NFSA
The Voice of the Fire Sprinkler Industry

Tuesday e-Tech Alert

Editor-Russell P. Fleming P.E.

Issue Number: 186
Issued: August 3, 2010

Best Questions of July 2010

We have selected the following questions as the "Best of July 2010" answered by the engineering staff as part of the NFSA's EOD member assistance program:

Question 1 – Testing Antifreeze Solutions

The recent NFPA safety alert on antifreeze could have huge ramifications for many fire sprinkler companies. I have one major problem with the letter that NFSA has recommended we distribute to customers who are affected. The letter suggests that we can test their system to determine the concentration, but the only test we perform checks the specific gravity of the mixture to determine the freeze point. I am not a scientist, but I don't think this is an adequate test to determine the true mix rate. Nor does it test the concentration in sprinkler drops where the problem poses the greatest threat.

Answer: You are correct that the standard tool that contractors use to determine the freezing point of an antifreeze solution measures the specific gravity of the solution and, based on which type of antifreeze is being used and accounting for temperature, the specific gravity can be converted to a concentration and freezing point. If your refractometer only gives you a freeze point, you can find the corresponding concentration using the tables within NFPA 13.

With respect to testing drops, that's probably not necessary. Our suggestion would be to take a sample from near the bottom of the system (wherever it is convenient) and another from near the top. If the two samples are the same, the system appears to have been mixed correctly and the solution in the drops should not be a different mix. But if the solution near the bottom is more concentrated than at the top, then the solution was not mixed properly and has separated, making the whole solution suspect. In such a case, the whole solution should be drained and replaced with pre-mixed solution even if the lower sample has an acceptable concentration at present, because the solution may continue to separate over time and collect in low portions at higher concentrations. As has been discussed in previous issues of *eTechAlert*, testing has been taking place through the NFPA's Fire Protection Research Foundation on various concentrations of propylene glycol and glycerin. The testing has included relatively "worst case" conditions of fire scenario, sprinkler K-factor and sprinkler operating pressures. While the actions of the NFPA Standards Council and Sprinkler Committees cannot be predicted, the research indicates that concentrations (by volume) of up to 40% propylene glycol and 50% glycerine can be safely and effectively used across the full range of conditions represented in the testing.

Question 2 – Thrust Block Sizing Tables

In NFPA 13 (2010 edition) Table A.10.8.2(a) gives thrust based on diameter of underground pipe and the degree of turn in the fitting, with adjustments for other than 100 psi pressure. As an example, the thrust force for 6-inch pipe at a 90-degree turn is 5,288 lbs, and for a 45-degree bend is 2,862 lb (which is 0.54

times the force on the 90-degree bend). Compare this with Table A.10.8.2(c) which gives the minimum bearing block areas for 90-degree bends, and for which the notes below the table specify the use of coefficients for other bend angles. For the 45-degree bend Note 2(a) specifies a coefficient of 0.414. If one calculates the thrust block area for 45° bend using Table A.10.8.2(a) compare to using Table A.10.8.2(c), results will be different.

Answer: You are correct that there is an inconsistency in the tables. While Table A.10.8.2(a) has been in the NFPA standards for some time, Table A.10.8.2(b) was included in the 2007 edition of NFPA13 and 24 based on a submittal from the Ductile Iron Pipe Research Association. The formula used for determining thrust block resistance is based on static pressures in the piping and assumes the thrust block is arranged with its face splitting the angle of turn, hence the use of the Θ/2 angle. In our view, the coefficients for the various degrees of bend should simply reflect the ratios of the sin Θ/2 factor within the determination of the thrust force. As such, the coefficients cited in Note 2 to Table A.10.8.2(b) should be 0.541 for the 45-degree bend, 0.276 for the 22½-degree bend, 0.139 for the 11¼-degree bend and 0.045 for the 5-1/8-degree bend.

However, it should be recognized that all of these tables for calculating area of thrust blocks are in the annex and therefore legally unenforceable. The intent of NFPA 13 is to have the user determine the size of the thrust blocks using a means acceptable to the AHJ. The tables may or may not be acceptable to the AHJ.

The NFSA will be bringing this inconsistency to the attention of the NFPA committee in the next amendment cycle.

Question 3 – Backflow Preventers on Standpipe Systems

Consider a manual wet standpipe system where the standpipe has a small water supply connection from the domestic water system. There is a backflow preventer on this supply to the standpipe. We have two questions:

1. Does the backflow preventer have to be a listed device?
2. If not, does one (or both) of the valves need to be an indicating valve?

Answer: NFPA 14 does not specifically require that backflow protection devices be listed, although NFPA 24, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances,* could be considered to require that such devices be listed for fire protection service. Specifically Section 5.4.2 of the 2007 edition of NFPA 24 states "Where equipment is installed to guard against possible contamination of the public water system, such equipment and devices shall be listed for fire protection service." Keep in mind that the local water purveyor could have additional or different requirements.

You have also asked if the valves need to be indicating. It is part of the listing criteria that the valves on listed fire protection backflow preventers be of an indicating type. However, an independent control valve that is not part of a backflow preventer connected to this small fill line would not be considered essential to the water supply for the standpipe and therefore would not be required to be listed or of the indicating type.

Question 4 – NFPA 13R Water Supply

I'm trying to figure out the domestic water usage for a tri-plex with a single supply line to both the fixtures and fire sprinkler system. I'm looking at Tables A.6.6.5 (a) and (b) in the 2007 edition of NFPA 13R. Do you need to figure that all of the fixtures (in all three units) will be flowing at the same time?

Each unit has:
2 toilets
2 bathtubs
2 bathroom sinks
1 kitchen sink
1 dishwasher
1 washing machine

Answer: Section 6.6.5 of the 2007 edition of NFPA 13R requires that the domestic demand be included as part of the overall system demand for systems with common domestic/fire mains where no provisions are made to prevent the domestic water flow upon sprinkler system activation.

The annex section A.6.6.5 suggests that Tables A.6.6.5(a) and (b) can be used to determine a domestic design demand. Using Table A.6.6.5(a), the total number of water supply fixture units downstream of any point in the piping serving both sprinkler and domestic needs is determined. Using Table A.6.6.5(b), the appropriate total flow allowance is determined and added to the sprinkler demand at the total pressure required for the sprinkler system at that point.

In your example, if all of the domestic components are downstream of common piping serving both sprinkler and domestic demands then all of the components in all three units should be considered. Keep in mind that Table A.6.6.5(a) is based on a "fixture load value" in units, not gallons per minute. Table A.6.6.5(b) then converts the total unit value to gpm.

Question 5 – Heat Collectors for Outside Sprinklers

I have a question as to the requirement of heat collection for a specific application.
We are installing an outside deluge system with pneumatic actuation to protect an exterior building wall from a tank farm storing cleaning chemicals, which has no roof.
The deluge line is mounted at 30 ft above grade along the portion of the building adjacent to the tank farm. The wall is approximately 35 ft in height. Both the sprinkler line and the pilot line are mounted to an angle bracket, with the pilot line closer to the wall. In this situation, is there any requirement or recommendation for heat collection over the pilot line sprinklers?

Answer: Typically, heat collectors have not been considered acceptable for use above sprinklers. Section 7.8 of the 2007 edition of NFPA 13, which deals with exposure protection sprinkler systems, does not require a heat shield or even a ceiling above the exposure sprinklers. Instead, Section 7.8.8.3 requires sprinklers to be located 6 to12 inches from the wall surface and within 6 inches of the top of the wall, with maximum spacing of 8 ft or as indicated in the sprinkler listing for exposure protection use.

Section 7.8.3.4 does require that automatic systems of open sprinklers be controlled by the operation of fire detection devices designed for the specific application. Section 8.14 provides information on pilot line detectors, with vertical spacing limited by Section 8.14.7 to a maximum of 17 ft. Section 8.14.8 limits the maximum horizontal distance between pilot line detectors installed outdoors to 8 ft, although Section 8.14.8.1 allows an increase to 10 ft when all of the following conditions are met:
(1) The elevation of the first level does not exceed 15 feet.
(2) The distance between additional levels does not exceed 12 feet.
(3) The pilot line actuators are staggered vertically.

Alternate vertical spacing of pilot line detectors differing from those required in 8.14.8.1 are permitted where installed in accordance with their listing

Question 6 – Minimum Distance between Pendent and Sidewall Sprinklers

NFPA 13 (2010 edition) Section 8.7.3.1.5 gives us the distance between two horizontal sprinklers installed "face to face" in the same room. What would be the minimum distance between a standard coverage horizontal sidewall and a standard coverage pendent that are installed in the same room?

Answer: NFPA 13 does not provide specific rules for all situations, including this one, but the intent is fairly clear that operation of one sprinkler should not prevent the operation of another through "cold-soldering." For standard pendent sprinklers the minimum distance is specified as 6 ft and for extended coverage sprinklers the minimum is 8 ft. For sidewall sprinklers installed adjacent along the same wall, the minimum distance is 6 ft per Section 8.7.3.4. You cited Section 8.7.3.1.5 in terms of allowing sidewall sprinklers on opposite walls, but Section 8.7.3.1.6 specifies that no sidewall sprinklers shall be within the protection area of another sprinkler installed on an opposite or adjacent wall. Based on this concept, the pendent sprinkler likewise should not be located within the protection area of the sidewall sprinkler. Obviously, this separation distance would not apply where a baffle or other building feature would serve to prevent the discharge of one sprinkler from reaching the adjacent sprinkler.

Question 7 – Sprinklers below Open Grating

We typically install sprinklers with water shields under open grated walkways and platforms over 4 ft wide. We have an owner/occupant of a building who does not want sprinklers beneath open grating for a variety of logistical reasons. There are many different types and configurations of open grating that are encountered in a variety of construction applications. Our questions:

1) Are sprinklers required beneath all open grating?

2) If the cross section of grating is 70% open (or greater), could Section 8.15.13 apply?

Answer: If the open grating is 4 ft or less in width and is located in a non-storage occupancy more than 18 inches below the sprinkler deflector and is protected by a standard spray sprinkler then it is possible that sprinkler protection below the open grating would not be required (see Sections 8.5.5.3, 8.5.5.3.1 and A.8.5.5.3 of the 2010 edition of NFPA 13).

If the open grating is used in rack storage occupancies then sprinkler protection would be required below the open grating regardless of the width of the grating (see Sections 6.2.5.1.1, 17.2.5.1.1, A.16.2.5.1.1 and A.17.2.5.1.1).

The open grid ceiling rules of Section 8.15.13 do not apply since they refer only to ceilings, with no possibility of storage between the sprinklers and the openings. Grates are generally walking surfaces, with the possibility that people will lay cardboard, carpeting, or some sort of flooring to cover the grating. Even where the grating is kept clear, tests have demonstrated that debris falling during a fire can cover the grating and serve as an obstruction to the sprinklers above.

Question 8 – Consolidated Spare Sprinkler Cabinet

When an owner has more than one building on a property, is it the intent that every building have a stock of spare sprinklers? Or can all of the sprinklers be stored in one location that is manned 24 hours a day on the same property (e.g. a military base on an island)? Personally I think that in this case the intent of the code would be met since the "premises" can be looked at as the entire base. The prompt replacement of activated sprinklers could be ensured in accordance with the requirement:

6.2.9 Stock of Spare Sprinklers.

6.2.9.1 A supply of at least six spare sprinklers (never fewer than six) shall be maintained on the premises so that any sprinklers that have operated or been damaged in any way can be promptly replaced.*

Answer: When a number of buildings are all owned by the same entity (like a military base or a college campus), we agree that NFPA 13 and NFPA 25 are met by simply having one central location for spare sprinklers, which might be better than scattering them where they can be lost, stolen or tampered with). As you note, the intent is to make sure that a sprinkler can be promptly replaced following activation so that the system can be returned to service. Of course, with such a central replacement pool, replacements for all of the sprinklers in the complex need to be available, no matter how many different kinds of sprinklers there are.

Question 9 – Protection of Fireworks Storage

I have a request for reviewing an existing sprinklered warehouse to upgrade the systems for the warehousing of "back yard fireworks" stored in racks and bulk stored to a yet to be determined height. These fireworks are considered non-explosive with no gun powder (sparklers?). What NFPA standard or handbook addresses this type of storage for purposes of sprinkler density, ventilation and fireproofing?

Answer: There is no NFPA code or standard that contains adequate information on fire sprinkler system design to protect fireworks of any kind. There was some information in NFPA 1124, but that information was ordered to be pulled out of that document when a review by the NFPA 13 Discharge Criteria Committee found significant problems with the tests used to generate the criteria.

There definitely needs to be more research on the subject. Until then, the owner will need to hire a professional engineer (PE) to study the problem and come up with design criteria on a case-by-case basis.

Question 10 – Foam System Calculations

In regards to the required calculation procedures for an NFPA 16 foam-water wet pipe system I have the following questions:

(a) In section 7.4.2.1, when the term 'uniform' is being used, is this requiring the discharge from the sprinklers to be within a given range, such as I understand is required for aircraft hangers per NFPA 409? If so, what is the allowable tolerance? Is it looking for a maximum 20% overage as mentioned for deluge systems in Section 7.4.1.1.1?

(b) In Section 7.4.2.2, is the standard asking for the most (1) and least (2) demanding areas to be calculated? It also mentions that they are to be balanced to the available water supply. Does this terminology require a "supply" type calculation, i.e. what the water supply will provide, as opposed to the standard "demand" calculation?

(c) While I didn't see a reference within the standard, are calculations required to be performed using the "velocity pressure method"?

(d) Can gridded systems be installed? I didn't see anything in NFPA 16 forbidding this for any of the types of systems (dry, preaction, or wet). The system I am dealing with is to be filled with water, not pre-primed with foam. My concern is that it might be similar to a standard NFPA 13 dry system, only that instead of the delay expelling air, there would be a delay in expelling the water prior to delivery of the foam.

Answer: You have asked several questions, so we will answer each separately.

(a) Section 7.4.2 of the 2007 edition of NFPA 16 requires that wet-pipe, dry-pipe and preaction foam/water sprinkler systems be calculated in accordance with NFPA 13. NFPA 13 achieves an acceptable distribution by installing listed sprinklers in accordance with the spacing rules in NFPA 13. A 20% allowable tolerance as used for deluge foam/water sprinkler systems is not required since it is not mentioned in Section 7.4.2 for closed-head type foam/water sprinkler systems nor is it required by NFPA 13.

(b) Typically the term balanced (as used in NFPA 13) requires that the sprinkler system hydraulic calculation be performed using the higher anticipated pressure at any point in the system. If two system demands are calculated at the same junction point then the higher pressure requirement is used. This would require that the lower pressure/flow demand be increased to reflect the higher pressure requirement. The term balanced when used in NFPA 16 indicates that the actual system demand be used since this is what the system will encounter during a real fire event. Balancing to the available water supply will require that the system be calculated using the highest pressures that the available water supply will provide.

You are correct that this is a "supply side" calculation. This needs to be done to make sure the system does not run out of foam before the required duration of 7 to 10 minutes. The actual flow from the water supply needs to be calculated, which will be greater than the flow from a typical demand calculation, in order to properly size the foam concentrate tank. There are two ways to do this calculation:

1. Use a computer program that does supply side calculations.
2. Do an adjustment to the demand calculation as follows:
    a. Calculate the demand area using the typical demand calculation method of NFPA 13.
    b. Determine the k-factor for the fire protection system by dividing the flow demand by the square root of the pressure demand.
    c. Apply the k-factor at the pressure from the water supply for the demand flow. In a water supply that is very flat (similar pressure for a wide range of flows) you are done, but in a situation where the water supply follows a steep slope (much lower pressure available at higher flow), you will have to go through a few iterations to figure out the proper pressure/flow combination that works with the k-factor for the system

Question 11 – Intermediate Rated Sprinklers in Light Hazard

I have a situation where my employee put in an intermediate temperature rated sprinkler in a bathroom. The fire marshal said he wants the sprinkler changed out to a 155ºF rated sprinkler. Does NFPA 13 require the ordinary rated sprinkler or can I have an intermediate rated sprinkler?

Answer: Yes, an intermediate temperature rated sprinkler (such as the 200^{o}F sprinkler) is permitted to be used in a light hazard space. Section 8.3.2.1 of NFPA 13, 2010 edition states: "Unless the requirements of [the following four sections] are met, ordinary- and intermediate-temperature sprinklers shall be used throughout buildings." In general, it is preferred to use the ordinary-temperature sprinklers in light hazard spaces that do not have a heat source that would require an increased temperature rating, but there is no prohibition against the use of an intermediate-temperature sprinkler. In bathrooms with heat lamps an intermediate rated sprinkler may be necessary.

Question 12 – Effects of Dry Ice on Sprinklers

I have a local contractor who does bedbug extermination with heat, specifically hot air heated by

propane. The process requires heating the space to about 140 degrees. Because it is so effective and uses no chemicals we will probably see much more of this type of extermination in the future nationwide. To prevent sprinklers from activating his practice appears to involve using dry ice suspended in a cup under each sprinkler. Apparently some jurisdictions have not allowed the practice but it does not appear to be based on best practice or science. Would you have any contact to help them establish the recommended or best practice from a sprinkler industry source?

Answer: We are not aware of any study of what happens to sprinklers suspended over dry ice. It is entirely possible that the practice could harm the sprinklers, reducing their immediate integrity or their service life. The promoters of this new technology should undertake an appropriate test program with sprinkler listing organizations to determine whether the technique can be used safely and effectively.

Upcoming NFSA "Technical Tuesday" Seminar – August 10th

Topic: Air Venting and Relief Valves
Instructor: Karl Wiegand, EIT, NFSA Manager of Installation Standards
Date: August 10, 2010

Starting with the 2010 edition of NFPA 13, all wet pipe sprinkler systems are going to have to take into account venting the air from the system as the system is being filled with water in order to minimize corrosion. Once most of the air has been removed from the system, it becomes more important to provide a relief valve to prevent the system from being over-pressurized as the water expands due to changes in temperature. This seminar will explore all of the new rules for providing venting and relief valves under the new standard.

To register or for more information, contact Michael Repko at (845) 878-4207 or e-mail to seminars@nfsa.org

Upcoming NFSA/FSI "Best Practices Thursday" Seminar – August 19th

Topic: Information Technology Update
Instructor: John Karnatz and Paul Johnson
Date: August 19, 2010

A lot is changing in the way we process information. From server-based applications to internet-based solution providers, the landscape is rich with labor and cost saving opportunities. Join us for a 45-minute discussion on the latest in technology applications for business and fire sprinkler contractors. One-on-one follow-up is available after the call at no additional charge.

To register or for more information, contact Michael Repko at (845) 878-4207 or e-mail to seminars@nfsa.org

Inspection & Testing for the Sprinkler Industry (3-day course)

New Castle, DE – September 28-30, 2010
Delaware State Fire School's Regional Center
2311 McArthur Drive, New Castle, DE 19720

For more information, contact Nicole Sprague using Sprague@nfsa.org or by calling 845-878-4200 ext. 149.

Additional In-Class Training Seminars

The NFSA training department also offers in-class training on a variety of subjects at locations across the country. Here are some seminars scheduled for 2010:

Aug 9	Wailuku, HI	CPVC Piping (1/2 day a.m.)
Aug 9	Wailuku, HI	Underground Piping (1/2 day p.m.)
Aug 10	Wailuku, HI	Standpipe Systems (1/2 day a.m.)
Aug 10	Wailuku, HI	Commissioning & Acceptance Testing (1/2 day p.m.)
Aug 11	Wailuku, HI	Inspection, Testing & Maintenance
Aug 24	Menasha, WI	NFPA 13 Update 2007
Aug 25	Menasha, WI	Sprinkler Protection for General Storage
Aug 26	Menasha, WI	Foam Water Systems (1/2 day a.m.)
Aug 26	Menasha, WI	Commissioning & Acceptance Testing (1/2 day p.m.)
Aug 31	Rochester Hills, MI	NFPA 13 Update 2007
Sept 1	Rochester Hills, MI	Plan Review Policies & Procedures
Sept 2	Rochester Hills, MI	Commissioning & Acceptance Testing (1/2 day a.m.)
Sept 2	Rochester Hills, MI	Introduction to Sprinklers (1/2 day p.m.)
Sept 8	Seattle, WA	Sprinklers for Dwellings
Sept 9	Seattle, WA	Plan Review Policies & Procedures
Sept 10	Seattle, WA	Commissioning & Acceptance Testing (1/2 day a.m.)
Sept 10	Seattle, WA	CPVC Piping (1/2 day p.m.)
Sept 14	Dayton, OH	Plan Review Policies & Procedures
Sept 15	Dayton, OH	Inspection, Testing & Maintenance
Sept 16	Dayton, OH	Basic Seismic Protection (1/2 day a.m.)
Sept 16	Dayton, OH	Standpipe Systems (1/2 day p.m.)
Sept 16	Concord, NH	Sprinkler Protection for General Storage
Sept 17	Concord, NH	Sprinkler Protection for Rack Storage
Sept 18	Concord, NH	Plan Review Policies & Procedures

These seminars qualify for continuing education as required by NICET, and meet mandatory Continuing Education Requirements for Businesses and Authorities Having Jurisdiction.

To register or for more information, contact Michael Repko at (845) 878-4207 or e-mail to seminars@nfsa.org

About the National Fire Sprinkler Association

Established in 1905, the National Fire Sprinkler Association (NFSA) is the voice of the fire sprinkler industry. NFSA leads the drive to get life-saving and property protecting fire sprinklers into all buildings; provides support and resources for its members – fire sprinkler contractors, manufacturers and suppliers; and educates authorities having jurisdiction on fire protection issues. Headquartered in Patterson, N.Y., NFSA has regional operations offices throughout the country. www.nfsa.org.