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NFSA NATIONAL FIRE SPRINKLER ASSOCIATION
The Voice of the Fire Sprinkler Industry
TechNotes

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Best of October 2017

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 October 2017. This information is being brought forward as the "Best of October 2017." 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 - Baggage Conveyor above Ceiling

An airport baggage handling conveyor is being installed in the space above a ceiling. Would this prohibit this space from being considered a noncombustible concealed space permitting sprinklers to be omitted?

Answer: This scenario would not likely permit the omission of sprinklers. To be able to omit sprinklers from this area as a noncombustible concealed space, it would need to meet the requirements of either NFPA 13-2016 Section 8.15.1.2.1 or 8.25.1.2.2 which specify that there can be no access to the space or limited access to the space without permitting occupancy or storage. Since this space will have the conveyor for transporting luggage installed throughout, it would not meet either of those sections and would require sprinkler protection per the letter of the standard.

Section 8.15.1.5 provides guidance on "Localized Protection of Exposed Combustible Construction or Exposed Combustible" which would permit sprinkler protection only around the perimeter of the combustibles in an otherwise

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noncombustible concealed space. The remainder of the space would not require sprinkler protection. This may be an applicable section to utilize when protecting the conveyor, based on discussions with your AHJ, which would allow you to only provide sprinklers around the conveyor.

Where sprinklers are required, they would need to meet the other obstruction rules. If the conveyor is over 48 inches in width it would require sprinklers to be installed beneath the conveyor belt as well based on the wide obstruction rules of 8.5.5.3.1.

Question 2 - Rooms with Louvered Ceilings under Sprinklers Above
A company is installing pre-fabricated rooms of varying sizes into a large open office space. The rooms are not designed for a sprinkler but rather rely on a louvered ceiling which is actuated by a heat detector within the room. The louvers open and allow for the outside area sprinklers above to provide coverage. When open, these louvers meet the annex language description of an open-grid ceiling per NFPA 13 (2016) A.3.7.2(2).

Question 2.1: Would this be considered an open-grid ceiling and could NFPA 13-2016 8.15.14(1)(a) apply?

Answer 2.1: No, this arrangement cannot be treated as an open-grid ceiling as the default closed position would not meet the definition. Relying on the ceiling opening based on a heat detector within the room to ensure that a sprinkler provides adequate discharge to the contents of the room is outside of the scope of NFPA 13.

Question 2.2: The manufacturer of the pre-fabricated rooms has submitted test data to demonstrate that the inside of the room gets acceptable coverage. Can these tests be used to determine if the room meets the conditions described in NFPA 13-2016 8.15.14(2)?

Answer 2.2: Section 8.15.14(2) states: "Other types of open-grid ceiling shall be permitted to be installed beneath sprinklers where they are listed for such service and are installed in accordance with instructions contained in each package of ceiling material".

The definition of listed is given under Section 3.2.2: "Equipment, materials, or services included in list published by an organization that is acceptable to the authority having jurisdiction, and concerned with the evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose".

Additionally, Section 1.5 states: "Nothing in this standard is intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength fire resistance, effectiveness, durability, and safety over those prescribed in this standard".

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Test results received from an organization acceptable to the AHJ that demonstrate that the use of this device and system would provide equivalent or superior quality in effectiveness and safety would be acceptable. A nationally recognized testing laboratory (NRTL) or a registered fire protection engineer would be able to evaluate criteria for the device to be deemed equivalent. Reliability of the actuator; response time; and performance of the sprinklers should be some of the criteria examined under those expected fire scenarios for the occupancy which prove most challenging in the room.

Question 3 - Fire Service Mains Extending under a Building
NFPA 13-2016 10.4.3.2 pertains to the requirements to allow private fire service mains to extend more than 10 feet under a building. Why does Subsection 10.4.3.2.2 use the words, "it shall be acceptable", since it is a requirement of the charging section, Section 10.4.3.2.

Answer: This wording simply states that, where mains are installed in covered trenches extending more than 10 feet under the building, this covered trench is required to be accessible. There is no requirement to place the private fire service main in a covered trench, but this section simply adds the requirement that it be accessible from inside the building when that option is taken in order to extend the piping more than 10 feet into the building.

Question 4 - Backflow Assembly Full Forward Flow Test
In order to perform a full forward flow test on a backflow assembly, it has been proposed to calculate flow rate through a main drain by using static/residual pressure, orifice diameter, and distance from the gauge to the open outlet. Is there a formula for this calculation?

Answer: While it is theoretically possible to determine the flow rate from a Main Drain, it is not necessary to measure flow for a full forward flow test. NFPA 13 Section A.8.17.4.6.1 suggests three potential options for providing the means for the backflow test:

1) A test header or other device that can be opened downstream of the backflow device (like a fire hydrant)
2) A bypass around the check valve in the FDC line (if you can flow out of the FDC connections)
3) A closed loop around the backflow device with a pump and sight glass

Any of these options would work. The intent of the forward flow test is simply to exercise the springs within a backflow preventer device. It is not necessary to measure the flow; only to ensure that a reasonable approximation of at least the system demand is periodically flowed through the backflow assembly. Any other arrangement that would flow at least the amount of water needed by the sprinkler system would also work which is why the standard does not specify a prescriptive test procedure. It is only necessary to exercise the springs in the backflow device and ensure that the clappers are free to open completely. This is not intended to be an onerous

requirement. There are no complicated calculations that need to be made. Just provide something downstream of the backflow device that can be opened to achieve the flow demand of the sprinkler system.

A detailed article on this subject written by Ken Isman was published is NFSA's SQ magazine, #125, Winter 2003. A copy of that article is available to NFSA members online by clicking here.

Question 5 - Length of Design Area along Branch Line
An NFPA 13-2007 project requires a design area for hydraulic calculations. The calculated number of sprinklers on a branch line results in an actual design area less than the required minimum design area.

Is it the intent of the standard for the designer to expand the remote area length until the required remote area square footage is obtained?

Answer: "Yes". In this example, the minimum design area has been determined to be 1950 square feet based on the applicable density/area for the hazard classification and any area adjustments. Enough sprinklers are required in the design area to cover this square footage. The required dimension for design area shall include a length of a rectangle to be at least 1.2*(Design Area)1/2 which is taken along the branch line.

This requirement in Section 22.4.4.1.1.1 and specifies this to be the minimum length, understanding that it may need to be a greater length. However, sometimes based on the dimensions of the building and the layout of the sprinkler piping, there are not enough sprinklers on a single branch line to meet this dimensions or not enough sprinklers in the design area when following this dimension. If either is the case, you would just pick up the closest sprinklers to this design area which are hydraulically most demanding until you have enough sprinklers to meet your required design area.

Question 6 - Partitions in Ordinary Hazard Occupancies
A resident storage area with partition walls to 7½ feet spaced approximately every 7 feet. The ceiling height is 9 feet. This space has been determined to be an Ordinary Hazard Group 1 (OH1) occupancy. NFPA 13-2013 8.6.5.2.2 regarding floor mounted vertical obstructions in Light Hazard (LH) occupancies has been referenced.

> ***8.6.5.2.2 Suspended or Floor-Mounted Vertical*** *Obstructions. The distance from sprinklers to privacy curtains, freestanding partitions, room dividers, and similar obstructions in light hazard occupancies shall be in accordance with Table 8.6.5.2.2 and Figure 8.6.5.2.2.*

What criteria should be used to assess these potential vertical obstructions in OH1?

Answer: "The partition walls would not be considered obstructions in OH1 provided that the tops of the partitions are

at least 18 inches below the sprinkler deflectors as per 8.5.6.1*". Because sprinklers in ordinary hazard are spaced more closely together than sprinklers in light hazard, there is no rule corresponding to 8.6.5.2.2 for ordinary hazard. Any parts of the partitions that extend within 18 inches vertically of the deflector would have to be evaluated using the "Three Times Rule", 8.6.5.2.1.3*.

> ***8.5.6.1**** *Unless the requirements of 8.5.6.2, 8.5.6.3, 8.5.6.4, or 8.5.6.5 are met, the clearance between the deflector and the top of storage or contents of the room shall be 18 in. (457 mm) or greater.*
>
> ***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 accordance with Figure 8.6.5.2.1.3(B).*

Question 7 - Covering Sprinklers during Bedbug Heat Treatments

A product designed to protect individual sprinklers during heat treatment for the mitigation of bed bugs consists of an insulated cup with a magnetic brim designed to be suspended from the sprinkler escutcheon ring. Ice is placed inside the bottom of the cup to provide cooling.

Is this an acceptable strategy for protecting sprinklers during bed bug heat treatments?

Answer: "No, there are elements missing from this strategy and attaching the device to the sprinkler is a violation of NFPA 13 and NFPA 25". NFPA 13-2016 section 9.1.1.8.1* and NFPA 25-2017 section 5.2.1.1.1* are generally considered to apply to hanging anything from any part of the sprinkler system. The sprinkler escutcheon is not intended to support any additional weight and should not be used to support insulating containers.

> ***9.1.1.8.1**** *Sprinkler piping or hangers shall not be used to support non-system components.*
>
> ***5.2.1.1.1**** *Any sprinkler that shows signs of any of the following shall be replaced:*
> *(1) Leakage*
> *(2) Corrosion detrimental to sprinkler performance*
> *(3) Physical damage*
> *(4) Loss of fluid in the glass bulb heat-responsive element*
> *(5) Loading detrimental to sprinkler performance*
> *(6) Paint other than that applied by the sprinkler manufacturer*

There are additional concerns about this strategy in that there are no means provided to monitor the temperature inside the device during heat treatments. Heat treatments for bed bug mitigation can raise ceiling temperatures as high as 160°F - well above the ambient temperature permitted for sprinklers

typically installed in residential occupancies. This strategy makes the erroneous assumption that no harm has been done to the sprinkler during heat treatment as long as it does not operate. This is not the case.

Ordinary temperature sprinklers should not be exposed to temperatures in excess of 100°F and even intermediate temperature-rated sprinklers should not be exposed to temperatures in excess of 150°F as per Table 6.2.5.1. There is no assurance that enclosing individual sprinklers in these containers will prevent them from being exposed to unsuitable temperatures. Exposure to elevated temperatures can cause damage to a sprinkler's heat-sensitive operating element that could cause the sprinkler to operate unintentionally at some time in the future.

Another important aspect of the treatment strategy must be the consideration of system impairment during heat treatment. The advisory provided in NFPA 25-2017 Table A.3.3.7 recommends that "foreign material attached or suspended from sprinklers" should be deemed an impairment to the system. This would trigger the implementation of an impairment program as detailed in Chapter 15.

> ***3.3.21* Impairment.*** *A condition where a fire protection system or unit or portion thereof is out of order, and the condition can result in the fire protection system or unit not functioning in a fire event.*

Additional information is provided in Heat Treatment for Bedbug Mitigation in Fire Sprinklered Properties, which can be downloaded by clicking here.

Question 8 - NFPA 13R and Interstitial Spaces in Existing Construction

Should sprinklers be installed in an existing interstitial residential space where NFPA 13R is used?

Answer: No. The issue of fire ratings between residential floors comes from the building code, or possibly when renovating an existing building, from the existing building code. NFPA 13R is not going to get involved supplementing the fire ratings. New or existing, the NFPA 13R standard is applied the same.

Does the building code or existing building code require a fire rating between floors of a residential occupancy? For a new building protected with NFPA 13R, the floors have a 1-hr rating (IBC 711.2.4.3). For existing buildings, the IEBC has several methods of renovating existing buildings, and it is difficult to guess which method the architect used, however, the IEBC may forgo the floor ratings with (or sometimes without) sprinkler protection, but not as an increase to the level of protection already in the standard. Meaning, the IEBC is not increasing the scope of protection of NFPA 13R.

Question 9 - ESFR Sprinklers in Extra Hazard Occupancies

A building is used to construct modular homes. It has been determined that the occupancy classification of this building is Extra Hazard Group 2 (EH2).

Can an ESFR sprinkler system be used to protect a non-storage occupancy (EH2)?

Answer: "No". NFPA 13-2007 12.6.7 limits the use of ESFR to storage. NFPA 13-2013 added the allowance to use ESFR sprinklers to protect light and ordinary occupancies but not in extra hazard occupancies. This allowance remains in the 2016 edition in Section 12.6.7.2 which reads as follows:

> ***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*

Extra Hazard occupancies were not allowed to be protected by ESFR sprinklers due to the potential shielding of combustibles in these occupancies.
This shielding is certainly the case with the situation of modular home construction.

Question 10 - Unsupported Armover Length for Pendent Sprinklers
With regard to the maximum unsupported armover length for pendent sprinklers,

NFPA 13 Section 9.2.3.5.2 states that the maximum unsupported armover length is 12 inches (steel pipe) where the maximum pressure exceeds 100 psi and the pendent sprinklers are installed below a ceiling.

Where pendent sprinklers are NOT installed below a ceiling (as in a storage warehouse application), is the cumulative arm-over length permitted to be 24 inches?

Answer: "Yes", as the pendent sprinkler is not installed below a ceiling, Section 9.2.3.5.1 would apply and the maximum cumulative horizontal armover length is 24 inches.

Section 9.2.3.5.2 is concerned with the pressure (100 psi or more) from a discharging sprinkler "pushing" the sprinkler above the ceiling where the water would be obstructed from reaching a fire. This is why the unsupported length is restricted to 12 inches. Where there is no ceiling to worry about, this is not a concern and the unsupported length may be up to 24 inches.

Question 11 - Attaching Coupons to Flow Switches or Fittings
There is a project where a pipe coupon was attached a flow switch but was knocked off and, presumably, lost.

Is there any requirement in NFPA 13 or NFPA 25 for pipe coupons to be attached to the flow switch at the location where the coupon was removed?

Answer: "No, pipe coupons or discs are not required to be attached to flow switches." NFPA 13-2016 6.5.5.2(2) requires discs (coupons) to be retrieved but does not require these discs to be attached to fittings or flow switches. However, attachment of the discs is often included as a project specification item for positive verification that the hole has been cut and that the coupon was retrieved.

> ***6.5.5.2 Outlet Fittings.*** *Rubber-gasketed outlet fittings that are used on sprinkler systems shall meet the following requirements:*
> *(1) Be installed in accordance with the listing and manufacturer's installation instructions*
> *(2) Have all disks retrieved*
> *(3) Have smooth bores cut into the pipe, with all cutting residue removed*
> *(4) Not be modified*

NFPA 25-2017 D.2.2 cautions that in some instances coupons or discs have been observed inside sprinkler system piping.

> ***D.2.2 Careless Installation or Repair.*** *Many obstructions are caused by careless workers during installation or repair of yard or public mains and sprinkler systems. Wood, paint brushes, buckets, gravel, sand, and gloves have been found as obstructions. In some instances, with welded sprinkler systems and systems with holes for quick-connect fittings, the cutout discs or coupons have been left within the piping, obstructing flow to sprinklers.*

Question 12 - Hydrant Flow Testing from Large Orifice Outlets

A scenario involves hydrant flow test information provided by an AHJ. The flow test was done through a 4-inch hydrant outlet with a velocity (pitot) pressure reading of 15 psi. The hydrant coefficient is 0.9 for the smooth, rounded outlet. The AHJ also applied an additional coefficient of 0.83 on top of the 0.9.

Where does this 0.83 coefficient come from?

Answer: NFPA 291, Recommended Practice for Fire Flow Testing and Marking of Hydrants, recommends an additional coefficient for calculating flow in larger (pumper) outlets being used on the hydrants. The additional coefficient is as follows:

Velocity Pressure	***Coefficient***
2 psi	*0.97*
3 psi	*.0.92*
4 psi	*0.89*
5 psi	*0.86*
6 psi	*0.84*
7 psi and over	*0.83*

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