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MARCH 2013

# BUILDING CODES TOOLKIT



Design Options (Tradeoffs)  
Allowed by the 2012  
Building Codes for Properties  
with Sprinkler Systems

# Design Options (Tradeoffs) Allowed by the 2012 Building Codes for Properties with Sprinkler Systems April 2013

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The National Multi Housing Council and the National Apartment Association (NMHC/NAA) have been involved in the model code development process for many years, with the emphasis on making the model codes work for the multifamily industry. We advocate for technologically feasible and cost-effective codes and standards that address the needs of the apartment industry.

A major part of that effort is to establish provisions in the codes that provide for safe yet affordable housing. Our major effort in that regard has been to place within the codes sprinkler provisions that save lives, as well as property, and to do so in a way that is cost-effective. This has entailed a continued effort to propose and support provisions for sprinkler design options (tradeoffs) that are permitted when sprinkler systems are installed. The design options have been effective in providing construction alternatives that more than offset the sprinkler installation cost without any impact on the safety of the apartment renter.

In fact, fire data from the National Fire Protection Association (NFPA) has documented and shown that apartment sprinkler systems have the highest activation rate of any occupancy when a fire occurs. When a fire happens, quick activation is very effective in saving lives and property. Nationally, fire deaths in wet pipe sprinklered apartment buildings average 17 fire per year compared to 424 per year in non-sprinklered properties. In more than 98% of the sprinklered apartment building fires, the fire is contained within the room of origin, versus only 89% of the fires in non-sprinklered apartment buildings. (Reference: NFPA Fire Report 1582, 2004-2008 Annual Averages, Tables 2, 4, 6 & 7, dated 1/2011, by Marty Ahrens.)

This paper reviews the design options permitted in the 2012 International Building Code (IBC) and the 2012 International Fire Code (IFC) when sprinklers are installed. With a couple of noted exceptions, the design options do not apply to NFPA 13D systems, which are permitted to be used in single-family homes and townhouses up to three stories in height. Section E below lists the design options permitted in the 2012 IBC and IFC with the installation of an NFPA 13 or NFPA 13R sprinkler system. Section F lists the additional design options permitted with the installation of an NFPA 13 sprinkler system.

## Notes:

- All “**B**” section designations are references to sections in the IBC.
- All “**F**” section designations are references to sections in the IFC.
- All “**R**” section designations are references to sections in the International Residential Code (IRC).
- Consult the IBC, IFC or IRC for exact wording and requirements.
- Consult the IBC, IFC or IRC for cross references to other sections.
- Appendix items are only required if specifically referenced in the adopting regulations.
- The code should be consulted for sprinkler requirements that are not related to design options.

## A. GENERAL PROVISIONS

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The sprinkler provisions in the IBC and IFC apply to buildings protected by NFPA 13 or 13R sprinkler systems, as noted. Design options are not permitted with NFPA 13D sprinkler systems, with the exception of Item E39 concerning fire department access roads and a specific provision in the 2009 and 2012 IRC that permits a one-hour separation between sprinklered townhouses (R302.2, Exception).

Starting with the 2003 IBC, all apartments are required to have sprinklers throughout the building (B903.2.8). Throughout the building means installed in accordance with NFPA 13 or 13R, with specific exceptions (903.1). Quick-response or residential sprinklers are required in all dwelling and sleeping units (B903.3.2). One- and two-family dwellings and townhouses up to three stories in height are permitted to use NFPA 13D sprinkler systems (903.3.1.3). Four-story townhouses of Type V construction under the IBC would be required to use an NFPA 13R sprinkler system.

NFPA 13R sprinkler systems are allowed in apartment buildings, R-2 occupancies, up to four stories in height (B903.3.1.2) and limited to buildings that are 60 ft. or less in height above grade plane. NFPA 13R sprinkler systems can be used in buildings of mixed use when the residential occupancy is completely separated and considered a separated occupancy under the local code (B508.4). NFPA 13R sprinkler systems can also be used in accessory or incidental occupancy areas that are considered to be part of the predominant (residential) occupancy.

Apartment buildings four stories or greater and more than 60 feet in height are required to use NFPA 13 sprinkler systems (B903.3.1.1).

Balconies and decks, in Type V construction (wood frame) are required to be sprinklered by the IBC (B903.3.1.2.1) and the 2013 edition of NFPA 13R Section 6.6.5.1. The sprinklers are only required if there is a roof or deck above. They can be sidewall sprinklers.

In high-rise buildings, two sprinkler risers that are in separate exterior exit stairways that are remotely located are required in buildings more than 420 feet in height. Risers are required to supply sprinklers on alternate floors (B403.3.1).

High-rise open parking garages are not required to be sprinklered (B403.3, Exception 2).

Low-rise open parking garages designed in accordance with IBC Section 406.5 are not required to be sprinklered.

Enclosed parking garages are required to be sprinklered when larger than 12,000 square feet or when located under all occupancies except R-3 (B903.2.10).

The design criteria for NFPA 13 light hazard, allowed for residential occupancies, and NFPA 13R sprinkler systems are very similar. The major difference is NFPA 13R systems do not require sprinklers in certain concealed spaces such as combustibles attics, floor/ceiling spaces, bathrooms less than or equal to 55 square feet, and small clothes/linen closets and pantries.

## **B. EXISTING BUILDINGS**

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Sprinkler requirements for existing buildings are included in the International Existing Building Code (IEBC). Sprinklers are required with a change of occupancy if sprinklers are required by Chapter 9 of the IBC for the new occupancy (IEBC 1012.2.1). Sprinklers can also be required depending on the amount of work being performed with a Level 2 or Level 3 alteration. Consult the IEBC for specific requirements.

## **C. SPRINKLER MONITORING**

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Sprinkler systems are required to be electrically monitored (903.4), except:

1. Systems protecting one- and two-family dwellings (B903.4 Exception 1).
2. NFPA 13R systems using a common water supply for domestic use and the sprinkler system, provided a separate shutoff valve is not installed for the sprinkler system (B903.4, Exception 3).

## **D. INTERNATIONAL RESIDENTIAL CODE (IRC)**

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Effective with the 2009 IRC, residential occupancies covered by the IRC, such as single-family dwellings and townhouses up to three stories in height, are required to be sprinklered (R313). The required separation between sprinklered townhouses has been reduced from 2 hours to 1 hour (R302.2, Exception). The sprinkler systems for one- and two-family dwellings and townhouses up to three stories in height constructed to the IBC would be permitted to be designed in accordance with NFPA 13D (B903.3.1.3). Sprinkler systems under the IRC can be designed in accordance with IRC Section P2904 or NFPA 13D (R313.2.1).

Four-story townhouses would be built under the IBC and sprinklered with NFPA 13R sprinkler systems and limited to 60 feet in height. In the IBC, they could be classified as either R-2 or R-3. If they were classified as R-2, without a property line between them, the separation between townhouses would be a fire barrier wall. If they were classified as R-3, without a property line between them, they could be built with a two-hour fire wall between every two units, and a one-hour fire barrier wall between the two units in each building (B420.2 or B420.3 as applicable).

## **E. DESIGN OPTIONS PERMITTED WITH INSTALLATION OF NFPA 13 OR 13R SPRINKLER SYSTEMS**

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1. Building height in Table 503 (Maximum Height and Area) can be increased 20 feet and one story (B504.2). Buildings protected with NFPA 13R systems are limited to a maximum height of 60 feet and four stories in height (B504.2).
2. The allowable building area from Table 503 can be increased based on the building's NFPA 13 sprinkler system (B506.3.1). The area increase permitted with an NFPA 13 sprinkler systems is not permitted with an NFPA 13R sprinkler system. The increase area can be used to determine the overall building area based on number of stories (B506.4). Maximum area for a building with an NFPA 13R system is four times the area permitted with the increase for frontage (B506.4.1, Exception 2).
3. Vertical separations of openings are not required (B705.8.5, Exception 2).
4. Fire walls are permitted to terminate at the interior surface of noncombustible exterior sheathing, and 18" extension of fire walls is not required when the building is protected on each side of the fire wall with a sprinkler system (B706.5, Exception 3).

5. Fire blocking or draft stopping is not required at partitions if sprinklers are installed in the combustible floor/ceiling and roof/ceiling spaces (B708.4, Exception 6).
6. Elevator lobbies are not required in apartment buildings where the elevator serves floors less than 75 feet above the lowest level of fire department vehicle access (B713.14.1, Exception 4).
7. Smoke partitions are permitted in lieu of fire partitions to separate the elevator lobby at each floor (B713.14.1, Exception 5).
8. The maximum transmitted temperature end point of 450 degrees is not required for door assemblies in interior exit stairways and ramps and exit passageways (B716.5.5, Exception).
9. Fire dampers are not required in ducts penetrating fire barriers (B717.5.2, Exception 3).
10. Fire dampers are not required in ducts penetrating corridor wall fire partitions when the duct is protected as a through penetration (B717.5.4, Exception 1).
11. Draft stopping at floor/ceiling spaces is not required if sprinklers are installed in the combustible concealed spaces (B718.3.2, Exception 1 and Exception 2).
12. Draft stopping in attics above and in line with the dwelling units is not required in mansards, overhangs or other concealed spaces if sprinklers are installed in the combustible concealed spaces where the sprinklers are omitted (B718.4.2, Exception 2 and Exception 4).
13. Interior wall and ceiling finish requirements are reduced from B to C when the vertical exits, exit passageways, exit access corridors, exit ways, or room and spaces are protected by sprinklers (B803.9 and Table 803.9).
14. Class A finishing materials are not required in set-out walls and dropped ceilings that are required to be fire-resistance-rated or of noncombustible construction (B803.11.2, Exception 1).
15. Floor coverings are only required to meet the radiant flux Class II requirements (B804.4.2, Exception).
16. Class I standpipes are permitted in place of Class III standpipes in buildings with the highest story more than 30 feet above the lowest fire department access (B905.3.1, Exception 1).
17. Risers and laterals of Class I standpipe systems are not required to be enclosed with fire-resistance rated construction (B905.4.1, Exception).
18. A manual fire alarm box is not required, unless required by the code official to provide a means for fire watch personnel to initiate an alarm (B907.2, Exception 2).
19. A manual fire alarm box is not required if the occupant notification appliances will automatically activate upon sprinkler water flow (B907.2.9.1 Exception 2).
20. A fire alarm system is not required in buildings that do not have interior corridors, provided that dwelling units have either an egress door opening directly to an exterior access or exits served by open-ended corridor (B907.2.9.1, Exception 3).
21. The egress width for stairs is reduced from 0.3 inches to 0.2 inches per occupant when the building is also provided with an emergency voice/alarm communication system (B1005.3.1, Exception).
22. The egress width for building components, other than stairs, is reduced from 0.2 inches to 0.15 inches when the building is also provided with an emergency voice/alarm communication system (B1005.3.2, Exception).
23. The accessible means of egress elevator is not required in buildings four or more stories above or below the level of discharge provided the area is served with a horizontal exit or ramp (B1007.2.1, Exceptions 1 and 2).
24. Minimum clear width for handrails of 48" is not required (B1007.3, Exception 1 and B1007.7.6, Exception).
25. Areas of refuge are not required at stairways (B1007.3, Exception 2).
26. Elevators are not required to be accessed from an area of refuge or horizontal exit (B1007.4, Exception 2).
27. Common path of egress travel is increased from 75 feet to 125 feet (B1014.3 and Table 1014.3).

28. One means of egress is permitted from individual dwelling units with an occupant load of 20 (B1015.1 (1)).
29. Exit separation is reduced from one-half to one-third the diagonal length of the overall diagonal dimension of the building area to be served. The distance is measured in a straight line between exit doors (B1015.2.1, Exception 2).
30. Exit access travel distance is increased from 200 feet to 250 feet (B Table 1016.2, Note b).
31. The corridor fire-resistance rating of one-hour is reduced to one-half-hour (B1018.1, Table 1018.1, Note c).
32. Stories with one exit with a maximum of four dwelling units per floor in a structure up to three stories in height are permitted provided they have an emergency escape rescue opening (B1029.1). This section was revised in 2012 to reference stories and removing the reference to buildings, which deleted the requirement for a two-hour separation between exits serving up to four apartments per exit. The allowable exit access travel distance was increased to 125 feet for consistency with the provisions for travel distance in sprinklered buildings (B1021.2, Table 1021.2(1)).
33. Separation for the interior of the building is not required for exterior stairways connected to open-ended corridors if the areas are protected with sprinklers (B1026.6, Exception 4).
34. Fifty percent of the exit capacity is permitted to egress through areas on the level of discharge if the area is protected by sprinklers (1027.1, Exception 1.3).
35. Emergency escape and rescue openings provisions have been revised to reflect the code requiring sprinklers in all apartments. Emergency rescue openings are now only required in stories with one exit constructed, in accordance with the single-exit provisions of the code. See Item 32 above.
36. Balconies and similar appendages on buildings of Type III, IV and V construction can be Type V construction and not have a fire-resistance rating or built of fire-retardant-treated FRT wood if the area is protected by sprinklers (B1406.3, Exception 3).
37. Dumpsters of 1.5 cubic yards or more can be stored in buildings if the area is protected with sprinklers (F304.3.3, Exception 1).
38. Open-flame cooking devices are permitted on combustible balconies and within 10 feet of combustible construction if the building and decks are protected with sprinklers (F308.1.4, Exception 2).
39. Fire apparatus access road distance from buildings can be increased beyond 150-foot maximum at the discretion of the fire code official. Allowed with NFPA 13, 13R and 13D sprinkler systems (F503.1.1, Exception 1).
40. Spacing of fire hydrants can be increased from 400 to 600 feet (F507.5.1, Exception 2).
41. Natural cut trees are permitted in areas protected with sprinklers and within dwelling units (F806.1.1, Exceptions 1 and 2).
42. Water fire flow can be reduced up to 75 percent provided it has a flow of not less than 1,500 gallons per minute (IFC Appendix B, Section 105.2, Exception).
43. Multifamily projects up to 200 units can have one fire department access road (IFC Appendix D, Section 106.1, Exception).

Note to Items 42 and 43: Appendix provisions of the International Codes apply only if the appendix is specifically referenced in the adopting legislation.

## F. ADDITIONAL DESIGN OPTIONS FOR NFPA 13 SPRINKLER SYSTEMS

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The following Design Options are not permitted with an NFPA 13R sprinkler system. They are only permitted with an NFPA 13 system.

1. The following reductions in building classification are permitted in high-rise apartment buildings when sprinkler control valves are supervised with water-flow initiating devices for each floor (B403.2.1.1). The reductions do not impact the allowable building height and area.
  - a. For buildings not greater than 420 feet in height, except for columns, Type IA construction can be reduced to Type IB.
  - b. Type IB can be reduced to Type IIA.
2. In high-rise buildings not greater than 420 feet in height, the required fire-resistance rating of the fire barriers enclosing vertical shafts, other than exit enclosures and elevator hoistway enclosures, is permitted to be reduced to 1-hour where automatic sprinklers are installed with the shafts at the top and at alternate floor levels (B403.2.1.2).
3. Building allowable height in Table 503 (Allowable Heights and Areas) can be increased one story and 20 feet (B504.2).
4. Overall building area can be increased 200 percent for multistory apartment buildings and 300 percent for single-story buildings (B506.3). (Note: Maximum building area differs for NFPA 13R systems because they are limited to four stories and 60 feet in height. See Section E, "Design Options with NFPA 13 or 13R Sprinkler Systems," Items 1 & 2 (B 504.2 & B506.4.1, Exception 2).
5. The maximum allowable area of unprotected openings is allowed to be the same as the area allowed for protected openings (B705.8.1 and B Table 705.8).
6. Area of openings in a fire wall is unlimited if the buildings on both sides of the fire wall are protected with sprinklers (B706.8, Exception 2).
7. Area of openings in a fire barrier is unlimited if fire areas on both sides of the fire barrier are protected with sprinklers (B707.6, Exception 1).
8. Area of openings in a fire barrier is unlimited where the opening protection is a fire door serving enclosures for exit access stairways, exit access ramps, interior exit stairways and interior exit ramps (B707.6, Exception 2).
9. Fire partitions separating dwelling units in Type IIB, IIIB and VB can be reduced from 1-hour to ½-hour (B708.3, Exception 2).
10. Floor assemblies separating dwelling units in Type IIB, IIIB and VB can be reduced from 1-hour to ½-hour (B711.3, Exception).
11. Enclosed elevator lobbies are not required at the level(s) of discharge (B713.14.1, Exception 1).
12. When a building requires smokeproof enclosures, vestibules are not required in the stairways when the exit stairways are pressurized (B909.20.5).
13. Building entrance and egress access control systems are permitted in buildings if the releases are activated with the sprinkler system (B1008.1.9.8, Exception 5).
14. Delayed egress locks are permitted if the doors are unlocked upon the activation of the sprinkler system (B1008.1.9.7, Exception 1).
15. The space between the corridor ceiling and the floor or floor structure can be used as a return plenum if the air-handling system is shut down upon activation of the sprinkler system (B1018.5.1, Exception 4).