

SECTION 21 05 11
COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The requirements of this Section apply to all sections of Division 21.
- B. Definitions:
 - 1. Exposed: Piping and equipment exposed to view in finished rooms.
 - 2. Option or optional: Contractor's choice of an alternate material or method.

1.2 RELATED WORK

- A. The following references are made a part of these specifications:
 - 1. Section 01 00 00, GENERAL REQUIREMENTS.
 - 2. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
 - 3. Section 03 30 00, CONCRETE AND GROUT, CAST-IN-PLACE CONCRETE.
 - 4. Section 05 31 00, BUILDING COMPONENTS FOR ATTACHMENT OF HANGERS, STEEL DECKING.
 - 5. SECTION 05 36 00, COMPOSITE METAL DECKING.
 - 6. Section 05 50 00, METAL FABRICATIONS.
 - 7. Section 07 84 00, FIRESTOPPING.
 - 8. Section 07 60 00, FLASHING AND SHEET METAL, FLASHING FOR WALL AND ROOF PENETRATIONS.
 - 9. Section 07 92 00, JOINT SEALANTS.
 - 10. Section 21 05 12, GENERAL MOTOR REQUIREMENTS FOR FIRE SUPPRESSION EQUIPMENT
 - 11. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS
 - 12. Section 31 20 00, EARTH MOVING, EXCAVATION AND BACKFILL,

1.3 QUALITY ASSURANCE

- A. Products Criteria:
 - 1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 3 years. See other specification sections for any exceptions.
 - 2. Equipment Service: Products shall be supported by a service organization which maintains a complete inventory of repair parts and is located reasonably close to the site.
 - 3. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
 - 4. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
 - 5. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.
 - 6. **ASBESTOS PRODUCTS OR EQUIPMENT OR MATERIALS CONTAINING ASBESTOS SHALL NOT BE USED.**
- B. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the Resident Engineer

prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

C. Guaranty: In GENERAL CONDITIONS.

D. Extended Guarantee Period Services:

1. Qualifications: All service technicians assigned to perform work under this contract shall be qualified and factory trained by the Original Equipment Manufacturer (O.E.M.). Each technician shall have at least three years experience of working on comparable systems and shall be a full time employee of the contractor. The contractor shall furnish, for the Department of Veterans Affairs (VA) review and approval, resumes of all service technicians scheduled to service the equipment and systems. The resume shall include details of experience, training, and educational qualifications and performance evaluations.
2. Replacement Parts: The contractor shall be equipped with all replacement parts of all equipment and systems to be serviced and the manufacturer's standard service and repair procedures. All replacement parts shall be brand new and of current design. The replacement parts shall be O.E.M. items. Obsolete or refurbished parts are unacceptable. "Approved Equal" parts must have prior approval of the Contracting Officer. Contractor shall furnish evidence of guaranteed supply of parts for the life of the system.
3. Service Supplies: The services shall include, without any additional cost to the government, all replacement parts, special tools and equipment, and consumable materials, that is, lubrication oil, grease, and cleaning materials, as required. The requirement of UL listing, where applicable, shall not be voided by any replacement parts, components, software, or modifications provided by the contractor.
4. Scheduled and Emergency Call Service: The service shall include a scheduled monthly visit to perform systematic examination of equipment and/or systems and a 7 day, 24 hours call back service for emergency service. The emergency service is defined as a situation created by a breakdown or malfunction of any equipment or system warranting urgent attention. A qualified service representative shall respond to the VA request for emergency service within two hours and assess the problem either by telephone or remote diagnostic capability. If the emergency situation cannot be rectified by the VA personnel, on site emergency service shall be provided by sending a qualified service representative within 24 hours. For the rural locations of the VA medical centers, situated over 200 miles from the contractor's established service depot, the maximum response time of 48 hours shall be acceptable. The emergency service shall be limited to adjustments and repairs specifically required to protect the safety of the equipment for which the emergency service was required to be performed.
5. Licensing: The contractor shall be licensed to perform the contracted services. The contractor shall furnish details of all applicable local and state licensing requirements to VA as a part of the qualification requirements. The licenses shall be current, valid through the term of the contract and in the name of the contractor.
6. Documentation Requirements: The contractor shall maintain a separate log for each item of equipment and each system covered under the extended guarantee period service contract with the VA Medical Center (VAMC) Engineering Service. The log shall list dates and times of all scheduled and emergency calls. Each emergency call shall be described with details of the nature and causes of emergency, steps taken to rectify the situations, and specific recommendations to avoid such conditions in the future.
7. Reports: The contractor shall provide a quarterly report for the first year and twice a year for the remainder of the guarantee period for all equipment and systems serviced under the extended guarantee period contract. The report shall clearly and concisely describe the services rendered, parts replaced, and repairs performed. The report shall prescribe anticipated future needs of the equipment and systems for preventive and predictive maintenance.

8. Quality Program: The contractor shall provide a description of the quality management and control program. The description shall include a tangible proof the existence of such program, names of at least three customers who have participated in the program, and specific information showing the applicability of program to the project.
 9. Training: During each scheduled service visit, the contractor shall actively involve the VAMC maintenance personnel in performing scheduled service and associated activities. The practical training during the scheduled service visits shall include parting oral and written instructions, for each specific task of the servicing contract, to the VAMC maintenance personnel who shall operate the hardware and software in accordance with the intent of the design and under direct supervision of the service contractor's qualified service technician. At the end of the first year of the service contract, the contractor shall obtain a certificate from the VAMC Engineering Service confirming completion of training to the authorized VA representatives.
 10. Classroom Training: Provide list and costs of available classroom training courses offered by contractor or O.E.M.
- E. Supports for sprinkler piping shall be in conformance with NFPA 13.
- F. Supports for standpipe shall be in conformance with NFPA 14.
- 1.4 SUBMITTALS
- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
 - B. Manufacturer's Literature and Data: Submit under the pertinent section rather than under this section.
 1. Equipment and materials identification.
 2. Fire-stopping materials.
 3. Hangers, inserts, supports and bracing. Provide load calculations for variable spring and constant support hangers.
 4. Wall, floor, and ceiling plates.
 - C. Coordination Drawings: Provide details of the following.
 1. Hangers, inserts, supports, and bracing.
 2. Pipe sleeves.
 3. Equipment penetrations of floors, walls, ceilings, or roofs.
 - D. Maintenance Data and Operating Instructions:
 1. Maintenance and operating manuals in accordance with Section 01 00 00, GENERAL REQUIREMENTS, Article, INSTRUCTIONS, for systems and equipment.
 2. Provide a listing of recommended replacement parts for keeping in stock supply, including sources of supply, for equipment. Include in the listing belts for equipment.
 3. APPLICABLE PUBLICATIONS
 - E. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
 - F. American Society for Testing and Materials (ASTM):

A36/A36M-2001	Carbon Structural Steel
A575-96	Steel Bars, Carbon, Merchant Quality, M-Grades R (2002)
E84-2003	Standard Test Method for Burning Characteristics of Building Materials
E119-2000	Standard Test Method for Fire Tests of Building Construction and Materials

- G. National Fire Protection Association (NFPA):
101-2009 Life Safety Code

1.5 COMMISSIONING.

- A. Commissioning of a system or systems specified in this section is part of the construction process. Documentation and testing of these systems, as well as training of the Owner's operation and maintenance personnel, is required in cooperation with the Owner's Representative and the Commissioning Authority. Project Closeout is dependent on successful completion of all commissioning procedures, documentation, and issue closure. Refer to Section 019113, Commissioning, for detailed commissioning requirements.

PART 2 - PRODUCTS

2.1 LIFTING ATTACHMENTS

- A. Provide equipment with suitable lifting attachments to enable equipment to be lifted in its normal position. Lifting attachments shall withstand any handling conditions that might be encountered, without bending or distortion of shape, such as rapid lowering and braking of load.

2.2 EQUIPMENT AND MATERIALS IDENTIFICATION

- A. Use symbols, nomenclature and equipment numbers specified, shown on the drawings and shown in the maintenance manuals.
- B. Interior (Indoor) Equipment: Engraved nameplates, with letters not less than 48 mm (3/16 inch) high of brass with black filled letters, or rigid black plastic with white letters permanently fastened to the equipment. Identify unit components such as coils, filters, fans, etc.
- C. Exterior (Outdoor) Equipment: Brass nameplates, with engraved black filled letters, not less than 48 mm (3/16 inch) high riveted or bolted to the equipment.
- D. Valve Tags and Lists:
1. Valve tags: Engraved black filled numbers and letters not less than 13 mm (1/2 inch) high for number designation, and not less than 6.4 mm (1/4 inch) for service designation on 19 gage 38 mm (1 1/2 inches) round brass disc, attached with brass "S" hook or brass chain.
 2. Valve lists: Typed or printed plastic coated card(s), sized 216 mm (8 1/2 inches) by 280 mm (11 inches) showing tag number, valve function and area of control, for each service or system. Punch sheets for a 3 ring notebook.
 3. Provide detailed plan for each floor of the building indicating the location and valve number for each valve. Identify location of each valve with a color coded thumb tack in ceiling.

2.3 FIRESTOPPING

- A. Section 07 84 00, FIRESTOPPING specifies an effective barrier against the spread of fire, smoke and gases where penetrations occur for piping.

2.4 GALVANIZED REPAIR COMPOUND

- A. Mil. Spec. DOD-P-21035B, paint form.

2.5 PIPE PENETRATIONS

- A. Install sleeves during construction for other than blocked out floor openings for risers in mechanical bays.
- B. To prevent accidental liquid spills from passing to a lower level, provide the following:
1. For sleeves: Extend sleeve 25 mm (one inch) above finished floor and provide sealant for watertight joint.

2. For blocked out floor openings: Provide 40 mm (1¹/₂ inch) angle set in silicone adhesive around opening.
 3. For drilled penetrations: Provide 40 mm (1¹/₂ inch) angle ring or square set in silicone adhesive around penetration.
- C. Penetrations are not allowed through beams or ribs, but may be installed in concrete beam flanges. Any deviation from this requirement must receive prior approval of Resident Engineer.
 - D. Sheet Metal, Plastic, or Moisture resistant Fiber Sleeves: Provide for pipe passing through floors, interior walls, and partitions, unless brass or steel pipe sleeves are specifically called for below.
 - E. Cast Iron or Zinc Coated Pipe Sleeves: Provide for pipe passing through exterior walls below grade. Make space between sleeve and pipe watertight with a modular or link rubber seal. Seal shall be applied at both ends of sleeve.
 - F. Galvanized Steel or an alternate Black Iron Pipe with asphalt coating Sleeves: Provide for pipe passing through concrete beam flanges, except where brass pipe sleeves are called for. Provide sleeve for pipe passing through floor of mechanical rooms, laundry work rooms, and animal rooms above basement. Except in mechanical rooms, connect sleeve with floor plate.
 - G. Brass Pipe Sleeves: Provide for pipe passing through quarry tile, terrazzo or ceramic tile floors. Connect sleeve with floor plate.
 - H. Sleeves are not required for wall hydrants for fire department connections or in drywall construction.
 - I. Sleeve Clearance: Sleeve through floors, walls, partitions, and beam flanges shall be one inch greater in diameter than external diameter of pipe. Sleeve for pipe with insulation shall be large enough to accommodate the insulation. Interior openings shall be caulked tight with fire stopping material and sealant to prevent the spread of fire, smoke, and gases.
 - J. Sealant and Adhesives: Shall be as specified in Section 07 92 00, JOINT SEALANTS.
- 2.6 TOOLS AND LUBRICANTS
- A. Furnish, and turn over to the Resident Engineer, special tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.
 - B. Tool Containers: Hardwood or metal, permanently identified for intended service and mounted, or located, where directed by the Resident Engineer.
- 2.7 WALL, FLOOR AND CEILING PLATES
- A. Material and Type: Chrome plated brass or chrome plated steel, one piece or split type with concealed hinge, with set screw for fastening to pipe, or sleeve. Use plates that fit tight around pipes, cover openings around pipes and cover the entire pipe sleeve projection.
 - B. Thickness: Not less than 2.4 mm (3/32 inch) for floor plates. For wall and ceiling plates, not less than 0.64 mm (0.025-inch) for up to 80 mm (3 inch pipe), 0.89 mm (0.035-inch) for larger pipe.
 - C. Locations: Use where pipe penetrates floors, walls and ceilings in exposed locations, in finished areas only. Use also where insulation ends on exposed water supply pipe drop from overhead. Provide a watertight joint in spaces where brass or steel pipe sleeves are specified.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Coordinate location of piping, sleeves, inserts, hangers, and equipment. Locate piping, sleeves, inserts, hangers, and equipment clear of windows, doors, openings, light outlets, and other services and utilities. Follow manufacturer's published recommendations for installation methods not otherwise specified.
- B. Protection and Cleaning:
1. Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the Resident Engineer. Damaged or defective items in the opinion of the Resident Engineer shall be replaced.
 2. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Tightly cover and protect equipment against dirt, water chemical or mechanical injury. At completion of all work thoroughly exposed materials and equipment.
- C. Concrete and Grout: Use concrete and shrink compensating grout 25 MPa (3000 psi) minimum, specified in Section 03 30 05, CAST-IN-PLACE CONCRETE.
- D. Install gages, valves, and other devices with due regard for ease in reading or operating and maintaining said devices. Locate and position gages to be easily read by operator or staff standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.
- E. Work in Existing Building:
1. Perform as specified in Article, OPERATIONS AND STORAGE AREAS, Article, ALTERATIONS, and Article, RESTORATION of the Section 01 00 00, GENERAL REQUIREMENTS for relocation of existing equipment, alterations and restoration of existing building(s).
 2. As specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, OPERATIONS AND STORAGE AREAS, make alterations to existing service piping at times that will least interfere with normal operation of the facility.
 3. Cut required openings through existing masonry and reinforced concrete using diamond core drills. Use of pneumatic hammer type drills, impact type electric drills, and hand or manual hammer type drills, will be permitted only with approval of the Resident Engineer. Locate openings that will least effect structural slabs, columns, ribs or beams. Refer to the Resident Engineer for determination of proper design for openings through structural sections and opening layouts approval, prior to cutting or drilling into structure. After Resident Engineer's approval, carefully cut opening through construction no larger than absolutely necessary for the required installation.
- F. Switchgear Drip Protection: Every effort shall be made to eliminate the installation of pipe above electrical and telephone switchgear. If this is not possible, encase pipe in a second pipe with a minimum of joints.
- G. Inaccessible Equipment:
1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled or remedial action performed as directed at no additional cost to the Government.
 2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.

3.2 GROUT

- A. Description: ASTM C 1107, factory mixed and packaged, dry, hydraulic cement, non-shrink and non-metallic grout; suitable for interior and exterior applications.
 - 1. Properties: Non-staining, non-corrosive, and non-gaseous.
 - 2. Design Mix: 5000 psi (34.5 MPa), 28-day compressive strength.

3.3 LUBRICATION

- A. Field check and lubricate equipment requiring lubrication prior to initial operation.

3.4 CLEANING AND PROTECTION

- A. Clean dirt and debris from sprinklers.
- B. Remove and replace sprinklers with paint other than factory finish.
- C. Protect sprinklers from damage until Substantial Completion.
- D. Provide instructions to VA personnel in accordance with Article, INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS.
- E. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.

3.5 OPERATING AND PERFORMANCE TESTS

- A. Prior to the final inspection, perform required tests as specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, TESTS and submit the test reports and records to the Resident Engineer.
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 3. Energize circuits to electrical equipment and devices.
 - 4. Start and run excess-pressure pumps.
 - 5. Start and run air compressors.
 - 6. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
 - 7. Flush, test, and inspect standpipe systems according to NFPA 14, "System Acceptance" Chapter.
 - 8. Coordinate with fire alarm tests. Operate as required.
 - 9. Coordinate with fire-pump tests. Operate as required.
 - 10. Verify that equipment hose threads are same as local fire department equipment.
- C. Report test results promptly and in writing to the ENGINEER and authorities having jurisdiction.
- D. Should evidence of malfunction in any tested system, or piece of equipment or component part thereof, occur during or as a result of tests, make proper corrections, repairs or replacements, and repeat tests at no additional cost to the Government.
- E. Functional Performance & Integrated Systems Testing is part of the Commissioning Process. Functional Performance & Integrated Systems Testing shall be performed by the contractor and witnessed and documented by the Commissioning Authority. Refer to Section 019113, Commissioning, for functional performance and integrated systems testing and commissioning requirements.

3.6 INSTRUCTIONS TO VA PERSONNEL

- A. Provide in accordance with Article, INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS.
- B. 3.6B Training of the Owner's operation and maintenance personnel is required in cooperation with the Owner's Representative. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems. The instruction shall be scheduled in coordination with the Owner's Representative after submission and approval of formal training plans. Refer to Section 017900, Demonstration and Training, and Section 019113, Commissioning, for contractor training requirements.

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SECTION 21 05 16
EXPANSION FITTINGS, LOOPS FOR FIRE SUPPRESSION
SEISMICALLY QUALIFIED PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following pipe expansion joints and expansion compensation devices for mechanical piping systems:
1. In Line Seismic expansion joints.
 2. Alignment guides and anchors.

1.3 DEFINITIONS

- A. The definitions listed herein may be used in these specifications
1. BR: Butyl rubber.
 2. Buna-N: Nitrile rubber.
 3. CR: Chlorosulfonated polyethylene synthetic rubber.
 4. CSM: Chlorosulfonyl-polyethylene rubber.
 5. EPDM: Ethylene-propylene-diene terpolymer rubber.
 6. NR: Natural rubber.
 7. PTFE: Polytetrafluoroethylene plastic.

1.4 PERFORMANCE REQUIREMENTS

- A. Compatibility: Products shall be suitable for piping system fluids, materials, working pressures, and temperatures.
- B. Capability: Products shall absorb 200 percent of maximum axial movement between anchors.

1.5 SUBMITTALS

- A. Product Data: For each type of pipe expansion joint and alignment guide indicated.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer.
1. Design Calculations: Calculate requirements for thermal expansion of piping systems and for selecting and designing expansion joints, loops, and bends.
 2. Anchor Details: Detail fabrication of each anchor indicated. Show dimensions and methods of assembly and attachment to building structure.
 3. Alignment Guide Details: Detail field assembly and attachment to building structure.
 4. Schedule: Indicate type, manufacturer's number, size, material, pressure rating, end connections, and location for each expansion joint.
- C. Product Certificates: For each type of pipe expansion joint, signed by product manufacturer.
- D. Welding certificates.
- E. Operation and Maintenance Data: For pipe expansion joints to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to the following:
 - 1. Steel Shapes and Plates: AWS D1.1, "Structural Welding Code - Steel."
 - 2. Welding to Piping: ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 INLINE SEISMIC EXPANSION JOINTS

- A. In Line Seismic Metal-Bellows & Ball joints Expansion Joints: Fully enclosed in-line construction. Expansion shall be three ply externally pressurized expansion for axial motion and lateral offset. Design requiring elbows or a change in direction are not acceptable .
 - 1. Acceptable Manufacturers:
 - a. Adsko Manufacturing, LLC.
 - b. Hyspan Precision Products, Inc Model Number .Series 3500 IS
 - c. Metraflex, Inc.
 - d. Senior Flexonics, Inc.; Pathway Division.
 - 2. Metal-Bellows and Ball Joint Expansion Joints for Steel Piping: Single-ply stainless-steel bellows, steel pipe end connections,
 - 3. Minimum Pressure Rating: 150 psig (1035 kPa) at 400⁰F, unless otherwise indicated.
 - 4. Configuration: Single bellows type without base, unless otherwise indicated.
 - 5. End Connections: Weld.
- B. Bellow design shall be in accordance with the Standards of the Expansion Joint Manufacturers Association, Inc., complying with ASME Boiler and Pressure Vessel Code: Section II, "Materials," and with ASME B31.9, "Building Services Piping," for materials and design of pressure-containing parts and bolting. Using ASME Section II part D for allowable stress. Minimum fatigue life shall be 100 cycles. Internal vented guiding shall be included.
 - 1. Angular Deflection for NPS 8 (DN 200) and Larger: 15-degree minimum

2.3 ALIGNMENT GUIDES

- A. Description: Steel, factory fabricated, with bolted two-section outer cylinder and base for alignment of piping and two-section guiding spider for bolting to pipe.
 - 1. Acceptable Manufacturers:
 - a. Adsko Manufacturing, LLC.
 - b. Hyspan Precision Products, Inc.
 - c. Metraflex, Inc.
 - d. Senior Flexonics, Inc.; Pathway Division.

2.4 MATERIALS FOR ANCHORS

- A. Steel Shapes and Plates: ASTM A 36/A 36M.
- B. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel, hex head.

- C. Washers: ASTM F 844, steel, plain, flat washers.
- D. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened Portland cement concrete, and tension and shear capacities appropriate for application.
 - 1. Stud: Threaded, zinc-coated carbon steel.
 - 2. Expansion Plug: Zinc-coated steel.
 - 3. Washer and Nut: Zinc-coated steel.
- E. Chemical Fasteners: Insert-type-stud bonding system anchor for use with hardened Portland cement concrete, and tension and shear capacities appropriate for application.
 - 1. Bonding Material: ASTM C 881, Type IV, Grade 3, 2-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.
 - 2. Stud: ASTM A 307, zinc-coated carbon steel with continuous thread on stud, unless otherwise indicated.
 - 3. Washer and Nut: Zinc-coated steel.
- F. Concrete: Portland cement mix, 3000 psi (20.7 MPa) minimum.
- G. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink, nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Non-staining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000 psi (34.5 MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 EXPANSION-JOINT INSTALLATION

- A. Install manufactured, nonmetallic expansion joints according to FSA's "Technical Handbook: Non-Metallic Expansion Joints and Flexible Pipe Connectors."
- B. Install expansion joint in accordance with EJMA (Expansion Joint Manufacturer's Association Standard)
- C. Install expansion joints of sizes matching size of piping in which they are installed.
- D. Install alignment guides to allow expansion and to avoid end-loading and torsional stress.

3.2 SWING CONNECTIONS

- A. Connect risers and branch connections to mains with at least five pipe fittings, including tee in main.
- B. Connect risers and branch connections to terminal units with at least four pipe fittings, including tee in riser.
- C. Connect mains and branch connections to terminal units with at least four pipe fittings, including tee in main.

3.3 ALIGNMENT-GUIDE INSTALLATION

- A. Install guides on piping adjoining pipe expansion joints and bends and loops.
- B. Attach guides to pipe and secure to building structure.

3.4 ANCHOR INSTALLATION

- A. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.
- B. Fabricate and install steel anchors by welding steel shapes, plates, and bars to piping and to structure. Comply with ASME B31.9 and AWS D1.1.
- C. Construct concrete anchors of poured-in-place concrete of dimensions indicated and include embedded fasteners.
- D. Install pipe anchors according to expansion-joint manufacturer's written instructions if expansion joints or compensators are indicated.
- E. Use grout to form flat bearing surfaces for expansion fittings, guides, and anchors installed on or in concrete.

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SECTION 21 05 19
METERS AND GAGES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section includes the following meters and gages for mechanical systems:
 - 1. Gages.

1.2 DEFINITIONS

- A. The definitions used herein may be used in these specifications
 - 1. CR: Chlorosulfonated polyethylene synthetic rubber.
 - 2. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated; include performance curves.
- B. Shop Drawings: Schedule for thermometers and gages indicating manufacturer's number, scale range, and location for each.
- C. Product Certificates: For each type of thermometer and gage, signed by product manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PRESSURE GAGES

- A. Manufacturers:
 - 1. AMETEK, Inc.; U.S. Gauge Div.
 - 2. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
 - 3. Ernst Gage Co.
 - 4. Terice, H. O. Co.
 - 5. Weiss Instruments, Inc.
 - 6. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
- B. Direct-Mounting, Dial-Type Pressure Gages: Indicating-dial type complying with ASME B40.100.
 - 1. Case: Dry type, drawn steel or cast aluminum, 6 inch (152-mm) diameter.
 - 2. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.
 - 3. Pressure Connection: Brass, NPS 1/4 (DN 8), bottom-outlet type unless back-outlet type is indicated.
 - 4. Movement: Mechanical, with link to pressure element and connection to pointer.
 - 5. Dial: Satin-faced, non-reflective aluminum with permanently etched scale markings.

6. Pointer: Red metal.
 7. Window: Glass.
 8. Ring: Brass.
 9. Accuracy: Grade B, plus or minus 2 percent of middle half scale.
 10. Vacuum-Pressure Range: 30 in. Hg of vacuum to 15 psig of pressure (100 kPa of vacuum to 103 kPa of pressure).
 11. Range for Fluids under Pressure: Two times operating pressure.
- C. Pressure-Gage Fittings:
1. Valves: NPS 1/4 (DN 8) brass or stainless-steel needle type.
 2. Syphons: NPS 1/4 (DN 8) coil of brass tubing with threaded ends.
 3. Snubbers: ASME B40.5, NPS 1/4 (DN 8) brass bushing with corrosion-resistant, porous-metal disc of material suitable for system fluid and working pressure.

PART 3 - EXECUTION

3.1 GAGE APPLICATIONS

- A. Install dry case type pressure gages in the standpipe/riser at every floor.

3.2 INSTALLATIONS

- A. Install direct-mounting pressure gages in piping tees with pressure gage located on pipe at most readable position.
- B. Install needle-valve and snubber fitting in piping for each pressure gage for fluids

3.3 CONNECTIONS

- A. Install gages adjacent to pipes to allow service and maintenance.

3.4 ADJUSTING

- A. Calibrate meters according to manufacturer's written instructions, after installation.
- B. Adjust faces of meters and gages to proper angle for best visibility.

--- E N D ---

SECTION 21 05 23
GENERAL DUTY VALVES FOR FIRE SUPPRESSION SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes the requirements for valves for fire suppression systems.

1.2 RELATED WORK

- A. Section 21 05 11, COMMON WORK RESULTS FOR FIRE SUPPRESSION.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES. Manufacturer's Literature and Data:
 - 1. Valves.
 - 2. Backflow Preventers.

1.4 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):A536-84(R 2004) Standard Specification for Ductile Iron Castings
- C. American Society of Sanitary Engineering (ASSE)
ASSE 1013-05, Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers
- D. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS):
 - SP-25-98 Standard Marking System for Valves, Fittings, Flanges and Unions
 - SP-67-02a (R 2004) Butterfly Valve of the Single flange Type (Lug Wafer)
 - SP-70-06 Cast Iron Gate Valves, Flanged and Threaded Ends.
 - SP-72-99 Ball Valves With Flanged or Butt Welding For General Purpose
 - SP-110-96 Ball Valve Threaded, Socket Welding, Solder Joint, Grooved and Flared Ends

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Valves shall be prepared for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, grooves, and weld ends.
 - 3. Set gate, and globe valves closed to prevent rattling.
 - 4. Set ball open to minimize exposure of functional surfaces
 - 5. Set butterfly valves closed or slightly open.
 - 6. Block check valves in either closed or open position.
- B. Valves shall be prepared for storage as follows:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher than ambient dew point temperature.
- C. A sling shall be used for large valves. The sling shall be rigged to avoid damage to exposed parts. Hand wheels or stems shall not be used as lifting or rigging points.

PART 2 - PRODUCTS

2.1 VALVES

- A. **ASBESTOS PACKING AND GASKETS ARE PROHIBITED.**
- B. Valves shall be in accordance with NFPA 13.
- C. Do not use quarter turn ball valves for 50 mm (2 inch) or larger drain valves.
- D. Shut-off:
1. 50 mm or DN 50 (2 inches) and smaller: Ball, MSS SP-72, SP-110, Ball valve shall be full port three piece or two piece with a union design with adjustable stem package. Threaded stem designs are not allowed. The ball valve shall have a SWP rating of 1035 kPa (150 psig) and a CWP rating of 4140 kPa (600 psig). The body material shall be Bronze ASTM B584, Alloy C844. The ends shall be solder,
 2. More than 50 mm but less than 100 mm DN 100 (4 inches): Butterfly shall have an iron body with EPDM seal and aluminum bronze disc. The butterfly valve shall meet MSS SP-67, type I standard. The butterfly valve shall have a SWP rating of 1380 kPa (200 psig). The valve design shall be lug type suitable for bidirectional dead-end service at rated pressure. The body material shall meet ASTM A 536, ductile iron.
 3. 100 mm (DN 100) (4 inches) and larger:
 - a. Class 125, OS&Y, Cast Iron Gate Valve. The gate valve shall meet MSS-SP-70 type I standard. The gate valve shall have a CWP rating of 1380 kPa (200 psig). The valve materials shall meet ASTM A 126, grey iron with bolted bonnet, flanged ends, bronze trim, and solid wedge disc. The gate valve shall be gear operated for sizes under 200 mms or DN 200 (8 inches) and crank operated for sizes 200 mms or DN 200 (8 inches) and above
 - b. Single flange, ductile iron butterfly valves: The single flanged butterfly valve shall meet the MSS SP-67 standard. The butterfly valve shall have a CWP rating of 1380 kPa (200 psig). The butterfly valve shall be lug type, suitable for bidirectional dead-end service at rated pressure without use of downstream flange. The body material shall comply with ASTM A536 ductile iron. The seat shall be EPDM with stainless steel disc and stem.
 - c. Grooved end, ductile iron butterfly valves. The grooved butterfly valve shall meet the MSS SP-67 standard. The grooved butterfly valve shall have a CWP rating of 1380 kPa (200 psig). The valve materials shall be polyamide coated ductile iron conforming to ASTM A536 with two piece stainless steel stem, EPDM encapsulated ductile iron disc, and EPDM seal. The butterfly valve shall be gear operated
- E. Check:
1. Check valves less than 80 mm or DN80 (3 inches) and smaller) shall be class 125, bronze swing check valves with non metallic Buna-N disc. The check valve shall meet MSS SP-80 Type 4 standard. The check valve shall have a CWP rating of 1380 kPa (200 psig). The check valve shall have a Y pattern horizontal body design with bronze body material conforming to ASTM B 62, solder joints, and PTFE or TFE disc.
 2. Larger than 100 mm or DN100 (4 inches and larger):
 3. Check valves shall be class 125, iron swing check valve with lever and weight closure control. The check valve shall meet MSS SP-71 Type I standard. The check valve shall have a CWP rating of 1380 kPa (200 psig). The check valve shall have a clear or full waterway body design with gray iron body material conforming to ASTM A 126, bolted bonnet, flanged ends, and bronze trim.

F. Globe:

1. 80 mm or DN80 (3 inches) or smaller: Class 150, bronze globe valve with non metallic disc. The globe valve shall meet MSS SP-80, Type 2 standard. The globe valve shall have a CWP rating of 2070 kPa (300 psig). The valve material shall be bronze with integral seal and union ring bonnet conforming to ASTM B 62 with solder ends, copper-silicon bronze stem, TPFPE or TFE disc, and malleable iron hand wheel.
2. Larger than 80 mm or DN80 (3 inches): Similar to above, except with cast iron body and bronze trim, class 125, iron globe valve. The globe valve shall meet MSS SP-85, Type 1 standard. The globe valve shall have a CWP rating of 1380 kPa (200 psig). The valve material shall be gray iron with bolted bonnet conforming to ASTM A 126 with flanged ends, bronze trim, malleable iron hand wheel.

2.2 BACKFLOW PREVENTERS

- A. A backflow prevention assembly shall be installed at any point in the fire suppression system where the potable water supply comes in contact with a potential source of contamination. The backflow prevention assembly shall be ASSE 1013 listed and certified.
- B. The double check detector backflow prevention assembly shall be ASSE listed 1048 and supply with full port OS&Y gate valves. The main body and access cover shall be epoxy coated ductile iron conforming to ASTM A536 grade. The seat ring and check valve shall be Noryl (NSF listed). The stem shall be stainless steel conforming to ASTM A 276. The seat disc elastomers shall be EPDM. The first and second check valve shall be accessible for maintenance without removing the device from the line.
- C. The wet system control valve shall be a listed indicating type valve. Control valve shall be UL Listed and FM Approved for fire protection installations. System control valve shall be rated for normal system pressure but in no case less than 175 PSI. (No Substitutions Allowed).
- D. Alarm valve shall be UL Listed and Factory Mutual Approved. The alarm valve shall be equipped with a removable cover assembly. The alarm valve shall be listed for installation in the vertical or horizontal position. The alarm valve shall be equipped with gauge connections on the system side and supply side of the valve clapper. The alarm valve shall be equipped with an external bypass to eliminate false water flow alarms. The alarm valve trim piping shall be externally galvanized. Maximum water working pressure to 250 PSI.

2.3 AUTOMATIC BALL DRIPS

- A. Cast brass 20 mm (3/4 inch) in-line automatic ball drip with both ends threaded with iron pipe threads.

2.4 FIRE DEPARTMENT SIAMESE CONNECTION

- A. Brass, flush wall type, exterior fire department connection with brass escutcheon plate, without sill cock, and a minimum of two 65 mm (2¹/₂ inch) connections threaded to match those on the local fire protection service, with polished brass caps and chains. Provide escutcheon with integral raised letters "Standpipe and Automatic Sprinkler". Install an automatic ball drip between fire department connection and check valve with drain piping routed to the exterior of the building or a floor drain.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Valve interior shall be examined for cleanliness, freedom from foreign matter, and corrosion. Special packing materials shall be removed, such as blocks, used to prevent disc movement during shipping and handling.
- B. Valves shall be operated in positions from fully open to fully closed. Guides and seats shall be examined and made accessible by such operations.
- C. Threads on valve and mating pipe shall be examined for form and cleanliness.
- D. Mating flange faces shall be examined for conditions that might cause leakage. Bolting shall be checked for proper size, length, and material. Gaskets shall be verified for proper size and that its material composition is suitable for service and free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Valves shall be located for easy access and shall be provide with separate support. Valves shall be accessible with access doors when installed inside partitions or above hard ceilings.
- C. Valves shall be installed in horizontal piping with stem at or above center of pipe
- D. Valves shall be installed in a position to allow full stem movement.
- E. Check valves shall be installed for proper direction of flow and as follows:
 - 1. Swing Check Valves: In horizontal position with hinge pin level.

3.3 ADJUSTING

- A. Valve packing shall be adjusted or replaced after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves shall be replaced if persistent leaking occurs.

--- E N D ---

SECTION 21 05 29
HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section includes hangers and supports for mechanical system piping and equipment.

1.2 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for the Valve and Fittings Industry.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.3 PERFORMANCE REQUIREMENTS

- A. Design channel support systems for piping to support multiple pipes capable of supporting the combined weight of supported systems, system contents, and test water.
- B. Design heavy-duty steel trapezes for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
- C. Design seismic restraint hangers and supports for piping and equipment.
- D. Design and obtain approval from authorities having jurisdiction for seismic restraint hangers and supports for piping and equipment.

1.4 SUBMITTALS

- A. Product Data: For each type of pipe hanger, channel support system component, and thermal-hanger shield insert indicated.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer for multiple piping supports and trapeze hangers. Include design calculations and indicate size and characteristics of components and fabrication details.
- C. Welding Certificates: Copies of certificates for welding procedures and operators.

1.5 QUALITY ASSURANCE

- A. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- B. Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support and trapeze by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Pipe Hangers:
 - a. AAA Technology and Specialties Co., Inc.
 - b. B-Line Systems, Inc.
 - c. Carpenter & Patterson, Inc.
 - d. Empire Tool & Manufacturing Co., Inc.

- e. Globe Pipe Hanger Products, Inc.
- f. Grinnell Corp.
- g. GS Metals Corp.
- h. Michigan Hanger Co., Inc.
- i. National Pipe Hanger Corp.
- j. PHD Manufacturing, Inc.
- k. PHS Industries, Inc.
- l. Piping Technology & Products, Inc.
- 2. Channel Support Systems:
 - a. B-Line Systems, Inc.
 - b. Grinnell Corp.; Power-Strut Unit.
 - c. GS Metals Corp.
 - d. Michigan Hanger Co., Inc.; O-Strut Div.
 - e. National Pipe Hanger Corp.
 - f. Thomas & Betts Corp.
 - g. Unistrut Corp.
 - h. Wesanco, Inc.
- 3. Thermal-Hanger Shield Inserts:
 - a. Carpenter & Patterson, Inc.
 - b. Michigan Hanger Co., Inc.
 - c. PHS Industries, Inc.
 - d. Pipe Shields, Inc.
 - e. Rilco Manufacturing Co., Inc.
 - f. Value Engineered Products, Inc.
- 4. Powder-Actuated Fastener Systems:
 - a. Gunnebo Fastening Corp.
 - b. Hilti, Inc.
 - c. ITW Ramset/Red Head.
 - d. Masterset Fastening Systems, Inc.

2.2 MANUFACTURED UNITS

- A. Pipe Hangers, Supports, and Components: MSS SP-58, factory-fabricated components. Refer to "Hanger and Support Applications" Article in Part 3 for where to use specific hanger and support types.
 - 1. Galvanized, Metallic Coatings: For piping and equipment that will not have field-applied finish.
 - 2. Non-metallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- B. Channel Support Systems: MFMA-2, factory-fabricated components for field assembly.
 - 1. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
 - 2. Non-metallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- C. Thermal-Hanger Shield Inserts: 100-psi (690-kPa) minimum compressive-strength insulation, encased in sheet metal shield.
 - 1. Material for Cold Piping: ASTM C 552, Type I cellular glass with vapor barrier.
 - 2. Material for Hot Piping: ASTM C 552, Type I cellular glass.
 - 3. For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.
 - 4. For Clevis or Band Hanger: Insert and shield cover lower 180 degrees of pipe.
 - 5. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.3 MISCELLANEOUS MATERIALS

- A. Powder-Actuated Drive-Pin Fasteners: Powder-actuated-type, drive-pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

- B. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.
- C. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.
- D. Grout: ASTM C 1107, Grade B, factory-mixed and -packaged, non-shrink and non-metallic, dry, hydraulic-cement grout.
 - 1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
 - 2. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 3. Design Mix: 5000 psi (34.5 MPa), 28 day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger requirements are specified in Sections specifying equipment and systems.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Specification Sections.
- C. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
 - 1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 6 (DN15 to DN150).
 - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F (49 to 232 deg C) pipes, NPS 4 to NPS 16 (DN100 to DN400), requiring up to 4 inches (100 mm) of insulation.
 - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 6 (DN20 to DN150), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
 - 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold pipes, NPS 1/2 to NPS 6 (DN15 to DN150), if little or no insulation is required.
 - 5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4 (DN15 to DN100), to allow off-center closure for hanger installation before pipe erection.
 - 6. Adjustable Swivel Split or Solid Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8 (DN20 to DN200).
 - 7. Adjustable Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 6 (DN15 to DN150).
 - 8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 6 (DN15 to DN150).
 - 9. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2 (DN15 to DN50).
 - 10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 6 (DN10 to DN150).
 - 11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3 (DN10 to DN80).
 - 12. U-Bolts (MSS Type 24): For support of heavy pipe, NPS 1/2 to NPS 6 (DN15 to DN150).
 - 13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 - 14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 6 (DN100 to DN150), with steel pipe base stanchion support and cast-iron floor flange.
 - 15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 6 (DN100 to DN150), with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
 - 16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2¹/₂ to NPS 36 (DN65 to DN900), if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.

17. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 6 (DN25 to DN150), from two rods if longitudinal movement caused by expansion and contraction might occur.
 18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20 (DN65 to DN500), from single rod if horizontal movement caused by expansion and contraction might occur.
 19. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 6 (DN50 to DN150), if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
 20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 6 (DN50 to DN150), if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
 21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 6 (DN50 to DN150), if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- D. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 6 (DN20 to DN150).
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 6 (DN20 to DN150), if longer ends are required for riser clamps.
- E. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450⁰ F (49 to 232⁰C) piping installations.
 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450⁰F (49 to 232⁰C) piping installations.
- F. Building Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.

12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb (340 kg).
 - b. Medium (MSS Type 32): 1500 lb (675 kg).
 - c. Heavy (MSS Type 33): 3000 lb (1350 kg).
 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where head room is limited.
- G. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe, 360 degree insert of high density, 100 psi (690 kPa) minimum compressive strength, water-repellent-treated calcium silicate or cellular-glass pipe insulation, same thickness as adjoining insulation with vapor barrier and encased in 360 degree sheet metal shield.
- H. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed $1\frac{1}{4}$ inches (32 mm).
 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
 6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- ### 3.2 HANGER AND SUPPORT INSTALLATION
- A. Pipe Hanger and Support Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.
1. Field assemble and install according to manufacturer's written instructions.

- C. Heavy-Duty Steel Trapeze Installation: Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated, heavy-duty trapezes.
1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.
- D. Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- E. Install powder-actuated drive-pin fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
- F. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- I. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," is not exceeded.
- K. Insulated Piping: Comply with the following:
1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits according to ASME B31.9.
 2. Install MSS SP-58, Type 39 protection saddles, if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.
 3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.
 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3¹/₂ (DN8 to DN90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
 - b. NPS 4 (DN100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
 - c. NPS 5 and NPS 6 (DN125 and DN150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
 5. Insert Material: Length at least as long as protective shield.

3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure above or to support equipment above floor.

3.4 METAL FABRICATION

- A. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

- A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.6 PAINTING

- A. Touching Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

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SECTION 21 05 53
FIRE PROTECTION IDENTIFICATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section includes the following fire protection identification materials and their installation:
1. Equipment identification devices.
 2. Pipe markers.
 3. Stencils.
 4. Valve tags.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Valve numbering scheme.

1.3 QUALITY ASSURANCE

- A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with location of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT IDENTIFICATION DEVICES

- A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.
1. Data:
 - a. Manufacturer, product name, model number, and serial number.
 - b. Capacity, operating and power characteristics, and essential data.
 - c. Labels of tested compliances.
 2. Location: Accessible and visible.
 3. Fasteners: As required to mount on equipment.
- B. Equipment Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive.
1. Terminology: Match schedules as closely as possible.
 2. Data:
 - a. Name and plan number.
 - b. Equipment service.

- c. Design capacity.
 - d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
3. Size: 2¹/₂ by 4 inches (64 by 100 mm) for control devices, dampers, and valves; 4¹/₂ by 6 inches (115 by 150 mm) for equipment.
- C. Equipment Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine sub-core, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for fire protection fastening.
1. Data: Instructions for operation of equipment and for safety procedures.
 2. Engraving: Manufacturer's standard letter style, of sizes and with terms to match equipment identification.
 3. Thickness: 1/16 inch (1.6 mm), unless otherwise indicated.
 4. Retain and edit subparagraph above or first subparagraph below.
 5. Thickness: 1/16 inch (1.6 mm) for units up to 20 sq. in. (130 sq. cm) or 8 inches (200 mm) in length, and 1/8 inch (3.2 mm) for larger units.
 6. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

2.2 PIPING IDENTIFICATION DEVICES

- A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.
1. Colors: Comply with ASME A13.1, unless otherwise indicated.
 2. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
 3. Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): Full-band pipe markers extending 360 degrees around pipe at each location.
 4. Pipes with OD, Including Insulation, 6 Inches (150 mm) and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.
 5. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.
- B. Pre-tensioned Pipe Markers: Pre-coiled semi-rigid plastic formed to cover full circumference of pipe and to attach to pipe without adhesive.
- C. Shaped Pipe Markers: Preformed semi-rigid plastic formed to partially cover circumference of pipe and to attach to pipe with fire protection fasteners that do not penetrate insulation vapor barrier.
- D. Self-Adhesive Pipe Markers: Plastic with pressure-sensitive, permanent-type, self-adhesive back.
- E. Plastic Tape: Continuously printed, vinyl tape at least 3 mils (0.08 mm) thick with pressure-sensitive, permanent-type, self-adhesive back.
1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): 3/4 inch (19 mm) minimum.
 2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches (150 mm) or Larger: 1¹/₂ inches (38 mm) minimum.

2.3 STENCILS

- A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1¹/₄ inches (32 mm) for ducts; and minimum letter height of 3/4 inch (19 mm) for access panel and door markers, equipment markers, equipment signs, and similar operational instructions.
1. Stencil Material: Metal or fiberboard.
 2. Stencil Paint: Exterior, gloss, alkyd enamel black, unless otherwise indicated. Paint may be in pressurized spray-can form.
 3. Identification Paint: Exterior, alkyd enamel in colors according to ASME A13.1, unless otherwise indicated.

2.4 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4 inch (6.4 mm) letters for piping system abbreviation and 1/2 inch (13-mm) numbers, with numbering scheme approved by Engineer. Provide 5/32 inch (4 mm) hole for fastener.
1. Material: 0.032-inch- (0.8-mm-) thick brass.
 2. Valve-Tag Fasteners: Brass wire-link chain.

PART 3 - EXECUTION

3.1 APPLICATIONS, GENERAL

- A. Products specified are for applications referenced in other Division 15 Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

3.2 EQUIPMENT IDENTIFICATION

- A. Install and permanently fasten equipment nameplates on each major item of fire protection equipment that does not have a nameplate nor has a nameplate that is damaged or located where not easily visible. Locate nameplates where accessible and visible.
- B. Install equipment markers with permanent adhesive on or near each major item of fire protection equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated.
1. Letter Size: Minimum 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 2. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
 3. Locate markers where accessible and visible. Include markers for the following general categories of equipment:
 - a. Fire department hose valves and hose stations.
- C. Install equipment signs with screws or permanent adhesive on or near each major item of fire protection equipment. Locate signs where accessible and visible.
1. Identify fire protection equipment with equipment markers.
 2. Letter Size: Minimum 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm),

and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

3. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
4. Include signs for the following general categories of equipment:

D. Install access panel markers with screws on equipment access panels.

3.3 PIPING IDENTIFICATION

A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.

1. Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, at least 3/4 inch (19 mm) wide, lapped at least 1¹/₂ inches (38 mm) at both ends of pipe marker, and covering full circumference of pipe.
2. Pipes with OD, Including Insulation, 6 Inches (150 mm) and Larger: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, at least 1¹/₂ inches (38 mm) wide, lapped at least 3 inches (75 mm) at both ends of pipe marker, and covering full circumference of pipe.

B. Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior nonconcealed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and non-accessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
6. On piping above removable acoustical ceilings. Omit intermediately spaced markers.

3.4 VALVE-TAG INSTALLATION

A. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following:

1. Valve-Tag Size and Shape: 1¹/₂ inches (38 mm) round.
2. Valve-Tag Color: Natural.
3. Letter Color: Black.

3.5 ADJUSTING

A. Relocate fire protection identification materials and devices that have become visually blocked by other work.

3.6 CLEANING

A. Clean faces of fire protection identification devices.

--- END ---

SECTION 21 12 00
FIRE-SUPPRESSION STANDPIPES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Class 1, Fire-suppression manual wet standpipes.

1.2 SCOPE OF WORK

- A. Design, installation and testing shall be in accordance with NFPA 14 except for specified exceptions.
- B. Design, materials, equipment and installation, inspection and testing of a complete and ready for operation fire-suppression manual wet standpipe system as required by NFPA 14.

1.3 RELATED WORK

- A. The following references are made a part of these specifications:
 - 1. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
 - 2. Section 07 84 00, FIRESTOPPING, Treatment of penetrations through rated enclosures.
 - 3. Section 08 31 13, ACCESS DOORS AND FRAMES: for access panels for plaster or gypsum finishes.
 - 4. Section 21 05 11 COMMON WORK RESULTS FOR FIRE SUPPRESSION for general mechanical requirements and items, which are common to more than one section.
 - 5. Section 21 05 23 GENERAL DUTY VALVES FOR FIRE SUPPRESSION SYSTEM.
 - 6. Section 28 31 00, FIRE DETECTION AND ALARM, Connection to fire alarm of flow switches, pressure switches and valve supervisory switches.

1.4 QUALITY ASSURANCE

- A. Designer's Qualifications: Design work and shop drawings shall be prepared by a licensed engineer practicing in the field of Fire Protection Engineering.
- B. Installer Reliability: The installer shall possess a valid State of Louisiana contractor's license. The installer shall provide documentation of having successfully completed three projects of similar size and scope.
- C. Materials and Equipment: All equipment and devices shall be of a make and type listed by UL and approved by FM, or other nationally recognized testing laboratory for the specific purpose for which it is used. All materials, devices, and equipment shall be approved by the VA.
- D. Testing: Materials and Testing Certificate as per NFPA 14. Provide certificates for all parts of the system.

1.5 DESIGN CRITERIA

- A. The design, materials, equipment, installation, and testing of the system shall be in accordance with NFPA 14 the latest edition.
- B. For hydraulic calculations, calculated demand shall not fall less than 10 percent below the water supply curve.
- C. Water Supply: Base water supply on a fire pumper truck being able to provide 3785 l/m (1000 gpm) at 1035 kPa (150 psig) and 2650 l/m (700 gpm) at 1380 kPa (200 psig) at the fire department connection.

- D. Size standpipes to provide 1,893 L/min (500 GPM) at 690 kPa (100 psig) at the most remote connections.

1.6 SUBMITTALS

- A. Submit as one package in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES. Prepare detailed working drawings that are stamped by a Registered Professional Engineer practicing in the field of Fire Protection Engineering. As Government review is for technical adequacy only, the installer remains responsible for correcting any conflicts with other trades and building construction that arise during installation. Material submittals shall be approved prior to the purchase or delivery to the job site. Suitably bind submittals in notebooks or binders and provide index referencing the appropriate specification section. Submittals shall include, but not be limited to, the following:
1. Certificates:
 - a. Installer's qualifications and documentation of previous work.
 - b. Materials and Testing certificates as specified.
 2. Drawings: Submit detailed 1:100 (1/8 inch) scale (minimum) working drawings conforming to NFPA 14. Include a site plan showing the fire hydrant nearest the fire department connection.
 3. Manufacturers Literature and Data Sheets: All pertinent literature and data for the materials and equipment proposed for the project. Include listing information and installation instructions in data sheets. Clearly identify the item to be used.
 - a. For backflow preventers, provide flow test curves from UL, FM, or the Foundation for Hydraulic Research and Cross-Connection Control to verify pressure loss calculations.
 - b. Provide for materials and equipment proposed for use on the system. Include listing information and installation instructions in data sheets. Where data sheet describes items in addition to that item being submitted, clearly identify proposed item on the sheet.
 4. Calculation Sheets: Submit hydraulic calculations in accordance with NFPA 14.
 5. Final Document Submittals: Provide as-built drawings, testing and maintenance instructions in accordance with the requirements in Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES. Submittals shall include, but not be limited to, the following:
 - a. One complete set of reproducible as-built drawings showing the installed system with the specific interconnections between the waterflow switch or pressure switch and the fire alarm equipment. One copy of final CADD drawing files shall be provided on diskettes that are compatible with the VAMC CADD system.
 - b. Four sets of complete, simple, understandable, step-by-step, testing instructions giving recommended and required testing frequency of all equipment, methods for testing all equipment, and a complete trouble shooting manual. Provide maintenance instructions on replacing any components of the system including internal parts, periodic cleaning and adjustment of the equipment and components with information as to the address and telephone number of both the manufacturer and the local supplier of each item.
 - c. Certificates shall document all parts of the installation.
 1. Installer's qualifications and documentation of previous work.
 2. Materials and Testing certificates as specified.
 - d. Instruction Manual: Provide one copy of the instruction manual covering the system in a flexible protective cover and mount in an accessible location adjacent to the riser.

1.7 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Mechanical Engineers (ASME):
B16.3-99 Malleable Iron Threaded Fittings
- C. Factory Mutual Engineering Corporation (FM):
Approval Guide – 2001
- D. National Fire Protection Association (NFPA):
14-2007 Installation of Standpipe, Private Hydrant and Hose Systems
101-2009 Safety to Life from Fire in Buildings and Structures (Life Safety Code)
170-2009 Fire Safety Symbols
- E. Underwriters Laboratories, Inc. (UL):
Fire Protection Equipment Directory – 2002
- F. International Building Code – 2009

PART 2 - PRODUCTS

2.1 GENERAL

- A. All devices and equipment shall be Underwriters Laboratories listed for their intended purpose.

2.2 PIPING & FITTINGS

- A. Shall be in accordance with NFPA 14, black steel, schedule 40 minimum.
- B. Threaded or flanged fittings shall be ANSI B 16.3 cast iron, class 125 minimum. Threaded fittings are not permitted on pipe with wall thickness less than schedule 40.
- C. Clamp-on fittings with rubber gaskets shall be listed for the piping application.
- D. Plain end pipe, fittings with locking lugs or shear bolts are not permitted. Use nonferrous piping in MRI Scanning Rooms.

2.3 VALVES

- A. Where allowed by the applicable codes, the contractor may use quarter turn ball valves for valves less than 50 mm (2 inch) and quarter turn butterfly valves for valves 50mm (2 inch) and larger.
- B. The wet system control valve shall be a listed indicating type valve. Control valve shall be UL Listed and FM Approved for fire protection installations. System control valve shall be rated for normal system pressure but in no case less than 175 PSI. (No Substitutions Allowed).
- C. Alarm valve shall be UL Listed and Factory Mutual Approved. The alarm valve shall be equipped with a removable cover assembly. The alarm valve shall be listed for installation in the vertical or horizontal position. The alarm valve shall be equipped with gauge connections on the system side and supply side of the valve clapper. The alarm valve shall be equipped with an external bypass to eliminate false water flow alarms. The alarm valve trim piping shall be externally galvanized. Maximum water working pressure to 250 PSI.
- D. Listed Indicating Valves:
 - 1. Gate: OS&Y, 1200kPa (175 psig) WOG.
 - 2. Butterfly: Gear operated, indicating type, 1200 kPa (175 psig) WOG.
- E. Check Valves: Swing type, rubber faced or wafer type spring loaded butterfly check valve, 1200 kPa (175 psig) WOG.

- F. Drain Valves: Threaded bronze angle, globe, ball or butterfly, 1000 kPa (150 psig.) WOG equipped with reducer and hose connection with cap or connected to a drain line.
- G. Standpipe Hose Valves: 65 mm (2¹/₂ inch) screwed, brass hose angle valve, and male hose threads same as local fire protection service, with permanently attached polished brass cap and chain.
- H. Automatic Ball Drips: Cast brass 20 mm (3/4 inch) in-line automatic ball drip with both ends threaded with iron pipe threads.

2.4 FIRE DEPARTMENT SUPPLY CONNECTION

- A. Brass, flush wall type, exterior fire department connection with brass escutcheon plate, with sill cock, and a minimum of two 65 mm (2¹/₂ inch) connections, or a configuration acceptable to the responding fire department. Connections shall be threaded to match those on the local fire protection service, with polished brass caps and chains. Install an automatic ball drip between fire department connection and check valve with drain piping routed to the exterior of the building or a floor drain.

2.5 IDENTIFICATION SIGNS/HYDRAULIC PLACARDS

- A. Provide for all new and existing sectional valves, riser control valves, drain valves and alarm devices. The signs shall be in accordance with NFPA 14 and attached securely to each item.
- B. Plastic, steel or aluminum signs with white lettering on a red background with holes for easy attachment. Enter pertinent data for each system on the hydraulic placard.

2.6 VALVE SUPERVISORY SWITCHES:

- A. Provide each indicated standpipe and control valve with adequate means for mounting a valve supervisory switch.
- B. Mount switch so as not to interfere with normal operation of the valve and adjust to operate within two revolutions toward the closed position of the valve control, or when the stem is moved no more than one fifth of the distance from its normal position.
- C. The mechanism shall be contained in a weatherproof die cast aluminum housing, which shall provide a 20 mm (3/4 in.) tapped conduit entrance and incorporate the necessary facilities for attachment to the valves.
- D. Switch housing to be finished in red baked enamel.
- E. Water flow Alarm Switches: Mechanical, non-coded, non-accumulative retard and adjustable from 0 to 60 seconds minimum. Set flow switches at an initial setting between 20 and 30 seconds.
- F. Valve Supervisory Switches for Ball and Butterfly Valves: May be integral with the valve.
- G. All conduit and wiring connected thereto shall be provided in Section 28 31 00, FIRE DETECTION AND ALARM.

2.7 GAUGES

- A. Provide gauges as required by NFPA 14.

2.8 PIPE HANGERS and SUPPORTS

- A. Supports, hangers, etc., of an approved pattern placement to conform to NFPA 14. System piping shall be substantially supported to the building structure. Materials used in the installation or construction of hangers and supports shall be listed and approved for such application. Hangers or supports not specifically listed for service shall be designed and bear the seal of a professional engineer.

2.9 WALL, FLOOR AND CEILING PLATES

- A. Provide chrome plated steel escutcheon plates for exposed piping passing through walls, floors or ceilings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be accomplished by the licensed contractor. Provide a qualified technician, experienced in the installation and operation of the type of system being installed, to supervise the installation and testing of the system.
- B. Installation of Piping: Accurately cut pipe to measurements established by the installer and work into place without springing or forcing. In any situation where bending of the pipe is required, use a standard pipe-bending template. Install concealed piping in spaces that have finished ceilings. Sidewall heads may need to be utilized. Locate piping in stairways as near to the ceiling as possible to prevent tampering by unauthorized personnel, and to provide a minimum headroom clearance of 2250 mm (seven feet six inches). To prevent an obstruction to egress, provide piping clearances in accordance with NFPA 101.
- C. Face fire department connections in valve cabinets outward in a manner which prevents crimping of the hose.
- D. Drains: Pipe drains to discharge at safe points outside of the building or to sight cones attached to drains of adequate size to readily carry the full flow from each drain under maximum pressure. Do not provide a direct drain connection to sewer system or discharge into sinks. Install drips and drains where necessary and required by NFPA 14.
- E. Valve Supervisory Switches: Provide supervisory switches for standpipe control valves. Do not provide standpipe hose valves and test and drain valves with supervisory switches. Do not provide valve supervisory switches on standpipe hose valves, test or drain valves. See Section 28 31 00, FIRE DETECTION AND ALARM for connections.
- F. Water flow Alarm Switches: Install water flow switch and adjacent valves in easily accessible locations.
- G. Affix cutout disks, which are created by cutting holes in the walls of pipe for flow switches and non-threaded pipe connections to the respective waterflow switch or pipe connection near to the pipe from where they were cut.
- H. Provide pressure gauge at each water flow alarm switch location, at the top of each standpipe, and at each main drain connection.
- I. For each fire department connection, provide the symbolic sign given in NFPA 170 and locate 2400 to 3000 mm (8 to 10 feet) above each connection location. Size the sign to 450 by 450 mm (18 x 18 inches) with the symbol being at least 350 by 350 mm (14 x 14 inches).
- J. Penetrations: Sleeve or core drill concrete and masonry. Provide clearance between pipe and openings as required by NFPA 14. Seal penetrations and clearances in fire rated wall and floor assemblies with listed through-penetration firestop materials in accordance with Section 07 84 00, FIRESTOPPING.
- K. For each fire department supply connection, provide the symbolic sign given in NFPA 170 located 2400 to 3000 mm (8 to 10 feet) above each connection. The sign shall be 450 x 450 mm (18 x 18 inches) with the symbol being at least 350 x 350 mm (14 x 14 inches).
- L. Securely attach identification signs to control valves, drain valves, and test valves. Locate hydraulic placard information signs at each sectional control valve where there is a zone water flow switch.
- M. Welding: All welding shall conform to the requirements and recommendations of NFPA 14 latest editions.

3.2 INSPECTION AND TEST

- A. Flushing: Flush newly installed systems prior to performing hydrostatic tests in order to remove any debris which may have been left as well as ensuring piping is unobstructed.
- B. Hydrostatic Testing: Hydrostatically test the system including the fire department connections, as specified in NFPA 14, NFPA-25 and NFPA 13 latest edition, in the presence of the Authority Having Jurisdiction or his designated representative.
- C. Final Inspection and Testing: Test the system in accordance with NFPA 14, NFPA 25 and NFPA 13 latest editions after all necessary corrections have been accomplished. Advise the Authority Having Jurisdiction who will then schedule the final inspection and test. Furnish all instruments, labor and materials required for the tests and provide the services of the installation foreman or other competent representative of the installer to perform the tests. Correct any deficiencies found and retest the system. Include the operation of all features of the systems under normal conditions in the test.

3.3 INSTRUCTIONS

- A. Furnish the services of a competent instructor for not less than two hours for instructing personnel in the operation and maintenance of the system, on the dates requested by the COTR/Resident Engineer.

3.4 WARRANTY

- A. All work performed and materials and equipment furnished under this contract shall be free from defects for a period of one year from date of acceptance by the government.
- B. All new piping and equipment incorporated into the new system shall be hydrostatically tested and warranted as new.

--- E N D ---

SECTION 21 13 13
WET-PIPE SPRINKLER SYSTEMS

RFI 02142.1: Confirms
sprinkler heads to be white.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Design, installation and testing shall be in accordance with NFPA 13 except for specified exceptions.
- B. The design and installation of a hydraulically calculated automatic wet system complete and ready for operation, for all portions of the Buildings, including the penthouse, mechanical equipment rooms, telephone rooms, elevator machine rooms, elevator pits and linen chutes.

1.2 RELATED WORK

- A. The following references are made a part of these specifications:
 - 1. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
 - 2. Section 07 84 00, FIRESTOPPING, Treatment of penetrations through rated enclosures.
 - 3. Section 21 05 11, COMMON WORK RESULTS FOR FIRE SUPPRESSION
 - 4. Section 21 05 19, METERS AND GAUGES
 - 5. Section 21 05 23, GENERAL DUTY VALVES FOR FIRE SUPPRESSION SYSTEM
 - 6. Section 21 05 29, HANGERS AND SUPPORTS
 - 7. Section 21 05 53, IDENTIFICATION
 - 8. Section 21 12 00, FIRE-SUPPRESSION STANDPIPES.
 - 9. Section 28 31 00, FIRE DETECTION AND ALARM, Connection to fire alarm of flow switches, pressure switches and valve supervisory switches.

1.3 QUALITY ASSURANCE

- A. Installer Reliability: The installer shall possess a valid State of Louisiana fire sprinkler contractor's license. The installer shall have been actively and successfully engaged in the installation of commercial automatic sprinkler systems for the past ten years.
- B. Materials and Equipment: All equipment and devices shall be of a make and type listed by UL and approved by FM, or other nationally recognized testing laboratory for the specific purpose for which it is used. All materials, devices, and equipment shall be approved by the VA.
- C. Submittals: Submit as one package in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Prepare detailed working drawings that are signed by a NICET Level III or Level IV Sprinkler Technician or stamped by a Registered Professional Engineer practicing in the field of Fire Protection Engineering. As Government review is for technical adequacy only, the installer remains responsible for correcting any conflicts with other trades and building construction that arise during installation. Partial submittals will not be accepted. Material submittals shall be approved prior to the purchase or delivery to the job site. Suitably bind submittals in notebooks or binders and provide index referencing the appropriate specification section. Submittals shall include, but not be limited to, the following:
 - 1. Qualifications:
 - a. Provide a copy of the installing contractor's fire sprinkler and state contractor's license.
 - b. Provide a copy of the NICET certification for the NICET Level III or Level IV Sprinkler Technician who prepared and signed the detailed working drawings unless the drawings are stamped by a Registered Professional Engineer practicing in the field of Fire Protection Engineering.
 - 2. Drawings: Submit detailed 1:100 (1/8 inch) scale (minimum) working drawings conforming to NFPA 13. Include a site plan showing the piping to the water supply test location.
 - 3. Manufacturers Data Sheets:

- a. For backflow preventers, provide flow test curves from UL, FM, or the Foundation for Hydraulic Research and Cross-Connection Control to verify pressure loss calculations.
 - b. Provide for materials and equipment proposed for use on the system. Include listing information and installation instructions in data sheets. Where data sheet describes items in addition to that item being submitted, clearly identify proposed item on the sheet.
4. Calculation Sheets: Submit hydraulic calculation sheets in tabular form conforming to the requirements and recommendations of NFPA 13.
 5. Final Document Submittals: Provide as-built drawings, testing and maintenance instructions in accordance with the requirements in Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Submittals shall include, but not be limited to, the following:
 - a. One complete set of reproducible as-built drawings showing the installed system with the specific interconnections between the waterflow switch or pressure switch and the fire alarm equipment.
 - b. Complete, simple, understandable, step-by-step, testing instructions giving recommended and required testing frequency of all equipment, methods for testing all equipment, and a complete trouble shooting manual. Provide maintenance instructions on replacing any components of the system including internal parts, periodic cleaning and adjustment of the equipment and components with information as to the address and telephone number of both the manufacturer and the local supplier of each item.
 - c. Material and Testing Certificate: Upon completion of the sprinkler system installation or any partial section of the system, including testing and flushing, provide a copy of a completed Material and Testing Certificate as indicated in NFPA 13.
 - d. Certificates shall document all parts of the installation.
 - e. Instruction Manual: Provide one copy of the instruction manual covering the system in a flexible protective cover and mount in an accessible location adjacent to the riser.
- D. Design Basis Information: Provide design, materials, equipment, installation, inspection, and testing of the automatic sprinkler system in accordance with the requirements of NFPA 13. Recommendations in appendices shall be treated as requirements.
1. Perform hydraulic calculations in accordance with NFPA 13 utilizing the Area/Density method. Do not restrict design area reductions permitted for using quick response sprinklers throughout by the required use of standard response sprinklers in the areas identified in this section.
 2. Sprinkler Protection: To determining spacing and sizing, apply the following coverage classifications:
 - a. Light Hazard Occupancies: Patient care, treatment, and customary access areas.
 - b. Ordinary Hazard Group 1 Occupancies: Laboratories, Mechanical Equipment Rooms, , Electric Closets, Elevator Shafts, Elevator Machine Rooms,
 - c. Ordinary Hazard Group 2 Occupancies: Storage rooms, trash rooms, clean and soiled linen rooms, storage areas, boiler plants, energy centers, file storage areas for the entire area of the space up to 140 square meters (1500 square feet).
 - d. Request clarification from the Government for any hazard classification not identified.
 3. Hydraulic Calculations: Calculated demand including hose stream requirements shall fall no less than 10 percent below the available water supply curve.
 4. Water Supply: Base water supply on a flow test of:
 - a. Location _____
 - b. Elevation Static Test Gauge _____ m (_____ ft)
 - c. Elevation Residual Test Gauge _____ m (_____ ft)
 - d. Static pressure: _____ kPa (_____ psi)
 - e. Residual pressure: _____ kPa (_____ psi)

- f. Flow: _____ L/s (_____ gpm)
- g. Date: _____ Time _____
- 5. Zoning:
 - a. For each sprinkler zone provide a control valve, flow switch and a test and drain assembly with pressure gauge.
 - b. Sprinkler zones shall conform to the smoke barrier zones shown on the drawings.
 - c. Provide seismic protection in accordance with NFPA 13.

1.4 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. National Fire Protection Association (NFPA):
 - 13-2007~~3~~..... Installation of Sprinkler Systems
 - 24-2007~~2~~..... Installation of Private Main
 - 101-2006..... Safety to Life from Fire in Buildings and Structures (Life Safety Code)
 - 170-2006..... Fire Safety Symbols
- C. Underwriters Laboratories, Inc. (UL):
 - Fire Protection Equipment Directory – 2001
- D. Factory Mutual Engineering Corporation (FM):
 - Approval Guide – 2001
- E. Foundation for Cross-Connection Control and Hydraulic Research-2005

1.5 COMMISSIONING

- A. Commissioning of a system or systems specified in this section is part of the construction process. Documentation and testing of these systems, as well as training of the Owner's operation and maintenance personnel, is required in cooperation with the Owner's Representative and the Commissioning Authority. Project Closeout is dependent on successful completion of all commissioning procedures, documentation, and issue closure. Refer to Section 019113, Commissioning, for detailed commissioning requirements.

PART 2 - PRODUCTS

2.1 PIPING & FITTINGS

- A. Sprinkler systems piping shall be in accordance with NFPA 13 except as noted.
 - 1. All sprinkler systems piping shall be not less than Schedule 10 black steel pipe.
- B. Underground sprinkler piping shall be Schedule 40 ductile iron pipe
- C. Sprinkler systems piping shall be copper piping in MRI room and radiology room areas.

2.2 SPRINKLERS

- A. All sprinklers except "institutional" type sprinklers shall be FM approved. "Institutional" type sprinklers in Mental Health and Behavior Units shall be UL listed or FM approved quick response type. Maximum break away strength shall be certified by the manufacturer to be no more than 39 kPa (85 pounds). Provide quick response sprinklers in all areas, except where specifically prohibited by their listing or approval.
1. Elevator shafts and elevator machine rooms: Standard response sprinklers.
 2. Elevator pit: sidewall sprinklers.
 3. In generator rooms: Standard response sprinklers.
(Note: Provide 'cages' to protect sprinkler heads from breakage/damage when the elevation of the head is less than 7 feet 6 inches above finished floor (mechanical rooms, janitor closets, etc).
 4. Sprinklers at glass partition walls shall be Tyco TFP/CSC Model WS units. The units shall be installed in accordance with manufacturer's recommendations. The units shall be activated when the temperature reaches 200°F.
 5. Sprinklers at MRI room and radiology room shall be brass sprinkler head. The sprinkler head and piping shall be installed in accordance with MRI unit and Radiology manufacturer's recommendations.
- B. Temperature Ratings: In accordance with NFPA 13, except as follows:
1. Sprinklers in elevator shafts, elevator pits, and elevator machine rooms: Intermediate temperature rated.
 2. Sprinklers in Generator Rooms: High temperature rated.

2.3 SPRINKLER CABINET

- A. Provide sprinkler cabinet with the required number of sprinkler heads of all ratings and types installed, and a sprinkler wrench for each system. Locate adjacent to the riser. Sprinkler heads shall be installed in center of tile or center to center.

2.4 IDENTIFICATION SIGNS/HYDRAULIC PLACARDS

- A. Plastic, steel or aluminum signs with white lettering on a red background with holes for easy attachment. Enter pertinent data for each system on the hydraulic placard.

2.5 SWITCHES:

- A. Contain in a weatherproof die cast/red baked enamel, oil resistant, aluminum housing with tamper resistant screws, 13 mm (1/2 inch) conduit entrance and necessary facilities for attachment to the valves. Provide two SPDT switches rated at 2.5 amps at 24 VDC.
- B. Water Flow Alarm Switches: Mechanical, non-coded, non-accumulative retard and adjustable from 0 to 60 seconds minimum. Set flow switches at an initial setting between 20 and 30 seconds.
- C. Pressure Switches: Activation by any flow of water equal to or in excess of the discharge from one sprinkler. Water Flow Indicating Pressure Switch will activate an alarm by way of an alarm pressure switch. The alarm pressure switch shall be compatible with system devices. The alarm pressure enclosure shall be UL Listed and Factory Mutual Approved for the application in which it is used. The alarm pressure switch shall have the ability to be wired for Class A or Class B service.
- D. Valve Supervisory Switches for Ball and Butterfly Valves: May be integral with the valve.

2.6 GAUGES

- A. Provide gauges as required by NFPA 13.

2.7 PIPE HANGERS and SUPPORTS

- A. Supports, hangers, etc., of an approved pattern placement to conform to NFPA 13. System piping shall be substantially supported to the building structure. The installation of hangers and supports shall adhere to the requirements set forth in NFPA 13, Standard for Installation of Sprinkler Systems. Materials used in the installation or construction of hangers and supports shall be listed and approved for such application. Hangers or supports not specifically listed for service shall be designed and bear the seal of a professional engineer.

2.8 WALL, FLOOR AND CEILING PLATES

- A. Provide chrome plated steel escutcheon plates for exposed piping passing through walls, floors or ceilings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be accomplished by the licensed contractor. Provide a qualified technician, experienced in the installation and operation of the type of system being installed, to supervise the installation and testing of the system.
- B. Installation of Piping: Accurately cut pipe to measurements established by the installer and work into place without springing or forcing. In any situation where bending of the pipe is required, use a standard pipe-bending template. Install concealed piping in spaces that have finished ceilings. Where ceiling mounted equipment exists, such as in operating and radiology rooms, install sprinklers so as not to obstruct the movement or operation of the equipment. Sidewall heads may need to be utilized. Locate piping in stairways as near to the ceiling as possible to prevent tampering by unauthorized personnel, and to provide a minimum headroom clearance of 2250 mm (7'-6"). To prevent an obstruction to egress, provide piping clearances in accordance with NFPA 101.
- C. Welding: Conform to the requirements and recommendations of NFPA 13.
- D. Drains: Pipe drains to discharge at safe points outside of the building or to sight cones attached to drains of adequate size to readily carry the full flow from each drain under maximum pressure. Do not provide a direct drain connection to sewer system or discharge into sinks. Install drips and drains where necessary and required by NFPA 13 and 14.
- E. Supervisory Switches: Provide supervisory switches for sprinkler control valves.
- F. Water flow Alarm Switches: Install water-flow switch and adjacent valves in easily accessible locations.
- G. Inspector's Test Connection: Install and supply in conformance with NFPA 13, locate in a secured area, and discharge to the exterior of the building.
- H. Affix cutout disks, which are created by cutting holes in the walls of pipe for flow switches and non-threaded pipe connections to the respective waterflow switch or pipe connection near to the pipe from where they were cut.
- I. Sleeves: Provide for pipes passing through masonry or concrete. Provide space between the pipe and the sleeve in accordance with NFPA 13. Seal this space with a UL Listed through penetration fire stop material in accordance with Section 07 84 00, FIRESTOPPING. Where core drilling is used in lieu of sleeves, also seal space. Seal penetrations of walls, floors and ceilings of other types of construction, in accordance with Section 07 84 00, FIRESTOPPING.
- J. Provide pressure gauge at each water flow alarm switch location and at each main drain connection.

- K. For each fire department connection, provide the symbolic sign given in NFPA 170 and locate 2400 to 3000 mm (8 to 10 feet) above each connection location. Size the sign to 450 by 450 mm (18 by 18 inches) with the symbol being at least 350 by 350 mm (14 by 14 inches).
- L. Fire stopping shall comply with Section 07 84 00, FIRESTOPPING.
- M. Securely attach identification signs to control valves, drain valves, and test valves. Locate hydraulic placard information signs at each sectional control valve where there is a zone water flow switch.
- N. Repairs: Repair damage to the building or equipment resulting from the installation of the sprinkler system by the installer at no additional expense to the Government.
- O. Interruption of Service: There shall be no interruption of the existing sprinkler protection, water, electric, or fire alarm services without prior permission of the Contracting Officer. Contractor shall develop an interim fire protection program where interruptions involve in occupied spaces. Request in writing at least one week prior to the planned interruption.

3.2 INSPECTION AND TEST

- A. Preliminary Testing: Flush newly installed systems prior to performing hydrostatic tests in order to remove any debris which may have been left as well as ensuring piping is unobstructed. Hydrostatically test system, including the fire department connections, as specified in NFPA 13, in the presence of the Contracting Officers Technical Representative (COTR) or his designated representative. Test and flush underground water line prior to performing these hydrostatic tests.
- B. Final Inspection and Testing: Subject system to tests in accordance with NFPA 13, and when all necessary corrections have been accomplished, advises COTR/Resident Engineer to schedule a final inspection and test. Connection to the fire alarm system shall have been in service for at least ten days prior to the final inspection, with adjustments made to prevent false alarms. Furnish all instruments, labor and materials required for the tests and provide the services of the installation foreman or other competent representative of the installer to perform the tests. Correct deficiencies and retest system as necessary, prior to the final acceptance. Include the operation of all features of the systems under normal operations in test.
- C. Functional Performance & Integrated Systems Testing is part of the Commissioning Process. Functional Performance & Integrated Systems Testing shall be performed by the contractor and witnessed and documented by the Commissioning Authority. Refer to Section 019113, Commissioning, for functional performance and integrated systems testing and commissioning requirements.

3.3 INSTRUCTIONS

- A. Furnish the services of a competent instructor for not less than two hours for instructing personnel in the operation and maintenance of the system, on the dates requested by the COTR/Resident Engineer.
- B. Training of the Owner's operation and maintenance personnel is required in cooperation with the Owner's Representative. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems. The instruction shall be scheduled in coordination with the Owner's Representative after submission and approval of formal training plans. Refer to Section 017900, Demonstration and Training, and Section 019113, Commissioning, for contractor training requirements.

3.4 WARRANTY

- A. All work performed and materials and equipment furnished under this contract shall be free from defects for a period of one year from date of acceptance by the government.

- B. All new piping and equipment incorporated into the new system shall be hydrostatically tested and warranted as new.

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