NFSA NATIONAL FIRE SPRINKLER ASSOCIATION
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TechNotes

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Editor - Mark Hopkins, P.E Issue # 371 April 11, 2017

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Best of March 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 March 2017. This information is being brought forward as the "Best of March 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 - Design Areas Beneath Barrel Ceilings

A building having 40-foot wide barrel ceilings with varying ceiling heights of 14 feet at the edges to 20 feet 3 ½ inches at the center is proposed to have sprinkler protection using three branch lines. One branchline will be installed along the top of the barrel vault and one along each side. Would a 30% area increase be required in accordance with NFPA 13-2013, section 11.2.3.2.4 when performing hydraulic calculations for this arrangement?

Answer: The answer to your question is "yes." A curved ceiling that has a continually changing slope, with the majority exceeding a slope of 1 in 6 would be required to have the 30% area of operation increase.
NFPA 13, section 11.2.3.2.4 states, "The system area of operation shall be increased by 30 percent without revising the density when the following types of sprinklers are used

on sloped ceilings with a pitch exceeding 1 in 6 (a rise of 2 units in a run of 12 units, a roof slope of 16.7 percent) in non-storage applications:

(1) Spray sprinklers, including extended coverage sprinklers listed in accordance with 8.4.3(4), and quick-response sprinklers

(2) CMSA sprinklers"
With a rise of approximately 6 ¼ feet and run of 20 from the edge of each vault to the center, the average slope is only about 1.875 in 6 (or 31.25%). The slope near the top is less than 1 in 6 but the slope along the edges is well in excess of 1 in 6. It could be argued that the area need only be increased by 30 percent for the portion of the area under excess slope but this is not directly supported by the standard.

Question 2 - Brass Extension Nipples

Is it permitted to use brass extension fittings as part of a drop to extend the sprinkler deflector below a lay in ceiling in accordance with NFPA 13-2010?

Answer: While NFPA 13-2010 does not include specific criteria regarding the use of extension fittings, the answer is "yes, if the requirements of NFPA 13-2016 can be used." This would require use of the equivalency provision of NFPA 13-2010, section 1.5.
New language was added to the 2016 edition of NFPA 13 to provide requirements for the use of extension fittings. NFPA 13-2016, section 6.4.8 allows the installation of a single extension fitting up to 2 inches without inclusion in the hydraulic calculations, provided that the internal diameter of the extension fitting has the same nominal inlet diameter as the attached sprinkler. This requirement would be applicable for extension fittings used with k-8.0 and smaller sprinklers in light and ordinary hazard occupancies only. Installation of multiple (two or more) extension fittings would not be permitted for larger dimensional needs. If needed, extension fittings having lengths greater than 2 inches could be used if specifically listed. However, these extension fittings would be required to be included in the hydraulic calculations.

Question 3 - Exposed Barrel Length of Dry Sprinkler When Using Insulation

A facility operator has insisted that insulation be wrapped around the "exposed barrel" of a dry type sprinkler to prevent freezing. The sprinkler manufacturer has claimed that the insulation would make the situation worse and will prevent the ambient temperature from warming up this exposed portion of the dry pendent above the cooler. Two

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questions were asked: Can pipe insulation be installed over the portion of the dry pendent that extends above a freezer? If yes, where would the exposed barrel length of a dry type sprinkler be measured from in accordance with Table 8.4.9.1 (a) of NFPA 13-2016 if insulation is wrapped around the sprinkler barrel?

Answer: The answer to the first question is "yes, but this would affect the exposed barrel length." Although it may be possible to install pipe insulation around the dry sprinkler barrel, this insulated portion of the dry barrel would not be considered part of the exposed barrel length.

NFPA 13 has very specific guidelines on measuring the exposed barrel length of a dry sprinkler. This guidance is found in NFPA 13, section 8.4.9.2, which states "The minimum barrel length shall be measured from the face of the fitting to which the dry sprinkler is installed to the inside surface of the insulation, wall, or ceiling leading to the cold space, whichever is closest to the fitting."

Section 8.4.9.2 requires the exposed barrel length to be measured from the face of the fitting to the inside surface of the insulation. Therefore, if pipe insulation is place on the barrel of the dry sprinkler, the barrel would not be considered exposed.

Dry sprinklers are required to have a specific exposed barrel length in a heated area (40°F and above) to prevent ice plugs and freezing. By covering this exposed length with insulation, it is in effect insulating that exposed barrel from the heated area since the insulation will prevent the ambient air from warming the barrel of the sprinkler. In this case, the insulation would do more harm than good as the sprinkler manufacturer had identified.

Question 4 - System Size (Protection Area) Limitation

NFPA 13-2016, section 8.2.3 addresses system size (protection area) limitations where mixed occupancy hazards are present. How would the size (protection area) of a sprinkler system be determined for a warehouse with a two-story office building? Does the "total area" include the area for both floors of the office or only the footprint of the building when discussing mixed hazards?

Answer: The answer is "the total area would include the combined areas of the warehouse and the lower level of the office building." Both NFPA 13-2016, sections 8.2.1 and 8.2.3 would be applied on a per
floor basis. NFPA 13, section 8.2.1 specifies building area limitations per floor of a building protected with any single sprinkler system. As an example, this means for a two-story building with a footprint of 30,000 square feet of storage on

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both floors, it would be acceptable to protect the entire building with a single system. NFPA 13, section 8.2.3 permits a system to protect mixed hazards where extra hazard or high piled storage do not exceed 40,000 square feet per floor and the total aggregate area including all light hazard or ordinary hazard areas is less than 52,000 square feet for each floor.

It should be noted that NFPA 13, section 8.2.4 requires that multistory buildings exceeding two-stories in height be provided with a separate floor control valve assembly per floor, which creates a separate sprinkler system on each floor. This would not be a concern for the two-story building identified, but is important to note for buildings having more than two-stories.

Question 5 - Pressure Relief Valves

NFPA 13-2016, sections 7.1.2, 8.16.1.2.3 and A.8.16.1.2.3 provide requirements for pressure relief valves and related discussion. Three separate questions have been asked regarding the use of pressure relief valves, which are each answered separately below.

Question 5.1: Can a pressure relief valve be utilized on a floor control valve assembly (FCVA)?

Answer 5.1: The answer to this question is "yes". Each system is required to have a pressure relief valve as indicated in NFPA 13, section 7.1.2. This can be through the pressure relief valve on a floor control valve assembly.

Question 5.2: In a multi-zoned building, are pressure relief valves required to be installed at each valve assembly (system)?

Answer 5.2: The answer to this question is "yes." As noted above, a pressure relief valve is required for each sprinkler system. NFPA 13-2016 section 3.3.23 defines a sprinkler system as "A system that consists of an integrated network of piping designed in accordance with fire protection engineering standards that includes a water supply source, a water control valve, a waterflow alarm and a drain. The portion of the sprinkler system above ground is a network of specifically sized or hydraulically designed piping installed in a building, structure, or area, generally overhead, and to which sprinklers are attached in a systematic pattern. The system is commonly activated by heat from a fire and discharges water over the fire area."

Based on this definition, each floor would have a separate system due to the inclusion of the floor control valve assemblies.

Question 5.3: What consideration should be given to any discharge at the floor control valve assemblies in stairwells?

Answer 5.3: Consideration should be given to any intermittent water that may discharge through a pressure relief valve. While there is no requirement to do so, if a drain riser is present it may be prudent to pipe the pressure relief to the drain riser to avoid accumulation of water.

Question 6 - Concrete Inserts

Do the requirements of NFPA 13-2013, section 9.3.7.8 regarding the use of ACI 355.2 qualified concrete anchors apply to hangers installed where seismic protection is provided?

Answer: The answer to your question is "yes." NFPA 13, section 9.3.7.8 states "Where seismic protection is provided, concrete anchors used to secure hangers to the building structure shall be in accordance with ACI 355.2, Qualification of Post-Installed Mechanical Anchors in Concrete and

Commentary, and installed in accordance with manufacturer's instructions." If seismic protection is being provided, all concrete anchors used for hangers supporting the system must be ACI 355.2 qualified. NFPA 13, section 9.3.7 applies throughout the system when seismic protection is required to be provided. In addition, it is important to remember that NFPA 13, section 9.1.1.5 requires all hanger components attached to sprinkler system piping and structure to be listed, unless otherwise permitted by sections 9.1.1.5.2 or 9.1.1.5.3.

Question 7 - Beam Pocket Rule and Sidewall Sprinklers

Clarification has been requested regarding the use of dry horizontal sidewall sprinklers for an unheated room approximately 15 ft by 40 ft having concrete tee construction. Would it be permitted to install sidewall sprinklers below the bottom of tees? Is so, is it appropriate to apply the beam pocket rule for placement of sprinklers?

Answer: The answer to your question is "no," it would not be appropriate to install sidewall sprinklers below concrete tees without modification and it would inappropriate to use the obstruction rules for sidewall sprinklers found in NFPA 13-2016, section 8.7.5.
NFPA 13-2016, section 8.4.2 provides specific conditions where sidewall sprinklers are permitted for use. These include the following:

(1) Light hazard occupancies with smooth, horizontal or sloped, flat ceilings;

(2) Ordinary hazard occupancies with smooth, flat ceilings where specifically listed for such use; and

(3) To protect areas below overhead doors
NFPA 13, Section 3.3.5.2 defines a flat ceiling as a continuous ceiling in a single plane. Section 3.3.5.4 defines a smooth ceiling as a continuous ceiling free from significant irregularities, lumps or indentations. A ceiling having concrete tees would not comply with either of these definitions. As a result, the use of horizontal sidewall sprinklers would not be appropriate without modifications to the ceiling.

Options would include: 1) installation of noncombustible or limited combustible ceiling assemblies (such as gypsum board or acoustic ceiling tiles) between tees resulting in a smooth flat ceiling, in which case dry horizontal sidewall sprinklers could be used as intended or 2) installation of a dry pipe sprinkler system with upright sprinklers complying with NFPA 13, section 8.6.4.1.2 (5).

Question 8 - Preaction Valve Testing

Clarification has been requested regarding NFPA 25 test requirements for preaction valves. NFPA 25-2017, Table 13.1.1.2 identifies that a full flow test of preaction/deluge valves shall be performed annually. However, section 13.4.3.2.5 identifies that the preaction valve shall be trip tested with the control valve fully open a every 3 years. Section 13.4.3.2.4 says during those years when full flow testing is not required, the preaction valve shall be trip tested with the control valve partially open.

Is it the intent of NFPA 25, that preaction systems valves be tested with the same frequency as dry pipe valves?

Answer: This section was confusing in the past editions since preaction and deluge valves were lumped together. In the 2017 edition, the committee separated the requirements to make it easier to understand the difference.

Preaction valves (except for those protecting freezers) are to be "trip tested with the control valve fully open" every 3 years, just like dry pipe valves. During the other 2 years, it is done with the valve partially
open, similar to the requirements for partial trip testing of dry pipe valves. The requirements have not changed in the new edition, but were just clarified and separated from the deluge valve requirements.

Question 9 - Standpipe Demand Flow Requirements

for Residential Podium Buildings

What maximum flow rate would apply for a standpipe system in a podium building having a sprinkler system designed and installed in accordance with NFPA 13 throughout the first floor and sprinkler systems designed and installed in accordance with NFPA 13R on residential levels 2 through 5?

Answer: The answer to your question is "1250 gpm." NFPA 14-2016, section 7.10.1.1.5 states "The maximum flow rate shall be 1000 gpm (3785 L/min) for buildings that are sprinklered throughout, in accordance with NFPA 13, and 1250 gpm (4731 L/min) for buildings that are not sprinklered throughout, in accordance with NFPA 13."

The NFPA 13R sprinkler systems provided on the residential floor levels of the building are not intended to provide the same level of protection for the structure as the sprinkler systems designed and installed in accordance with NFPA 13. As a result, NFPA 14 does allow the same reduction in the required standpipe flow demand. It could be argued that the first floor protected by the NFPA 13 sprinkler system only has a maximum standpipe system demand of 1000 gpm. However, unless the systems for the two buildings are installed separately the 1250 gpm maximum required above would be available on the first floor as well as in the upper floors anyway.

Question 10 - Comparison of Palletized and Solid Piled Storage

A project having exposed expanded Group A Plastics stored in solid piles to a height of 12 feet is intended to be protected using control mode specific application (CMSA) sprinklers. It has been noted that NFPA 13-2016, Table 15.3.1 provides CMSA protection criteria for palletized exposed expanded Group A plastics but not for solid piled storage. Would it be permitted to use the criteria for palletized storage for the same commodity since there is no criteria provided for solid piled storage?

Answer: The answer to this question is "No." Palletized storage arrangements are not necessarily a more severe scenario than solid piled storage. Palletized storage provides a structured arrangement where quantity is limited, where solid piled can be any shape or quantity. Additionally, there are typically two reasons for the omission of storage criteria in NFPA 13 tables, either the arrangement was never tested or it was tested with unsatisfactory results. In any event, no design criteria would be developed for the storage configuration. Solid piled exposed expanded Group A plastics presents a very different fire challenge compared to palletized exposed

expanded Group A plastics and cannot be directly compared.

Question 11 - Design Areas for K=11.2 and Larger Sprinklers

What is the rationale for NFPA 13-2013, section 12.6.9 permitting the use of the lower densities associated with high temperature rated sprinklers where ordinary and intermediate temperature sprinklers have a k-factor of 11.2 or larger for storage application?

Answer: This requirement permits the density curves (lower densities) associated with high temperature sprinklers in storage applications to be used when ordinary and intermediate temperature rated sprinklers are utilized with k-factors over 11.2. The rationale is that the larger orifice sprinkler will produce sufficient discharge to achieve fire control, which would not be achieved with sprinklers having smaller k-factors. Tests conducted with ordinary temperature k-5.6 and k-8.0 sprinklers demonstrated that higher densities were needed to control the number of sprinklers operating. Testing of high temperature rated sprinklers demonstrated fire control with lower densities and without concern for additional sprinklers operating beyond the design area. Testing of ordinary temperature k-11.2 sprinklers demonstrated performance exceeding the previous tests conducted using k-5.6 and k-8.0 high temperature sprinklers. As a result, the densities associated with high temperature k-5.6 and k-8.0 sprinklers were considered to be appropriate for ordinary temperature rated k-11.2 sprinklers.

Question 12 - Hydraulic Calculations of Light Hazard Systems with Standard Response Sprinklers

A tenant renovation (fit out) for an existing light hazard system equipped with standard-response sprinklers will use standard-response sprinklers to match the existing sprinklers as permitted by NFPA 13-2016, section 8.3.3.1 (5) and (6). After the modifications, hydraulic calculations will be required.

Would the area and density requirements of 0.1gpm/square feet over 1500 square feet be applicable for a light hazard sprinkler system with standard response sprinklers?

Answer: The answer to this question is "yes," this is a light hazard occupancy and the minimum density/area for light hazard occupancies is 0.1gpm/square feet over 1500 square feet. This does not change due the fact that standard response sprinklers are being used. Standard response sprinklers are permitted to be used in this case as the existing system uses standard response sprinklers

and the density area curve is based upon the occupancy classification and not on the type of sprinkler used.