Sprinklers, Standpipes, Fire Pumps and Secondary Water Supply for High-Rises

TECHNICAL BULLETIN
FIRE-9-1

City of San Diego
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The purpose of this Technical Bulletin is to establish the minimum requirements for the design of sprinkler systems, standpipes, secondary water supply, and fire pumps in high-rise buildings. High-rise buildings are defined in the California Building Code (CBC) as a building having an occupied floor located more than 75 feet above the lowest level of fire department vehicle access.

Documents referenced in this Information Bulletin

- **California Building Code, (CBC)**
- **California Fire Code, (CFC)**
- **National Fire Protection Association Standard for the Installation of Sprinkler Systems, (NFPA 13)**
- **National Fire Protection Association Standard for the Installation of Standpipe and Hose Systems, (NFPA 14)**
- **National Fire Protection Association Standard for the Installation of Stationary Pumps for Fire Protection, (NFPA 20)**
- **National Fire Protection Association Standard for Water Tanks for Private Fire Protection, (NFPA 22)**
- **City of San Diego Storm Water Standards**

I. FIRE SPRINKLER SYSTEMS

Fire sprinkler systems shall be designed and installed in accordance with NFPA 13, as modified by the California Building and Fire Codes (CBC & CFC), City of San Diego policies, and the following requirements.

A. Control Valves

Each floor shall be provided with an individual approved, supervised indicating sprinkler control valve at the point of connection to the riser. The valves shall be monitored in accordance with the CFC.

B. Water–Flow Devices

Each floor shall be provided with an individual approved, supervised sprinkler water-flow alarm-initiating device at the point of connection to the riser. The water-flow device shall be monitored in accordance with the CFC.

C. Water Discharge from Drains

The discharge from drains serving the sprinkler and standpipe systems shall not empty directly or indirectly into the storm drain. The discharge must return to the on-site secondary water supply.

D. Redundant Risers

Fire sprinkler systems in buildings more than 420 feet in building height shall be supplied by connections to a minimum of two sprinkler or combined sprinkler/standpipe system risers. Each sprinkler system must be hydraulically designed so that the worst-case system demand can be supplied through only the hydraulically most remote riser.

E. Riser Locations

Standpipe and combined sprinkler/standpipe system risers must be located within exit stair enclosures. Where the exit stair is a smokeproof enclosure that is accessed by a vestibule, the system risers shall be located in the vestibules. The standpipe location within the vestibule or exit enclosure is not permitted to obstruct egress when the hose lines are connected and charged, and the hose valves are not permitted to be obstructed by open doors. Where redundant risers are required by CBC 403 (see Section I-D above), they shall be installed in separate smokeproof enclosures that are remotely located in accordance with CBC 1007.

F. Fire Department Connection (FDC)

Two FDCs, at separate locations on the building's exterior, must be provided for high-rise buildings, At least one of the FDCs must be located on the

address side of the building.

Hose connection inlets on the FDCs must be provided with threaded, male caps. The number of inlets provided shall be determined based upon the requirements of NFPA 14.

Permanent signage shall be provided to indicate the minimum pressure required for the fire apparatus to pump into the FDC. Example of required signage:

FD Minimum Pump Pressure 225 psi

G. Pressure Regulating Valve (PRV)

If PRVs are installed on the floor control valves for the sprinkler systems, the PRVs must be factory-set with no field adjustment capabilities.

II. STANDPIPE SYSTEMS

Standpipe systems shall be designed and installed in accordance with NFPA 14, as modified by the CFC, City of San Diego policies, and the following requirements.

A. Maximum Pressure

Where the static pressure at a 2½-inch hose connection exceeds 175 psi, an approved pressure-regulating device shall be provided to limit static and residual pressures at the outlet of the hose connection to 175 psi. Pressure-regulating hose connections shall be field-adjustable.

B. Minimum Pressure and Design

Standpipes shall be hydraulically designed and field tested to provide a minimum residual pressure of 100 psi at the outlet of the hydraulically most remote 2½-inch hose connection. Pressure loss through the hose valve shall be calculated as required by NFPA 14. The minimum flow rate shall be 500 gpm through the two most remote 2½-inch outlets and 250 gpm for each additional standpipe to a maximum of 1,000 gpm for buildings that are sprinkler protected throughout, in accordance with NFPA 13.

C. Drain and Test Riser

A permanently installed drain riser shall be provided adjacent to each standpipe equipped with pressure-regulating devices to facilitate testing of each device. The drain shall be sized large enough to handle the full flow required from the largest pressure-regulating device, but shall not be less than 3-inch pipe. The drain riser shall be equipped with a 2½-inch inlet to allow for a 2½-inch diameter fire hose to be connected between the pressure-regulating device and the drain. Where standpipes are located in stairwells that extended to the roof level, the drain riser must also be extended to the roof level.

III. SECONDARY WATER SUPPLY

In accordance with CBC 903, a secondary on-site water supply must be provided for all new high-rise buildings. This required secondary on-site water supply shall be an on-site water storage tank designed and installed in accordance with the requirements of NFPA 22 and the following requirements.

A. Tank Sizing

The on-site secondary water supply tank must have a usable capacity equal to 15,000 gallons or the hydraulically calculated sprinkler demand plus 100 gpm for inside hose stream, for a duration determined by the sprinkler system design occupancy hazard classification in NFPA 13, whichever is greater. The system design occupancy hazard classification shall be the worst-case hazard classification for the high-rise portion of the building. The Class I standpipe system demand is not required to be included in the water supply calculations used to determine the required tank sizing.

B. Water Supply Discharge

All required water supply connections

from the public water distribution system must discharge directly into the on-site water supply tank, thereby allowing the tank to serve as both the primary and secondary water supply for the building's fire suppression systems.

C. Tank Water Level Indicator

A tank water level indicator must be provided at a location that is visible to the fire pump operator. When an electronic-type water level indicator is installed, provide standby power to the device or equipment.

D. Low Water Signal

A low water level supervisory switch must be installed in the on-site water storage tank. The switch must be connected to the Fire Alarm Control Panel (FACP) to indicate when the tank water level drops to 9 inches below the full water line. This will signal that more water is being pumped from the tank than is being replenished, allowing time to open the manual fill valve and to initiate a supervisory signal at the FACP.

E. Water Supply Connections

To maintain the minimum required capacity of the on-site water storage tank at all times, the tank water supply connections, including all piping, valves and fittings between the public water main POCs and the tank fill connections, must be sized for the flow and pressure required to refill the water storage tank at a rate equal to 110% of the total fire protection system demand (i.e. the worst case sprinkler demand plus 100 gpm hose stream, determined as required for sizing the tank).

F. Multiple Water Supply Connections

In buildings with an occupied floor more than 120 feet above the lowest level of FD vehicle access, water supply to the on-site water storage tank must be provided by no less than two separate connections to the public water distribution system.

When water supply to the on-site water storage tank is provided by multiple supply connections to the public water distribution system, the supply connections must be configured using one of the following two options:

1. The supply piping must be connected to at least two different public water mains located in different streets, or

2. The supply piping can be connected to a single water main when the main is valved such that an interruption can be isolated so that water supply will continue without interruption through at least one of the supply connections.

When multiple water supply connections are provided, each connection must be sized so that it can independently supply the flow and pressure required to refill the water tank as described in Section III-E above.

G. Fill Valves

Each on-site water storage tank supply connection must be provided with at least one automatic and one manual fill valve. All fill valves must be sized to refill the water storage tank at a rate equal to 110% of the total fire protection system demand (i.e. worst case sprinkler demand plus 100 gpm hose stream, determined as required for sizing the tank). When the automatic fill valves have electronic actuators and/or solenoids, provide standby power to all electronic components.

H. Overflow Discharge

Per the City of San Diego Storm Water Standards, overflow from the on-site water storage tank must discharge to a sanitary sewer inlet. That inlet and the attached sanitary sewer system piping must be properly sized for the maximum expected flow rate, and the inlet shall be located outside of the fire pump room.

I. Bypass

A bypass line, sized equal to the diameter of the inlet of the pump, and supplied from one of the tank water

supply connections, shall be provided in the event of fire pump and/or water storage tank failure.

J. Very Tall Buildings

NFPA 20 sets forth specific requirements for water supply required in very tall buildings. For projects in the City of San Diego, a very tall building is a building that is more than 500 feet in building height, as defined by the CBC.

IV. FIRE PUMPS

Provide fire pump(s) sized in accordance with NFPA 13 and NFPA 14, as modified by the CFC, NFPA 20, and the following requirements.

A. Pump Room Designs

The fire pump room must be designed with adequate space and clearances for all equipment necessary for the installation in accordance with the manufacturer's specifications. A door or doors and an unobstructed path of travel must be provided into the fire pump room in order to allow for the removal of the largest piece of equipment.

B. System Working Pressures

System working pressures shall not exceed the listed pressure rating of the equipment being used.

C. Redundant Fire Pumps

A redundant fire pump system must be provided for all buildings having an occupied floor more than 200 feet above the lowest level of fire department vehicle access. Each fire pump system shall be capable of automatically supplying the required demand for the sprinkler and standpipe systems.

D. Fire Pump Test Header/Test Loop

Fire pump installations must be provided with a means for testing the pump at rated pressure and flow. Acceptable means for performing this testing include providing a test header located on the exterior of the building or providing a flow meter test loop that discharges back into the water storage tank. When a test header is provided, it shall be located adjacent to one of the two required FDCs.

E. Fuel Supply

Fire pumps must be provided with an on-premises fuel supply, sufficient for not less than 8-hour full-demand operation at 100 percent of the rated pump(s) capacity in addition to all other supply demands in accordance with NFPA 20 Chapters 9 & 11.