Fire Sprinkler System Modifications at M&T Bank Stadium

Prepared For:
Maryland Stadium Authority

Bid Documents

Submission Date:

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DIVISION 01 – GENERAL REQUIREMENTS

SECTION 011000 - SUMMARY

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 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Identification: Fire Sprinkler System Modifications at M&T Bank Stadium

1. Project Location: M&T Bank Stadium
   1101 Russel Street
   Baltimore, MD 21230

B. Owner: Maryland Stadium Authority (MSA)

C. Engineer: EBL Fire Engineering
   Division of EBL Engineers, LLC
   8005 Harford Road
   Baltimore, Maryland 21234-5701

D. The Work consists of the following:

1. The Work includes but is not limited to: Modifications to the existing fire sprinkler system and fire alarm systems, as indicated on the contract drawings.

2. Contractor shall submit shop drawings for approval by the City of Baltimore and the Fire Marshal and the Fire Protection Engineer of Record prior to the installation.

1.3 TYPE OF CONTRACT

A. Project will be constructed under a single prime contract.

1.4 USE OF PREMISES

A. General: Contractor’s access is not exclusive but will be in evening hours and weekends as required. Contractor's use of premises is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

B. Use of Site: Limit use of premises to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Owner Occupancy: Allow for Owner occupancy of Project site and use by the public.

2. Driveways and Entrances: Keep driveways, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

   a. Schedule deliveries to minimize use of driveways and entrances.
   b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

C. Use of Existing Building: Maintain existing building throughout construction period. Repair damage caused by construction operations. Protect building and its occupants during construction period.

1.5 OWNER'S OCCUPANCY REQUIREMENTS

A. Full Owner Occupancy: Owner will occupy site and existing building 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.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
2. Provide not less than 120 hours' (5days) notice to Owner of activities that will affect Owner's operations.

1.6 WORK RESTRICTIONS

A. On-Site Work Hours: Work shall generally be performed inside the existing building during normal working hours of 7:30 a.m. to 4:00 p.m., Monday through Friday, except otherwise required by the owner. Evening work hours are subject to change based on owner related activity schedule. The Contractor may not have access to the building or certain areas during private/public events. The following will apply:

Hours for Utility Shutdowns: To be coordinated with Owner.
1. Hours for Core Drilling: To be coordinated with Owner.
2. The use of powder actuated devices/tools will <u>not</u> be permitted.

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

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

D. Work on this project may not proceed until all submittals and shop drawings have been approved by the A/E or jurisdiction having authority over the installed system.

1.7 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: The Specifications are organized into Divisions and Sections using the 15-division format and AIA's "Masterspec" numbering system.

1. Section Identification: The Specifications use Section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.
2. Division 1: Sections in Division 1 govern the execution of the Work of all Sections in the Specifications.

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

1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.

a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

1.8 MISCELLANEOUS PROVISIONS

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

3.1 PROJECT PHASING

A. The project shall be completed in a phased manner, as identified in the following phasing plan. Phasing plan is subject to change by the MSA. Scheduling of all work for each phase of the project shall be coordinated with MSA.

B. Phase 1 (Club Level):
   1. Club Level All Areas-
      a. Perform Internal Pipe Assessment, in accordance with NFPA 25, Section 14.3 for the following zones, and provide documentation of findings to MSA:
         1) West Scoreboard Preaction System
         2) East Scoreboard Preaction System
         3) Club Level Kitchen Dry Pipe System
      b. Replace piping per MSA direction, based on findings of Internal Pipe Assessment
      c. Replace Dry Pipe and Preaction valves, and associated fire alarm devices
      d. Provide new Nitrogen Generators and associated fire alarm devices
      e. Final Acceptance Testing

C. Phase 2 (Quad A):
   1. Upper Concourse
      a. Perform Internal Pipe Assessment, in accordance with NFPA 25, Section 14.3 for the North Deck Dry Pipe System, and provide documentation of findings to MSA
      b. Replace piping per MSA direction, based on findings of Internal Pipe Assessment
      c. Replace Dry Pipe valve, and associated fire alarm devices.
      d. Provide new Nitrogen Generator and associated fire alarm devices
      e. Final Acceptance Testing

   2. Press Level
      a. Perform Internal Pipe Assessment, in accordance with NFPA 25, Section 14.3 for both Press Level Dry Pipe zones serving the Quad A Elevators, and provide documentation of findings to MSA.
      b. Replace piping per MSA direction, based on findings of Internal Pipe Assessment
      c. Replace Dry Pipe valves, and associated fire alarm devices.
      d. Provide new Nitrogen Generator and associated fire alarm devices
      e. Final Acceptance Testing

   3. Main Concourse
      a. Perform Internal Pipe Assessment, in accordance with NFPA 25, Section 14.3 for the Main Concourse Dry Pipe zone serving Quad A, and provide documentation of findings to MSA.
      b. Replace piping per MSA direction, based on findings of Internal Pipe Assessment
      c. Final Acceptance Testing

   4. Service Level
      a. Perform Internal Pipe Assessment, in accordance with NFPA 25, Section 14.3 for the following zones, and provide documentation of findings to MSA:
         1) Dirt Storage Dry Pipe System
         2) Loading Dock Dry Pipe System
      b. Replace piping per MSA direction, based on findings of Internal Pipe Assessment
      c. Replace Dry Pipe valves, and associated fire alarm devices for the following zones:
         1) Quad A Main Concourse Dry Pipe System
         2) Dirt Storage Dry Pipe System
         3) Loading Dock Dry Pipe System
      d. Provide new Nitrogen Generators and associated fire alarm devices
      e. Final Acceptance Testing

D. Phase 3 (Quad B):
   1. Upper Concourse
      a. Perform Internal Pipe Assessment, in accordance with NFPA 25, Section 14.3 for the South Deck Dry Pipe System, and provide documentation of findings to MSA
      b. Replace piping per MSA direction, based on findings of Internal Pipe Assessment
      c. Replace Dry Pipe valve, and associated fire alarm devices.
      d. Provide new Nitrogen Generator and associated fire alarm devices
      e. Final Acceptance Testing

   2. Upper Suite
      a. Perform Internal Pipe Assessment, in accordance with NFPA 25, Section 14.3 for the East Deck Dry Pipe System, and provide documentation of findings to MSA
      b. Replace piping per MSA direction, based on findings of Internal Pipe Assessment
      c. Replace Dry Pipe valve, and associated fire alarm devices.
      d. Provide new Nitrogen Generator and associated fire alarm devices
      e. Final Acceptance Testing

   3. Press Level
      a. Perform Internal Pipe Assessment, in accordance with NFPA 25, Section 14.3 for both Press Level Dry Pipe zones serving the Quad B Elevators and the Control Room Preaction System, and provide documentation of findings to MSA.
      b. Replace piping per MSA direction, based on findings of Internal Pipe Assessment
      c. Replace Dry Pipe valves, and associated fire alarm devices.
      d. Provide new Nitrogen Generators and associated fire alarm devices
      e. Final Acceptance Testing

   4. Main Concourse
      a. Perform Internal Pipe Assessment, in accordance with NFPA 25, Section 14.3 for the Main Concourse Dry Pipe zone serving Quad B, and provide documentation of findings to MSA.
      b. Replace piping per MSA direction, based on findings of Internal Pipe Assessment
      c. Final Acceptance Testing

   5. Service Level
      a. Perform Internal Pipe Assessment, in accordance with NFPA 25, Section 14.3 for the following zones, and provide documentation of findings to MSA:
         1) East Dry Standpipe System
         2) West Dry Standpipe System
         3) Telephone Room Preaction System
      b. Replace piping per MSA direction, based on findings of Internal Pipe Assessment
      c. Replace Dry Pipe and Preaction valves, and associated fire alarm devices for the following zones:
         1) East Dry Standpipe System
         2) West Dry Standpipe System
         3) Quad B Main Concourse Dry Pipe System
         4) Telephone Room Preaction System
      d. Provide new Nitrogen Generators and associated fire alarm devices
      e. Final Acceptance Testing

E. Phase 4 (Quad C):
   1. Main Concourse
      a. Perform Internal Pipe Assessment, in accordance with NFPA 25, Section 14.3 for the Main Concourse Dry Pipe zone serving Quad C, and provide documentation of findings to MSA.
      b. Replace piping per MSA direction, based on findings of Internal Pipe Assessment
      c. Final Acceptance Testing

   2. Service Level
      a. Replace Quad C Dry Pipe valve, and associated fire alarm devices
      b. Final Acceptance Testing

F. Phase 5 (Quad D):
   1. Upper Suite
      a. Perform Internal Pipe Assessment, in accordance with NFPA 25, Section 14.3 for the West Deck Dry Pipe System, and provide documentation of findings to MSA
      b. Replace piping per MSA direction, based on findings of Internal Pipe Assessment
      c. Replace Dry Pipe valve, and associated fire alarm devices.
      d. Provide new Nitrogen Generator and associated fire alarm devices
      e. Final Acceptance Testing

   2. Main Concourse
      a. Perform Internal Pipe Assessment, in accordance with NFPA 25, Section 14.3 for the Main Concourse Dry Pipe zone serving Quad D, and provide documentation of findings to MSA.
      b. Replace piping per MSA direction, based on findings of Internal Pipe Assessment
      c. Final Acceptance Testing

   3. Service Level
      a. Replace Quad D Dry Pipe valve, and associated fire alarm devices
      b. Final Acceptance Testing

G. Phase 6 (Generator Plant):
   1. Generator Plant
      a. Perform Internal Pipe Assessment, in accordance with NFPA 25, Section 14.3 for the Generator Plant Dry Pipe System, and provide documentation of findings to MSA
      b. Replace piping per MSA direction, based on findings of Internal Pipe Assessment
      c. Replace Dry Pipe valve, and associated fire alarm devices.
      d. Provide new Nitrogen Generator and associated fire alarm devices
      e. Final Acceptance Testing

END OF SECTION 011000

SECTION 013100 - COORDINATION

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 SECTION INCLUDES

A. Administrative and supervisory requirements for coordinating construction.

B. Procedures for review of documents and coordination of construction activity, including preparation of coordination drawings.

C. Coordination with Owner's requirements.

D. Coordination of work of various trades, suppliers, and subcontractors.

1.3 PROJECT ADMINISTRATION

A. Project Administrator: Owner's Project Manager.

B. Cooperate with the Administrator in allocation of mobilization areas of site; on site material storage, for field offices and sheds, for access, traffic, and parking facilities.

C. During construction, coordinate use of site and facilities through the Project Manager.

D. Comply with Project Manager's procedures for intra-project communications; submittals, reports, and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.

E. Comply with instructions of the Administrator for use of temporary utilities and construction facilities.

F. Coordinate field engineering and layout work under instructions of the Project Manager.

1.4 ENGLISH-SPEAKING PERSONNEL

A. At all times during construction, the Foreman must speak English and be able to communicate with each language among the crew and subcontractors.

1.5 COORDINATION PROCEDURES

A. In accordance with requirements of the Owner, before starting each portion of the work, study and compare the various drawings and other contract documents relative to that portion of the work, as well as other information and field measurements and drawings.

B. Examples of items which may require particular field adjustment and coordination include, but are not limited to:

1. As-built fire sprinkler plans, which require coordination with mechanical and electrical equipment installed in and above ceilings.

2. Specifications and drawings for equipment and furnishings which require connections to and coordination with associated mechanical and electrical systems and devices.

3. Installation of systems typically shown on contract drawings as diagrams and therefore subject to field adjustment.

C. Immediately report.

1. If, during the coordination review or later during the progress of the work, errors, inconsistencies, or omissions are discovered.

2. If a situation should develop which prevents the proper installation of any equipment or item, or compliance with the contract documents.

D. Coordinate scheduling, submittals and work of the various sections of specifications to assure efficient, timely, and orderly sequence of installation of construction elements. Provide for accommodating items to be installed later. Coordinate work so that each trade will have completed installations prior to construction which could obstruct their work.

E. Dimensions: Coordinate sizing of various components to assure proper fit and location. Verify dimensions of existing work and of new construction and equipment.

F. Drawings: Various products and systems have been indicated schematically or diagrammatically. Coordinate actual layout and dimensions, and prevent interference between components or trades.

G. Substitution or Change: Determine and coordinate the effects. Upon approval of substitution or change in the work, accommodate all the consequent ramifications and costs.

H. Sequence: Coordinate to provide normal progression of the work in a timely manner without delays. Determine long-lead items and the requirements for items on which each sequence is dependent.

I. Individual Inspection: Every subcontractor or trade is responsible for reviewing contract documents, and inspecting surfaces, substrates and areas related to the execution of their work.

J. Coordinate trades to insure that proper clearances and access are provided for items which require operation and maintenance.

K. Cooperate with the Owner in setting up the schedule of work during the entire course of the project so as not to interfere with normal operations of Owner.

1. All passageways and means of egress from the building shall be kept open during normal hours except where special arrangements are made in advance with Owner and authorities having jurisdiction.

2. Do not schedule work within the existing building unless an owners representative is on duty.

3. Do not shut down domestic water, heating, air conditioning, electric, fire alarm, or waste systems, or Owner's equipment without consent of the Owner. Coordinate and schedule shutdowns with the Owner, giving the maximum notice time possible with a minimum of three working days in advance.

4. The Fire sprinkler and Fire alarm systems shall always be in operation when Contractor's personnel leave the project.

1.6 COORDINATION MEETINGS

A. Progress meetings, coordination meetings, and pre-installation meetings with personnel and subcontractors to assure coordination of work shall be as required by the Owner.

1.7 COORDINATION OF SUBMITTALS

A. Schedule and coordinate submittals as specified in Section 001330.

B. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, equipment.

C. Coordinate requests for substitutions to assure compatibility of space, of operating elements and effect on work of other sections.

1.8 COORDINATION SUBMITTALS

A. Coordination Drawings: Prepare coordination drawings where careful and detailed coordination is needed, as required for situations described in "Coordination Procedures" above, and where required in other sections of specifications.

1. Show relationships of components shown on separate shop drawings.

2. Show proposed field coordination of systems shown schematically or diagrammatically on contract drawings.

3. Indicate installation sequences.

1.9 COORDINATION OF SPACE

A. Coordinate use of project space and sequence of installation of mechanical and electrical work which is indicated diagrammatically on drawings. Follow route shown for pipes, ducts and conduits as closely as practicable, with due allowance for available physical space; make runs parallel with lines of building. Use space efficiently to provide access for other installations, for maintenance, and for repairs.

B. In finished areas, conceal pipes, ducts, and wiring in the construction. Coordinate locations of fixtures and outlets with finish elements.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Review of Work: Prior to the commencement of work of each section of the specifications, carefully examine previously executed work performed under other sections or by other trades, which might affect execution of work of a section.

B. Acceptance: Commencement of work of a section will indicate acceptance by the Contractor of previously executed surfaces, substrates and areas of work. The commencement indicates that previous work has been inspected and meets the Contractor's requirements for warranty.

3.2 FIELD QUALITY CONTROL

A. A competent superintendent shall be on the premises at all times to check, lay out, coordinate, and superintend the installation of work. Superintendent shall establish grades and lines relative to the work before starting and be responsible for their accuracy.

B. Coordinate completion and clean-up of work of separate section in preparation for Substantial Completion.

C. Coordinate access to site by various trades and subcontractors for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

D. Assemble and coordinate closeout submittals specified in Section 211313 and 284621.11.

END OF SECTION 013100

SECTION 013300 - SUBMITTAL 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. Submittal procedures.

B. Manufacturer and subcontractor list.

C. Submittal Log.

D. Product Data.

E. Shop Drawings.

F. Samples.

G. Manufacturer’s instructions.

H. Schedule of Values.

I. Manufacturer’s certificates.

1.3 RELATED DOCUMENTS

A. Amendments to Supplemental General Conditions.

1.4 SUBMITTAL PROCEDURES

A. Sequentially number the transmittal forms. Resubmittals shall have original number with an alphabetic suffix.

B. Identify project, Contractor, subcontractor or supplier, pertinent drawing sheet and detail number(s), and specification section number, and paragraph, as appropriate. Identify specific service or location for which the item is to be used.

C. Apply Contractor’s stamp, signed or initialed certifying that review, verification of products required, field dimensions, adjacent construction work, and coordination of information, is in accordance with the requirements of the work and contract documents.

D. Schedule submittals to expedite the project and deliver to Engineer. Coordinate submission of related items.

E. Identify variations from contract documents and product or system limitations which may be detrimental to successful performance of the completed work.

F. Provide space for Contractor and Engineer review stamps.

G. Revise and resubmit submittals as required, identify all changes made since previous submittal.

H. Contractor's failure to make submittals in time for review and resubmittals shall not be allowed as a reason for extending contract time.

I. Product data and shop drawings will not be reviewed until the manufacturer and subcontractor list has been accepted. Do not order, fabricate, or install any item until it has been reviewed and accepted.

J. Distribute copies of reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions.

1.5 MANUFACTURER AND SUBCONTRACTOR LIST

A. Within 21 days of the contract award, submit complete list of manufacturers and subcontractors proposed for use, and list of major products with name of manufacturer, trade name, and model number of each product. A partial or incomplete list will not be accepted.

B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

1.6 PRODUCT DATA

A. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturer's standard data to provide information unique to this project.

B. The approval of a shop drawing or product data does not guarantee the measurements or the building conditions or that the shop drawings or product data have been checked to see that item submitted properly fits the building conditions. Approval shall not relieve the Contractor of the responsibility for furnishing material and performing work as required by the specifications and contract drawings; or the responsibility for verifying correctness of dimensions and quantities, and proper coordination of details and interface among trades.

C. All exclusively electrical items furnished as associated items with mechanical items but not specifically described in the mechanical item submission, shall be submitted as a separate shop drawing, but shall be clearly marked as associated with the mechanical item by specification paragraph.

1.7 SHOP DRAWINGS

A. Available space for equipment is indicated by the size of equipment shown on the drawings. Suppliers shall ascertain that their equipment will fit the available space. Include with shop drawings of equipment, drawings showing necessary deviations and changes required in materials and appurtenances made necessary by the units proposed to be furnished. Contractor shall be responsible for required changes without any additional cost.

1.8 SAMPLES

A. Submit samples, where required, to illustrate functional and aesthetic characteristics of the Product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.

B. Submit samples of finishes from the full range of manufacturer's standard colors, textures, and patterns for Engineer's selection.

C. Include identification on each sample, with full project information.

D. Submit the number of samples specified in individual specification sections, or two if not specified; one of which will be retained by Engineer and one for review by Owner.

E. Reviewed samples which may be used in the work are indicated in individual specification sections.

1.9 MANUFACTURER'S INSTRUCTIONS

A. When specified in individual specification sections, submit manufacturer's printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, in quantities specified for product data.

B. Identify conflicts between manufacturer's instructions and contract documents.

1.10 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of Schedule of Values with preparation of the Contractor's Construction Schedule.

1. Submit the Schedule of Values at the earliest possible date but no later than the Pre-Construction Meeting for approval.

1.11 MANUFACTURER'S CERTIFICATES

A. When specified in individual specification sections, submit manufacturer's certificate to Engineer to review, in quantities specified for product data.

B. Indicate whether material or product conforms to, or exceeds, specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

C. Certificates may be recent or previous test results on material or product but must be acceptable to Engineer.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Review each submittal and check for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Owner and Engineer. The Contractor is responsible for maintaining an accurate and up-to-date submittal log, tracking the transmittal of documents, and outstanding issues.

B. Approval Stamp: Stamp each submittal with the following certification:

I certify that this submittal required by Specification Section _____ complies with the Contract Documents and all dimensions, conditions and quantities are verified as shown and/or as corrected on these drawings.

Signed _____ Date _____

Company Name: _____

END OF SECTION 013300

SECTION 014000 - QUALITY REQUIREMENTS

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 quality assurance and quality control.

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

1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and -control services required by Owner and/or his designated representative or authorities having jurisdiction are not limited by provisions of this Section.

C. Related Sections include the following:

1. Divisions 21, 26, and 28 Sections for specific test and inspection requirements.

1.3 DEFINITIONS

A. 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.

B. 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. Services do not include contract enforcement activities performed by Owner and/or his designated representative.

C. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.

1.4 SUBMITTALS

A. Qualification Data: 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.

B. Permits, Licenses, and Certificates: For Owner's records, 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.

1.5 QUALITY ASSURANCE

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

B. Installer Qualifications: A firm or individual experienced in installing, erecting, 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.

C. 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.

D. 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.

1.6 QUALITY CONTROL

A. Contractor's Responsibilities: Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction.

1. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

B. 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.

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. Associated Services: Cooperate with owners representative performing required inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify owner sufficiently, minimum of 5 days, 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.

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, 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. Restore patched areas and extend restoration into adjoining areas in a manner that eliminates evidence of patching.

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 016320 - PRODUCTS AND SUBSTITUTIONS

PART 1 - GENERAL

RELATED DOCUMENTS:

Drawings and general provisions of Contract apply to work of this section.

1.1 SUMMARY

This Section specifies administrative and procedural requirements governing the Contractor's selection of products for use in the project.

The Contractor's Construction Schedule and the Schedule of Submittals are included under Section "Submittals".

Administrative procedures for handling requests for substitutions made after award of the Contract are included under Section "Product Substitutions".

MSA will not accept any products that contain any asbestos containing materials. Carefully follow the related information and forms for materials.

1.2 DEFINITIONS:

Definitions: Definitions used in this paragraph are not intended to negate the meaning of other terms used in the contract documents, including such terms as, "specialties", "systems", "structure", "finishes", "accessories", "furnishings", "special construction" and similar terms. Such terms are self-explanatory and have recognized meanings in the construction industry.

"Products" are items purchased for incorporation in the Work, regardless of whether they were specifically purchased for the project or taken from the Contractor's previously purchased stock. The term "product" as used herein includes the terms "material", "equipment", "system" and other terms of similar intent.

"Named Products" are products identified by use of the manufacturer's name for a product, including such items as a make or model designation, as recorded in manufacturer's published product literature, of the latest issue as of the date of the contract documents.

"Materials" are products that must be substantially cut, shaped, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form units of work.

"Equipment" is defined as a product with operational parts, regardless of whether motorized or manually operated, and in particular, a product that requires service connections such as wiring or piping.

1.3 SUBMITTALS

Required Submittals: Submittal requirements are found in each specification section. Prepare a schedule in tabular form showing each product listed. Include the manufacturer's name and proprietary product names for each item listed.

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

Coordinate the product list schedule with Contractor's Construction Schedule and the Schedule of Submittals.

Form: Prepare the product-listing schedule with information on each item tabulated under the following column headings:

Related Specification Section number.
Generic name used in Contract documents.
Proprietary name, model number and similar designations.
Manufacturer's name and address.
Supplier's name and address.
Installer's name and address.

Owner's Representative's Action: The Owner's Representative will respond in writing to the Contractor within two (2) weeks of receipt of the completed product list schedule. No response within this time period constitutes no objection to listed manufacturers or products, but does not constitute a wavier of the requirement that products comply with Contract Documents. The Owner's Representative's response will include the following:

A list of unacceptable product selections, containing a brief explanation for this action.

1.4 QUALITY ASSURANCE:

Source Limitations: To the fullest extent possible, provide products of the same generic kind, from a single source, for each unit of work.

When it is discovered that specified products are available only from sources that do not or cannot produce an adequate quantity to complete project requirements in a timely manner, consult with the Owner’s **Representative** for a determination of what product qualities are most important before proceeding. The **Owner's Representative** will designate those qualities, such as visual, structural, durability, or compatibility that are most important. When the **Owner's Representative** determination has been made, select products from those sources that produce products that possess the most important qualities, to the fullest extent possible.

Compatibility of Options: Compatibility of products is a basic requirement of product selection. When the Contractor is given the option of selecting between

two or more products for use on the project, the product selected must be compatible with other products previously selected, even if the products previously selected were also Contractor options. The complete compatibility between the various choices available to the Contractor is not assured by the various requirements of the Contract documents, but must be provided by the Contractor.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING:

General: Deliver, store, and handle products in accordance with manufacturer's recommendations, using means and methods that will prevent damage, deterioration and loss, including theft.
Control to prevent overcrowding of construction spaces.

In particular coordinate delivery and installation to ensure minimum holding or storage times for items known or recognized to be flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other sources of loss.

1.6 SUBMITTALS - SUBSTITUTION:

Substitution Request Submittal:

Requests for Substitutions: Submit 3 copies of each request for substitution. In each request identify the product or fabrication or installation method to be replaced by the substitution; include related specification section and drawing numbers, and complete documentation showing compliance with the requirements for substitutions. Include the following information, as appropriate, with each request.

Provide complete product data, drawings and descriptions of products, and fabrication and installation procedures.

Provide samples where applicable or requested.

Provide a detailed comparison of the significant qualities of the proposed substitution with those of the work originally specified. Significant qualities include elements such as size, weight, durability, performance and visual effect where applicable.

Provide complete coordination information. Include all changes required in other elements of the work to accommodate the substitution, including work performed by the Owner and separate Contractors.

Provide a statement indicating the effect the substitution will have on the work schedule in comparison to the schedule without approval of the proposed substitution. Include information regarding the effect of the proposed substitution on the Contract Time.

Provide complete cost information, including a proposal of the net change, if any in the Contract Sum.

Provide certification by the Contractor to the effect that, in the Contractor's opinion, after thorough evaluation, the proposed substitution will result in

work that in every significant respect is equal-to or better than the work required by the Contract documents, and that it will perform adequately in the application indicated.

Include in this certification, the Contractor's waiver of rights to additional payment or time, which may subsequently be necessary because of the failure of the substitution to perform adequately.

1.7 PROCEDURES:

Substitutions: The Contractor's requests for changes in the products, materials, equipment and methods of construction required by the contract documents are considered requests for "substitutions", and are subject to the requirements specified herein. The following are not considered as substitutions:

Revisions to the contract documents, where requested by the Owner, or **Owner's Representative** are considered as "changes" not substitutions.

No substitutions will be accepted during the bidding process.

Substitutions requested during the bidding period, which have been accepted prior to the Contract Date, are included in the contract documents and are not subject to the requirements for substitutions as herein specified.

Specified Contractor options on products and construction methods included in the contract documents are choices available to the Contractor and are not subject to the requirements for substitutions as herein specified.

Except as otherwise provided in the contract documents, the Contractor's determination of and compliance with governing regulations and orders as issued by governing authorities do not constitute "substitutions" and do not constitute a basis for change orders.

1.8 Standards: Refer to Division-1 section "Definitions and Standards" for the applicability of industry standards to the products specified for the project, and for the acronyms used in the text of the specification sections.

PART 2 – PRODUCTS

2.1 GENERAL PRODUCT COMPLIANCE:

General: Requirements for individual products are indicated in the contract documents; compliance with these requirements is in itself a contract requirement. These requirements may be specified in any one of several different specifying methods, or in any combination of these methods. These methods include the following:

Proprietary.
Descriptive.
Performance.
Compliance with Reference Standards.

Compliance with codes, compliance with graphic details, allowances, and similar provisions of the contract documents also have a bearing on the selection process.

Procedures for Selecting Products: The Contractor's options in selecting products are limited by requirements of the contract documents and governing regulations. They are not controlled by industry traditions or procedures experienced by the Contractor on previous construction projects. Required procedures include but are not limited to the following for the various indicated methods of specifying:
Non Proprietary Specification Requirements: Where the specifications name products or manufacturers that are available and may be incorporated in the Work, but do not restrict the Contractor to the use of these products only, the Contractor may, at his option, use any available product that complies with contract requirements.

Or Equal: Where some particular product or device is specified by brand name or manufacturer it is to be considered a standard. If approved equal, items of other manufacturer than those mentioned may be used, unless specifically noted otherwise for purposed of standardization. Any substitution must receive the written approval of the Owner's Representative. In the specifications, many times are preceded or followed by the phrase "or approved equal" and many others are not. The absence of that phrase is not to be interpreted as in derogation of the provisions of the paragraph. Comply with those contract document provisions concerning "substitutions" for obtaining Owner's Representative's approval.

Descriptive Specification Requirements: Where the specifications describe a product or assembly generically, in detail, listing the exact characteristics required, but without use of a brand or trade name, provide products or assemblies that provide the characteristics indicated and otherwise comply with contract requirements.

Performance Specification Requirements: Where the specifications require compliance with indicated performance requirements, provide products that comply with the specific performance requirements indicated, and that are recommended by the manufacturer for the application indicated.

The manufacturer's recommendations may be contained in published product literature, or by the manufacturer's individual certification of performance. General overall performance of a product is implied where the product is specified for specific performances.

Compliance with Standards, Codes, and Regulations: Where the specifications require only compliance with an imposed standard, code or regulation, the Contractor has the option of selecting a product that complies with specification requirements, including standards, codes, and regulations.

Visual Matching: Where matching an established sample or existing is required, the final judgment of whether a product proposed by the Contractor matches the sample satisfactorily will be determined by the **Owner's Representative.** Where there is no product available within the specified product category that matches the sample satisfactorily and also complies with other specified requirements, comply with the provisions of the contract documents concerning "substitutions" and "change orders" for the selection of a matching product in another product category, or for non-compliance with specified requirements.

Visual Selection: Except as otherwise indicated, where specified product requirements include the phrase "...as selected from the manufacturer's standard colors, patterns, textures..." or similar phrases, the Contractor has the option of selecting the product and manufacturer, provided the selection complies with other specified requirements. The **Owner's Representative** is subsequently responsible for selecting the color, pattern and texture from the product line selected by the Contractor.

2.2 SUBSTITUTIONS:

Conditions: The Contractor's request for a substitution will be received and considered when extensive revisions to the contract documents are not required, when the proposed changes are in keeping with the general intent of the contract documents, when the requests are timely, fully documented and properly submitted, and when one or more of the following conditions is satisfied, all as judged by the **Owner's Representative**. Otherwise, the requests will be returned without action except to record non-compliance with these requirements.

The **Owner's Representative** will consider a request for substitution where the request is directly related to an "or equal" clause or similar language in the contract documents.

The **Owner's Representative** will consider a request for substitution where the specified product or method cannot be provided within the Contract Time. However, the request will not be considered if the product or method cannot be provided as a result of the Contractor's failure to pursue the work promptly or to coordinate the various activities properly.

The **Owner's Representative** will consider a request for substitution where the specified product or method cannot receive necessary approval by a governing authority, and the requested substitution can be approved.

The **Owner's Representative** will consider a request for a substitution where a substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting of offsetting responsibilities the Owner may be required to bear. These additional responsibilities may include such considerations as additional compensation to the Owner's Representative for redesign and evaluation services, the increased cost of other work by the Owner or separate Contractors, and similar considerations.

The **Owner's Representative** will consider a request for substitution when the specified product or method cannot be provided in a manner, which is compatible with other materials of the work, and where the Contractor certifies that the substitution will overcome the incompatibility.

The **Owner's Representative** will consider a request for substitution when the specified product or method cannot be properly coordinated with other materials in the work, and where the Contractor certifies that the proposed substitution can be properly coordinated.

The **Owner's Representative** will consider a request for substitution when the specified product or method cannot receive a warranty as required by the contract documents and where the Contractor certifies that the proposed substitution includes the required warranty.

Work-Related Submittals: The Contractor's submittal of and the Owner's Representative's acceptance of shop drawings, product data or samples which relate to work not complying with requirements of the contract documents, does not constitute an acceptable or valid request for a substitution, nor approval thereof.

2.3 GENERAL PRODUCT REQUIREMENTS:

General: Provide products that comply with the requirements of the contract documents that are undamaged and, unless otherwise indicated, unused at the time of installation. Provide products that are complete with all accessories, trim, and finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect.

Standard Products: Where they are available, provide standard products of types that have been produced and used successfully in similar situations on other projects.

Continued Availability: Where, because of the nature of its application, the Owner is likely to need replacement parts or additional amounts of a product at a later date, either for maintenance and repair or replacement, provide standard, domestically produced products for which the manufacturer has published assurances that the products and its parts are likely to be available to the Owner at a later date.

Nameplates: Except as otherwise indicated for required labels and operating data, do not permanently attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products which will be exposed to view either in occupied spaces or on the exterior of the completed project.

Labels: Locate required product labels and stamps on a concealed surface or, where required for observation after installation, on an accessible surface which, in occupied spaces, is not conspicuous.

PART 3 - EXECUTION

3.1 INSTALLATION OF PRODUCTS:

General: Except as otherwise indicated in individual sections of these specifications, comply with the manufacturer's instructions and recommendations for installation of the products in the applications indicated.
Anchor each product securely in place, accurately located and aligned with other work.
Clean exposed surfaces and protect surfaces as necessary to ensure freedom from damage and deterioration at time of acceptance.

END OF SECTION 016320

DIVISION 21 – FIRE SUPPRESSION

SECTION 210518 - ESCUTCHEONS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and Specification Sections:

1. Sprinkler System: Section 211313.

1.2 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.3 DEFINITIONS

A. Existing Piping to Remain: Existing piping that is not to be removed and that is not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Argco or approved equal.

2.2 ESCUTCHEONS

A. One-Piece, Steel Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Stainless-Steel Type: With polished stainless-steel finish.

C. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped steel with polished, chrome-plated finish and spring-clip fasteners.

D. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.

E. Split-Plate, Stamped-Steel Type: With polished, chrome-plated finish; concealed and exposed-rivet hinge; and spring-clip fasteners.

2.3 FLOOR PLATES

A. Split Floor Plates: Steel with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.
b. Chrome-Plated Piping: One-piece or split-plate steel with polished, chrome-plated finish.
c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece steel with polished, chrome-plated finish.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece stainless steel with polished stainless-steel finish.
e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece cast brass with polished, chrome-plated finish.
f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece stainless steel with polished stainless-steel finish.
g. Bare Piping in Unfinished Service Spaces: One-piece steel with polished, chrome-plated finish.
h. Bare Piping in Unfinished Service Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
i. Bare Piping in Equipment Rooms: One-piece steel with polished, chrome-plated finish.
j. Bare Piping in Equipment Rooms: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.

3.2 FIELD QUALITY CONTROL

A. Using new materials, replace broken and damaged escutcheons and floor plates.

END OF SECTION 210518

SECTION 211313 - SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Pipes, fittings, and specialties.
2. Specialty valves.
3. Sprinkler specialty pipe fittings.
4. Sprinklers.
5. Alarm devices.
6. Manual control stations.
7. Control panels.
8. Pressure gauges.
9. Nitrogen generator-based corrosion-mitigation systems.

B. Related Requirements:

1. Section 284621 "Addressable Fire Alarm Systems" for pressure and supervisory switches.

1.3 DEFINITIONS

A. Standard-Pressure Sprinkler Piping: Dry-pipe sprinkler system piping designed to operate at working pressure of 175-psig (1200-kPa) maximum.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For dry-pipe sprinkler systems.

1. Include plans, elevations, sections, and attachment details.
2. Include diagrams for power, signal, and control wiring.

C. Delegated-Design Submittal: For dry-pipe sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Domestic water piping.
2. Compressed air piping.
3. HVAC hydronic piping.
4. Items penetrating finished ceiling including the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.

5. Structural Elements.

B. Design Data:

1. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."

D. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For dry-pipe sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

1.8 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility.

a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

1.9 FIELD CONDITIONS

A. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:

1. Notify Owner no fewer than five days in advance of proposed interruption of sprinkler service.
2. Do not proceed with interruption of sprinkler service without Owner's written permission.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTIONS

A. Dry-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing compressed air or nitrogen. Opening of sprinklers releases compressed air or nitrogen and permits water pressure to open dry-pipe valve. Water then flows into piping and discharges from opened sprinklers.

B. Combined Dry-Pipe and Preaction Sprinkler System: Automatic sprinklers are attached to piping containing compressed air or nitrogen. Fire-detection system, located in same area as sprinklers, actuates tripping devices that open dry-pipe valve without loss of nitrogen pressure and actuates fire alarm. Water discharges from opened sprinklers.

C. Single-Interlock Preaction Sprinkler System: Automatic sprinklers are attached to piping containing low-pressure air or nitrogen. Actuation of fire-detection system, located in same area as sprinklers, opens pre-action valve, permitting water to flow into sprinkler piping and to discharge from opened sprinklers.

D. Double-Interlock Preaction Sprinkler System: Automatic sprinklers are attached to piping containing low-pressure air or nitrogen. Actuation of a fire-detection system, located in same area as sprinklers, will activate the normally closed solenoid but will not open the pre-action valve. Activation of a sprinkler head will not permit water to flow into sprinkler piping. Activation of both the normally closed solenoid valve and automatic sprinkler is required to cause the pre-action valve to open, permitting water to flow into sprinkler piping, and water will then discharge from opened sprinkler.

2.2 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.

B. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with NFPA 13.

C. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.

2.3 STEEL PIPE AND FITTINGS

A. Standard-Weight, Black-Steel Pipe: ASTM A53/A53M. Pipe ends may be factory or field formed to match joining method.

B. Schedule 10, Black-Steel Pipe: ASTM A135/A135M; ASTM A795/A795M; or ASME B36.10M wrought steel, with wall thickness not less than Schedule 10 and not more than Schedule 40. Pipe ends may be factory or field formed to match joining method.

C. Black-Steel Pipe Nipples: ASTM A733, made of ASTM A53/A53M, standard-weight, seamless steel pipe with threaded ends.

D. Ductile Iron, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

E. Cast-Iron Flanges: ASME B16.1, Class 125.

F. Grooved-Joint, Steel-Pipe Appurtenances:

1. Pressure Rating: 300-psig minimum.
2. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.4 SPECIALTY VALVES

A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

B. Pressure Rating:

1. Standard-Pressure Piping Specialty Valves: 175-psig (1200-kPa) minimum.

C. Body Material: Cast or ductile iron.

D. Size: Same as connected piping.

E. End Connections: Flanged or grooved.

F. Dry-Pipe Valves:

1. Manufacturers: Viking or approved equal.
2. Standard: UL 260.
3. Design: Differential-pressure type.
4. Include UL 1486, quick-opening devices, trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gauges, priming chamber attachment, and fill-line attachment.
5. Air-Pressure Maintenance Device:

    a. Standard: UL 260.
    b. Type: Automatic device to maintain minimum air pressure in piping.
    c. Include shutoff valves to permit servicing without shutting down sprinkler piping, bypass valve for quick filling, pressure regulator or switch to maintain pressure, strainer, pressure ratings with 14- to 60-psig (95- to 410-kPa) adjustable range, and [175-psig (1200-kPa)] [300-psig (2070-kPa)] outlet pressure.

G. Pre-Action Valves:

1. Manufacturers: Viking.
2. Standard: UL 260.
3. Design: Hydraulically operated, differential-pressure type.
4. Include trim sets for alarm-test bypass, drain, electrical water-flow alarm switch, pressure gauges, drip cup assembly piped without valves and separate from main drain line, and fill-line attachment with strainer.
5. Dry, Pilot-Line Trim Set: Include dry, pilot-line actuator; air- and water-pressure gauges; low-air-pressure warning switch; air relief valve; and actuation device. Dry, pilot-line actuator includes cast-iron, operated, diaphragm-type valve with resilient facing plate, resilient diaphragm, and replaceable bronze seat. Valve includes threaded water and air inlets and water outlet. Loss of air pressure on dry, pilot-line side allows pilot-line actuator to open and causes deluge valve to open immediately.

2.5 DRY-SPRINKLER SYSTEM NITROGEN GENERATOR WITH PURGE/VENT

A. Dry-Sprinkler System Nitrogen Generator with Purge/Vent: Nitrogen generator system to serve dry sprinkler zones for piping corrosion mitigation, including system venting.

1. Manufacturer: ECS or approved equal.
2. Description: Nitrogen generator system for dry-sprinkler system providing required supervisory pressure within sprinkler zone. System is to include either an integrated, oil-less air compressor located within the nitrogen generator system package, or a separate vibration-isolation mounted air compressor, also provided by nitrogen generator manufacturer.
3. Standards:

    a. FM Approvals 1035.
    b. UL 508A listed.

4. Nitrogen Generator:

a. Wall-mounted or skid-mounted nitrogen generator to provide minimum nitrogen purity of 98 percent to designated sprinkler systems.
b. Power: 120 V ac.
c. Bypass mode and nitrogen generating mode.
d. Minimum Capacity: As recommended by manufacturer.

5. Automatic Purge Vent/Valve:

a. Vents oxygen during system nitrogen fill.
b. Automatically closes when 98 percent minimum nitrogen has been reached.
c. Sized to allow correct purge rate per manufacturer's written instructions and with 14 days.
d. Provide one venting device for each dry/pre-action sprinkler system zone.
e. Include a connection port for a portable nitrogen purity sensor or a nitrogen purity manifold.

6. Supervisory Gas Monitoring - Nitrogen Purity Sensing Device:

a. Portable Handheld Nitrogen Purity Sensing Device: Portable sensing device to connect to the outlet of the automatic purge/vent valve during periodic inspections to obtain a nitrogen purity reading within each zone.
b. Permanently Mounted Nitrogen Purity Monitoring Device or Manifold: Permanent monitoring device to continuously monitor system's nitrogen purity.

2.6 PRE-ACTION SPRINKLER SYSTEM NITROGEN GENERATOR WITH PURGE/VENT

A. Pre-Action Sprinkler System Nitrogen Generator Corrosion-Mitigation with Purge/Vent: Nitrogen generator system to serve pre-action sprinkler zones for piping corrosion mitigation, including system venting.

1. Manufacturer: Viking or approved equal.
2. Description: Nitrogen generator system for pre-action sprinkler system providing required supervisory pressure within sprinkler zone. System is to include either an integrated, oil-less air compressor located within the nitrogen generator system package, or a separate vibration-isolation mounted air compressor, also provided by nitrogen generator manufacturer.
3. Standards:

a. FM Approvals 1035.
b. UL 508A listed.

4. Nitrogen Generator:

a. Stand-alone nitrogen generator to provide minimum nitrogen purity of 98 percent to the designated sprinkler systems.
b. Power: 120 V ac.
c. Bypass mode and nitrogen generating mode.
d. Minimum Capacity: As recommended by manufacturer.

5. Air Compressor:

a. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
b. Motor Horsepower: Fractional.

1) Power: 120 V ac, 60 Hz, single phase.

c. Sized for application and capable of achieving system supervisory pressure within 30 minutes in accordance with requirements of NFPA 13. Provide ASME air receiver tank as required to meet requirements on larger systems.
d. Include filters, relief valves, coolers, automatic drains, and gauges.
e. Minimum Capacity: Match capacity of nitrogen generator.

6. Automatic Purge Vent/Valve:

a. Vents oxygen during system nitrogen fill.
b. Automatically closes when 98 percent minimum nitrogen has been reached.
c. Sized to allow correct purge rate per manufacturer's written instructions and with 14 days.
d. Provide one venting device for each dry/pre-action sprinkler system zone.
e. Include a connection port for a portable nitrogen purity sensor or a nitrogen purity manifold.

7. Supervisory Gas Monitoring - Nitrogen Purity Sensing Device:

a. Portable Handheld Nitrogen Purity Sensing Device: Portable sensing device to connect to the outlet of automatic purge/vent valve during periodic inspections to obtain a nitrogen purity reading within each zone.
b. Permanently Mounted Nitrogen Purity Monitoring Device or Manifold: Permanent monitoring device to continuously monitor system's nitrogen purity.

2.7 SPRINKLER PIPING SPECIALTIES

A. General Requirements for Dry-Pipe System Fittings: UL listed, FM approved for dry-pipe service.

B. Branch Outlet Fittings:

1. Manufacturer: Merit or approved equal.
2. Standard: UL 213.
3. Pressure Rating: 175-psig minimum.
4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
5. Type: Mechanical-tee and -cross fittings.
6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
8. Branch Outlets: Grooved, plain-end pipe, or threaded.

2.8 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Pressure Switches - Water-Flow Alarm Detection:

1. Manufacturer: Potter Electric or approved equal.
2. Standard: UL 346.
3. Type: Electrically supervised, pressure-activated water-flow switch.
4. Components: Two single-pole, double-throw switches.
5. Design Operation: Rising pressure to 6 psi, plus or minus 2 psi signals water flow.
6. Adjustability: Each switch is to be independently adjustable.
7. Wire Separation: Pressure switch to provide separation of wiring to each switch connection to allow for low and high volume connections to comply with NFPA 70 Article 760 requirements.

C. Pressure Switches - Low/High Air Pressure Supervisory:

1. Manufacturer: Potter Electric or approved equal
2. Standard: UL 346.
3. Type: Electrically supervised pressure supervisory switch.
4. Components: Two single-pole, double-throw switches.
5. Design Operation: Detects increase and/or decrease from normal supervisory air pressure.
6. Adjustability: Each switch is to be independently adjustable.
7. Wire Separation: Pressure switch shall provide for separation of wiring to each switch connection to allow for low and high voltage connections to comply with NFPA 70 Article 760 requirements.

D. Valve Supervisory Switches:

1. General Requirements for Valve Supervisory Switches:

a. Standard: UL 346.
b. Type: Electrically supervised.
c. Design: Signals that controlled valve is in other than fully open position.
d. Wire Terminal Designations: Indicates normal switch position when switch is properly installed on the valve and valve is fully open.

2. Requirements for OS&Y Valve Supervisory Switches:

a. Components: One or two single-pole, double-throw switches.
b. NEMA Rating: NEMA 4 and NEMA 6P enclosures suitable for mounting in any position indoors or outdoors.
c. Visual Switch Indication: Indicates device is properly installed and OS&Y valve is fully open.
d. Mounting Hardware: Mounting bracket to grip valve yoke and prevent movement of switch assembly on OS&Y valve.
e. Trip Rod Length: Adjustable.

3. Requirements for PIV and Butterfly Valve Supervisory Switches:

a. Components: Two single-pole, double-throw switches.
b. NEMA Rating: NEMA 4 and NEMA 6P enclosures suitable for mounting in any position indoors or outdoors.
c. Mounting Hardware: Removable nipple.
d. Trip Rod Length: Adjustable.

2.9 PRESSURE GAUGES

A. Standard: UL 393.

B. Dial Size: 3-1/2- to 4-1/2-inch (90- to 115-mm) diameter.

C. Pressure Gauge Range: 0- to 250-psig minimum.

D. Label: Include "WATER" or "AIR/WATER" label on dial face.

E. Air System Piping Gauge: Include retard feature and "AIR" or "AIR/WATER" label on dial face.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.

C. Install seismic restraints on piping. Comply with NFPA 13 requirements for seismic-restraint device materials and installation.

D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install unions adjacent to each valve in pipes NPS 2 and smaller.

F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.

H. Install sprinkler piping with drains for complete system drainage.

I. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

J. Install automatic (ball drip) drain valves to drain piping between fire department connections and check valves. Drain to floor drain or to outside building.

K. Connect compressed-air supply to dry-pipe sprinkler piping.

L. Connect air compressor to the following piping and wiring:

1. Pressure gauges and controls.
2. Electrical power system.
3. Fire-alarm devices, including low-pressure alarm.

M. Install alarm devices in piping systems.

N. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements in NFPA 13. In seismic-rated areas, refer to Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."

O. Install pressure gauges on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gauges with connection not less than NPS 1/4 (DN 8) and with soft-metal seated globe valve, arranged for draining pipe between gauge and valve. Install gauges to permit removal, and install where they are not subject to freezing.

P. Drain dry-pipe sprinkler piping.

Q. Pressurize and check dry-pipe sprinkler system piping and air-pressure maintenance devices, air compressors.

R. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 210518 "Escutcheons for Fire-Suppression Piping."

3.2 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.

D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

H. Twist-Locked Joints: Plain-end-pipe fitting that utilizes a retainer lug shall not be used.

I. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.

J. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.3 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Specialty Valves:

1. Install valves in vertical position for proper direction of flow, in main supply to system.
2. Install dry-pipe and preaction valves with trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gauges, priming chamber attachment, and fill-line attachment.

    a. Install air compressor and compressed-air-supply piping.
    b. Install air-pressure maintenance device with shutoff valves to permit servicing without shutting down sprinkler system; bypass valve for quick system filling; pressure regulator or switch to maintain system pressure; strainer; pressure ratings with 14- to 60-psig adjustable range; and 175-psig maximum inlet pressure.
    c. Install compressed-air-supply piping from building's compressed-air piping system.

3.4 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

3.5 NITROGEN-GENERATION, CORROSION-MITIGATION SYSTEM

A. Install in accordance with manufacturer's written installation instructions.

B. Locate purge vent/valve in accordance with manufacturer's written installation instructions.

C. Route alarm signals in code-approved electrical conduit from nitrogen generator system control panel to the supervisory circuit of BAS.

3.6 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist and gauge remains at a constant for minimum two hours per NFPA 13.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
4. Energize circuits to electrical equipment and devices.
5. Start and run air compressors.
6. Coordinate with fire-alarm tests. Operate as required.
7. Coordinate with fire-pump tests. Operate as required.
8. Verify that equipment hose threads are same as local fire department equipment.

B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.7 EQUIPMENT REMOVAL

A. The owner shall be given right of first refusal to retain all fire sprinkler equipment (including existing air compressors) demolished as part of this work. Any equipment that the owner does not elect to retain shall be removed from the site by the contractor.

3.8 CLEANING

A. Clean dirt and debris from sprinklers.

B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

3.9 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.

3.10 PIPING SCHEDULE

A. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.

B. Standard-pressure, dry-pipe sprinkler system, NPS 2 and smaller, shall be one of the following:

1. Standard-weight, black-steel pipe with threaded ends; ductile, gray-iron threaded fittings; and threaded joints.
2. Standard-weight, black-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

C. Standard-pressure, dry-pipe sprinkler system, NPS 2-1/2 to NPS 6, shall be one of the following:

1. Standard-weight, black-steel pipe with threaded ends; ductile, gray-iron threaded fittings; and threaded joints.
2. Standard-weight, Schedule 10, black-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

END OF SECTION 211313

SECTION 215000 - CORROSION MANAGEMENT

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Provide all required labor, materials, equipment and services necessary for a complete and operational Corrosion Management Program for the fire protection systems (FPS) as hereinafter described and as indicated on the drawing(s). Specific manufacturer installation guidelines shall be adhered to.

B. Basis of Design: Engineered Corrosion Solutions or “Approved Equal” .

C. Corrosion Management Work may include the following listed products and services:

1. Corrosion Management Products shall be as specified herein:

    a. ECS Protector Nitrogen Generator (PGEN Series)
    b. Air Compressor
    c. Air Maintenance Device
    d. ECS Protector Dry SMART Vent (PSV-D)
    e. ECS Protector Handheld Gas Analyzer (PHGA-1)

2. Installation of air compressor and FPS air maintenance device.
3. Installation of corrosion management products.
4. Miscellaneous piping, fittings, couplings, valves, etc. as required.
5. Coordination of work and schedules with other trades.
6. System pressure testing.
7. System commissioning.

1.2 REFERENCES

A. All corrosion management work shall be designed, installed, inspected, tested and maintained in accordance with all applicable codes, referenced standards, documents listed herein, the manufacturer’s instructions and the provisions of this specification:

1. NFPA 13, Standard for the Installation of Sprinkler Systems
2. NFPA 25, Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems

B. All corrosion Monitoring Devices shall be provided to achieve compliance with Section 24.1.5.2 (4) of the 2016 Edition NFPA 13, Standard for the Installation of Sprinkler Systems and shall be U.L. 2987 listed for monitoring corrosion in fire sprinkler systems.

1.3 QUALITY ASSURANCE

A. Equipment and components not specifically specified shall be FM Approved or listed by Underwriter's Laboratories, Inc. for FPS installation.

B. All fire sprinkler system components shall be installed free of rust/corrosion or visible damage. All items not complying with this requirement shall be replaced at no cost to the Owner.

1.4 REGULATORY REQUIREMENTS

A. All work shall meet the requirements of Section 1.02, References.

B. The fire sprinkler contractor shall not pursue any interpretations of the Corrosion Management Program except through the Engineer.

PART 2 - PRODUCTS

2.1 PIPING

A. Dry Pipe or Preaction FPS:

1. Per local requirements and NFPA 13.
2. All piping shall have a Corrosion Resistance Ratio (CRR) greater than or equal to 1.00. Refer to the current UL Fire Protection Equipment Directory – Steel Sprinkler Pipe for acceptable manufacturers, sizes and joining methods.
3. All dry pipe FPS (including preaction systems in heated areas) shall be pitched at least as prescribed by NFPA 13.

2.2 JOINING OF PIPE AND FITTINGS

A. Dry Pipe or Preaction FPS:

1. Fittings shall be 175 psi screwed, roll grooved, or mechanical fittings. Where roll grooved or mechanical fittings and couplings are used together they shall be of the same manufacturer.
2. All gaskets shall be Victaulic Flush Seal or equivalent.

2.3 CORROSION MANAGEMENT PRODUCTS

A. ECS Protector Nitrogen Generator (PGEN):

1. The nitrogen generator shall be sized to provide all dry and preaction fire sprinkler systems with supervisory nitrogen gas. Sizing shall be based on the total volume of all fire sprinkler systems being served by the nitrogen generator as determined by hydraulic calculations for each system. Documentation of the calculations and nitrogen generator sizing must be provided with the submittals. Where the quantity of systems, total cumulative volume of systems or physical location of system risers require, multiple nitrogen generators shall be supplied.

a. Models:

i. PGEN-3 Wall Mount: up to 675 Gallons
ii. PGEN-5 Wall Mount: up to 950 Gallons
iii. PGEN-10 Wall Mount: up to 2,000 Gallons
iv. PGEN-50 Standalone: up to 18,500 Gallons

2. The nitrogen generator shall be FM 1035 Approved.
3. The nitrogen generator shall be electronically controlled with the capability to adjust system operating pressure settings without the requirement of any additional equipment.
4. The nitrogen generator shall be supplied with compressed air sized per the manufacturer's requirements.
5. The nitrogen generator shall be designed to achieve a nitrogen concentration of 98% or greater within fourteen (14) days of start-up and maintain that concentration within the all fire protection systems continuously.
6. The nitrogen generator shall not require a nitrogen storage tank or refrigerated dryer.
7. The nitrogen generator shall have an hour meter, cycle counter, air bypass alarm, leak alarm and flow meter.
8. The nitrogen generator shall provide the following monitoring output points, nitrogen generator running mode, bypass mode, nitrogen generator on (presence of power), leak monitor, nitrogen line pressure (analog).
9. The nitrogen generator shall have a connection to attach and sample the purity of nitrogen within the FPS. Purity sampling device can be portable or fixed.
10. The nitrogen generator shall be equipped with a filtration system to remove residual water and hydrocarbons (if needed) from the compressed air stream.
11. The nitrogen generator shall be powered by a 120VAC power supply. Coordinate power requirements and location with electrical contractor. The nitrogen generator power supply shall be per NFPA 70 and all local requirements.
12. The nitrogen generator shall be equipped with an external bypass with bypass alarm to prevent long term oxygen exposure in fire sprinkler system.

B. Wall Mount Generator Compressed Air Source:

1. The nitrogen generator shall be wall mounted with integral oil-less air compressor, rated for continuous duty with an output pressure rating of 100 psig, sized per the manufacturer's requirements.
2. The integral air compressor shall be capable of producing a continuous volume of compressed air that is sufficient to fill the largest FPS being supplied by the air compressor to operating pressure within thirty (30) minutes per NFPA 13 requirements and meet the compressed air requirements of the nitrogen generator it is supplying.

a. Models:

i. PGEN-3 Wall Mount: 215 Gal. @40 psig/540 Gal. @20 psig
ii. PGEN-5 Wall Mount: 265 Gal. @40 psig/590 Gal. @20 psig
iii. PGEN-10 Wall Mount: 560 Gal. @40 psig/1,120 Gal. @20 psig

3. Wall mount nitrogen generators with integral air compressors shall not require an air receiver tank.

C. Air Compressor (simplex):

1. The fire sprinkler contractor shall furnish and install a simplex air compressor to supply air to the nitrogen generator. Integral air compressor shall be oil-less, separate air compressor shall be splash lubricated with an on-board after cooler and be rated by the manufacturer for continuous duty service.
2. The air compressor shall have an output pressure rating of 100 psig (oil-less) or 150 psig (splash lubricated).
3. The air compressor shall be capable of producing a continuous volume of compressed air that is sufficient to fill the largest FPS being supplied by the air compressor to operating pressure within thirty (30) minutes per NFPA 13 requirements and also meet the compressed air requirements of the nitrogen generator it is supplying.

    a. Models:

        i. TCMP-50 (PGEN-50): 2,025 Gal. @ 40 psig/4,050 Gal. @ 20 psig

4. Splash lubricated air compressor shall be equipped with an air receiver tank with a minimum 60 gallons and be equipped with an adjustable electronic automatic blow down device that empties condensate from the air receiver tank. This water discharge shall be piped to a floor drain or building exterior per local requirements.
5. Non-integral air compressors shall be connected to the nitrogen generator with a minimum 1/2 in. diameter black steel or galvanized piping.
6. Each compressor power source shall include a service disconnect installed adjacent to the air compressor sized as required by the air compressor manufacturer. Coordinate power requirements and location with electrical contractor. The air compressor power supply shall be per NFPA 70 and all local requirements.

D. Air Maintenance Device:

1. The fire sprinkler contractor shall furnish and install an approved air maintenance device for each dry or preaction fire sprinkler system.
2. The air maintenance device shall be equipped with a field adjustable pressure regulator for use in setting the maximum system pressure.

    Approved air maintenance devices are:

    a. Victaulic Series 757
    b. Tyco Model AMD-1
    c. Reliable Model A-2
    d. Or approved equal

3. Air maintenance device shall be installed per the manufacturer's instructions.

E. ECS Protector Dry SMART Vent (PSV-D):

1. The fire sprinkler contractor shall furnish and install an electric inerting vent for each fire sprinkler system that will close automatically once the desired nitrogen concentration has been reached.
2. The electric inerting vent shall be installed on the fire sprinkler riser at the locations shown on the drawings. Installation of the electric inerting vent outside of the fire sprinkler valve room is not permitted.
3. The electric inerting vent shall be equipped with a solenoid valve and separate electric control box. The electric inerting vent shall be powered by a 120VAC power supply. Coordinate power requirements and location with electrical contractor.
4. The electric control box shall be wall-mounted and installed adjacent to the inerting vent on the fire sprinkler riser. Coordinate solenoid connection requirements and location with electrical contractor.
5. The solenoid valve shall be wired to the electric control box per NFPA 70 and all local requirements.
6. The inerting vent shall have an adjustable pressure regulator to prevent accidental depressurization of the fire sprinkler system should a disruption occur to the air/nitrogen supply.
7. The electric inerting vent shall have a connection to attach and sample the purity of nitrogen within the FPS. Purity sampling device can be portable or fixed.
8. The piping between FPS and electric inerting vent must not create a water trap; the connecting piping must drain when FPS is drained or the electric automatic inerting vent will not function properly.
9. A 1/2 in. outlet is required to attach the vent assembly to the FPS.
10. The isolation ball valve of the electric automatic inerting vent shall be closed during hydrostatic and/or air pressure testing of the FPS and then placed in the open position for the commissioning and operation of the nitrogen generator.

F. ECS Protector Handheld Gas Analyzer (PGHA-1):

1. The fire sprinkler contractor shall furnish a handheld gas analyzer with each nitrogen generator or as directed by the design engineer.
2. The handheld gas analyzer shall be equipped with a quick connect fitting compatible with gas sampling ports on all nitrogen generation system equipment and inerting vents.
3. The handheld gas analyzer shall include a one button calibration feature.
4. The oxygen sensing element of the handheld gas analyzer shall have a minimum useful life of two (2) years.

PART 3 - EXECUTION

3.1 COORDINATION WITH OTHER TRADES

A. Coordinate closely with the General Contractor, other trades and the Owner to expedite construction, commissioning and avoid interference.

3.2 SUPERVISION AND TRAINING

A. The fire sprinkler contractor shall provide on-site ECS Commissioning Services Package which shall include an ECS certified representative on-site for a minimum of one (1) day to verify the installation of the equipment and provide training to the Owner and Owner's Representative.

B. The fire sprinkler contractor shall provide one (1) printed copy and an electronic file of the Owner's Operation and Maintenance Manual for all corrosion control equipment. The Owner's Manual shall include protocols for operation and maintenance of all equipment installed as part of this scope of work.

3.3 CORROSION PRODUCTS/SYSTEM COMMISSIONING PROTOCOL

A. Dry Pipe and Preaction FPS:

1. The fire sprinkler contractor shall confirm the operation of system air compressor and connect air compressor and nitrogen generator to the FPS.
2. The fire sprinkler contractor shall determine the operating pressure range for the dry/preaction FPS and set the system air maintenance device for each FPS.
3. The fire sprinkler contractor shall document the twenty-four (24) hour leak rate, in psig/hour, of each FPS and provide documentation as part of the As-Built document submittal.
4. The fire sprinkler contractor shall install all of the inerting vents at the locations shown on the approved shop drawings. The isolation ball valve of each device shall be closed during hydrostatic and/or air pressure testing of the FPS and then placed in the open position for the commissioning and operation of the system.
5. The fire sprinkler contractor shall confirm the condensate water discharge from the air compressor drain and the nitrogen generator drain are piped to a floor drain or building exterior per local requirements.
6. The fire sprinkler contractor shall coordinate with the nitrogen generator manufacturer to schedule the on-site commissioning package at a time that has been coordinated with the General Contractor, Owner and Owner's Representative.
7. The fire sprinkler contractor shall close all inerting vents that are not equipped with electronic activation once the FPS nitrogen concentration has reached 98% or greater within fourteen (14) days. Continuous venting is not permitted.

END OF SECTION 215000

DIVISION 26 – ELECTRICAL

SECTION 260000 - GENERAL ELECTRICAL REQUIREMENTS

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.

B. Refer to the following topics of other portions of these specifications:

1. Supplementary Conditions of the Contract for Construction
2. Summary of the Work
3. Submittals
4. Products
5. Project Closeout

C. Refer to Proposal Form for bid breakdown and unit prices, if required.

1.2 SCOPE

A. Provide all labor, materials, tools, equipment, supervision, services, etc., necessary for and incidental to the complete installation of all electrical work and related systems as shown on the drawings, specified herein, and/or required to deliver to the Owner a complete installation ready for continuous and satisfactory operation.

B. All items, systems, etc., necessary or required to make the electrical installation complete and operable shall be understood as part of the work.

C. Any questions as to the scope of the electrical work shall be submitted to the Engineer for resolution prior to bid.

1.3 EXAMINATION OF PREMISES

A. The Contractor shall examine the premises prior to submitting his bid and observe the conditions under which the work will be done or other circumstances which will affect the contemplated work. No allowance will be made subsequently in this connection for any error or negligence on the Contractor's part.

1.4 PERMITS, INSPECTION AND CERTIFICATION

A. Permits

1. The Contractor shall secure and pay for all required permits.
2. The Contractor shall secure and pay for all required low voltage (50 volts and less) permits.

B. Inspection

1. The Contractor shall secure and pay for all required inspections.

C. Certification

1. Certificates of final inspection and approval required by agencies or authorities have jurisdiction shall cover all electrical work.
2. All certificates of final inspection and approval shall be delivered to the Engineer prior to final acceptance of the electrical work.

1.5 GUARANTY

A. The Contractor's attention is hereby directed to the guaranty obligations contained in the GENERAL CONDITIONS of the specifications.

B. All electrical equipment and systems shall be guaranteed by the Contractor for two (2) years after date of acceptance. Contractor shall be fully responsible for all repairs and adjustments to equipment and systems during this guaranty period.

1.6 SHOP DRAWINGS AND MATERIAL LISTS

A. Complete shop drawings and material lists shall be submitted by the Contractor for the approval of the Engineer in accordance with the requirements of the GENERAL CONDITIONS. No work shall be fabricated or ordered by the Contractor until approval has been given by the Engineer.

B. Complete shop drawings showing dimensions, materials, arrangements, and other pertinent data shall be submitted.

C. Complete lists of materials and equipment shall be submitted. For materials and minor items of equipment readily identified in standard publications of various manufacturers, it will be sufficient to state in submission the catalog number for identification. For equipment and material not listed in standard publications of various manufacturers, full description catalog or other data shall be submitted.

D. Shop drawings and material lists shall be submitted.

E. Original manufacturer’s data and specification sheets for all equipment, devices, etc. Annotate descriptive data to show specific model, type and size of each item.

F. Submittals shall include reference to page and paragraph of the specifications or drawing number.

G. Submittals shall include but not be limited to the following information; size, type, functional characteristics, compliance with standards, required service access which shall be suitable for intended location and use, electrical service connections and requirements, and deviations from Contract Document requirements.

H. Submittals shall include Riser Diagrams and Schematic Wiring Diagrams, complete conduit and wire requirements, outlet and junction box sizes and power requirements, for the following systems:

1. Refer to Section 13851 for additional shop drawings and material list requirements.

2. As indicated elsewhere on the drawings or specifications.

1.7 PROTECTION

A. All materials and equipment shall be properly and effectively protected by the Contractor during the execution of the work.

1.8 CODES AND STANDARDS

A. The electrical work covered under the specifications and drawings shall be performed in strict accordance with:

1. National Electrical Code (NEC), NFPA 70-2014 Edition.
2. Appropriate standards of the National Fire Protection Association (NFPA).

B. Standards: The work covered under the specifications and drawings shall be performed using the following references as minimum standards for construction and testing:

1. American National Standards Institute (ANSI).
2. National Electrical Manufacturers Association (NEMA).
3. The Occupational Safety and Health Act (OSHA).
4. Electrical construction materials shall, where a listing is normal for the particular class of material, be listed in "Electrical Construction Material List" of the Underwriters' Laboratories, Inc. (UL) and shall bear the listing label. Electrical equipment shall, where a listing is normal for the particular class of equipment, be listed in the "Electrical Appliance and Utilization Equipment List" of the Underwriters' Laboratories, Inc. (UL) and shall bear the listing label. Materials and equipment listed and labeled as "approved for the purpose" by other nationally recognized testing laboratory, inspection agency or approved organization (such as ETL or Factory Mutual) shall be acceptable.

1.9 CONTRACT DOCUMENTS AND REFERENCES

A. The complete set of fire protection drawings and specifications apply to this work.

B. The drawings and specifications shall be followed in layout of work.

1.10 COORDINATION

A. The Contractor shall have competent supervision on the site at all times to layout, check, coordinate and supervise the installation of all electrical work and be responsible for the accuracy thereof. He shall plan the installation of all electrical work, giving consideration to the work of other trades, to prevent interference.

B. Conditions and/or situations, which prevent the proper installation of any equipment or item where shown on the drawings shall be called to the attention of the Engineer for instructions.

C. The Contractor shall have equipment shipped or fabricated in sections of suitable size for entering the building and being removed from the finished building in the future if necessary.

D. The Contractor shall fully investigate all peculiarities and space limitations for all materials and equipment.

E. Outlet, pull and junction boxes and other appliances which require operation, examination, adjustment, servicing or maintenance shall be readily accessible.

F. The Contractor shall take all field measurements necessary for this work and shall assume responsibility for their accuracy.

G. The Contractor shall coordinate the electrical work with all other sub-contractors. All work shall be so arranged that there will be no delay in the proper installation and completion of any part or parts of electrical equipment. All electrical work shall be installed in proper sequence with other trades without any unnecessary delay.

H. The drawings are to some extent diagrammatic and indicate the general arrangement of the equipment, the runs of conduit and the manner of connection.

I. The Contractor shall confer with all sub-contractors engaged in the construction of the project, regarding the work, which may in any way affect his installation. Whenever interference occurs, before installing any of the work in question, the Contractor shall consult with all sub-contractors and shall come to an agreement with them as to the exact location and level of his conduit parts of his equipment.

J. The Contractor shall be solely responsible for the proper arrangement of his conduit and equipment.

K. The Engineer shall make all final decisions as to any conditions, which require the changing of any work.

1.11 CUTTING AND PATCHING

A. All cutting of walls, floors, roofs, ceilings and/or partitions for the passage of conduits, etc., and closing up of superfluous openings around them in connection with the work under this contract, including the removal of all debris caused thereby, shall be performed by the Contractor.

B. All cutting, patching and finishing shall be performed in accordance with the requirements of the respective division of the specification and shall conform to adjacent work, subject to the approval of the Engineer.

C. Where fireproofing and waterproofing has been removed or damaged in the execution of the work, the Contractor shall have such damage repaired by the respective trades working in the building.

D. Any work already in place that has been disturbed in the execution of the work shall be repaired and restored in harmony with the surrounding work.

1.12 WATERPROOFING

A. Coordinate the work to minimize penetration of waterproof construction including roofs, exterior walls and interior waterproof construction. Where such penetrations are necessary, provide all necessary curbs, sewer, shields, flashings, PATE boxes, fittings and caulking to make the penetrations absolutely watertight.

1.13 MATERIAL AND EQUIPMENT

A. All materials and equipment shall be new, the best of their respective kinds and suitable for the conditions and duties imposed on them.

B. The Contractor shall set-in place and connect all electrical equipment furnished under this Section and all other Sections of the Contract.

C. Verify exact electrical service requirements for each piece of equipment receiving electrical connections. Provide proper service for each.

D. Include any and all items required by the National Electrical Code and/or field conditions for the proper connection and installation of each piece of equipment.

E. Products of one manufacturer shall be used where two or more items of the same kind are required.

1.14 WORKMANSHIP

A. All materials and equipment shall be installed and completed in a first-class workmanlike manner and in accordance with the best modern methods and practice. Any materials installed which shall not present an orderly and reasonably neat or workmanlike appearance shall be removed and replaced when so directed by the Engineer. The removal and replacement of this work shall be done, when directed in writing by the Engineer, at the Contractor's expense.

1.15 MANNER OF INSTALLATION

A. Equipment Supports

1. Provide equipment supports consisting of structural racks, hangers, rods, etc.
2. Equipment supports shall be designed and constructed to safely support and distribute loads evenly over building areas, and withstand stresses to which they may be subjected.
3. Equipment suspended or supported from above shall be secured by approved hanger rods or other supports properly attached to the building structural system. Provide additional steel supports as necessary to prevent swaying of equipment. Hangers shall be as follows:

    a. Concrete - double-plated expansion-type anchors: Hilti, Phillips, or approved equal. Loads shall not exceed 25% of tested pull out or shear strength.
    b. Precase concrete plank construction - drill holes through plank and bolt hanger rod to 4" x 4" x 1/4" steel plate on top of plank. Do not drill through cells.
    c. Steel beams - iron or steel beam clamps.

4. Provide vibration isolators between enclosure of all vibration producing equipment, transformers, etc. and their supports or floor slab. Isolators shall be Mason Industrial Type NK Neoprene and cork sandwich pads.
5. Powder and/or pneumatic actuated type fasteners are not permitted.

B. Access Doors

1. Furnish finish metal access doors and frames as indicated or required for access to concealed electrical equipment requiring inspection, adjustment, maintenance, manual operation, etc., or required by code.
2. Access doors shall be properly sized for the particular application and shall be Inland Steel Products Company's "Milcor" as follows:

    a. Style DW in drywall surfaces.
    b. Style AT in acoustic plaster surfaces.
    c. Style M (stainless steel) in masonry or ceramic tile surfaces and standard in masonry.
    d. Style K in plaster surfaces.

3. In suspended metal pan, lay-in-panel, and accessible tile ceilings, the ceiling element may be used as the access panel.
4. Access doors in 1-1/2 hour fire-rated construction shall bear the Underwriters' Laboratories "B" label.
5. Paint access doors to match existing wall color/finish.

1.16 EQUIPMENT DEVIATIONS

A. The Contractor shall be governed by the requirements of the GENERAL CONDITIONS of these specifications. After an item has been approved, no substitution will be permitted except where such substitution is considered by the Engineer to be the best interest of the Owner or is due to circumstances beyond the control of the Contractor.

B. Where a Contractor proposes to use an item of equipment other than that specified or detailed on the drawings, which requires any redesign of the structure, partitions, foundations, piping, ductwork, wiring, or any other part of the mechanical, electrical, or architectural layout, all such redesign, and all new drawings, and detailing required therefore shall, with the approval of the Engineer, be prepared by the Contractor at his own expense.

C. Where such approved deviation requires a different quantity and arrangement of ductwork, piping, wiring, conduit, and equipment from that specified or indicated on the drawings, with the approval of the Engineer, the Contractor shall furnish and install such ductwork, piping, structural supports, insulation, controllers, motors, starters, electrical wiring and conduit, and any other additional equipment required by the system at no additional cost to the Owner.

1.17 CLEANING AND PAINTING

A. Cleaning

1. All equipment and piping shall be thoroughly cleaned of all cutting waste from reaming and tapping. All burrs and other foreign matter shall be removed. Should any part of the

system be stopped up by such refuse after the various equipment and apparatus has been accepted, the Contractor shall be required to pay for all labor and materials required to locate and remove the obstruction, and replace and repair all work in any way disturbed thereby. All enclosures, etc., shall be cleaned of all rubbish, plaster, and other debris at the completion of the work.

B. Painting

1. Paint all exposed metal surfaces, except for galvanized surfaces, of all electrical equipment in mechanical rooms and equipment spaces.
2. Paint all exposed metal surfaces, except for galvanized surfaces, in crawl spaces and damp or wet locations with one priming coat and one finishing coat of black asphaltum, the priming coat being applied immediately after installation.
3. Do not paint nameplates or other elements where such application would interfere with operation or maintenance of equipment.
4. All scratches or marred areas on factory-painted equipment shall be touched up to match finish.

1.18 TESTS

A. Refer to Section 13851 for additional testing requirements.

B. The Contractor shall provide tests and adjustments for the distribution system (600 volts and below), including branch circuits and the low voltage alarm and signaling systems.

C. The tests shall be performed by competent personnel and shall demonstrate to the satisfaction of the Engineer the following:

1. That all power and control circuits are continuous and free from short circuits.
2. That all circuits are free from unspecified grounds.
3. That the resistance to ground of all non-grounded circuits is not less than one megohm.
4. That all circuits are properly connected in accordance with the applicable wiring diagrams.
5. That all circuits are operable which demonstration shall include functioning of each control not less than ten times and continuous operation of each power circuit for not less than 1/2 hour.
6. That all alarm and signal systems are properly functioning.

D. Any defects shall be corrected at once, and the tests reconducted.

E. All tests shall be conducted prior to the connection of any equipment which would be subject to damage from the testing exercise.

F. The test results shall show that the electrical installation meets the Contract Document requirements.

G. The Contractor shall submit three copies of test results to the Engineer prior to the final acceptance of work. The test results shall include, but not be limited to, the following:

1. Resistance to ground of all phases of all feeders and sub-feeders from all panelboards and transformers back through the distribution to their source.

H. All low voltage signaling and communications systems shall be checked and tested by a qualified representative of the equipment manufacturer. A report shall be submitted to the Engineer prior to final acceptance of the work.

1.19 RECORD DRAWINGS

A. The Contractor shall provide the Owner, upon completion and acceptance of the work, with a set of reproducible record drawings, clearly showing the path of the underground systems, locations of equipment, and any dimensional changes.

B. Refer to individual sections for more detailed record drawing requirements (if applicable).

1.20 IDENTIFICATION

A. Refer to Section 13851 for additional identification requirements.

B. All equipment (disconnects, starters, relays, etc.) shall be identified as to its function, equipment, or area served, etc.

1. In finished areas and mechanical rooms and equipment spaces, identification shall be engraved phenolic plates with approximate 3/16" high black letters on white background. Plates shall be attached to front of devices with stainless steel, oval head, machine screws.
2. Equipment cabinets shall also be identified with stenciled letters, 3/4" high, on inside of cabinet door, colored to contrast with background.

C. All conduits containing electrical branch circuits shall be identified with W. H. Brady B-500 vinyl cloth pipe markers. Labels shall be applied whenever a conduit enters or leaves a switchboard, panelboard, or a junction or pull box, and at each side of penetrations of walls or floors.

D. All identification shall be subject to the approval of the Engineer.

1.21 OPERATING INSTRUCTIONS AND MAINTENANCE MANUALS

A. Operating Instructions

1. The following operating instructions shall be considered a minimum. Refer to individual sections for more detailed operating instruction requirements (if applicable).
2. Upon completion of all work, the Contractor shall thoroughly instruct the Owner's representatives in the proper operation and maintenance of all electrical equipment and systems.
3. Instructions shall be done only after completed systems have been put into operation and tested for proper operation and performance.
4. Instructions shall be given only by experts in the equipment or systems and shall include descriptions and demonstrations of procedures of operation, data record keeping, etc.

B. Maintenance Manuals

1. Maintenance Manuals shall include the following for electrical work. Refer to individual sections for more detailed maintenance manual requirements (if applicable).

a. Index, neatly typed at front.
b. List of materials and equipment with name and address of vendor.
c. List of fuses (style and ampere rating), overload heaters, and other expendable equipment and devices with type, size, or ordering description with name and address of vendor.
d. Operating, maintenance, and installation instructions for all systems and components with name and address of vendor and servicing supplier.
e. A Certificate of Approval from the Electrical Inspector.
f. Final copies of Shop Drawings and Submittals.
g. Manufacturer's guarantees and warranties.

1.22 FINALLY

A. On the completion of the work, the systems and equipment shall be carefully tested by the Contractor for actual operation, and the various pieces of equipment made to function as intended. The entire installation will not be ready for acceptance until it is functioning smoothly and satisfactorily.

B. It is the intention of these specifications to fully cover all required work and equipment for the complete systems so that the whole installation, when accepted, shall be complete and in readiness for regular and satisfactory use.

END OF SECTION 260000

SECTION 260111 - CONDUITS/RACEWAYS

PART 1 - GENERAL

1.1 GENERAL

A. All wiring shall be installed in conduits/raceways as hereinafter specified, unless indicated otherwise.

B. All conduit and surface metal raceway shall be supported per manufacturer’s recommendations and the National Electrical Code.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Rigid metal conduits and couplings shall be full weight, heavy wall steel, galvanized, with threaded connections conforming to the latest editions and revisions of A.N.S.I. Standard C-80.1, Federal Specification WW-C-581E and listed by Underwriters' Laboratories as conforming to Standard UL 6.

1. Provide O-Z type "AX" or "BX" or approved equal fittings with bonding jumpers in each rigid metal conduit passing across a building expansion joint. Type of fitting shall be properly chosen for the movement anticipated.

2. Provide fittings of steel or cast malleable iron by O-Z, T&B, Steel City, or approved equal.

3. Provide O-Z type "A", or approved equal, insulating bushings on all rigid metal conduit terminations.

4. Provide T & B Series 141, or approved equal, locknuts on both inside and outside of all enclosures.

5. Provide O-Z type "S", or approved equal, cable supports in conduit risers as required by the N.E.C.

B. Electrical Metallic Tubing (EMT) shall be galvanized, conforming to the latest editions and revisions of A.N.S.I. Standard C80.3, Federal Specifications WW-C-563, and listed by Underwriters' Laboratories as conforming to Standard 797.

1. Provide O-Z type "TX", or approved equal, expansion fitting with bonding jumpers in each E.M.T. conduit passing across a building expansion joint.

2. Provide steel concrete-tight for interior locations (raintight in damp and liquidtight in wet locations) compression type box connections and couplings with nylon insulating throats by O-Z, T&B, or equal.

3. Provide O-Z type "SBT", or equal, bushing on all EMT conduit terminations not in metal enclosures.

C. Surface Metal Raceways shall be galvanized steel with snap-on covers. Finish with manufacturer's standard prime coating to match existing wall finishes/color. Provide Wiremold Company, Panduit, or an approved equal.

1. Types, sizes, and channels as indicated and required for each application, with fittings that match and mate with raceways.

2. Use two hole straps (704) on all surface metal raceway (minimum 700 series).

3. All exposed surface metal in public areas shall be Wiremold 700.

D. Flexible metal conduit shall be steel, metal strip interlocked construction, zinc-coated, conforming to the latest editions and revisions of Federal Specification WW-C566B and Underwriters' Laboratories Standard for Flexible Steel Conduit, UL 1. Liquid type flexible metal conduit shall be "Sealtite" type UA with PVC cover by Anaconda, or approved equal, with liquid type box connectors.

1. Box connectors shall be two-screw clamp type, of "Tite-Bite" with nylon insulated throat, by T & B or equal.

PART 3 - EXECUTION

3.1 EXECUTION

A. Rigid metal conduit shall be used only under the following conditions:

1. Where required by the NEC.

2. Exposed in crawl spaces or in damp or wet locations.

3. Exposed in mechanical equipment spaces.

B. Electrical Metallic Tubing (EMT) may be used in dry locations throughout except where rigid metal conduit is required and flexible conduit is permitted or indicated.

C. Surface Metal Raceway may be used in dry locations throughout, except where rigid metal conduit and electrical metallic tubing is required and flexible conduit is permitted or indicated.

D. Flexible metal conduit shall be used:

1. For connections to motor terminal boxes and other vibration producing equipment, in 18"-36" lengths, liquid-tight only.

2. Flexible metal conduit may be used in sizes up to 1-1/4" in dry wall partitions where use of other conduit is not practical.

3. Shall not exceed 6 feet in length.

4. Provide a ground wire installed in the conduit bonded to all boxes.

E. Minimum conduit size shall be 3/4" for fire alarm wiring.

F. All conduits shall be installed exposed on walls and concealed above ceilings, etc., throughout, except as follows:

1. In vertical shafts, mechanical and electrical equipment spaces, etc., where concealment is not practical.

2. At surface mounted panelboards and equipment cabinets in finished areas, limited to vertical runs above and below cabinet.

3. Where required for equipment connections.

4. Where indicated on the drawings.

G. All conduit shall be installed as neatly as possible to afford least interference with other trades.

H. All conduits above suspended ceilings shall be rigidly supported by suitable hangers independently from the ceiling and ceiling support systems. Conduits above ceilings with removable panels or tiles shall be located to insure removal of such panels and tiles. Conduits shall be located to insure access to mechanical systems requiring maintenance.

I. All conduits installed exposed shall be rigidly supported and shall closely follow ceiling and building structure contours.

J. All conduits shall be tested for clearance and smooth joints and then capped immediately after installation by T & B "push penny" plugs, or equal, to prevent entrance of moisture or debris.

K. No wire shall be pulled into conduits until system is complete.

L. Conduits shall be located a minimum of 3" from steam and hot water piping.

M. Conduits passing from heated to unheated spaces, exterior spaces, refrigerated spaces, cold air plenums, etc., shall be suitably sealed with "Duxseal" by Johns Manville or sealing fittings to prevent accumulation of condensation.

N. Conduits and sleeves penetrating floor slabs shall have the chopped out space between the outer wall of the piping and the concrete sealed with fire resistant silicone foam listed by UL, or approved equivalent, for use in 2-hour fire rated floor systems.

O. Conduits less than 12" in length connecting outlets of adjoining rooms shall be sealed with "Duxseal" by Johns Manville to prevent noise transmission between rooms.

P. Provide nylon pull wires in all empty conduits.

END OF SECTION 260111

SECTION 260120 – WIRE

PART 1 – GENERAL

1.1 GENERAL

A. Provide all necessary conductors as indicated on the drawings or specified herein.

PART 2 – PRODUCTS

2.1 PRODUCTS

A. All wiring #12 through #10 AWG shall be soft drawn solid copper, 98% conductivity, 600-volt insulation, NEC type THW, THHN or THWN, unless otherwise indicated.

B. All wiring #8 and larger shall be soft drawn stranded copper, 98% conductivity, 600 volt insulation, NEC Type THW, THHN, THWN or XHHW, unless otherwise indicated.

C. All wiring in high ambient temperature locations shall be NEC Type THHN, or XHHW.

D. All wiring #8 and larger for branch circuits shall be stranded. All wiring for control circuits shall be stranded.

E. Wiring smaller than #12 will not be permitted unless specifically indicated, except #14 color-coded wire may be used for control circuits.

F. Wire shall be manufactured by Anaconda, General Cable, Phelps Dodge, Southwire, or an approved equivalent.

G. All wiring shall have identification markings along their outer braid denoting conductor size, type of insulation, and manufacturer's trade name. All wiring shall be color-coded throughout branch circuits as follows:

PHASE	120/208 VOLTS
A	Black
B	Red
C	Blue
Neutral	White
Ground	Green

H. Wiring in sizes up to #8 shall have colored insulation, wiring in sizes #6 and larger shall be coded by colored tape for 6 inches of insulation.

PART 3 – EXECUTION

3.1 EXECUTION

A. Wiring shall not be installed until building is under roof.

B. All wiring for 120 volts general branch circuits shall be sized as follows, unless otherwise indicated.

HOME RUN LENGTH	WIRE SIZE
0 – 75’	#12
75 – 150’	#10
Over 150’	#8

CIRCUIT LENGTH	WIRE SIZE
0 – 100’	#12
Over 100’	#10

In accordance with the above, where the size of branch circuit conductors is increased by the minimum required by the NEC for the branch circuit rating, it is the Electrical Contractor’s responsibility to insure that the termination provisions of all equipment connected to such circuits are listed as suitable for the conductor sizes involved.

C. Use manufacturer approved pulling compound or lubricant where necessary, compound used must not deteriorate conductor insulation. Do not exceed manufacturer’s recommended pulling tensions and side wall pressure values. The use of oils and greases shall not be permitted.

END OF SECTION 260120

SECTION 260130 - BOXES, FITTINGS, AND WIRE TROUGHS

PART 1 - GENERAL

1.1 GENERAL

A. Provide outlet, pull and junction boxes, surface mounted outlet boxes for fire alarm devices, conduit fittings, and wire troughs as indicated on the drawings, required by field conditions for a complete electrical installation or required by the NEC.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. All boxes herein specified shall be galvanized steel or cast malleable iron and of a type suitable for the intended use.

B. Flush boxes to accommodate wiring devices shall be a minimum of 4" square pressed steel with appropriate raised covers.

C. Surface mounted boxes to accommodate fire alarm devices shall be in manufacture’s square cover and back box. Cover shall have twistouts for surface metal raceway on each side. Factory Red finish.

D. Rigid boxes less than 50 cubic inches in size to accommodate wiring devices or used as junctions or pull boxes installed flush in exterior locations, damp or wet locations, or exposed on walls shall be cast boxes equal to Crouse-Hinds Type FS/FD Condulets.

E. EMT boxes less than 50 cubic inches in size to accommodate wiring devices installed exposed on walls and used for junction or pull boxes shall be minimum 4" square pressed steel, equipped with matching covers.

F. Boxes less than 50 cubic inches in size used for junction or pull boxes shall be pressed steel with appropriate blank covers.

G. Boxes 50 cubic inches and larger shall be constructed of hot dip galvanized sheet steel with flat covers secured with round head brass machine screws. All joints shall be welded and ground smooth.

H. Covers for pressed steel boxes, not used for wiring devices, in unfinished areas shall be flat galvanized steel, and in finished areas shall be blank stainless steel device plate. Covers for cast boxes, not used for wiring devices, shall be galvanized steel except cast covers to match box in exterior damp or wet locations.

I. Cast aluminum boxes shall not be permitted.

J. Manufactured boxes shall be Appleton, Raco, Steel City, Crouse-Hinds, Wiremold or an approved equivalent.

PART 3 - EXECUTION

3.1 EXECUTION

A. Boxes flush in block, brick or tile walls shall be located at a course line and provided with square tile covers.

B. Boxes in damp or wet locations shall be equipped with cover gaskets.

C. Boxes flush in or exposed on walls shall be exactly plumb. Flush boxes shall not project beyond the finished surfaces nor shall surfaces project more than 1/8" beyond the box enclosure.

END OF SECTION 260130

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and Specification Sections:

1. Addressable Fire Alarm System: Section 284621.11.

1.2 SUMMARY

A. Section Includes:

1. Labels.
2. Bands and tubes.
3. Tapes and stencils.
4. Tags.
5. Signs.
6. Cable ties.
7. Miscellaneous identification products.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.

B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.

C. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with ASME A13.1.

B. Comply with NFPA 70.

C. Comply with ANSI Z535.4 for safety signs and labels.

D. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 COLOR AND LEGEND REQUIREMENTS

A. Raceways and Cables Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

B. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded branch-circuit conductors.

1. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
2. Colors for 208/120-V Circuits:

a. Phase A: Black.
b. Phase B: Red.
c. Phase C: Blue.

3. Color for Neutral: White.
4. Color for Equipment Grounds: Green.
5. Colors for Isolated Grounds: Green with two or more yellow stripes.

C. Raceways and Cables Carrying Circuits at More Than 600 V:

1. Black letters on an orange field.
2. Legend: "DANGER - CONCEALED HIGH VOLTAGE WIRING."

D. Warning Label Colors:

1. Identify system voltage with black letters on an orange background.

E. Warning labels and signs shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."

2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

F. Equipment Identification Labels:

1. Black letters on a white field.

2.3 LABELS

A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

B. Snap-around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters and that stay in place by gripping action.

C. Self-Adhesive Wraparound Labels: Preprinted, 3-mil- (0.08-mm-) thick, vinyl flexible label with acrylic pressure-sensitive adhesive.

1. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
2. Marker for Labels:

a. Permanent, waterproof, black ink marker recommended by tag manufacturer.
b. Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.

D. Self-Adhesive Labels: Vinyl, thermal, transfer-printed, 3-mil- (0.08-mm-) thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.

1. Minimum Nominal Size:

a. 3-1/2 by 5 inches (76 by 127 mm) for equipment.
b. As required by authorities having jurisdiction/Owner.

2.4 BANDS AND TUBES

A. Snap-around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches (50 mm) long, with diameters sized to suit diameters and that stay in place by gripping action.

B. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameter and shrunk to fit firmly. Full shrink recovery occurs at a maximum of 200 deg F (93 deg C). Comply with UL 224.

2.5 TAPES AND STENCILS

A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide; compounded for outdoor use.

C. Tape and Stencil: 4-inch- (100-mm-) wide black stripes on 10-inch (250-mm) centers placed diagonally over orange background and are 12 inches (300 mm) wide. Stop stripes at legends.

D. Floor Marking Tape: 2-inch- (50-mm-) wide, 5-mil (0.125-mm) pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.

2.6 SIGNS

A. Baked-Enamel Signs:

1. Preprinted aluminum signs, high-intensity reflective, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal Size: 7 by 10 inches (180 by 250 mm).

2.7 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 Deg F (23 Deg C) according to ASTM D638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black, except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 Deg F (23 Deg C) according to ASTM D638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black.

C. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 Deg F (23 Deg C) according to ASTM D638: 7000 psi (48.2 MPa).
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).
5. Color: Black.

2.8 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 PREPARATION

A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of each item before installing identification products.

D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.

G. Vinyl Wraparound Labels:

1. Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.

H. Snap-around Labels: Secure tight to surface at a location with high visibility and accessibility.

I. Self-Adhesive Wraparound Labels: Secure tight to surface at a location with high visibility and accessibility.

J. Self-Adhesive Labels:

1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.

K. Snap-around Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.

L. Heat-Shrink, Preprinted Tubes: Secure tight to surface at a location with high visibility and accessibility.

M. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.

N. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.

1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.

O. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.

P. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's written instructions.

Q. Nonmetallic Preprinted Tags:

1. Place in a location with high visibility and accessibility.
2. Secure using general-purpose cable ties.

R. Write-on Tags:

1. Place in a location with high visibility and accessibility.
2. Secure using general-purpose cable ties.

S. Baked-Enamel Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on minimum 1-1/2-inch- (38-mm-) high sign; where two lines of text are required, use signs minimum 2 inches (50 mm) high.

3.3 IDENTIFICATION SCHEDULE

A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.

C. Power-Circuit Conductor Identification, More Than 600 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use write-on tags.

D. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use write-on tags with the conductor or cable designation, origin, and destination.

E. Workspace Indication: Apply floor marking tape to finished surfaces. Show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

F. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.

G. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Baked-enamel warning signs.

1. Apply to exterior of door, cover, or other access.
2. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:

    a. Power-transfer switches.
    b. Controls with external control power connections.

H. Arc Flash Warning Labeling: Self-adhesive labels.

I. Operating Instruction Signs: Baked-enamel warning signs.

J. Emergency Operating Instruction Signs: Baked-enamel warning signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer.

K. Equipment Identification Labels:

1. Indoor Equipment: Baked-enamel signs.
2. Equipment to Be Labeled:

    a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of a self-adhesive, engraved, laminated acrylic or melamine label.
    b. Enclosures and electrical cabinets.
    c. Access doors and panels for concealed electrical items.
    d. Enclosed switches.
    e. Enclosed circuit breakers.
    f. Enclosed controllers.
    g. Power-transfer equipment.
    h. Contactors.
    i. Remote-controlled switches, dimmer modules, and control devices.
    j. Battery-inverter units.
    k. Monitoring and control equipment.

END OF SECTION 260553

DIVISION 28 – ELECTRICAL SAFETY AND SECURITY

SECTION 284621.11 - ADDRESSABLE FIRE ALARM SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes, but is not limited to:

1. Modifications of the existing fire alarm system (Manufacturer: Siemens; Model: FireFinder XLS) to incorporate new fire alarm addressable interface devices associated with modifications to the existing fire sprinkler systems in the building.

2. Work covered by this section includes the furnishing of labor, equipment, materials, and complete operational performance required for the Fire Alarm System as specified, and as directed by the Engineer.

3. The fire alarm system shall be a phased installation. The intent of the design is to have an operational system in building areas when work is completed and these areas are opened to the public. Therefore, the new fire alarm system shall be operational in all public and staff-occupied areas of the building.

4. The fire alarm/electrical contractor shall provide all necessary equipment, material, design, hardware, software, firmware, and labor to modify the existing fire alarm system, as indicated on the contract drawings.

5. The fire alarm/electrical contractor is responsible for the coordination and costs (material, and labor) to integrate and perform a complete functional test to certify correct operation of the modified portions of the system. Costs do not include the required costs to repair the existing system components.

6. Equipment Removal: After acceptance of the new fire alarm system, disconnect and carefully remove the existing fire alarm equipment, wiring, exposed conduit, and restore damaged surfaces. The owner shall be given right of first refusal to retain all fire alarm equipment demolished as part of this project. Any equipment that the owner does not elect to retain shall be removed from the site by the contractor.

7. The sequence of operations programming for all new devices shall match the sequence of operations of the existing fire alarm system.

1.2 ACTION SUBMITTALS

A. Approved Permit Submittal: Submittals must be approved by authorities having jurisdiction prior to submitting them to Architect.

B. Product Data, Shop Drawings, and Calculations for modifications to fire alarm system.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire alarm systems and components to include in emergency, operation, and maintenance manuals. Provide a complete list of each addressable device to be supervised identifying its associated ID address.

B. Software and firmware operational documentation.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Material: Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

B. Provide the owner with a Device Programmer / Test Unit that is compatible with the equipment included in the existing / modified fire alarm system.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Personnel must be trained and certified by manufacturer for installation of units required for this Project.
2. Installation must be by personnel certified by NICET as fire alarm Level III.
3. Obtain certification by NRTL in accordance with NFPA 72.
4. Licensed or certified by authorities having jurisdiction.

1.6 FIELD CONDITIONS

A. Seismic Conditions: Unless otherwise indicated on Contract Documents, specified Work in this Section must withstand the seismic hazard design loads determined in accordance with ASCE/SEI 7 for installed elevation above or below grade.

1. The term "withstand" means "unit must remain in place without separation of parts from unit when subjected to specified seismic design loads and unit must be fully operational after seismic event."

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace fire alarm system equipment and components that fail because of defects in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Manufacturers: Subject to compliance with the Owner requirements, provide products by SIEMENS.

B. Existing Fire Alarm System To Be Modified:

1. Basis for Pricing: Siemens; Model FireFinder XLS

2.2 ADDRESSABLE INTERFACE DEVICES

A. Description: Monitor module listed for use in providing a system address for listed alarm-initiating devices for wired applications with normally open contacts.

PART 3 – EXECUTION

3.1 EXECUTION

A. Preparation:

1. Interruption of Existing Fire Alarm Service: Do not interrupt fire alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service in accordance with requirements indicated:

a. Notify Architect, Owner no fewer than seven days in advance of proposed interruption of fire alarm service.
b. Do not proceed with interruption of fire alarm service without Architect's, Owner's written permission.

B. Installation of Equipment:

1. Connecting to Existing Equipment: Verify that existing fire alarm system is operational before making changes or connections.

a. Expand, modify, and supplement existing monitoring equipment as necessary to extend existing monitoring functions to new points. New components must be capable of merging with existing configuration without degrading performance of either system.

C. Electrical Connections:

1. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

a. Nameplate must be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
b. Nameplate must be laminated acrylic or melamine plastic signs with black background and engraved white letters at least 1/2 inch (13 mm) high.

D. Pathways:

1. Pathways above recessed ceilings and in inaccessible locations may be routed exposed.

a. Exposed pathways located less than 96 inch (2440 mm) above floor must be installed in EMT.

2. Pathways must be installed in EMT.
3. Exposed EMT must be painted red enamel.

E. Connections:

1. Connect hardware and devices to fire alarm system.

a. Verify that hardware and devices are listed for use with installed fire-alarm system before making connections.

F. Field Quality Control:

1. Field tests must be witnessed by Architect, Engineer of Record.

2. Tests and Inspections:

a. Factory-authorized service representative must prepare "Fire Alarm System Record of Completion" in "Documentation" section of "Fundamentals" chapter in NFPA 72 and "Inspection and Testing Form" in "Records" section of "Inspection, Testing and Maintenance" chapter in NFPA 72.

3. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
4. Annual Test and Inspection: One year after date of Substantial Completion, test fire alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

G. Demonstration:

1. Train Owner's maintenance personnel to adjust, operate, and maintain fire alarm system. Provide video recording of training to Owner. Provide a minimum of sixteen (16) hours of training. Training/demonstration will be provided over two to four sessions.

H. Maintenance:

1. Maintenance Service: Beginning at Substantial Completion, maintenance service must include 12 months' full maintenance by skilled employees of manufacturer's designated service organization.

I. Software Service Agreement:

1. Technical Support: Beginning at Substantial Completion, service agreement must include software support for two years.
2. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software must include operating system and new or revised licenses for using software.

    a. Upgrade Notice: At least 30 days to allow Owner to schedule access to system and to upgrade computer equipment if necessary.

END OF SECTION 284621.11