

TechNotes Issue # 435

March 10, 2020

Best of February 2020

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 February 2020. This information is being brought forward as the "Best of February 2020." If you have a question for the NFSA EOD (and you are an NFSA member), send your question to eod@nfsa.org and the subject matter expert will get back to you.

It should be noted that the following are the opinions of the NFSA Engineering, Codes, and Standards staff, generated as members of the relevant NFPA and ICC 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 or ICC Council Policy #11 and should therefore not be considered, nor relied upon, as the official positions of the NFPA, ICC, or its Committees. Unless otherwise noted the most recent published edition of the standard referenced was used.

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Question #1 - Cloud Ceilings

Given the scenario below, if three branch lines are installed, spaced equally on both sides of the clouds

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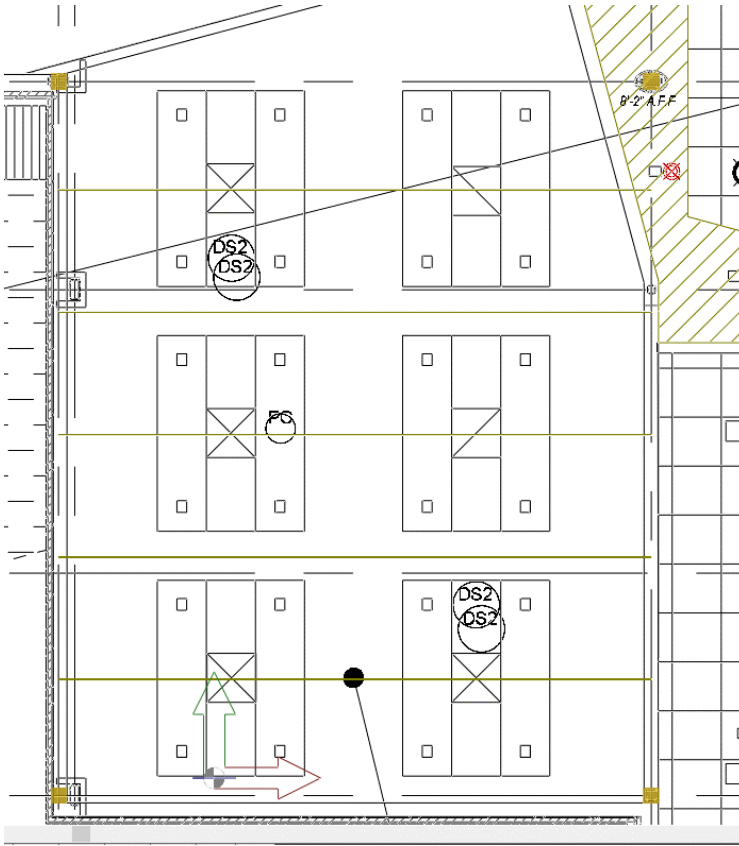
To improve your response time, please include in the email subject line the following information: code/standard and edition year (example: NFPA 13 2016, 2018 IBC, 2017 NFPA 25, etc.).

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(treating like an obstruction), would protections still be required below the clouds?



Answer: The answer to the question is "no," because the clouds exceed 4 ft in width, the clouds would still require sprinkler protection beneath. Typically, the requirements for cloud ceilings are used to omit sprinklers from above the floating (cloud) ceiling assembly when meeting the criteria identified in NFPA 13-2019 section 9.2.7. There are specific requirements for each of the clouds as well as the dimension of openings between cloud ceiling panels, and perimeter openings between walls and cloud ceiling panels. The described scenario does not meet these requirements.

Your question related to the inverse condition, having sprinklers below the underside of the upper ceiling over the ceiling clouds, and asking if sprinklers are required beneath the cloud ceilings. The described scenario is specifically addressed by NFPA 13-2019 section 10.2.7.3.2 for obstructions over 4 ft in width and located 18 in. or greater below the sprinkler deflector.

Per NFPA 13-2019:

10.2.7.3* Obstructions that Prevent Sprinkler Discharge from Reaching Hazard.

10.2.7.3.1 Continuous or noncontinuous obstructions that interrupt the water discharge in a horizontal plane more than 18 in. (450 mm) below the sprinkler deflector in a manner to limit the distribution from reaching the protected hazard

shall comply with 10.2.7.3.

10.2.7.3.2* Sprinklers shall be installed under fixed obstructions over 4 ft (1.2 m) wide.

Question #2 - Combustible Stairways

Can a stairway consisting of combustible construction be encased in noncombustible or limited combustible sheathing and be protected as if it were a noncombustible stairway?

Answer: The answer to the question is "no," a stairway built of combustible materials remains of combustible construction regardless of how it is sheathed. This is clear from the wording of NFPA 13-2019 Section 9.3.4.2.1 that allows omission of most sprinklers from noncombustible stairways:

9.3.4.2.1 *In noncombustible stair shafts having noncombustible stairs with noncombustible or limited-combustible finishes, sprinklers shall be installed at the top of the shaft and under the first accessible landing above the bottom of the shaft.*

As there is no parallel section within Section 9.3.4.1 dealing with stairways of combustible construction, sprinklers must be provided under landings at each floor level in accordance with Section 9.3.4.1.2.

Stairways play a key role in life safety from fires, and it is to be expected that protection criteria are more severe.

Question #3 - Three Season Rooms

Can a three-season room provided with a thermostat-controlled heating system (but not air conditioning) and enclosed by windows be considered an "open attached porch" and therefore exempt from sprinkler protection in accordance with NFPA 13D-2013 Section 8.3.4?

Answer: Although NFPA 13D does not include a specific definition of "open attached porch", that exemption has been in the standard since the first edition and was intended to maintain an economical cost of installation of a dwelling sprinkler system by avoiding the need for specialty equipment to provide sprinkler protection in areas where piping could be subject to freezing. As such, the main criterion should be whether it is possible to protect the space with a wet pipe sprinkler system. If water-filled pipe can be maintained above 40°F in this space in accordance with Section 9.1.1, then it should be protected with sprinklers.

Question #4 - Typical Branch Lines

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For the design of a residential building with identical units on either side of a hallway, is there a need to show each unit in the overall floor plan (367 total units), or can a typical design for the 11 different types of units be shown on the plan instead?

Answer: As long as the shop drawing clearly depict the entire scope of installation, it should be acceptable. The section most closely relating to this issue is NFPA 13-2019 Section 27.1.3(20):

(20) Nominal pipe size and cutting lengths of pipe (or center-to-center dimensions). Where typical branch lines prevail, it shall be necessary to size only one typical line.

The extent to which the practicality intended by that section can be applied to other situations such as the one described above would depend on the willingness of the AHJ to agree that the repetition is not necessary. The International Building Code states that construction documents "must be of sufficient clarity to indicate the location, nature and extent of the work proposed and show in detail that it will conform to the provisions of this code and relevant laws, ordinances, rules and regulations, as determined by the building official." With regard to fire protection shop drawing the code specifically states that they must "contain all information as required by the referenced installation standards.

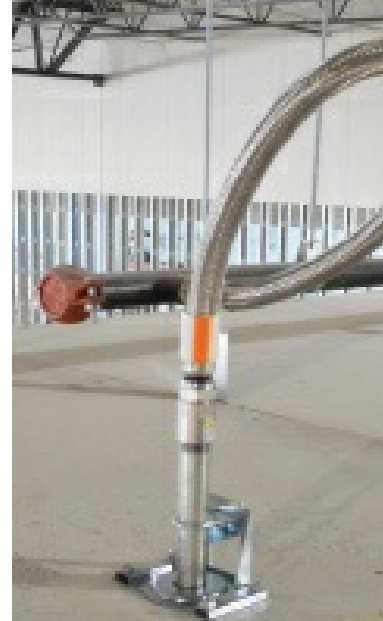
With today's technology, repetition would seem to be less of a problem compared to the hand drawings of yesteryear. Still, the AHJ will decide what is necessary and what can be accomplished by cross-reference without repetition.

Question #5 - 1-1/2 in. Hose Connections

Do 1-1/2 in. hose connections installed in a high-piled storage area require pressure and flow testing in the field?

Answer: The answer to the question is "no." If operational tests were required, they would be part of the system acceptance testing as reflected in the Contractors Material and Test Certificate for Aboveground Piping. By comparison, it should be noted that the certificate does require forward flow testing of pressure reducing valves and backflow prevention assemblies consistent with NFPA 13-2019 Sections 28.2.4 and 28.2.5.

NFPA 14 requires flow testing as part of acceptance testing for standpipe systems, but the 1-1/2-inch hose connections to sprinkler systems are not Class II standpipe connections. NFPA 13 specifically notes this in Section 16.15.1.2. It should also be noted that the 1-



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1/2 in. sprinkler system hose connections traditionally have 1-inch diameter inlets, as compared to the 1-1/2 in. inlets for Class II standpipe hose connections.

Although there may be a need to verify that the 100 psi maximum residual pressure (and 175 psi static pressure) is not being exceeded, as required by Sections 16.15.1.4(5) and 16.15.1.4(6), there is no requirement that such verification be accomplished by means of testing as compared to an analysis of system hydraulic calculations.

Question #6 - Baggage Handling Conveyor

Does a baggage handling conveyor passing through an otherwise noncombustible concealed space require sprinkler protection? If so, to what extent?

Answer: NFPA 415 - 2016, Standard on Airport Terminal Buildings, Fueling Ramp Drainage, and Loading Walkways provides requirements for fire protection in airports.

Section 4.5.1.1 identifies that an airport terminal building with more than 12,000 sq. ft total floor area for the assembly portion of the occupancy shall be provided with an automatic sprinkler system in accordance with NFPA 13. Section 4.5.1.4 identifies that baggage, package, and mail-handling areas shall be classified as ordinary hazard group 2 occupancy, as defined in NFPA 13, for the purpose of sprinkler system design.

Depending on the handling of the baggage by crew members, it may be possible for bags to jam or fall off the conveyors which could introduce the presence of combustibles. The conveyor design and arrangement should also be considered. Some conveyors use rubber belts with integrated steel for strength. Loading of the conveyor belts has been found to allow generation of heat due to friction caused by binding of rollers if not properly greased. The introduction of hazardous materials in luggage could also be cause for some concern. In my opinion, this would be considered a baggage area in accordance with NFPA 415 and would require sprinkler protection and should be positioned per NFPA 13-2016 section 8.15.1.5 for localized exposed combustibles:

8.15.1.5 Localized Protection of Exposed Combustible Construction or Exposed Combustibles. *When otherwise noncombustible or limited-combustible concealed spaces that would not require sprinkler protection have localized exposed combustible construction, or contain localized areas of exposed combustibles, the combustibles shall be permitted to be protected as*

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follows:

(1) If the exposed combustibles are in the vertical partitions or walls around all or a portion of the enclosure, a single row of sprinklers spaced not over 12 ft (3.7 m) apart nor more than 6 ft (1.8 m) from the inside of the partition shall be permitted to protect the surface. The first and last sprinklers in such a row shall not be over 5 ft (1.5 m) from the ends of the partitions.

(2) If the exposed combustibles are in the horizontal plane, the area of the combustibles shall be permitted to be protected with sprinklers on a light hazard spacing. Additional sprinklers shall be installed no more than 6 ft (1.8 m) outside the outline of the area and not more than 12 ft (3.7 m) on center along the outline. When the outline returns to a wall or other obstruction, the last sprinkler shall not be more than 6 ft (1.8 m) from the wall or obstruction.

Question #7 - High-rise Zones

Per NFPA 14-2010 Section 7.12.2 "High-rise buildings shall have at least two remotely located fire department connections for each zone. In this instance, does the word "zone" refer to water entrances supplying the sprinkler systems/standpipes?"

Answer: The answer to the question is "no," the term zone does not refer to the water entrances supplying the system but to the definition of a "Standpipe System Zone" per NFPA 14 (2010) Section 3.3.13:

3.3.13 Standpipe System Zone. *A vertical subdivision of a standpipe system limited or determined by the pressure limitations of the system components.*

Where a zone is outside the pumping capacity of the local fire department, there is an exception to this in 7.12.1.1 which omits the high zone fire department connection(s) where 7.9.3 applies.

7.9.3* *For systems with two or more zones in which any portion of the higher zones cannot be supplied by means of the fire department pumper through a fire department connection, an auxiliary means of supply in the form of high level water storage with additional pumping equipment or other means acceptable to the AHJ shall be provided.*

Question #8 - Clearance Using Sleeves

What sleeve sizes are required to provide proper clearance for pipe sized 1 in. through 3-1/2 in. where

flexible couplings are not used?

Answer: The requirements are identified in NFPA 13-2013 section 9.3.4.3. The pipe sleeve is required to be nominally 2 in. larger than the nominal diameter of the sprinkler system pipe for sizes 1 in. through 3.5 in. For pipes having a nominal diameter of 4 in. and greater the sleeve diameter must be nominally 4 in. larger than the sprinkler pipe:

9.3.4.3 Where clearance is provided by a pipe sleeve, a nominal diameter 2 in. (50 mm) larger than the nominal diameter of the pipe shall be acceptable for pipe sizes 1 in. (25 mm) through 3 1/2 in. (90 mm), and the clearance provided by a pipe sleeve of nominal diameter 4 in. (100 mm) larger than the nominal diameter of the pipe shall be acceptable for pipe sizes 4 in. (100 mm) and larger.

Question #9 - Special Occupancy Applications

When would NFPA 45 be initiated when laying out a sprinkler system? Does it apply in a two-story academic building with ten various lab rooms?

Answer: The sprinkler requirements contained in NFPA 45 are initiated when the room in question falls within the scope of the standard. In this case, NFPA 45 would apply per NFPA 45-2019 section 1.1.2 if chemicals defined in NFPA 704 are used in the individual lab. Other requirements such as the handling of time sensitive materials, storage and use of restricted materials, or ventilation may be required by adopted fire codes in a specific jurisdiction. See 2018 IFC Chapter 38 for Higher Education Laboratories as an example.

Per NFPA 13-2019 the application of special occupancy standards shall comply with section 26.1.1:

26.1 General.

26.1.1 Application.

26.1.1.1 *In addition to the requirements of Chapter 8, Chapters 11 through 22, and Chapter 23, the following special occupancy requirements shall apply.*

26.1.1.1.1 *All provisions of design criteria in this standard, including design area increases and reductions, shall also apply to these special occupancy requirements.*

26.1.1.2 *Where the requirements of the reference standard differ from the requirements of this standard, the reference standard shall take*

precedence.

Per the scope of NFPA 45-2019, the standard applies to the scenario described:

1.1.2 *This standard shall apply to all educational laboratory units and instructional laboratory units in which any quantity of chemicals, as defined in NFPA 704 with one or more of the following hazard ratings, is handled or stored: health - 2, 3, or 4; flammability - 2, 3, or 4; or instability - 2, 3, or 4. (See also Section B.2.)*

If any of the chemicals bears the symbol below and the numbers in the red, yellow or blue sections are 2 or greater, then NFPA 45 would apply. See a sample NFPA hazard diamond below for reference.



Question #10 - Fire Pump Alarms

Are fire pump alarms required to be monitored by a fire alarm control panel or can they be received at the controller?

Answer: NFPA 20 does not require a fire pump to be monitored by a fire alarm system. NFPA 20-2010 section 10.4.7 requires that fire pumps located in an area that is not constantly attended (most are not) have an audible or visible signal powered by a source not exceeding 125 V provided at a point of constant attendance. This is often accomplished through use of a fire alarm system but can be done using equipment produced by the fire pump or controller manufacturer as long as the power requirement is met. The intention of constantly attended would be a guard station, or facilities maintenance staff office if operated 24/7. Many large industrial facilities, nuclear power plants, military installations, government buildings and others have staff on duty in constantly attended locations. Most typical buildings will not be able to meet this requirement so use of a fire alarm system with central station for monitoring is the preferred arrangement.

NFPA 25-2011 section 8.3.3.5 requires all features required to be provided in accordance with NFPA 20-2010 section 10.4.7.2.1 through 10.4.7.2.4 to be tested at the fire pump controller. NFPA 25 section A.8.3.3.5 indicates that it is not the intent to verify that all signals transmit to the remote location but rather that the alarms can be individually verified at the fire pump controller.

Question #11 - Centrifugal Vertical In-line Pump Mounting

Is a vertical in-line fire pump required to be mounted on a housekeeping pad, or can it be anchored to another solid base such as the floor?

Answer: NFPA 20-2019 does not require a vertical in-line pump to be mounted on a housekeeping pad. Section 6.4.2 indicates that a vertical in-line pump is permitted to be mounted on a base attached to the pump mounting base plate. This can be the floor of the pump room. Requirements for foundation (a.k.a. housekeeping) pads or encasement might be imposed as part of the manufacturer's installation requirements which would also be part of the pump listing. In these cases, NFPA 20 would require the pad. In addition, design specifications might include requirements for a pad. However, in general terms a pad is not required for a vertical in-line pump.

Sections 6.4.4 and 6.4.5 require a permanent and rigid support for the base plate which is to be level on the foundation.

6.4 Foundation and Setting.

6.4.1* *Overhung impeller and impeller between bearings design pumps and driver shall be mounted on a common grouted base plate.*

6.4.2 *Pumps of the overhung impeller close coupled in-line type [see Figure A.6.1.1(c)] shall be permitted to be mounted on a base attached to the pump mounting base plate.*

6.4.3 *The base plate shall be securely attached to a solid foundation in such a way that pump and driver shaft alignment is ensured.*

6.4.4* *The foundation shall be sufficiently substantial to form a permanent and rigid support for the base plate.*

6.4.5 *The base plate, with pump and driver mounted on it, shall be set level on the foundation*

It should be noted that the grouting requirements for a horizontal split case pump would not apply to a vertical in-line pump.

Question #12 - Vertical Turbine Fire Pump Testing

When conducting a fire pump flow test of a vertical turbine fire pump, should the lift (per ft/psi) as negative pressure be factored in?

Answer: The answer to the question is "yes." This is not directly pointed out in the testing procedures listed in Chapter 8 of NFPA 25; however, in Chapter 3 you will find that the definition of net pressure points this out. Per NFPA 25-2017:

3.6.2.5.2* Net Pressure (Differential Pressure).

For vertical turbine fire pumps the total pressure at the pump discharge flange plus the total suction lift. For other fire pumps, the total pressure at the fire pump discharge flange minus the total pressure at the fire pump suction flange. [20,2016]

Annex A also provides some additional explanation:

Table A.8.3.2.9 Observations - While Pumping Vertical pumps

- 1. Read discharge gauge - add distance to water level in feet (or meters) and divide by 2.31 to compute psi (30.47 to compute bar). This total must match churn pressure as shown on fire pump nameplate.*
- 2. Observe packing glands for proper leakage for cooling of packing.*
- 3. Observe discharge from casing relief valve - adequate flow keeps pump case from overheating*

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