

# FIRE PUMPS FOR HIGH RISES

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## LEARNING OBJECTIVES

- 1 Define a high-rise, Very Tall Building and understand how to evaluate a building to determine if they meet these definitions
- 2 Understand the requirements set forth in NFPA 20 for high rise and very tall buildings
- 3 Define a vertical fire protection zone and the options for designing a building with multiple fire protection zones.
- 4 Apply the requirements of NFPA 20 to these buildings



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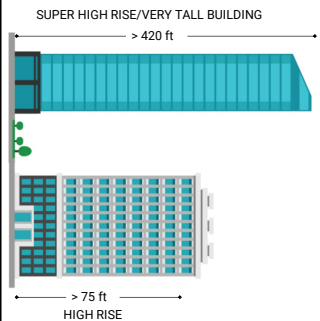
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HIGH RISE DEFINITIONS

- **High rise** – A building with an occupied floor located more than 75 feet above the lowest level of fire department vehicle access
- NFPA and IBC have same definition
- Buildings over 420 feet have specific requirements in both IBC and NFPA
- NFPA refers to these buildings as “Very Tall Buildings”



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IBC WATER SUPPLY REQUIREMENTS (>420 FT)

- Section 403.3.2
- Fire pumps need to be connected to at least two separate mains
  - Each connection sized to handle the demand of the fire protection system
  - Exception: connection to a single water main is permitted if the main can be isolated so that the water supply can continue into one of the connections
  - Also applies to buildings of IV-A and IV-B construction that are more than 120 feet in building height



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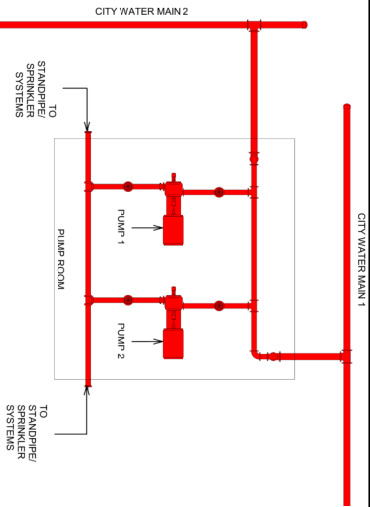
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SECTION 403.3.2



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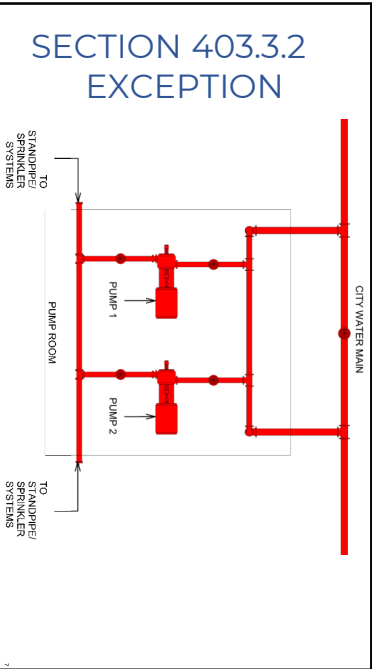
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**IBC WATER SUPPLY REQUIREMENTS (>420 FT)**

Each sprinkler system zone in buildings that are more than 420 feet (128 m) in *building height* shall be supplied by not fewer than two risers. Each riser shall supply sprinklers on alternate floors. If more than two risers are provided for a zone, sprinklers on adjacent floors shall not be supplied from the same riser.

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**IBC WATER SUPPLY REQUIREMENTS SEISMIC ZONES C,D,E OR F**

Section 403.3.3

- An automatic secondary on-site water supply shall be provided for buildings assigned to seismic Design Category C,D,E or F.
- An additional fire pump shall not be required for the secondary water supply unless needed to provide the minimum design intake pressure at the suction side of the fire pump
- The secondary water supply shall have a duration of at least 30 minutes as determined by the design basis seismic classification in accordance with NFPA 13.

**SEISMIC ZONES**

**NFSA**

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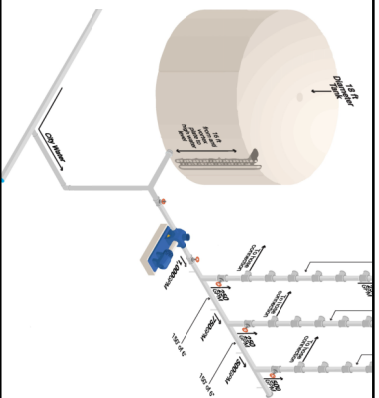
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### SECTION 403.3.3



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### IBC EXERCISE



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### NFPA 20 – HIGH RISE REQUIREMENTS

- NFPA 20 uses the term, "Very Tall Building"
- Very Tall Building Definition: (3.3.79) A high-rise building where the fire protection water demand exceeds the pumping capacity of the fire department.
- Intent is to analyze what *pressure* the fire department can produce, not what *flow*



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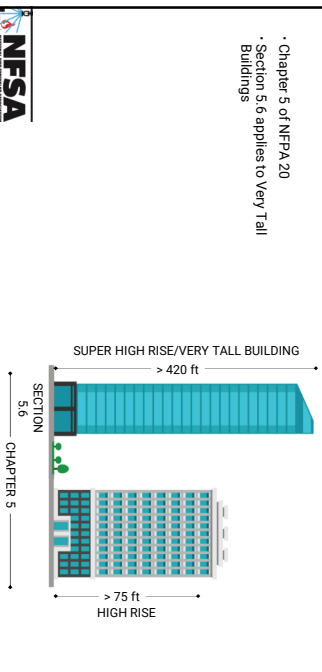
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## NFPA 20 – HIGH RISE REQUIREMENTS

- Chapter 5 of NFPA 20
- Section 5.6 applies to Very Tall Buildings



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## CHAPTER 5 REQUIREMENTS FOR ALL HIGH-RISE BUILDINGS

- **Section 5.3**
  - 5.3.1 – When Provided tanks shall be in accordance with NFPA 22
  - 5.3.2 – Tanks can be shared with domestic supply, however domestic connection shall be above fire protection demand.
- **Section 5.4** – Where tank is provided test connection piped back to tank with either:
  - Listed flow meter
  - Calibrated nozzles set up to measure pressure (convert to flow)
- **Section 5.5**
  - Electric pumps require alternate power or back-up fire pump



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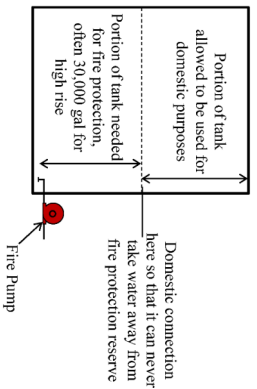
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## SECTION 5.3



From *Standpipes for Fire Protection Systems* by Isman, used with permission

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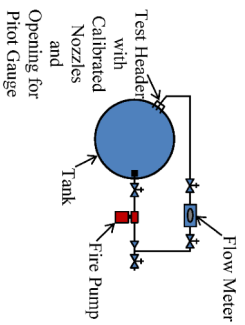
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SECTION 5.4



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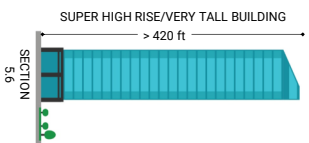
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SECTION 5.6

- Assumption is that the building is divided into multiple vertical zones for fire protection
- Where the primary source is stored water, each zone needs to be served by at least 2 tanks (or a single tank that can be compartmented to work like 2 or more tanks)
- Total capacity of all tanks must meet system duration demand
- With any one tank out of service, must have 50% of duration demand still in service



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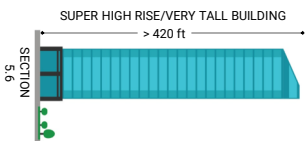
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SECTION 5.6

- 1 automatic refill for each tank or compartment
- 1 manual refill for each tank or compartment
- Each refill sized to handle maximum system flow demand for duration demand
- Automatic and manual valve must each have a connection to one of the following:
  - A standpipe riser from a different zone (not dependent on the tank it fills) that has a back-up pump
  - Gravity fed riser from a different zone
  - Dedicated riser from a pump in a zone below
- Reliable domestic riser that can handle to the flow



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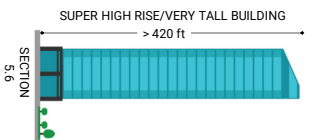
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### SECTION 5.6

- Each refill connection must be to a different riser
- Refill connections must be interconnected
- Where connected to different zones, check valves shall be installed in each standpipe connection to prevent cross flow between zones
- Isolation valves on both sides of each check valve
- Isolation valves between each interconnection



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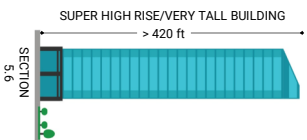
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### SECTION 5.6

- Each tank (or compartment) needs to have an overflow sized for maximum refill rate
- Overflow must be piped to a drain that can handle the flow
- Fire Pumps require one of the following:
  - Back-up pump
  - Auxiliary means of providing fire protection system demand that is acceptable to the AHJ



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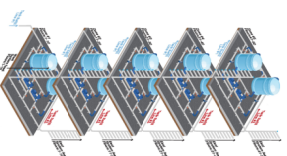
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### VERTICAL FIRE PROTECTION ZONES

**2019** - A vertical zone within a high-rise building that is supplied from a fire pump(s) and/or water storage tank(s)

**2022** - The portion of a vertical fire protection system of standpipes with hose valves, sprinkler systems with sprinkler system connections, or combination standpipe sprinkler systems that are supplied by a fire pump(s) or a water storage tank(s) where the static pressure difference between levels is only a function of the elevation difference.



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IBC EXERCISE



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LAST SLIDE



Questions?



Contact: Jeff Dunkel

[DunkelJ@ttsa.org](mailto:DunkelJ@ttsa.org)



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Next Learning Branch: April 27th

*Elevator, Sprinkler, and Fire Alarm Requirements*

John Swanson



23

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