

TechNotes Issue # 419 May 14, 2019

Following are a dozen questions answered by the engineering staff as part of the NFSA's Expert of the Day (EOD) member assistance program during the month of April 2019. This information is being brought forward as the "Best of April 2019." If you have a question for the NFSA EOD (and you are an NFSA member), send your question to eod@nfsa.org and the EOD will get back to you.

It should be noted that the following are the opinions of the NFSA Engineering Department staff, generated as members of the relevant NFPA technical committees and through our general experience in writing and interpreting codes and standards. They have not been processed as formal interpretations in accordance with the NFPA Regulations Governing Committee Projects and should therefore not be considered, nor relied upon, as the official positions of the NFPA or its Committees. Unless otherwise noted the most recent published edition of the standard referenced was used

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Question #1 - Nursing Stations

Nursing stations are being added to a hospital to provide privacy to breastfeeding mothers. Are sprinklers required to be added to protect these features?

Answer: Yes sprinklers are required. NFPA 13-2013 section 8.6.5.2.2 is applicable as it pertains to the nursing stations as

Upcoming Technical Tuesdays

May 21, 2019

Proposed Updates to
NFPA 25, 2020 edition

Presented by Vincent
Powers, ITM Specialist

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obstruction to the overhead sprinkler protection. Sprinklers would be required to be installed in each pod per the basic requirements of section 8.1.1.

Per NFPA 13-2013:

8.1* Basic Requirements.

8.1.1*

The requirements for spacing, location, and position of sprinklers shall be based on the following principles:

- (1) Sprinklers shall be installed throughout the premises.*
- (2) Sprinklers shall be located so as not to exceed the maximum protection area per sprinkler.*
- (3)* Sprinklers shall be positioned and located so as to provide satisfactory performance with respect to activation time and distribution.*
- (4) Sprinklers shall be permitted to be omitted from areas specifically allowed by this standard.*
- (5) When sprinklers are specifically tested and test results demonstrate that deviations from clearance requirements to structural members do not impair the ability of the sprinkler to control or suppress a fire, their positioning and locating in accordance with the test results shall be permitted.*
- (6) Clearance between sprinklers and ceilings exceeding the maximums specified in this standard shall be permitted, provided that tests or calculations demonstrate comparable sensitivity and performance of the sprinklers to those installed in conformance with these sections.*
- (7) Furniture, such as portable wardrobe units, cabinets, trophy cases, and similar features not intended for occupancy, does not require sprinklers to be installed in them.*
- (8)* Sprinklers shall not be required to be installed within electrical equipment, mechanical equipment, or air handling units not intended for occupancy.*

Bullet 7 of the above referenced section only allows for features not intended for occupancy an allowance to omit sprinklers. As these pods are intended to be occupied. No other provision is applicable to omit sprinklers per NFPA 13-2013, so sprinklers would be required to be installed per bullet 4 and the basic requirements of section 8.1.1.

Question #2 - Irregular Stairwell

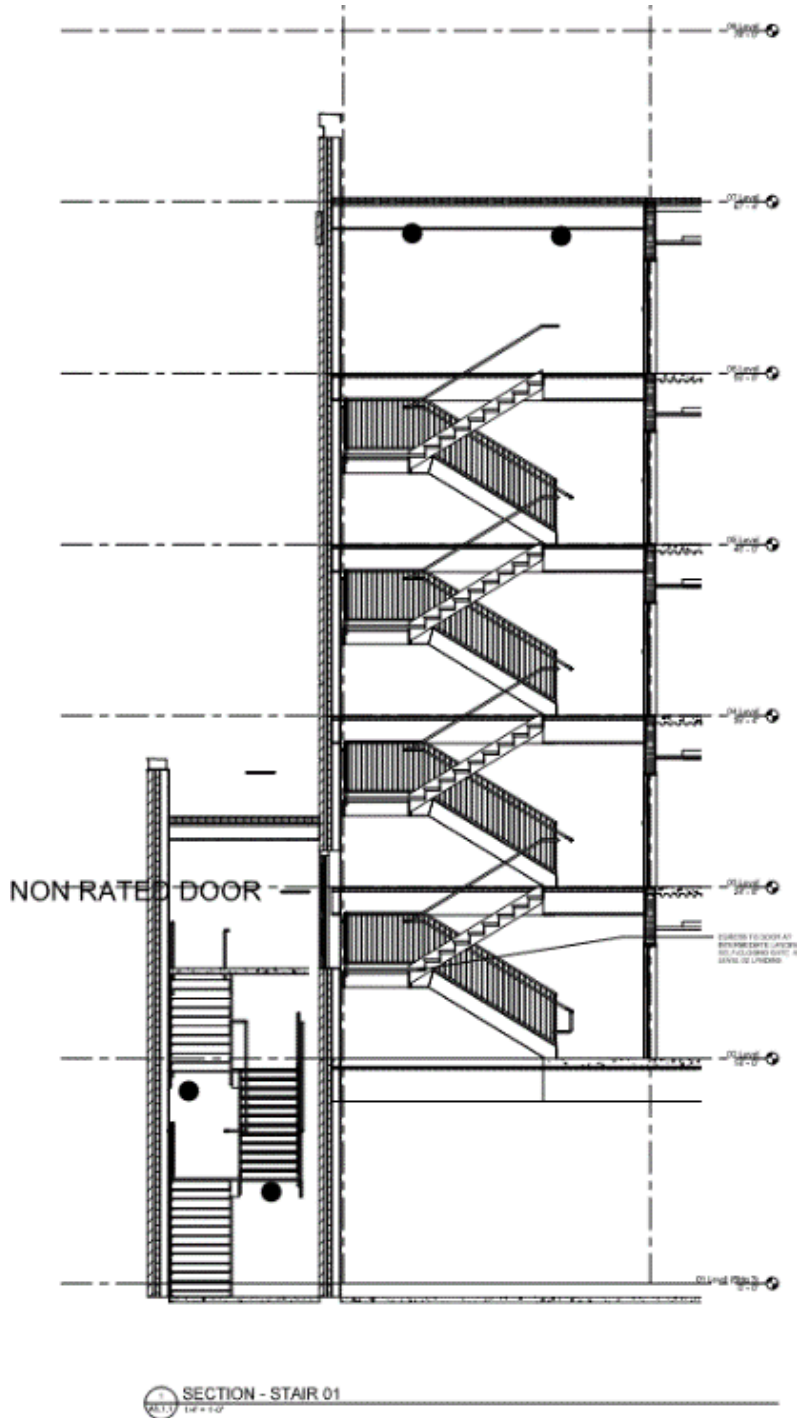
A stairwell is being constructed where the stair shaft changes footprint. The stair extends down from the top story four levels and then the stair path goes through an unrated door and extends to the exterior. See the detail to the right. Sprinklers are installed at the top of the main shaft and the bottom of the auxiliary shaft. Are any additional sprinklers required?

Answer: Based upon the diagram you provided, sprinklers



should be installed at the top and bottom of each stairwell footprint, treating each stair well footprint as a separate stairwell. The sprinkler at the bottom of the stairwells can be omitted if the bottom is blocked off so no storage is possible in accordance with NFPA 13-2016 section 8.15.3.2.3.1. Additionally, sprinklers should be provided on either side of the non-rated door per section 8.15.3.2.2:

8.15.3.2.2 *Where noncombustible stair shafts are divided by walls or doors, sprinklers shall be provided on each side of the separation.*



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This Month in Engineering

Top Tech Competition
Nashville, TN
May 15 - 18, 2019

Elimination Round
May 15th at 2:00 pm

Preliminary Round
May 16th

Round 1: 12:30 p.m.
Round 2: 1:00 p.m.

Question #3 - Backflow Preventer Location (Fire Pump)

Is it permissible for a RPZ backflow preventer to be installed in the discharge pipe of a fire pump assembly or would this

be considered a pressure restricting device and not be allowed?

Answer: The backflow preventer is allowed to be installed in the fire pump discharge piping, per NFPA 20-2016:

4.16.7* *A listed check valve or backflow preventer shall be installed in the pump discharge assembly.*

According to this section, it is permissible to install a backflow preventer in the discharge pipe of a fire pump. Although RPZ backflow preventers can have a substantial friction loss, this does not classify them as a pressure restricting device as indicated in the question above.

According to the annex, there are a few things to keep in mind when the backflow preventer is installed in this position:

A.4.16.7 [...]

Where a backflow preventer is substituted for the discharge check valve, an additional backflow preventer might be necessary in the bypass piping to prevent backflow through the bypass.

Where a backflow preventer is substituted for the discharge check valve, the connection for the sensing line is permitted to be between the last check valve and the last control valve if the pressure sensing line connection can be made without altering the backflow valve or violating its listing. This method can sometimes be done by adding a connection through the test port on the backflow valve. In this situation, the discharge control valve is not necessary, because the last control valve on the backflow preventer serves this function.

Where a backflow preventer is substituted for the discharge check valve and the connection of the sensing line cannot be made within the backflow preventer, the sensing line should be connected between the backflow preventer and the pump's discharge control valve. In this situation, the backflow preventer cannot substitute for the discharge control valve because the sensing line must be able to be isolated.

Finally, because a backflow preventer is installed, the evaluation requirements of section 4.28.4 must be followed. As for the proximity of the controller, clearances shall be provided as required per NFPA 70 and a proper NEMA enclosure rating shall be used in the case of water spray conditions.

There is an additional consideration related to the functionality of the reduced pressure zone (RPZ) backflow prevention device. Having the devices on the discharge side of the fire pump could cause operation of the pump if pressure is relieved from the RPZ. In some instances, a check valve has also been required to achieve proper performance.

Round 3: 1:30 p.m.
Round 4: 2:00 p.m.
Round 5: 2:30 p.m.
Round 6: 3:00 p.m.

**Semi-Final Round
May 17th**

Round 1: 1:00 p.m.
Round 2: 2:00 p.m.

**Final Round at
3:00 p.m.**

**Upcoming In-Class
Seminars**

Design Advantage - Fire
Sprinkler Systems and the
International Building Code
(Minneapolis, MN)
May 23, 2019

Design Advantage - Fire
Sprinkler Systems and the
International Building Code
(Washington, D.C.)
May 30, 2019

Register Here

Question #4 - Seismic Bracing

What options are available to brace sprinkler pipe installed on top of a roof or walk-in freezer/cooler?

Answer: In lieu of sway bracing, u-hooks may be used to keep the pipe tight to the structural elements.

For the pipe laid on top of the roof, sprinklers may be braced with u-hooks per NFPA 13-2019 section 18.5.5.11:

18.5.5.11 *The lateral sway bracing required by 18.5.5 shall be permitted to be omitted when 18.5.5.11.1 for branch lines or 18.5.5.11.2 for mains is met.*

18.5.5.11.1 *Branch lines shall comply with the following:*

(1) The branch lines shall be individually supported by wraparound u-hooks or u-hooks arranged to keep pipe tight to the structural element provided the legs are bent out at least 30 degrees from the vertical and the maximum length of each leg and the rod size satisfies the conditions of Table 18.5.11.8(a) through Table 18.5.11.8(f), or the length of the rod shall be calculated.

(2) At least 75 percent of all the hangers on the branch line shall meet the requirements of 18.5.5.11.2(1).

(3) Consecutive hangers on the branch line shall not be permitted to exceed the limitation in 18.5.5.11.2(1).

18.5.5.11.2 *Mains shall comply with all the following:*

(1) The main piping shall be individually supported by wraparound u-hooks or u-hooks arranged to keep pipe tight to the structural element provided the legs are bent out at least 30 degrees from the vertical and the maximum length of each leg and rod size satisfies the conditions of Table 18.5.11.8(a) through Table 18.5.11.8(f).

(2) At least 75 percent of all the hangers on the main shall meet the requirements of 18.5.5.11.2(1).

(3) Consecutive hangers on the main shall not be permitted to exceed the limitation in 18.5.5.11.2(1).

(4) The seismic coefficient (C_p) shall not exceed 0.5.

(5) The nominal pipe diameter shall not exceed 6 in. (150 mm) for feed mains and 4 in. (100 mm) for cross mains.

(6) Hangers shall not be omitted in accordance with 17.4.4.3, 17.4.4.4, or 17.4.4.5.

The above arrangement can also be utilized for the freezer with the additional requirement that drops to the pipe feeding the freezer is installed with flexible couplings per NFPA 13-2019 section 18.2.4:



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18.2.4* Flexible Couplings for Drops. Flexible couplings for drops to hose lines, rack sprinklers, mezzanines, and free-standing structures shall be installed regardless of pipe sizes as follows:

- (1) Within 24 in. (600 mm) of the top of the drop
- (2) Within 24 in. (600 mm) above the uppermost drop support attachment, where drop supports are provided to the structure, rack, or mezzanine
- (3) Within 24 in. (600 mm) above the bottom of the drop where no additional drop support is provided

The deck of the freezer should be of substantial construction to support the u-hook attachments and verified by the design professional for the project or a structural engineer.

Question #5 - Solid Shelving vs. Open Rack

A storage occupancy is being protected per NFPA 13-2013 edition. The owner is storing millwork products such as solid wood doors and trim and intends to store these doors horizontally, which would essentially be two "pallets" wide on a double row rack system. Would the open frame racks qualify as solid shelf if the area of the product is greater than 20 sq. ft?

Answer: No, this is still considered an open rack as long as the storage load does not infringe upon the flue space.

The definition of solid shelving per NFPA 13-2013 states:

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. Solid shelves having an area equal to or less than 20 ft² 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.

The 2016 edition added the text that seems to be the crux of this question:

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 ft² 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.

The new text underlined refers to the placement of loads in

relation to the required flue spaces and is not referring to obstructions greater than 20 sq. ft referenced earlier in the section. The 20 sq. ft only applies to the shelf material itself and not any loads. As the annex note explains, the issue here is a lack of flue space on all sides and not the cross-sectional area that a load takes up on a rack. The load should not be considered in determining whether a rack has solid shelving or not unless it infringes on the required flue spaces. This is consistent with the associated annex note (NFPA 13-2016 section A.3.9.3.8).

Question #6 - Furniture Store Classification

There is an existing pipe schedule system having sprinklers spaced at 10 ft x 12 ft. The space is being converted to a furniture store and the fire marshal is classifying the new occupancy of the building as a Group S-1 per the IBC. Would a furniture store be considered mercantile per NFPA 13 as an ordinary hazard group 2 or since the fire marshal has classified this as S-1 occupancy would this go to class III commodity per the table A.5.6.3 in NFPA 13-2010?

Answer: NFPA 13-2010 does not classify building occupancies in the way that the IBC does. The IBC/IFC classifies a "store" as mercantile (M use). However, IFC Section 903.2.7.1 requires any mercantile building that has merchandise high-piled or in racks to be protected per IFC Chapter 32 for high-piled storage. A S-1 (moderate storage) use goes to IFC Chapter 32 when the Class I-IV commodity is over 12 feet in height or is over 6 feet for high-hazard. In short, both uses get to IFC Chapter 32 and it appears this is where the fire marshal is coming from. When in the IFC Chapter 32, the mattresses are classified as a commodity and the appropriate NFPA 13 storage protection criteria is applied.

As for a specific classification of the hazard, questions regarding hazard or commodity classification are difficult except in those circumstances where an NFPA committee has specifically addressed the issue. This is especially true because the classification is considered in many states to be the most important aspect of fire protection system design, and an obligation of the responsible design professional. One reason many states require involvement of a responsible design professional is to ensure that the site-specific attributes of the project are recognized and properly addressed, which cannot be accomplished in a generic manner.

The annex of NFPA 13-2010 provides furniture as examples of several commodity classes depending on their exact composition. A responsible design professional in your jurisdiction should be consulted to determine the appropriate commodity classification. If the area were to be deemed storage, a typical showroom floor would contain a single level of furniture and no stacking would be expected. As such, heights would be expected to be limited to 10-12 feet and a

Class IV commodity stored in this way would only require an Ordinary Hazard, Group 2 design per NFPA 13-2010 Table 13.2.1

Question #7 - Hex Bushings and Hydraulic Calculations

Where sprinklers are installed in hex bushings, is the sprinkler still considered to be connected directly to the fitting, even though there's a hex bushing present?

Answer: Yes, the sprinkler is still considered connected directly to the fitting and the friction loss for the tee/bushing assembly can be excluded. Per NFPA 13-2016, hex bushings can be utilized in two instances:

***6.4.7.2** Hexagonal or face bushings shall be permitted in reducing the size of openings of fittings when standard fittings of the required size are not available.*

***6.4.7.3** Hexagonal bushings as permitted in 8.15.20.2 shall be permitted to be used.*

***8.15.20.2** In new installations, it shall be permitted to provide minimum 1 in. outlets with hexagonal bushings to accommodate sprinklers attached directly to branch line fittings to allow for future system modifications.*

In both instances, the bushing is used to replace a single fitting either out of convenience (future fit-out per 8.15.20.2) or necessity (fitting is not available). Due to this allowance, the provisions of section 23.4.4.8.1(9) can be used.

***23.4.4.8.1(9)** Friction loss shall be excluded for the fitting directly connected to a sprinkler.*

Question #8 - ESFR Protection Under Conveyors

Per NFPA 13-2010 section 8.12.5, are floor mounted conveyors wider than 24 in. that are not enclosed underneath required to have sprinklers installed under if the overhead system utilizes ESFR sprinklers?

Answer: A conveyor extending through the protection areas of 2 or more sprinklers would be considered a continuous obstruction in accordance with Section 8.12.5.3.1 of the 2010 edition of NFPA 13. Unless the conveyor is so close to the ceiling that provisions of Table 8.12.5.1.1 could be applied, an additional row of sprinklers would be required below a conveyor more than 2 ft in width.

It is required that the sprinklers placed under obstructions to the discharge of ESFR sprinklers also be ESFR sprinklers. The one exception spelled out in the standard (NFPA 13-2010 section 8.12.5.3.4) specifically permits the use of quick response spray sprinklers under overhead garage doors. Although a case could be made that ESFR sprinklers would not be needed under certain other obstructions, and that the hazard could be adequately addressed through the use of quick response sprinklers, this would need to be discussed

with and approved by the Authority Having Jurisdiction on a case-by-case basis.

Question #9 - Adjacent ESFR Systems

A building is constructed where the deck height transitions from less than 40' to over 40'. For this instance, the break point is on a girder. K17 ESFR sprinklers are being used where the deck is below 40 ft and K22 ESFR sprinklers where the deck is above 40 ft. Are the sprinklers allowed to transition without any other separation?

Answer: Yes, the sprinklers may be switched over at the 40 ft break as long as [MH1] the difference in ceiling height is 2 ft or greater. Draft curtains would not be required per Chapter 8 as they are only needed when ESFR sprinklers are installed adjacent to a standard response sprinkler area per NFPA 13-2016 section 8.4.6.4.1.

This requirement comes from NFPA 13-2016 Chapter 12 on storage. Section 12.3(3) allows for the 2 ft difference in ceiling levels:

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 beyond its perimeter.

(2) [...]

(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, located above an aisle, horizontally a minimum 2 ft from the adjacent hazard on each side.

Question #10 - Screened Porches (13D)

A single-family home is being constructed with a NFPA 13D-2016 sprinkler system. The owner wants to put an addition on it with a foundation, roof, 3 walls, except the walls are screened, and it is not a conditioned space. Are sprinklers required?

Answer: No, sprinklers would not be required as this space meets the requirements of an open attached porch. Per NFPA 13D-2016:

8.3.1 *Sprinklers shall be installed in all areas except where omission is permitted by 8.3.2 through 8.3.8.*

[...]

8.3.4* *Sprinklers shall not be required in garages, open*

attached porches, carports, and similar structures.

While still screened in, the entire structure is open enough to allow the provisions of 8.3.4 to be used and sprinklers would not be required.

Question #11 - Carwash Pipe Materials

Would galvanized pipe be required in a car wash where pipe would be exposed to a significant amount of moisture?

Answer: Galvanized pipe is not specifically required, but it would be an acceptable solution. Per NFPA 13-2016:

8.16.4.2* Protection of Piping Against Corrosion

8.16.4.2.1* *Where corrosive conditions are known to exist due to moisture or fumes from corrosive chemicals or both, special types of fittings, pipes, and hangers that resist corrosion shall be used, or a protective coating shall be applied to all unprotected exposed surfaces of the sprinkler system.*

While galvanized pipe is an option that would meet the first part of section 8.16.4.2.1, it is not specifically required and black pipe, painted with a corrosive resistant coating, could be installed. Additional guidelines are explained in the annex; however, the annex is not an enforceable part of the standard:

A.8.16.4.2.1 *Being exposed to the outside atmosphere is not necessarily a corrosive environment. Types of locations where corrosive conditions can exist include bleacheries, dye houses, metal plating processes, animal pens, and certain chemical plants. If corrosive conditions are not of great intensity and humidity is not abnormally high, good results can be obtained by using a good grade of commercial acid-resisting paint. The paint manufacturer's instruction should be followed in the preparation of the surface and the method of application*

Where moisture conditions are severe but corrosive conditions are not of great intensity, copper tube or galvanized steel pipe, fittings, and hangers might be suitable. The exposed threads of steel pipe should be painted.

In the end, this decision should be made by a registered design professional to determine the adequacy of protection and acceptable level or risk for the materials chosen for install.

Question #12 - Standard Response vs. Quick Response

Extended coverage dry sidewalls are installed and are listed as standard response sprinklers despite having a 3mm quick-response glass bulb. Per NFPA 13-2016:

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.*

Could the dry sidewall sprinkler be considered quick-response to satisfy the requirement above as it has a 3mm quick-response glass bulb?

Answer: No. Although the 3mm bulb is typically considered a fast response operating element, section 8.3.3.5 specifically states that it applies to sprinklers that carry a listing for both standard response protection and quick-response protection at different coverage areas.

As stated, this sprinkler does not have a listing for quick response and is only listed as a standard response, therefore section 8.3.3.5 would not apply. This section is intended to apply to light hazard occupancies where the sprinkler in question holds both a quick response and a standard response listing based upon its coverage area. If, however, the dry sprinkler did have a quick response listing (at lesser coverage areas) then this sprinkler would be permitted to be used at spacings where it is listed as a standard response within the same compartment as other quick response sprinklers.

Did You Know??

The NFSA assigns a member of the Engineering Department staff every business day to answer your technical questions. We call this the Expert of the Day (EOD) program and it is available to our members by phone, or e-mail. Call us at (845) 878-4200 and press 2, or you can e-mail us at eod@nfsa.org. Last year we answered more than 1400 requests for assistance.

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