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Best of August 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 August 2017. This information is being brought forward as the "Best of August 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 - Heat Treatment for Bedbugs

A thermal termite control process has been proposed for use in residential buildings protected with fire sprinkler systems. It has been noted that this method has been used in California and is gaining popularity on the East Coast.

Will the high temperature used in this process, typically 120° F to 140° F, affect sprinkler systems?

Answer: The answer to your question is "yes, most residential sprinklers are not intended to be exposed to ambient temperatures in excess of 100° F and exposure to those elevated temperatures could negatively affect sprinkler performance." Special care should be taken when heat treatment strategies are employed for pest control in sprinklered properties. Please find attached an NFSA white paper on heat treatment for bedbug mitigation. The featured pest is different but the potential impact on the sprinkler system is the same.

Additional information on bedbug treatment in sprinkler protected properties can be found on the National Fire Sprinkler Association website at www.nfsa.org by searching for "Bedbug."



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Question 2 - Listed Antifreeze Solution

Are any listed antifreeze solutions on the market?

Answer: At this time, there are no listed antifreeze solutions available. U.L. representatives have indicated that a solution in the near future is possible since test protocols have been established. However, no specific details could be divulged. This issue will be discussed during the upcoming NFPA 25 revision cycle since the September 30, 2022 sunset clause in NFPA 25-2017, section 5.3.3.4.1 is approaching. It is possible that the NFPA 25 committee will either extend the deadline for one or more cycles, or develop a TIA to extend the deadline if there is no solution available by September 30, 2022.

Question 3 - Installation of Sprinklers Below Fireproofed Bar Joists

A project in an existing building having 24-inch bar joists spaced 4 feet 6 inches on center is having fireproofing material applied so that the joists will be solid.

Would this be considered obstructed construction and allow the use NFPA 13-2010, section 8.6.4.1 to permit the installation of upright sprinklers with deflectors located one (1) inch below the bottom of the structural members?

Answer: The answer to this question is "No", this would not permit sprinklers to be installed one (1) inch below the structural members in this scenario. The only time you can place sprinklers one (1) inch below the structural members without taking into consideration the maximum depth of the members, is for concrete tee construction. As these are fireproofed bar joists, the sprinkler deflector would be limited to a maximum depth of 22 inches. Additionally, since the bar joists are greater than 22 inches, your only option would be to install the sprinklers in accordance with section 8.6.4.1.2(2) which allows you to install the upright sprinklers up to 22 inches below the deck, between the structural members while meeting the obstruction criteria set out by section 8.6.5.1.2.

Question 4 - Very Tall Building

What is a "very tall building" as referenced in NFPA 20 and how do these requirements correlate with IBC requirements for high rise buildings?

Answer: This criteria does not correlate to the additional criteria for high-rise buildings in the IBC that are over 420 feet in height. The "very tall building" in NFPA 20-2013, section 5.6 is not defined, nor is there charging text. The intent of section 5.6 is to address the situations where the fire department does not have the capability to deliver sufficient flow at sufficient pressure through the fire department connection to hose connections in the upper levels of the building. In short, if the fire department cannot supply water to the upper floors at design pressure, then the criteria in section 5.6 applies.

Concealed Spaces: Part 2

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The height of the very tall building in NFPA 20 is subject to the pumping capacities of the local fire department. The Annex of section 5.6 of NFPA 20 further explains the varying heights.

Question 5 - In-Service Testing of Sprinklers

Guidance is requested for a situation involving sample (in-service) testing of ESFR sprinklers (20-year test in accordance with NFPA 25) in a building with multiple systems and a total of 2,600 ESFR sprinklers.

If sample sprinklers are taken from each system and one of the sample sprinklers fails; do all the sprinklers from that system only or do all the ESFR sprinklers in the facility need to be replaced?

Answer: The answer is "It depends on how you choose the sample area for the sprinklers tested."

If a single sprinkler fails then all sprinklers in the sample area must be replaced. This requirement is found in NFPA 25-2017, section 5.3.1.3 (similar language was used in prior editions) which states that "Where one sprinkler within a representative sample fails to meet the test requirements, all sprinklers within the area represented (emphasis added) by that sample shall be replaced."

So the question becomes what area is represented by the samples sent in for testing. NFPA 25 doesn't provide a lot of detailed guidance when it comes to choosing the sample area but does give the inspector latitude in determining these representative or sample areas. Although NFPA 25 currently does not have much guidance on how to choose these areas, NFSA did submit a public input to the next edition of NFPA 25 to provide such guidance (see example below).

If the sprinklers sent in for testing represent the entire warehouse (all 2,600 sprinklers) then the answer is: "all the sprinklers must be replaced if a single sprinkler failed." Per section 5.3.1.2 the number of sprinklers to be tested for a sample area representing the entire facility (2,600 sprinklers) would be 1% or 26 sprinklers).

It may be a better practice to submit multiple sample areas so that if a sprinkler fails, only the sprinklers in the area represented must be replaced.

In the case of a facility with multiple systems, each system could represent a sample area and a different sample set could be tested for each individual system. This way, if a single sprinkler fails this testing, the required replacement is limited to the system and not all sprinklers in the entire building. In this case 1% but no less than 4 sprinklers would need to be tested per system. This requirement is found in NFPA 25-2017, section 5.3.1.2. This may lead to more sprinklers being tested but may result in less sprinklers needing to be replaced.

The sample areas could be further refined. For example, sprinklers in the warehouse area could be one sample area and the sprinklers in the office areas could be a second sample set.

For further clarification, an additional example is provided below. This example has been proposed to be added to annex section A.5.3.1.2 of the next edition of NFPA 25.

The sample sprinklers sent for testing can represent any group of sprinklers that is practical, keeping in mind that if one sprinkler in the sample set fails, then all sprinklers that the sample represents should be replaced. The following are examples of sample sprinklers chosen for testing:

Example #1: A warehouse has five overhead systems with 300 sprinklers per system, and an office area with 200 sprinklers. The warehouse sprinklers are all subjected to the same ambient environment and all of the office area sprinklers are subjected to the same ambient environment.

- Sample Option #1: All warehouse sprinklers as one sample set (1% of 1,500 = 15 sprinklers). All office sprinklers as one sample set (1% of 200 = 2, but a minimum of 4 sprinklers must be tested).
 - Total of 19 sprinklers tested.
- Sample Option #2: Each warehouse system as a sample set (1% of 300 = 3, but a minimum of 4 sprinklers must be tested, 4 x 5 = 20 sprinklers). All office sprinklers as one sample set (1% of 200 = 2, but a minimum of 4 sprinklers must be tested).
 - Total of 24 sprinklers tested.

Question 6 - NFPA 13R Sprinkler Requirements Beneath an Exterior Overhang

A project involving a four-story wood frame condominium building will have a sprinkler system designed and installed in compliance with NFPA 13R-2016. The first floor at grade has interior garages in each individual unit. There is a 19 feet wide by 70 feet long exterior overhang that is referred to as a "drive aisle" where the cars pull under the building to enter the garages. The overhang is built with wood joists with an exterior finish that is a smooth ceiling on the bottom of the joists.

Are sprinklers required to be installed under this exterior overhang?

Answer: The answer to the question is "no, NFPA 13R does not require sprinklers in that exterior location." As a rule, NFPA 13R does not require sprinklers under exterior projections with the exception being section 6.6.5.1. In this case, the exterior projection is not above a patio so sprinklers would not be required. If sprinklers are provided, they would need to be installed in accordance with NFPA 13, section 7.2.3.

6.6.5.1 Where a roof or deck is provided above, sprinklers shall be installed to protect attached exterior

balconies, attached exterior decks, and ground floor patios serving dwelling units in buildings of Construction Type V.

7.2.3 The design discharge and design area criteria for areas protected by quick-response sprinklers shall comply with NFPA 13 except as allowed by 7.2.3.1.

Question 7 - Maximum Protection Area of Coverage in Combustible Concealed Spaces

An opinion was requested about a recent project, which included an attic space with wood trusses spaced 4 ft.- 0 in. on center. It was asked if this configuration would be considered combustible, unobstructed construction with exposed members 3 ft. or more on center, which would allow a maximum protection area of coverage per sprinkler of 225 sqft. in accordance with NFPA 13-2016, Table 8.6.2.2.1 (a). It was also indicated that the discussion led to a question regarding combustible concealed spaces as referenced in NFPA 13-2016, section 8.6.4.1.4, which states "Sprinklers under a roof or ceiling in combustible concealed spaces of wood joist or wood truss construction with members less than 3 ft on center with a slope having a pitch of 4 in 12 or greater shall be positioned in accordance with Figure 8.6.4.1.4 and the requirements of 8.6.4.1.4.1 through 8.6.4.1.4.6." If either the structural spacing or pitch requirements noted are not met, would it be allowed to use the appropriate construction type for determining maximum protection (sans combustible concealed)? This also brought up a debate due to the differences in the maximum permitted spacing (120 sf versus 225 sf) based on consideration of the structural members being spaced 3 ft. on center versus 3 ft. 6 in. on center.

Answer: It is not surprising that combustible concealed spaces have been a point of discussion. Issues involving combustible concealed spaces and attics are often complicated. NFPA 13-2016, Table 8.6.2.2.1(a) includes a number of different permissible spacing and protection area limitations for light hazard occupancies based on construction type and system type. Once the variables are narrowed, the answer regarding the appropriate requirements becomes clear.

The information identified for the project indicated wood trusses spaced 4 ft. on center. This is clearly combustible construction, ruling out all options for noncombustible construction. Consideration of the construction as obstructed or unobstructed would depend on whether the trusses are greater than 70% open. The information for the project identified that these trusses were considered to be unobstructed construction. This would limit the information in the table to rows containing requirements for combustible, unobstructed construction with members spaced 3 ft. or more on center.

There are two sets of requirements provided for these configurations; one set of requirements for hydraulically calculated systems and a separate set of requirements for

pipe schedule systems. For hydraulically calculated systems, a maximum protection area of coverage of 225 sqft. and a maximum spacing of 15 ft. would be permitted. For pipe schedule systems, a maximum protection area of coverage of 200 sqft. and a maximum spacing of 15 ft. would be permitted. It should be noted that these same requirements would also apply to spaces with steep slopes having noncombustible (steel) structural members, which are also considered combustible, unobstructed construction with members spaced 3 ft. or more on center.

The requirements of section 8.6.4.1.4 are specific to steeply sloped roofs and ceilings (e.g. greater than 4 in 12) with wood joists or wood trusses spaced less than 3 ft. on center. If the concealed space does not have a slope greater than 4 in 12, does not have wood joists or wood truss construction, and does not have members less than 3 ft on center, NFPA 13-2016, section 8.6.4.1.4 would not apply. A spacing of 120 sqft. only applies where these three conditions exist. Hopefully, this provides the requested clarification regarding this subject. There have been a number of articles written by the NFSA Engineering Staff on this subject matter, including the recent Technically Speaking article by Victoria Valentine in the December 2016 Issue of SQ titled "Back to Basics: Reviewing Concealed Spaces" and the Technically Speaking Article in the March April 2017 issue of NFS Magazine titled, "Combustible Concealed Spaces: What do you do when there is no permitted omission for sprinkler protection?" These articles go into further discussion on the topic of concealed spaces.

Question 8 - Apartment Entryway

Guidance using NFPA 13R-2013 to determine the requirements for the protection of a two-story apartment building with a covered entryway serving two separate dwelling units was asked. Section 6.6.5 was referenced which states that "attached exterior balconies, attached exterior decks, and ground floor patios serving dwelling units in a building of construction Type V" require sprinkler protection. The Annex section A.6.6.5 states that open corridors, stairs and breezeways are not required to be protected with sprinklers. A drawing provided shows two open corridors which provide entry to two units. An additional drawing provided shows one of the dwelling units having a patio. Do these areas require sprinkler protection?

Answer: First, the patio serving one of the dwelling units would require sprinkler protection assuming this is Type V construction and there is an exterior protection above the patio.

Second, NFPA 13R would not require sprinkler protection for the open corridors leading into the units. However, the applicable building code might require these corridors to have sprinkler protection. The 2015 edition of the International Building Code had included a new section 903.3.1.2.2, which requires sprinklers to be provided in open-ended corridors and exterior stairways as specified in Section 1027.6, Exception 3.

Question 9 - Glycerine or Propylene Glycol

Is there is a definitive test to see if antifreeze in an untagged system is either glycerine or propylene glycol?

Answer: There is no field test able to determine what type of antifreeze is in a system. In order to determine the type of antifreeze in a system, you may contact a nationally recognized testing laboratory or manufacturers of antifreeze to see if a sample could be submitted to determine the type of antifreeze in the system. Otherwise, it would be recommended for the solution to be replaced with a premixed solution in accordance with the appropriate NFPA standard.

Question 10 - Seismic Bracing of In-Rack Sprinkler Branch Lines

In a facility where seismic protection is required, all attachments have been designed to attach to the main building structure. With regards to the rack structures, all overhead piping has been structurally braced up until the top of the drops supplying the in-rack systems. The drops are then secured to the rack structure with flexible couplings installed as shown in NFPA 13 (2016) Figure A.9.3.2.4. Is additional bracing required on in-rack branch lines 2 inches or less in diameter?

Answer: The answer to the question is "no, the rules for bracing in-rack piping are the same as for the rest of the system as per NFPA 13, section 9.2.1.2".

9.2.1.2 Storage Racks. Where sprinkler piping is installed in storage racks, piping shall be supported from the storage rack structure or building in accordance with all applicable provisions of Sections 9.2 and 9.3.

Section 9.3.5.5.1* only requires lateral bracing on branch lines 2 ½ inches in diameter or larger and section 9.3.5.6.1 does not require longitudinal bracing on branch lines at all.

9.3.5.5.1* Lateral sway bracing shall be provided on all feed and cross mains regardless of size and all branch lines and other piping with a diameter of 2-1/2 in. (65 mm) and larger.

9.3.5.6.1 Longitudinal sway bracing spaced at a maximum of 80 ft (24 m) on center shall be provided for feed and cross mains.

Question 11 - CMSA Sprinkler Protection in an Existing Building

In an existing building that is 37 ft in height and has rack storage, protection is provided by a ceiling level wet pipe sprinkler system with K11.2 sprinklers. The design criteria for the system includes 15 operating sprinklers at a pressure of 25 psi.

Will the owner be able to store Class III commodities to 20 ft in height with the existing protection or would the system need to be modified using K19.6 sprinklers and a design using 15 sprinklers @ 30 psi in accordance with NFPA 13-2016, Table 16.2.2.1?

Answer: The answer is "no, the owner will not be able to store Class III commodities to 20 ft in height with the existing protection," since this building is over 25 ft high. Assuming these sprinklers are CMSA type since 16.2.2.1 has been referenced, NFPA 13 would require the use of K19.6 CMSA sprinklers with a design including 15 sprinklers at 30 psi calculated.

NFPA 13 does not provide a CMSA protection scheme for buildings 27 ft high with K11.2 CMSA sprinklers and it has been correctly stated that Table 16.2.2.1 offers only one option (K19.6) when the ceiling height exceeds 35 ft but is less than 40 ft. However, if the sprinklers in question were CMDA type sprinklers and not CMSA type, this ceiling height would not be a concern and the K11.2 CMDA sprinklers could be used based on the appropriate criteria found in section 16.2.1.

Question 12 - Another Ceiling Cloud Question

A scenario involving three ceiling clouds located at the same elevation, 13-feet 2-inches above finished floor, and a ceiling deck at 24-feet above finished floor was described. The cloud ceiling panel sizes and locations are as follows: 8-feet by 18-feet with a 1-foot gap, 6-feet by 18-feet with a 1-foot gap, and 8-feet by 18-feet. Upright sprinklers will be located beneath the roof deck above.

Can extended coverage quick response pendent sprinklers be installed beneath the two outer cloud ceiling panels or would sprinklers be needed beneath each panel?

Answer: There are two approaches to dealing with the described cloud ceiling configuration. The first is to check if this would meet the cloud ceiling protection criteria outlined in NFPA 13-2016, section 8.15.24. This allows for omission of the upper ceiling sprinkler protection beneath the roof deck. Sprinklers would be installed below the cloud ceiling panels. However, in order to utilize this protection, the cloud ceilings need to meet the following criteria:

- 1) the cloud ceiling panels must be in the same plane, and smooth, flat, horizontal members;
- 2) the cloud ceiling system cannot be greater than 20-feet above finished floor;
- 3) The openings in the cloud ceiling system to the area above cannot be greater than 20 percent;
- 4) Any gap between the panel-to-panel or panel-to-wall cannot exceed 1-inch for every 1-foot of elevation (a 13-foot 2-inch cloud ceiling elevation is limited to a maximum 13.16-inch gaps);

5) the minimum dimension of any cloud cannot be less than 2-feet 6-inches.

Based on the description of the cloud ceiling system, a maximum 13.16-inch gap would be permitted between the cloud ceiling panels and the at the outer perimeter walls for the given cloud ceiling height. If the aggregate area of the openings in the cloud ceiling system is less than 20 percent open to the area above, it would be permitted to omit sprinklers at the upper roof deck. This would permit sprinklers to be installed below the cloud ceiling without additional protection above the cloud ceiling panels per section 8.15.24 and Table 8.15.24.1. It would be permissible to install extended coverage sprinklers below the cloud ceilings, but the sprinkler spacing would be limited to a maximum of 16-feet between sprinklers in accordance with NFPA 13, section 8.15.24.2.1.1.

The second approach to dealing with these clouds is the scenario where they do not meet the criteria outlined above. In this scenario, you would treat each cloud ceiling panel like an obstruction that prevents sprinkler discharge from reaching the hazard since the ceiling panels are greater than 4 ft. wide and would be greater than 18 inches below the deflectors of the sprinklers installed beneath the roof deck. The appropriate obstruction criteria from chapter 8 would applied for the selected sprinkler type. This would require a sprinkler to be located beneath any obstruction that is over 4-feet in width, which would require each cloud ceiling panel in the described scenario to have a sprinkler installed beneath it.

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