

**December 10, 2019**

## Best of November 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 November 2019. This information is being brought forward as the "Best of November 2019." If you have a question for the NFSA EOD (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 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 - Antifreeze Loops

An owner wishes to add extra sprinklers than what the code requires, including in the garage and exterior patios for a residential sprinkler system. An antifreeze loop to feed the additional sprinklers was chosen as

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*NFPA 15 Water Spray Fixed Systems*

Presented by Roland Asp,  
Manager of Installation Standards

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**EOD will be closed Monday, 12/23 - Friday, 12/27 and will resume operation on Monday, 12/30.**



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the design option. The system is supplied by a pump and tank. The tank will be equipped with an auto-fill valve that will be hard pipe connected to the home water supply that will be fed from a well with a constant pressure pump. The tank has an overflow port so that there theoretically should be no way for the water in the tank to back-siphon into the water supply, although it will be hard piped (no air gap). The antifreeze loop would be in the basement feeding the sprinklers on the floor above.

**Question 1a:** Does the backflow preventer that is mentioned in NFPA 13D-2016 section 9.2.3, apply in this situation since the system is drawing off of a tank and no back siphonage should occur?

**Answer:** The intent of the backflow device is to maintain antifreeze concentrations in the unconditioned space; however, it is not required.

**Question 1b:** If we do need to add a backflow preventer, would you recommend it go between the tee and the tank?

**Answer:** While not required, the backflow preventer for the antifreeze system should be arranged per Figure 9.2.3.2.1 and be placed as close to the unheated area as possible (while still being in the conditioned space not subject to freezing) to minimize the volume of the antifreeze system.

**Question 1c:** Would the arrangement below be acceptable as it is drawn? Or since this does not have a backflow preventer, we would need to do a loop or add one between the sprinkler water and antifreeze?

**Answer:** This would not be acceptable, either replace the isolation valve and check valve with a backflow preventer or provide the loop per Figure 9.2.3.1.1

## **Question #2 - Air Intake Requirements for Diesel Fire Pumps**

Is the air intake louver permitted to be installed on an interior wall of a diesel pump room where the air would be pulled from within the facility?

**Answer:** Yes. Technically, there is nothing in NFPA 20-2019 that prevents this, although it is standard industry practice to utilize outside walls. There are several reasons for preferring outside walls. First, as indicated in subsection 11.3.2.1(1), a main purpose of the ventilation is to address the maximum temperatures in the pump room, ensuring that the intake combustion air does not exceed 120°F, so it should be recognized that operations in a connecting room that could affect ambient temperatures would affect air temperatures in



the pump room. The need for limited restrictions on air flow are also critical and are addressed specifically in subsection 11.3.2.3.2 which states: "The total air supply path to the pump room shall not restrict the flow of air more than 0.2 in. water column." By placing the louver on an interior wall, the determination of the air supply path must include both the connecting room and whatever air supply path there is to that room. With buildings being increasingly sealed for energy conservation purposes, this limit might prove difficult, especially since the air access must be considered for the maximum expected running time of the pump. With a complicated air supply path, the 0.2 in. pressure differential is probably something that is easier to test than to calculate in advance, and exterior louvers for the pump room might well end up as the most practical solution if the pressure differential requirement is not achieved. Air discharge must also be considered per subsection 11.3.2.4.2.

### **Question #3 - Fire Pump Controller Testing**

What tests need to be performed when a fire pump controller needs to be replaced?

**Answer:** The NFPA Fire Pump Committee worked with the Inspection, Testing and Maintenance Committee to answer this question by adding Table 8.6.1 to NFPA 25. This table states that a full acceptance test needs to be performed in accordance with NFPA 20 (Chapter 14) whenever a complete controller is installed, regardless of how new the other equipment is. You need to run the pump under no-load, rated load and full load conditions in order to make sure that the controller is working properly. You also need to do the multiple starts (with at least one from each starting mechanism) to make sure that the controller can start the pump from any condition in which it would need to start the pump.

### **Question #4 - Flame Spread Ratings**

Aluminum Foil/Scrim/Kraft (FSK) paper is specified to be applied to the bottom of solid combustible 2 in. x 12 in. wood joist construction. If properly install per manufacturer's directions, the FSK paper product is rated to have a Class A Flame Spread Rating less than 25. Does the use of this product meet the intent of NFPA 13-2016 section 8.15.1.2.10 to allow the exemption of sprinklers in a concealed space above a suspended ceiling installed below this product?

**Answer:** No, the requirements of NFPA 13-2016 section 8.15.1.2.10 exceed the basic requirements of E-84 used to establish this materials flame spread rating. Per NFPA 13-2016:



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**8.15.1.2.10** 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 not to propagate more than 10.5 ft when tested in accordance with ASTM E84, Standard Test Method of 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, shall not require sprinkler protection.

The entire assembly must also be tested in accordance with ASTM E84 or UL 723 extended an additional 20 minutes. If the index is less than 25 after that test is performed, then this would be acceptable.

### Question #5a - Stacked Conveyors

ESFR sprinklers are installed in a building containing a system of conveyors. If the conveyors are stacked vertically, does each level need protection individually?

**Answer:** ESFR sprinklers would need to be installed under each conveyor if the conveyors are greater than 2 ft in width due to the possible fire load on each conveyor level. If the stacked obstructions were ducts or something similar, sprinklers would only need to be installed beneath the lowest obstruction.

### Question #5b - Multiple Adjacent Conveyors

If conveyors are installed side by side can they be protected by one line of sprinklers? What would be the maximum allowed distance or space between the two conveyors?

**Answer:** The obstruction may be protected with one line of ESFR sprinklers as long as the area of protection covers the entire obstruction footprint per NFPA 13-2016 section 8.12.2.2.

If the conveyors are less than 2 ft in width, ESFR sprinklers at the ceiling level may be spaced per NFPA 13-2016 section 8.12.5.3.1(4) to avoid sprinkler protection beneath the obstruction:

#### **8.12.5.3 Continuous Obstructions Below Sprinklers.**

**8.12.5.3.1 General Continuous Obstructions.** Sprinklers shall be arranged with respect to obstructions in accordance with one of the following:

- (1) Sprinklers shall be installed below continuous obstructions, or they shall be arranged to comply with Table 8.12.5.1.1 for horizontal obstructions entirely below the

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*elevation of sprinklers that restrict sprinkler discharge pattern for two or more adjacent sprinklers such as ducts, lights, pipes, and conveyors.*

*(2) Additional sprinklers shall not be required where the obstruction is 2 in. (50 mm) or less in width and is located a minimum of 2 ft (600 mm) below the elevation of the sprinkler deflector or is positioned a minimum of 1 ft (300 mm) horizontally from the sprinkler.*

*(3) Additional sprinklers shall not be required where the obstruction is 1 ft (300 mm) or less in width and located a minimum of 1 ft (300 mm) horizontally from the sprinkler.*

*(4) Additional sprinklers shall not be required where the obstruction is 2 ft (600 mm) or less in width and located a minimum of 2 ft (600 mm) horizontally from the sprinkler.*

*(5) Ceiling sprinklers shall not be required to comply with Table 8.12.5.1.1 where a row of sprinklers is installed under the obstruction.*

Note that when a line of sprinklers is installed beneath the obstruction, the requirements of Table 8.12.5.1 for the ceiling level protection can be ignored for that obstruction.

When considering multiple obstructions, the following reference would be appropriate:

**8.12.5.3.3\*** *For pipes, conduits, or groups of pipes and conduit to be considered individual, they shall 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.*

### **Question #6 - Sprinkler Temperature Rating and Occupancy Hazard**

A core and shell building was designed at an ordinary hazard occupancy and utilized high temperature sprinklers. For future tenant improvements, is it acceptable to use the high temperature sprinkler if the occupancy hazard changes to light hazard?

**Answer:** No, if the occupancy hazard changes from Ordinary/Extra Hazard to Light Hazard, the high temperature sprinklers must be changed to ordinary or intermediate temperature unless they are within the range of a heat source per NFPA 13-2016 Table 8.3.2.5(a) or where ambient temperatures at the ceiling exceed the values in Table 6.2.5.1.

### **Question #7 - Hose Allowance and Fire Pumps**

A fire pump feeds hydrants as well as ESFR sprinkler

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systems in a storage warehouse. Where does the hose allowance need to be added when performing the hydraulic calculations?

**Answer:** NFPA 13-2016 specifically answers this question in section 12.8.3

12.8.3 Water allowance for outside hose shall be added to the sprinkler requirement at the connection to the city main or a yard hydrant, whichever is closer to the system riser.

It is important, in this case, that you put the hose stream demand at the hydrant downstream of the fire pump so that you size the pump to handle the additional 250 gpm flow. Since the pump serves the hydrant, you need to size the pump to meet the flow demand of the system including the demand of the hydrant.

### **Question #8 - Hydraulic Placards**

Multiple systems are installed with some system risers being installed in the main riser room and other system risers installed in remote locations. Is it acceptable to display a single hydraulic design placard (with all hydraulic information from calculations performed on the various systems) in a single location such as the riser room?

**Answer:** No, the hydraulic nameplate is required to be located near the system valve unless the AHJ is consulted and permits a sign at a single location. The prescriptive requirements of NFPA 13 requires this sign to be located at each riser of the separate systems. Specifically, section NFPA 13-2019 section 28.5.2 states that the Hydraulic Data Nameplate is to be located at "...the alarm valve, preaction valve, or deluge valve supplying the corresponding hydraulically designed area."

### **Question #9 - Clearance**

Which type of ceilings needs to have clearance around fire sprinkler drops when hard piped?

**Answer:** Sprinkler pipe passing through non-frangible ceilings would require clearance or flexible couplings on either side of the penetration. Frangible construction would break away in the event of a seismic quake. An example of frangible construction would include gypsum board and non-frangible construction would include block walls, poured concrete, or metal ceiling assemblies.

### **Question #10 - Dwelling Unit Bathrooms**

Is it the intent of NFPA 13 to limit the bathroom

exclusion to hotels and motels, or does it extend to dormitories as well as they are the same classification in NFPA-101?

Answer: No. Bathrooms located within dwelling units are permitted to have sprinkler protection omitted as long as they meet the requirements of NFPA 13-2019 section 9.2.4.1:

#### **9.2.4 Dwelling Units.**

##### **9.2.4.1 Bathrooms.**

**9.2.4.1.1\*** *Unless sprinklers are required by 9.2.4.1.2 or 9.2.4.1.3, sprinklers shall not be required in bathrooms that are located within dwelling units, that do not exceed 55 ft<sup>2</sup> (5.1 m<sup>2</sup>) 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.*

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

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

The reference to hotels and motels was only present in the 2013 edition and was quickly reversed in the following revision cycle with this substantiation:

*This revision reinstates the sprinkler exception that was recently deleted in the 2013 edition of NFPA 13 from Section 8.15.8.1.1. The NFPA 13 AUT-SSI Committee accepted a code proposal to delete this apartment dwelling unit sprinkler exception that has been in its standard since the 1991 edition of NFPA 13. The original code proposal, as well as the public comment that the AUT-SSI Committee accepted to delete this bathroom sprinkler exception, provided no technical fire data and substantiation to delete this exception for apartment bathrooms in dwelling units. In addition, the deletion of this exception will have an adverse effect on the retrofitting of existing high-rise apartment buildings with sprinklers. During the 2010 NFPA 13 code process, the AUT-SSI Committee attempted to delete this same exception, but the NMHC submitted a CAM that was approved by the membership at the Annual Technical Meeting in Chicago that reinstated the exception. This bathroom exception has been in NFPA Codes (first placed NFPA 101 and then moved to NFPA 13) for over 34 years with no adverse fire protection or life safety issues. The apartment dwelling unit sprinkler exception was original in the 1976 edition of NFPA 101, and was only removed from the*

NFPA 101 editions after 1991 because of the informal understanding between the NFPA 101 Residential Subcommittee and NFPA 13 Committee that sprinkler contractors would rather have such an exception in NFPA 13 so it would not be missed during the bidding, design and installation process. The NFPA Fire Data Report, "1582-Area of Origin in Reported Apartment Fires 2004-2008," dated January 2011, that clearly provides fire data showing that fires in bathrooms in sprinklered apartment buildings are small in number, with limited property loss, and have not caused any fire deaths. In this report for the latest fire data (2004-2008 annual averages): 1. Table 3, "Apartment fires in Which Sprinklers were Present, by Area of Origin", that include fire data for both NFPA 13 & NFPA 13R systems, bathrooms fires accounted for only 300 (1%) fires out of a total of 18,200/year fires in such buildings, with 0 deaths out of 17 deaths/year, with 7 injuries (2%) out of 399/year, with a total direct property loss of \$1 million (2%) out of \$71 million/year. 2. Table 20, "Apartment Buildings of Five or More Stories in Which Sprinklers were Present, by Area of Origin", that would be only apartment buildings sprinklered in accordance with NFPA 13 systems (NFPA 13R systems are limited to buildings up to 4 stories in height), bathrooms fires accounted for only 80 (1%) fires out of a total of 6,070/year fires in such buildings, with 0 deaths out of 9 deaths/year, with 1 injury (1%) out of 129/year, with a total direct property loss of \$0 out of \$11 million/year. 3. Table 22, "Apartment Buildings of Five or More Stories in Which Sprinklers were Present and Flame Damage Spread beyond the Room of Origin, by Area of Origin", that would be only apartment buildings sprinklered in accordance with NFPA 13 systems (NFPA 13R systems are limited to buildings up to 4 stories in height), bathrooms fires accounted for only 1 (1%) fires out of a total of 72/year fires in such buildings, with 0 deaths out of 2 deaths/year, with 0 injuries out of 21/year, with a total direct property loss of \$0 out of \$3 million/year. Based on NFPA fire data there is no rational reason or evidence to support the deletion of this reasonable bathroom sprinkler exception for dwelling units in apartment buildings that was in the Codes for over 34 years until it was removed in the 2013 edition of NFPA 13. It is entirely reasonable based on the NFPA fire data report to reinstate this bathroom exception for such small bathrooms (less than or equal to 55 sq. ft.) in dwelling units in apartment buildings.

### **Question #11 - Old-Style Sprinklers**

Is an existing system utilizing old-style sprinklers



required to have the sprinklers replaced with quick response sprinklers?

**Answer:** Although NFPA 25 calls for replacement of sprinklers manufactured prior to 1920 (Section 5.3.1.1.2 in the 2017 edition), and although as you note that they are only permitted by NFPA 13 in new installations for specific applications, there is nothing inherently defective in the continued use of old-style sprinklers. It is true that they distributed a good percentage of their discharge in an upward direction, but because of this their spacing was very limited as compared to the post-1950's spray sprinklers with their umbrella-shaped spray pattern.

Old-style sprinklers were generally less thermally sensitive than newer standard response sprinklers, but unless the new occupancy is of a type that would require the use of fast response sprinklers there is no urgency for sprinkler replacement, provided sample testing in accordance with NFPA 25 shows adequate thermal performance. Since replacement old-style sprinklers would be difficult to find, Section 5.4.1.2.1 of NFPA 25-2017 allows their replacement with spray sprinklers.

With regard to the design basis, it should be recognized that the ordinary hazard density/area curves were developed on the basis of the densities that would be delivered from the old pipe schedule systems. Hydraulic calculations made it possible to reduce pipe sizes based on stronger than typical water supplies, so an existing sprinkler system utilizing old-style sprinklers should be comparable to an ordinary hazard design, somewhere between the present OH Group 1 and OH Group 2.

All that being said, there may be aesthetic reasons that would make it desirable to replace the old sprinklers, as well as the realization that today's sprinklers represent decades of product improvement.

#### **Question #12 - Residential Sprinklers in Corridors**

An elder care facility is constructed where the assisted living portion is arranged in a large square. At each corner of the square there are incidental non-dwelling rooms such as exercise rooms, a salon, physical therapy etc. Do these incidental rooms affect the ability to utilize residential sprinklers in the corridor?

**Answer:** No, residential sprinklers may be used in the corridors adjoining the dwelling units.

Per NFPA 13-2010:

#### **8.4.5 Residential Sprinklers.**

*8.4.5.1\* Residential sprinklers shall be permitted in dwelling units and their adjoining corridors, provided they are installed in conformance with their listing.*

Residential sprinklers are allowed in these corridors and the annex note points to a clarification for the use of the sprinkler's listing when selecting a coverage area. It should be noted that the incidental rooms off of the corridor that are not dwelling units cannot be protected with residential sprinklers.

*NFSA TechNotes is c. 2019 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 Mark Hopkins, P.E. at [Hopkins@nfsa.org](mailto:Hopkins@nfsa.org).*

