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# EDITING NOTE

All bracketed blanks, words, phrases, sentences, and paragraphs in this specification require the editor to either include or delete the bracketed section, or provide required information.

# DRY PIPE AND PREACTION SPRINKLER SYSTEM - SECTION 211316

PART 1 - GENERAL

* 1. RELATED DOCUMENTS
		1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
		2. The following sections apply to the work of this section:
			1. 211100 Exterior Water Supply Mains for Fire Protection Service
			2. 078413 Penetration Firestopping
			3. 238111 Fire Detection and Alarm Systems
			4. 211000 Fire Protection General Requirements
			5. 213110 Fire Pump Systems
	2. SUMMARY
		1. Scope: Provide a complete, code compliant dry-pipe [preaction] sprinkler system, and associated equipment, ready for operation.
		2. The work includes designing and [modifying][installing] an automatic dry-pipe [preaction]fire extinguishing sprinkler system for [[Ordinary Hazard II] [Extra Hazard - Group [I] [II]] [High-Piled Storage] and uniform distribution of water by hydraulic design to afford complete fire protection coverage throughout the contract area.
		3. Existing Sprinkler Equipment: Existing sprinkler equipment shall be maintained fully operational until the new equipment has been tested and accepted by the COTR and OSHEM fire protection engineer. [After acceptance of the new equipment, all existing equipment so indicated shall be removed.]
		4. Authority Having Jurisdiction: Any reference in the specifications or applicable codes to the "authority having jurisdiction" shall be interpreted to mean the OSHEM Fire Protection Engineer.
	3. ALLOWANCES

[List Allowances, if included as part of the contract. Confirm with OSHEM and COTR]

* 1. UNIT PRICES

[List Unit Prices, if included as part of the contract. Confirm with OSHEM and COTR]

* 1. DEFINITIONS
		1. COTR: Contracting Officer Technical Representative
		2. FM: FM Global (Factory Mutual)
		3. FPE: Fire Protection Engineer
		4. Furnish: To supply the stated equipment or materials
		5. Install: To set in position and connect or adjust for use
		6. NFPA: National Fire Protection Association
		7. NICET: National Institute for Certification in Engineering Technologies
		8. OSHEM: Office of Safety Health and Environmental Management
		9. Provide: To furnish and install the stated equipment or materials
		10. UL: Underwriters Laboratories
	2. SYSTEM DESCRIPTION:
		1. The design shall conform to NFPA 13 and the requirements specified herein. Design of the automatic dry-pipe (preaction) sprinkler system shall be for [[Ordinary Hazard II] [Extra Hazard - Group [I] [II]] [High-Piled Storage] occupancy by hydraulic calculation. The design, equipment, materials, installation, workmanship, examination, inspection and testing shall be in strict accordance with NFPA 13, except as modified herein.
		2. The system shall include all materials, accessories, and equipment inside and outside the building to provide a system complete and ready for use. Refer to Section 211100 for Installation of Exterior Water Supply Main for Fire Protection Service.
		3. Design and provide each system giving full consideration to obstructions, blind spaces, piping, electrical equipment, duct work and other construction and equipment in accordance with detailed drawings to be submitted for approval.
		4. Equipment for fire protection service shall be UL listed or FM approved for use in [wet and] dry pipe sprinkler systems.
		5. In the NFPA publications referred to herein, the advisory provisions shall be considered mandatory, as though the word "shall" had been substituted for "should," wherever it appears.
	3. PERFORMANCE REQUIREMENTS
		1. Water Distribution: Distribution shall be uniform throughout the area which it is assumed the sprinkler heads will open. Variation in discharge from individual heads in the hydraulically most remote area shall be between 100 and 120 percent of the specified density.
		2. Piping Restrictions: Piping is prohibited in the following areas, except when solely supplying sprinklers in such areas:
			1. Transformer, switchgear, or similar rooms
			2. Elevator machine rooms and elevator shafts.
			3. IT Computer spaces (mission critical).
			4. Collection storage rooms.
		3. Clearance From Electrical Equipment: Piping and automatic sprinklers are prohibited directly over:
			1. Transformers.
			2. Substations.
			3. Switchboards.
			4. Motor control centers.
			5. Emergency generators.
			6. Bus Ducts.
			7. Electrical panels.
		4. If installing pipe over electrical equipment is unavoidable, provide drip pans under piping to protect electrical equipment.
		5. [Sprinkler systems shall be designed for earthquake protection in accordance with the requirements and recommendations of NFPA 13.]
		6. Location of Sprinkler Heads: Heads in relation to the ceiling and the spacing of sprinkler heads shall not exceed their listed area of coverage for [[Ordinary Hazard II] [Extra Hazard - Group [I] [II]] [High-Piled Storage]. Uniformly space sprinklers on the branch piping. Locate sprinkler heads in a consistent pattern with ceiling grid, lights, and supply air diffusers.
		7. Sprinkler Discharge Area: The sprinkler discharge area shall be the hydraulically most remote areas as defined in NFPA 13. Remote area reductions permitted per NFPA 13 shall not apply.
		8. [Compact Shelving: Fire sprinkler coverage for compact shelving units shall be in accordance with the SI Fire Protection and Life Safety Design Manual.]
		9. Hose Allowances: System design shall include an allowance of 100 gpm (6.31 l/s) for inside hose stream, and 250 gpm (15.77 l/s) for total combined inside and outside hose streams.
		10. Hydraulic Calculations: Hydraulic calculations shall be in conformance with NFPA 13 and the following requirements:
			1. Water Supply: [Base hydraulic calculations on a static pressure of psi (kPa) with gpm (LPM) available at a residual pressure of psi (kPa) at .] [The Contractor shall determine the characteristics of the water supply and if necessary, conduct appropriate flow tests at their expense.] [Provide a copy of the most recent waterflow test with the hydraulic calculations. The water supply test may be no more than 10 months old when used for hydraulic calculations.]
			2. Margin of Safety: The sprinkler system shall be hydraulically designed so that the total waterflow and pressure demand is at least 10% less than the available water flow and pressure at the site.
			3. Friction Losses: Calculate losses in piping in accordance with the Hazen-Williams formula with "C" value of 100 for unlined ductile iron piping, 120 for steel piping, 140 for cement-lined ductile-iron piping, 150 for copper tubing and plastic piping.
			4. Flow Velocity: Piping shall be sized so that the water flow velocity does not exceed 20 ft/sec (6.1 m/s) at any point in the system during maximum water flow (including inside hose demand). Flow velocity in each pipe segment is to be provided in the calculations.
			5. Test Point: Calculations shall be brought back to the flow test point.
			6. Area of Coverage and Density: The area of coverage and density for each sprinkler shall be provided in the calculations.
			7. Equivalent Lengths: The equivalent lengths for all types of fittings and valves used shall be provided.
			8. Supply and Demand Graph(s): A graph comparing the water supply and the sprinkler and hose stream demand for each remote area shall be provided. Pressure and flow values for the supply and demand curves are to be provided on N 1.85 graph paper.
	4. SUBMITTALS
		1. Partial submittals will not be acceptable. Any installation work performed prior to the approval of the submittal shall be at the Contractor’s own risk.
		2. Before any work is commenced, submit manufacturer's data (with listing or approval), system calculations, [water supply data,] and complete sets of working drawings.
		3. The OSHEM Fire Protection Engineer shall review and approve submittals.
		4. Manufacturers' Data: Annotate descriptive data to show the specific model, type and size of each item the Contractor proposes to furnish. Include data for proper installation of each system including:
			1. Pipe and fittings
			2. Dry pipe valves
			3. Preaction valves
			4. Gate and check valves
			5. Globe valves
			6. Backflow preventers
			7. Water motor alarms
			8. Sprinkler heads
			9. Pipe hangers and supports
			10. Seismic bracing attachments and equipment
			11. Pressure and waterflow switches
			12. Tamper switches
			13. Inspector's test station
			14. Retard chamber
			15. Ball drip
			16. Fire department connections
			17. Lubricating compound/PTFE tape.
			18. Signs
			19. Caps, chains
			20. Cabinets
			21. Hose valves
			22. Drip pans
			23. Air Compressor
		5. Shop Drawings: Prepare working drawings on sheets not smaller than 24 in by 36 in (610 mm by 914 mm), in accordance with the requirements for "Working Plans" as specified in NFPA 13. A scaled site plan, with the location and elevation of the water flow test, shall be provided on the drawings. [Drawings are to include isometric diagram of sprinkler risers and feed mains, including all control valves.]
		6. As-Built (Record) Working Drawings: On a weekly basis, the Contractor Superintendent, in conjunction with the COTR, shall review and record as-built conditions on a set of drawings maintained at the job site. After completion, but before final acceptance of the work, furnish a complete set of as-built drawings for review and approval by OSHEM. Make all necessary corrections to the drawings and furnish four sets of as-built drawings for record purposes. All deviations from the approved shop drawings shall be highlighted on the as-built drawings; if required by OSHEM the Contractor shall also provide hydraulic calculations justifying deviations. The drawings shall not be smaller than 24 in by 36 in (610 mm by 914 mm) on reproducible sepia with title block similar to full size contract documents. Provide 1 compact disc containing CAD based drawings in DXF and PDF based format of all as-built drawings and schematics.
		7. Operation and Maintenance Manuals: Furnish four (4) instruction manuals containing complete operation and maintenance instructions for the specific make and model of all check valves, detector check valves, alarm valves, dry-pipe valve and deluge valve assemblies waterflow and tamper switches, backflow preventers, and other trim furnished. Serial numbers and ordering information shall be provided. Place one copy of each instruction manual in a flexible, oil-resistant protective binder and mount in an accessible location in the vicinity of each dry-pipe or preaction control valve. Furnish three additional copies of each instruction manual.
	5. QUALITY ASSURANCE
		1. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. All publications listed below refer to the most current edition.
		2. Manufacturers Qualifications
			1. American Society for Testing and Materials (ASTM) Publications:
				1. A53 Pipe, Steel, Black and Hot Dipped, Zinc-Coated, Welded and Seamless
				2. A135 Welded and Seamless Steel Pipe
			2. Factory Mutual System (FM) Publications
				1. Approval Guide
			3. National Fire Protection Association (NFPA) Publications
				1. 13 Standard for the Installation of Sprinkler Systems
				2. 14 Standard for the Installation of Standpipe and Hose Systems
				3. 70 National Electrical Code
				4. 72 National Fire Alarm and Signaling Code
				5. 101 Life Safety Code
				6. 291 Recommended Practice for Fire Flow Testing and Marking of Hydrants
				7. 1963 Standard for Fire Hose Connections
			4. International Code Council (ICC)
				1. International Building Code
			5. Underwriters Laboratories, Inc. (UL) Publications:
				1. Fire Protection Equipment Directory
				2. 262 Gate Valves for Fire Protection Service
				3. 789 Indicator Posts for Fire Protection Service
			6. American Society of Mechanical Engineers (ASME)
				1. A17.1 Safety Code for Elevators and Escalators
		3. Qualifications Of Installer:
			1. Prior to installation, submit data for approval by OSHEM, showing that the Contractor has successfully installed automatic wet pipe fire extinguishing sprinkler systems of at least 200 sprinkler heads each, or there is a firm contractual agreement with a subcontractor having such required experience. These systems shall be the same type and design which have been retrofitted into existing museums and historical buildings as specified herein. The data shall include the names and locations of at least two installations where the Contractor, or the subcontractor referred to above, has installed such systems. The Contractor shall indicate the

type and design of each system and certify that each system has performed satisfactorily in the manner intended for a period of not less than 18 months.

* + - 1. Design (including hydraulic calculations) shall be by a NICET Level III or IV Technician (in automatic sprinkler system design) or a Professional Engineer (P.E.), licensed in Fire Protection Engineering. Qualifications of the designer must be submitted to OSHEM for approval. The designer’s NICET or P.E. stamp shall be present on each sheet of the working drawings.
		1. Service Organization: The Contractor shall furnish, to the COTR, evidence that there is an experienced and effective service organization which carries a stock of repair parts for the system in order to readily conduct repairs throughout the warranty period. Should the Contractor fail to comply with the service requirements of this section, the Government will then have the option to make the necessary repairs and back charge the Contractor without any loss of warranty or guarantee as provided by the contract documents.
	1. DELIVERY STORAGE AND HANDLING
		1. Deliver products to project site in original, unopened packages with intact and legible manufacturers’ labels identifying product and manufacturer, date of manufacture, and shelf life if applicable.
		2. Store materials inside, under cover, above ground, kept dry and protected from physical damage until ready for use. Remove from site and discard wet or damaged materials.
		3. Automatic sprinklers must be kept in original packaging until they are installed. Loose carrying or storage is not permitted. Loose sprinklers shall be discarded immediately and replaced at Contractor’s expense
	2. PROJECT CONDITIONS

[List any special project conditions and/or environmental limitations on system installation, such as temperature, humidity, ventilation, etc.]

* 1. COORDINATION
		1. Coordinate sprinkler head layout with reflected ceiling plan and all ceiling – mounted equipment, including diffusers, lights, security cameras, fire alarm devices, exit signs, and other devices.
		2. Coordinate major equipment and piping layouts with other trades to avoid obstructions and excessive changes in direction for piping.
	2. WARRANTY
		1. The Contractor shall guarantee labor, materials, and equipment provided under this contract against defects for a period of one year after the date of final acceptance of this work by the Government.
		2. Final acceptance includes, but is not limited to, the receipt and OSHEM approval of, as-built drawings and operation and maintenance manuals.
	3. SERVICE AGREEMENT

[List requirements, if part of the contract. Confirm with OSHEM and COTR].

* 1. EXTRA MATERIALS
		1. [List special requirements for spare parts, if part of the contract. Confirm with OSHEM and COTR]. PART 2 - PRODUCTS
	2. ACCEPTABLE MANUFACTURERS
		1. All products are subject to the following listed acceptable manufacturers. If the product is not addressed herein the product shall be from a US based manufacturer and listed for fire protection use.
		2. All products shall be FM approved/UL listed.
		3. Double Check Detector Backflow Preventer Assembly
			1. Ames
			2. Watts
			3. Febco
			4. Hersey
		4. Fire Department Connections
			1. Allenco
			2. Elkhart Brass
			3. Potter-Roemer Inc
			4. Reliable Automatic Sprinkler Co.
		5. Fire Protection Valves and Drain Assemblies
			1. Tyco Fire & Building Products
			2. Victaulic
			3. Stockham
			4. Kennedy
			5. Jenkins
			6. Reliable Automatic Sprinkler Co.
			7. Viking Corporation
		6. Sprinklers
			1. Tyco Fire & Building Products
			2. Reliable Automatic Sprinkler Co.
			3. Viking Corporation
			4. Victaulic Corporation
		7. Valve Supervisory Switches
			1. Potter Electric Signal
			2. System Sensor
			3. McWane, In. Kennedy Valve Div.
	3. ABOVEGROUND PIPING SYSTEMS
		1. Provide fittings for changes in direction of piping and for all connections. Arrange piping so that it can be drained at the main riser. Make changes in piping sizes through standard tapered, reducing pipe fittings; the use of bushings is not permitted. Perform welding in the shop; field welding is not permitted.
		2. Jointing compound for pipe threads shall be polytetrafluoroethylene (PTFE) pipe thread tape only, applied on the male threads**.**
		3. Use of pipe dope is not permitted.
		4. Lubricant used on gaskets for mechanical fittings must be non-petroleum based and approved by OSHEM.
		5. Run piping concealed in areas with suspended ceilings, except as noted on the drawings.
		6. Sprinkler Pipe and Fittings: Provide in accordance with NFPA 13, except as modified herein. Steel piping shall be Schedule 40 per ASTM A53 for sizes less than 4 inches (101.6 mm) and Schedule 10 or 40 per ASTM A53 for sizes 4 inches(101.6 mm) and larger. ASTM A135, Schedule 40 piping may be used for pipe sizes less than 2 ½ inches (63.5 mm).
			1. Standard Installation:
				1. Nominal pipe sizes 4 inches or larger: Schedule 10 or 40 Pipe meeting ASTM A-53, A- 135 or A-795 with factory- or field-formed cut-grooved ends. Roll-grooved fittings are not permitted.
				2. Nominal pipe sizes smaller than 4-inches: Schedule 40 Pipe meeting ASTM A-53, A-135, and A-795 with factory- or field-formed threaded ends.
				3. For connections between 4 inch and larger pipes on risers, feed mains, cross-mains and drain lines, the requirements are as follows:

Grooved pipe couplings and fittings for grooved pipe.

Outlet coupling with screwed connection for grooved pipe.

* + - * 1. For connections from risers, feed mains, cross-mains, or drains to branch lines, the requirements are as follows:

Welded outlet with screwed connection or threaded coupling or fittings.

* + - * 1. For connections to and between branch line pipes less than 4 inches the requirement is as follows:

Threaded pipe couplings and fittings only.

* + - * 1. For connections between drain pipes requirement is as follows:

Galvanized threaded or cut-grooved pipe couplings and fittings.

* + - 1. [Animal Holding Area/Keeper Areas:
				1. Nominal pipe sizes 4-inches or larger: Schedule 10 or 40 Pipe meeting ASTM A-53, A- 135 or A-795, hot-dip galvanized and with factory- or field-formed cut-grooved ends.
				2. Nominal pipe sizes smaller than 4-inches: Schedule 40 Pipe meeting ASTM A-53, A-135, and A-795 hot-dip galvanized and with factory- or field-formed threaded ends.
				3. For connections between 4 inch and larger pipes on risers, feed mains, cross-mains and drain lines, the requirements are as follows:

Galvanized grooved pipe couplings and fittings for grooved pipe.

Galvanized outlet coupling with screwed connection for grooved pipe.

* + - * 1. For connections from risers, feed mains, cross-mains, or drains to branch lines, the requirements are as follows

Galvanized welded outlet with screwed connection or threaded coupling or fittings.

* + - * 1. For connections to and between branch line pipes less than 4 inches the requirement is as follows:

Galvanized threaded pipe couplings and fittings only.

* + - * 1. For connections between drain pipes requirement is as follows:

Galvanized threaded or cut-grooved pipe couplings and fittings.]

* + - 1. Underground piping: Shall comply with the requirements of NFPA 24 and shall be constructed of centrifugally case ductile iron or C900 polyvinyl chloride.
			2. Pressure ratings: All fittings and gaskets shall meet or exceed maximum working pressures present within the system.
			3. Corrosion protection: All piping and hangers where exposed to the weather or installed in a corrosive atmosphere shall be protected against corrosion.
			4. Pipe and Hanger Supports: Provide pipe supports, hangers, and clamps conforming to NFPA 13 and listed by UL or approved by FM. Provide galvanized supports, hangers, and clamps for all galvanized piping.
			5. Joint Construction
				1. Plain-end fittings with mechanical couplings, hole-cut mechanical threaded outlet fittings, hole-cut mechanical grooved outlet fittings, and hole-cut saddle clamp outlet fittings are not permitted for new systems. The above fitting types are only permitted on  a case-by-case basis when approved by OSHEM.
				2. Procedures for welding outlets shall be in strict conformance with the welding requirements of NFPA 13, including submission of welding certifications. Welding shall not be performed on site.
				3. Threaded Joints: Comply with NFPA 13 for pipe thickness and threads. Do not thread pipe with wall thickness less than Schedule 40.
				4. Grooved Joints and Fittings: Assemble joints and fittings with listed coupling and gasket, lubricant, and bolts from same manufacturer. Fittings and attached couplings shall be from the same manufacturer.
				5. Steel Pipe: Square-cut piping as indicated. Use grooved-end fittings and rigid, grooved- end-pipe couplings, unless otherwise indicated. Roll-grooved fittings are not permitted.
				6. If the galvanized coating on piping is found to be chipped or cracked upon grooving of joint, two coats of liquid galvanizing material shall be applied to groove. The first coat shall be thoroughly dry prior to applying the second coat.
		1. Use of restriction orifices, reducing flanges, unions, and plain-end fittings is not permitted.
		2. Flanged fittings shall be used in lieu of unions with the exception of drain lines.
		3. The corrosion resistance ratio of pipe and fitting method shall not be less than 0.95.
		4. Pipe Hangers and Supports: Provide in accordance with NFPA 13.
		5. Identification Signs: Attach properly lettered approved metal or polycarbonate signs conforming to NFPA 13 to each valve and alarm device. Polycarbonate signs shall be red with engraved white letters. Signs at valves shall describe the sprinkler zone it controls and state that the valve is to remain open. Permanently affix design data nameplate to the riser of each system.
		6. Inspector's Test Connection: Provide test connections no higher than 6 ft (1.83 m) above the floor for each sprinkler system or portion of each sprinkler system equipped with an alarm device; locate at the [hydraulically most remote part of each system and at the] control valve/drain assembly. Provide combination drain valve and test connection. Discharge shall be readily visible from the inspector's test connection, either by direct observation of the discharge or through a sight glass. Discharge shall be piped to either an open building drain or to the outside. Drainage and test valves shall be bronze globe, angle, or gate valves.
		7. Drains: Provide drain piping to discharge at safe points outside the building or to sight cones attached to drains of adequate size to readily receive the full flow from each drain under maximum pressure. All drain piping and fittings are to be galvanized. Provide auxiliary drains as required by NFPA 13. Splash guards are to be provided where necessary at discharge outlets.
		8. Pipe Sleeves and Seals. Provide where conduit or piping passes through walls, floors, roofs and partitions. Provide clearance between exterior of piping and interior of sleeve in accordance with NFPA 13. See Section 078413 Penetration Firestopping, for sleeves and seals through fire-rated assemblies. Secure sleeves in proper position and location during construction. Provide sleeves of sufficient length to pass through the entire thickness of walls, floors, roofs, and partitions.
			1. Sleeves in Masonry and Concrete Walls, Floors, and Roofs: Provide ASTM A53, Schedule 40, zinc-coated steel pipe sleeves. Sleeves in floors shall project 4 inches (101.6 mm) above finished floors to prevent seepage.
			2. Sleeves in Partitions and Other than Masonry and Concrete Walls, Floors and Roofs: Sleeves shall be constructed from either zinc-coated schedule 40 steel pipe or zinc-coated 26 gauge steel sheet.
		9. Escutcheon Plates: Provide one piece or split-hinge-type metal plates for piping passing through floors, walls, and ceilings in exposed and concealed areas. Provide chromium-plated or color- coordinated metal plates where pipe passes through finished ceilings. Securely anchor plates in proper position. Provide sprinkler escutcheon plates to match sprinkler head finish.
	1. BACKFLOW ASSEMBLIES
		1. Backflow assemblies installed in buildings within the limits of Washington DC shall comply with DC Water and Sewer Authority (DC WASA) and ASSE 1048 requirements. Backflow preventers outside of Washington DC shall comply with the requirements of the local water authority.
		2. The backflow assemblies shall be of the Double Check Detector Assembly (DCDA) type with bypass meter assembly, two independently operated spring-loaded check valves, top mounted test cocks, and two UL FM OS&Y resilient seated gate valves. DC Water and Sewer Authority
		3. Assemblies shall be listed for fire protection use.
	2. DRY PIPE VALVE
		1. Dry pipe valves shall include all trimming as required for a standard unit, that are UL listed or FM approved. Provisions shall be made to prevent excessive water accumulation. The dry pipe valve shall be fitted with an alarm bypass test connection so the waterflow device may be tested without opening the dry pipe valve.
		2. Each dry pipe valve shall be equipped with an automatic air maintenance device, in addition to all other required components.
		3. Provide an approved quick-opening device for dry pipe valves controlling systems having capacity of more than 500 gallons.
	3. AUTOMATIC AIR COMPRESSOR
		1. The automatic air compressor shall have a tank capable of maintaining the required operating pressure on the dry system and shall be capable of full recovery within 30 minutes. Provide all pressure switches, flow switches, supervisory switches and low/high air pressure switches in accordance with NFPA and the manufacturer's recommendations.
		2. The compressor shall operate on 208 volt, 3 phase power and shall have a horsepower rating of 1½ or less. The starter shall be provided by the Fire Protection Contractor.
		3. Where the building is provided with an emergency power system, the compressor shall be connected to emergency power circuits.
	4. PREACTION VALVE
		1. Preaction valves shall be operated by a listed releasing service panel that is connected to the building fire alarm system. Preaction valve clappers shall incorporate a latching mechanism that will not be affected by pressure changes in the water system. If 6-inch valves are used on 8-inch risers, provide smoothly tapered connections. In addition to automatic operation, arrange each valve for manual release at the valve. Provide pressure gauges and other appurtenances at the preaction valves. Provide a test detection device for each actuation circuit adjacent to each valve which the device controls, as required by NFPA 13.
	5. DETECTION SYSTEM
		1. Provide a mixture of photoelectric and ionization smoke detectors for actuation of the preaction system by cross-zoning. There shall be a minimum of two detectors provided for each preaction system. Provide an independent control panel and secondary power supply. Supervise preaction sprinkler piping and detection system. A break in piping shall activate a trouble alarm. Refer to Section 283111 for specifications on the control panel, detectors, spacing of detectors, secondary power supply, and supervision. Furnish no less than two spare detectors of each type for each system.
	6. MANUAL RELEASE STATION
		1. Stations shall be surface mounted and shall not be subject to operation by jarring or vibration. Break-glass-front stations will not be permitted; however a pull-lever, break-glass-rod type is acceptable. Display operating instructions on face of station in engrave or raised letters of a contrasting color. Provide permanent metal or engraved plastic signs mounted above or beside each station, indicting which system that the station controls. Lettering shall be a minimum of 1.5 inches high.
	7. SPRINKLER HEADS
		1. Provide quick response sprinklers in offices and all other areas where their use is listed or approved. Heads located within the air streams of unit heaters or other heat-emitting equipment or skylights shall be selected for proper temperature rating.
		2. Where only a portion of the automatic sprinklers in a space are being replaced as part of a renovation, the response characteristics of the new sprinklers shall match those existing in the space.
		3. Heads shall have a nominal ½ inch (12.7 mm) orifice. Corrosion-resistant sprinkler heads shall be installed where they are exposed to the weather, moisture or corrosive vapors. Heads installed where they might receive mechanical injury or are less than 7 feet (2.13 m) above the floor level, shall be protected with approved guards in accordance with NFPA 13. Provide finish as indicated.
	8. VALVES:
		1. Provide valves as required by NFPA 13. Valves shall be UL listed or FM approved for fire protection service.
		2. Gate Valves: Gate valves shall be the outside stem & yoke (OS&Y) type, and open by counterclockwise rotation. Gate valves installed higher than 7 feet (2.13 m) above the floor shall be provided with a chain drive or permanently mounted ladder. Provide a gate valve beneath each alarm valve in each riser when more than one alarm valve is supplied from the same water supply pipe. [For post indicator valves, provide operating nut located about 3 feet above finish grade. Gate valves for use with indicator post shall conform to UL 262. Indicator posts shall conform to UL 789. Provide each indicator post with one coat of primer and two coats of red enamel paint.
		3. Check Valves: Check valves shall be clear-opening, swing-check type, with a bronze or stainless steel seat ring and an EPDM rubber clapper facing. Flanged check valves of sizes 4 inch (101.6 mm) and larger shall have flanged inspection and access cover plates.
		4. Butterfly valves: Butterfly valves are permitted only for pipe sizes of 4 inches (100 mm) and smaller.
		5. [Floor Control Assemblies: Provide floor control valve assemblies at each floor level consisting of an indicating, supervised control valve, check valve, water flow switch, pressure gauge and test/drain assembly. The test/drain assembly must be routed to the main drain or an open building drain.]
	9. FIRE DEPARTMENT CONNECTION
		1. Fire department connection shall be in accordance with NFPA 13, with self-closing clapper valve in each inlet. The siamese connection shall be polished brass [bronze], [with polished chromium finish].
		2. Connection shall include a check valve, automatic drip (to drain to outside or building drain), caps and chains, 2 ½ inch (63.5 mm) female fire hose thread connections with [National Standard][Local Fire Department] threads, and nameplate.
		3. Nameplate shall be positioned so it is clearly visible and shall state the type of connection and the system(s) it serves.]
	10. ALARMS
		1. Pressure Switch: Provide switch with circuit opener and closer for automatic transmittal of an alarm over the facility fire alarm system and connect into the fire alarm system per Section 283111. Alarm actuating device shall instantly recycle. Switches shall be compatible with the fire alarm system.
		2. Low/High Air Pressure Alarm: Provide alarm for each sprinkler system. Alarm shall give a visual and audible alarm when air pressure in the system drops halfway from the normal pressure to the tripping point and when air pressure in the system rises 10 psi above the normal pressure. Mount an alarm bell, light signal and cut-off switch for silencing the bell on the low air pressure alarm panel. Provide electrical power supply connections at the supply side of the building service panel with a separate fused safety-type switch for each connection with locked lever. [Locate the panel as indicated.]
		3. [Water Motor Alarm: Provide a weatherproof and guarded 10 inch (254 mm) water motor alarm, to sound on the flow of water in each corresponding sprinkler system. Mount alarm on the outside of the wall of the building at a location indicated on the drawings. Provide a splash block beneath the drain for the water motor alarm. Install a permanent sign next to the water motor alarm stating the nature of the alarm and instructions for responding.]
		4. Valve Supervisory Switch: Valve supervisory switches shall be installed on all sprinkler control valves. The switches shall be mounted so as not to interfere with the normal operation of the valve and shall be adjusted to operate within two revolutions of the valve control or when the stem has moved no more than 1/5 of the distance from its normal open position. The mechanism shall be contained in a weather-proof, die-cast, aluminum housing that shall be provided with a ½ inch (12.7 mm) tapped conduit entrance and incorporate the necessary facilities for attachment to the valve. Switch housing shall be finished in red baked enamel. The entire installed assembly shall be tamper- proof and arranged to cause a switch operation if the housing cover is removed or if the unit is removed from its mounting. Devices shall be compatible with and connected to the fire alarm system per Section 283111.
	11. CABINET
		1. Furnish and install a metal cabinet containing a stock of spare sprinkler heads of all types and ratings installed. The cabinet shall be located near the [alarm][control] valve and where the temperature will not exceed 100º F (37.8º C) The number of spare sprinkler heads shall be as required by NFPA 13
		2. Provide a sprinkler head wrench for each sprinkler type present in the sprinkler head cabinet.
	12. STANDPIPE VALVES
		1. General: Provide bronze hose valves that are gate or angle type with screw-in bonnets, and 2-1/2 inch threaded male outlets with 1-1/2 inch adapters. Brass caps and chains are to be provided for

each outlet. Valves and adapters are to have [National Standard threads][local fire department threads].

PART 3 - EXECUTION

* 1. INSTALLATION
		1. Equipment, materials, installation, workmanship, examination, inspection and testing shall be in accordance with NFPA 13, except as modified herein. Install piping straight and true to bear evenly on hangers and supports. Install piping as close to the ceiling as possible, without interfering with other equipment and construction. Nipples shall be perpendicular to ceilings.
		2. Accurately align sprinkler heads in suspended ceilings symmetrically with diffusers, lights, and ceiling tiles. Install sprinkler heads in the center of the ceiling tiles unless directed otherwise. Concealed head covers shall not be installed until ceiling construction is complete and an inspection to determine height compliance has been conducted by OSHEM.
		3. Keep the interior and ends of all piping affected by Contractor's operations thoroughly clean of water and foreign matter by means of plugs or other approved methods. Inspect piping before placing into position. All pipe, fittings, and gaskets are to be cleaned of oil prior to installation.
	2. FIELD CHANGES
		1. Do not make field changes in the piping layout, pipe sizes, or type of equipment, without the prior approval of the COTR.
	3. CONNECTIONS TO EXISTING SPRINKLER SYSTEM
		1. Connection to the existing sprinkler system shall be done only after successfully testing new piping. Connections shall be as shown on the drawings. The COTR shall be notified at least 4 days prior to interruption of sprinkler protection.
		2. A schedule of any interruption of service shall be provided to the COTR and approval received before any service is interrupted. In no case shall the existing sprinkler system be shut off during periods other than normal Contractor construction hours.
	4. FIELD PAINTING
		1. Painting shall be per Section 099000, Painting, except as modified herein. The above-ground steel piping systems including valves, piping [in finished areas], pipe sleeves, conduit, hangers, miscellaneous metal work and accessories shall be cleaned, pre-treated, primed and painted. Coatings shall be applied only to clean, dry surfaces using clean brushes. Surfaces shall be cleaned to remove all dust, dirt, rust and loose mill scale.
		2. Immediately after cleaning, provide the metal surfaces with one coat of primer, applied to a minimum dry film thickness of 1.0 to 1.5 mil. Due care shall be exercised to avoid the painting of sprinkler heads or protective devices or allowing paint to drip or splatter on any equipment, artifacts, building structures, and floors. Materials which are used to protect sprinkler heads while painting is in progress shall be removed upon completion of painting.
		3. The Contractor shall remove all sprinkler heads which are painted and provide new, clean sprinkler heads of the proper type at his own expense. In addition to the primer, surfaces shall receive the following:
			1. Above-Ground Piping Systems in Unfinished Areas: Unfinished areas are defined as attic spaces, mechanical equipment spaces, spaces above suspended ceilings, crawl spaces, pipe chases, and spaces where walls or ceilings are not painted or not constructed of a pre-finished material. [Provide primed surfaces with one coat of red enamel.][Provide 2 inch (50.8 mm) wide red enamel or self-adhering plastic bands on sprinkler piping, spaced at a maximum of 10 ft (3.05 m) intervals.]
			2. Above-Ground Piping Systems in Other Areas: Provide primed surfaces with two coats of paint to match adjacent surfaces, except valves and operating accessories shall receive one coat of red enamel. Provide piping with 2 inch (50.8 mm) wide red enamel bands or self-adhering red plastic bands spaced at a maximum of 10 ft (3.05 m) intervals. In finished areas such as offices, the red bands may be omitted.
			3. All other coatings (e.g., zinc for galvanized pipe) shall be in compliance with NFPA 13.
	5. FIELD TESTING AND FLUSHING
		1. All testing shall be scheduled with the COTR.
		2. At the discretion of the OSHEM Fire Protection Engineer, an air pressure test may be required prior to filling the system with water. The test shall be conducted by raising the air pressure in the system to 40 psi (275.8 kPa) and allowing it to stand for 24 hours. There shall be no loss of air pressure greater than 1.5 psi (10.34 kPa) over the 24 hour period. Air pressure during this test shall be tracked via a graph over the 24 hour period by a pressure monitoring device or pressure monitoring gauge.
		3. Hydrostatic tests shall be conducted at the greater of 200 psi (1379 kPa) or the normal system pressure plus 50 psi (345 kPa) for a 2 hour period with no leakage or reduction in gage pressure. Hydrostatic test pressures shall not be maintained on the system overnight. Flush piping with potable water in accordance with NFPA 13.
		4. Preliminary Tests and Procedures: Test the alarms and other devices. Test the water flow alarms by flowing water through the inspector's test connection. [Prior to the hydrostatic test, perform an air test on the system.] [In areas where piping will be concealed by ceilings, walls, or other construction before the system is complete and ready for final testing, the preliminary hydrostatic test shall be conducted prior to piping being concealed. This test shall be witnessed by the COTR and the OSHEM Fire Protection Engineer.] When all tests and procedures are completed and corrections made, submit a signed and dated certificate, similar to that specified in NFPA 13, with a request for formal inspection and tests.
		5. Formal Inspection and Tests: At this time, all piping sprinklers, and other system components shall be in-place and all adjustments to the system completed. The OSHEM Fire Protection Engineer shall be notified by the COTR, shall witness all tests, and shall approve all systems before they are accepted. Submit a request for a formal inspection at least five working days prior to the date the inspection is to take place. A competent representative of the sprinkler installer shall be present during testing and inspection. As-built drawings shall be on-site for the inspection. At this inspection, the system shall be hydrostatically tested. Any or all of the required tests shall be conducted by the Contractor at his own expense and additional tests made until it has been demonstrated that the systems comply with all contract requirements. The Contractor shall furnish all appliances, equipment, instruments, connecting devices and personnel for the tests. **Any costs incurred by the SI for repeat tests, due to the failure of the Contractor to adequately demonstrate that the system complies with the contract requirements, shall be borne by the Contractor.**
		6. CONNECTIONS TO EXISTING PIPING: During air and hydrostatic testing, the Contractor shall test new piping prior to connecting to the existing system. If the Contractor chooses to test the new piping while it is connected to existing piping or valves, the Contractor shall assume responsibility for all piping and equipment which is pressurized, as well as any damage caused by the failure of existing or new sprinkler systems. **The SI accepts no responsibility for existing valves' performance to withstand hydrostatic pressure testing.**

END SECTION 211316