e-TechNotes

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Best Questions of December 2011

We have selected the following questions as the "Best of December 2011" answered by the engineering staff as part of the NFSA's EOD member assistance program:

Question 1 – Using QR Sprinklers at 0.05 gpm/sq ft Density

In the 2007 edition of NFPA 13R, Section 6.8.3.3 allows the use of quick response or residential sprinklers at a 0.05 density, which would indicate a light hazard situation. The 2010 edition offers similar verbiage. If the garages are a typical apartment style setup with a car and general personal items, can light hazard spacing with quick response sprinklers at a density of less than 0.1 gpm/ sq ft be used? The wording is slightly different between the 2007 and 2010 editions, but the main issue would seem to be life safety vs. property protection.

Answer: Yes, quick response spray sprinklers may be used under NFPA 13R in garages that are a part of the dwelling unit at a 0.05 gpm/sq ft density, which is only allowance under which quick response sprinklers can be used at a 0.05 density in the NFPA standards. The maximum 15 ft x 15 ft spacing is permitted. This is because the garage is considered to be part of the dwelling unit, which is usually protected with residential sprinklers. The quick response sprinklers are seen as roughly equivalent in this instance.

Question 2 – Requirements for Listed Flexible Seismic Assemblies

In an area requiring earthquake protection for the sprinkler system, are you required to use a listed flexible seismic assembly for a 2-inch auxiliary drain crossing an expansion joint?

Answer: First, we need to point out that NFPA standards do not require the use of listed flexible seismic assemblies under any circumstances. There are some circumstances where seismic separation assemblies (joints made up with grooved elbows that allow movement in all directions) are required, and there are special listed flexible seismic assemblies that, when installed in accordance with their listing, meet the requirements for seismic separation assemblies.

Next, we need to clarify whether you are asking about the piping crossing an expansion joint or a seismic separation joint. Any piping, regardless of size, crossing a seismic separation joint needs to be protected with a seismic separation assembly. Even drain piping crossing a seismic separation joint needs to be protected with a seismic separation assembly. However, if the drain piping that is crossing the joint is already downstream of the drain valve, damage to the piping would not affect the sprinkler system performance. In the 2013 edition of the standard, clarification will be made that for drain piping crossing a seismic separation joint downstream of the drain valve, a seismic separation assembly will not be required.

If the joint in question is truly just an expansion joint, then no protection is required for 2-inch pipes of any kind. If the drain was 2-1/2 inch or larger in size, it would require a flexible coupling within 24 inches of the expansion joint (see Section 9.3.2.3(4)). Clarification will also be made in the 2013 edition that no protection is required for these larger drain pipes if the expansion joint is downstream of the drain valve.

Question 3 – Acceptable Tanks for Sprinkler System Suction Supplies

As an AHJ, I am having a hard time determining whether a water tank being used for a water supply for a sprinkler system needs to meet NFPA 22. I'm using the 2007 editions of NFPA standards 20 and 13. At question is a religious building that will be getting its water supply from a buried water tank. The water will be transported to the building via a vertical turbine pump that will be mounted in a conditioned pump house on top of the tank. NFPA 20 does not have any direction that I can find on regulating tanks supplying fire pumps. Section 23.2 of NFPA 13discusses gravity tanks that are "elevated," but nothing about tanks that are being used as wells. Any direction would be appreciated.

Answer: This is a hole in the standards system that people have been reluctant to fill. One could make an argument that, technically speaking, NFPA 13 does not allow the use of suction tanks for sprinkler systems. The types of acceptable water supplies in Section 23.2 include pressure tanks and gravity tanks, but suction tanks are not included in the list. It should be noted, however, that these other types of tanks are sources of pressurized water for the system, whereas a suction tank is never used without a pump and therefore a reference to NFPA 20. NFSA has addressed the situation with a proposal (13-501) for the 2013 edition, but we did not address the issue of a reference to NFPA 22 for other reasons, which we'll explain here.

The concerns for mandating NFPA 22 for suction tanks revolve around the other situations that are intended to be acceptable. Suction from wet pits, reservoirs, underground wells, rivers, ponds, and standing water bodies are all permitted by NFPA 20. Since none of these situations would meet NFPA 22, it would be difficult for the NFPA 20 committee to mandate the use of NFPA 22 when using a tank instead of a pond, wet pit or well.

NFPA 13 and NFPA 20 contain similar language regarding water supplies for pumps. Section 23.1.2 of NFPA 13 says that the water supply needs to be capable of providing the flow and pressure required for the system for the duration required by the standard. It would be up to the AHJ to decide on the reliability of any individual water supply and what requirements they might have to make sure that the water was available when needed.

Similarly, Section 5.6 of NFPA 20 requires a reliable source of water for the pump. The AHJ gets to determine what is reliable. Chapter 7 of NFPA 20 goes on to state several requirements for the source of water for vertical shaft turbine pumps including well construction and wet pit installations. An AHJ might conclude that it would take an NFPA 22 tank to be equivalent to these construction requirements, but we're not sure of the implications of such a declaration. NFPA 22 certainly contemplates the use of tanks as suction for vertical shaft turbine fire pumps. We added Figures B.1(w) and B.1(x) to the 2008 edition of NFPA 22 to help clarify how to arrange such tanks. If you decide that you do not need to enforce NFPA 22, here is a list of concerns that you might want to consider having the installing contractor address before determining that the tank installation is reliable:

1. How is the tank going to be filled?
2. How is the water level going to meet the submergence requirement of section 7.2.2 of NFPA 20? (Note that in both Figure B.1(w) and B.1(x) of NFPA 22, the minimum water level in the tank is above the impellor bowl assemblies.)
3. How is the water level going to be provided for the pump operator in accordance with section 7.3.5.3 of NFPA 20?
4. How is the tank going to be vented so that it does not collapse as water discharges?

5. Will there be a manway so that the tank can be maintained on the inside?
6. Will the tank be protected from corrosion both inside and outside (concerns over both interior corrosion due to contact with water and external corrosion as the tank is in contact with soil of varying acidity)?
7. Will the tank be strong enough to hold up to the stresses placed on it by soil around the tank and structure above?

Question 4 – "Cold Fire" Antifreeze Alternative

I am working with a company called Cold Fire, which has a new product that is non-combustible and rated to -32ºF. Information I have on the product shows MSDS hazards are all zeros, and that it does not need an expansion tank since it does not expand. Since it has zero flammability and also works to suppress fire quickly, would it be an acceptable substitute for conventional sprinkler antifreeze solutions?

Answer: Both NFPA 13 and NFPA 25 require any potential antifreeze product other than propylene glycol or glycerine to be listed. The listing process is intended to ensure that there will be no compatibility problems with the components of the sprinkler system. Without a listing, we don't know how the chemicals in these solutions will react with the brass, steel, rubber, and other materials used in sprinklers, fittings, gaskets and seals. While we believe Cold Fire has been listed by UL as a wetting agent in accordance with NFPA 18, this is not a sufficient listing to allow its use in fire sprinkler systems.

Question 5 – Clearance to Structural Members in Earthquake Areas

My question concerns Section 9.3.4.9, which requires a 2-inch clearance from structural members not penetrated or used. My situation is that the sprinkler piping wraps a beam and/or is very close to a horizontal beam. This beam is part of the floor assembly of which the piping is attached to and should (in my opinion) move as a unit.

In the NFPA's *Sprinkler Handbook* under this section, the last sentence of the commentary refers to a building column. Am I to gather that this 2-inch clearance is only for vertical structural members such as a column, or was that only used as a general example?

Are beams (steel, concrete or wood) that are part of a floor assembly required to also have the 2-inch clearance even though they may not be penetrated or used?

Answer: No to both questions. By the description you provided it sounds like the piping is being hung by the structural members in question, which means that the 2-inch clearance would not be required. However, there are construction scenarios where horizontal or vertical members may be anticipated to move differently than the sprinkler system piping during a seismic event and clearance would be needed. When a sprinkler system is supported from structural beams, it will move with them. It is important to be aware if there are other structural components (which could be horizontal or vertical) that could move independently from the ones supporting the sprinkler system, in which case the minimum 2-inch clearance would be needed.

Question 6 – Thickness of Cellophane Bags

NFPA 25 – Section 5.4.1.7.1 specifies protection for sprinklers subject to overspray accumulation using cellophane bags having a maximum thickness of .076 mm.

It appears to us that a standard cellophane bag is approximately 1 to 1.5 mm. Do you know of a cellophane bag that is available in the specified thickness?

Answer: Be very careful regarding this section. The typical sandwich bags that you can buy in the grocery store are not cellophane. These bags are plastic and cannot be used on sprinklers. During a fire, the plastic bags could melt onto the sprinkler and possibly impair the correct operation of the sprinkler.

You may want to contact true cellophane bag manufacturers through the Internet. In the meantime, NFPA 25 also allows "thin" paper bags. Since the word "thin" is not defined in this context, it should be easier to use paper bags that comply with the standard.

Question 7 – High Pressure Air Tests

I have an IT/server/computer room protected by a double interlock preaction system. The owner's concern is, of course, water leakage from the hydrostatic testing with no objection to air testing. NFPA mentions a 40 psi air test for 24 hours but requires a 200 psi hydrostatic for 2 hours for system approval. The owner has asked if an alternative to the hydrostatic would be acceptable, and has proposed a 24-hour air test at 200 psi. Obviously, air and water are two different mediums with different properties, acting very differently under 200 psi pressure. My first concern is compliance with NFPA 13, my second being, should there be a pipe failure at 200 psi of air, you could end up with shrapnel that could be even more detrimental than the water. Should we consider this since the owner has requested it?

Answer: Never test piping systems with air in excess of 40 psi. As you note, when a failure occurs during an air test at high pressure (like 200 psi) the failure will potentially cause shrapnel that will be a serious safety hazard. Water, on the other hand, as a fluid can absorb the reactionary force from a failure without contraction (since it is essentially incompressible) and therefore is much safer.

The ideal scenario with pressure testing sprinkler systems in sensitive rooms is to perform the test before the sensitive equipment is brought into the room. Evidently, this was not scheduled to happen, or the sprinkler system is a retrofit. Since the equipment is in place, my suggestion is to conduct the test with a limited volume of water. The pressure here is the important variable. Since leaks are not allowed, you can run the test with the water supply closed. If a failure occurs, the limit of the water that will exit the system is the water in the volume of the piping. Plastic can be draped over sensitive equipment to keep it dry, even if a failure occurs.

Most important equipment today has remote site backup. It might be a good idea during the test to have the computer systems working from or ready for the remote backup if at all possible.

Question 8 – Sizing the Fire Department Connection Piping

There is a debate in our office. Section 8.17.2.3(3) of NFPA 13 (2007 edition) states that the minimum size of piping for the fire department connection in a hydraulically calculated system "shall be permitted to be less than 4 in. (100 mm) and no less than the size of system riser, where serving one system riser." This paragraph obviously says that a 3-inch riser would only need 3-inch piping to the FDC, but what size piping would a 6-inch riser need? Some feel that 4-inch would be sufficient (the minimum as required by subsection (1) of the same section). Others feel 6-inch piping out to the FDC would be required per the line "no less than the size of the system riser".

If 6-inch would be required, is there an upper limit? In other words, would a 12-inch riser require 12-inch piping to the FDC?

Answer: For systems with risers 6 inches or greater in diameter, the pipe to the fire department connection is only required to be 4 inches in size. Section 8.17.2.3(3) only applies when you are trying to make the pipe smaller than 4 inches, which NFPA 13 allows, as long as the pipe is not smaller than the riser. The key to

understanding this section is the phrase “shall be permitted” making this an option, not a mandatory requirement to have all FDC pipe match all risers.

Question 9 – Water Curtain Design

I am installing a fire sprinkler system in a high rise “open” parking garage. One side of this building is located on an alley and its proximity to the building across the alley requires that the openings in the wall be protected. Each floor of the open parking garage is protected with a dry pipe fire sprinkler system and to protect the opening this system is extended with closed upright sprinklers as required by our local building code. I do not think that this system is an “exposure protection system” but rather a water curtain provided at opening in lieu of providing fire shutters etc, which still allows the area of the opening to be increased (2009 IBC, Section 705.8.2). Two questions:

1. Would this system as I have described be subject to the design requirements of 2010 NFPA 13, Section 11.3.2 or 2010 NFPA 13, Section 11.3.3?
2. If this system is subject to the design requirements of 2010 NFPA 13, Section 11.3.3, is the intent of 2010 NFPA 13, Section 11.3.3.1 to require that all sprinklers within the water curtain be calculated as flowing at the same time? For example, if the water curtain protects 300 linear feet of opening on a level would Section 11.3.3.1 require you to calculate the entire 300 linear feet flowing? Or would you calculate 53 linear feet (1.2*1950^0.5) as required in Section 11.3.3.2?

Answer: The sprinklers that you have described protecting the openings in the parking garage wall would be considered “water curtains” and would need to be designed in accordance with Section 11.3.3 of NFPA 13. We arrive at this conclusion in two ways:

1. The exception to Section 705.8.2 of the IBC specifically uses the term “water curtain” in its description of the sprinklers that are needed to protect the opening.

2. Section 11.3.2 of NFPA 13 is entitled “Exposure Protection”. An exposure protection system sprays directly on the exposed object, keeping it cool during an adjacent fire. In this case, the exposed object is the building across the alley. But the sprinklers are not going to spray on the building across the alley. The sprinklers are designed to spray across the opening in the parking garage. Therefore, this system would not be considered an exposure protection system.

The design of a water curtain under Section 11.3.3 of NFPA 13 is very clear. The design area is only required to be the number of sprinklers in the length of the system equal to 1.2 times the square root of the system design area. As you stated in your request, the design area is most likely 1950 sq ft (assuming a flat roof above the sprinklers). As such, the length of the design area of the water curtain would be 53 ft. The sprinklers along the 53 ft of the opening would be added to the ceiling sprinklers adjacent to the opening in the hydraulic calculations.

Question 10 – Through Bolts in Glu-Lam Beams

The State of California does not allow the use of lag screws or lag bolts in wood for attachment of earthquake bracing. This sometimes leads to a problem when wood beams are thicker than 5 ½ inches. This is the maximum "Length of Bolt in Timber" noted in Figure 9.3.5.9.1.

Is there any guidance for attaching earthquake bracing to large glu-lam beams with thicknesses greater than 5 ½ inches (6-3/4 up to 8-3/4 are not uncommon) without using lag screws or lag bolts?

Answer: We have two suggestions as to how you could move forward:

1. Use the values for load carrying capability for the 5.5 inch beams for all larger beams. These loads are more than acceptable for use with larger beams. There is nothing wrong with putting a through bolt through a larger beam (as long as the structural engineer is okay with you drilling a hole in the beam) and the load that the bolt through the beam could carry would be greater than the load allowed for the 5.5 inch beam. So, until a higher load can be calculated, use the values for the 5.5 inch beam already in the figure when you have larger beams.

2. Hire a structural engineer to calculate the load that could be carried with the larger beam. Make sure that the engineer uses the Allowable Stress Design (ASD) calculation method to be consistent with NFPA 13. Many structural engineers use an Ultimate Strength Design (USD) method that is different from the ASD method. In order to make sure that the engineer is looking at the situation similarly to the rest of the figure, the analysis should reproduce the values in the figure as well as producing values for larger beams.

Question 11 – Protecting Large Diesel Fuel Tanks

Just a quick question concerning the protection of a large diesel fuel tank (Class IIIB) that is stored in a room of 45 ft x 30 ft that is fire rated for 2hrs. Would NFPA 30 be the correct code to follow to protect the room with sprinklers? I'm figuring a maximum spacing of 100 sq ft per sprinkler but am not sure about the density requirements.

Answer: There are many different ways to protect large diesel fuel tanks. Most of them start with NFPA 30, but there are many other NFPA standards that also may apply. For example, NFPA 20 contains rules for protecting diesel fuel tanks in fire pump rooms that store up to 1320 gallons. So, knowing what occupancy the room is and what the tank is being used for might have some bearing on the decision.

In general, NFPA 30 does not contain specific sprinkler criteria for protecting large tanks. Instead, Chapter 21 of NFPA 30 (which applies to large tanks) requires that the protection measures for tank storage facilities be provided by "an engineering evaluation of the installation and operation, followed by the application of recognized fire and explosion prevention and process engineering principles." In other words, the specifying engineer is supposed to evaluate the situation, determine an appropriate strategy for protection that includes sprinkler discharge criteria if sprinklers are a part of the design solution, and communicate that strategy to the contractor. There is no single discharge criterion that is correct in all cases.

If the tank meets the definition of an Intermediate Bulk Container (IBC, see Section 3.3.12.2 of NFPA 30 for the definition), Table 16.5.2.9 could be used for a storage height of a single container as long as the ceiling height does not exceed 30 ft. This would require a density of 0.45 over 3000 sq ft and the use of standard response sprinklers with a k-factor of 11.2 or higher.

Question 12 – Balancing In-Rack and Ceiling Sprinklers

I am working on a fire sprinkler design in accordance with NFPA 30, providing 0.45 gpm/sq ft for the overhead sprinklers and calculating 8 sprinklers in the racks, 4 on each of two levels. Do I have to balance the rack sprinklers with the overhead sprinklers? If I do, how do I get it to balance without overflowing the overhead?

Answer: The rule is that you always balance the sprinkler protection for the in-racks with the ceiling sprinklers unless the design standards specifically say to not do so. There are some cases where NFPA 30 specifically says not to do the balancing, and there are some cases where NFPA 30 says to do the balancing. For example,

Section 16.6.1.6 says that when you are following "Scheme A" for the combination of ceiling sprinklers, in-rack sprinklers, and barriers, you do not need to balance the ceiling sprinklers with the in-rack sprinklers. But Section 16.6.2.7(2) says that when you are using "Scheme B" with containers between 1 and 60 gallons in capacity, you do need to balance the ceiling sprinklers with the in-rack sprinklers. It all depends on what you are trying to protect and what design scheme you have selected.

If you do find that you need to balance the in-rack sprinklers and the ceiling sprinklers, you will find that the sprinklers with the lower pressure demand will overdischarge. That is what the concept of balancing is supposed to show you. At the higher pressure, more water will flow out of the sprinklers and this greater discharge needs to be able to get from the water supply to the sprinklers. We would expect the ceiling sprinklers in this case to discharge more. You can actually deal with this issue by downsizing some of the ceiling sprinkler pipe to increase the pressure demand and match the pressure at the in-rack connection. This would get the final ceiling sprinkler demand closer to the minimum demand.

Upcoming NFSA "Technical Tuesday" Seminar – January 10th

Topic: Introduction to Standpipes
Instructor: **Karl Wiegand, E.I.T.**
Date: Tuesday, January 10, 2012- 10:30 am EST

Standpipe systems are required in buildings that are four stories or more to fight fires in these larger structures. This seminar serves as an introduction to standpipe systems, NFPA 14, and this series of standpipe lessons. It covers the general types, classes, and components of these systems as well as typical layouts used for standpipe systems.

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

Register Now for 2012 "Tech Tuesday" Series on Standpipes

NFSA Engineering has announced a new series of 12 "Technical Tuesday" online seminars for the first half of 2012, focusing on all aspects of standpipe system design, installation, testing and inspection. The series starts on January 10th, so register now and take advantage of the multi-seminar discounts of up to 25 percent:

Jan 10th - Introduction to Standpipes
Jan 24th - Class II Standpipe Systems
Feb 7th - Class I and Class III Standpipe Systems
Feb 21st - Pressure Control in Buildings with Standpipe
Mar 6th - Pumps and Standpipe Systems
Mar 20th - NFPA 20 and NFPA 14 for High-Rise Buildings
April 3rd - Hanging, Bracing and Protection of Standpipe System Piping
April 17th - Manual Standpipe Systems
May 8th - Dry Standpipe Systems
May 22nd - Horizontal Standpipes and Lateral Piping
June 5th - Acceptance Testing of Standpipes
June 19th - Inspection, Testing and Maintenance of Standpipe Systems

Price for NFSA Members - $125 per session
Price for Non-Members - $250 per session

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Sprinkler System Basic Hydraulics – Distance Learning

Seminar Description: Over a course of nine weeks, basic hydraulic calculations for fire sprinkler systems will be covered so that the participant will be able to recognize and apply the terminology used in the fire sprinkler industry, calculate flow and pressure demands for a sprinkler system by hand, prepare the input for a computer program to perform hydraulic calculations, and interpret the output from a program. The seminar will be taught via the internet in a live distance learning format using the NFSA Media Center to broadcast lectures and facilitate live discussions from wherever the participants are, worldwide. Activities will be done in class and homework will be assigned each week, graded, and returned with comments. Participants will need a computer and a good internet connection.

Duration: One class (60 to 90 minutes) per week for nine weeks.

Seminar Fees: $250 for NFSA members and $375 for non-members.

Seminar Schedule: Nine classes on Wednesday afternoons from 2:00 p.m. to 3:30 p.m. EST

February 1, 2012: Module 1 – Introduction to Hydraulics
February 8, 2012: Module 2 – Basic Hydraulics
February 15, 2012: Module 3 – Hydraulic Calculation Theory, Part 1
February 22, 2012: Module 4 – Hydraulic Calculation Theory, Part 2
February 29, 2012: Module 5 – First Full System Hydraulic Calculation
March 7, 2012: Module 6 – Computer Input and Output
March 14, 2012: Module 7 – Residential Systems
March 21, 2012: Week 8 – Complex Operating Areas and Non-Uniform Layouts
March 28, 2012: Week 9 – Homework review and final comments

Registration materials are being developed…stay tuned to www.nfsa.org for further information.

Layout Technician Training Course (2-week course)

Orlando, FL – February 6-17, 2012
Fishkill, NY – October 8-19, 2012

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

Upcoming In-Class Training Seminars

The NFSA training department also offers in-class training on a variety of subjects at locations across the country, and in recognition of the current recession has adopted a new reduced fee structure. Here are some upcoming seminars:

Jan 10	Poughkeepsie, NY	NFPA 13, 13R & 13D Update 2007/2010
Jan 11	Poughkeepsie, NY	Basic Seismic Protection/Protection of Flammable & Combustible Liquids
Jan 12	Poughkeepsie, NY	Inspection, Testing & Maintenance for the AHJ
Mar 6	Pataskala, OH	Inspection, Testing & Maintenance for the AHJ
Mar 7	Pataskala, OH	Hydraulics for Fire Protection
Mar 8	Pataskala, OH	Foam Water Systems/Compacted Storage
Mar 13	Winston-Salem, NC	Hydraulics for Fire Protection
Mar 14	Winston-Salem, NC	Plan Review Policies & Procedures
Mar 15	Winston-Salem, NC	Inspection, Testing & Maintenance for the AHJ

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

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

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.