NATIONAL FIRE SPRINKLER ASSOCIATION, INC.

Tuesday e-Tech Alert
December 5, 2006
Number 71

Best Questions of November 2006

We have selected the following questions as the "best of November 2006" answered by the engineering staff as part of the NFSA "Engineer of the Day" member assistance program:

Question 1 – Preventing FDC Piping from Freezing

To prevent freeze damage to fire department connections, is there a minimum distance required between the check valve in a heated area and the Siamese connection on the outside of the building? Someone told me they thought the minimum was 4 feet.

Answer: The wording of NFPA 13 is performance-oriented when discussing the prevention of freezing for an FDC. Section 8.16.2.6 of the standard (2002 edition) calls for an automatic drip for the FDC in areas subject to freezing. Section 8.15.3.1 criteria also apply to protect water-filled piping against freezing. The reason you have heard about a 4 ft separation is that there is a note to Figure A.8.16.4.2(a) calling for at least 4 ft of exposed piping in a warm room beyond the valve on a system test connection for a wet pipe system. Admittedly this is somewhat of a parallel situation, but it should be noted the annex is advisory only, and the actual rule is to maintain the temperature of the water-filled pipe at or above 40^{o}F. There obviously can be a wide range of conditions that will affect whether a 4 ft separation is adequate.

Question 2 - Theoretical Water Discharge from Main Drain Test

Main drain test connections for sprinkler system risers are addressed in Section 5-15.4.1 of the 1999 edition of NFPA 13, which is Section 8.16.4.1 in the 2002 edition of NFPA 13. The NFPA standard explains that this drain will be discharged when the system is installed new, to establish the benchmark available pressure, so that the owner can compare future test pressure readings to the benchmark and determine if there is a degradation in the available water supply. Is there a way to anticipate roughly the amount of water flowing from the drain line, given the available static, residual pressure and residual flow, at some point in the piping system up-stream of the drain line?

Answer: Although the Insurance Services Office advanced the concept of quantitatively evaluating water supplies using the main drain test back in 1983, there is still no accepted way to use the main drain results to specifically evaluate system water supplies. There are too many variables, including assumptions needed relative to the roughness of the discharge line, and unknown losses in various check valves, alarm valves, and other equipment. There is also no need to calculate the flow from the main drain. The most important use of the main drain test is to make sure that the valves between the water supply and the sprinkler system are open. As long as the main drain connection is opened the same amount during each test, the residual pressure from the water supply can be compared to the previous tests to make a determination regarding the potential for closed valves (or obstructed supply pipes).

The 2008 edition of NFPA 25 is in preparation, scheduled for final discussion and approval at the June 2007 meeting of the NFPA. Proposed new text will require that observed degradation of the water supply

be identified and corrected if necessary if there is a 10 percent reduction in full flow pressure when compared to the original acceptance test or previously performed tests.

Question 3 – Ladders for Bolted Steel Tanks

A question in the "Best of October 2006" (e-Tech Alert 69) discussed the fact that interior ladders from the roof hatch to the floor level are required by NFPA 22 for welded steel aboveground tanks. Does the same requirement exist for bolted steel tanks?

Answer: No. With regard to interior ladders, NFPA 22 does not contain any specific requirements for bolted steel tanks as it does for welded tanks in Section 5.7.4.1. The standard does contain a number of references to AWWA D103 – *Factory-Coated Bolted Steel Tanks for Water Storage*, including fabrication of parts per Section 6.5.1 and erection per Section 6.6.1. However, AWWA D103 actually recommends against inside ladders. Older editions included the recommendation against inside ladders in climates where ice may form, but the recommendation is more general in the referenced 1997 edition of D103.

Question 4 – Pressure Testing of Bolted Steel Tank Fill Tube

When performing the initial fill of a coated, bolted steel tank it was noted that at least one of the internal joints on the fill tube was leaking. Does the fill tube require integrity testing to a pressure above its normal working pressure?

Answer: No. NFPA 22 does not contain any requirements for testing gravity tanks at pressures other than fill pressures. Section 6.6.4 (2003 edition) states: "The completed tank shall be tested by filling it with water, and any detected leaks shall be repaired in accordance with AWWA D103, *Factory-Coated Bolted Steel Tanks for Water Storage*." The NFPA 22 requirement does not extend to the fill tube, assuming there is no leakage once the tank is placed in service. However, it would be expected that the fill tube for a new installation should be free of leaks on the basis of standard good workmanship.

Question 5 - Electrical Grounding for Main Building Electrical Service

Do either NFPA 70 (the National Electrical Code), NFPA 13 or NFPA 25 contain any specific rules that prohibit grounding the building electrical service using the main fire protection water pipe supply?

Answer: Section 10.6.8 of NFPA 13 (2002 edition) prohibits the use of pipe as the grounding electrode for electrical systems. This prohibition also appears as Section 10.6.8 of NFPA 24. However, for safety reasons, all metallic piping systems in a building needs to be bonded together to form a ground. Therefore, while the sprinkler system is not allowed to be the only grounding electrode for an electrical system in a building, it is expected to be grounded along with the other metallic systems in a building.

Question 6 – Conflicting Thrust Block Formulae

In annex section A.10.8.2 of NFPA 13 (2002 edition), the formula for calculated thrust block width is given as $b = 2(S_f)(P)(A)\sin(\theta/2) / (h)(S_b)$. However, the NFPA's *Automatic Sprinkler Systems Handbook* for the 2002 edition shows the same formula given as $b = 2(S_f)(A)\sin(\theta/2) / (h)(S_b)$., without reference to pressure P. Which is correct?

Answer: The standard is correct, not the handbook. Maximum pressure is an important factor in sizing thrust blocks and should be included.

Question 7 – Lists of Approved Backflow Preventers

Is it possible to access the list of backflow preventers approved by the University of Southern California's Foundation for Cross-Connection Control and Hydraulic Research (FCCCHR)?

Answer: The list of approved backflow preventers is available at the website of the FCCCHR (www.usc.edu/fccchr), but only for Foundation members. For fire systems, UL lists backflow preventers and lists only those that have previously been approved by the FCCCHR for their backflow protection ability, so it is better to go to the UL.com website and view the online certification directory.

Question 8 – Use of Dielectric Fittings

A recent discussion regarding the use of dielectric fittings in MRI rooms and similar situations led to a question about the sensing lines on the fire pumps being directly connected to the steel outlets on the fire pump piping. Is there any reference in the literature that addresses this situation? We prefer to use threaded brass pipe for our installations.

Answer: Dielectric couplings are typically used on piping systems where dissimilar metals are installed and where water is continuously flowing. Since the water does not continuously flow in a fire sprinkler system, or in the sensing lines to fire pumps, there is less need for their use. Section 7.6.1.1.4 of NFPA 13 requires the use of dielectric fittings to protect sprinklers in closed-loop circulating systems because the water in these systems is constantly circulating, which helps transfer the ions from one metal to the other. The commentary in the NFPA's *Automatic Sprinkler Systems Handbook* contains additional information. Dissimilar metals are common in sprinkler systems. Bronze sprinklers are typically in contact with iron fittings, yet dielectric fittings are not used in these locations. The relatively slight movement of water in these systems is not sufficient to cause degradation of the sacrificial metals. Relative mass also plays a role, and the large mass of the sacrificial iron and steel relative to the mass of the sprinklers has not resulted in field problems.

Question 9 – Evaluating Combined Domestic and Fire Water Storage for NFPA 13R

A UL-listed fire pump will supply water to an NFPA 13R sprinkler system protecting a motel. The proposed water supply is a non-pressurized underground storage tank that is also being used for the domestic water storage. The bottom of the storage tank is just above the inlet to the fire pump. Because of the combined use, the health department requires a backflow device between the storage tank and the pump. Does this type of requirement usually create a situation in which the owner would be better off with a separate supply tank?

Answer: The option does exist for a separate tank for fire service. The disadvantage to this approach is that the owner will have to pay for installation and maintenance of the additional tank. There is also a reliability disadvantage, since a combined tank for domestic and fire protection water creates an incentive to promptly repair the tank if there is a problem. The backflow preventer is acceptable in the suction line as long as you can account for the friction loss and provided it is located at least 10 times the pipe diameter away from the suction flange of the pump. The friction loss may be the biggest problem. NFPA 20 allows you to go down to a suction pressure of -3 psig. You may have to increase the size of the tank so that there is more water higher in the tank. This would provide the ability to use the increased head pressure of the water up in the tank to push the water through the backflow preventer and still get it to the suction flange of the pump without dropping below -3 psig.

Question 10 – Safety Factors for Concrete Inserts

NFPA 13 - 9.1.1.2 (2007 edition) allows unique sprinkler hangers such as multiple pipes on a common trapeze hanger to be calculated as five times the water-filled weight plus 250 lbs. Commercially available hanger components such as concrete inserts, threaded rod and hanger struts have published allowable and ultimate loads. Typically the ultimate load values exceed the allowable by a (safety) factor of between 3 and 5 depending on the type and consistency of the component. Is it acceptable to use the published ultimate load when calculating hanger assemblies per NFPA 13-9.1.1.2 provided the actual load does not exceed the allowable as well? If it were required to use the allowable load when calculating the same we would essentially be using a safety factor of 7 to 10 plus 250 lbs which does not seem appropriate.

Answer: First, it should be noted that NFPA 13 requires the hanger components that are attached to the building structure to be listed (Section 9.1.1.4.1 in the 2007 edition). There are available concrete inserts and powder-driven fasteners, and they can be viewed at the ul.com website in categories VFXT and VGLR. You are correct that Section 9.1.1.2 allows an alternate approach certified by a professional engineer, and contains the 5 times plus 250 lb criteria. It would be reasonable to assume that the engineer would use the ultimate load as the basis of the analysis prior to the consideration of safety factors. The exception to the above might be a material that exhibits a yield point at a load less than the ultimate load, but concrete is not generally considered to be such a material. As you indicate, the allowable load after applying the NFPA 13 safety factors should never exceed the manufacturer's published allowable load for a fastener.

Question 11 – Earthquake Bracing for Piping Extending Below Grade

A steel grated stairway has been constructed that extends 300 ft below grade for an underground sewage overflow pumping station. The only structure attached to the stairway is at grade. At the very lowest two levels 300 ft down a 6-inch standpipe riser are the zone control stations attached to the standpipe. Are flexible couplings required above and below each landing, or are they only required where the pipe extends out to the zone control stations?

Answer: The NFPA 13 earthquake protection requirements do not differentiate between above grade and below grade construction with one exception: the Section 9.3.3 (2002 edition) requirement for seismic separation joints applies only to seismic separation joints above grade level. However, this does not necessarily mean that flexible couplings are required at every landing. In normal building construction points of support and flexible couplings above and below such points of support are based on floor penetrations. Since it would appear that you do not have floor penetrations, points of support would be limited to a maximum 25 ft by Section 9.2.5.4, assuming there are no offsets in the riser. Section 9.3.2.3(7) would then require flexible couplings above and below each such point of support. With regard to additional flexible couplings on laterals to zone control stations, Section 9.3.2.3(2) again refers to "floors" because mains are braced to the floor/ceiling assembly. If the zone control stations are braced to anything other than the stairwell, similar flexible couplings should be provided.

Question 12 – Four-Way Slope in Small 4 in 12 Combustible Attic Tower

A square attic tower 12'7" along each of its four sides has combustible 2x12 members spaced less than 3 ft on center with a 4 in 12 pitch in all four directions and there is a question as to how many sprinklers are required to protect this small space. Can a single sprinkler be installed in the very center? If the area were larger the decision would be more straightforward. It seems impossible to meet the rules for steeply sloped combustible spaces, and it seems ridiculous to install four sprinklers in such a small area.

Answer: For roof slopes 4 in 12 or greater in combustible concealed spaces of wood trusses or joists spaced 3 ft or less on center, the wording of NFPA 13 Section 8.6.4.1.4 (2002 edition) calls for quick

response sprinklers installed with a row within 12 inches horizontally of the peak. The wording further calls for sprinklers at the eave not less than 6 ft from the outer line of the concealed space. (In the 2007 edition this was changed to 5 ft to allow greater flexibility). Overall spacing is restricted to 130 sq. ft. per Table 8.6.2.2.1(a). Maximum spacing perpendicular to the slope is 8 ft with minimum 7 psi (and maximum 15 ft along the slope) or 10 ft with minimum 20 psi (and maximum 12 ft along the slope). The floor area of this protected space is only about 160 sq. ft (12'7" on a side), and the distance along the slope from the center peak to the eave line is less than 7 ft. Technically, not even four sprinklers can be used to protect the space (one at the top of each side of the roof), since they would then effectively be placed 12'7" perpendicular to the slope as measured at the eaves. An attempt could be made to use special listed attic sprinklers, but a preliminary review of the listings does not suggest a simple solution.

Perhaps the most reasonable option is to approach the Authority Having Jurisdiction with a proposal to use a single fast response upright sprinkler at the center point, citing the Equivalency clause of NFPA 13 Section 1.5. Note that the maximum spacing allowed per Table 8.6.2.2.1(a) for combustible obstructed construction with members 3 ft or more on center is 168 sq. ft., with maximum spacing in either direction of 15 ft. The more restrictive criteria applied to combustible obstructed construction with members less than 3 ft on center, as well as the special criteria of Section 8.6.4.1.4, is based on the concern that the heat from a fire will be channeled upward by the structural members, preventing the sprinklers adjacent to the fire from operating promptly. In the situation at hand, the single sprinkler at the high point of the tower will not be prevented from prompt operation since the heat from the fire will be channeled to that point from all sides. Allowing the use of the spacing criteria applicable to combustible obstructed construction with members more than 3 ft apart, therefore, should not reduce the level of safety, and provides a much more practical solution.

NFSA Announces "Top Tech" Competition

The National Fire Sprinkler Association has announced that it will be sponsoring a "Top Tech" competition in conjunction with its Annual Seminar and Exhibition in Las Vegas on May 3-4, 2007. System layout and detailing technicians will be able to compete through examinations for spots on regional teams from the United States and Canada, which will then enter a final competition at the Las Vegas seminar. Details will be available on our website, www.nfsa.org, by December 12th.

Upcoming NFSA Technical Tuesday Online Seminar - December 12th

Topic: Problem Areas/Frequently Asked Questions
Instructor: Kenneth E. Isman, P.E., NFSA Vice President of Engineering
Date: December 12, 2006

In addition to the problems covered in recent "Technical Tuesday" online seminars, there are a number of other areas where users of the NFPA standards frequently get tripped up. This program will begin with a discussion of the items that frequently get asked of the NFSA Engineer of the Day and then the second half of the seminar will be devoted to answering questions that come in from anyone participating in the seminar. Participants are encouraged to ask questions about NFPA 13, NFPA 13R, NFPA 13D or NFPA 20. Questions can be submitted during the seminar or in advance by e-mailing them to isman@nfsa.org.

Information and registration for this seminar is available at www.nfsa.org or by calling Dawn Fitzmaurice at 845-878-4200 ext. 133 or email: dawn@nfsa.org.

AHJ Business Thursday Online Seminar Rescheduled for December 14th

Due to a scheduling conflict, the "Confusing Aspects of Storage Protection" online has been rescheduled from December 7th to December 14th, one week later.

Topic: AHJ Relationships
Instructors: Jeffrey Hugo and David Bowman, NFSA Regional Managers
Date: December 14, 2006

Project delays are often caused by plans review and inspection delays. Inspections often result in demands that cost money and delay projects even though the demand may not be based on a code requirement. Your relationship with code enforcement personnel can make the difference between a profitable project and a lingering nightmare. This presentation brings a building official and a fire marshal to the podium to explain the role of the AHJ, what to expect in plans review, inspection practices, and conflict resolution. Also discussed is the issue of code enforcement boards: when to use them and when not to use them.

Information and registration for this seminar is available at www.nfsa.org or by calling Dawn Fitzmaurice at 845-878-4200 ext. 133 or email: dawn@nfsa.org.

Spring 2007 Technical Tuesdays Feature Changes in 2007 NFPA Standards

During the first half of 2007, NFSA will be devoting its "Technical Tuesday" online seminar series to an in-depth review of changes to the new 2007 editions of NFPA 13, 13D, 13R, 14 and 20. This is your chance to learn from the experts who represent the fire sprinkler industry on the technical committees that write the sprinkler rules. See the changes in the 2007 edition that can clarify older rules and make the installation of fire sprinkler systems more cost effective.

Jan 16	***Changes to Definitions and System/Component Requirements***
	Russell P. Fleming, P.E.
Jan 30	***Changes to the Installation Rules***
	Cecil Bilbo, Jr.
Feb 13	***Changes to the Hanging Requirements***
	Victoria B. Valentine, P.E.
Mar 6	***Changes to Underground Piping and Water Supplies***
	Kevin J. Kelly, P.E.
Mar 20	***Changes to Design Approaches and Calculations***
	Cecil Bilbo, Jr.
Apr 3	***Changes to the Seismic Protection Rules***
	Victoria B. Valentine, P.E.
Apr 17	***Changes to Storage Protection Requirements***
	Russell P. Fleming, P.E.
May 8	***Changes to the Residential Sprinkler Standards***
	Kenneth E, Isman, P.E.
May 22	***Changes to the Standpipe Rules***
	Kevin J. Kelly, P.E.
June 12	***Changes to the Pump Requirements***
	Kenneth E. Isman, P.E.

The level of all seminar topics is considered intermediate. Because these seminars are being offered as a complete program on NFPA 13, a 30% discount is available when signing up for all ten seminars in the series.

Information and registration for this seminar series is available at www.nfsa.org or by calling Dawn Fitzmaurice at 845-878-4200 ext. 133 or email: dawn@nfsa.org.

NFSA Sets 2007 Schedule for 3-day Advanced Technician Training and NICET Inspector Certification Review Classes

The NFSA Engineering Department has set up the following classes for open registration:

May 22-24	ITM NICET Review	Anchorage, AK
June 19-21	ITM NICET Review	Wilmington, DE
July 24-26	Advanced Technician Training	Chicago, IL
August 14-16	ITM NICET Review	San Antonio, TX
September 5-7	Advanced Technician Training	St Louis, MO
November 6-8	ITM NICET Review	Providence, RI

For more information, contact Nicole Sprague at 845-878-4200 ext. 149 or email: Sprague@nfsa.org.