NATIONAL FIRE SPRINKLER ASSOCIATION, INC.

Tuesday e-Tech Alert
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Number 94

Best Questions of August 2007

We have selected the following questions as the "best of August 2007" answered by the engineering staff as part of the NFSA's EOD member assistance program:

Question 1 - Spare Sprinkler Cabinets for 13D Systems

Is a spare sprinkler box required for a 13D system? I find nothing indicating it is or isn't required.

Answer: You are correct that there is no guidance requiring a spare sprinkler cabinet in NFPA 13D. The NFPA 13D Committee has tried to keep the sprinkler system requirements for homes at a minimal cost to the homeowner. This is a good example of that practicality. The added benefit of not having a replacement is that the owner will more likely call a qualified contractor to replace the sprinkler in the event there is an activation of the system.

Question 2 – Oversized Wood Joist Construction

I would like your interpretation on wood construction consisting of 5x14 and 5x16 wood joists on 5'-5" centers spanning 15 ft and 20 ft framed into 12x16 and 14x16 beams supporting a wood floor. A drywall ceiling will be attached to 1½-inch channels to the underside of the wood joists. If insulation is added filling the space from the ceiling to the bottom edge of the joists and beams, can sprinklers be omitted from the combustible concealed spaces that are formed per NFPA 13 section 8.15.1.2.8 even though the wood members do not actually meet the definition for wood joist construction?

Answer: In our view the construction is essentially the same or superior to wood joist construction, and the Authority Having Jurisdiction should be asked to agree that this construction can be addressed with the criteria of Section 8.15.1.2.8. NFPA 13 (2007 edition) annex section A.3.7.1(6) describes solid wood joists as members 2 to 4 in. nominal width up to 14 inches deep spaced up to 3 ft on center. The construction at hand obviously doesn't meet this definition, nor even the latter part of A.3.7.1(6) that includes members up to 4 inches in nominal width and up to 14 inches deep, spaced more than 3 ft on center. However, the allowable omission of sprinklers in accordance with 8.15.1.2.8

applies not only to solid wood joists, but also to composite wood joists where the channels are firestopped into volumes not exceeding 160 ft^3 with materials at least equivalent to the web construction. In the case at hand, even with the greater depth and larger spacing, the individual channel volumes will be less than 160 ft^3, and the heavier timber presents a better level of protection against fire passage than regular solid wood joist construction. It should also be noted that the definitions of construction types appear only as annex advisory material, giving the AHJ more discretion.

Question 3 – Number of Inlets for Standpipe FDCs

NFPA 14, 2003 edition, section 7.13, calls for a fire department connection (FDC) for each standpipe. Section A.7.13 indicates the number of FDC inlets may depend on several factors including the water volume and pressure required for the standpipe. Section 11.5.4 indicates the maximum flow expected thru a single 2½-inch connection is 250 gpm. Since a manual-wet standpipe gets its complete demand thru the FDC, should we at least assume the number of FDC inlets would typically be the total standpipe demand divided by 250-gpm? Is there any clearer information in NFPA 14 concerning the number of inlets for the FDC? Would the requirements for an automatic standpipe be the same as a manual standpipe, or is this FDC only to supplement the standpipe system supply as in NFPA 13 for fire sprinkler systems?

Answer: Standard industry practice has been to provide one 2½-inch connection for each 250 gpm of demand for the standpipe system. This practice has always been done for both manual and automatic standpipe systems. Certainly for manual systems it is important because this is the only way for the fire department to get flow into the system. For automatic systems it is less important, but fire departments have always wanted the ability to provide the flow to the systems themselves. The issue has been specifically added to the 2007 edition of NFPA 14 in section 7.12.3.

Question 4 - Kitchen Classification in 13R Occupancies

In 13R occupancies, are kitchens considered Ordinary Hazard areas? A case in point is a 2-story fraternity house with 35-40 occupants. There is a 420 sq. ft. kitchen with commercial type cooking equipment. Meals are prepared daily for the guests.

Answer: There is no definitive answer to this question. NFPA 13R leaves the door open to interpretation either way. The definition of “dwelling unit” (Section 3.3.4 in the 2007 edition) includes the idea that “cooking facilities” are included within the dwelling unit. The case can be made that the kitchen is a cooking area inside the dwelling unit that can be protected with residential sprinklers. However, the case can also be made that the cooking facilities contemplated in section 3.3.4 are more like the kitchen of a home where meals are prepared for a small number of people. The portion of the definition that comes into play is that the individuals in the building “live together as a single housekeeping unit.” This would imply that they eat around the same time and generally

eat the same meal. If the kitchen in the fraternity house is more like a cafeteria that serves many different people choices of many different foods and allows them to eat over extended periods of time, then the situation is not like a single housekeeping unit and you would not be able to consider the space being within the dwelling unit. As such, the commercial kitchen would be treated as ordinary hazard. As in NFPA 13, the seating area would be considered light hazard.

Question 5 – Pressure Reducing Valves on Manual Wet Standpipes

I have a job that specifies a "Manual Wet Combined Class I Automatic Standpipe". It is not a high rise. The pumper truck will connect to the freestanding FDC and provide water at 100 psi for the hose valves. There is a potential for the pumper truck to pump 195 psi into the standpipe from the FDC in order to achieve 100 psi flowing 1000 gpm for the entire standpipe. Would there still be a need for pressure reducing valves on the lower floors to protect the sprinkler systems against pressures greater than 175 psi? The normal static on the system is 50 psi (underground supply).

Answer: Yes. You will need to ensure that the system is designed to handle the pressures that will be delivered. If 195 psi is going to be required at the FDC in order to deliver 100 psi to hose valves elsewhere on the standpipe, then you should use components and devices that will meet the requirements of NFPA 14. NFPA 14 will require a sign at the FDC to indicate that the standpipe will need 195 psi from the fire department pumper truck. This will deliver more than 175 psi to lower floors and will require some means to reduce pressures and the effects of these pressures at the lower level hose valves. Section 7.2.1.2 of NFPA 14 states, *"7.2.1.2 Where the static pressure at a hose connection exceeds 175 psi (12.1 bar), an approved pressure-regulating device shall be provided to limit static and residual pressures at the outlet of the hose connection to 100 psi (6.9 bar) for 1½ in. (40 mm) hose connections and 175 psi (12.1 bar) for other hose connections. The pressure on the inlet side of the pressure-regulating device shall not exceed the device's rated working pressure."* The same requirement should be applied to the sprinkler system in accordance with NFPA 13 section 6.7.1.1, where it states, *"When water pressures exceed 175 psi (12.1 bar), valves shall be used in accordance with their pressure ratings."* NFPA 13 has similar requirements for all components of the sprinkler system. Exceeding 175 psi will require consideration of the rated pressure for the components throughout the entire system.

Question 6 – Omitting Sprinklers from Small Freezers

Is there any relief or rational basis found within the code one might apply to omitting a dry type sprinkler from a small (10 ft x 10 ft) freezer that contains plasma in plastic containers? The freezer normally operates at -40 degrees F. The owner has a concern about operation and contamination of the blood supply.

Answer: No. NFPA 13 protection assumes that all spaces are sprinklered unless there is an arrangement that specifically allows for the sprinkler(s) to be omitted. You have

noted that the temperature in the freezer is -40^{o}F. However, the temperature alone is not enough to protect against fire and the space will still require sprinkler protection. If the owner is especially concerned about false operation and contamination, a double interlock preaction system may be an option.

Question 7 – Water Curtain vs. Deluge System

A current project we have has an escalator with an opening measuring 28 ft x 12 ft. The plan reviewer is interpreting the code to require that we flow ALL sprinklers in the water curtain, some 80 lineal feet of sprinklers. I read the (2002) NFPA 13 Section 11.2.3.8.2 as stating that we only need to calculate the number of sprinklers for the water curtain as corresponding to the length parallel to the branch lines per Section 14.4.4.1.1, "a rectangular area having a dimension parallel to the branch lines at least 1.2 times the square root of the area ....." since the design area is 1500 sq ft, the overall length of water curtain sprinklers would equal 46.5 feet, rounded up to the next sprinkler. However, the plan reviewer is requiring ALL of the sprinklers in the water curtain to flow citing the (2002) NFPA 13 Section 11.2.3.8.3, which reads: "If a single fire can be expected to operate sprinklers within the water curtain and within the design area of a hydraulically calculated system, the water supply to the water curtain shall be added to the water demand of the hydraulic calculations and shall be balanced to the calculated area demand." He feels that "in case of a fire the water curtain and the design area of a calculated system must be expected to operate correctly therefore it is necessary to include the entire water curtain area into the hydraulic calculation".

We have performed calculations that include the 1500 sq ft most remote area and also the portion of the water curtain that corresponds to the 46.5 feet. We have NOT included a calculation flowing ALL of the water curtain sprinklers, 80 lineal feet. We have tried to verbalize our opinion of this matter in writing and thought that it would be resolved. Apparently he still feels firm in his interpretation of this section of NFPA. Could you please weigh in on this and provide your written understanding of Section 11.2.3.8.3 and how it does not contradict the Section 11.2.3.8.2?

Answer: You have not indicated whether the sprinklers in the water curtain are open or closed. The plan reviewer would be correct if the water curtain is designed as a deluge system with all of the sprinklers open (no links installed) and triggered by the same detection system. But the plan review official is incorrect if the sprinklers are closed (automatic) and will only individually open from the heat of a fire. Section 11.2.3.8.2 defines how many sprinklers the water supply needs to be able to handle considering any reasonable fire event. This section applies to systems “employing automatic sprinklers”. The possibility of a fire opening all of the sprinklers in the water curtain in addition to the sprinklers in the remote area is such a low probability that the writers of NFPA 13 have determined that it is not a design consideration. Section 11.2.3.8.3 is not a contradiction of the previous section, nor is it incompatible with the previous section. The statement in section 11.2.3.8.3 is that you add the water demand for the water curtain to the demand of the remote area if there is a chance that a single fire will open both. The water demand for the water curtain that you need to add is defined by the previous section (11.2.3.8.2).

The water demand for the water curtain required by section 11.2.3.8.3 is the number of sprinklers in the dimension of 1.2 times the square root of the design area required by section 11.2.3.8.2. Nowhere in section 11.2.3.8.3 does the section state that the design is to include all of the sprinklers in the water curtain.

Question 8 – Wet Grid System Relief Valve Location

I have a situation where we can not put the inspectors test connection at the end of a gridded sprinkler system. Typically we will do this and combine the test connection and the grid relief at the same point. In this situation we will be providing the inspectors test on the system riser. My question is, is it acceptable to also put the grid relief valve at the riser location or does it have to be at a more remote area?

Answer: Section 7.1.2.1 in NFPA 13 (2007 edition) requires a relief valve to be put on gridded wet pipe systems. However, there is not a specific location requirement to accompany that. In other words, the location of the relief valve can be located anywhere along the system. There are a couple of items to think about when choosing a location for the relief valve. First, there should be someplace for the water to go if the relief valve actually has to operate. The second item is the pressure setting of the relief valve. This may vary depending on where the relief valve is actually installed. The elevation pressure in the system should be considered to make sure that none of the components in the system will be over-pressurized.

Question 9 - Hydrostatic Testing of New Sprinkler Drops

Section 24.2.1.6 of NFPA 13 (2007 edition) allows for modifications that cannot be isolated to be tested at system pressure. Does this apply to new drops off existing branch lines (we cut in saddles on existing branch line piping for each drop)? Is there a limit on the number of drops you can do? Some AHJs try to apply Section 24.2.1.5's 20-sprinkler rule to this section.

Answer: You have asked if the new drops that you have installed from some existing branchline piping needs to be hydrostatically tested. Section 24.2.1.6 states: *"Modifications that cannot be isolated, such as relocated drops, shall not require testing in excess of system working pressure."* In our opinion, however, the work described goes beyond a simple relocation of drops, since it involves the installation of new piping and sprinklers. Because cutting in new mechanical tees is more complex than simply relocating a drop from an existing outlet, we would interpret the standard to be mandating the hydrostatic test in this case. In fact, Section 24.2.1.5 uses the words "addition or modification" to differentiate the two types of work. The 20-sprinkler rule would therefore apply. Hopefully, the new work can be isolated from other parts of the system to minimize the potential for damage to occupied building areas.

Question 10 – Second Fire Pump in Lieu of Jockey Pump

Would a jockey pump be needed to maintain pressure in a system with two fire pumps, if one is acting as a jockey?

Answer: Yes, the system needs a separate jockey pump. NFPA 20 requires a mechanism to maintain system pressure that is NOT the fire pump. Even if there is a second fire pump, it is still a fire pump and not allowed to be used to maintain system pressure since it is too large to use as a jockey pump. The jockey pump needs to be sized so that it does not keep up with flow from a single open sprinkler so that a pump running alarm sounds when the pump comes on. If you tried to use a fire pump as a jockey pump, it would not work in the manner assumed by NFPA 20.

Question 11- Extending Design Areas Beyond Slope

In the 2007 edition of the *Automatic Sprinkler Systems Handbook*, the last paragraph of the commentary to Section 11.2.3.2.4 on sloped ceilings states that the design area increase is intended to apply only to continuously sloped ceilings or roofs, such as those in large attic spaces. We are dealing with a building that has an area with a sloped ceiling in the center. The sloped area is surrounded by a barrier that drops 25 inches to a 10-ft ceiling level for the remainder of the space. We are calculating the entire sloped area, which should be the worst case. The remainder of the building with the 10 ft ceiling height is utilizing quick response sprinklers along with the area reduction criteria per 11.2.3.2.3.1. I should also mention that this entire light hazard area outside of the sloped ceiling area is broken up with ceiling pockets throughout. My first question is whether the increase in area required for hydraulic calculations under sloped ceilings should extend beyond the sloped area into the portion that has a horizontal ceiling. Secondly, is the 25-inch barrier that drops below the level of the ceiling sufficient to separate the sloped and horizontal ceiling spaces for the purposes of hydraulic calculations?

Answer: The answer to your first question is "yes". When there is a ceiling slope the risk of opening sprinklers farther away from the fire is likely and needs to be addressed. The scenario that you have does represent a continuous ceiling. Due to the lintel it would not be a smooth ceiling (Section 3.3.4.4) but it is still continuous. The answer to your second question is "no." The Committee has modified the definition of compartment to be a space enclosed by walls with openings in each wall limited to 8 feet in width with a minimum lintel depth of 8 inches. Therefore, the hydraulic area in your building would be in one compartment and the calculation area (if larger than the actual sloped area of the building) will extend into the area with the horizontal ceiling. This is representative of a fire that starts near the edge of the slope, with the hot gasses spreading both up the slope and across the horizontal ceiling.

We should point out that while the Handbook is a great reference for additional information, it is not processed as an NFPA committee document. In this case the author was pointing out that it need not be applied to sawtooth roofs. It should also be noted that NFPA 13 allows for engineering analysis of the space. This means that fire modeling can be completed to show where the heat from sample fires would travel with this ceiling

configuration. This may lead to a design area that is more representative of the actual building structure. This is permitted under the equivalency clause, which appears as Section 1.5 in the 2007 edition of NFPA 13, with similar sections in prior editions of the standard.

Question 12 – Usable Reservoir Volume Relative to Vortex Plates

The NFPA *Fire Pump Handbook* speaks to vortex plates in Section 2-9.10 and Figure A-3-3.1, but I'm trying to identify where the "usable volume" ends. Can we use the volume clear to the bottom of the vortex plate, or is it the centerline of the suction pipe, or the centerline of the pump? We've got a design based on reservoir usable volume to 1.5 inches above the vortex plate and I'm concerned that we will start to pull air into the system prior to that.

Answer: You shouldn't get air into the suction pipe until after the water has dropped below the anti-vortex plate. While it might be theoretically possible to have some wave in the tank that allowed the water to slosh around and cause air to get into the suction pipe even if the mean water level was above the bottom of the anti-vortex plate, such a wave would be unusual and unexplained. The whole point of the anti-vortex plate is to dampen any effect caused by the water being pulled out of the tank so that the water level drops evenly in the tank with no vortex or waves.

Technically speaking, NFPA 20 does not directly address the concept of usable volume. The only guidance we are given is that the water needs to arrive at the pump suction flange at a positive gage pressure (there is an exception that we'll cover further down in this response). So, if the tank sits below the centerline of the pump, the water between the bottom of the tank and the centerline plane of the pump is not usable because this water can't leave the tank and rise to the level of the pump and still arrive at a positive pressure. In fact, the usable water will need to start higher than the centerline plane of the pump because the elevation pressure needs to overcome the friction loss in the pipe so that the water can still arrive at a positive gage pressure. For example, if the friction loss of water flowing through the pipe is 5 psi, then the usable water in the tank starts 11.5 ft above the tank (11.5 ft x 0.433 psi/ft = 5 psi) to arrive at the pump suction flange at a positive gage pressure. Any water below this plane does not count as usable. If the bottom of the tank is on the same plane as the pump, or is above the level of the pump, then NFPA 20 allows the water to arrive at the pump suction flange at a pressure of -3 psi (see the exception to 2-9.3. If the tank is on the same elevation as the pump and the friction loss in the pipe does not exceed 3 psi, then there should be no problem with considering the usable portion of water in the tank as the portion above the anti-vortex plate.

Upcoming NFSA "Technical Tuesday" Seminar – September 11th

Topic: Smoke Vents, Heat Vents, and Draft Curtains –
Instructor: Michael J. Friedman, P.E., NFSA Consultant
Date: September 11, 2007

While not the primary function of a sprinkler design technician, the effect of smoke vents, heat vents, and draft curtains on sprinkler performance is critical to proper sprinkler placement and integration of venting systems. This seminar will provide information a technician needs to know and the effect on sprinkler layout.

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

Upcoming NFSA "Business Thursday" Seminar – September 20th

Topic: Developing Positive Relationships with Fire Officials
Instructor: Doyle Sutton, NFSA Southwest Regional Manager (Former Nevada State Fire Marshal)
Date: September 20, 2007

Positive relationships with fire officials are professional relationships based on many factors: professional association, knowledge, training, certification and licensing are just a few of these factors. The foundations of permanent relationships are basic communication, trust, honesty, and ethics and an oath to uphold the ethics of their profession to a higher stand of accountability. Positive relationships require an act of advocacy, that one regularly acts as a advocate for another individual, group, or entity in support of a common goal or ideal. Developing relationships in the fire service does not happen overnight. It takes time, commitment and hard work. This seminar will cover: what is a positive relationship and how to development a relationship with fire officials in today's busy work environment, plus review some examples of successful ongoing methods of sustaining those relationships.

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

NFSA Technician Training Classes

Only the following classes remain in the 2007 NFSA engineering department training schedule:

Two-Week Technician Training Seminar
November 5-16 Newburgh, NY

NICET Inspector Certification Review Classes
November 6-8 Providence, RI

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

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 upcoming seminars:

Sept 11	Inspection, Testing & Maintenance	Brea, CA
Sept 13	Sprinklers for Dwellings	Brea, CA
Sept 18	Sprinkler Protection for General Storage	Seattle, WA
Sept 19	Sprinkler Protection for Rack Storage	Seattle, WA
Sept 20	Pumps for Fire Protection	Seattle, WA
Sept 18-19	Two-day NFPA 13 Overview & Intro to Plan Review	Baltimore, MD
Sept 20	Pumps for Fire Protection	Baltimore, MD
Sept 25	Sprinkler Protection for General Storage	Eugene, OR
Sept 26	Sprinkler Protection for General Storage	Eugene, OR
Sept 27	Inspection, Testing & Maintenance	Eugene, OR
Oct 23	Introduction to Sprinkler Systems (1/2 day)(AM)	Woodland, CA
Oct 23	Underground Piping (1/2 day)(PM)	Woodland, CA
Oct 24	Inspection, Testing & Maintenance	Woodland, CA
Oct 25	Basic Seismic Protection (1/2 day)(AM)	Woodland, CA
Oct 25	Advanced Seismic Protection (1/2 day)(PM)	Woodland, CA
Oct 30-31	Two-day NFPA 13 Overview & Intro to Plan Review	Spokane, WA
Nov 1	Sprinkler Protection for Special Storage	Spokane, WA

For more information on these seminars, or to register, please visit www.nfsa.org or call Mike Repko at 845-878-4207.

consultation or services. Please send comments to Russell P. Fleming, P.E. (*fleming@nfsa.org*).