



# TechNotes

Editor - Mark Hopkins, P.E

Issue # 394

May 8, 2018

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### Best of April 2018

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 April 2018. This information is being brought forward as the "Best of April 2018." If you have a question for the NFSA EOD (and you are an NFSA member), send your question to [eod@nfsa.org](mailto: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: Collapsible Duct as an Obstruction

You have asked if collapsible duct work is considered an obstruction in accordance with NFPA 13 section 8.8.5.2.1.2. You clarified that by "collapsible" you are referring to "Sock Ducts" that inflate when air is moved through them and fall limp when there is no air flow. You have indicated that NFPA 13 section 8.8.5.2.1.2 refers to "solid continuous obstructions," however, in your opinion the "Sock Duct" is neither solid nor continuous because it collapses when there is no air flow. You have also indicated that the duct in question is 72 in. in diameter.

**Answer:** The answer to your question is "it depends." If airflow is maintained in the sock duct for prolonged periods of time it would be considered an obstruction. Section 8.8.5.2.1 and its subsections refer to obstructions that are less than 18 inches below the sprinkler deflector of extended coverage upright or pendent sprinklers. Section 8.8.5.1.1 establishes that the performance objective is to minimize obstructions to discharge in accordance with sections 8.8.5.2 and 8.8.5.3 or that additional sprinklers are to be provided to ensure adequate coverage. The described collapsible duct will create a substantial obstruction in its inflated configuration.

### Upcoming Technical Tuesdays

May 15, 2018

2015 and 2018  
Changes to Building  
Codes for Sprinkler  
Contractors  
by Jeff Hugo, CBO  
Director of Codes

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### 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](mailto:eod@nfsa.org). Last year we answered more than 2600 requests for assistance.

No information has been provided about the size and shape of the collapsible duct when air is not flowing through it.

**8.8.5.1.1** *Sprinklers shall be located so as to minimize obstructions to discharge as defined in 8.8.5.2 and 8.8.5.3, or additional sprinklers shall be provided to ensure adequate coverage of the hazard.*

It does not appear that a workable solution using the requirements of sections 8.8.5.2 or 8.8.5.1.2 can be established given the size of the duct when inflated. It would be necessary to install additional sprinklers below the collapsible duct in accordance with the performance objective of section 8.8.5.1.1. Section 8.8.5.3 would only apply if the collapsible duct is located more than 18 inches below the sprinkler deflectors. Since the duct is greater than 4 ft. in width additional sprinklers would be required in accordance with 8.8.5.3.2 if the top of the duct is greater than 18 inches below the ceiling level sprinkler deflectors.

If the collapsible duct is only inflated for short durations and normally in its collapsed condition consideration could be given to omitting the sprinkler(s) beneath the duct. However, it would be advisable to apply section 8.8.5.2.1.4 if the requirements can be achieved when the duct is collapsed. Another consideration would be to shut down the fan upon operation of the waterflow switch which would collapse the duct. Either of these options would need to be discussed with and approved by the AHJ prior to implementation.

**8.8.5.2.1.4** *Sprinklers shall be permitted to be spaced on opposite sides of the obstruction where the distance from the center-line of the obstruction to the sprinklers does not exceed one-half the allowable distance between sprinklers.*

## **Question 2: Residential Sprinklers in Dining Areas per NFPA 13**

You describe a situation where a corridor in a building to be protected using an NFPA 13 sprinkler system connects dwelling units, a dining area, a lobby, and sitting areas. You note that dining, lobby, and sitting areas are not separated from the corridor by walls or doors.

You ask where residential sprinklers are permitted to be used in this situation.

**Answer:** The answer to your question is "residential sprinklers may be used in the dwelling units and in the corridor if it is a compartment separate from the dining, lobby, and sitting areas as per NFPA 13 (2016) 8.4.5.1.

8.4.5.1 permits residential sprinklers to be installed in dwelling units and the corridors serving them but does not permit them to be used in areas such as the dining, lobby, or sitting areas. If those areas are in the same compartment as the corridor, then the corridor cannot use residential sprinklers as they cannot be used unless all of the sprinklers in the compartment are residential as per 8.4.5.3.

### **8.4.5.1\***



*Residential sprinklers shall be permitted in dwelling units and their adjoining corridors, provided they are installed in conformance with their listing.*

#### **8.4.5.3**

*Where residential sprinklers are installed in a compartment as defined in 3.3.6, all sprinklers within the compartment shall be residential sprinklers.*

Note that a compartment does not require a door or wall for a separation. If the dining, lobby, and sitting areas are separated from the corridor by a lintel with a minimum depth of 8 inches or certain single openings 36 inches in width as per 3.3.6, they would be separate compartments and the corridor could be protected with residential sprinklers.

**3.3.6 Compartment.** *A space completely enclosed by walls and a ceiling. Each wall in the compartment is permitted to have openings to an adjoining space if the openings have a minimum lintel depth of 8 in. (200 mm) from the ceiling and the total width of the openings in each wall does not exceed 8 ft (2.4 m). A single opening of 36 in. (900 mm) or less in width without a lintel is permitted when there are no other openings to adjoining spaces.*

In those areas where residential sprinklers are not permitted, quick response sprinklers would be required as per 8.3.3.1(1).

#### **8.3.3.1\***

*Sprinklers in light hazard occupancies shall be one of the following:*

- (1) Quick-response type as defined in 3.6.4.8*
- (2) Residential sprinklers in accordance with the requirements of 8.4.5*

### **Question 3: Area behind Residential Sidewall in NFPA 13R**

You have cited NFPA 13R-2013 section 6.4.6.3.3.2 and NFPA 13-2013 section 8.1.1(3). You have indicated that NFPA 13R section 6.4.6.3.3.2 allows for an area specifically identified as a corridor being no more than two feet deep and 9 feet wide as not requiring sprinklers.

**Question:** You have asked if NFPA 13R section 6.4.6.3.3.2 would be allowed within a dwelling unit that has an indented door area within a bedroom such as typically found when a closet is placed next to the door. You have provided an example.

**Answer:** The answer to your question is "no." The requirement of NFPA 13R section 6.4.6.3.3.1 identifies that shadow areas are permitted in the "protection area of a sprinkler..."

#### **6.4.6.3.3.1\* Shadow Areas.**

*Shadow areas shall be permitted in the protection area of a sprinkler as long as the cumulative dry areas do not exceed 15 sq.ft. (1.4 sq.m.) per sprinkler.*

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**6.4.6.3.3.2**

*Shadow areas in corridors up to 2 ft (0.61 m) in depth and up to 9 ft (2.7 m) in length behind sidewall sprinklers shall be permitted as shown in Figure 6.4.6.3.3.2.*

The allowance for a shadow area behind a sidewall sprinkler in accordance with section 6.4.6.3.3.2 would be considered outside of its protection area. The cited condition in section 6.4.6.3.3.2 was specifically added to address a common configuration found in hotel and motel corridors. Application of this rule to other conditions having shadow areas outside of the sprinkler protection area have not been specifically addressed in NFPA 13R.

As the given the scenario is within a dwelling unit and not a corridor, the provisions of section 6.4.6.3.3.2 would not apply. Within a dwelling unit, an allowable shadow area would be limited to the space within the protection area of the sprinkler in question.

**Question 4: Location of Air Relief Valve**

You ask where the appropriate location is for the installation of an air relief valve on a dry-pipe or preaction sprinkler system.

**Answer:** The answer to your question is "between the air supply and the shutoff valve as per NFPA 13 (2016) 7.2.6.5". 7.2.6.5 applies both to dry-pipe systems directly and air supervised preaction systems via 7.3.4.2. Note that the air relief valve may be omitted in single interlock preactions system where the air source is not capable of developing more than 15 psi as per 7.3.2.4.3.

**7.2.6.5 Relief Valve.** *An approved relief valve shall be provided between the air supply and the shutoff valve and shall be set to relieve pressure no less than 10 psi (0.7 bar) in excess of system air pressure provided in 7.2.6.7.1 and shall not exceed the manufacturer's limitations.*

**7.3.2.4.2** *Except as permitted by 7.3.2.4.3, air or nitrogen supervising pressure for preaction systems shall be installed in conformance with the dry pipe system air pressure and supply rules of 7.2.6.*

**7.3.2.4.3** *The relief valves required by 7.2.6 shall be permitted to be omitted for the type of preaction system described in 7.3.2.1(1) when the air pressure is supplied from a source that is not capable of developing pressures in excess of 15 psi (1.0 bar).*

**7.3.2.1** *Precision systems shall be one of the following types:  
(1) A single interlock system, which admits water to sprinkler piping upon operation of detection devices*

**Question 5: "Stressed" CPVC Piping and Air Testing**

You have described sprinkler system utilizing CPVC piping. A pneumatic air test was done on this system for 24 hours with

35 psi of air pressure. You have stated that the fire marshal wants assurance that the CPVC was not "stressed" when the pneumatic test was performed.

Your question is: Is there any literature that we can show the fire marshal, that the pipe was not stressed?

**Answer:** This information needs to come from the manufacturer of the CPVC. It must be noted that every manufacturer of CPVC piping cautions against air testing as it is not considered a safe practice. Air testing of CPVC is a safety issue. An air test can result in a dangerous failure of CPVC piping. Air is a compressible gas and can store far more energy than water when put under pressure and can release this energy very rapidly. This raises the possibility of an "explosion" which may break off small pieces of piping and/or fittings. The extreme pressure release could turn these small pieces into shrapnel and cause damage to personnel and property.

Some manufactures do allow air testing but only at low pressures. An informal survey of the manufactures of CPVC piping found slightly different air testing provisions, with one manufacturer allowing an air test at a maximum of 25 psi, some manufacturers allowing up to 15 psi and some manufacturers stating that air testing is not allowed at all.

Another issue with air testing of CPVC is the compatibility issue of CPVC and oils that may be in the air used to test. If allowed, only an oil-free air supply may be used.

NFSA's TechNotes #286 from February 11, 2014 discusses the air testing of CPVC piping in detail. Past TechNotes can be accessed from the "members only" section of our website

This TechNote does not discuss whether the CPVC pipe is stressed or weakened by such a test and as stated above, the manufacture of the CPVC piping would need to be consulted.

### **Question 6: Forward Flow Testing of Backflow Prevention Device**

During an annual inspection of a sprinkler system with a backflow preventer that was originally installed in 2004, it was identified that the system is not equipped with a connection to perform full flow tests. You have also cited NFPA 13 section 8.17.4.6.1 which states, "Means shall be provided downstream of all backflow prevention valves for flow tests at system demand." You identified that the actual flow that can be obtained is less than the designed flow rate because the system doesn't have an adequate connection to permit the full flow. You have cited NFPA 25 - 2011 section 13.6.2.1 which requires "All backflow preventers installed in fire protection system piping shall be tested annually by conducting a forward flow test of the system at the designed flow rate, including hose stream demand, where hydrants or inside hose stations are located downstream of the backflow preventer." You have indicated that your company and the customer have the following question:

Since the building was built in 2004 is the sprinkler system grandfathered so that the annual sprinkler system forward flow testing doesn't need to meet the designed flow rate or are they required by code to have the system modified so that the designed flow rate can be achieved?

**Answer:** The answer to your question is "no, but it does not need to be grandfathered." The use of test header for conducting full flow testing of the backflow preventer is only one available option. Another option as identified in NFPA 25 section A.13.6.2.1 is to either reverse the direction of the check valve or to use a by-pass around the fire department (Siamese) connection check valve so that the Siamese connection can be used for this purpose. However, NFPA 25 section 13.6.2.1.3 identifies that tests are permitted to be conducted at the maximum flow rate possible. The same language appears in section 13.6.2.2.

### **13.6.2.1.3**

*Where connections do not permit a full flow test, tests shall be completed at the maximum flow rate possible.*

This section of NFPA 25 acknowledges that many systems were installed without forward flow test headers/connections. Use of the main drain, the inspector's test drain and any others on the system would achieve the maximum flow rate possible. Use of the fire department connection with a by-pass or by reversing the check valve to allow flow through the system would also be acceptable. Older backflow preventers were more susceptible to degradation of the valve seats causing sticking. Springs and other mechanisms were also susceptible to seizure. The purpose of the test is to ensure that the backflow check valves are not seizing or preventing water flow for fire protection purposes. The provisions of NFPA 25 sections 13.6.2.1.3 and 13.6.2.2 are intended to address the described situation if the owner does not want to invest in the installation of a forward flow test connection/header.

It should also be noted that reversing the check valve will not be an option for new systems moving forward. During the development of the 2019 edition of NFPA 13, a new section (16.14.5.1.1) was added as follows:

#### **16.14.5.1\* Backflow Prevention Valves.**

*Means shall be provided downstream of all backflow prevention valves for forward flow tests at a minimum flow rate of the system demand including hose allowance where applicable.*

**16.14.5.1.1 The arrangement required in 8.17.4.5.116.14.5.1 shall be serviceable without requiring the owner to modify the system to perform the test**

This new section indicates that the means to perform the forward flow test must be built in to the system. Reversing the check valve on the FDC piping, while still an option in existing systems will not be an option for new systems.

## **Question 7: Obstructed Construction?**

There is an existing, non-combustible office building with 24-inch deep open-web steel bar joists spaced approximately 5 feet on-center. One area in the building will not have a finish ceiling below the trusses and will require sprinklers located at the roof deck. The fire-proofing contractor has applied a metal-lath along one side of each joist, then applied the spray-on fire-proofing so that the entire joist has essentially become 'solid' from top to bottom. The ends of each joist are not solid due to the bottom chord stopping short of the girders leaving a triangle-shaped area at both ends of each joist open. The governing document is NFPA 13 (2016).

The question is: Is this arrangement regarded as obstructed construction?

**Answer:** The answer to your question is "yes, by definition it cannot be classified as unobstructed due to being less than 70 percent open as per 3.7.2". The application of the definitions of obstructed and unobstructed can be somewhat subjective in some case with the examples in the annex providing some guidance as to what types of typical construction may or may not 'impede heat flow or water distribution'. However, in this case, the fact that the bar joists have been rendered less than 70 percent open explicitly removes them from consideration as unobstructed construction.

### **3.7.1\* Obstructed Construction.**

*Panel construction and other construction where beams, trusses, or other members impede heat flow or water distribution in a manner that materially affects the ability of sprinklers to control or suppress a fire.*

### **3.7.2\* Unobstructed Construction.**

*Construction where beams, trusses, or other members do not impede heat flow or water distribution in a manner that materially affects the ability of sprinklers to control or suppress a fire. Unobstructed construction has horizontal structural members that are not solid, where the openings are at least 70 percent of the cross-section area and the depth of the member does not exceed the least dimension of the openings, or all construction types, with the exception of panel construction, where the spacing of structural members exceeds 7 1/2 ft (2.3 m) on center.*

## **Question 8: Preaction system in Light Hazard Areas**

You ask if it is permissible under NFPA 13 to use a preaction system in a light hazard occupancy.

**Answer:** The answer to your question is "yes, with certain restrictions if the light hazard occupancy is residential". NFPA 13 (2016) does not prohibit the use of preaction systems in light hazard occupancies. It does not explicitly state that they may be used but it does mention them in connection with in light hazard occupancies in 8.3.4.4.

**8.3.4.4 Sprinklers with nominal K-factors of K-4.2 (57) shall be permitted to be installed on dry pipe**

*and preaction systems protecting light hazard occupancies where piping is corrosion resistant or internally galvanized.*

It should be noted that 8.4.5.2 requires residential sprinklers on preaction systems to be listed for that use.

#### **8.4.5.2**

*Residential sprinklers shall be used only in wet systems unless specifically listed for use in dry systems or preaction systems.*

Also, 7.2.3.6.3 via 7.3.2.3.1.3 requires a maximum 15-second water delivery time when double-interlock preactions system are used to protect residential occupancies.

**7.3.2.3.1.3** *The system size for double interlock preaction systems shall be based on calculating water delivery in accordance with 7.2.3.6, anticipating that the detection system activation and sprinkler operation will be simultaneous.*

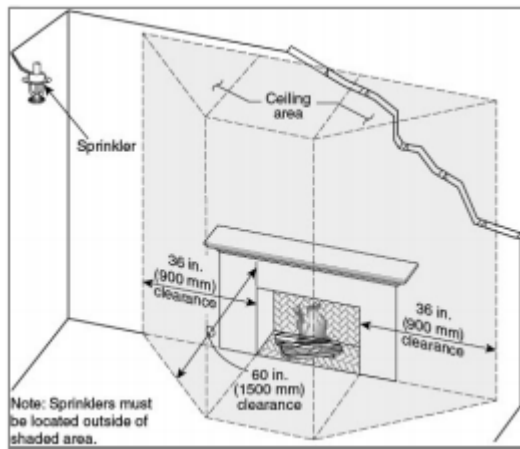
**7.2.3.6.3** *For dry pipe systems protecting dwelling unit portions of any occupancy, the sprinklers in the dwelling unit shall have a maximum water delivery time of 15 seconds to the single most remote sprinkler.*

### **Question 9: Residential Sprinkler near Fireplace**

There is a residential horizontal sidewall sprinkler directly above a gas fireplace within a residential unit in an apartment building. You indicated that the sprinkler would be 5 ft. above the top edge of the fire place. You have asked if the minimum distances identified in NFPA 13-2016, Table 8.3.2.5(c) is measured horizontally or vertically from the side of an open or recessed fire place. You have specifically asked if an intermediate temperature sprinkler must be located at least 12 in. from the side of an open or recessed fireplace.

**Answer:** The answer to your question is "horizontally." The defined minimum dimensions in Table 8.3.2(c) extend from floor to ceiling in front and to the side of the fire place. This issue will be clarified in NFPA 13-2019 through a series of diagrams added in Annex A. The document has been reorganized so the numbering will be different. The diagram will be located in section A.9.4.2 as Figure A.9.4.2.5 (b) titled "Intermediate-Temperature Sprinkler over Recessed Fireplace." This second revision may be viewed on the NFPA website and is copied below:





### Question 10: Maintenance Requirements for an NFPA 13D System

What authority to local fire departments have on requiring maintenance of a 13D system installed in a single family residence?

**Answer:** The answer is, unless state or local ordinance specifically addresses the maintenance requirements of NFPA 13D systems, the local fire department probably has no authority to require maintenance of a NFPA 13D system. NFPA 13D leaves the maintenance of these sprinkler systems to the owner.

NFPA 13D type sprinkler systems are exempt from the requirements of NFPA 25. Section 1.1.5 of the 2017 edition of NFPA 25 (similar language in earlier editions) read as follows:

**1.1.5** *Unless required by Chapter 16, this standard shall not apply to sprinkler systems designed, installed, and maintained in accordance with NFPA 13D.*

Chapter 16 of NFPA 25 deals with NFPA 13D systems installed in residential board and care facilities and would not apply to a single family residence.

The maintenance of these NFPA 13D systems are left to owners in keeping with the cost-conscious intent of NFPA 13D. Adding specific requirements for inspection and maintenance of these systems will add to the cost and as these systems are inherently simple, the committee believes that the owner should be able to adequately maintain these systems. NFPA 13D notes in Section 12.1 (2016 edition) that instructions should be provided to the owner for maintaining the system properly. Also, Section A.12.2 in the annex notes seven items that would be a good idea as part of the maintenance program. These "Good Practices" are intended to be performed by the owner.

It should be noted that the A.12.2(7), is the only item that suggests that trained personnel should be involved. This section states that when there is a change in ownership, the NFPA 13D system should be inspected by individuals knowledgeable and trained in these systems. As

this language is in the annex, it is suggestive in nature and not legally enforceable.

### **Question 11: "Partition Rule" for Ordinary Hazard**

You have described a self-storage building where there are partitions extending to 16 inches below the roof deck. The sprinkler deflectors will be 12 inches above the top of the partitions. You have noted that this configuration is similar to figure 8.6.5.2.2 of NFPA 13 but have correctly noted that this figure is limited to light hazard occupancies.

Your question is: Is there anything that would allow the sprinkler to spray over the partitions in ordinary hazard occupancies?

**Answer:** The answer is "no", as the top of the partition is within 18 inches of the sprinkler deflector and this is an ordinary hazard occupancy there is no special "rule" in NFPA 13 that would address this situation. As you have indicated, section 8.6.5.2.2 is limited to light hazard occupancies only. As you are dealing with an ordinary hazard occupancy and the top of the partition is within 18 inches of the sprinkler deflector, the partitions are considered an obstruction to sprinkler discharge pattern development and the appropriate obstruction rules of section 8.6.5.2 of NFPA 13 must be followed. As there is no practical way to meet these rules the only appropriate solution would be to position the sprinklers in between the partitions so that the water spray can reach the floor.

Your second question is: Is it true that "the sprinkler would not be considered obstructed enough to allow for them to be less than 6' apart?"

The answer is "no", these sprinklers would not be considered obstructed enough to allow them to be placed closer than 6 ft apart without the use of baffles. If the sprinklers are installed closer than 6 ft apart, then the baffle rules of NFPA 13 section 8.6.3.4.2 must be followed.

### **Question 12: ITM of Limited Area Systems**

You have asked two questions regarding the ITM requirements for Limited Area Sprinkler Systems (IFC - 20 or fewer heads and supplied by the domestic system) which will be answered separately.

Before answering your specific questions, it must be noted that the 2015 edition of the IFC changed the requirements for Limited Area Sprinkler systems from fewer than 20 sprinklers on a single connection to no more than 6 sprinklers in any single fire area.

Your questions are:

**Question 1:** Are limited area sprinkler systems required to be Inspected, Tested and Maintained in accordance with the applicable requirements of NFPA 25?

**Answer 1:** Yes, limited area sprinkler systems need to be inspected, tested and maintained in accordance with the requirements of NFPA 25 as applicable. This is made clear in NFPA 13 (2016) in section 4.2.1 which states that for partial systems, the requirements of NFPA 13 apply as they are applicable. Section 27.1 of NFPA 13(2016) requires that the sprinkler system be inspected, tested and maintained in accordance with NFPA 25. This requirement applies to limited area sprinkler systems.

NFPA 13, Section 4.2 reads as follows:

**4.2 Limited Area Systems.**

**4.2.1** *When partial sprinkler systems are installed, the requirements of this standard shall be used insofar as they are applicable.*

**4.2.2** *The authority having jurisdiction shall be consulted in each case.*

**Question 2:** Is there model code language stating that limited area systems are required to be Inspected, Tested and Maintained in accordance with NFPA 25?

**Answer 2:** Yes, Section 901.6 of the IFC (same section number in 2009 through 2018 editions) requires all fire protection systems to be maintained and section 901.6.1 specifically states that water-based fire protection systems must be inspected, tested and maintained in accordance with NFPA 25. Although this section does not specifically mention limited area systems, this requirement would apply. Limited area sprinkler systems are still considered a water-based fire protection system. Section 901.6.1 reads as follows:

**901.6.1 Standards.** *Fire protection systems shall be inspected, tested and maintained in accordance with the referenced standards listed in Table 901.6.1.*

**TABLE 901.6.1  
FIRE PROTECTION SYSTEM MAINTENANCE STANDARDS**

SYSTEM	STANDARD
Portable fire extinguishers	NFPA 10
Carbon dioxide fire-extinguishing system	NFPA 12
Halon 1301 fire-extinguishing systems	NFPA 12A
Dry-chemical extinguishing systems	NFPA 17
Wet-chemical extinguishing systems	NFPA 17A
Water-based fire protection systems	NFPA 25
Fire alarm systems	NFPA 72
Smoke and heat vents	NFPA 204
Water-mist systems	NFPA 750
Clean-agent extinguishing systems	NFPA 2001
Aerosol fire-extinguishing systems	NFPA 2010

*NFSA TechNotes is c. 2018 National Fire Sprinkler Association, and is distributed to NFSA members on Tuesdays for which no NFSA Technical Tuesday Online Seminar is scheduled. Statements and conclusions are based on the best judgment of the NFSA Engineering staff, and are not the official position of the NFPA or its technical committees or those of other organizations except as noted. Opinions expressed herein are not intended, and should not be relied upon, to provide professional consultation or services. Please send comments to Mark Hopkins, P.E. at [Hopkins@nfsa.org](mailto:Hopkins@nfsa.org).*





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