

Best of February 2016

Following are a dozen questions answered by the engineering staff as part of the NFSA's Expert of the Day (EOD) member assistance program being brought forward as the "Best of February 2016." 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.

Question 1 – Omitting Sprinklers in Adjacent Ceiling Pockets

You have described a project with three ceiling pockets 24 in. deep and less than 10 ft. apart. The volume of each ceiling pocket is 600 cu.ft.

Your question is: Could we install standard spray sprinklers in only the center ceiling pocket, and eliminate the sprinklers in the outer ceiling pockets since the outer ceiling pockets are over 10 ft. apart?

Answer: The answer is yes, as long as the entire floor area is covered by sprinklers, the sprinklers are quick response, the finish materials of the pockets are non or limited combustibles and the two outer pockets (with no sprinklers) are more than 10 ft apart.

The requirements for this are found in section 8.6.7.2 (standard spray sprinklers) which reads:

8.6.7.2 *Sprinklers shall not be required in ceiling pockets where all of the following are met:*

(1) *The total volume of the unprotected ceiling pocket does not exceed 1000 ft³ (28.3 m³).*

(2) *The depth of the unprotected ceiling pocket does not exceed 36 in. (914 mm).*

(3) *The entire floor under the unprotected ceiling pocket is protected by sprinklers at the lower ceiling elevation.*

(4) **The total size of all unprotected ceiling pockets in the same compartment within 10 ft (3 m) of each other does not exceed 1000 ft³ (28.3 m³).*

(5) *The unprotected ceiling pocket has noncombustible or limited-combustible finishes.*

(6) *Quick-response sprinklers are utilized throughout the compartment.*

Based upon your description, it appears that you could just install sprinklers in the center pocket and meet the requirements of this section. Assuming the other requirements can be met; installing sprinklers in the center pocket only would satisfy requirement (4). You would have two unprotected pockets of 600 cubic feet each. As long as these pockets are more than 10 feet apart, you would not have unprotected pockets that exceed 1,000 ft³ within 10 feet of each other.

Question 2 – Unistrut or Power-Strut as a trapeze Hanger

You have asked if a material other than steel pipe or angle iron, such as Unistrut or Power-Strut, can be used to support a trapeze assembly to support sprinkler pipe.

Answer: The answer to your question is "yes, provided it provides the equivalent section modulus". The required minimum section modulus would be obtained from NFPA 13, Table 9.1.1.7.1 and is dependent on the pipe type, nominal pipe diameter and the span between structural members. The material chosen to make up the trapeze must have a section modulus equal to or greater than the value from this table.

This concept is found in **NFPA 13, section 9.1.1.7.2** which reads: *Any other sizes or shapes giving equal or greater section modulus shall be acceptable.*

Section modulus information should be available from the manufacturer.

Question 3 – Retractable Projector Screen as an Obstruction

You have described a project where there is an 8 to 10-foot wide projector screen positioned against a curved wall which creates a gap that ranges from 12 inches to 24 inches off the wall when the projector screen is down. Specifically, you have asked if additional sprinklers are required to protect this space when the projector screen is fully extended down.

Answer: The answer to this question is "no". There are no specific requirements to provide sprinklers for obstructions that are not fixed in place, and therefore you would not be required to protect this area. Also, the section A.8.1.1(3) in the annex states that "Notwithstanding the obstruction rules provided in chapter 8, it is not intended or expected that water will fall on the entire floor space of the occupancy. When obstructions or architectural features interfere with the sprinkler's spray pattern, such as columns, angled walls, wing walls, slightly indented walls, and various soffit configurations, shadowed areas can occur. "

For example, the 'shadow area' generated by 3x rules can allow up to 15 square feet of floor area not directly reached from a sprinklers discharge. Since the projector screen is not typically down, and when it is down it is only covering a small area between the projector and the wall (less than 15 square feet), this would not be a concern.

Question 4 – What is a "System" in Accordance with NFPA 25?

You noted that you have a building zoned into 7 areas and each which will have a control valve, waterflow switch, drain and water supply. Specifically, you have asked if the combination of a

water supply, control valve, water flow switch, and drain constituted a "system" as defined in NFPA 25.

Answer: The answer is yes. As you correctly pointed out, with these 4 components, each of the 7 zones would be considered a separate system.

You have asked additional questions which will be answered below:

Inadequate main drain size: Based on that answer, you also asked if pointing out improperly sized drains would be considered a deficiency by NFPA 25. The answer to that question is no. That would be a design issue and outside the scope of the ITM standard. As you mentioned, an observation report, etc. would be an appropriate place to note it if you wanted to bring it to the attention of the owner.

Lack of Pressure Gauge: If there is no gauge on the riser, a main drain test cannot be conducted. If there is a pressure gauge at the base of the riser, you can comply with the main drain test requirement of NFPA 25. , Beginning in the 2014 edition of NFPA 25, section 13.2.5 states that a main drain test shall be conducted annually at each "water supply lead in to a building". So with at least one gauge, you can comply with this requirement.

The answer to your question about the lack of a gauge is the same as the drain size. It is a design issue and outside the scope of NFPA 25.

Internal Inspections: Lastly, you asked about internal inspections. Since we addressed the system definition above, this drives the decision about the internal inspections. With 7 wet pipe systems, section 14.2.2 states that these inspections (called "assessments of internal condition" in the 2014 edition) are to be conducted on alternate systems each 5-year cycle. So systems 1, 3, 5, & 7 the first round, 5 years later, systems 2, 4, & 6. If foreign materials are found during the inspection, however, all systems must be inspected internally.

Question 5 – Obstructions Close to the Floor or Deck

You have described a combustibile concealed space approximately 4 ft high above a suspended ceiling. There are sprinklers both above and below the suspended ceiling. There is a 50 inch wide duct to be installed in this concealed space. This duct will be installed below the level of the sprinklers in the concealed space and the bottom of the duct is within 12 inches of the suspended ceiling below.

Your question is: Is there anything in the code that would allow sprinklers to be omitted from below this 50”?

Answer: The answer is "yes" the 2016 edition of NFPA 13 has addressed situations of obstructions located near the floor or deck. Section 8.5.5.3.1.4 allows sprinklers to be omitted from beneath noncombustible obstructions where the bottom of the obstruction is located 24 inches or less above the floor or deck. This new section reads as follows:

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. (600 mm) or less above the floor or deck.*

In the case you described, the suspended ceiling could be considered the deck and as long as the bottom of the 50-inch duct is no more than 24 inches above the suspended ceiling, sprinklers would be permitted to be omitted from underneath this wide obstruction.

Previous editions of NFPA 13 did not have similar allowances to omit sprinklers under these low obstructions; however, the AHJ should recognize this new section as the current thinking of the committee and allow it under the equivalency clause of NFPA 13 (Section 1.5).

Prior to the inclusion of this new section in the standard, sprinklers were required to be installed under these low obstructions. A common method to allow these sprinklers to be omitted was to create a noncombustible concealed space by installing a noncombustible material such as sheet metal from the obstruction down to the deck. This would create a noncombustible concealed space that would not require sprinkler protection.

It must be noted that the sprinklers located above the duct in this space must still comply with the appropriate obstruction rules.

Question 6 – Calculating CPVC Tee Runs (flow straight through)

You have asked: Are tees installed on the run in CVPC piping required to be hydraulically calculated in NFPA13, NFPA 13R, and NFPA 13D systems?

Answer: The answer depends on the standard being used and the method of calculation.

NFPA 13 and NFPA 13R calculations are not required to include friction loss straight through a tee. Section 23.4.4.8 (5) of NFPA 13 -2016 (similar language in earlier editions), specifically allows you to ignore the friction loss straight through any fitting. This means you can ignore tees on the run. As the information for the friction loss through a tee run is available in the manufacturer's literature, it would not be prohibited to include these friction losses, however, NFPA 13 and NFPA 13R do not specifically require these friction losses to be included.

Years ago NFSA submitted a proposed change to NFPA 13 to count the tee on the run for small pipes. But the committee rejected by proposal saying that there are sufficient safety factors in what we do and we do not need to worry about it.

NFPA 13D does imply that the friction loss for tee runs be included when hydraulic calculation methods per NFPA 13 are not being performed.

NFPA 13D - 2016 in requires that NFPA 13 hydraulic calculation methods be used for gridded systems, looped-type systems and when the city water main is less than 4-inch. When using the NFPA 13 method, NFPA 13D makes no reference requiring the use of friction loss tables in NFPA 13D as opposed to NFPA 13 tables. The Manufactures instructions for CPVC do include a table showing equivalent feet of pipe for friction loss on the run through a tee, however it is not clear that these tables must be used or if the friction loss tables in NFPA 13 are acceptable. This would be the choice of the layout technician.

The only language in 13D that specifically requires adding friction loss through a fitting is in Section 10.4.2.3 (6) which relates to Network Systems.

Section 10.4.4 (8) (b) regarding General Pipe Sizing Method refers to Equivalent Length Tables for fittings. These tables include entries for flows straight through a tee implying that such losses need to be included when this method is used.

Based on the current wording in applicable documents, a case can be made that for a NFPA 13D system using hydraulic calculations per NFPA 13 that do not include friction loss for flow straight through a CPVC tee is acceptable. For NFPA 13D systems that do not use hydraulic calculations in accordance with NFPA 13, you should include any tees on the run because they are given by manufacturers in their literature and you have to use specially listed products like CPVC in accordance with the manufacturer's literature.

Treating NFPA 13D as more stringent than NFPA 13, makes sense from a hydraulics perspective. The friction loss through a small tee (run) of $\frac{3}{4}$ or 1 inch is actually more noticeable than the friction loss straight through a large tee. So on the smaller systems it makes sense to include the friction loss. In the larger pipes, the friction loss rounds off the zero, so there is no sense in worrying about it.

Question 7 – ESFR in Beam Pockets and 8 ft Minimum Distance

You have described a project using ESFR sprinklers. The structure has 14 inch beams on 7 ft 6 in centers. The sprinklers will be installed within the beam pockets and would be spaced 7 ft 6 in apart and the sprinklers would be prevented from cold soldering as the beams will act as a baffle.

Your question is: Is it the intent of the standard to comply with the 8 ft minimum distance between heads in obstructed construction?

Answer: The answer is "yes", ESFR sprinklers must be installed at least 8 feet apart. The minimum acceptable distance between ESFR sprinklers is 8 feet, regardless of the existence of solid structural members or baffles between the sprinklers. There is no language in NFPA 13 Section 8.12 that permits the installation of ESFR sprinklers closer than 8 feet. NFPA 13 Section 8.4.6.3.1 states that where ESFR sprinklers are being used with obstructed types of construction more than 12 inches deep, the sprinklers need to be in every channel formed by the structural members and Section 8.4.6.3.2 states that the sprinklers must still meet the requirement of Sections 8.12.2 and 8.12.3 which means that the sprinklers still must be at least 8 feet apart.

The concern is not just one sprinkler spraying on the adjacent sprinkler. In occupancies where high challenge fires are possible, the concern is that the water droplets that leave the sprinkler and head down to the floor may be picked up by the vertical momentum of the fire plume and deposited on a nearby sprinkler. Tests have shown that this effect can be minimized by putting the sprinklers at least 8 feet apart.

In this situation, as the beams are 7 1/2 feet apart you may be able to maintain the 8 ft distance by staggering the sprinklers in the joist pockets

Question 8 - Sprinkler listed as both quick response and standard response depending on the spacing.

There is a residential project using extended coverage heads. The sprinkler is listed as both a quick response sprinkler and a standard response head depending on the spacing. Is

it permissible to install these sprinklers at the standard response spacing in the same compartment as quick response sprinklers?

Answer: Yes. This concept has been addressed in the 2016 edition of NFPA 13 in section 8.3.3.5. This new section addresses the situation that you have described, sprinklers that hold both a standard response listing and quick response listing (depending on the spacing) and uses a fast response element. Prior to the 2016 edition mixing these sprinklers at standard response spacing with quick response sprinklers in the same compartment was technically prohibited by section 8.3.3.2.

The 2016 edition addressed this concept by adding an exception to section 8.3.3.2 that reads:

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.

The exception applicable to your situation is 8.3.3.5 which reads:

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.

Although this concept is new to the 2016 edition of NFPA 13, this concept reflects the current thinking of the committee and should be allowed in jurisdiction using earlier editions of NFPA 13 per the equivalency clause in in NFPA 13 in section 1.5.

Question 9 – Replacing vs. Testing Pressure Reducing Valves

You have stated that an owner has suggested replacing PRV's on a combination standpipe every five years as a way to save on the higher cost of flow testing them every five years. You have also correctly stated that it is your understanding that one benefit of flow testing a PRV is to first give you a baseline, to which future flow and pressures could be compared to.

Specifically, does a new PRV need to be flow tested to confirm that they are functioning properly?

Answer: The answer is "yes", Both NFPA 13 and NFPA 14 require that pressure reducing valves must be flow tested at completion of the installation. Flow testing of all pressure-regulating devices is required as part of the acceptance testing protocols of NFPA 14 (2013) and NFPA 13 (2016) and these results must be noted on the contractor's test certificate. This is made clear in Section 11.5.5 of NFPA 14 and in Section 25.2.4 of NFPA 13 (similar language in earlier editions).

The purpose of this testing is to verify the following:

- Installation is correct
- Valve is operating
- Inlet and outlet pressures and flows are in accordance with the design

Both new and existing PRVs require a full flow test (new at install and existing every 5 years). Simply replacing pressure regulating valves every five years would not permit these valves to be put into service without a flow test.

Question 10 – Plywood as Limited-Combustible Construction

You have described a concealed space above a ceiling constructed of steel bar joists and a plywood deck. You have asked: Could the plywood be considered “limited-combustible construction” and could sprinklers be omitted from this concealed space per NFPA 13, Section 8.15.1.2.1?

Answer: The answer is "no", plywood does not generally meet the definition of limited combustible and therefore this concealed space would not meet the requirements of Section 8.15.1.2 to allow the omission of sprinklers in concealed spaces of non or limited combustion construction. NFPA13 (2016) has a definition of limited combustible in section 3.3.16. This definition references the combustibility and flame spread characteristics of a material defined as limited combustible. In short, this term refers to material such as gypsum board.

Although the space described does not meet the criteria of limited combustible construction, section 8.15.1.2 may allow sprinklers to be omitted. The premise of NFPA 13 is that all spaces of the building are sprinklered unless there is a section that allows the omission of the sprinklers. Section 8.15.1.2 includes 18 situations where sprinklers may be omitted from concealed spaces of combustible construction. If your situation does not fit with one of those descriptions, then sprinklers will have to be installed in the space.

Question 11 – Small Room Rule with Small Openings

You have referenced the "Small Room Rule" in NFPA 13, Section 8.6.3.2.4 in the 2016 Edition (similar text exists in earlier editions). Specifically, you have asked if openings in the ceiling are permitted, such as that for a return air grill.

Answer: In order to discuss the "Small Room Rule", it is important to review the definition of a small room in NFPA 13. Section 3.3.22 states that a small room is "a compartment of light hazard occupancy classification having unobstructed construction and a floor area not exceeding 800 sq.ft." Section 3.3.6 then defines a compartment as "A space completely enclosed by walls and a ceiling. Each wall in the compartment is permitted to have openings to an adjoining space if the openings have a minimum lintel depth of 8 in. from the ceiling and the total width of the openings in each wall does not exceed 8 ft. A single opening of 36 in. or less in width without a lintel is permitted when there are no other openings to adjoining spaces."

Through the definitions the focus is on the compartment and the openings in the walls or vertical separations of the compartment from other spaces as these dividers bound where the smoke and heat of a fire travel within the building. The ceiling needs to be a material and arrangement such that heat will collect and operate the sprinklers should a fire incident occur. It is common to have air return grills in ceiling arrangements to accommodate the HVAC needs of a building and sprinklers have historically operated acceptably in these spaces. Therefore, without any prohibition in NFPA 13, it would be acceptable to have an air return or similar opening in a ceiling and still apply the "Small Room Rule."

As there is not a specific statement on these openings, then obviously an acceptable size is not referenced in the standard. It would be typical for an air return grill to take up the space of a ceiling tile. Obviously, this will vary with the grid installed for a suspended ceiling and the planned HVAC system. Common sizes range from 0.5 ft by 1 ft through 2 ft by 4 ft and some even larger. (The 2016 edition of NFPA 13 has defined the maximum size of small openings to a concealed space as 20 % of the ceiling area and if the opening is greater than four feet in length the width is limited to 8 inches) The sprinklers in the room will operate in a timely fashion even with this type of opening even if it is located against a wall. The Small Room Rule only allows for the sprinklers to be spaced a little farther from a single wall. The maximum coverage areas are still maintained (although calculated slightly differently). The small size of the room will also help to contain the heat and operate the sprinklers when needed. Therefore, there should be minimal effect on the operation time of the fire sprinklers.

Question 12 - Exterior Horn/Strobes at exterior in NFPA 13D

You have asked if NFPA 13D requires horn/strobes to be located on the outside of the structure.

Answer: The answer to your question is "no, NFPA 13D has no requirement for alarms of any kind provided the building is provided with smoke alarms as per NFPA 72". Since building codes typically require smoke alarms in all new construction, additional alarms are rarely needed in NFPA 13D systems. Where smoke alarms are *not* provided, NFPA 13D only requires a local waterflow alarm audible from outside the building. The applicable sections of NFPA 13D – 2016 are cited below. Similar language is contained in all recent editions.

7.6* Alarms. Local waterflow alarms shall be provided on all sprinkler systems in homes not equipped with smoke alarms or smoke detectors in accordance with NFPA 72.

A.7.6 The waterflow detection device and the audible alarm device do not have to be listed. The local waterflow alarm is intended to be a single alarm audible from the outside of the building. It can be mounted on the outside of the home or within the building close to the outside. This should not limit its use to prevent interior or remote notification. Interconnection with a smoke alarm or remote monitoring might improve notification, but is considered too costly to mandate for every system installed in accordance with this standard. It is not the intent of this standard to require central station monitoring or a fire alarm system.