Changes to NFPA 13 from the 2013 Edition to the 2016 Edition

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Soft Metric Conversion

1.6.3* Some dimensions used in this standard are exact and some are not. Nominal dimension are often used, such as the dimensions used for pipe sizes. The metric equivalent shown in this standard might not be an exact conversion to the SI unit, but the nominal metric equivalent is typically used or a reasonably equivalent value or approximate conversion is used. It shall be acceptable to use the exact conversion or the conversions stated in the standard, even though they might not be exact.

Soft Metric Conversion

A.1.6.3 Some dimensions used in this standard require a tight precision and other do not. For example when performing hydraulic calculations more precision is required than when specifying a nominal dimension. An example is pipe sizes, where we typically refer to a nominal diameter rather than the exact diameter. The metric equivalents also have a set of generally accepted nominal measurements and they are not a precise conversion from the "English Unit" nominal dimension. Throughout the standard the generally accepted nominal pipe sizes have been used. For example 1" pipe = 25 mm, 1¼" pipe = 32 mm, 1½" pipe = 40 mm, etc. In other cases rounding is used and the number of significant digits taken into account. For example a 30 ft ceiling would be 9.144 meters. This implies a level of precision that is higher than used for the original dimension and a conversion to 9.1m or even 9m is more appropriate. Another example is that in the standard, 1 inch (in.) has been converted to 25mm and not 25.4mm, 2 in. to 50mm, 6 in. to 150mm etc. Finally, locally available material may have different characteristics in countries that use metric units than are typically found in the US. Examples are things like standard door or window sizes, rack dimensions, etc. In these cases a soft conversion may also be used. Where soft conversions have been used, it is acceptable for a designer or installer to use an exact or "hard" conversion rather than the soft conversion used in the standard.

Cloud Ceiling Definition

3.3.5 Ceiling Types.

3.3.5.1 Cloud Ceiling. Any ceiling system installed in the same plane with horizontal openings to the structure above on all sides. This does not include sloped ceilings as defined in 3.3.5.4.

3.3.5.2 Flat Ceiling. A continuous ceiling in a single plane.

3.3.5.2 3 Horizontal Ceiling. A ceiling with a slope not exceeding 2 in 12.

3.3.5.3 4 Sloped Ceiling. A ceiling with a slope exceeding 2 in 12.

3.3.5.4 5 Smooth Ceiling. A continuous ceiling free from significant irregularities, lumps, or indentations.

Small Openings

3.3.21* Small Openings. Openings in the ceiling or construction features of a concealed space that allow limited amounts of heat to enter the concealed space.

A.3.3.21 Small Openings. A return air diffuser may be 4 feet by 2 feet and meet the definition of a small opening. A linear diffuser may be longer than 4 feet but is then limited to 8 inches in width (or least dimension). Spaces between ceiling panels of architectural features that create a concealed space must meet the same criteria.

No Definition

~~3.3.7 Concealed Space. That portion (s) of a building behind walls, over suspended ceilings, in pipe chases and attics, and whose size might normally range from 1 in. (44.45 mm) stud spaces to 8 ft (2.44 m) interstitial truss spaces and that might contain combustible materials such as building structural members, thermal and/or electrical insulation, and ducting.~~

3.5.6 Extension Fitting.

A male by female adapter intended to be used with a sprinkler to adjust the final fit where the sprinkler is installed in a finished ceiling or wall.

3.6.4.1* Control Mode Density/Area (CMDA) Sprinkler.

A type of spray sprinkler intended to provide fire control in storage applications using the design density/area criteria described in this standard.

Deleted

~~**3.9.1.1* Available Height for Storage.** The maximum height at which commodities can be stored above the floor and still maintain necessary clearance from structural members and the required clearance below sprinklers.~~

3.9.1.17 Low-Piled Storage.

Solid-piled, palletized, rack storage, bin box, and shelf storage up to 12 ft (3.7 m) in height.

Change description

3.9.2.8 Solid Unit Load of ~~Nonexpanded~~ Unexpanded Plastic (Either Cartoned or Exposed).

Definition

3.9.3.7.9 Solid Shelf Rack.

A rack that is not defined as an open rack where shelves are fixed in place with a solid, slatted, or wire mesh barrier used as the shelf material and having limited openings in the shelf area.

3.9.3.8* Solid Shelving.

Shelving that is fixed in place, slatted, wire mesh, or other type of shelves located within racks. The area of a solid shelf is defined by perimeter aisle or flue space on all four sides or by the placement of loads that block openings that would otherwise serve as the required flue spaces . Solid shelves having an area equal to or less than 20 ft 2 (1.9 m 2) are defined as open racks. Shelves of wire mesh, slats, or other materials more than 50 percent open and where the flue spaces are maintained are defined as open racks.

5.6.1.1* Classification of Commodities.

5.6.1.1.1

Commodity classification and the corresponding protection requirements shall be determined based on the makeup of individual storage units (i.e., unit load, pallet load).

5.6.1.1.1.1 The type and amount of materials used as part of the product and its primary packaging as well as the storage pallet shall be considered in the classification of the commodity.

Class III Definition

5.6.3.3* Class III.

5.6.3.3.1 A Class III commodity shall be defined as a product fashioned from wood, paper, natural fibers, or Group C plastics with or without cartons, boxes, or crates and with or without pallets.

5.6.3.3.2 A Class III commodity shall be permitted to contain a limited amount (5 percent or less by weight of unexpanded plastic or ~~volume~~ 5 percent or less by volume of expanded plastic) of Group A or Group B plastics.

5.6.3.3.3 Commodities containing a mix of both Group A expanded and unexpanded plastics shall comply with Figure 5.6.3.3.3(a) where they are within cartons, boxes, or crates or with Figure 5.6.3.3.3(b) where they are exposed.

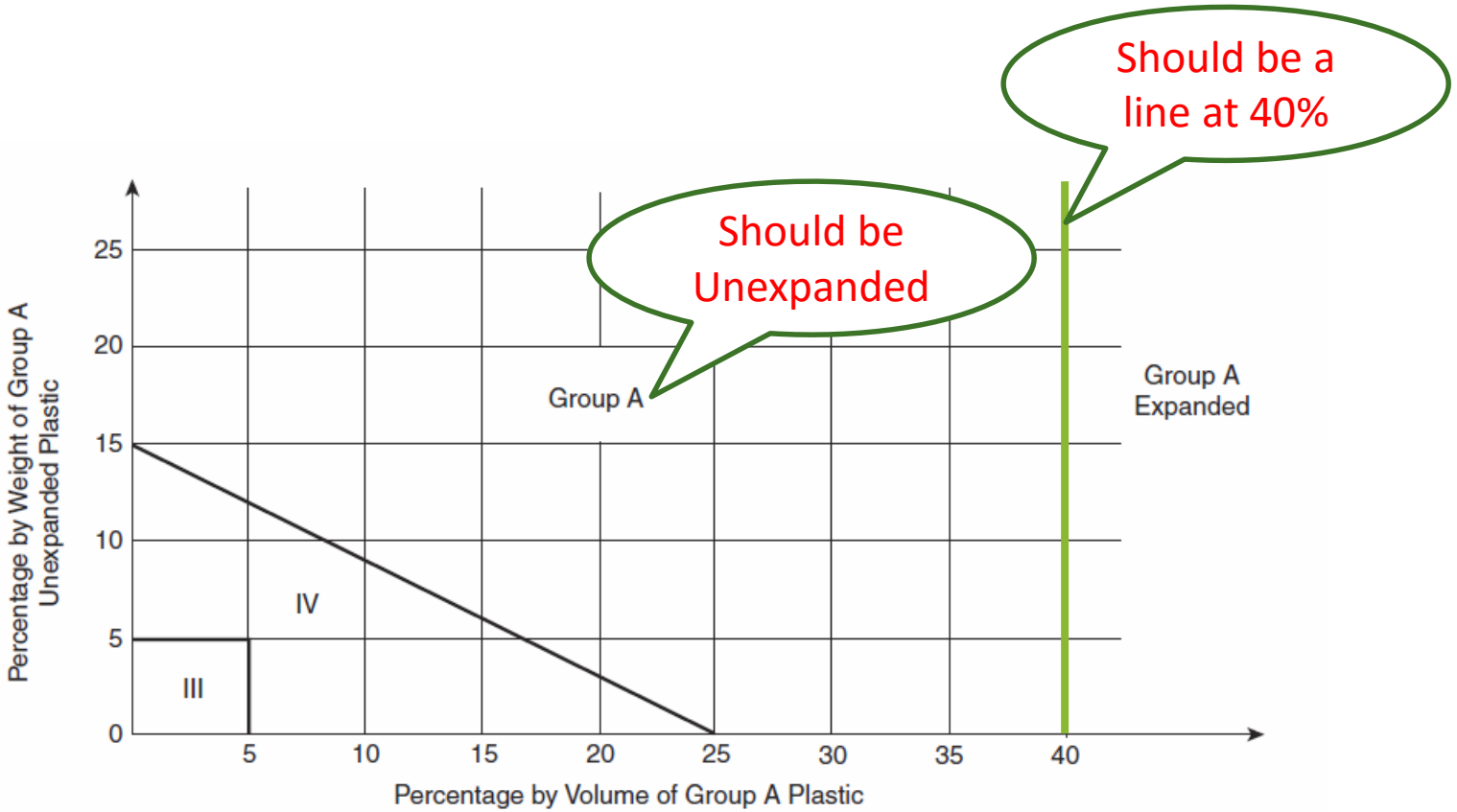
Class IV Definition

// **5.6.3.4*** Class IV.

// **5.6.3.4.1** A Class IV commodity shall be defined as a product, with or without pallets, that meets one of the following criteria:

- (1) Constructed partially or totally of Group B plastics
- (2) Consists of free-flowing Group A plastic materials
- (3) Cartoned, or within a wooden container, that contains greater than 5 percent and up to 15 percent by weight of Group A unexpanded plastic
- (4) Cartoned, or within a wooden container, that contains greater than 5 percent and up to 25 percent by volume of expanded Group A plastics
- (5) Cartoned, or within a wooden container, that contains a mix of Group A expanded and unexpanded plastics and complies with Figure 5.6.3.3.3(a)
- (6) Exposed, that contains greater than 5 percent and up to 15 percent by weight of Group A unexpanded plastic
- (7) Exposed, that contains a mix of Group A expanded and unexpanded plastics and complies with Figure 5.6.3.3.3(b)

Mixed Commodities - New Figure 5.6.3.3.3(a)



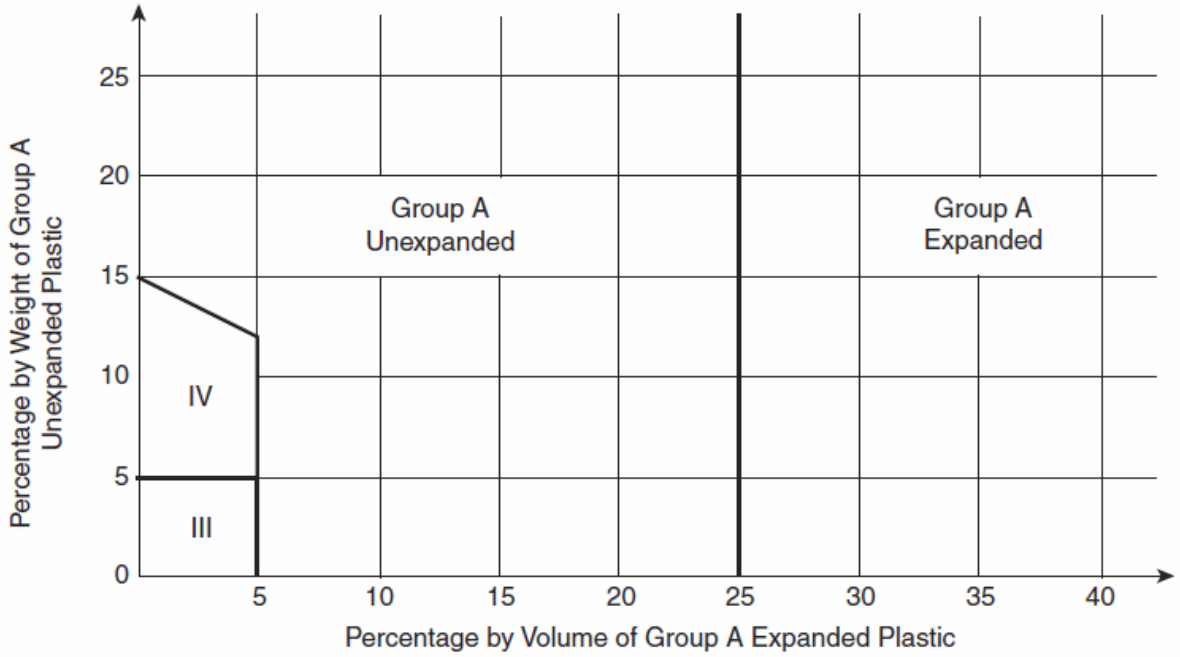
III - Class III Commodity. Refer to 5.6.2 if a plastic pallet is used.

IV - Class IV Commodity. Refer to 5.6.2 if a plastic pallet is used.

FIGURE 5.6.3.3.3(a) Commodities Containing a Mixture of Expanded and Unexpanded Group A Plastics.

Should be Cartoned

Mixed Commodities - New Figure 5.6.3.3.3(b)



III - Class III Commodity. Refer to 5.6.2 if a plastic pallet is used.

IV - Class IV Commodity. Refer to 5.6.2 if a plastic pallet is used.

FIGURE 5.6.3.3.3(b) Exposed Commodities Containing a Mixture of Expanded and Unexpanded Group A Plastics.

Group A Plastics

5.6.4* Classification of Plastics, Elastomers, and Rubber. Plastics, elastomers, and rubber shall be classified as Group A, Group B, or Group C.

5.6.4.1* Group A. The following materials shall be classified as Group A:

- (5) Cellulosics (cellulose acetate, cellulose acetate butyrate, ethyl cellulose)
- (8) Natural rubber ~~(if expanded)~~
- (10) Nylon (nylon 6, nylon 6/6)
- (20) PVF (polyvinyl fluoride)

5.6.4.1.1 * Group A plastics shall be further subdivided as either expanded or unexpanded.

A.5.6.4.1.1 Generally, expanded plastics are low-density materials and commonly referred to as “foam plastics”.

5.6.4.1.1.1 A Group A expanded plastic commodity shall be defined as a product, with or without pallets, that meets one of the following criteria:

- (1) Cartoned, or within a wooden container, that contains greater than 40 percent by volume of Group A expanded plastic
- (2) Exposed, that contains greater than 25 percent by volume of Group A expanded plastic

Group B Plastics

5.6.4.2 Group B. The following materials shall be classified as Group B:

- ~~(1) Cellulosics (cellulose acetate, cellulose acetate butyrate, ethyl cellulose)~~
- (2) Chloroprene rubber
- (3) Fluoroplastics (ECTFE — ethylene-chlorotrifluoro-ethylene copolymer; ETFE — ethylenetetrafluoroethylene- copolymer; FEP — fluorinated ethylene-propylene copolymer)
- ~~(4) Natural rubber (not expanded)~~
- ~~(5) Nylon (nylon 6, nylon 6/6)~~
- (6) Silicone rubber

Group C Plastic

5.6.4.3 Group C. The following materials shall be classified as Group C:

- (1) Fluoroplastics (PCTFE — polychlorotrifluoroethylene; PTFE — polytetrafluoroethylene)
- (2) Melamine (melamine formaldehyde)
- (3) Phenolic
- (4) PVC (polyvinyl chloride — flexible — PVCs with plasticizer content up to 20 percent)
- (5) PVDC (polyvinylidene chloride)
- (6) PVDF (polyvinylidene fluoride)
- ~~(7) PVF (polyvinyl fluoride)~~
- (8) Urea (urea formaldehyde)

Compatibility

6.1.1.6 ~~The new materials or devices listing instructions shall identify and specify the existing system components, including the fluids conveyed, with which the new listed materials, devices, or components are compatible~~. Materials and components shall be installed in accordance with material compatibility information that is available as a part of a listing or manufacturer's published information.

~~**6.1.1.6.1** This listing requirement shall also apply to chemical or material modifications made to components listed in Table 6.3.1.1 and Table 6.4.1~~

Removing Sprinklers & Dry Sprinkler - reinstallation

6.2.1.1* When a sprinkler ~~has been removed for any reason~~ is removed from a fitting or welded outlet , it shall not be reinstalled except as permitted by 6.2.1.1.1 .

6.2.1.1.1* Dry sprinklers shall be permitted to be reinstalled l ~~where they are not removed by applying torque at the point where the sprinkler is attached to the barrel~~ when removed in accordance with the manufacturer's installation and maintenance instructions .

Nonmetalic Pipe – (same for fittings)

6.3.9.2 When nonmetallic pipe is used in ~~combination~~ systems utilizing steel piping internally coated with corrosion inhibitors ~~and nonmetallic piping~~ , the steel pipe coating shall be ~~investigated~~ listed for compatibility with the nonmetallic ~~piping by a testing laboratory~~ pipe materials .

6.3.9.3 When nonmetallic pipe is used in ~~combination~~ systems utilizing steel pipe that is not internally coated with ~~chemica~~l corrosion inhibitors, no additional evaluations shall be required.

6.3.9.4* When nonmetallic pipe is used in ~~combination~~ systems utilizing steel pipe, cutting oils and lubricants used for fabrication of the steel piping shall be compatible with the nonmetallic pipe materials in accordance with 6.1.1.6 .

6.3.9.5 Fire-stopping materials intended for use on nonmetallic piping penetrations shall ~~be investigated for compatibility~~ compatible with the nonmetallic pipe materials in accordance with 6.1.1.6 .

6.3.9.6 Pipe or tube listed for light hazard occupancies shall be permitted to be installed in ordinary hazard rooms of otherwise light hazard occupancies where the room does not exceed 400 ft2 (37 m2).

6.3.9.6.1 Pipe or tube installed in accordance with 6.3.7.8.2 shall be permitted to be installed exposed, in accordance with the listing.

6.4.8 Extension Fitting.

6.4.8 Extension Fitting.

6.4.8.1 Extension fittings shall be permitted to be used with sprinklers K-8.0 or smaller.

6.4.8.2 Extension fittings shall be permitted to be used with sprinklers in light hazard and ordinary hazard occupancies only.

6.4.8.3 The internal diameter of extension fittings shall have the same nominal inlet diameter of the attached sprinkler.

6.4.8.4 A single extension fitting up to a maximum of 2 in. (50 mm) in length shall be permitted to be installed with a sprinkler.

6.4.8.4.1 Extension fittings longer than 2 in. (50 mm) shall not be permitted unless specifically listed.

6.4.8.5 Extension fittings shall be included in the hydraulic calculations.

6.4.8.5.1 Extension fittings 2 in. (50 mm) and less shall not be required to be included in the hydraulic calculations.

Air Venting & Supply

7.1.5 Air Venting. A single air vent with a connection conforming to 8.16.6 shall be provided on each wet pipe system utilizing metallic pipe. *(See A.8.16.6.)*

7.1.5.1 Venting from multiple points on each system shall not be required.

7.2.6.6.3.1 Each dry pipe system shall have ~~an air~~ a dedicated air maintenance device.

Deleted Entire Section

~~**7.7 Automatic Sprinkler Systems with Non–Fire Protection Connections.**~~

~~**7.7.1 Circulating Closed-Loop Systems.**~~

8.2.4 Floor Control Valve Assemblies.

8.2.4.1 * Multistory buildings exceeding two stories in height shall be provided with a floor control valve, check valve, main drain valve, and flow switch for isolation, control, and annunciation of water flow for each individual floor level.

8.2.4.2 The floor control valve, check valve, main drain valve, and flow switch required by 8.2.4.1 shall not be required where sprinklers on the top level of a multistory building are supplied by piping on the floor below.

8.2.4.3 The floor control valve, check valve, main drain valve, and flow switch required by 8.2.4.1 shall not be required where the total area of all floors combined does not exceed the system protection area limitations of 8.2.1 .

8.2.4.4 The requirements of 8.2.4 shall not apply to dry systems in parking garages.

Added CMSA and ESFR to Light Hazard

8.3.3.1* Sprinklers in light hazard occupancies shall be one of the following:

- (1) Quick-response type as defined in 3.6.4.8 3.6.4.7
- (2) Residential sprinklers in accordance with the requirements of 8.4.5
- (3) Quick response CMSA sprinklers
- (4) ESFR sprinklers
- (5) Standard-response sprinklers used for modifications or additions to existing light hazard systems equipped with standard response sprinklers
- (6) Standard-response sprinklers used where individual standard-response sprinklers are replaced in existing light hazard systems

Light Hazard

8.3.3.2 Where quick-response sprinklers are installed, all sprinklers within a compartment shall be quick-response unless otherwise permitted in 8.3.3.3, 8.3.3.4 , or 8.3.3.5 .

8.3.3.3 Where there are no listed quick-response sprinklers in the temperature range required, standard-response sprinklers shall be permitted to be used.

8.3.3.4 The provisions of 8.3.3.2 shall not apply to in-rack sprinklers.

8.3.3.5 Where a sprinkler carries a listing for both standard-response protection and quick-response protection at different coverage areas, that sprinkler shall be permitted to be installed within a compartment at the spacing for both the quick-response and standard-response listings without any separation between the areas so covered.

8.4.3 Extended Coverage Sprinklers. Extended coverage sprinklers shall only be installed as follows:

- (7) Extended coverage sprinklers installed to protect areas below a single overhead door(s)

CMSA - Galvanized Pipe

~~8.4.7.2* Galvanized Pipe.~~

~~8.4.7.2.1~~ ~~Where steel pipe is used in preaction and dry pipe systems, piping materials shall be limited to internally galvanized steel.~~

~~8.4.7.2.2~~ ~~Black steel pipe shall be permitted when the system is installed in freezers where the air temperature is below 32°F (0°C) and the air supply is either nitrogen or a listed regenerative air dryer.~~

~~8.4.7.2.3~~ ~~Nongalvanized fittings shall be permitted.~~

Sprinklers Under Obstructions – More than 18 inches below the sprinkler

8.5.5.3.1* Sprinklers shall be installed under fixed obstructions over 4 ft (1.2 m) ~~wide~~ in width .

8.5.5.3.1.1 ~~Open grate flooring over 4 ft (1.2 m) in width shall require sprinkler protection below the grating~~. Sprinklers shall be located below the obstruction and not more than 3 in. (75 mm) from the outside edge of the obstruction.

8.5.5.3.1.2 Where sprinklers are located adjacent to the obstruction, they shall be of the intermediate level rack type.

8.5.5.3.1.3 The deflector of automatic sprinklers installed under fixed obstructions shall be positioned no more than 12 in. (300 mm) below the bottom of the obstruction.

8.5.5.3.1.4 Sprinklers shall not be required under noncombustible obstructions over 4 ft (1.2 m) wide where the bottom of the obstruction is 24 in. (620 mm) or less above the floor or deck.

Sprinklers Under Obstructions

8.5.5.3.3 Sprinklers installed under obstructions shall be of the same type (spray, CMSA, ESFR, residential) as installed at the ceiling except as permitted by 8.5.5.3.3.1 .

8.5.5.3.3.1 ~~Quick-response spray~~ Spray sprinklers shall be permitted to be utilized under overhead doors.

8.5.5.4 Closets. In all closets and compartments, including those closets housing mechanical equipment, that are not larger than 400 ft3 (11.33 m3) in size, a single sprinkler at the highest ceiling ~~space~~ level shall be sufficient without regard to obstructions or minimum distance to the wall.

8.5.7.1.1 When a sprinkler is installed directly beneath a skylight not exceeding 32 ft2 (3.0 m2), the distance to the ceiling shall be measured to the plane of the ceiling as if the skylight was not present.

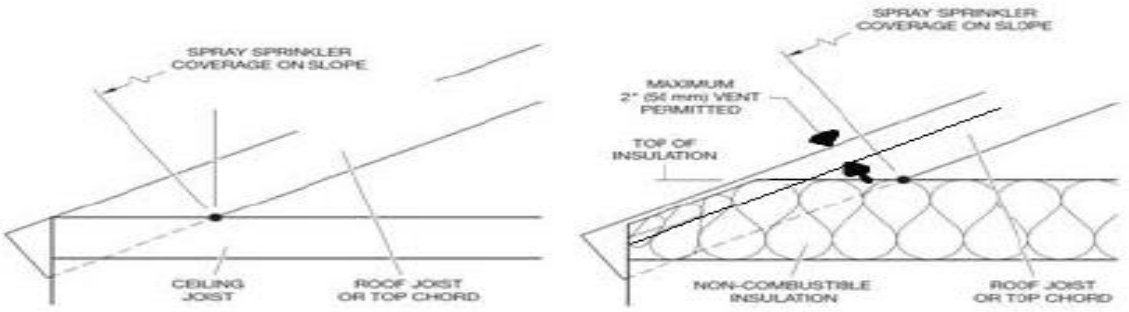
8.6.4.1.2 Obstructed Construction.

(5)* Installed with deflectors of sprinklers under concrete tee construction with stems spaced less than 7**1⁄2** ft (2.3 m) ~~but more than 3 ft (0.91 m)~~ on centers, regardless of the depth of the tee, located at or above a horizontal plane 1 in. (25.4 mm) below the bottom of the stems of the tees and complying with Table 8.6.5.1.2

Where to Measure from

8.6.4.1.4.3 * Sprinklers shall be installed so that the sprinklers installed along the eave are located not less than 5 ft (1.52 m) from the intersection of the upper and lower truss chords or the wood rafters and ceiling joists.

A.8.6.4.1.4.3 Attic width and sprinkler spacing should be measured from the point of intersection between the bottom of the top cord of the roof joist or truss and the top of the ceiling joist or noncombustible insulation. *(See Figure A.8.6.4.1.*



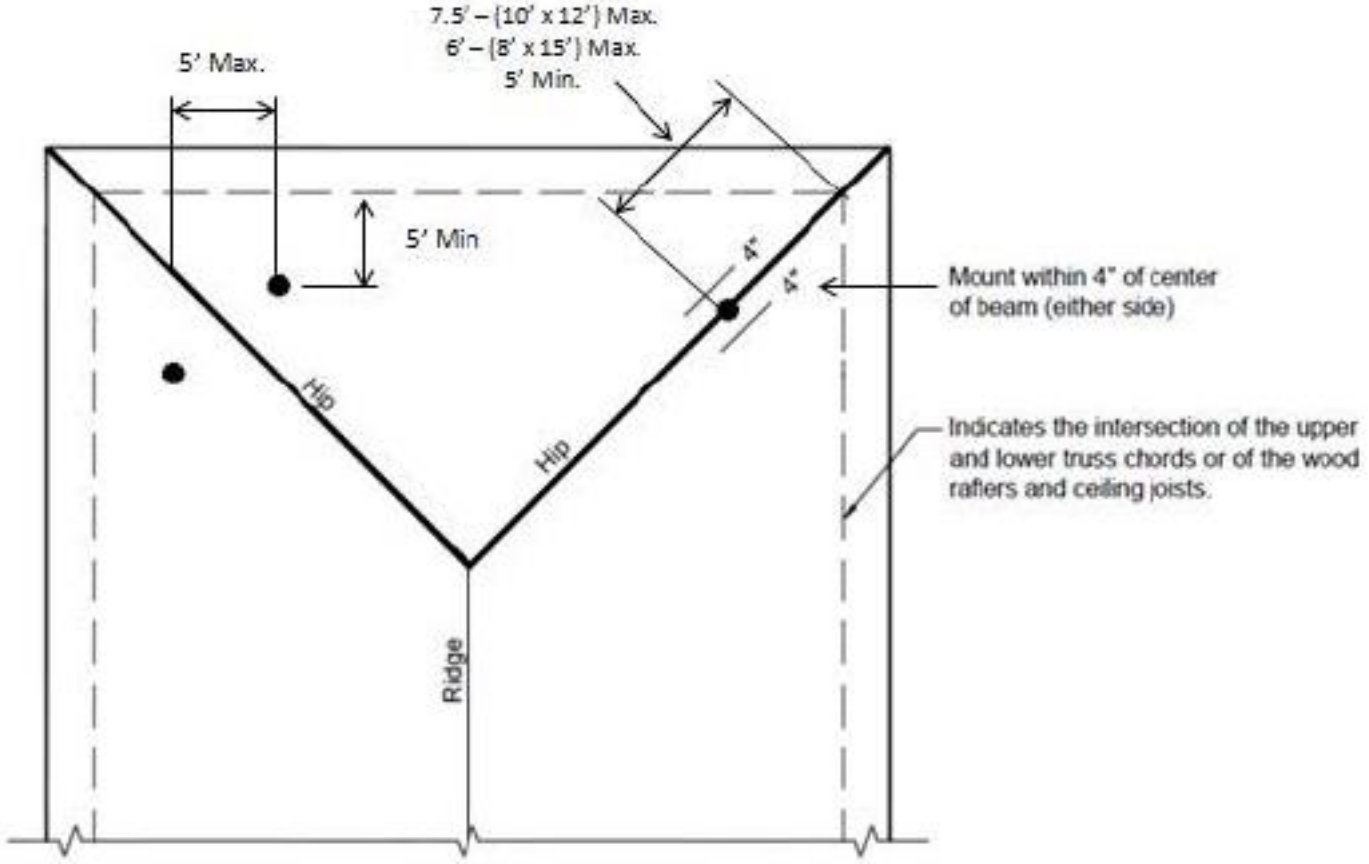
Hip Roof

8.6.4.1.4.5 * The requirements of 8.6.4.1.4.3 or 8.6.4.1.4.4 shall not apply to sprinklers installed at the corner of the eave of a hip type roof where located directly under the hip line spaced in accordance with 8.6.3.2.3 or located along the eave spaced on the slope plane not less than 5 ft (1.52 m) from the intersection of the upper and lower truss chords or the wood rafters and ceiling joists.

A.8.4.1.4.5* See Figure A.8.4.1.4.5.

Hip Roof

Figure A.8.4.1.4.5 – Hip Roof Installations



Hip Corner Sprinkler Spacing

Eliminate 18 inch (457mm) minimum -

2016

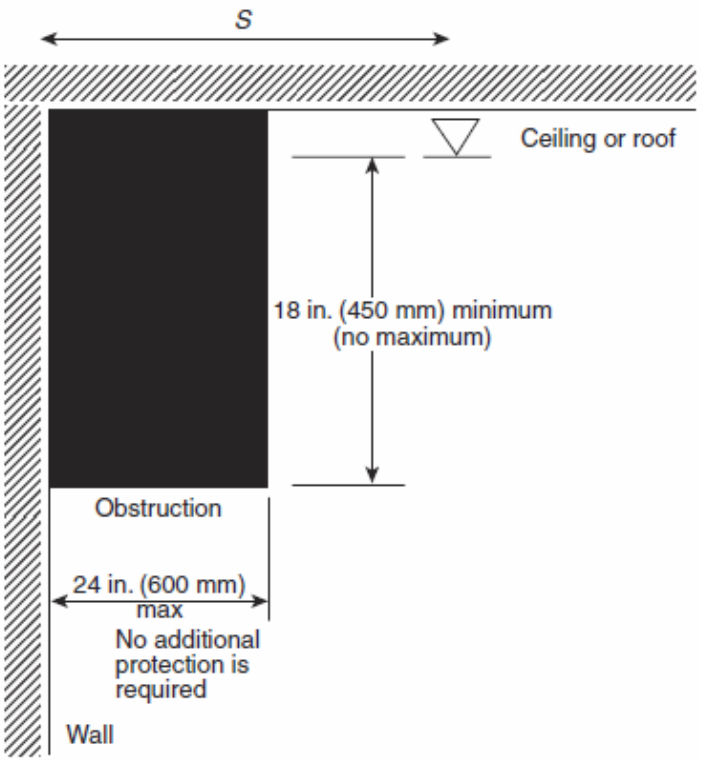
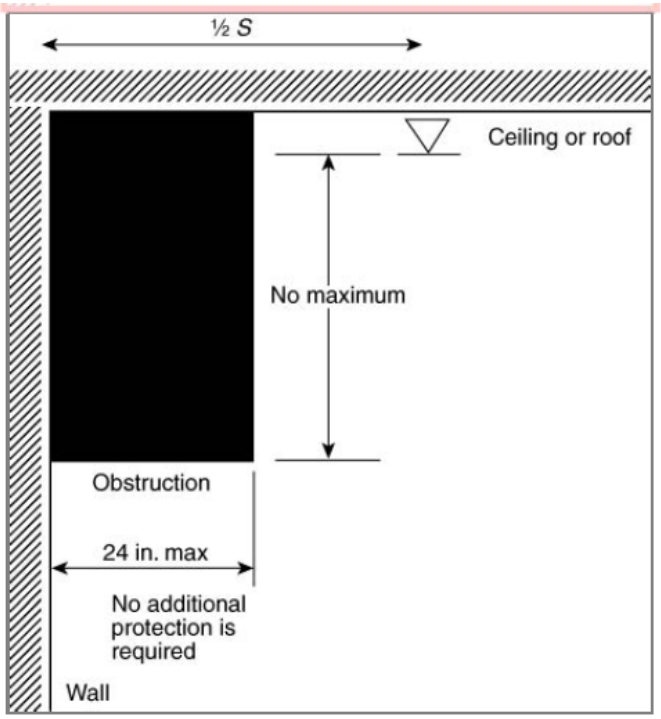


FIGURE 8.6.5.1.2(c) Obstructions Against Walls (SSU/SSP).

Voted on 1st revision



8.6.5.2 Obstructions to Sprinkler Discharge Pattern Development.

SSU and SSP Obstructions

8.6.5.2.1.3 * Minimum Distance from Obstructions . ~~(A)~~ Unless the requirements of 8.6.5.2.1.4 through 8.6.5.2.1.9 are met, sprinklers shall be positioned away from obstructions a minimum distance of three times the maximum dimension of the obstruction (e.g., structural members, pipe, columns, and fixtures) ~~(B) The maximum clear distance required shall be 24 in. (609 mm) in~~ , in accordance with Figure ~~8.6.5.2.1.3(Ba)~~ and Figure 8 .~~Figure 8.~~6.5.2.1.3(~~B) Minimum Distance from Obstruction (SSU/SSP).~~

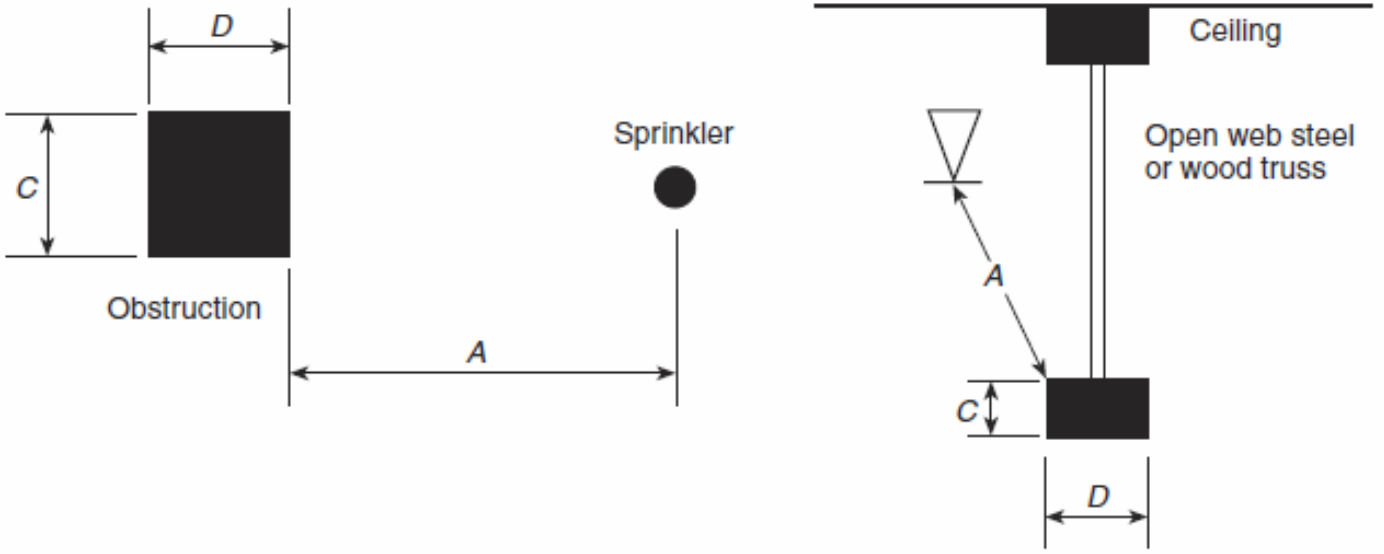
(A) The maximum clear distance required from obstructions in the horizontal orientation (e.g. light fixtures and truss chords), shall be 24 in. (609 mm).

(B) The maximum clear distance shall not be applied to obstructions in the vertical orientation (e.g. columns).

INSERT NEW FIGURES

Revised the 2013 Figure

2013 Edition

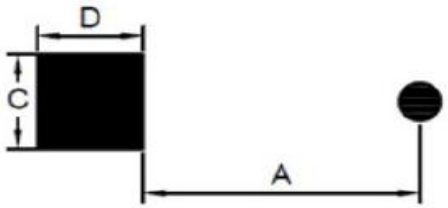


$A \geq 3C$ or $3D$
$A \leq 24$ in. (610 mm)
(Use dimension C or D, whichever is greater)

FIGURE 8.6.5.2.1.3(B) Minimum Distance from Obstruction (SSU/SSP).

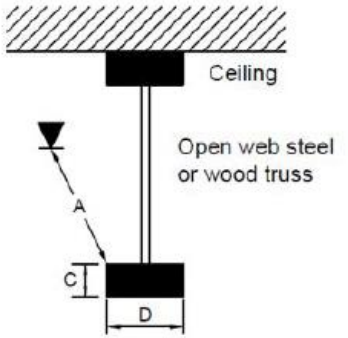
SSU and SSP Obstructions - Deleted 24 inch (610mm) exception

Eliminated 24 inch allowance



Plan View of Column
(Obstruction in Vertical Orientation)
A ≥ 3C or 3D
(Use dimension C or D, whichever is greater)

FIGURE 8.6.5.2.1.3 (a) Minimum Distance from Obstruction (SSU)



Elevation View of Truss
(Obstruction in Horizontal Orientation)
A ≥ 3C or 3D
A ≤ 24 in, (610 mm)
(Use dimension C or D, whichever is greater)

FIGURE 8.6.5.2.1.3 (b) Minimum Distance from Obstruction (SSP)

SSU and SSP Obstructions

8.6.5.3.6 The deflector of automatic sprinklers installed under fixed obstructions shall be positioned no more than 12 in. (305 mm) below the bottom of the obstruction.

8.6.5.3.7 Sprinklers installed under round ducts shall be of the intermediate level/rack storage type or otherwise shielded from the discharge of overhead sprinklers.

Eliminate minimum distance from bottom of soffit

8.7.4.1.3.2* Where soffits used for the installation of sidewall sprinklers are less than or equal to 8 in. (203 mm) in width or projection from the wall, additional sprinklers shall not be required below the soffit when the sidewall sprinkler is installed on the soffit. ~~is within 4 in. (102 mm) from the bottom of the soffit.~~

Soffits and Cabinets

8.7.4.1.4* Soffits and Cabinets. Where soffits are used for the installation of sidewall sprinklers, the sprinklers and soffits shall be installed in accordance with 8.7.4.1.4.1 , 8.7.4.1.4.2 , or 8.7.4.1.4.3 .

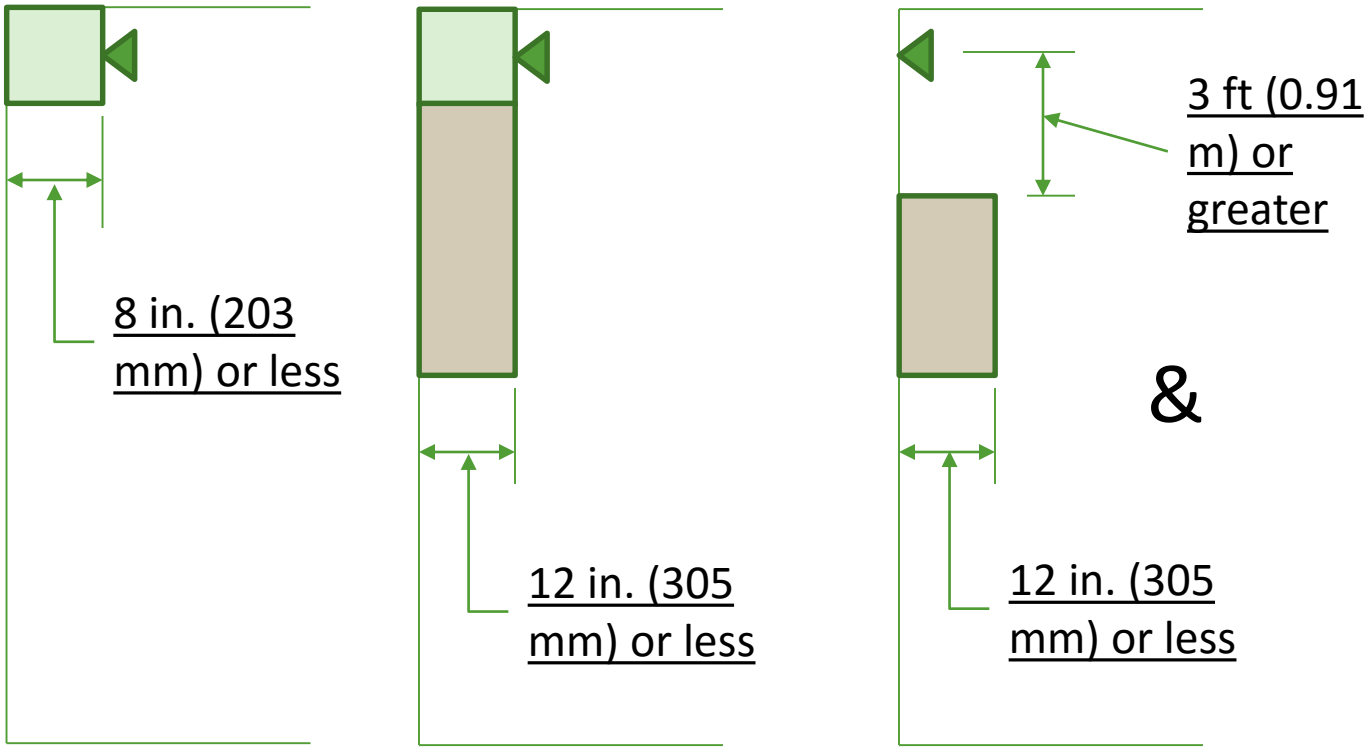
8.7.4.1.4.1 Where soffits exceed more than 8 in. (203 mm) in width or projection from the wall, pendent sprinklers shall be installed under the soffit.

8.7.4.1.4.2 Sidewall sprinklers shall be permitted to be installed in the face of a soffit located directly over cabinets, without requiring additional sprinklers below the soffit or cabinets, where the soffit does not project horizontally more than 12 in. (305 mm) from the wall.

8.7.4.1.4.3 Where sidewall sprinklers are more than 3 ft (0.91 m) above the top of cabinets, the sprinkler shall be permitted to be installed on the wall above the cabinets where the cabinets are no greater than 12 in. (305 mm) from the wall.

Sidewall Location in Soffit or Above Cabinet

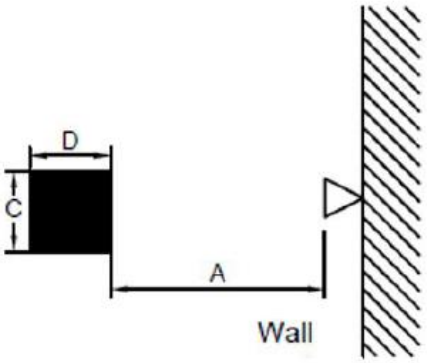
8.7.4.1.4* Soffits and Cabinets.



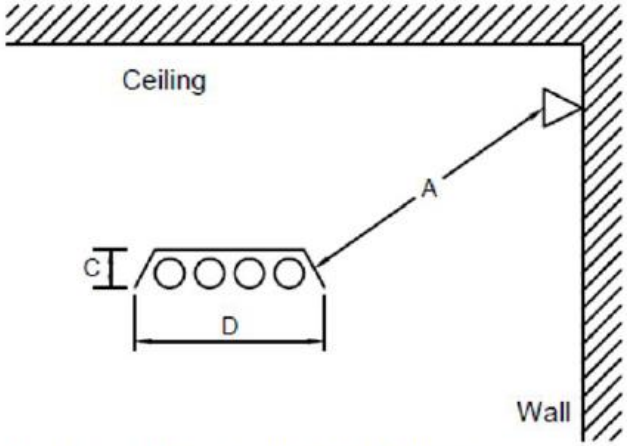
Not in NFPA 13 – just for explanation

Standard Sidewall - Deleted 24 inch (610mm) exception

Eliminated 24 inch allowance



Plan View of Column
(Obstruction in Vertical Orientation)
A ≥ 3C or 3D
(Use dimension C or D, whichever is greater)



Elevation View of Pipe Conduit or Light Fixture
(Obstruction in Horizontal Orientation)
A ≥ 3C or 3D
A ≤ 24 in, (610 mm)
(Use dimension C or D, whichever is greater)

FIGURE 8.7.5.2.1.3 (b) Minimum Distance from Obstruction (Standard Sidewall Spray Sprinkler)

8.7.5.2.1.3 (a) Minimum Distance from Obstruction (Standard Sidewall Spray Sprinkler) Plan of View Column

8.8.4.1.2 Obstructed Construction. Under obstructed construction, the sprinkler deflector shall be located in accordance with one of the following arrangements:

- (1) Installed with the deflectors within the horizontal planes of 1 in. to 6 in. (25.4 mm to 152 mm) below ~~the~~ noncombustible structural members and a maximum distance of 22 in. (559 mm) below the ceiling/roof deck
- (2) Installed with the deflectors at or above the bottom of ~~the~~ noncombustible structural member to a maximum of 22 in. (559 mm) below the noncombustible ceiling/roof deck where the sprinkler is installed in conformance with 8.8.5.1.2
- (3) Installed in each bay of combustible or noncombustible obstructed construction, with the deflectors located a minimum of 1 in. (25.4 mm) and a maximum of 12 in. (305 mm) below the ceiling
- (4) Installed in accordance with their listing where sprinklers are listed for use under other ceiling construction features or for different distances

8.9.4.1.3 Lintels and Soffits.

8.9.4.1.3.1* Where soffits used for the installation of sidewall sprinklers are less than or equal to 8 in. (203 mm) in width or projection from the wall, additional sprinklers shall not be required below the soffit ~~when the sidewall sprinkler on the soffit is within 4 in. (102 mm) from the bottom of the soffit .~~

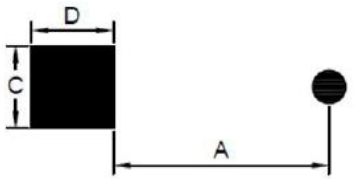
EC SSU and SSP

8.8.4.2 Deflector Orientation. Deflectors of sprinklers shall be aligned parallel to ceilings or roofs.

8.8.4.2.1 Roofs and ceilings having a pitch not exceeding 2 in 12 (16.7 percent) are considered horizontal in the application of 8.8.4.2 , and sprinklers shall be permitted to be installed with deflectors horizontal.

EC SSU and SSP

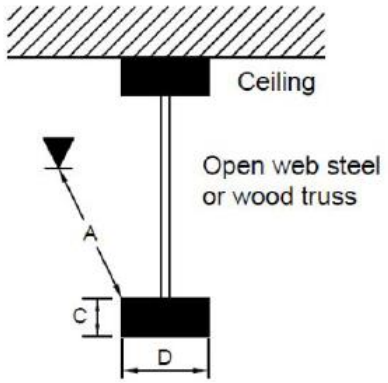
Eliminated 24 inch allowance



Plan View of Column
(Obstruction in Vertical Orientation)

A ≥ *4C or 4D*
(Use dimension C or D, whichever is greater)

FIGURE 8.8.5.2.1.3(a) Minimum Distance from Obstruction (Extended Coverage Upright and Pendent Spray Sprinkler)



Elevation View of Truss
(Obstruction in Horizontal Orientation)

A ≥ *4C or 4D*
A ≤ 36 in. (914 mm)
(Use dimension C or D, whichever is greater)

FIGURE 8.8.5.2.1.3(b) Minimum Distance from Obstruction (Extended Coverage Upright and Pendent Spray Sprinkler)

EC Sidewalls in Residential

8.9.4.1.4* Soffits and Cabinets in Residential Areas/Occupancies. Where soffits are used for the installation of sidewall sprinklers, the sprinklers and soffits shall be installed in accordance with 8.9.4.1.4.1, 8.9.4.1.4.2, or 8.9.4.1.4.3.

8.9.4.1.4.1 Where soffits exceed more than 8 in. (200 mm) in width or projection from the wall, pendent sprinklers shall be installed under the soffit.

8.9.4.1.4.2 Sidewall sprinklers shall be permitted to be installed in the face of a soffit located directly over cabinets, without requiring additional sprinklers below the soffit or cabinets, where the soffit does not project horizontally more than 12 in. (300 mm) from the wall.

8.9.4.1.4.3 Where sidewall sprinklers are more than 3 ft (900 mm) above the top of cabinets, the sprinkler shall be permitted to be installed on the wall above the cabinets where the cabinets are no greater than 12 in. (300 mm) from the wall.

Figure 8.9.5.1.3 Positioning of Sprinkler to Avoid Obstruction (Extended Coverage Sidewall Spray Sprinklers).

8.9.5.1.2 Sidewall sprinklers shall be installed no closer than 8 ft (2.4 m) from light fixtures or similar obstructions.

8.9.5.1.3 The distance between light fixtures or similar obstructions located more than 8 ft (2.4 m) from the sprinkler
shall be in conformance with Table 8.9.5.1.3 and Figure 8.9.5.1.3.

Table 8.9.5.1.3 Positioning of Sprinklers to Avoid Obstructions (Extended Coverage Sidewall Spray Sprinklers)

Distance from Sidewall Sprinkler to Side of Obstruction *(A)*	Maximum Allowable Distance of Deflector Above Bottom of Obstruction *(B)* [in. (mm)]
Less than 8 ft (2.4 m)	Not allowed
8 ft (2.4 m) to less than 10 ft (3.0 m)	1 (25)
10 ft (3.0 m) to less than 11 ft (3.3 m)	2 (50)
11 ft (3.3 m) to less than 12 ft (3.7 m)	3 (75)
12 ft (3.7 m) to less than 13 ft (4.0 m)	4 (100)
13 ft (4.0 m) to less than 14 ft (4.3 m)	6 (150)
14 ft (4.3 m) to less than 15 ft (4.6 m)	7 (175)
15 ft (4.6 m) to less than 16 ft (4.9 m)	9 (225)
16 ft (4.9 m) to less than 17 ft (5.2 m)	11 (275)
17 ft (5.2 m) or greater	14 (350)

Note: For *A* and *B*, refer to Figure 8.9.5.1.3.

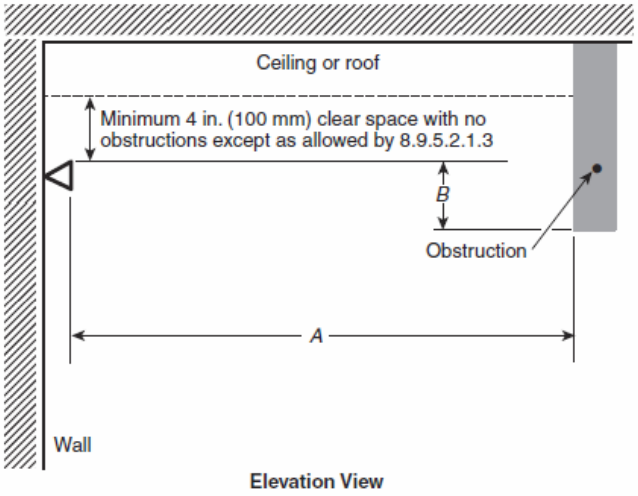


FIGURE 8.9.5.1.3 Positioning of Sprinkler to Avoid Obstruction (Extended Coverage Sidewall Spray Sprinklers).

EC SW

8.9.5.1.4 Continuous obstructions projecting from the same wall as the one on which the sidewall sprinkler is mounted shall be in accordance with ~~Table 8.9.5.1.4 and Figure 8.9.5.1.4~~ . one of the following arrangements:

- (1) Sprinklers shall be installed in accordance with Table 8.9.5.1.4 and Figure 8.9.5.1.4(a) .
- (2) Sprinklers shall be permitted to be spaced on opposite sides of obstructions less than 4 ft (1.22 m) in width where the distance from the centerline of the obstruction to the sprinklers does not exceed one-half the allowable distance between sprinklers.
- (3) Obstructions located against the wall and that are not over 30 in. (762 mm) in width shall be permitted to be protected in accordance with Figure 8.9.5.1.4(b) .
- (4) Obstructions located against the wall and that are not over 24 in. (610 mm) in width shall be permitted to be protected in accordance with Figure 8.9.5.1.4(c) . The maximum distance between the sprinkler and the wall shall be measured from the sprinkler to the wall behind the obstruction and not to the face of the obstruction.

8.9.5.1.5 Isolated Obstructions. Isolated obstructions projecting from the same wall as the one on which the extended coverage sidewall sprinkler is mounted shall be located a minimum of 6 in. (152 mm) from the sidewall sprinkler.

~~**8.9.5.1.6** Sprinklers shall be permitted to be spaced on opposite sides of obstructions less than 4 ft (1.22 m) in width where the distance from the centerline of the obstruction to the sprinklers does not exceed one-half the allowable distance between sprinklers.~~ Relocated to 8.9.5.1.4(2)

ECSW Obstructions

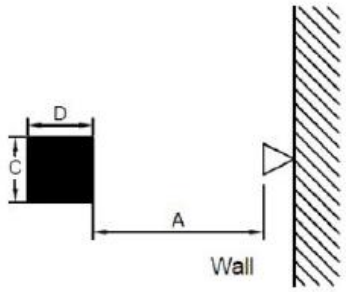
8.9.5.2.1.3* Unless the requirements of 8.9.5.2.1.4 through 8.9.5.2.1.5 are met, sprinklers shall be positioned away from obstructions a minimum distance of four times the maximum dimension of the obstruction (e.g., truss webs and chords, pipe, columns, and fixtures) in accordance with Figure 8.9.5.2.1.3(a) and Figure 8.9.5.2.1.3(b).

- **(A)** The maximum clear distance required to obstructions in the horizontal orientation (e.g., light fixtures and truss chords), shall be 36 in. (900 mm).
- **(B)** The maximum clear distance shall not be applied to obstructions in the vertical orientation (e.g., columns).

8.9.5.2.1.4 The requirements of 8.9.5.2.1.3 *and 8.9.5.2.1.4* shall not apply where sprinklers are positioned with respect to obstructions in accordance with 8.9.5.1.2 and 8.9.5.1.3.

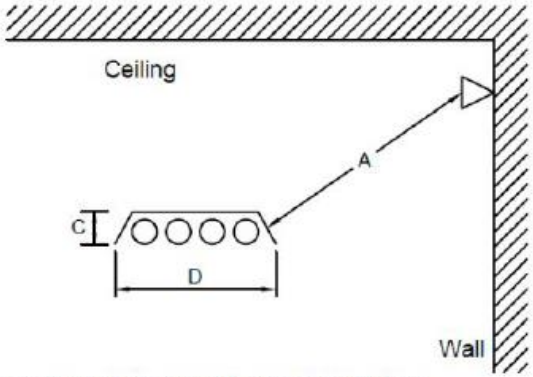
8.9.5.2.1.4 used to be the reference the section covered by 8.9.5.1.4 (obstructions located on the same wall)

EC SW – Deleted 36 inch (914mm) exception



Plan View of Column
(Obstruction in Vertical Orientation)
A ≥ 4C or 4D
(Use dimension C or D, whichever is greater)

FIGURE 8.9.5.2.1.4(a) Minimum Distance from Obstruction (Extended Coverage Sidewall)



Elevation View of Pipe Conduit or Light Fixture
(Obstruction in Horizontal Orientation)
A ≥ 4C or 4D
A ≤ 36 in. (914 mm)
(Use dimension C or D, whichever is greater)

FIGURE 8.9.5.2.1.4(b) Minimum Distance from Obstruction (Extended Coverage Sidewall)

Residential

8.10.2.2 Residential sprinklers shall not be permitted to be used on ceilings with slopes greater than 8 in 12 or ceiling with heights greater than 24 ft unless specifically listed for this purpose.

Be careful on Beamed Ceiling applications – needs to be cleaned up

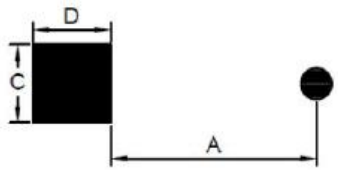
8.10.4.7 Deflector Orientation (Residential Upright and Pendent Spray).

8.10.4.7.1 Unless the requirements of 8.10.4.7.2 or 8.10.4.7.3 are met, deflectors of upright and pendent sprinklers shall be aligned parallel to ceilings, roofs, or the incline of stairs.

8.10.4.7.2 Where upright or pendent sprinklers are installed at the peak below a sloped ceiling or roof surface, the sprinkler shall be installed with the deflector horizontal.

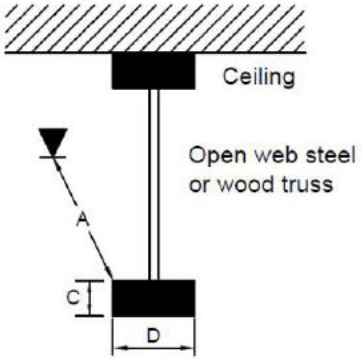
8.10.4.7.3 Roofs and ceilings having a pitch not exceeding 2 in 12 (16.7 percent) are considered horizontal in the application of 8.10.4.7 , and upright and pendent sprinklers shall be permitted to be installed with deflectors horizontal.

Residential - Deleted 36 inch (914mm) exception



Plan View of Column
(Obstruction in Vertical Orientation)
A ≥ 4C or 4D
(Use dimension C or D, whichever is greater)

FIGURE 8.10.6.2.1.3(a) Minimum Distance from Obstruction (Residential Upright and Pendent Spray Sprinkler)



Elevation View of Truss
(Obstruction in Horizontal Orientation)
A ≥ 4C or 4D
A ≤ 36 in, (914 mm)
(Use dimension C or D, whichever is greater)

FIGURE 8.10.6.2.1.3(b) Minimum Distance from Obstruction (Residential Upright and Pendent Spray Sprinkler)

ESFR

8.12.5.3.3* For pipes, conduits, or groups of pipes and conduit to be considered individual, they must be separated from the closest adjacent pipe, conduit, cable tray, or similar obstructions by a minimum of three times the width of the adjacent pipe, conduit, cable tray, or similar obstruction.

Concealed Space Openings

8.15.1.2.1* Concealed spaces of noncombustible and limited-combustible construction with minimal combustible loading having no access shall not require sprinkler protection.

8.15.1.2.1.1 The space shall be considered a concealed space even with small openings such as those used as return air for a plenum.

8.15.1.2.1.2 Small openings with a combined total area of not more than 20 percent of the ceiling, construction feature, or plane used to determine the boundaries of the concealed space shall be permitted where length greater than 4 ft shall not have a width greater than 8 in.

8.15.1.2.1.3 The space above cloud ceilings meeting the requirements in 8.15.24.1 and having openings with a combined total area of not more than 20 percent of the ceiling, construction feature, or plane used to determine the boundaries of the concealed space shall be permitted.

Combustible Concealed

8.15.1.6.1 Sprinklers specifically listed to provide protection of combustible concealed spaces described in 8.15.1.6 shall be permitted to be used in accordance with 8.3.1.2 where the space is less than 12 in. (305 mm) from deck to deck or deck to ceiling .

8.15.1.6.2 Sprinklers specifically listed to provide protection of combustible concealed spaces described in 8.15.1.6 shall be permitted to be used in accordance with 8.3.1.2 throughout the area when a portion of the area exceeds a depth of 36 in. (914 mm).

8.15.1.7 Sprinklers specifically listed to provide protection of combustible concealed spaces described in 8.15.1.6 shall be permitted to be used in accordance with 8.3.1.2 to protect composite wood joist construction with a maximum of 36 in. (914 mm) from deck to deck, from deck to ceiling, or with double composite wood joist construction with a maximum of 36 in. (914 mm) between the top of the bottom joist and the bottom of the upper joist.

Sprinkler Omission - outside

8.15.7.2* Sprinklers shall be permitted to be omitted where the exterior canopies, roofs, porte-cocheres, balconies, decks, and similar projections are constructed with materials that are noncombustible, limited-combustible, or fire retardant–treated wood as defined in NFPA 703, *Standard for Fire Retardant-Treated Wood and Fire-Retardant Coatings for Building Material* , or where the projections are constructed utilizing a noncombustible frame, limited-combustibles, or fire retardant–treated wood with an inherently flame-resistant fabric overlay as demonstrated by Test Method 2 in accordance with NFPA 701 , *Standard Methods of Fire Tests for Flame Propagation of Textiles and Films* .

Omitting Bathroom Sprinklers

8.15.8.1.1* ~~Sprinklers~~ Unless sprinklers are required by 8.15.8.1.2 or 8.15.8.1.3 , sprinklers shall not be required in bathrooms that are located within dwelling units ~~of hotels and motels~~ , that do not exceed 55 ft2 (5.1 m2) in area, and that have walls and ceilings of noncombustible or limited-combustible materials with a 15-minute thermal barrier rating, including the walls and ceilings behind any shower enclosure or tub.

8.15.8.1.2 Sprinklers shall be required in bathrooms of limited care facilities and nursing homes, as defined in NFPA *101* , *Life Safety Code* .

8.15.8.1.3 Sprinklers shall be required in bathrooms opening directly onto public corridors or exitways.

Closets and Pantries

8.15.8.2* Closets and Pantries. Sprinklers are not required in clothes closets, linen closets, and pantries within dwelling units in hotels and motels where the area of the space does not exceed 24 ft2 (2.2 m2) , ~~the least dimension does not exceed 3 ft (0.9 m)~~, and the walls and ceilings are surfaced with noncombustible or limited-combustible materials.

Eliminate vague criteria

~~**8.15.11.2** Hoods or shields installed to protect important electrical equipment from sprinkler discharge shall be noncombustible.~~

8.15.24 Cloud Ceilings

8.15.24 Cloud Ceilings.

8.15.24.1* Sprinklers shall be permitted to be omitted abovecloud ceilings where both of the following apply:

- (1)*The openings around the cloud and the maximum sprinkler protection area meet the requirements of 8.15.1.2.1.2 and Table 8.15.24.1
- (2) The requirements of 8.15.24.2 are met.

8.15.24.2 When sprinklers are omitted from above a cloud ceiling in accordance with 8.15.24.1, the requirements of this section shall apply.

8.15.24.2.1 All sprinklers shall be quick response standard spray or extended coverage pendent or upright sprinklers.

8.15.24.2.1.1 Where extended coverage sprinklers are used, the maximum distance between sprinklers shall not exceed 16 ft (4.9 m).

8.15.24.2.2 Maximum cloud ceiling height shall not exceed 20 ft (6.1 m).

8.15.24.2.3 Maximum spacing shall not exceed the maximum requirements of Table 8.6.2.2.1(a) for light hazard and Table 8.6.2.2.1(b) for ordinary hazard.

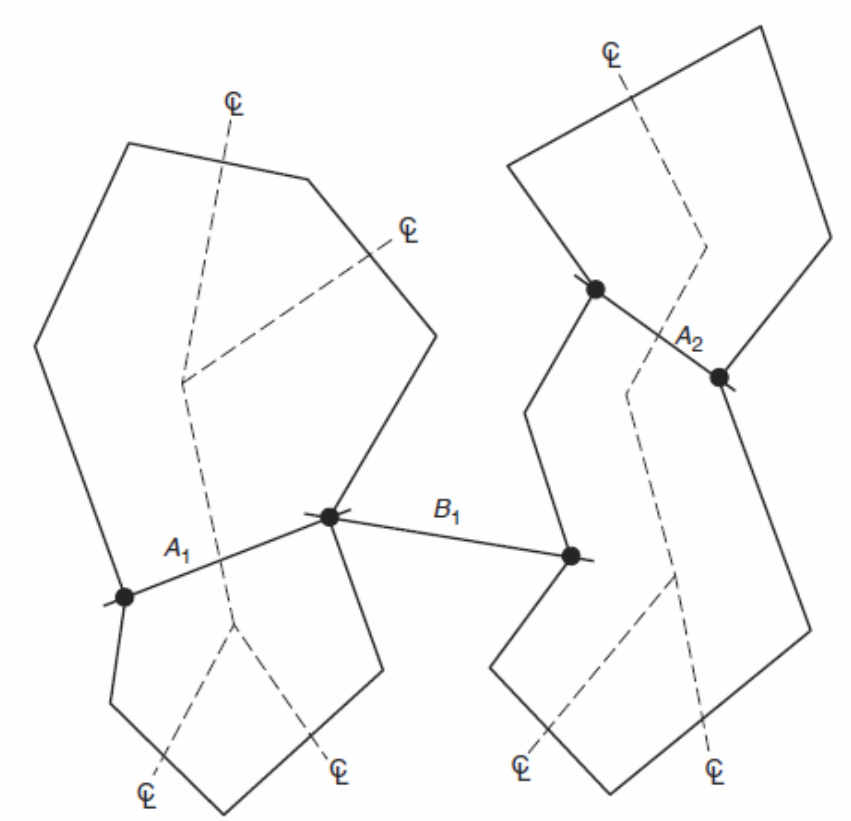
8.15.24.2.4 Cloud ceilings shall be of smooth ceiling construction.

8.15.24.2.5* For irregular shaped ceiling clouds (not rectangular) the minimum width dimension shall be the smallest width dimension of the cloud and for the gap shall be the greatest dimension between clouds or adjacent walls as applicable.

Cloud Ceilings

Table 8.15.24.1 Maximum Sprinkler Protection Area Based on Ceiling Cloud Width and Opening Width

Ceiling Cloud — Minimum Width Dimension (ft)	Maximum Area (ft^2) — Opening Width ≤0.5 in./ft of Ceiling Height	Maximum Area (ft^2) — Opening Width ≤0.75 in./ft of Ceiling Height	Maximum Area (ft^2) — Opening Width ≤1 in./ft of Ceiling Height
2–<2.5	175	70	NP
2.5–4	225	120	70
>4	225	150	150



A = Minimum cloud width *B* = Maximum cloud width

FIGURE A.8.15.24.2.5 Irregular Shaped Cloud Dimensioning.

Sprinkler Omission

8.15.25 Revolving Doors Enclosures. Sprinkler protection shall not be required within revolving door enclosures.

Sprinkler-Protected Glazing

8.15.25* Sprinkler-Protected Glazing. Where sprinklers are used in combination with glazing as an alternative to a required fire-rated wall or window assembly, the sprinkler-protected assembly shall comply with the following:

- (1) Sprinklers shall be listed as specific application window sprinklers unless the standard spray sprinklers are specifically permitted by the building code.
- (2) Sprinklers shall be supplied by a wet-pipe system.
- (3) Glazing shall be heat-strengthened, tempered, or glass ceramic and shall be fixed.
- (4) Where the assembly is required to be protected from both sides, sprinklers shall be installed on both sides of the glazing.
- (5) The use of sprinkler-protected glazing shall be limited to non-load-bearing walls.
- (6) The glazed assembly shall not have any horizontal members that would interfere with uniform distribution of water over the surface of the glazing, and there shall be no obstructions between sprinklers and glazing that would obstruct water distribution.
- (7) The water supply duration for the design area that includes the window sprinklers shall not be less than the required rating of the assembly

Sprinkler-Protected Glazing

A.8.15.25 It is not the intent of this section to apply to sprinkler protection of glass atrium enclosures, pedestrian walkways, which are permitted by NFPA 101, or model building codes to be protected by standard spray sprinklers installed in accordance with the special provisions set forth in those codes for atrium construction. In some cases sprinkler protected assemblies as an alternative to a required fire rated wall or window assembly may require the approval of the building official.

8.16.2.4.6* Main Drain Test Connections.

8.16.2.4.6.1 Main drain test connections shall be provided at locations that will permit flow tests of water supplies and connections.

8.16.2.4.6.2 Main drain test connections shall be installed that the valve can be opened wide for a sufficient time to assure a proper test without causing water damage.

8.16.2.4.6.3 Main drain connections shall be sized in accordance with 8.12.4.2 .

A.8.16.2.4.2 Sizing the main drain connection so that it can flow the sprinkler system demand flow rate provides a practical means for performing the forward flow test of the backflow device as required by 8.17.4.5.1.

Heat Tracing

8.16.4.1.4.2 ~~Heat tracing systems shall be supervised by one of the following methods:~~

- ~~(1) Central station, proprietary, or remote station signaling service~~
- ~~(2) Local signaling service that will cause a signal at a constantly attended location~~

Electric supervision of the heat-tracing system shall provide positive confirmation that the circuit is energized.

Air Venting

8.16.6 * Air Venting The vent required by 7.1.5 shall be located near ~~the highest~~ a high point in the system to ~~remove the majority~~ allow air to be removed from that potion of the air system by one of the following methods:

(1) Manual valve, minimum **1⁄2** in. size

(2) Automatic air vent

(3) Other approved means

FDC

8.17.2.3* Size. The size of the pipe for the fire department connection shall be in accordance with one of the following:

- (1) Pipe size shall be a minimum of 4 in. (100 mm) for fire engine connections.
- (2) Pipe size shall be a minimum of 6 in. (150 mm) for fire boat connections.
- (3) For hydraulically calculated systems, the ~~fire department connection~~ pipe size shall be permitted to be less than 4 in. (100 mm) ~~and no~~ , but not less than the ~~size of system riser, where serving one system riser~~ largest riser being served by that connection .

8.17.2.6* Drainage. The piping between the check valve and the outside hose coupling shall be equipped with an approved automatic ~~drip~~ drain valve in areas subject to freezing.

8.17.2.6.1 The automatic drain valve shall be installed in a location that permits inspection and testing as required by NFPA 25 .

Backflow Prevention

8.17.4.5.1* Backflow Prevention Valves. Means shall be provided downstream of all backflow prevention valves for forward flow tests at a minimum flow rate of the system demand including hose allowance where applicable .

8.18 Electrical Bonding and Grounding.

8.18 Electrical Bonding and Grounding.

8.18.1 In no case shall sprinkler system piping be used for the grounding of electrical systems.

8.18.2* The requirement of 8.18.1 shall not preclude the bonding of the sprinkler system piping to the lightning protection grounding system as required by NFPA 780 in those cases where lightning protection is provided for the structure.

Skipping Hanging and Bracing

If $Cr >$ Brace angle from vertical

$$Pr = ((\mathrm{C} + \mathrm{A}) - \left(\frac{\mathrm{D}}{Tan\theta}\right))/\mathrm{A}$$

For braces acting in **COMPRESSION**:

If $Cr <$ Brace angle from vertical

$$Pr = \left(\left(\frac{\mathrm{D}}{Tan\theta}\right) - (C + A)\right)/\mathrm{A}$$

Chapter 10

Extract Chapter 10 and Associated annex from NFPA 24 into NFPA 13 for the 2016 edition.

11.1.2* Adjacent Hazards or Design Methods. For buildings with two or more adjacent hazards or design methods, the following shall apply:

- (1) Where areas are not physically separated by a draft curtain, barrier, or partition capable of delaying heat from a fire in one area from fusing sprinklers in the adjacent area, the required sprinkler protection for the more demanding design basis shall extend 15 ft (4.6 m) beyond its perimeter.
- (2) The requirements of 11.1.2(1) shall not apply where the areas are separated by a draft curtain, or barrier located above an aisle, where the aisle has a minimum 2 ft (600 mm) horizontal separation from the adjacent hazard on each side, or a partition that is capable of delaying heat from a fire in one area from fusing sprinklers in the adjacent area.
- (3) The requirements of 11.1.2(1) shall not apply to the extension of more demanding criteria from an upper ceiling level to beneath a lower ceiling level where the difference in height between the ceiling levels is at least 2 ft (600 mm), located above an aisle, where the aisle has a minimum 2 ft (600 mm) horizontal separation from the adjacent hazard on each side.

Inside Hose

11.1.6.3.1 Where the system is a combined sprinkler/standpipe system (Class I or Class III) and the building is fully sprinklered in accordance with NFPA 13, no inside hose demand shall be required at any of the standpipe outlets.

Unsprinklered Combustible Concealed Spaces.

11.2.3.1.5 Unsprinklered Combustible Concealed Spaces.

11.2.3.1.5.1 When using the density/area or room design method, unless the requirements of 11.2.3.1.5.2 are met for buildings having unsprinklered combustible concealed spaces, as described in 8.15.1.2 and 8.15.6 , the minimum area of sprinkler operation for that portion of the building shall be 3000 ft 2 (280 m 2).

- (A) The design area of 3000 ft 2 (280 m 2) shall be applied only to the sprinkler system or portions of the sprinkler system that are adjacent to the qualifying combustible concealed space.
- (B) The term *adjacent* shall apply to any sprinkler system protecting a space above, below, or next to the qualifying concealed space except where a barrier with a fire resistance rating at least equivalent to the water supply duration completely separates the concealed space from the Sprinklered area.

Relocated 11.2.3.1.4(4)

11.2.3.1.5.2 The following unsprinklered concealed spaces shall not require a minimum area of sprinkler operation of 3000 ft 2 (279 m 2):

- (1) Noncombustible and limited-combustible concealed spaces with minimal combustible loading having no access. The space shall be considered a concealed space even with small openings such as those used as return air for a plenum.
- (2) Noncombustible and limited-combustible concealed spaces with limited access and not permitting occupancy or storage of combustibles. The space shall be considered a concealed space even with small openings such as those used as return air for a plenum.
- (3) Combustible concealed spaces filled entirely with noncombustible insulation.

Relocated 11.2.3.1.4(4) (cont)

- (4) * Light or ordinary hazard occupancies where noncombustible or limited-combustible ceilings are directly attached to the bottom of solid wood joists or solid limited-combustible construction or noncombustible construction so as to create enclosed joist spaces 160 ft 3 (4.5 m 3) or less in volume, including space below insulation that is laid directly on top or within the ceiling joists in an otherwise sprinklered concealed space.
- (5) Concealed spaces where rigid materials are used and the exposed surfaces have a flame spread index of 25 or less and the materials have been demonstrated to not propagate fire more than 10.5 ft (3.2 m) when tested in accordance with ASTM ~~E 84~~ E84 , *Standard Test Method ~~of~~ for Surface Burning Characteristics of Building Materials,* or ANSI/UL 723, *Standard for Test for Surface Burning Characteristics of Building Materials* , extended for an additional 20 minutes in the form in which they are installed in the space.
- (6) Concealed spaces in which the exposed materials are constructed entirely of fire-retardant – treated wood as defined by NFPA 703.

Relocated 11.2.3.1.4(4) (cont)

- (7) Concealed spaces over isolated small ~~compartments~~ rooms not exceeding 55 ft 2 (5.1 m 2) in area.
- (8) Vertical pipe chases under 10 ft 2 (0.93 m 2), provided that in multifloor buildings the chases are firestopped at each floor using materials equivalent to the floor construction, and where such pipe chases shall contain no sources of ignition, piping shall be noncombustible, and pipe penetrations at each floor shall be properly sealed.
- (9) Exterior columns under 10 ft 2 (0.93 m 2) in area formed by studs or wood joists, supporting exterior canopies that are fully protected with a sprinkler system.
- (10) * Light or ordinary hazard occupancies where noncombustible or limited-combustible ceilings are attached to the bottom of composite wood joists either directly or on to metal channels not exceeding 1 in. (25.4 mm) in depth, provided the adjacent joist channels are firestopped into volumes not exceeding 160 ft 3 (4.5 m 3) , using materials equivalent to **1⁄2** (14) 1⁄2 in.(12.7 mm) gypsum board, and at least 3 **1⁄2** (15) 31⁄2 in. (90 mm) of (16) batt insulation is installed at the bottom of the joist channels when the ceiling is attached utilizing metal channels.

QR Reduction

11.2.3.2.3.1 Where listed quick-response sprinklers, including extended coverage quick-response sprinklers, are used throughout a system or portion of a system having the same hydraulic design basis, the system area of operation shall be permitted to be reduced without revising the density as indicated in Figure 11.2.3.2.3.1 when all of the following conditions are satisfied:

- (1) Wet pipe system
- (2) Light hazard or ordinary hazard occupancy
- (3) 20 ft (6.1 m) maximum ceiling height
- (4~~) There are no~~ No unprotected ceiling pockets as allowed by 8.6.7 and 8.8.7 exceeding 32 ft2 (3 m2)
- (5) No unprotected areas above cloud ceilings as allowed by 8.15.24

Residential design

11.3.1.3

Unless the requirements of 11.3.1.4 are met, the minimum required discharge from each of the four hydraulically most demanding ~~sprinklers~~ design area sprinkler shall be the greater of the following:

- (1) In accordance with minimum flow rates indicated in ~~individual~~ the sprinkler listings
- (2) ~~Calculated based on delivering a minimum of 0.1 gpm/ft 2 (4.1 mm/min) over the design area in accordance with the provisions of 8.5.2.1 or 8.6.2.1.2~~ In rooms or compartments greater than 800 ft² (74.3 m 2), calculated based on delivering a minimum of 0.1 gpm/ft 2 (4.1 mm/min) over the design area in accordance with the provisions of 8.5.2.1
- (3) In rooms or compartments 800 ft 2 (74.3 m 2) or less calculated based on delivering a minimum of 0.1 gpm/ft 2 (4.1 mm/min) over the room or the compartment using the area of the room divided by the number of sprinklers in the room

Residential design

11.3.1.4 For modifications or additions to existing systems equipped with residential sprinklers, the listed discharge criteria less than 0.1 gpm/ft2 (4.1 mm/min) shall be permitted to be used.

11.3.1.4.1 Where replacing residential sprinklers manufactured prior to 2003 that are no longer available from the manufacturer and that are installed using a design density less than 0.05 gpm/ft 2 (2.04 mm/min), a residential sprinkler with an equivalent K-factor (± 5 percent) shall be permitted to be used provided the currently listed coverage area for the replacement sprinkler is not exceeded.

Sprinkler-Protected Glazing

11.3.5 Sprinkler-Protected Glazing. Where the sprinkler-protected glazing is required to comply with 8.15.25, the water supply duration for the design area that includes the window sprinklers shall be not less than the required rating of the assembly.

Height of Ceiling

12.1.3.1 The maximum building height shall be measured to the underside of the roof deck or ceiling or in accordance with 12.1.3.1.1 through 12.1.3.1.3 .

12.1.3.1.1 For corrugated metal deck roofs up to 3 in. (76 mm) in depth, the maximum roof height shall be measured from floor to the bottom of the deck.

12.1.3.1.2 For decks deeper than 3 in. (76 mm), the maximum roof height shall be measured to the highest point on the deck.

12.1.3.1.3 For ceilings that have insulation installed directly against underside of the ceiling or roof structure, the maximum roof height shall be measured to the bottom of insulation and shall be in accordance with 12.1.3.1.3.1 or 12.1.3.1.3.2 .

12.1.3.1.3.1 For insulation that is installed directly against the ceiling or roof structure and is installed flat and parallel to the ceiling or roof structure, the maximum roof height shall be measured to the underside of the insulation.

12.1.3.1.3.2 For insulation that is installed in a manner that causes it to deflect or sag down from the ceiling or roof structure, the maximum roof height shall be measured as half of the distance of the deflection from the insulation high point to the insulation low point. If the deflection or sag in the insulation exceeds 6 in. (152 mm), the maximum roof height shall be measured to the high point of the insulation.

Pitched and Stepped Ceilings

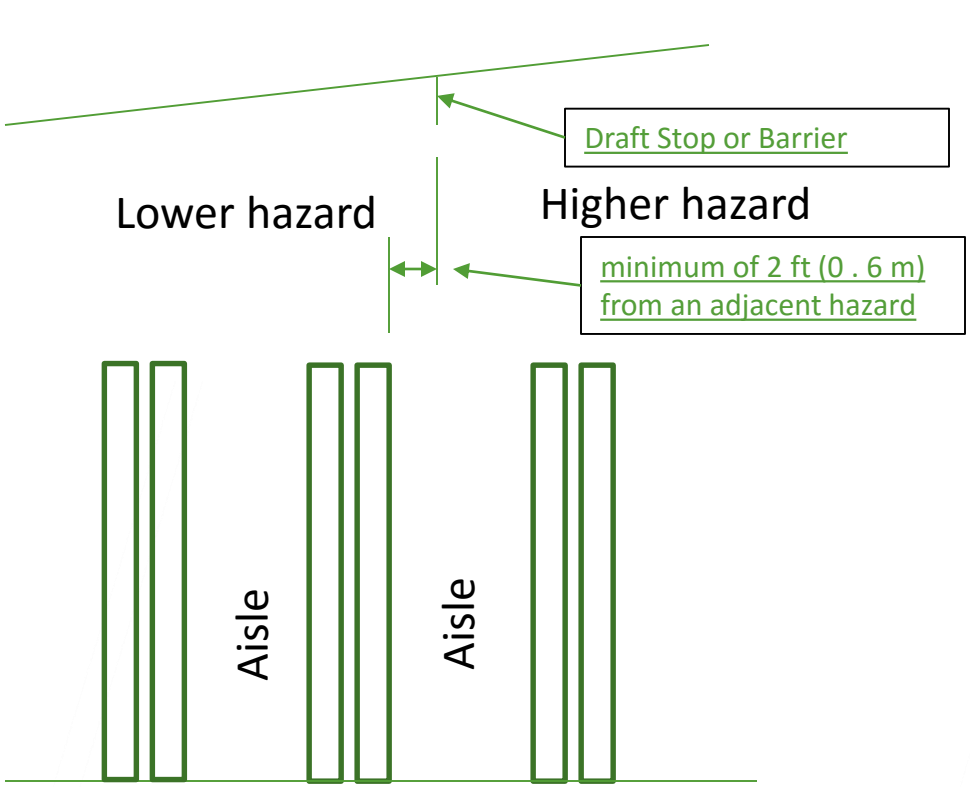
12.1.3.1.4* Where the building height changes within a compartment, the sprinklers directly over the storage shall be capable of protecting storage directly beneath.

12.1.3.1.4.1 Where a barrier to heat and smoke in accordance with 12.3(2) or 12.3(3) is not present, the sprinkler criteria 15 ft into the perimeter of the lower ceiling area shall be the same as the sprinkler protection for the high ceiling area.

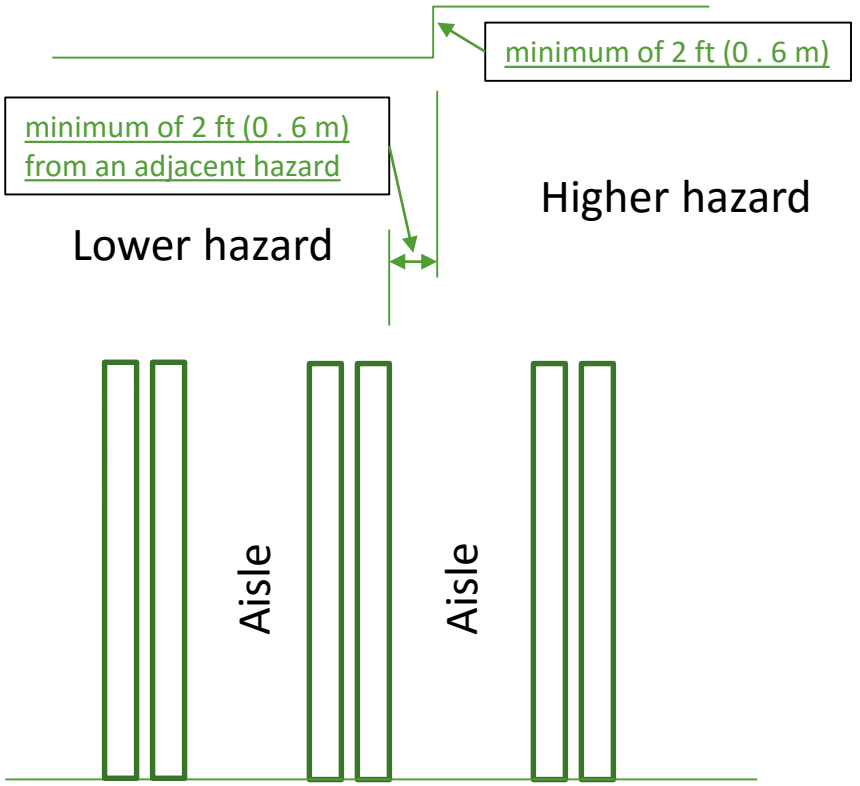
Adjacent Hazards

12.3* Adjacent Hazards or Design Methods. For buildings with two or more adjacent hazards or design methods, the following shall apply:

- (1) Where areas are not physically separated by a barrier or partition capable of delaying heat from a fire in one area from fusing sprinklers in the adjacent area, the required sprinkler protection for the more demanding design basis shall extend 15 ft (4.6 m) beyond its perimeter.
- (2) The requirements of 12.3 (1) shall not apply where the areas are separated by a draft curtain , or barrier located above an aisle , horizontally a minimum of 2 ft (0.6 m) from an adjacent hazard, or a partition that is capable of delaying heat from a fire in one area from fusing sprinklers in the adjacent area.
- (3) The requirements of 12.3 (1) shall not apply to the extension of more demanding criteria from an upper ceiling level to beneath a lower ceiling level where the difference in height between the ceiling levels is at least 2 ft (0.6 m), located above an aisle, horizontally a minimum of 2 ft (0 . 6 m) from an adjacent hazard .


Draft Stop or Barrier
Lower hazard
Higher hazard
minimum of 2 ft (0 . 6 m)
from an adjacent hazard
Aisle
Aisle

12.3(2)


minimum of 2 ft (0 . 6 m)
minimum of 2 ft (0 . 6 m)
from an adjacent hazard
Lower hazard
Higher hazard
Aisle
Aisle

12.3(3)

Dry and Preaction

~~**12.4.3** ESFR sprinklers shall only be permitted to be wet pipe systems.~~

12.5 Dry Pipe and Preaction Systems. For dry pipe systems and preaction systems, the area of sprinkler operation shall be increased by 30 percent without revising the density.

~~**12.5.1** For dry pipe systems and preaction systems, the area of sprinkler operation shall be increased by 30 percent without revising the density.~~

~~**12.5.2** Densities and areas shall be selected so that the final area of operation after the 30 percent increase is not greater than 3900 ft 2 (360 m 2).~~

ESFR and CMSA in Chapter 12

12.6.7.1 ESFR sprinklers designed to meet any criteria in Chapter 12 or Chapter 14 through Chapter 20 shall be permitted to protect any of the following:

- (1) Light hazard occupancies
- (2) Ordinary hazard occupancies
- (3) Any storage arrangement in Chapter 13 referencing OH1, OH2, EH1, and EH2 design criteria

12.6.7.2 Quick-response CMSA sprinklers designed to meet any criteria in Chapter 12 or Chapter 14 through Chapter 20 shall be permitted to protect any of the following:

- (1) Light hazard occupancies
- (2) Ordinary hazard occupancies
- (3) Any storage arrangement in Chapter 13 referencing OH1, OH2, EH1, and EH2 design criteria

12.6.7.3 Standard-response CMSA sprinklers designed to meet any criteria in Chapter 12 or Chapter 14 through Chapter 20 shall be permitted to protect any of the following:

- (1) Ordinary hazard occupancies
- (2) Any storage arrangement in Chapter 13 referencing OH1, OH2, EH1, and EH2 design criteria

Hose

Table 12.8.6 Hose Stream Allowance and Water Supply Duration

Commodity	Sprinkler Type	Sprinkler Spacing Type	Number of Ceiling Sprinklers in Design Area*	Size of Design Area at Ceiling	Hose Stream Allowance		Water Supply Duration (minutes)
					gpm	L/min	
	Control mode density/area (CMDA)	Standard and extended-coverage	NA	Up to 1200 ft² (110 m²)	250	950	60
				Over 1200 ft² (111 m²) up to 1500 ft² (140 m²)	500	1900	90
				Over 1500 ft² (139 m²) up to 2600 ft² (240 m²)	500	1900	120
				Over 2600 ft² (240 m²)	500	1900	150
Class I-IV Commodities, Group A plastics, idle wood pallets, idle plastic pallets and miscellaneous storage	Control Mode Specific Application (CMSA)	Standard	Up to 12	NA	250	950	60
			Over 12 to 15	NA	500	1900	90
			Over 15 to 25	NA	500	1900	120
			Over 25	NA	500	1900	150
		Extended-coverage	Up to 6	NA	250	950	60
			Up to 8†	NA	250	950	60
			Over 6 to 8	NA	500	1900	90
			Over 8 to 12	NA	500	1900	120
			Over 12	NA	500	1900	150
	Early Suppression Fast Response (ESFR)	Standard	Up to 12	NA	250	950	60
			Over 12 to 15	NA	500	1900	90
			Over 15 to 25	NA	500	1900	120
			Over 25	NA	500	1900	150
On-floor rubber tire storage up to 5 ft (1.5 m) in height	CMDA & CMSA	Standard and extended-coverage	Any	Any	250	950	120

Table 12.8.6 *Continued*

Commodity	Sprinkler Type	Sprinkler Spacing Type	Number of Ceiling Sprinklers in Design Area*	Size of Design Area at Ceiling	Hose Stream Allowance		Water Supply Duration (minutes)
					gpm	L/min	
Rubber tire storage	CMDA	Standard and extended-coverage	NA	Up to 5000 ft² (372 m²)	750	2850	180
	CMSA	Standard	Up to 15	NA	500	1900	180
	ESFR	Standard	Up to 12	NA	250	950	180
			Over 12 to20	NA	500	1900	180
Roll paper	CMDA	Standard	NA	Up to 4000 ft² (372 m²)	500	1900	120
	CMSA	Standard	Up to 25	NA	500	1900	120
	ESFR	Standard	Up to 12	NA	250	950	60
Alternative Protection per 16.1.2.4 or 17.1.2.9	NA	NA	NA	NA	500	1900	120

NA: Not applicable.
*For CSMA and ESFR sprinklers, the additional sprinklers included in the design area for obstructions do not need to be considered in determining the total number of sprinklers in this column.
†Limited to a maximum of 144 ft² (13.4 m²) per sprinkler.

Room Design in Storage

12.9.1* When using the density/area method or room design method , unless the requirements of 12.9.2 are met for buildings having unsprinklered combustible concealed spaces as described in 8.15.1.2 and 8.15.6, the minimum area of sprinkler operation for that portion of the building shall be 3000 ft2 (279 m2).

Eliminate High Temp Column

Table 12.12.1.2(a) Control Mode Density/Area Sprinkler Protection for Indoor Storage of Idle Wood Pallets

Type of Sprinkler	Location of Storage	Nominal K-Factor	Maximum Storage Height		Maximum Ceiling/Roof Height		Sprinkler Density		Areas of Operation	
			ft	m	ft	m	gpm/ft²	mm/min	ft²	m²
Control mode density/area	On floor	8 (115) or larger	Up to 6	Up to 1.8	20	6.1	0.20	8.1	3000*	280*
	On floor	11.2 (160) or larger	Up to 8	Up to 2.4	30	9.1	0.45	18.3	2500	230
	On floor or rack without solid shelves	11.2 (160) or larger	8 to 12	2.4 to 3.7	30	9.1	0.6	24.4	3500	325
			12 to 20	3.7 to 6.1	30	9.1	0.6	24.4	4500	420
	On floor	16.8 (240) or larger	Up to 20	Up to 6.1	30	9.1	0.6	24.4	2000	185

*The area of sprinkler operation should be permitted to be reduced to 2000 ft² (186 m²) when sprinklers having a nominal K-factor of 11.2 or larger are used or if high temperature–rated sprinklers with a nominal K-factor of 8.0 are used.

Wood Pallets

Wood pallets, where stored indoors, shall be protected in accordance with one of the following:

(4) Control mode density/area sprinkler protection in accordance with the OH2 curve of Figure 13.2.1 existing with a hose stream demand of at least 250 gpm (946 L/min) for a duration of at least 60 minutes when pallets are stored no higher than 6 ft (1.8 m) and each pile of no more than four stacks shall be is separated from other pallet piles by at least 8 ft (1.4 m) of clear space or 25 ft (7.6 m) of commodity. The maximum clearance to ceiling of 20 ft (6.1 m) specified in 12.1.3.4 shall not apply to arrangement 12.12.1.2(4).

12.12.1.2.1 The maximum clearance to ceiling of 20 ft (6.1 m) specified in 12.1.3.4 shall not apply to arrangement 12.12.1.2 (4).

Chapter 13

~~13.1 Miscellaneous Storage Up to 12 ft (3.7 m) in Height. General.~~

13.1.1 This chapter shall apply to any of the following situations:

- (1) Miscellaneous storage of Class I through Class IV commodities up to 12 ft (3.7 m) in height
- (2) Miscellaneous storage of Group A plastics up to 12 ft (3.7 m) in height
- (3) Miscellaneous storage of rubber tires up to 12 ft (3.7 m) in height
- (4) Miscellaneous storage of rolled paper up to 12 ft (3.7 m) in height
- (5) Storage of Class I through Class IV commodities up to 12 ft (3.7 m) in height as directed by 14.2.3.1 and 16.2.1.2.1
- (6) Storage of Group A plastics up to 5 ft (1.5 m) in height as directed by 15.2.1 and 17.2.1.1

Low Piled Solid Shelf Criteria

13.1.3 Solid Shelf Racks.

13.1.3.1 For storage of Class I through Class IV 12 ft (3.7 m) or less in height that does not meet the definition of *Miscellaneous Storage* that is on solid shelf racks, in-rack sprinklers shall be provided in accordance with 16.1.6, and ceiling sprinkler protection shall be provided in accordance with Chapter 13.

13.1.3.2 For storage of Group A Plastics 5 ft (1.5 m) or less in height that does not meet the definition of *Miscellaneous Storage* that is on solid shelf racks, in-rack sprinklers shall be provided in accordance with 17.1.5, and ceiling sprinkler protection shall be provided in accordance with Chapter 13.

13.2.1 The protection criteria shall be selected from Table 13.2.1 and Figure 13.2.1 ~~shall apply to any of the following situations: .~~

- ~~Miscellaneous storage of Class I through Class IV commodities up to 12 ft (3.7 m) in height~~
- ~~Miscellaneous storage of Group A plastics up to 12 ft (3.7 m) in height~~
- ~~Miscellaneous storage of rubber tires up to 12 ft (3.7 m) in height~~
- ~~Miscellaneous storage of rolled paper up to 12 ft (3.7 m) in height~~
- ~~Storage of Class I through Class IV commodities up to 12 ft (3.7 m) in height as directed by 14.2.3.1 and 16.2.1.2.1~~
- ~~Storage of Group A plastics up to 5 ft (1.5 m) in height as directed by 15.2.1 and 17.2.1.1~~

Reference back to occupancy

13.2.2 Installation criteria as permitted by NFPA 13 and design criteria and modifiers as permitted by the density/area method of Chapter 11 for ordinary hazard Group 1, ordinary hazard Group 2, extra hazard Group 1, and extra hazard Group 2 occupancies shall be applicable ~~for the protection of any of the following: .~~

- ~~Miscellaneous storage as described by Table 13.2.1~~
- ~~Commodity Class I through Class IV storage 12 ft (3.7 m) or less in height as directed by 14.2.3.1 and 16.2.1.2.1~~
- ~~Storage of Group A plastics up to 5 ft (1.5 m) in height as directed by 15.2.1 and 17.2.1.1~~

In-Rack Spacing

13.3.4.2 ~~Maximum horizontal~~ Horizontal spacing of in-rack sprinklers ~~in single- or double-row racks with Class Ithrough IV commodities, Group A plastics, tires, and rolled paper shall be in accordance with Table 13.3.4.2 .~~

~~Table 13.3.4.2 In-Rack Sprinkler Spacing for Class I, II, III, and IV Commodities Stored in Single- or Double-Row Racks Up to 12 ft (3.7 m) in Height~~

~~Commodity Class Aisle Widths I and II III IV Group A Plastics, Tires and Rolled Paper Encapsulated ft m ft m ft m ft m ft m No 8 2.4 12 3.7 12 3.7 10 3.0 8 2.4 No 4 1.2 12 3.7 10 3.0 10 3.0 8 2.4 Yes ——8 2.4 8 2.4 8 2.4 8 2.4~~

shall not exceed 8 ft (2.4 m).

Group A covers Class I to IV

14.1.3 Protection criteria for Group A plastics shall be permitted to be used for Class I, II, III, and IV commodities with the same storage and height configuration.

Open Rack

16.1.2.3 The ceiling design criteria for single-, double- and multiple-row racks in Chapter 16 are based on Open Rack configurations as defined in Section 3.9.3.7.4.

Alternative Protection

16.1.2.4 Alternative Protection. Class I, II, III, IV commodities requiring a greater level of protection than is available from the overhead sprinkler system shall be permitted to be protected in accordance with 16.1.2.4.1 through 16.1.2.4.7.

16.1.2.4.1 Where the storage rack will not be solely dedicated to the storage of commodities requiring a greater level of protection than is available from the overhead sprinkler system, either of the following shall apply:

- (1) Extend the protection prescribed by 16.1.2.4 horizontally one pallet load in all directions beyond the commodity storage area requiring the higher level of protection.
- (2) Install a vertical barrier to segregate the commodities requiring the higher level of protection from any adjacent commodities.

16.1.2.4.2 Commodities that can be protected by the ceiling level sprinkler system shall be permitted to be stored vertically above and horizontally adjacent to the portions of the storage rack equipped as prescribed by 16.1.2.4.

Alternative Protection

16.1.2.4.3 Horizontal Barriers. Horizontal barriers shall be installed at every tier level of the dedicated storage rack where the rack is equipped with solid shelves.

16.1.2.4.3.1 Where the dedicated storage rack is open-frame, horizontal barriers shall be installed at vertical increments not exceeding 12 ft (3.6 m).

16.1.2.4.3.2 The barriers shall span horizontally so that all flue spaces within the rack bay are covered.

16.1.2.4.3.3 A maximum 3 in. (75 mm) wide gap shall be permitted at rack uprights.

16.1.2.4.3.4 The solid barrier shall be installed on a horizontal plane within a rack, beneath which in-rack sprinklers shall be installed, as follows:

- (1) The barrier shall be constructed of minimum 22 gauge (0.7 mm) sheet metal or of minimum 3⁄8 in. (10 mm) plywood.
- (2) The barrier shall extend to both aisle faces of the racks, covering up both the longitudinal and the transverse flue spaces of the rack bays in which they are installed.
- (3) The barrier shall be fitted to within 3 in. (75 mm) of any vertical rack member or other equipment that would create an opening, such as vertical in-rack sprinkler pipe drops.

Alternative Protection

16.1.2.4.4 In-Rack Sprinklers. Minimum K-8.0 (K-115) quick-response sprinklers (ceiling-level or in-rack) shall be installed beneath each horizontal barrier. The deflector of the sprinkler shall be located as close to the underside of the horizontal barrier as possible.

16.1.2.4.4.1 Single-Row Racks.

- **(A)** For single-row racks, sprinklers shall be installed at each rack upright and at each rack mid-bay as shown in Figure 16.1.2.4.4.1(A).
- **(B)** The maximum linear spacing between sprinklers shall not exceed 5 ft (1.5 m).

Alternative Protection

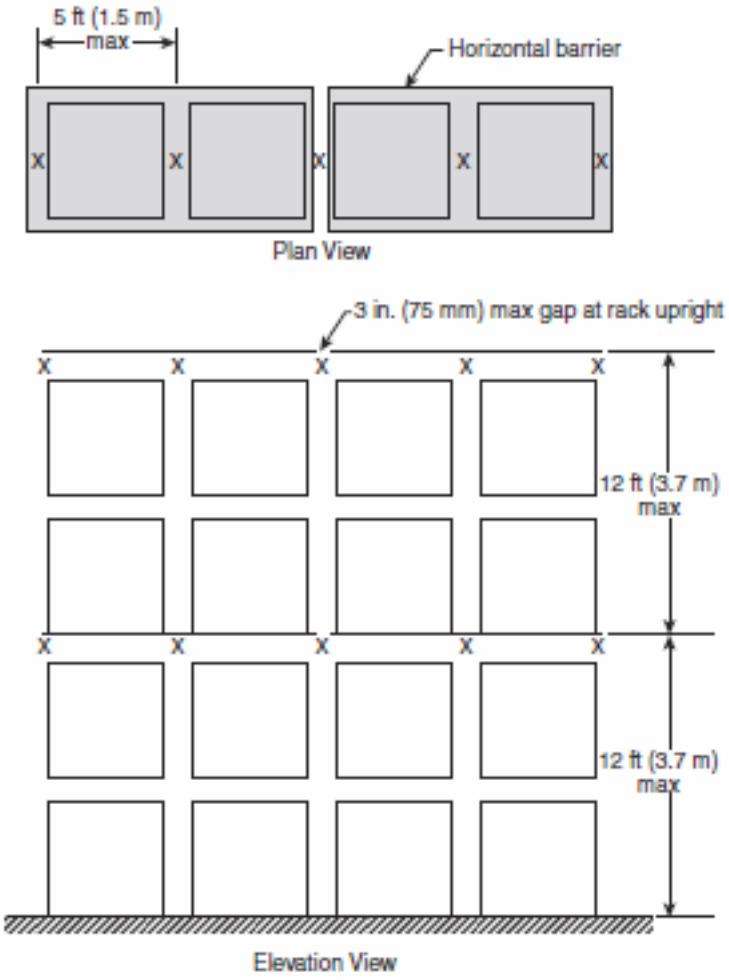


FIGURE 16.1.2.4.4.1(A) Alternative Protection for Single-Row Racks.

Alternative Protection

16.1.2.4.4.2 Double-Row Racks.

- **(A)** For double-row racks, sprinklers shall be installed at each rack upright within the longitudinal flue space and at the face of the rack and at the mid-bay face of each rack bay as shown in Figure 16.1.2.4.4.2(A).
- **(B)** The maximum linear spacing between sprinklers shall not exceed 5 ft (1.5 m) at the rack face and 10 ft (3.0 m) within the longitudinal flue space.

Alternative Protection

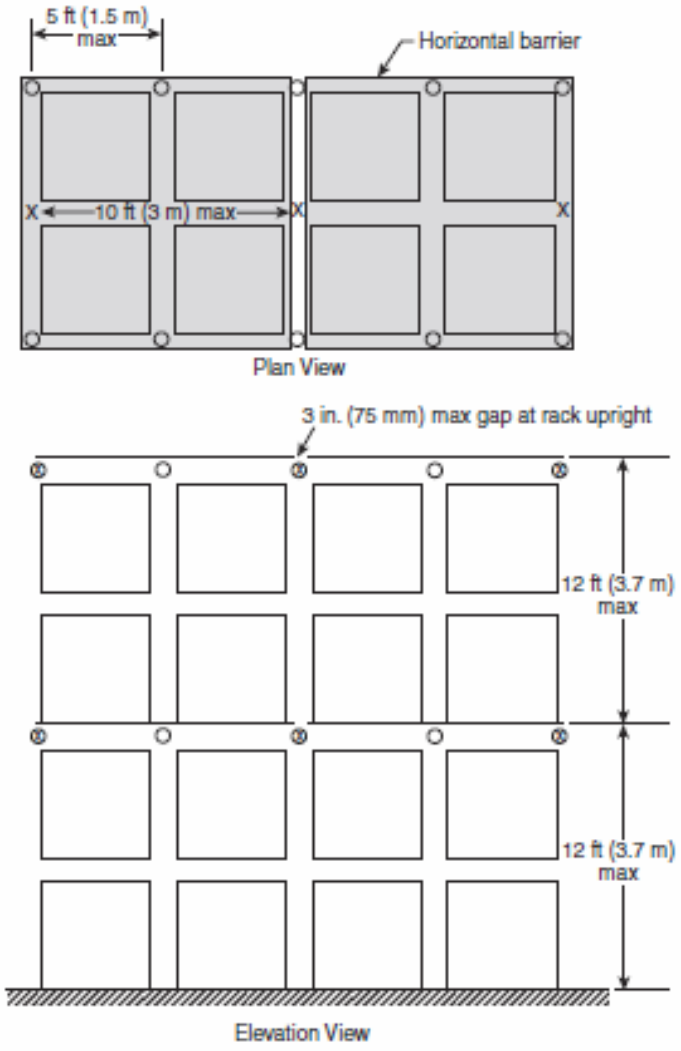


FIGURE 16.1.2.4.4.2(A) Alternative Protection for Double-Row Racks.

Alternative Protection

16.1.2.4.4.3 Multiple-Row Racks.

- **(A)** For multiple-row racks, an alternating sprinkler arrangement shall be installed within adjacent transverse flue spaces as shown in Figure 16.1.2.4.4.3(A), with sprinklers at the face of each flue space.
- **(B)** The maximum linear spacing between sprinklers at the face and at each alternating bay shall not exceed 5 ft (1.5 m) and shall not exceed 10 ft (3.0 m) between sprinklers at every other bay.

16.1.2.4.5 The design of an in-rack sprinkler system shall be based on a minimum flow of 60 gpm (230 L/min) from the most remote six sprinklers for single-row racks or the most remote eight sprinklers for both double-row and multiple-row racks.

16.1.2.4.6 The in-rack sprinkler demand shall not be required to be hydraulically balanced with the ceiling-level sprinkler system.

Alternative Protection

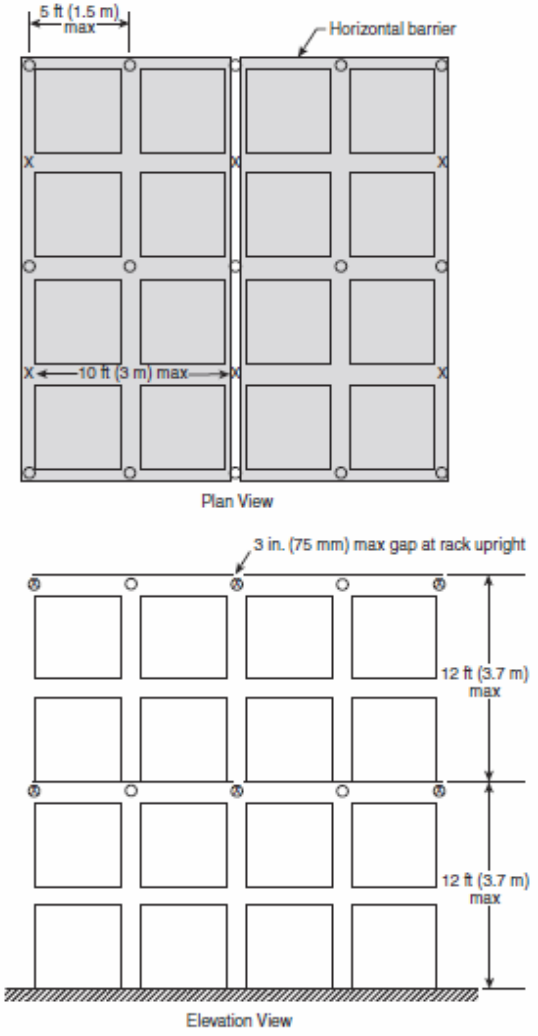


FIGURE 16.1.2.4.4.3(A) Alternative Protection for Multiple-Row Racks.

Alternative Protection

16.1.2.4.7 Ceiling Sprinkler System. The ceiling-level sprinkler system shall be designed based on the highest commodity hazard not protected by the criteria prescribed by 16.1.2.4.

16.1.3 Movable Racks. Rack storage in movable racks shall be protected in the same manner as multiple-row racks.

16.1.4 Fire Protection of Steel Columns — Columns Within Storage Racks of Class I Through Class IV and Plastic Commodities

16.1.4.1* Where fireproofing of building columns is not provided and storage heights are in excess of 15 ft (4.6 m), protection of building columns located wholly or partially within the ~~rack structure or vertical rack members supporting the building~~ footprint inclusive of flue spaces or within 12 in. (305 mm) of the footprint shall be protected in accordance with one of the following:

- (1) In-rack sprinklers
- (2) Sidewall sprinklers at the 15 ft (4.6 m) elevation, pointed toward one side of the steel column
- (3) Provision of ceiling sprinkler density for a minimum of 2000 ft2 (186 m2) with ordinary 165°F (74°C) or high-temperature 286°F (141°C) rated
- sprinklers as shown in Table 16.1.4.1 for storage heights above 15 ft (4.6 m), up to and including 20 ft (6.1 m)
- (4) Provision of CMSA or ESFR ceiling sprinkler protection

~~**16.1.4.1.1** This protection shall not be required where storage in fixed racks is protected by in-rack sprinklers.~~

16.1.4.2 Where storage heights are in excess of 15 ft (4.6 m) and vertical rack members support the building structure, the vertical rack members shall be protected in accordance with one of the options in 16.1.4.1 .

Clarification

16.1.6.7* Where solid shelves obstruct only a portion of the rack, in-rack sprinklers shall be installed horizontally, within the flue a minimum of 4 ft (1.2 m) beyond the end of the solid shelf, and vertically as follows:

- (1) In accordance with 16.1.6.1 and 16.1.6.2 for CMDA sprinklers
- (2) Beneath all tiers under the highest solid shelf for CMSA
- and ESFR sprinklers

16.1.6.8 Ceiling design criteria for CMDA, CMSA, and ESFR sprinklers shall be an applicable option for open racks combined with in-rack sprinklers installed in accordance with the criteria for solid shelving.

In-Rack Location

16.1.8.4* In-rack sprinklers shall be located at an intersection of transverse and longitudinal flues while not exceeding the maximum spacing rules.

- **(A)** Where distances between transverse flues exceed the maximum allowable distances, sprinklers shall be installed at the intersection of the transverse and longitudinal flues and additional sprinklers shall be installed between transverse flues to meet the maximum distance rules.
- **(B)** Where no transverse flues exist, in-rack sprinklers shall not exceed the maximum spacing rules.

16 – Remove general rule

~~16.1.11.2 In single-row, double-row, or multiple-row racks, a minimum 6 in. (152.4 mm) vertical clear space shall be maintained between the in-rack sprinkler deflectors and the top of a tier of storage.~~

~~16.1.11.2.1 Face sprinklers in such racks shall be located within the rack a minimum of 3 in. (76 mm) from rack uprights and no more than 18 in. (460 mm) from the aisle face of storage.~~

~~16.1.11.2.2 Longitudinal flue in-rack sprinklers shall be located at the intersection with the transverse flue space and with the deflector located at or below the bottom of horizontal load beams or above or below other adjacent horizontal rack members.~~

~~16.1.11.2.3 Such in-rack sprinklers shall be a minimum of 3 in. (76 mm) radially from the side of the rack uprights.~~

In-Rack for Low-Piled Storage

16.2.1.2.3 For storage 12 ft (3.7 m) or less in height that does not meet the definition of *Miscellaneous Storage* that is on solid shelf racks, in-rack sprinklers shall be provided in accordance with 16.1.6 , and ceiling sprinkler protection shall be provided in accordance with Chapter 13 .

Portable Racks

16.2.1.3.3.1 Multiple-Row Racks — Rack Depth Up to and Including 16 ft (4.9 m) with Aisles 8 ft (2.4 m) or Wider. For Class I, Class II, Class III, or Class IV commodities, encapsulated or nonencapsulated, ceiling sprinkler water demand in terms of density [gpm/ft2 (mm/min)] and area of sprinkler operation [ft2 (m2) of ceiling or roof] shall be selected from the density/area curves of Figure 16.2.1.3.2(a) through Figure 16.2.1.3.2(d) that are appropriate for each commodity and configuration as shown in Table 16.2.1.3.3.1 and shall be modified as appropriate by 16.2.1.3.4. The protection criteria shall apply to portable racks arranged in the same manner as ~~single- or double-row~~ multiple-row racks.

Encapsulated

16.2.1.3.3.3 Where Class I, Class II, and Class III commodities are encapsulated, ceiling sprinkler density shall be 25 percent greater than for nonencapsulated.

16.2.1.3.3.4 Where Class IV commodities are encapsulated, ceiling sprinkler density shall be 50 percent greater than for nonencapsulated.

Clarification of every tier

16.2.1.3.4.6 For storage height over 20 ft (6.1 m) up to and including 25 ft (7.6 m) protected with ceiling sprinklers and in-rack sprinklers at each tier except above the top tier , densities obtained from design curves shall be permitted to be reduced 40 percent, as indicated in Table 16.2.1.3.4.3. Densities shall not be adjusted in accordance with Figure 16.2.1.3.4.1 for storage height.

Moved to 16.1

~~**16.2.1.4.2.3*** In-rack sprinklers shall be located at an intersection of transverse and longitudinal flues while not exceeding the maximum spacing rules.~~

- ~~**(A)** Where distances between transverse flues exceed the maximum allowable distances, sprinklers shall be installed at the intersection of the transverse and longitudinal flues and additional sprinklers shall be installed between transverse flues to meet the maximum distance rules.~~
- ~~**(B)** Where no transverse flues exist, in-rack sprinklers shall not exceed the maximum spacing rules.~~

In-Rack - Up to 25 ft (7.6m)

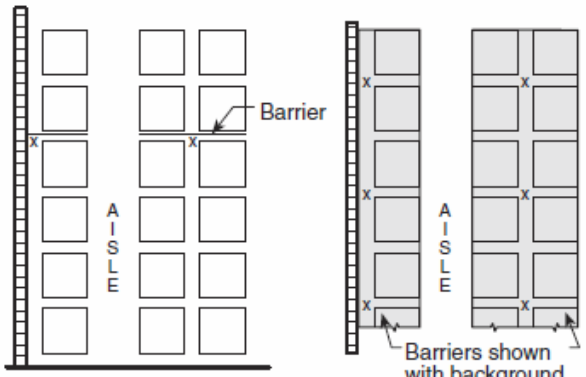
16.2.1.4.2.4* In single- or double-row racks without solid shelves with storage over 20 ft (6.1 m) high, or in multiple-row racks, or in single- or double-row racks with solid shelves and storage height up to and including 25 ft (7.6 m), a minimum of 6 in. (152 mm) vertical clear space shall be maintained between the in-rack sprinkler deflectors and the top of a tier of storage.

- (A) Sprinkler discharge shall not be obstructed by horizontal rack members.

16.2.1.4.2.5 For multiple-row racks, a minimum of 6 in. (152 mm) shall be maintained between the in-rack sprinkler deflector and the top of a tier of storage.

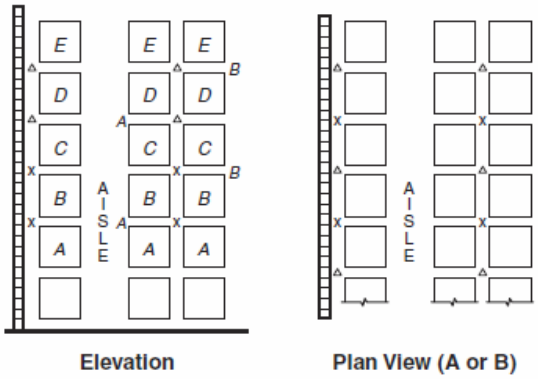
- (A) Sprinkler discharge shall not be obstructed by horizontal rack members.

Error in Printed Version – Printed copy shows Multiple row rack



Notes:
1. Symbol x indicates in-rack sprinklers.
2. Each square represents a storage cube measuring 4 ft to 5 ft (1.2 m to 1.5 m) on a side. Actual load heights can vary from approximately 18 in. (450 mm) up to 10 ft (3.0 m). Therefore, there could be as few as one load or as many as six or seven loads between in-rack sprinklers that are spaced 10 ft (3.0 m) apart vertically.

FIGURE 16.3.1.3.1.1(A)(a) In-Rack Sprinkler Arrangement, Class I Commodities, Storage Height 25 ft to Maximum 30 ft (7.6 m to Maximum 9.1 m).



Notes:
1. Alternate location of in-rack sprinklers. Sprinklers shall be permitted to be installed above loads *A* and *C* or above loads *B* and *D*.
2. Symbol Δ or x indicates sprinklers on vertical or horizontal stagger.
3. Each square represents a storage cube measuring 4 ft to 5 ft (1.2 m to 1.5 m) on a side. Actual load heights can vary from approximately 18 in. (450 mm) up to 10 ft (3.0 m). Therefore, there could be as few as one load or as many as six or seven loads between in-rack sprinklers that are spaced 10 ft (3.0 m) apart vertically.

FIGURE 16.3.1.3.1.1(A)(c) In-Rack Sprinkler Arrangement, Class I, II, or III Commodities, Storage Height 25 ft to Maximum 30 ft (7.6 m to Maximum 9.1 m).

CMSA with Solid Shelves

16.2.2.1.1 CMSA sprinklers shall not be permitted to protect storage on solid shelf racks unless the solid shelf racks are protected within-rack sprinklers in accordance with 16.1.6.

16.2.2.1.1.1 Where solid shelves are used, in-rack sprinklers shall be installed in every level below the highest solid shelf.

16.3.2.1.1 Protection of solid shelf racks with CMSA sprinklers at the ceiling shall be permitted where in-rack sprinklers are installed in accordance with 16.1.6 . In-rack sprinklers shall be installed in every level below the highest solid shelf.

16.3.3.2.1.1 Where solid shelves are used, the in -rack sprinklers shall be installed in every level below the highest solid shelf.

Moved clearance to Ceiling

16.3.1.1* For single- and double-row racks, the water demand for nonencapsulated storage ~~without solid shelves~~ separated by aisles at least 4 ft (1.2 m) wide and with ~~not more than~~ a clearance to ceiling up to and including 10 ft (3.1 m) ~~between the top of storage and the sprinklers~~ shall be in accordance with Table 16.3.1.1 .

Same for **16.3.1.2**

Moved clearance to Ceiling

16.3.1.1* For single- and double-row racks, the water demand for nonencapsulated storage ~~without solid shelves~~ separated by aisles at least 4 ft (1.2 m) wide and with ~~not more than~~ a clearance to ceiling up to and including 10 ft (3.1 m~~) between the top of storage and the sprinklers~~ shall be in accordance with Table 16.3.1.1 .

Same for **16.3.1.2**

In-Racks Above 25ft (7.6m)

6.3.1.3.2.5 The minimum of 6 in. (152.4 mm) vertical clear space shall be maintained between the sprinkler deflectors and the top of a tier of storage.

- (A) Sprinkler discharge shall not be obstructed by horizontal rack members.

16.3.1.3.2.6 In-rack sprinklers shall be a minimum of 3 in. (76 mm) radially from the side of the rack uprights.

16.3.1.3.2.7 Face sprinklers in such racks shall be located within the rack a minimum of 3 in. (76 mm) from rack uprights and no more than 18 in. (460 mm) from the aisle face of storage.

ESFR with Solid Shelves

16.2.3.2 ESFR sprinklers shall not be permitted to protect storage on solid shelf racks unless the solid shelf racks are protected with in-rack sprinklers in accordance with 16.1.6.

16.2.3.2.1 Where solid shelves are used, in-rack sprinklers shall be installed in every level below the highest solid shelf.

16.3.3.2.1 ESFR sprinklers shall not be permitted to protect storage on solid shelf racks unless the solid shelf racks are protected with in-rack sprinklers in accordance with 16.1.6.

16.3.3.2.1.1 Where solid shelves are used, in-rack sprinklers shall be installed in every level below the highest solid shelf.

Chapter 17

2013

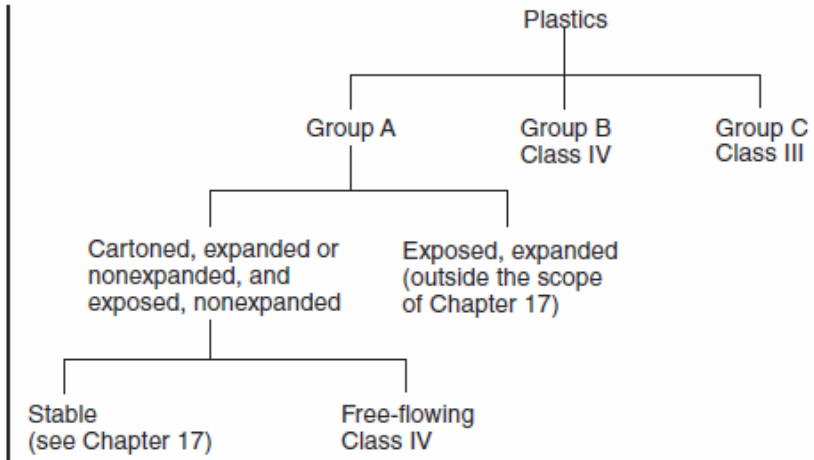


FIGURE 17.1.2.1 Decision Tree.

2016

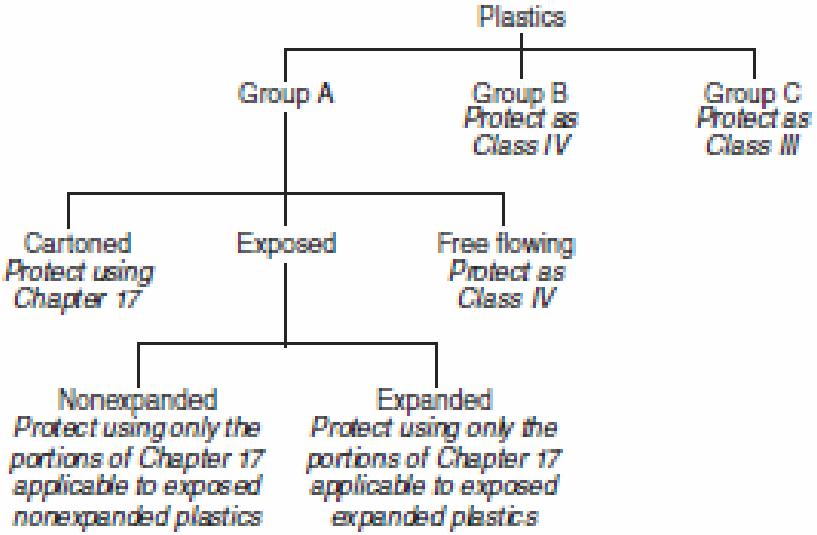


FIGURE 17.1.2.1 Decision Tree.

General

17.1.2.6 Sprinkler protection criteria for the storage of ~~materials~~ Group A plastic commodities on racks shall be in accordance with Section 17.2 for storage up to 25 ft (7.6 m) and Section 17.3 for storage over 25 ft (7.6 m).

17.1.2.8 The ceiling design criteria for single, double and multiple row racks in Chapter 17 are based on Open Rack configurations as defined in Section 3.9.3.7.7.

17.1.2.8 Alternative Protection

Same concept as Chapter 16

Vertical Column and Rack Member Protection

17.1.4.1* Where fireproofing of building columns is not provided and storage heights are in excess of 15 ft (4.6 m), protection of building columns located wholly or partially within the rack ~~structure or vertical rack members supporting the building~~ footprint inclusive of flue space or within 12 in. (305 mm) of the footprint shall be protected in accordance with one of the following:

17.1.4.2 Where storage heights are in excess of 15 ft (4.6 m) and vertical rack members support the building structure, the vertical rack members shall be protected in accordance with one of the options in 17.1.4.1 .

General

17.1.5.5 ~~Design~~ Ceiling design criteria for ~~combined ceiling and in-rack~~ CMDA, CMSA, and ESFR sprinklers shall be ~~used for the storage configurations in~~ an applicable option for open racks combined with in-rack sprinklers installed in accordance with ~~17.1.5.1 and 17.1.5.2~~ the criteria for solid shelving.

17.1.5.8 Where solid shelves obstruct only a portion of the rack, in-rack sprinklers shall be installed horizontally, within the flue a minimum of 4 ft (1.2 m) beyond the end of the solid shelf, and vertically as follows:

- (1) In accordance with 17.1.5.1 and 17.1.5.2 for CMDA sprinklers
- (2) Beneath all tiers under the highest solid shelf for CMSA and ESFR sprinklers

In-Rack

17.1.7.4* I~~n-rack~~ Where in-rack sprinklers are installed in longitudinal flues, they shall be located at an intersection of transverse and longitudinal flues while not exceeding the maximum spacing rules.

17.1.7.4.3 For storage over 25 ft in height, in-rack sprinklers in longitudinal flues shall be installed with the deflector located at or below the bottom of horizontal load beams or above or below other adjacent horizontal rack members, and such in-rack sprinklers shall be a minimum of 3 in. (76 mm) radially from the side of the rack uprights.

Moved to individual sections

~~17.1.10.2 In single-, double-, or multiple-row racks, a minimum 6 in. (152 mm) vertical clear space shall be maintained between the in-rack sprinkler deflectors and the top of a tier of storage.~~

~~17.1.10.2.1 Face sprinklers in such racks shall be located within the rack a minimum of 3 in. (76 mm) from rack uprights and no more than 18 in. (460 mm) from the aisle face of storage.~~

~~17.1.10.2.2 Such in-rack sprinklers shall be a minimum of 3 in. (76 mm) radially from the side of the rack uprights.~~

10 ft (3 m) Clear and In-Rack for solid shelf 5 ft (1.5 m) or less

17.2.1 Control Mode Density/Area Sprinkler Protection Criteria for Single-, Double-, and Multiple-Row Racks for ~~Plastics~~ Group A Plastic Commodities Stored Up to and Including 25 ft (7.6 m) in Height ~~, with a Clearance to Ceiling Up to and Including 10 ft (3.1 m) .~~

17.2.1.1.1 For storage 5 ft (1.5 m) or less in height that does not meet the definition of *Miscellaneous Storage* that is on solid shelf racks, in-rack sprinklers shall be provided in accordance with 17.1.5 , and ceiling sprinkler protection shall be provided in accordance with Chapter 13 .

10 ft (3 m) Clearance

17.2.1.2.1 For Group A plastic commodities in cartons, encapsulated or nonencapsulated in single-, double-, and multiple-row racks and with a clearance to ceiling up to and including 10 ft. (3.1 m) , ceiling sprinkler water demand in terms of density [gpm/ft 2 (mm/min)] and area of operation [ft 2 (m 2)] shall be selected from Figure 17.2.1.2.1(a) through Figure 17.2.1.2.1(f) .

Every other transverse flue

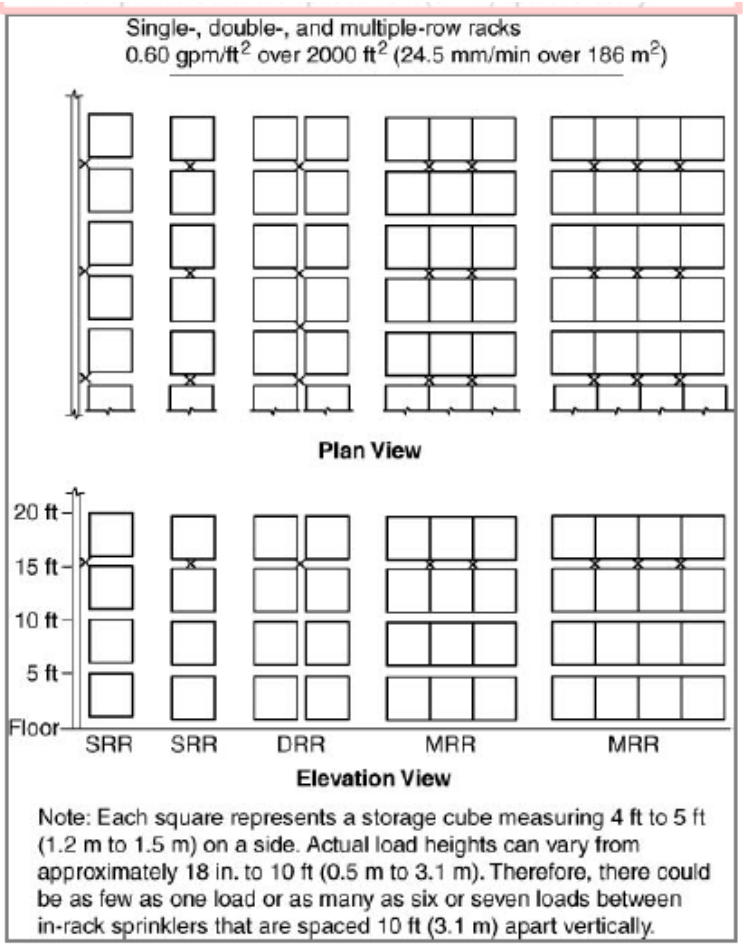


Figure 17.2.1.4(g) Exposed Nonexpanded Group A Plastics up to 20 ft in Height in up to a 25 ft High Building with One Level of Closely Spaced In-Rack Sprinklers.

In-Rack Up to 25ft (7.6m)

17.2.1.5.1 In-Rack Sprinkler Clearance. The minimum of 6 in. (152 mm) vertical clear space shall be maintained between the sprinkler deflectors and the top of a tier of storage.

- (A) Sprinkler discharge shall not be obstructed by horizontal rack members.

CMSA and Solid Shelf

17.2.2.1.1 CMSA sprinklers shall not be permitted to protect storage on solid shelf racks unless the solid shelf racks are protected with in-rack sprinklers in accordance with 17.1.5.

17.2.2.1.1.1 Where solid shelves are used, the in -rack sprinklers shall be installed in every level below the highest solid shelf.

ESFR Limitations

17.2.3.1.1 ESFR protection as defined shall not apply to the following:

- (1) Rack storage involving solid shelves, except as permitted by 17.2.3.1.2
- (2) Rack storage involving open-top cartons or containers

17.2.3.1.2 ESFR sprinklers shall not be permitted to protect storage on solid shelf racks unless the solid shelf racks are protected with in-rack sprinklers in accordance with 17.1.5.

17.2.3.1.2.1 Where solid shelves are used, in-rack sprinklers shall be installed in every level below the highest solid shelf.

Exposed Expanded up to 25 ft (7.6m)

17.2.3.5* Protection of Exposed Expanded Group A Plastics.

17.2.3.5.1 Protection of single-, double-, and multiple-row rack storage of exposed expanded Group A plastics shall be permitted to be in accordance with 17.2.3.5.2 through 17.2.3.5.9.

17.2.3.5.2 The maximum storage height shall be 25 ft (9.1 m).

17.2.3.5.3 The maximum ceiling height shall be 40 ft (12.2 m).

17.2.3.5.4 Sprinklers shall be intermediate temperature–rated ESFR pendent sprinklers with a nominal K-factor of K-25.2 (360).

Exposed Expanded up to 25 ft (7.6m) (cont.)

17.2.3.5.5 The design area shall consist of the most hydraulically demanding area of 12 sprinklers.

17.2.3.5.6 The minimum operating pressure shall be either 30 psi (2.0 bar) or 60 psi (4.1 bar) based upon the applicable storage and ceiling height for the installation as follows:

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- a) 30 psi (2.0 bar) for storage heights up to 25 ft (7.6 m) with a maximum ceiling height of 30 ft (9.1 m).
- b) 60 psi (4.1 bar) for storage heights up to 25 ft (7.6 m) with a maximum ceiling height of 40 ft (12.2 m).

17.2.3.5.7 The minimum aisle width shall be 8 ft (2.4 m).

17.2.3.5.8 The rack shall have a solid vertical barrier of 3⁄8 in. (9.5 mm) plywood or particleboard, 22 gauge sheet metal, or equivalent, from face of rack to face of rack, spaced at a maximum 16.5 ft (5.0 m) interval.

Exposed Expanded up to 25 ft (7.6m) (cont.)

17.2.3.5.8.1 The vertical barrier shall extend from a maximum of 4 in. (102 mm) above the floor to the maximum storage height.

17.2.3.5.8.2 The plan area of storage between vertical barriers and aisles shall not exceed 124 ft2 (11.52 m2)

17.2.3.5.8.3 The vertical barrier shall extend across the longitudinal flue.

17.2.3.5.8.4 Commodity shall be permitted to extend a nominal 4 in. (102 mm) beyond the vertical barrier at the aisle.

10 ft (3 m) Clearance

17.3.1.1 Protection of Group A plastics in cartons, expanded or ~~nonexpanded~~ unexpanded , whether encapsulated or nonencapsulated and with a clearance to ceiling up to and including 10 ft. (3.1 m) , shall be permitted using control mode density/area sprinklers in accordance with 17.3.1 .

17.3.1.2 Protection of Group A plastics that are exposed and ~~nonexpanded~~ unexpanded , whether encapsulated or nonencapsulated racks and with a clearance to ceiling up to and including 10 ft. (3.1 m) , shall be permitted only using in-rack sprinkler arrangements that are specifically permitted to be used with exposed ~~nonexpanded~~ unexpanded plastics.

In-Rack Above 25ft (7.6m)

17.3.1.9 The minimum of 6 in. (152 mm) vertical clear space shall be maintained between the in-rack sprinkler deflectors and the top of a tier of storage.

- (A) Sprinkler discharge shall not be obstructed by horizontal rack members.

17.3.1.13 In-rack sprinklers shall be a minimum of 3 in. (76 mm) radially from the side of the rack uprights.

17.3.1.14 Face sprinklers in such racks shall be located within the rack a minimum of 3 in. (76 mm) from rack uprights and no morethan 18 in. (460 mm) from the aisle face of storage.

Solid Shelf Above 25 ft (7.6m) with CMSA and ESFR

17.3.2.1.1 CMSA sprinklers shall not be permitted to protect storage on solid shelf racks unless the solid shelf racks are protected with in-rack sprinklers in accordance with 17.1.5.

17.3.2.1.1.1 Where solid shelves are used, in-rack sprinklers shall be installed in every level below the highest solid shelf.

17.3.3.1.1 ESFR sprinklers shall not be permitted to protect storage on solid shelf racks unless the solid shelf racks are protected with in-rack sprinklers in accordance with 17.1.5.

17.3.3.1.1.1 Where solid shelves are used, in-rack sprinklers shall be installed in every level below the highest solid shelf.

Exposed Expanded over 25 ft (7.6m)

17.3.3.5* Protection of Exposed Expanded Group A Plastics.

17.3.3.5.1 Protection of single-, double-, and multiple-row rack storage of exposed expanded Group A plastics shall be permitted to be in accordance with 17.3.3.5.2 through 17.3.3.5.8.

17.3.3.5.2 The maximum storage height shall be 35 ft (11 m).

17.3.3.5.3 The maximum ceiling height shall be 40 ft (12 m).

17.3.3.5.4 Sprinklers shall be intermediate temperature–rated ESFR pendent sprinklers with a nominal K-factor of K-25.2 (360).

17.3.3.5.5 The design area shall consist of the most hydraulically demanding area of 12 sprinklers.

17.3.3.5.6 The minimum operating pressure shall be 60 psi (4.1 bar).

17.3.3.5.7 The minimum aisle width shall be 8 ft (2.4 m).

Exposed Expanded over 25 ft (7.6m) (cont.)

17.3.3.5.8 The rack shall have a solid vertical barrier of 3⁄8 in. (9.5 mm) plywood or particleboard, 22 gauge sheet metal, or equivalent, from face of rack to face of rack, spaced at a maximum 16.5 ft (5.0 m) interval.

17.3.3.5.8.1 The vertical barrier shall extend from a maximum of 4 in. (102 mm) above the floor to the maximum storage height.

17.3.3.5.8.2 The plan area of storage between vertical barriers and aisles shall not exceed 124 ft2 (11.5 m2).

17.3.3.5.8.3 The vertical barrier shall extend across the longitudinal flue.

17.3.3.5.8.4 Commodity shall be permitted to extend a nominal 4 in. (100 mm) beyond the vertical barrier at the aisle.

Chapter 18 Rubber tires

18.3 Water Supplies. Total water supplies shall ~~be in accordance with the following options:~~

~~A minimum of not less than 750 gpm (2835 L/min) for hose streams in addition to that required for automatic sprinklers and foam systems. Water supplies shall be capable of supplying the demand for sprinkler systems and hose streams for not less than 3 hours.~~

~~For on-floor storage up to and including 5 ft (1.5 m) in height, hose stream requirements shall be permitted to be 250 gpm (946 L/min) with a water supply duration of not less than 2 hours. For ESFR and CMSA sprinkler systems approved for rubber tire storage, duration and hose allowance shall be in accordance with Table 18.4(c) and Table 18.4(d)~~ capable of providing flow for automatic sprinklers, hose streams and foam systems (if provided) for the duration required in Table 12.8.6 .

Chapter 20 Record Storage

20.5.6.4 Sprinklers shall be provided in transverse flue spaces in accordance with 20.5.6.4.1 through 20.5.6.4.3.1 and Figure 20.5.6.4.

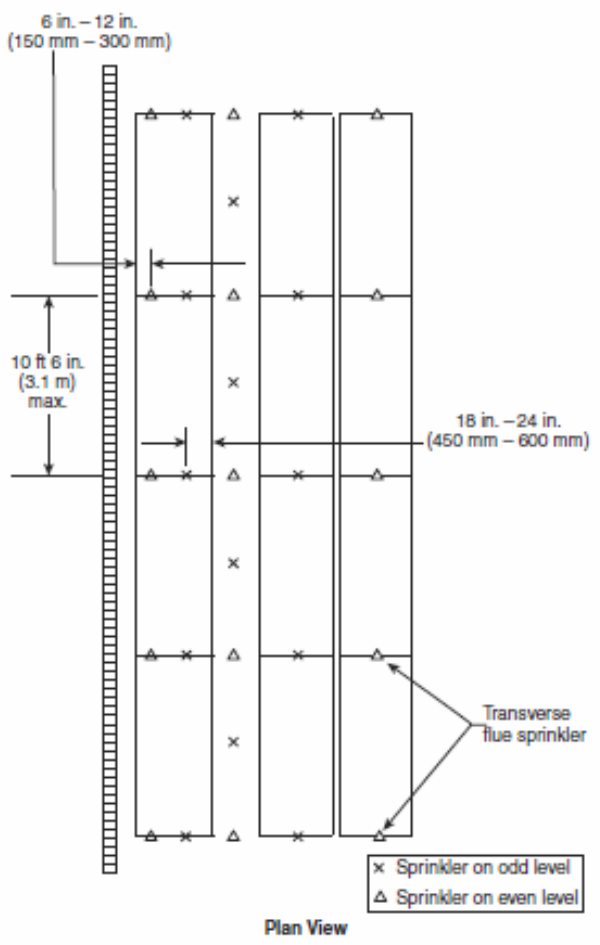


FIGURE 20.5.6.4 Sprinkler Location and Spacing in Transverse Flues.

Chapter 20 Record Storage

20.5.6.4.1 ~~In-rack~~ For double- and multiple-row racks, in-rack sprinklers shall be installed in the transverse flues at each catwalk level and shall be staggered vertically. For single-row racks, in-rack sprinklers shall be installed in the transverse flue at each catwalk level.

20.5.6.4.2 ~~Sprinklers~~ For double- and multiple-row racks sprinklers installed in the transverse flues shall be located not less than 18 in. (0.46 m) but not greater than 24 in. (0.61 m) from the face of the rack on the catwalk side .

20.5.6.4.3 For single-row racks, sprinklers installed in the transverse flues shall be staggered horizontally such that the sprinkler at first level is not less than 18 in. (0.46 m) but not greater than 24 in. (0.61 m) from the face of the rack on the catwalk side.

20.5.6.4.3.1 At the next level the sprinkler in the transverse flue shall be located not less than 6 in. (0.15 m) but not greater than 12 in. (0.30 m) from the back face of the rack. This staggering shall be repeated throughout all catwalk levels.

Chapter 21- Calculation Method

21.1.2.1 Sprinklers having standard coverage areas that require up to 20 sprinklers to be included in the hydraulic calculation shall be installed in accordance with 8.4.6.2, 8.4.6.3, 8.4.6.3.1 and 12.1.1.

21.1.2.1.1 Quick-response sprinklers shall also be installed in accordance with 8.4.6.4.1 and 8.4.6.4.2.

21.1.2.2 Sprinklers having extended coverage areas that require up to 10 sprinklers to be included in the hydraulic calculation shall be installed in accordance with 8.4.6.2, 8.4.6.3, 8.4.6.3.1 and 12.1.1.

21.1.2.2.1 Quick-response sprinklers shall also be installed in accordance with 8.4.6.4.1 and 8.4.6.4.2.

?

Chapter 21- Calculation Method and New Technology

21.1.8.3 The design area and number of sprinklers calculated on a branch line shall be in accordance with 23.4.4.2 using an area of sprinkler operation equal to the required number of operating sprinklers and the maximum allowable coverage for the specific design criteria being utilized.

21.1.9 Listed storage sprinklers that are not specifically referenced in Sections 21.2 and 21.3 but are tested in accordance with Chapter 21 with system design criteria based upon Sections 21.1 , 21.4 , and 21.5 shall be permitted to be used in accordance with their listing limitations, where approved.

Delete Table 21.2.1, 21.2.2, 21.3.1, 21.3.2

Table 21.2.1 Extended Coverage, CMSA [K-factor 25.2 (360) Pendent] Sprinkler Design Criteria for Palletized and Solid-Piled Storage of Class I Through Class IV and Cartoned Unexpanded Plastic Commodities

Storage Arrangement	Commodity Class	Maximum Storage Height		Maximum Ceiling/Roof Height		K-Factor/Orientation	Type of System	Number of Design Sprinklers	Minimum Operating Pressure	Maximum Coverage Area	Hose Stream Allowance	Water Supply Duration (minutes)
		ft	m	ft	m							
Palletized and solid piled	Class I through IV and cartoned nonexpanded plastics	25	7.6	30	9.1	25.2 (360) Pendent	Wet	6	30 psi (2.1 bar)	14 ft × 14 ft (4.3 m × 4.3 m)	250 gpm (950 L/min)	60
		30	9.1	35	10.6	25.2 (360) Pendent	Wet	8	40 psi (2.8 bar)	12 ft × 12 ft (3.7 m × 3.7 m)		60

Table 21.2.1 Extended Coverage, CMSA [K-factor 25.2 (360)] Sprinkler Design Criteria for Palletized and Solid-Piled Storage of Class I Through Class IV and Cartoned Unexpanded Plastic Commodities

Table 21.2.1 Extended Coverage, CMSA [K-factor 25.2 (360)] Sprinkler Design Criteria for Palletized and Solid-Piled Storage of Class I Through Class IV and Cartoned Unexpanded Plastic Commodities

Storage Arrangement	Commodity Class	Maximum Storage Height		Maximum Ceiling/Roof Height		K-Factor/ Orientation	Type of System	Number of Design Sprinklers	Minimum Operating Pressure	Maximum Coverage Area
		ft	m	ft	m					
Palletized and solid-piled	Class I through Class IV, encapsulated and nonencapsulated, and cartoned nonexpanded plastics	20	6.1	30	9.1	25.2 (360) Upright/ pendent	Wet	6	30 psi (2.1 bar)	12 ft × 12 ft (3.7 m × 3.7 m) 144 ft² (13.4 m ²)
		20	6.1	30	9.1	25.2 (360) Upright/ pendent	Wet	6	30 psi (2.1 bar)	14 ft × 14 ft (4.3 m × 4.3 m) 196 ft² (18.2 m ²)
		25	7.6	30	9.1	25.2 (360) Upright/ pendent	Wet	6	30 psi (2.1 bar)	12 ft × 12 ft (3.7 m × 3.7 m) 144 ft² (13.4 m²)
		25	7.6	30	9.1	25.2 (360) Upright/ pendent	Wet	6	30 psi (2.1 bar)	14 ft × 14 ft (4.3 m × 4.3 m) 196 ft² (18.2 m ²)
		25	7.6	35	11	25.2 (360) Upright/ pendent	Wet	8	40 psi (2.7 bar)	12 ft × 12 ft (3.7 m × 3.7 m) 144 ft² (13.4 m ²)
		25	7.6	35	11	25.2 (360) Upright	Wet	8	40 psi (2.8 bar)	14 ft × 14 ft (4.3 m × 4.3 m) 196 ft² (18.2 m ²)
		30	9.1	35	11	25.2 (360) Upright/ pendent	Wet	8	40 psi (2.8 bar)	12 ft × 12 ft (3.7 m × 3.7 m) 144 ft² (13.4 m ²)
		30	9.1	35	11	25.2 (360) Upright	Wet	8	40 psi (2.8 bar)	14 ft × 14 ft (4.3 m × 4.3 m) 196 ft² (18.2 m ²)

Table 21.3.1 Extended Coverage, CMSA [K-Factor 25.2 (360)] Sprinkler Design Criteria for Single-, Double-, and Multiple-Row Racks Without Solid Shelves of Class I Through Class IV and Cartoned Unexpanded Plastic Commodities

Table 21.3.1 Extended Coverage, CMSA [K-Factor 25.2 (360)] Sprinkler Design Criteria for Single-, Double-, and Multiple-Row Racks Without Solid Shelves of Class I Through Class IV and Cartoned Unexpanded Plastic Commodities

Storage Arrangement	Commodity Class	Maximum Storage Height		Maximum Ceiling/Roof Height		K-Factor/ Orientation	Type of System	Number of Design Sprinklers	Minimum Operating Pressure	Maximum Coverage Area
		ft	m	ft	m					
Single-, double-, and multiple-row racks without solid shelves (no open-top containers)	Class I through Class IV, encapsulated and nonencapsulated, and cartoned nonexpanded plastics	20	6.1	30	9.1	25.2 (360) Upright/ pendent	Wet	6	30 psi (2.1 bar)	12 ft × 12 ft (3.7 m × 3.7 m) 144 ft² (13.4 m ²)
		20	6.1	30	9.1	25.2 (360) Upright/ pendent	Wet	6	30 psi (2.1 bar)	14 ft × 14 ft (4.3 m × 4.3 m) 196 ft² (18.2 m ²)
		25	7.6	30	9.1	25.2 (360) Upright/ pendent	Wet	6	30 psi (2.1 bar)	12 ft × 12 ft (3.7 m × 3.7 m) 144 ft² (13.4 m ²)
		25	7.6	30	9.1	25.2 (360) Upright/ pendent	Wet	6	30 psi (2.1 bar)	14 ft × 14 ft (4.3 m × 4.3 m) 196 ft² (18.2 m ²)
		25	7.6	35	11	25.2 (360) Upright/ pendent	Wet	8	40 psi (2.6 bar)	12 ft × 12 ft (3.7 m × 3.7 m) 144 ft² (13.4 m ²)
		25	7.6	35	11	25.2 (360) Upright	Wet	8	40 psi (2.6 bar)	14 ft × 14 ft (4.3 m × 4.3 m) 196 ft² (18.2 m ²)
		30	9.1	35	11	25.2 (360) Upright/ pendent	Wet	8	40 psi (2.7 bar)	12 ft × 12 ft (3.7 m × 3.7 m) 144 ft² (13.4 m ²)
		30	9.1	35	11	25.2 (360) Upright	Wet	8	40 psi (2.6 bar)	14 ft × 14 ft (4.3 m × 4.3 m) 196 ft² (18.2 m ²)

Table 21.3.2 and 21.3.3

Table 21.3.2 CMSA K-25.2 Upright Standard Coverage Sprinkler Design Criteria for Single-, Double-, and Multiple-Row Racks Without Solid Shelves and Solid-Piled, Palletized Storage Arrangement of Class I Through IV and Cartoned Unexpanded Plastic Commodities

Storage Arrangement	Commodity Class	Maximum Storage Height		Maximum Ceiling/Roof Height		K-Factor Orientation	System Type	Number of Design Sprinklers	Minimum Operating Pressure	Sprinkler Linear Spacing		Sprinkler Area Spacing	
		ft	m	ft	m					Min	Max	Min	Max
Solid-piled, palletized, and single-, double-, and multiple-row racks without solid shelves (no open top containers)	Class I–IV encapsulated and nonencapsulated, and cartoned nonexpanded plastics	25	7.6	30	9.1	25.2 (360) Upright	Wet	12	20 psi (1.4 bar)	8 ft (2.4m)	12 ft (3.6 m)	80 ft^2 (7.5m^2)	100 ft^2 (9.0 m^2)

Table 21.3.3 CMSA K-25.2 Upright Standard Coverage Sprinkler Design Criteria for Single-, Double-, and Multiple-Row Racks Without Solid Shelves and Solid-Piled, Palletized Storage Arrangement of Class I Through IV and Cartoned Unexpanded Plastic Commodities

Storage Arrangement	Commodity Class	Maximum Storage Height		Maximum Ceiling/Roof Height		K-Factor Orientation	System Type	Number of Design Sprinklers	Minimum Operating Pressure	Sprinkler Linear Spacing		Sprinkler Area Spacing	
		ft	m	ft	m					Min	Max	Min	Max
Solid-piled, palletized, and single-, double-, and multiple-row racks without solid shelves (no open top containers)	Class I–IV encapsulated and nonencapsulated, and cartoned nonexpanded plastics	25	7.6	30	9.1	25.2 (360) Upright	Wet	12	15 psi (1.0 bar)	8 ft (2.4 m)	12 ft (3.6 m)	80 ft^2 (7.5m^2)	100 ft^2 (9.0 m^2)

Skipping – Extracted Text

Hydraulic Reports

23.3.5 ~~Computer-Generated~~ Hydraulic Reports.

23.3.5.1.2 The data shall be presented in the order shown in Figure 23.3.5.1.2(a) through Figure 23.3.5.1.2(d).

23.3.5.2 Summary Sheet

The summary sheet as shown in Figure 23.3.5.1.2(a) shall contain the following information, where applicable:

- (1) Project name and date
- (2) Location (including street address)
  - ~~Drawing number~~
  - ~~Remote area number~~
  - ~~Remote area location~~
- (3) Owner or expected occupant of space being designed
- (4) Name, address, and phone number of installing contractor
- (5) Name and phone number of designer
- (6) Authority having jurisdiction
- (7) Standard or document system is being designed to, including the edition of the document
- (8) Design area number and location
- (9) Drawing or sheet number where design area is located

23.3.5.2 Summary Sheet (cont)

- (10) Occupancy or commodity classification and information
- (11) For storage applications (including miscellaneous), additional information including storage height, ceiling height, storage configuration, aisle width, orientation of upright or pendent, sprinkler K-factor and sprinkler temperature, and the table and or curve utilized in the design
- (12) System type, including the system volume with type of protection system indicated in the notes
- (13) Sprinkler type, including coverage and response type.
- (14) Slope of roof or ceiling within the design area
- (15) System design requirements, as follows:
  - (a) Design area of water application, ft2 (m2)
  - (b) Minimum rate of water application (density), gpm/ft2 (mm/min)
  - (c) Area per sprinkler, ft2 (m2)
  - (d) Number of sprinklers calculated

23.3.5.2 Summary Sheet (cont)

- (16) Total water requirements as calculated, including allowance for inside hose, outside hydrants, water curtain, and exposure sprinklers, and allowance for in-rack sprinklers, gpm (L/min~~) Type of system and, if dry or preaction, the volume of the system in gallons (liters)~~
- (17) Ceiling height if used for quick response sprinkler reduction
- (18) Elevation of highest calculated sprinkler
- (19)Water supply information, including the following:
  - (a) Date and time of test
  - (b) Location of the test and flow hydrant(s)
  - (c) Source of the water for the flow test
  - (d) Elevation of the test hydrant relative to the finished floor
  - (e) Size of fire pump, gpm @ psi
  - (f) Size of on-site water tank
  - Name and address of installing contractor
  - Name of designer
  - Authority having jurisdiction
- (20) Notes that include items such as peaking information for calculations performed by a computer program, type of preaction system, limitations (dimension, flow, and pressure) on extended-coverage or other listed special sprinklers, system type, including the system volume

Pipe and Velocity Limits

23.4.1.2 Pipe sizes shall be no less than 1 in. (25 mm) nominal for ~~ferrous~~ black or galvanized steel piping and **~~3/~~4** in. (20 mm) nominal for copper tubing or brass, stainless steel piping or nonmetallic piping listed for fire sprinkler service unless permitted by 8.15.20.4 and 8.15.20.5.

23.4.1.4 ~~Velocity Limitations. Unless~~ Unless required by other NFPA standards, the velocity of water flow shall not be limited when hydraulic calculations are performed using the Hazen Williams ~~and/~~ or Darcy Weisbach formulas.

Room Design Method

23.4.4.1.1 Room Design Method. Where the design is based on the room design method, the calculation shall be based on the room and communicating space, if any, that is hydraulically the most demanding.

23.4.4.3 CMSA Sprinkler Method

23.4.4.3.3 In systems having branch lines with an insufficient number of sprinklers to fulfill the 1.2 requirement, the design area shall be extended to include sprinklers on adjacent branch lines supplied by the same cross main.

ESFR

~~**23.4.4.6.4** The requirements of 23.4.4.6.1.1 to include every sprinkler in the design area shall not apply where ESFR sprinklers are installed above and below obstructions.~~

23.4.5 In-Rack Sprinklers.

23.4.5.1 Pipes to in-rack sprinklers shall be sized by hydraulic calculations.

23.4.5.2 Water demand of sprinklers installed in racks shall be added to ceiling sprinkler water demand over the same protected area at the point of connection.

23.4.5.3 The demand shall be balanced to the higher pressure.

23.4.5.4 Water demand of sprinklers installed in racks or water curtains shall be added to the ceiling sprinkler water demand at the point of connection. Demands shall be balanced to the higher pressure. *(See Chapter 8 .)*

Where to add outside hose

23.4.6 Hose Allowance. Water allowance for outside hose shall be added to the sprinkler and inside hose requirement at the connection to the city water main or a yard hydrant, whichever is closer to the system riser.

24.1.3.3 ~~For new systems to be supplied by~~ Where a single main less than 4 in. (100 mm) in diameter , ~~which will~~ ~~serve both domestic and~~ serves both fire systems and other uses , the ~~domestic~~ non-fire demand shall be added to the hydraulic calculations for the fire system at the point of connection unless provisions have been made to automatically isolate ~~the domestic demand~~ the non-fire demand during a fire event .

Testing due to modifications

25.2.1.4 Modifications affecting 20 or fewer sprinklers shall ~~not~~ require testing ~~in excess of~~ at system working pressure.

25.2.1.~~5 Where additions are~~4.1 Where modification is made to an existing system affecting more than 20 sprinklers , the new portion shall be isolated and tested at not less than 200 psi (13.8 bar) for 2 hours.

25.2.1.~~7 Loss shall be determined by a drop in gauge pressure or visual leakage~~4.2Modifications that cannot be isolated, such as relocated drops, shall require testing at system working pressure .

Air test on Dry Systems

25.2.2.1.1 Modifications to existing systems shall be tested for air leakage, using one of the following test methods:

- (1) An air pressure test at 40 psi (3. 2 bar) shall be performed for 2 hours.
  - (a) The system shall be permitted to lose up to 3 psi(0.2 bar) during the duration of the test.
  - (b) Air leaks shall be addressed if the system loses more than 3 psi (0.2 bar) during this test.
- (2) With the system at normal system air pressure, the air source shall be shut off for 4 hours. If the low pressure alarm goes off within this period, the leaks shall be addressed.

QOD

25.2.3.2.2 Where a quick opening device is present, the trip test described in 25.2.3.2.1 shall be sufficient to test the quick opening device as long as the device trips properly during the test.

Additions to Sign

25.6.2 The sign shall include the following information:

- (13) Location of venting valve
- (16) Original results of dry pipe and double interlock preaction valve test

Annex

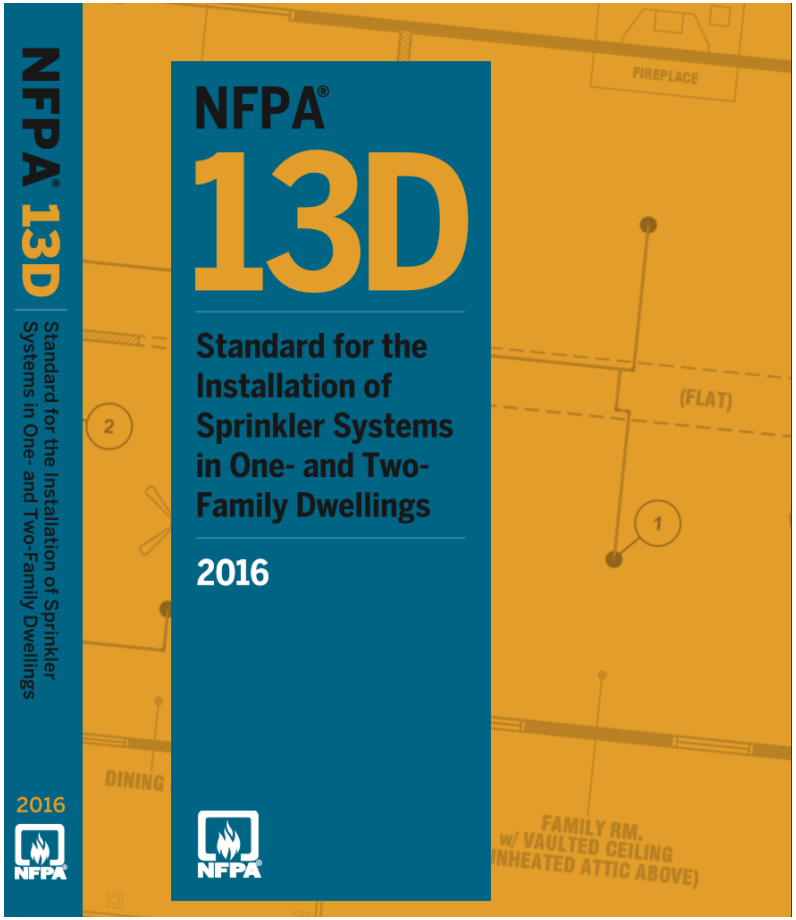
Just as important but not enough time!

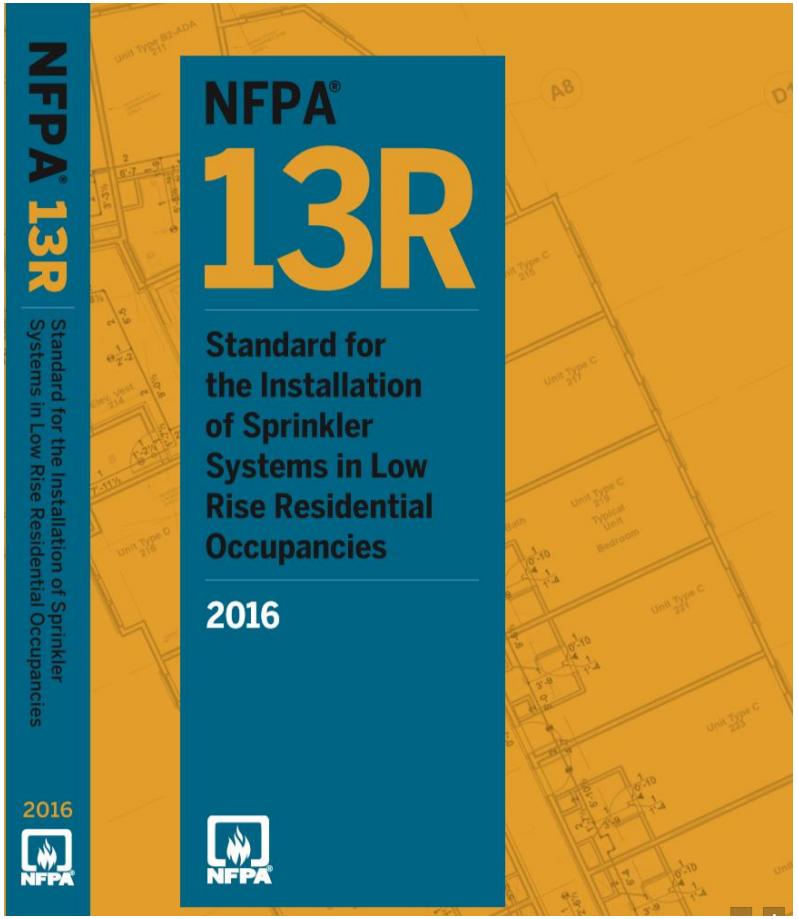
Changes to NFPA 13R and 13D for the 2016 Edition

SESSION AGENDA

- Review of Major Changes to Applicable Criteria

Changes to NFPA 13R and 13D , 2016 Edition





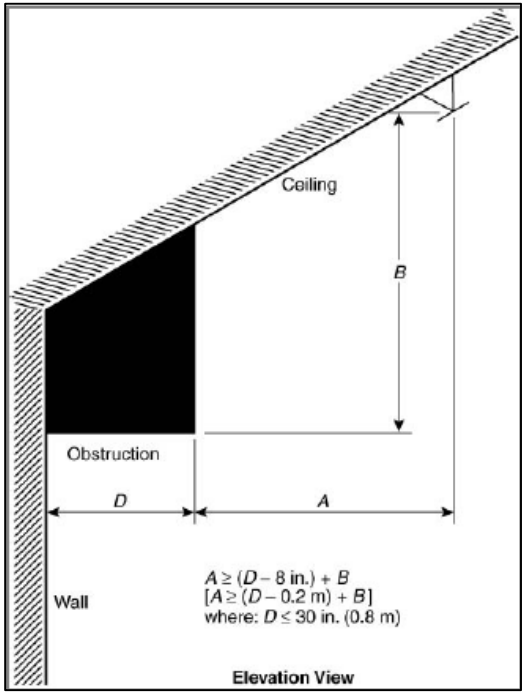
Addition of Requirements Related to Reinstalling Sprinklers

5.1.1.1*
Where a sprinkler is removed from a fitting or welded outlet, it shall not be reinstalled except as permitted by 5.1.1.1.1 .

5.1.1.1.1*
Dry sprinklers shall be permitted to be reinstalled when removed in accordance with the manufacturer's installation and maintenance instructions.

Sprinkler Position Clarification

Figure 8.2.5.3.3(b)-NFPA 13D & 6.4.6.3.6.3(b)-NFPA 13R Positioning of Sprinkler to Avoid Obstruction Against Walls (Residential Upright and Pendent Spray Sprinklers);



Closets Smaller Than 400 ft^3

8.2.7 - NFPA 13D (New) & 6.4.6.3.2 - NFPA 13R (Revised) Closets. In all closets and compartments that are enclosed by walls and a door , ~~including those housing mechanical equipment~~, and that are smaller than 400 ft^3 (11.3 m^3), ~~a single sprinkler at the highest ceiling space shall be sufficient without regard to obstructions or minimum distances to wall.~~ including those housing mechanical equipment, pendent, upright, and sidewall residential sprinklers shall be permitted to be installed in either of the following situations:

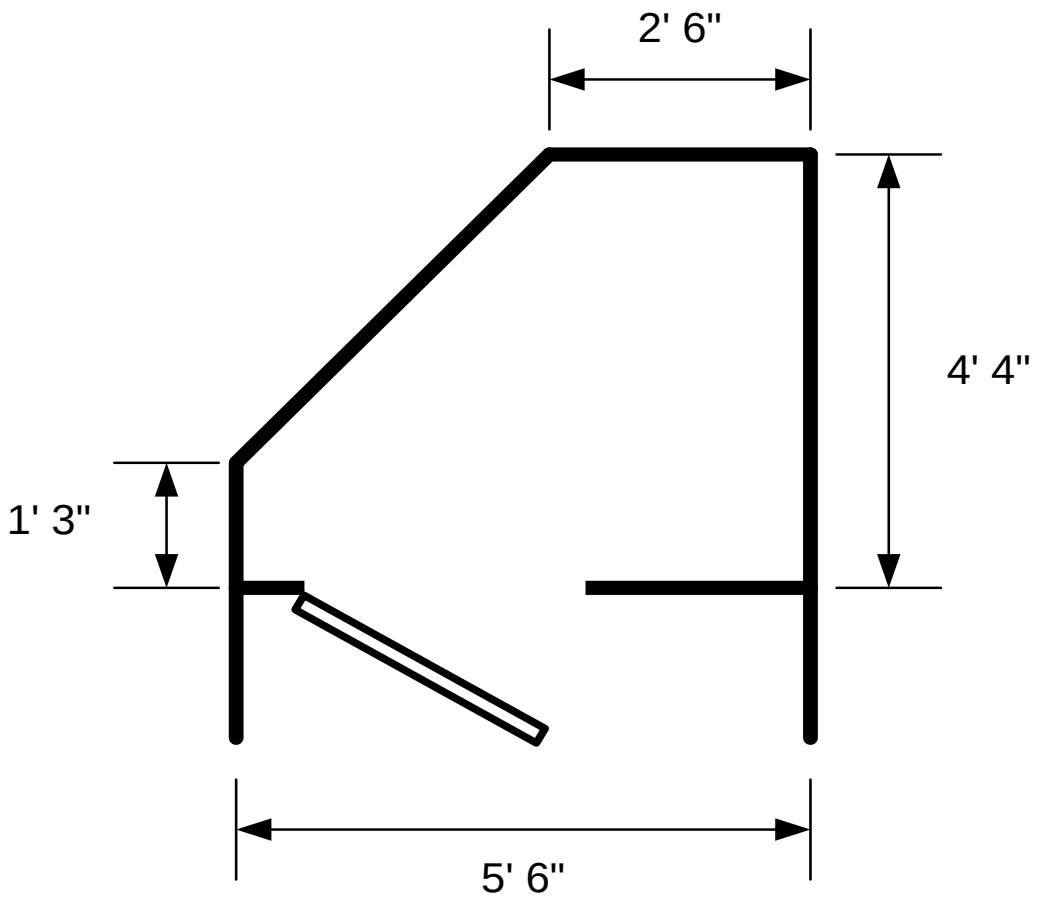
(1) Within 18 in. (460 mm) of the ceiling to avoid obstructions near the ceiling
(2) At the highest ceiling level without regard to obstructions or minimum distances to wall

Closets Not Requiring Sprinklers

- 8.3.3 – NFPA 13D & 6.6.3 – NFPA 13R
  Sprinklers shall not be required in clothes closets, linen closets, and pantries that meet all of the following conditions:

  (1) The area of the space does not exceed 24 ft^2 (2.1 m^2).
  (2) The ~~shortest dimension does not exceed 3 ft (0.9 m).~~ walls and ceilings are surfaced with noncombustible or limited-combustible materials as defined in NFPA 220.
  (3) ~~The walls and ceilings are surfaced with noncombustible or limited-combustible materials as defined in NFPA 220 .~~

Example of Closet With Angles

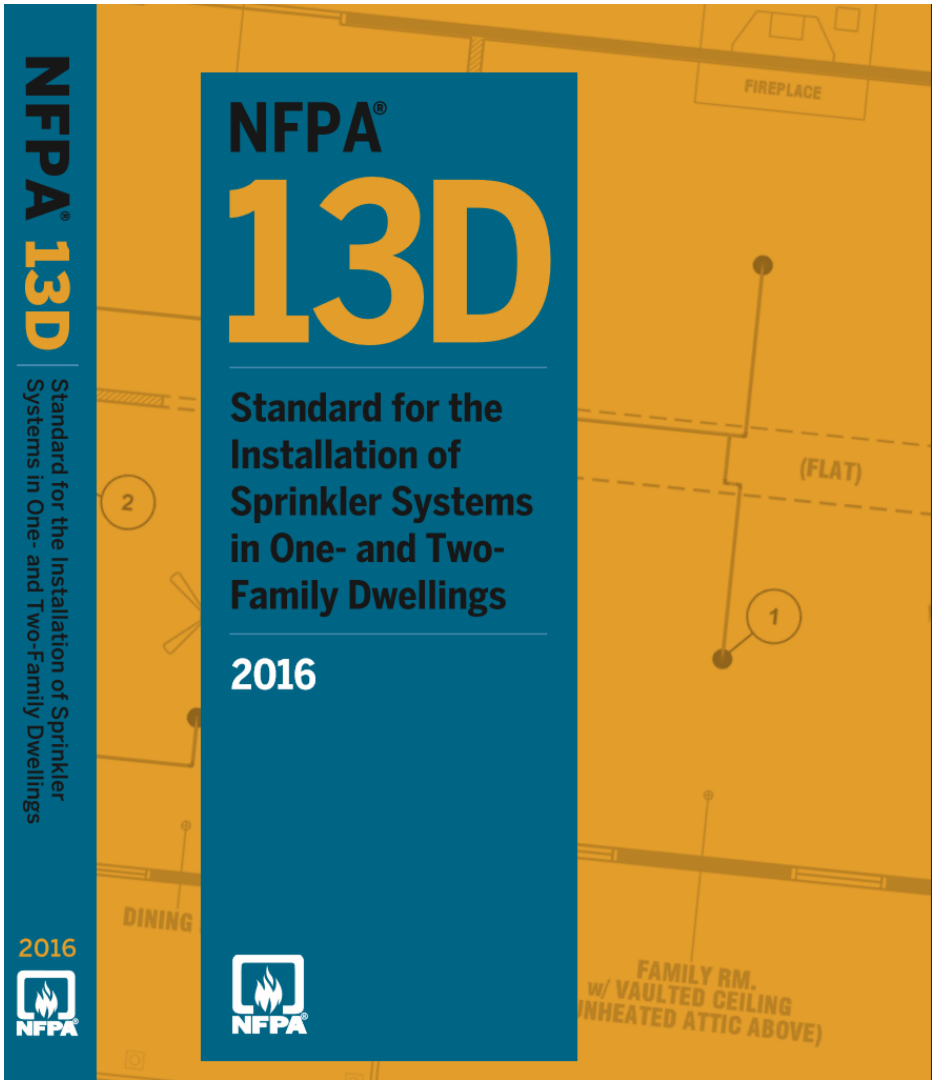


Replacing Residential Sprinklers Manufactured Prior to 2003

12.3.2.1* - NFPA 13D & 5.1.1.2* - NFPA 13R
Where replacing residential sprinklers manufactured prior to 2003 that are no longer available from the manufacturer and are installed using a design density less than 0.05 gpm/ft^2 (204 mm/min), a residential sprinkler with an equivalent K-factor (± 5 percent) shall be permitted to be used provided the currently listed coverage area for the replacement sprinkler is not exceeded.

Background

- Research conducted by UL and FM resulted in a modified fire test protocol used to certify residential sprinklers and a minimum discharge density of 0.05 gpm/ft^2 adopted into NFPA 13D and 13R.
- Sprinklers were available prior to 2003 with listed flows that provided a discharge density less than 0.05 gpm/ft.
- While some of the old residential sprinkler models are still produced for replacement purposes, many of these models are no longer produced.


NFPA® 13D
Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings
2016
NFPA
FIREPLACE
(FLAT)
DINING
FAMILY RM.
w/ VAULTED CEILING
UNHEATED ATTIC ABOVE)

Modifications to Clarify Pump Wiring

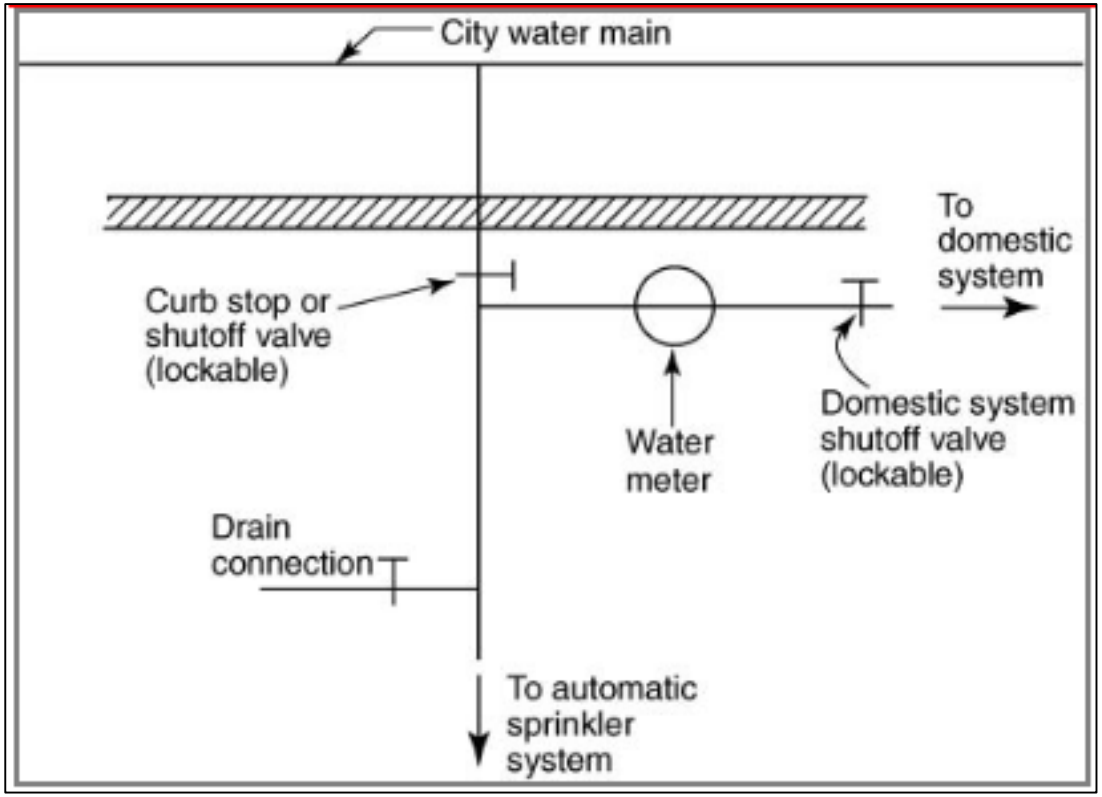
//6.2.1

Where a pump is the source of pressure for the water supply for a fire sprinkler system but is not a portion of the domestic water system, the following shall be met:

(1) A test connection shall be provided downstream of the pump that creates a flow of water equal to the smallest sprinkler K-factor on the system.
(2) Pump motors using ac power shall be ~~connected to a 240 V normal circuit~~ rated for 240 V and wired in accordance with the NEC (NFPA 70) .
(3) Any disconnecting means for the pump shall be approved.
(4) The pump shall ~~not be permitted to sit directly on~~ be located not less than 1 1⁄2 in. off the floor.

Alterations to Water Supply Sketches Continued

Figure A.6.2(a) ~~Preferable Arrangement~~ Minimum Requirements for a Stand-Alone ~~Piping~~ Systems~~s~~ .



Addition of 10.1.2

// 10.1.2 Water Supply.

10.1.2.1
Where the water supply is a public or private water main 4 in. (nominal) in size or larger, the static pressure shall be permitted to be used for comparison to the sprinkler system demand regardless of the method used to determine the adequacy of the piping.

Architectural Features Addition to A.8.2.5

// A.8.2.5

Small areas created by architectural features such as planter box windows, bay windows, and similar features can be evaluated as follows:

(1) Where no additional floor area is created by the architectural feature, no additional sprinkler protection is required.

(2) Where additional floor area is created by an architectural feature, no additional sprinkler protection is required, provided all of the following conditions are met:

(a) The floor area does not exceed 18 ft 2 (1.7 m 2).

(b) The floor area is not greater than 2 ft (0.65 m) in depth at the deepest point of the architectural feature to the plane of the primary wall where measured along the finished floor.

(c) The floor area is not greater than 9 ft (2.9 m) in length where measured along the plane of the primary wall.

Measurement from the deepest point of the architectural feature to the sprinkler should not exceed the maximum listed spacing of the sprinkler. The hydraulic design is not required to consider the area created by the architectural feature.

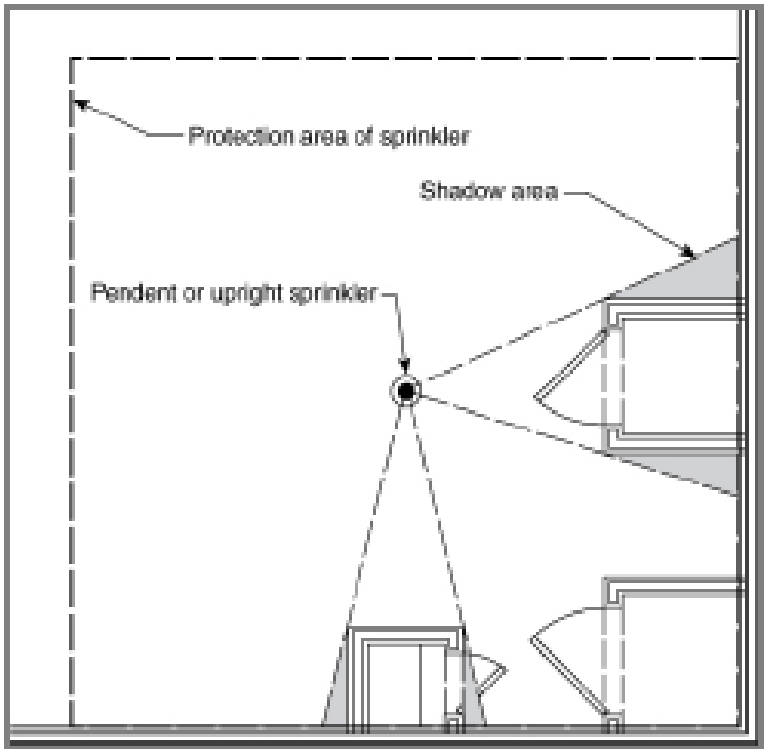
Addition A.8.2.5.6 Regarding Shadow Areas

A.8.2.5.6

Corridors being protected with sidewall sprinklers ~~will~~ frequently have small areas behind the sprinklers called shadow areas that are inset for a doorway. Even though these shadow areas are slightly behind the sprinklers, it is not the intent of NFPA 13D to require additional sprinkler protection in these doorways.

Examples of shadow areas are provided in Figure A.8.2.5.6(a) and Figure A.8.2.5.6(b).The obstruction shown in Figure A.8.2.5.6(a) is a vertical obstruction in a room similar to a column. Sprinkler response and water distribution tests have been conducted on such obstructions and the data shows that the size of the obstruction as well as the size of the compartment are critical variables to sprinkler response. A larger shadow area can be acceptable in a smaller compartment. The obstruction shown in Figure A.8.2.5.6(b) is a bump out of a wall. Sprinkler response and water distribution tests have shown that this type of obstruction is not a problem.

Addition A.8.2.5.6 Regarding Shadow Areas Continued



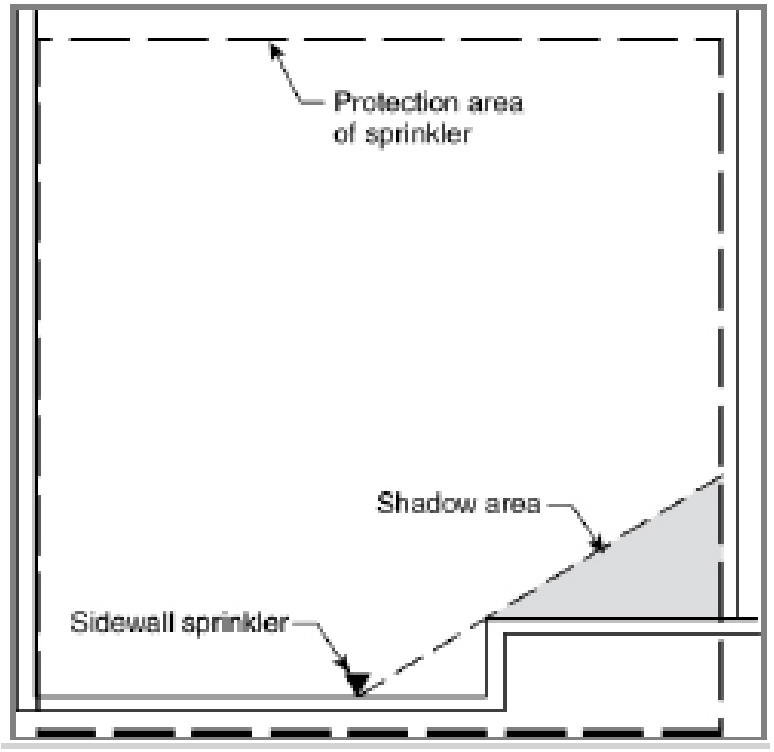
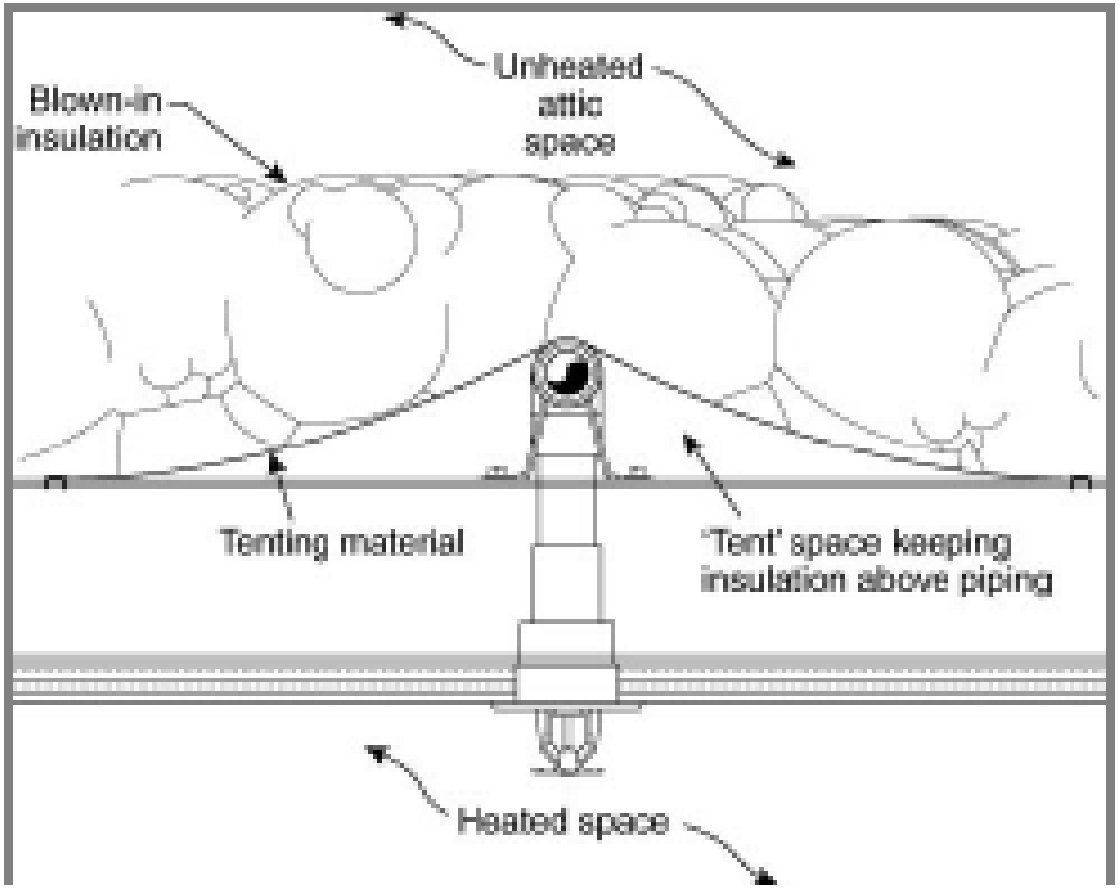


Figure Changes for A.9.1.1 Continued

Figure A.9.1.1(f) Insulation Recommendations — Arrangement 6.



AntiFreeze

- No new information, only incorporated the information from the TIA ((TIA 1067) issued by the Standards Council on August 9, 2012).
- Existing system allowed to remain with the following conditions:
  - Pre-mixed solution
  - Glycerine – max. concentration of 50% by volume
  - Propylene Glycol – max concentration 40% by volume

AntiFreeze

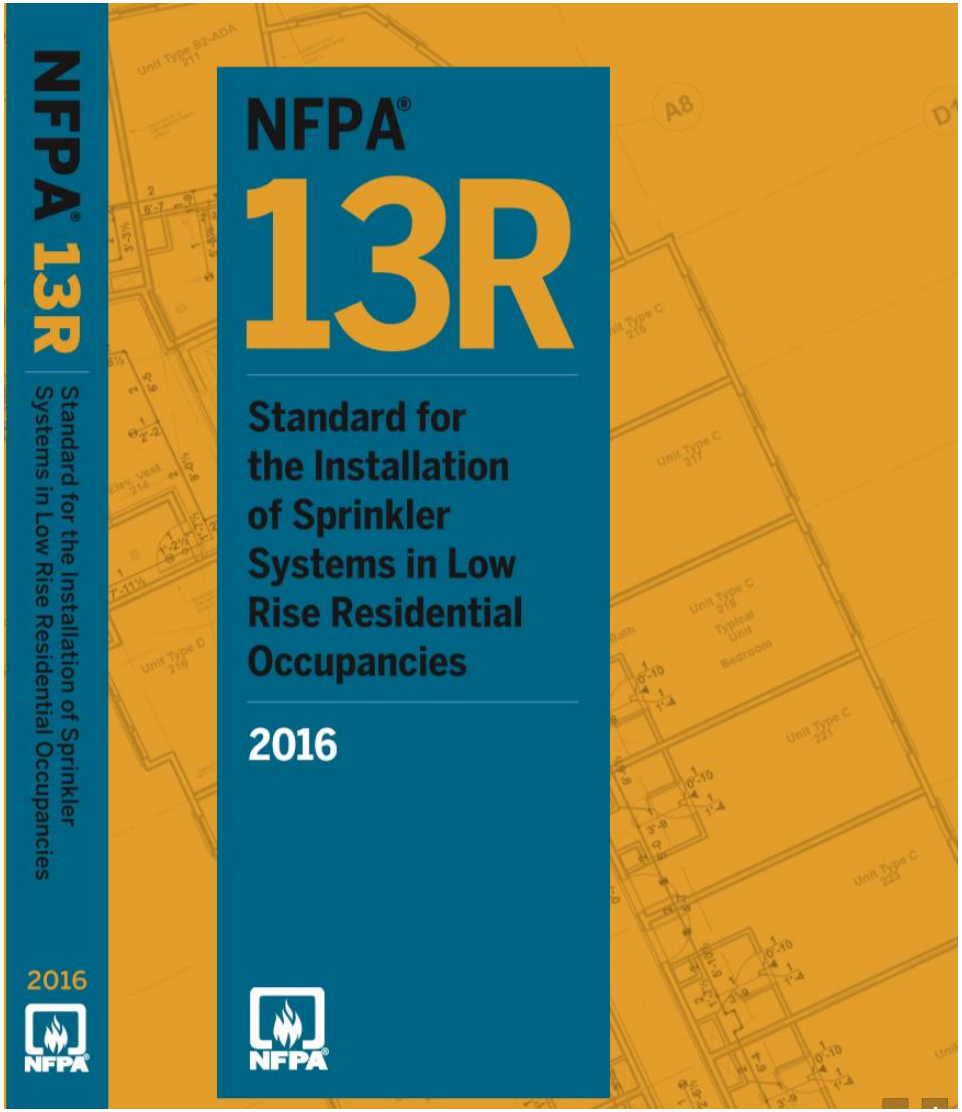
- New Systems:
  - Pre-mixed solutions
  - Glycernine – 48% by volume
  - Propylene Glycol – 38% by volume
- Allowed for specific areas of dwelling unit
- Where acceptable by the AHJ
- “Documentation shall be presented to the AHJ to substantiate the use of the antifreeze solution”

Antifreeze Testing Table A.9.2.1

// Table A.9.2.2.2 provides and overview of the testing.

Topic	Information
Scope of sprinklers tested	The following sprinklers were used during the residential sprinkler research program described in *Antifreeze Systems in Home Fire Sprinkler Systems — Phase II Final Report*: (1) Residential pendent style having nominal K-factors of 3.1, 4.9, and 7.4 gpm/psi$^{1/2}$ (2) Residential concealed pendent style having a nominal K-factor of 4.9 gpm/psi$^{1/2}$ (3) Residential sidewall style having nominal K-factors of 4.2 and 5.5 gpm/psi$^{1/2}$ The following sprinklers were used during the spray sprinkler research program described in *Antifreeze Solutions Supplied through Spray Sprinklers — Interim Report*: (1) Residential pendent style having a nominal K-factor of 3.1 gpm/psi$^{1/2}$ (2) Standard spray pendent style having nominal K-factors of 2.8, 4.2, 5.6, and 8.0 gpm/psi$^{1/2}$ (3) Standard spray concealed pendent style having a nominal K-factor of 5.6 gpm/psi$^{1/2}$ (4) Standard spray upright style having a nominal K-factor of 5.6 gpm/psi$^{1/2}$ (5) Standard spray extended coverage pendent style having a nominal K-factor of 5.6 gpm/psi$^{1/2}$
Antifreeze solution concentration	**<50% glycerine and <40% propylene glycol antifreeze solutions:** Solutions were not tested.
	50% glycerine and 40% propylene glycol antifreeze solutions: Large-scale ignition of the sprinkler spray did not occur in tests with sprinkler discharge onto a fire having a nominal heat release rate (HRR) of 1.4 MW. Large-scale ignition of the sprinkler spray occurred in multiple tests with sprinkler discharge onto a fire having a nominal HRR of 3.0 MW.
	55% glycerine and 45% propylene glycol antifreeze solutions: Large-scale ignition of the sprinkler spray occurred in tests with sprinkler discharge onto a fire having a nominal HRR of 1.4 MW.

Table A.9.2.2.2 FPRF Antifreeze Testing Summary


NFPA® 13R
Standard for the Installation of Sprinkler Systems in Low Rise Residential Occupancies
2016
NFPA
NFPA® 13R
Standard for the Installation of Sprinkler Systems in Low Rise Residential Occupancies
2016
NFPA

3.3.6 Grade Plane

3.3.6 Grade Plane.

A reference plane upon which vertical measurements of a building are based representing the average of the finished ground level adjoining the building at all exterior walls. ~~When the finished ground level slopes down from the exterior walls, the grade plane is established by the lowest points within the area between the building and the lot line or, when the lot line is more than 6 ft (1830 mm) from the building, between the building and a point 6 ft (1830 mm) from the building.~~*[See also 3.3.222, Finished Ground Level Grade, of NFPA 5000.]*~~, Finished Ground Level (Grade).]~~ [**5000,**~~2012~~2015]

5.1.2.2 (New Section)

5.1.2.2

Materials and components shall be installed in accordance with material compatibility information that is available as a part of a listing or manufacturer’s published information.

Nonmetallic Pipe Compatibility

5.2.3.2*

When nonmetallic pipe is used in ~~combination~~ systems utilizing steel~~piping~~ pipe internally coated with corrosion inhibitors ~~and nonmetallic piping~~ , the steel pipe coating shall be ~~investigated~~ listed for compatibility ~~with the nonmetallic piping by a testing laboratory~~ .

5.2.3.3

When nonmetallic pipe is used in ~~combination~~ systems utilizing steel pipe that is not internally coated with ~~chemical~~ corrosion inhibitors, no additional evaluations ~~are~~ shall be required.

5.2.3.4

When nonmetallic pipe is used in ~~combination~~ systems utilizing steel pipe, cutting oils and lubricants used for fabrication of the steel piping shall be compatible with the nonmetallic pipe materials in accordance with 5.1.2.2 .

Nonmetallic Pipe Compatibility (Continued)

5.2.3.5

Fire-stopping materials intended for use on nonmetallic piping penetrations shall be ~~investigated for compatibility~~ compatible with the nonmetallic pipe materials in accordance with 5.1.2.2 .

5.2.3.6

Nonmetallic pipe listed for light hazard occupancies shall be permitted to be installed in ordinary hazard rooms of otherwise light hazard occupancies where the room does not exceed 400 ft^2 (37 m^2).

5.2.3.7

Nonmetallic pipe shall not be listed for portions of an occupancy classification.

Nonmetallic Pipe Compatibility (Continued)

5.2.12.2.1.2

When nonmetallic fittings are used in ~~combination~~ systems utilizing~~non–internally coated steel piping and nonmetallic fittings~~ steel pipe that is not internally coated with corrosion inhibitors , no additional evaluations shall be required. ~~Cutting oils and lubricants used for fabrication of the steel piping shall be compatible with the nonmetallic fitting materials.~~

5.2.12.2.1.3

When nonmetallic fittings are used in systems utilizing steel pipe, cutting oils and lubricants used for fabrication of the steel piping shall be compatible with the nonmetallic fittings in accordance with5.1.2.2 .

5.2.12.2.1.4

Fire-stopping materials intended for use on nonmetallic fitting penetrations shall be investigated for compatibility with the nonmetallic fitting materials in accordance with 5.1.2.2 .

5.2.13

Welded pipe and fittings shall be permitted to be used in accordance with the rules of NFPA 13 .

5.2.14.5.2 (Section Removed)

~~**5.2.14.5.2**~~

~~Backflow devices 2 in. (50 mm) in size or smaller shall be permitted in accordance with 6.8.5 .~~

6.2.2 Outside Dwelling Units

6.2.2 Outside Dwelling Units.

6.2.2.1

~~All sprinklers used~~Sprinklers outside of the dwelling units shall be ~~in accordance with6.2.2~~
quick response, except as permitted by 6.2.2.2.

6.2.2.1.1 The sprinkler design criteria shall be in accordance with Chapter 7.

6.2.2.2 ~~Sprinklers outside the dwelling units shall be quick-response, except as allowed by6.2.2.3,6.2.2.4, and 6.2.2.5.~~The following types of spaces shall be permitted to be protected by residential sprinklers in accordance with Section 7.1:

(1) Lobbies not in hotels and motels
(2) Foyers
(3) Corridors
(4) Halls
(5) Lounges
(6) Ordinary hazard areas in accordance with 7.2.4.1
(7) Garages in accordance in accordance with 7.3.3 and 7.3.3.1(1)
Other areas with fire loads similar to residential fire loads

6.5.4 Sprinkler-Protected Glazing (New Section)

6.5.4* Sprinkler-Protected Glazing.
Where sprinklers are used in combination with glazing as an alternative to a required fire-rated wall or window assembly, the sprinkler-protected assembly shall comply with the following:
(1) Sprinklers shall be listed as specific application window sprinklers unless the standard spray sprinklers are specifically permitted by the building code.
(2) Sprinklers shall be supplied by a wet-pipe system.
(3) Glazing shall be heat-strengthened, tempered, or glass ceramic and shall be fixed.
(4) Where the assembly is required to be protected from both sides, sprinklers shall be installed on both sides of the glazing.
(5) The use of sprinkler-protected glazing shall be limited to non-load-bearing walls.
(6) The glazed assembly shall not have any horizontal members that would interfere with uniform distribution of water over the surface of the glazing, and there shall be no obstructions between sprinklers and glazing that would obstruct water distribution.
(7) The water supply duration for the design area that includes the window sprinklers shall not be less than the required rating of the assembly.

6.6.6 Elevators

// Sprinklers shall not be required in attics, penthouse equipment rooms, elevator machine rooms, concealed spaces dedicated exclusively to and containing only dwelling unit ventilation equipment, crawl spaces, floor/ceiling spaces, ~~noncombustible~~ elevator shafts where the elevator ~~cars comply~~ installation complies with ANSI A17.1, *Safety Code for Elevators and Escalators,* and other concealed spaces that are not ~~used or~~ intended for living purposes or storage and do not contain fuel-fired equipment.

6.7.2.2.3 (New Section)

6.7.2.2.3

Heat tracing systems shall be supervised by one of the following methods:

(1) Central station, proprietary, or remote station signaling service

(2) Local signaling service that will cause a signal at a constantly attended location

6.9.2

6.9.2

The drain pipe shall be at least 1 in. (25 mm) nominal diameter ~~and shall be arranged so that it can drain all portions of the system~~.

6.9.5 (New Section)

6.9.5

For trapped sections of dry pipe systems not subject to freezing temperatures, the pipe shall be arranged to drain in one of the following manners:

(1) The system shall contain an auxiliary drain consisting of a nipple and cap or plug not less than ½ in. (15 mm) in size.

(2) Where the capacity of trapped sections of pipes is less than 5 gal (18.9 L), one of the following arrangements shall be provided:

(a) System piping arranged to drain by removing a single pendent sprinkler

(b) A flexible coupling or other easily separated connection

6.9.6 (New Section)

6.9.6

For wet pipe systems, trapped sections of pipe shall be arranged to drain in one of the following manners:

(1) The system shall contain an auxiliary drain consisting of a nipple and cap or plug not less than ½ in. (15 mm) in size.

(2) Where the capacity of trapped sections of pipes in wet systems is less than 5 gal (18.9 L), one of the following arrangements shall be provided:

(a) System piping arranged to drain by removing a single pendent sprinkler

(b) A flexible couplings or other easily separated connection

6.8.8 Backflow Prevention Valves (New Section)

6.8.8* Backflow Prevention Valves.

Means shall be provided downstream of all backflow prevention valves for forward flow tests at a minimum flow rate of the system demand.

A.1.1

A.1.1

NFPA 13R is appropriate for use as an ~~option~~ alternative to NFPA 13 only in those residential occupancies, as defined in this standard, up to and including four aboveground stories in height, and limited to buildings that are 60 ft (18 m) or less in height above grade plane, which is consistent with limits established by model building codes for buildings of Type V construction. The height of a building above grade plane is determined by model building codes, which base the height on the average height of the highest roof surface above grade plane. For further information on the building height story limits, see model building codes.~~It is the intent of this standard that if NFPA 13R is appropriate for use, it be used throughout the entire building. It is recognized that an accessory or incidental occupancy to the operations of the residential occupancy might exist within that residential occupancy.~~

A.1.1 (Continued)

// Buildings that contain multiple occupancies (either separated or non-separated), accessory occupancies or incidental uses are often subject to special rules that may restrict the use of NFPA 13R. Refer to the adopted building code to determine whether such restrictions are applicable.~~Such accessory or incidental occupancy would be considered part of the predominant (residental) occupancy and subject to the provisions of the predominant (residental) occupancy by 6.1.14.2 of NFPA *101* and similar provisions in many local building and fire codes. Use of NFPA 13R throughout the entire building in this case is allowed.~~

A.1.1 (Continued)

The criteria in this standard are based on full-scale fire tests of rooms containing typical furnishings found in residential living rooms, kitchens, and bedrooms. The furnishings were arranged as typically found in dwelling units in a manner similar to that shown in Figure A.1.1(a) , Figure A.1.1(b) , and Figure A.1.1(c) . Sixty full-scale fire tests were conducted in a two-story dwelling in Los Angeles, California, and 16 tests were conducted in a 14 ft (4.3 m) wide mobile home in Charlotte, North Carolina. Sprinkler systems designed and installed according to this standard are expected to prevent flashover within the compartment of origin where sprinklers are installed in the compartment. A sprinkler system designed and installed according to this standard cannot, however, be expected to completely control a fire involving fuel loads that are significantly higher than average for dwelling units [10 lb/ft^2 (49 kg/m^2)], configurations of fuels other than those with typical residential occupancies, or conditions where the interior finish has an unusually high flame spread index (greater than 225).

A.1.1 (Continued)

// ~~Where buildings are greater than four stories in height, or where buildings are of mixed use where residential is not the predominant occupancy, residential portions of such buildings should be protected with residential or quick-response sprinklers in accordance with 8.4.5 of NFPA 13 . Other portions of such buildings should be protected in accordance with NFPA 13 . Where buildings of mixed use can be totally separated so that the residential portion is considered a separate building under the local code, NFPA 13R can be used in the residential portion while NFPA 13 is used in the rest of the building. Examples of accessory occupancies found in NFPA 13R installations can include parking garages/areas, community laundry rooms, clubhouses, exercise facilities, tenant storage, and so forth.~~

A.1.1 (Continued)

// The criteria in this standard are based on full-scale fire tests of rooms containing typical furnishings found in residential living rooms, kitchens, and bedrooms. The furnishings were arranged as typically found in dwelling units in a manner similar to that shown in Figure A.1.1(a) , Figure A.1.1(b) , and Figure A.1.1(c) . Sixty full-scale fire tests were conducted in a two-story dwelling in Los Angeles, California, and 16 tests were conducted in a 14 ft (4.3 m) wide mobile home in Charlotte, North Carolina. Sprinkler systems designed and installed according to this standard are expected to prevent flashover within the compartment of origin where sprinklers are installed in the compartment. A sprinkler system designed and installed according to this standard cannot, however, be expected to completely control a fire involving fuel loads that are significantly higher than average for dwelling units [10 lb/ft^2 ($49 kg/m^2$)], configurations of fuels other than those with typical residential occupancies, or conditions where the interior finish has an unusually high flame spread index (greater than 225).

A.1.1 (Continued)

To be effective, sprinkler systems installed in accordance with this standard need to open the sprinklers closest to the fire before the fire exceeds the ability of the sprinkler discharge to extinguish or control the fire. Conditions that allow the fire to grow beyond that point before sprinkler activation or that interfere with the quality of water distribution can produce conditions beyond the capabilities of the sprinkler system described in this standard. Unusually high ceilings or ceiling configurations that tend to divert the rising hot gases from sprinkler locations or change the sprinkler discharge pattern from its standard pattern can produce fire conditions that cannot be extinguished or controlled by the systems described in this standard.

NFPA 13R references NFPA 13 in many aspects (hanging and bracing, design densities and spacing outside of dwelling unit, painting and finish of sprinklers, welding, etc.). If this standard does not specifically address a situation, NFPA 13 is a good resource that can be utilized by the installer and the authority having jurisdiction for a solution. It is not the intent of this standard to require compliance with NFPA 13 when NFPA 13R is silent on a subject. Only AHJ approval should be required.

DISCLAIMER

// This seminar and its content is not a formal interpretation issued pursuant to NFPA regulations. Any opinion expressed is the personal opinion of the author and presenter and does not necessarily present the official position of the NFPA and its Technical Committees.

National Fire Protection Association

The authority on fire, electrical, and building safety

Thank You

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Questions