

## **SECTION 21 00 10: FIRE PROTECTION SYSTEM DESIGN**

1. SUMMARY
  - A. This section includes design and performance information for fire protection and suppression systems.
2. GENERAL
  - A. All fire protection materials and equipment shall be approved by Factory Mutual (FM).
  - B. Components required for a complete installation that are not available with the FM approval shall be listed by Underwriters Laboratories, Inc.
  - C. System design criteria shall be confirmed with Brown's designated Factory Mutual loss prevention representative. The contract documents shall clearly state the basis of design as reviewed and approved by the FM loss prevention consultant.
3. SYSTEM DESCRIPTION/PERFORMANCE:
  - A. Fire Protection designs shall take into account the needs of the end users, building environmental considerations, service and maintenance accessibility, and the actual building conditions which will be encountered in the field during construction.
  - B. Construction drawings shall reflect as closely as possible the actual locations of equipment and the actual routings of pipe.
4. HYDRAULIC CALCULATIONS:
  - A. Fire Protection and Sprinkler systems shall be hydraulically designed for each hazard group density in a project and the available water utility infrastructure in the area by a qualified fire protection engineer.
  - B. The fire protection engineer shall:
    1. Determine the Fire Protection hazard type and group, for each area.
    2. Show water density per square foot for each Fire Protection hazard type and group.
    3. Develop the basic layout, scope of the project, locations and routing of pipe mains and riser locations.
    4. Perform initial hydraulic calculations for the sprinkler and standpipe systems.
  - C. The Contractor shall perform hydraulic calculations based on the FM approved design criteria to confirm that the final Working (Fabrication) Drawing Layout provides sufficient pressures and flows, and the specified fire pump, if required, is adequate to provide sufficient pressure and flow for the protected hazards.
  - D. Contractor shall provide sealed shop drawings and the hydraulic calculations performed by a licensed Fire Protection Engineer.

5. SHOP DRAWINGS:

- A. Riser Diagram of the proposed system, showing all major isolation valves, equipment and accessories. Riser Diagram to be “geographically correct” with regard to the building configuration.
- B. Floor plans showing equipment and valve locations and routing of pipe.

6. SPRINKLER SYSTEM GENERAL DESIGN REQUIREMENTS:

- A. Fire suppression systems shall be wet pipe except in areas subject to temperatures below freezing, which will have a Dry Pipe System installed (Attics and Unheated Areas).
- B. Pre-Action systems will be used only in areas where the concern for water damage by accidental activation or damage to a sprinkler head is of utmost concern.
- C. Corridor Fire Mains:
  - 1. Fire mains in building corridors to be sized with a uniform size for the entire length of the corridor, as per the hydraulic calculations, so that the system can be expanded as needed without repiping the system.
  - 2. Corridor fire mains that are installed before the rooms/labs have been fitted out with sprinkler protection are to be provided with 2" taps on the fire main every 25 ft. for future connections.
- D. Drains:
  - 1. All drains from the sprinkler system and standpipe system (including but not limited to: backflow preventers, alarm check valves, dry pipe valves, pre-action valves, deluge valves, riser valves, sectional drain connections and drain lines at floor control valves), are to be piped to a proper drain location that can handle the water flow from both water flow testing and draining of the systems.
  - 2. Exterior drains shall be located to avoid water flowing onto pedestrian sidewalks (to minimize slip/fall hazards).
- E. Fire Department Connections.
  - 1. Check valve and auto ball drip to be provided on each connection.
  - 2. Location to be coordinated with the City and Brown Project Manager on the exterior of the building.

7. PIPING, FITTINGS, AND JOINTS:

- A. Buried Fire Service Entrance: Ductile iron, Class 52, cement-lined with mechanical joints. Provide restrained mechanical joints at changes of direction.
- B. Main fire feed piping and piping in Pump/Valve Room: Black steel Schedule 40, ASTM A53 with flanged threaded or grooved joints, or rigid couplings.
- C. Piping:
  - 1. The selection of piping types is to be reviewed in the project Design phase.
  - 2. Schedule 10 piping is allowed for most sprinkler system applications. Schedule 40 piping is required for high-pressure (over 100 PSI) applications, critical-use Research, storage and academic facilities.

- D. Wet System Sprinkler Piping:
    - 1. Steel: ASTM 135 Schedule 40 or Schedule 10 (where applicable) black steel with grooved or threaded joints.
    - 2. Copper: Type K or L copper. Provide dielectric fittings between copper and ferrous piping.
  - E. Dry Pipe Sprinkler Systems
    - 1. ASTM A795 Schedule 40 or Schedule 10 (where applicable) galvanized steel pipe with galvanized steel or malleable iron screwed fittings.
    - 2. Galvanized cast iron fittings shall be used only in drip legs at system low points.
  - F. Pre-action Sprinkler Systems
    - 1. ASTM A795 Schedule 40 or Schedule 10 (where applicable) galvanized steel pipe with galvanized steel or malleable iron screwed fittings.
  - G. Grooved Fittings and Couplings:
    - 1. Grooved mechanical pipe couplings, fittings, valves and other grooved components may be used as an option to welding, threading or flanged methods.
    - 2. Grooved piping system shall be listed for fire protection use.
    - 3. Approved grooved piping, components and connectors, and grooving tools manufacturer is Victaulic.
  - H. Flexible Sprinkler Head Whips:
    - 1. Flexible braided type 304 stainless steel braided whips, with 1-piece mounting brackets, are acceptable for final connections from branch lines to sprinkler heads. Maximum length of whips is 6 feet.
    - 2. Whip Manufacturer to be Victaulic.
8. BACK FLOW PREVENTER:
- A. Back-flow preventer to be installed on all fire sprinkler/standpipe systems.
  - B. The Back Flow Preventer to be installed inside the building with control valves before and after the unit to allow ready servicing of the backflow preventers.
  - C. Approved valve manufacturers:
    - 1. Ames
    - 2. Wilkinson
    - 3. Colt
9. VALVES:
- A. Above ground and within buildings: Control valves at backflow preventers and around fire pumps to be resilient seat OS&Y gate type valves. All other valves may be ball-type or butterfly type, with handwheel gear operator, position indicator and tamper switch.
  - B. Underground: Post Indicator Valves (PIV's) and other underground control valves to be of the lockable type and include a built-in tamper switch.

- C. Tamper switches to be connected to the building fire alarm system as a separate point or zone as a supervisory alarm (trouble), and not on the same point or zone of any alarm causing device.
  - D. Alarm check valve or equivalent to be installed at the main feed for each system. The trim on the valve to include: integral shutoff valve, supply and system pressure gauges (with shut off valves), main drain/test connection (with control valve), a retard chamber on the valve assembly to reduce false alarms due to fluctuating water pressure, and system flow switch.
  - E. Approved valve manufacturers: Tyco, Victaulic.
10. FLOOR CONTROL EQUIPMENT:
- A. Each system zone to be provided with an inspector's test/drain.
  - B. Control valves and test/drain assemblies shall be located a maximum 7 ft. above finished floor.
  - C. Preferred location of floor zone control valves and flow monitors is in stairways, either exposed or in properly sized wall cabinets. Avoid installations in ceilings.
  - D. Approved manufacturers: Tyco, Victaulic.
11. FIRE HOSE VALVES:
- A. Hose valves to include pressure-reducing feature, where installed on lower floors of facilities that have a fire pump.
  - B. Fire hoses are not to be provided.
  - C. Hose valves shall be centered within the cabinet to allow for adequate clearance for gloved hand operation.
12. SPRINKLER HEADS:
- A. Sprinkler guards to be installed in any location where sprinkler heads are subject to mechanical damage or are located below 7' 6" above finished floor.
  - B. Sprinkler heads with Corrosion-Resistant Coatings to be used in hostile and corrosive environments and exterior locations.
  - C. Provide spare sprinkler heads, for each type of sprinkler head installed, wrenches, spare cover plates and escutcheons, housed in a suitable storage box located in the main Fire Service room.
  - D. Approved sprinkler head manufacturers: Tyco, Victaulic.
13. DRY PIPE SYSTEM:
- A. Provide Dry Pipe Systems in all areas subject to freezing or temperatures below 40°F, such as attics.

- B. Configure dry type piping layouts to prevent sections of piping that will not drain or that may trap water. Provide drum-drip drain assemblies in all system low points for draining water and condensation.

14. DRY SPRINKLER HEADS:

- A. Dry-type sprinkler heads including pendant, upright and sidewall types, are to be used within Cold rooms /Environmental rooms on wet pipe systems, and in unheated spaces such as attics on dry pipe systems.

15. PRE-ACTION SYSTEMS:

- A. Pre-Action System shall be used only in areas where the concern for water damage by accidental activation or damage to a sprinkler head is of utmost concern.
- B. Pre-Action systems should be of the double-interlock design with a pre-action control valve for the dry-sprinkler zone and interlocked with the fire alarm system. The fire alarm system zone smoke detection must be in alarm for that area before the pre-action valve can activate.
- C. Provide a separate pre-action control panel for each pre-action zone to monitor the valve status and to control the activation of the pre-action valve from the building main fire alarm control panel.

16. FIRE PUMPS:

- A. Preference is for electric-powered fire pumps.
- B. Fire pump to be provided with a bypass loop around the pump.
- C. Fire pump to be provided with a test header, located outside of the building, with number of outlets per NFPA20.
- D. Fire Pump Controllers:
  - 1. Review the need to connect the fire pump / controller to an alternate power source or Emergency generator.
  - 2. Where the fire pump/controller is required to have an alternate power supply, preference is for the fire pump controller(s) to include an integral automatic transfer switch.
  - 3. Fire Pump controllers to utilize Solid-State-Reduced-Voltage type motor controller for “soft” starting and stopping of the fire pump. Coordinate controller settings for ramp up/ramp down rate and current limiting with emergency generator design limitations for motor starting KVA and voltage drop.
  - 4. Approved fire pump controller manufacturers: Emerson, Metron
- E. Fire Pumps:
  - 1. Horizontal, Split-case centrifugal type preferred.
  - 2. Approved fire pump manufacturers: Aurora, Patterson, Peerless.
- F. Jockey Pumps and Controllers:
  - 1. Approved Jockey Pump manufacturers: Grundfos
  - 2. Approved Jockey Pump Controller manufacturers: Metron

17. SYSTEM IDENTIFICATION

- A. Valve Tags and Charts:
  - 1. Valve tags on fire protection valves and valve charts to be provided.
  - 2. Valve tags to be brass and list the building and valve number. The chart to be wall mounted, location to be coordinated with FM-Operations.
- B. Signage:
  - 1. Provide per NFPA 13.
  - 2. Control Valves and Inspector's Test stations located in closets or rooms to have a sign on or near the door to indicate the device is in the closet or room. If behind a wall hatch, the sign shall be mounted on or near the wall hatch.

End of Section