NATIONAL FIRE SPRINKLER ASSOCIATION, INC.

Tuesday e-Tech Alert
May 2, 2006

Best Questions of April 2006

We have selected the following questions as the "best of April 2006" answered by the NFSA Engineering staff:

Question 1 – Drops to Suction Flanges of Vertical In-line Pumps

Is it allowable to install a 90-degree elbow directly onto the suction flange of vertical in-line pumps? In our particular case, we are dropping vertically due to space constraints in a pump room. We are concerned that this is the same unacceptable arrangement shown for horizontal pumps in NFPA 20, A-2-9.6.

Answer: Yes. A change in direction is permitted vertically into the feed of a vertical in-line fire pump. Section 5.14.6.3 of NFPA 20 (2003 Edition) discusses this issue, and the acceptable arrangement is shown in Figure A.5.14.6. It is important to recognize that this guidance applies for all types of fire pumps. For horizontal split-case pumps, changing water flow direction with a 90-degree elbow in the plan view loads the impeller unevenly, which can damage the pump. Although the impeller of an in-line pump is oriented in the horizontal plane and it might seem that a vertical turn would produce corresponding difficulties, the manufacturers have not indicated potential problems. This may be due to the fact that the in-line pumps are single suction pumps in which water enters the impeller from only one side, leading to less concern that the water be distributed evenly to the impeller.

Question 2 – The Meaning of "Quarterly" in NFPA 25

Where NFPA 25 states that quarterly inspections shall be done, what is meant? For example, if a quarterly inspection is completed on January 13th, would the next inspection have to be completed by April 13th, or could it be done any time in April, or could it be done any time in April, May, or June (since these three months are part of the 2nd quarter of the year)?

Answer: Since NFPA 25 does not contain a specific definition of "quarterly", the dictionary definition would prevail, meaning four times per year at approximately even intervals. Given that there are 365 days in a year (366 in a leap year) this would put an average of 91.25 days (91.5 days in a leap year) between intervals of performing the desired test or inspection. It is reasonable to allow leeway in the timing, at least a leeway of 10 percent, which would allow the quarterly inspections to range from 80 to 100 days apart. A proposal was submitted during the preparation of the 2007 edition of NFPA 25 (25-7 in the ROP) that sought to define the "quarterly" interval as a period not exceeding 112 days. The committee rejected this proposal, stating that tolerances should be determined by the Authority Having Jurisdiction.

Question 3 – Sprinklers Positioned Directly Over Beams

Would NFPA 13 allow the installation of sprinklers directly above an obstruction like a beam 12 inches wide and 22 inches deep when there is a clear space of 12 inches between the sprinkler deflector and the top of the obstruction with 10 ft between sprinklers and with an identical obstruction halfway between the sprinklers? If this is permitted, can the sprinklers above the beam be installed with the spray directed upward?

Answer: The answer to the first question is yes, provided the space is classified as light hazard. The rules that apply are Table and Figure 8.6.5.2.2, and section 8.6.5.1.2(2). It should initially be noted that Table and Figure 8.6.5.2.2 are only applicable to light hazard occupancies. This table allows partitions to be closer than 18 inches (vertically) to the sprinkler deflector as long as there is enough room for the sprinkler's spray pattern to reach the far side of the partition. In this case, the obstructions can be treated as partitions. With the sprinkler centered over the 12-inch wide obstruction, the distance between the center of the sprinkler and the far side of the obstruction is 6 inches. According to Table 8.6.5.2.2, a sprinkler is permitted to be installed as close as 3 inches vertically in order to spray past an obstruction 6 inches to the side. At 12 inches above the obstruction, the sprinkler would be well above the minimum vertical requirement of 8.6.5.2.2.

The next obstruction to be concerned with is the obstruction halfway between the sprinklers. Normally, it would be required to show that the sprinkler could spray water under a continuous obstruction of this kind. However, section 8.6.5.1.2(2) makes an exception if the obstruction is not more than 4 ft wide, if a sprinkler is installed on the other side, and if the distance from the center of the obstruction to the sprinkler does not exceed half of the allowable distance between sprinklers. The arrangement described in the question meets all three of these criteria, so the obstruction in the middle is not a problem for either of the sprinklers to the side.

The answer to the second question is "no." Fires occur below sprinklers. Bouncing water off of the ceiling to a fire below alters the momentum, spray pattern and droplet size distribution of the water and can render the sprinklers considerably less effective.

Question 4 – NFPA 291 Pumper Outlet Tests

Please indicate the proper use of NFPA 291 section 4.8 when using a pumper outlet for a flow test. Is it the intent of 4.8.3 to use Figure 4.7.1 to determine outlet coefficients and apply table 4.8.2 and multiply the coefficient? For example, is a 0.90 coefficient for a smooth rounded outlet per Figure 4.7.1 multiplied by a 0.83 coefficient from Table 4.8.2 for a resulting coefficient of 0.90 x 0.83= 0.747?

Answer: This is correct. NFPA 291 does require an additional adjustment for flows taken from the pumper connection of a hydrant. The pumper connection adjustment factor proposed (0.83) assumes a pitot reading of 7 psi or greater. This should be combined with the factor used for the type of outlet (0.90 = smooth rounded outlet). Therefore, any calculated flows would ultimately be adjusted by 0.747.

Question 5 – Spacing Sprinklers in Attics

Regarding the 8 ft spacing rule in unoccupied attics with pitch greater than 4 in 12. What are the spacing requirements along the peak of the roof? Can the sprinklers be spaced 15 feet apart along the peak of the roof or are they restricted to 8 feet apart?

Answer: Sprinkler spacing is done on a rectangular basis. In the case of spacing in attics that use the special rules for trusses less than 3 ft on center and slope exceeding 4 in 12, the two directions are "along the slope" and "perpendicular to the slope". The direction "along the slope" is measured from the first sprinkler down near the eave moving up towards the peak and can be seen as the dimension "S" in Figure 8.6.4.1.3.1(a) of NFPA 13 (2002 edition - don't get hung up on branch line direction in the Figure, just look at it in terms of direction in relation to the slope) and as the only distance between sprinklers shown in Figure 8.6.4.1.4. The direction "perpendicular to the slope" is the other direction, which could also be described as parallel to the roof ridge, and is shown as the dimension "L" in Figure 8.6.4.1.3.1(a). The direction "perpendicular to the slope" is not shown in Figure 8.6.4.1.4 because that direction is not in the Figure and would be coming out of the page.

With the definition of the dimension "perpendicular to the slope" the answer to the second question is obvious. The sprinklers can only be spaced at a maximum of 8 ft along the peak because this is the dimension perpendicular to the slope.

Question 6 – ESFR Sprinklers Under Skylights

ESFR pendent sprinklers are typically positioned such that their deflectors are not more than 14 inches below the deck. In the situation where there is a skylight directly above a sprinkler, does this have any implications for the position of the sprinkler deflector relative to the bottom of the skylight? NFPA 13 has provisions for small "ceiling pockets" such as skylights. Can these guidelines be applied in this situation? Can the sprinkler be placed below the skylight even though the distance between the deflector and the bottom of the skylight exceeds 14 inches since the 4 ft x 8 ft skylight represents such a small volume of potential trapped heat?

Answer: First, Section 8.5.7 of NFPA 13 (2002 Edition) states, "Sprinklers shall be permitted to be omitted from skylights and similar ceiling pockets not exceeding 32 sq. ft. in area, regardless of hazard classification, that are separated by at least 10 feet horizontally from any other skylight or unprotected ceiling pocket." For a skylight not exceeding 32 sq. ft. there is no requirement for a separate sprinkler in the ceiling pocket.

One of the better options for spacing ESFR sprinklers would be to locate them so that the sprinkler does not fall directly beneath the recessed skylight area. This would allow the sprinklers to be spaced avoiding direct interaction with the recessed space. With the proper distance below the deck the ESFR will be in the fire plume or ceiling jet as intended.

If the ESFR sprinklers cannot be located such that they are not below the skylight then there are a couple of other options. One option is to locate sprinklers less than 14 inches below the deck. By putting them closer to the deck it should help them to operate faster and help to reduce the small delay caused by a skylight. Another option, if the recessed area is truly a skylight and not a heat vent, is to install a sheet of plexi-glass or other transparent material at the base of the skylight to eliminate the recess. This would allow the heat from the fire to travel to the sprinkler without an additional delay, equivalent to any smooth flat ceiling.

Question 7 – Earthquake Protection Below Grade

In the formula applied to determine earthquake force Fp in the model building codes and reference standard ASCE-7, are "z" and "h" are referenced at grade? If so, then Fp for piping in sub-basement braces could be a negative number (caused by negative z). Does that imply the potential for no braces required in sub-basements? Do we default to the number 1 for (1+2(z/h)) for basement and sub-basement piping? It would seem that with certain soil conditions, no bracing should be required in basements and sub-basements.

Answer: ASCE 7 (2002 edition) defines "z" as the "height in structure of point of attachment of component with respect to the base. For items at or below the base, z shall be taken as 0. The value of z/h need not exceed 1.0." This clearly indicates the intent of anything below grade level to be taken as z=0.

It should also be noted that while NFPA 13 Section 9.3.3 (2002 edition) permits the omission of the seismic separation assembly below grade (a flexible coupling would be installed at that point instead), all other bracing and flexibility requirements are nevertheless required. There is typically less movement at the base of the structure, but as the earthquake motion originates in the ground the piping protection should not be eliminated.

Question 8 – Sprinklers Installed on Balconies Without Roofs

Our building code makes the following statement regarding sprinkler protection of balconies and patios: “Sprinkler protection shall be provided for exterior balconies, decks and ground floor patios serving dwelling units in buildings regulated by this appendix chapter. Sidewall sprinklers that are used to protect such areas shall be permitted to be located such that there deflectors are within 1 inch to 6 inches below the structural members, and a maximum distance of 14 inches below the deck of the exterior balconies that are constructed of open wood joist construction.”

When there are no structural or architectural features in the area where the sprinkler is placed that can be utilized to trap heat, what should be done to ensure that the sprinkler will activate and function properly?

Answer: Nothing. Generally, on the outside of a building, there are architectural features that would trap some of the heat created by a fire on the balcony. These might be the decking of the balcony above, or some eave or overhang above the top floor. If there are none of these features, then the heat from the fire will not be trapped. It is also less likely that the heat from the fire is going to involve the building, although exposure fires can occur. This type of requirement has frequently been proposed as a change to NFPA 13R but has been rejected on the basis that there is relatively little benefit to a sprinkler on the outside of a building.

Question 9 - Pipe Schedule System Addition Water Supply Requirements

What are the minimum water supply requirements applicable to the expansion of an existing ordinary hazard pipe schedule system? Since the code of record for the pipe schedule sprinkler system was prior to the 1991 edition of NFPA 13, a minimum residual pressure of 15 psi was required at the elevation of the highest sprinkler. The 1991 revision changed the this minimum

residual pressure requirement from 15 psi to 20 psi and limited the size of the sprinkler system unless a residual pressure of 50 psi was available. When minor modifications are made to an existing pipe schedule sprinkler system (addition of one or a few sprinklers), does the residual pressure water supply requirement at the elevation of the highest sprinkler need to meet the NFPA 13 code of record requirement or the requirement identified in the latest revision?

Answer: You are correct that the increased pressure requirement was added for new pipe schedule systems in the 1991 edition of NFPA 13. This was done to encourage the use of hydraulic calculations. The NFPA 13 Committee had observed that pipe schedule systems were being used only where hydraulically calculated systems were not economically advantageous, which generally meant that water supplies were poor.

When the new requirements were put in place, the intent was to continue to allow the use of existing pipe schedule systems under available pressures, which generally were based on minimum 15 psi residual pressure at the top of the riser. For this reason, Section 11.2.2.3 (2002 edition) states "Unless the requirements of 11.2.2.5 are met the pipe schedule method shall be permitted only for new installations of 5000 sq ft or less or for additions or modifications to existing pipe schedule systems..." Section 11.2.2.5 contains the 50 psi minimum pressure requirement at the top of riser, but it is therefore not applicable to modifications of existing systems. Likewise the size limitation would not apply to an existing system.

You are also correct that the minimum pressure for ordinary hazard was also changed from 15 psi to 20 psi at the same time, and this produces the most interesting question, i.e. whether the water supply to new sprinklers added to the system would have to meet the higher minimum water supply requirements. We would propose that it depends on whether the additional sprinklers are being installed to extend protection into previously unprotected areas or whether the additional sprinklers are simply being added to address a change in configuration of an area already protected by the system. In this way it would parallel the building code convention that new additions be built in conformance with new code requirements, while older portions of buildings attached to the new sections are not necessarily upgraded to meet current codes.

Reference can also be made to the retroactivity clause of NFPA 13 Section 1.4 (2002 edition), which states that the provisions of the standard are not intended to apply to facilities and structures that existed prior to the effective date of the standard, but that the AHJ can retroactively apply newer portions of the standard if it is determined that an existing situation presents an unacceptable level of risk.

Question 10 – Mixed Hazard Design Areas

A building has a ceiling slope of 3 in 12, requiring an increase in area of 30%. All the rooms within the building are generally small. The highest hazard is an area of ordinary hazard group 2 but is nowhere near 1950 sq ft without including a corridor and a larger area of light hazard. Is it necessary to supply a full theoretical design area of the higher hazard or are there exceptions to allow the selection of an area without forcing the full design area on a labyrinth of building spaces?

Answer: Multiple calculations are often required to determine which is the most hydraulically demanding area within a building, particularly when there are areas with different hazards of different sizes, and there are many options that can help reduce the size of the design area. The

room design method allows the use of small design areas for highly compartmented occupancies with protected openings. Light hazard compartmented areas that do not have protected door openings to adjacent spaces can be calculated using the room design method by picking up two additional sprinklers in the corresponding space as per Section 11.2.3.3.5 (2) in NFPA 13 (2002 edition). In ordinary hazard spaces with no doors in place the room design method cannot be applied. However, it should be noted that Section 11.1.2 states, "For buildings with two or more adjacent occupancies that are not physically separated by a barrier or partition capable of delaying heat from a fire in one area from fusing sprinklers in the adjacent area, the required sprinkler protection for the more demanding occupancy shall extend 15 feet beyond its perimeter." This means that if the spaces are simply open to each other then the ordinary hazard protection must be carried into the light hazard area 15 feet around the perimeter. For the scenario described, it was noted that 1950 square feet needed to be calculated. This could be laid out in a rectangular design area in accordance with Section 14.4.4.1.1.1. The additional 15 feet mentioned above should also be accounted for in the ordinary hazard calculations and design area rectangle. If the rectangle is proposed to cross over walls the additional 15 feet of higher hazard is not necessary, provided the walls can be expected to contain the heat and hot gases from spreading into the lower hazard area. Sprinklers outside the ordinary hazard area but within the minimum 1950 sq. ft. rectangle can be calculated as light hazard.

Question 11 – Checking the Pitch of Pipe During a Dry System Inspection

Is there any inspection requirement in NFPA 25 to check the slope of dry system piping, after it is installed, to make sure adequate pitch is maintained to allow proper drainage of system?

Answer: No. There is no specific requirement that an inspection of a dry pipe system include a check on the pitch of pipe. Section 5.2.2.1 of NFPA 25 (2002 edition) states that pipe should be in good condition and "free of misalignment." If the pitch of the pipe is noticeably tilted away from any method of draining, then it could be considered "misaligned" within the interpretation of that requirement. Under maintenance of dry pipe valves, Section 12.4.4.3.3 states, "Low points in dry pipe sprinkler systems shall be drained after each operation and before the onset of freezing weather conditions." It is significant, however, that in acting upon public proposals for the next (2007) edition of the standard, the Committee agreed to change similar language relating to preaction and deluge systems. The new wording, which will likely be extended to dry pipe systems as well for consistency, replaces the requirement that “low points…be drained” with a requirement that “auxiliary drains…be operated”.

Question 12 – Outdated Water Flow Information

Water supply information for a project was received from a town water department, but dates back to 1969. The water department seems reluctant to do a water flow test. Are there any code restrictions on using information this old?

Answer: You cannot use water supply information that is so old. Section 15.2.1.2 of NFPA 13 (2002 edition) requires that the volume and pressure of the water supply be determined from water flow test data, and also requires that appropriate adjustments be made to the data for adverse conditions. Accurate water supply information is necessary in order to make appropriate adjustments. The building owner needs to pressure the water department into conducting new tests or allowing new tests to be conducted on its system by others.

Upcoming NFSA Technical Tuesday Online Seminar

NOTE: This online seminar has been rescheduled from the original May 9, 2006 date

Topic: Sprinkler Aesthetics and Protective Coverings
Instructor: – Russell P. Fleming, P.E., NFSA Executive Vice President
Date: May 16, 2006

NFPA 13 defines recessed, flush and concealed sprinklers but does not separately present requirements applicable to their proper use as ceiling sprinklers, and only briefly discusses the expected differences in their performance. NFPA 13 also contains requirements relating to escutcheons and cover plates, guards and shields, and requirements for special coatings that can be either protective or ornamental coatings. Also included are aspects relating to earthquake protection requirements and to the inspection, testing and maintenance requirements of NFPA 25.

Information and registration for this seminar is available at www.nfsa.org.

2006 Basic and Advanced Technician Training NICET Inspection Seminars

The NFSA is the only organization that offers two-week basic technician training seminars, 3-day advanced technician training seminars, and NICET-oriented inspection and testing review seminars at various locations across the United States. The 2006 schedule has been set for the following dates and locations:

2-week Basic Technician Training

August 14-25, 2006 – Seattle, WA
October 16-27, 2006 – Philadelphia, PA

3-day Advanced Technician Training

October 3-5, 2006 – Minneapolis, MN

3-day NICET Inspection and Testing Certification Review

June 27-29, 2006 – Sugarland, TX
July 11-13, 2006 – Edwards, CO
September 6-8, 2006 – Dallas, TX
November 14-16, 2006 – Anchorage, AK

For more information, contact Nicole Sprague using Sprague@nfsa.org

NFSA In-Class Training Opportunities

NFSA also offers in-class training on a variety of subjects at locations across the country. Here are some upcoming seminars:

May 9	Colorado Springs, CO	Pumps for Fire Protection
May 10	Colorado Springs, CO	Sprinkler Protection for General Storage
May 11	Colorado Springs, CO	Sprinkler Protection for Rack Storage
May 9-10	Nags Head, NC	Plan Review & Inspection
May 11	Nags Head, NC	Hydraulics for Fire Protection
May 16	Winston-Salem, NC	Inspection, Testing & Maintenance
May 17	Winston-Salem, NC	Pumps for Fire Protection
May 18	Winston-Salem, NC	Underground Piping (1/2 day)
May 16-17	Richmond, CA	Plan Review & Inspection
May 18	Richmond, CA	Underground Piping (1/2 day)
May 18	Richmond, CA	Seismic Protection (1/2 day)
May 23-24	Freeland, MI	Plan Review & Inspection
May 25	Freeland, MI	Residential: Homes to High-Rise
May 23-24	Murray, UT	Plan Review & Inspection
May 25	Murray, UT	Hydraulics for Fire Protection
May 23	Spokane, WA	Sprinkler Protection for General Storage
May 24	Spokane, WA	Sprinkler Protection for Rack Storage
May 25	Spokane, WA	Hydraulics for Fire Protection
June 13	Quogue, NY	Residential: Homes to High-Rise
June 14	Quogue, NY	Inspection, Testing & Maintenance
June 15	Quogue, NY	Standpipe Systems (1/2 day)
June 13	Lake Jackson, TX	Inspection, Testing & Maintenance
June 14	Lake Jackson, TX	Pumps for Fire Protection
June 15	Lake Jackson, TX	Sprinklers for Dwellings
June 20-21	Bozeman, MT	NFPA 13 Overview & Plan Review
June 23	Bozeman, MT	Hydraulics for Fire Protection
June 20	Dallas/Ft. Worth, TX	Sprinkler Protection for General Storage
June 21	Dallas/Ft. Worth, TX	Sprinkler Protection for Rack Storage
June 22	Dallas/Ft. Worth, TX	Sprinkler Protection for Special Storage

For more information or to register, visit www.nfsa.org or call 845-878-4207.

In the promotion of the fire sprinkler concept, the National Fire Sprinkler Association represents all fire sprinkler industry interests including fire sprinkler contractors, manufacturers and suppliers of fire sprinklers and related equipment and fire protection professionals. Established in 1905, the National Fire Sprinkler Association provides publications, nationally accredited seminars, representation in codes and standards-making, market development, labor relations and other services to its membership. Headquartered in Patterson, New York, the National Fire Sprinkler Association has regional operations offices throughout the country