

Tuesday e-Tech Alert

September 20, 2005



Mixing Orifice Sizes

A major city in California recently debated the question of whether residential sprinklers of different orifice sizes could be used within the same compartment in an NFPA 13 application. In this specific situation the residential sprinklers had two different thread sizes, and the NFSA took the position that this effectively should allow their use since there was no danger of confusing the locations during replacement after a fire.

The governing section in the 2002 edition of NFPA 13 is Section 14.4.4.6, entitled Orifice Plates. The basic requirement has been in the standard since hydraulic calculations were introduced in the 1970's and states, "orifice plates or sprinklers of different orifice sizes shall not be used for balancing the system." The corresponding annex section provides additional information:

"A.14.4.4.6 The use of sprinklers with differing orifice sizes in situations where different protection areas are needed is not considered balancing. An example would be a room that could be protected with sprinklers having different orifice size in closet, foyer and rooms areas. However, this procedure introduces difficulties when restoring a system to service after operation since it is not always clear which sprinklers go where."

In its purest form, balancing would involve adjustment of orifice sizes such that flow is throttled close to the source of supply where pressures are highest, ensuring that the flow from all sprinklers is fairly even. Uniform sprinkler discharge of foam-water deluge systems, with a maximum variation of 15 percent, has been required by NFPA 409 for Group I aircraft hangars for many years, although that standard likewise prohibits the use of orifice plates or sprinklers of different orifice sizes, and additionally prohibits the use of pipe sizes less than 1 inch and multiple fittings installed between a branch line fitting and an individual sprinkler for the sole purpose of increasing pressure loss. Balanced flow has advantages in terms of prolonging the supply of additives such as foam, and in ensuring minimum discharge time of captive water supplies such as pressure tanks. With regard to residential sprinklers, use of smaller maximum protection areas on upper floors is a typical measure used to make up for the increased elevation losses and is a variation of balancing that is considered appropriate.

Two subsections within NFPA 13 address situations under which orifice sizes can be mixed. Section 14.4.4.6.2 allows sprinklers with different orifice sizes "for special use such as exposure protection, small rooms or enclosures, or directional discharge." This section has been in the standard for decades and accommodates the larger orifice extended coverage sidewall installed alongside smaller pendent sprinklers in foyers of typical hotel rooms. Section 14.4.4.6.3 originated with the 1991 edition of the standard and more specifically allows extended coverage sprinklers with different orifice sizes to be "acceptable for part of the protection area where installed in accordance with their listing." Although not specifically stated in the documentation for this change, it is presumed that the Committee felt it would be obvious by the spacing where replacement called for extended coverage sprinklers. The NFPA 13 Committee has tentatively approved a proposed change for the next edition of the standard that would specifically allow such a mixing of orifices with residential sprinklers as it presently does for extended coverage sprinklers.

One proposed rationale for allowing different orifice sizes with residential sprinklers is that they are all virtually extended coverage sprinklers as compared to the original residential sprinkler, which had a

protection area of 12 ft by 12 ft. It has also been pointed out that the advent of Sprinkler Identification Numbers reduces the concern that improperly sized replacement sprinklers will be used.

The NFSA recently requested a Formal Interpretation from the NFPA Committee on Sprinkler System Installation Criteria. We asked a series of four questions to progressively test the waters. Asked with regard to the 1999 edition, the questions require at least a three-fourths agreement in order to be considered the official position of the committee:

Q: Can residential sprinklers of different orifice sizes be used within a compartment provided they have different directional characteristics (i.e. pendent vs. sidewall)?

A: Yes

Q: Can residential sprinklers of different orifice sizes be used within a compartment provided they have different thread sizes such that replacement cannot be confused?

A: Yes

Q: Can residential sprinklers of different orifice sizes but identical thread sizes be used within a compartment provided they have different maximum protection areas?

A: *Committee unable to reach three-fourths consensus*

Q: Can residential sprinklers of different orifice sizes be used within a compartment without regard to discharge characteristics, thread sizes or maximum protection areas?

A: No

So, while the formal vote of the Committee supports the NFSA position regarding the legitimacy of different orifice sizes based on different thread sizes, there is insufficient consensus with regard to mixing of orifice sizes based on protection areas, at least with regard to the present wording of the standard. As it prepares the next (2007) edition of NFPA 13, it is expected that the Committee will fully clarify its intent.

Error in NFPA 16 C-Factor for Black Steel in Foam-Water Deluge Systems

NFPA 16 – *Foam-Water Sprinkler and Foam-Water Spray Systems* is currently in cycle. One of the changes that will be made to the current 2003 edition is a correction to Table 7-4.1.5. The C-factor for black steel pipe used in deluge systems is shown as 100, but should be 120 to match NFPA 13. In the 1991 edition, the appendix of NFPA 16 recognized the use of C-120 for black steel deluge systems. In preparing the 1995 edition, the Committee moved the table of C-factors to the body of the standard, but an editorial glitch allowed the C-factor to appear as 100. This has followed through the 1999 and 2003 editions. As an aside, NFPA 15 – *Water Spray Fixed Systems*, dropped the reference to the 120 C-factor for black steel in the 2001 edition, when it added the requirement that all steel pipe systems be either stainless steel or both internally and externally galvanized.

Upcoming NFSA Technical Tuesday Online Seminar

Topic: Meters, Backflow Preventers and Pressure Reducing Valves

Instructor: Russell P. Fleming, P.E.

Date: September 27, 2005

Meters, backflow preventers, and pressure reducing valves share a common feature: they are installed on water supply lines upstream of fire sprinklers. This seminar describes the function of these devices, the various types, laboratory requirements, and how they work. It also examines how these devices are

regulated with regard to installation in accordance with NFPA 13 and inspection in accordance with NFPA 25. A discussion of the forthcoming NFPA 14 rules on the use of “master” pressure regulating devices will also be included.

Other Training Opportunities Available from NFSA Engineering

Inspection and Testing NICET Level 2 Review Seminar

November 4-6, 2005 – Warwick, RI

November 29-December 1, 2005 – Dallas/Ft. Worth, TX

Advanced Technician Training Seminar

October 4-6, 2005 – St. Louis, MO

For information and registration for all seminars visit www.nfsa.org.