

## Best of May 2015

Following are a dozen questions answered by the engineering staff as part of the NFSA's EOD member assistance program being brought forward as the "Best of May 2015." If you have a question for the NFSA Expert of the Day (and you are an NFSA member), send your question to [eod@nfsa.org](mailto: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 a formal interpretation in accordance with the NFPA Regulations Governing Committee Projects and should therefore not be considered, nor relied upon, as the official position of the NFPA or its Committees. Unless otherwise noted the most recent published edition of the standard referenced was used.

### Question 1 - Testing Fire Sprinklers

According to NFPA 25, sample sprinklers need to be tested periodically over the life of the fire sprinkler system. Do the sprinklers have to be removed from the system or can sprinklers from the spare sprinkler cabinet be used?

**Answer:** It is the intent of NFPA 25, Section 5.3.1, that a representative sample of sprinklers be removed from the system for testing. While the testing interval varies with the environment and type of sprinkler, the intent is to test a representative sample of sprinklers exposed to similar conditions. Testing sprinklers from the spare sprinkler cabinet would only provide information about the rest of the sprinklers in the same cabinet. As an example a loading dock is a different environment than the adjoining warehouse and separate samples should be taken from each environment. The annex goes on to say that similar sidewalls, pendants and uprights produced by the same manufacturer could be part of a single sample but sprinklers produced by different manufacturers should be considered different samples.

Applying this to a 300,000 sq.ft. building there are many possible variations that could impact which sprinklers are sampled. A few examples are:

- If the entire building could be considered a single environment and all sprinklers were produced by the same manufacturer at the same time-frame, there would be one sample area and the minimum test sample should consist of 1 percent (or a minimum of four) of the total number of sprinklers within the building.
- If the entire building could be considered a single environment but the sprinklers present were produced by two different manufacturers, then there would be two sample areas to be tested. Each sample area would consist of 1 percent (or a minimum of four) of the sprinklers of each sample (i.e. one sample for manufacturer #1 and another sample for manufacturer #2).
- If the building consists of two environments (an environment would be areas subject to different environmental or working conditions) and all sprinklers consist of a sprinklers from the same manufacturer, then there would be two sample areas.

Obviously, a working knowledge of the system would be required to determine appropriate sample areas to be tested. Each facility is different and determining a testing recommendation would need to be done on a case-by-case basis.

### **Question 2 - Air Testing Dry Pipe Systems**

This question references NFPA 13, Section 25.2.2.1, dealing with air testing of dry pipe and double interlock preaction systems. Does a dry pipe system have to be tested with water at 200 psi for 2 hours, or is it acceptable for the dry section of piping to be filled with air and have it demonstrate no air loss for a set time?

**Answer:** All systems must be hydrostatically tested at 200 psi for 2 hours. There are some exceptions listed in 25.2.1. There are occasions, especially in colder climates, when freezing temperatures will not permit the hydrostatic test at the time of installation. In these occasions, an air test is acceptable until the weather is above freezing, at which time the hydrostatic test is required to be performed.

For dry-pipe systems, the air test is required in addition to the hydrostatic test. This is why section 25.2.2.1 starts with the statement, "In addition to the standard hydrostatic test, an air pressure leakage test at 40 psi (2.8 bar) shall be conducted..." The purpose of the air pressure test is to make sure that the dry-pipe system will not trip accidentally due to loss of air. Even when a system passes the hydrostatic test, there is the possibility that there will be unacceptable amount of air leakage. The basic problem is that air can more easily escape from tiny openings than water.

### **Question 3 - Light Fixture Obstruction in NFPA 13R**

A residential sprinkler has been positioned 13 inches from a light fixture that is 9 inches in diameter. The bottom of the light fixture is 3 inches below the sprinkler deflector. An AHJ has ruled this arrangement as not compliant, citing NFPA 13R Section 6.4.6.3.4.1 which references Section 6.4.6.3.6. How can Section 6.4.6.3.6 apply as the section is titled "Continuous Obstructions to Pendent Sprinklers" and the light fixture is not a continuous obstruction? Is the sprinkler permitted to be located as described?

**Answer:** No, the sprinkler cannot be located near the light fixture as described. Although the light fixture is not a continuous obstruction, that section is applicable as a special condition provided as an exception to Section 6.4.6.3.4.1 which would otherwise require at least 3 feet between the sprinkler and light fixture. Based on that exception, a light fixture 13 inches from the sprinkler is not permitted to extend below the level of the deflector.

### **Question 4 - Application of NFPA 13D**

There is a project which has multiple structures each containing four family dwelling units. A builder would like to use an interconnected PEX piping system. As this building has four units, an NFPA 13R system was being planned. If there are 2-hour fire ratings separating the units, can NFPA 13D be installed to protect the dwellings?

**Answer:** No. The IBC gives requirements for NFPA 13R sprinkler systems which allows Group R occupancies, up to and including four stories in height not exceeding 60 feet in height above grade plane, to be permitted to install sprinkler systems in accordance with NFPA 13R. In regards to NFPA 13D sprinkler systems, they are permitted to be installed in one- and two- family dwelling; Group R-3, Group R-4 condition 1 and townhouses. Therefore, if the building can meet a Group R-3, Group R-4 Condition 1 or a townhouse, then it would be permitted to install an NFPA 13D system. However, if this is not the case and NFPA 13R has to be followed, then PEX piping would not be permitted to be used.

### **Question 5 - Slatted Ceilings**

Approximately 16 inches below the sprinkler deflector, a wood "slatted ceiling" has been installed. The slats consist of 1-inch by 4-inch oak planks with 2-inch open space between the planks. There will be sprinklers installed below the structural (upper) ceiling. Are sprinklers required to be installed below the slatted ceiling?

**Answer:** Yes, sprinklers will be required both above and below this slatted ceiling. The sprinklers are required above the slatted ceiling because sprinklers need to be within 12 inches of the top of the space in order to provide cooling for the structure. Sprinklers are required below the slatted ceiling because the slats of wood create a significant obstruction to the spray from the sprinklers above the ceiling.

Based upon the size of the slats and the opening dimensions provided, this slatted ceiling is approximately 30% open. This limited open area would certainly create a cumulative obstruction that would need to be considered. When the slatted ceiling is less than or equal to 18 inches below the upper level sprinkler deflectors, then Section 8.5.2 would apply.

While it may be possible to meet the obstruction rules for the individual slats, NFPA 13 does not have language to deal with multiple small obstructions that are spaced close together. In this case it would be best to consider NFPA 13 Section 8.1.1 (3) which states that "Sprinklers shall be positioned and located so as to provide satisfactory performance with respect to activation time and distribution". Another variable that should be considered would be the combustible nature of the wood slats themselves.

Section 8.15.14, Open-Grid Ceilings, can provide guidance for the situation described. This section does indicate that sprinklers would be permitted to be omitted below the lower ceiling if the openings constitute 70% or more of the total ceiling area. However, this scenario is not open enough to draw a parallel. Therefore, sprinklers should be installed below the lower ceiling.

#### **Question 6 - Shower Enclosures**

There is a bathroom in a dwelling unit in a residential high-rise which will be protected according to NFPA 13. You have stated that the shower enclosure has a full height glass enclosure and that the bathroom with the shower is more than 55 sq. ft. Is an additional sprinkler required inside the shower enclosure?

**Answer:** This will depend on the specifics of the shower enclosure itself. When the shower enclosure is a compartment on its own (see the definition of a compartment in NFPA 13), then sprinklers can be omitted if the compartment is less than 55 sq ft and if the shower stall is in a dwelling unit since the shower stall can be considered its own bathroom. If the shower enclosure is a compartment and is less than 55 sq. ft. and if the remainder of the bathroom is also a compartment less than 55 sq. ft. you would have two separate bathrooms each less than 55 sq ft and both would be permitted to omit the sprinkler. If the shower enclosure does not meet the definition of a compartment, then the bathroom needs to be sprinklered. The sprinklers need to protect the floor area of the bathroom including the area of the shower stall. However, the sprinkler does not necessarily need to be physically in the shower stall to protect that floor area.

#### **Question 7 - Calculating Sprinklers Below a Mezzanine**

There is a small stage area (1,000 sq. ft.) that includes two mezzanines with solid floors. Do the sprinklers under the mezzanines have to be included in the hydraulic calculations for the roof level sprinklers?

**Answer:** No. In general, the ceiling sprinklers are designed and calculated to protect the upper level ceiling while the area under the mezzanine would be considered a separate fire area and require separate hydraulic calculations. Typically, the ceiling (roof) level is more demanding as the higher elevation needs additional pressure to move the water upwards.

The design area for the mezzanine would include sprinklers under the mezzanine and if the required design area is not met, sprinklers at the ceiling level would be added until the required design area is met. The calculations cannot be limited to the area below the mezzanine if the hazard requires a larger design area as it is possible for a fire below the mezzanine to operate sprinklers above the mezzanine.

#### **Question 8 - Residential Sidewall Sprinklers with a Beamed Ceiling**

Residential sidewall sprinklers are being installed. The ceiling has 11-inch beams creating obstructions for the sprinklers. Can the residential sidewall sprinklers be installed 1 inch below the beams (12 inches

from the ceiling) under NFPA 13R or NFPA 13D?

**Answer:** No. Neither NFPA 13R, Table 6.4.6.3.7.2 (a) nor NFPA 13D, Table 8.2.5.5.2 (a) permit a continuous obstruction within 8 feet of the sidewall sprinkler. While having the beam above the deflector seems reasonable, the sidewall sprinkler needs to maintain the 4-inch distance from the ceiling in order to effectively "lob" the water discharge across the room. The water leaving a sidewall sprinkler travels up before it comes back down and the sprinkler needs room to develop this spray pattern. In this case, with the deflector being 1 inch below the beam, the beam could disrupt the discharge pattern of the sidewall sprinkler.

#### **Question 9 - Clean Agent Systems in Place of Sprinklers**

There are situations that call for a clean agent system or FM200 system to be installed. There are no exceptions in NFPA 13 to omit sprinklers when a room is protected with a clean agent system. When a clean agent or wet chemical system is installed, would it then also require a sprinkler system?

**Answer:** While it may be possible to eliminate sprinklers from a room with the approval of the code official, doing so may not be prudent. The 2012 IBC does state in section 903.1.1 the "Alternate automatic fire extinguishing systems complying with section 904 shall be permitted in lieu of automatic sprinkler protection where recognized by the applicable standard and approved by the fire code official."

NFPA 13, in Section 8.1.1(1) requires sprinklers to be installed throughout the building except where omissions are specifically permitted. As there is no language in NFPA 13 that clearly permits sprinklers to be omitted in an area protected by an alternative system and eliminating those sprinklers would result in a system that would have to meet the code official approval for a variance in order to be fully NFPA 13 compliant.

Specifically, in Section 8.1.1(1) of NFPA 13, it states that sprinklers shall be installed throughout the premises. To remove sprinklers from an area would technically put the building out of compliance with NFPA 13. The code official would need to consider the alternate system as equivalent to the level of safety provided by a sprinkler system. It is important to note that a clean agent system does not have the same duration as a fire sprinkler system. Most clean agent systems are "one-shot" suppression systems. If a fire rekindles or is not suppressed, there is no more agent available to control or attempt to suppress again. When the fire continues to grow and grow beyond the room of origin, then the surrounding fire sprinkler system may not be able to control the fire. As a result, omitting sprinklers from the room may result in insurance implications that should be investigated.

As stated above, the IBC may allow another automatic fire extinguishing system as an alternative to required fire sprinkler systems, but it does not accept them "for the purposes of exceptions and reductions allowed by other requirements of this code" (see section 904.2). This could have implications on code "tradeoffs" throughout the entire building that should also be investigated.

#### **Question 10 - Testing a High-Zone Fire Pump**

Fire pumps in series are needed to meet the system demand for a high-rise building. When the fire pump for the high-zone is tested, should the low-zone fire pump be running?

**Answer:** Yes. NFPA 20 fire pumps installed in series are required to perform as a unit. Section 4.19.1.1 states, "A series fire pump unit (pumps, drivers, controllers and accessories) shall perform in compliance with this standard as an entire unit."

The high-zone fire pump is expected to function in conjunction with the low-zone fire pump and is therefore required to be tested as a unit. The bypass from the city water main is not required, but is allowable where pressure of material value is accessible to the high-zone fire pump from the water supply.

**Question 11 - NFPA 13D and Quick Response Sprinklers**

Can quick response institutional sprinklers (pendent and sidewall) be used in a building protected according to NFPA 13D as long as the minimum pressure (7 psi) is maintained?

**Answer:** Yes, quick response sprinklers can be used, but only in mechanical closets and saunas and steam rooms per section 7.5.4 and 7.5.5 of NFPA 13D. For other spaces NFPA 13D requires sprinklers to be residential sprinklers per Section 7.5.1. There are a few exceptions, but those sections only allow quick response sprinklers in mechanical closets, saunas and steam rooms. In situations where quick response sprinklers are used in an NFPA 13D system, they are required to follow NFPA 13 spacing and location requirements.

**Question 12 - Common Drain Riser**

There is a multi-story building with a combined system where a standpipe supplies sprinkler systems for each floor. The riser size of each system requires a 2-inch drain for each riser on each floor per NFPA 13. Is the common drain riser serving all floors required to be sized at 2 ½ inches at the point where the 2-inch drain from the uppermost floor is combined with the 2 inch drain from the floor below it?

**Answer:** Yes. Section 8.16.2.4.7 in NFPA 13 states, "Where drain connections for floor control valves are tied into a common drain riser, the drain riser shall be one pipe size larger downstream of each size drain connection tying into it." The system drains are not required to exceed 2 inches. It is only at the point where they are combined into a common drain that the rule applying to the common drain riser comes into play.

*NFSA Tuesday TechNotes is c. 2015 National Fire Sprinkler Association, and is distributed to NFSA members on Tuesdays for which no NFSA Technical Tuesday Online Seminar is scheduled. Statements and conclusions are based on the best judgment of the NFSA Engineering staff, and are not the official position of the NFPA or its technical committees or those of other organizations except as noted. Opinions expressed herein are not intended, and should not be relied upon, to provide professional consultation or services. Please send comments to Victoria B. Valentine, P.E. at [valentine@nfsa.org](mailto:valentine@nfsa.org).*