Work of this Section in accordance with the manufacturer's printed installation instructions, unless otherwise specified.

B. Name Plates:

1. Install plastic nameplates on properly prepared and dry surface with adhesive and ensure permanent adhesion.

C. Stick-On Pipe Markers:

1. Install minimum of 2 markers at each specified location, 90 degrees apart on visible side of pipe.

2. Encircle ends of pipe markers around pipe or insulation with banding tape with one inch lap. Use plain banding tape on markers with integral flow arrows, and flow arrow banding tape on markers without integral flow arrows.

D. Underground Plastic Pipe Markers:

1. Install 6 to 8 inches below finished grade, directly above buried pipe.

3.3 PIPING IDENTIFICATION

A. Piping Identification Types:

1. Piping or Insulation 3/4 inch and larger: Snap-on pipe markers or stick-on pipe markers.

B. Identify exposed piping, bare or insulated, as to content and direction of flow, with the following exceptions:

1. Piping in non-walk-in tunnels or underground conduits between manholes.

2. Piping in furred spaces or suspended ceilings, except at valve access panels where valves and piping shall be identified as specified for exposed piping systems.

3. Piping exposed in finished spaces such as offices, classrooms, wards, toilet rooms, shower rooms, and corridors.

C. Locate piping identification to be visible from exposed points of observation.

1. Locate piping identification at valve locations; at points where piping enters and leaves a partition, wall, floor or ceiling, and at intervals of 20 feet on straight runs.

2. Where 2 or more pipes run in parallel, place printed legend and other markers in same relative location.

3.4 EQUIPMENT IDENTIFICATION

A. Identify uninsulated plumbing equipment by means of plastic nameplates:

1. Letter Size: 3/8 inches height.

B. Small inline pumps may be identified with tags equivalent as specified for pipe service.

C. Locations: Co-locate nameplates with manufacturer's equipment nameplates where readily visible. Where view of manufacturers nameplate is obstructed locate nameplate to be readily visible.

D. Equipment Identification Legend:

1. Equipment identification shall match tags as scheduled on drawings.

END OF SECTION

SECTION 22 0719 - PLUMBING PIPING INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.2 RELATED REQUIREMENTS

A. Section 22 0515 - Plumbing Firestopping.

B. Section 22 1005 - Plumbing Piping.

1.3 REFERENCE STANDARDS

A. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2007.

B. ASTM C 177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus; 2004.

C. ASTM C 195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007.

D. ASTM C 449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement; 2007.

E. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2004.

F. ASTM C 533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation; 2009.

G. ASTM C 534/C 534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2008.

H. ASTM C 547 - Standard Specification for Mineral Fiber Pipe Insulation; 2007.

I. ASTM C 610 - Standard Specification for Molded Expanded Perlite Block and Pipe Thermal Insulation; 2009.

J. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2010.

K. ASTM E 96/E 96M - Standard Test Methods for Water Vapor Transmission of Materials; 2005.

L. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.

M. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than five years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum five years of documented experience.

C. Regulatory Requirements:

1. Insulation installed inside buildings, including laminated jackets, mastics, sealants and adhesives shall have a Fire Spread/Smoke Developed Rating of 25/50 or less based on ASTM E 84, NFPA 255, and UL 723.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.7 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.1 PIPING INSULATION

A. Fibrous Glass (Mineral Fiber) Insulation: Composed principally of fibers manufactured from rock, slag, or glass, with or without binders, and asbestos free.

1. Manufacturers:

a. Johns Manville Corporation.

b. Knauf Fiber Glass.

c. Owens Corning Corporation.

2. Preformed Pipe Insulation: Minimum density 3 pcf; ASTM C 547.

a. Class 1 (Suitable for Temperatures Up to 450 degrees F): 'K' value of 0.26 at 75 degrees F.

3. Premolded Fitting Insulation: Minimum density 4.0 pcf, K of 0.26 at 75 degrees F; ASTM C 547, Class 1.

4. Insulation Inserts for PVC Fitting Jackets: Minimum density 1.5 pcf, K of 0.28 at 75 degrees F; ASTM C 553, Type III.

a. Suitable for temperatures up to 450 degrees F.

B. Flexible Elastomeric Foam Insulation:

1. Manufacturers:

a. Armacell Engineered Foams.

b. Rubatex Corporation.

c. Enviro-tec Corporation.

2. Preformed Pipe and Fitting Insulation: ASTM C 534, Type I.

3. FM tested and approved, meeting the following:

a. Maximum Water Vapor Transmission: 0.10 perm-inch based on ASTM E 96, Procedure A.

b. K of 0.27 at 75 degrees F based on ASTM C 518 or C 177.

c. Fire Spread/Smoke Developed Rating: 25/50 or less based on ASTM E 84.

4. Polyethylene and polyolefin insulation is not acceptable.

C. High Density Jacketed Insulation Inserts for Hangers and Supports:

1. Manufacturers:

a. Johns Manville Corporation.

b. Knauf Fiber Glass.

c. Owens Corning Corp.

2. For Use with Fibrous Insulation:

a. Cold Service Piping:

1) Polyurethane Foam: Minimum density 4 pcf, K of 0.13 at 75 degrees F, minimum compressive strength of 125 psi.

b. Hot Service Piping:

1) Calcium Silicate: Minimum density of 15 pcf, K of 0.50 at 300 degrees F; ASTM C 610.

2) Perlite: Minimum density 12 pcf, K of 0.60 at 300 degrees F; ASTM C 610.

3. For Use with Flexible Elastomeric Foam Insulation: Hardwood dowels and blocks, length or thickness equal to insulation thickness, other dimensions as required.

D. Cements:

1. Fibrous Glass Thermal Insulating Cement: Asbestos free; ASTM C 195.

2. Fibrous Glass Hydraulic Setting Thermal Insulating and Finishing Cement: ASTM C 449/C 449M.

2.2 INSULATION JACKETS AND FITTING COVERS

A. Laminated Vapor Barrier Jackets for Piping Insulation: Factory applied by insulation manufacturer, conforming to ASTM C 1136, Type I.

1. Type I: Reinforced white kraft and aluminum foil laminate with kraft facing out.

a. Pipe Jackets: Furnished with integral 1-1/2 inch self sealing longitudinal lap, and separate 3 inch wide adhesive backed butt strips.

2. Type II: Reinforced aluminum foil and kraft laminate with foil facing out.

3. Laminated vapor barrier jackets are not required for flexible elastomeric foam insulation.

B. Canvas Jacket: Cotton duck, fire retardant, complying with NFPA 701, 4 oz/sq yd. or 6 oz/sq yd as specified.

C. Premolded PVC Fitting Jackets:

1. Constructed of high impact, UV resistant PVC.

a. ASTM D 1784, Class 14253-C.

b. Working Temperature: 0-150 degrees F.

D. Metal Jacketing:

1. Aluminum Jacket: ASTM B 209 (ASTM B 209M) formed aluminum sheet, Type 1100, 3003, 3105, or 5005, Temper H14.

    a. Factory Pre-formed Sectional Pipe Jacketing:

        1) Thickness: 0.016 inch.

        2) Finish: Smooth outer finish with integral bonded laminated polyethylene film - kraft paper moisture barrier underside.

        3) Joining: Pittsburgh or modified Pittsburg longitudinal lock seams. 2 inch overlapping circumferential joints with integral locking clips, or butt joints sealed with 2 inch wide mastic backed aluminum snap bands.

        4) Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.

    b. Roll Jacketing: Smooth outer finish with integral bonded laminated polyethylene film - kraft paper moisture barrier underside.

    c. Sheet Jacketing: Corrugated 1-1/4 inch x 1/4 inch deep with integral bonded laminated polyethylene film - kraft paper moisture barrier underside.

    d. Fastening Devices:

        1) Metal Jacket Bands: 1/2 inch wide; 0.020 inch thick Type 18-8 stainless steel.

        2) Wing Seals: Type 18-8 stainless steel, 0.032 inch thick.

        3) Sheet Metal Screws: Pan-head Type A hardened aluminum, or stainless steel.

2. Circumferentially Corrugated Aluminum Jacketing: Childer's Corrolon.

    a. Construction: 3/16 inch circumferentially corrugated embossed aluminum, ASTM B 209, Type 1100, 3003, 3105, or 5005, Temper H14.

    b. Thickness: 0.016 inch.

    c. Moisture Barrier: Integrally bonded to jacket over entire surface in contact with insulation.

    d. Fastening Devices:

        1) Strapping: 0.020 inch thick by 1/2 inch wide, Type 3003, 3105, or 5005 aluminum. Temper H14.

        2) Wing Seals: 0.032 inch thick Type 5005 aluminum. Temper H14.

2.3 ADHESIVES, MASTICS, AND SEALERS

A. Lagging Adhesive (Canvas Jackets): Childer's CP-50A, Epolux's Cadalag 336, Foster's 30-36.

B. Vapor Seal Adhesive (Fibrous Glass Insulation): Childers' CP-82, Epolux's Cadoprene 400, Foster's 85-75 or 85-20.

C. Vapor Barrier Mastic/Joint Sealer (Fibrous Glass Insulation): Childers' CP-30, Epolux's Cadalar 670, Foster's 95-44 or 30-35.

D. Adhesive (Flexible Elastomeric Foam): Armstrong's 520, Childers' CP-80, Epolux's Cadoprene 488, Foster's 82-40.

E. Adhesive (Reinforcing Membrane): Childers' Chil-Spray WB CP-56.

F. Mastic (Reinforcing Membrane): Childers' AK-CRYL CP-9.

G. Sealant (Metal Pipe Jacket): One-part silicone sealant for high temperatures; Dow Corning's Silastic 736 RTV or General Electric's RTV 106.

2.4 MISCELLANEOUS MATERIALS

A. Insulation Fasteners:

1. Acceptable Manufacturers: Duro-Dyne Corp.; Erico Fastening Systems, Inc.

2. Type: Weld pins, complete with self-locking insulation retaining washers.

B. Pressure Sensitive Tape for Sealing Laminated Jackets:

1. Acceptable Manufacturers: Alpha Associates, Childers, Ideal Tape, Morgan Adhesive.

2. Type: Same construction as jacket.

C. Wire, Bands, and Wire Mesh:

1. Binding and Lacing Wire: Nickel copper alloy or copper clad steel.

2. Bands: Galvanized steel, 1/2" wide x 0.015 inch thick, with 0.032 inch thick galvanized wing seals.

3. Wire Mesh: Woven 20 gage steel wire with 1 inch hexagonal openings, galvanized after weaving.

D. Reinforcing Membrane: Glass or Polyester, 10 x 10 mesh. Alpha Associates Style 59, Childers Chil-Glas, Foster's MAST-A-FAB.

PART 3 EXECUTION

3.1 PREPARATION

A. Perform the following prior to starting insulation Work:

1. Install all hangers, supports, and appurtenances in their permanent locations.

2. Complete testing of piping.

3. Clean and dry all surfaces to be insulated.

3.2 INSTALLATION, GENERAL

A. Install the Work of this Section in accordance with manufacturer's printed installation instructions unless otherwise specified.

B. Provide continuous piping insulation and jacketing when passing thru interior wall, floor, and ceiling construction.

1. At Through Penetration Firestops: Coordinate insulation densities with the requirements of approved firestop system being installed. See Section 22 0515.

a. Insulation densities required by approved firestop system may vary with the densities specified in this Section. When this occurs use the higher density insulation.

C. Individual piping runs shall have consistent insulation type.

D. Apply Insulation to completely cover entire surface of piping. Do not insulate over weld certification stamps.

3.3 INSTALLATION AT HANGERS AND SUPPORTS

A. Reset and realign hangers and supports if they are displaced during insulation installation.

B. Install high density jacketed insulation inserts at hangers and supports for insulated piping as specified.

1. Insulation Inserts For Use with Fibrous Glass Insulation:

a. Where clevis hangers are used, install insulation shields and high density jacketed insulation inserts between shield and pipe.

b. Where insulation is subject to compression at points over 180 degrees apart, e.g. riser clamps, U-bolts, or trapezes, fully encircle pipe with 2 protection shields and 2 high density jacketed fibrous glass insulation inserts within supporting members.

1) Exception: Locations where pipe covering protection saddles are specified for hot service piping, 6 inch and larger.

2. Insulation Inserts For Use with Flexible Elastomeric Foam Insulation:

a. Where clevis hangers are used, install insulation shields with hardwood filler pieces, same thickness as adjoining insulation, inserted in undersized die cut or slotted holes in insulation at support points.

b. Where hardwood blocks are used, contour to match the curvature of pipe, and shield.

c. Coat dowels and blocks with insulation adhesive, and insert while sill wet.

d. Vapor seal outer surfaces of dowels and blocks with adhesive after insertion.

e. Provide minimum 2 dowels plugs or one filler block per hanger.

3.4 INSTALLATION OF FIBROUS GLASS COLD SERVICE INSULATION

A. Install insulation materials with a field or factory applied ASTM C 1136 Type I laminated vapor barrier jacket, unless otherwise specified.

B. Piping:

1. Butt insulation joints together.

2. Continuously seal joints with minimum 1-1/2 inch wide self-sealing longitudinal jacket laps and 3-inch wide butt adhesive backed strips, or 3 inch wide pressure sensitive sealing tape of same material as jacket.

3. Bed insulation in a 2-inch wide band of vapor barrier mastic,and vapor seal exposed ends of insulation with vapor barrier mastic at each butt joint between pipe insulation and equipment, fittings or flanges at the following intervals:

a. Horizontal Pipe Runs: 21 ft.

b. Vertical Pipe Runs: 9 ft.

C. Fittings, Valves, Flanges and Irregular Surfaces:

1. Insulate with mitre cut or pre-molded fitting insulation of same material and thickness as adjoining pipe insulation.

2. Secure insulation in place with 16 gage wire, with ends twisted and turned down into insulation.

3. Butt fitting, valve, and flange insulation against pipe insulation and bond with insulating cement.

4. Insulate valves up to and including bonnets, without interfering with packing nuts.

5. Apply leveling coat of insulating cement to smooth out insulation and cover wiring.

6. When insulating cement has dried, seal fitting, valve and flange insulation by embedding a layer of reinforcing membrane of 4 oz. canvas jacket between 2 flood coats of vapor barrier mastic, each 1/8 inch thick wet.

7. Lap reinforcing membrane or canvas on itself and adjoining pipe insulation at least 2 inches.

8. Trowel, brush, or rubber glove outside coat over entire insulated surface.

D. Fittings, Valves, Flanges and Irregular Surfaces - Alternate:

1. Apply one piece pre-molded PVC fitting covers with fibrous glass insulation inserts with galvanized coated tack fasteners. Tape circumferential joint between insulation and premolded fitting cover with 2 inch wide pressure sensitive polyvinyl tape.

a. Exception: Provide additional insulation inserts on service operating at under 45 degrees F or where insulation thickness exceeds 1-1/2 inches. Ensure that insulation is adequate to prevent PVC fitting jacket temperature from falling below 45 degrees F.

3.5 INSTALLATION OF FIBROUS GLASS HOT SERVICE INSULATION

A. Install insulation materials with field or factory applied ASTM C 1136 Type I laminated vapor barrier jacket unless otherwise specified.

B. Canvas Jackets on Piping, Fittings, Valves, Flanges, Unions, and Irregular Surfaces:

1. For piping 2 inch size and smaller: 4 oz per sq yd unless otherwise specified.

2. For piping over 2 inch size: 6 oz per sq yd unless otherwise specified.

C. Piping:

1. Butt insulation joints together.

2. Continuously seal joints with minimum 1-1/2 inch wide self-sealing longitudinal jacket laps and 3-inch wide butt adhesive backed strips, or 3 inch wide pressure sensitive sealing tape of same material as jacket.

3. Fill voids in insulation at hanger with insulating cement.

4. Exceptions:

a. Piping in Accessible Shafts, Attic Spaces, Crawl Spaces, Unfinished Spaces, and Concealed Piping: Butt insulation joints together and secure with minimum 1-1/2" wide longitudinal jacket laps and 3 inch wide butt strips of same material as jacket, with outward clinching staples on maximum 4 inch centers. Fill voids in insulation at hangers with insulating cement.

b. Piping in Tunnels: Butt insulation joints together and secure with minimum 1-1/2" wide longitudinal jacket laps and 3 inch wide butt strips, of same material as jacket, with outward clinching staples on maximum 4 inch centers and 16 gage wires a minimum of 4 loops per section. Fill voids in insulation with insulating cement.

5. Fittings, Valves, Flanges and Irregular Surfaces:

a. Insulate with mitre cut or pre-molded fitting insulation of same material and thickness as adjoining pipe insulation.

b. Secure insulation in place with 16 gage wire, with ends twisted and turned down into insulation.

c. Butt fitting, valve, and flange insulation against pipe insulation and bond with insulating cement.

d. Insulate valves up to and including bonnets, without interfering with packing nuts.

e. Apply leveling coat of insulating cement to smooth out insulation and cover wiring.

f. When insulating cement has dried, coat insulated surface with lagging adhesive, and apply 4 oz. or 6 oz. canvas jacket as required by pipe size.

1) Lap canvas jacket on itself and adjoining pipe insulation at least 2 inches.

2) Size entire canvas jacket with lagging adhesive.

g. Exceptions:

1) Insulate fittings, valves, and irregular surfaces 3 inch size and smaller with insulating cement covered with 4 oz or 6 oz canvas jacket as required by pipe size. Terminate pipe insulation adjacent to flanges and unions with insulating cement, troweled down to pipe on a bevel.

2) Sizing of canvas surface is not required on fittings, valves, flanges, and irregular surfaces in concealed piping, piping in accessible shafts, attic spaces, crawl spaces, unfinished spaces, and tunnels.

6. Fittings, Valves, Flanges and Irregular Surfaces - Alternate:

a. Apply one piece pre-molded PVC fitting covers with fibrous glass insulation inserts with galvanized coated tack fasteners. Tape circumferential joint between insulation and premolded fitting cover with 2 inch wide pressure sensitive polyvinyl tape.

1) Exception: Provide additional insulation inserts on service operating at over 250 degrees F or where insulation thickness exceeds 1-1/2 inches. Ensure that insulation is adequate to prevent PVC fitting jacket temperature from exceeding 150 degrees F.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC FOAM INSULATION

A. Slit insulation and install over pipe. Seal longitudinal and butt joints with adhesive.

B. Insulate fittings and valves with miter cut sections. Use templates provided by the manufacturer and assemble the cut sections in accordance with the manufacturer's printed instructions.

1. Insulate threaded fittings and valves with sleeved fitting covers. Over lap and seal the covers to the adjoining pipe insulation with adhesive.

C. Carefully mate and seal with adhesive all contact surfaces to maintain the integrity of the vapor barrier system.

D. Insulated Covers for Pumps:

1. Do not extend pump insulation beyond or interfere with stuffing boxes, or interfere with adjustment and servicing of parts requiring regular maintenance or operating attention.

E. Piping Exposed to the Elements:

1. Apply flexible elastomeric foam insulation to piping with adhesive.

2. Apply reinforcing membrane around piping insulation with adhesive or mastic.

3. Adhesive Applied System: Apply another coat of mastic over reinforcing membrane.

4. Mastic Applied System: Apply another coat of mastic over reinforcing membrane.

3.7 INSTALLATION OF METAL JACKETING ON PIPING

A. Secure jacketing to insulated piping with preformed aluminum snap straps and stainless steel strapping installed with special banding wrench.

B. Jacket exposed insulated fittings, valves and flanges with mitered sections of aluminum jacketing.

1. Seal joints with sealant and secure with preformed aluminum bands.

2. Alternate:

    a. Factory fabricated, preformed, sectional aluminum fitting covers may be used in lieu of mitered sections of aluminum jacketing for covering fittings, valves and flanges.

3.8 SCHEDULE OF PIPING INSULATION

A. Insulate all cold service and hot service piping, and appurtenances except where otherwise specified.

B. Plumbing Piping Systems:

1. Domestic Hot Water Supply (105 to 140 degrees F):

    a. Glass Fiber Insulation:

        1) Pipe Size Range: Up to 1-1/2 inch.

            (a) Thickness: 1 inch.

        2) Pipe Size Range: Over 1-1/2 inch.

            (a) Thickness: 2 inch.

2. Domestic Hot Water Recirculation:

    a. Glass Fiber Insulation:

        1) Pipe Size Range: All sizes.

            (a) Thickness: 1 inch.

3. Tempered Domestic Water Supply:

    a. Glass Fiber Insulation:

        1) Pipe Size Range: Up to 1-1/2 inch.

            (a) Thickness: 1 inch.

        2) Pipe Size Range: Over 1-1/2 inch.

            (a) Thickness: 2 inch.

4. Tempered Domestic Water Recirculation:

    a. Glass Fiber Insulation:

        1) Pipe Size Range: All sizes.

(a) Thickness: 1 inch.

5. Domestic and non-potable Cold Water:

a. Glass Fiber Insulation:

1) Pipe Size Range: All sizes.

(a) Thickness: 1/2 inch.

6. Plumbing Vents Within 10 Feet of the Exterior:

a. Glass Fiber Insulation:

1) Pipe Size Range: All sizes.

(a) Thickness: 1 inch.

7. Cold Condensate Piping:

a. Flexible Elastomeric Cellular Rubber Insulation:

1) Pipe Size Range: All sizes.

(a) Thickness: 1/2 inch.

C. Schedule of Items Not to be Insulated:

1. Chrome plated piping, unless otherwise specified.
2. Water heater blow-off piping.
3. Air vents, pressure reducing valves, pilot lines, safety valves, relief valves.
4. Water meters.
5. Sprinkler and standpipe piping, unless otherwise specified.

END OF SECTION

SECTION 22 1005 - PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe, pipe fittings, valves, and connections for piping systems.

1. Sanitary sewer.

2. Domestic water

3. Gas.

1.2 RELATED REQUIREMENTS

A. Section 09 9000 - Painting and Coating.

B. Section 22 0515 - Plumbing Firestopping.

C. Section 22 0553 - Plumbing Identification.

D. Section 22 0719 - Plumbing Piping Insulation.

1.3 SUBMITTALS

A. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with State of New York, standards.

1. Maintain one copy on project site.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. Welding Materials and Procedures: Conform to ASME (BPV IX) and applicable state labor regulations.

D. Welder Qualifications: Certified in accordance with ASME (BPV IX).

E. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.5 REGULATORY REQUIREMENTS

A. Perform Work in accordance with State of New York plumbing code.

B. Conform to applicable code for installation of backflow prevention devices.

C. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.7 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.1 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. PVC Pipe: ASTM D 2665 or ASTM D 3034.

1. Fittings: PVC.

2. Joints: Solvent welded, with ASTM D 2564 solvent cement.

2.2 SANITARY SEWER PIPING, ABOVE GRADE

A. PVC Pipe: ASTM D 2665.

1. Fittings: PVC.

2. Joints: Solvent welded, with ASTM D 2564 solvent cement.

2.3 WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Copper Pipe: ASTM B 42, hard drawn.

1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.

2. Joints: ASTM B 32, alloy Sn95 solder.

2.4 POTABLE WATER PIPING, ABOVE GRADE

A. Copper Tube: ASTM B 88 (ASTM B 88M), Type L (B), Drawn (H).

1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.

2. Joints: ASTM B 32, alloy Sn95 solder.

2.5 PROPANE GAS PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Steel Pipe: ASTM A 53/A 53M Schedule 40 black.

1. Fittings: ASTM A 234/A 234M, wrought steel welding type, with AWWA C105/A21.5 polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape.

2. Joints: ASME B31.1, welded.

2.6 PROPANE GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A 53/A 53M Schedule 40 black.

1. Fittings: ASME B16.3, malleable iron, or ASTM A 234/A 234M, wrought steel welding type.

2. Joints: NFPA 58, threaded or welded to ASME B31.1.

2.7 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Ferrous Pipe Sizes 3 Inches and Under:

1. Class 150 malleable iron threaded unions.

B. Unions for Copper Tube and Pipe 2 Inches and Under:

1. Class 150 bronze unions with soldered joints.

C. Flanges for Pipe Size Over 1 Inch:

1. Ferrous pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.

2. Copper tube and pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

D. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.8 PIPE HANGERS AND SUPPORTS

A. All plumbing piping shall be supported in accordance with the Plumbing Code of New York State. Hangers, anchors and supports shall support the piping and the contents of the piping. Hangers and strapping shall be of approved material that will not promote galvanic action.

B. Plumbing Piping - Drain, Waste, and Vent:

1. Conform to ASME B31.9.

2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.

3. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.

4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

5. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.

6. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.

7. Vertical Support: Steel riser clamp.

8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

9. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

C. Plumbing Piping - Water:

1. Conform to ASME B31.9.

2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.

3. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.

4. Hangers for Hot Pipe Sizes 2 Inches to 4 Inches: Carbon steel, adjustable, clevis.

5. Multiple or Trapeze Hangers: Steel channels with welded supports or spacers and hanger rods.

6. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.

7. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.

8. Vertical Support: Steel riser clamp.

9. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

10. Floor Support for Hot Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, locknut, nipple, floor flange, and concrete pier or steel support.

11. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.9 GATE VALVES

A. Manufacturers:

1. Conbraco Industries: www.conbraco.com.

2. Nibco, Inc: www.nibco.com.

3. Milwaukee Valve Company: www.milwaukeevalve.com.

4. Approved Equal.

B. Up To and Including 3 Inches:

1. MSS SP-80, Class 125, bronze body, bronze trim, rising stem, handwheel, inside screw, solid wedge disc, solder ends.

C. 2 Inches and Larger:

1. MSS SP-70, Class 125, iron body, bronze trim, outside screw and yoke, handwheel, solid wedge disc, flanged ends. Provide chain-wheel operators for valves 6 inches and larger mounted over 8 feet above floor.

2.10 GLOBE VALVES

A. Manufacturers:

1. Conbraco Industries: www.conbraco.com.

2. Nibco, Inc: www.nibco.com.

3. Milwaukee Valve Company: www.milwaukeevalve.com.

4. Substitutions: See Section 01 6000 - Product Requirements.

B. Up To and Including 3 Inches:

1. MSS SP-80, Class 125, bronze body, bronze trim, handwheel, bronze disc, solder ends.

C. 2 Inches and Larger:

1. MSS SP-85, Class 125, iron body, bronze trim, handwheel, outside screw and yoke, renewable bronze plug-type disc, renewable seat, flanged ends. Provide chain-wheel operators for valves 6 inches and larger mounted over 8 feet above floor.

2.11 BALL VALVES

A. Manufacturers:

1. Conbraco Industries: www.conbraco.com.

2. Nibco, Inc: www.nibco.com.

3. Milwaukee Valve Company: www.milwaukeevalve.com.

4. Approved Equal.

B. Construction, 4 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze, two piece body, chrome plated brass ball, full port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, solder ends with union.

2.12 PLUG VALVES

A. Manufacturers:

1. Conbraco Industries.

2. Homestead Valve.

3. Nordstrom.

4. Approved Equal.

B. Construction 2 inches and Less: 100 psig WOG, gas cock type with cast iron or bronze body, bronze plug, square head, wrench operator, and threaded ends.

C. Construction 2-1/2 inches and Larger: 200 psig WOG, lubricated type with standard port opening, cast iron or semi-steel body, sealed lubrication system with lubricant fitting and dial indicator, cylindrical plug or teflon tapered plug, lubricant grooves in body or plug, flanged ends, and capable of lubrication with valve under pressure and plug in any position. Wrench operator.

2.13 BUTTERFLY VALVES

A. Manufacturers:

1. Hammond Valve: www.hammondvalve.com.

2. Crane Co.: www.cranevalve.com.

3. Milwaukee Valve Company: www.milwaukeevalve.com.

4. Substitutions: See Section 01 6000 - Product Requirements.

B. Construction 1-1/2 Inches and Larger: MSS SP-67, 200 psi CWP, cast or ductile iron body, nickel-plated ductile iron disc, resilient replaceable EPDM seat, wafer ends, extended neck, 10 position lever handle.

C. Provide gear operators for valves 8 inches and larger, and chain-wheel operators for valves mounted over 8 feet above floor.

2.14 SOLENOID VALVES

A. Manufacturers:

1. ASCO Valve, Inc.: www.ascovalve.com

2. Substitutions: See Section 01 6000 - Product Requirements.

B. Water service.

1. Model 8221 series; Slow closing to protect system from water hammer.

2. Construction: Brass body with stainless steel core and springs; NBR or PTFE seals and disks. Provide watertight solenoid enclosure.

3. Normally closed (Closed when de-energized).

C. Combustion (Fuel gas) service.

1. Model: 8040 series.

2. Construction: Aluminum body with stainless steel core and springs; NBR seals and disk. Provide watertight solenoid enclosure.

3. Normally closed (Closed when de-energized).

2.15 SWING CHECK VALVES

A. Manufacturers:

1. Hammond Valve: www.hammondvalve.com.

2. Nibco, Inc: www.nibco.com.

3. Milwaukee Valve Company: www.milwaukeevalve.com.

4. Approved Equal.

B. Up to 2 Inches:

1. MSS SP-80, Class 125, bronze body and cap, bronze swing disc with rubber seat, solder ends.

C. Over 2 Inches:

1. MSS SP-71, Class 125, iron body, bronze swing disc, renewable disc seal and seat, flanged or grooved ends.

2.16 SPRING LOADED CHECK VALVES

A. Manufacturers:

1. Hammond Valve: www.hammondvalve.com.

2. Crane Co.: www.cranevalve.com.

3. Milwaukee Valve Company: www.milwaukeevalve.com.

4. Approved Equal.

B. Class 125, iron body, bronze trim, stainless steel springs, bronze disc, Buna N seals, wafer style ends.

2.17 WATER PRESSURE REDUCING VALVES

A. Manufacturers:

1. Amtrol Inc: www.amtrol.com.

2. Cla-Val Co: www.cla-val.com.

3. Watts Regulator Company: www.wattsregulator.com.

4. Appproved Equal.

B. Up to 2 Inches:

1. MSS SP-80, bronze body, stainless steel and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded single union ends.

C. Over 2 Inches:

1. MSS SP-85, cast iron body, bronze fitted, elastomeric diaphragm and seat disc, flanged.

2.18 RELIEF VALVES

A. Pressure Relief:

1. Manufacturers:

    a. Cla-Val Co: www.cla-val.com.

    b. Henry Technologies: www.henrytech.com.

    c. Watts Regulator Company: www.wattsregulator.com.

    d. Approved Equal.

2. AGA Z21.22 certified, bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated.

B. Temperature and Pressure Relief:

1. Manufacturers:

    a. Cla-Val Co: www.cla-val.com.

    b. Henry Technologies: www.henrytech.com.

    c. Watts Regulator Company: www.wattsregulator.com.

    d. Approved Equal.

2. AGA Z21.22 certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F, capacity ASME (BPV IV) certified and labelled.

2.19 STRAINERS

A. Manufacturers:

1. Armstrong International, Inc: www.armstronginternational.com.

2. Green Country Filtration: greencountryfiltration.com.

3. WEAMCO: www.weamco.com.

4. Approved Equal.

B. Size 2 inch and Under:

1. Threaded brass body for 175 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.

2. Class 150, threaded bronze body 300 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.

C. Size 1-1/2 inch to 4 inch:

1. Class 125, flanged iron body, Y pattern with 1/16 inch stainless steel perforated screen.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Install piping to maintain headroom, conserve space, and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 22 0516.

G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 0719.

H. Provide access where valves and fittings are not exposed.

I. Install vent piping penetrating roofed areas to maintain integrity of roof assembly. Terminate at least 18 inches above roof.

J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

K. Provide support for utility meters in accordance with requirements of utility companies.

L. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 09 9000.

M. Excavate in accordance with Section 31 2316.

N. Backfill in accordance with Section 31 2323.

O. Install bell and spigot pipe with bell end upstream.

P. Install valves with stems upright or horizontal, not inverted.

Q. Pipe vents from gas pressure reducing valves to outdoors and terminate in weather proof hood.

R. Use non-hardening pipe dope on gas piping threads, do not use thread seal tape.

S. PVC Pipe: Make solvent-welded joints in accordance with ASTM D 2855.

T. Sleeve pipes passing through partitions, walls and floors.

U. Inserts:

1. Provide inserts for placement in concrete formwork.

2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.

4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

V. Pipe Hangers and Supports:

1. Support horizontal piping as scheduled.

2. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

3. Place hangers within 12 inches of each horizontal elbow.

4. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.

5. Support vertical piping as scheduled.

6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

7. Provide copper plated hangers and supports for copper piping.

8. Prime coat exposed steel hangers and supports. Refer to Section 09 9000. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

9. Provide hangers adjacent to motor driven equipment with vibration isolation.

10. Support cast iron drainage piping at every joint.

3.4 APPLICATION

A. Install unions downstream of valves and at equipment or apparatus connections.

B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

C. Install gate or ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

D. Install globe valves for throttling, bypass, or manual flow control services.

E. Provide lug end butterfly valves adjacent to equipment when provided to isolate equipment.

F. Provide spring loaded check valves on discharge of water pumps.

G. Provide plug valves in natural gas systems for shut-off service.

3.5 TOLERANCES

A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/4 inch per foot slope for pipes 2-1/2" diameter and less, 1/8 inch per foot slope for pipes 3" to 6" in diameter and 1/16 inch per foot slope for pipes 8" and larger in diameter.

B. Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points with capped drain valves.

3.6 TESTING AND INSPECTIONS

A. New plumbing systems and parts of existing systems that have been altered, extended or repaired shall be tested in accordance with the Plumbing Code of New York State or the authority having jurisdiction to disclose leaks and defects.

B. Pressure test piping systems inside buildings, at the roughing-in stage of installation, before piping is enclosed by construction Work, and at other times as directed. Perform test operations in sections as required and directed, to progress the Work in a satisfactory manner and not delay the general construction of the building. Valve or cap-off sections of piping to be tested, utilizing valves required to be installed in the permanent piping systems, or temporary valves or caps as required to perform the Work.

C. The contractor shall make the applicable tests prescribed below to determine compliance with the provisions of the Plumbing Code of New York State. The contractor shall give reasonable advance notice to the code officail when the plumbing work is ready for tests. The equipment, material, power and labor necessary for the inspection and test shall be furnished by the contractor. All plumbing system piping shall be tested with either water or air. Plastic piping shall not be tested with air.

D. Piping shall be tight under test and shall not show loss in pressure or visible leaks, during test operations or after the minimum duration of time as specified. Remove piping which is not tight under test; remake joints and repeat test until no leaks occur.

E. Required Inspections:

1. Underground inspection shall be made after trenches or ditches are excavated and bedded, piping installed, and before any backfill is put in place.

2. Rough-in inspection shall be made of completed portions of all sanitary, storm and water distribution piping, after the framing, fireblocking, firestopping, draft-stopping and bracing for that portion is in place, and prior to the installation of wall or ceiling membranes.

3. Final inspection shall be made after the building is completed, all plumbing fixtures are in place and properly connected, and the structure is ready for occupancy.

F. Drainage and Vent Water Test:

1. A water test shall be applied to the drainage system either in its entirety or in sections. If applied to the entire system, all openings in the piping shall be tightly closed, except highest opening, and the system shall be filled with water to the point of overflow. If the system is tested in sections, each opening shall be tightly plugged except the highest openings of the section under test, and each section filled with water, but no section shall be tested with less than a 10-foot head of water. In testing successive sections, at least the upper 10-foot of the next proceeding section shall be tested so that no joint or pipe in the building, except the uppermost 10 feet of the system, shall have been submitted to a test of at least 10-foot head of water. Test by filling the entire system with water, and allowing to stand for 3 hours, with no noticeable loss of water.

G. Drainage and Vent Air Test:

1. An air test shall be made by forcing air into the system until there is a uniform gauge pressure of 5 pounds per square inch (psi) or sufficient to balance a 10-inch column of mercury. This pressure shall be held for a test period of 3 hours with no noticeable loss. Any adjustments to the test pressure required because of changes in ambient temperature or the seating of gaskets shall be made prior to the beginning of the test period.

H. Drainage and Vent Final Test:

1. After the plumbing fixtures have been set and their traps filled with water, the entire drainage system shall be submitted to final tests. The final test shall be visual and in sufficient detail to determine compliance with the provisions of the Plumbing Code of New York State.

I. Domestic Water (Potable Cold, Domestic Hot and Recirculation) Inside Buildings:

1. Before fixtures, faucets, trim and accessories are connected, perform hydrostatic test at 125 psig minimum for 4 hours.

2. After fixtures, faucets, trim and accessories are connected, perform hydrostatic retest at 75 psig for 4 hours.

3. The water utilized for the tests shall be obtained from a potable water source of supply.

J. Forced Sewer Test:

1. Forced sewer tests shall consist of plugging the end of the building sewer at the point of connection with the public sewer and applying a pressure of 5 psi greater than the pump rating, and maintaining such pressure for 3 hours with no noticeable loss.

K. Gas Piping:

1. Before backfilling or concealment perform air test of duration and pressure as required by the local gas company. However, for gas piping designed for pressures of from 4 inches to 6 inches water column, air test at 15 inches Hg for one hour, without drop in pressure. Test gas piping with air only. Check joints for leaks with soap suds.

L. Inspection and Testing of Backflow Prevention Assemblies:

1. Backflow prevention assemblies shall be tested at the time of installation and immediately after repairs or relocation.

2. The testing procedure shall be performed in accordance with one of the following standards:

a. ASSE Series 5000 - Standards 5013, 5015, 5020, 5047, 5052 or 5056.

3.7 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. New and repaired potable water systems shall be purged of deleterious matter and disinfected prior to utilization.

B. The method to be followed for the disinfection of potable water systems shall be in accordance with the applicable NYSDOH Regulations.

1. Completely fill the piping, including water storage equipment if installed, with a water solution containing 50 mg/l available chlorine and allow to stand for 24 hours. Operate all valves during this period to ensure their proper disinfection. After the 24 hour period, the chlorine residual shall be 25 mg/l or greater. If not, flush and repeat chlorination procedure.

2. After the retention period, discharge the solution into an approved waste and flush the system thoroughly with potable water until substantially all traces of chlorine are removed. Drain and flush water storage equipment if installed.

3.8 SERVICE CONNECTIONS

A. Provide new sanitary sewer services. Before commencing work check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.

B. Provide new water service complete with approved backflow preventer and water meter with by-pass valves, pressure reducing valve.

1. Provide sleeve in wall for service main and support at wall with reinforced concrete bridge. Calk enlarged sleeve and make watertight with pliable material. Anchor service main inside to concrete wall.

2. Provide 18 gage galvanized sheet metal sleeve around service main to 6 inch above floor and 6 feet minimum below grade. Size for minimum of 2 inches of loose batt insulation stuffing.

C. Coordinate new gas service complete with gas meter and regulators with local utility. Provide regulators on each line serving gravity type appliances, sized in accordance with equipment.

3.9 SCHEDULES

A. Pipe Hanger Spacing.

1. Copper or Copper-Alloy Tubing.

a. 1-1/4" diameter and smaller:

1) Maximum Horizontal Spacing: 6 ft.

2) Maximum Vertical Spacing: 10 ft.

b. 1-1/2" diameter and larger:

1) Maximum Horizontal Spacing: 10 ft.

2) Maximum Vertical Spacing: 10 ft.

2. PVC Pipe.

a. All Sizes:

1) Maximum Horizontal Spacing: 4 ft.

2) Maximum Vertical Spacing: 10 ft. (midstory guide for sizes 2" and smaller)

3. Steel Pipe.

a. All Sizes:

1) Maximum Horizontal Spacing: 12 ft.

2) Maximum Vertical Spacing: 15 ft.

END OF SECTION

SECTION 22 1006 - PLUMBING PIPING SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Drains.

B. Cleanouts.

C. Hydrants.

D. Backwater valves.

E. Backflow preventers.

F. Water hammer arrestors.

G. Mixing valves.

H. Relief valves.

I. Air vents.

J. Floor drain trap seals.

1.2 RELATED REQUIREMENTS

A. Section 22 1005 - Plumbing Piping.

B. Section 22 3000 - Plumbing Equipment.

C. Section 22 4000 - Plumbing Fixtures.

1.3 REFERENCE STANDARDS

A. ASME A112.6.3 - Floor and Trench Drains; 2001 (R2007).

B. ASSE 1013 - Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers; 2011.

C. ASSE 1017 - Performance Requirements for Temperature Actuated Mixing Valves for Hot Water Distribution Systems; 2023.

D. ASSE 1019 - Performance Requirements for Wall Hydrant with Backflow Protection and Freeze Resistance; 2011.

E. NSF 61 - Drinking Water System Components - Health Effects; 2014 (Errata 2015).

F. NSF 372 - Drinking Water System Components - Lead Content; 2011.

G. PDI-WH 201 - Water Hammer Arresters; 2010.

1.4 SUBMITTALS

A. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

2.2 DRAINS

A. Floor Drain:

1. ASME A112.6.3; lacquered cast iron or stainless steel epoxy coated, two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer.

2.3 CLEANOUTS

A. Cleanouts at Exterior Surfaced Areas:

1. Round cast nickel bronze access frame and non-skid cover.

B. Cleanouts at Exterior Unsurfaced Areas:

1. Line type with lacquered cast iron body and round epoxy coated gasketed cover.

C. Cleanouts at Interior Finished Floor Areas:

1. Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round gasketed scored cover in service areas and round gasketed depressed cover to accept floor finish in finished floor areas.

D. Cleanouts at Interior Finished Wall Areas:

1. Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw.

E. Cleanouts at Interior Unfinished Accessible Areas: Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

2.4 HYDRANTS

A. Wall Hydrants:

1. ASSE 1019, freeze resistant, self-draining, hose thread spout, and integral vacuum breaker.

2.5 BACKWATER VALVES

A. Plastic Backwater Valves: ABS body and valve, extension sleeve, and access cover.

2.6 BACKFLOW PREVENTERS

A. Reduced Pressure Backflow Preventer Assembly:

1. ASSE 1013; cast bronze body and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure, and non-threaded vent outlet.

2.7 WATER HAMMER ARRESTORS

A. Water Hammer Arrestors:

1. Copper construction, bellows type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range minus 100 to 300 degrees F and maximum 250 psi working pressure.

2.8 MIXING VALVES

A. Thermostatic Master Mixing Valves:

1. Valve: ASSE 1017, bronze or brass body; thermostatic element; corrosion- and lime-resistant internal components; integral locking temperature adjustment.

2. Accessories:

a. Strainer stop checks on inlets.

b. Shut-off valve on outlet.

c. Stem thermometer on outlet.

d. Strainer stop checks on inlets.

3. Cabinet: 16 gauge, 0.0598 inch prime-coated steel, for surface mounting with keyed lock.

2.9 RELIEF VALVES

A. Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labelled.

2.10 AIR VENTS

A. Manual Type: Short vertical sections of 2 inch diameter pipe to form air chamber, with 1/8 inch brass needle valve at top of chamber.

B. Float Type:

1. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.

2. Cast iron body and cover, float, bronze pilot valve mechanism suitable for system operating temperature and pressure; with isolating valve.

C. Washer Type:

1. Brass with hygroscopic fiber discs, vent ports, adjustable cap for manual shut-off, and integral spring loaded ball check valve.

2.11 FLOOR DRAIN TRAP SEALS

A. Description: Push-fit EPDM or silicone fitting with a one-way membrane.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

C. Encase exterior cleanouts in concrete flush with grade.

D. Install floor cleanouts at elevation to accommodate finished floor.

E. Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibbs, process mechanical equipment, etc.

F. Pipe relief from backflow preventer out exterior wall or to nearest floor drain.

G. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to longest length lines, and wherever necessary.

END OF SECTION

SECTION 22 3000 - PLUMBING EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Commercial gas-fired water heaters.

B. Diaphragm-type compression tanks.

C. In-line circulator pumps.

1.2 SUBMITTALS

A. Product Data:

1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.

2. Indicate pump type, capacity, power requirements.

3. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.

4. Provide electrical characteristics and connection requirements.

B. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

C. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.4 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Provide five year manufacturer warranty for domestic water heaters.

PART 2 PRODUCTS

2.1 WATER HEATERS

A. Manufacturers:

1. A.O. Smith Water Products Co: www.hotwater.com.
2. Vaughn Thermal Corporation: www.vaughncorp.com.
3. Bradford White: www.bradfordwhite.com.
4. Approved Equal.

B. Commercial Gas-Fired Water Heaters:

1. Type: Automatic, propane-fired, vertical storage.
2. Minimum Efficiency Required: ASHRAE Std 90.1 I-P.
3. Tank: Antimicrobial-infused, enamel-lined, welded steel, ASME labeled; multiple flue passages, 4-inch diameter inspection port, thermally insulated with minimum 2 inches glass fiber, encased in corrosion-resistant steel jacket; baked-on enamel finish; floor shield and legs.
4. Accessories:
    a. Water Connections: Brass.
    b. Dip Tube: Brass.
    c. Drain valve.
    d. Anode: Magnesium.

2.2 DIAPHRAGM-TYPE COMPRESSION TANKS

A. Construction: Welded steel, tested and stamped in accordance with ASME BPVC-VIII-1; supplied with National Board Form U-1, rated for working pressure of 125 psig, with flexible EPDM diaphragm sealed into tank, and steel legs or saddles.

B. Accessories: Pressure gauge and air-charging fitting, tank drain; precharge to 12 psig.

2.3 IN-LINE CIRCULATOR PUMPS

A. Manufacturers:

1. Armstrong Fluid Technology: www.armstrongfluidtechnology.com.

2. Bell & Gossett, a brand of Xylem, Inc: www.bellgossett.com.

3. Approved Equal.

B. Casing: Bronze, rated for 125 psig working pressure, with stainless steel rotor assembly.

C. Impeller: Bronze.

D. Shaft: Alloy steel with integral thrust collar and two oil lubricated bronze sleeve bearings.

E. Seal: Carbon rotating against a stationary ceramic seat.

F. Drive: Flexible coupling.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions required for applicable certifications.

B. Coordinate with plumbing piping and related electrical work to achieve operating system.

C. Pumps:

1. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

END OF SECTION

SECTION 22 4000 - PLUMBING FIXTURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Flush valve water closets.

B. Wall hung urinals.

C. Lavatories.

D. Sinks.

E. Bi-level, electric water coolers.

F. Service sinks.

G. Emergency Combination Eyewash/showers.

1.2 RELATED REQUIREMENTS

A. Section 22 1005 - Plumbing Piping.

B. Section 22 1006 - Plumbing Piping Specialties.

1.3 SUBMITTALS

A. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

B. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

C. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.2 FLUSH VALVE WATER CLOSETS

A. Water Closets:

1. Vitreous china, ASME A112.19.2, wall hung, siphon jet flush action, china bolt caps.

2. Flush Valve: Exposed (top spud).

3. Flush Operation: Manual, oscillating handle.

4. Handle Height: 44 inches or less.

B. Flush Valves:

1. Manual Operated:

a. Type: ASME A112.18.1 or ASME A112.19.5; diaphragm type complete with vacuum breaker stops, and accessories.

b. Supplied Volume Capacity: 1.5 gal per flush.

C. Toilet Seats:

1. Plastic: Solid, white finish, enlongated shape, open front, hinged seat cover, and brass bolts with covers.

D. Water Closet Carriers:

1. ASME A112.6.1M; adjustable cast iron frame, integral drain hub and vent, adjustable spud, lugs for floor and wall attachment, threaded fixture studs with nuts and washers.

2.3 URINALS

A. ASME A112.19.2; vitreous china wall urinal with integral flushing rim, removable stainless steel strainer 3/4 inch top spud.

B. Trapway Outlet: Integral.

C. Flush Valves:

1. Exposed: ASME A112.18.1; chrome plated, diaphragm type with oscillating handle, escutcheon, integral screwdriver stop, vacuum breaker; maximum 1.0 gal flush volume.

D. Stall Urinal Carriers:

1. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded fixture studs for fixture hanger, bearing studs.

2.4 LAVATORIES

A. Drop-In Basin:

1. Vitreous China: ASME A112.19.2; self-rimming, white, oval shape, front overflow, soap depression, seal of putty, caulking, or concealed vinyl gasket, and white finish. Size as indicated on drawings with 4-inch centerset spacing.

B. Supply Faucet:

1. ASME A112.18.1; chrome plated combination supply fitting with pop-up waste, water economy aerator with maximum flow of 2.2 gpm, single lever handle.

2.5 SINKS

A. Double Basin Kitchen Sink (KS-A): Undermount double equal bowl kitchen sink; stainless steel; brushed satin finish; sound dampening rubber pads and insulation coating.

1. Faucet: Single handle pull down spray kitchen faucet; ceramic disk valve cartridge; metal body and handle; nylon braided pull out hose with check valves; lead free. Meets ADA ANSI A117.1 requirements.

2.6 BI-LEVEL, ELECTRIC WATER COOLERS

A. Water Cooler: Bi-level, electric, mechanically refrigerated; surface mounted, ADA compliant; stainless steel top, vinyl on steel body, elevated anti-squirt bubbler with stream guard, automatic stream regulator, push button, mounting bracket; integral air cooled condenser and stainless steel grille.

1. Capacity: 8 gph of 50 degrees F water with inlet at 80 degrees F and room temperature of 90 degrees F, when tested in accordance with ASHRAE Std 18.

2. Electrical: 115 VAC, 60 Hertz compressor, 6 foot cord and plug for connection to electric wiring system including grounding connector.

B. Bottle Filler: Materials to match fountain.

2.7 **SERVICE SINKS**

A. Utility Tub: One piece molded construction (polypropylene); faucet with 6" swing end with aerator and hose end; leakproof, integrally molded-in drain with drain stopper; accomodates dual handle faucet with 4" center; includes finished steel legs with adjustable levelers for floor mounting; mold and mildew resistant components.

2.8 **COMBINATION EMERGENCY EYEWASH/SHOWERS**

A. Shower: ANSI Z358.1; free standing, self- cleaning, non-clogging 3-1/10 inch diameter plastic deluge shower head with elbow, one inch full flow valve with pull chain and 8 inch diameter ring, one inch interconnecting fittings.

B. Emergency Wash: ANSI Z358.1; self-cleaning, non-clogging eye and face wash with quick opening, full-flow valves, plastic eye and face wash receptor, twin eye wash heads and face spray ring, plastic dust cover, copper alloy control valve and fittings.

C. Options:

1. Provide with Guardian Model G6040 or approved equal Thermostatic Mixing Valve: ANSI Z358.1 Rated

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

B. Verify that electric power is available and of the correct characteristics.

C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.2 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.3 INSTALLATION

A. Install each fixture with trap, easily removable for servicing and cleaning.

B. Provide chrome-plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons.

C. Install components level and plumb.

D. Install and secure fixtures in place with wall supports and bolts.

E. Solidly attach water closets to floor with lag screws. Lead flashing is not intended to hold fixture in place.

3.4 INTERFACE WITH WORK OF OTHER SECTIONS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.5 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.6 CLEANING

A. Clean plumbing fixtures and equipment.

3.7 PROTECTION

A. Protect installed products from damage due to subsequent construction operations.

B. Repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 23 0510 - BASIC MECHANICAL REQUIREMENTS

PART 1 GENERAL

1.1 WORK INCLUDED

A. Provide all labor, tools, materials, accessories, parts, transportation, taxes, and related items, essential for installation of the work and necessary to make work complete and operational. Provide new equipment and material unless otherwise called for. References to codes, specifications, and standards called for in the specification sections and on the drawings mean the latest edition, amendment, and revision of such referenced standard in effect on the date of these contract documents.

1.2 LICENSING

A. The Contractor shall hold a license to perform the work as issued by the local jurisdiction.

B. The Contractor shall be responsible for reviewing the local jurisdiction requirements prior to bidding.

1.3 PERMITS

A. Apply for and obtain all required permits and inspections, pay all fees and charges including all service charges.

1.4 CODE COMPLIANCE

A. Provide work in compliance with the following:

1. The Building Code of New York State including The Fire Code; Property Maintenance Code; Plumbing Code, Mechanical Code and Fuel Gas Code; and The Energy Code of New York.

2. New York State Department of Labor Rules and Regulations.

3. Occupational Safety and Health Administration (OSHA).

4. National Fuel Gas Code, NFPA 54.

5. National Electrical Code, NFPA 70.

6. Local Codes and Ordinances.

7. Life Safety Codes, NFPA 101 (2003).

8. New York Board of Fire Underwriters.

9. Part 4 of Title 12 Rules and Regulations of the State of New York Industrial Code Rule No. 4 (12NYCRR4)

1.5 GLOSSARY

A. AGA American Gas Association

B. AMCA Air Moving and Conditioning Association, Inc.

C. ANSI American National Standards Institute

D. ARI Air Conditioning and Refrigeration Institute

E. ASHRAE American Society of Heating, Refrigeration, and Air Conditioning Engineers, Inc.

F. ASME American Society of Mechanical Engineers

G. ASPE American Society of Plumbing Engineers

H. ASTM American Society for Testing Materials

I. NEC National Electrical Code

J. NEMA National Electrical Manufacturer's Association

K. NFPA National Fire Protection Association

L. SMACNA Sheet Metal and Air Conditioning Contractors National Association

M. UL Underwriter's Laboratories, Inc.

N. OSHA Occupational Safety and Health Administration

O. NYS/UFPBC New York State Uniform Fire Prevention and Building Code

1.6 SHOP DRAWINGS/PRODUCT DATA/SAMPLES

A. Submit Shop Drawings on all items of equipment and materials to be furnished and installed. Submission of Shop Drawings and samples shall be accompanied by a transmittal letter, stating name of project and contractor, number of drawings, titles, and other pertinent data called for in individual sections. Shop Drawings shall be dated and contain: Name of project; name of prime professional; name of prime contractor; description or names of equipment, materials and items; and complete identification of locations at which materials or equipment are to be installed. Individual piecemeal or incomplete submittals will not be accepted. Similar items, (all types specified) shall be submitted at one time. Number each submittal by trade. Indicate deviations from contract requirements on Letter of Transmittal. Shop Drawings will be given a general review only. Corrections or comments made on the Shop Drawings during the review do not

relieve Contractor from compliance with requirements of the drawings and specifications. The Contractor is responsible for: confirming and correcting all quantities; checking electrical characteristics and dimensions; selecting fabrication processes and techniques of construction; coordinating his work with that of all other trades; and performing his work in a safe and satisfactory manner.

B. See Specification Section 01 3000 Administrative requirements for Submittal procedures.

1.7 PROTECTION OF PERSONS AND PROPERTY

A. Contractor shall assume responsibility for construction safety at all times and provide as part of contract all trench or building shoring, scaffolding, shielding, dust/fume protection, mechanical/electrical protection, special grounding, safety railings, barriers, and other safety features required to provide safe conditions for all workmen and site visitors.

1.8 EQUIPMENT ARRANGMENTS

A. The contract documents are prepared on basis of one manufacturer as “design equipment,” even though other manufacturer’s names are listed as acceptable makes. If Contractor elects to use one of the listed makes other than “design equipment,” submit detailed drawings, indicating proposed installation of equipment. Show maintenance arrangement. Make required changes in the work of other trades, at no increase in any contract. Provide larger motors, feeders, breakers, and equipment, additional control devices, valves, fittings and other miscellaneous equipment required for proper operation, and assume responsibility for proper location of roughing and connections by other trades. Remove and replace door frames, access doors, walls, ceilings, or floors required to install other than design make equipment. If revised arrangement submittal is rejected, revise and resubmit specified “design equipment” item which conforms to contract documents.

1.9 ROUGHING

A. Due to small scale of Drawings, it is not possible to indicate all offsets, fittings, changes in elevation, interferences, etc. Make necessary changes in contract work, equipment locations, etc., as part of a contract to accommodate work to obstacles and interferences encountered. Before installing, verify exact location and elevations at work site. DO NOT SCALE plans. If field conditions, details, changes in equipment or shop drawing information require an important rearrangement, report same to Owner’s Representative for review. Obtain written approval for all major changes before installing.

B. Install work so that items both existing and new are operable and serviceable. Eliminate interference with removal of coils, motors, filters, belt guards and/or operation of doors. Provide easy, safe, and code mandated clearances at controllers, motor starters, valve access, and other equipment requiring maintenance and operation. Where Contractor could not reasonably be expected to find such trade interferences due to concealment in walls, ceiling or floors, such relocations will be done by Change Order, if not, included in contract work. Contractor shall relocate existing work in way of new construction. VISIT

SITE BEFORE BIDDING TO DETERMINE SCOPE OF WORK SINCE FEW OF SUCH ITEMS CAN BE SHOWN. Provide new materials, including new piping and insulation for relocated work.

C. Coordinate work with other trades and determine exact route or location of each duct, pipe, conduit, etc., before fabrication and installation. Coordinate with Architectural Drawings. Obtain from Owner's Representative exact location of all equipment in finished areas, such as thermostat, fixture, and switch mounting locations, and equipment mounting locations. Coordinate all work with the architectural reflected ceiling plans and/or existing Architecture. Mechanical drawings show design arrangement only for diffusers, grilles, registers, air terminals, and other items. Do not rough-in contract work without reflected ceiling location plans.

D. Before roughing for equipment furnished by Owner or in other contracts, obtain from Owner and other Contractors, approved roughing drawings giving exact location for each piece of equipment. Do not "rough in" services without final layout drawings approved for construction. Cooperate with other trades to insure proper location and size of connections to insure proper functioning of all systems and equipment. For equipment and connections provided in this contract, prepare roughing drawing as follows:

1. Existing equipment: Measure the existing equipment and prepare for installation in new location.

2. New equipment: Obtain equipment roughing drawings and dimensions, then prepare roughing-in-drawings. If such information is not available in time, obtain an acknowledgement in writing, then make space arrangements as required with Owner's Representative.

1.10 EQUIPMENT AND MATERIAL INSTALLATION

A. Provide materials that meet the following minimum requirements:

1. Materials shall have a flame spread rating of 25 or less and smoke developed rating of 50 or less, in accordance with NFPA 255.

2. All equipment and material for which there is a listing service shall bear a UL label.

3. Gas-fired equipment and system shall meet AGA Regulations and shall have AGA label.

4. Mechanical and electrical equipment and systems with electrical components shall be UL Listed and meet UL Standards and requirements of the NEC.

1.11 CUTTING AND PATCHING

A. Contractor shall include their required cutting and patching work unless shown as part of the General Construction work on the architectural drawings. Refer to "General Conditions of the Contract for Construction," for additional requirements. Cut and drill from both sides of walls and/or floors to eliminate splaying. Patch any cut or abandoned

holes left by removals of equipment, fixtures, etc. Patch adjacent existing work disturbed by installation of new work including insulation, walls and wall covering, ceiling and floor covering, other finished surfaces. Patch openings and damaged areas equal to existing surface finish. Cut openings in prefabricated construction units in accordance with manufacturer's instructions.

1.12 PAINTING

A. Include painting for patchwork with color to match adjacent surfaces. Where color cannot be adequately matched, paint entire surface. Provide one (1) coat of primer and two (2) finish coats or as called for in the Specifications. Refer to Specifications for additional information.

1.13 CONCEALMENT

A. Conceal all contract work above ceilings and in walls, below slabs, and elsewhere throughout building. If concealment is impossible or impractical, notify Owner's Representative before starting that part of the work and install only after his review. In areas with no ceilings, install only after Owner's Representative reviews and comments on arrangement and appearance.

1.14 CHASES

A. New Construction:

1. Certain chases, recessed, openings, shafts, and wall pockets will be provided as part of "General Building Construction Plans and Specifications." Contractor shall provide all other openings required for their contract work.

2. Check Architectural and Structural Design and Shop Drawings to verify correct size and location for all openings, recesses and chases in general building construction work.

3. Assume responsibility for correct and final location and size of such openings.

4. Rectify improperly sized, improperly located or omitted chases or openings due to faulty or late information or failure to check final location.

5. Provide 18 gauge galvanized sleeves and inserts. Extend all sleeves 2" above finished floor. Set sleeves and inserts in place ahead of new construction, securely fastened during concrete pouring. Correct, by drilling, omitted or improperly located sleeves. Assume responsibility for all work and equipment damaged during course of drilling. Firestop all unused sleeves.

6. Provide angle iron frame where openings are required for contract work.

1.15 FLASHING, SEALING, FIRE-STOPPING

A. See Specification Section 23 0515 - Mechanical Firestopping.

1.16 SUPPORTS

A. Provide required supports, beams, angles, hangers, rods, bases, braces, and other items to properly support contract work. Supports shall meet the approval of the Owner's Representative. Modify studs, add studs, add framing, or otherwise reinforce studs in metal stud walls and partitions as required to suit contract work. If necessary, in stud walls, provide special supports from floor to structure above. For Precast Panels/Planks and Metal Decks, support mechanical/electrical work as determined by manufacturer and Owner's Representative. Provide heavy gauge steel mounting plates for mounting contract work. Mounting plates shall span two or more studs. Size, gauge, and strength of mounting plates shall be sufficient for equipment size, weight, and desired rigidity.

1.17 ACCESS PANELS

A. Access panels shall be furnished and installed by the Contractor. Location and size shall be the responsibility of Contractor. Bear cost of construction changes necessary due to improper information or failure to provide proper information in ample time. Access panels over 324 square inches shall have two cam locks. Contractor shall provide proper frame and door type for various wall or ceiling finishes. Access panels shall be equal to "Milcor" as manufactured by Inland Steel Products Co., Milwaukee, Wisconsin.

1.18 CONCRETE BASES

A. Provide concrete bases for all floor-mounted equipment (unless otherwise noted). Provide 3,000 lb. concrete, chamfer edges, trowel finish, and securely bond to floor by roughening slab and coating with cement grout. Bases 4" high (unless otherwise indicated); shape and size to accommodate equipment. Set anchor bolts in sleeves before pouring and after anchoring and leveling, fill equipment bases with grout.

1.19 HVAC EQUIPMENT CONNECTIONS

A. Contractor is responsible for draining, filling, venting, chemically treating and restarting any systems which are affected by work shown on the Contract Documents unless specifically noted otherwise.

B. Provide final hydronic, steam, drain, vent, and gas connections to all equipment as required by the equipment. Provide final connections, including domestic water piping, controls, and devices from equipment to outlets left by other trades. Provide equipment waste, drip, overflow and rail connections extended to floor drains.

C. Provide for Owner furnished and contractor furnished equipment all valves, piping, piping accessories, traps, pressure reducing valves, gauges, relief valves, vents, drains, insulation, sheet metal work, controls, dampers, as required.

D. Refer to manufacturer drawings and specifications for requirements of kitchen equipment, laboratory equipment and special equipment. Verify connection requirements before bidding.

1.20 DELIVERY

A. Accept materials delivered on site in manufacturer's packaging, labeled with manufacturer's identification and product information.

1.21 STORAGE AND PROTECTION OF MATERIALS

A. Store materials on dry base, at least 6" above-ground or floor. Store so as not to interfere with other work or obstruct access to buildings or facilities. Provide waterproof/windproof covering. Remove and provide special storage for items subject to moisture damage. Protect against theft or damage from any cause. Replace items stolen or damaged, at no cost to Owner.

B. Maintain ambient conditions for each product as required by each manufacturer from time of delivery. Maintain appropriate ambient conditions for installation as recommended by each manufacturer for a minimum of 24 hours prior and 24 hours after installation.

C. Refer to "General Conditions of the Contract for Construction."

1.22 FREEZING AND WATER DAMAGE

A. Take all necessary precautions with equipment, systems and building to prevent damage due to freezing and/or water damage. Repair or replace, at no charge in contract, any such damage to equipment, systems, and building. Perform first seasons winterizing in presence of Owner's operating staff.

1.23 OWNER INSTRUCTIONS

A. Before final acceptance of the work, furnish necessary skilled labor to operate all systems by seasons. Instruct designated person on proper operation, and care of systems/equipment. Repeat instructions, if necessary. Obtain written acknowledgement from person instructed prior to final payment. Contractor is fully responsible for system until final acceptance, even though operated by Owner's personnel, unless otherwise agreed in writing. List under clear plastic, operating, maintenance, and starting precautions procedures to be followed by Owner for operating systems and equipment.

1.24 MAINTENANCE MANUALS

A. Prepare Instructions and Maintenance Portfolios. Include one copy of each of approved Shop Drawings, wiring diagrams, piping diagrams spare parts lists, as-built drawings and manufacturer's instructions. Include typewritten instructions, describing equipment, starting/operating procedures, emergency operating instructions, summer-winter changeover, freeze protection, precautions and recommended maintenance procedures. Include name, address, and telephone number of supplier manufacturer representative and service agency for all major equipment items in a three ring binder with name of project on the cover. Include warranty information for all associated equipment. Deliver to Owner's Representative before request for final acceptance.

1.25 RECORD DRAWINGS

A. The Contractor shall obtain at his expense one (1) set of construction Contract Drawings including non-reproducible black and white prints and one set of reproducible drawings for the purpose of recording record conditions.

B. The Contractor shall perform all survey work required for the location and construction of the work and to record information necessary for completion of the record drawings. Record drawings shall show the actual location of the constructed facilities in the same manner as was shown on the bid drawings. All elevations and dimensions shown on the drawings shall be verified or corrected so as to provide a complete and accurate record of the facilities as constructed.

C. It shall be the responsibility of the Contractor to mark each sheet of the non-reproducible drawings in pencil and to record thereon in a legible manner, any and all approved field changes and conditions as they occur. A complete file of approved field sketches, diagrams, and other changes shall also be maintained. At completion of the work, each sheet of record prints, plus all approved field sketches and diagrams shall be used in preparation of the reproducible record drawings.

D. Completed reproducible drawings shall be certified as reflecting record conditions and submitted to the engineer for approval.

1.26 ADDITIONAL ENGINEERING SERVICES

A. In the event that the Consultant is required to provide additional engineering services as a result of substitution of equivalent materials or equipment by the Contractor, or changes by the Contractor in dimension, weight, power requirements, etc., of the equipment and accessories furnished, or if the Consultant is required to examine and evaluate any changes proposed by the Contractor for the convenience of the Contractor, then the Consultant's expenses in connection with such additional services shall be paid by the Contractor and may be deducted from any monies owed to the Contractor.

1.27 FINAL INSPECTION

A. Upon completion of all punch list items, the Contractor shall provide a copy of the punch list back to the Architect/Engineer with each items noted as completed or the current status of the item. Upon receipt, the Architect/Engineer will schedule a final inspection.

1.28 ALL TRADES TEMPORARY HEAT

A. Refer to the Standard General Conditions of the contract for Construction and Supplemental General Conditions.

1.29 HVAC MAINTENANCE OF SYSTEMS DURING TEMPORARY USE PERIODS

A. Provide each air handling system with a set of prefilters in addition to the permanent filters. Furnish four sets of prefilters for each system for use when system is operated for temporary heating or cooling. During such use, change prefilters as often as directed by Owner's Representative. Provide necessary temporary throw away filters in all return openings to keep dust out of ductwork. Change as often as necessary. Remove all such temporary filters upon completion. Use supply units only. Do not operate return fans.

B. Blank-off outside air intake opening during temporary heating period. Install first set of permanent filters and prefilters.

C. Adjust dampers on supply system.

D. Set all heating coil control valves for manual operation.

E. Do not install any grilles or diffusers at room terminal ends of ducts until permission is given.

F. Assume responsibility for systems and equipment at all times, even though used for temporary heat or ventilating. Repair or replace all dented, scratched or damaged parts of systems prior to final acceptance.

G. Remove concrete, rust, paint spots, other blemishes, then clean.

H. Just prior to final acceptance, remove used final filter. Deliver all unused sets of prefilters to the Owner and obtain written receipt. Properly lubricate system bearings before and during temporary use. Maintain thermostats, freeze stats, overload devices, and all other safety controls in operating condition.

1.30 CLEANING

A. It is the Contractor's responsibility to keep clean all equipment and fixtures provided under this contract for the duration of the project. Each trade shall keep the premises free from an accumulation of waste material or rubbish caused by his operations. The facilities require an environment of extreme cleanliness, and it is the Contractor's

responsibility to adhere to the strict regulations regarding procedures on the existing premises. After all tests are made and installations completed satisfactorily:

B. Thoroughly clean entire installation, both exposed surfaces and interiors.

C. Remove all debris caused by work.

D. Remove tools, surplus, materials, when work is finally accepted.

1.31 SYSTEM START-UP AND TESTING

A. All new heating and ventilating shall be started up and operated at normal operating temperature for a period of 24 hours to "bake-off" the equipment. The associated ventilation system shall run on 100% outside air during the bake-off for an additional eight hours to purge the building. This work shall be completed prior to building occupancy or if the work is not completed in time for summer "bake-off" on a Saturday with the Contractor responsible for being on site during the entire purge and bake-off operation.

B. Work of any contract which includes system "bake-off", system start-up, system cut-over or staff training shall not be done one week prior to and one week after the opening of the building/addition except upon written approval by the Owner.

C. Start-up and testing of HVAC systems shall occur while the building is not occupied by Owner and only after notice to the Project Inspector is made at least 24 hours in advance. The Contractor shall be responsible for providing temporary filter media over all supply air registers and diffusers during the HVAC system start-up procedure. The Contractor shall provide airtight plastic covers over all supply and return air openings prior to the start of construction by any Contractor. The plastic shall be maintained airtight throughout the project construction and removed only with the approval of the Project Inspector.

END OF SECTION

SECTION 23 0515 - MECHANICAL FIRESTOPPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Firestopping materials.

B. Firestopping of all penetrations, openings, and interruptions to fire rated assemblies, whether indicated on drawings or not, including but not limited to piping, tubing, ductwork and similar utilities passing through or penetrating fire rated walls and floor assemblies.

1.2 RELATED SECTIONS

A. Refer to "Code Compliance Drawings" for location of fire rated assemblies. At a minimum all corridor walls and all floors between stories have a 1hour rating.

1.3 REFERENCES

A. ASTM International:

1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

3. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

B. National Fire Protection Association:

1. NFPA 70 - National Electrical Code.

C. Underwriters Laboratories Inc.:

1. UL 263 - Fire Tests of Building Construction and Materials.

2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

3. UL 1479 - Fire Tests of Through-Penetration Firestops.

4. UL - Fire Resistance Directory.

D. Mechanical Code of New York State.

1.4 FIRE-STOP SYSTEM PERFORMANCE REQUIREMENTS

A. General: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration fire-stop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.

1. Fire-resistance-rated walls including fire walls, fire partitions, fire barriers and smoke barriers.

2. Fire-resistance-rated horizontal assemblies including floors and ceiling membranes of roof/ceiling assemblies.

1.5 SUBMITTALS

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

1.6 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs which provide the specified fire ratings when tested in accordance with methods indicated.

1. Listing in the current-year classification or certification books of UL will be considered as constituting an acceptable test report.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation. Maintain minimum temperature before, during, and for 3 days after installation of materials.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Hilti.

B. Nelson Fire Stop Products.

C. Specified Technology.

D. 3M Fire Protection Products.

E. Approved equals meeting UL requirements.

2.2 MATERIALS

A. Sealant Firestopping:

1. Intumescent firestop sealant designed to expand when exposed to fire.
2. Paintable
3. Fire Resistance: Up to 4 hours
4. Curing Time: 14-21 days
5. Elongation: 5%
6. Density: 1.5 g/cm3
7. Product: FS-ONE Intumescent Firestop Sealant manufactured by Hilti USA.
8. Uses: Insulated and uninsulated metal pipes, with or without sleeve, jacketed cables, cable bundles, plastic pipes, sheet metal duct, and top of wall joints.

B. Silicone Sealant Firestopping:

1. Silicone based firestop sealant that provides maximum movement in fire-rated joint applications and pipe penetrations.
2. Not paintable
3. Fire Resistance: Up to 4 hours
4. Elongation: 25%
5. Product: CP 601S Elastomeric Firestop Sealant manufactured by Hilti USA.
6. Uses: Joints in walls, floor to floor or fire compartments.

C. Safing Insulation:

1. Mineral-wool type insulation.
2. Thickness: 1" to 1-1/2"
3. Density: 4 to 8 pcf
4. Product: THERMAFIBER Safing Insulation

D. Sleeves:

1. Provide sleeves as required by section 1206.4 of the Mechanical Code.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing through-penetration fire-stop systems to comply with fire-stop system manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration fire-stop systems.

2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration fire-stop systems. Remove loose particles remaining from cleaning operation.

3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by through-penetration fire-stop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

A. General

1. Install materials in manner described in UL Detail and in accordance with manufacturer's instructions, completely closing openings.

B. Installation

1. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping.

2. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

3. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating, to uniform density and texture.

4. Fire Rated Surface:

a. Seal opening at floor, wall, partition, and roof as follows:

1) Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.

2) Size sleeve allowing minimum of 1 inch void between sleeve and building element.

3) Pack void with backing material.

4) Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.

b. Where piping, ductwork, cables, etc. penetrates fire rated surface, install firestopping product in accordance with manufacturer's instructions.

5. Non-Rated Surfaces:

a. Seal opening through non-fire rated wall, floor, ceiling, and roof opening as follows:

1) Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.

2) Size sleeve allowing minimum of 1 inch void between sleeve and building element.

3) Install type of firestopping material recommended by manufacturer.

b. Install floor plates or ceiling plate where piping penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.

c. Exterior wall openings below grade: Assemble rubber links of mechanical seal to size of pipe and tighten in place, in accordance with manufacturer's instructions.

d. Interior partitions: Seal pipe penetrations at mechanical rooms. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

C. Identification:

1. Identify through-penetration fire-stop systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of edge of the fire-stop systems so that labels will be visible to anyone seeking to remove penetrating items or fire-stop systems. Use mechanical fasteners for metal labels. For plastic labels, use self-adhering type with adhesives capable of permanently bonding labels to surfaces on which labels are placed and, in combination with label material, will result in partial destruction of label if removal is attempted. Include the following information on labels:

a. The words "Warning - Through-Penetration Fire-Stop System - Do Not Disturb. Notify Building Management of Any Damage."

b. Date of installation.

c. Through-penetration fire-stop system manufacturer's name.

3.4 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration fire-stop system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration fire-stop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration fire-stop systems immediately and install new materials to produce systems complying with specified requirements.

END OF SECTION

SECTION 23 0553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

B. Adhesive-backed duct markers.

1.2 REFERENCE STANDARDS

A. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2013.

1.3 SUBMITTALS

A. Product Data: Provide manufacturers catalog literature for each product required.

PART 2 PRODUCTS

2.1 IDENTIFICATION APPLICATIONS

A. Furnaces: Nameplates.

B. Condensing Units: Nameplates.

C. Fans: Nameplates.

D. Control Panels: Nameplates.

E. Ductwork: Nameplates or Duct Markers.

F. Unit Heaters: Nameplates.

G. Thermostats: Nameplates.

2.2 NAMEPLATES

A. Manufacturers:

1. Advanced Graphic Engraving: www.advancedgraphicengraving.com.

2. Kolbi Pipe Marker Co.: www.kolbipipemarkers.com.

3. Seton Identification Products: www.seton.com.

4. Approved Equal.

B. Letter Color: White.

C. Letter Height: 1/4 inch.

D. Background Color: Black.

E. Plastic: Comply with ASTM D709.

2.3 ADHESIVE-BACKED DUCT MARKERS

A. Material: High gloss acrylic adhesive-backed vinyl film 0.0032 inch; printed with UV and chemical resistant inks.

B. Style: Individual Label.

C. Color: Yellow/Black.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install ductwork with plastic nameplates or duct markers. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION

SECTION 23 0593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Testing, adjustment, and balancing of refrigerating systems.

C. Measurement of final operating condition of HVAC systems.

1.2 REFERENCE STANDARDS

A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition; 2016.

B. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; 2008.

C. NEBB (TAB) - Procedural Standards for Testing Adjusting and Balancing of Environmental Systems; 2015, Eighth Edition.

D. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing; 2002.

1.3 SUBMITTALS

A. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.

1. Include at least the following in the plan:

a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.

b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.

c. Discussion of what notations and markings will be made on the duct and piping drawings during the process.

d. Final test report forms to be used.

e. Procedures for formal deficiency reports, including scope, frequency and distribution.

B. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

1. Revise TAB plan to reflect actual procedures and submit as part of final report.

2. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Engineer and for inclusion in operating and maintenance manuals.

3. Include actual instrument list, with manufacturer name, serial number, and date of calibration.

4. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.

5. Units of Measure: Report data in I-P (inch-pound) units only.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:

1. AABC (NSTSB), AABC National Standards for Total System Balance.

2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.

3. SMACNA (TAB).

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. TAB Agency Qualifications:

1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.

D. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.2 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:

1. Systems are started and operating in a safe and normal condition.
2. Temperature control systems are installed complete and operable.
3. Proper thermal overload protection is in place for electrical equipment.
4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
5. Duct systems are clean of debris.
6. Fans are rotating correctly.
7. Air coil fins are cleaned and combed.
8. Access doors are closed and duct end caps are in place.
9. Air outlets are installed and connected.
10. Duct system leakage is minimized.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

C. Beginning of work means acceptance of existing conditions.

3.3 PREPARATION

A. Hold a pre-balancing meeting at least one week prior to starting TAB work.

B. Provide additional balancing devices as required.

3.4 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

3.5 RECORDING AND ADJUSTING

A. Ensure recorded data represents actual measured or observed conditions.

B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.6 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

G. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

H. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

I. Where modulating dampers are provided, take measurements and balance at extreme conditions.

J. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches positive static pressure near the building entries.

3.7 MINIMUM DATA TO BE REPORTED

A. Electric Motors:

1. Manufacturer.

2. Model/Frame.

3. HP/BHP.

4. Phase, voltage, amperage; nameplate, actual, no load.
5. RPM.
6. Starter size, rating, heater elements.
7. Sheave Make/Size/Bore.

B. Air Cooled Condensers:

1. Identification/number.
2. Location.
3. Manufacturer.
4. Model number.
5. Serial number.
6. Number of compressors.

C. Air Moving Equipment:

1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Arrangement/Class/Discharge.
6. Air flow, specified and actual.
7. Return air flow, specified and actual.
8. Outside air flow, specified and actual.
9. Total static pressure (total external), specified and actual.
10. Inlet pressure.
11. Discharge pressure.
12. Sheave Make/Size/Bore.
13. Number of Belts/Make/Size.
14. Fan RPM.

D. Return Air/Outside Air:

1. Identification/location.
2. Design air flow.
3. Actual air flow.
4. Design return air flow.
5. Actual return air flow.
6. Design outside air flow.
7. Actual outside air flow.
8. Return air temperature.
9. Outside air temperature.
10. Required mixed air temperature.
11. Actual mixed air temperature.
12. Design outside/return air ratio.
13. Actual outside/return air ratio.

E. Fans:

1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Air flow, specified and actual.
6. Total static pressure (total external), specified and actual.
7. Inlet pressure.
8. Discharge pressure.
9. Sheave Make/Size/Bore.
10. Number of Belts/Make/Size.
11. Fan RPM.

END OF SECTION

SECTION 23 0713 - DUCT INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Duct insulation.

B. Duct Liner.

C. Insulation jackets.

1.2 RELATED REQUIREMENTS

A. Section 23 0515- Mechanical Firestopping.

B. Section 23 0553 - Mechanical Identification.

C. Section 23 3100 - Ductwork.

1.3 REFERENCE STANDARDS

A. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2007.

B. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2004.

C. ASTM C 553 - Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2008.

D. ASTM C 612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2009.

E. ASTM C 1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2005.

F. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2010.

G. ASTM E 96/E 96M - Standard Test Methods for Water Vapor Transmission of Materials; 2005.

H. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 2005.

1.4 SUBMITTALS

A. Product Data: Manufacturer's catalog cuts sheets, specifications, and installation instructions for the following:

1. Insulation Materials.

2. Jacket Materials.

B. Materials Schedule: Itemize insulation materials and thicknesses for each specified application in Insulation Material Schedules in Part 3 of this Section. Where optional materials are specified, indicate the option selected.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of work specified in this section, with minimum five years of experience.

B. Regulatory Requirements:

1. Insulation installed inside buildings, including duct lining materials, laminated jackets, mastics, sealants, and adhesives shall have a Fire Spread/Smoke Developed Rating of 25/50 or less based on ASTM E 84.

1.6 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of insulations, adhesives, mastics, and insulation cements.

B. Maintain temperature before, during, and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.1 FIBROUS GLASS INSULATION

A. Composed principally of fibers manufactured from rock, slag, or glass, with or without binders, and asbestos free.

B. Manufacturers:

1. Knauf Insulation.

2. Johns Manville Corporation.

3. Owens Corning Corporation.

C. Type 'A' Insulation: ASTM C 553; Flexible Blanket.

1. 'K' value: 0.31 at 75 degrees F, when tested in accordance with ASTM C 518.
2. Maximum Service Temperature: 450 degrees F.
3. Minimum Density: 1.0 pcf.

D. Type 'B' Insulation: ASTM C 612; Rigid Board.

1. 'K' value: 0.26 at 75 degrees F, when tested in accordance with ASTM C 518.
2. Maximum Service Temperature: 450 degrees F.
3. Minimum Density: 3.0 pcf or 6.0 pcf as specified.

E. Type 'C' Insulation: ASTM C 1071; Thermal and Acoustic Duct Liner Board Insulation.

1. 'K' value: 0.27 at 75 degrees F, when tested in accordance with ASTM C 518.
2. Maximum Service Temperature: 250 degrees F.
3. Minimum Density: 3.0 pcf.
4. Erosion, temperature, and fire resistant type; NFPA 90-A and 90-B.
5. Minimum Noise Reduction Coefficients:
    a. 1/2 inch Thickness: 0.30.
    b. 1 inch Thickness: 0.45.
    c. 1-1/2 inch Thickness: 0.60.

2.2 FLEXIBLE ELASTOMERIC FOAM INSULATION

A. Manufacturers:

1. Armacell Engineered Foams.
2. Rubatex Corporation.
3. Enviro-tec Corporation.

B. Type 'D' Insulation: ASTM C 534; Sheet Insulation.

1. 'K' value: 0.27 at 75 degrees F, when tested in accordance with ASTM C 518 or C 177.
2. Maximum Water Vapor Transmission: 0.10 perm - inch based on ASTM E 96, Procedure A.

3. Fire Spread/Smoke Developed Rating: 25/50 or less based on ASTM E 84.

2.3 INSERTS

A. High Density Jacketed Insulation Inserts for Hangers and Supports:

1. For Use with Fibrous Glass Insulation: ASTM C 612 Fibrous Glass Board.

a. 'K' value: 0.26 at 75 degrees F, when tested in accordance with ASTM C 518.

b. Minimum Density: 6.0 pcf.

2. For Use with Flexible Elastomeric Foam Insulation: Hardwood dowels or blocks, length or thickness equal to insulation thickness, other dimensions as specified or required.

2.4 JACKETS

A. Laminated Vapor Barrier Jackets: Factory applied by insulation manufacturer, conforming to ASTM C 1136.

1. Type I: Reinforced white kraft and aluminum foil laminate with kraft facing out.

2. Type II: Reinforced aluminum foil and kraft laminate with foil facing out.

3. Laminated vapor barrier jackets are not required for flexible elastomeric foam insulation.

B. Canvas Jackets: Fire retardant cotton duck, 6 oz/sq yd, complying with NFPA 701.

C. Aluminum Jacket: ASTM B 209 formed aluminum sheet, Type 1100, 3003, 3105, or 5005, Temper H14.

1. Thickness: 0.020 inch sheet.

2. Finish: Smooth.

3. Joining: Longitudinal slip joints and 2 inch laps.

4. Fastening Devices:

a. Metal Jacket Bands: 1/2 inch wide; 0.020 inch thick Type 18-8 stainless steel.

b. Wing Seals: Type 18-8 stainless steel, 0.032 inch thick.

c. Sheet Metal Screws: Pan-head Type A hardened aluminum, or stainless steel.

2.5 ADHESIVES, MASTICS, AND SEALERS

A. Lagging Adhesive (Canvas Jackets): Childers' CP-50A, Epolux's Cadalag 336, Foster's 30-36.

B. Vapor Seal Adhesive (Fibrous Glass Insulation): Childers' CP-82, Epolux's Cadoprene 400, Foster's 85-75 or 85-20.

C. Vapor Barrier Mastic/Joint Sealer (Fibrous Glass Insulation): Childers' CP-30, Epolux's Cadalar 670, Foster's 95-44 or 30-35.

D. Adhesive (Flexible Elastomeric Foam): Armstrong's 520, Childers' CP-80, Epolux's Cadoprene 488, Foster's 82-40.

2.6 MISCELLANEOUS MATERIALS

A. Insulation Fasteners:

1. Manufacturers:

a. Duro-Dyne Corporation.

b. Erico Fastening Systems Inc.

c. Carlisle Hardcast Inc.

2. Fastener Type: Galvanized steel, impact applied or welded with integral head, complete with self-locking insulation retaining washers.

B. Pressure Sensitive Tape for Sealing Laminated Jackets:

1. Manufacturers:

a. Alpha Associates.

b. Childers.

c. Morgan Adhesive.

2. Tape Type: Same construction as jacket.

C. Metal Corner Angles: Galvanized steel, 2 inch x 2 inch x 28 gage.

D. Reinforcing Membrane:

1. Manufacturers:

a. Alpha Associates Style 59.

b. Childers' Chil-Glas.

c. Foster's Mast-A-Fab.

PART 3 EXECUTION

3.1 PREPARATION

A. Perform the following prior to starting insulation Work:

1. Install hangers, supports, and appurtenances in their permanent locations.
2. Complete testing of ductwork and equipment.
3. Clean and dry surfaces to be insulated.

3.2 INSTALLATION

A. General:

1. Install the Work of this Section in accordance with manufacturer's printed installation instructions unless otherwise specified.
2. All ductwork shall be thermally insulated in accordance withe the New York State Energy Conservation Code and NAIMA National Insulation Standards.
3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
4. Insulate ducts prior to erection in place when ducts are required to be installed proximate to walls, ceilings, equipment or other ductwork which will not permit adequate space for installation of insulation after ducts are installed.

B. Fibrous Glass Board Insulation Application:

1. Secure insulation to ductwork with insulation fasteners spaced 3 inches in from all corners of ducts, with intermediate fasteners at maximum 16 inch centers in all directions.
2. Butt edges of insulation and fill voids with similar insulation.
3. Seal longitudinal jacket laps continuously with vapor seal adhesive minimum 1-1/2 inch wide.
4. Lap circumferential joints with 4 inch wide jacket material and seal laps continuously with vapor barrier adhesive or 3 inch wide pressure sensitive sealing tape.
5. Install metal corner angles over the jacketed insulated corners. Seal exposed ends of insulation with vapor barrier mastic.

6. Vapor seal breaks in vapor barrier jacketing, exposed surfaces of duct insulation fasteners, and metal corner angles with pressure sensitive sealing tape or coat with vapor barrier mastic.

7. Field apply 6 oz canvas jacket over the vapor barrier jacketed insulation where indicated on Schedule of Ductwork Insulation in this Section.

    a. Apply canvas jacket with lagging adhesive with a 2 inch lap on all seams.

    b. Use outward clinching staples for additional securement of canvas to bottom of ducts in excess of 48 inch width.

    c. Apply heavy coat of lagging adhesive to entire canvas surface.

8. Place trapeze hangers outside of jacketed insulated ducts.

    a. Install high density insulation inserts, of thickness equal to insulation minimum of 4 inch width by the bottom dimension of the duct at points of support.

    b. Continuously jacket insulated ducts and filler pieces through supports.

C. Fibrous Glass Blanket Insulation Application:

1. Cut insulation to stretch-out dimensions as recommended by insulation manufacturer.

2. Remove 2 inch wide strip of insulation material from the jacketing on the longitudinal and circumferential joint edges to form and overlapping flap. Install insulation with jacketing outside so flap overlaps insulation and jacketing on other end.

3. Butt ends of insulation tightly together. Do not compress insulation at duct corners on rectangular or square ductwork.

4. Staple joints with outward clinching staples minimum 6 inches on center and seal with pressure sensitive sealing tape.

5. Cut off protruding ends of fasteners flush with insulation surface and seal with pressure sensitive sealing tape.

6. Seal any tears, punctures, and penetrations of insulation jacketing with sealing tape.

7. Insulation fasteners:

    a. Install duct insulation fasteners on bottom side of horizontal duct runs when bottom dimension of the duct is in excess of 24 inches.

b. Install duct insulation fasteners on sides of duct risers having a dimension in excess of 24 inches.

c. Evenly space fasteners where required maximum of 16 inches on center in all directions.

D. Flexible Elastomeric Foam Insulation Application:

1. Apply sheet insulation to ductwork with adhesive. Insulate sheet metal duct seams, angle bracing, and reinforcing with same insulation thickness specified for ductwork.

2. Apply reinforcing membrane around ductwork insulation with adhesive or mastic.

a. Adhesive Applied System: Apply 2 coats of finish per Section 09900.

b. Mastic Applied System: Apply mastic coat over reinforcing membrane.

E. Duct Liner Application:

1. Adhere insulation with adhesive for 90 percent coverage only where mechanical fasteners can not be used due to space or size constraints.

2. Secure insulation with mechanical liner fasteners. Refer to SMACNA HVAC Duct Construction Standards - Metal and Flexible for spacing.

3. Seal and smooth joints. Seal and coat transverse joints.

4. Seal liner surface penetrations with adhesive.

5. Duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for insulation thickness.

3.3 SCHEDULE OF DUCTWORK INSULATION

A. Exhaust Ducts Within 10 ft of Exterior Openings:

1. Type 'C' Thermal and Acoustic Duct Liner Board Insulation

a. Thickness: 1 inch.

B. 100% Outside Air Ducts:

1. Concealed inside building envelope in unconditioned spaces:

a. Type 'A' Flexible Blanket.

1) Minimum Thickness: 2 inch.

2) Minimum R value: R-5.

3) Jacket Type: Type I or Type II.

b. Type 'B' Rigid Board.

1) Minimum Thickness: 1-1/2 inch.

2) Minimum R value: R-5.

3) Jacket Type: Type I or Type II.

2. Exposed inside building envelope:

a. Type 'B' Rigid Board.

1) Minimum Thickness: 1-1/2 inch.

2) Minimum R value: R-5.

3) Jacket Type:

(a) Type I with Canvas Outer Jacket in unclassified and non-corrosive dry areas.

C. Air Conditioning Supply and Return; Heating Supply and Return:

1. Concealed inside building envelope in unconditioned spaces:

a. Type 'A' Flexible Blanket.

1) Minimum Thickness: 2 inch.

2) Minimum R value: R-5.

3) Jacket Type: Type I or Type II.

b. Type 'B' Rigid Board.

1) Minimum Thickness: 1-1/2 inch.

2) Minimum R value: R-5.

3) Jacket Type: Type I or Type II.

2. Exposed inside building envelope in unconditioned spaces & mechanical rooms:

a. Type 'B' Rigid Board.

1) Minimum Thickness: 1-1/2 inch.

2) Minimum R value: R-5.

3) Jacket Type: Type I with Canvas Outer Jacket.

3. Exposed inside building envelope in conditioned spaces:

    a. Uninsulated unless otherwise indicated on drawings.

D. Transfer Ducts:

1. Concealed inside building envelope in unconditioned spaces:

    a. Type 'C' Thermal and Acoustic Duct Liner Board Insulation

E. Air Conditioning Supply and Return; Heating Supply and Return:

1. Inside building envelope, exposed to outside air (i.e. ventilated attic)

    a. Type 'A' Flexible Blanket.

        1) Minimum Thickness: 2-1/2 inch.

        2) Minimum R value: R-8.

        3) Jacket Type: Type I or Type II.

    b. Type 'B' Rigid Board.

        1) Minimum Thickness: 2 inch.

        2) Minimum R value: R-8.

        3) Jacket Type: Type I or Type II.

F. Air Conditioning Supply and Return; Heating Supply and Return:

1. Exposed exterior to building:

    a. Type 'D' Elastomeric Foam Sheet.

        1) Minimum Thickness: 2-1/2 inch.

        2) Minimum R value: R-8.

        3) Jacket Type: Aluminum Jacket.

END OF SECTION

SECTION 23 0719 - PIPING AND EQUIPMENT INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Piping insulation.

1.2 RELATED REQUIREMENTS

A. Section 23 0515 - Mechanical Firestopping.

B. Section 23 0553 - Mechanical Identification.

C. Section 23 2300 - Refrigerant Piping.

1.3 REFERENCE STANDARDS

A. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2007.

B. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2004.

C. ASTM C 533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation; 2009.

D. ASTM C 547 - Standard Specification for Mineral Fiber Pipe Insulation; 2007.

E. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2010.

F. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.

G. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. Product Data: Manufacturer's catalog cut sheets, specifications, and installation instructions for the following:

1. Insulation Materials.

2. Jacket Materials.

B. Materials Schedule: Itemize insulation materials and thicknesses for each specified application in Insulation Material Schedules in Part 3 of this Section. Where optional materials are specified, indicate the option selected.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of Work specified in this Section, with minimum five years of documented experience.

B. Regulatory Requirements:

1. Insulation installed inside buildings, including laminated jackets, mastics, sealants and adhesives shall have a Fire Spread/Smoke Developed Rating of 25/50 or less based on ASTM E 84, NFPA 255, and UL 723.

1.6 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of insulations, adhesives, mastics, and insulation cements.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.1 PIPING INSULATION

A. Flexible Elastomeric Foam Insulation:

1. Manufacturers:

a. Armacell Engineered Foams.

b. Rubatex Corporation.

c. Enviro-tec Corporation.

2. Preformed Pipe and Fitting Insulation: ASTM C 534, Type I.

3. FM tested and approved, meeting the following:

a. Maximum Water Vapor Transmission: 0.10 perm-inch based on ASTM E 96, Procedure A.

b. K of 0.27 at 75 degrees F based on ASTM C 518 or C 177.

c. Fire Spread/Smoke Developed Rating: 25/50 or less based on ASTM E 84.

4. Polyethylene and polyolefin insulation is not acceptable.

B. High Density Jacketed Insulation Inserts for Hangers and Supports:

1. Manufacturers:

a. Johns Manville Corporation.

b. Knauf Fiber Glass.

c. Owens Corning Corp.

2. For Use with Flexible Elastomeric Foam Insulation: Hardwood dowels and blocks, length or thickness equal to insulation thickness, other dimensions as required.

2.2 ADHESIVES, MASTICS, AND SEALERS

A. Lagging Adhesive (Canvas Jackets): Childer's CP-50A, Epolux's Cadalag 336, Foster's 30-36.

B. Vapor Seal Adhesive (Fibrous Glass Insulation): Childers' CP-82, Epolux's Cadoprene 400, Foster's 85-75 or 85-20.

C. Vapor Barrier Mastic/Joint Sealer (Fibrous Glass Insulation): Childers' CP-30, Epolux's Cadalar 670, Foster's 95-44 or 30-35.

D. Adhesive (Flexible Elastomeric Foam): Armstrong's 520, Childers' CP-80, Epolux's Cadoprene 488, Foster's 82-40.

E. Adhesive (Reinforcing Membrane): Childers' Chil-Spray WB CP-56.

F. Mastic (Reinforcing Membrane): Childers' AK-CRYL CP-9.

G. Sealant (Metal Pipe Jacket): One-part silicone sealant for high temperatures; Dow Corning's Silastic 736 RTV or General Electric's RTV 106.

2.3 MISCELLANEOUS MATERIALS

A. Insulation Fasteners:

1. Acceptable Manufacturers: Duro-Dyne Corp.; Erico Fastening Systems, Inc.

2. Type: Weld pins, complete with self-locking insulation retaining washers.

B. Pressure Sensitive Tape for Sealing Laminated Jackets:

1. Acceptable Manufacturers: Alpha Associates, Childers, Ideal Tape, Morgan Adhesive.

2. Type: Same construction as jacket.

C. Wire, Bands, and Wire Mesh:

1. Binding and Lacing Wire: Nickel copper alloy or copper clad steel.

2. Bands: Galvanized steel, 1/2" wide x 0.015 inch thick, with 0.032 inch thick galvanized wing seals.

3. Wire Mesh: Woven 20 gage steel wire with 1 inch hexagonal openings, galvanized after weaving.

D. Reinforcing Membrane: Glass or Polyester, 10 x 10 mesh. Alpha Associates Style 59, Childers Chil-Glas, Foster's MAST-A-FAB.

PART 3 EXECUTION

3.1 PREPARATION

A. Perform the following prior to starting insulation Work:

1. Install all hangers, supports, and appurtenances in their permanent locations.

2. Complete testing of piping.

3. Clean and dry all surfaces to be insulated.

3.2 INSTALLATION, GENERAL

A. Install the Work of this Section in accordance with manufacturer's printed installation instructions unless otherwise specified.

B. All piping serving as part of a heating or cooling system shall be thermally insulated in accordance withe the New York State Energy Conservation Code and NAIMA National Insulation Standards.

C. Provide continuous piping insulation and jacketing when passing thru interior wall, floor, and ceiling construction.

1. At Through Penetration Firestops: Coordinate insulation densities with the requirements of approved firestop system being installed. See Section 23 0515.

a. Insulation densities required by approved firestop system may vary with the densities specified in this Section. When this occurs use the higher density insulation.

D. Individual piping runs shall have consistent insulation type.

E. Apply Insulation to completely cover entire surface of piping. Do not insulate over weld certification stamps.

3.3 INSTALLATION AT HANGERS AND SUPPORTS

A. Reset and realign hangers and supports if they are displaced during insulation installation.

B. Install high density jacketed insulation inserts at hangers and supports for insulated piping as specified.

1. Insulation Inserts For Use with Flexible Elastomeric Foam Insulation:

a. Where clevis hangers are used, install insulation shields with hardwood filler pieces, same thickness as adjoining insulation, inserted in undersized die cut or slotted holes in insulation at support points.

b. Where hardwood blocks are used, contour to match the curvature of pipe, and shield.

c. Coat dowels and blocks with insulation adhesive, and insert while sill wet.

d. Vapor seal outer surfaces of dowels and blocks with adhesive after insertion.

e. Provide minimum 2 dowels plugs or one filler block per hanger.

3.4 INSTALLATION OF FLEXIBLE ELASTOMERIC FOAM INSULATION

A. Slit insulation and install over pipe. Seal longitudinal and butt joints with adhesive.

B. Insulate fittings and valves with miter cut sections. Use templates provided by the manufacturer and assemble the cut sections in accordance with the manufacturer's printed instructions.

1. Insulate threaded fittings and valves with sleeved fitting covers. Over lap and seal the covers to the adjoining pipe insulation with adhesive.

C. Carefully mate and seal with adhesive all contact surfaces to maintain the integrity of the vapor barrier system.

D. Piping Exposed to the Elements:

1. Apply flexible elastomeric foam insulation to piping with adhesive.

2. Apply reinforcing membrane around piping insulation with adhesive or mastic.

3. Adhesive Applied System: Apply another coat of mastic over reinforcing membrane.

4. Mastic Applied System: Apply another coat of mastic over reinforcing membrane.

3.5 SCHEDULE OF PIPING AND EQUIPMENT INSULATION

A. Cold Service Piping Insulation Schedule:

1. Refrigerant Piping Insulation:

a. Flexible Elastomeric Insulation:

1) Up to and Including 1 inch pipe size - Insulation thickness = 1 inch.

2) 1-1/4 inch and larger pipe size - Insulation thickness = 1-1/2 inch.

END OF SECTION

SECTION 23 2300 - REFRIGERANT PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Piping.

B. Refrigerant.

C. Moisture and liquid indicators.

D. Valves.

E. Strainers.

F. Check valves.

G. Pressure relief valves.

H. Filter-driers.

I. Solenoid valves.

J. Expansion valves.

K. Flexible connections.

1.2 RELATED REQUIREMENTS

A. Section 23 0719 - HVAC Piping Insulation.

1.3 REFERENCE STANDARDS

A. AHRI 750 - Standard for Thermostatic Refrigerant Expansion Valves; 2007.

B. AHRI 760 (I-P) - Performance Rating of Solenoid Valves for Use with Volatile Refrigerants; 2014.

C. ASHRAE Std 15 - Safety Standard for Refrigeration Systems and Designation and Classification of Refrigerants ; 2019, with Errata (2020).

D. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2018.

E. ASME B31.5 - Refrigeration Piping and Heat Transfer Components; 2013.

F. ASME B31.9 - Building Services Piping; 2020.

G. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2020.

H. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.

I. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service; 2020.

J. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2011 (Amended 2012).

K. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018.

L. UL 429 - Electrically Operated Valves; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. Product Data: Provide general assembly of specialties, including manufacturers catalogue information. Provide manufacturers catalog data including load capacity.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store piping and specialties in shipping containers with labeling in place.

B. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.

C. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Filter-Driers:

1. Use a filter-drier immediately ahead of liquid-line controls, such as thermostatic expansion valves, solenoid valves, and moisture indicators.

2.2 REGULATORY REQUIREMENTS

2.3 PIPING

A. Copper Tube: ASTM B280, H58 hard drawn or O60 soft annealed.

1. Fittings: ASME B16.22 wrought copper.

2. Joints: Braze, AWS A5.8M/A5.8 BCuP silver/phosphorus/copper alloy.

B. Copper Tube to 7/8-inch OD: ASTM B88 (ASTM B88M), Type K (A), annealed.

C. Pipe Supports and Anchors:

1. Provide hangers and supports that comply with MSS SP-58.

a. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.

2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Malleable iron adjustable swivel, split ring.

3. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.

4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

5. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.

6. Vertical Support: Steel riser clamp.

7. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

8. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

9. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.4 REFRIGERANT

2.5 MOISTURE AND LIQUID INDICATORS

A. Indicators: Single port type, UL listed, with copper or brass body, flared or soldered ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap; for maximum temperature of 200 degrees F and maximum working pressure of 500 psi.

2.6 VALVES

A. Diaphragm Packless Valves:

1. UL listed, globe or angle pattern, forged brass body and bonnet, phosphor bronze and stainless steel diaphragms, rising stem and handwheel, stainless steel spring, nylon seat disc, soldered or flared ends, with positive backseating; for maximum working pressure of 500 psi and maximum temperature of 275 degrees F.

B. Packed Angle Valves:

1. Forged brass or nickel plated forged steel, forged brass seal caps with copper gasket, rising stem and seat with backseating, molded stem packing, soldered or flared ends; for maximum working pressure of 500 psi and maximum temperature of 275 degrees F.

C. Ball Valves:

1. Two piece bolted forged brass body with teflon ball seals and copper tube extensions, brass bonnet and seal cap, chrome plated ball, stem with neoprene ring stem seals; for maximum working pressure of 500 psi and maximum temperature of 300 degrees F.

D. Service Valves:

1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or soldered ends, for maximum pressure of 500 psi.

2.7 STRAINERS

A. Straight Line or Angle Line Type:

1. Brass or steel shell, steel cap and flange, and replaceable cartridge, with screen of stainless steel wire or monel reinforced with brass; for maximum working pressure of 430 psi.

2.8 CHECK VALVES

A. Globe Type:

1. Cast bronze or forged brass body, forged brass cap with neoprene seal, brass guide and disc holder, phosphor-bronze or stainless steel spring, teflon seat disc; for maximum temperature of 300 degrees F and maximum working pressure of 425 psi.

B. Straight Through Type:

1. Brass body and disc, phosphor-bronze or stainless steel spring, neoprene seat; for maximum working pressure of 500 psi and maximum temperature of 200 degrees F.

2.9 PRESSURE RELIEF VALVES

A. Straight Through or Angle Type: Brass body and disc, neoprene seat, factory sealed and stamped with ASME UV and National Board Certification NB, selected to ASHRAE Std 15, with standard setting of 235 psi.

2.10 FILTER-DRIERS

A. Cores: Molded or loose-fill molecular sieve desiccant compatible with refrigerant, activated alumina, activated charcoal, and filtration to 40 microns, with secondary filtration to 20 microns; of construction that will not pass into refrigerant lines.

B. Construction: UL listed.

1. Connections: As specified for applicable pipe type.

2.11 SOLENOID VALVES

A. Valve: AHRI 760 (I-P), pilot operated, copper, brass or steel body and internal parts, synthetic seat, stainless steel stem and plunger assembly (permitting manual operation in case of coil failure), integral strainer, with flared, soldered, or threaded ends; for maximum working pressure of 500 psi.

B. Coil Assembly: UL 429, UL listed, replaceable with molded electromagnetic coil, moisture and fungus proof, with surge protector and color coded lead wires, integral junction box with pilot light.

2.12 EXPANSION VALVES

A. Angle or Straight Through Type: AHRI 760 (I-P); design suitable for refrigerant, brass body, internal or external equalizer, bleed hole, adjustable superheat setting, replaceable inlet strainer, with nonreplaceable capillary tube and remote sensing bulb and remote bulb well.

B. Selection: Evaluate refrigerant pressure drop through system to determine available pressure drop across valve. Select valve for maximum load at design operating pressure and minimum 10 degrees F superheat. Select to avoid being undersized at full load and excessively oversized at part load.

2.13 FLEXIBLE CONNECTORS

A. Corrugated stainless steel hose with single layer of stainless steel exterior braiding, minimum 9 inches long with copper tube ends; for maximum working pressure of 500 psi.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.2 INSTALLATION

A. Install refrigeration specialties in accordance with manufacturer's instructions.

B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and avoid interference with use of space.

D. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

E. Inserts:

1. Provide inserts for placement in concrete formwork.

2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.

4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

F. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.5.

2. Support horizontal piping as indicated.

G. Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.

H. Provide clearance for installation of insulation and access to valves and fittings.

I. Provide access to concealed valves and fittings.

J. Flood piping system with nitrogen when brazing.

K. Where pipe support members are welded to structural building frame, brush clean, and apply one coat of zinc rich primer to welding.

L. Prepare unfinished pipe, fittings, supports, and accessories ready for finish painting. See Section 09 9123.

M. Insulate piping.

N. Follow ASHRAE Std 15 procedures for charging and purging of systems and for disposal of refrigerant.

O. Provide replaceable cartridge filter-driers, with isolation valves and valved bypass.

P. Locate expansion valve sensing bulb immediately downstream of evaporator on suction line.

Q. Provide external equalizer piping on expansion valves with refrigerant distributor connected to evaporator.

R. Install flexible connectors at right angles to axial movement of compressor, parallel to crankshaft.

S. Fully charge completed system with refrigerant after testing.

T. Provide electrical connection to solenoid valves. See Section 26 2717.

3.3 FIELD QUALITY CONTROL

A. Test refrigeration system in accordance with ASME B31.5.

B. Pressure test system with dry nitrogen to 200 psi. Perform final tests at 27 inches vacuum and 200 psi using halide torch. Test to no leakage.

3.4 SCHEDULES

A. Hanger Spacing for Copper Tubing.

1. 1/2 inch, 5/8 inch, and 7/8 inch OD: Maximum span, 5 feet; minimum rod size, 1/4 inch.
2. 1-1/8 inch OD: Maximum span, 6 feet; minimum rod size, 1/4 inch.
3. 1-3/8 inch OD: Maximum span, 7 feet; minimum rod size, 3/8 inch.
4. 1-5/8 inch OD: Maximum span, 8 feet; minimum rod size, 3/8 inch.
5. 2-1/8 inch OD: Maximum span, 8 feet; minimum rod size, 3/8 inch.
6. 2-5/8 inch OD: Maximum span, 9 feet; minimum rod size, 3/8 inch.
7. 3-1/8 inch OD: Maximum span, 10 feet; minimum rod size, 3/8 inch.
8. 3-5/8 inch OD: Maximum span, 11 feet; minimum rod size, 1/2 inch.
9. 4-1/8 inch OD: Maximum span, 12 feet; minimum rod size, 1/2 inch.

END OF SECTION

SECTION 23 3100 - HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal ducts.

B. Flexible ducts.

1.2 RELATED REQUIREMENTS

A. Section 23 0713 - Duct Insulation: External insulation and duct liner.

B. Section 23 3300 - Air Duct Accessories.

C. Section 23 3700 - Air Outlets and Inlets: Fabric air distribution devices.

1.3 REFERENCE STANDARDS

A. ASHRAE (FUND) - ASHRAE Handbook - Fundamentals; 2013.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

D. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.

E. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.

F. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; current edition, including all revisions.

1.4 SUBMITTALS

A. Product Data: Provide data for duct materials.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Provide UL Class 1 ductwork, fittings, hangers, supports, and appurtenances in accordance with NFPA 90A and SMACNA (DCS) guidelines unless stated otherwise.

B. Duct Fabrication Requirements:

1. Duct and Fitting Fabrication and Support: SMACNA (DCS) including specifics for continuously welded round and oval duct fittings.

2. Use reinforced and sealed sheet-metal materials at recommended gauges for indicated operating pressures or pressure class.

3. Construct tees, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide airfoil turning vanes of perforated metal with glass fiber insulation.

4. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.

5. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

6. Provide turning vanes of perforated metal with glass fiber insulation when an acoustical lining is required.

7. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

C. Ducts:

1. Galvanized steel - For use with unclassified or non-corrosive locations, and other dry areas.

D. General Exhaust: 1 inch w.g. pressure class.

E. Outside Air Intake: 1 inch w.g. pressure class.

2.2 DUCTWORK FABRICATION

A. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes.

2.3 METAL DUCTS

A. Material Requirements:

1. Galvanized Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.

B. Connectors, Fittings, Sealants, and Miscellaneous:

1. Fittings: Manufacture with solid inner wall of perforated galvanized steel.

2. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.

    a. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.

    b. VOC Content: Not more than 250 g/L, excluding water.

    c. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.

3. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

4. Hanger Fasteners: Attach hangers to structure using appropriate fasteners as follows:

    a. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.

    b. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.

    c. Concrete Screw Type Anchors: Complying with ICC-ES AC193.

    d. Masonry Screw Type Anchors: Complying with ICC-ES AC106.

    e. Concrete Adhesive Type Anchors: Complying with ICC-ES AC308.

2.4 FLEXIBLE DUCTS

A. Flexible Ducts: UL 181, Class 1, polyethylene film, mechanically fastened and rolled using galvanized steel to form spiral helix.

    1. Pressure Rating: 10 in-wc positive and 5 in-wc negative.

    2. Maximum Velocity: 5500 fpm.

    3. Temperature Range: Minus 20 degrees F to 250 degrees F.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA (DCS).

B. Install products following the manufacturer's instructions.

C. During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering the ductwork system.

D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

E. Flexible Ducts: Connect to metal ducts with adhesive.

F. Duct sizes indicated are precise inside dimensions. For lined ducts, maintain sizes inside lining.

G. Provide openings in ductwork as indicated to accommodate thermometers and controllers. Provide pilot tube openings as indicated for testing of systems, complete with metal can with spring device or screw to insure against air leakage. For openings, insulate ductwork and install insulation material inside a metal ring.

H. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

I. Connect diffusers or light troffer boots to low-pressure ducts directly or with 5 feet maximum length of flexible duct held in place with strap or clamp.

J. At exterior wall louvers, seal duct to louver frame.

END OF SECTION

SECTION 23 3300 - AIR DUCT ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Air turning devices/extractors.

B. Backdraft dampers - metal.

C. Duct access doors.

D. Flexible duct connectors.

E. Volume control dampers.

F. Low leakage (Class 1A) control dampers.

1.2 RELATED REQUIREMENTS

A. Section 23 3100 - HVAC Ducts and Casings.

1.3 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.

B. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.

1.4 SUBMITTALS

A. Product Data: Provide for shop-fabricated assemblies including volume control dampers, duct access doors, duct test holes, and hardware used. Include electrical characteristics and connection requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.1 AIR TURNING DEVICES/EXTRACTORS

A. Manufacturers:

1. Carlisle HVAC Products; Dynair Hollow Vane and Rail (Double Wall Vane): www.carlislehvac.com.

2. Krueger: www.krueger-hvac.com.

3. Ruskin Company: www.ruskin.com.

4. Titus: www.titus-hvac.com.

5. Approved Equal.

B. Multi-blade device with blades aligned in short dimension; steel construction; with individually adjustable blades, mounting straps.

2.2 BACKDRAFT DAMPERS - METAL

A. Manufacturers:

1. Louvers & Dampers, Inc: www.louvers-dampers.com.

2. Nailor Industries Inc: www.nailor.com.

3. Ruskin Company: www.ruskin.com.

4. Approved Equal.

B. Gravity Backdraft Dampers, Size 18 by 18 inches or Smaller, Furnished with Air Moving Equipment: Air moving equipment manufacturer's standard construction.

C. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: Galvanized steel, with center pivoted blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.3 DUCT ACCESS DOORS

A. Manufacturers:

1. Acudor Products Inc: www.acudor.com.

2. Elgen Manufacturing: www.elgenmfg.com.

3. Nailor Industries Inc: www.nailor.com.

4. Ruskin Company: www.ruskin.com.

5. Approved Equal.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

2.4 FLEXIBLE DUCT CONNECTORS

A. Manufacturers:

1. Carlisle HVAC Products; Dynair Connector Plus G90 Steel Offset Seam Neoprene Fabric: www.carlislehvac.com.

2. Ductmate Industries, Inc, a DMI Company: www.ductmate.com.

3. Elgen Manufacturing Company, Inc: www.elgenmfg.com.

4. Approved Equal.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Flexible Duct Connections: Fabric crimped into metal edging strip.

2.5 VOLUME CONTROL DAMPERS

A. Manufacturers:

1. Louvers & Dampers, Inc: www.louvers-dampers.com.

2. Nailor Industries Inc: www.nailor.com.

3. Ruskin Company: www.ruskin.com.

4. Approved Equal.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Single Blade Dampers:

1. Fabricate for duct sizes up to 6 by 30 inch.

2. Blade: 24 gauge, 0.0239 inch, minimum.

D. Multi-Blade Damper: Fabricate consisting of opposed blades with maximum blade sizes 8 by 72 inches. Assemble center- and edge-crimped blades in prime-coated or galvanized-channel frame with suitable hardware.

1. Blade: 18 gauge, 0.0478 inch, minimum.

2.6 LOW LEAKAGE (CLASS 1A) CONTROL DAMPERS

A. Maximum Leakage Allowed: 3 cfm/sq ft at 1 in-wc.

B. Frame:

1. Material: 20-gauge galvanized steel.

2. Free-area: Single cross section.

C. Blade:

1. Type: Single-blade rectangle shape.

2. Operation: Opposed type.

3. Maximum Individual Blade Height: 8 inches.

4. Material: 12-gauge galvanized steel.

D. Insulation: Water-resistant sound absorbing material.

E. Temperature Service Range: Minus 25 to 185 degrees F.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). See Section 23 3100 for duct construction and pressure class.

B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide minimum 8 by 8 inch size for hand access, size for shoulder access, and as indicated. Provide 4 by 4 inch for balancing dampers only. Review locations prior to fabrication.

D. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

E. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.

F. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum two duct widths from duct take-off.

G. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION

SECTION 23 3416 - CENTRIFUGAL HVAC FANS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Cabinet exhaust Fans.

B. Centrifugal In-line Fans.

1.2 RELATED SECTIONS

A. Section 23 3100 - HVAC Ducts and Casings.

B. Section 23 3300 - Air Duct Accessories.

1.3 REFERENCES

A. AMCA 99 - Standards Handbook; Air Movement and Control Association International, Inc.; 2003.

B. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating; Air Movement and Control Association International, Inc.; 1999 (ANSI/AMCA 210, same as ANSI/ASHRAE 51).

C. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; Air Movement and Control Association International, Inc.; 1990.

D. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2003.

E. UL 705 - Power Ventilators; Underwriters Laboratories Inc.; 2004.

1.4 SUBMITTALS

A. Product Data: Manufacturer's catalog sheets, standard schematic drawings, specifications, and installation instructions for each size unit and curb.

1. Provide fan curves with specified operating point clearly plotted.

B. Detailed Dimensional Data: If roof curb is not the product of the fan manufacturer, provide detailed dimensional data confirming the fan and curb match exactly.

C. Contract Closeout Submittals:

1. Operation and Maintenance Data: Deliver 2 copies covering the installed products to the Owner's Representative.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Fans shall be licensed to bear the AMCA seal.

2. All electrical components shall be UL listed.

3. Fiberglass fans shall conform to ASTM Standard D4167 for fiberglass reinforced plastic fans and blowers.

PART 2 PRODUCTS

2.1 CABINET EXHAUST FANS

A. Manufacturers:

1. Greenheck

2. Loren Cook Company

3. Hartzell Fan Corporation

4. Approved Equal

B. General: Fans shall be of the electric motor direct driven centrifugal type, installed in a galvanized sheet steel unit casing, with electric terminal box inside housing, Include a decorative air intake grille and outside wall cap where indicated on Drawings.

1. Fan Assembly:

a. Fan Housing: Fan wheel housing and integral outlet duct shall be injection molded from polypropylene resin, or manufactured from sheet steel with corrosion resistant coating. Integral motor mounting shall be stamped galvanized steel with vibration isolation mounts.

b. Fan Wheel: Centrifugal forward curved type, injection molded from polypropylene resin, or manufactured from sheet steel with corrosion resistant coating. Wheel shall be balanced at the factory in accordance with AMCA Standard 204-96.

c. Motor: Low speed (1200 RPM or below), with built-in thermal overload protection. Assembly shall be complete with flexible electric cord, plug and electrical receptacle inside housing. Suitably ground fan motor.

2. Unit Casing: Fabricate from heavy gage sheet steel, with a corrosion resistant coating. Provide discharge outlet complete with backdraft damper.

3. Accessories:

a. Inlet Air Grille:

1) Aluminum: Primed and finished with baked-on white enamel

2) Plastic: White, non-yellowing, injection molded plastic.

b. Speed Control: Solid state circuitry, with polished chromium plated wall plate, suitable for use with standard electrical wall box.

c. Wall Cap: Polished aluminum, with built-in backdraft damper.

2.2 CENTRIFUGAL IN-LINE FANS

A. Manufacturers:

1. Greenheck
2. Loren Cook Company
3. Hartzell Fan Corporation
4. Approved Equal

B. General:

1. Fans shall be of size, arrangement, type, capacity, motor location, discharge location, rotation and constructed for Class 1 operating limits, unless otherwise indicated. Fans shall be non-overloading, backward curved type.

2. Backward Curved Fans:

a. General: Fabricate housings from heavy gage aluminum, properly reinforced and supported to prevent breathing and vibration at all speed. Blades, shrouds and center plates shall be fabricated from sheet steel, with the blades die formed and welded or riveted in place. Provide close grained cast iron hubs, securely riveted to the center plate. Shafts shall be steel, accurately turned, of ample diameter to prevent whipping, with precision bearings of the self-aligning, grease packed pillow block type, complete with grease seal. Statically and dynamically balance fan wheels at factory in accordance with AMCA Standard 204-96.

b. Fan Housings: Fabricate scrolls, sides and inlet cones from sheet steel, with angle bracing on housings. Provide a clean out door in scroll. Access doors shall be pan type, with inner surface flush with scroll and the rim secured to the frame on the scroll with hand grip bolts. Raised frame on scroll and door shall be suitable for installation of insulation, when specified.

3. Fan Shafts: Fabricate shafts from hot rolled or forged steel, extended on bearing end, to permit mounting of fan pulley, with end of shaft countersunk. Fan shafts shall be turned, ground, polished, and rust protected.

4. Bearings: Ball, roller or taper grease packed type, as required, rated for a minimum L50 life exceeding 200,000 hours. Provide with pressure type lubricating fittings, extend lubricating fittings to accessible locations.

5. Drive Assembly: Electric motor driven V-belt drive assembly, with belts having a service factor which is 50% greater than the rated HP of the motor. Provide cast iron or steel adjustable pulleys, with keyed hub, securely attached to shaft. Mount driving motor on rails for ease in adjustment of belt tension.

6. Motors shall be heavy duty ball bearing open drip proof motors (except explosion proof where necessary). Motors shall be high efficiency with minimum nominal efficiencies in accordance with ASHRAE standard 90.1-2010. Efficiencies shall be demonstrated in accordance with NEMA standard MGI.

7. Guards: Provide belt drive with an expanded metal or sheet metal guard, of substantial construction to comply with all safety codes. Floor supported guards shall have the legs securely fastened to the floor, as directed and approved. Guards supported from the fan shall be securely bolted thereto. Guards shall be easily removable for access to belts and pulleys, and shall be provided with covered test openings, to permit RPM readings of fan and motor, without removal of belt guard.

PART 3 EXECUTION

3.1 INSTALLATION

A. General:

1. Install fans and accessories in complete accordance with manufacturer's printed installation instructions and the requirements of the Contract Documents.

2. Provide sheaves required for final air balance.

3. Provide backdraft dampers on outlet from cabinet and ceiling exhauster fans and as indicated.

a. Provide 120 volt automatic air dampers in lieu of gravity damper were indicated on drawings. Include line voltage motor drive, power open, spring return.

B. Hung Cabinet Fans:

1. Install fans with resilient mountings.

2. Install flexible connections specified in Section 23 3300 between fan and ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.

C. Centrifugal In-line and Duct Fans:

1. Install fans with vibration isolation.

2. Install flexible connections specified in Section 23 3300 between fan and ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.

3. Provide inlet air screens on fans not indicated to have an inlet duct connection. If fan has inlet bearing, mount screen inside bearing.

END OF SECTION

SECTION 23 3700 - AIR OUTLETS AND INLETS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Diffusers.

B. Registers/grilles.

C. Louvers.

D. Dampers.

1.2 RELATED REQUIREMENTS

A. Section 23 3100 - HVAC Ducts and Casings.

B. Section 23 3300 - Air Duct Accessories.

1.3 REFERENCE STANDARDS

A. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; Air Movement and Control Association International, Inc.; 2007.

B. ASHRAE Std 70 - Method of Testing for Rating the Performance of Air Outlets and Inlets; American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.; 2006.

C. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 2005.

1.4 SUBMITTALS

A. Product Data: Catalog sheets, diagrams, standard schematic drawings, and installation instructions for each manufactured product.

B. Color Selection: Submit manufacturer's color selection chart to Architect for louver color selection.

C. Schedule of Outlets and Inlets: Indicate type keyed to contract drawings, application, size, airflow, pressure drop, and noise level.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Unless otherwise shown or specified comply with the applicable requirements of the following:

    a. SMACNA: Gages of material, fabrication, sealing, and installation shall be in accordance with the SMACNA Manuals.

        1) HVAC Duct Construction Standards.

        2) Round Industrial Duct Construction Standard.

        3) Rectangular Industrial Duct Construction Standard.

    b. NFPA: Standards No. 90A, 90B, 91, 96, and 101.

    c. UL: Standards No. UL181, UL555, and UL555S.

    d. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.

    e. Test and rate louver performance in accordance with AMCA 500-L.

1.6 MAINTENANCE

A. Special Tools:

1. One bar deflection key for every five supply grilles or diffusers.

2. Two keys or socket wrenches for each type of damper adjustment screw or device on manual damper regulators.

3. One tool for each type and size security fastener.

PART 2 PRODUCTS (SEE MECHANICAL SCHEDULES FOR PRODUCTS)

2.1 SUPPLY AIR OUTLETS:

A. Manufacturers:

1. Price Industries.

2. Titus.

3. Krueger.

4. Approved Equal.

B. Type 'S1':

1. Model: Price SCD.

2. Description: Steel - Square ceiling diffuser with round neck and 4 cones. Back cone shall be one piece seamless construction and corporate a round inlet collar of sufficient length for connecting, rigid or flexible duct.

3. Diffuser shall integrate with all duct sizes shown on plans without affecting face size or appearance.

4. Border: Provide appropriate border to accommodate mounting per ceiling type.

5. Finish: B12 White powder coat.

2.2 RETURN AIR INLETS:

A. Manufacturers:

1. Price Industries.

2. Titus.

3. Krueger.

B. Type 'R1':

1. Model: Price Series 80.

2. Description: Aluminum 1/2"x1/2"x1" grids (egg crate core) with extruded aluminum border. Sized per schedule on drawings.

3. Border: Type TSF for lay-in installation, Type SF for surface mount. Panel mounting shall not be allowed.

4. Finish: B12 white powder coat.

5. Provide with factory fabricated square to round adapter for connection to ductwork.

2.3 LOUVERS

A. Manufacturers:

1. Greenheck.

2. Louvers and Dampers/Mestek Inc..

3. Ruskin.

4. Approved Equal.

B. Type: Stationary type louver with welded construction and drainable blades mounted in a 4 inch louver frame. Each stationary blade shall incorporate an integral downspout so water drains to blade end, then down the downspouts and out at the louver sill.

C. Blades: Position blades at 35 degree angle at 4 inch on centers.

D. Material: 6063T5 Extruded aluminum 0.081 inch nominal thickness.

E. Bird Screen: 3/4 inch x 3/4 inch framed, removable, rear-mounted aluminum bird screen. Provide insect screen in lieu of bird screen where indicated on drawings.

F. Finish: Louver shall be supplied with a baked enamel finish, color to be selected by Architect.

2.4 DAMPERS

A. Manufacturers:

1. Damper shall be of same Manufacturer as Louver.

B. Damper shall be same size as corresponding louver and be suitable for mounting directly to the louver or a flanged wall sleeve.

C. Type: Insulated airfoil opposed blade low leakage control damper. Maximum leakage rate 6 cfm/sq ft at 4 in wg.

D. Frame: 5 inch x 1 inch 16 gage galvanized steel hat channel with reinforced corners and welded joints.

E. Blades: Airfoil shaped, galvanized steel double skin construction equivalent to 14 gauge with integral 1/2 inch polystyrene. Mounted on 1/2 inch diameter plated steel axles with synthetic sleeve type bearings.

F. Linkage: Side linkage out of airstream concealed in frame. Weld actuator bracket to frame.

G. Seals: Extruded silicone rubber blade seals. Flexible metal compression type jamb seals.

H. Actuator:

1. Positive positioning, 120 volt actuator with spring return, furnished and sized for each louver by damper manufacturer. If no voltage is specified for actuator, coordinate voltage with equipment voltage.

2. Actuator shall fail closed upon loss of electric power.

PART 3 EXECUTION

3.1 INSTALLATION

A. Unless otherwise specified, install the Work of this Section in accordance with manufacturer's printed installation instructions and the appropriate SMACNA Manual.

B. Coordination: Coordinate location of outlets and inlets with other trades. Make necessary minor adjustments in position to conform with architectural features, symmetry, sprinkler/smoke heads, and lighting arrangement.

1. Locate outlets and inlets to conform to reflected ceiling plans.

2. Arrange and locate duct taps to accomodate proper placement of outlets and inlets.

END OF SECTION

SECTION 23 5400 - FURNACES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Forced air furnaces.

B. Thermostats.

1.2 RELATED REQUIREMENTS

1.3 REFERENCE STANDARDS

A. ANSI Z21.47 - American National Standard for Gas-Fired Central Furnaces; 2012.

B. ASHRAE Std 103 - Methods of Testing for Annual Fuel Utilization Efficiency of Residential Central Furnaces and Boilers; 2017, with Errata (2019).

C. NFPA 54 - National Fuel Gas Code; 2018.

D. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.

E. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2015.

F. NFPA 211 - Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances; 2019.

1.4 SUBMITTALS

A. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.

B. Shop Drawings: Indicate assembly, required clearances, and location and size of field connections.

C. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.

D. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.5 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide three year manufacturers warranty for solid state ignition modules.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Trane Inc, a subsidiary of Ingersoll Rand: www.trane.com.

B. Comfort Aire

C. Rheem

D. Armstrong

E. Approved Equal.

2.2 GAS FIRED FURNACES

A. Annual Fuel Utilization Efficiency (AFUE): 0.95 ("condensing") in accordance with ASHRAE Std 103.

B. Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heating element, controls, air filter, cooling coil, and accessories; wired for single power connection with control transformer.

1. Safety certified by CSA in accordance with ANSI Z21.47.

2. Venting System: Direct.

3. Combustion: Sealed.

4. Air Flow Configuration: Upflow.

5. Heating: Propane gas fired.

6. Accessories:

a. Concentric wall termination kit.

C. Cabinet: Steel with baked enamel finish, easily removed and secured access doors with safety interlock switches, glass fiber insulation with reflective liner.

D. Gas Burner:

1. Atmospheric type with adjustable combustion air supply.

2. Gas valve, two stage provides 100 percent safety gas shut-off; 24 volt combining pressure regulation, safety pilot, manual set (On-Off), pilot filtration, automatic electric valve.

3. Electronic pilot ignition, with electric spark igniter.

4. Combustion air damper with synchronous spring return damper motor.

5. Non-corrosive combustion air blower with permanently lubricated motor.

E. Gas Burner Safety Controls:

1. Thermocouple sensor: Prevents opening of gas valve until pilot flame is proven and stops gas flow on ignition failure.

2. Flame rollout switch: Installed on burner box and prevents operation.

3. Vent safety shutoff sensor: Temperature sensor installed on draft hood and prevents operation, manual reset.

4. Limit Control: Fixed stop at maximum permissible setting, de-energizes burner on excessive bonnet temperature, automatic resets.

F. Supply Fan: Centrifugal type rubber mounted with direct drive with adjustable variable pitch motor pulley.

G. Motor:

1. multiple speed, permanently lubricated, hinge mounted.

H. Air Filters: 1 inch thick urethane, washable type arranged for easy replacement.

I. Operating Controls:

1. Room Thermostat: Cycles burner to maintain room temperature setting.

2. Supply Fan Control: Energize from bonnet temperature independent of burner controls, with adjustable timed off delay and fixed timed on delay, with manual switch for continuous fan operation.

2.3 THERMOSTATS

A. Room Thermostat: Low voltage, electric solid state microcomputer based room thermostat with remote sensor:

1. Preferential rate control to minimize overshoot and deviation from setpoint.

2. Programming based on weekdays, Saturday and Sunday.

3. Thermostat Display:

a. Actual room temperature.

b. System Mode Indication: Heating, cooling, fan auto, off, and on, auto or on, off.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions and requirements of authorities having jurisdiction.

B. Install in accordance with NFPA 90A.

C. Install gas fired furnaces in accordance with NFPA 54.

D. Provide vent connections in accordance with NFPA 211.

END OF SECTION

SECTION 23 5533 - UNIT HEATERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electric Unit heaters.

B. Room thermostats.

1.2 SUBMITTALS

A. Product Data: Provide manufacturer's literature and data indicating rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.

B. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listing.

C. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner s name and registered with manufacturer.

1.3 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.4 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturers warranty for heat exchangers.

PART 2 PRODUCTS

2.1 **ELECTRIC UNIT HEATERS**

A. Manufacturers:

1. Trane Inc: www.trane.com.

2. Marley Engineered Products: www.marleymep.com.

3. Modine: www.modinehvac.com.

4. Ruffneck: www.thermon.com

5. Approved Equal.

B. Assembly: UL listed and labelled assembly with terminal box and cover, and built-in controls.

C. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and 60-Hz hum, embedded in magnesium oxide refractory and sealed in corrosion-resistant metallic sheath. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware, and limit controls for high-temperature protection. Provide integral circuit breaker for overcurrent protection.

D. Cabinet: 0.0478 inch steel with easily removed front panel with integral air outlet and inlet grilles.

E. Element Hangers: Quiet operating, ball bearing cradle type providing unrestricted longitudinal movement, on enclosure brackets.

F. Fan: Direct drive propeller type, statically and dynamically balanced, with fan guard.

G. Motor: Permanently lubricated, sleeve bearings for horizontal models, ball bearings for vertical models.

H. Control: Separate fan speed switch and thermostat heat selector switch, factory wired, with switches built-in behind cover. Provide thermal overload.

I. Electrical Characteristics:

1. Disconnect Switch: Factory mount disconnect switch.

2.2 ROOM THERMOSTATS

A. Room Thermostat: Factory supplied room thermostat with remote sensor:

1. Thermostat display:

a. Actual room temperature.

b. Setpoint temperature.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install unit heaters with vibration isolation or mount rigidly in accordance with manufacturer recommendations .

END OF SECTION

SECTION 23 6313 - AIR COOLED REFRIGERANT CONDENSERS

<<<< UPDATE NOTES

PART 1 GENERAL

2.1 SECTION INCLUDES

A. Manufactured units.

B. Casing.

C. Condenser coils.

D. Fan requirements.

E. Controls.

2.2 RELATED REQUIREMENTS

A. Section 23 2300 - Refrigerant Piping.

2.3 REFERENCE STANDARDS

A. AHRI 210/240 - Standard for Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment; 2008, Including All Addenda.

B. ASHRAE Std 15 - Safety Standard for Refrigeration Systems and Designation and Classification of Refrigerants ; 2019, with Errata (2020).

C. ASHRAE Std 20 - Methods of Testing for Rating Remote Mechanical-Draft Air-Cooled Refrigerant Condensers; 1997 (R2006).

D. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

F. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical; Current Edition, Including All Revisions.

2.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide rated capacities, weights, accessories, electrical requirements, and wiring diagrams.

C. Operation and Maintenance Data: Include start-up instructions, maintenance instructions, parts lists, controls, and accessories.

D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

PART 2 PRODUCTS

3.1 MANUFACTURERS

A. Armstong:

B. York:

C. Comfort Aire

D. Approved Equal.

3.2 MANUFACTURED UNITS

A. Provide packaged, factory assembled, pre-wired unit, suitable for outdoor use consisting of casing, condensing coil and fans, integral sub-cooling coil liquid accumulator.

B. Construction and Ratings: In accordance with AHRI 210/240 and UL 207. Testing shall be in accordance with ASHRAE Std 20.

C. Performance Ratings: Energy Efficient Rating (EER)/Coefficient of Performance (COP) not less than prescribed by ASHRAE Std 90.1 I-P, in combination with compressor units.

3.3 CASING

A. House components in welded steel frame with steel panels with weather resistant, baked enamel finish.

B. Mount starters, disconnects, and controls in weatherproof panel provided with full opening access doors. Provide mechanical interlock to disconnect power when door is opened.

C. Provide removable access doors or panels with quick fasteners.

3.4 CONDENSER COILS

A. Coils: Aluminum fins mechanically bonded to seamless copper tubing. Provide sub-cooling circuits. Air test under water to 425 psig, and vacuum dehydrate. Seal with holding charge of nitrogen.

3.5 FAN REQUIREMENTS

A. Vertical discharge direct driven propeller type condenser fans with fan guard on discharge, equipped with roller or ball bearings with grease fittings extended to outside of casing.

B. Motors as indicated, in compliance with Section 23 0513.

3.6 CONTROLS

A. Provide factory wired and mounted control panel, NEMA 250, containing fan motor starters, fan cycling thermostats, compressor interlock, and control transformer.

B. Provide thermostat to cycle fan motors in response to outdoor ambient temperature.

PART 3 EXECUTION

4.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide for connection to electrical service. See Section 26 2717.

C. Align condensers on concrete foundations.

D. Provide connection to refrigeration piping system. See Section 23 2300. Comply with ASHRAE Std 15.

E. Provide cooling season start-up, winter season shut-down service, for first year of operation.

F. Shut-down system if initial start-up and testing takes place in winter and machines are to remain inoperative. Repeat start-up and testing operation at beginning of first cooling season.

END OF SECTION

SECTION 26 0501 - MINOR ELECTRICAL DEMOLITION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Electrical demolition.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify field measurements and circuiting arrangements are as indicated.

B. Verify that abandoned wiring and equipment serve only abandoned facilities.

C. Demolition drawings are based on casual field observation and existing record documents.

D. Report discrepancies to Engineer before disturbing existing installation.

E. Beginning of demolition means installer accepts existing conditions.

3.2 PREPARATION

A. Disconnect electrical systems in walls, floors, and ceilings to be removed.

B. Coordinate utility service outages with utility company and the owner.

C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

D. Existing Electrical Service: Maintain existing system in service at all times throughout project duration. Disable system only to make switchovers and connections. Minimize outage duration to max extent possible. Contractor to provide temporary power as required. Refer to Section 26 0510 Basic Electrical Requirements for additional temporary power information, as well as, Contract Drawings for Sequence of Construction and Removals. Coordinate final sequencing with all trades, owner, and engineer prior to proceeding with work.

1. Obtain permission from Owner at least 72 hours before partially or completely disabling system.

2. Make temporary connections to maintain service in areas adjacent to work area.

E. Existing Fire Alarm System: Maintain existing system in service at all times throughout project duration. Disable system only to make switchovers and connections. Minimize outage duration to max extent possible.

1. Notify Owner before partially or completely disabling system. Make notifications at least [72] hours in advance.

2. Notify local fire service at least [72] hours before partially or completely disabling system.

3. Make temporary connections to maintain service in areas adjacent to work area.

F. Existing Telephone / Network System: Maintain existing system in service at all times throughout project duration. Disable system only to make switchovers and connections. Minimize outage duration to max extent possible.

1. Notify Owner at least 72 hours before partially or completely disabling system.

2. Notify telephone utility company at least 72 hours before partially or completely disabling system.

3. Make temporary connections to maintain service in areas adjacent to work area.

G. Existing Security System: Maintain existing system in service at all times throughout project duration. Disable system only to make switchovers and connections. Minimize outage duration to max extent possible.

1. Obtain permission from Owner at least 72 hours before partially or completely disabling system.

2. Make temporary connections to maintain service in areas adjacent to work area.

3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Perform work for removal and disposal of equipment and materials containing toxic substances regulated under the Federal Toxic Substances Control Act (TSCA) in accordance with applicable federal, state, and local regulations. Applicable equipment and materials include, but are not limited to:

1. PCB-containing electrical equipment, including transformers, capacitors, and switches.

2. PCB- and DEHP-containing lighting ballasts.

3. Mercury-containing lamps and tubes, including fluorescent lamps, high intensity discharge (HID), arc lamps, ultra-violet, high pressure sodium, mercury vapor, ignitron tubes, neon, and incandescent.

B. Remove, relocate, and extend existing installations to accommodate new construction.

C. Remove abandoned wiring to source of supply.

D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.

F. Disconnect and remove abandoned panelboards and distribution equipment.

G. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

H. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

I. Repair adjacent construction and finishes damaged during demolition and extension work.

J. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

K. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified. All requirements to be per NEC.

L. The owner shall have the right to maintain ownership of all material and equipment scheduled to be removed from the site throughout the project duration. Contractor to coordinate with the owner and all material/equipment that the owner wishes to maintain ownership of shall be moved to a location on the site as designated by the owner. All material the owner does not wish to maintain ownership of shall become the property of the contractor and the contractor assumes responsibility to remove from the site.

3.4 CLEANING AND REPAIR

A. Clean existing materials and equipment that remain or that are to be reused.

B. Panelboards: Clean exposed surfaces, panel interior, and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

C. Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts and broken electrical parts as necessary.

END OF SECTION

SECTION 26 0510 - BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Provide all labor, items, articles, materials, operations, methods or equipment listed, mentioned, indicated or scheduled on the drawings and specified herein, and required to complete the electrical work. Contract drawings and specifications are complementary and must be so construed to determine the full scope of work.

B. Drawings:

1. Contract Drawings are, in part, diagrammatic and are intended to convey the scope of the work and indicate the general arrangement of the equipment. Follow these drawings in laying out the work. Consult all drawings to become familiar with all conditions affecting the work and to verify spaces in which the work will be installed.

2. Reasonable changes required by job conditions (including offsetting of conduits around beams, etc.) shall be made, after obtaining the Engineer's approval, at no additional cost to the Owner.

C. Definitions: The term "provide" shall have the same meaning as "furnish and install". All materials so implied either on the drawings or in these specifications shall be furnished and installed unless specifically noted otherwise.

1.2 QUALITY ASSURANCE

A. All work specified in Division 26 shall be performed by approved workmen qualified by satisfactory experience in the particular work.

1.3 STANDARDS

A. The following standards shall govern and shall constitute minimum requirements as approved. If the requirements of this specification exceed those of the standards mentioned, this specification shall govern.

1. Local building codes.

2. Underwriters Laboratories Inc., (UL) approved or listed: All materials shall be UL approved or third party certified.

3. National Electrical Manufacturer's Association, NEMA: Equipment enclosures, mountings and connections.

4. America National Standards Institute, ANSI: Where mentioned herein.

5. American Institute of Electronic and Electrical Engineers, IEEE: Power equipment.

6. National Electrical Safety Code, NESC: Outdoor and overhead work for temporary service.

7. Occupational Safety and Health Act, OSHA: Requirements for safety and health of employees.

8. National Fire Prevention Association, NFPA:

    a. No. 70, National Electric Code, NEC.

    b. No. 101, Life Safety Code.

1.4 SUBMITTALS

A. Submittals: Obtain approval before procurement, fabrication, or delivery of items to the job site. Partial submittals will not be acceptable and will be returned without review. Submittals shall include the manufacturer's name, trade name, place of manufacture, catalog number or model, nameplate data, size, layout dimensions, capacity, project specification and paragraph reference, applicable federal, military, industry, and technical society publication references, and other information necessary to establish contract compliance of each item to be furnished. Furnish a minimum of three (3) copies of shop drawings for each device/piece of equipment specified or called for.

B. Shop Drawings: In addition to the requirements specified elsewhere, shop drawings shall meet the following requirements. Drawings shall be a minimum of 8.5 inches by 11 inches in size, except as specified otherwise. Drawings shall include complete ratings information, wiring diagrams, and installation details of equipment indicating proposed location, layout/arrangement, control panels, accessories, piping, ductwork, and other itmes that must be shown to assure a coordinated installation. Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices. If equipment is disapproved, revise drawings to show acceptable equipment and resubmit.

C. Manufacturer's Data: Submittals for each manufactured items shall be current manufacturer's descriptive literature of cataloged products, equipment drawings, diagrams, performace and characteristic curves, and catalog cuts.

D. Publication Compliance: Where equipment or materials are specified to conform to industry and technical society publications or organizations such as American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), and Underwriters Laboratories Inc. (UL), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word "shall" had been substituted for "should" wherever it appears. In lieu of the label or listing, submit a certificate from an approved independent testing

organization, adequately equipped and competent to perform such services, stating that the item has been tested in accordance with the specified organization's test methods and that the item conforms to the specified organization's publications.

E. Submittals required: Supply shop drawing submittal information on the equipment as noted in each individual section.

1.5 RECEIPTS FOR LOOSE EQUIPMENT

A. Provide one receipt for all equipment as follows, to be signed by the Owner and delivered to the Engineer prior to request for final payment:

1. Spare material and equipment where specified.
2. Equipment accessories where specified.
3. Keys for panelboards and all other key operated equipment.
4. Circuit breaker handle locks and equipment pad-locks where specified.
5. As built drawings.
6. O&M manuals, shop drawings, wiring diagrams, field start-up and testing reports, warranties, etc...

1.6 OPERATING INSTRUCTIONS

A. Provide approved shop drawings, wiring diagrams, instruction manuals, operating instructions, service manuals, and signed instruction receipts bound in common folder; submit to Engineer for approval and delivery to Owner prior to request for final acceptance and payment.

B. Provide instruction on the operation and maintenance of all equipment installed in this Contract for personnel designated by the Owner. A minimum of one personnel instruction period (8 hours long) by qualified instructors shall be provided on normal operating procedures, minor adjustments and changes, preventive maintenance, and safety precautions. Obtain signed receipt that Owner's representative has been so instructed and can satisfactorily operate the equipment. These instruction periods are in addition to the training requirements specified in each individual equipment specification section.

1.7 AS-BUILT DRAWINGS

A. Electrical Contractor shall record locations of all conduit runs with number and size of conductors as they are installed. This shall be done for all systems (power, control, signaling, communication, emergency, lighting, fire alarm, etc...). Underground conduit plans shall include elevations and conduit and pull box locations shall be dimensioned. As-built drawings shall include all field and addendum changes.

B. All circuit numbers/positions shall be correctly recorded on the drawings as they were installed. In addition, all Panelboard Schedules shall be computer generated and attached to the inside cover of each field installed panelboard.

C. At completion of the job before final payment will be certified, the Electrical Contractor shall submit four prints to the Engineer who will in turn transmit three copies to the Owner.

1.8 PERMITS AND INSPECTIONS

A. Cost of fees shall be included in the bid as follows:

1. Construction permits.

2. Inspections and tests as described in this section.

B. Underwriters' Certificate: Prior to submittal of Request for Final Payment, an electrical inspection certificate shall be obtained and submitted for approval. List of approved 3rd party inspecting underwriters is listed below:

1. Commonwealth Code Inspection Services, Inc.

2. Electrical Underwriters of NY, LLC (845-569-1759)

3. The Inspector, LLC (800-487-0535)

4. Other Underwriters are not restricted, however credentials shall be provided for Engineer approval prior to Inspection.

1.9 CODES, STANDARDS, AND LISTINGS

A. All wiring, conduit, and materials shown on the drawings and/or herein specified shall be in accordance with National Electrical Code (NEC), New York State Uniform Fire Prevention Building Code and Life Safety Code.

B. Wiring, conduit, and materials for all systems shall be provided in sizes and numbers sufficient to function as specified and in accordance with manufacturer's recommendations.

C. Any discrepancies shall be called to the attention of the Engineer before bids are taken. Bids shall be based on code and functional adequacy. Failure of the Contractor in this respect shall not relieve him of responsibility for a fully adequate installation at no increase in cost.

D. If requested by the Engineer, when equipment that is not specified is proposed, then provide a list of usages in New York State when the proposed equipment has been in operation for at least 3 years.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All equipment and/or materials shall be new and shall carry the label of Underwriter's Laboratories Inc., whenever UL requirements are applicable.

B. Materials of same general type, such as wiring devices and luminaries, shall be of the same make throughout the building so that appearance and operation are uniform.

C. "Equal materials" shall comply with Supplementary General Conditions.

D. Drawings and specifications are based on one manufacturer's equipment requirements. The costs of all revisions required to meet the requirements of a different manufacturer's equipment (even though mentioned on the drawings or specified) furnished by the Contractor shall be borne by the Contractor.

PART 3 - EXECUTION

3.1 INFORMATION FOR OTHER DIVISIONS

A. Provide all information concerning the equipment or work of Division 26 required by other Divisions in ample time to prevent delay in building progress.

3.2 INSTALLATION

A. All new material required shall be provided as part of this contract.

B. Electrical Contractor shall include all work as shown and described on Site Drawings, including site electrical drawings.

3.3 OPENINGS AND CHASES

A. Contractor shall provide all boxed openings, chases, recesses, lintels, and bucks required for the admission of the work.

B. Do not cut walls or floors that are waterproofed or pierce any structural member without written permission from the Engineer.

3.4 MOUNTING HARDWARE/EQUIPMENT

A. All electrical equipment, control panels, instrument panels, power panels, motor control centers, transmitters, controllers, starters, or VFDs are to be installed by this contract. Contractor is responsible for providing all unistrut, hardware, brackets, supports, equipment pads, and equipment as necessary to mount all electrical equipment, control

panels, instrument panels, power panels, motor control centers, transmitters, controllers, starters, and VFDs as indicated on the Contract Drawings. Close coordination with owner, engineer, and applicable trade contractor required.

3.5 ANCHORS

A. Provide anchor bolts, sleeves, washers, nuts, and templates for anchoring of equipment. Check locations as work progresses.

3.6 SLEEVES AND INSERTS

A. Provide sleeves and inserts ahead of the general construction work and maintain them in position.

B. The Contractor shall bear the cost of cutting and patching required to make corrections resulting from the omission or improper location of sleeves and/or inserts.

C. Make sleeves in floors and partitions of galvanized steel with lock seam joints.

D. Make sleeves of extra heavy cast iron pipe or rigid galvanized steel pipe in outside walls, foundations, and footings.

E. Conduit sleeves shall be two sizes larger than the conduit passing through it.

F. Terminate sleeves flush with walls, partitions, and ceilings. Terminate sleeves 1/4" above floors.

G. Fill space between sleeve and conduit in underground walls with oakum and caulk with lead on both sides of wall, or use "Link Seal".

H. Fill space between sleeve and conduit with fiberglass blanket insulation when sleeve does not occur in an underground wall. Seal with an approved fire seal caulk.

3.7 PAINTING AND PROTECTIVE COATING

A. Finished Areas: All equipment and fittings shall be factory pre-finished and installed in such a manner as to eliminate necessity for field painting. Paint as directed when rusted or otherwise damaged. Conduit or surface raceway where shown exposed on drawings will be painted by others.

B. Unfinished areas (except crawl spaces): Hanger rods, brackets, angle supports, straps, etc., shall be cadmium plated per ASTM 165, Type NS.

C. Outdoor Work: All ferrous equipment and fittings cadmium plated after fabrication (ASTM 165 Type NS); all screws, nuts, washers, etc., brass or stainless steel.

3.8 ROUGHING

A. Before roughing for equipment furnished by others, obtain approved roughing drawings and exact location for each piece of equipment. Do not "rough-in" services without approved drawings.

B. Obtain drawings or proper information giving final location of all motor and control connections.

C. Unless otherwise detailed or specified:

1. All services shall be concealed within walls, above ceilings, etc.

2. Work shall be exposed only where approved by the Engineer.

3. Notify Engineer if work cannot be concealed, as intended.

4. Conduit to be buried in concrete with approval of Engineer only and then a conduit plan must be submitted.

5. Wiremold is to be used only per drawings as indicated. Usage otherwise only by written consent of Engineer.

3.9 CLEAN-UP

A. Contractor shall at all times keep the project free from accumulation of waste material or rubbish caused by their operation. Shall be done on a daily basis as required or directed by Engineer.

B. When directed, just prior to final acceptance, clean all equipment under contract including, but not limited to the following:

1. Lighting fixtures, panelboards, control centers, receptacles and switch plates.

2. All equipment to be painted, removing all rust, etc., and leave ready for painting.

3. Building, by removing all debris, leftover conduits, wire insulation, cartons, etc., left as a result of this work.

3.10 SUPPORTS

A. After thorough investigation of Architectural, Structural and Shop Drawings related to work to determine how and where equipment, fixtures, conduit, panelboards, etc., are to be supported, mounted or suspended, provide:

1. Extra steel, bolts, inserts, pipe stands, brackets or any other items required for proper support.

2. Supporting accessories where required, whether or not shown on drawings.

END OF SECTION

SECTION 26 0515 - ELECTRICAL FIRESTOPPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Firestopping materials.

B. Firestopping of all penetrations, openings, and interruptions to fire rated assemblies, whether indicated on drawings or not, including but not limited to piping, tubing, and similar utilities passing through or penetrating fire rated walls and floor assemblies.

1.2 RELATED SECTIONS

A. Refer to "Code Compliance Drawings" for location of fire rated assemblies (coordinate with the engineer). At a minimum all corridor walls and all floors between stories have a 1-hour rating. Final requirements to be closely coordinated with the engineer.

1.3 REFERENCES

A. ASTM International:

1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

3. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

B. National Fire Protection Association:

1. NFPA 70 - National Electrical Code.

C. Underwriters Laboratories Inc.:

1. UL 263 - Fire Tests of Building Construction and Materials.

2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

3. UL 1479 - Fire Tests of Through-Penetration Firestops.

4. UL - Fire Resistance Directory.

1.4 FIRE-STOP SYSTEM PERFORMANCE REQUIREMENTS

A. General: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration fire-stop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.

1. Fire-resistance-rated walls including fire walls, fire partitions, fire barriers and smoke barriers.

2. Fire-resistance-rated horizontal assemblies including floors and ceiling membranes of roof/ceiling assemblies.

1.5 SUBMITTALS

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

B. Shop Drawings: For each through-penetration fire-stop system, show each type of construction condition penetrated, relationships to adjoining construction, and type of penetrating item. Include fire-stop design designation of qualified testing and inspecting agency that evidences compliance with requirements for each condition indicated. Submit UL Standard detail for each penetration type proposed.

1.6 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs which provide the specified fire ratings when tested in accordance with methods indicated.

1. Listing in the current-year classification or certification books of UL will be considered as constituting an acceptable test report.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation. Maintain minimum temperature before, during, and for 3 days after installation of materials.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Hilti.

B. Nelson Fire Stop Products.

C. Specified Technology.

D. 3M Fire Protection Products.

E. Approved equals meeting UL requirements.

2.2 MATERIALS

A. Sealant Firestopping:

1. Intumescent firestop sealant designed to expand when exposed to fire.

2. Paintable

3. Fire Resistance: Up to 4 hours

4. Curing Time: 14-21 days

5. Elongation: 5%

6. Density: 1.5 g/cm3

7. Product: FS-ONE Intumescent Firestop Sealant manufactured by Hilti USA.

8. Uses: Insulated and uninsulated metal pipes, with or without sleeve, jacketed cables, cable bundles, plastic pipes, sheet metal duct, and top of wall joints.

B. Silicone Sealant Firestopping:

1. Silicone based firestop sealant that provides maximum movement in fire-rated joint applications and pipe penetrations.

2. Not paintable

3. Fire Resistance: Up to 4 hours

4. Elongation: 25%

5. Product: CP 601S Elastomeric Firestop Sealant manufactured by Hilti USA.

6. Uses: Joints in walls, floor to floor or fire compartments.

C. Safing Insulation:

1. Mineral-wool type insulation.

2. Thickness: 1" to 1-1/2"

3. Density: 4 to 8 pcf

4. Product: THERMAFIBER Safing Insulation

D. Mechanical systems with fillers. Uses: cable trays, bus duct.

E. Sleeves:

1. Provide sleeves in accordance with Installation requirements section.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify openings are ready to receive sleeves and firestopping materials proposed.

3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing through-penetration fire-stop systems to comply with fire-stop system manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration fire-stop systems.

2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration fire-stop systems. Remove loose particles remaining from cleaning operation.

3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by through-penetration fire-stop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

A. General

1. Install materials in manner described in UL Detail and in accordance with manufacturer's instructions, completely closing openings.

B. Installation

1. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping.

2. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

3. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating, to uniform density and texture.

4. Fire Rated Surface:

    a. Seal opening at floor, wall, partition, and roof as follows:

        1) Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.

        2) Size sleeve allowing minimum of 1 inch void between sleeve and building element.

        3) Pack void with backing material.

        4) Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.

    b. Where cable tray, conduit, wireway, and trough penetrates fire rated surface, install firestopping product in accordance with manufacturer's instructions.

5. Non-Rated Surfaces:

    a. Seal opening through non-fire rated wall, floor, ceiling, and roof opening as follows:

        1) Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.

        2) Size sleeve allowing minimum of 1 inch void between sleeve and building element.

        3) Install type of firestopping material recommended by manufacturer.

    b. Install floor plates or ceiling plate where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.

    c. Exterior wall openings below grade: Assemble rubber links of mechanical seal to size of conduit and tighten in place, in accordance with manufacturer's instructions.

    d. Interior partitions: Seal pipe penetrations at telecommunication rooms and data rooms. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

C. Identification:

1. Identify through-penetration fire-stop systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of edge of the fire-stop systems so that labels will be visible to anyone seeking to remove penetrating items or fire-stop systems. Use mechanical fasteners for metal labels. For plastic labels, use self-adhering type with adhesives capable of permanently bonding labels to surfaces on which labels are placed and, in combination with label material, will result in partial destruction of label if removal is attempted. Include the following information on labels:

    a. The words "Warning - Through-Penetration Fire-Stop System - Do Not Disturb. Notify Building Management of Any Damage."

    b. Date of installation.

    c. Through-penetration fire-stop system manufacturer's name.

3.4 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration fire-stop system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration fire-stop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration fire-stop systems immediately and install new materials to produce systems complying with specified requirements.

END OF SECTION

SECTION 26 0519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Single conductor building wire.

B. Metal-clad cable.

C. Wiring connectors.

D. Electrical tape.

E. Heat shrink tubing.

F. Wire pulling lubricant.

1.2 REFERENCE STANDARDS

A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013.

B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2011.

C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010 (Reapproved 2014).

D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2014).

E. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2010.

F. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes; 2013.

G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

H. NECA 120 - Standard for Installing Armored Cable (AC) and Metal-Clad Cable (MC); 2012.

I. NEMA WC 70 - Nonshielded Power Cable 2000 V or Less for the Distribution of Electrical Energy; 2009.

J. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.

M. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.

N. UL 267 - Outline of Investigation for Wire-Pulling Compounds; Most Recent Edition, Including All Revisions.

O. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.

P. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.

Q. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.

R. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.

S. UL 1569 - Metal-Clad Cables; Current Edition, Including All Revisions.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.

2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.

3. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.4 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.

B. Field Quality Control Test Reports.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing.

1.5 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.7 FIELD CONDITIONS

A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Engineer and obtain direction before proceeding with work.

PART 2 - PRODUCTS

2.1 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

C. Nonmetallic-sheathed cable is not permitted.

D. Underground feeder and branch-circuit cable is not permitted.

E. Service entrance cable is not permitted.

F. Armored cable is not permitted.

G. Metal-clad cable is permitted only as follows:

1. Where not otherwise restricted, may be used:

a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.

b. Where concealed in hollow stud walls, above accessible ceilings, and under raised floors for branch circuits up to 20 A.

1) Exception: Provide single conductor building wire in raceway for circuit homerun from first outlet to panelboard.

2. In addition to other applicable restrictions, may not be used:

a. Unless approved by Owner.

b. Where not approved for use by the authority having jurisdiction.

c. Where exposed to view.

d. Where exposed to damage.

e. For damp, wet, or corrosive locations.

2.2 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Provide new conductors and cables manufactured not more than one year prior to installation.

D. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

E. Comply with NEMA WC 70.

F. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

G. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

H. Conductors for Grounding and Bonding: Also comply with Section 26 0526.

I. Conductors and Cables Installed in Cable Tray: Listed and labeled as suitable for cable tray use.

J. Conductors and Cables Installed Where Exposed to Direct Rays of Sun: Listed and labeled as sunlight resistant.

K. Conductors and Cables Installed Exposed in Spaces Used for Environmental Air (only where specifically permitted): Plenum rated, listed and labeled as suitable for use in return air plenums.

L. Conductor Material:

1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated on drawings are based on copper.

2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.

3. Tinned Copper Conductors: Comply with ASTM B33.

M. Minimum Conductor Size:

1. Branch Circuits: 12 AWG.

a. Exceptions:

1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.

2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.

3) 20 A, 277 V circuits longer than 150 feet: 10 AWG, for voltage drop.

2. Control Circuits: 14 AWG (unless specifically called out on the Contract Drawings).

N. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

O. Conductor Color Coding:

1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.

2. Color Coding Method: Integrally colored insulation.

a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.

3. Color Code:

a. 480Y/277 V, 3 Phase, 4 Wire System:

1) Phase A: Brown.

2) Phase B: Orange.

3) Phase C: Yellow.

4) Neutral/Grounded: Gray.

b. 208Y/120 V, 3 Phase, 4 Wire System:

1) Phase A: Black.

2) Phase B: Red.

3) Phase C: Blue.

4) Neutral/Grounded: White.

c. 240/120 V, 1 Phase, 3 Wire System:

1) Phase A: Black.

2) Phase B: Red.

3) Neutral/Grounded: White.

d. Equipment Ground, All Systems: Green.

e. Isolated Ground, All Systems: Green with yellow stripe.

f. Travelers for 3-Way and 4-Way Switching: Pink.

g. For modifications or additions to existing wiring systems, comply with existing color code when existing code complies with NFPA 70 and is approved by the authority having jurisdiction.

h. For control circuits, comply with manufacturer's recommended color code.

2.3 SINGLE CONDUCTOR WIRE

A. Manufacturers:

1. Copper Wire:

a. Service Wire Co: www.servicewire.com/#sle

1) ServicePRO-X

b. Approved equal

B. Description: Single conductor insulated wire.

C. Conductor Stranding:

1. Feeders and Branch Circuits: Stranded.

2. Control Circuits: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation:

1. Copper Wire: Type XHHW-2, Thermoset XLPE Insulation.

a. All insulation, whether installed outdoors, underground, building interior, damp environment, dry environment, hazardous spaces, etc. to be XHHW-2 (thermoset XLPE insulation).

2.4 METAL-CLAD CABLE

A. Manufacturers:

1. Encore Wire Corporation: www.encorewire.com/#sle.

2. Service Wire Co: www.servicewire.com/#sle.

3. Southwire Company: www.southwire.com/#sle.

4. Approved Equal

B. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.

C. Conductor Stranding:

1. All conductors to be Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation: Type XHHW-2.

F. Provide oversized neutral conductors where indicated.

G. Grounding: Full-size integral equipment grounding conductor.

H. Armor: Steel, interlocked tape.

2.5 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B. Connectors for Grounding and Bonding: Comply with Section 26 0526.

C. Wiring Connectors for Splices and Taps:

1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.

2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.

D. Wiring Connectors for Terminations:

1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.

2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.

3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.

4. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.

5. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.

6. Conductors for Control Circuits: Use crimped terminals for all connections.

E. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.

F. Push-in Wire Connectors: Rated 600 V, 221 degrees F.

G. Mechanical Connectors: Provide bolted type or set-screw type.

H. Compression Connectors: Provide circumferential type or hex type crimp configuration.

I. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.

2.6 ACCESSORIES

A. Electrical Tape:

1. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.

a. Product: Scotch Super 33+ or approved equal.

2. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil; suitable for continuous temperature environment up to 194 degrees F and short-term 266 degrees F overload service.

    a. Product: Scotch 130C or approved equal.

B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.

C. Wire Pulling Lubricant:

1. Listed and labeled as complying with UL 267.

2. Suitable for use with conductors/cables and associated insulation/jackets to be installed.

3. Suitable for use at installation temperature.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that field measurements are as indicated.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.3 INSTALLATION

A. Circuiting Requirements:

1. Unless dimensioned, circuit routing indicated is diagrammatic.

2. When circuit destination is indicated without specific routing, determine exact routing required.

3. Arrange circuiting to minimize splices.

4. Include circuit lengths required to install connected devices within 10 ft of location indicated.

5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.

6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.

7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is permitted, under the following conditions:

    a. Provide no more than six current-carrying conductors in a single raceway. Dedicated neutral conductors are considered current-carrying conductors.

    b. Increase size of conductors as required to account for ampacity derating.

    c. Size raceways, boxes, etc. to accommodate conductors.

    d. Refer to contract drawings for additional information.

8. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.

9. Provide oversized neutral/grounded conductors where indicated.

B. Install products in accordance with manufacturer's instructions.

C. Perform work in accordance with NECA 1 (general workmanship).

D. Install metal-clad cable (Type MC) in accordance with NECA 120.

E. Installation in Raceway:

1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.

2. Pull all conductors and cables together into raceway at same time.

3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.

4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

F. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

G. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.

    1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.

H. Terminate cables using suitable fittings.

    1. Metal-Clad Cable (Type MC):

        a. Use listed fittings.

        b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.

I. Install conductors with a minimum of 12 inches of slack at each outlet.

J. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet of slack.

K. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

L. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

M. Make wiring connections using specified wiring connectors.

    1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.

    2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.

    3. Do not remove conductor strands to facilitate insertion into connector.

    4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.

    5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.

6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

N. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.

1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.

a. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.

2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.

a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.

b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.

3. Wet Locations: Use heat shrink tubing.

O. Insulate ends of spare conductors using vinyl insulating electrical tape.

P. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.

Q. Identify conductors and cables in accordance with Section 26 0553.

R. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified.

S. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

3.4 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is required.

1. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.

C. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION

SECTION 26 0526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Conductors for grounding and bonding.

C. Connectors for grounding and bonding.

D. Ground bars.

E. Ground rod electrodes.

1.2 REFERENCE STANDARDS

A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System; 2012.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

C. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings; 2007.

D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. NFPA 780 - Standard for the Installation of Lightning Protection Systems; 2014.

G. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Verify exact locations of underground metal water service pipe entrances to building.

2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.

3. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.4 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

B. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

C. Field quality control test reports.

D. Project Record Documents: Record actual locations of grounding electrode system components and connections.

1.5 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING REQUIREMENTS

A. Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.

B. Do not use products for applications other than as permitted by NFPA 70 and product listing.

C. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

D. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

E. Grounding System Resistance:

1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Engineer. Precipitation within the previous 48 hours does not constitute normally dry conditions.

2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.

3. Between Grounding Electrode System and Major Electrical Equipment Frames, System Neutral, and Derived Neutral Points: Not greater than 0.5 ohms, when tested using "point-to-point" methods.

F. Grounding Electrode System:

1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.

    a. Provide continuous grounding electrode conductors without splice or joint.

    b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.

2. Metal Underground Water Pipe(s):

    a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet at an accessible location not more than 5 feet from the point of entrance to the building.

    b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.

    c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.

3. Metal In-Ground Support Structure:

a. Provide connection to metal in-ground support structure that is in direct contact with earth in accordance with NFPA 70.

4. Gas Piping:

    a. Provide connection to underground metal (where present) gas service pipe(s) that are in direct contact with earth for at least 10 feet (3.0 m) at an accessible location not more than 5 feet (1.5m) from the point of entrance to the building. All requirements to be per applicable codes/regulations.

5. Concrete-Encased Electrode:

    a. Provide connection to concrete-encased electrode consisting of not less than 20 feet of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.

6. Ground Ring:

    a. Provide a ground ring encircling proposed buildings, structure, and equipment as indicated on the contract drawings. Ground ring shall consist of bare copper conductor not less than 2 AWG in direct contact with earth, installed at a depth of not less than 30 inches. Refer to the contract drawings for additional information.

    b. Where location is not indicated, locate ground ring conductor at least 24 inches outside building perimeter foundation.

    c. Provide connection from ground ring conductor to:

        1) Perimeter columns of metal building frame.

        2) Ground rod electrodes located as indicated.

        3) All Structures and equipment within 5 feet of ground ring.

7. Ground Rod Electrode(s):

    a. Provide four ground rod electrodes (one at each corner of ground ring) unless otherwise indicated or required.

    b. Space electrodes not less than 10 feet from each other and any other ground electrode.

    c. Where location is not indicated, locate electrode(s) at least 5 feet outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.

8. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.

G. Grounding for Separate Building or Structure Supplied by Feeder(s) or Branch Circuits:

1. Provide grounding electrode system for each separate building or structure.

2. Provide equipment grounding conductor routed with supply conductors.

3. For each disconnecting means, provide grounding electrode conductor to connect equipment ground bus to grounding electrode system.

4. Do not make any connections and remove any factory-installed jumpers between neutral (grounded) conductors and ground.

H. Bonding and Equipment Grounding:

1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.

2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.

3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.

4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.

6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.

7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:

    a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.

    b. Metal gas piping.

    c. Metal process piping.

8. Provide bonding for interior metal air ducts.

9. Provide bonding for metal building frame.

10. Provide bonding for metal siding / roofing not effectively bonded through attachment to metal building frame.

I. Communications Systems Grounding and Bonding:

1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.

2. Provide bonding jumper in raceway from intersystem bonding termination to each communications room or backboard and provide ground bar for termination.

a. Bonding Jumper Size: 6 AWG, unless otherwise indicated or required.

b. Raceway Size: 3/4 inch trade size unless otherwise indicated or required.

c. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.

d. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.

J. Lightning Protection Systems:

1. Do not use grounding electrode dedicated for lightning protection system for component of building grounding electrode system provided under this section.

2. Provide bonding of building grounding electrode system provided under this section and lightning protection grounding electrode system in accordance with NFPA 70 and NFPA 780.

2.2 GROUNDING AND BONDING COMPONENTS

A. General Requirements:

1. Provide products listed, classified, and labeled as suitable for the purpose intended.

2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 0526:

1. Use insulated copper conductors unless otherwise indicated.

a. Exceptions:

1) Use bare copper conductors where installed underground in direct contact with earth.

2) Use bare copper conductors where directly encased in concrete (not in raceway).

C. Connectors for Grounding and Bonding:

1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.

2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.

3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.

D. Ground Bars:

1. Description: Copper rectangular ground bars with mounting brackets and insulators.

2. Size: As indicated.

3. Holes for Connections: As indicated or as required for connections to be made.

E. Ground Rod Electrodes:

1. Comply with NEMA GR 1.

2. Material: Copper-bonded (copper-clad) steel.

3. Size: 3/4 inch diameter by 10 feet length, unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that field measurements are as indicated.

C. Verify that conditions are satisfactory for installation prior to starting work.

D. Ground rod locations and other grounding componenet locations shown on the contract drawings are shown as diagramatical in nature. Exact locations to be determined in the field by the contractor to avoid interferances with existing conditions and proposed work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.

1. Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches below finished grade.

2. Indoor Installations: Unless otherwise indicated, install with 4 inches of top of rod exposed.

D. Make grounding and bonding connections using specified connectors.

1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.

2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.

3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.

4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.

5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

E. Identify grounding and bonding system components in accordance with Section 26 0553.

3.3 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.13.

C. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.

D. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

E. Submit detailed reports indicating inspection and testing results and corrective actions taken.

END OF SECTION

SECTION 26 0529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.2 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2013.

D. MFMA-4 - Metal Framing Standards Publication; 2004.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes and arrangement of supports and bases with actual equipment and components to be installed.

2. Coordinate work to provide additional framing and materials required for installation.

3. Coordinate compatibility of support and attachment components with mounting surfaces at installed locations.

4. Coordinate arrangement of supports with ductwork, piping, equipment and other potential conflicts.

5. Notify Engineer of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with specifications.

1.4 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel/strut framing systems, nonpenetrating rooftop supports, and post-installed concrete/masonry anchors.

B. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.5 QUALITY ASSURANCE

A. Maintain at project site one copy of each referenced document that prescribes execution requirements.

B. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.1 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:

1. Comply with the following. Where requirements differ, comply with most stringent.

a. NFPA 70.

b. Requirements of authorities having jurisdiction.

2. Provide required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for complete installation of electrical work.

3. Provide products listed, classified, and labeled as suitable for purpose intended, where applicable.

4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of 25%. Include consideration for vibration, equipment operation, and shock loads where applicable.

5. Do not use products for applications other than as permitted by NFPA 70 and product listing.

6. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.

7. Steel Components: Use corrosion-resistant materials suitable for environment where installed.

    a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.

    b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated or specified on the Drawings. Supports shall match the materials of the equipment required to be supported.

    c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.

    d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps and clamps suitable for conduit or cable to be supported.

    1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.

    2. Conduit Clamps: Bolted type unless otherwise indicated.

C. Outlet Box Supports: Hangers and brackets suitable for boxes to be supported.

D. Metal Channel/Strut Framing Systems:

    1. Description: Factory-fabricated, continuous-slot, metal channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.

    2. Comply with MFMA-4.

E. Hanger Rods: Threaded, zinc-plated steel unless otherwise indicated.

    1. Minimum Size, Unless Otherwise Indicated or Required:

a. Equipment Supports: 1/2-inch diameter.

b. Single Conduit up to 1-inch (27 mm) Trade Size: 1/4-inch diameter.

c. Single Conduit Larger than 1-inch (27 mm) Trade Size: 3/8-inch diameter.

d. Trapeze Support for Multiple Conduits: 3/8-inch diameter.

e. Outlet Boxes: 1/4-inch diameter.

f. Luminaires: 1/4-inch diameter.

F. Anchors and Fasteners:

1. Unless otherwise indicated and where not otherwise restricted, use anchor and fastener types indicated for specified applications.

2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.

3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.

4. Hollow Masonry: Use toggle bolts.

5. Hollow Stud Walls: Use toggle bolts.

6. Steel: Use beam clamps, machine bolts, or welded threaded studs.

7. Sheet Metal: Use sheet metal screws.

8. Wood: Use wood screws.

9. Plastic and lead anchors are not permitted.

10. Preset Concrete Inserts: Continuous metal channel/strut and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.

a. Manufacturer: Same as manufacturer of metal channel/strut framing system.

b. Comply with MFMA-4.

c. Channel Material: Use galvanized steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install hangers and supports in accordance with NECA 1.

C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

D. Unless specifically indicated or approved by Engineer, do not provide support from suspended ceiling support system or ceiling grid.

E. Unless specifically indicated or approved by Engineer, do not provide support from roof deck.

F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

G. Equipment Support and Attachment:

1. Use metal, fabricated supports or supports assembled from metal channel/strut to support equipment as required.

2. Use metal channel/strut secured to studs to support equipment surface mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.

3. Use metal channel/strut to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.

4. Unless otherwise indicated, mount floor-mounted equipment on properly sized 4 inch high concrete pad constructed in accordance with specifications.

5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

H. Conduit Support and Attachment: See Section 26 0534 for additional requirements.

I. Box Support and Attachment: See Section 26 0537 for additional requirements.

J. Interior Luminaire Support and Attachment: See Section 26 5100 for additional requirements.

K. Exterior Luminaire Support and Attachment: See Section 26 5600 for additional requirements.

L. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

M. Secure fasteners in accordance with manufacturer's recommended torque settings.

N. Remove temporary supports.

O. Identify independent electrical component support wires above accessible ceilings, where permitted, with color distinguishable from ceiling support wires in accordance with NFPA 70.

3.3 FIELD QUALITY CONTROL

A. Inspect support and attachment components for damage and defects.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 26 0534 - CONDUIT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Rigid galvanized steel metal conduit (RGS).

B. Flexible metal conduit (FMC).

C. Liquidtight flexible metal conduit (LFMC).

D. Galvanized steel electrical metallic tubing (EMT).

E. Rigid polyvinyl chloride (PVC) conduit.

1.2 RELATED REQUIREMENTS

A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems.

1. Includes additional requirements for fittings for grounding and bonding.

C. Section 26 0529 - Hangers and Supports for Electrical Systems.

D. Section 26 0537 - Boxes.

E. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.3 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2005.

B. ANSI C80.3 - American National Standard for Steel Electrical Metallic Tubing (EMT); 2005.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

D. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2013.

E. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2003.

F. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2012.

G. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2013.

H. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2015.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.

K. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

L. UL 360 - Liquid-Tight Flexible Steel Conduit; Current Edition, Including All Revisions.

M. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

N. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

O. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

P. UL 2419 - Outline of Investigation for Electrically Conductive Corrosion Resistant Compounds; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate minimum sizes of conduits with actual type and quantity of conductors to be installed, including adjustments for conductor sizes increased for voltage drop.

2. Coordinate arrangement of conduits with structural members, ductwork, piping, equipment, and other potential conflicts.

3. Verify exact conduit termination locations required for boxes, enclosures, and equipment.

4. Coordinate work to provide roof penetrations that preserve integrity of roofing system and do not void roof warranty.

5. Notify Engineer of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not begin installation of conductors and cables until installation of conduit between termination points is complete.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

B. Shop Drawings:

1. Indicate proposed arrangement for conduits to be installed within structural concrete slabs, where permitted.

2. Include proposed locations of roof penetrations and proposed methods for sealing, where permitted.

C. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs, and conduits 3/4" trade size and larger.

1.6 QUALITY ASSURANCE

A. Documents at Project Site: Maintain at project site one copy of manufacturer's instructions and shop drawings.

B. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.1 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70, manufacturer's instructions, and product listing.

B. Refer to the Raceway Schedule on the Electrical Drawings for permitted usage and restrictions.

C. Unless otherwise indicated and where not otherwise restricted, use conduit types indicated for specified applications. Where more than one listed application applies, comply with most restrictive requirements. Where conduit type for particular application is not specified, use galvanized steel rigid metal conduit.

D. Connections to Luminaires: Use flexible metal conduit only where necessary/required (use of conduit type specified is not feasible). The length of flexible metal conduit is to be limited to the greatest extent possible.

1. Dry Locations: Use flexible metal conduit.

2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.

3. Maximum Length: 3.28 feet.

a. Contractor to minimize length of liquid-tight flexible metal conduit to greatest extent possible.

E. Flexible Connections to Vibrating Equipment:

1. Dry Locations: Use flexible metal conduit (FMC).

2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit (LFMC).

3. Maximum Length: 3.28 feet unless otherwise indicated.

a. Contractor to limit the length of flexible conduit connections to the greatest extent possible.

2.2 CONDUIT - GENERAL REQUIREMENTS

A. Comply with NFPA 70.

B. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling mandrel through them.

C. Fittings for Grounding and Bonding: See Section 26 0526 for additional requirements.

D. Provide conduit, fittings, supports, and accessories required for complete raceway system.

E. Provide products listed, classified, and labeled as suitable for purpose intended.

F. Minimum Conduit Size, 3/4-inch Unless Otherwise Indicated:

G. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.3 GALVANIZED STEEL RIGID METAL CONDUIT (RGS)

A. Description: NFPA 70, Type RGS galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

B. Fittings:

1. Fittings to be manufactured by American Fittings Corporation or approved equal.

2. Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6.

3. Material: Use steel or malleable iron.

    a. Do not use die cast zinc fittings.

4. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.4 FLEXIBLE METAL CONDUIT (FMC)

A. Description: NFPA 70, Type FMC standard-wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems.

B. Fittings:

1. Fittings to be manufactured by American Fittings Corporation or approved equal.

2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.

3. Material: Use steel or malleable iron.

    a. Do not use die cast zinc fittings.

4. Contractor to minimize the use/lengths to greatest extent possible.

2.5 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

B. Fittings:

1. Fittings to be manufactured by American Fittings Corporation or approved equal.

2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.

3. Material: Use steel or malleable iron.

    a. Do not use die cast zinc fittings.

4. Contractor to minimize the use/lengths to greatest extent possible.

2.6 GALVANIZED STEEL ELECTRICAL METALLIC TUBING (EMT)

A. Description: NFPA 70, Type EMT galvanized steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

B. Fittings:

1. Fittings to be manufactured by American Fittings Corporation or approved equal.

2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.

3. Material: Use steel or malleable iron.

a. Do not use die cast zinc fittings.

4. Connectors and Couplings: Use compression/gland or set-screw type.

a. Do not use indenter type connectors and couplings.

2.7 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 80 unless otherwise indicated; rated for use with conductors rated 90 degrees C.

B. Fittings:

1. Manufacturer: Same as manufacturer of conduit to be connected, American Fittings Corporation, or approved equal.

2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.8 ACCESSORIES

A. Conduit Joint Compound: Corrosion-resistant, electrically conductive compound listed as complying with UL 2419; suitable for use with conduit to be installed.

B. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

C. Pull Strings: Use nylon or polyester tape with average breaking strength of not less than 1,250 lbf.

D. Foam Conduit Sealant:

1. Removable, two-part, closed-cell foam, specifically designed for sealing conduit openings against water, moisture, gases, and dust.

2. Suitable for use with conductors/cables and associated insulation/jackets to be installed.

3. Rated to hold minimum of 10 ft water head pressure.

E. Conduit Mechanical Seals:

1. Listed as complying with UL 514B.

2. Specifically designed for sealing conduit openings against water, moisture, gases, and dust.

3. Suitable for sealing around conductors/cables to be installed.

F. Sealing Systems for Concrete Penetrations:

1. Sleeves: Provide water stop ring or cement coating that bonds to concrete to prevent water infiltration.

2. Rate for minimum of 40 psig; suitable for sealing around conduits to be installed.

G. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for conduits and roofing system to be installed; designed to accommodate existing penetrations where applicable.

H. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.

I. Duct Bank Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for concrete encasement in open trench installation; suitable for conduit/duct arrangement to be installed.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install conduit in accordance with NECA 1.

C. Install galvanized steel rigid metal conduit (RGS) in accordance with NECA 101.

D. Rigid Polyvinyl Chloride (PVC) Conduit: Install in accordance with NECA 111.

E. Conduit Routing:

1. Unless dimensioned, conduit routing indicated is diagrammatic.

2. When conduit destination is indicated without specific routing, determine exact routing required.

3. Conceal all conduits within new walls and above ceilings where feasible/possible. Conduits within the control building to be concealed to greatest extent possible.

4. Conduits installed underground or embedded in concrete may be routed in shortest possible manner unless otherwise indicated. Route other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.

5. Arrange conduit to maintain adequate headroom, clearances, and access.

6. Arrange conduit to provide no more than equivalent of four 90-degree bends between pull points.

7. Arrange conduit to provide no more than 150 feet between pull points.

8. Route conduits above water and drain piping where possible.

9. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.

10. Maintain minimum clearance of 6 inches between conduits and piping for other systems.

11. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:

    a. Heaters.

    b. Hot water piping.

    c. Flues.

12. Group parallel conduits in same area on common rack.

F. Conduit Support:

1. Secure and support conduits in accordance with NFPA 70 using suitable supports and methods approved by authorities having jurisdiction; see Section 26 0529.

2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.

4. Use conduit strap to support single surface-mounted conduit.

    a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.

5. Use metal channel/strut with accessory conduit clamps to support multiple parallel surface-mounted conduits.

6. Use conduit clamp to support single conduit from beam clamp or threaded rod.

7. Use trapeze hangers assembled from threaded rods and metal channel/strut with accessory conduit clamps to support multiple parallel suspended conduits.

8. Use nonpenetrating rooftop supports to support conduits routed across rooftops, where approved.

9. Use of wire for support of conduits is not permitted.

10. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with most stringent requirements.

G. Connections and Terminations:

1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.

2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.

3. Use suitable adapters where required to transition from one type of conduit to another.

4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.

5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.

6. Where spare conduits stub up through concrete floors and are not terminated in box or enclosure, provide threaded couplings equipped with threaded plugs set flush with finished floor.

7. Provide insulating bushings, insulated throats, or listed metal fittings with smooth, rounded edges at conduit terminations to protect conductors.

8. Secure joints and connections to provide mechanical strength and electrical continuity.

H. Penetrations:

1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.

2. Make penetrations perpendicular to surfaces unless otherwise indicated.

3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.

4. Conceal bends for conduit risers emerging above ground.

5. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.

6. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.

7. All conduit penetrations to be properly caulked, sealed, and patched to match adjacent finished surfaces. Coordinate final requirements with the owner.

8. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified.

I. Underground Installation:

1. Minimum Cover, Unless Otherwise Indicated or Required:

a. Underground, Exterior: 18 inches.

b. Under Slab on Grade: 12 inches to bottom of slab.

2. Provide underground warning tape in accordance with Section 26 0553 and the Contract Drawings along entire conduit length for all underground conduits.

3. Refer to Burial Details on Electrical Drawings for additional details.

J. Embedment Within Structural Concrete Slabs (only where approved by Structural Engineer):

    1. Maximum Conduit Size: 1-inch trade size unless otherwise approved.

    2. Secure conduits to prevent floating or movement during pouring of concrete.

K. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:

    1. Where conduits cross structural joints intended for expansion, contraction, or deflection.

    2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.

    3. Where conduits are subject to earth movement by settlement or frost.

L. Conduit Sealing:

    1. Use foam conduit sealant to prevent entry of moisture and gases. This includes, but is not limited to:

        a. Where conduits enter building from outside.

        b. Where service conduits enter building from underground distribution system.

        c. Where conduits enter building from underground.

        d. Where conduits may transport moisture to contact live parts.

    2. Where conduits cross barriers between areas of potential substantial temperature differential, use foam conduit sealant at accessible point near penetration to prevent condensation. This includes, but is not limited to:

        a. Where conduits pass from outdoors into conditioned interior spaces.

        b. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

M. Provide pull string in each empty conduit and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.

N. Provide grounding and bonding; see Section 26 0526.

O. Identify conduits; see Section 26 0553.

3.3 FIELD QUALITY CONTROL

A. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

B. Correct deficiencies and replace damaged or defective conduits.

3.4 CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

3.5 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION

SECTION 26 0537 - BOXES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

C. Underground boxes/enclosures.

1.2 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0529 - Hangers and Supports for Electrical Systems.

C. Section 26 0534 - Conduit:

1. Conduit bodies and other fittings.

2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.

D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26 2726 - Wiring Devices:

1. Wall plates.

2. Additional requirements for locating boxes for wiring devices.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

D. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2012.

E. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013.

F. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports; 2013.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. SCTE 77 - Specification for Underground Enclosure Integrity; 2013.

I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

J. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

K. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

L. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

M. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.

2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.

3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.

4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.

5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.

6. Coordinate the work with other trades to preserve insulation integrity.

7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.

8. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for outlet and device boxes, junction and pull boxes, cabinets and enclosures, and underground boxes/enclosures.

B. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

C. Project Record Documents: Record actual locations for outlet and device boxes, junction boxes, pull boxes, cabinets and enclosures, and underground boxes/enclosures.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.1 BOXES

A. General Requirements:

1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.

2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.

3. Provide products listed, classified, and labeled as suitable for the purpose intended.

4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

6. All new/modified boxes to be provided with covers and caps (all conduit knock-outs to be closed).

B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:

1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.

2. Use cast iron boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.

3. Use cast iron boxes where exposed galvanized steel rigid metal conduit is used.

4. Use nonmetallic boxes where exposed rigid PVC conduit is used.

5. Use suitable concrete type boxes where flush-mounted in concrete.

6. Use suitable masonry type boxes where flush-mounted in masonry walls.

7. Use raised covers suitable for the type of wall construction and device configuration where required.

8. Use shallow boxes where required by the type of wall construction.

9. Do not use "through-wall" boxes designed for access from both sides of wall.

10. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.

11. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.

12. Nonmetallic Boxes: Comply with NEMA OS 2, and list and label as complying with UL 514C.

13. Boxes for Supporting Luminaires: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.

14. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.

15. Wall Plates: Comply with Section 26 2726.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:

1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.

2. Provide block-off plates for all existing cabinets, enclosures, and boxes in which are existing to remain but have had conduits/circuits remoived. To clarify, cabinets, enclosures, and boxes are to be 100% closed with no openings upon completion of project. Contract to field verify.

3. NEMA 250 Environment Type, Unless Otherwise Indicated:

    a. Indoor Clean, Dry Locations: Type 1, painted steel.

    b. Indoor Process rooms: Type 4X, Stainless steel.

    c. Outdoor Locations: Type 4X, stainless steel.

4. Junction and Pull Boxes Larger Than 100 cubic inches:

    a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.

5. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.

D. Underground Boxes/Enclosures:

1. Description: In-ground, open bottom boxes furnished with flush, non-skid, gasketed covers with legend indicating type of service and stainless steel tamper resistant cover bolts.

2. Size: As indicated on drawings.

3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 12 inches.

4. Provide logo on cover to indicate type of service.

5. Refer to spec section 26 0543 for additional info.

6. Polymer Concrete Underground Boxes/Enclosures: Comply with SCTE 77.

    a. Manufacturers:

        1) Hubbell Incorporated; Quazite Products: www.hubbellpowersystems.com

        2) Oldcastle Precast, Inc: www.oldcastleprecast.com

    b. Combination fiberglass/polymer concrete boxes/enclosures are acceptable.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide separate boxes for emergency power and normal power systems.

E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.

G. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.

H. Box Locations:

1. Locate boxes to be accessible. Provide access panels in accordance with specifications as required.

2. Unless dimensioned, box locations indicated are approximate.

3. Locate boxes as required for devices installed under other sections or by others.

    a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 26 2726.

4. Locate boxes so that wall plates do not span different building finishes.

5. Locate boxes so that wall plates do not cross masonry joints.

6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.

7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.

8. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.

    a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.

9. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26 0534.

I. Box Supports:

1. Secure and support boxes in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.

2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.

3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.

J. Install boxes plumb and level.

K. Flush-Mounted Boxes:

1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.

2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.

3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.

L. Install boxes as required to preserve insulation integrity.

M. Underground Boxes/Enclosures:

1. Install enclosure on gravel base, minimum 6 inches deep.

2. Flush-mount enclosures located in concrete or paved areas.

3. Mount enclosures located in landscaped areas with top at 1 inch above finished grade.

4. Install additional bracing inside enclosures in accordance with manufacturer's instructions to minimize box sidewall deflections during backfilling. Backfill with cover bolted in place.

5. Refer to contract drawings and specification section 26 0543.

N. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

O. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified.

P. Close unused box openings.

Q. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

R. Provide grounding and bonding in accordance with Section 26 0526.

S. Identify boxes in accordance with Section 26 0553.

3.3 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.4 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION

SECTION 26 0543 - UNDERGROUND ELECTRICAL WORK

PART 1 - GENERAL

1.1 DESCRIPTION:

A. Under this Section, the Contractor shall furnish all labor, materials and equipment for Underground Electrical Work, as shown on the Plans, as specified, and/or directed.

1.2 REFERENCES:

A. The publications listed below and their latest revisions form a part of this Specification. Adhear to applicable sections of the following publications:

1. American National Standards Institute (ANSI) Publications.

2. American Society for Testing and Materials (ASTM) Publications

3. Institute of Electrical and Electronics Engineers (IEEE) Publications.

4. National Fire Protection Association (NFPA) Publications:

5. American Concrete Institute (ACI) Publications:

6. Underwriters Laboratories (UL)

7. National Electrical Manufacturer's Association (NEMA) Publications

B. GENERAL REQUIREMENTS: Specification section 26 0510, applies to this Section with additions and modifications specified herein.

C. Underground Service: Terminate underground service into buildings at interior terminating points indicated. Protect ends of underground conduit with threaded metal caps until connections are made.

D. SUBMITTALS:

1. Shop Drawings (S) or Manufacturer’s Data (M):

a. Cable (M)

b. Conduit (M)

c. Splice kits (M)

d. Insulating tape (M)

e. Hand hole frames and covers (S) (M)

f. Cable lubricants (M)

g. Sealing materials for hand hole joints (M)

2. Manufacturer's Instructions:

   a. Manufacturer's directions for use of ground megger with proposed method indicated.

   b. Terminator manufacturer's installation instructions.

3. Certificates of Compliance:

4. Materials and Equipment: Provide manufacturer's statement certifying that the product supplied meets or exceeds contracts requirements.

   a. Hand holes and accessories.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT: PROVIDE MATERIALS AND EQUIPMENT LISTED BY UL OR APPROVED BY FACTORY MUTUAL (FM) SYSTEM WHEN SUCH EQUIPMENT IS LISTED OR APPROVED.

A. Conduit (also reference specification section 26 0534 for additional requirements): Shall be as indicated on the Contract Drawings Raceway Schedule conforming to the following:

1. Rigid galvanized steel conduit and fittings shall conform to the requirements of UL 6 and UL 1242, for threaded type, respectively, and shall be coated with a polyvinyl chloride (PVC) sheath bonded to the galvanized exterior surface, nominal 40 mils thick, conforming to NEMA RN 1, Type A40, except that hardness shall be nominal 85 Shore A durometer, dielectric strength shall be minimum 400 volts per mil at 60 Hz, tensile strength shall be minimum 3500 psi, and aging shall be minimum 1000 hours in an Atlas Weatherometer.

2. Plastic conduit for direct burial shall be PVC conforming to NEMA TC 2 (conduit) and NEMA TC 3 (fittings). Type shall be as indicated on Contract Drawings.

3. Plastic Insulating Tape: UL 510.

4. Outlet boxes for use with rigid or flexible steel conduit shall be cast metal cadmium or zinc coated if of ferrous metal with gasketed closures and shall conform to UL 514A. Fittings for steel conduit and outlet boxes shall conform to UL 514B.

5. Refer to specification section 26 0534 and raceway schedule on Contract Drawings for additional requirements/information.

B. WIRE & CABLE:

1. Wire and cable conductor sizes are designated by American Wire Gauge (AWG) and Thousands of Circular Mils (MCM). Conductor and conduit sizes indicated are for copper conductors, unless otherwise noted. Insulated conductors shall bear the date of manufacture imprinted on the wire insulation with other identification. Wire and cable manufactured more than 24 months before delivery to the job site shall not be used.

2. Conductors rated 600 volts and less, including service entrances, shall conform to UL 854, Type XHHW-2. Conductor size and number of conductors in each cable shall be as indicated. Cable shall be color coded. Conductor identification shall be provided within each enclosure where a tap, splice, or termination is made. Conductor identification shall be by color-coded insulated conductors, plastic-coated self-sticking printed markers, colored nylon cable ties and plates, or heat shrink type sleeves. Control circuit terminations shall be properly identified.

3. Shielded control wire shall be direct burial rated, insulated twisted pair #18 copper conductors with braid or tape shields, number of pairs per cable as scheduled on the Contract Drawings.

4. Pull Wire: Shall be plastic, having a minimum tensile strength of 200 pounds.

5. Connectors and Terminals: Shall be designed and approved for use with the associated conductor material, and shall provide a uniform compression over the entire contact surface. Solderless terminal lugs shall be used on stranded conductors

6. Grounding and Bonding Equipment: UL 467. Ground rods shall be copperweld type copper clad steel with diameter adequate to permit driving to full length of the rod, but not less than 3/4 inch in diameter and 10 feet long unless otherwise indicated.

7. Refer to additional specification sections for additional requirements/information.

C. Handholes (where shown on the Contract Drawings):

1. Power and data pull boxes shall be constructed of polymer concrete with steel and/or fiberglass reinforcement. Hand holes shall be non-conductive, fire retardant material, skid resistant, gasketed cover. Provide Penta bolts. Provide logo on cover (Electric). Provide complete assembly with cable entry openings. Hand Holes to be sized in accordance with NEC article 314.30. Covers shall be capable of being locked into position. Hand holes must meet all requirements of ANSI/SCTE 77. Manufactured by Quazite, CDR, Hubbell Enclosures, Oldcastle, or approved equal. Polymer concrete/fiberglass pull boxes. Provide split handhole with permanent divider for all hand hole to be used for power and communication/control circuits. Refer to the contract drawings for additional information.

WIRE & CABLE:

3.1 INSTALLATION: UNDERGROUND INSTALLATION SHALL CONFORM TO ANSI C2 AND NFPA 70 EXCEPT AS OTHERWISE SPECIFIED OR INDICATED.

A. Contractor Damage: The Contractor shall promptly repair any indicated utility lines or systems damaged by Contractor operations. Damage to lines or systems not indicated, which are caused by Contractor operations, shall be treated as “Changes” under the terms of the General Provisions of the Contract. If the Contractor is advised in writing of the location of a non-indicated line or system, such notice shall provide that portion of the line or system with “indicated” status in determining liability for damages. In any event, the Contractor shall immediately notify the Engineer of any such damage.

B. Underground ducts without concrete encasement: Conduits shall be per the Raceway Schedule on the Contract Drawings.

C. The top of the conduit shall be not less than 24 inches below grade, shall have a minimum slope of 3 inches in each 100 feet away from buildings and toward manholes and other necessary drainage points, and shall run in straight lines except where a change of direction is necessary. As each conduit run is completed, a testing mandrel not less than 12 inches long with a diameter 1/4 inch less than the inside diameter of the conduit shall be drawn through each conduit, after which a stiff bristled brush shall be drawn through until the conduit is clear of earth, sand, or gravel particles. Conduit plugs shall then immediately be installed. Ensure a minimum 3 inch clearance from the conduit to each side of the trench. Grade the bottom of the trenches smooth; where rock, soft spots, or sharp edged materials are encountered, excavate the bottom for an additional 3 inches; fill with sand or earth, free from particles that would be retained on a 1/4 inch sieve; and tamp level with the original bottom.

D. Under roads and paved areas, install conduits in reinforced concrete encasement of rectangular cross section providing a minimum of 3 inch concrete cover around ducts. The concrete encasement shall extend at least 5 feet beyond the edges of paved areas and roads.

E. Separate multiple conduits with a minimum concrete thickness of 2 inches, except that light and power conduits shall be separated from control, signal, and telephone conduits by a minimum distance of 3 inches. Stagger the joints of the conduits by rows and layers to strengthen the conduit assembly. Provide plastic duct spacers that interlock vertically and horizontally. Spacer assembly shall consist of base spacers, intermediate spacers, and top spacers to provide a completely enclosed and locked in conduit assembly. Install spacers per manufacturer's instructions, but provide a minimum of two spacer assemblies per 10 feet of conduit assembly.

F. Duct banks, except at conduit risers, with changes in direction of runs exceeding a total of 10 degrees, either vertical or horizontal, shall be accomplished by long sweep bends having a minimum radius of curvature of 25 feet; sweep bends may be composed of one or more curved or straight sections or combinations thereof. Manufactured bends shall have a minimum radius of 24 inches for use with conduits of less than 3 inches in

diameter and a minimum radius of 36 inches for ducts of 3 inches in diameter and larger. Excavate trenches along straight lines.

G. New conduit indicated as being unused or empty shall be provided with plugs on each end. Plugs shall contain a weep hole or screen to allow water drainage. Provide a plastic pull rope having 3 feet of slack at each end of unused or empty conduits.

H. Underground Conduit for Service Into Buildings: Shall be rigid steel from the service equipment to a point 5 feet beyond the building and projections thereof. Protect the ends of the conduit by threaded metal caps or bushings; coat the threads with graphite grease or other coating. Clean and plug conduit until conductors are installed.

I. Concrete for Electrical Requirements: Shall be composed of fine and coarse aggregate, Portland cement, and water proportioned and mixed to produce a plastic, workable mixture. Fine aggregate shall be of hard, dense, durable, clean, and uncoated sand. The coarse aggregate shall be 3/16 inch to 1 inch size. The fine and coarse aggregates shall not contain dirt, vegetable matter, soft fragments, or other deleterious substances. Water shall be fresh, clean, and free from salts, alkali, organic matter, and other impurities. Concrete shall be 3000 psi minimum ultimate 28 day compressive strength. Slump shall not exceed 4 inches. Retempering of concrete will not be permitted. Exposed, unformed concrete surfaces shall be given a smooth, wood float finish. Concrete shall be cured for a period of not less than 7 days, and concrete made with high early strength Portland cement shall be repaired by patching honeycombed or otherwise defective areas with cement mortar as directed. Air entrain concrete exposed to weather using an air entraining admixture conforming to ASTM C260. Air content shall be between 4 and 6 percent.

J. Buried Utility Warning and Identification Tape: Provide detectable aluminum foil plastic backed tape or detectable magnetic plastic tape manufactured specifically for warning and identification of buried cable and conduit. Tape shall be detectable by an electronic detection instrument. Provide tape in rolls, 2 inches minimum width, color coded for the utility involved with warning and identification imprinted in bold black letters continuously and repeatedly over entire tape length. Warning and identification shall be CAUTION BURIED ELECTRIC CABLE BELOW or similar. Use permanent code and letter coloring unaffected by moisture and other substances contained in trench backfill material. Bury tape with the printed side up at a depth of 12 inches below the top surface of earth or the top surface of the subgrade under pavements.

K. Unpaved surfaces disturbed during the installation of duct or direct burial cable shall be restored to the original elevation and condition. Sod or topsoil shall be preserved carefully and replaced after the backfilling is completed. Replace damaged sod with sod of equal quality. Where the surface is disturbed in a newly seeded area, the disturbed surface shall be reseeded with the same quantity and formula of seed as that used in the original seeding.

L. Paving Repairs: Where trenches, pits, or other excavations are made in existing roadways and other areas of pavement where surface treatment of any kind exists, such surface treatment or pavement shall be restored to the same thickness and in the same kind as previously existed, except as otherwise specified, and to match and tie into the adjacent and surrounding existing surfaces in a neat and acceptable manner.

M. Cable Pulling: Test existing ducts with a mandrel and thoroughly swab out to remove foreign material before the pulling of cables. Cable lubricants shall be soapstone, graphite, or talc for rubber or plastic jacketed cables. Cable pulling tensions shall not exceed the maximum pulling tension recommended by the cable manufacturer. Do not exceed the specified cable bending radii when installing cable under any conditions, including turnups into switches, transformers, switchgear, switchboards, and other enclosures. Cable with tape shield shall have a bending radius not less than 12 times the overall diameter of the completed cable. Cable with wire shield shall have a bending radius not less than eight times the overall diameter of the completed cable. If basket grip type cable pulling devices are used to pull cable in place, cut off the section of cable under the grip before splicing and terminating.

N. Secondary cable runs, 600 volts and less, shall include an insulated copper equipment grounding conductor sized as required by the rating of the overcurrent device supplying the phase conductors.

O. Excavating, Backfilling, and Compacting: Excavate to depths indicated. If hard material is encountered, the provisions of the contract respecting an adjustment for changed conditions shall apply, subject to the requirements of notification thereunder being given. Hard material shall be defined as solid rock; firmly cemented unstratified masses; conglomerate deposits possessing the characteristics of solid rock not ordinarily removed without systematic drilling and blasting; or any boulder, masonry, or concrete (except pavement) exceeding 1/2 cubic yard in volume.

P. Excavated materials not required or suitable for backfill shall be removed from the project site. Provide sheeting and shoring as necessary for protection of work and safety of personnel. Remove water from excavation by pumping or other approved method.

Q. Backfilling around structures shall consist of earth, loam, sand clay, or sand and gravel, free from large clods of earth or stones over 1 inch in size. Backfill materials shall be placed symmetrically on all sides in loose layers not more than 9 inches deep. Each layer shall be moistened, if necessary, and compacted with mechanical or hand tampers to 90 percent compaction.

R. Backfilling Around Hand Holes: Provide excavation and backfilling include minimum 6” gravel base under the hand hole assembly with the gravel 3“ to 4” wider than the sides of the hand hole. (Internal bracing may be warranted for any manufacturer’s underground enclosure if 95% compaction is required or if heavy vehicles are going to be present during construction and/or throughout the life of the enclosure. See manufacturer recommended practices and instruction including applicable sizes that would require internal bracing.)

S. Backfilling Trenches: Place backfill in layers not more than 6 inches thick, and compact each layer. Backfilling shall progress as rapidly as the construction, testing, and acceptance of the work permits. Backfill shall be free from roots, wood scrap material, and other vegetable matter and refuse. Compaction of backfill shall be to 90 percent of ASTM D698 density. The first layer shall be earth or sand, free from particles that would be retained on a 1/4 inch sieve and extending not less than 3 inches above the top of the conduit or cables. The succeeding layers shall be excavated material having stones no larger than would pass through a 4 inch ring. The backfill may be moistened. The backfill

shall be level with the adjacent surface, except that in sodded areas, leave a space equal to the thickness of the sod.

T. Splices for 600 Volt Class Cables: Splices in underground systems shall be made only in accessible locations such as hand holes, using a compression connector on the conductor and by insulating and waterproofing by one of the following methods suitable for continuous submersion in water.

1. Cast type splice insulation shall be provided by means of a molded casting process employing a thermosetting epoxy resin insulating material which shall be applied by a gravity poured method or by a pressure injected method. The component materials of the resin insulation shall be in a packaged form ready for convenient mixing without removing from the package. Do not allow the cables to be moved until after the splicing material has completely set.

2. Gravity poured method shall employ materials and equipment contained in an approved commercial splicing kit which includes a mold suitable for the cables to be spliced. When the mold is in place around the joined conductors, prepare and pour the resin mix into the mold. Do not allow cables to be moved until after the splicing materials have completely set.

U. Grounding: Noncurrent carrying metallic parts associated with electrical equipment shall have a maximum resistance to solid earth ground not exceeding values established within the IEEE Green Book: Where values are not listed within the IEEE Green Book, resistance to solid earth ground shall not exceed 25 ohms.

V. Grounding electrodes shall be cone pointed ground rods, driven full depth plus 6 inches, installed when indicated to provide an earth ground of the appropriate value for the equipment being grounded.

W. Grounding connections which are buried or otherwise normally inaccessible, and excepting specifically those connections for which access for periodic testing is required, shall be made by exothermic weld or compression connector. Exothermic welds shall be made strictly in accordance with the weld manufacturer's written recommendations. Welds which are "puffed up" or which show convex surfaces, indicating improper cleaning, are not acceptable. Mechanical connectors are not required at exothermic weldments. Compression connector shall be the type which uses a hydraulic compression tool to provide the correct circumferential pressure. Tools and dies shall be as recommended by the manufacturer. An embossing die code or other standard method shall provide visible indication that a connector has been adequately compressed on the ground wire.

X. Grounding conductors shall be stranded bare copper conforming to ASTM B8, Class B, for sizes No. 6 AWG and larger, and shall be solid bare copper conforming to ASTM B1 for sizes No. 8 and smaller. Surge arresters shall be grounded to ground rods with No. 4 AWG.

Y. Special Conditions: During the construction of duct banks located in streets, the streets shall remain open to traffic. Plan and execute the work to meet this condition.

Z. Field Tests: As an exception to requirements that may be stated elsewhere in the Contract, notify the Engineer in writing at least 5 working days prior to each test. Furnish labor, equipment, and incidentals required for testing, except that the Owner will provide electric power required for the tests. Correct defects in the work provided by the Contractor and repeat tests until the work is in compliance with contract requirements. Show by demonstration in service that circuits and devices are in good operating condition. Tests shall be such that each item of control equipment will function not less than five times.

AA. Distribution Conductors 600 Volt Class: After wiring is completed and connected ready for operation, but prior to placing systems in service and before any branch circuit breakers are closed, perform insulation resistance tests in all circuits. Measure the insulation resistance between conductors and between each conductor and ground. Use an instrument capable of making measurements at an applied potential of 500 volts. Take readings after the voltage has been applied for a minimum of 1 minute. The minimum insulation resistance for circuits of No. 12 AWG conductors shall be 1,000,000 ohms.

AB. Ground Rods: Test ground rods for ground resistance value before any wire is connected. Perform ground resistance measurements in normally dry weather, not less than 48 hours after rainfall. Ground resistance shall also be measured for each piece of equipment to the ground electrode. Use a portable ground testing megger to test each ground or group of grounds. The instrument shall be equipped with a meter reading directly in ohms or fractions thereof to indicate the ground value of the ground electrode under test. Provide one copy of the ground megger manufacturer's directions, indicating the method to be used.

AC. Compaction: Backfill shall be tested in accordance with ASTM D1556, one test per lift per 2000 square feet.

END OF SECTION

SECTION 26 0553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Wire and cable markers.

D. Voltage markers.

E. Underground warning tape.

F. Warning signs and labels.

1.2 REFERENCE STANDARDS

A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2011.

B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2011.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. NFPA 70E - Standard for Electrical Safety in the Workplace; 2015.

E. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.

B. Sequencing:

1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.

2. Do not install identification products until final surface finishes and painting are complete.

1.4 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

B. Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation and installation of product.

1.5 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.6 FIELD CONDITIONS

A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 - PRODUCTS

2.1 IDENTIFICATION REQUIREMENTS

A. Existing Work: Unless specifically excluded, identify existing elements to remain that are not already identified in accordance with specified requirements.

B. Identification for Equipment:

1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.

a. Panelboards:

1) Identify ampere rating.

2) Identify voltage and phase.

3) Identify power source and circuit number. Include location.

4) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.

5) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.

6) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Identify spares and spaces.

b. Transformers:

1) Identify kVA rating.

2) Identify voltage and phase for primary and secondary.

3) Identify power source and circuit number. Include location.

4) Identify load(s) served. Include location.

c. Enclosed switches, circuit breakers, and motor controllers:

1) Identify voltage and phase.

2) Identify power source and circuit number. Include location.

3) Identify load(s) served. Include location.

d. Time Switches:

1) Identify loads served and associated circuits controlled. Include location.

2. Use voltage marker to identify highest voltage present for each piece of electrical equipment.

3. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.

4. Use identification label or handwritten text using indelible marker on inside of door at each fused switch to identify required NEMA fuse class and size.

5. Use identification label or handwritten text using indelible marker on inside of door at each motor controller to identify nameplate horsepower, full load amperes, code letter, service factor, voltage, and phase of motor(s) controlled.

6. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".

7. Use warning labels to identify required equipment working clearances where indicated or where required by the authority having jurisdiction.

8. Arc Flash Hazard Warning Labels: Use warning labels to identify arc flash hazards for electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized.

a. Minimum Size: 3.5 by 5 inches.

b. Legend: Include orange header that reads "WARNING", followed by the word message "Arc Flash and Shock Hazard; Appropriate PPE Required; Do not operate controls or open covers without appropriate personal protection equipment; Failure to comply may result in injury or death; Refer to NFPA 70E for minimum PPE requirements" or approved equivalent.

C. Identification for Conductors and Cables:

1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 0519.

2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment.

3. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:

a. At each source and load connection.

b. Within boxes.

c. Within equipment enclosures.

d. In cable tray, at maximum intervals of 10 feet.

4. Use wire and cable markers to identify connected grounding electrode system components for grounding electrode conductors.

D. Identification for Raceways:

1. Use voltage markers to identify highest voltage present for accessible conduits at maximum intervals of 10 feet.

2. Use voltage markers, color-coded bands, or factory-painted conduits to identify systems other than normal power system for accessible conduits.

a. Maximum Intervals: 10 feet.

b. Color-Coded Bands: Use vinyl color coding electrical tape to mark bands 3 inches wide.

1) Vinyl Color Coding Electrical Tape: Comply with Section 26 0519.

c. Color Code:

1) Fire Alarm System: Red.

3. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify circuits enclosed for accessible conduits at wall

penetrations, at floor penetrations, at roof penetrations, and at equipment terminations.

4. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify spare conduits at each end. Identify purpose and termination location.

5. Use underground warning tape to identify underground raceways.

6. Use voltage markers to identify highest voltage present for wireways at maximum intervals of 10 feet.

E. Identification for Boxes:

1. Use voltage markers to identify highest voltage present.

2. Use voltage markers or color coded boxes to identify systems other than normal power system.

a. Color-Coded Boxes: Field-painted per the following color code:

1) Fire Alarm System: Red.

3. Use identification labels or handwritten text using indelible marker to identify circuits enclosed.

4. Use warning labels to identify electrical hazards with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".

F. Identification for Devices:

1. Wiring Device and Wallplate Finishes: Comply with Section 26 2726.

2. Use identification label to identify fire alarm system devices.

3. Use identification label or engraved wallplate to identify serving branch circuit for all receptacles.

4. Use identification label or engraved wallplate to identify load controlled for wall-mounted control devices controlling loads that are not visible from the control location and for multiple wall-mounted control devices installed at one location.

G. Identification for Luminaires:

1. Use permanent red dot on luminaire frame to identify luminaires connected to emergency power system, including luminaires with integral emergency battery back-up.

2.2 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:

1. Materials:

    a. Indoor Clean, Dry Locations: Use plastic nameplates.

    b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.

2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.

3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.

4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.

5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

B. Identification Labels:

1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.

    a. Use only for indoor locations.

2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Equipment Identification:

1. Minimum Size: 1 inch by 2.5 inches.

2. Legend:

    a. Equipment designation or other approved description.

3. Text: All capitalized unless otherwise indicated.

4. Minimum Text Height:

    a. Equipment Designation: 1/2 inch.

    b. Exception: Provide minimum text height of 1 inch for equipment located more than 10 feet above floor or working platform.

5. Color:

    a. Normal Power System: White text on black background.

    b. Fire Alarm System: White text on red background.

2.3 WIRE AND CABLE MARKERS

A. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.

B. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

C. Legend: Power source and circuit number or other designation indicated.

D. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.

E. Minimum Text Height: 1/8 inch.

F. Color: Black text on white background unless otherwise indicated.

2.4 VOLTAGE MARKERS

A. Markers for Conduits: Use factory pre-printed self-adhesive vinyl, self-adhesive vinyl cloth, or vinyl snap-around type markers.

B. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.

C. Minimum Size:

1. Markers for Equipment: 1 1/8 by 4 1/2 inches.

2. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.

3. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches.

4. Markers for Junction Boxes: 1/2 by 2 1/4 inches.

D. Legend:

1. Markers for Voltage Identification: Highest voltage present.

2. Markers for System Identification:

a. Other Systems: Type of service.

E. Color: Black text on orange background unless otherwise indicated.

2.5 UNDERGROUND WARNING TAPE

A. Materials: Use foil-backed detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.

B. Foil-backed Detectable Type Tape: 3 inches wide, with minimum thickness of 5 mil, unless otherwise required for proper detection.

C. Legend: Type of service, continuously repeated over full length of tape.

D. Color:

1. Tape for Buried Power Lines: Black text on red background.

2. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

2.6 WARNING SIGNS AND LABELS

A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

B. Warning Signs:

1. Materials:

a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.

b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.

2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.

3. Minimum Size: 7 by 10 inches unless otherwise indicated.

C. Warning Labels:

1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.

2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.

3. Minimum Size: 2 by 4 inches unless otherwise indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:

1. Surface-Mounted Equipment: Enclosure front.
2. Flush-Mounted Equipment: Inside of equipment door.
3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
4. Elevated Equipment: Legible from the floor or working platform.
5. Branch Devices: Adjacent to device.
6. Interior Components: Legible from the point of access.
7. Conduits: Legible from the floor.
8. Boxes: Outside face of cover.
9. Conductors and Cables: Legible from the point of access.
10. Devices: Outside face of cover.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.

1. Do not use adhesives on exterior surfaces except where substrate cannot be penetrated.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Install underground warning tape above buried lines with one tape per trench at 3 inches below finished grade.

G. Secure rigid signs using stainless steel screws.

H. Mark all handwritten text, where permitted, to be neat and legible.

3.3 FIELD QUALITY CONTROL

A. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION

SECTION 26 0915 - FIBER OPTIC CABLING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Fiber Optic Cable & Accessories

B. Fiber Optic Patch Panel

C. Installation

D. Terminations & Testing

E. Commisioning, Startup Services, & Training

1.2 RELATED SECTIONS

A. All Division 26 Specifications

1.3 REFERENCE STANDARDS

A. Underwriters Laboratories, Inc. (UL)

1. UL 1581 VW-1; Vertical Tray Cable Flame Test.

2. UL 1666 Riser Cable.

B. IEEE Standard 383-1974 Flame Retardancy.

C. ANSI/NECA/BICSI 568-2001, Standard for Installing Commercial Building Telecommunications Cabling.

D. ANSI/TIA/EIA-569-A for maximum length of conduit and bends between pull points and pull box sizing.

E. ISO/IEC 11801 - Type OM3 fiber

F. IEC 60793-2-10 - Type A1a.2 fiber

G. All wiring shall be in complete conformance with the National Electrical Code, State, local and NEMA electrical standards. All incoming and outgoing wires (within control panels whether new or existing) shall be connected to numbered terminal blocks and all wiring neatly tied and fastened to chassis as required.

H. All equipment and installations shall satisfy applicable Federal, State, and local codes.

I. Furnish products listed and classified by Underwriters Laboratories (UL), CSA, or FM approval as suitable for purpose specified and indicated.

1.4 REQUIRED MEETINGS & COORDINATION

A. Contractor to take the lead on coordinating communication requirements with other suppliers of Ethernet/fiber-based systems and control panels. Refer to Contract Drawings for system architecture.

1. Coordinate with the general contractor, engineer, and owner as it relates to the proposed process equipment and control panels shown on the Contract Drawings that are provided by others.

2. All meetings to take place at the project site.

1.5 SUBMITTALS

A. Contractor to provide one (1) electronic copy of the following documentation:

1. Bill of Materials.

2. Vendor Data/Product Sheets.

3. System Warranty (see below).

4. Cable pulling plan that specifies the sequence of work tasks, materials and equipment used, and a schedule for the work. PDF drawings illustrating all runs of fiber, patch panels (if required), network cabinets (if required), transition from jacked cable to individual fibers, Ethernet switches, and PLCs.

    a. Cable pulling plan to generally show routing of specified fiber optic cabling.

5. Proposed test equipment to be used including optical time domain reflectometer (OTDR) and power meter, including make and model number. Detail the exact procedure that will be utilized to test cable reels once they are delivered to the site. Separately detail the procedure that will be utilized to test installed cables.

1.6 WARRANTY

A. The Contractor shall provide with the above submittals, a written parts warranty against system failure for twelve (12) months from system startup, not to exceed eighteen (18) months from date of shipment from their factory. This warranty period will, with the exception of human negligence or acts of nature such as lightning, floods, etc., provide for repair or replacement of any defective or failed components, at the project site, and at no cost to others.

1. Warranty to include all equipment, hardware, devices, cabling, instruments, etc. that are specified and provided as part of this specification.

1.7 QUALITY ASSURANCE

A. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.

PART 2 - PRODUCTS

2.1 FIBER OPTIC CABLING

A. General Requirements

1. Refer to Contract Drawings for routing and length requirements.

a. Contractor to provide pull points as necessary. Note, pull points not always shown on the Contract Drawings for clarity.

b. Provide in continuous lengths. No splices permitted.

2. Provide multi-mode, optical glass fiber cores compatible with LED-based transmission systems and the media switch specified below.

3. All-plastic fiber-core construction is not acceptable.

4. Provide as OM4 rated.

B. Fiber Optic Cable

1. Heavy duty, tight-buffered or gel-filled construction with additional strength members, PVC inner jacket, and oil, water, and chemical resistant, UV stabilized, flame retardant, polyethylene outer jacket, designed for indoor/outdoor application and direct burial.

2. Cable Specifications

a. Fiber Size - 50 micron/125 micron (core/cladding diameter).

b. Fiber Count - Twelve fibers (minimum).

c. Maximum Short-Term Tensile Load - 300 lb.

d. Maximum Long-Term Tensile Load - 180 lbs.

e. Crush Resistance - 80 pounds per square inch.

f. Operating Temperature - -40 to +50 degrees C.

g. Fibers shall have the following optical properties:

1) Maximum attenuation at 850 nm wavelength - 2.5 dB/km.

2) Maximum attenuation at 1300 nm wavelength - 0.8 dB/km.

3) Minimum bandwidth at 850 nm wavelength 1500 MHz/km.

4) Minimum bandwidth at 1300 nm wavelength - 500 MHz/km.

5) Numerical aperture - 0.250 + 0.015.

3. Provide SC style connectors for terminating cabling at media switches, patch panels, control panels.

4. All unused fibers are to be coiled within plastic wire duct for protection. Provide additional plastic wire duct within control panel as necessary. Contractor to field verify.

C. Manufacturer

1. Corning, Model ClearCurve.

2. OFS Laboratories, Model LaserWave 300.

3. Belden.

4. Approved equal.

2.2 FIBER OPTIC PATCH PANEL

A. Contractor to provide a 6-pair (12-port) fiber optic patch panel within a NEMA 1 enclosure. Install patch panel adjacent to each control panel where fiber optic cable is shown as being terminated. Patch panel to accept incoming fiber optic cabling. Fiber optic patch panel enclosure to be item # FE-WM12PP as manufactured by L-com or approved equal. Fiber optic patch panel to be item # FSP-LCD6-BR as manufactured by L-com or approved equal.

B. Provide all necessary patch cables, breakout kits, connectors, and termination kits.

C. Contractor to field verify/locate. Locate adjacent to proposed control panels. Coordinate final location with the owner and all trade contractors prior to rough-in.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Contractor responsible for terminating and testing incoming fiber optic cabling at locations as shown on the Contract Drawings. Provide all necessary connectors, patch cables, breakout kits, terminations, etc..

B. Install equipment at locations indicated on the drawings. Install fiber optic cabling per approved cable pulling plan (refer to above submittal requirements).

C. Provide Maxcell Fabric Innerduct within all conduit systems which are to contain Fiber Optic Cable. Refer to Contract Drawings for additional information.

D. Provide all necessary cable, conduits, and fittings as required to provide a fully operable system. All wiring to be in conduit. Refer to the contract drawings for additional information/requirements.

E. Install fiber optic cabling per manufacturer requirements.

1. Adhere to ANSI/TIA/EIA-569-A for maximum length of conduit and bends between pull points and pull box sizing.

2. Lubricate cables during installation. Do not exceed cable manufacturer's specifications for tensile strength and bending radius.

3. Label cables and reels prior to pulling cable into place. Labeling to be in accordance with ANSI/TIA/EIA-606 standards.

4. Provide adequate put-up lengths on cable reels to make termination-to-termination runs without splices. Spliced cables are not acceptable.

5. Support cables in riser conduits at intervals as required by NEC and cable manufacturer.

F. Contractor to perform point-to-point wire testing on all circuitry entering/leaving the control panels. Verify wire integrity, continuity, and proper transmission of signal.

G. Refer to the contract drawings for all field wiring specifications/requirements.

3.2 CHECKOUT, TESTING, AND CERTIFICATION

A. Upon receipt of fiber optic cable reels at the site, perform pre-installation ("on the reel") OTDR measurements on each strand of optical fiber to verify attenuation, length and continuity. The optical fiber shall be tested using a multimode OTDR at 850-nm wavelength. Record the results of all measurements and submit to the Engineer within one week after cable delivery to the site. Cable reels that fail continuity or that have higher than specified attenuation (greater than 3 dB) shall be subject to rejection and shall be replaced at no additional cost to the Owner.

B. Make the following tests after cable installation:

1. Visually inspect terminations for out-of-round condition and surface defects such as micro-chips and cracks using a 200x inspection microscope.

2. Upon completion of the cable installation, including all connectors, perform 100 percent bi-directional end-to-end loss testing on each optical fiber. The

multimode fiber shall be tested using Light Emitting Diode (LED) sources (insertion loss test set and power meter) operating at 850 nm wavelength.

3. The calculated and measured values of the end to end shall vary by no more than +0.75 dB. End-to-end losses shall not exceed 3 dB. In the event that any differences are in excess, implement troubleshooting techniques and methods to provide agreement. If the discrepancies cannot be reconciled, the cable installation shall be removed, replaced, and retested at no additional cost to the Owner.

C. Verify proper identification numbering and color coding on cables and fibers.

D. Install, test, and service equipment as necessary to accommodate the sequence of construction.

E. Perform an additional one visit of on-site testing of fiber with OTDR test equipment at the request of the Engineer to assist in the troubleshooting of network issues as necessary to eliminate the fiber as the source of potential network issues.

F. Unless waived in writing by the Engineer, all tests shall be made in the presence of a duly authorized representative of the Owner. When the presence of such representative is so waived, certified results of the tests made and the results thereof shall be furnished by the Contractor.

G. All tests shall be performed in the presence of the Owner. Written notice of all tests shall be given to the Engineer and Owner at least two weeks in advance.

3.3 START-UP SERVICE

A. The contractor shall provide the services of a qualified manufacturer representative to perform the following service duties.

1. Provide a minimum of one (1) day on-site services to provide installation instruction to the contractor on all aspects of equipment installation.

2. Provide a minimum of one (1) day of onsite startup services to provide a final system calibration, programming, and testing after completion of equipment installations.

B. Following completion of the above services, the supplier shall provide an affidavit to the facility, certifying that the system is installed and operating in accordance with the contract documents.

END OF SECTION

SECTION 26 0922 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Occupancy sensors.

B. In-wall time switches.

C. Outdoor photo controls.

1.2 RELATED REQUIREMENTS

A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems.

C. Section 26 0529 - Hangers and Supports for Electrical Systems.

D. Section 26 0537 - Boxes.

E. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

F. Section 26 2726 - Wiring Devices: Devices for manual control of lighting, including wall switches.

1. Includes finish requirements for wall controls specified in this section.

G. Section 26 5100 - Interior Lighting.

H. Section 26 5600 - Exterior Lighting.

1.3 REFERENCE STANDARDS

A. 47 CFR 15 - Radio Frequency Devices; current edition.

B. ANSI C136.24 - American National Standard for Roadway and Area Lighting Equipment - Nonlocking (Button) Type Photocontrols; 2004 (R2010).

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

D. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 773A - Nonindustrial Photoelectric Switches for Lighting Control; Current Edition, Including All Revisions.

G. UL 916 - Energy Management Equipment; Current Edition, Including All Revisions.

H. UL 917 - Clock-Operated Switches; Current Edition, Including All Revisions.

I. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of lighting control devices with millwork, furniture, equipment, etc. Final locations to be coordinated with the Engineer and Owner.

2. Coordinate placement of wall switch occupancy sensors with installed door swings.

3. Coordinate the placement of occupancy sensors with millwork, furniture, equipment or other potential obstructions to motion detection coverage.

4. Coordinate lighting control device product selections with luminaire characteristics; see Section 26 5100 and lighting fixture schedule.

5. Notify Engineer of conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B. Sequencing:

1. Do not install lighting control devices until final surface finishes and painting are complete.

1.5 SUBMITTALS

A. Product Data: Include ratings, operating modes or sequence of functions, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.

1. Occupancy Sensors: Include detailed motion detection coverage range diagrams.

B. Shop Drawings:

1. Occupancy Sensors: Provide lighting plan indicating location, model number, and orientation of each occupancy sensor and associated system component.

C. Field quality control reports.

D. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Operation and Maintenance Data: Include detailed information on device programming and setup.

F. Project Record Documents: Record actual installed locations and settings for lighting control devices.

1.6 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Maintain at project site one copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

D. Product Evaluation and Listing Organization Qualifications: Organization engaged in evaluation of products and services, including those recognized by OSHA as Nationally Recognized Testing Laboratories (NRTL), and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Store products in clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.8 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.9 WARRANTY

A. Provide two year manufacturer warranty for all lighting control devices.

PART 2 - PRODUCTS

2.1 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for purpose intended.

B. Unless specifically indicated as excluded, provide components necessary for complete operating system including, but not limited to, conduit, wiring, connectors, hardware, and accessories.

2.2 OCCUPANCY SENSORS

A. Manufacturers:

1. WattStopper: www.wattstopper.com/#sle.

B. Refer to Contract Drawings for Occupancy Sensor Schedule and Basis of design. All substitutions must be approved by the Engineer.

C. General Requirements:

1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.

2. Sensor Technology as noted on the Drawings.

a. Passive Infrared (PIR) Occupancy Sensors: Designed to detect occupancy by sensing movement of thermal energy between zones.

b. Ultrasonic Occupancy Sensors: Designed to detect occupancy by sensing frequency shifts in emitted and reflected inaudible sound waves.

c. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using combination of both passive infrared and ultrasonic technologies.

3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.

4. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during an adjustable turn-off delay time interval.

5. Dual Technology Occupancy Sensors: Field configurable turn-on and hold-on activation with settings for activation by either or both sensing technologies.

6. Passive Infrared Lens Field of View: Field customizable by addition of factory masking material, adjustment of integral blinders, or similar means to block motion detection in selected areas.

7. Turn-Off Delay: Field adjustable, with time delay settings up to 30 minutes.

8. Sensitivity: Field adjustable.

9. Compatibility (Non-Dimming Sensors): Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, LED lighting systems, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.

10. Load Rating for Line Voltage Occupancy Sensors: As required to control load indicated on drawings.

11. Where wired sensors are indicated, wireless sensors are acceptable provided that components and wiring modifications necessary for proper operation are included.

12. Wireless Sensors:

    a. RF Range: 30 feet through typical construction materials.

    b. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class B application.

    c. Power: Battery-operated with minimum ten-year battery life.

D. Wall Switch Occupancy Sensors:

1. General Requirements:

    a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.

    b. Unless otherwise indicated or required to control load indicated on drawings, provide line voltage units with self-contained relay.

    c. Where indicated, provide two-circuit units for control of two separate lighting loads, with separate manual controls and separately programmable operation for each load.

    d. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).

    e. Manual-Off Override Control: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.

    f. Finish: Match finishes specified for wiring devices in Section 26 2726, unless otherwise indicated.

E. Wall Dimmer Occupancy Sensors:

1. General Requirements:

    a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with field of view of 180 degrees, integrated dimming control capability, and no leakage current to load in off mode.

b. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).

c. Manual-Off Override Control Capability: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.

d. Dimmer: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, and listed as complying with UL 1472; type and rating suitable for load controlled.

e. Provide field adjustable dimming preset for occupied state.

f. Provide fade-to-off operation to notify occupant of impending load turn-off.

g. Finish: Match finishes specified for wiring devices in Section 26 2726, unless otherwise indicated.

F. Ceiling Mounted Occupancy Sensors:

1. General Requirements:

a. Description: Low profile occupancy sensors designed for ceiling installation.

b. Unless otherwise indicated or required to control load indicated on drawings, provide low voltage units, for use with separate compatible accessory power packs.

c. Provide field selectable setting for disabling LED motion detector visual indicator.

d. Occupancy sensor to be field selectable as either manual-on/automatic-off or automatic on/off.

e. Finish: White unless otherwise indicated.

G. Power Packs for Low-Voltage Occupancy Sensors:

1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage occupancy sensors for switching of line voltage loads.

2. Provide quantity and configuration of power and slave packs with associated wiring and accessories as required to control load indicated on drawings.

3. Input Supply Voltage: Dual rated for 120/277 V ac.

4. Load Rating: As required to control the load indicated on drawings.

H. Power Packs for Wireless Occupancy Sensors:

1. Description: Plenum rated, self-contained relay compatible with specified wireless occupancy sensors for switching of line voltage loads.

2. Input Supply Voltage: Dual rated for 120/277 V ac.

2.3 IN-WALL TIME SWITCHES

A. Manufacturers:

1. Wattstopper.

2. Approved equal.

B. Digital Electronic In-Wall Time Switches:

1. Description: Factory-assembled solid state programmable controller with LCD display, suitable for mounting in standard wall box, and listed and labeled as complying with UL 916 or UL 917.

2. Program Capability:

a. Astronomic Time Switches: Capable of different schedule for each day of the week and field-configurable astronomic feature to automatically adjust for seasonal changes in sunrise and sunset times.

3. Provide power outage backup to retain programming and maintain clock.

4. Manual override: Capable of overriding current schedule both permanently and temporarily until next scheduled event.

5. Switch Configuration: Suitable for use in either SPST or 3-way application.

6. Contact Ratings: As required to control the load indicated on drawings.

2.4 OUTDOOR PHOTO CONTROLS

A. Manufacturers:

1. Intermatic, Inc: www.intermatic.com/#sle.

B. Stem-Mounted Outdoor Photo Controls:

1. Description: Direct-wired photo control unit with threaded conduit mounting stem and field-adjustable swivel base, listed and labeled as complying with UL 773A.

2. Housing: Weatherproof, impact resistant polycarbonate.

3. Photo Sensor: Cadmium sulfide.

4. Provide external sliding shield for field adjustment of light level activation.

5. Light Level Activation: 1 to 5 footcandles turn-on and 3 to 1 turn-off to turn-on ratio with delayed turn-off.

6. Voltage: As required to control the load indicated on the drawings.

7. Failure Mode: Fails to the on position.

8. Load Rating: As required to control the load indicated on the drawings.

9. Provide accessory wall-mounting bracket where indicated or as required to complete installation.

C. Button Type Outdoor Photo Controls

1. Description: Direct-wired photo control unit complying with ANSI C136.24 with weatherproof gasketed wall plate where required or indicated, listed and labeled as complying with UL 773A.

2. Housing: Weather resistant polycarbonate.

3. Photo Sensor: Cadmium sulfide.

4. Light Level Activation: 1 to 3 footcandles turn-on and 3 to 1 turn-off to turn-on ratio with delayed turn-off.

5. Voltage: As required to control the load indicated on the drawings.

6. Failure Mode: Fails to the on position.

7. Load Rating: As required to control the load indicated on the drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.

F. Verify that service voltage and ratings of lighting control devices are appropriate for service voltage and load requirements at location to be installed.

G. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

A. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 26 0537 as required for installation of lighting control devices provided under this section. Final locaitons to be coordianted with the owner and architect.

1. Mounting Heights: Unless otherwise indicated, as follows:

    a. Wall Switch Occupancy Sensors: 48 inches above finished floor.

    b. In-Wall Time Switches: 48 inches above finished floor.

2. Orient outlet boxes for vertical installation of lighting control devices unless otherwise indicated.

C. Maintain separation of remote-control, signaling, and power-limited circuits.

1. See manufacturer instructions and Section 26 0519 for control wiring conductors, wiring methods, and identification requirements.

D. Install lighting control devices in accordance with manufacturer's instructions.

E. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

F. Install lighting control devices plumb and level, and held securely in place.

G. Where required and not furnished with lighting control device, provide wall plate; see Section 26 2726.

H. Provide required supports; see Section 26 0529.

I. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

J. Identify lighting control devices; see Section 26 0553.

K. Occupancy Sensor Locations:

1. Location Adjustments: Within the design intent, reasonably minor adjustments to locations may be made in order to optimize coverage and avoid conflicts or problems affecting coverage.

2. Location Adjustments: Locations indicated are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for complete coverage of respective room or area based on manufacturer's recommendations for installed devices.

3. Locate ultrasonic and dual technology passive infrared/ultrasonic occupancy sensors minimum of 4 feet from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.

L. Outdoor Photo Control Locations:

1. Where possible, locate outdoor photo controls with photo sensor facing north. If north facing photo sensor is not possible, install with photo sensor facing east, west, or down.

2. Locate outdoor photo controls so that photo sensors do not face artificial light sources, including light sources controlled by photo control itself.

M. Install outdoor photo controls so that connections are weatherproof. Do not install photo controls with conduit stem facing up in order to prevent infiltration of water into photo control.

N. Unless otherwise indicated, install power packs for lighting control devices above accessible ceiling or above access panel in inaccessible ceiling near sensor location.

O. Where indicated, install separate compatible wall switches for manual control interface with lighting control devices or associated power packs.

P. Unless otherwise indicated, install switches on load side of power packs so that switch does not turn off power pack.

3.4 FIELD QUALITY CONTROL

A. Inspect each lighting control device for damage and defects.

B. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.

C. Test time switches to verify proper operation.

D. Test outdoor photo controls to verify proper operation, including time delays where applicable.

E. Correct wiring deficiencies and replace damaged or defective conductors, cables, and lighting control devices.

3.5 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Engineer.

C. Adjust time switch settings to achieve desired operation schedule as indicated or as directed by Engineer. Record settings in written report to be included with submittals.

D. Adjust external sliding shields on outdoor photo controls under optimum lighting conditions to achieve desired turn-on and turn-off activation as indicated or as directed by Engineer.

3.6 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.7 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of lighting control devices to Engineer, and correct deficiencies or make adjustments as directed.

B. Training: Train Owner's personnel on operation, adjustment, programming, and maintenance of lighting control devices.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

2. Provide minimum of four hours of training.

3. Instructor: Manufacturer's authorized service representative.
4. Location: At project site.

END OF SECTION

SECTION 26 2200 - LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. General purpose transformers.

1.2 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0529 - Hangers and Supports for Electrical Systems.

C. Section 26 0534 - Conduit: flexible conduit connections.

D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.3 REFERENCE STANDARDS

A. 10 CFR 431, Subpart K - Energy Efficiency Program for Certain Commercial and Industrial Equipment - Distribution Transformers; Current Edition.

B. IEEE C57.94 - IEEE Recommended Practice for Installation, Application, Operation, and Maintenance of Dry-Type General Purpose Distribution and Power Transformers; 1982 (R2006).

C. IEEE C57.96 - Guide for Loading Dry-Type Distribution and Power Transformers; 2013.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

E. NECA 409 - Standard for Installing and Maintaining Dry-Type Transformers; 2009.

F. NEMA ST 20 - Dry-Type Transformers for General Applications; 2014.

G. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

H. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. UL 506 - Standard for Specialty Transformers; Current Edition, Including All Revisions.

K. UL 1561 - Standard for Dry-Type General Purpose and Power Transformers; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.

2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.

3. Coordinate the work with placement of supports, anchors, etc. required for mounting.

4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.

5. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. Product Data: Include voltage, kVA, impedance, tap configurations, insulation system class and rated temperature rise, efficiency, sound level, enclosure ratings, outline and support point dimensions, weight, required clearances, service condition requirements, and installed features.

B. Shop Drawings: Provide dimensioned plan and elevation views of transformers and adjacent equipment with all required clearances indicated.

C. Source Quality Control Test Reports: Include reports for tests designated in NEMA ST 20 as design and routine tests.

D. Field Quality Control Test Reports.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Maintenance Data: Include recommended maintenance procedures and intervals.

G. Project Record Documents: Record actual locations of transformers.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

1.8 WARRANTY

A. After equipment is installed and operational, the Contractor shall furnish a two-year warranty against defects in material and workmanship. Warranty coverage shall include all parts, labor, and travel expenses.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Eaton Corporation: www.eaton.com.

B. Source Limitations: Furnish transformers produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

1. To clarify, all power distribution equipment (panelboards, transformers, safety switches, controllers, etc.) as part of this Contract shall be produced by a single manufacturer and supplied by a single supplier.

2.2 TRANSFORMERS - GENERAL REQUIREMENTS

A. Description: Factory-assembled, dry type transformers for 60 Hz operation designed and manufactured in accordance with NEMA ST 20 and listed, classified, and labeled as suitable for the purpose intended.

B. Unless noted otherwise, transformer ratings indicated are for continuous loading according to IEEE C57.96 under the following service conditions:

1. Altitude: Less than 3,300 feet.

2. Ambient Temperature:

    a. Greater than 10 kVA: Not exceeding 104 degrees F.

    b. Less than 10 kVA: Not exceeding 77 degrees F.

C. Core: High grade, non-aging silicon steel with high magnetic permeability and low hysteresis and eddy current losses. Keep magnetic flux densities substantially below saturation point, even at 10 percent primary overvoltage. Tightly clamp core laminations to prevent plate movement and maintain consistent pressure throughout core length.

D. Impregnate core and coil assembly with non-hydroscopic thermo-setting varnish to effectively seal out moisture and other contaminants.

E. Basic Impulse Level: 10 kV.

F. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.

G. Isolate core and coil from enclosure using vibration-absorbing mounts.

H. Nameplate: Include transformer connection data, ratings, wiring diagrams, and overload capacity based on rated winding temperature rise.

2.3 GENERAL PURPOSE TRANSFORMERS

A. Refer to transformer schedule on Contract Drawings.

B. Description: Self-cooled, two winding transformers listed and labeled as complying with UL 506 or UL 1561; ratings as indicated on the drawings.

C. Insulation System and Allowable Average Winding Temperature Rise:

1. Less than 15 kVA: Class 180 degrees C insulation system with 80 degrees C average winding temperature rise.

2. 15 kVA and Larger: Class 220 degrees C insulation system with 115 degrees C average winding temperature rise.

D. Coil Conductors: Continuous copper windings with terminations brazed or welded.

E. Winding Taps:

1. Less than 3 kVA: None.

2. 3 kVA through 15 kVA: None.

3. 15 kVA through 300 kVA: Refer to the Contract Drawings Transformer Schedule.

4. 500 kVA and Larger: Two 2.5 percent full capacity primary taps above and two 2.5 percent full capacity primary taps below rated voltage.

F. Energy Efficiency: Comply with 10 CFR 431, Subpart K.

G. Sound Levels: Standard sound levels complying with NEMA ST 20.

H. Mounting Provisions:

1. Refer to the Contract Drawings and to the below mounting provisions.

a. Less than 15 kVA: Suitable for wall mounting.

b. 15 kVA through 75 kVA: Suitable for wall, floor, or trapeze mounting.

1) Provide a 4" concrete house keeping pad as indicated on the Contract Drawings.

c. Larger than 75 kVA: Suitable for floor mounting.

1) Provide a 4" concrete house keeping pad as indicated on the Contract Drawings.

I. Transformer Enclosure: Comply with NEMA ST 20. Provide with enclosure type (NEMA Rating) per the contract drawings transformer schedule unless otherwise indicated.

1. Environment Type per NEMA 250: As indicated on the drawings.

2. Construction: Steel.

a. Less than 15 kVA: Totally enclosed, non-ventilated.

b. 15 kVA and Larger: Ventilated.

3. Finish: Manufacturer's standard grey, suitable for outdoor or indoor installations.

4. Provide lifting eyes or brackets.

J. Accessories:

1. Mounting Brackets: Provide manufacturer's standard brackets.

2. Weathershield Kits: Provide for ventilated transformers installed outdoors to provide a listed NEMA 250, type 3R assembly.

3. Lug Kits: Sized as required for termination of conductors as indicated on the drawings.

2.4 SOURCE QUALITY CONTROL

A. Factory test transformers according to NEMA ST 20.

B. Sound Level Tests: Perform factory test designated in NEMA ST 20 as "design" test on each production unit.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that suitable support frames and anchors are installed where required and that mounting surfaces are ready to receive transformers.

C. Perform pre-installation tests and inspections on transformers per manufacturer's instructions and as specified in NECA 409. Correct deficiencies prior to installation.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Install transformers in accordance with NECA 409 and IEEE C57.94.

D. Use flexible conduit, under the provisions of Section 26 0534, 2 feet minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.

E. Arrange equipment to provide minimum clearances as specified on transformer nameplate and in accordance with manufacturer's instructions and NFPA 70.

F. Install transformers plumb and level.

G. Transformer Support:

1. Provide required support and attachment in accordance with Section 26 0529, where not furnished by transformer manufacturer.

2. Use integral transformer flanges, accessory brackets furnished by manufacturer, or field-fabricated supports to support wall-mounted transformers.

3. Use trapeze hangers assembled from threaded rods and metal channel (strut) to support suspended transformers. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

H. Mount floor-mounted transformers on properly sized 4 inch (100 mm) high concrete pad as indicated on the Contract Drawings.

I. Provide grounding and bonding in accordance with Section 26 0526.

J. Remove shipping braces and adjust bolts that attach the core and coil mounting bracket to the enclosure according to manufacturer's recommendations in order to reduce audible noise transmission.

K. Where not factory-installed, install lugs sized as required for termination of conductors as indicated.

L. Where furnished as a separate accessory, install transformer weathershield per manufacturer's instructions.

M. Identify transformers in accordance with Section 26 0553.

3.3 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

3.4 ADJUSTING

A. Measure primary and secondary voltages and make appropriate tap adjustments.

B. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.5 CLEANING

A. Clean dirt and debris from transformer components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 2416 - PANELBOARDS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Power distribution panelboards.

B. Overcurrent protective devices for panelboards.

1.2 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0529 - Hangers and Supports for Electrical Systems.

C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 26 4300 - Surge Protective Devices.

1.3 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; Federal Specification; Revision E, 2013.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

C. NECA 407 - Standard for Installing and Maintaining Panelboards; 2009.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

E. NEMA PB 1 - Panelboards; 2011.

F. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; 2013.

G. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

J. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

K. UL 67 - Panelboards; Current Edition, Including All Revisions.

L. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

M. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

N. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

O. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.

P. UL 1699 - Arc-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.

2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.

3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.

4. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.

1. Include characteristic trip curves for each type and rating of overcurrent protective device.

B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1. Include dimensioned plan and elevation views of panelboards and adjacent equipment with all required clearances indicated.

2. Include wiring diagrams showing all factory and field connections.

3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.

C. Source Quality Control Test Reports: Include reports for tests designated in NEMA PB 1 as routine tests.

D. Field Quality Control Test Reports.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.

G. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Panelboard Keys: Two of each different key.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

1.8 FIELD CONDITIONS

A. Maintain ambient temperature within the following limits during and after installation of panelboards:

1. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Eaton Corporation; Cutler-Hammer Products. : www.eaton.com.

B. Source Limitations: Furnish panelboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

1. To clarify, all power distribution equipment (panelboards, transformers, safety switches, controllers, etc.) as part of this Contract shall be produced by a single manufacturer and supplied by a single supplier.

2.2 PANELBOARDS - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended. Refer to the Contract Drawings for additional information.

B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:

1. Altitude: Less than 6,600 feet.

2. Ambient Temperature:

a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

C. Short Circuit Current Rating:

1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.

D. Panelboards Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

E. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

F. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.

G. Bussing: Sized in accordance with UL 67 temperature rise requirements.

1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.

2. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.

3. Provide separate isolated/insulated ground bus where indicated or where isolated grounding conductors are provided.

H. Conductor Terminations: Suitable for use with the conductors to be installed.

I. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.

1. Environment Type per NEMA 250: As indicated on the drawings.

2. Boxes: Galvanized steel unless otherwise indicated.

a. Provide wiring gutters sized to accommodate the conductors to be installed.

b. Increase gutter space as required where sub-feed lugs, feed-through lugs, gutter taps, or oversized lugs are provided.

3. Fronts:

a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.

b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.

c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.

4. Lockable Doors: All locks keyed alike unless otherwise indicated.

J. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

K. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 26 4300, list and label panelboards as a complete assembly including surge protective device.

L. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.

1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.

M. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

N. Multi-Section Panelboards: Provide enclosures of the same height, with feed-through lugs or sub-feed lugs and feeders as indicated or as required to interconnect sections.

O. Load centers are not acceptable unless specifically specified on the Contract Drawings.

P. Provide the following features and accessories where indicated or where required to complete installation:

1. Feed-through lugs.

2. Sub-feed lugs.

2.3 POWER DISTRIBUTION PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:

1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

2. Main and Neutral Lug Type: Mechanical.

C. Bussing:

1. Phase and Neutral Bus Material: Copper.

2. Ground Bus Material: Copper.

D. Circuit Breakers:

1. Provide bolt-on type.

2. Provide thermal magnetic circuit breakers for circuit breaker frame sizes less than 225 amperes.

3. Provide electronic trip (LSI) circuit breakers for circuit breaker frame sizes 225 amperes and above.

E. Enclosures:

1. Provide surface-mounted enclosures unless otherwise indicated.

2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.

3. Provide clear plastic circuit directory holder mounted on inside of door.

    a. Provide typed circuit directory for all proposed panelboards and panelboards in which have had circuit modifications performed. Circuit directories to be labeled with equipment type (not the equipment tag) as indicated on the equipment connection schedule on the contract drawings. Coordinate final labeling requirements with the engineer/owner.

2.4 OVERCURRENT PROTECTIVE DEVICES

A. Molded Case Circuit Breakers:

1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.

2. Interrupting Capacity:

    a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating as indicated on the Contract Drawings

    b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.

3. Conductor Terminations:

    a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.

    a. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 100 amperes and larger, unless otherwise noted.

5. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units for any circuit breakers rated 225A and larger, unless otherwise noted/indicated on the Contract Drawings.

    a. Provide the following field-adjustable trip response settings:

        1) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.

        2) Long time delay.

        3) Short time pickup and delay.

4) Instantaneous pickup.

5) Ground fault pickup and delay where ground fault protection is indicated.

6. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.

7. Provide the following circuit breaker types where indicated:

   a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.

   b. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.

   c. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Combination type listed as complying with UL 1699.

   d. 100 Percent Rated Circuit Breakers: Listed for application within the panelboard where installed at 100 percent of the continuous current rating.

8. Provide listed switching duty rated circuit breakers with SWD marking where indicated.

9. Do not use handle ties in lieu of multi-pole circuit breakers.

10. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.

11. Provide the following features and accessories where indicated or where required to complete installation:

    a. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.

    b. Handle Pad-Lock Provision: For locking circuit breaker handle in OFF position.

    c. Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.

2.5 SOURCE QUALITY CONTROL

A. Factory test panelboards according to NEMA PB 1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive panelboards.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.

D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

E. Provide required support and attachment in accordance with Section 26 0529.

F. Install panelboards plumb.

G. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.

H. Mount floor-mounted power distribution panelboards on properly sized 4 inch (80 mm) high concrete pad.

I. Provide grounding and bonding in accordance with Section 26 0526.

1. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on isolated/insulated ground bus.

2. Terminate branch circuit isolated grounding conductors on isolated/insulated ground bus only. Do not terminate on solidly bonded equipment ground bus.

J. Install all field-installed branch devices, components, and accessories.

K. Set field-adjustable circuit breaker tripping function settings as indicated. Settings to be field applied during equipment startup by certified manufacturer representative..

L. Set field-adjustable ground fault protection pickup and time delay settings as indicated.

M. Provide filler plates to cover unused spaces in panelboards.

N. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated.

O. Identify panelboards in accordance with Section 26 0553.

3.3 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than 400 amperes. Tests listed as optional are not required.

C. Test GFCI circuit breakers to verify proper operation.

D. Test AFCI circuit breakers to verify proper operation.

E. Test shunt trips to verify proper operation.

F. Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.

G. Certified manufacturer repreentative to provide equipment startup services, inspect equipment installation, adjust overcurrent protective device settings (per results of section 26 05 73), and provide operator training.

1. Include one (1) 4-hour session at the project site to provide above listed services.

H. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.4 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of panelboard fronts.

C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

3.5 CLEANING

A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 2717 - EQUIPMENT WIRING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Electrical connections to equipment.

1.2 RELATED REQUIREMENTS

A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables.

B. Section 26 0534 - Conduit.

C. Section 26 0537 - Boxes.

D. Section 26 2726 - Wiring Devices.

E. Section 26 2818 - Enclosed Switches.

F. Section 26 2913 - Enclosed Controllers.

1.3 REFERENCE STANDARDS

A. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (R 2010).

B. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2012.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.

2. Determine connection locations and requirements.

B. Sequencing:

1. Install rough-in of electrical connections before installation of equipment is required.

2. Make electrical connections before required start-up of equipment.

1.5 SUBMITTALS

A. Product Data: Provide wiring device manufacturer’s catalog information showing dimensions, configurations, and construction.

B. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Products: Listed, classified, and labeled as suitable for the purpose intended.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.

1. Colors: Comply with NEMA WD 1.

2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.

3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

B. Disconnect Switches: As specified in Section 26 2818 and in individual equipment sections.

C. Wiring Devices: As specified in Section 26 2726.

D. Flexible Metal Conduit: As specified in Section 26 0534.

E. Wire and Cable: As specified in Section 26 0519.

F. Boxes: As specified in Section 26 0537.

2.2 EQUIPMENT CONNECTIONS

A. Provide as indicated on the Contract Drawings:

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.2 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.

B. Make conduit connections to equipment using flexible metal conduit.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Provide receptacle outlet to accommodate connection with attachment plug.

E. Provide cord and cap where field-supplied attachment plug is required.

F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

H. Install terminal block jumpers to complete equipment wiring requirements.

I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

END OF SECTION

SECTION 26 2726 - WIRING DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Wall switches.

B. Receptacles.

C. Wall plates and covers.

1.2 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0537 - Boxes.

C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 26 0922 - Lighting Control Devices.

E. Section 26 2717 - Equipment Wiring: Cords and plugs for equipment.

1.3 REFERENCE STANDARDS

A. FS W-C-596 - Connector, Electrical, Power, General Specification for; Federal Specification; Revision G, 2001.

B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush-mounted (General Specification); Federal Specification; Revision F, 1999.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

D. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.

E. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (R 2010).

F. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2012.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.

I. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.

J. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.

K. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.

2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.

3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.

4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.

5. Notify Engineer of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B. Sequencing:

1. Do not install wiring devices until final surface finishes and painting are complete.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

B. Field Quality Control Test Reports.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Operation and Maintenance Data:

1. GFCI Receptacles: Include information on status indicators.

E. Project Record Documents: Record actual installed locations of wiring devices.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Extra Keys for Locking Switches: Two of each type.

2. Extra Wall Plates: Two of each style, size, and finish.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Products: Listed, classified, and labeled as suitable for the purpose intended.

E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Lutron Electronics Company, Inc: www.lutron.com.

B. Legrand

2.2 WIRING DEVICE APPLICATIONS

A. Provide wiring devices suitable for intended use and with ratings adequate for load served.

B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.

C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors, in damp or wet locations, or where indicated on the contract drawings.

D. Provide GFCI protection for receptacles installed within 6 feet of sinks, toilets, showers, hoses, etc..., or where indicated on the contract drawings.

E. Provide GFCI protection for receptacles installed in kitchens, bathrooms, labs, etc...

F. Provide GFCI protection for receptacles serving electric drinking fountains.

G. Unless noted otherwise, do not use combination switch/receptacle devices.

2.3 WIRING DEVICE FINISHES

A. Provide wiring device finishes as noted on E-001, Legend.

2.4 WALL SWITCHES

A. Manufacturers:

1. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.

B. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.

1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

2. Coordinate device and faceplate cover colors with the Engineer and Owner.

C. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

D. Pilot Light Wall Switches: Industrial specification grade, 20 A, 120/277 V with red illuminated standard toggle type switch actuator and maintained contacts; illuminated with load on; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

E. Keyed Wall Switches: Industrial specification grade, 20 A, 120/277 V with lever type keyed switch actuator and maintained contacts; all switches keyed alike; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

2.5 RECEPTACLES

A. Manufacturers:

1. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.

2. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wallplates by the same manufacturer in locations indicated.

B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.

1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.

2. NEMA configurations specified are according to NEMA WD 6.

C. Convenience Receptacles:

1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.

2. Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.

D. GFCI Receptacles:

1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.

a. Provide test and reset buttons of same color as device.

2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.

3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.

2.6 WALL PLATES AND COVERS

A. Manufacturers:

1. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.

2. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wallplates by the same manufacturer in locations indicated.

B. Wall Plates: Comply with UL 514D.

1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.

2. Finish: Refer to E-001, Legend.

C. Weatherproof Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

F. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 26 0537 as required for installation of wiring devices provided under this section.

1. Mounting Heights: Unless otherwise indicated, as follows:

    a. Wall Switches: 48 inches above finished floor.

    b. Receptacles: 18 inches above finished floor, 6 inches above counter, or as indicated on the Contract Drawings.

2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.

3. Where multiple receptacles or wall switches are installed at the same location and at the same mounting height, gang devices together under a common wall plate.

4. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Engineer to obtain direction prior to proceeding with work.

C. Install wiring devices in accordance with manufacturer's instructions.

D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.

F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

H. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.

I. Install wiring devices plumb and level with mounting yoke held rigidly in place.

J. Install wall switches with OFF position down.

K. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.

L. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

M. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

N. Identify wiring devices in accordance with Section 26 0553.

3.4 FIELD QUALITY CONTROL

A. Inspect each wiring device for damage and defects.

B. Operate each wall switch with circuit energized to verify proper operation.

C. Test each receptacle to verify operation and proper polarity.

D. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

E. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.5 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

3.6 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

SECTION 26 2813 - FUSES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Fuses.

1.2 RELATED REQUIREMENTS

A. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

B. Section 26 2818 - Enclosed Switches: Fusible switches.

C. Section 26 2913 - Enclosed Controllers: Fusible switches.

1.3 REFERENCE STANDARDS

A. NEMA FU 1 - Low Voltage Cartridge Fuses; 2012.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements; Current Edition, Including All Revisions.

D. UL 248-4 - Low-Voltage Fuses - Part 4: Class CC Fuses; Current Edition, Including All Revisions.

E. UL 248-10 - Low-Voltage Fuses - Part 10: Class L Fuses; Current Edition, Including All Revisions.

F. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.

a. Fusible Enclosed Switches: See Section 26 2818.

b. Fusible Switches for Enclosed Motor Controllers: See Section 26 2913.

2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.

3. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.

B. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Extra Fuses: Two set(s) of three for each type and size installed.

2. Fuse Pullers: One set(s) compatible with each type and size installed.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Bussmann, a division of Eaton Corporation: www.cooperindustries.com.

B. Littelfuse, Inc: www.littelfuse.com.

2.2 APPLICATIONS

A. Service Entrance:

1. Fusible Switches up to 600 Amperes: Class RK5, time-delay.

2. Fusible Switches Larger Than 600 Amperes: Class L, time-delay.

B. Feeders:

1. Fusible Switches up to 600 Amperes: Class RK5, time-delay.

2. Fusible Switches Larger Than 600 Amperes: Class L, time-delay.

C. General Purpose Branch Circuits: Class RK1, time-delay.

D. Individual Motor Branch Circuits: Class RK1, time-delay.

E. In-Line Protection for Pole-Mounted Luminaires: Class CC, time-delay.

F. Primary Protection for Control Transformers: Class CC, time-delay.

2.3 FUSES

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.

C. Provide fuses of the same type, rating, and manufacturer within the same switch.

D. Comply with UL 248-1.

E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.

F. Voltage Rating: Suitable for circuit voltage.

G. Class R Fuses: Comply with UL 248-12.

H. Class L Fuses: Comply with UL 248-10.

I. Class CC Fuses: Comply with UL 248-4.

J. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.

B. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Do not install fuses until circuits are ready to be energized.

B. Install fuses with label oriented such that manufacturer, type, and size are easily read.

END OF SECTION

SECTION 26 2818 - ENCLOSED SWITCHES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Enclosed safety switches.

1.2 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0529 - Hangers and Supports for Electrical Systems.

C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 26 2813 - Fuses.

E. Section 26 2913 - Enclosed Controllers: Manual motor controllers.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

C. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.

D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

H. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

I. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.

2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.

3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.

4. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

B. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

C. Field Quality Control Test Reports.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

E. Project Record Documents: Record actual locations of enclosed switches.

F. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

1.8 FIELD CONDITIONS

A. Maintain ambient temperature between -22 degrees F and 104 degrees F during and after installation of enclosed switches.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Eaton Corporation: www.eaton.com.

B. Source Limitations: Furnish enclosed switches and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

1. To clarify, all power distribution equipment (panelboards, transformers, safety switches, controllers, etc.) as part of this Contract shall be produced by a single manufacturer and supplied by a single supplier.

2.2 ENCLOSED SAFETY SWITCHES

A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:

1. Altitude: Less than 6,600 feet.

2. Ambient Temperature: Between -22 degrees F and 104 degrees F.

D. Horsepower Rating: Suitable for connected load.

E. Voltage Rating: Suitable for circuit voltage.

F. Short Circuit Current Rating:

1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.

2. Minimum Ratings:

a. Switches Protected by Class H Fuses: 100,000 rms symmetrical amperes.

b. Heavy Duty Single Throw Switches Protected by Class R, Class J, Class L, or Class T Fuses: 200,000 rms symmetrical amperes.

G. Enclosed Safety Switches Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

H. Provide with switch blade contact position that is visible when the cover is open.

I. Fuse Clips for Fusible Switches: As required to accept fuses indicated.

1. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.

J. Conductor Terminations: Suitable for use with the conductors to be installed.

K. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.

L. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.

M. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.

1. Environment Type per NEMA 250: As indicated on the drawings.

2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.

N. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

O. Heavy Duty Switches:

1. Comply with NEMA KS 1.

2. Conductor Terminations:

    a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.

    a. Provide means for locking handle in the ON position where indicated.

4. General duty switches are not acceptable.

P. Provide the following features and accessories where indicated or where required to complete installation:

1. Auxiliary Switch: SPDT switch suitable for connection to system indicated, with auxiliary contact operation before switch blades open and after switch blades close. Refer to the Contract Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed safety switches.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required support and attachment in accordance with Section 26 0529.

E. Install enclosed switches plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 26 0526.

H. Provide fuses complying with Section 26 2813 for fusible switches as indicated or as required by equipment manufacturer's recommendations.

I. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

J. Identify enclosed switches in accordance with Section 26 0553.

3.3 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

C. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.4 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.5 CLEANING

A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 2913 - ENCLOSED CONTROLLERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Enclosed NEMA controllers for low-voltage (600 V and less) applications:

1. Magnetic motor starters.
2. General purpose contactors.
3. Manual motor starters.
4. Motor-starting switches.

B. Overcurrent protective devices for motor controllers, including overload relays.

C. Control accessories:

1. Auxiliary contacts.
2. Pilot devices.
3. Control and timing relays.
4. Control power transformers.
5. Control terminal blocks.

1.2 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0529 - Hangers and Supports for Electrical Systems.

C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 26 2813 - Fuses: Fuses for fusible switches.

1.3 REFERENCE STANDARDS

A. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers; 2008.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

D. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2000 (R2005), with errata, 2008.

E. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices; 2000 (R2010).

F. NEMA ICS 6 - Industrial Control and Systems: Enclosures; 1993 (R2011).

G. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

J. UL 60947-1 - Low-Voltage Switchgear and Controlgear - Part 1: General Rules; Current Edition, Including All Revisions.

K. UL 60947-4-1 - Low-Voltage Switchgear and Controlgear - Part 4-1: Contractors and Motor-starters - Electromechanical Contractors and Motor-starters; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.

2. Coordinate the work to provide motor controllers and associated overload relays suitable for use with the actual motors to be installed.

3. Coordinate the work to provide controllers and associated wiring suitable for interface with control devices to be installed.

4. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.

5. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.

6. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for motor controllers, enclosures, overcurrent protective devices, and other installed components and accessories.

1. Include characteristic trip curves for each type and rating of overcurrent protective device.

B. Shop Drawings: Indicate dimensions, voltage, controller sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1. Include dimensioned plan and elevation views of enclosed controllers and adjacent equipment with all required clearances indicated.

2. Include wiring diagrams showing all factory and field connections.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Field Quality Control Test Reports.

E. Project Record Documents: Record actual installed locations of controllers and final equipment settings.

1. Include nameplate data of actual installed motors and associated overload relay selections and settings.

2. Motor Circuit Protectors: Include magnetic instantaneous trip settings.

F. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Indicating Lights: Two of each different type.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to internal components, enclosure, and finish.

1.8 FIELD CONDITIONS

A. Maintain field conditions within required service conditions during and after installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Eaton Corporation; Cutler-Hammer Products. : www.eaton.com.

B. Source Limitations: Furnish enclosed motor controllers and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

1. To clarify, all power distribution equipment (panelboards, transformers, safety switches, controllers, etc.) as part of this Contract shall be produced by a single manufacturer and supplied by a single supplier.

2.2 ENCLOSED CONTROLLERS

A. Provide enclosed controller assemblies consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Description: Enclosed controllers complying with NEMA ICS 2, and listed and labeled as complying with UL 60947-1 and UL 60947-4-1; ratings, configurations and features as indicated on the drawings.

D. Service Conditions:

1. Provide controllers and associated components suitable for operation under the following service conditions without derating:

a. Altitude:

1) Class 1 Km Equipment (devices utilizing power semiconductors, e.g. variable frequency controllers): Less than 3,300 feet.

2) Class 2 Km Equipment (electromagnetic and manual devices): Less than 6,600 feet.

b. Ambient Temperature: Between 32 degrees F and 104 degrees F.

2. Provide controllers and associated components suitable for operation at indicated ratings under the service conditions at the installed location.

E. Short Circuit Current Rating:

1. Provide controllers with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.

F. Conductor Terminations: Suitable for use with the conductors to be installed.

G. Enclosures:

1. Comply with NEMA ICS 6.

2. Environment Type per NEMA 250: As indicated on the drawings.

3. Finish: Manufacturer's standard unless otherwise indicated.

H. Instrument Transformers:

1. Comply with IEEE C57.13.

2. Select suitable ratio, burden, and accuracy as required for connected devices.

3. Current Transformers: Connect secondaries to shorting terminal blocks.

4. Potential Transformers: Include primary and secondary fuses with disconnecting means.

I. Magnetic Motor Starters: Combination type unless otherwise indicated.

1. Combination Magnetic Motor Starters: NEMA ICS 2, Class A combination motor controllers with magnetic contactor(s), externally operable disconnect and overload relay(s).

2. Noncombination Magnetic Motor Starters: NEMA ICS 2, Class A noncombination motor controllers with magnetic contactor(s) and overload relay(s).

3. Configuration: Full-voltage non-reversing unless otherwise inidcated on the Contract Drawings.

4. Minimum Starter Size: NEMA Size 0.

5. Use of non-standard starter sizes smaller than specified standard NEMA sizes is not permitted.

6. Disconnects: Circuit breaker type.

    a. Circuit Breakers: Motor circuit protectors (magnetic-only) unless otherwise indicated or required.

    b. Provide externally operable handle with means for locking in the OFF position. Provide safety interlock to prevent opening the cover with the disconnect in the ON position with capability of overriding interlock for testing purposes.

    c. Provide auxiliary interlock for disconnection of external control power sources where applicable.

7. Overload Relays: Bimetallic thermal type unless otherwise indicated.

8. Pilot Devices Required:

    a. Furnish local pilot devices for each unit as specified below unless otherwise indicated on drawings.

    b. Single-Speed, Non-Reversing Starters:

        1) Pushbuttons: START-STOP.

        2) Selector Switches: HAND/OFF/AUTO.

        3) Indicating Lights: Red ON, Green OFF.

    c. Single-Speed, Reversing Starters:

        1) Pushbuttons: FOR-REV-STOP.

        2) Selector Switches: HAND/OFF/AUTO.

        3) Indicating Lights: Red FOR, Red REV, Green OFF.

    d. Two-Speed Starters:

        1) Pushbuttons: FAST-OFF-SLOW.

        2) Selector Switches: HAND/OFF/AUTO.

        3) Indicating Lights: Red FAST, Red SLOW, Green OFF.

J. General Purpose Contactors: Combination type unless otherwise indicated.

1. Combination Contactors: NEMA ICS 2, Class A combination controllers with magnetic contactor(s) and externally operable disconnect, but without integral overload relay(s).

2. Noncombination Contactors: NEMA ICS 2, Class A noncombination motor controllers with magnetic contactor(s), but without integral overload relay(s).

3. Configuration: Full-voltage non-reversing unless otherwise indicated.

4. Minimum Contactor Size: NEMA Size 0.

5. Use of non-standard contactor sizes smaller than specified standard NEMA sizes is not permitted.

6. Disconnects: Circuit breaker type.

    a. Circuit Breakers: Thermal magnetic unless otherwise indicated or required.

    b. Provide externally operable handle with means for locking in the OFF position. Provide safety interlock to prevent opening the cover with the disconnect in the ON position with capability of overriding interlock for testing purposes.

    c. Provide auxiliary interlock for disconnection of external control power sources where applicable.

K. Manual Motor Starters:

1. Description: NEMA ICS 2, Class A manually-operated motor controllers with overload relay(s).

2. Configuration: Non-reversing unless otherwise indicated.

3. Fractional-Horsepower Manual Motor Starters:

    a. Furnish with toggle operator.

    b. Overload Relays: Bimetallic or melting alloy thermal type.

    c. Provide means for locking operator in the OFF or ON position.

    d. Furnish Red ON indicating light.

4. Integral-Horsepower Manual Motor Starters:

    a. Furnish with toggle or pushbutton operator.

    b. Overload Relays: Bimetallic or melting alloy thermal type.

    c. Provide means for locking operator in the OFF or ON position.

d. Furnish Red ON indicating light.

e. Provide auxiliary contact; normally open (NO) or normally closed (NC) as indicated or as required.

L. Motor-Starting Switches: Horsepower-rated switches without overload protection; toggle operator.

2.3 OVERCURRENT PROTECTIVE DEVICES

A. Overload Relays:

1. Provide overload relays and, where applicable, associated current elements/heaters, selected according to actual installed motor nameplate data, in accordance with manufacturer's recommendations and NFPA 70; include consideration for motor service factor and ambient temperature correction, where applicable.

2. Inverse-Time Trip Class Rating: Class 20 unless otherwise indicated or required.

3. Trip-free operation.

4. Visible trip indication.

5. Resettable.

a. Employ manual reset unless otherwise indicated.

b. Do not employ automatic reset with two-wire control.

6. Bimetallic Thermal Overload Relays:

a. Interchangeable current elements/heaters.

b. Adjustable trip; plus/minus 10 percent of nominal, minimum.

c. Trip test function.

7. Melting Alloy Thermal Overload Relays:

a. Interchangeable current elements/heaters.

B. Circuit Breakers:

1. Interrupting Capacity (not applicable to motor circuit protectors):

a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than specified minimum requirements.

b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.

2. Motor Circuit Protectors:

a. Description: Instantaneous-trip circuit breakers furnished with magnetic instantaneous tripping elements for short circuit protection, but not with thermal inverse time tripping elements for overload protection; UL 489 recognized only for use as part of a listed combination motor controller with overload protection; ratings, configurations, and features as indicated on the drawings.

b. Provide field-adjustable magnetic instantaneous trip setting.

c. Provide the following features and accessories where indicated or where required to complete installation:

1) Pad-Lock Provision: For locking circuit breaker handle in OFF position.

2) Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.

3. Molded Case Circuit Breakers:

a. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers; listed and labeled as complying with UL 489; ratings, configurations, and features as indicated on the drawings.

1) Provide thermal magnetic circuit breakers unless otherwise indicated.

2) Provide electronic trip circuit breakers where indicated.

b. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.

1) Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 100 amperes and larger.

2) Provide interchangeable trip units where indicated.

c. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.

1) Provide the following field-adjustable trip response settings:

(a) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.

(b) Long time delay.

(c) Short time pickup and delay.

(d) Instantaneous pickup.

d. Provide the following features and accessories where indicated or where required to complete installation:

1) Pad-Lock Provision: For locking circuit breaker handle in OFF or ON position as indicated.

2) Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.

2.4 CONTROL ACCESSORIES

A. Auxiliary Contacts:

1. Comply with NEMA ICS 5.

2. Provide number and type of contacts indicated or required to perform necessary functions, including holding (seal-in) circuit and interlocking, plus one normally open (NO) and one normally closed (NC) spare contact for each magnetic motor starter, minimum.

B. Pilot Devices:

1. Comply with NEMA ICS 5; heavy-duty type.

2. Nominal Size: 30 mm.

3. Pushbuttons: Unless otherwise indicated, provide momentary, non-illuminated type with flush button operator; normally open or normally closed as indicated or as required.

4. Selector Switches: Unless otherwise indicated, provide maintained, non-illuminated type with knob operator; number of switch positions as indicated or as required.

5. Indicating Lights: Push-to-test type unless otherwise indicated.

6. Provide LED lamp source for indicating lights and illuminated devices.

C. Control and Timing Relays:

1. Comply with NEMA ICS 5.

2. Provide number and type of relays indicated or required to perform necessary functions.

D. Control Power Transformers:

1. Size to accommodate burden of contactor coil(s) and all connected auxiliary devices, plus 25% VA spare capacity.

2. Include primary and secondary fuses.

E. Control Terminal Blocks: Include 25 percent spare terminals.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that ratings of enclosed controllers are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed controllers.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install controllers in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required support and attachment in accordance with Section 26 0529.

E. Install enclosed controllers plumb and level.

F. Provide grounding and bonding in accordance with Section 26 0526.

G. Install all field-installed devices, components, and accessories.

H. Provide fuses complying with Section 26 2813 for fusible switches as indicated.

I. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

J. Set field-adjustable controllers and associated components according to installed motor requirements, in accordance with manufacturer's recommendations and NFPA 70.

K. Set field-adjustable circuit breaker tripping function settings as indicated.

L. Identify enclosed controllers in accordance with Section 26 0553.

3.3 FIELD QUALITY CONTROL

A. Provide services of a manufacturer's authorized representative to perform inspection and testing. Include manufacturer's reports with submittals.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Motor Starters: Perform inspections and tests listed in NETA ATS, Section 7.16.1.1. Tests listed as optional are not required.

D. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for circuit breakers larger than 400 amperes. Tests listed as optional are not required.

E. Correct deficiencies and replace damaged or defective enclosed controllers or associated components.

F. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.4 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.5 CLEANING

A. Clean dirt and debris from controller enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

3.6 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of controllers to Owner, and correct deficiencies or make adjustments as directed.

B. Training: Train Owner's personnel on operation, adjustment, and maintenance of enclosed controllers and associated devices.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

2. Provide minimum of four hours of training.

3. Instructor: Manufacturer's authorized representative.

4. Location: At project site.

3.7 PROTECTION

A. Protect installed enclosed controllers from subsequent construction operations.

END OF SECTION

SECTION 26 4113 - LIGHTNING PROTECTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Under this Section, the Contractor shall furnish all labor, materials and equipment as necessary to provide an adequate Lightning Protection System, as specified for the following buildings/structures in accordance with NFPA. Refer to the Contract Drawings for building floor plans to obtain dimensions and roof information.

1. WWTP Site - Control Building (Sheet E-900)

1.2 SECTION INCLUDES

A. Strike (air) terminals and interconnecting conductors.

B. Grounding and bonding for lightning protection.

C. All associated components/hardware.

1.3 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems: Electrical system grounds.

1.4 REFERENCE STANDARDS

A. NFPA 780 - Standard for the Installation of Lightning Protection Systems; 2020.

B. UL 96 and UL96A - Lightning Protection Components and Installation; Current Edition, Including All Revisions.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination with Concrete Work: Coordinate the embedding of lightning protection components in new concrete as required.

1. Note, proposed structures will have down conductors in conduit within the exterior wall. Refer to the Contract Drawings for additional information.

B. Coordination with Roofing Work: Ensure adequate attachment of strike terminals and conductors without damage to roofing.

1. Contractor to coordinate with applicable trade contractor, owner, and engineer to provide suitable air terminal bases for the new roof construction anticipated.

C. Preinstallation Meeting: Convene a meeting at least two weeks prior to commencement of any work affected by lightning protection system requirements to discuss prerequisites and coordination required by other installers; require attendance by representatives of installers whose work will be affected.

D. Closely coordinate the installation of the LPS system for the above listed buildings and structures with equipment manufacturers, owner, engineer, and applicable trade contractor. Refer to contract drawings for additional information.

1.6 SUBMITTALS

A. Shop Drawings: Indicate location and layout of air terminals, grounding electrodes, and bonding connections to structure and other metal objects. Include terminal, electrode, and conductor sizes, and connection and termination details.

1. Where conductors or grounds are to be embedded or concealed in other construction, submit shop drawings at least 30 days prior to start of construction.

2. If concrete-encased grounds are to be used and are not shown in Contract Documents, provide sufficient data to determine concrete encasement dimensions and location.

3. Include data on actual ground resistance determined by field measurement in accordance with NFPA 780.

4. Include engineering analysis of equalization of potential to metal bodies within the structure.

5. Roof/wall penetration and mounting details.

B. Product Data: Provide dimensions and materials of each component, indication of testing agency listing, and installation instructions.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Installation Certification: Submit copy of certification agency's approval.

E. Upon completion of construction submit Master UL Label. If a Master UL label is not obtainable based upon the building classification (hazardous) the contractor is to submit a UL "Letter of Findings". Letter of Findings to indicate the system has been inspected and in compliance with UL 96A.

F. Operation and Maintenance Data: Provide recommended inspection and testing plan, including recommended intervals, to achieve periodic maintenance as recommended in NFPA 780; provide customized plan reflecting actual installation configuration with specific installed components identified.

G. Project Record Documents: Record actual locations of air terminals, grounding electrodes, bonding connections, and routing of system conductors in project record documents.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in lightning protection equipment installation with minimum three years documented experience.

B. Designer Qualifications: Person or entity, employed by installer, who specializes in lightning protection system design with minimum three years documented experience and certified by the LPI (Lightning Protection Institute) as a Master Installer / Designer.

C. Installer Qualifications: Capable of providing the specified certification of the installed system and certified by the LPI as a Journeyman Lightning Protection Installer.

D. Products: Must be UL listed for lightning protection systems.

E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Lightning Protection Components:

1. VFC: https://vfclp.com/

2. Independent Protection Company: www.ipclp.com

3. Advanced Lightning Technology (ALT): www.altfab.com.

4. Harger Lightning and Grounding: www.harger.com.

5. National Lightning Protection Corporation: www.theprotectionsource.com.

6. Robbins Lightning Incorporated: www.robbinslightning.com

B. The system to be furnished under this Specification shall be the standard product of a manufacturer regularly engaged in the production of lightning protection systems and shall be the manufacturer's latest approved design. The equipment manufacturer shall also be an UL listed and approved manufacturer and a fully certified manufacturer member in good standing of the Lightning Protection Institute.

C. Lightning Protection Installer:

1. TEL Inc. (www.tel-lightning.com).

2. Crowley Lightning Protection, Inc.

3. Morse-Collins, Inc.(www.morse-collins.com)

4. VFC: https://vfclp.com/

5. Robbins Lightning Incorporated: www.robbinslightning.com

2.2 LIGHTNING PROTECTION SYSTEM

A. Lightning Protection System: Provide complete system complying with NFPA 780, including air terminals, bonding, interconnecting conductors and grounding electrodes.

1. Provide system that protects:

a. The entire structure (refer to article 1.01 A above for the proposed buildings/structures which are to be provided with a lightning protection system as part of this contract).

b. Open air areas within 100 feet of exterior walls at grade level.

c. Open air areas within building/structure footprint.

d. Metal fences identified on site plan.

e. Aboveground tanks.

2. Coordinate with other grounding and bonding systems specified.

3. Determine ground resistance by field measurement.

4. Provide copper, bronze, or stainless steel components, except where aluminum is allowed by NFPA 780.

5. Provide system certified by Underwriters Laboratories. Refer to article 1.06 (E) above for additional information.

B. Strike Terminals: Provide strike (air) terminals on the following:

1. Roofs (buildings).

2. Roof mounted equipment.

3. Aluminum handrail encircling basin/tank structures.

2.3 COMPONENTS

A. All Components: Complying with applicable requirements of UL 96.

B. Strike (Air) Terminals: Copper, solid, where applicable and allowed by standard. Use aluminum where required to prevent galvanic corrosion.

1. Provide size as required by building classification.

C. Grounding Rods: Copper Clad

D. Ground Plate: Copper.

E. Conductors: Copper cable where applicable and allowed by standard. Use aluminum where required to prevent galvanic corrosion.

F. Connectors and Splicers: Bronze / cast aluminum.

G. Through Roof Connectors: Stainless/Bronze. Coordinate with owner, engineer, and applicable trade contractor closely as required.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated on shop drawings.

B. Coordinate work with installation of roofing and exterior and interior finishes.

3.2 INSTALLATION

A. Install in accordance with referenced system standards and as required for specified certification.

B. Submit UL master label upon completion of construction. Refer to article 1.06 (E) above for additional information.

C. Connect conductors using mechanical connectors or exothermic welding process; protect adjacent construction elements and finishes from damage.

D. Main down conductors to be installed within the new wall construction within protective PVC conduit. Where lightning protection system is to be provided for existing buildings/structures the main down conductor is to be installed within conduit along the building exterior wall. Refer to the Contract Drawings for additional information.

E. Each down conductor to be tied to a single copper 3/4" x 10'-0" ground rod driven 12" under grade and at least 2'-0" away from the building edge. Down conductor connection to the ground rod to be mechanical or exothermic. Final requirements to be per UL requirements.

F. All connections to the roofing system to be watertight.

G. Provide necessary bonds where required to bond the lightning protection system to the electric, gas, and water systems.

3.3 FIELD QUALITY CONTROL

A. Perform visual inspection as specified in NFPA 780 as if this were a periodic follow-up inspection.

B. Perform continuity testing as specified in NFPA 780 as if this were testing for periodic maintenance.

C. Obtain the services of the specified certification agency to provide inspection and certification of the lightning protection system, including performance of any other testing required by that agency.

END OF SECTION

SECTION 26 4300 - SURGE PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Surge protective devices for branch panelboard locations.

1.2 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 2416 - Panelboards.

1.3 ABBREVIATIONS AND ACRONYMS

A. SPD: Surge Protective Device.

1.4 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

C. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate size and location of overcurrent device compatible with the actual surge protective device and location to be installed. Notify Engineer of any conflicts or deviations from Contract Documents to obtain direction prior to ordering equipment.

1.6 SUBMITTALS

A. Product Data: Include detailed component information, voltage, surge current ratings, repetitive surge current capacity, voltage protection rating (VPR) for all protection modes, maximum continuous operating voltage (MCOV), nominal discharge current (I-n), short circuit current rating (SCCR), connection means including any required external

overcurrent protection, enclosure ratings, outline and support point dimensions, weight, service condition requirements, and installed features.

B. Shop Drawings: Include wiring diagrams showing all factory and field connections with wire and circuit breaker/fuse sizes.

C. Certificates: Manufacturer's documentation of listing for compliance with the following standards:

1. UL 1449.

D. Field Quality Control Test Reports.

E. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Operation and Maintenance Data: Include information on status indicators and recommended maintenance procedures and intervals.

G. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

H. Project Record Documents: Record actual connections and locations of surge protective devices.

1.7 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.8 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in accordance with manufacturer's written instructions.

1.9 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.10 WARRANTY

A. Manufacturer's Warranty: Provide minimum five year warranty covering repair or replacement of surge protective devices showing evidence of failure due to defective materials or workmanship.

B. Exclude surge protective devices from any clause limiting warranty responsibility for acts of nature, including lightning, stated elsewhere.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Factory-installed, Internally Mounted Surge Protective Devices:

1. Same as manufacturer of equipment containing surge protective device, to provide complete listed assembly including SPD.

2.2 SURGE PROTECTIVE DEVICES - GENERAL REQUIREMENTS

A. Description: Factory-assembled surge protective devices (SPDs) for 60 Hz service; listed, classified, and labeled as suitable for the purpose intended; system voltage as indicated on the drawings.

B. Unless otherwise indicated, provide field-installed, externally-mounted or factory-installed, internally-mouonted SPDs.

C. List and label as complying with UL 1449, Type 1 when connected on line side of service disconnect overcurrent device and Type 1 or 2 when connected on load side of service disconnect overcurrent device.

D. Protected Modes:

1. Wye Systems: L-N, L-G, N-G, L-L.

E. UL 1449 Voltage Protection Ratings (VPRs):

1. 480Y/277V System Voltage: Not more than 1,500 V for L-N, L-G, and N-G modes and 2,000 V for L-L mode.

F. UL 1449 Maximum Continuous Operating Voltage (MCOV): Not less than 115% of nominal system voltage.

G. Enclosure Environment Type per NEMA 250: As indicated on the drawings.

H. Equipment Containing Factory-installed, Internally Mounted SPDs: Listed and labeled as a complete assembly including SPD.

1. Panelboards: See Section 26 2416.

2.3 SURGE PROTECTIVE DEVICES FOR BRANCH PANELBOARD LOCATIONS

A. Unless otherwise indicated, provide factory-installed, internally mounted SPDs.

B. Surge Current Rating: Not less than 80 kA per mode/160 kA per phase.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the service voltage and configuration marked on the SPD are consistent with the service voltage and configuration at the location to be installed.

C. Verify that electrical equipment is ready to accept connection of the SPD and that installed overcurrent device is consistent with requirements of drawings and manufacturer's instructions.

D. Verify system grounding and bonding is in accordance with Section 26 0526, including bonding of neutral and ground for service entrance and separately derived systems where applicable. Do not energize SPD until deficiencies have been corrected.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Unless indicated otherwise, connect service entrance surge protective device on load side of service disconnect main overcurrent device.

E. Provide conductors with minimum ampacity as indicated on the drawings, as required by NFPA 70, and not less than manufacturer's recommended minimum conductor size.

F. Install conductors between SPD and equipment terminations as short and straight as possible, not exceeding manufacturer's recommended maximum conductor length. Breaker locations may be reasonably rearranged in order to provide leads as short and straight as possible. Twist conductors together to reduce inductance.

G. Do not energize SPD until bonding of neutral and ground for service entrance and separately derived systems is complete in accordance with Section 26 0526 where applicable. Replace SPDs damaged by improper or missing neutral-ground bond.

H. Disconnect SPD prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPD connected.

3.3 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS Section 7.19.1.

C. Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.

3.4 CLEANING

A. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 5100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Interior luminaires.

B. Emergency lighting units.

C. Exit signs.

D. Drivers.

E. Accessories.

1.2 RELATED REQUIREMENTS

A. Section 26 0529 - Hangers and Supports for Electrical Systems.

B. Section 26 0537 - Boxes.

C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 26 0922 - Lighting Control Devices: Automatic controls for lighting including occupancy sensors, time switches, and outdoor photo controls.

E. Section 26 2726 - Wiring Devices: Manual wall switches.

F. Section 26 5600 - Exterior Lighting.

1.3 REFERENCE STANDARDS

A. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products; 2008.

B. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules; Illuminating Engineering Society; 2015.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

D. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; 2006.

E. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; 2006.

F. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2012.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. NFPA 101 - Life Safety Code; 2015.

I. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

J. UL 1598 - Luminaires; Current Edition, Including All Revisions.

K. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.

2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.

3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.

4. Notify Engineer of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.

1. LED Luminaires:

a. Include estimated useful life, calculated based on IES LM-80 test data.

B. Certificates for Dimming Drivers: Manufacturer's documentation of compatibility with dimming controls to be installed.

C. Field quality control reports.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Extra Lenses: Two percent of total quantity installed for each type, but not less than two of each type where used.

2. Extra Drivers: Two percent of total quantity installed for each type, but not less than two of each type where used.

G. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components, including circuit routing, controls, junction and pull boxes.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.8 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.9 WARRANTY

A. Provide 3-year manufacturer warranty for LED luminaires, including drivers.

B. Provide 5-year pro-rata warranty for batteries for emergency lighting units.

C. Provide 10-year pro-rata warranty for batteries for self-powered exit signs.

PART 2 - PRODUCTS

2.1 MANUFACTURERS - LUMINAIRES

A. Cooper Lighting, a division of Cooper Industries or approved equal. : www.cooperindustries.com.

2.2 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings or approved equal.

2.3 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including all drivers, reflectors, lenses, housings and other components required to position, energize, protect and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. Recessed Luminaires:

1. Ceiling Compatibility: Comply with NEMA LE 4.

2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.

3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.

H. LED Luminaires:

1. Components: UL 8750 recognized or listed as applicable.

2. Tested in accordance with IES LM-79 and IES LM-80.

3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

2.4 EMERGENCY LIGHTING UNITS

A. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

B. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

C. Battery:

1. Size battery to supply all connected lamps, including emergency remote heads where indicated.

D. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.

E. Provide low-voltage disconnect to prevent battery damage from deep discharge.

F. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.

G. Where indicated, provide units with integral time delay to maintain emergency illumination for 15 minutes after restoration of normal power source.

H. Accessories:

1. Provide compatible accessory mounting brackets where indicated or required to complete installation.

2. Where indicated, provide emergency remote heads that are compatible with the emergency lighting unit they are connected to and suitable for the installed location.

2.5 EXIT SIGNS

A. Description: Exit signs complying with NFPA 101 and applicable state and local codes, and listed and labeled as complying with UL 924.

1. Number of Faces: Single- or double-face as indicated or as required for installed location.

2. Directional Arrows: As indicated or as required for installed location.

B. Powered Exit Signs: Internally illuminated with LEDs unless otherwise indicated.

1. Self-Powered Exit Signs:

a. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

b. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.

c. Provide low-voltage disconnect to prevent battery damage from deep discharge.

2.6 DRIVERS

A. Dimmable LED Drivers:

1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.

2. Control Compatibility: Fully compatible with the dimming controls to be installed.

2.7 ACCESSORIES

A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.

B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4" size, field-painted as directed.

C. Provide accessory plaster frames for luminaires recessed in plaster ceilings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 0537 as required for installation of luminaires provided under this section.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install products in accordance with manufacturer's instructions.

D. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).

E. Provide required support and attachment in accordance with Section 26 0529.

F. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

G. Install luminaires in locations as shown on the contract drawings or as close as possible to the locations shown with minor adjustments as required to avoid interferances.

H. Suspended Ceiling Mounted Luminaires:

1. Do not use ceiling tiles to bear weight of luminaires.

2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.

3. Secure surface-mounted and recessed luminaires to ceiling support channels or framing members or to building structure.

4. Secure pendant-mounted luminaires to building structure.

5. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.

6. In addition to ceiling support wires, provide two galvanized steel safety wire(s), minimum 12 gauge, connected from opposing corners of each recessed luminaire to building structure.

I. Recessed Luminaires:

1. Install trims tight to mounting surface with no visible light leakage.

2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.

3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.

J. Suspended Luminaires:

1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.

2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.

3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet nominal length, with no more than 4 feet between supports.

K. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

L. Install accessories furnished with each luminaire.

M. Bond products and metal accessories to branch circuit equipment grounding conductor.

N. Emergency Lighting Units:

1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

O. Exit Signs:

1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

P. Identify luminaires connected to emergency power system in accordance with Section 26 0553.

3.4 FIELD QUALITY CONTROL

A. Inspect each product for damage and defects.

B. Operate each luminaire after installation and connection to verify proper operation.

C. Test self-powered exit signs and emergency lighting units to verify proper operation upon loss of normal power supply.

D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy drivers as determined by Engineer.

3.5 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Engineer. Secure locking fittings in place.

B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Engineer or authority having jurisdiction.

C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Engineer or authority having jurisdiction.

3.6 CLEANING

A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.7 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of luminaires to Engineer, and correct deficiencies or make adjustments as directed.

B. Just prior to Substantial Completion, clean luminaires.

3.8 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

SECTION 26 5600 - EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Exterior luminaires.

1.2 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0529 - Hangers and Supports for Electrical Systems.

C. Section 26 0537 - Boxes.

D. Section 26 0922 - Lighting Control Devices: Automatic controls for lighting including time switches and outdoor photo controls.

E. Section 26 2726 - Wiring Devices.

F. Section 26 5100 - Interior Lighting.

1.3 REFERENCE STANDARDS

A. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products; 2008.

B. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules; Illuminating Engineering Society; 2015.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

D. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems; 2006.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 1598 - Luminaires; Current Edition, Including All Revisions.

G. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Notify Engineer of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.5 SUBMITTALS

A. Shop Drawings:

1. Indicate dimensions and components for each luminaire.

2. Provide photometric calculations.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.

1. LED Luminaires:

a. Include estimated useful life, calculated based on IES LM-80 test data.

C. Field Quality Control Reports.

1. Include test report indicating measured illumination levels.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

E. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

F. Project Record Documents: Record actual connections and locations of luminaires, controls, circuit routing, and any pull or junction boxes.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, handle, and store products according to NECA/IESNA 501 and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.8 WARRANTY

A. Provide 2-year manufacturer warranty for all LED luminaires, including drivers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Cooper Lighting, a division of Cooper Industries or approved equal. : www.cooperindustries.com.

1. Refer to schedules on the Contract Drawings for additional basis of design info.

2.2 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings or approved equal.

2.3 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including all reflectors, lenses, housings and other components required to position, energize, protect, and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. Provide luminaires listed and labeled as suitable for wet locations unless otherwise indicated.

H. LED Luminaires:

1. Components: UL 8750 recognized or listed as applicable.

2. Tested in accordance with IES LM-79 and IES LM-80.

3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

I. Exposed Hardware: Stainless steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 0537 as required for installation of luminaires provided under this section.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install products in accordance with manufacturer's instructions.

D. Install luminaires in accordance with NECA/IESNA 501.

E. Provide required support and attachment in accordance with Section 26 0529.

F. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

G. Install luminaires in locations as shown on the contract drawings or as close as possible to the locations shown when necessary to make minor modifications to avoid interferances.

H. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

I. Install accessories furnished with each luminaire.

3.4 FIELD QUALITY CONTROL

A. Inspect each product for damage and defects.

B. Operate each luminaire after installation and connection to verify proper operation.

C. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy drivers as determined by Engineer.

D. Measure illumination levels at night with calibrated meters to verify compliance with performance requirements. Record test results in written report to be included with submittals.

3.5 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Engineer. Secure locking fittings in place.

B. Luminaires with Field-Rotatable Optics: Position optics according to manufacturer's instructions to achieve lighting distribution as indicated or as directed by Engineer.

3.6 CLEANING

A. Clean surfaces according to NECA/IESNA 501 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.7 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of luminaires to Engineer, and correct deficiencies or make adjustments as directed.

B. Just prior to Substantial Completion, clean luminaires.

3.8 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

SECTION 311100 - CLEARING AND GRUBBING

PART 1 - GENERAL

A. WORK INCLUDED:

B. All necessary clearing and grubbing of all trees, brush, stumps, fences, debris, miscellaneous materials and miscellaneous structures not covered under other Contract Items within the construction area.

C. Clear and grub such additional areas within the limits of the right-of-way and easement lines, or other such areas specifically noted or specified.

D. Stripping of topsoil from construction areas and all areas to be excavated or filled with material to be stockpiled as directed by the Owner and/or acceptable to the Engineer.

E. Removal and proper disposal of all materials noted herein and/or encountered during the work.

1.2 RELATED WORK:

A. Erosion and Sediment Control – Section 312500

B. Rough Grading - 312213

1.3 EXISTING CONDITIONS:

A. The locations of existing underground utilities are shown in an approximate way only. The Contractor shall determine the exact location of all existing utilities before commencing the work.

B. The Contractor shall contact the Underground Utilities Call Center and/or utilities individually as necessary for proper notification.

C. The Contractor agrees to be fully responsible for any and all damage, which might be occasioned by his failure to exactly locate and preserve any and all underground utilities.

D. It shall be the Contractor's responsibility to investigate all site conditions that may affect his work.

PART 2 - MATERIALS

2.1 All materials utilized for related work shall comply with the requirements of the individual specification sections.

PART 3 - CONSTRUCTION DETAILS

3.1 LIMIT OF WORK AREAS:

A. The Engineer will establish the limits of areas to be cleared and grubbed, to be cleared but not grubbed, or areas, objects or features that are designated to remain undisturbed.

B. In general, work areas shall include the road section, stream channels, ditches, detours, and other areas shown on the plans or as specified.

C. The Engineer will designate fences, structures, debris, trees, and brush to be cleared where grubbing is not required.

D. Clearing beyond the areas of construction shall be done only where specified.

3.2 CLEARING AND GRUBBING:

A. On or adjacent to Roadways - all trees felled or trimmed to be immediately removed so as not to present any hazard to traffic. Grubbed stumps to be moved at least 30 feet from edge of pavement.

B. Embankments - grubbing will be required beneath all embankments unless otherwise specified by the Engineer.

C. Where trees or existing stumps are cleared and grubbing is not required, the tree trunk or existing stump shall be cut off not more than six (6) inches above the original ground surface, unless otherwise accepted. Exposed stumps not required to be removed but which are within 30' of the edge of the pavement shall be chipped out to a depth of not less than six (6) inches below the finished grade and the holes backfilled as accepted by the Engineer. This work shall be completed within one (1) week after start of work on the tree.

3.3 STRIPPING:

A. Strip any topsoil from Contractor areas and all areas to be excavated or filled.

B. Prevent mixing of topsoil with subsoil.

C. Stockpile topsoil on-site in an area acceptable to the Owner and the Engineer.

D. Prevent brush, trash, large stones and other objectionable material from being placed with stockpiled topsoil.

E. Protect stockpiled topsoil during construction operations.

F. Remove remaining topsoil from the site after completion of all restoration work and when authorized by the Owner and/or Engineer.

3.4 DISPOSAL (GENERAL):

A. No burning will be permitted on or off the contract site. All material generated by any activity for the development, modification and construction of any transportation facility shall not be burned. This shall include but not be limited to land clearing material and demolition material. Such material shall hereinafter be referred to as disposable material.

B. All wood, including grubbed stumps, shall be removed from the contract site and shall be the responsibility of the Contractor.

3.5 DISPOSAL (METHODS):

A. Disposal (no burning). All wood and brush shall be disposed of within fifteen (15) days after cutting or felling, unless otherwise accepted in writing by the Engineer and the property owner. No burning of land clearing materials that results from clearing and grubbing operations will be permitted. The Contractor will have the following options or combination of options for disposal of this material.

1. The Contractor may bury the disposable material in conformance with all local and State laws, rules or regulations off the right-of-way in locations obtained by him at his own expense. If the disposal is not in conformance with local and State requirements, the Contractor shall bear the expense for any and all required corrections, remediation, etc.
2. The Contractor may reduce all woody materials to chips and dispose the chips in compliance with paragraph B of this subsection.

B. Chipping. Wood may be reduced to chips by the use of a chipping machine or stump grinder. The chips shall be 1/2 inch maximum thickness or of other acceptable thicknesses. Chips resulting therefrom may be disposed of by being stockpiled and used as mulch for planting, in the right-of-way as accepted by the property owner, or by disposal at a location obtained at the Contractor's expense off the contract site.

C. Burying. No tree trunks, stumps, chips or other debris shall be buried at the work site. Disposal areas off site shall be acquired by the Contractor at his own expense.

PART 4 – MEASUREMENT AND PAYMENT

4.1 PAYMENT:

A. Easement Areas or Right-of-Ways: Clearing and grubbing in easement areas or right-of-ways shall be included in the unit price bid under the payment items to be installed, constructed, etc., in the easement area or right-of-ways, and no separate payment will be made.

B. All Other Areas: Clearing and grubbing shall be included in the lump sum price bid under the "Clearing and Grubbing" item. If no such item for payment is provided within the proposal, the costs for the necessary clearing and grubbing shall be deemed included in the other prices bid in the proposal, and no separate payment for this work shall be made.

END OF SECTION 311100

SECTION 312213 - ROUGH GRADING (NY)

PART 1 – GENERAL

1.1 WORK INCLUDED:

A. Excavate and fill for roadways/walkways, parking areas, landscaped areas and areas of improvement or other work as shown on the Drawings to subgrade elevations (or final elevations, if applicable).

B. Compaction of subgrades for all roadways, walkways or other improvements.

C. Furnish and install additional subsoil, if required to complete the work.

D. Dewater excavations as required.

E. Protect and maintain the work site.

F. Proper disposal of all excess or waste materials, and any objectionable materials encountered.

1.2 RELATED WORK:

A. Dewatering – Section 312319

B. Clearing and Grubbing - Section 311100

C. Erosion and Sediment Control – Section 312500

D. Rock Excavation - Section 312316

E. Trenching, Backfilling and Compacting - Section 312333

F. Finish Grading - Section 312219

1.3 EXISTING CONDITIONS:

A. The locations of existing underground utilities are shown in an approximate way only. The Contractor shall determine the exact location of all existing utilities before commencing work.

B. The Contractor agrees to be fully responsible for any and all damage, which might be occasioned by his failure to exactly locate and preserve any and all underground utilities.

1.4 REFERENCE STANDARDS:

A. The latest edition of the following standards, as referenced herein, shall be applicable.

B. "Standard Specifications, Construction and Materials, New York State Department of

Transportation, Office of Engineering".

C. "Standard Specifications for Highway Materials and Methods of Sampling and Testing, American Association of State Highway and Transportation Officials (AASHTO)".

D. Requirements of Regulatory Agencies: Contractor shall comply with the requirements for soil erosion and sedimentation control and other requirements of governmental authorities having jurisdiction, including the State of New York.

E. The following test standards apply to the work under this section:

1. ASTM D2216, “Laboratory Determination of Moisture Content of Soil.”
2. ASTM D422, “Particle-Size Analysis of Soils.”
3. ASTM D698, “Test method for Laboratory Compaction Characteristics of Soil Using Standard Effort.(Standard Proctor)
4. ASTM D1557, “Test method for Laboratory Compaction Characteristics of Soil Using Modified Effort.(Modified Proctor)
5. ASTM D2922, “Density of Soil and Soil Aggregate in Place by nuclear Methods.”
6. ASTM D2937, “Density of Soil in Place by the Drive-Cylinder Method.”
7. ASTM D3107, “Test for Moisture Content of Soil and Soil Aggregate in Place by Nuclear Methods.”

1.5 TESTING AGENCY:

A. Contractor shall provide and pay for all costs in connection with an approved independent testing facility to determine conformance of soils and aggregate with the specifications.

1.6 SUBMITTALS REQUIRED:

A. Samples: The Contractor shall furnish earth materials to the testing laboratory for their analysis and report, as directed by the Engineer.

B. Test Results: The testing laboratory shall submit written reports of all tests, investigations, findings and recommendations to the Contractor and the Engineer. The cost for the testing shall be borne by the Contractor.

1.7 PROJECT REQUIREMENTS:

A. Notify the Engineer of any unexpected subsurface conditions.

B. Existing Utilities: Locate existing underground utilities in areas of work. If utilities are to remain in place, provide adequate means of support and protection during earthwork operations. Comply with OSHA requirements.

C. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult utility owner immediately for directions.

D. Cooperate with the Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner; at no cost to the Owner.

E. Do not interrupt existing utilities serving facilities occupied and used by the Owner or others, during occupied hours, except when permitted in writing by the Owner and then only after acceptable temporary utility services have been provided.

F. Provide a minimum of 48-hour notice to the Owner and receive written notice to proceed before interrupting any utility.

G. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shutoff of services if lines are active.

1.8 USE OF EXPLOSIVES:

A. Do not bring explosives onto site or use in work without prior written permission from authorities having jurisdiction. Contractor is solely responsible for handling, storage, and use of explosive materials when their use is permitted.

1.9 PROTECTION OF PERSONS AND PROPERTY:

A. Barricade open excavations occurring as part of this work and post with adequate warning lights.

B. Operate warning lights as recommended by authorities having jurisdiction.

C. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.

D. Perform excavation within drip-line of large trees to remain by hand, and protect the root system from damage or dryout to the greatest extent possible. Maintain moist conditions for root system and cover exposed roots with burlap. Paint root cuts of 1" diameter and larger with emulsified asphalt tree paint.

1.10 EXCAVATION CLASSIFICATIONS:

A. The following classifications of excavation will be made when rock excavation is encountered in work.

B. Earth excavation includes excavation of pavements and other obstructions visible on ground surface; underground structures, utilities and other items indicated to be demolished and removed; together with earth and other materials encountered that are not classified as rock or unauthorized excavation.

C. Rock excavation in trenches and pits includes removal and disposal of materials and obstructions encountered which cannot be excavated with a 1.0 cubic yard (heaped) capacity, (3/4 cu. yd. backhoe for smaller work), 24" wide bucket on track-mounted power excavator equivalent to Caterpillar Model 215, rated at not less than 90 HP flywheel power and 30,000 lb. drawbar pull. Trenches in excess of 10'-0" in width and pits in excess of 30'-0" in either length or width are classified as open excavation.

D. Rock excavation in open excavations includes removal and disposal of materials and obstructions encountered which cannot be dislodged and excavated with modern track-mounted heavy-duty excavating equipment without drilling, blasting or ripping.

E. Rock excavation equipment is defined as Caterpillar Model No. 973 or No. 977K, or equivalent track-mounted loader, rated at not less than 170HP flywheel power and developing 40,000 lb. break-out force (measured in accordance with SAE J732C).

F. Typical of materials classified as rock are boulders 1.0 cu. yd. or more in volume, solid rock, rock in ledges, and rock-hard cementitious aggregate deposits.

G. Intermittent drilling, blasting or ripping performed to increase production and not necessary to permit excavation of material encountered will be classified as earth excavation.

H. Do not perform rock excavation work until material to be excavated has been cross-sectioned and classified by the Engineer.

I. Rock Payment Lines Are Limited To The Following:

1. Two feet outside of concrete work for which forms are required, except footings.
2. One foot outside perimeter of footings.
3. In pipe trenches, 6" below invert elevation of pipe 1' to either side of the pipe.
4. Neat outside dimensions of concrete work where no forms are required.
5. Under slabs on grade, verify subgrade depth requirement.
6. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific written acceptance of the Engineer or authorization by the Owner. Unauthorized excavation, as well as remedial work directed by the Engineer, shall be at the Contractor's expense.

PART 2 - MATERIALS

2.1 SELECTED FILL:

A. Selected fill is to be placed, as required, to replace deficient subsoil as directed by the Engineer. Selected fill is soil material native to the area, that is capable of being compacted to the specified densities and that is free from organic matter and other deleterious materials. Selected fill shall contain no stones larger than 2" at its greatest dimension, and shall contain no more than 10% clay or silt (passing the No. 200 sieve).

B. Local pockets of material that are substantially different in composition from the surrounding may be unsatisfactory for use as selected fill under certain climatic conditions. Do not use such materials without acceptance from the Engineer.

C. If sufficient selected fill material is not available from excavation under the Contract, additional fill suitable for use, shall be brought to the site from other sources.

PART 3 - EXECUTION

3.1 PREPARATION:

A. Establish required lines, levels, contours and datum.

B. Maintain benchmarks and other elevation control points. Re-establish, if disturbed or destroyed, at no additional cost to the Owner.

C. Establish location and extent of utilities before commencement of grading operations.

3.2 ROUGH GRADING:

A. Rough grade the project area to required subgrade levels and elevations as indicated on the drawings. The subgrades are as follows:

1. Sodded Areas: 6" below finished elevation.
2. Paved Areas: See details.

B. Prior to placing selected fill material over undisturbed soil, scarify to a depth of 6".

C. When grading operations have reached the required subgrade elevations, notify the Engineer for a review of the conditions.

D. Removal of materials beyond the indicated subgrade elevations without authorization by the Engineer will be classified as unauthorized excavation and shall be at no additional cost to the Owner.

E. Maintain slopes of excavation in safe condition until completion of grading operations.

3.3 DEWATERING:

A. Prevent surface, subsurface or ground water from flowing into excavation and from flooding project area, as well as surrounding areas.

B. Do not allow water to accumulate in excavations. Remove water to prevent soil changes detrimental to the stability of subgrades.

C. Provide, operate and maintain a temporary dewatering system including pumps, well points, sumps, suction and discharge lines, and other dewatering components necessary to convey water away from excavations and control the groundwater level so that the necessary construction work can be properly performed.

D. Provide and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations by dewatering, to collection or runoff areas.

E. Dewatering operations shall be conducted in accordance with Specification 312319 “Dewatering” and as acceptable to the Engineer.

F. The Contractor shall be fully responsible for, and shall correct at his own expense, any and all damages that may result from the operations of his dewatering system or failure to make any provisions.

G. There shall be no discharge of silty, muddy or otherwise polluted water from any dewatering operation to a natural water course.

H. Provide, as necessary, sediment control measures to ensure that discharged waters are of the highest possible quality.

3.4 PLACEMENT AND COMPACTION:

A. Place fill materials in layers not more than 8" loose depth for material compacted by heavy construction equipment, and not more than 4" in loose depth for material compacted by hand-operated tampers.

B. Do not place fill material on surfaces that are muddy, frozen, or contain frost or ice.

3.5 PERCENTAGE OF MAXIMUM DENSITY REQUIREMENTS:

A. Compact soil to not less than the following percentages of maximum density for soils which exhibit a well-defined moisture density relationship (cohesive soils) determined in accordance with ASTM D1557; and not less than the following percentages of relative density, determined in accordance with ASTM D2419, for soils which will not exhibit a well-defined moisture-density relationship (cohesionless soils).

3.6 PAVEMENTS:

A. Compact top 12" of subgrade and each layer of backfill or fill material at 90% maximum density for cohesive material or 95% relative density for cohesionless material.

3.7 LAWN OR UNPAVED AREAS:

A. Compact top 6" of subgrade and each layer of backfill or fill material at 85% maximum density for cohesive soils and 90% relative density for cohesionless soils.

3.8 MOISTURE CONTROL:

A. Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade or layer of soil material, to prevent free water appearing on the surface during or subsequent to compaction operations.

B. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.

C. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or

spread and allowed to dry. Assist drying by dicing, harrowing or pulverizing until moisture content is reduced to a satisfactory value.

3.9 FIELD QUALITY CONTROL:

A. The testing laboratory shall check the degree of compaction of all fill, including proof-rolling. Perform tests for each layer, of each kind of fill. Determine maximum density at optimum moisture for each material per ASTM D1557. Make field compaction tests per ASTM D1556. The in-place density specified is the relation of the field compaction test and the maximum density determination of the same soil. This testing shall be performed as requested by the Owner.

B. If in the opinion of the Engineer, based on testing service reports and inspection, subgrade or fills which have been placed are below specified density, provide additional compaction and testing at no additional cost to the Owner.

C. If so required by the Engineer, the Contractor shall at his own expense, perform turbidity sampling to insure that the construction operations have not negatively impacted a water course.

D. At all times, special measures shall be taken to prevent spillage of chemicals, fuels, oils, greases, bituminous materials, or any deleterious materials to the environment or any water course.

3.10 CLEANUP:

A. Provide and maintain protections or newly filled areas against damage. Upon completion or when directed, correct all damaged and deficient work by building up low spots and remove temporary protections, fencing, shoring and bracing.

B. Remove all surplus excavated material not required for filling and backfilling and legally dispose of same away from premises.

C. Leave the premises and work in clean, satisfactory condition, ready to receive subsequent operations.

3.11 QUALITY CONTROL: SUPERVISION, INSPECTION, AND RECORDS:

A. The Contractor shall retain an Independent Testing Agency to perform fill sampling and testing. The work performed by the testing agency shall be supervised by a registered geotechnical engineer.

B. Test material gradation for all fill materials in accordance with ASTM 422. Sample and test a minimum of one test per every 5,000 cubic yards placed.

C. Perform compaction testing of each lift of the embankment fill and final grading in accordance with ASTM D 1556 or ASTM D 6938. Perform at least one test for every 5,000 ft^2 of surface area. Report failing tests immediately to the Engineer.

D. A complete tabulation of all test results shall be certified by the independent Testing Agency and shall be delivered to the Engineer

PART 4 - MEASUREMENT AND PAYMENT

4.1 PAYMENT:

A. Paved Areas:

1. Rough grading under and adjacent to paved areas shall be included in the unit price bid under the appropriate payment item for the paving work. If no such item exists, the work shall be deemed included in the other payment items of the Proposal.

B. Earthwork:

Rough grading related to a Site Grading Plan shall be included in the lump sum price bid under the "Earthwork" item. If no such item for payment is provided within the Proposal, and no other specific item for payment is provided, then the costs for the required rough grading shall be deemed included in the other prices bid in the Proposal, and no separate payment for this work shall be made.

END OF SECTION 312213

SECTION 312219 - FINISH GRADING (NY)

PART 1 – GENERAL

1.1 WORK INCLUDED:

A. Place, grade and compact topsoil, or other materials as may be called for, shown or required to complete the project work.

1.2 RELATED WORK:

A. Rough Grading - Section 312213

B. Erosion and Sediment Control – Section 312500

C. Seeding - Section 329219

D. Topsoil Placement and Grading (Topsoil) - Section 329219.13

1.3 EXISTING CONDITIONS:

A. It shall be the Contractor's responsibility to visit the entire project site and investigate all conditions that may affect his work.

B. The Contractor shall take all necessary as-built measurements and make all necessary investigations in the field, prior to layout of the proposed installation of the work.

1.4 COORDINATION:

A. Coordinate the finish grading with the completion of the underground and other work of the project, before final restoration or paving is begun.

1.5 REFERENCE STANDARDS:

A. The latest edition of the following standards, as referenced herein, shall be applicable.

B. "Standard Specifications, Construction and Materials, New York State Department of Transportation, Office of Engineering".

C. "Standard Specifications for Highway Materials and Methods of Sampling and Testing, American Association of State Highway and Transportation Officials (AASHTO)".

D. Requirements of Regulatory Agencies: Contractor shall comply with the requirements for soil erosion and sedimentation control and other requirements of governmental authorities having

jurisdiction, including the State of New York.

E. The following test standards apply to the work under this section:

1. ASTM D2216, “Laboratory Determination of Moisture Content of Soil.”
2. ASTM D422, “Particle-Size Analysis of Soils.”
3. ASTM D698, “Test method for Laboratory Compaction Characteristics of Soil Using Standard Effort.(Standard Proctor)
4. ASTM D1557, “Test method for Laboratory Compaction Characteristics of Soil Using Modified Effort.(Modified Proctor)
5. ASTM D2922, “Density of Soil and Soil Aggregate in Place by nuclear Methods.”
6. ASTM D2937, “Density of Soil in Place by the Drive-Cylinder Method.”
7. ASTM D3107, “Test for Moisture Content of Soil and Soil Aggregate in Place by Nuclear Methods.”

1.6 TESTING AGENCY:

A. Contractor shall provide and pay for all costs in connection with an approved independent testing facility to determine conformance of soils and aggregate with the specifications.

1.7 SUBMITTALS REQUIRED:

A. Samples: The Contractor shall furnish earth materials to the testing laboratory for their analysis and report, as directed by the Engineer.

B. Test Results: The testing laboratory shall submit written reports of all tests, investigations, findings and recommendations to the Contractor and also directly to the Engineer.

PART 2 - MATERIALS

2.1 TOPSOIL:

A. Provide topsoil which is fertile, friable, natural loam, reasonably free of subsoil, clay lumps, brush, weeds, roots, stumps and other deleterious material.

B. Topsoil shall meet the requirements specified in Topsoil Placement and Grading Specification 329119.13, unless otherwise indicated on the plans.

2.2 OTHER MATERIALS:

A. Other materials as may be involved for finish grading work shall comply with the respective and applicable provisions as noted otherwise in these documents.

PART 3 - CONSTRUCTION DETAILS

3.1 STOCKPILING:

A. Topsoil shall be stockpiled from on-site sources or provided from off-site sources and stockpiled if on-site quantities are deficient.

B. Stockpiles shall contain not less than 200 cu. yds. or the minimum required for the project.

C. Stockpiles shall have a height of at least 4' and shall be trimmed to uniform surfaces and slopes.

D. The sites of all stockpiles and areas adjacent thereto which have been disturbed by the Contractor shall be graded and put into an acceptable condition as required by the property Owner, and deemed acceptable by the Engineer.

E. Stockpiles shall be provided with suitable provisions for soil erosion prevention.

3.2 TOPSOIL PLANNING:

A. Placing topsoil on compacted subgrades conforming with Section 312213, Rough Grading, only after subgrades have been accepted by the Engineer.

B. Scarify the subgrade parallel to the contours to permit sufficient bonding with the topsoil. Do not scarify to the extent that the subgrade stability and density is disrupted.

C. Place topsoil in areas where sodding is to be performed. Place a 4" minimum depth to the finished grade elevations as required.

D. Fine grade topsoil to eliminate uneven areas and to ensure proper drainage. Maintain finished grade elevations required.

E. Remove all stones, roots, grass, weeds or other foreign matter while placing.

F. Lightly compact the topsoil to ensure its stability.

G. Topsoil in an unworkable condition due to excessive moisture, frost, or other conditions shall not be placed until it is suitable for placement.

3.3 CLEAN-UP:

A. Remove all surplus subsoil and topsoil from project site.

B. Leave the site in clean, satisfactory condition ready to receive subsequent operations.

PART 4 - MEASUREMENT AND PAYMENT

4.1 PAYMENT:

A. Earthwork: Finish grading related to completion of the project work shall be deemed included in the lump sum and unit prices bid under the proposal items. No separate payment for this work shall be made.

END OF SECTION 312219 (NY)

SECTION 312316- ROCK REMOVAL (ROCK EXCAVATION) (NY)

PART 1 – GENERAL

1.1 WORK INCLUDED:

A. Removal of rock, within the payment limits, for installation of piping as shown on the plans or called for in the Specifications.

B. Removal of rock, within the payment limits, for installation of roadway surfaces, curbing and sidewalks as shown on the plans or called for in the Specifications.

C. Removal of all other rock, for structures or other improvements designated on the plans, called for in the Specifications or indicated in the field by the Engineer.

D. Proper disposal of all excavated rock at a location acceptable to the Owner and Engineer.

E. Provide selected borrow backfill to make up for any deficiencies due pursuant to the rock excavation. In roadway areas, or where otherwise called for, utilize Roadway Subbase Material.

1.2 RELATED WORK:

A. Erosion and Sediment Control – Section 312500

B. Rough Grading – Section 312213

C. Finish Grading - Section 312219

D. Backfill (Selected Borrow Backfill) - Section 312323.13.02

E. Trenching, Backfilling and Compaction - Section 312333

1.3 EXISTING CONDITIONS:

A. Where information exists regarding the presence of rock within the work limits and same is made available by the Owner, the Engineer does not purport said information as being correct or having been verified and said information is made available only to assist the Contractor in determining those areas where previous data indicates the possibility of rock being encountered.

B. The Contractor shall, based on any subsurface information made available, make all interpretations using the information according to his own judgement.

C. The Owner and/or the Engineer shall assume no responsibility or liability pertaining to the Contractor's utilization or interpretation of any information made available.

D. The quantity indicated in the Contract Proposal is provided as an estimated quantity for the purpose of comparing bids and has been obtained using the information available at time of

design.

E. It shall be the Contractor's responsibility to investigate all site conditions that may affect his work.

PART 2 - MATERIALS:

2.1 All equipment utilized by the Contractor and/or subcontractors in his (their) performance of the work under this section shall comply with all provisions of local jurisdictions and/or agencies.

2.2 All equipment and/or procedures utilized in the possession, handling, storage and transportation of all explosives shall comply with the requirements of Industrial Code Rule 39 of the State of New York, Department of Labor, Board of Standards and Appeals, and the applicable conditions of Section 107-05 of the New York State Department of Transportation Standard Specifications.

PART 3 - CONSTRUCTION DETAILS

3.1 GENERAL:

A. The Contractor shall comply with Title 29, Code of Federal Regulations Part 1926, Safety and Health Regulations for Construction (OSHA) regarding the safety and protection of persons employed in construction and demolition work.

B. All blasting shall be done in compliance with all Federal, State and Local regulations.

C. The Contractor shall obtain all appropriate and required blasting permits from all applicable jurisdictions. The cost for all fees, bonds, etc., shall be paid for by the Contractor.

D. The Contractor shall provide any applicable supplemental Certificates of Insurance, or Certificates for the blasting subcontractor, to the Owner prior to any blasting work. All Certificates shall comply with the requirements elsewhere noted herein this document for Certificates of Insurance provided under this Contract.

3.2 PRECAUTIONS:

A. In blasting, all necessary precautions shall be taken to protect persons and property.

B. The Contractor shall take all possible precautions to prevent accidents from blasting.

C. The Contractor shall be liable for all damages done to persons and/or property caused by blasts or explosives or from neglect in properly guarding the trenches. No compensation will be allowed said Contractor for loss so incurred.

D. Blasting shall be done only by workmen skilled in this kind of work. The Owner and/or the Engineer shall have the right to require references to suitably indicate the ability of the workmen to perform the work in a safe manner.

E. Rock shall be well covered and sufficient warning shall be given to all persons within the vicinity before blasting.

3.3 DEFINITION:

A. Materials, which in the sole opinion of the Engineer cannot be excavated except by drilling and blasting or drilling and wedging, shall be considered rock. Refer to Specification 312213 “Rough Grading” for excavation classifications.

B. Boulders exceeding 1.0 cubic yards will also be considered rock.

C. Materials such as hardpan or disintegrated rock and other materials which can be broken down with picks, sledge hammers or power activated mechanical equipment will not be considered rock even if the Contractor elects to remove such materials by drilling and blasting or drilling and wedging.

D. Intermittent drilling, blasting or ripping performed to increase production and not necessary to permit excavation of material encountered will not be classified as Rock Excavation.

3.4 METHODS:

A. In general, blasts shall be covered with suitable blasting mats and/or heavy timbers.

B. No blasts are to be set off within fifty (50) feet of the pipe as laid, with the end of the pipe tightly plugged and covered during any blast nearer than one hundred (100) feet.

C. All blasting work shall be completed within the excavation before other work is started there.

D. Caps or other exploders shall in no instance be kept near a place where dynamite or explosives are stored, and no more than 100 pounds of dynamite shall be stored in the vicinity of the work at any time except by special permission.

E. If so called "wagon drills" are used, the Contractor must, at a minimum, excavate test pits on 200' centers and at all changes in alignment. These test pits must be excavated with a track mounted power excavator equivalent to a Caterpillar Model 215, rated at not less than 90HP flywheel power, and 30,000 lb. draw bar pull with a 24" wide bucket. The test pit shall be dug to refusal depth or subgrade line, whichever is less. The depth of disintegrated/fractured rock, which is able to be excavated as outlined above, shall be measured by the Engineer and averaged between successive test pits, to determine the amount and elevation of diggable rock present. If the top of rock is below the subgrade line, the next closest test pits diggable rock depth (elevation) shall be used for calculation purposes. The Engineer shall be the sole judge of when refusal is reached. The Engineer must be given a minimum of 72 hours prior written notice of test pits being dug.

F. After blasting and removal of the rock, the Contractor shall so clean the faces of the excavation that the upper surface of the rock can be easily determined for measurement. Boulders removed should be laid at the side of the trench and the Engineer notified and given ample time to measure the same.

G. When rock is encountered, it shall be stripped of all earth and left with a clean surface until the height of this surface is measured by the Engineer. The Contractor shall notify the Engineer upon same being prepared for measurement.

3.5 TIME FOR BLASTING:

A. Blasting shall only be accepted between the hours of 8:00 a.m. and 5:00 p.m. on weekdays, except holidays, unless otherwise accepted by the Engineer.

B. No blasts shall be made on Sunday under any conditions.

C. Blasting times shall conform to the conditions of the issued permit and/or any local ordinances.

D. Should the Contractor wish to perform blasting at times other than noted in A (above), a request shall be made a minimum of 48 hours in advance, with acceptance of the Engineer conditional with approval of all other jurisdictions.

3.6 LIMITS OF ROCK EXCAVATION:

A. Trenches - Trench rock shall be excavated to a point at least twelve (12) inches to the side of the pipe and six (6) inches below the pipe when laid. Minimum trench width shall be three feet (3'). Selected Borrow Backfill acceptable to the Engineer shall be used to fill the trench up to the proper grade.

B. Roadways - Rock to be excavated in road areas shall be excavated to a depth of six (6) inches below subgrade elevation and shall extend to the outside limits of the shoulder areas.

C. Sidewalks and Curb - Rock excavation within the actual areas where the curb, sidewalk or foundation material is to be placed.

D. Structures:

1. Two (2) feet outside of concrete work for which forms are required except footings.
2. One (1) foot outside perimeter of footings.
3. Underslabs on grade, verify subgrade depth requirements.

PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT:

A. Measurement will be made on the basis of cubic yards of non-diggable rock removed as measured by the Engineer. No separate payment will be made for test pits, exposing rock faces, etc., as required under this specification.

4.2 PAYMENT:

A. Payment for rock excavation will be made based on the unit price bid for Rock Excavation as bid in the Contract Proposal. The unit price bid shall include the cost to furnish all labor, materials, equipment, the cost for the necessary selected borrow or roadway subbase backfill, and incidental costs to complete the work.

B. In order to avoid unbalanced bids, the unit price for Rock Excavation is established at a minimum of thirty-five dollars ($35.00) and a maximum of one hundred dollars ($100.00) per cubic yard.

END OF SECTION 312316.26 (NY)

SECTION 312319 - DEWATERING

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies performance of dewatering required to lower and control ground water table levels and hydrostatic pressures to permit excavation, backfill and construction. Control of surface water shall also be considered as part of the work under this specification.

1.2 SUMMARY:

A. The work to be completed by the Contractor includes, but is not necessarily limited to the following:
   1. Implementation of the Erosion and Sedimentation Control Plan.
   2. Dewater excavations, including seepage and precipitation.
   3. The Contractor shall be responsible for providing all materials, equipment, labor, and services necessary for care of water and erosion control. Excavation work shall not begin before the Erosion and Sedimentation Control Plan is in place.

1.3 PERFORMANCE REQUIREMENTS:

A. Dewatering system shall be of sufficient size and capacity necessary to lower and maintain ground water table to an elevation at least (1 foot) below lowest foundation subgrade or bottom of pipe trench and to allow material to be excavated, and concrete placed, in a reasonably dry condition. Materials to be removed shall be sufficiently dry to permit excavation to grades shown and to stabilize excavation slopes where sheeting is not required. Operate dewatering system continuously until backfill work has been completed.

B. Reduce hydrostatic head below any excavation to the extent that water level in the construction area is a minimum of (1 foot) below prevailing excavation surface.

C. Prevent loss of fines, seepage, boils, quick conditions or softening of foundation strata.

D. Maintain stability of sides and bottom of excavation.

E. Construction operations are performed in the dry.

F. Control of surface and subsurface water is part of dewatering requirements. Maintain adequate control so that:
   1. The stability of excavated and constructed slopes are not adversely affected by saturated soil, including water entering prepared subbase and subgrades where underlying materials are not free draining or are subject to swelling or freeze-thaw action.
   2. Erosion is controlled.
   3. Flooding of excavations or damage to structures does not occur.
   4. Surface water drains away from excavations.
   5. Excavations are protected from becoming wet from surface water, or ensure excavations are dry before additional work is undertaken.

1.4 RELATED WORK:

A. Rock Removal (Rock Excavation) - Section 312316

B. Structural Excavation, Backfill and Compaction – Section 312334

C. Trenching, Backfilling and Compaction Work – Section 312333

D. Erosion and Sediment Control – Section 312500

1.5 SUBMITTALS:

A. Drawings and Design Data:
   1. Submit drawings and data showing the method to be employed in dewatering excavated areas 14 days before commencement of excavation.
   2. Material shall include: location, depth and size of wellpoints, headers, sumps, ditches, size and location of discharge lines, capacities of pumps and standby units, and detailed description of dewatering methods to be employed to convey the water from site to adequate disposal.
   3. Include a written report outlining control procedures to be adopted if dewatering problem arises.
   4. Capacities of pumps, prime movers, and standby equipment.
   5. Detailed description of dewatering procedure and maintenance method.

PART 2 - PRODUCTS (Not used)

PART 3 – EXECUTION

3.1 INSTALLATION:

A. Install a dewatering system to lower and control ground surface water in order to permit excavation, construction of structure, and placement of backfill materials to be performed under dry conditions. Make the dewatering system adequate to pre-drain the water-bearing strata above and below the bottom of structure foundations, utilities and other excavations.

B. In addition, reduce hydrostatic pressure head in water-bearing strata below structure foundations, utility lines, and other excavations, to extent that water levels in construction area are a minimum of (1 foot) below prevailing excavation surface at all times.

3.2 OPERATION:

A. Prior to any excavation below the ground water table, place system into operation to lower water table as required and operate it continuously 24 hours a day, 7 days a week until utilities and structures have been satisfactorily constructed, which includes the placement of backfill materials and dewatering is no longer required.

B. Place an adequate weight of backfill material to prevent buoyancy prior to discontinuing operation of the system.

3.3 WATER DISPOSAL:

A. Dispose of water removed from the excavations in such a manner as:
   1. Will not endanger portions of work under construction or completed.
   2. Will cause no inconvenience to Owner or to others working near site.
   3. Will comply with the stipulations of required permits for disposal of water.
   4. Will Control Runoff: The Contractor shall be responsible for control of runoff in all work areas including but not limited to: excavations, access roads, parking areas, laydown, and staging areas. The Contractor shall provide, operate, and maintain all ditches, basins, sumps, culverts, site grading, and pumping facilities to divert, collect, and remove all water from the work areas. All water shall be removed from the immediate work areas and shall be disposed of in accordance with applicable permits.

B. Excavation Dewatering:
   1. The Contractor shall be responsible for providing all facilities required to divert, collect, control, and remove water from all construction work areas and excavations.
   2. Drainage features shall have sufficient capacity to avoid flooding of work areas.
   3. Drainage features shall be so arranged and altered as required to avoid degradation of the final excavated surface(s).
   4. The Contractor shall utilize all necessary erosion and sediment control measures as described herein to avoid construction related degradation of the natural water quality.

C. Dewatering equipment shall be provided to remove and dispose of all surface and ground water entering excavations, trenches, or other parts of the work during construction. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure to be built, or the pipe to be installed therein, is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.

3.4 STANDBY EQUIPMENT:

A. Provide complete standby equipment, installed and available for immediate operation, as may be required to adequately maintain de-watering on a continuous basis and in the event that all or any part of the system may become inadequate or fail.

3.5 CORRECTIVE ACTION:

A. If dewatering requirements are not satisfied due to inadequacy or failure of the dewatering system (loosening of the foundation strata, or instability of slopes, or damage to foundations or structures),

perform work necessary for reinstatement of foundation soil and damaged structure or damages to work in place resulting from such inadequacy or failure by Contractor, at no additional cost to Owner.

3.6 DAMAGES:

A. Immediately repair damages to adjacent facilities caused by dewatering operations.

3.7 REMOVAL:

A. Ensure compliance with all conditions of regulating permits and provide such information to the Resident Engineer. Obtain written approval from Resident Engineer before discontinuing operation of dewatering system.

END OF SECTION 312319

SECTION 312323.13.01- BACKFILL (CRUSHED STONE FOUNDATION) (NY)

PART 1 - GENERAL

1.1 WORK INCLUDED:

A. Furnish and place crushed stone foundation material at the depths and locations shown on the Plans and/or called for in the Specifications.

B. Furnish and place Crushed Stone Foundation material in areas or locations where, in the opinion of the Engineer, the subgrade will not properly support the pipe or structure.

C. As an alternate and where specific written acceptance of the Engineer is received, the Contractor shall be permitted to utilize sand as a foundation in lieu of crushed stone. At any time the material quality becomes questionable in the opinion of the Engineer, the acceptance can be withdrawn.

1.2 EXISTING CONDITIONS:

A. It shall be the Contractor's responsibility to investigate all site conditions that may affect his work.

1.3 RELATED WORK:

A. Trenching, Backfilling and Compaction - Section 312333

1.4 SUBMITTALS REQUIRED:

A. Samples: The Contractor shall furnish earth materials to the testing laboratory for their analysis and report, as directed by the Engineer.

B. Test Results: The testing laboratory shall submit written reports of all tests, investigations, findings and recommendations to the Contractor and the Engineer. The cost for the testing shall be borne by the Contractor.

PART 2 - MATERIALS

2.1 GENERAL:

A. The material shall conform to "Coarse Aggregates" Section 703-02, as specified in "Standard Specifications Construction and Materials, New York State Department of Transportation", latest edition.

B. Crushed stone material shall be approximately two-thirds (67%) of the sized stone indicated in the table below, with the remainder of mixed stone of other gradations as the Engineer may select due to the conditions.

C. Crushed stone provided shall be of the size noted below for the use indicated:

Use	Size
Piping Foundation	No. 2
Structures	No. 2
Curtain Drains	No. 3
All other uses (unless noted otherwise and subject to Engineer's acceptance)	No. 2

PART 3 - CONSTRUCTION DETAILS

3.1 GENERAL:

A. All methods utilized for the placement of crushed stone foundation material shall comply with the details shown on the Plans for the type of work being performed.

B. Placement shall strictly comply with the specific requirements of the appropriate specification section(s) for the type of work being performed.

C. Foundation material shall be well compacted and leveled so that it will properly support the pipe or structure.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Crushed stone placed to the minimum dimensions indicated on the Plans will be included under the individual prices bid for the respective Contract Items.

4.2 Crushed stone placed to a height of 24 inches above piping will be included under the unit price bid for the respective Contract Item.

4.3 Measurement for all other "additional" Crushed stone Backfill will be made on the basis of cubic yards of select borrow backfill in-place as measured by the Engineer. The Contractor is reminded that this material is to be placed only where required for the Engineer's acceptance of the work.

4.4 The Contractor is reminded that no payment will be made for Selected Borrow Backfill placed in connection with Rock Excavation, since the cost for such material is included under the Rock Excavation unit price bid.

4.5 Where no payment item is provided in the Contract Proposal, and crushed stone is necessary or required to complete the work, no separate payment will be made and such material (in-place) shall be deemed included under the other payment items of the Proposal.

END OF SECTION 312323.13.01 (NY)

SECTION 312323.13.02 - BACKFILL (SELECTED BORROW BACKFILL)

PART 1 – GENERAL

1.1 WORK INCLUDED:

A. Furnish and place selected borrow backfill at the depths and locations shown on the Plans and/or called for in the Specification.

B. Furnish and place selected borrow backfill to replace material considered by the Engineer to be unsuitable for backfill or to make up for deficiencies in quantity of suitable material where and when necessary and as required for acceptance by the Engineer.

C. Furnish and place selected borrow backfill to replace rock excavated in accordance with Section 312316, although in this case payment for select borrow is deemed included under Rock Removal.

D. Perform test pits and explorations to evaluate acceptability of borrowed material in the location the Contractor proposes to utilize for such material.

1.2 EXISTING CONDITIONS:

A. It shall be the Contractor's responsibility to investigate all site conditions that may affect his work.

1.3 RELATED WORK:

A. Trenching, Backfilling and Compaction - Section 312333

B. Rock Removal (Rock Excavation) – Section 312316

1.4 SUBMITTALS REQUIRED:

A. Samples: The Contractor shall furnish earth materials to the testing laboratory for their analysis and report, as directed by the Engineer.

B. Test Results: The testing laboratory shall submit written reports of all tests, investigations, findings and recommendations to the Contractor and the Engineer. The cost for the testing shall be borne by the Contractor.

PART 2 - MATERIALS

2.1 GENERAL:

A. Selected borrow consists of unclassified material containing no rock or stones over 2" of its greatest dimension and containing no humus, topsoil or other objectionable materials.
B. Shall contain no more than 10% clay or silt (passing the 200 sieve).

C. Where selected granular backfill is specified on the drawings or elsewhere in the Technical Specifications, the granular fill shall conform to this section and, in addition, the granular fill shall conform with ASTM D2487, Class III soil types; GM, GC, SM, and SC.

2.2 ACCEPTANCE:

A. All materials utilized under this Section shall be as acceptable to the Engineer.

B. A minimum of ten (10) days prior to taking any material from the source, the Contractor shall request the acceptance of the Engineer of the proposed borrow area.

C. Acceptability of the source and material will not be based only on the characteristics of the material but also on whether it will be satisfactory in that portion of trench in which it is to be used.
D. Any soil having a natural in-place moisture content in excess of 2 percent wetter than optimum moisture content, as determined by the ASTM Designation D1557, Method D, (year of latest revision) will not be considered as acceptable borrow material.

E. The Contractor shall supply any requested samples and pay for any testing laboratory fees to prove suitability of the selected borrow backfill.

F. Excavated material from the site can be used as select borrow backfill provided it is screened, tested and meets the general material requirements of this Technical Specification.

PART 3 - CONSTRUCTION DETAILS

3.1 GENERAL:

A. All methods utilized for the placement of selected borrow backfill shall comply with the details shown on the plans for the type of work being performed.

B. Placement shall strictly comply with the specific requirements of the appropriate Specification Section(s) for the type of work being performed.

PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT:

A. Selected Borrow Backfill placed to the minimum dimensions indicated on the Plans will be included under the individual prices bid for the respective Contract Items.

B. Selected Borrow Backfill placed to a height of 24 inches above piping will be included under the unit price bid for the respective Contract Item.

C. Measurement for all other "additional" Selected Borrow Backfill will be made on the basis of cubic yards of select borrow backfill in-place as measured by the Engineer. The Contractor is reminded that this material is to be placed only where required for the Engineer's acceptance of the work.

4.2 PAYMENT:

A. The Contractor is reminded that no payment will be made for Selected Borrow Backfill placed in connection with Rock Removal, since the cost for such material is included under the Rock Removal unit price bid.

B. The unit price bid per cubic yard shall include the cost of furnishing all labor, materials, tests and equipment necessary to complete the work. No additional payment will be made for disposal of unsuitable excavated material or for handling material to the point of placement.

C. Where no payment item is provided in the Contract Proposal, and selected borrow backfill is necessary or required to complete the work, no separate payment will be made and such material (in-place) shall be deemed included under the other payment items of the Proposal.

END OF SECTION 312323.13.02

SECTION 312323.13.03 - BACKFILL (SUBBASE MATERIAL) (NY)

PART 1 – GENERAL

1.1 WORK INCLUDED:

A. Furnish and place subbase material at the depths and locations shown on the Plans and/or called for in the Specifications.

B. Furnish and place subbase material to make up for deficiencies in the quantity of suitable subbase material or quality of subgrade where and when necessary and as required for acceptance by the Engineer.

C. Subbase material, unless otherwise noted, shall be NYSDOT Subbase Course, Item 304.15, also meeting the requirements noted herein.

1.2 EXISTING CONDITIONS:

A. It shall be the Contractor's responsibility to investigate all site conditions that may affect his work.

PART 2 - MATERIALS

2.1 MATERIALS REQUIREMENTS:

A. Materials for subbase course shall consist of sand and gravel, approved blast furnace slag or stone. All materials furnished shall be well graded from coarse to fine and free from organic or other deleterious materials.

B. It shall be the Contractor's responsibility to provide material which meets this specification and is within his capabilities to fine grade to the required tolerances. Should the subbase course become unstable at any time prior to the placement of the overlying course due to the gradation of the material furnished, the Contractor shall, at his own expense, correct the unstable condition to the satisfaction of the Engineer.

C. Materials furnished for Types 1 and 4 shall consist of approved blast furnace slag, stone, sand and gravel or blends of these materials. Material furnished for Type 2 shall consist solely of acceptable blast furnace slab or of stone which is the product of crushing ledge rock.

D. Gradation:

Type	Sieve Size Designation	Percent Passing by Weight
1	3 inch (75mm)	100
	2 inch (50mm)	90-100
	1/4 inch (6.3mm)	30-65
	No. 40	5-40
	No. 200	0-10

2	2 inch (50mm)	100
	1/4 inch (6.3mm)	5-60
	No. 40	5-40
	No. 200	0-10
4	2 inch (50mm)	100
	1/4 inch (6.3mm)	30-65
	No. 40	5-40
	No. 200	0-10

D. Soundness:

1. Material for Types 1, 2, and 4 will be accepted on the basis of a Magnesium Sulfate Soundness Loss after 4 cycles of 20 percent or less.

E. Plasticity Index:

1. The Plasticity Index of the material passing the No. 40 mesh sieve shall not exceed 5.0.

F. Elongated Particles:

1. Not more than 30 percent, by weight, of the particles retained on a 1/2 inch sieve shall consist of flat or elongated particles. A flat or elongated particle is defined herein as one which has its greatest dimension more than 3 times its least dimension. Acceptance for this requirement will normally be based on a visual inspection by the Engineer. When the Engineer elects to test for this requirement, material with a percentage greater than 30 will be rejected.

2. All material shall meet the specified gradation prior to placement on the grade. All processing shall be completed at the source.

PART 3 - CONSTRUCTION DETAILS

3.1 GENERAL:

A. All methods utilized for the placement of subbase course shall comply with the details shown on the plans for the work being performed.

B. Placement shall strictly comply with the specific requirements of the appropriate specification section(s) for the work being performed.

C. Subbase material shall be compacted and leveled so that it will properly support the pavement structure or other improvement as indicated on the Plans.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Subbase Material placed to the minimum dimensions indicated on the Plans will be included under the individual prices bid for the respective Contract Items.

4.2 Subbase material placed to the minimum requirements and dimensions shown on the drawings for pavement restoration or new pavement construction shall be included in the unit price bid for the applicable pavement Item.

4.3 Measurement for all other "Additional" Subbase Material will be made on the basis of cubic yards of material in-place as measured by the Engineer. The Contractor is reminded that this "additional" material is to be placed only where required for the Engineer's acceptance of the work.

4.4 The unit price bid per cubic yard shall include the cost of furnishing all labor, materials, tests and equipment necessary to complete the work. No additional payment will be made for the excavation and disposal of unsuitable excavated material or for handling the material to the point of placement.

END OF SECTION 312323.13.03

SECTION 312333 - TRENCHING, BACKFILLING AND COMPACTION WORK (NY)

PART 1 - GENERAL

1.1 WORK INCLUDED:

A. Excavate for all pipe lines, conduits, culvert pipes, utility, walls, structures and other improvements shown on the Plans or called for in the Specifications.

B. Excavate within the limits of the Contract as necessary for the completion of the work.

C. Place and thoroughly compact granular beds and fills over the pipes, services or other improvements, to rough grade elevations after satisfactorily testing.

D. Dewater excavations so that no piping, conduit, concrete work, etc. is installed in water and so that a firm stable, firm bedding is provided.

1.2 EXISTING CONDITIONS:

A. Locations of existing underground utilities are shown in an approximate way only.

B. The Contractor shall determine the exact location of all existing utilities before commencing work. The Contractor shall also consult with applicable Utility Companies for locations.

C. The Contractor shall notify UDig NY Center a minimum of three (3) working days prior to the work.

D. The Contractor agrees to be fully responsible for any and all damage, which might be caused by his failure to exactly locate and preserve any and all underground Utilities.

E. It shall be the Contractor's responsibility to investigate all site conditions that may affect his work.

1.3 RELATED WORK:

A. Rough Grading – Section 312213

B. Rock Removal – Section 312316

C. Dewatering – Section 312319

D. Backfill (Crushed Stone Foundation) – Section 312323.13.01

E. Backfill (Selected Borrow Backfill) – Section 312323.13.02

1.4 REFERENCE STANDARDS:

A. The following test standards apply to the work under this section:

1. ASTM D2216, “Laboratory Determination of Moisture Content of Soil.”
2. ASTM D422, “Particle-Size Analysis of Soils.”
3. ASTM D698, “Test method for Laboratory Compaction Characteristics of Soil Using Standard Effort.(Standard Proctor)
4. ASTM D1557, “Test method for Laboratory Compaction Characteristics of Soil Using Modified Effort.(Modified Proctor)
5. ASTM D2922, “Density of Soil and Soil Aggregate in Place by nuclear Methods.”
6. ASTM D2937, “Density of Soil in Place by the Drive-Cylinder Method.”
7. ASTM D3107, “Test for Moisture Content of Soil and Soil Aggregate in Place by Nuclear Methods.”

1.5 SUBMITTALS REQUIRED:

A. Samples: The Contractor shall furnish earth materials such as select backfill if required to the testing laboratory for their analysis and report, as acceptable to the Engineer.

B. Test Results: The testing laboratory shall submit written reports of all tests, investigations, findings and recommendations to the Contractor and the Engineer.

C. Original signed copies of all reports shall be sent directly to the Engineer.

D. Design drawings showing the spacing of all whalers, bracing or other structural components required for all sheeting (wood or steel) shall be provided bearing the original seal and signature of a licensed P.E. in the State of New York. Said drawings shall be placed on record for the project; the Owner nor their agents will review or approve same as a function of their responsibilities. The Contractor shall be fully responsible for the safety of the project operations, as noted under Section 7 of the General Conditions.

1.6 PROJECT REQUIREMENTS:

A. Protect excavations by shoring, bracing, sheet piling, underpinning or by other methods, as required to ensure the stability of the excavation.

B. Underpin or otherwise support structure and other facilities and lines adjacent to the excavation which may be damaged by the excavation. This includes service lines.

C. Immediately notify the Engineer of any unexpected subsurface conditions.

D. Existing Utilities: Locate existing underground utilities in areas of work. If utilities are to remain in place, provide adequate means of support and protection during earthwork operations. Comply with OSHA requirements:

E. Should uncharted or incorrectly charted piping or other utilities be encountered during

excavation, consult utility owner immediately for directions.

F. Cooperate with the Owner and utility companies in keeping respective services and facilities in operation.

G. Repair damaged utilities to satisfaction of utility owner; at no cost to the Owner.

H. Do not interrupt existing utilities serving facilities occupied and used by the Owner or others, during occupied hours, except when permitted in writing by the Owner and then only after acceptable temporary utility services have been provided.

I. Provide a minimum of 48-hour notice to the Owner and receive written notice to proceed before interrupting any utility.

J. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for temporary shutoff of services if lines are active.

1.7 USE OF EXPLOSIVES:

A. Do not bring explosives onto site or use in work without prior written permission from authorities having jurisdiction. Contractor is solely responsible for handling, storage, and use of explosive materials when their use is permitted.

B. Obtain all necessary permits, bonds, Certificates of Insurance and other such authorizations and pay all necessary fees and costs as required by all applicable jurisdictions.

1.8 PROTECTION:

A. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights.

B. Operate warning lights as recommended by authorities having jurisdiction.

C. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.

D. Perform excavation within drip-line of large trees to remain by hand, and protect the root system from damage or dryout to the greatest extent possible. Maintain moist conditions for root system and cover exposed roots with burlap. Paint root cuts of 1" diameter and larger with emulsified asphalt tree paint.

1.9 EXCAVATION CLASSIFICATIONS:

A. The following classifications of excavation are applicable to this project:

1. Unclassified Excavation - Includes excavation of earth, pavements and other obstructions

visible or not visible on ground surface; underground structures, utilities and other items indicated to be demolished and removed; together with any other earth or other materials encountered that are not classified as rock or unauthorized excavation.

2. Rock Excavation - Includes removal and disposal of materials and obstructions encountered, which in the opinion of the Engineer, cannot be excavated except by drilling and blasting or drilling and wedging (as further defined under Section 312316).
3. Unauthorized Excavation - Consists of the removal of materials beyond indicated subgrade elevations or dimensions without specific acceptance of the Engineer. Unauthorized excavation, as well as the remedial work required to obtain acceptance from the Engineer, shall be at the Contractor's expense.

PART 2 – MATERIALS:

2.1 BEDDING MATERIAL:

A. Crushed stone shall conform to the requirements of the Standard Specification's Construction and Materials, New York State Department of Transportation and the requirements of Section 312323.13.01, "Crushed Stone Foundation".

B. Sand shall conform to the requirements of NYSDOT Section 703-06 and meet the requirements following gradation requirements:

Sieve Size	% Passing
1/4"	100
No. 50	0-35
No. 100	0-10

2.1 BACKFILL MATERIALS:

A. Selected Borrow Backfill and Selected Granular Backfill: Selected fill is soil material native to the area, that is capable of being compacted to specified densities and that is free from organic matter, humus, topsoil, and other deleterious materials. Selected fill shall conform to Section 312323.13.02 Backfill (Select Borrow Backfill).

B. If sufficient selected fill material is not available from excavation under the contract, additional fill suitable for use, shall be brought to the site from other sources. Additional or separate payment for such materials shall only be made where so provided in the Contract Proposal.

PART 3 - CONSTRUCTION DETAILS

3.1 PREPARATION:

A. All subgrades shall be formed of suitable material free from sod, roots, stumps, trees, brush and

frozen soil or any other objectionable material.

B. All techniques and equipment used to place the material shall provide an embankment uniformly compacted to the required grades.

C. Any portion of subgrade which, in the opinion of the Engineer, has been damaged by the Contractor's equipment in the progress of his work shall be corrected to the satisfaction of the Engineer by the Contractor.

D. The Contractor shall:

1. Establish extent of excavation by area and elevation as indicated on the drawings.
2. Set required lines and elevations.
3. Maintain benchmarks and other elevation control points. Re-establish, if disturbed or destroyed, at no additional cost to the Owner.
4. Accurately determine all existing utility line elevations and locations prior to any excavation or work being undertaken.

3.2 TRENCHING:

A. Excavation:

1. Dig trenches to the uniform width required for particular item to be installed, sufficiently wide to provide ample working room. Provide 12" clearance on both sides of pipe or conduit.
2. Excavate the trenches to depth indicated or required. Carry the depth of trenches for piping to establish indicated flow lines and invert elevations.
3. Trim and shape trench bottoms and leave free of irregularities, lumps, and projections.
4. Stockpile excavated subsoil for reuse where required. Remove excess or unsuitable excavated subsoil from site.
5. Do not backfill trenches until tests and inspections have been made.
6. The Contractor shall conduct all rock excavation operations, including blasting, in strict accordance with all State and Local laws and ordinances and he shall exercise maximum precautions including the use of mats in order to avoid damage to property and utilities.
7. The bottom of the excavation shall not be disturbed and the final removal of material to grade shall not be made until just before the pipe, structure or improvement is to be placed.
8. Removing and loosening material on the back slopes of cut sections shall be avoided, and any such material removed or loosened shall be replaced and thoroughly compacted to the required cross section at the Contractor's expense.

B. Stability of Excavation:

1. The Contractor shall be responsible for providing a safe and prudent excavation operation in a manner so that the workers, public and authorities will be protected from unreasonable hazard.
2. Slope sides of excavations to comply with local codes and ordinances having jurisdiction.

Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Comply with OSHA requirements.

3. Maintain sides and slopes of excavation in safe condition until completion of backfilling.
4. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights stringers, and cross-braces, in good serviceable condition.
5. Establish requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction.
6. For the safety of personnel, sheeting shall be used as required in any trench or excavation more than five (5) feet above the personnel's footing.

3.3 DRAINAGE AND DEWATERING:

A. The Contractor shall maintain all excavations, slopes and all surfaces such that satisfactory drainage is insured at all times.

B. Temporary facilities shall be provided when the Contractor finds it is necessary to interrupt the existing sewers, drainage pipes or surface drainage facilities and these temporary facilities shall be considered incidental to the construction of the project.

C. The Contractor shall excavate and dispose of seepage pockets of soft, wet, unstable materials, as acceptable to the Engineer. The excavated areas shall be immediately backfilled and covered with accepted granular material as necessary for acceptance by the Engineer.

D. In addition the Contractor shall:

1. Prevent surface, subsurface or ground water from flowing into excavation and from flooding project area, as well as surrounding areas.
2. Not allow water to accumulate in excavations.
3. Remove water to prevent soil changes detrimental to the stability of subgrades.
4. Provide, operate and maintain a temporary dewatering system including pumps, well points, sumps suction and discharge lines, and other dewatering components necessary to convey water away from excavations and control the groundwater level so that the necessary construction work can be properly performed.
5. Provide and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations by dewatering, to collecting or run-off areas.
6. Insure that no damages result from improper drainage and dewatering implementation; the Contractor shall be fully responsible for, and shall correct at his own expense, any and all such damages which may result from his operations or failure to make any provisions.

E. Dewatering operations shall be in accordance with Specification 312319 “Dewatering”, and as acceptable to the Engineer.

F. The Contractor shall be fully responsible for the diversion of all drainage flows. The Contractor shall maintain the efficiency of all existing drainage systems both underground and surface.

G. There shall be no discharge of silty, muddy or otherwise polluted water from any dewatering

operation to any natural water course. Temporary facilities to prevent same shall be understood as a requirement of their project, provided at no cost to the Owner.

H. Provide, as necessary and acceptable to the Engineer, sediment control measures to ensure that discharged waters are of the highest possible quality.

3.4 BEDDING:

A. Place the type and thickness of bedding as indicated on the drawings.

B. Place systematically to create a uniform stable surface true to grade to ensure proper bedding of the pipe, structure or improvement.

3.5 PLACEMENT OF PIPE (GENERAL):

A. All pipe shall be placed in accordance with the specific requirements of the applicable technical specification section.

B. All pipe shall be inspected prior to being placed in the trench. Defective materials shall be immediately removed from the project site.

C. All pipe shall be laid at the location and grade shown on the plans and as necessary for completed work acceptable to the Engineer.

D. A suitable base in conformance will any details shown, shall be provided to support the pipe throughout its entire length.

E. All work shall be subject to testing and acceptance of Engineer and all applicable authorities.

3.6 PLACEMENT OF PIPE:

A. Unless specifically noted otherwise in other Specification sections, placement shall at minimum comply with these requirements.

B. Special care shall be exercised in placing and compacting of the material, immediately adjacent to the pipe in order to avoid damage, either to the pipe or its alignment.

C. Any pipe that is damaged or moved out of alignment, regardless of cause, shall be replaced at no cost to the Owner.

D. All culverts shall be completed, backfilled and compacted before the road is rough graded.

E. Only if no other requirements are delineated in other Specification Sections and no details are provided; at minimum, in backfilling, loose, selected fine earth backfill free from stones shall be placed manually to a point two (2) feet above the top of pipes. From the bottom of the trench to the spring line of the pipe, the filling shall be thoroughly compacted by the use of tampers or

similar implements and shall be brought up evenly on both sides of the pipe. The balance of the trench may be filled with "run-of-trench" materials, well compacted, except that no stone or rock shall be greater than 4" at its greatest dimension.

3.7 BACKFILLING:

A. Backfill excavation as promptly as work permits, but not until completion of the following:

1. Observation, testing, acceptance, and recording locations of underground improvements by the Contractor for the as-built drawings required under Section 7.12 of the Contract Documents, or for measurement taken by the Owner or the Engineer for the records or purposes.
2. Removal of concrete formwork.
3. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structure or utilities, or leave in place if required.
4. Removal of trash and debris.

B. The type of materials to be used in bedding, filling and backfilling at the structures, culverts, pipes or other improvements and the procedure of placement shall be in strict accordance with the details shown as noted on the plans and/or in the specifications.

C. Ensure trenches are free of snow, ice and water and that ground surface are not frozen.

D. Fill and backfill within, around and including that against the exterior of foundation walls shall be placed in uniform horizontal layers not exceeding six (6) inches in thickness before compaction. The material shall be spread on the existing subgrade after all sod, topsoil and unsuitable material has been stripped and removed. All portions of each layer shall be compacted with a minimum of three (3) passes of an acceptable vibrating roller. In areas inaccessible to the roller, a vibrating plate compactor or an impact rammer shall be used.

E. Otherwise, place backfill and fill materials in layers not more than 9" in loose depth for material compacted by heavy compaction equipment, and not more than 6" in loose depth for material compacted by hand-operated tampers.

F. In backfilling, special care shall be taken to thoroughly compact the material. No refilling shall be made with frozen earth, and no refilled trench shall contain more than one-third (1/3) stone, unless otherwise acceptable to the Engineer. Material in the opinion of the Engineer to be unsuitable for backfilling shall not be used.

G. Place backfill to the subgrade elevations of further indicated work.

H. Use care in backfilling to avoid damage or displacement of pipe systems.

I. Maintain optimum moisture content of fill materials in order to attain required compaction density.

J. Compact in conformance with specific requirements noted hereinbelow.

K. Remove surplus fill materials from site to a proper disposal area.

3.8 COMPACTION:

A. A thoroughly and satisfactorily compacted earth subgrade is defined as having a minimum dry density of 90 percent of the maximum density. However, where the material consists of sand and gravel mixtures containing less than 20 percent, by weight, of particles passing the No. 200 mesh sieve, as determined by washing through the sieve in accordance with ASTM Designation D1140 (latest revision), a minimum dry density of 95 percent of the Maximum Density will be required. The in-place density shall be determined by ASTM Designation D 6938 (latest revision).

B. All fill material shall be compacted at a moisture content suitable for obtaining the required density. In no case, shall the moisture content be less than three (3) percent drier than the Optimum Moisture Content determined by the ASTM Designation D1557(latest revision), Method D.

C. When the moisture content of the material in the layer is less than the required amount, water shall be added by pressure distributors or other equipment; water may be added also in excavation or borrow pits. Water shall be uniformly and thoroughly incorporated into the soil by discing, harrowing, blading or by other acceptable means. This manipulation may be omitted for coarse and gravel soils. When the moisture content of material is in excess of the required Optimum amount, dry material shall be thoroughly incorporated into the wet material, or wet material shall be dried to the required Optimum by evaporation.

D. Any method or combination of methods used for the purpose of drying shall be subject to acceptance by the Engineer.

E. Maximum Density is defined as the maximum dry weight density in pounds per cubic foot as determined by ASTM D-1557 (latest revision), Method D.

F. Embankments - Where the subgrade material contains less than one third (1/3), by volume, of stones or rocks larger than six (6) inches in greatest dimension, it shall be placed in successive uniform layers not exceeding eight (8) inches in thickness, loose measure, over the entire area of the embankment. Each layer shall be thoroughly rolled over its entire area with equipment intended for use to provide a uniformly compacted embankment, as acceptable to the Engineer. Equipment must be on the site prior to the start of construction of any embankment. All equipment must be in good working order. Pneumatic tired rollers shall have an operating weight of not less than 1000 pounds per tire. Smooth steel wheel rollers shall have a minimum weight of ten (10) tons and shall exert pressure of not less than 300 pounds per lineal inch of compression wheel or roll width.

G. All testing required to demonstrate compaction in compliance with these specifications shall be provided at the expense of the Contractor.

3.9 FIELD QUALITY CONTROL:

A. The testing laboratory shall check the degree of compaction of all fill, including proof-rolling.

Perform tests for each layer, of each kind of fill. Determine maximum density at optimum moisture for each material per ASTM D1557. Make field compaction tests per ASTM D 6938. The in-place density specified is the relation of the field compaction test and the maximum density determination of the same soil. This testing shall be performed as requested by the Engineer.

B. If, in the opinion of the Engineer, based on testing service reports and inspection, subgrade or fills which have been placed are below specified density, provide additional compaction and testing at no additional cost to the Owner.

PART 4 - MEASUREMENT AND PAYMENT

4.1 PAYMENT:

A. Payment for all Trenching, Backfilling and Compaction shall be included in the individual prices bid in the Proposal.

B. It is possible that groundwater will be encountered on the project site. Any costs incurred for the dewatering of excavations and for the installations, operation and maintenance of any and all dewatering facilities shall be deemed included in the prices bid in the proposal.

C. For all timber used for sheeting, bracing, etc., which is not shown upon the drawings to be left in place and which shall not be left as necessary for acceptance of the Engineer or as noted in writing to be left in place during the progress of the work, but which shall be actually left in the ground for convenience or to serve the interests of the Contractor, the Contractor shall receive no payment, it being understood and agreed that his compensation therefore is included in the prices bid in the Proposal.

D. There will be no separate payment made for any work, materials or testing required for compliance with this Section.

END OF SECTION 312333 (NY)

SECTION 312334 - STRUCTURAL EXCAVATION, BACKFILL AND COMPACTION

PART 1 – DESCRIPTION

1.1 RELATED DOCUMENTS:

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

1.2 DESCRIPTION OF WORK:

A. This Section pertains to an area bound by the exterior limit of excavation of each structure. including, but not limited to buildings, tanks, channels, troughs, precast box culverts. bridge abutments, wingwalls, and elements attached to structures.

B. This work includes the following:

1. Preparing subgrade for structures, slabs, walks, and pavements.
2. Preparing subbase and drainage fill beneath foundation footings, slabs, and pavements.
3. Excavating and backfilling for structure.
4. Excavating and backfilling of trenches within structure lines.
5. Excavating and backfilling for underground mechanical utilities and buried mechanical appurtenances.
6. Excavating and Backfilling for Mechanical, Electrical, and Plumbing Work: Refer to Divisions 22, 23 and 26 sections for excavation and backfill required in conjunction with underground mechanical, electrical and plumbing utilities and buried mechanical, electrical, and plumbing appurtenances.
7. Final Grading, together with placement and preparation for topsoil for lawns and planting, is specified in Division 32 Sections.

1.3 RELATED SECTIONS:

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

B. Rock Excavation – Section 312316

C. Selected Borrow Backfill- Section 312323.13.2

D. Trenching, Backfill and Compaction – Section 312333

E. Backfill Subbase Material – Section 312323.13.03

F. Topsoil Placement and Grading (Topsoil) - Section 329119.13

G. All other sections of this document for which excavation, backfilling or compaction work is

called for or required or is related and applicable.

1.4 REFERENCE STANDARDS:

A. The following test standards apply to the work under this section:

1. ASTM D2216, “Laboratory Determination of Moisture Content of Soil.”
2. ASTM D422, “Particle-Size Analysis of Soils.”
3. ASTM D698, “Test method for Laboratory Compaction Characteristics of Soil Using Standard Effort. (Standard Proctor)
4. ASTM D1557, “Test method for Laboratory Compaction Characteristics of Soil Using Modified Effort. (Modified Proctor)
5. ASTM D2922, “Density of Soil and Soil Aggregate in Place by nuclear Methods.”
6. ASTM D2937, “Density of Soil in Place by the Drive-Cylinder Method.”
7. ASTM D6938, “Test for Moisture Content of Soil and Soil Aggregate in Place by Nuclear Methods.”
8. ASTM D4253 “Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.”

1.5 QUALITY ASSURANCE:

A. Comply With: NYSDOT "Standard Specification for Construction and Materials".

B. Routine testing of existing soils, and compacted material for compliance with these Specifications shall be performed by a testing agency acceptable to Engineer.

C. Compacted material which does not meet density requirements shall be removed and/or re-compacted, and re-tested.

D. Testing agency shall be employed by contractor to perform the following services:

1. Test materials proposed for use by Contractor to verify specified requirements and determine optimum moisture at which maximum density can be obtained in accordance with ASTM D 1557, Modified Proctor.

2. Perform field density tests for any fill material outside of the structure area.

E. Testing agency shall be employed by Owner to perform Special Inspections noted on the drawings and the following services:

1. Perform field density and bearing capacity tests for footing subgrade, and field density tests for all fill material within structure area.

a. For footing subgrade and for each stratum of soil on which footings will be placed, conduct minimum of one field density test of each spread footing, and one test per 20-foot length of strip footing.

b. For structure subgrade and for each lift of compacted material, conduct one field density test for every 1,000 sq. ft. of structure area, but not less than four tests.

2. Verify placement of each layer of drainage course and subbase to required cross sections and thicknesses and compaction.

3. The testing agency shall inspect and approve each subgrade and fill layer before further backfill or construction work is performed. Approval shall be based on satisfactory achievement of compaction criteria and achievement of required bearing strength. Notify Engineer of any remedial action required prior to performance of work.

4. Testing agencies shall submit copies of reports within 7 days of test to Owner, Contractor, Geotechnical Engineer, and Engineer. Include dates of site visit, description of work observed and summary of observations. Include dates of testing, location, elevation, and readings of all tests performed.

F. A licensed professional Geotechnical Engineer will be employed by the Owner/Engineer for quality control and to review test data provided by the testing agency.

1. Geotechnical Engineer shall be present during proof-rolling and when subgrade is exposed to identify soils requiring undercutting and replacement.

2. Geotechnical Engineer shall review and approve all materials proposed by Contractor for use as compacted fill based on test data and information submitted by testing agency.

3. Geotechnical Engineer shall verify footing bearing stratums; review and approve filling and compaction procedures; and be present to review and approve preparation of slab-on-grade subgrade and subbase.

1.6 DEFINITIONS:

A. Excavation consists of removal of material encountered to subgrade elevations indicated and subsequent disposal of materials removed.

B. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be at Contractor's expense.

1. Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position, when acceptable to Engineer.
2. In locations other than those above, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Engineer.

C. Additional Excavation: When excavation has reached required subgrade elevations, notify Engineer and Geotechnical Engineer, who will make an inspection of conditions. If

Geotechnical Engineer determines that bearing materials at required subgrade elevations are unsuitable, continue excavation until suitable bearing materials are encountered and replace excavated material as directed by Geotechnical Engineer/Engineer. The Contract Sum may be adjusted by an appropriate contract modification.

D. Removal of unsuitable material and its replacement as directed will be paid on basis of Conditions of the Contract relative to changes in work.

E. Subgrade: The undisturbed earth or the compacted soil layer immediately below granular subbase, base of structure, or topsoil materials.

F. Structure: Buildings, foundations, slabs, tanks, curbs, walks, or other man-made stationary features occurring above or below ground surface.

1.7 RESPONSIBILITIES OF CONTRACTOR:

A. Advise testing agency/Special Inspector sufficiently in advance of operation to allow assignment of personnel. Coordinate daily testing requirements with testing service.

B. Advise Geotechnical Engineer sufficiently in advance of operation to schedule inspections and review of work specified.

C. Use of testing services and review by Geotechnical Engineer shall in no way relieve Contractor of his responsibility to furnish materials and construction as specified.

1.8 PROJECT CONDITIONS:

A. Site Information: Subsurface investigation reports were used for the basis of the design and are available to the Contractor for information only. Conditions are not intended as representations or warranties of accuracy or continuity between soil borings. The Owner will not be responsible for interpretations or conclusions drawn from this data by Contractor.

1. Additional test borings and other exploratory operations may be performed by Contractor, at the Contractor's option; however, no change in the Contract Sum will be authorized for such additional exploration.

B. Existing Utilities: Locate existing underground utilities in area of Work before starting earthwork operations. Where utilities are to remain in place, provide adequate means of protection during earthwork operations.

1. If uncharted, or incorrectly charted, piping or other utilities are encountered during excavation, consult utility owner and Engineer immediately for directions. Cooperate with Owner, and public and private utility companies to keep their respective services and facilities in operation. Repair damaged utilities as required by utility owner, at the sole expense of the Contractor.
2. Do not interrupt existing utilities serving facilities occupied by Owner or others, during occupied hours, except when permitted in writing by Engineer and then only after

acceptable temporary utility services have been provided.

3. Provide minimum of 48-hour notice to Engineer and Owner, and receive written notice to proceed before interrupting any utility.
4. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shutoff of services if lines are active.

C. Use of Explosives: Do not bring explosives onto site nor use in Work, unless written permission is secured from the Owner.

D. Protection of Property: Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

E. Perform excavation by hand within dripline of large trees to remain. Protect root systems from damage or dry out to the greatest extent possible. Maintain moist condition for root system and cover exposed roots with moistened burlap.

PART 2 - MATERIALS

2.1 SELECT FILL:

A. Select fill shall meet the minimum design criteria shown on the project plans and shall be free of organics and other deleterious materials.

B. Select fill material specification shall be submitted to Engineer for approval prior to use on site.

C. Unless otherwise noted, use medium (less than 2-inch diameter maximum) well graded bank-run sand or sand and gravel which are sound, durable, and free of organic and other deleterious materials and has less than 15 percent passing the No. 200 sieve with a maximum Plasticity Index of seven (PI = 7). Submit sample to Engineer for approval.

2.2 SUBBASE MATERIAL:

A. Sand and gravel which is sound, durable, and free of organic and other deleterious materials conforming to the following limits of gradation:

Percent Passing by Weight	Sieve Size
100	2"
30 to 65	1/4"
5 to 40	No. 40
0 to 10	No. 200

2.3 DRAINAGE FILL:

A. Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, with 100

percent passing a 1-1/2 inch sieve and not more than 5 percent passing a No. 4 sieve.

2.4 FILTER FABRIC:

A. Mirafi 140N by Mirafi, Inc., or accepted equivalent.

2.5 DRAINAGE PIPE:

A. 4-inch diameter perforated pipe.

2.6 EXCAVATED MATERIALS:

A. Do not use as select fill or subbase material, unless approved by engineer. The contractor's testing agency shall sample materials and perform testing to determine compliance with fill specifications listed in this section. Submit testing results to engineer for approval.

2.7 VAPOR BARRIER: Provide vapor barrier cover over prepared base material where indicated below slabs on grade. Use only materials that are resistant to deterioration when tested in accordance with ASTM E 154, as follows:

A. Polyethylene sheet not less than 10 mils thick, or as indicated on the plans.

B. Water-resistant barrier consisting of heavy Kraft papers laminated together with glass-fiber reinforcement and overcoated with black polyethylene on each side. Moistop by Fortifiber Corp. or accepted equivalent.

PART 3 – EXECUTION

3.1 JOB CONDITIONS:

A. Examine all substrates and conditions under which Work shall be performed. Do not proceed with Work until all unsatisfactory conditions are corrected.

B. Drainage shall be maintained and traffic within building area shall be restricted during construction to maintain integrity of subgrade. Failure to observe these precautions will require Contractor, at his own expense, to remove disturbed areas and correct.

3.2 COLD WEATHER PROTECTION:

A. Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.

3.3 REMOVALS:

A. Clear, grub, and strip site of vegetation, topsoil, and other organic materials per specific specification.

B. Remove all brick fragments and other construction debris. Plow, strip, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface.

C. When existing ground surface has a density less than that specified for particular area classification, break up ground surface, pulverize, moisture-condition to optimum moisture content, and compact to required depth and percentage of maximum density.

D. Removal from Owner's Property: Remove waste materials, including unacceptable excavated material, trash, and debris, and dispose of it off Owner's property, at the Contractor's expense.

3.4 EXCAVATION:

A. Excavation shall be considered unclassified and understood to mean any and all materials encountered during excavation.

B. Excavation Classifications: The following classifications of excavation will be made when rock is encountered:

1. Earth excavation includes excavation of pavements and other obstructions visible on surface; underground structures, utilities, and other items indicated to be demolished and removed; together with earth and other materials encountered that are not classified as rock or unauthorized excavation.
2. Rock excavation for trenches and pits includes removal and disposal of materials and obstructions encountered in accordance with the specific technical specifications.

C. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross braces, in good serviceable condition. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Extend shoring and bracing as excavation progresses.

1. Design submittals and other requirements of sheeting and shoring are provided in Division 31 Section “Excavation Support and Protection”.

3.5 DEWATERING:

A. As specified in Division 31 “Dewatering”.

3.6 PROOF ROLLING:

A. Following stripping and removal of miscellaneous fill, grade, and compact exposed subgrade.

B. Proof roll subgrade by making five passes across the building area in each direction using a smooth drum vibrating roller having a static weight of at least 10 tons.

C. All soft spots which develop during proof rolling shall be undercut and replaced with compacted select fill if under slabs or compacted subbase material if under foundations and footings.

D. Proof rolling shall not be performed during or immediately after periods of inclement weather.

3.7 FILLING, BACKFILLING AND COMPACTION:

A. Do not place fill material on surfaces that are muddy, frozen, or contain frost or ice.

B. Place soil stabilization geotextile below structural fill if required after subgrade has been approved and before placement of fill material.

C. Use select fill to increase grades within structure areas, as interior backfill against foundations and in trenches, as exterior backfill against walls, as exterior backfill where pavement or walkways abut the structure, and where indicated on Drawings.

D. Use subbase material to increase grades and establish bearing elevation above exposed subgrade beneath footings and foundations, and where indicated on Drawings.

E. Use drainage material directly below slabs and pad as indicated on Drawings.

F. Use select fill material to increase grades outside the structure area, except as otherwise specified.

G. Use drainage fill around footing drains or as detailed on Drawings. Wrap footing drains and drainage fill with filter fabric. Prewrapped footing drains shall not be used. Where the perimeter pipe is bedded in native soil, the bottom of the trench should be left uncompacted.

H. Backfill trenches with lean concrete where trench excavations pass within 18 inches footings and that are carried below bottom of such footings or that pass under wall footings. Place concrete to level of bottom of adjacent footing.

I. Backfill foundation excavations as soon as possible following construction of foundations and foundation walls.

J. Backfill and fill against foundation walls evenly on both sides to prevent any displacement of construction. Do not backfill walls with fill on one side only until concrete has achieved 70 percent of its design strength.

K. Begin filling in the lowest section of the area.

L. Place fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted

by hand-operated tampers.

M. Scarify the surface of the subgrade and of each lift of fill, prior to placing the next lift to promote vertical drainage.

N. Any lift or portion thereof, which is not compacted in accordance with Specifications shall be re-compacted or removed and replaced to meet compaction requirements.

O. Percentage of Maximum Density Requirements: Compact soil and fill to not less than the following percentages of maximum density, in accordance with ASTM D 1557:

1. Under structures, building slabs and steps, and pavements, compact top 12 inches of subgrade and each layer of fill material at 95 percent maximum density.
2. Under walkways, compact top 6 inches of subgrade and each layer of fill material at 95 percent maximum density.

P. Where a power roller is used for compaction, do not approach nearer than 10 feet from the walls of new or existing construction.

Q. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade of layer of soil material. Apply water in minimum quantity as necessary to prevent free water from appearing on surface during or subsequent to compaction operations.

R. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.

S. Stockpile or spread soil material that has been removed because it is too wet to permit compaction. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to a satisfactory value.

3.8 DRAINAGE FILL:

A. Place drainage fill material on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade and precast concrete structures as follows:

1. Place drainage course 6 inches or less in compacted thickness in a single layer.
2. 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.
3. Compact each layer of drainage course to required cross sections and thicknesses to not less than 70 percent of relative density according to ASTM D 4253.

C. Where footings and foundations bear directly on native subgrade materials, contractor may over-excavate and cap subgrade with compacted drainage fill to protect native materials from disturbance and mitigate mud from forming in the excavation.

D. Place soil stabilization geotextile above drainage fill if required additional fill material is to be placed above it to prevent loss of fines.

3.9 VAPOR BARRIER INSTALLATION:

A. General: Following leveling and tamping of granular base for slabs on grade, place vapor retarder/barrier sheeting with longest dimension parallel with direction of pour, as shown in the Drawings.

B. Lap joints 6 inches and seal vapor barrier joints with manufacturers' recommended mastic and pressure-sensitive tape.

C. After placement of vapor retarder, cover with sand cushion and compact to depth as shown on Drawings.

3.10 TOLERANCES:

A. Excavation for structures shall conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot except to facilitate drainage during construction stage.

B. Surface of subbase under structure slabs shall be graded smooth and even, free of voids, and rolled to required elevation. Provide final grades within a tolerance of 1/2 inch when tested with a 10-foot straightedge.

END OF SECTION 312334

SECTION 312500 - EROSION AND SEDIMENT CONTROL (NY)

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 erosion and sediment control measures. The Owner's Representative has the authority to limit the surface area of earth exposed by earthwork operations and to direct the Contractor to provide immediate temporary or permanent erosion or pollution control measures to minimize damage to property, dirt tracked onto roadways from vehicles, and contamination of watercourses and water impoundments.

B. The Contractor has the ultimate responsibility for providing adequate erosion control and water quality throughout the duration of the project. The Contractor shall provide all measures that may be needed to control erosion and water pollution.

C. In the event of a conflict between the Contract Plans, the reference standards herein, and the requirements laws, rules, or regulations of any other Federal, State, or local agency having jurisdiction, the more restrictive requirement shall apply.

D. This specification shall be utilized in conjunction with the Stormwater Pollution Prevention Plan (SWPPP) which has been prepared and is part of the Contract Documents.

1.3 RELATED SECTIONS:

A. The following sections contain related information:

1. Clearing and Grubbing – Section 311100
2. Rough Grading - Section 312213
3. Finish Grading – Section 312219
4. Dewatering – Section 312319
5. Topsoil Placement and Grading – Section 329119.13
6. Seeding – Section 329219

1.4 REFERENCE STANDARDS:

A. New York State Standards and Specifications for Erosion and Sediment Control Manual, latest edition.

B. New York State (NYS) Stormwater Management Design Manual, latest edition.

1.5 SUBMITTALS:

A. Erosion and Sediment Control Plan: Shall include methods of erosion control for the project in general, methods along haul roads and/or borrow pits, plans for disposal of waste material, and temporary stream crossing plans, as applicable.

B. Product Data: Provide catalog sheets or shop drawings for each type of product to be utilized as called for on the contract plans. Acceptable products for erosion control include, but are not limited to the following:

1. Compost Filter Sock.
2. Hay Bale.
3. Mulches.
4. Stream Protection.
5. Seed, Fertilizer.

1.6 QUALITY CONTROL:

A. Contractor shall retain the services of a certified E&SC inspector for construction storm water management inspections. The inspector shall have taken a 4-hour E&SC training course endorsed by the New York State Department of Environmental Conservation.

PART 2 - PRODUCTS

2.1 GENERAL:

A. Products shall conform to the latest edition of the New York State Erosion and Sediment Control Manual. Only products allowed under this manual shall be approvable by the Engineer.

2.2 SOIL MATERIALS:

A. Mulches: Materials that meet minimum requirements published in Table 3.7 of the New York State Erosion and Sediment Control Manual. Anchoring material shall be Table 3.8 of the New York State Erosion and Sediment Control Manual.

B. Grasses: Seed mixture as specified in Division 31 Section “Seeding” or other species suitable for temporary cover that will not compete with the grasses sown later for permanent cover.

C. Jute Matting: Enkamat 7010 or approved equal.

2.3 COMPOST FILTER SOCK:

A. The compost filter sock shall be in accordance with the NYS Standards and Specifications for Erosion and Sediment Control (latest edition).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL:

A. Where applicable, installation of all erosion and sediment control devices shall be performed pursuant to the more restrictive of:

1. Manufacturer's written instructions.
2. Specifications as published in the New York State (NYS) Standards for Erosion and Sediment Control.
3. Specifications as published in Appendix C of the New York State (NYS) Stormwater Management Design Manual.

B. Installation of all erosion control devices shall occur prior to site disturbance to the maximum extent possible.

C. All temporary and permanent erosion and sediment control practices shall be maintained and repaired as needed to ensure continued performance of their intended function.

D. Owner will monitor Contractor's erosion control and work methods.

1. If the overall function and intent of erosion control is not being met, Owner will require Contractor to provide additional measures as required to obtain the desired results.
2. The erosion control features installed by Contractor shall be adequately maintained by Contractor until the project is accepted.

E. Working In or Crossing Watercourses and Wetlands:

1. Construction vehicles shall be kept out of watercourses to the extent possible.
   a. Where in-channel work is necessary, precautions shall be taken to stabilize the work area during construction to minimize erosion.
2. The channel (including bed and banks) shall always be re-stabilized immediately after in-channel work is completed.
3. Where a live (wet) watercourse must be crossed by construction vehicles during construction, a Temporary Stream Crossing in accordance with the latest NYS Erosion and Sediment Control Manual shall be provided for this purpose.

3.2 PROTECTION OF ADJACENT PROPERTIES:

A. Properties adjacent to the project site(s) shall be protected from loss of soil due to erosion as well as sediment deposition.

B. In addition to the erosion control measures required on the Contract Plans, perimeter controls may be required if damage to adjacent properties is likely, and may include, but is not limited to:

1. Sediment barriers such as straw bales, erosion logs, and compost filter sock.
2. Diversion swales.
3. Sediment basins.
4. Combination of above measures.

3.3 STABILIZED CONSTRUCTION ENTRANCE:

A. Stabilized construction entrances shall be provided at all construction site traffic entrance/exit points, outside of paved entrances or as specified in the *Standard Specifications For Stabilized Construction Entrance* included in the New York Guidelines for Urban Erosion and Sediment Control.

B. The stabilized construction entrances shall be provided prior to any activity on the site; maintained throughout construction and removed, and area restored, following construction.

C. The intent of the entrance is to prevent sediment from depositing upon Town, County, and State roadways. The Contractor's plans to enter and exit the construction site may require additional installations to achieve this goal. These will be provided as required to provide complete site access coverage, at no cost to the Owner.

3.4 MULCHES:

A. Ensure other erosion control measures are in place prior to mulching.

B. Slope and grade site to fit needs of selected mulch products.

C. Remove all undesirable stones and debris.

D. Install and anchor mulch according to Tables 3.7 and 3.8 of the New York State Erosion and Sediment Control Manual.

3.5 COMPOST FILTER SOCK AND HAYBALES:

A. Compost Filter Sock and haybales, as specified in the Standard Specifications included in the New York Guidelines for Urban Erosion and Sediment Control, shall be installed and maintained to control and prevent sediment movement. Required locations for silt socks and haybales shall include the following:

1. All down gradient areas of the site; to protect nearby watercourses and water supply wells.
2. Along paved areas to prevent sediment movement to the surface of the pavement.
3. All locations dictated by the Owner’s representative.

B. Compost Filter Sock and haybales shall be installed prior to site disturbance as required by the contract plans and the owner’s representative.

C. Compost Filter Sock and haybales shall be maintained throughout the period of disturbance.

D. Compost Filter Sock and haybales shall be removed following establishment of sufficient vegetation for unpaved areas and after the period of disturbance for paved areas to control and prevent erosion.

3.6 SEDIMENT BASIN:

A. Sediment Basins, as shown or required, shall be as specified in the New York State Standards and Specifications for Erosion and Sediment Control Design Manual, shall be installed and maintained to control and prevent sediment movement.

3.7 DEWATERING ACTIVITIES SEDIMENT CONTROL:

A. All waters which the Contractor pumps from excavations on this project shall be routed through a portable sedimentation tank, filter bag or other acceptable practice, so as to remove all sediments carried by such water. The practice shall be in accordance with the Standard Specifications included in the New York Guidelines for Urban Erosion and Sediment Control. The practice(s) shall be provided at any and all locations along the trench route/excavation area, as warranted by dewatering activities. Dewatering activities shall conform to Specification 312319 "Dewatering."

3.8 DUST CONTROL:

A. Activities on this project may create dust from traffic and dry weather conditions. Dust control shall be provided to prevent dust throughout the project in accordance with the Standard Specifications for Dust Control included in the New York Erosion and Sediment Control Design Manual.

B. All pavement and sidewalks in all work areas shall be brush cleaned at the end of each working day to minimize dust potential.

3.9 SOIL RESTORATION:

A. Soil restoration is required where soils have been disturbed for development. Soil restoration is applied in the cleanup and landscaping phase followed by permanent vegetative ground cover. Soil restoration is to be performed in accordance with the NYSDEC Stormwater Management Design Manual Section 5.1.6 and as summarized in the following table:

Soil Restoration Requirements			
Type of Soil Disturbance	Soil Restoration Requirement		Comments/Examples
No soil disturbance	Restoration not permitted		Preservation of Natural Features
Minimal soil disturbance	Restoration not required		Clearing and grubbing
Areas where topsoil is stripped	HSG A &B	HSG C&D	Protect area from any ongoing construction

only - no change in grade	apply 6 inches of topsoil	Aerate* and apply 6 inches of topsoil	activities.
Areas of cut or fill	HSG A &B	HSG C & D	
	Aerate and apply 6 inches of topsoil	Apply full Soil Restoration **	
Heavy traffic areas on site (especially in a zone 5-25 feet around buildings but not within a 5 foot perimeter around foundation walls)	Apply full Soil Restoration (de-compaction and compost enhancement)		
Areas where Runoff Reduction and/or Infiltration practices are applied	Restoration not required, but may be applied to enhance the reduction specified for appropriate practices.		Keep construction equipment from crossing these areas. To protect newly installed practice from any ongoing construction activities construct a single phase operation sock area
Redevelopment projects	Soil Restoration is required on redevelopment projects in areas where existing impervious area will be converted to pervious area.		

*Aeration includes the use of machines such as tractor-drawn implements with coulters making a narrow slit in the soil, a roller with many spikes making indentations in the soil, or prongs which function like a mini-subsoiler.
** Per “Deep Ripping and De-compaction, DEC 2008”.

3.10 SURFACE RESTORATION:

A. Areas that are disturbed as a result of this project shall be restored. This cover shall consist of grasses or other landscaping pursuant to these specifications.

3.11 EROSION CONTROL DEVICE REMOVAL:

A. Removal of any and all devices used for the purposes of preventing soil runoff shall be removed after suitable vegetation has stabilized the soil.

3.12 CONTRACTOR SITE INSPECTIONS:

A. Inspection Protocol: The Contractor is responsible for conducting and documenting inspections of the construction site(s) once every 7 calendar days and within 24 hours after a rainfall event of 0.5 inch or greater or equivalent snowfall.

B. Inspection Documentation: Use the inspection checklists in Appendix G of the NYS Stormwater Management Manual, latest edition. All inspection checklists shall be turned over to the Owner upon completion of the project.

END OF SECTION 312500

SECTION 321216 - ASPHALT CONCRETE PAVEMENT (NY)

PART 1 - GENERAL

1.1 WORK INCLUDED:

A. Under this item, the Contractor shall furnish and place pavement courses of hot, plant-mixed asphalt concrete on a prepared base in accordance with these specifications and in reasonable close conformity with the required lines, grades, thickness and typical sections shown on the plans, at the locations shown on the plans.

PART 2 - MATERIALS

2.1 MATERIAL REQUIREMENTS:

A. Subbase: Subbase course material will comply with Standard Specifications for Construction Materials, New York State Department of Transportation, Item 304 "Subbase Course" Types 1,2 or 4 and Technical Specification 312323.13.03. The Contractor shall have the subbase material tested for compliance to the Specification requirements and submit the test results to the Engineer for acceptance, at no additional cost to the Owner.

B. Asphalt Concrete: Asphalt concrete materials will comply with Standard Specifications for Construction and Materials, New York State Department of Transportation, Section 403.

PART 3 - CONSTRUCTION DETAILS

Prior to placement of any subbase the subgrade shall be proofrolled as follows:

3.1 EQUIPMENT:

A. The proof roller shall consist of a chariot type rigid steel frame with a box body filled with proofrolling ballast thirty (30) tons gross weight, and mounted on four (4) pneumatic tired wheels acting in a single line across the width of the roller on its transverse load center line. The wheels shall be equipped with 18.00 x 24, or 18.00 x 25,24 ply tires, and shall be suspended on articulated axles such that all wheels carry approximately equal loads when operating over uneven surfaces.

B. Two complete passes of the roller shall be applied over all elements of the area to be proof rolled. Any deficiencies disclosed during the proof rolling operation shall be corrected. Subsidence depressions shall be filled with material similar to the subgrade soil and then compacted in a normal manner. After compaction, these areas shall be proof rolled again. Corrective work shall

be judged complete when all elements of the subgrade surface over a given embankment show a satisfactory uniform response to the proof roller, acceptable to the Engineer.

3.2 SUBBASE COURSE:

A. Contractor shall lay a foundation course of a compacted depth as shown on the drawings. The laying of this course shall not be allowed if there is any indication of rain, if the ground is wet or will knead under the loaded truck wheels or if there is frost in the ground.

B. In laying the subbase, care is to be exercised to see that it is uniformly spread. After it is leveled and rolled until it does not wave, creep or sag under a ten (10) ton roller, the surface is to be carefully checked to see that the full thickness is laid and to assure that the surface is to grade for the asphaltic concrete pavement. The tolerance for the final grade of the subbase is +/- 1/4".

3.3 WEATHER AND SEASONAL LIMITATIONS:

A. Bituminous plant mix shall not be placed on any wet surface or when the surface temperature is less than specified in "Temperature and Seasonal Requirements" or when weather conditions otherwise prevent proper handling or finishing of bituminous mixtures as determined by the Engineer. Top course mixes shall be paved within the seasonal limitations indicated in "Temperature and Seasonal Requirements".

B. Surface temperatures shall, in all cases, be the controlling temperatures at which material is placed. Paving shall be discontinued as soon as the temperature falls below the requirements.

C. The base and binder course shall be covered with a surface course prior to the end of the paving season. If this cannot be accomplished by the Contractor, he shall be solely responsible for any damage to the subbase, base or binder courses. Repairs made to the damaged areas shall be acceptable to the Engineer.

D. Bituminous paving mixtures for driveways, sidewalks, gutters and other incidental construction shall be placed on surfaces having a temperature of 45 degrees Fahrenheit or greater, unless otherwise accepted by the Engineer.

TEMPERATURE AND SEASONAL REQUIREMENTS

Nominal Compacted Lift Thickness	Surface Temperature Minimum (Note 1)	Seasonal Limits
3" or greater	40 degrees Fahrenheit	None
Greater than 1" but less than 3"	45 degrees Fahrenheit	April 1st to Nov. 15
1" or less	50 degrees Fahrenheit	April 1st to Nov. 15

Note 1: All temperatures shall be measured on the surface where the asphalt is to be placed and the controlling temperature shall be the average of three temperature readings taken at locations +/- 25 feet apart.

3.4 HAULING EQUIPMENT:

A. The mixture shall be transported from mixing plants to the work site in tight vehicles having clean and smooth metal beds. Each load shall be covered with canvas or other suitable material of such size as to protect the mixture from the weather. When necessary, so that the mixture will be delivered on the road at the specified temperatures, truck bodies shall be properly insulated.

B. The inside surface of the vehicles used for the transportation of plant mixes shall be lightly coated, just before the vehicles are loaded, with either a whitewash of lime and water, soap solutions or detergents.

C. After application, the truck bodies shall be raised for a sufficient time to allow the excess fluid to drain.

3.5 BITUMINOUS PAVERS:

A. Bituminous pavers shall be self-powered with an activated screed or strike-off assembly. The machine shall be capable of spreading and finishing courses of bituminous plant mix material in lane widths applicable to the specified typical section and thicknesses shown on the plans. Pavers used for shoulders and similar construction shall be capable of spreading and finishing courses of bituminous plant material in widths shown on the plans. The paver shall have a receiving hopper with sufficient capacity for uniform spreading operation and with automatic flow controls to place the mixture uniformly in front of the screed. The screed or strike-off assembly shall effectively produce a finished surface of the required evenness and texture without tearing, shoving or gouging the mixture. When laying mixtures, the paver shall be capable of operating at forward speeds consistent with satisfactory placement of the mixtures.

B. All bituminous pavers, used to place base, binder and surface courses shall be equipped with automatic transverse slope and longitudinal grade screed controls. The controls shall automatically adjust the screed and increase or decrease the mat thickness to compensate for irregularities that are in the surface being paved. The controls shall be capable of maintaining the proper transverse slope and be readily adjustable so transitions and superelevated curves can be satisfactorily paved. The controls shall operate from suitable fixed or moving references as prescribed in "Spreading and Finishing", hereinafter. Widths in excess of seventeen (17) feet shall have approved automatic transverse slope and longitudinal grade screed controls that operate from references on both sides of the paver.

C. The transverse slope and longitudinal grade screed controls of the bituminous paver may be manually adjusted, where acceptable to the Engineer, according to the requirements of "Spreading and Finishing" hereinafter. Any paver in the sole opinion of the Engineer to be found worn or defective at any time shall immediately be prohibited from use on the project until such time as repairs have been made to the satisfaction of the Engineer and at no additional cost to the Owner.

3.6 ROLLERS:

A. Rollers shall be either a vibratory or static steel wheel or pneumatic tire type in good mechanical condition free from excessive backlash and capable of operating at speeds slow enough to avoid displacement of the bituminous mixture. The number and weight of rollers shall be sufficient to satisfactorily compact the mixture while it is still in a working condition. The use of equipment which results in excessive crushing of aggregate will not be permitted.

B. Vibratory rollers shall be on the current NYSDOT approved list - Bituminous Concrete Vibratory Compaction Equipment. The use of vibratory compaction equipment shall be at the Contractor's own risk. The Contractor shall be fully responsible for the cost of repairing all damages which may occur to highway components and adjacent property caused by vibratory equipment.

C. Steel rollers shall be self-propelled and be either of the 10-12 ton tandem three-axle type, or 8-10 ton tandem two-axle type.

D. Pneumatic rubber-tired rollers shall be self-propelled and consist of two axles on which are mounted multiple pneumatic-tired wheels in such a manner that the rear wheels will not follow in the tracks of the forward wheels and will be spaced to give essentially uniform coverage with each pass. The axles shall be mounted in a rigid frame provided with means for adding ballast. Wheels shall be so mounted as to oscillate individually or in pairs. The tires shall be smooth and show no tread pattern, be of equal size and diameter, and be uniformly inflated. Pneumatic rollers shall not be utilized for compaction of the top course of pavement either vibratory or static steel wheel roller must be used. Pneumatic rollers shall meet the following requirements:

Maximum Wheel Load	5,600 pounds
Tire Compression on Pavement	80 p.s.i. +/- 5 p.s.i.
Maximum Axle Load	22,400 pounds

Alternate types of rollers may be acceptable to the Engineer, if field tests or other data demonstrates that satisfactory results can be achieved.

3.7 SPREADING AND FINISHING:

A. Base and binder course material may be delivered from more than one plant provided that no placing or compaction difficulties are evident to the Engineer. The delivery of top course material from two or more plants, in alternate deliveries to the same spreader, will not be permitted unless both the same aggregate source and job mix formula are used by all plants.

B. The mixture shall be laid upon an acceptable clean, dry surface, spread and struck off to the established grade and elevation. Acceptable bituminous pavers shall be used to distribute the mixture either over the entire width or over such partial width as may be practicable. Bituminous pavers shall be in the charge of an experienced operator. Placing of the mixture shall be continuous at a desired rate of not less than fifty (50) tons per hour. The Engineer may permit a lesser rate, if satisfactory results are achieved. Upon arrival at the site, the mixture shall be dumped into the paver and immediately spread and struck off to the width required and to such appropriate loose depth that when the work is completed, the required compacted thickness of

mixture will be obtained. The depth of any one course of plant mixed material shall not be greater than that necessary to produce a compacted thickness of four (4) inches.

C. For the initial pavement course laid with automatic bituminous pavers, the paver shall be guided by a taut reference line positioned at or near the pavement centerline or edge. The reference line shall be supported at approximately twenty-five (25) feet intervals on tangent sections and at closer intervals on curves. The line shall be tensioned sufficiently to remove any sags.

D. The Contractor shall erect and maintain the reference line to the satisfaction of the Engineer. A moving reference of at least thirty (30) feet in length, such as a floating beam, ski, or other suitable type may be substituted for the reference line if the surface to be paved is sufficiently even and satisfactory results can be achieved. A short ski or shoe may also be used for the initial course, if a satisfactory fixed reference, such as a curb, gutter or other fixed reference, is adjacent to the pavement.

E. Subsequent pavement courses placed over the initial course can be placed using a suitable fixed reference or by a moving reference having a minimum length of thirty (30) feet. Any course in an adjacent lane may be used as a reference line for a short ski, or other similar device.

F. The automatic screed controls will not be required where existing grades at roadway intersections or drainage structures must be met, for shoulders, temporary detours, behind curbs, or in other areas where its use is impractical as determined by the Engineer.

G. If the areas to be paved are small and scattered, a paver may be dispensed with and the course spread by hand methods as acceptable to the Engineer. For such areas, the mixture shall be dumped, spread and screeded to give the required section and compacted thickness.

H. Before any rolling is started, the loose mat shall be checked, any irregularities adjusted, and all unsatisfactory material shall be removed and replaced.

3.8 COMPACTION:

A. Immediately after the bituminous mixture has been spread, struck off and surface irregularities adjusted, it shall be thoroughly and uniformly compacted by rolling. The surface shall be rolled when the mixture is in the proper condition and when the rolling does not cause undue displacement, cracking or shoving.

B. During the initial rolling, a static roller with a minimum weight of 8 tons shall travel parallel to the center line of the pavement beginning at each edge and working toward the center, overlapping on successive trips by one half the width of the roller. Banked curves shall be rolled starting at the low side edge and working toward the superelevated edge.

C. Rollers shall move at a slow and uniform speed, not exceeding 2.5 miles per hour. The roller drive roll or wheel shall be nearest the paver.

D. Any displacement occurring as a result of reversing the direction of a roller, or from other causes, shall be corrected at once by the use of rakes and addition of fresh mixture where required. Care

shall be exercised in rolling not to displace the line and grade of the edges of the bituminous mixture. To prevent adhesion of the mixture to the rollers, the wheels shall be kept properly moistened with water or water mixed with small quantities of detergent. In no case shall a solvent having affect upon bituminous material be used.

E. The Contractor shall provide a combination of the rollers and utilize one of the options in Section 401-3.12 of the NYSDOT Standard Specifications.

F. Along forms, curbs, headers, walls and other areas not accessible to the rollers, the mixture shall be thoroughly compacted with mechanical tampers as accepted by the Engineer. On depressed areas, a trench roller may be used or cleated compression strips may be used under the roller to transmit compression to the depressed area.

G. Suitable means shall be provided to keep the pavers, other equipment and tools free from bituminous accumulations. The surface of the pavement shall be protected from drippings of oil, kerosene, or other materials used in paving, and cleaning operations.

H. The Contractor may be required to adjust and change both equipment and compaction procedure if in the sole opinion of the Engineer insufficient compaction is being achieved.

I. Any mixture that becomes loose and broken, mixed with dirt, or is in any way defective shall be removed and replaced with fresh hot mixture, which shall be compacted to conform with the surrounding area. Any area showing an excess or deficiency of the bituminous material shall be corrected to the satisfaction of the Engineer. If in the sole opinion of the Engineer, an unsatisfactory area that develops during the life of the contract, the area shall be removed and replaced with suitable material at the expense of the Contractor.

3.9 CONDITIONING OF EXISTING SURFACE:

A. The surface of the existing pavement shall be cleaned, joints and cracks filled, and the surface leveled to a uniform grade and cross slope in all areas prior to the application of a new bituminous concrete course. The surface shall be cleaned and the joints and cracks filled to the satisfaction of the Engineer. The expense for cleaning foreign material from the pavement shall be borne by the Contractor. Leveling of the surface shall be in conformance with the requirements stated below.

B. Contract surfaces between bituminous mixtures and Portland Cement concrete such as adjacent pavement, edges, existing pavement, curbing, gutters, manholes and other structures shall be painted with a thin, uniform coating of bituminous material prior to the bituminous mixture being placed against them.

C. If an Asphalt Concrete Truing and Leveling Course is specified on the plans or in the itemized proposal, the work shall consist of placing a course of the minimum variable thickness of proper plant mix necessary to bring the surface of the existing pavement to the same transverse slope and longitudinal grade required for the finished pavement surface. The work shall consist of removing irregularities in the old pavement, filling and patching holes, correcting variations in banked pavement, establishing pavement crowns, etc. All depressions and wheel path ruts shall

be filled prior to the paving of the truing and leveling course. For compacted thickness not in excess of 1-1/2 inches, a top course or shim course mix shall be used. For compacted thickness in excess of 1-1/2 inches, the dense binder course mix shall be used; however, where compacted thicknesses 4 inches or greater are required, the Engineer may find acceptable the use of the dense base course mix. Special attention shall be paid to the proper compaction of thin sections.

3.10 JOINTS:

A. The finished pavement at joints shall comply with surface smoothness requirements and exhibit the same uniformity of texture and compaction as other sections of the course. Rollers shall not pass over the unprotected edges of a freshly laid mixture.

B. In the formation of all joints, the exposed edge of the existing layer that will become part of the joint shall be the full thickness of the layer and straight. If the existing edge is unacceptable to the Engineer, the edge shall be corrected by using a power driven saw or other acceptable tools to cut a neat line at the expense of the contractor. A light coat of bituminous material shall be applied to existing pavement edges in order to provide bond with the newly laid pavement.

C. Transverse - The placing of the course shall be as continuous as possible. The joint shall be formed by cutting back on the previous run to expose the full depth of the course.

D. Longitudinal - Longitudinal joints in the surface course shall correspond with the edges of proposed traffic lanes unless otherwise accepted by the Engineer. When traffic is maintained on the roadway during paving operations, the mixture shall be laid such that no more than 100 feet of pavement edge will be exposed at the end of the working day. The Engineer may permit an exposed edge of this type in excess of 100 feet providing that the edge is adequately protected against damage by vehicles and equipment.

3.11 SURFACE TOLERANCE:

A. The pavement surface shall be tested in the presence of the Engineer with a sixteen (16) foot straight-edge or string line placed parallel to the centerline of pavement and with a ten (10) foot straight-edge or string line placed transversely to the centerline of pavement on any portion of the pavement surface. Variations exceeding 1/4" shall be satisfactorily corrected or the pavement relaid at no additional cost to the Owner. The Contractor shall supply the materials and labor as necessary to perform this test in the presence of the Engineer at no additional cost.

3.12 THICKNESS TOLERANCES:

A. The thickness indicated for each of the various courses of bituminous pavement is the nominal thickness. The pavement shall be so constructed that the final compacted thickness is as near to the nominal thickness as is practical and within the tolerances specified below.

B. Determinations for final acceptance and pavement will be made from cores or thickness measurements taken on the completed pavement. The Contractor shall fill all core holes with

bituminous concrete and compact the mixture in a manner acceptable to the Engineer. The cost of all testing and associated work shall be at the Contractor's expense.

C. A tolerance not to exceed minus (-) 1/4" from nominal thickness required for the course specified will be acceptable where the required nominal thickness is four (4) inches or less. A tolerance not to exceed minus (-) 1/2" from the nominal thickness required for the course or courses specified will be acceptable where the required nominal thickness is over four (4) inches. In addition, the sum total thickness of all bituminous mixture courses shall not vary from the total of the nominal thickness indicated on the plans by more than minus (-) 1/4" where the total nominal thickness is eight (8) inches or less; or more than minus (-) 1/2" where the total nominal thickness is more than eight (8) inches.

D. No payment will be made for any extra thickness placed over and above the permissible tolerance.

END OF SECTION 321216

SECTION 321613 - CONCRETE CURB

PART 1 – GENERAL

1.1 WORK INCLUDED:

A. Place concrete curbs at the locations shown on the Plans including the excavation and removal of existing items where encountered.

B. Curbs to be of the type shown on the Plans complete with all special configurations indicated, called for or required.

C. Provide Foundation Material (Run-of-Bank unless other type is specifically called for) to the minimum requirements indicated for proper placement of the curbs.

D. Restoration of the adjoining areas if not specifically covered under another item.

1.2 RELATED WORK:

A. Backfill (Subbase Material) – Section 312323.13.03

B. Asphalt concrete pavement – Section 321216

C. Cast-in-Place Concrete – Section 033000

1.3 EXISTING CONDITIONS:

A. It shall be the Contractor's responsibility to investigate all site conditions that may affect his work.

PART 2 - MATERIALS

2.1 GENERAL:

A. All curbs shall be cast in-place, of the type and dimensions shown on the Plans and/or details.

B. Curbs shall be of "Class H Concrete", per Section 033000, unless otherwise noted, and shall conform to all the specific requirements of that section.

PART 3 - CONSTRUCTION DETAILS

3.1 GENERAL:

A. Curbs shall be cast in-place, at the locations and grades required by the Drawings.

B. Shall have sections no greater than fifteen (15) feet in length. In curved areas joints shall be more closely spaced as acceptable to the Engineer. However, all joints shall maintain the same spacing throughout the entire project.

C. Shall have provisions at each joint for expansion of 1/2".

D. One-half inch (1/2") expansion joint material shall be premoulded bituminous cut to conform with the cross-section of the curb.

3.2 FORMS:

A. All forms shall be set true to line and grade and held rigidly in position.

B. They shall be either metal or of acceptable plan and matched lumber, and of such construction that there will be no interference to the inspection of grade and alignment and that a smooth surface will be provided.

C. Forms shall be left in place at least twenty-four (24) hours or until the concrete has set sufficiently in order that, in the opinion of the Engineer, they can be removed without injury to the curb.

D. Upon removal of the forms, the curb shall be immediately rubbed down to a smooth and uniform surface, but no plastering will be permitted.

E. For this work, competent and skillful finishers shall be employed.

3.3 PLACEMENT OF CONCRETE:

A. Placement and handling of concrete shall comply to the requirements of Specification Section 033000, "Class H Concrete".

B. The concrete shall be compacted by means of an acceptable immersion type, mechanical vibrator of a size and weight sufficient to thoroughly vibrate the entire concrete mass without damaging or misaligning the forms.

C. The vibrator shall be introduced into the concrete at one foot intervals for a period not to exceed two seconds for each immersion and shall vibrate at not less than 5000 impulses per minute.

3.4 CURING:

A. At the Contractor's option, either waterproof paper blankets, quilted covers, polyethylene coated burlap blankets or polyethylene curing covers shall be used in curing concrete curb.

B. Other methods of curing may be used only when so indicated on the plans or acceptable to the Engineer.

C. The method of curing shall comply with the requirements of "Class A Concrete".

3.5 PROTECTION:

A. The Contractor shall protect the curb and keep it in alignment and first class condition until the completion of the Contract.

B. Any curb, which is damaged or substandard in the sole opinion of the Engineer at any time prior to the final acceptance of the work, shall be removed and replaced with satisfactory curb at the Contractor's expense.

3.6 COORDINATION WITH DRAINAGE REQUIREMENTS:

A. It is the intent of this specification to provide a completed work which properly coordinates the pavement replacement work in such a way as to promote proper drainage to adjacent stormwater catch basins, if existing or to be installed.

B. Where on the plans the term "gutter" is referenced with regards to the curb or pavement replacement area, special controlled grade placement in accordance with Section 02616 shall be understood.

PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT:

A. Measurement will be made on the basis of lineal footage of curb placed in accordance with the plans and specifications, as measured by the Engineer.

4.2 PAYMENT:

A. Payment will be made at the unit price bid under the "Concrete Curb" Item of the Proposal; the price bid per lineal foot shall include excavation, preparing subgrades, foundation material, all necessary forms, concrete, expansion joints, backfill, labor and equipment as necessary for the complete installation.

B. In the case where existing curb must be removed for the installation of the concrete curb, the cost for same shall be deemed included in the unit price bid for the Concrete Curb Item; no separate

payment will be made for removal of the existing curbs.

C. Where no separate item for payment is included in the Proposal, the work required under this Section shall be provided, with the payment deemed included under the other item of the Proposal.

END OF SECTION 321613

SECTION 321623 – CONCRETE SIDEWALKS

PART 1 - GENERAL

1.1 WORK INCLUDED:

A. This work shall consist of furnishing and placing Portland cement concrete for sidewalks and other exterior improvements, including furnishing and setting of all reinforcing rods as indicated on the plans and in accordance with the specifications.

1.2 RELATED WORK:

A. Backfill (Subbase Material) – Section 312323.13.03

B. Cast-in-Place Concrete - Section 033000

1.3 REFERENCES:

A. American Concrete Institute, ACI 301, latest edition, Specification for Structural Concrete

B. American Concrete Institute, ACI 117, latest edition, Specification for Tolerances for Concrete Construction and Materials

C. New York State Department of Transportation Standard Specifications (US Customary Units)

1.4 SUBMITTALS:

A. Product Data:

1. Concrete Design Mix: Submit proposed concrete design mix together with name and location of batching plant at least 28 days prior to the start of concrete work.
2. Portland Cement: Brand and Manufacturer's name.

B. Aggregate: Gradation and Source

1. Air-entraining Admixture: Brand and manufacturer's name.
2. Water-reducing or High Range Water-reducing Admixture: Brand and manufacturer's name.
3. Curing Compound: Manufacturer's specifications and application instructions.
4. ADA Detectable Warning Surface: Manufacturer's specifications, product data, test reports, method of installation, and maintenance instructions.

C. Samples:

1. Colored Concrete. Provide prepared samples of hardened concrete to the design professional for approval.

1.5 QUALITY ASSURANCE:

A. Concrete batching plants shall be currently approved as concrete suppliers by the New York State Department of Transportation.

B. Performance Criteria: The following criteria are required for the products included in this section:

1. Cast-in-place Concrete shall contain post-industrial and/or post-consumer recycled content as follows:

a. Fly Ash: ASTM C618, including Table 1, except for footnote A, Class F, except loss on ignition shall not exceed 4.0 percent. Concrete shall incorporate fly ash as a replacement for 15 percent (by weight) of the Portland cement. All design mixes are subject to review and approval by the Director.
b. GGBF (Ground Granulated Blast Furnace) Slag: Concrete shall incorporate GGBF slag as a replacement for at least 20 percent (by weight) of the Portland cement. All design mixes are subject to review and approval by the Director.
c. Certification of recycled content shall be in accordance with the SUBMITTALS Article above.
d. Recycled Steel: Reinforcing bar, steel wire, welded wire fabric, and miscellaneous steel accessories shall contain a minimum of 35 percent (combined) post-industrial/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials).

2. Concrete manufactured within 500 miles (by air) of the project site shall be documented in accordance with the SUBMITTALS Article above.
3. Steel reinforcement manufactured within 500 miles (by air) of the project site shall be documented in accordance with SUBMITTALS Article above.

1.6 DELIVERY:

A. Batch Ticket Information: Indicate on the delivery ticket the type, brand, and amount of fibrous concrete reinforcement material added to each batch of concrete.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Concrete shall conform to Specification 033000 Class H.

B. Reinforcing shall conform to Specification 032000.

C. Type 1 Expansion Joint Filler: Preformed, resilient, non-extruding cork units complying with ASTM D1752, Type II.

D. Type 3 Expansion Joint Filler: Preformed, resilient, non-extruding bituminous units complying with ASTM D1751.

E. ADA Detectable Warning Surface: Precast or prefabricated paving units or detectable Warning plate with a non-slip texture on the travel surface. Color shall be a shade of brick red. There shall be a minimum of 70 percent contrast in light reflectance between the detectable warning surface and the adjoining surfaces. Material used to provide visual warning shall be an integral part of the detectable warning surface. Visual contrast to meet the existing ADAAG A4.2.9.2.

1. Detectable Warning Plate Model R-4984 by Neenah Foundry, 2121 Brooks Avenue, Neenah, WE 54956, (800) 558-5075, www.nfco.com.
2. ADA Pavers by Whiteacre-Greer, 1400 S. Mahoning Avenue, Alliance, OH 44601, (800) 947-2837, www.wgpaver.com.
3. Detectable Warning Surface System by Detecto-Tile, 10133 State Highway 7, Worcester, NY 12197, (607) 397-9381, www.detectotile.com.
4. Classic Dot Detectable Warning Pavers by Oaks Concrete Products, 1900 Vulcan Blvd., Bartlett, IL 60103, (800) 263-4162, www.oakspavers.com.
5. Granite Truncated Dome Pavers by Cold Spring Granite Company, 202 S. Third Avenue, Cold Spring, MN 56320-2593, (800) 551-7502, www.coldspringgranite.com.

2.2 JOINTS AND EMBEDDED ITEMS (AMENDMENTS TO ACI 301, SECTION 5.3.2.6):

A. Obtain bond at construction joints by the use of epoxy bonding agent (adhesive) or the use of cement grout.

PART 3 - EXECUTION

3.1 PREPARATION:

A. Do not use items of aluminum for mixing, chuting, conveying, forming, or finishing concrete. Magnesium alloy tools may be used for finishing.

B. Set forms true to line and grade and anchor rigidly in position.

C. Space expansion joints equally at not more than 20’-0” on center unless otherwise indicated. Place expansion joints to isolate sidewalk from other structures and fixed objects.

D. Place joint filler at expansion joints and where new concrete abuts existing concrete paving and fixed structures or appurtenances. Protect the top edge of the joint filler during concrete placement with a temporary cap and remove after concrete has been placed.

3.2 USE OF FIBER REINFORCEMENT:

A. Fiber reinforcement may be utilized in place of welded wire fabric, if approval is given by the design engineer.

B. Add required amount of fibrous concrete reinforcement to the concrete and mix in accordance with fiber manufacturer's batching and mixing instructions.

C. Fibers shall be uniformly dispersed in the concrete, and concrete shall be free of fiber balls or lumps when discharged at the Site.

3.3 PLACING STEEL REINFORCEMENT (AMENDMENTS TO ACI 301, SECTION 3):

A. At the time concrete is placed, reinforcement shall be free of mud, oil, loose rust, loose mill scale, and other materials or coatings that may adversely affect or reduce the bond.

B. Unless otherwise shown differently on the Drawings, all reinforcement to be placed per ACI 301-05.

3.4 PLACING CONCRETE:

A. Consolidate concrete by spading, rodding, forking, or using an approved vibrator eliminating all air pockets, stone pockets, and honeycombing. Work and float concrete surface so as to produce a uniform texture.

B. Locate construction joints, if any, at expansion joints.

3.5 PLACING ADA DETECTABLE WARNING SURFACE:

A. The ADA detectable warning surface shall be installed behind the edge of the curb.

B. Domes shall be aligned on a square grid in the predominant direction of travel to permit wheels to roll between the domes.

C. Install in accordance with the manufacturer's printed instructions.

D. The curb, ADA detectable warning surface, and sidewalk shall be flush with the elevation of the road surface.

3.6 FINISHING AND CURING:

A. Wait until bleeding is stopped before final finishing operations.

B. Keep surface damp but not wet between initial strike off and final finish.
   1. Utilize a fog spray, evaporative inhibitor, or midrange water reducer that is compatible with supplementary cementing materials to help control the amount of surface drying of the fresh concrete.

C. Minimize working of the surface during finishing.

D. Utilize a magnesium or wood float.

E. Avoid the use of steel finishing trowels and utilize a concrete finishing machine when possible.

3.7 CONTROL JOINTS:

A. Saw control joints (CJ) one inch deep after the concrete has set. Complete saw cuts within 18 hours after slab is placed. Space control joints equally between expansion joints at approximately 5'-0" on center, except where a different spacing is shown on the drawings.

B. Provide tooled control joints one inch deep. Space control joints equally between expansion joints approximately 5'-0" on center, except where a different spacing is shown on the drawings.

C. Finish edges of walk and expansion and control joints with a 1/4 inch radius edging tool.

D. Provide broom finish for walk surfaces.

E. Apply curing compound immediately after final finish. Application shall be in accordance with the manufacturer's printed instructions.

3.8 HOT WEATHER CONCRETING:

A. Comply with ACI 305R whenever the atmospheric temperature or the form surface temperature is at or above 90 degrees F., or climatic conditions of wind and/or low humidity will cause premature drying of the concrete.

3.9 CURING TEMPERATURE:

A. Maintain the temperature of the concrete at 50 degrees F. or above during the curing period. Keep the concrete temperature as uniform as possible and protect from rapid atmospheric temperature changes. Avoid temperature changes in concrete which exceeds 5 degrees F. in any one hour and 50 degrees F. in any 24-hour period.

END OF SECTION 321623

SECTION 323113 - CHAIN LINK FENCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Chain-link fences.
2. Privacy slats.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of fence and gate assembly.

1. Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each exposed product and for each color and texture specified.

D. Delegated-Design Submittal: For structural performance of chain-link fence frameworks, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Product test reports.

C. Sample warranty.

1.5 WARRANTY

A. Special Warranty: Installer agrees to repair or replace components of chain-link fences that fail in materials or workmanship within specified warranty period.

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

PART 2 - PRODUCTS

2.1 CHAIN-LINK FENCE FABRIC

A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist according to "CLFMI Product Manual" and requirements indicated below:

1. Fabric Height: 8’-0” As indicated on Drawings.
2. Steel Wire for Fabric: Wire diameter of 0.192 inch.

    a. Mesh Size: 2 inches.
    b. Polymer-Coated Fabric: ASTM F668, Class 1 over zinc-coated steel wire.

        1) Color: As selected by Engineer/Architect from manufacturer's full range, according to ASTM F934.

    c. Coat selvage ends of metallic-coated fabric before the weaving process with manufacturer's standard clear protective coating.

3. Selvage: Knuckled at both selvages.

2.2 FENCE FRAMEWORK

A. Posts and Rails: ASTM F1043 for framework, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F1043 or ASTM F1083 based on the following:

1. Fence Height: As indicated on Drawings 8’-0”.
2. Heavy-Industrial-Strength Material: Group IA, round steel pipe, Schedule 40.

    a. Line Post: 4.0 inches in diameter.
    b. End, Corner, and Pull Posts: 4.0 inches in diameter.

3. Horizontal Framework Members: Intermediate top and bottom rails according to ASTM F1043.
4. Brace Rails: ASTM F1043.
5. Metallic Coating for Steel Framework:

    a. Type A zinc coating.
    b. Type B zinc with organic overcoat.
    c. External, Type B zinc with organic overcoat and internal, Type D zinc-pigmented coating.
    d. Type C, Zn-5-Al-MM alloy coating.
    e. Coatings: Any coating above.

6. Polymer coating over metallic coating.

a. Color: As selected by Engineer/Architect from manufacturer's full range, according to ASTM F934.

2.3 TENSION WIRE

A. Metallic-Coated Steel Wire: 0.177-inch-diameter, marcelled tension wire according to ASTM A817 or ASTM A824, with the following metallic coating:

1. Type I: Aluminum coated (aluminized).
2. Type II: Zinc coated (galvanized) with minimum coating weight matching chain-link fabric coating weight.
3. Type III: Zn-5-Al-MM alloy with the following minimum coating weight matching chain-link fabric coating weight.

B. Polymer-Coated Steel Wire: 0.177-inch- diameter, tension wire according to ASTM F1664, Class 1 over zinc-coated steel wire.

1. Color: As selected by Engineer/Architect from manufacturer's full range, according to ASTM F934.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not begin installation before final grading is completed unless otherwise permitted by Engineer. Final grades and installation conditions shall be examined. Installation shall not begin until all unsatisfactory conditions are corrected.

3.2 CHAIN-LINK FENCE INSTALLATION

A. Install chain-link fencing according to ASTM F567 and more stringent requirements specified.

B. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.

C. Post Setting: Set posts with mechanical anchors at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.

D. Terminal Posts: Install terminal end, corner, and gate posts according to ASTM F567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more. For runs exceeding 500 feet, space pull posts an equal distance between corner or end posts.

E. Line Posts: Space line posts uniformly at 96 inches o.c.

F. Tension Wire: Install according to ASTM F567, maintaining plumb position and alignment of fence posts. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch-diameter

hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches o.c. Install tension wire in locations indicated before stretching fabric. Provide horizontal tension wire at the following locations:

1. Extended along top and bottom of fence fabric.

G. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 2-inch bottom clearance between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.

H. Privacy Slats: Install slats in direction indicated, securely locked in place.

1. Diagonally for privacy factor of 80 to 85.

I. Barbed Wire: Install barbed wire uniformly spaced, angled toward security side of fence. Pull wire taut, install securely to extension arms, and secure to end post or terminal arms.

END OF SECTION 323113

323216 - PRE-CAST MODULAR BLOCK RETAINING WALL SYSTEM

PART 1- GENERAL

1.1 SUMMARY

A. Section Includes:

1. Work includes furnishing and installing precast modular blocks (PMB) to the lines and grades shown on the plans and as specified herein. Also included is furnishing and installing appurtenant materials required for construction of the complete system.

2. The contractor is solely responsible for safety. The Engineer and Owner shall not be responsible for means or methods of construction for safety of workers or the public.

1.2 REFERENCES

A. ASTM - American Society for Testing and Materials (AASHTO - American Association of State and Highway Transportation Officials)

B. ASTM C33 - Standard Specification for Concrete Aggregates (AASHTO M43)

C. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens (AASHTO T22)

D. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregate (AASHTO T27)

E. ASTM C1776 - Standard Specification for Wet-Cast Precast Modular Retaining Wall Units

F. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils (AASHTO T89 & T90)

G. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (AASHTO T99)

H. ASTM D4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles

I. ASTM D4595 - Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method

J. ASTM D5262 - Standard Test Method for Evaluating the Unconfined Creep Behavior of Geosynthetics

K. ASTM D6638 - Standard Test Method for Determining Connection Strength Between Geosynthetic Reinforcement and Segmental Concrete Units (Modular Concrete Blocks)

L. ASTM D6916 - Standard Test Method for Determining the Shear Strength Between Segmental Concrete Units

1.3 SUBMITTALS

A. If a complete design is not depicted in the plans, submit for review shop drawings for the retaining wall system prepared by a Professional Engineer registered in the state of New York. The shop drawings shall indicate the layout, height, and construction details of the retaining wall system. Upon request, design calculations shall also be submitted. Minimum safety factors for design shall be as follows:

	Gravity Wall
Sliding	1.5
Overturning	1.5
Bearing	2.0

B. If stain will be applied to the wall system, a sample shall be stained on site for review and approval by the Owner/Engineer. The color sample may be part of the completed wall, but shall be located in an inconspicuous area.

C. Submit grain size test results for aggregates to be used for the wall base and for unit fill.

D. Submit test results on borrow material to be used for common backfill and for select backfill (if used) including Proctor and grain size or Atterberg limits results.

1.4 DELIVERY, STORAGE AND HANDLING

A. Contractor shall check the materials upon delivery to assure that proper materials have been received.

B. Contractor shall protect the materials from damage. Damaged material shall not be incorporated into the wall or the reinforced soil embankments.

C. Contractor shall prevent excessive mud, concrete, adhesives and other substances that may adhere from coming in contact with the materials.

D. Exposed faces of precast modular block units shall be reasonably free of chips, cracks, or stains when viewed from a distance of 10 feet (3 m).

PART 2: MATERIALS

2.1 WALL UNITS

A. Precast modular blocks shall be Stone Strong units manufactured under license from Stone Strong LLC or an approved equal.

B. Wall units shall conform to ASTM C1776.

C. Dimension tolerances for precast modular blocks shall be +/- 1/8 inch (+/-3 mm) for height, +/- 1/8 inch (+/-3 mm) for length (along face), and +1/2 to -1/4 inch (+13 mm to -6 mm) for width (face to tail).

D. Concrete for precast modular blocks shall have a minimum 28-day compressive strength of 4,000 psi (28 MPa). Entrained air content shall be between 5 and 7%.

E. Internal unit reinforcement or unreinforced units shall be provided according to published Stone Strong engineering guidance. Reinforced units shall be marked with the type of reinforcement.

F. The face pattern shall be selected from the manufacturer's standard molds. The color of the units shall be natural gray. A concrete stain may be field applied to color the units if specified by the Engineer or Owner.

2.2 WALL BASE

A. The wall base shall consist of dense graded crushed aggregate. A minimum of 75% of coarse material shall have 2 or more fractured faces. Wall base material shall meet the following gradation:

US Standard Sieve Size	Metric Standard Sieve Size	Percent Passing
1-1/2"	37.5 mm	80-100
3/4"	19.0 mm	50-90
#4	4.75 mm	0-40
#200	75 μm	0-10

B. The contractor may substitute concrete with a minimum 28-day compressive strength of 3,000 psi (21 Mpa) for the granular base material. Concrete may be placed full thickness or as a topping over a compacted granular the base. If used as a topping, the concrete shall have a minimum thickness of 3 inches (75 mm).

2.3 UNIT FILL

A. Unit fill shall consist of a screened crushed aggregate. A minimum of 75% of coarse material shall have 2 or more fractured faces. Unit fill material shall meet the following gradation:

US Standard Sieve Size	Metric Standard Sieve Size	Percent Passing
1-1/2"	37.5 mm	100
3/4"	19.0 mm	50-90
#4	4.75 mm	0-10
#8	2.36 mm	0-5

2.4 BACKFILL

A. If a select granular reinforced zone is indicated, it shall consist of fill sand or other clean aggregate meeting the following gradation:

US Standard Sieve Size	Metric Standard Sieve Size	Percent Passing
3/4"	19.0 mm	100
#200	75 μm	0-5

C. All other backfill behind and in front of the wall shall consist of suitable on-site soil or imported borrow and shall be approved by the Geotechnical Engineer. Backfill shall generally consist of sands, silts, or lean clays with a liquid limit less than 45 and a plasticity index less than 20. Fat clay soils, cobbles, and large rock should generally be avoided unless approved by the Geotechnical Engineer based on local practices. Frozen soils, excessively wet or dry soils, debris, and deleterious materials should not be used.

2.5 DRAIN TILE

A. Drain tile shall be a perforated or slotted PVC or corrugated HDPE pipe. The drain tile should be connected to storm drains or daylighted at low points and/or periodically along the wall alignment as shown on the plans.

2.6 GEOTEXTILE FABRIC

A. Provide a geotextile filter for separation from backfill at the tails of the blocks. The geotextile shall be a needle punched non-woven fabric with a minimum grab tensile strength of 120 pounds (534 N). The geotextile may cover the entire back face of the blocks or may be cut in strips to cover the gaps between tail units with a minimum of 6 inches (150 mm) of overlap over the concrete tail on both sides.

PART 3: EXECUTION

3.1 EXCAVATION

A. Excavate as required for installation of the retaining wall system. Excavate to the base level for a sufficient distance behind the face to permit installation of the base.

B. Slope or shore excavation as necessary for safety and for conformance with applicable OSHA requirements.

3.2 WALL BASE

A. Foundation soils shall be excavated to the dimensions shown on the plans. Foundation soil shall be observed by the Geotechnical Engineer to confirm that the bearing soils are similar to the design conditions or assumptions.

B. Construct the wall base to the lines and grades shown on the plans. Place and consolidate concrete, strike, and finish plane and level. Overexcavated areas shall be filled with additional concrete or granular base material. Compact granular base material to provide a hard and level surface to support the wall units. Base material shall be compacted to a minimum of 95 percent of the maximum dry density (ASTM D698, Standard Proctor). Final base elevation shall be within 0.1 feet (30 mm) of plan elevation.

C. Prepare and smooth the granular material to ensure complete contact of the first course with the base. The base may be dressed with fine aggregate to aid leveling.

3.3 UNIT INSTALLATION

A. Place the first course of units directly on the wall base. Check units for level and alignment. Units shall be within 1/8 inch (3 mm) of level from end to end and from front to back. Adjacent units should be in contact. If possible, begin placing units at the lowest section of the wall.

B. Fill all voids between and within the blocks with granular unit fill. Additional unit fill is not required behind the units, but may be placed for the convenience of the contractor.

C. Place backfill behind the units in maximum loose lifts of 8 inches (200 mm) and compact. Compact all backfill to a minimum of 95 percent of the maximum dry density (ASTM D698, Standard Proctor). For cohesive soils, the moisture content at the time of compaction should

be adjusted to within -2 and +3 percent of optimum. Place backfill in successive lifts until level with the top of the facing unit.

D. Remove all excess aggregate and other materials from the top of the units before laying up the next course.

E. Place the next course of precast modular block units in running bond with the previous course. Place the web recess over the alignment hoop protruding from the unit below, and pull the unit forward to contact the hoop. Batter should be within ¼ inch (6 mm) tolerance (4 inches/102 mm from 24 SF unit below, 2 inches/51 mm from 6 SF unit below).

F. Continue placing successive courses to the elevations shown on the plans. Construct wall in level stages, placing the units at each course for the entire length of the wall, if possible. Unit fill and backfill should be placed to the level of the top of the facing unit before placing the next course.

G. Provide temporary swales to divert runoff away from wall excavation and away from face.

H. Final grade above and below the retaining wall shall provide for positive drainage and prevent ponding. Protect completed wall from other construction. Do not operate large equipment or store materials above the wall that exceed the design surcharge loads.

PART 4: CONSTRUCTION QUALITY CONTROL AND ASSURANCE

4.1 CONSTRUCTION QUALITY CONTROL

A. The contractor is responsible to ensure that all installation and materials meet the quality specified in the construction drawings.

B. The contractor shall verify that installation is in accordance with the specifications and construction drawings.

4.2 QUALITY ASSURANCE

A. The owner is responsible to engage testing and inspection services to provide independent quality construction assurance.

B. Compaction testing shall be done a minimum of every 1 foot (300 mm) of vertical fill and every 100 lineal feet (30 m) along the wall.

C. Testing shall be done at a variety of locations to cover the entire backfill zone.

D. The independent inspection professional should perform sufficient testing and observation to verify that wall installation substantially conforms to the design drawings and specifications.

END OF SECTION 323216

SECTION 329119.13 - TOPSOIL PLACEMENT AND GRADING (TOPSOIL)

PART 1 - GENERAL

1.1 WORK INCLUDED:

A. Furnishing and placing topsoil in conformance with the lines, grades and thicknesses shown on the plans or as required for acceptance by the Engineer.

B. Furnishing and placing topsoil in conformance with the minimum requirements as noted under other Contract Work Items (i.e. Seeding, Topsoil and Sodding, etc.).

1.2 RELATED WORK:

A. Trenching, Backfilling and Compaction – Section 312333

B. Seeding - Section 329219

C. Finish Grading – Section 312219

D. Erosion and Sediment Control – Section 312500

1.3 EXISTING CONDITIONS:

A. It shall be the Contractor's responsibility to investigate all site conditions that may affect his work.

PART 2 - MATERIALS

2.1 GENERAL:

A. Ordinary topsoil shall be the surface layer of soil and sod, suitable for use in seeding and planting.

B. Ordinary topsoil or Topsoil from Borrow shall be friable, loamy and contain no mixture of refuse or any substance toxic to plant growth, and shall be free from sub-soil, debris, stumps, brush, roots, clay lumps, stones, or similar objects larger than 3/8 inches (0.375") in greatest dimension.

C. The topsoil or soil mixture, unless otherwise specified, shall have an acidity range of approximately 6.0 pH to 7.6 pH, when tested according to the methods of A.O.A.C., in effect on the date of the invitation to bids.

D. The organic content shall be not less than 6% nor more than 12% as determined by the wet combustion method (chromic acid reduction).

E. There shall be not less than 10% nor more than 30% passing the 200-mesh sieve as determined by the wash test made in accordance with the standard test ASTM Designation D1140.

F. Natural topsoil may be amended by the Contractor with acceptable materials and methods, to meet the above specifications.

2.2 QUALITY ASSURANCE:

A. Samples of the topsoil or soil mixture will be taken by the Owner or his designated representative.

B. All topsoil from borrow will be tested unless otherwise accepted.

C. Testing may be done by the U.S. Department of Agriculture, Soil Conservation Service, the New York State Department of Transportation, Bureau of Soil Mechanics, or any independent testing laboratory acceptable to the Owner and Engineer.

D. The Contractor shall notify the Engineer of the intended source of material at least three (3) weeks in advance of the scheduled use of the material, to allow time for sampling, shipping of the sample and testing.

E. If at any time the quality of the topsoil being utilized becomes questionable, the Contractor shall perform such additional testing as necessary to demonstrate the acceptability of the material being used.

F. The Contractor shall furnish, at his own expense, suitable excavating equipment as required for taking of samples by the Owner or his representative.

G. All costs for sampling and testing shall be borne by the Contractor and shall be deemed included in the unit price bid for topsoil or the associated Items.

PART 3 - CONSTRUCTION DETAILS

3.1 GENERAL:

A. Placement of topsoil shall be in strict accordance with the details shown and the specific requirement of the related specifications.

B. No material shall be utilized unless it meets all the "Material" and test requirements.

3.2 SUB-SOIL PREPARATION:

A. The sub-soil within the areas to be covered by topsoil shall be graded so that the completed work shall conform to the specified lines and grades.

B. Unless otherwise noted or accepted, the Contractor shall scarify or till the surface of the sub-soil before the topsoil is placed to permit bonding of the topsoil with the sub-soil.

C. Tillage by disking, harrowing, raking, or by other methods acceptable to the Engineer shall be accomplished in such a manner that depressions and ridges formed by the tillage shall be parallel to the contours.

D. Brush and vegetation which will not be incorporated with the soil during handling operations shall be cut and removed prior to stripping.

3.3 TOPSOIL PLACEMENT:

A. Topsoil in an unworkable condition due to excessive moisture shall not be placed until it is suitable for spreading.

B. Topsoil shall be placed on the designated areas and spread to the specified thickness.

C. After the topsoil is spread, all large soil clogs, rocks, roots and other foreign material shall be cleared and disposed of by the Contractor so that the finished surface will be acceptable for subsequent work, such as seeding, sodding, mulching or planting.

D. Ordinary sods and herbaceous growth, such as grass and weeds, are not to be removed but shall be thoroughly broken up and intermixed with the soil during handling operations.

3.4 EROSION CONTROL:

A. It is the responsibility of the contractor to ensure that the soil of the topsoil preparation area is not blown or washed from the site and that nearby areas are protected from soil, fertilizer, compost, etc.

B. In the event of heavy rain or win that cause damage to the site, then the contractor will repair the damaged areas so they are restored to a condition acceptable under the specifications.

C. Watering of seeded areas will be done with equipment necessary to prevent seed from being displaced from its original location.

3.5 ACCEPTANCE OF WORK:

A. A uniform grade will be established so that no depressions or elevations are present, and so that the safe and effective operation of mowing equipment will not be hindered after the turf grass is established.

B. The topsoil will not be loose whereby footprints greater than 0.5 inch are observed, nor will it be too dense whereby only footprints less than one-quarter of an inch are observed.

3.6 ACCEPTANCE OF WORK:

A. Prior to final completion, the Engineer will make the final inspection and consideration acceptance of the seeding.

B. No relief will be granted to the Contractor for the failure of turf to establish for any reason.

C. Satisfactory seeded turf will be healthy in color, uniform, free of weeds and surface irregularities, with coverage exceeding 95% and bare spots not exceeding 4 inches x 4 inches. No erosion washes, clumps or deformation of the turf area caused by mowing or other Contractor equipment will be allowed.

PART 4 - MEASUREMENT AND PAYMENT

4.1 PAYMENT:

A. Where topsoil work is called for as part of individual Contract Items, the cost for all work related to the topsoiling, as required by this specification, shall be included in the individual prices bid for the respective Contract Item.

B. If the Contract Proposal includes a separate "Topsoiling" Item, the cost for all work related to all topsoiling, not included under any other items, shall be paid for under the price bid under the "Topsoiling" Item. If no such item for payment is provided within the Proposal, all topsoiling costs shall be deemed included in the other prices bid in the Proposal, and no separate payment for this work shall be made.

END OF SECTION 329119.13

SECTION 329219 - SEEDING

PART 1- GENERAL

1.1 WORK INCLUDED:

A. Preparing all ground surfaces as required.

B. Furnishing and sowing seed on areas shown on the plans, all other disturbed areas, and areas of restoration and caring for the work as specified.

C. Action and means as necessary for control of soil erosion and stability maintenance.

1.2 RELATED WORK:

A. Finish Grading - Section 312219

B. Topsoil Placement and Grading – Section 329119.13

C. Erosion and Sediment Control – Section 312500

1.3 EXISTING CONDITIONS:

A. It shall be the Contractor's responsibility to investigate all site conditions that may affect his work.

PART 2 - MATERIALS

2.1 GENERAL:

A. Each of the species, variety and strain of grasses, legumes and cereals shall be as specified, unless otherwise acceptable to the Engineer.

B. All seed and seed labels shall be in accordance with State and Federal Laws, Rules and Regulations as each is in effect on the date of Invitation for Bids.

2.2 SEED LOT CONTENT:

A. The weight of pure live seed in each lot of seed is computed by the labeled purity percent, times the labeled germination percent, times the weight. (Example: 34 pounds of pure live seed of a particular grass is required. Stock available has 85% purity and 80% germination which meets the minimum requirements in this example and equals 68% pure live seed; 34 divided by 68%

equals 50 pounds gross as being required to furnish the 34 pounds of pure live seed.) Other material shall comprise the remaining 32% between 68% of pure live seed and 100% in the example.

B. The Contractor shall furnish the vendor with the specifications for the material. Seed mixes shall be as follows:

NAME	VARIETY	WT. OF PURE LIVE SEED
Red Fescue (Festuca rubra)	Commercial	40
Kentucky Bluegrass (Poa Pratensis)	Commercial	10
Perennial Ryegrass (Lolium perenne)	Commercial	15
White Clover (Trifolium repens)	Commercial max.25% hard seed	5
TOTAL		70 lbs.

C. Material other than the pure live seed shall comprise only non-viable seed, chaff hulls, live seed of crop plants other than those specified, harmless inert matter and weed seeds, except that weed seeds, other than seeds of noxious weeds will be permitted up to 1% of the gross weight of each kind of seed. Legume seeds shall be accompanied by adequate amounts of their proper inoculants unless accompanied by certification of pre-inoculation.

2.3 INOCULATION:

A. All the seed of leguminous plants shall be inoculated prior to mixing or sowing unless otherwise specified or approved or unless accompanied by a certificate of pre-inoculation. It is very important to use crownwatch inoculant at double the usual rate; follow carefully the instructions on the inoculant bag. When seed is to be sown dry and is to be inoculated, the culture shall be applied as directed by the manufacturer and seed allowed to dry sufficiently to be in the proper condition for mixing or sowing. Seed must be sown within thirty (30) hours after this treatment. When seed is to be distributed by water pressure, proper proportion of inoculant may be added to water and seed mixture, together with any limestone or fertilizer specified, providing the alkalinity of the solution does not exceed a pH of 8.

B. The inoculants for treating seeds of legumes shall be standard culture of nitrogen fixing bacteria not more than one (1) year old. Each inoculant shall be the specific culture required by each legume. It shall be supplied only from the manufacturers licensed to sell legume inoculants in New York State.

PART 3 - CONSTRUCTION DETAILS

3.1 GENERAL:

A. Each kind of seed shall be furnished and delivered, unless otherwise approved, in separate, sealed containers, or bags acceptably sewn tight or sealed.

B. The percentage of purity as shown on the label will be acceptable if in conformance with these specifications. Percentage of germination as shown on the label shall not be less than the minimum percentage specified. The common and scientific names of the grasses, legumes and cereals under this contract are in conformity with the Standardized Plant Names adopted by the American Joint Committee on Horticulture Nomenclature and in effect on the date of the Invitation for Bids.

C. The seeds shall meet the minimum specified requirements regardless of the guarantee of the qualities or dates of testing.

3.2 TIME FOR WORK:

A. This work may be performed at any season of the year when a mulch is used unless otherwise specified.

B. When conditions of high winds, excessive moisture, or ice are such, that satisfactory results are not likely to be obtained, the work shall be stopped, and will be resumed only when the desired results are likely to be obtained or when acceptable corrective measures and procedures are adopted.

C. The Contractor shall notify the Engineer at least forty-eight (48) hours in advance of the time he intends to begin sowing seed and shall not proceed with such work until permission to do so has been obtained.

3.3 ACCEPTANCE:

A. Provisional acceptance of the seeds must be obtained before the seeds are mixed. Each lot of seed shall be subject to sampling and testing before mixing. Sowing seed shall not be delayed pending reports of these tests. Sampling shall be accomplished by the Owner's Representative. Seeds of the kind specified shall be mixed on the job in the formula specified unless otherwise accepted. Seed mixed prior to delivery may be accepted on the basis of certification by the vendor stating the minimum percentage of germination and purity of each kind of seed and the quantity of each kind of seed in the mixture.

B. The provisional acceptance of seeds must be obtained before the seed is sown. Final acceptance may be subject to the results of official sampling and testing.

3.4 STORAGE:

A. Seed after delivery to the Contractor shall be stored in such a manner as to protect it from damage or deterioration from any source.

B. Seed, which has become wet, moldy, or otherwise damaged in transit or storage will not be acceptable and shall be removed from the site immediately upon such damage being discovered.

3.5 MAINTENANCE:

A. Areas to be seeded shall be maintained at acceptable grades. Irregularities, which will form low places and hold water shall be eliminated. Limestone, fertilizers, and seeds in amounts specified shall be evenly distributed on the surfaces to be seeded. Rates, unless otherwise specified, are as follows:

1. Fertilizer - 800 pounds/acre (20 pounds/1,000 sq. ft.)
2. Seed - 150 pounds of pure live seed/acre

B. Agriculture limestone, fertilizer and seed may be mixed together immediately before placing. Any method of distribution, such as by air or water pressure, will be acceptable except that the seed shall not be injured in the process of spreading.

C. The Contractor shall care for the seeded and mulched areas until final acceptance of the project. Such care shall consist of repairing any areas damaged following the seeding or mulching operations due to wind, water, fire or other causes. Such damaged areas shall be repaired to re-establish the condition and grade of the area prior to seeding, and shall then be refertilized, re-seeded and re-mulched as specified herein.

END OF SECTION – 329219

330110.13 - PRESSURE AND LEAKAGE TESTING OF PIPELINES

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. The Contractor shall pressure test all potable water pressure and sewer forcemain pipelines shown on the contract drawings. All piping and equipment shall be tested in the field in the presence of the Engineer.

B. Prior to testing, all mains shall be flushed and pigged to remove all sand and other foreign matter. Flushing shall be terminated at the direction of the Engineer. The Contractor shall dispose of the flushing water without causing a nuisance or property damage.

C. No testing shall be done until all joints are restrained. Temporary thrust blocks or reverse deadmen may be used with the Engineer's prior approval.

1.3 RELATED SECTIONS:

A. Related Sections include the following:

1. Division 33 Sections for buried pipe installation requirements.
2. Division 33 Section "Disinfection of Pipelines" for disinfection testing requirements of pipelines.

1.4 SUBMITTALS:

A. For closeout: Pressure Test Reports performed as well as any laboratory results received as part of this work. Specifically:
1. Pressure Report:
2. Hydrostatic Test Pressure.
3. Dates and time for start and completion of pressure testing.
4. Pressure results at start and finish of each section tested.
5. Amount of Water Used during testing.
6. Signature of person performing tests and signature of witness.

B. Certificate: Certify that pressure testing of water distribution system meets or exceeds requirements of the AWWA.

PART 2 – PRODUCTS

PART 3 - EXECUTION

3.1 GENERAL:

A. All hydrant control valves must be open while pressure testing.

B. All blow-off standpipes and injection points shall be removed upon satisfactory completion of sampling and testing. Corporation stops shall remain in line.

C. Teflon tape shall be used on all threaded joints to avoid contamination (No pipe dope allowed).

D. It is the Contractor's sole responsibility to place sample points where designated by the Design Engineer.

E. The Contractor shall backfill all pipe and thrust blocking before pressure testing unless the Engineer directs certain joints or connections left uncovered. Where thrust blocking is provided the pressure test shall not be made until at least five days after the thrust blocking has been installed. A high early strength concrete may be used to reduce this time.

F. Each valved section of pipe shall be slowly filled with water and a pump shall be hooked to the pipe in a manner satisfactory to the Engineer to supply the test pressure. The pump, pipe connection and all necessary apparatus shall be furnished by the Contractor.

G. While the system is being filled with water, air shall be carefully and completely exhausted. If permanent air vents are not located at all high points, the Contractor shall install corporation stops or fittings and valves at such points so the air can be expelled as the pipe system is slowly filled with water. Service shall be tested as part of the main pipeline.

H. Source water that is from a public water supply shall use backflow protection. A double check valve assembly or better device approved by the New York State Department of Health is acceptable.

3.2 PRESSURE TEST FOR DUCTILE IRON AND PVC PIPING

A. All newly laid pipe, including fitting and valves shall be pressure tested by the Contractor, in accordance with the latest editions of AWWA C600 and C605, to verify the integrity of the pipeline.

B. Test pressures and durations shall be as follows:

	Pressure (psi)	Duration (hrs)
Sewage force main	150	2
Reclaimed water mains	150	2
Potable water mains	150	2
Fire mains	200	2

*Water mains should be tested at 1.5 times the working pressure.

C. A leakage test shall be conducted in the presence of the Engineer and, after the pressure test has been satisfactorily completed. The Contractor shall, as before, furnish all pumps, pipe, connections and other items required to satisfactorily complete the leakage test. The leakage test shall have a duration of two hours at the pressure specified for the pressure test. No pipe installation will be accepted if the leakage is greater than that determined by the formula for mechanical and push-on joints per hour:

$$L = \frac{SDP^{1/2}}{148{,}000}$$

L= Allowable leakage [gph]
S= Length of pipe tested [feet]
D= Nominal diameter of pipe [inches]
P= Average pressure during test [psig]

150 psi (per 1000ft.) at 2 hours
(Per AWWA C600& AWWA C605 Tables)

Line Size (in)	Allowable Leakage (gal)
2	0.34
4	0.66
6	1.0
8	1.32
10	1.66
12	2.0
16	2.64
18	2.98
20	3.32
24	3.98
30	4.96
36	5.96
42	6.96
48	7.94
54	8.94

D. The Engineer, or his duly authorized representative, shall witness these tests. The Contractor shall be responsible for finding and repairing leaks. No additional cost may be incurred by the Owner due to repairs because of failure of the test. The Engineer has the authority to determine the number of repairs that will be made within a given length of pipe and has the right to request the Contractor to remove and relay a section of pipe if such does not comply with the established leakage rates as calculated using the formula above.

E. For the duration of the test, the pressure in the main shall not be allowed to drop more than 5 psi below the test pressure per AWWA C600 & C605. Should the pressure drop 5 psi, makeup water shall be added to the line to restore the pressure to the test pressure. This makeup water shall be measured and shall be included in the total leakage measured. If loss is greater than 5 psi, the test fails.

3.3 PRESSURE TESTING OF HDPE PIPELINES:

A. Filled pipelines shall be allowed to thermally stabilize such that the temperature of the water and the pipe are equal. At temperatures above one hundred (100) degrees F, the Engineer shall be consulted regarding the need to reduce the test pressure.

B. The piping shall be tested between valved sections to a maximum length of five thousand (5,000) feet.

C. For any test pressure from 1.0 to 1.5 times the system design pressure, the total test time including initial pressurization, initial expansion, and time at test pressure, shall not exceed eight hours. If the pressure test is not completed due to leakage, equipment failure or other reason, the test section shall be depressurized, and allowed to "relax" for at least eight hours before bringing the test section up to test pressure again.

D. The test procedure consists of initial expansion, and the test phase:
   1. During the initial expansion phase, the test section is pressurized to 10 psi above the test pressure (see Table A for Expansion Pressure), and sufficient make-up water is added each hour for three hours to return to the expansion phase pressure.
   2. After the initial expansion phase, about four hours after pressurization, the test phase begins.

   3. During the test phase, the pipe is stabilized at the test pressure (see Table A). The pressure shall remain steady within five percent of this target value for two hours. If the pressure drop is greater than 5% or if the pressure falls below 95% of the test pressure (see Table A), leakage or insufficient expansion is indicated, and the test shall be repeated after the pipe is allowed to "relax" as indicated above. Make-up water is not allowed during the test phase.

TABLE A

Pipe Class (SDR)	Expansion Pressure (psi)	Test Pressure (psi)	5% Reduction Pressure (psi)
17	150	140	133
13.5	170	160	152
11	170	160	152
9	210	200	190

3.4 REPAIR

A. The Contractor shall repair all leaks in the piping at no cost to the Owner.

PART 4 - MEASUREMENT AND PAYMENT:

4.1 MEASUREMENT:

A. Measurement shall be made on the basis of lineal foot of pipe of the type and size(s) properly placed, as measured by the Engineer. Measurements shall be made horizontally along the axis of the pipe and shall include all fittings and/or accessories not specifically included for measurement and payment under other items in the Proposal.

4.2 PAYMENT:

A. Payment will be made at the unit price bid under the appropriate item(s) of the Proposal.

END OF SECTION 330110.13

SECTION 330505.41 - LOW PRESSURE AIR TEST - SANITARY SEWER LINES

PART 1 – GENERAL

1.1 WORK INCLUDED:

A. This item shall govern for furnishing all labor, materials, tools and equipment and for performing low pressure air testing on completed sanitary sewer lines.

1.2 RELATED SECTIONS:

A. Trenching and Backfilling and Compaction Work – Section 312333.S

1.3 SUBMITTALS:

A. Conform to the requirements of Section 013300– Submittals

PART 2 – PRODUCTS

2.1 EQUIPMENT:

A. The equipment used shall meet the following requirements:

1. Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe being tested.
2. Pneumatic plugs shall resist the internal test pressures without requiring external bracing or blocking.
3. One of the pneumatic plugs shall have an inlet tap or other provision for connecting air supply to introduce low pressure air into the line for testing.
4. All air used shall pass through a single control panel.
5. Air supply system shall have the necessary valves and gauges to control the rate at which air enters the test section and for reading test results.
6. Pressure gauges shall have minimum gradations of 0.1 psi and an accuracy of plus or minus 0.04 psi.

PART 3 – EXECUTION

3.1 GENERAL:

A. After the gravity sanitary sewer line has been laid and backfilled, but prior to replacement of pavement, the sanitary sewer line shall be subjected to a low pressure air test. Test shall be performed using equipment denoted herein and according to the outlined procedures.

B. The contractor shall take such precautions as required to prevent damage to the lines and appurtenances being tested. Damage resulting from any testing shall be repaired at the Contractor's expense. All testing shall be completed in the presence of the Engineer.

3.2 PRETESTING PROCEDURES:

A. In an area where groundwater is known to exist, prior to conducting any tests, the Contractor shall provide for determining groundwater level by installing groundwater gauges in the manholes.

B. Gauges shall consist of a minimum 1/2 inch diameter pipe, capped and inserted horizontally in the manhole wall as near as possible to the top of the sewer, sealed so as to be watertight. Immediately prior to the performance of the test, groundwater back pressure shall be determined by removing pipe cap, blowing air through the pipe into the ground to clean the pipe. Clear plastic tube shall be held vertically and measurement of height (in feet) of water over invert of pipe to be taken after water has stopped rising.

C. Height shall be divided by 2.3 feet to establish pounds (psi) of back pressure to be added to all readings. Upon satisfactory completion of the air test, remove the groundwater gauge from the wall of manhole and neatly and permanently close opening with a non-shrinking, noncorrosive grout. Prior to testing flush and clean sewer lines of any debris, also, plug all pipe outlets to resist test pressure.

3.3 TESTING PROCEDURES:

A. The testing procedure shall be as follows:

1. Seal-test all pneumatic plugs before using in the test installation. Lay one length of pipe on the ground and seal at both ends with the pneumatic plug. Introduce air into the pneumatic plug to 24 psig. Sealed pipe to be pressurized to 5 psig. Plugs shall hold against this pressure without external bracing.
2. Contractor shall carefully observe safety precautions during air testing; no one shall be allowed in the manholes during testing.
3. Place pneumatic plugs in the line at each manhole and inflate to 25 psig. Introduce low pressure air into sealed line until internal air pressure reaches a pressure of 4 psig plus the average groundwater back pressure. Allow two minutes for the internal air pressure to stabilize.
4. When the internal air pressure has stabilized and is at or above test pressure (3.5 psig minimum, plus groundwater back pressure), commence the test. Disconnect air hose from the control panel to the air supply. Record the pressure drop for the test period.
5. If the pressure drops more than 1.0 psig during the test period, line is presumed to have failed. Test may be discontinued, when the prescribed test time has been reached.
6. The time required for the pressure to decrease from 3.5 psig to 2.5 psig (greater than the average groundwater back to pressure over the pipe) to be not less than the time shown for the diameter given in Table No. 1. Times shown are based on loss of air not to exceed 0.003 cubic feet per minute per square foot of internal pipe surface tested at an average pressure of 3.0 psi greater than the groundwater back pressure.

Table No. 1
Allowable Time Table

Pipe Size(inches)	Min. Time Sec.

6	2	50
8	3	56
10	4	43
12	5	40
15	7	5
18	8	30

Pipe Size (inches)	Min. Time	Sec.
21	9	55
24	11	20
27	12	45
30	14	10
36	17	0
42	19	50

7. Sanitary sewers failing to meet the requirements of the low pressure air test shall be tested again after the Contractor has located and remedied defects causing this failure. No sanitary sewer shall be accepted until the requirements of the test procedure are satisfied.

PART 4 - MEASUREMENT AND PAYMENT:

4.1 PAYMENT:

A. No separate payment for work performed under this item. Include the cost in the contract unit price bid for the item of which this work is a component.

END OF SECTION 330505.41

SECTION 330531.11 - POLYVINYL CHLORIDE (PVC) PIPE FOR NON-PRESSURE SEWER SERVICE

PART 1 – GENERAL

1.1 WORK INCLUDED:

A. This specification section includes all materials, equipment, labor, and incidentals required for the supply and installation of polyvinyl chloride (PVC) pipe and fittings, 4-inch diameter to 60-in diameter for use in storm sewer, sanitary sewer, or other non-pressure sewer applications.

1.2 RELATED SECTIONS:

A. Low Pressure Air Testing – Section 330505.41

B. Tracer Wire: Section 330000

C. Trenching, Backfilling and Compaction – Section 312333

1.3 REFERENCES:

A. The Contractor and/or Pipe Manufacturer shall follow the standards listed below, except as otherwise specified herein. The latest revision or edition in effect at the time of bid opening shall be utilized.

1. American Society for Testing and Materials (ASTM)
    a. D1784 – Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
    b. D2321 – Practice for Underground Installation of Thermoplastic Pipe for Sewer and Other Gravity-Flow Applications
    c. D3034 – Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
    d. D3212 – Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
    e. F477 – Elastomeric Seals (Gaskets) for Joining Plastic Pipe
    f. F679 – Polyvinyl Chloride (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
    g. F1417 – Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air
2. American Water Works Association (AWWA)
    a. M23 – PVC Pipe – Design and Installation
3. Uni-Bell PVC Pipe Association
    a. UNI-B-6 – Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe
    b. UNI-PUB-6 – Installation Guide for PVC Solid-Wall Sewer Pipe (4 - 48 in.)
    c. UNI-TR-3 – Maintenance of PVC Sewer Pipe
    d. Handbook of PVC Pipe Design and Construction

1.4 QUALIFICATIONS:

A. The Pipe Manufacturer shall be a member of the Uni-Bell PVC Pipe Association.

B. The pipe and fittings shall be designed, manufactured, and installed in accordance with industry standards and shall comply with the specification requirements herein.

1.5 SUBMITTALS:

A. Conform to the requirements of Section 013300– Submittal Procedures.

B. Submit product data on pipe, fittings, gaskets and appurtenances as required to ensure products meet the requirements of this specification.

1.6 DELIVERY, STORAGE, AND HANDLING:

A. Pipe shall be shipped so as to not bend, dent, or otherwise damage the pipe during transport.

B. Contractor shall take all necessary precautions to prevent damage to pipe and fittings during delivery and unloading.

C. Owner shall observe and inspect unloading of pipe to ensure proper unloading procedures are followed.

D. Under no circumstances will pipe be allowed to be rolled, pushed, or dropped off from any height for delivery, storage, or installation. Any pipe found to have been damaged due to improper handling procedures truck will be immediately marked for identification and removed from the jobsite at the Contractor's expense.

E. Stacking of pipe shall be performed in accordance with Pipe Manufacturer's recommendations.

F. Once pipe has been unloaded, it shall be stored as near to its point of installation as possible. Contractor shall limit moving or restacking of pipe prior to installation.

G. Where necessary, because of ground conditions, store pipe on wooden sleepers, spaced suitably and of such widths as not to allow deformation of pipe at point of contact with sleeper or between supports.

H. Pipe shall not be stored close to heat sources or hot objects such as heaters, boilers, steam lines, and engine exhaust.

I. If pipe is to be exposed to direct sunlight for extended periods (in excess of two years from the date of manufacture), then Contractor shall cover/shade pipe utilizing canvas or other opaque materials. Black plastic will not be acceptable as a shading material.

J. Gaskets shall be protected from exposure to excessive heat, prolonged direct sunlight, and oil and grease.

K. Material storage shall be performed in accordance with Pipe Manufacturer's recommendations.

PART 2 – PRODUCTS

2.1 PIPE:

A. Pipe shall be manufactured and supplied in accordance with ASTM D3034 (4-Inch to 15-Inch) or F679 (18-Inch to 60-Inch).
   1. Pipe should have a standard dimension ratio (SDR) of SDR 35.

B. Pipe shall have lay lengths between 14 and 22 feet unless otherwise specified by the Owner.

C. The pipe shall be made of PVC compound having a cell classification of 12454 or 12364 in accordance with ASTM D1784.

D. Pipe shall be homogenous throughout, free of voids, cracks, inclusions, and other defects.

E. Pipe shall have markings at intervals of 5ft or less including:
   1. Manufacturer's name or trademark and code
   2. Nominal pipe size
   3. PVC cell classification
   4. Legend (e.g. " SDR-41 PVC Sewer Pipe" or "PS 46 PVC Sewer Pipe")
   5. ASTM Designation
   6. Gasketed pipe shall be marked with an insertion depth mark on the spigot end.

F. Pipe for non-potable water and wastewater uses shall be green or white in color.

G. Pipe outside diameters shall be equal to those of cast iron unless otherwise specified by the Owner.

2.2 PIPE DESIGN:

A. Pipe shall be supplied to meet the external loading requirements of the project as follows:
   1. Maximum calculated deflection of 7.5%
   2. Live loads as calculated per AWWA M23 based on the profile shown on the plans
   3. Depth of cover as shown on the plans
   4. Trench width as shown on the plans
   5. Modulus of soil reaction (E'), bedding constant (K), and soil density (γ) shall be based on design and site conditions.

2.3 FITTINGS:

A. Fittings shall be manufactured and supplied in accordance with ASTM D3034 (4-Inch to 15-Inch) or ASTM F679 (18-Inch to 60-Inch). Molded and fabricated fittings may be supplied in accordance with ASTM F1336.

B. Fittings shall be made of PVC compound having a cell classification of 12454 or 13343 in accordance with ASTM D1784.

C. Pipe used in fabricated fittings shall have a wall thickness equal to or greater than the wall thickness of the pipes to which the fitting (or that part of the fitting) will be joined.

D. Molded and fabricated fittings shall have markings including:
   1. Manufacturer's name or trademark
   2. Nominal size
   3. Material designation (e.g. "PVC")
   4. ASTM Designation

E. Fittings may also be supplied as ductile iron fittings in accordance with AWWA C110 and/or C153.

2.4 PIPE JOINTS:

A. Joints shall be gasketed push-on type conforming to ASTM D3212.

B. Gasket materials shall meet requirements of ASTM F477.

C. Joint lubricant shall be approved by the Pipe Manufacturer and shall have no detrimental effect on the gasket or pipe.

PART 3 – EXECUTION

3.1 GENERAL:

A. Install pipe, fittings, specials, and appurtenances in accordance with ASTM D2321, UNI-PUB-6 and/or in accordance with the Pipe Manufacturer's recommendations.

B. Lay pipe to the lines and grades as indicated on the Plans.

3.2 PIPE HANDLING:

A. Handle pipe and piping materials with care to avoid damage.

B. Prior to installation, each pipe length shall be carefully inspected for damage.

C. All pipe, fittings, and appurtenances shall be thoroughly cleaned before installation and shall be kept clean until installation and backfilling has completed.

D. Use only nylon ropes, slings, or other lifting devices that will not damage the surface of the pipe.

E. Keep the pipe clean and free of debris, dirt, animals, and trash during and after laying operations.

F. At the close of each operating day, seal the open end of the pipe using a gasketed night cap.

3.3 PIPE INSTALLATION:

A. Do not drag pipe over gravel or rock. Avoid striking rocks or hard objects when lowering pipe into the trench.

B. Placement of pipe and fittings into the trench should be done with ropes and skids, slings on a backhoe bucket, or by hand.

C. Pipe or fittings shall not be thrown into the trench and no part of the pipe shall be allowed to take an unrestrained fall onto the trench bottom.

D. Joint sockets shall be carefully cleaned before pipes are lowered into trenches.

E. Pipe trenches and excavation shall be kept free of water during pipe laying operations and other related work. If high groundwater levels are expected or encountered, Contractor is to ensure that a minimum depth of cover of 1.5 times the pipe diameter will be maintained over the pipe once it has been installed or provide other methods approved by the Owner and Pipe Manufacturer of preventing flotation of the pipe.

3.4 JOINT MAKING:

A. Install push-on joints in accordance with Pipe and Fittings Manufacturer's recommendations.

B. Inspect the gasket, pipe spigot bevel, gasket groove, and sealing surfaces for damage or deformation. In cases when gaskets are supplied separately from pipe, Contractor is to ensure that gaskets supplied are designed for the pipe in use.

C. Clean the gasket of all extraneous matter.

D. Apply a thin film of joint lubricant to the inside of the gasket and the outside of the spigot prior to entering the spigot into the bell. Lubricated spigots ends shall not come in contact with soil or backfill material.

E. Insert the spigot end of the pipe carefully into the bell until the reference mark on the spigot is flush with the bell. If two reference marks are present, the mark closest to the spigot end shall be considered the minimum insertion mark, and the second mark shall be considered the maximum insertion mark. Under no circumstances will the spigot be inserted into the bell past the reference mark or maximum insertion mark.

F. For small diameter pipe, use the bar-and-block method for joint assembly or other method approved for use by the Owner and Pipe Manufacturer.

G. For large diameter pipe, use mechanical assistance such as hydraulic pipe pullers, jacks, pulleys, come-alongs, or a backhoe bucket. Observation by a spotter will be required when assembling joints for large diameter pipe to prevent over-insertion.

H. When using a field cut plain end piece of pipe, bevel the end with a beveling tool, wood rasp, or power sander to the same angle and length as provided on the factory-finished pipe. Redraw the insertion line on the spigot using a factory-marked spigot as a guide.

I. Angular changes in pipe alignment shall be achieved by either fittings, joint deflection, or longitudinal bending of the pipe.

J. Joint deflection shall not exceed the Pipe Manufacturer's recommendation.

K. Field assembly of pipe fittings shall follow the Pipe Fittings Manufacturer's recommendations.

L. Mechanical joints shall be assembled per the Pipe and/or Fittings Manufacturer's recommendations as well as the recommendations of the mechanical joint supplier.

3.5 LONGITUDINAL PIPE BENDING:

A. Controlled changes in direction may be accomplished by longitudinal bending of the pipe barrel.

B. Pipe Manufacturer shall be consulted prior to start of construction for recommendations on longitudinal bending.

C. When longitudinal bending of pipe is utilized, Contractor shall use manual force alone to achieve prescribed bending. Mechanical means shall not be utilized to achieve longitudinal bending of the pipe.

D. When the desired change of direction in the pipeline exceeds the maximum allowable deflection specified, the longitudinal bending shall be made throughout a number of pipe lengths.

E. Contractor will ensure that pipe joints will not be over-pulled or over-inserted during longitudinal bending operations.

3.6 FIELD TESTING:

A. After pipe has been installed and backfilled, deflection testing shall be performed in accordance with ASTM D3034 and/or F679, PVC Pipe Handbook, and the specifications herein. Deflection testing shall utilize a "go/no-go" mandrel for measurement of pipe deflection. Contractor shall allow for stabilization of the pipe/soil system (minimum of 30 days) prior to testing.

B. All finished installations for non-pressure applications shall be tested via low-pressure air testing in accordance with ASTM F1417, UNI-B-6, and the specifications herein.

C. Isolate the section of non-pressure sewer line to be air tested by inflatable stoppers or other suitable test plugs/caps.

D. Ends of all branches, laterals, tees, wyes, and/or stubs in the test section shall be plugged or capped to prevent air leakage. One of the plugs/caps shall have an inlet tap or other method for connecting the air hose to an air control source.

E. Test ends should be restrained and/or braced during air testing.

F. Add air slowly to the test section until the pressure reaches 4.0 psi. After the test pressure is obtained, regulate the air supply so that the pressure is maintained between 3.5 and 4.0 psi for at least 2 minutes until the air temperature stabilizes and is in equilibrium with the temperature of the pipe walls.

G. After equilibrium is achieved, determine the rate of air pressure loss by either the constant pressure method or the time-pressure drop method as outlined in ASTM F1417.

H. Upon completion of the test, open the bleeder valve and allow all air to escape. Caps/plugs shall not be removed until all air pressure in the test section has been reduced to atmospheric pressure.

PART 4 - MEASUREMENT AND PAYMENT:

4.1 MEASUREMENT:

A. Measurement shall be made on the basis of lineal foot of PVC sewer pipe of the type and size(s) properly placed, as measured by the Engineer. Measurements shall be made horizontally along the axis of the pipe and shall include all fittings and/or accessories not specifically included for measurement and payment under other items in the Proposal.

4.2 PAYMENT:

A. Payment will be made at the unit price bid under the appropriate item(s) of the Proposal; the price bid shall include ,excavation, shoring, dewatering, disposal, bedding, NYSDOT sub-base backfill, compaction, compaction testing, thrust blocks, retaining rods, fittings and specials, including reducers, disinfection, testing and sampling, restoration; identification tape, locating wire, record drawings, miscellaneous work, including connection to existing mains and appurtenances, abandonment of existing mains, as required to complete the work.

B. Where no payment items is provided in the Contract proposal, and PVC sewer pipe is necessary or required for the work, no separate payment will be made and such material, in place, shall be deemed included in other payment items of the proposal.

END OF SECTION 330531.11

SECTION 331113.13 DUCTILE IRON (D.I.) WATER PIPE AND SPECIALS (NY)

PART 1 – GENERAL

1.1 WORK INCLUDED:

A. Provide and install ductile cast iron pressure water pipe and specials, with end types (mechanical joint, flanged, push-on or ball and socket) as called for or shown with integral wall bell and spigot joints.

1.2 RELATED WORK:

A. Trenching, Backfilling and Compaction - Section 312333

B. Pressure and Leakage Testing of Pipelines – Section 330110.13

C. Disinfection Testing of Pipelines – Section 331301

1.3 EXISTING CONDITIONS:

A. It shall be the Contractor's responsibility to investigate all site conditions that may affect his work.

PART 2 – MATERIALS

2.1 PIPE (GENERAL):

A. All pipe shall be centrifugally cast.

B. Shall be coated on the outside and cement-lined.

C. Shall be in nominal eighteen (18) feet laying lengths, according to the Manufacturer's standard practice.

D. Shall be Class 52, unless otherwise indicated, suitable for a working pressure of 350 psi.

E. The weight, class or nominal thickness and casting period shall be shown on each pipe.

F. The manufacturer's mark, the year in which the pipe was produced and letters "DI" or "Ductile" shall be cast or stamped on each pipe.

2.2 DEFINITIONS:

A. "Pipe" - all straight sections

B. "Specials" - all branches, bends, tees, other fittings, reducers, etc.

C. Straight pipe which is cut to fit to work, or short sections of straight pipe, will not be considered specials.

D. All cast iron specials shall be Class 250, shall have the same type ends and shall be in accordance with the Specifications for the pipe with which they are to be placed unless specifically indicated otherwise.

2.3 PIPE (JOINTS AND FITTINGS):

A. Mechanical Joint Pipe:

1. Joint shall meet all requirements of American standard Specifications for Mechanical Joints, A21.11 "year of latest revision".
2. Shall have the same pressure rating as the pipe of which it is part.
3. Bell of mechanical joint shall be cast integrally with the pipe and shall meet the applicable requirements of the specifications under which the pipe is produced.
4. The iron in the glands shall meet the requirements of Class 25 of American Standard Specifications for gray iron cast, ASA G25.1, or most recent revision thereof.
5. The annular surfaces of the gland lip and the bolt circle, shall be concentric and tolerances shall be given by the American Standard Specifications for Mechanical Joints, A21.11 - 1964, or "year of latest revisions".
6. The surface of the gland shall be smooth and free from defects of every nature which would unfit them for the use intended.
7. Glands shall be coated with a bituminous dip or paint, unless otherwise specified.
8. Gaskets shall be vulcanized natural or vulcanized synthetic rubber and shall be in accordance with American Standard Specification A21.11 "year of latest revision". No reclaimed rubber shall be used. When two (2) hardnesses of rubber are included in a gasket, the soft and hard portions shall be integrally molded and joined in a strong vulcanized bond. They shall be free of porous areas, foreign material, and visible defects. Tests shall be made by the manufacturer in accordance with the applicable ASTM Test Methods. Gaskets shall be Rainbow, Durable, Garlock or "approved" equal.
9. The mechanical joint for ductile iron pipe shall meet all the requirements of the American Standard Specifications for Mechanical Joints A21.11 "year of latest revision", and shall have the same pressure rating as the pipe of which it is a part.

B. Push-on Joint Pipe:

1. Joint shall meet all requirements of ANSI A21.11 "year of latest revision" (AWWA C111) for the rubber gasket joints.
2. All joints shall be provided with two (2) serrated bronze wedges at the 10 o'clock and 2 o'clock positions in accordance with the pipe manufacturer's standards. Wedges shall insure electrical conductivity throughout the entire length of pipeline.

C. Flanged Pipe (Only utilized where specifically called for or required):

1. To be provided where specifically indicated on the Plans or called for in the Specifications.

2. Shall be of the water pattern, as under American Standard Association Specification 3.6.1, Class 125 or Class 250 (as indicated), latest revision.
3. Shall conform to ANSI A21.10 (latest revision).
4. All flanged pipe ends and fittings shall be faced and drilled in accordance with the aforementioned standard.
5. The gasket material, bolts and nuts, and all other items necessary to provide a complete installation of flanged pipe and fittings shall be provided and included.

D. Ball and Socket (Only utilized where specifically called for or required):

1. To be provided where specifically indicated on the Plans or called for in the specifications.
2. Shall be suitable for usage on the water system shown.
3. Joints shall be boltless, push-on, with bayonet-type locking retainer and capable of deflections to a maximum of 5 degrees.
4. Joint bell, ball and retainer shall be of cast 70-50-05 ductile iron in accordance with ANSI A21.20 (year of latest revision).
5. Pipe components shall be machined to precise tolerances to assure premium performance and ease of assembly.
6. Gasket shall be of high quality rubber and symmetrical to insure it cannot be installed backwards.
7. Pipe shall be ductile iron of cast 60-42-10 in accordance with ANSI A21.51.
8. Pipe shall be of the thickness class number to overcome buoyancy.
9. Pipe shall be cement-lined, bituminous coated, 18' lengths and conform to all other requirements under this section, unless otherwise noted.

2.4 STANDARDS:

A. All pipe and fittings shall at minimum meet all the applicable requirements of the American Water Works Association (AWWA) as well as the Standard Design and Construction Requirements for Water Distribution Main Extensions for the Town of New Windsor Consolidated Water District.

B. Pipe shall conform to American National Standard for Ductile Iron Pipe, Centrifugally Cast in Metal Molds, for the water or other liquids of AWWA Specifications C151, year of latest revision.

C. All the ductile cast iron pipe and fittings shall be cement-lined in accordance with "American Standard Specifications for Cement Mortar Lining for Cast Iron Pipe and Fittings, A21-4 "year of latest revision" or AWWA C104.

D. Bituminous seal coat shall be applied over the cement lining as specified in A.S.A. Specification A21.4 "year of latest revision.

PART 3 - CONSTRUCTION DETAILS

3.1 GENERAL:

A. All pipe must be installed in accordance with AWWA Standard C600, year of latest revision, as defined in 10 NYCRR 5-1.22(a).

B. All pipe and fittings shall be placed as shown on the plans and in compliance with the requirements of the specifications.

C. All pipe shall be installed and assembled in accordance with the manufacturer's recommendations.

D. All materials used in the construction shall be lead free in accordance with the 2014 “Lead Free” law.

3.2 INSPECTION OF PIPE:

A. Previous to being lowered into the trench, each pipe and fittings or coupling shall be carefully inspected, and those not meeting the specifications shall be rejected and immediately removed from the project site and replaced with acceptable materials. Such replacement shall be made at no cost to the Owner.

B. Movement of construction equipment and all other vehicles and loads over and adjacent to any pipe shall be done at the Contractor's risk. Any pipe, which in the judgement of the Engineer is damaged or disturbed through any cause, shall be replaced at the expense of the Contractor and at no cost to the Owner.

3.3 PIPE PLACEMENT (GENERAL):

A. Pipe lines shall be placed in the locations and grades as indicated on the Plans and in conformance with this Specification.

B. Trenches shall be kept free from water, and no pipe shall be laid in water.

C. Every effort shall be made to prevent any contaminating materials from entering the watermain during storage, construction or repair.

D. Pipe shall be so laid as to be evenly supported throughout the whole length of the barrel, with no weight resting on the bell or coupling. "Bell holes" shall be provided so that bells or couplings of pipe hang free.

E. If the trench is dug deeper than the grade of the barrel, no spalls, shims or lumps shall be used to raise the pipe to the grade, but an even bed shall be formed of sand or accepted fine material properly tamped at no additional expenses to the Owner.

F. In all cases where piping is being installed below the ground surface, before leaving the work for the night or any other time, the end of the pipe shall be securely closed with a watertight tight-fitting plug, and sufficient backfilling placed to protect the pipe.

G. When pipe is under pressure, and as indicated by the Engineer, reaction or thrust blocks shall be applied on all pipe lines size four (4) inches in diameter or larger at all tees, plugs, caps, and joints deflecting 22-1/2 degrees or more.

H. Tie rodding shall be done using pipe clamps manufactured for this purpose with minimum of 2-3/4" diameter steel rods. Thrust blocks shall be provided for any bends 22-1/2 degree or greater. Thrust

blocks shall comply with the details shown on the plans (if no such details are shown, dimensions shall meet Engineer's requirements). All costs of furnishing and placing such thrust blocks or tie rods shall be at the expense of the Contractor, and shall be included in the price bid under these items.

3.4 PIPE PLACEMENT (FOUNDATION):

A. All pipe shall be laid on a foundation of compacted Crushed Stone Foundation to the minimum dimensions noted on the detail on the Plans.

B. If in the opinion of the Engineer the subgrade will not properly support the pipe, additional crushed stone materials shall be provided as necessary to provide a firm pipe bedding as acceptable to the Engineer.

C. Ground conditions such as quick sand, other soft and yielding or otherwise unsuitable material shall be immediately brought to the Engineer's attention such that evaluation of the necessary bedding can be made.

D. The Contractor is advised that additional crushed stone foundation material shall only be placed where required for the Engineer's acceptance of the work.

E. All Crushed Stone Foundation material shall conform to the requirements of the applicable technical section of the Specifications.

3.5 PIPE PLACEMENT (LOCATION & GRADE):

A. The pipe or invert grade referred to in the specifications and as indicated on the plans is the lowest point of the pipe invert or flow line.

B. Pipe shall be placed in the location and at exactly the lines and grades indicated on the plans.

C. The Engineer shall have the power to require the removal or relaying of any pipe laid contrary to the plans during his absence or that of his assistants or the Project Representative from the project site.

D. Grade or alignment shall not be disturbed by the operation of tamping or backfilling. Care must be taken not to disturb the pipes by stepping on or near them, or by throwing earth on them from the bank or otherwise.

E. The pipes and fittings or couplings shall be so laid in the trench that after the line is completed the interior surface thereof shall conform accurately to the grade and line required by the Engineer, and as indicated on the plans.

F. Contractor must transfer line and grade to "batter boards" and string line over the trench. The Contractor may not transfer line and grade to and/or utilize a "side line" or string set to line and grade other than over and above the center line of the pipe to be laid.

G. Other methods of Grade and Alignment control are subject to acceptance by the Engineer.

3.6 PIPING JOINTS:

A. Mechanical:

1. Joints shall be installed in full conformance with the manufacturer's recommendations.
2. Spigot end of the pipe shall be thoroughly brushed with a wire brush and then the gasket and spigot end of the pipe shall be brushed with soapy water. Cast iron gland shall then be slipped on the spigot end of the pipe with lip extension toward the joint. The gasket shall then be slipped on with the thick edge of the gasket toward the gland. The bell end of the joint shall then be thoroughly brushed and the pipe inserted into the bell. The gasket shall then be pushed into position so that it is evenly seated in the socket of the bell. The gland shall then be moved into position against the face of the gasket. Bolts shall then be inserted, the nuts placed, and made up tightly with the fingers. Nuts shall then be tightened gradually, half turn at a time, using a torque-limited wrench of suitable size for the bolt sizes used, moving it from one nut to another and repeating until all nuts are uniformly tight. Torque limits of the bolts shall be in accordance with the pipe manufacturer's recommendations.

B. Push-On:

1. Joints shall be installed in full conformance with the manufacturer's recommendations.
2. The inside of the bell and outside of the spigot end shall be thoroughly cleaned and to remove oil, grit, excess coating and other foreight matter. The circular rubber gasket shall be flexed inward and inserted in the gasket recess of the bell socket. A thin film of gasket lubricant shall be applied to either the inside surface of the gasket or the spigot end of the pipe, or both. Gasket lubricant shall be as supplied by the pipe manufacturer and accepted by the Engineer. The spigot end of the pipe shall be entered into the socket with care used to keep the joint from contacting the ground. The joint shall then be completed by forcing the plain end to the bottom of the socket with a forked tool or jack-type tool or other device acceptable to the Engineer. Pipe that is not furnished with a depth mark shall be marked before assembly to assure that the spigot end is inserted to the full depth of the joint. Field cut pipe lengths shall be filed or ground to assemble the spigot end of such pipes as manufactured. Assemble instructions of the manufacturer shall be followed where not in conflict with the foregoing.

3.7 DISINFECTION:

A. All elements of water line construction installed or disturbed under this contract when complete, shall be disinfected in accordance with these specifications, all applicable requirements of the local, county and state health department and AWWA Standard C651 (latest revision).

B. The method of disinfection shall be in accordance with the methods outlined in the Attachment provided hereto these documents a copy of AWWA Standard for Disinfecting Water Mains C651 except that disinfection in accordance with Section 4.3, TABLET METHOD, is not acceptable.

C. The basic disinfection procedure consists of:

1. Removing, by flushing or any approved method necessary, any materials that may have entered the watermain.
2. Chlorinating any residual contamination that may remain, and flushing the chlorinated water from the main.

3. Protecting the existing distribution system from backflow due to hydrostatic pressure test and disinfection procedures.
4. Determining the bacteriological quality by laboratory test after disinfection.
5. Redisinfection, if necessary.
6. Final connection of the approved new watermain to the active distribution system.

D. When the project includes existing mains which are wholly or partially dewatered, special disinfection procedures in accordance with Subsection 3.9 (hereunder) and the provisions of Section 4 of AWWA C651 shall be utilized.

3.8 TESTING:

A. Sequence of Testing:

1. The hydrostatic test and leakage test shall be performed prior to disinfection to preclude the possibility of having to redisinfect if any repairs are necessary.

B. Hydrostatic Test:

1. After the water mains have been installed and before pipe joints, fittings, valves or other appurtenances are covered, all of the excess air shall be expelled and the water main shall be pressure tested.
2. Test pressure shall be at least 1.5 times the maximum working pressure at the point of lowest elevation in the section of pipe tested and at least 1.25 times the maximum working pressure at the point of highest elevation in the section of pipe tested, whichever is greater.
3. For pipe size of up to and including 16-inch, test pressure shall not exceed 350psi. For pipe size of 18-inch and greater, test pressure shall not exceed 250psi.
4. The pressure test shall be at least two hours in length, preferably before complete backfilling of the pipeline, when the joints are exposed.
5. All visible leaks, any cracked or defective pipe, fittings, valves, or hydrants discovered in consequent of the pressure test shall be removed and replaced by the Contractor with sound material; and the test shall be repeated until results satisfactory to the Engineer are obtained.
6. The Contractor shall furnish all necessary appliances and make the test at his own expense.

C. Leakage Test:

1. Leakage test shall be conducted concurrently with the pressure test.
2. Leakage is defined as the quantity of water to be supplied into the newly laid pipe or any valved section thereof, necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled.
3. The leakage test shall be performed in accordance with AWWA Standard C600 "year of the latest revision" as well as the Standard Design and Construction Requirements for Water Distribution Main Extensions for the Town of Newburgh Consolidated Water District.
4. There shall be no leakage during the test. The test pressure during the leakage test and the duration shall be the same as the hydrostatic test and shall be maintained within 5 psi.
5. The Contractor shall furnish all necessary appliances and make the test at his own expense.

D. Bacteriological Testing:

1. After the piped system has been disinfected and thoroughly flushed, but before the new water lines are final connected to the distribution system or placed in service, the water shall be tested for bacteriological quality and shall show the absence of coliform organisms.
2. Two (2) consecutive sets of acceptable samples, taken at least 24 hours apart shall be collected from the new main. At least one set of samples shall be collected from every 1200 ft. of new watermain, plus one set from the end of the line and at least one set from each branch.
3. Samples shall be collected in sterile containers treated with sodium thiosulfate in accordance with the procedures of the "Standard Methods for the Examination of Water and Wastewater". Samples shall be collected by qualified personnel from sampling taps installed on the main. No hose or fire hydrant shall be used in the collection of samples.
4. Samples shall be tested by a laboratory approved by the New York State Department of Health for bacteriological testing acceptable to the Engineer. Original signed copies of the results of these tests shall be submitted in writing to the Engineer.
5. All samples shall be tested for bacteriological quality in accordance with "Standard Methods for the Examination of Water and Wastewater", and shall show the absence of coliform organisms. A standard heterotrophic plate count may be required at the option of the Owner and/or Engineer.
6. Sufficient samples shall be collected and tested from the various portions of the system to indicate, to the satisfaction of the Engineer, that a uniform representative sample has been obtained and tested.
7. If samples tested fail to produce satisfactory results, the main shall be reflushed and resampled, and, if necessary, redisinfected as called for in Section 5.1.6 of C651 (latest revision).
8. If trench water has entered the new main during construction or, if in the opinion of the Owner and/or Engineer, excessive quantities of dirt or debris have entered the new main, bacteriological samples shall be taken at intervals of approximately 200 ft and shall be identified by location. Samples shall be taken of water that has stood in the new main for at least 16 hours after final flushing has been completed.
9. The Contractor shall furnish all necessary appliances and make the test at his own expense.

3.9 SPECIAL DISINFECTION PROCEDURES (FOR CUT-INS OR REPAIRS TO EXISTING MAINS):

A. The procedures referenced herein primarily apply to those cases when existing mains are wholly or partially dewatered or, where in the opinion of the Engineer, conditions warrant utilization of these special procedures.

B. When an existing main is opened, either by accident or by design, the excavation will likely be wet and may be badly contaminated from nearby sewers. Liberal quantities of hypochlorite applied to open trench areas will lessen the danger from such pollution. Provisions shall be made to provide such chlorination in these cases.

C. The interior of all pipe and fittings (particularly couplings and sleeves) used in making the repair or installation shall be swabbed or sprayed with a 1 percent hypochlorite solution before they are installed.

D. The Contractor shall utilize thorough flushing as an effective and practical means of removing contamination introduced during repairs. If valve and hydrant locations permit, flushing toward the work location from both directions is recommended. Flushing shall be started as soon as the repairs

are completed and shall be continued until discolored water is eliminated. At least 24-hour prior notice shall be made to the Owner and Engineer before any flushing is performed.

E. After the appropriate procedures have been completed, the existing main may be returned to service prior to completion of bacteriological testing in order to minimize the time customers are out of water.

F. Bacteriological samples shall be taken after repairs are completed to provide a record for determining the procedure's effectiveness. If the direction of flow is unknown, then samples shall be taken on each side of the main break (or cut-in installation). If positive bacteriological samples are recorded, then the situation shall be evaluated with the Engineer and Owner, at which time corrective actions shall be determined and then taken by the Contractor. Daily sampling shall be continued by the Contractor until two consecutive negative samples are recorded.

PART 4 - MEASUREMENT AND PAYMENT:

4.1 Measurement shall be made on the basis of lineal foot of ductile iron water pipe of the type and size(s) properly placed, as measured by the Engineer. Measurements shall be made horizontally along the axis of the pipe and shall include all fittings and/or accessories not specifically included for measurement and payment under other items in the Proposal.

4.2 Payment will be made at the unit price under the appropriate items(s) of the Proposal; the price bid shall include excavation, crushed stone foundation, backfill in a manner acceptable to the Engineer, including all labor, materials, fittings, equipment, rodding and thrust blocks, all "specials" and appurtenances, disinfection, testing and other work, miscellaneous work as called for or shown, as required to complete the work.

END OF SECTION 331113.13

SECTION 331213.15 - TAPPING SLEEVE AND VALVE ASSEMBLY

PART 1 – GENERAL

1.1 WORK INCLUDED:

A. Provide and install a tapping sleeve and valve, including valve box(es), at the location indicated on the plans, or as required in the field and accepted by the Engineer.

B. Furnish all material labor, tools and equipment as required to tap the existing main with the required sleeve and valve.

1.2 RELATED WORK:

A. Backfill (Crushed Stone Foundation) – Section 312323.13.01

B. Trenching, Backfilling and Compaction Work - Section 312333

C. Ductile Iron (DI) Water Pipe and Specials - Section 331113.13

1.3 EXISTING CONDITIONS:

A. It shall be the Contractor's responsibility to investigate all site conditions that may affect his work.

B. Contractor shall locate the existing main, and verify conditions in the area shown on the plans for the tap.

PART 2 - MATERIALS

2.1 TAPPING SLEEVE AND VALVE:

A. Sleeve may have caulked or mechanical joint connections to the existing main.

B. Sleeve and valve shall be designed for at least 200 psi working pressure.

C. Valve shall be double disc gate valve, in accordance with AWWA C500 (latest revision).

D. Shall be as manufactured by Clow, Mueller, or approved equal.

2.2 VALVE BOX:

A. Shall be five and one-quarter inch (5 1/4") inside diameter.

B. Shall be two-piece, cast iron, and standard slide type, with cast iron cover.

C. Shall be of proper length for actual trench depth.

D. Cover face shall be lettered "WATER" and have an arrow indicating the direction of opening.

E. Shall be as manufactured by Clow, Mueller, or approved equal.

PART 3 - CONSTRUCTION DETAILS

3.1 The tap shall be made without interruption of water service.

3.2 The completed tap shall be without leakage and any damage to mains shall be repaired by and at the expense of the Contractor.

3.3 Disinfection procedures shall be followed, in accordance with the specific requirements of this specification, the "Special Disinfection Procedures" subsection of Technical Specification 331113, and per AWWA C651 (Section 10 and 11).

3.4 Before a tapping sleeve is installed, the exterior of the main to be tapped shall be thoroughly cleaned, and the interior surface of the sleeve shall be lightly dusted with calcium hypochlorite powder.

PART 4 - MEASUREMENT AND PAYMENT

4.1. The cost for all items required for each complete Tapping Sleeve and Valve Assembly, as specified herein, including tapping sleeve and valve, valve box, tie rods, determination of existing conditions, excavation and backfill, crushed stone foundation, use of tapping machine, dewatering and pumping if necessary, testing, disinfection and any and all other work or material required for tapping mains under pressure shall be included in the unit price bid in the Proposal under the appropriate item.

END OF SECTION 331213.15

SECTION 331213 - FURNISHING AND INSTALLING TAPS, SERVICE PIPE AND CURB STOP

PART 1 - GENERAL

1.1 WORK REQUIRED:

A. Perform all excavation and backfill work, furnish all the materials, labor, tools and equipment as required to install services from the main to the curb stop location.

B. Work shall include the installation of the corporation tap, copper service pipe and installing the curb stop and box.

1.2 EXISTING CONDITIONS:

A. It shall be the Contractor's responsibility to investigate all site conditions that may affect his work.

B. It shall be the Contractor's responsibility to locate any and all existing service taps in the case where existing mains are in the area of work or are to be abandoned.

1.3 SUBMITTALS REQUIRED:

A. The Contractor shall not place any materials until such time that each material used in the work has been accepted by the Engineer.

B. Submittals shall comply with the requirements as delineated in the Contract General Conditions.

1.4 RELATED WORK:

A. Ductile Iron Water Pipe and Specials – Section 331113.13

PART 2 - MATERIALS

2.1 CORPORATION STOPS:

A. Shall be standard waterworks stops and shall meet ANSI/NSF61 Standards, similar or equal to Mueller Style 110 Compression Connection NL (no lead allow), AY McDonald no lead # 74701, or Ford F1000 NL (no lead allow).

B. Contractor shall check with the municipality on the exact type to be used.

2.2 COPPER TUBING:

A. Copper service pipe shall be Type K copper tubing annealed after R-88.

B. All couplings required to join sections of tubing shall be similar or equal to the Mueller H-15403 NL, Ford C-44ML or AY McDonald no lead #74759, copper to copper. All couplings shall meet ANSI/NSF61 Standards.

2.3 CURB STOP AND BOX:

A. Curb stops shall be standard waterworks, inverted key, roundway, ground key, curb stops, similar or equal to Mueller Style NL 110 Compression Connection, AY McDonald no lead # 76104, or Ford Z44 Ml Coupling for copper tubing on the inlet or outlet. All curb stops shall meet ANSI/NSF61 Standards.

B. The word, "Water" shall be lettered on the cover.

C. Curb boxes shall be extension type for four foot cover, arch pattern base with stationary rod and two hole cover.

PART 3 - CONSTRUCTION DETAILS

3.1 GENERAL:

A. The main shall be tapped as shown on the plans.

B. The work shall be done by skilled workmen.

3.2 TAPS AND SERVICES:

A. All taps are to be installed in accordance with the pipe manufacturer's direction, and allowing three threads of the corporation tap to be exposed.

B. In general, copper service pipe shall be installed at a minimum depth of 4 feet below finished grade.

C. In making cuts in copper service pipe, a hacksaw, preferably with a miter box, shall be used to cut the tubing.

D. The tubing shall be reamed, and after placing the coupling nut on the pipe, the pipe shall be flanged, using a flanging tool designed particularly for this purpose.

3.3 CURB STOPS AND BOXES:

A. Curb stops and curb boxes shall be installed on the property line in such locations as are specifically directed by the Engineer in the field at the time of construction.

B. All curb boxes shall be set in a truly plumb position with the cast iron lid left flush with, or slightly above, the surface of the ground.

C. The copper tubing shall be attached to the corporation stop and curb stop in a manner acceptable to the Engineer; and sufficient slack shall be left adjacent to the corporation stop and curb to prevent damage to the copper tubing by movement of the pipelines.

D. The Contractor is to check with the municipal water department on type to be used.

PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT:

A. Unit of measurement shall be for each complete tap, service pipe and curb stop properly installed.

4.2 PAYMENT:

A. Payment will be made based on the price bid per unit in the Proposal; payment will be made for the complete installation.

B. In the case where the Proposal provides for payment on a lump sum basis, no individual payment will be made for each complete tap; the lump sum price bid shall reflect the cost for proper installation of all taps along the contract work.

C. The price bid per unit (or lump sum) shall include the cost of the complete service tap as specified herein, including corporation tap, copper service pipe, curb stop and box, excavation and backfill, testing the completed installation; all labor, equipment and appurtenances as required to complete the work.

END OF SECTION 331213

SECTION 331216.01 - RESILIENT-DISC GATE VALVES

PART 1 - GENERAL

1.1 WORK INCLUDED:

A. Furnish and install resilient-disc gate valves and valve boxes (if applicable) at locations shown on the plans and in accordance with these specifications.

1.2 RELATED WORK:

A. Ductile Iron (DI) Pipe and Specials - Section 331113.13

1.3 EXISTING CONDITIONS:

A. It shall be the Contractor's responsibility to investigate all site conditions that may affect his work.

1.4 SUBMITTALS REQUIRED:

A. The Contractor shall not place any materials until such time that each material used in the work has been accepted by the Engineer.

B. Submittals shall comply with the requirements as delineated in the Contract General Conditions.

PART 2 - MATERIALS

2.1 VALVE (GENERAL):

A. Shall be "Ken-Seal" as manufactured by ITT Kennedy Valve, or acceptable equal.

B. Shall conform to AWWA C509 "year of latest revision".

C. Shall turn to open in the direction similar to the existing municipal valves and have a rustproof steel, hex-shaped operating nut.

D. The ends shall be flanged or mechanical joint with adapters at the Contractor's option, unless a specific valve body is indicated on the plans.

E. Valves shall be non-rising stem, unless otherwise noted.

2.2 VALVE BOXES:

A. Shall be provided for all exterior installations, unless otherwise noted.

B. Shall be manufactured by Kennedy Valve, the Mueller Company, or acceptable equal.

C. Shall be five and one-quarter inch (5 1/4") inside diameter.

D. Shall be a two piece, cast iron, standard slide type, with cast iron cover of proper length for actual trench depth.

E. Each coverface shall be lettered "WATER" (or other designation as specifically applicable) and have an arrow indicating direction of opening.

PART 3 - CONSTRUCTION DETAILS

3.1 PLACEMENT (GENERAL):

A. Valves shall be installed in accordance with the manufacturer's instructions for the type of ends used at the location shown on the plans.

B. At the intersections of mains, valves shall be as close to the intersection as possible.

C. Valve boxes (if provided) shall be centered and plumb over the operating nut, and the cover shall be set at finished grade of pavement or in areas outside pavement, at height acceptable to the Engineer.

D. Valve boxes shall be clear of dirt, stones or any other debris prior to acceptance.

E. Valve boxes shall not bear on the valve and shall be independently supported.

F. Valves shall be operated to determine that they are in correct operating condition and do not leak, prior to the completion of backfilling, after hydrostatic and leakage tests are completed.

G. Valve boxes shall be supported so they do not transmit shock or stress to the valve.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Unit of measurement shall be for each complete valve and valve box assembly properly installed.

4.2 Payment will be made based on the price bid per unit in the Proposal. Payment will be made for the completed assembly.

4.3 The price bid per unit shall include the cost for the valve, valve box and appurtenances as required for the complete installation including all labor, equipment and materials as required to complete the work.

4.4 Where no separate payment item is provided in the Contract proposal, no separate payment shall be

made and valves shall be deemed included in other payment items of the proposal.

END OF SECTION 331216.01

SECTION 331219 - HYDRANT ASSEMBLIES

PART 1 - GENERAL

1.1 WORK REQUIRED:

A. Furnish and install hydrant assemblies at the locations and depths shown on the Plans and in accordance with these Specifications.

B. Provide necessary thrust blocks and/or tie-rods as required or as shown on the Plans.

1.2 EXISTING CONDITIONS:

A. It shall be the Contractor's responsibility to investigate all site conditions that may affect his work.

1.3 SUBMITTALS REQUIRED:

A. The Contractor shall not place any materials until such time that each material used in the work has been accepted by the Engineer.

B. Submittals shall comply with the requirements as delineated in the Contract General Conditions.

PART 2.0 - MATERIALS

2.1 HYDRANTS:

A. All hydrants provided on any project shall at minimum meet the requirements of the municipality and/or match the current hydrants being installed wherein the work is being performed.

B. Unless otherwise directed by the Owner, the hydrants shall be provided with a main valve opening of 5-1/4", break flange construction, 6" inlet connection, having two(2) 2-1/2" hose nozzles and one(1) 4-1/2" pumper nozzle.

C. Hydrants (unless otherwise noted on the typical detail or directed by the Owner) shall be Centurion A-423 type as manufactured by Mueller Company, or acceptable equal.

D. Hydrants shall open in the same direction as existing hydrants within the municipality.

E. Shall conform to AWWA C502, latest revision.

2.2 AUXILIARY VALVES:

A. Shall be six inches (6") in size.

B. Provide with ends to match connecting pipe.

C. Shall conform to AWWA C500 (latest revision).

D. Unless otherwise directed by the Owner, shall be as manufactured by Clow or acceptable equal.

E. Shall be provided complete with 5-1/4" inside diameter, two-piece, cast iron, standard slide type valve box of proper length for actual trench depth.

F. Cover face for valve box shall be lettered "WATER" and have an arrow indicating direction of opening.

G. Valve boxes shall be as manufactured by Clow or acceptable equal.

2.3 CONNECTING PIPING AND FITTINGS:

A. All connecting piping shall be Ductile Iron and all fittings shall be gray cast iron.

B. Both connecting piping and fittings shall be cement-lined, seal-coated, either push-on or mechanical joint, of the sizes and lengths shown on the Plans.

C. Thrust blocks shall be placed as shown on the Plans, and valves and hydrants shall be tied to the main by means of 3/4" galvanized tie rods, a minimum of two (2) per section, mounted 180° apart.

PART 3.0 - CONSTRUCTION DETAILS

3.1 GENERAL:

A. Contractor's attention is directed to the requirements for inspection, marking of rejected specimens, foundation and closing the pipe as found in the specifications for the water pipe being provided as found elsewhere in these documents. These requirements shall be met in the installation of Hydrant Assemblies.

B. Hydrants shall be installed to provide a minimum clear height to nozzle of eighteen (18) inches.

C. Hydrants shall be set and drained in accordance with the applicable detail shown on the Plan Sheet.

D. If groundwater, or evidence thereof, is noted within 2 ft. of the base of the hydrant, same shall immediately be brought to the attention of the Engineer. In such case, the Contractor shall plug the drain hole and the hydrant labeled to instruct the Fire Department to pump out the hydrant after use.

3.2 PAINTING:

A. Hydrants shall be furnished with a shopcoat of yellow paint.

B. Upon completion of the installation, the Contractor shall completely repaint the hydrant, using Koppers Glamortex 501 Enamel, or an acceptable equal. Color to match town Standard.

3.3 TESTING:

A. Testing shall be performed per the requirements as noted under the piping section of these Specifications.

B. All testing shall comply with the applicable standards of the American Water Works Association (AWWA).

3.4 DISINFECTION:

A. Disinfection of the water system will proceed only after completion of hydrant assembly installations.

B. Disinfection shall comply with the requirements as noted under the piping section of these specifications.

C. All disinfection shall comply with the applicable Standards of the American Water Works Association (AWWA).

PART 4.0 - MEASUREMENT AND PAYMENT

4.1 Unit of measurement shall be for each complete hydrant assembly properly installed.

4.2 Payment will be made based on the price bid per unit in the Proposal; payment will be made for the completed assembly.

4.3 The price bid per unit shall include the costs for the hydrant, valve, valve box, thrust blocks, tie rods, connecting piping, painting and all accessories and appurtenances as required for the complete installation including all labor, equipment and materials as required to complete the work.

4.4 Where no separate payment item is provided in the Contract proposal, no separate payment shall be made and valves shall be deemed included in other payment items of the proposal.

END OF SECTION 331219

SECTION 331301 – DISINFECTION TESTING OF PIPELINES

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. The Contractor shall disinfect all potable and non-potable water pressure pipelines shown on the contract drawings in accordance with ANSI/AWWA C651, latest edition. The Tablet method described in ANSI/AWWA C651 shall not be acceptable. All piping and equipment shall be tested in the field in the presence of the Engineer.

B. Bacteriological samples shall be collected and analyzed on two consecutive days, 24 hours apart from one another. Samples shall be analyzed by an independent laboratory certified by the New York State Department of Health.

C. Chlorination shall not take place until:

1. The main is constructed in accordance with the Contract Documents as modified by the Engineer during construction and all construction permit requirements are met.
2. All blow offs, injection and sample points are constructed and ready for use.
3. The main has been pigged and thoroughly flushed with scouring velocities as needed.
4. The main has been successfully pressure and leakage tested as specified in Division 33.
5. Chlorine neutralization chemicals, and methods for application and disposal of chlorinated water, have been established by the Contractor. The Contractor shall dispose of the water without causing a nuisance, property damage, or contamination of waters of the State

1.3 RELATED SECTIONS:

A. Related Sections include the following:

1. Division 33 Sections for buried pipe installation requirements.
2. Division 33 Section “Pressure and Leakage Testing of Pipelines” for pressure testing requirements of pipelines.

1.4 SUBMITTALS:

A. Prior to Testing: A Disinfection Plan shall be prepared for review and acceptance prior to initiation of work.

1. Disinfection Plan:
   a. Type and form of disinfectant proposed.

b. Method and location of disinfectant injection.
c. Test locations.
d. Initial and final disinfectant residuals (quantity in treated water) in ppm for each outlet tested.
e. Flushing locations.
f. Procedure for neutralizing disinfectant and for discharge of flushed water.
g. Proposed testing laboratory name, address and telephone number.

B. For closeout: Disinfection Test Reports performed as well as any laboratory results received as part of this work. Specifically:

1. Disinfection Report:
   a. Type and form of disinfectant used.
   b. Date and time of disinfectant injection start and time of completion.
   c. Test locations.
   d. Initial and final disinfectant residuals (quantity in treated water) in ppm for each outlet tested.
   e. Date and time of flushing start and completion.
   f. Disinfectant residual after flushing in ppm for each outlet tested.
   g. Procedure for neutralizing disinfectant and for discharge of flushed water.
   h. Signature of person performing tests and signature of witness.

2. Bacteriological report:
   a. Date issued, project name, and testing laboratory name, address, and telephone number.
   b. Time and date of water sample collection.
   c. Name of person collecting samples.
   d. Test locations.
   e. Initial and final disinfectant residuals in ppm for each outlet tested.
   f. MFT Coliform bacteria test results for each outlet tested. (Other testing methods are not acceptable).
   g. Certification that water conforms, or fails to conform, to bacterial standards of New York State Department of Health.

C. Certificate: Certify that disinfection testing of water distribution system meets or exceeds requirements of the AWWA.

PART 2 - PRODUCTS

2.1 CHLORINATION CHEMICALS:

A. Forms of chlorine to be used for disinfection shall be as listed in AWWA C651 and shall be NSF 60 certified for use with potable water:

1. Liquid chlorine per ANSI/AWWA B301.
2. Sodium hypochlorite liquid per ANSI/AWWA B300.

2.2 DECHLORINATION CHEMICALS:

A. Chemicals to be used to dechlorinate flushing water shall be as listed AWWA C655, latest edition. Unless superseded by the latest edition acceptable chemicals include but are not limited to:

1. Sodium Thiosulfate ($Na_2S_2O_3*5H_2O$)
2. Sodium Bisulfite ($NaHSO_3$)
3. Sodium Sulfite ($Na2SO_3$)
4. Sulfur Dioxide (SO_2)
5. Sodium Metabisulfite ($Na_2S_2O_5$)
6. Calcium Thiosulfate($Ca_2S_2O_3*5H_2O$)
7. Ascorbic Acid (CH_3COOH)
8. Sodium Ascorbate ($NaCH_3COO$)

PART 3 - EXECUTION:

3.1 GENERAL

A. The Contractor shall locate blow-off valves at low points and dead ends in the grid to permit the removal of sediment.

B. The corporation stops to be used for pressure testing and chlorination shall be installed at the tap valve by the Contractor.

C. Tap for injection of chlorine shall be located to allow for one-way travel through the pipeline to the end point.

D. Source water that is from a public water supply shall use backflow protection. A double check valve assembly or better device approved by the New York State Department of Health is acceptable.

3.2 PRE-TEST FLUSHING:

A. All pipelines shall be flushed to remove the lighter solids in the line. Because flushing cannot be relied on to remove heavy material allowed to get into pipeline during installation, every precaution shall be made to protect the pipeline against entrance of foreign material during the installation process.

B. Every new pipeline shall be flushed at a minimum velocity of 3.0 feet per second (fps) to ensure that the lighter solids are removed from the pipe interior. (Note that it may be difficult to obtain scouring velocities in a pipe over two hundred (200) feet in length.) Where instances of velocity cannot be ascertained easily, Contractor, Engineer and Water Supplier shall agree on when sufficient flushing has occurred.

C. Discharge velocity can be determined by a simple field procedure involving the "trajectory" method. For any size pipe discharging horizontally three feet above the ground, a stream of water traveling at twelve (12) feet per second will strike the ground six feet away. Similarly, a stream of water traveling at five feet per second will strike the ground more than two feet from the end

of the pipe. This test must be made thru an open-ended pipe; it must not end with a valve or fitting, which would be smaller than the inside diameter of the pipe.

D. All pipelines eight inches in diameter or greater, or pipelines suspected of having heavy foreign material in them, shall be subjected to open end flushing to remove any foreign material from the pipeline. Pigging is required in addition to open-end flushing.

E. A velocity of 5.0 fps is desirable and a velocity of 12 fps may be needed to remove sand from river undercrossings and other subsurface inverts if applicable to the water main route or known deposits.

F. Table 1, provided at the end of this Specification, outlines the number and size of flushing assemblies required.

G. During the flushing process, a clean white cup shall be used at all sampling points to visually check for water clarity. When all the sample points are clear, meaning there is no background sediment, and the system chlorine residual is present, the line is ready to schedule for chlorination.

H. In the case of mains twenty-four (24) inch and larger, preliminary flushing may be replaced by stringent measures for removal of dirt and sediment from the pipe and the thorough cleaning of its interior prior to filling with the high chlorine solution. Swabbing with a chlorine solution may be required at the discretion of the Engineer. Confined space procedures shall be followed if personnel enter the pipe to perform work.

3.3 CHLORINATION:

A. Upon satisfactory completion of all testing and flushing, the Contractor shall furnish all materials and labor necessary to disinfect all water mains in accordance with the applicable sections of AWWA C-651, latest edition.

B. Prior to chlorine injection the following shall be ensured:

1. That the source water tap valve for the water mains to be chlorinated has been shut off.
2. That all blow offs and sample points involved in the Project are open
3. That there are no open valves to activate water mains tied into the water mains to be chlorinated.
4. That there is an uninterrupted supply of potable water or adequate number of barrels to assure there is no interruption once the injection process begins.

C. Disinfection of water mains shall be completed in accordance with ANSI/AWWA C651, latest edition standards and shall include the following; preflushing or cleaning of the water mains before the application of chlorine, disinfecting the mains with the prescribed chlorine dose for the disinfection method being utilized, allow for the proper amount of chlorine holding or contact time, ensuring that the applicable chlorine residual was maintained for the duration of the disinfection period, and final flushing and clearing of the heavily chlorinated water with the disposal and treatment of the heavily chlorinated water in accordance with applicable dechlorination methods.

D. All sampling points shall be at sites as designated by the approved plan.

E. Satisfactory bacteriological analysis shall be determined by the results of samples collected by the Contractor and analyzed at a New York State certified lab as required by the Department of Health.

F. The Town shall furnish the Contractor with sufficient water to perform the disinfection required. As the chlorine solution is being injected the chlorine residual at the closest sample point to the injection point shall be tested with a high Cl2 test kit or DPD reagent as applicable**.** The water flow or solution strength shall be adjusted as necessary to achieve the recommended minimum chlorine strength.

G. As the high chlorine solution reaches each successive sample point, the valve at the sample point shall be closed. Prior to closing the valve at the last sample point, the following water main shut down process shall take place in sequence:

1. The source water control valve shall be closed.
2. The injection pump should be shut off and its valve closed.
3. The last blow off/ sample point valve should be closed.

ALL BLOW-OFF VALVES SHALL NEVER BE CLOSED BEFORE THE SOURCE WATER VALVE IS CLOSED.

H. The initial chlorine solution shall be no less than 50 ppm and not more than 1000 ppm in concentration and shall be left standing in the main for a period of not less than twenty-four (24) hours and not more than forty-eight (48) hours. There must be a chlorine residual of 10 ppm at the sample point after twenty-four (24) hours. After this period, the high chlorine water shall be drained and/or flushed from the system.

3.4 POST TEST FLUSHING:

A. Draining and/or flushing the solution from the main shall be the responsibility of the Contractor and shall be performed so as not to cause damage to the environment or create a nuisance to property or environment. The Contractor shall inform the Engineer of the proposed methods of disposal of the high chlorine solution.

B. Where applicable flushed water shall be treated to remove the chlorine residual from the water being discharged that has the potential to impact storm sewer, retention pond, lake, bay, or any other body of water, chemicals for dechlorinating the water shall be as specified above. See AWWA Standard C655, for additional details. This process shall be followed each time water is discharged. The following doses are for reference only. Their use does not release the Contractor from the responsibility of achieving full dechlorination. Manufacturer's suggested dose shall supersede the below values.

De-Chlorination Chemical	Dose in Parts (mg) required per part (mg) Chlorine at pH 8.0
Sodium Thiosulfate ($Na_2S_2O_3*5H_2O$)	1.86

Sodium Bisulfite ($NaHSO_3$)	1.61
Sodium Sulfite ($Na2SO_3$)	1.96
Sulfur Dioxide (SO_2)	0.9
Sodium Metabisulfite ($Na_2S_2O_5$)	1.47
Calcium Thiosulfate($Ca_2S_2O_3*5H_2O$)	1.19
Ascorbic Acid (CH_3COOH)	2.48
Sodium Ascorbate ($NaCH_3COO$)	2.78

3.5 SAMPLING

A. The Contractor shall schedule bacteriological sampling through the state certified lab. The Engineer shall be present during all sampling times.

B. Before the water samples are collected, the Contractor shall ensure that all the blow off(s) and sample point(s) are opened and that the source water control valve is open.

C. Bacteriological sampling shall be conducted in accordance with New York State Department of Health regulations. Disinfection residuals shall be measured and recorded. Bacteriological samples shall be collected and analyzed on two or more consecutive business days each taken twenty-four (24) hours apart.

D. Prior to initiating sampling, a check for the Free Chlorine Residual at the last sample point is recommended to confirm that the residual is representative of the incoming source water.

E. If the Free Chlorine Residuals are satisfactory, the specialist will begin water sample collection.

F. After the sampling is completed, the Contractor shall initiate the shut down process using the following sequence:
   1. Turn off blow off(s) and sample point(s).
   2. Shut off the control valve.

G. Main Clearance Sampling is completed when each sample site has two consecutive day satisfactory (Total Coliform Absent) results.

H. Bacteriological test results for new and altered public drinking water mains will be considered invalid if the pressure in the mains is not maintained at 20 psi or greater after the samples are collected.

I. Flushing and sampling shall be repeated, as required, if total coliform is detected in a water sample. If necessary, the main shall be re-chlorinated.

3.6 ACTIVATION

A. No section of any main shall be put into service without the written permission of the Engineer and Department of Health.

B. The water main(s) needs to be thoroughly flushed before it is actually placed into service using potable water.

C. To achieve this flushing, fire hydrants may be utilized on 6-inch and larger water mains. On water mains less than 6-inches, a permanent blow-off may be used if provided. Otherwise the temporary blow-offs setup for the flushing, chlorination and main clearance sampling procedures must be utilized.

D. Before activation, new water mains should be flushed until the water runs clean and clear. In addition, after the water main has been flushed, field tests for FreeChlorine should be taken to ensure disinfection residual. A minimum detectable level of 0.2 mg/l is required. Notify the Engineer of any discrepancies.

E. If a water main tie-in is involved or if the pressure in the main was not maintained at 20 psi or greater, notify the Engineer and water samples for bacteriological analysis should be collected.

TABLE 1

(For Information Purposes Only, Nozzles based on 40 psi Residual Pressure)

Pipe Size (NPS)	Flow (gpm) Required for 3.0 fps	Number of Hydrant Outlet Nozzles	Size (in.) of Hydrant Nozzles
4	120	1	2.5
6	260	1	2.5
8	270	1	2.5
10	730	1	2.5
12	1,060	2	2.5
14	1,440	2	2.5
16	1,880	2	2.5
18	2,380	1	4.5
20	2,940	1	4.5
24	4,240	2	4.5

TABLE 2

(For Information Purposes Only, Chlorine Required to produce an initial 25 mg/L concentration in 100 ft of pipe)

Pipe Size (NPS)	100% Chlorine (lbs)	1% Hypochlorite Solution (gal)
4	0.013	0.16
6	0.03	0.36

8	0.054	0.65
10	0.085	1.02
12	0.12	1.44
16	0.217	2.60

PART 4 - MEASUREMENT AND PAYMENT:

4.1 MEASUREMENT:

A. Measurement shall be made on the basis of lineal foot of pipe of the type and size(s) properly placed, as measured by the Engineer. Measurements shall be made horizontally along the axis of the pipe and shall include all fittings and/or accessories not specifically included for measurement and payment under other items in the Proposal.

4.2 PAYMENT:

A. Payment will be made at the unit price bid under the appropriate item(s) of the Proposal.

END OF SECTION 331301

SECTION 333100 - SANITARY UTILITY SEWERAGE PIPING

PART 1 – GENERAL

1.1 SUMMARY

A. Furnish and install unplasticized polyvinyl chloride (PVC) gravity sewer pipe with integral wall bell and spigot joints.

1.2 RELATED SECTIONS

A. Trenching, Backfilling and Compaction Work - Section 312333

1.3 EXISTING CONDITIONS

A. It shall be the Contractor's responsibility to investigate all site conditions that may affect his work.

PART 2 - MATERIALS

2.1 PIPE (GENERAL)

A. Furnish and install unplasticized polyvinyl chloride (PVC) gravity sewer pipe for conveyance of sewage.

B. All pipe shall be extruded from Class 12454A or 12454B PVC compound.

C. Pipe shall have integral wall bell and spigot joints.

D. Minimum "pipe stiffness" (F/y at 5% deflection) shall be 46 psi for SDR 35 and 129 psi for SDR 25 when tested in accordance with ASTM Method of Test D2412, “External Loading Properties of Plastic Pipe by Parallel Plate Loading”.

E. Provisions must be made for contraction and expansion at each joint with a solid cross-section Elastomeric seal.

F. The bell shall consist of an integral wall section with a solid cross section rubber ring, factory assembled, securely locked in place with a locking bulb and formed race to prevent displacement during assembly of the Elastomeric seal.

G. Standard length shall be twenty (20) feet or twelve and one-half (12.5) feet.

H. There shall be no evidence of splitting, cracking or breaking when the pipe is tested as follows:

Flatten specimen of pipe, six (6) inches long between parallel plates in a suitable press until the distance between the plates is forty percent (40%) of the outside diameter of the pipe. The rate of loading shall be uniform and such that compression is completed within two to five minutes.

I. The pipe (6" long section) shall be capable of being subjected to an impact from a free falling TUB (20 lb. TUB A) in accordance with ASTM Method of Test D2444. No shattering or splitting shall be evident when the energy is impacted.

J. All pipes and fittings shall conform to ASTM D2122.

K. The pipe shall be designed to pass all tests at 73^{o} F.

2.2 PIPE (JOINTS AND FITTINGS)

A. All fittings and accessories shall be as manufactured and furnished by the pipe supplier and shall have a bell and/or spigot configuration compatible with that of the pipe.

B. The bell shall have the same strength as the pipe section.

C. All pipe shall be installed and assembled in accordance with the manufacturer's recommendations.

D. One Elastomeric gasket shall be supplied with each length of pipe. The gaskets shall conform with ASTM F477.

E. Joints shall be tested in accordance with ASTM D3212, "Joints for Drain and Sewer Plastic Pipe Using Flexible Elastomeric Seals".

F. Sufficient pipe lubricant shall be supplied with each length of pipe supplied. The lubricant shall be compatible with the PVC pipe and Elastomeric gasket.

2.3 LOCATION DETECTION WIRE

A. Materials: Continuous, 10-gauge single strand coil core copper wire with non-metallic insulation. The insulation shall be color coded for the type of pipe being installed.

B. Installation: Directly above (1-inch maximum) centerline of pipe terminating at top of each valve box collar in a manner so as not to interfere with valve operation. At a minimum, the tracing wire is to be attached to the pipe with nylon wire ties. The wire itself shall maintain continuous continuity along the entire length of the pipe run. Permanent splices must be made in the length of the wire using wire connectors approved for underground applications as listed in the uniform electric code handbook. The coiled wire shall extend to a minimum of 12 inches above the surface and be connected to a test station box at valve locations.

2.4 STANDARDS

A. Pipe and fittings shall meet the requirements of ASTM Specification D3034 for SDR 35.

B. The manufacturer shall supply the Engineer with certifications for each length of pipe that the pipe conforms with ASTM Specification D3034

C. Pressure testing shall be performed on a representative basis of one joint per 24 hours of productions. Certifications shall be given to the Engineer for the pipe tested.

D. SDR 35 pipe shall be green or white. The color shall be achieved through the use of pigments prior to extrusion.

E. The Engineer reserves the right to have their representatives observe all testing at the production facility, such scheduling and transportation to be arranged and provided by the Contractor at no additional cost to the Engineer or Owner.

PART 3 - CONSTRUCTION DETAILS

3.1 GENERAL

A. All pipe and fittings shall be placed as shown on the plans and in compliance with the requirements of the specifications.

B. All pipe shall be installed and assembled in accordance with the manufacturer's recommendations.

3.2 INSPECTION OF PIPE

A. Prior to being lowered into the trench, each pipe and fitting or coupling shall be carefully inspected, and those not meeting the specifications shall be rejected and immediately removed from the project site and replaced with acceptable materials. Such replacement shall be made at no cost to the Owner.

B. Movement of construction equipment and all other vehicles and loads over and adjacent to any pipe shall be done at the Contractor's risk. Any pipe, which in the judgement of the Engineer is damaged or disturbed through any cause, shall be replaced at the expense of the Contractor and at no cost to the Owner.

3.3 PIPE PLACEMENT (GENERAL)

A. Pipe lines shall be placed in the locations and grades as indicated on the Plans and in conformance with this Specification.

B. Trenches shall be kept free from water, and no pipe shall be laid in water.

C. Pipe shall be so laid as to be evenly supported throughout the whole length of the barrel, with no weight resting on the bell or coupling. "Bell holes" shall be provided so that bells or couplings of pipe hang free.

D. If the trench is dug deeper than the grade of the barrel, no spalls, shims or lumps shall be used to raise the pipe to the grade, but an even bed shall be formed of sand or accepted fine material properly tamped at no additional expenses to the owner.

E. Push-on pipe shall be installed so that all joints are tight with the bell end in the upstream direction.

F. In all cases where piping is being installed below the ground surface, before leaving the work for the night or any other time, the end of the pipe shall be securely closed with a tight-fitting watertight plug, and sufficient backfilling placed to protect the pipe.

3.4 PIPE PLACEMENT (FOUNDATION)

A. All pipe shall be laid on a foundation of compacted crushed stone foundation to the minimum dimensions noted on the detail on the Plans.

B. If in the opinion of the Engineer the subgrade will not properly support the pipe, additional crushed stone material shall be provided as necessary to provide a firm pipe bedding as acceptable to the Engineer.

C. Ground conditions such as quick sand, other soft and yielding or otherwise unsuitable material shall be immediately brought to the Engineer's attention such that evaluation of the necessary bedding can be made.

D. The Contractor is advised that additional crushed stone foundation material shall only be placed where required for the Engineer's acceptance of the work.

E. All crushed stone foundation material shall conform to the requirements of the applicable technical section of the Specifications.

3.5 PIPE PLACEMENT (LOCATION & GRADE)

A. The pipe or invert grade referred to in the specifications and as indicated on the plans is the lowest point of the pipe invert or flow line.

B. Pipe shall be placed in the location and at exactly the lines and grades indicated on the plans.

C. The Engineer shall have the power to require the removal or relaying of any pipe laid contrary to the plans during his absence or that of his assistants or the Project Representative from the project site.

D. Grade or alignment shall not be disturbed by the operation of tamping or backfilling. Care must be taken not to disturb the pipes by stepping on or near them, or by throwing earth on them from the bank or otherwise.

E. The pipes and fittings or couplings shall be so laid in the trench that after the line is completed the interior surface thereof shall conform accurately to the grade and line required by the Engineer, and

as indicated on the Plans.

F. Contractor must transfer line and grade to "batter boards" and string line over the trench. The Contractor may not transfer line and grade to and/or utilize a "side line" or string set to line and grade other than over and above the center line of the pipe to be laid.

G. Other methods of Grade and Alignment control are subject to acceptance by the Engineer.

3.6 TESTING

A. Time for Testing

1. In general, piping shall be tested prior to placement of paving materials. Paving prior to testing and acceptance of the piping shall be at the Contractor's risk.
2. Testing shall be performed at as late a date as possible, after work has been completed and a time period for settlement has had a chance to occur.
3. In no instance shall sewers be tested prior to completion of construction work in the area, nor prior to two (2) weeks after installation of the piping.

B. Procedures for Testing

1. In order to keep leakage and infiltration in sewers to a minimum, it is necessary that special attention be given to the specification requirements covering workmanship, materials and testing. The specification for this installation includes the following provisions:

(a) Low pressure air test

(b) Mandrel test

2. Low pressure air test: Where acceptable to the Engineer and all applicable reviewing authorities, the Contractor shall perform low pressure air tests in conformance with ASTM C-828 latest revision), entitled “Recommended Practice for Low-Pressure Air Test of Vitrified Clap Pipe Lines (4-12)” and section 330505.41 “Low Pressure Air Test – Sanitary Sewer Lines.”

3. Deflection testing will be required unless same is waived by the Owner and Engineer in writing. The sole opinion of the Engineer and Owner will determine if the requirement may be waived.

Mandrel test: Each and every length of gravity sewer line shall be checked for alignment using a standard alignment gage (such as USA Bluebook #26911 or equal) by hand pulling such an instrument from manhole to manhole. Binding of the gage inside the pipeline shall be cause for rejection of that section of line, whereupon the Contractor shall uncover, separate, relay, and re-compact the failing section, and then retest the entire leg until it passes the mandrel. The deflection testing shall be accomplished by use of the "GO - NO GO" Mandrel of the correct diameter as determined by the following equation:

Mandrel Dia = (avg. pipe outside dia.) -

$$2(1.06)T - ((A)^2 + (B)^2 + (B)^2 + (C)^2)^{1/2}$$

Where:
- A = Outside dia tolerance (ASTM D3034)
- B = Excess wall thickness tolerance = 0.06T
- C = Out-of-roundness tolerance = 0.015 (avg. outside dia.)
- T = Min. wall thickness (ASTM F679)

C. Other Testing Requirements (General)

1. All testing shall be performed with a representative of the Engineer and/or Owner present.

2. The Contractor shall give ample notification (minimum 72 hours) of his intended test date such that observation scheduling can be made. Any delays and associated costs caused by the Contractor's failure to schedule the attendance of necessary representatives shall be borne by the Contractor.

3. Length and location of sections to be tested, duration of test, and other requirements shall be acceptable to the Engineer.

4. All evident leaks shall be investigated and the necessary repairs made, and leakage minimized regardless of total leakage as shown by test.

5. Lines which fail to meet tests shall be repaired and retested as necessary until compliance with test requirements. Defective pipe and branch connections shall be removed and replaced at the Contractor's expense.

6. All materials and equipment, cooperation and assistance necessary to perform the tests specified herein to the satisfaction of the Engineer or his duly authorized agent shall be borne by the Contractor.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Measurement shall be made on the basis of lineal foot of PVC Sewer Pipe of the type and size(s) properly placed, as measured by the Engineer. Measurements shall be made horizontally along the axis of the pipe and shall include all fittings, laterals (unless otherwise indicated), and accessories required but not specifically included for measurement and payment under other items in the Proposal. Measurement shall not include the run through manholes.

4.2 Payment will be made at the unit price bid under the appropriate item(s) of the Proposal; the price bid shall include the pipe, excavation, crushed stone foundation, select fill to a point two (2) feet above the pipe, backfill in an acceptable manner to the Engineer, testing, including all labor,

materials, fittings, equipment and appurtenances as required to complete the work.

END OF SECTION 333100

SECTION 334100 – HIGH DENSITY POLYETHYLENE DRAINAGE PIPE
(Double-Wall Corrugated)

PART 1 - GENERAL

1.1 WORK INCLUDED:

A. Furnish and install corrugated double-wall high density polyethylene drainage pipe of the size(s) shown on the Plans and in the Proposal.

1.2 RELATED WORK:

A. Backfill (Crushed Stone Foundation) - Section 312323.13.01

B. Trenching, Backfilling and Compaction Work - Section 312333

1.3 EXISTING CONDITIONS:

A. It shall be the Contractor's responsibility to investigate all site conditions that may affect his work.

PART 2 - MATERIALS

2.1 GENERAL:

A. All drainage pipe to be installed shall be Type N-12 as manufactured by Advanced Drainage Systems, Inc. (ADS), or acceptable equal per AASHTO.

B. Pipe Requirements
   1. 4 through 10-inch (100 to 250mm) pipe shall meet AASHTO M252, Type S
   2. 12 through 60-inch (300 to 1500 mm) pipe shall meet AASHTO M294, Type S or ASTM F2306
   3. Manning’s “n” value for use in design shall be 0.012

C. Fitting Requirements
   1. Fittings shall conform to AASHTO M252, AASHTO M294, or ASTM F2306. Bell and spigot connections shall utilize a welded bell and valley or saddle gasket meeting the watertight join performance requirements of AASHTO M252, AASHTO M294, or ASTM F2306.

D. Material Properties
   1. Material of pipe and fitting production shall be high-density polyethylene conforming with the minimum requirements of cell classification 424420C for 4 through 10-inch (100 to 250 mm) diameters, and 435400C for 12 through 60-inch (300 to 1500 mm) diameters, as defined and described in the latest version of ASTM D3350. Except that carbon black

content should not exceed 4%. The 12 through 60-inch pipe material shall comply with the notched constant ligament-stress (NCLS) test as specified in Sections 5.1 and 9.5 of AASHTO M294 and ASTM F2306 respectively.

PART 3 - CONSTRUCTION DETAILS

3.1 GENERAL:

A. All pipe shall be handled and assembled in accordance with the manufacturer's instructions, except as modified herein or on the Plans.

B. Piping shall be set at the elevations and locations as shown on the Plans.

C. Installation shall conform to the requirements of the details as shown on the Plans.

D. Installation shall be in accordance with ASTM D2321 and ADS recommended installation guidelines, with the exception that minimum cover in trafficked areas for 4 through 48 inch (100 to 1200 mm) diameters shall be one foot and for 60-inch diameter the minimum cover shall be 2 feet in single run applications.

3.2 JOINTS:

A. Pipe shall be joined using a bell and spigot join meeting the requirements of AASHTO M252, AASHTO M294, or ASTM F2306.

B. The joint shall be watertight according to the requirement of ASTM D3213.

C. Gaskets shall meet the requirements of ASTM F477. Gaskets shall be installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gasket is free from debris.

D. A joint lubricant available from the manufacturer shall be sued on the gasket and bell during assembly. 12 through 60-inch diameter shall have an exterior bell wrap installed by the manufacturer.

3.3 FIELD PIPE AND JOINT PERFORMANCE:

A. To assure watertightness, filed performance verification may be accomplished by testing in accordance with ASTM F2487. Appropriate safety precautions must be used when field-testing any pipe material. Contact the manufacturer for recommended leakage rates.

3.4 DAMAGES TO MATERIALS:

A. Movement of construction equipment and all other vehicles and loads over and adjacent to any pipe shall be done at the Contractor's risk. Any pipe, which in the judgement of the Engineer is damaged or disturbed through any cause, shall be replaced at the expense of the Contractor and at no cost to the Owner.

B. Any pipe or materials designated by the Engineer as defective or damaged shall be immediately removed from the project site and replaced with acceptable materials. Such replacement shall be made at no cost to the Owner.

PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT:

A. Measurement will be made based on the total linear foot of pipe, type and size placed, as measured by the Engineer. Measurements shall be made horizontally along the axis of the pipe and shall include the run through all fittings and/or manholes and catch basins.

4.2 PAYMENT:

A. Payment will be made at the unit price bid under the appropriate item(s) of the Proposal; the price bid shall include excavation, removal of any existing piping shown to be removed, pipe and fittings, end sections, crushed stone foundation (as required by the details), backfill in a manner acceptable to the Engineer, restoration, including all labor, materials, equipment and appurtenances as required to complete the work.

END OF SECTION 334100

SECTION 334413.13 - PRECAST CONCRETE CATCH BASINS

PART 1 – GENERAL

1.1 WORK INCLUDED:

A. Furnish and install precast concrete catch basins at the locations and elevations shown on the Plans.

1.2 RELATED WORK:

A. Trenching, Backfilling and Compaction - Section 312333

1.3 EXISTING CONDITIONS:

A. It shall be the Contractor's responsibility to investigate all site conditions that may affect his work.

PART 2 - MATERIALS

2.1 GENERAL:

A. All catch basins shall be precast concrete, manufactured in accordance with ASTM Designation C478 (latest revision).

B. The minimum compressive strength of concrete for all sections shall be 4000 psi.

C. Catch basins shall conform to the typical details shown on the Plans.

2.2 CONCRETE (GENERAL):

A. All reinforced concrete shall consist of Portland Cement, mineral aggregates and water at the proper ratios with steel reinforcement.

B. The cement shall be air-entrained Portland Cement per ASTM Designation C175.

C. All aggregates shall conform with, with the exception of gradation requirements, the specifications for concrete aggregate, ASTM C33.

D. All concrete shall be thoroughly mixed by mechanical batch mixer. The proportions of aggregate, cement and water shall be such as to acquire the proper strength and quality of concrete required (4000 psi).

2.3 CONCRETE (REINFORCEMENT):

A. Bar reinforcement shall consist of deformed bars which conform to the requirements of ASTM A615, Grade 40. Stirrups may be structural grade.

B. Bars shall be rolled from billets directly reduced from ingots of properly identified heats of open hearth or electric furnace steel, and shall be protected from moisture by being stored in warehouses or other acceptable places prior to use.

2.4 FRAMES, GRATES AND COVERS:

A. Shall be made of tough, close-grained gray-iron, without the admixture of any cinder, iron or metal of inferior quality.

B. Iron shall be capable of developing a tensile strength of 18,000 psi and shall be able to stand chipping and drilling by hand.

C. Shall be made from properly prepared patterns and be sound, true, smooth and free from blisters, sand holes, scales or any other defects.

D. No plugging or other stopping of holes will be permitted.

E. Frames, grates and covers shall be of the type as called for on the Plans.

PART 3 - CONSTRUCTION DETAILS

3.1 GENERAL:

A. Installation of catch basins shall meet the requirements as shown on the Plans.

B. All catch basins shall be set at the elevations and locations as shown on the Plans.

3.2 GRADE ADJUSTMENT:

A. Adjustment to grade for all frames and covers shall be made by means of solid concrete bricks laid in mortar.

B. All joints shall be completely filled and watertight.

C. In no instance shall the grate adjustment be more than twelve (12) inches.

3.3 PIPE ENTRANCES:

A. All pipe entrances at catch basins shall be sealed with mortar completely filling the annular space and watertight.

PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT:

A. The unit of measurement will be for each catch basin properly installed of the type specified on the Plans and in the Proposal.

4.2 PAYMENT:

A. Payment will be made for the number of catch basins of each type and shall include all excavation, foundations, frames, grates, and covers, adjusting masonry and all work necessary for a completed structure.

END OF SECTION 334413.13