

SECTION 21 10 00 - WATER-BASED FIRE-SUPPRESSION SYSTEMS

PART I - GENERAL

1.1 SUMMARY

- A. Inclusion of sprinkler and standpipe systems shall be as determined by NFPA National Fire Code pamphlet 101 and program statement. Provide equipment, material, devices, labor, and supervision necessary to fabricate and erect hydraulically designed Wet Pipe and Dry Pipe Fire Suppression Sprinkler Systems as required by the Drawings and this Section.

[Note to PSC: The use of a clean agent fire suppression system does not necessarily exempt the space from requiring fire sprinklers. If pre-action systems are desired, they must be single-interlock type unless freezing temperatures require a double-interlock pre-action system.]

1.2 CODES AND REGULATIONS

- A. Sprinkler system design, equipment, materials, devices, and installation shall conform to the following:
1. NFPA National Fire Code pamphlets 13 (or 13R), 14, 101, and other applicable pamphlets.
 2. International Fire Code (NFPA National Fire Code pamphlet 101 shall take precedence where conflicts arise)
 3. Factory Mutual Global Approval Guide
 4. Underwriters Laboratory
 5. Fire Investigation Act. Part 41, Illinois Administrative Code Section 425, Section 25/6

1.3 WIRING

- A. The Division 26 Contractor shall furnish wiring for signal and alarm devices furnished by sprinkler contractor.

1.4 SPRINKLER DESIGN

- A. Fire Hydrant Flow Test: Sprinkler system hydraulic calculations shall be based on a recent (within five calendar years or since the last major modification was made to the surrounding distribution system) fire hydrant flow test as performed by the water purveyor University Water Station or Illinois American Water Company. Hydrants used should be immediately adjacent to water service connection building.
- B. Fire Service Line: The fire service line to the building is preferred to also provide domestic water service. Therefore, the fire protection contractor will start work at the backflow preventer.

1.5 SUBMITTALS

- A. Product Data: Product Data: Submit manufacturer's technical product data and installation instructions for all fire protection materials and products.
- B. Shop Drawings: Contractor shall submit scaled, dimensioned installation drawings and supporting hydraulic calculations. Contractor shall provide drawings and calculations that are prepared and stamped by a Registered Engineer.
- C. Contractor's Material & Test Certificate: Submit completed Contractor's Material & Test Certificate for each system.
- D. At project closeout, submit record drawings of installed fire protection piping and products.

- E. Submit operating and maintenance data and parts lists for fire protection materials and products. Include this data, product data, shop drawings, approved drawings, approved calculations, certificate of installation, and record drawings in maintenance manual.

PART 2 - PRODUCTS

2.1 FIRE PUMPS

- A. Fire pumps shall be electric driven horizontal splitcase centrifugal type as manufactured by Aurora, Patterson, Peerless, and Xylem/ITT-AC.
- B. Fire Pump Controllers: Masters, Firetrol, and Cutler-Hammer/Eaton
- C. Motors: Refer to Division 26

2.2 FITTINGS

- A. Couplings: Grooved couplings shall be prelubricated type only. Any field lubrication is prohibited.
- B. Cast-Iron Threaded Flanges: ASME B16.1, Class 125, raised ground face, bolt holes spot faced.
- C. Cast-Iron Threaded Fittings: ASME B16.4, Class 125, and standard pattern, with threads according to ASME B1.20.1.
- D. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, and standard pattern, with threads according to ASME B1.20.1.
- E. Grooved-End Fittings for Ductile-Iron Pipe: ASTM A 536 ductile-iron or ASTM A 47 malleable-iron, AWWA pipe-size, designed to accept AWWA C606 grooved couplings. Include cement lining or Food and Drug Administration (FDA)-approved interior coating.
- F. Steel Fittings: ASTM A234, seamless or welded; ASME B16.9, butt welding; or ASME B16.11, socket-welding type for welded joints.
- G. Steel Flanges and Flanged Fittings: ASME B16.5.
- H. Grooved-End Fittings for Steel Pipe: UL-listed and FM-approved, ASTM A 536, Grade 65-45-12 ductile iron or ASTM A 47 Grade 32510 malleable iron, with grooves or shoulders designed to accept grooved couplings.
- I. "Full-body style" mechanical tees are acceptable. "U-bolt style" mechanical tees are not allowed.

2.3 PIPE

- A. Use pipe, fittings, and joining methods according to the following applications. Piping may be joined with flanges instead of indicated joints. Use grooved end fittings with grooved couplings that are made by the same manufacturer and that comply with listing when used together for grooved-coupling joints.
- B. All sprinkler piping in fire pump room or where the fire service enters the building shall be painted to prevent external corrosion.
- C. Pipe between Backflow Preventer and Pump: Use galvanized steel for piping between the backflow preventer and pump.
- D. Drains and Pipe between Fire Department Connections and Check Valves: Use Galvanized steel pipe instead as specified below for dry pipe systems. Do not use welded joints.
- E. Sizes 2" and Smaller for Wet Pipe Systems: ASTM A 53 or A 135 Schedule 40 steel pipe with rolled-groove or cut-groove ends, grooved-end steel pipe fittings, and grooved-coupling joints. Threaded fittings and joints are also acceptable.

- F. Sizes 2" and Smaller for Dry Pipe Systems: ASTM A 53 or A 135 Schedule 40 galvanized steel pipe with cut-groove ends, grooved-end steel pipe fittings, and grooved-coupling joints. Threaded fittings and joints are also acceptable.
- G. Sizes 2 ½ and larger for Wet Pipe Systems: ASTM A 135 or A 795, Schedule 10 (minimum) steel pipe with rolled groove ends, grooved-end steel pipe fittings, and grooved-coupling joints.
- H. Sizes 2 ½ " and larger for Dry Pipe Systems: ASTM A 135 or A 795, Schedule 10 (minimum) galvanized steel pipe with grooved-end steel pipe fittings, and grooved-coupling joints.
- I. UL and FM approved flexible stainless steel piping drops to sprinkler heads are allowed only if there is not enough space for standard threaded fittings and pipe. *[Note to PSC: Consult with owner for approval prior to allowing these.]*
- J. CPVC may be used where listed and where pipe is concealed.

2.4 SPRINKLERS

- A. Components: O-rings shall not be used with any sprinkler.
- B. Response Rating: Automatic Sprinklers with quick-response element conforming to UL 199 for applications except residential. Replace existing adjacent sprinklers when they are not quick response.
- C. Sprinkler types and categories are as indicated and as required by application. Furnish automatic sprinklers with nominal ½-inch orifice and ½-inch NPT when available.
- D. Sprinkler types include:
 1. Coated or plated sprinklers
 2. Recessed sprinklers
 3. Sidewall sprinklers
 4. Upright sprinklers
 5. Concealed sprinklers
- E. Sprinkler Finishes: Painted, chrome, and bronze
- F. Sprinkler Escutcheons: Escutcheons for recessed-type sprinklers are specified with sprinklers.
- G. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler.
- H. Sprinkler Cabinets: Finished steel cabinets and hinged cover, with space for minimum of 6 spare sprinklers plus sprinkler wrench, suitable for wall mounting. Include number of sprinklers required by NFPA 13 and 1 wrench for sprinklers. Include separate cabinet with sprinklers and wrench for each style of sprinkler on project.
- I. Dry Sprinklers: Dry pendent and dry sidewall sprinklers shall be at least 24 inches long.

2.5 JOINING MATERIALS

- A. Refer to Division 21 for joining materials not included in this section.

2.6 GENERAL DUTY VALVES

- A. Refer to Division 21 for general-duty gate and ball valves.

2.7 GENERAL DUTY VALVES

- A. General: UL-listed and FM-approved, with 175-psig non-shock minimum working pressure rating.
 1. Option: Valves for use with grooved piping may be grooved type.

2.8 SPECIALTY VALVES

- A. Ball Drip Valves: UL 1726 automatic drain valve, ¾-inch size, spring loaded, ball check device with threaded ends.
- B. Backflow Preventer: Double check shall be Ames 2000ss, Wilkins, Watts.
- C. Dry Pipe Valve: Dry Pipe Valves shall be UL-listed and FM-approved, with 175-psig working pressure. Include trim sets for bypass, drain, electric sprinkler alarm switch, air pressure monitoring switch, pressure gauges, precision retarding chamber, air line, and fill line attachment with strainer.
 - 1. Drip Cup Assembly: Pipe drain with check valve to main drain piping.
 - 2. Option: Grooved-end connections for use with grooved-end piping.
- D. Manual Air Vent: Require manual air vent at high point for each zone.

2.9 CONNECTIONS

- A. Flush, Wall-Type Fire Department Connections (*for buildings without basements*): UL 405, cast-brass body; National Standard Thread inlets according to NFPA 1963 and matching local fire department threads; and threaded NPS outlet. Include lugged cap, gasket, and chain; lugged swivel connection, extension pipe nipples, and clappers for each hose connection inlet; and a wall escutcheon plate with marking "AUTO SPKR".
 - 1. Finish: Polished brass
- B. Freestanding Fire Department Connections (*for buildings with basements*): Freestanding Fire Department Connections supplying standpipe systems shall be polished brass with double clappers, plugs and chains, polished brass sleeve to cover standpipe and escutcheon lettered "Standpipe." The 2-1/2 inch by 2-1/2 inch by 4 inch Fire Department Connection shall be located on the street side of the building not less than 18 inches or more than 48 inches above grade or adjoining ground.
- C. Standpipe Hose Connections: Each standpipe hose connection shall be 2 ½ inches and shall be approximately 4 feet, 6 inches above the floor.

2.10 ALARM DEVICES

- A. Waterflow Indicators: UL 346, electrical-supervision type, vane-type Waterflow detector, rated to 250 psig, and designed for horizontal or vertical installation. Include 2 SPDT (single-pole, double-throw) circuit switches to provide isolated alarm and auxiliary contacts, 7 ampere, 125 volts AC and 0.25 ampere, 24 volts DC; complete with factory-set, field-adjustable retard element to prevent false signals, and tamper-proof cover that sends a signal when cover is removed.
- B. Supervisory Switches: UL 753 for valves, electrical-supervision type, SPDT (single-pole, double-throw), normally closed contacts, designed to signal controlled valve in other than full open position.
- C. Supervisory Pressure Switches (*Dry Systems*): UL 753, for low air alarm, air pressure switch with retard, electrical-supervision type, SPDT (single-pole, double-throw), normally closed contacts, designed to operate on rise or drop in air pressure.
- D. Acceptable Manufacturers: Potter, System Sensor, and Notifier.

2.11 PRESSURE GAUGES

- A. ANSI Grade AA (2A), ½% full scale accuracy
 - 1. 4½" diameter dial, with dial range of 0-250 psig.

PART 3 - EXECUTION

3.1 VALVE APPLICATIONS

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply.
 - 1. Shut-off Duty: Use gate, ball, or butterfly valves.
 - 2. Throttling Duty: Use globe, ball, or butterfly valves.

3.2 JOINT CONSTRUCTION

- A. Refer to Division 21 for basic piping joint construction.
- B. Grooved-End Pipe and Grooved-End Fitting Joints: Use groove-end fittings and grooved couplings that are made by the same manufacturer and that are listed for use together. Groove pipe and assemble joints with grooved coupling, pre-lubricated gasket, and bolts according to coupling and fitting manufacturer's written instructions. Field lubrication is prohibited. Fittings shall not be used to straighten a run of pipe and shall not exceed the amount of deflection recommended by the manufacturer.

3.3 SERVICE ENTRANCE PIPING

- A. Connect fire protection piping to building water service of size and in location indicated.
- B. Install shutoff valve, backflow preventer (double check type if from U of I water main and reduced pressure detector type with drain line to floor drain if from Illinois-American Water Company water main), pressure gauge, drain, and other accessories where indicated.

3.4 PIPING INSTALLATIONS

- A. Refer to Division 21 for basic piping installation.
- B. Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
 - 1. Deviations from approved shop drawings for sprinkler piping require written approval from authority having jurisdiction. File written approval with the PSC prior to deviating from approved shop drawings.
- C. Install flanges or flange adapters on valves, apparatus, and equipment have 2½-inch and larger connections.
- D. Main drains shall be located immediately after the backflow preventer and shall discharge to a location capable of accepting full flow under system pressure while allowing complete drainage to the outdoors (typically). Provisions shall be made to drain the main drain line at the conclusion of main drain tests. Floor drains can be used to provide drainage of the system but are not adequately sized for main drain tests.
- E. Sprinkler riser drains shall discharge into hub drains that are at least 4 inches in size.
- F. Gravity drain lines from fire pump shall be PVC. Pressurized drain lines shall be steel.
- G. Install Inspector's Test Connection, Drain, and relief valve at each riser, sized on the system riser. Route drains to outdoors or to a drain capable of accepting full flow under system water pressure such as a 4" hub drain. Custodial sinks are not considered proper drain receptors. Inspector's Test Connections use shall not require the use of ladders or temporary hoses.
- H. Install sprinkler piping with drains for complete system drainage.
- I. Install ball drip valves to drain piping between fire department connections and check valves, and where indicated. Drain outside building when elevations permit. Else, route drain line to floor drain.

- J. Install alarm devices in piping systems. Bells and water motor gongs on the exterior of the building are not desired. All flow switches, including those monitoring flow in standpipe systems, shall have a 45-second retard and shall have an Inspector's Test Connections for testing.
- K. Hangers and Supports: Comply with NFPA 13.
 - 1. Install hanger and support spacing and locations for steel piping joined with grooved mechanical couplings according to manufacturer's written instructions for rigid systems.
 - 2. Do not hang from joist bridging. Joist bridging is not considered structural.
- L. Install pressure gauges on riser. Include pressure gauges with connection not less than ¼" and with soft metal seated globe valve, arranged for draining pipe between gauge and valve. Install gauges to permit removal, and install where they will not be subject to freezing.
- M. Hold riser piping and components as close to wall as allowable. When in stairwells, install in the corner of the intermediate landings. Install riser components vertically, when possible, rather than horizontally to minimize space requirements. Risers to second floor shall not pass through electrical rooms.
- N. For dry pipe systems, no portion of the sprinkler system shall be gridded, looped, or arranged in such a manner as to allow water to flow to any sprinkler from more than one direction.
- O. Air gaps (pockets) shall be avoided. Provide a manual air release through a quarter-turn ball valve at high points. Outlet shall be turned down to allow use of a bucket and it shall terminate in a ¾" capped hose connection.

3.5 HYDRAULIC CALCULATIONS

- A. Size system piping such that total required system pressure at demand flow (including hose streams) is at least 5 psi less than the available pressure at demand flow.

3.6 VALVE INSTALLATIONS

- A. Refer to Division 21 for installation of general-duty valves. Install fire-protection specialty valves, trim, fittings, controls, and specialties according to NFPA 13, manufacturer's written instructions, and the authority having jurisdiction.
- B. Gate Valves: Install fire-protection service valves supervised-open, located to control sources of water supply. Where there is more than 1 control valve, provide permanently marked identification signs indicating portion of system controlled by each valve.
- C. Install tamper switches on valves controlling water supply to the sprinkler system.
- D. Install backflow preventers in potable water supply sources.
- E. Dry Pipe Valves: Install valves in vertical position for proper direction of flow, including bypass check valve and retard chamber drain line connection.
- F. Install permanent signs supported by chains identifying all drains, test connections, air supplies (for dry pipe systems), and water supply valves. Install placards indicating all hydraulic design criteria for each area and permanently attach placards to riser.

3.7 SPRINKLER APPLICATIONS

- A. Rooms without Ceilings: Upright sprinklers.
- B. Rooms with Ceilings: Recessed sprinklers.
- C. Beneath Overhead Doors: Sidewall sprinklers.
- D. Vestibules, stairwells, shipping, and other rooms with exterior doors: Dry pendent or dry sidewall sprinklers.
- E. Sprinkler Finishes: Use sprinklers with following finishes:
 - 1. Upright and Sidewall Sprinklers: Rough bronze.
 - 2. Recessed Sprinklers: White with white escutcheon.
- F. Sprinkler Temperature Ratings: Use sprinklers with the following temperature ratings in the applications listed unless noted otherwise on drawings:
 - 1. Ordinary Temperature Classification (165° F): Top of elevator hoistways where ambient temperatures cannot exceed 100° F, bottom of elevator hoistways for hydraulic elevators, elevator machine rooms, public areas, offices, custodial rooms, mechanical equipment rooms, alteration room.
 - 2. Intermediate Temperature Classification (212° F): Top of elevator hoistways where ambient temperatures can exceed 100° F, stock rooms, telephone/communication rooms.
 - 3. Thermal Response: Quick response sprinklers shall be used for light hazard and ordinary hazard occupancies.

3.8 SPRINKLER INSTALLATIONS

- A. Install sprinklers in locations indicated. When sprinkler locations are not indicated in an area, locate sprinklers to meet this specification.
- B. Install sprinklers in suspended ceiling in center of acoustical panels and in center of half of acoustical panels, as shown on plans. The location of sprinklers may deviate up to 1 inch from the center, provided the deviation is continued for all sprinklers in the rows of both directions.
- C. Install sprinkler guards on sprinklers under overhead doors, in elevator hoistways, elevator machine rooms, electrical rooms, mechanical rooms, telephone/communication closets and on non-recessed heads within 90 inches of the floor.

3.9 ELEVATOR-RELATED REQUIREMENTS

- A. Machine Rooms: Sprinklers are required in all elevator machine rooms. NFPA 13, 5-13.6 *[Note to PSC: Include wording in appropriate section of construction documents and show on the fire protection drawings.]*
- B. Hoistway Overhead No Sprinklers: No sprinklers shall be installed at the tops of elevator hoistways if a building is sprinkled “throughout” as per NFPA 5-13.6.3. *Exception. New construction shall never have sprinklers at the top of standard elevator hoistways.

- C. Sprinklers required in elevator Overhead in Existing buildings: Sprinklers are required in elevator overheads if the hoistway or existing elevator cab is not fire rated as per applicable codes.
- D. Hoistway Pit: Sprinklers are required in the pits of hydraulic elevators only. They shall be mounted within 2' of the pit floor per NFPA 13, 5-13.6.1. Per ASME A17.1, sprinklers located within 24" of the pit floor are not required to have shunt trip breakers as described below and NO smoke detectors or heat detectors shall be installed in any elevator pit on the U of I campus. *[Note to PSC: Include wording in appropriate section of construction documents and show on the fire protection drawings.]*
- E. Shunt Trip: Per ASME A17.1 and IBC 3006.5, wherever elevator hoistway overheads or machine rooms are protected with automatic sprinklers, a means shall be provided to disconnect the main line power supply prior to the application of water. See Section 26 80 00 - Elevator Electrical Requirements for Shunt Trip Protection.

3.10 CONNECTIONS

- A. Connect to fire department connections and accessories.
- B. Connect water supplies to sprinkler systems. Include backflow preventers.
- C. Electrical Connections: By Division 26 Contractor.
- D. For Dry Pipe Systems: Connect air lines to air compressor controlled by an automatic air maintenance device. Flexible connections and hose are not allowed.
- E. Follow NFPA 24 testing requirements of below ground piping prior to connecting to the above ground pipes.

3.11 FIELD QUALITY CONTROL

- A. Perform field acceptance tests of each fire protection system with PSC and authority having jurisdiction present.
 - 1. Flush, test, and inspect sprinkler piping systems according to NFPA 13 Chapter "System Acceptance."
- B. Replace piping system components that do not pass test procedures specified, then retest to demonstrate compliance. Repeat procedure until satisfactory results are obtained.
 - 1. Complete the Contractor's Material & Test Certificate and submit form promptly to Owner's representative and authority having jurisdiction.

3.12 CLEANING

- A. Clean dirt and debris from sprinklers. Replace sprinklers having paint other than factory finish with new sprinklers. Cleaning and reuse of painted sprinklers is prohibited.

3.13 COMMISSIONING

- A. Starting Procedures: Follow manufacturer's written procedures. If manufacturer prescribes no procedures, proceed as follows:
 - 1. Verify that valves, trim, fittings, controls, and accessories have been installed correctly and operate correctly.

2. Verify that specified tests of piping are complete.
 3. Check that damaged sprinklers and sprinklers with paint or coating not specified have been replaced with new, correct type of sprinklers.
 4. Check that sprinklers are correct type, have correct finish and temperature ratings, and have guards where required for applications.
 5. Check that potable water supplies have correct type of backflow preventer.
 6. Check that fire department connections have threads compatible with local fire department equipment and have correct pressure rating.
 7. Fill wet pipe sprinkler systems with water and bleed air through vents.
 8. Fill dry pipe sprinkler systems with air and drain water from low points.
 9. Energize circuits to electrical equipment and devices.
 10. Adjust operating controls and pressure settings.
- B. Coordinate with fire alarm system tests. Operate systems as required.
- 3.14 DEMONSTRATION
- A. Provide a demonstration of equipment, specialties, and accessories. Review operating and maintenance information.
 - B. Schedule demonstration with at least 7 days advance notice.

END OF SECTION **21** 10 00

This section of the *U of I Facilities Standards* establishes minimum requirements only.
It should not be used as a complete specification.