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

TechNotes

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Best of June 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 June 2017. This information is being brought forward as the "Best of June 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 - Strainers in Fire Protection Systems

Are strainers allowed to be installed on fire protection backflow preventers on the incoming water service?

Answer: The answer is to this question is "yes," strainers for fire protection use are permitted. Such strainers are required to be listed. Strainers are required to be installed in the main water supply where sprinklers having a k-factor of 2.8 (4) or less are used per NFPA 13-2016, sections 7.7.6, 7.9.10, 8.3.4 and 8.15.13.4. Strainers may also be required by local plumbing codes when solid materials, rocks and debris are known to exist in the water supplies.
Friction loss for strainers is required to be included in the hydraulic calculations per NFPA 13-2016, sections 23.4.3.3 and 23.4.4.8.1

Upcoming Technical Tuesdays

July 18, 2017

NFPA 13 and Sprinklers Under

Question 2 - Adjustment of the C-value for System Alterations

Is it required to adjust the Hazen-Williams friction loss coefficient (c-factor) value when calculating an alteration to an existing system? As the existing system has been installed for some time; scale and buildup within the system is anticipated.

Answer: The answer to this question is: It depends. NFPA 13-2016, section 23.4.4.8.1 indicates that hydraulic calculations shall be conducted using Hazen-Williams C Values from Table 23.4.4.8.1.

The C value for galvanized or black steel used in wet pipe and deluge systems would be 120. This would allow for some degradation of the pipe interior surface since new pipe would have an actual C value closer to 140 or 150.

The C value for galvanized or black steel used in in dry pipe and preaction systems would be 100. This would allow for scaling.

The footnote at the bottom of the table also indicates that the AHJ is permitted to allow other c values. If a lower c value is needed. Testing or some other justification of the value below 100 should be provided to support the adjustment.

Buildup of material within the pipe would trigger an obstruction investigation in accordance with NFPA 25-2017, section 14.3. This would require an internal examination of the piping or alternative nondestructive examination such as ultrasonic scanning as required by section 14.3.2. Hydraulic or hydro-pneumatic flushing would be a possible solution for removal of the debris as suggested in annex D, sections D.5.3 and D.5.4.

Question 3 - Bathroom with Glass Door

There is a bathroom in a dwelling unit in a building protected by an NFPA 13 sprinkler system. The water closet is separated from the rest of the bathroom by a full height glass door. The water closet "room" is less than 55 sq. ft.
In order to eliminate the sprinkler in this small toilet area, does this glass door need to have a 15-minute thermal barrier rating?

View older issues in the "Member's Only" section

Did You Know??

The NFSA keeps a member of the Engineering Department staff on duty every business day to answer your technical questions live. We call this the Expert of the Day (EOD) program and it is available to our members by phone, fax or e-mail. Call us at (845) 878-4200 and press 2, or you can send a fax to (845) 878-4215, or you can e-mail us at eod@nfsa.org. Last year we answered more than 2600 requests for assistance.

Answer: The answer is "no", section 8.15.8.1 of the 2016 edition of NFPA 13 states that sprinklers may be omitted from small bathrooms (not exceeding 55 sq ft) in dwelling units that have walls and ceilings with a 15-minute thermal barrier.
The requirement for this thermal barrier is specific to the walls and the ceilings and does not extend to the doors. In fact, as stated in the annex to this section, a door is not necessary at all in order to omit sprinklers. This annex section reads as follows:

"*A.8.15.8.1.1 A door is not required in order to omit sprinklers as long as the bathroom complies with the definition for compartment."*

If a door is not required, it stands to reason that, if a door is present, the 15-minute thermal barrier is not required for this door.

It must be noted that this annex section does state that the door is not required as long as the bathroom meets the definition of a compartment. This means the door opening (with no door) may be 36 inches wide if there is no lintel and up to 8 ft wide if there is an 8-inch lintel.

As there is a door (a full height glass door) this opening does not necessarily have to meet the definition of a compartment (and its opening requirements) as long as it is considered a room. NFPA 13 defines a bathroom as a *room or a compartment* (see section 3.3.2). NFPA 13 does not define a room, however Merriam-Webster's Collegiate Dictionary, 11th edition does define a room as "*a partitioned part of the inside of a building".* As you have stated that the glass door is a full height door, this would be a partitioned part of the building and would be considered a room.

Based upon this, even if the door opening does not meet the criteria of a compartment and it is considered a room, the door would not need to have a 15-minute thermal barrier as 8.15.8.1.1 specifically states walls and ceilings must have this thermal barrier.

Question 4 - Fire Department Connection Signage

NFPA 14-2013, section ***6.4.5.2.2*** *states:"A sign also shall indicate the pressure required at the inlets to deliver the system demand."*

The question is: Is this signage required to be on the exterior of the building at the FDC?
If so, I have rarely seen this code enforced. Typically, I've only ever seen it where standpipe demand exceeds

150psi at the inlets. What is the intent of this section of the code?

Answer: The answer to your question is that the intent is to provide important operational information at the immediate location of the FDC for fire service personnel responding to an emergency. The signage required by NFPA 14, section 6.4.5 is intended to clearly identify manual standpipe systems and to distinguish between standalone standpipes and combination standpipe/sprinkler systems.

NFPA 14, section 6.4.5.2.2, in particular, is intended to advise responding personnel how much pressure is required to produce the required design pressure at the hydraulically most remote point in the system; usually the hose connection on the uppermost floor. Given that 150 psi is a commonly recommend default pressure for the support of sprinkler and standpipe systems in fire department standard operating procedures, it is not uncommon for AHJs to permit the omission of the demand pressure sign if the calculated system demand is 150 psi or less. However, a strict reading of the standard requires a demand pressure sign regardless of the required pressure.

Question 5 - Laying Sprinkler Pipe on Bar Joist

A sprinkler main is to be supported by resting on the bottom chord of a truss at the "V" formed by two web members. The main is to be attached to the truss with an inverted teardrop ring and to the bottom chord of the truss with a listed horizontal fastener.

Is this arrangement permissible per NFPA 13?

Answer: The answer to your question is "yes, provided that the hanger assembly is not weight bearing and that the truss assembly has suitable load bearing capacity at the point(s) of support". NFPA 13, section 9.2.1.3.1 implicitly permits piping to be supported on top of structural elements provided that they are stabilized in place. Although supporting the weight of the pipe in this configuration would be outside of the listing for the hanger assembly, it is arguably not required to function as a listed assembly if it is only providing stabilization.

This concept is discussed in the annex to section 9.1.1 which reads as follows:

Section A.9.1.1 - *"As an alternative to the conventional method of hanging pipe from the structure using attachments and rod, the piping can be simply laid on the*

structural member, provided the structure can adequately support the added load in accordance with 9.2.1.3.1 and the maximum distance between supports as required by Chapter 9 is not exceeded. Listed pipe should still be installed and supported in accordance with its listing limitations. To prevent pipe movement, it should be secured with an approved device to the structure and located to ensure that the system piping remains in its original location and position."

Question 6 - Extra Hazard Pipe Schedule System for Storage

An existing Extra Hazard Pipe Schedule System is protecting a warehouse. The owner of the building wants to store Group A plastic in this building. Is an existing extra hazard pipe schedule system sufficient for 20 feet high storage of Class IV commodity on racks and 8 feet high storage of unstable Group A non-expanded Plastic materials.

Answer: NFPA 25-2017 is the governing document for when there are changes of occupancy, use, process or materials in a building protected by a water-based fire protection system. As such, section 4.1.6 of NFPA 25 requires an evaluation of the existing system for adequacy to protect this change in occupancy, use, process or materials in the facility.

Based on the protection criteria in NFPA 13-2016, you would be unable to protect 20 feet high storage of Class IV commodities and would also not be likely to protect 8 feet of the Group A plastics either. This is because pipe schedule is not allowed for storage occupancies, but could be used for low-piled or miscellaneous storage under Chapter 13 of NFPA 13. The 20 feet high storage of Class IV commodity could not be considered low-piled nor miscellaneous storage and therefore you would need to reference the applicable design criteria for the Class IV commodity in Chapter 16 of NFPA 13. In regard to the Group A Plastics, you may be able to protect this with the existing extra hazard pipe schedule if this is considered miscellaneous storage, which would require you to meet the definition of miscellaneous per section 3.9.1.18 of NFPA 13-2016. If this does not meet the definition of miscellaneous storage, you would then need to follow the requirements of Chapter 15 in NFPA 13.

It should be noted that while existing extra hazard pipe schedule systems are still allowed, there are no provisions that allow for new extra hazard pipe schedule systems for any situation.

Question 7 - Beams as Baffles

A portion of a storage warehouse is being converted from standard spray upright (SSU) sprinklers to ESFR sprinklers. The new ESFR portion ends at a 24-inch deep I-beam and the existing standards spray sprinklers will continue the other side of this beam.

Does the I-beam can count as the required draft curtain separating the systems if it is sealed tight to the ceiling at its upper edge?

Answer: The answer to your question is "yes, as long as the draft curtain and aisle arrangement below complies with NFPA 13 (2016) 8.4.6.4". NFPA 13 sections 8.4.6.4.1 and 8.4.6.4.2 state:

"8.4.6.4.1 Where ESFR sprinkler systems are installed adjacent to sprinkler systems with standard-response sprinklers, a draft curtain of noncombustible construction and at least 2 ft (0.6 m) in depth shall be required to separate the two areas.
8.4.6.4.2 A clear aisle of at least 4 ft (1.2 m) centered below the draft curtain shall be maintained for separation."

The standard does not require a separate assembly to serve as a draft curtain if the structure already provides a sufficient continuous barrier to collect smoke and heat as per section 3.3.8. (The 2016 edition is cited below. Similar language appears in all recent editions.)

"3.3.8 Draft Curtain.A continuous material protruding downward from the ceiling to create*
a reservoir for collecting smoke and heat."

Question 8 - Gridded System with Different K-Factor Sprinklers

A project is to have a gridded sprinklers system. The intent is to use k-16.8 CMSA sprinklers in a portion of the building and sprinklers with larger k-factors in other areas of the building. There are no walls separating the different areas.
Are sprinklers with different k-factors permitted to be used or must larger k-factor sprinklers must be used throughout?

Answer: The answer to this question is yes, different k-factor sprinklers are permitted to be used. For the described scenario, there would be four (4) options. The first option would be to use sprinklers with the larger k-

factor throughout. However, this may require larger diameter piping to be used throughout. The other options are identified in NFPA 13-2016, section 12.3.

NFPA 13, section 12.3 states the following:

"12.3 Adjacent Hazards or Design Methods. For buildings with two or more adjacent hazards or design methods, the following shall apply:*
(1) Where areas are not physically separated by a barrier or partition capable of delaying heat from a fire in one area from fusing sprinklers in the adjacent area, the required sprinkler protection for the more demanding design basis shall extend 15 ft (4.6 m) beyond its perimeter.
(2) The requirements of 12.3 (1) shall not apply where the areas are separated by a draft curtain or barrier located above an aisle, horizontally a minimum of 2 ft (600 mm) from the adjacent hazard on each side, or a partition that is capable of delaying heat from a fire in one area from fusing sprinklers in the adjacent area.
(3) The requirements of 12.3 (1) shall not apply to the extension of more demanding criteria from an upper ceiling level to beneath a lower ceiling level where the difference in height between the ceiling levels is at least 2 ft (600 mm), located above an aisle, horizontally a minimum 2 ft (600 mm) from the adjacent hazard on each side."

The described scenario would be considered as two adjacent hazards. Therefore, any of the three options of 12.3 could be considered. If there is no physical separation required or provided, the protection method used for the higher hazard would need to be extended into the lower hazard area by 15 ft beyond its perimeter as identified in section 12.3 (1). The second option would include the use of draft curtains or barriers located above aisles with a minimum of 2 ft horizontal separation from the adjacent hazards as identified in section 12.3 (2). The third option applies when multiple ceiling levels exist.

There are other considerations regarding temperature rating, thermal sensitivity and draft curtains. NFPA 13, section A.12.3 identifies design area perimeter increases when high temperature rated sprinklers are used. These range from 30 to 55 ft, e.g. increases of 15 to 40 ft of the higher protection method into the lower hazard area. This relates to option (1) where the higher hazard protection method would be extended 15 ft beyond the perimeter of the higher hazard. Another consideration relates to thermal sensitivity. If ESFR sprinklers with k factors larger than k-16.8 are used in the adjacent areas, draft curtains might be required per NFPA 13, section

8.4.6.4 if applicable. However, the use of sprinklers having different k factors would be permitted for use in protecting adjacent hazards.

Question 9 - Sizing Fuel Tank for Diesel Fire Pump

A fuel tank for a diesel fire pump is to be located in a room which limits tank capacity. NFPA 20 section 11.4.2.1 refers to a capacity based on 1 gallon per HP while the annex refers to sizing based on 8 hours of run time.

The specific fire pump has a 525 HP motor requiring a storage tank with a minimum volume of 577 gallons (525 HP x 1.1 gal/HP = 577 gal). However, a 537-gallon tank designed to fit within the room has been proposed.

What is the proper way to size this diesel fuel tank?

Answer: The required fuel tank size would be 577 gallons unless otherwise approved by the AHJ. The language in the body of the standard (NFPA 20 section 11.4.2.1) defines the requirement. The language in the annex (A.11.4.2.1) is for clarification purposes only. As a result, the requirement is to size the tank to provide 1 gallon of fuel per HP. The annex clarifies that diesel fire pumps will typically consume 1 pint per hour. The 8-hour duration was calculated by multiplying 1 pint per hour by the conversion of 8 pints per gallon. There is no further clarification provided in the handbook.

The book titled "Pumps for Fire Protection Systems" by Isman and Puchovsky provides some additional discussion regarding this issue. While this is not part of the standard it does provide background information regarding the 8-hour duration. The following is stated in the book:

"*Every fire protection system has a specified minimum duration, and the pump needs to run for that full duration. None of the fire protection standards require a duration as long as 8 hours, but after the fire, some fuel should remain in the tank so that the fire protection system can be put back in service and the building reoccupied. In addition, the engine needs to be run at least 30 minutes each week for maintenance and once each year an annual test needs to be run. So the fuel tank needs to be large enough to supply the weekly and annual runs of the pump plus the duration of the fire protection system, plus the duration of the fire protection system again. Sometimes depending on the frequency with which the tank is refilled, these durations may exceed the size required using the one-gallon per horse power rule, so*

the size of the tank must be increased or the frequency with which the tank is refilled needs to be changed."

The section goes on to explain why the 5% volume is required for sump and expansion.

It would be advantageous to discuss the actual fuel consumption rate with the manufacturer. If the actual consumption rate is less than 1 pint per hour, then there may be an opportunity to discuss sizing the tank based on the actual consumption rate multiplied by the 8-hour duration. Having a lower consumption rate would result in a smaller required fuel tank capacity. If this is the case, the AHJ might permit a smaller tank size.

It is also interesting to look at the actual numbers. The 537-gallon tank is sized to meet the 525-gallon requirement, but does not provide adequate space for sump and expansion or the tank provides 488.2 gallons of storage with 5% sump and 5% capacity for expansion; e.g. 537 gallons divided by 1.1. Neither of these perspectives changes the fact that the fuel storage volume is less than that required based on the requirement of Section 11.4.2.1 to provide 1 gallon of fuel per HP plus 5% for sump and 5% for expansion. The amount of fuel provided exceeds the minimum amount of fuel necessary to operate the fire pump to meet the water supply duration of the pump plus the weekly maintenance run and annual test requirements of the pump, but does not meet the reserve capacity as referred to in the book by Isman and Puchovsky. The AHJ might be willing to discuss arrangements where the tank is refilled on a frequent basis to ensure that the duration requirements and test requirements are met or consider that the fuel tank would need to be refilled after a fire. Otherwise, the required fuel tank size would be 577 gallons based on the 1 gallon per 1 HP rule.

Question 10 - Water Delivery Time for Dry Systems

The question has been asked to provide clarification on the options to meet the water delivery time requirements for a dry pipe system in accordance with the 2013 edition of NFPA 13. The specific project consists of a dry pipe system protecting high-piled storage.

Question 10.1: Section 7.2.3.1 of the 2013 edition of NFPA 13 appears to give (5) options to meeting this criterion. Does this mean only (1) of these (5) options has to be met?

Answer 10.1: Yes, section 7.2.3.1 gives 5 options for determining system capacity (and by extension water

delivery time). Only one of these five options need to be met. This is made clear by the use of the word "or" in this section. Section 7.2.3.1 reads as follows:

7.2.3.1* *The system capacity (volume) controlled by a dry pipe*
valve shall be determined by 7.2.3.2, 7.2.3.3, 7.2.3.4, 7.2.3.5, or
7.2.3.7.

Question 10.2: If a water delivery calculation using a program per 7.2.3.5 is performed does the 60-second water delivery time per 7.2.3.2 need to be met?

Answer 10.2: No, as stated above, only one of the five options listed in section 7.2.3.1 needs to be met. If the requirements for a water delivery calculation per section 7.2.3.5 is met, there is no need to also meet the 60 second requirement of section 7.2.3.2.

Question 10.3: The 40 second water delivery time requirement (Table 7.2.3.6.2) utilizing a water delivery calculation has been met. For system testing can a single inspector's test with no water delivery requirement be used? or would it need to meet 60 seconds water delivery time requirement?

Answer 10.3: For system testing, where the water delivery calculation method was used, there is no requirement to meet the 60 second requirement. The test is performed utilizing the inspector's test but there is no requirement to meet any specific water delivery time.

It should be noted that per NFPA 25, you still need to record the trip time and the water delivery time. Even though the trip time of the valve is not required to be any specific time in order to pass the NFPA 25 trip test, it is important to record this time during the test and keep that data for future use. It is also important to record the water delivery time. Comparison of this time to previous times is useful in assessing the overall condition of the dry-pipe system. For example, if a much longer time on a recent test was noted as compared to an earlier test, this may be an indication that something is wrong or has changed within the system. This requirement is found in section 13.4.5.2.5.2 of the 2017 edition of NFPA 25 which reads:

13.4.5.2.5.2 *Records of dry pipe valve tripping time and water transit delivery time to the inspector's test connection shall be maintained for full flow trip tests.*

Question 11 - Proper Coverage of Floating Ceilings

A project where there are a number of offices which have "floating ceilings" has been described. These "floating ceilings have a 1-foot gap between the walls and the acoustical drop ceiling creating an opening around the drop ceiling. All the offices will have adequate coverage of the floor space from the acoustical ceiling sprinkler(s). Is additional sprinkler coverage required above the acoustical ceilings due to the openings/gaps in the ceiling?

Answer: Additional sprinkler protection above this drop ceiling is likely required. NFPA 13-2016 requires sprinklers to be installed throughout the building to protect all areas unless a section specifically allows an area to omit sprinklers. There are three situations in NFPA 13 that would allow you to omit sprinklers from this space above;

1. If the sprinkler deflectors below the acoustical drop ceiling are within the maximum ceiling distance from the upper ceiling, you would be able to omit sprinklers from above. For example, if you are installing standard spray pendent sprinklers, which have a maximum deflector distance of 12 inches from the ceiling, you would be permitted to omit sprinklers from above if the lower sprinkler deflectors were within 12 inches from the upper ceiling.
2. You would be able to omit sprinklers from above if this space above the acoustical drop ceiling met the requirements of a non-combustible concealed space under 8.15.1.2 of NFPA 13. However, for this area to be considered "concealed", it is only permitted to have small openings. Small openings were defined in the 2016 edition of NFPA 13 to be "no greater than 20 percent of the ceiling/boundary area of the concealed space where the width is no greater than 8 inches when the length is over 4 feet. This would allow a small opening of up to 4 feet by 4 feet while being less than 20 percent of the total area. Anything longer than 4 feet would then be limited to 8 inches in width. As this runs the

border of your room the gap would need to be limited to 8 inches in width to be considered "concealed with small openings"

3. You would need to meet the requirements for the new "cloud ceiling" criteria of 8.15.24 in order to place sprinklers below and not above. This section also limits the opening to up to 20 % of the ceiling area, but does not limit the dimensions (It must be noted that there is an error in the 2016 edition of NFPA 13. Section 8.15.24.2(2) should reference section 8.15.1.2.1.3 and not section 8.15.1.2.1.2.). However, the limiting factor would be the height of the "cloud ceiling". The criteria provide coverage area of sprinklers below the panels based on a ratio between the gap to the height of the cloud ceiling panels. The maximum ratio is permitted to be 1, which would allow you 1 inch of gap to every 1 foot of height. Therefore, if you have a 1-foot gap between the acoustical drop ceiling, the ceiling height would need to be at least 12 feet above finished floor.

Of these three options, the first one seems to be the only viable one based on the information provided. If that is also not possible you would be required to install sprinklers above the acoustical drop ceiling.

Question 12 - Vane type Waterflow Switch on the Suction Side of a Fire Pump

Does NFPA 20 regulate the use of a vane type waterflow detector installed on the suction piping of a fire pump?

Answer: The answer to your question is "yes, a vane-type water flow switch arguably restricts water flow and would be prohibited by a strict reading of **4.15.9.1**. This section reads:
4.15.9* Devices in Suction Piping.
4.15.9.1 *No device or assembly, unless identified in 4.15.9.2, that will stop, restrict the starting of, or restrict the discharge of a fire pump or pump driver shall be installed in the suction piping.*

Even if the small restriction created by a vane-type water flow switch is discounted, the turbulence created by the vane should be considered in determining how close to the pump it should be installed. There is also the possibility of the vane or paddle dislodging and entering pump. Mounting the flow switch on the discharge side of the pump would be a preferable option.