NFSA NATIONAL FIRE SPRINKLER ASSOCIATION
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TechNotes

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Best of September 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 September 2017. This information is being brought forward as the "Best of September 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 - Main Drain Testing

Does main drain testing in a multi-story building need to occur at the riser where the underground enters the building, at each floor control valve, or at the auxiliary drain on each floor?

Answer: The answer depends on whether this is acceptance testing in accordance with NFPA 13, or part of testing procedures in accordance with NFPA 25. These two standards look at the testing differently due to the different scopes and applicability.

For acceptance testing in accordance with NFPA 13, the main drain test is required to be conducted for each system. Based on the definition of a sprinkler system provided in NFPA 13-2013, Section 3.3.23, the floor control valve assembly would be considered a separate system and

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a main drain test would be required to be conducted at each floor. The definition of Sprinkler System found in section 3.3.23, states:

> ***3.3.23* Sprinkler System.*** *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.*

The annex material in section A.3.3.23 provides additional clarification and states:

> ***A.3.3.23 Sprinkler System.*** *As applied to the definition of a sprinkler system, each system riser serving a portion of a single floor of a facility or where individual floor control valves are used in a multistory building should be considered a separate sprinkler system. Multiple sprinkler systems can be supplied by a common supply main.*

Additional clarification related to multi-story buildings is provided in NFPA 13, section 8.16.1.5.1, which states:

> ***8.2.4.1**** *Multistory buildings exceeding two stories in height shall be provided with a floor control valve, check valve, main drain valve, and flow switch for isolation, control, and annunciation of water flow for each individual floor level.*

NFPA 25 by contrast allows the annual main drain test to be performed at the supply lead-in to the building only. This concept is found in NFPA 25-2017, sections 13.2.5 and 13.2.5.1, which state:

> ***13.2.5****Main Drain Test. A main drain test shall be conducted annually for each water supply lead-in to a building water-based fire protection system to determine whether there has been a change in the condition of the water supply.*
>
> ***13.2.5.1****Where the lead-in to a building supplies a header or manifold serving multiple systems, a single main drain test shall be permitted.*

Question 2 - Fire Pumps in Series

Are there any requirements for the distance between the discharge of a horizontal split case pump and the suction of

a second horizontal split case pump when the two pumps are connected in series?

Answer: The answer to this question is, "No". There are no specific requirements for a minimum distance between the discharge flange of a first pump to the suction flange of the second pump in series. NFPA 20-2016, section 4.20 provides the requirements specific to series fire pump arrangement and does not discuss any minimum distances. However, a minimum distance may be required based on the piping arrangement between the discharge flange of pump one and the suction flange of pump two.

Section 4.15.6.3 specifies that there shall be no elbows or tees within a centerline plane parallel to the horizontal split-case pump shaft within 10 times the suction pipe diameter from the suction flange. Annex Figure A.4.15.6 provides a clearer representation of this concept, but this would mean when viewing the layout in a plan view, there would be no horizontal elbows or tees within 10 times the suction pipe diameter to the suction flange. This would allow for vertical elbows and tees in this distance.

Question 3 - Plastic Commodity Classification

Is it permitted to apply a reduction in commodity classification for ABS and HIPS plastic materials using flame retardants? The storage includes flat screen TVs, either ABS-FR or HIPS-FR plastic, exposed on racks. Would "Fire Resistant" (should be flame retardant) ABS and HIPS plastics be permitted to be downgraded from a Group A plastic?

Answer: Questions regarding hazard or commodity classification are difficult except in those circumstances where an NFPA committee has specifically addressed the issue. This is especially true because the classification is considered in many states to be the most important aspect of fire protection system design, and an obligation of the responsible design professional. One reason many states require involvement of a responsible design professional is to ensure that the site-specific attributes of the project are recognized and properly addressed, which cannot be accomplished in a generic manner.

In this case, since we are not aware of any relevant decisions by other NFPA technical committees, the responsible design professional should be encouraged to investigate the correlation to determine if a reduction can be made. There are many types of fire retardants, which have different impacts on the fire related performance of plastics. Without knowing specific information, such as heat release rate and flame spread, related to the plastic materials or having data related to the effectiveness of the flame

retardants on reducing these parameters, recommendations regarding reduction in commodity classification cannot be made.

Question 4 - Draft Curtain Sprinkler Requirements

A project having unenclosed stair openings is intended to be protected with draft stops and closely spaced sprinklers in accordance with NFPA 13-2016, section 8.15.4. There will be a concrete draft stop installed with closely spaced sprinklers at the front of the stair opening but no sprinklers to the side of this opening. Concerns were expressed that the configuration may not meet the requirements of section 8.15.4. Several questions were asked and answered separately.

Question 4a: Can concrete beams at the side and front of the stair be used as draft stops?

Answer 4a: It does not appear so, section 8.15.4.2 states that the draft stops must be installed:

- immediately adjacent to the opening
- Be at least 18 inches deep
- be of noncombustible or limited combustible construction.

The concrete beams are arranged to the front and one side of the opening with the other side of the stair being a wall. These beams appear to be over 18 inches deep (at least in the front). At the front of the stair, the draft stop (beam) does not appear to be immediately adjacent to the opening and there is a considerable distance between the draft stop (beam) and the beginning of the opening. As the term "immediately adjacent" is not defined in the standard, it is suggested to communicate with the architect, design engineer and the AHJ to confirm that this arrangement is acceptable. Assuming that it is acceptable, sprinkler coverage would be needed at the horizontal ceiling inside the draft stop.

An additional concern with the draft stop is the portion to the side of the opening. This draft stop extends from the bottom of a large concrete beam that is sloped. The draft stop depth below this sloped beam lessens along its length and does not extend 18 inched down through its entire length. However, the concrete beam itself would appear to meet the requirement of a draft stop.

Question 4b: There are closely spaced sprinklers at the front of the draft stop but not to the side. Are closely spaced sprinklers required at the side draft stop?

Answer 4b: Yes, closely spaced sprinklers are required to

surround the unenclosed opening.

Question 4c: As the side draft stop does not extend 18 inches down throughout its length, can the concrete beam itself be considered the draft stop?

Answer 4c: Yes, the beam itself seems to meet the requirement of a draft stop in accordance with 8.15.4. Since this configuration for vertical opening protection and draft stops is not standard, it is suggested to consult with the project's design professionals and the AHJ to determine acceptable protection for this situation.

Question 5 - Platforms

Would the space beneath a raised floor or platform located on the third floor of a building meet the criteria of NFPA 13, section 8.15.6.2 for the omission of sprinklers? The section is titled "Spaces under ground floors, exterior docks, and Platforms" and has the areas separated by commas indicating that they are unique and distinct. In other words, it is being interpreted as not being limited to ground floor platforms, but rather to platforms in general and they can be located anywhere in the building.

Is this interpretation correct?

Answer: The answer is "no", section 8.15.6.2 applies to crawl spaces (under ground floors) and exterior docks and platforms and not to platforms on the interior of the building. Although the grammar of the title of this section is misleading (the commas do suggest that these three areas are distinct areas), it is believed that the omission of sprinklers allowed by this would only apply to exterior platforms. This is based on the wording of the conditions of this section, namely "... protected against the accumulation of wind-borne debris." And the Report on Proposals for the 1991 revision of NFPA 13.

The 1991 edition of NFPA 13 was an entire rewrite of the standard to make the standard more user friendly and the 1991 edition was the first to have this exact wording, See below from the 1991 Report of Proposals (ROP):

4-4.1.7.5 (4-4.3 and 4-4.9.3) Spaces Under Ground Floors, Exterior Docks, and Platforms.

> *Sprinklers shall be installed in spaces under all ground floors, exterior docks, and platforms.*
>
> *Exception: Sprinklers shall be permitted to be omitted when all of the following conditions prevail:*
> *(a) The space is not accessible for storage purposes and is protected against accumulation of wind-borne debris;*
> *(b) The space contains no equipment such as*

steam pipes, electric wiring, or conveyors;
(c) The floor over the space is of tight construction; '
(d) No combustible or flammable liquids or materials that under fire conditions may convert into combustible or flammable liquids are processed, handled, or stored on the floor above the space.

The ROP for the 1991 edition indicates that this new wording was a combination of section 4-4.3 and 4-4.9.3 of the 1989 edition of NFPA 13.

Section 4.4.3 from the 1989 edition of NFPA 13 was titled: "Spaces under Ground Floors" and section 4-4.9 was titled Exterior Canopies, Docks, and platforms and Section 4-4.9.3 read as follows:

> ***4-4.9.3*** *Sprinklers shall be installed under exterior docks and platforms of combustible construction unless such place is closed off and protected against the accumulation of debris*

These sections are clearly limited to spaces under ground floors and exterior docks and platforms only and there is nothing in the 1991 ROP to suggest that the committee intended to extend this allowable omission to platforms on the interior of the building.

The area below a platform in the interior of the building would be a concealed space and sprinklers would need to be provided unless one of the exception of section 8.15.1.2 is applicable.

Question 6 - Determining Sprinkler Pressure Based on Average Height

For a warehouse with varying ceiling deck heights ranging from 30 feet 6 inches to 32 feet 9 inches would it be permissible to use the average ceiling deck height to determine the appropriate sprinkler pressure?

Answer: The answer to your question is "no, it is necessary to use the actual sprinkler deflector elevations for calculations". For purposes of early estimation, it might be reasonable to use the highest deflector level to approximate hydraulic demands but plans submitted for approval and construction would need to be based on actual deflector heights.

Question 7 - Substituting a Backflow Assembly for OS&Y Control Valve

NFPA 20-2016, section 4.15.5 and its subsections require an OS&Y type control valve on the fire pump the suction piping.

4.15.5 Valves*.

***4.15.5.1** A listed outside screw and yoke (OS&Y) gate valve shall be installed in the suction pipe.*

***4.15.5.2** No control valve other than a listed OS&Y valve and the devices as permitted in 4.28.3 shall be installed in the suction pipe within 50 ft (15.3 m) of the pump suction flange.*

***A.4.15.5** Where the suction supply is from public water mains, the gate valve should be located as far as is practical from the suction flange on the pump. Where it comes from a stored water container, the gate valve should be located at the outlet of the container. A butterfly valve on the suction side of the pump can create turbulence that adversely affects the pump performance and can increase the possibility of blockage of the pipe.*

Can a backflow assembly including listed OS&Y control valves installed as required by the water utility serve as the required OS&Y control valve?

Answer: The answer to the question is "yes, it is permissible to utilize the listed OS&Y valves on a backflow assembly as the OS&Y required by 4.15.5.1." Note, however, that the backflow assembly must be installed at least 10 pipe diameters away from the pump suction flange in accordance with NFPA 20, section 4.28.3. In situations where the backflow assembly is installed a significant distance away, there may be practical value in installing a redundant OS&Y closer to the pump.

***4.28.3** Devices in Suction Piping. Where located in the suction pipe of the pump, check valves and backflow prevention devices or assemblies shall be located a minimum of 10 pipe diameters from the pump suction flange.*

Question 8 - Sprig with Horizontal Offset

A sprig having an approximate 3 ft. vertical height with a 1 ft. horizontal offset has been identified. NFPA 13-2010, section 9.2.3.7 states, "Sprigs 4 ft. and longer shall be restrained to prevent movement." Is the horizontal offset length required to be included in the sprig measurement?

Answer: The answer to your question is "no." Portions of the described configuration with the horizontal offset would meet both the definitions of armover (section 3.5.3) and sprig (section 3.5.10).

An armover is defined as "a horizontal pipe that extends from the branch line to a single sprinkler or a sprinkler above

and below a ceiling." The horizontal section of pipe in the assembly would meet this definition. Since it is limited to 12 inches (1 ft) a hanger would not be required by NFPA 13, section 9.2.3.5.1 or section 9.2.3.5.2.1.

A sprig is defined as "a pipe that rises vertically and supplies a single sprinkler." Considering that by definition a sprig is "a pipe," the overall assembly would not be considered a sprig. The 2 ft. vertical section of pipe with the sprinkler could be considered as a sprig. Given that this length is less than 4 ft., a lateral support would not be required based on section 9.2.3.7. However, a practical consideration is that the restraint required by section 9.2.3.7 is to prevent the vertical pipe from twisting in the fitting causing the deflector to be misaligned with the ceiling or loosening a joint and causing a leak. Although the measured assembly contains a sprig that is less than 4 ft. long, the geometry of the configuration may actually be of greater concern. As a result, a lateral restraint should be considered even though it is not required by section 9.2.3.7.

Question 9 - Hydraulic Node for a Looped Underground Main

A project with a looped underground main serving as the water supply used the point of connection between the sprinkler system and main as the endpoint for your hydraulic calculations. The AHJ has required that the endpoint be extended to the base of the hydrant used for flow testing based on NFPA 13-2016, section 23.4.1.6.

> ***23.4.1.6*** *Hydraulic calculations shall extend to the effective point of the water supply where the characteristics of the water supply are known.*

Is this the correct interpretation of NFPA 13-2016, section 23.4.1.6?

Answer: The answer to the question is "no, the requirement is to extend the calculations to the point where the water supply characteristics are known; not the to point where measurements were taken to estimate the water supply". Hydrant flow testing is a means for determining the capacity of the water main, not just the specific capacity of the test hydrant. The data obtained from a flow test conducted at a hydrant on the same main serving the sprinkler system and in the vicinity of the system should provide a good estimate of the capacity available at the point of connection; this is typically the point of the water supply where the "characteristics of the water supply" are known. It is not the intent of the standard to require calculations to be carried back to the test hydrant as the hydraulic data required to do so is often not readily available. The purpose of the test is to determine the water supply pressure and demand directly from the flow test as per 24.2.2.2*.

24.2.2.2* *The volume and pressure of a public water supply shall be determined from waterflow test data or other approved method.*

Question 10 - Draft Stops

For a situation where sprinklers and draft stops are being used to protect a vertical opening, the design of the ceiling poses obstacles which make it difficult to position sprinklers exactly 6 feet apart. Referencing NFPA 13-2016, sections 8.15.4.3.1 and 8.15.4.3.2 regarding separation of sprinklers, it has been observed that these rules indicate that sprinklers must be placed exactly 6 feet apart with no tolerance: They are not permitted to be placed any more than 6 feet apart but require baffling between them if they are any less than 6 feet apart.

8.15.4.3.1 *Sprinklers shall be spaced not more than 6 ft (1.8 m) apart and placed 6 in. to 12 in. (150 mm to 300 mm) from the draft stop on the side away from the opening.*

8.15.4.3.2 *Where sprinklers are closer than 6 ft (1.8 m), cross baffles shall be provided in accordance with 8.6.3.4.2.*

Will the standard permit any exceptions without baffles?

Answer: The answer to your question is "yes, but this situation should be discussed with the AHJ." The 6-foot separation is arguably a nominal rather than precise measurement. The standard does not require the precision of "6.0 feet"; just "6 feet". The nominal nature of this dimension can be demonstrated by comparing the SI requirement, 6 feet, to the metric requirement, 1.8 meters. Strictly speaking, 1.8 meters does not equal 6 feet: It equals about 5 feet 107/8 inches. Based on that conversion and section 1.6.3*, it can be argued that the standard actually permits the sprinklers to be slightly less than 6 feet apart and not require baffles. Based on the idea that the 6-foot limit is nominal, an AHJ may permit spacing to vary slightly from 6 feet in order to avoid obstructions; possibly more than the plus or minus 1 inch implied in the soft unit conversion.

1.6.3* *Some dimensions used in this standard are exact and some are not. Nominal dimension are often used, such as the dimensions used for pipe sizes. The metric equivalent shown in this standard might not be an exact conversion to the SI unit, but the nominal metric equivalent is typically used or a reasonably equivalent value or approximate conversion is used. It shall be acceptable to use the exact conversion or the conversions stated in the standard, even though they might not be exact.*

Question 11 - Monitored Control Valve Above a Dry Pipe Valve

Can a monitored control valve be installed above a dry pipe valve for the purpose during hydrostatic testing so the dry pipe valve does not get pressurized during testing?

Answer: The answer is "No", NFPA 13 requires that all piping and attached appurtenances, including the dry pipe valve, be subject to the hydrostatic test. You are not permitted to use an control valve to isolated the dry pipe valve from this test. This requirement is found in NFPA 13-2016, section 25.2.1.1, which states:

25.2.1.1 *Unless permitted by 25.2.1.2 through 25.2.1.5, all piping and attached appurtenances subjected to system working pressure shall be hydrostatically tested at 200 psi (13.8 bar) and shall maintain that pressure without loss for 2 hours.*

It is true that certain dry pipe valves may be damaged by the "high" pressures experienced during a hydrostatic test. To mitigate this concern, NFPA 13 identifies for differential dry pipe valves, the clapper needs to be held off the seat during hydrostatic test. This requirement is found in section 25.2.1.12 which reads:

> ***25.2.1.12*** *When subject to hydrostatic test pressures, the clapper of a differential-type valve shall be held off its seat to prevent damaging the valve.*

Question 12 - Three-Year Air Test

NFPA 25-2014, section 13.4.4.2.9 states "Dry pipe systems shall be tested once every 3 years for gas leakage...." This is a hard sell to building owners especially if the system appears to be holding fine, no leaks are observed, and the air compressor is not running excessively.

What is the reasoning behind the requirement to test the dry system every three years for gas leakage?

Answer: The purpose of this requirement is to protect the building owner. This test will ensure that there are no major leakage problems within the system. As stated in the NFPA 25 handbook "*Dry pipe systems that have excessive leakage can become costly for owners who constantly have to drain dry piping that becomes inadvertently filled*." This three-year leakage test will ensure that the system does not trip even in instances where the air compressor is offline such as during a power outage.

This provision was added to NFPA 25 in 2008. Prior to 2008, NFPA 25 allowed a 10 psi pressure loss per week, however, this loss was difficult to detect because the air compressors made up this loss. The provisions of section 13.4.4.2.9 outlines two options for testing for gas leakage and gives a concrete way to determine if the system is leaking excessively. This section reads as follows:

13.4.4.2.9* *Dry pipe systems shall be tested once every 3 years for gas leakage, using one of the following test methods:*

(1) A gas (air or nitrogen) pressure test at 40 psi (3.2 bar) shall be performed for 2 hours.

(a) The system shall be permitted to lose up to 3 psi (0.2 bar) during the duration of the test.

(b) Gas leaks shall be addressed if the system loses more than 3 psi (0.2 bar) during this test.

(2) With the system at normal system pressure, the gas source (nitrogen supply, compressor, or shop air) shall be shut off for 4 hours. If the low pressure alarm goes off within this period, the leaks shall be addressed

Clarification - Best of July, Issue# 380

A clarification is needed for the response to Question 1 of the Best of July, Issue # 380. The response to question 1a did not include reference to use of quick response sprinklers with the room design method in a residential occupancy in accordance with NFPA 13. It could read to imply that you can use the room design method with residential sprinklers, which is not the case. When using residential sprinklers, four sprinklers must be included in the hydraulic calculations. To take advantage of the passive fire resistive construction using the room design method quick response sprinklers would be required. This might be one area of NFPA 13 that may warrant a change in the future to acknowledge the use of fast response operating elements with residential sprinklers.