

**GENERAL:**

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1. All fire protection systems shall be installed in accordance with the International Fire Code and applicable NFPA standards. This guideline provides additional requirements for the design and installation of Fire Protection and Fire Safety systems which will assure a functional and maintainable system over the life of the facility.
2. **Fire Safety** systems such as smoke detectors and fire alarms are intended to increase the level of life safety.
3. **Fire Protection** systems are intended to control fires and limit building damage.
4. Where a fire sprinkler is required as part of a fire safety system, as in an assembly or residence hall occupancy, it shall be designated as a **Fire Safety** system.
5. No fire protection system shall be removed or modified without permission of the AHJ.
6. The University is responsible for the operation and maintenance of the building fire protection systems.
7. Ensure construction drawings include details for all the proposed firestopping systems that could be encountered on the project based on the construction type and rating of the assemblies being penetrated. A specific Division 21 firestopping spec can be inserted, or reference related section 078400 for details.

**DESIGN GUIDELINES:**

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1. Fire Protection systems design includes all of the following components and systems:
  - 1.1. Automatic Sprinkler Systems
  - 1.2. Alternate Extinguishing systems
  - 1.3. Standpipes, combination and standard
  - 1.4. Fire pumps when required
  - 1.5. Fire extinguishers
  - 1.6. Supervision by the building Fire alarm
  - 1.7. Adequate provisions for testing and inspection
2. All new facilities and major renovations shall have an automatic fire sprinkler system, fire protection standpipe, fire extinguishers and fire alarm system throughout the facility, unless directed otherwise by the UM Director of FPD. It should be noted that regardless

of code exceptions for canopies or other structures that provide egress protection, the structure will be included per UM insurance requirements.

3. Building occupancies shall be determined based on International Building Code. Hazard Class occupancy shall be based on NFPA 13 and 14
4. Automatic wet pipe fire sprinklers
  - 4.1. All sprinkler systems will have a double check type backflow preventer installed at the point of building entry
  - 4.2. Automatic wet pipe fire sprinkler systems are preferred.
  - 4.3. Fire department connection shall be located to provide unobstructed access as approved by the Project Manager.
  - 4.4. Automatic wet pipe sprinkler systems shall utilize flow switches as the waterflow detecting device. Flow switches shall be connected to the building fire alarm system. Buildings should be zoned by floor or by area limitations. Each zone shall have a control valve, flow switch, pressure gauge and test drain connection. All zone water flow devices, valve tamper switches and air pressure for dry pipe systems shall be supervised by the building fire alarm system.
  - 4.5. Pressure reducing valves on automatic systems are not required. Pressures are not expected to exceed pipe pressure ratings.
  - 4.6. High temperature areas
    - 4.6.1. High or intermediate temperature sprinklers heads shall be provided in all mechanical rooms, and emergency generator rooms, attics and elsewhere when elevated ambient temperatures might be expected.
  - 4.7. Elevator Shafts and Equipment Rooms
    - 4.7.1. Automatic fire sprinklers shall not be required in elevator machine rooms, elevator machinery spaces, control spaces or hoistways of **traction** elevators where all the conditions of 8.15.5 of NFPA 13 are met.
  - 4.8. Dry pipe, Pre-action and combination systems
    - 4.8.1. Where space function, contents or process raises concerns about accidental water discharge a dry pipe, pre-action or combination systems shall be provided.
      - 4.8.1.1 Where the system is of significant capacity (i.e. >400 gallons), the engineer should review the option of providing a nitrogen generation system. If desired, the following requirements must be included in the specifications:
        - 1) The Nitrogen Generation System shall provide a minimum of 98% Nitrogen purity to the FPS utilizing Pressure Swing Adsorption (PSA) separation technology.
        - 2) Each Nitrogen Generation System provided must be FM 1035 Approved & UL 508A -Industrial Control Panel Listed.
        - 3) The Nitrogen Generation System shall be sized to maintain NFPA 25 acceptable leak rate (3 PSI loss over 2 Hours).

- 4) The system shall be provided with an air compressor package capable of filling the largest zone of the fire suppression system to pressure within 30 minutes per NFPA 13 requirements.
- 4.8.2. Pre-action, interlocked systems should use smoke or heat detectors for one of the initiating signals.
- 4.9. Areas subject to freezing
  - 4.9.1. Where sprinklers may be subject to freezing temperatures, limited areas may be served by dry pipe heads.
  - 4.9.2. Larger areas should be served by a dry-pipe system.
  - 4.9.3. Glycol systems shall not be installed, unless approved by the Project Manager.
- 4.10. Drainage
  - 4.10.1. All portions of the sprinkler system shall be provided with drain points. Any section of the systems that is trapped, shall be provided with a drain.
  - 4.10.2. Main drain shall be 2" diameter minimum.
  - 4.10.3. Drains shall be directed to a floor sink capable of handling the flow.
- 4.11. Alarm test connections
  - 4.11.1. Alarm test connections shall be provided for each zone. Test connection piping shall be routed to a single location, preferably a mechanical room. The location shall be provided with a floor sink capable of handling flow from the system. If a mechanical room is not practical, an exterior location, away from sidewalks and drives is acceptable.
5. Alternate Extinguishing Systems
  - 5.1. Alternate extinguishing Systems (non-water based) may be required for certain areas where the function of the room or value of the contents, requires alternate methods. Examples include:
    - 5.1.1. Chemical storage areas
    - 5.1.2. Archive storage
    - 5.1.3. Data centers
    - 5.1.4. Kitchen Hoods and grease ducts
  - 5.2. Alternate systems will be designed and installed per IFC Chapter 9 and applicable NFPA standards.
6. Fire Standpipe Systems
  - 6.1. Fire standpipes will be designed in accordance with NFPA 14.
  - 6.2. Systems type shall be Class 1.
  - 6.3. Fire hoses will NOT be provided.
  - 6.4. Where practical, the standpipes may be combined with the automatic fire sprinkler riser.
  - 6.5. Where a fire pump is not required for the automatic sprinkler systems, a manual standpipe is acceptable.

## 7. Fire pumps

- 7.1. Fire Pumps shall be provided when water supplies are shown to be inadequate.
- 7.2. Fire pump systems shall be designed in accordance with NFPA 20.
- 7.3. Fire pumps shall be located in a 2-hour fire room.
- 7.4. Base mounted pumps are preferred over vertical inline pumps. Vertical inline pumps require approval of the project manager.
- 7.5. Main fire pump and Jockey pump shall be accessible from all sides and shall not obstruct access to each other.
- 7.6. Piping and electrical conduit shall not obstruct access to the pumps. This includes routing on the floor of the walkways around the fire pump.
- 7.7. Room shall be provided with a 12 x 12 x 9" deep floor drain with a 4" waste connection.
- 7.8. Pumps shall be installed with PVC drain lines.
- 7.9. Pumps shall be installed with a common pressure gauge, with small ball valves to isolate suction and discharge pressures.
- 7.10. Pump drain shall be provided with a ball valve shutoff and a 1" balance valve.
- 7.11. Pressure reducing valves on automatic systems are not required. Pressures are not expected to exceed pipe pressure ratings.
- 7.12. The jockey pump shall be on an independent circuit so that when the fire pump is turned off, the jockey pump will remain in service.

## 8. Fire Extinguishers

- 8.1. Fire extinguisher types, quantity and locations shall conform to NFPA 10 and as follows.
- 8.2. All fire extinguishers provided in public locations shall be provided with a recessed cabinet.
- 8.3. A 5 lb. ABC Fire extinguishers shall be provided in all laboratories, with an exposed hanger, preferably near the door.

## **CONTRACT DRAWINGS:**

1. Consultants will prepare contract drawings which describe in general terms the scope of work and specify the requirements for fire protection system actual design and installation. All fire protection and fire safety drawings shall be packaged together under the FP heading.
  - 1.1. These drawings, as a minimum, will provide the following information:
    - 1.1.1. Service entrance and back flow preventer location.
    - 1.1.2. Fire department connection.
    - 1.1.3. Building zones and classification of occupancy hazards.
    - 1.1.4. Areas of special situations requiring alternate extinguishing systems.

- 1.1.5. Air venting valves and respective valve locations, per NFPA 13, 8.1.5 and 16.7.  
Manual air vent valves shall be minimum ½ inch size.
- 1.1.6. Main pipe routing, standpipe and zone valve, tamper and flow switch locations.
- 1.1.7. Drain valves and test locations.
- 1.1.8. Areas of possible obstructions from architectural, structural or mechanical objects.
- 1.1.9. Riser diagrams for all systems shall be included.
- 1.1.10. Fire Extinguisher locations.
- 1.1.11. Fire damper locations.
  
2. Design Coordination
  - 2.1. Coordination of design is critical to a successful building project. During the design phase of a project, promptly notify architect, structural, civil and electrical engineers of changes which affect their work. Coordination should include but, is not limited to the following:
    - 2.2. Architect shall:
      - 2.2.1. Indicate the ceiling heights in all areas.
      - 2.2.2. Indicate fire walls and firestop requirements.
      - 2.2.3. Indicate soffits and other ceiling features that may be an obstruction to water distribution.
    - 2.3. Civil/Structural engineer shall:
      - 2.3.1. Indicate any large structural members which might be an obstruction to water spray.
    - 2.4. Mechanical engineer shall:
      - 2.4.1. Indicate any large duct or other similar obstruction to fire protection piping and water spray pattern.
    - 2.5. Fire Protection engineer shall:
      - 2.5.1. Provide locations of fire extinguisher cabinets to the Architect.
      - 2.5.2. Provide information to the electrical engineer of locations of flow switches and tamper switches.
      - 2.5.3. Be aware of other areas and functions which might require special treatment such as archival space, kitchen areas, kitchen hoods, refrigerated areas, data centers, or chemical storage areas.
      - 2.5.4. Consultant shall request a recent water flow test from a fire hydrant near the project location unless a test has been performed within the last 12 months. Project manager will coordinate the request with the local water purveyor.

## **SPECIFICATIONS:**

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1. The following specifications apply to:
  - 1.1. Automatic Wet Pipe Sprinkler Systems
  - 1.2. Standpipes

### 1.3. Fire pumps

2. Design and install a new [or modify existing] automatic wet pipe fire extinguishing sprinkler systems for complete fire protection coverage.
3. Automatic wet pipe fire extinguishing sprinkler systems shall be designed in accordance with the required and advisory provisions of NFPA 13 by hydraulic calculations for uniform distribution of water over the design area.
4. Discharge from individual heads in the hydraulically most remote area shall be between 100 percent and 120 percent of the specified density.
5. Each system shall include materials, accessories, and equipment inside and outside the building to provide each system complete and ready for use. Design and install each system to consider blind spaces, piping, electrical equipment, ducts, and other construction and equipment in accordance with detailed working drawings to be submitted for approval.
6. Locate sprinkler heads in a consistent pattern with ceiling grid, lights, and air supply diffusers. Heads in relation to the ceiling and the spacing of sprinkler heads shall not exceed that permitted by NFPA 13 for the indicated hazard occupancy.
7. Devices and equipment for fire protection service shall be UL Fire Prot Dir listed or FM P7825 approved for use in wet pipe sprinkler systems.
  - 7.1. Design Water Density \_\_\_\_\_ per SF
  - 7.2. Design Area \_\_\_\_\_ sq ft
  - 7.3. Hose Allowance \_\_\_\_\_ GPM
8. Calculate losses in piping in accordance with the Hazen-Williams formula with 'C' value of 120 for steel piping.
9. Base hydraulic calculations on a static pressure of [\_\_\_\_\_] psig with [\_\_\_\_\_] gpm available at a residual pressure of [\_\_\_\_\_] psig at the base of the sprinkler piping riser.
10. Computer calculations and or computer aided designs may be used to provide hydraulic calculations.
11. Prepare Minimum 24 by 36 inch detail working drawings of sprinkler heads and piping system layout in accordance with NFPA 13, "Working Drawings (Plans)." Show data essential for proper installation of each system. Show details, plan view, elevations, and sections of the systems supply and piping. Show piping schematic of systems supply, devices, valves, pipe, and fittings. Show point to point electrical wiring diagrams.

Submit drawings including the hydraulic calculations signed and stamped by a registered fire protection engineer.

12. Fire Sprinkler shop drawings shall be submitted for review and approval PRIOR to installation. The plans will be reviewed by:
  - 12.1. MU campus only: Maintenance Engineer /Fire Protection shop, City of Columbia Fire Marshal, and Design Engineer
  - 12.2. MS&T, UMKC and UMSL: AHJ Approved Code Consultant and Design Engineer
13. All sprinkler heads in a building shall be of the same manufacturer.
14. Only new equipment and pipe shall be used. All equipment shall be UL listed and FM approved.
15. Pipe material shall be schedule 40 (Type ERW) steel pipe per ASTM A53/135. Do **not** allow Schedule 10 pipe for permanent installations. All steel pipes should be specified to include a bacterial resistant internal coating. To help reduce the potential for accelerated internal pipe corrosion of longitudinally welded black steel sprinkler system pipe, include a requirement to install the pipe with the weld line rotated at least 45° in relationship to the floor (for reference, the weld line points at the floor at 0°).
  - 15.1. Exception: Chlorinated Poly Vinyl Chloride is acceptable for areas of light hazard in residential classification in accordance with all applicable codes. Use of this product requires prior written authorization from the AHJ.
  - 15.2. Exception: Flexible braided hose sprinkler drops are allowed as an option to hard pipe arm overs. Victaulic is the only approved manufacturer at this time. Specify appropriate support brackets as recommended by Victaulic. Note: MUHC Design Guidelines do not allow this option.
16. Pipe fittings shall be cast iron, malleable iron or steel.
17. Pipe joints may be seamless, welded, threaded or mechanically coupled.
  - 17.1. Welder and weld procedure qualifications shall be submitted with the sprinkler shop drawings. All welders and welding procedures shall meet or exceed AWS standard D10.9, level AR-3. *Note: Qualified welders in Missouri are very limited. It will be very costly to weld sprinkler piping.*
  - 17.2. Grooved joint fittings are acceptable, except tee fittings serving small branches or single sprinkler heads shall be secured with a 2 bolt, cast iron strap. Branch fittings secured with wire straps are not permitted.
18. Fire department connections shall be as follows:

- 18.1. Columbia: 4-inch STORZ type with lockable caps.
  - 18.2. Rolla: See City of Rolla Ordinance 4104 referenced below.
  - 18.3. Kansas City:
  - 18.4. St Louis:
19. All fire protection piping shall be supported independently of all other building systems.
  20. Zone control valves shall be butterfly with aluminum bronze or neoprene coated ductile iron discs.
  21. Hydraulic design information shall be posted per NFPA 13 near the water service entrance.

## REFERENCES

### City of Rolla Ordinance 4104

#### Sec. 14-72. Fire Department Connection - Fire Department Connection (FDC) Requirements

The City of Rolla requires the Fire Department Connection (FDC) to be a standalone connection. The connection must follow all International Fire Code 2018 and NFPA requirements. The FDC connection shall meet all test requirements.

- a. The fire department connection FDC shall be a free standing and remote from the building at a distance from the building equal to half the height of the exterior wall.
- b. The FDC shall be equipped with a 2-2½ inch National Standard Thread connection. The FDC piping underground shall be equipped with a ball drip valve to ensure there is no standing water in the connection and that the piping does not freeze.
- c. The FDC shall be arranged to face a paved roadway, sidewalk or other approved area and shall be installed so that it will not interfere with access to the building when hoses are laid from the closest public hydrant to the FDC. The FDC shall be located on the same side of the lot/or building as the closet public fire hydrant or a maximum of one hundred (100) feet.
- d. The FDC shall be arranged so that the connection is no more than (48) inches above the finished grade, sidewalk or location of the connection.
- e. A Knox brand locking cap with a chain or cable shall be provided for the FDC. A Knox application can be obtained at the City of Rolla Fire & Rescue.
- f. Where the FDC is subject to vehicle damage, the connection shall be protected per the fire code.

