

12

HIGH-RISE BUILDING PROVISIONS

12.01 *Standards Established*

12.01-1. Scope. The purpose of this standard is to clarify existing Code and City of Bellevue Fire Department requirements relating specifically to high-rise buildings. This information is to supplement existing code requirements and does not cover all aspects.

The City of Bellevue has adopted the 2007 edition of NFPA 13, 14, 20 and 72.

12.01-2. Provide life safety systems to include fire alarm, automatic fire sprinklers, emergency voice/alarm communication systems, fire communications system, standpipes, smoke control and shaft pressurization systems, building radio coverage system.

12.01-3. Provide Standby and Emergency power systems and fuel systems in accordance with the requirements of the IBC/IFC, in particular City Of Bellevue Amended IBC/IFC 604.

12.01-4. Provide a communication amplification (Building radio coverage) system in accordance with COB Amended IFC 511 (23.11.511).

12.01-5. Demolition and construction shall conform to Chapter 14 of the IFC.

12.02 *Automatic Sprinkler Systems*

Ref.: IFC 903, BFDDS Chapter 7, NFPA 13

12.02-1. The sprinkler and standpipe system is addressed in Chapter 7 of the BFDDS. Bellevue has adopted the 2007 edition of NFPA-13, but does not grant a reduction in remote area for quick response sprinklers. Wet systems in commercial spaces must be designed as a minimum to a criteria for Light Hazard (0.10 gpm/sq. ft. over the remote 1,500 sq. ft. of floor area).

12.02-2. Pressure Reducing Valves must be set in accordance with COB Amended IFC 905.3.8.

12.02-3. Sprinkler piping on floors up to the 2nd floor shall be sized for street pressure only.

- 12.02-4. Adequate heat to maintain 40 deg. F must be provided. Heat tracing is not a substitute where other engineering options can be used.

12.03 Standpipe Systems

Ref.: IFC 905, BFDDS Chapter 7, NFPA 14

- 12.03-1. Standpipe systems shall be provided in accordance with Amended IFC 905 and Chapter 7 of the BFDDS. In particular:
- a. The standpipe risers shall be interconnected and have an isolation valve for each standpipe.
 - b. Two four-way fire department connections shall be provided on separate streets, piped to separate standpipe risers.
 - c. At least one fire department connection shall be piped to the standpipe side of an isolation valve.
 - d. FDC's must be located at an approved location.
 - e. A Fire hydrant must be located within 50ft of the FDC
 - f. FDC must be labeled in accordance with Amended IFC 912.4
 - g. Roof and floor remote areas must be within 200 feet of hose travel distance from a protected standpipe hose connection in accordance with Amended IFC 905.4.
- 12.03-2. Location of Class I standpipe hose connections must be in accordance with City of Bellevue amended IFC 905.4.
- 12.03-3. The City of Bellevue has amended the 2006 International Fire Code by Ord. 5749. Section 905.3.8 of the IFC is amended to read as follows:

905.3.8 High Rise Building Standpipes. Standpipe risers shall be combination standpipe/sprinkler risers using a minimum pipe size of 6 inch. One 2-1/2 inch hose connection shall be provided on every intermediate floor level landing in every required stairway and elsewhere as required by NFPA 14. Where, and only where, static or residual water pressures at any hose outlet exceeds 175 psi (1207 kPa), approved pressure-regulating devices shall be installed to limit the pressure to 175 psi (1207 kPa).

Such devices shall be adjusted to provide 175 psi (1207 kPa), or as close to that pressure as the adjustment will permit while flowing 300 gpm, without exceeding 200 psi (1207 kPa). The pressure on the inlet side of the pressure-regulating device shall not exceed the rated working pressure of the device. An equally sized bypass around the pressure regulating device with a normally closed control valve shall be provided. Signage in accordance with NFPA 14 and Section 912.4 shall be provided.

Point of Information: Additional flow and pressure requirements are contained in NFPA 14. Designers should be cognizant of space considerations within stair shafts and additional signage needed for the PRV by-pass control valves. For city wide uniformity, the City of Bellevue desires the PRV settings to be such that the required flow is available at

175psi. However, a range of up to 200psi is provided to allow for design flexibility. Further, dual hose connections- one with a PRV and one without, can be installed as an acceptable alternative to the equally sized bypass detailed above.

- 12.03-4. NFPA-14 requires that 500 gpm be provided at the most remote standpipe and that an additional 250 gpm be added for each additional standpipe within the high rise building. The residual pressure at the remote point must be at least 100 psi. The primary water supply system (including pumps) must be sized to satisfy this requirement.

12.04 Water Supply

Ref.: IFC 903.3.5.2; NFPA-13,

- 12.04-1. Two separate water supplies are required for the sprinkler/standpipe system in accordance with City of Bellevue amended IFC 903.3.5.2. One must be a permanent City water main connection and the second must be a dedicated reservoir. The reservoir must be sized in accordance with IFC 903.3.5.2 and must comply with NFPA-22 (Water Tanks) and be equipped with an automatic fill assembly that will refill the tank within 4 hours.

- 12.04-2. A secondary water supply is required for high rise buildings within the City of Bellevue, as per IFC 903.3.5.2, as amended. The definition of water supply includes both the water reservoir and the ability to pump it to the roof. Therefore a separate pump associated with the reservoir is required. A seismic separation must be provided between the two systems to insure survivability of the secondary supply.

- 12.04-3. The precise hydraulic calculation of the sprinkler system demand always comes too late in a project to be of assistance in designing the secondary water supply system. Therefore the City of Bellevue has amended the 2006 International Fire Code by Ord. 5749. Section 903.3.5.2 of the IFC is amended to read as follows:

903.3.5.2 Secondary water source. A secondary on-site water source shall be provided for high-rise buildings as follows:

- 1) High-rise buildings containing R-2 or B occupancy only shall be provided with a net useable volume of 15,000 gallons.
- 2) High-rise buildings containing an S-2 occupancy shall be provided with a net useable volume of 40,000 gallons.
- 3) High-rise buildings containing an M occupancy shall be provided with a net useable volume of 50,000 gallons.
- 4) Multi high-rise complexes sharing a common secondary water source shall be provided with a net useable volume calculated by combining the highest demand of number 2 or 3 above, with number 1 above. Only one parking/retail area and 2 high-rise buildings may share a common secondary water source.

An acceptable alternative to items 1 through 4 above, is to provide a calculated net useable volume capable of meeting the hydraulically calculated sprinkler demand, including the total (combined inside and outside) hose stream requirement, as per NFPA 13. The duration of this calculated source shall have a duration of not less than 30 minutes for buildings with light hazard occupancies only and a 60 minute duration for buildings with ordinary hazard occupancies as defined by NFPA 13.

Exception: Existing buildings, including those undergoing substantial renovation

- 12.04-4. The storage tank volume must provide the net usable volume requirements of IFC 903.3.5.2 as amended by the City of Bellevue. The net usable volume is calculated based on delivering positive pressure at the pump suction flange for tanks located below the centerline of the pump or calculated based on delivering -3psi at the at the pump suction flange for tanks at or above the pump, in accordance with NFPA 20-07, 5.14.3.1-2.
- 12.04-5. A minimum of two fire pumps independently driven shall be provided and sized for the sprinkler demand and for standpipe operations. At least one fire pump shall be piped to the standpipe side of an isolation valve.
- 12.04-6. Fire pumps per NFPA 20- 2007 edition and 2005 NEC. Backup power and primary and secondary wiring must be provided, routed and protected per NFPA 20- 2007 edition requirements.
- 12.04-7. When large diameter pressure reducing valves are utilized to control zone pressures, two valves shall be installed in parallel, each capable of handling the required water flow.
- 12.04-8. The same pumping system must provide 300 gpm at 175 psi noted above, in addition to the calculated fire sprinkler demand (theoretical minimum flow for Light Hazard = 150 gpm, Ordinary Haz-2 = 300 gpm).
- 12.04-9. The primary and secondary boosted supplies must meet the flow and pressure demands of the standpipe and sprinkler systems as outlined in this Standard and the IFC.
- 12.04-10. The two pumps must be arranged such that the booster pump comes on for the initial drop in pressure from that maintained by the jockey (pressure maintenance) pump. If that pump cannot sustain the operating pressure, then the secondary pump will automatically start.
- 12.04-11. Because we expect a fire to occur within a parking garage as likely as one above grade following a seismic event, we require the garage sprinklers to also be connected to the pumped water supply. This frequently results in too much pressure being placed below the dry valves themselves, which contributes to inadvertent valve actuations. Although not allowed by

NFPA-20, we allow parallel, main-line PRVs to be used to reduce the pressure to the manifolds directly serving the dry valves.

12.05 Fire Alarms

Ref.: IFC 907, 509, BFDDS Chapter 8, 11, NFPA 72

- 12.05-1 Fire Alarm systems shall be provided in accordance with IFC 907, Chapter 8 of the BFDDS, and NFPA 72 – 2007 edition. In particular:
- a. Smoke detectors shall be installed to comply with IFC 907. They shall be connected to the Fire Alarm system.
 - b. Sprinkler zoning by floor is required.
 - c. Wiring for the fire alarm systems shall meet the requirements of NFPA 72 with regards to survivability, and IBC 909.20.6 as relates to shaft pressurization control wiring.
 - d. The voice message used for phased evacuation must be approved by the Bellevue Fire Department. Re-entry to occupied floors from the stairwell must be unobstructed, resulting in unlocked stairwell doors or automatically unlocking doors upon fire alarm signal.
- 12.05-2 The City of Bellevue requires at least one Fire Command Center (FCC) with direct exterior exit at an approved location near core stairwells.
- 12.05-3 The Fire FCC is required to contain the following equipment per City of Bellevue amended IFC 509 and BFDDS.
- a. The voice alarm and public address system panel
 - b. Fire Department communications panel and 8 portable phone handsets
 - c. The fire-detection and alarm system annunciator panel
 - d. Annunciator visually indicating the location of the elevators and whether they are operational
 - e. Status indicators and controls for the air-handling systems
 - f. Controls for unlocking all stairway and electronic doors simultaneously
 - g. Sprinkler valve and water-flow detector display panels
 - h. Emergency and standby power status indicator, manual start and transfer features
 - i. Telephone for Fire Department use with controlled access to the public telephone system
 - j. Fire pump status indicators and remote manual start must be provided separate of the fire alarm panel.
 - k. A pressure gauge indicating the pressure within the standpipe at the control station level
 - l. Schematic building plans indicating the typical floor plan and detailing the building core, means of egress, fire protection systems, firefighting equipment, and fire department access suitable for marking with a grease pencil
 - m. Work table or counter
 - n. Shaft pressurization systems status indicators and controls
 - o. Annunciation identification

- p. A building-wide manual door release shall be provided in the Central Control Room for firefighter's use.
- q. Emergency Operational Plan
- r. Smoke control documents required per Chapter 11 of the BFDDS.

12.05-4 An approved two-way, fire department communication system designed and installed in accordance with NFPA 72 shall be provided for fire department use as required by IFC 907.2.12.3 and 1007.6.3. This system is required in addition to the in building radio amplification system.

12.06 Smoke Control

Ref.: IFC 909, BFDDS Chapter 11

12.06-1 A smoke control system that complies with IBC 909 and Chapter 11 of this Standard must be provided. A Smoke Control system is required for high rise buildings (IBC 403.1), underground buildings (IBC 405.5), and Atriums (IBC 404.4).

12.06-2 A separate permit is required for a smoke control system. Submittal requirements are detailed in Chapter 11 of the BFDDS and Number Sheet 42. Drawings must include all zones, all required equipment, definitions of fans and dampers, positive indication supervisory switches, wiring in raceways, a listed smoke control panel (SCP), and a smoke control functional matrix. Note that the BFDDS include many details and standard features applicable to the Smoke Control Panel and procedures applicable to the Special Inspector.

12.06-3 Provide 2hr protection of control and power wiring for stair and elevator pressurization systems per COB Amended 909.20.6.1. Wiring for the fire alarm systems shall meet the requirements of NFPA 72 on Survivability, and IBC 909.20.6 as relates to shaft pressurization.

12.06-4 Pressurization of all stairways leading into a parking garage that descend more than 30 ft. below grade is required, as well as pressurization of any pressurized stair tower above grade that extends below grade, and the reverse combination.

12.07 Generators

12.07-1 The installation of generators, fuel tanks and fuel piping requires a review and approval by both the fire and mechanical departments.

12.07-2 Storage of more than 240 gallons of diesel fuel for (emergency generators, etc.) shall be in a Group H, Division 3 occupancy.

12.07-3 The requirements of IFC 3404 must be met. In particular:

- a. Section 3404.2.9.6:

1. Fill connections shall be located outside buildings, at least 10 feet from building openings and property lines, provided with a liquid-tight cap, and protected from possible vehicular damage. A metallic pipe shall extend to within 6 inches of the bottom of the tank to minimize the generation of static electricity.
 2. Tank overfill prevention shall be provided, including an audible or visual alarm signal at the fill location to indicate when the tank is 85 percent full and automatic shut off of the flow of fuel when the quantity of liquid in the tank reaches 90 percent of tank capacity.
 3. The fill pipe shall be provided with a means for making a direct connection to the supply tank vehicle's fuel-delivery hose so that the delivery of fuel is not exposed to the open air during the fueling operation. When any portion of the fill pipe exterior to the tank extends below the level of the top of the tank, a check valve shall be installed in the fill pipe not more than 12 inches from the fill hose connection.
 4. An approved spill container having a capacity of not less than 5 gallons shall be provided for the fill connection for above ground tanks.
- b. 3404.2.7.3:
1. Normal vents shall discharge to the outside, not less than 12 feet above the adjacent ground level, at least 5 feet from building openings and property lines, and not under eaves or building overhangs.
 2. Approved flame arrestors shall be installed in normal vents

12.07-4 One or more portable fire extinguishers having a rating of not less than 20-B shall be located not less than 10 feet nor more than 50 feet from the tank storage area.

12.07-5 A fire department permit is required to store, handle or use Class II or Class III-A combustible liquids in excess of 25 gallons inside a building.

12.08 Additional Requirements

12.08-1 Provide a construction standpipe as required by Chapter 14 of the IFC. A construction standpipe system shall be installed when the progress of construction is not more than 40 feet in height above the lowest level of fire department access or two or more levels below grade. Such standpipe systems shall be extended as construction progresses to within one floor of the highest point of construction having secured decking or flooring.

12.08-2 Provide fire extinguishers in accordance with IFC 1415 and 23.11.906.1. Verify that all portions of the building are within 75 feet of foot travel of a fire extinguisher.

12.08-3 These projects require the services of a designated, full-time Safety Officer at the discretion of the Fire Department at any time during construction.

This job assignment may be mobilized for intermittent periods during the course of construction. The Safety Officer shall be an employee of the Developer or the General Contractor, with qualifications approved by the Fire Department. This persons primary responsibility shall be the supervision of the safety conditions on the project site. They will maintain a daily log, recording all related events and personnel involved, including safety system shutdowns and startups. This person will regularly report his findings and observations to the Bellevue Fire Department's assigned Fire Prevention Officer.

- 12.08-4 High rise buildings are required to have a Fire Safety and Evacuation Plan in accordance with IFC 404 reviewed and approved by the Fire Department prior to final occupancy.
- 12.08-5 Before the parking garage can be used for storage, vehicular parking or construction shacks the permanent automatic sprinklers, fire alarms, emergency lighting and exit lighting shall be installed. The Fire Marshal may allow temporary water supplies or other protection systems but specific prior approval is required.
- 12.08-6 Before any floor of the building can be occupied for use the following shall be completed.
- a. Permanent automatic sprinkler protection shall be installed on the occupied floor and all floors below.
 - b. The permanent fire alarm system shall be installed on the occupied floor and all floors below.
 - c. The elevator recall system shall be installed on all floors
 - d. The emergency generator shall be in service.
 - e. The smoke control system shall be complete and functional
 - f. An approved evacuation and life safety plan shall be in place
 - g. Other requirements may be imposed by the fire department as needed to insure life safety.

12.09 Phased Evacuation

In a phased evacuation, occupants from the zone of fire origin may be moved to another area of the building that is protected from the fire zone. This allows occupants an opportunity to stage — that is, be relocated — within the building, offering an extended period of time to evacuate a building completely, if the fire department ultimately determines complete evacuation is needed. Phased evacuation is most often associated with high-rise buildings. Other occupancies that may use this approach include health care and detention/correctional facilities, where occupants may not be capable of evacuating the building on their own.

The City of Bellevue has historically utilized phased evacuation for buildings 11 stories or higher in height. This approach relies on the premise that occupants on the fire floor and adjacent floors can be safely relocated within the building while building features in

combination with the responding fire department can extinguish the fire before an untenable environment is reached.

- 12.09-1 Phased evacuation is initiated using multiple notification devices. Horn/speakers- voice alarms, in combination with strobe devices, are generally used to notify occupants of a phased building evacuation. The City of Bellevue requires a voice alarm system where specific instructions are issued to building occupants. Occupants on the floor (zone) of fire origin and the floor above and below are given a signal and message to evacuate and to re-enter four (4) floors below their originating floor.
- 12.09-2 The following requirements must be met for phased evacuation to be considered in high rise buildings within the City of Bellevue’s jurisdiction:
- a. Fire Resistive Construction. Phased evacuation is only effective if the occupants being removed from the zone of fire origin can be moved to another area of the building that is protected and properly separated from the zone of origin. At a minimum, the building must be of fire-resistive construction (structural frame, floor and vertical openings protected). Additionally, the building must be provided with smoke or fire compartmentation — that is, the building is subdivided into distinct zones (compartments) that are separated from other zones in the building by construction that will delay or minimize the movement of fire and smoke through the building. Most of the compartmentation is achieved through fire-resistive building construction.
 - b. Full Automatic Sprinkler Protection. The building must be fully protected with quick response automatic sprinklers. Sprinklers offer the ability to control a fire early in its growth, while also providing an effective means of automatically detecting a fire. Thus, they are also an effective means of initiating the occupant notification system. Sprinkler systems must be zoned to coincide with fire and/or smoke compartment boundaries.
 - c. Fire Alarm System. The fire alarm system must meet the requirements for system survivability of NFPA 72- National Fire Alarm Code. In addition, the voice message must be approved by the Bellevue Fire Department. Re-entry to occupied floors from the stairwell must be unobstructed, resulting in unlocked stairwell doors or automatically unlocking doors upon fire alarm signal.
 - d. Fire Safety Management. Building management and occupant training play a critical role in evaluating phased evacuation capabilities. Annual training must be conducted in accordance with Bellevue Fire Department requirements with full support of building management and tenants.
- 12.09-3 If phased evacuation is to be used, it is imperative that fire zone boundaries are identical to occupant notification zone boundaries and

smoke control zones. In other words, the entire fire zone must be a single zone for occupant notification and protection, so that all occupants within the fire zone receive the same message and level of protection. If occupant notification zones (i.e., horn or speaker circuits) do not correspond precisely with fire zone boundaries, occupants in the fire zone may not get the appropriate evacuation notification signal.