NFSA The Voice of the Fire Sprinkler Industry

# TechNotes

Editor - Victoria B. Valentine, P.E Issue # 354 July 26, 2016

***The example has been editorially amended.***

This issue of TechNotes was written by Bob Upson, M.S.F.P.E., Manager of Engineering Services.

## Buildings with Multiple Sprinkler Systems

Back in the 2013 edition of **NFPA 13**, a couple of minor changes quietly occurred that have created ripples that some would argue are "unintended consequences". Both of those requirements are still with us in the 2016 edition and show no sign of changing in the early proposals to the 2019 edition. The reality is that the consequences of these changes are not really all that worrisome once they are understood.

First of all, a simple definition was changed such that the presence of a water supply source, a water control valve, a waterflow alarm, and a drain were really all that it took to define a "sprinkler system".

> **3.3.23* Sprinkler System.** A system that consists of an integrated network of piping designed in accordance with fire protection engineering standards that includes a water supply source, a water control valve, a waterflow alarm, and a drain and is commonly activated by heat from a fire, discharging water over the fire area. The portion of the sprinkler system above ground is a network of specifically sized or hydraulically designed piping installed in a building, structure, or area, generally overhead, and to which sprinklers are attached in a systematic pattern. The system is commonly activated by heat from a fire and discharges water over the fire area. (NFPA 13)

Second, **NFPA 13 (2010) 8.16.1.5 Sectional Valves** was replaced with **NFPA 13 (2013) 8.16.1.5 Floor Control Valve Assemblies**. *(This section was moved to **NFPA 13 (2016) 8.2.4** for editorial reasons along with the addition of an exemption for dry systems in parking garages.)*

> **8.2.4 Floor Control Valve Assemblies.**
> **8.2.4.1*** Multistory buildings exceeding two stories in height shall be provided with a floor control valve, check valve, main drain valve, and flow switch for isolation, control, and annunciation of water flow for each individual floor level.
> **8.2.4.2** The floor control valve, check valve, main drain valve, and flow switch required by 8.2.4.1 shall not be required where sprinklers on the top level of a multistory building are supplied by piping on the floor below.
> **8.2.4.3** The floor control valve, check valve, main drain valve, and flow switch required by 8.2.4.1 shall not be required where the total area of all floors combined does not exceed the system protection area limitations of 8.2.1.
> **8.2.4.4** The requirements of 8.2.4 shall not apply to dry systems in parking garages. (NFPA 13)

Together these to small changes have the effect of making each story with its own floor control valve assembly its own distinct sprinkler system.

**Consequences**

Prior to the addition of specific language on floor control valve assemblies, a sprinkler system could protect any number of floors as long as the area was under the maximum permitted by **8.2 System Protection Area Limitations**.



**Upcoming Technical**

For example, given the maximum protection area of 52,000 square-feet for light or ordinary hazard occupancies, a hypothetical four-story building with floor areas of 18,000 square-feet or less could be protected by a single sprinkler system. Under the new language, the same protection requires not one, but four sprinkler systems. *(Three, if the fourth floor is supplied by the system on the third.)* This starts to become significant when you consider that most of the requirements in **NFPA 13** apply to "sprinkler systems", not "buildings". In other words, all of those requirements have to be applied to *each individual system* including hydraulic calculations, acceptance testing, required signage, and ITM.

**Hydraulic Calculations**

In the past, the common practice in multistory buildings with "typical" sprinkler layouts on each floor, i.e. the same layout serving the same hazards, was to simply identify the hydraulically remote area on the uppermost floor and perform a single set of calculations that would apply to the whole building. That practice no longer works when you consider the sprinklers on each floor as separate sprinkler systems. AHJs who recognize the change in the way systems have been defined may legitimately require that demand calculations are provided for each system.

Does this mean that complete duplicate calculations need to be provided for each floor? No. All that's needed is one set of representative calculations back to the sprinkler riser on any representative floor. Those calculations are good for any floor sharing the same typical layout. A set of water supply calculations can then be prepared for each level of the sprinkler riser where it connects to the floor control valve on each floor. **NFPA 13 (2016) 23.4.1.6** allows system calculations to terminate where the water supply characteristics are known. One representative sprinkler system calculation and multiple simple water supply calculations treating the sprinkler riser as a vertical manifold supplying multiple systems meets that requirement rather than doing separate - and mostly redundant - calculations all the way back to the street for each floor.

> **23.4.1.6** Hydraulic calculations shall extend to the effective point of the water supply where the characteristics of the water supply are known. (NFPA 13)

**Acceptance Testing**

A building with a single sprinkler system would require a single set of acceptance tests. Only a single air test and hydrostatic test would be needed with the hydrostatic test requiring 200 psi at the lowest level of the system as required by **NFPA 13 (2016) 25.2.1.5**. In our hypothetical four-story building with separate sprinkler systems on each floor, at least four sets of tests would need to be conducted along with a test of the riser being employed as a vertical manifold. The riser could either be tested separately or as part of the system at the lowest floor - as they would share the same low point elevation - but each floor's sprinkler system would require its own tests.

> **25.2.1.5*** The test pressure shall be read from a gauge located at the low elevation point of the system or portion being tested. The pressures in piping at higher elevations shall be permitted to be less than 200 psi (13.8 bar) when accounting for elevation losses. Systems or portions of systems that can be isolated shall be permitted to be tested separately. (NFPA 13)

**Required Signage**

One of the first consequences to surface after the 2013 edition change in the sprinkler system definition was the need to provide signage at every floor in our hypothetical building; one set of signs for each sprinkler system as opposed to a single set of signs at a single sprinkler system riser serving the whole building.

**NFPA 13 (2016) 25.5*** requires a hydraulic design information sign for each system to be placed at the alarm valve serving the area. This explicitly means that a sign must be placed on each floor in our hypothetical building because each floor has its own alarm valve (or equivalent combination of control valve and waterflow alarm). Where the sprinkler system on each floor is the same, the signs would be the same but each system must be provided with its own.

> **25.5* Hydraulic Design Information Sign.**
> **25.5.1** The installing contractor shall identify a hydraulically designed sprinkler system with a permanently marked weatherproof metal or

**Tuesdays**

August 16

Miscellaneous and Low-Piled Storage

*NEW REDUCED PRICE FOR MEMBERS!*

Register Here


View older issues in the "Member's Only" section

**Upcoming In-Class Seminars**

July 27 Medford, OR

rigid plastic sign secured with corrosion resistant wire, chain, or other approved means. Such signs shall be placed at the alarm valve, dry pipe valve, preaction valve, or deluge valve supplying the corresponding hydraulically designed area. (NFPA 13)

**NFPA 13 (2016) 25.6*** requires a general information sign for each system to be placed at the (*undefined*) "system control riser" as per **25.6.1.2**. This appears to be a gray area except that the list of information required on the sign by **25.6.2(15)** includes "*Original results of main drain flow test*" which can only be applied to a single sprinkler system. This implicitly means that a sign must be placed on each floor in our hypothetical building because each floor has its own main drain. Where the sprinkler system on each floor is the same, the signs would still likely be slightly different as we would expect slightly different main drain tests on each floor due to the differences in elevation and normal fluctuations in water supply.

> **25.6* General Information Sign.**
> **25.6.1** The installing contractor shall provide a general information sign used to determine system design basis and information relevant to the inspection, testing, and maintenance requirements required by NFPA 25.
> **25.6.1.1** Such general information shall be provided with a permanently marked weatherproof metal or rigid plastic sign, secured with corrosion-resistant wire, chain, or other acceptable means.
> **25.6.1.2** Such signs shall be placed at each system control riser, antifreeze loop, and auxiliary system control valve. (NFPA 13)

Depending on the system arrangement and conditions of any given building, an AHJ *may* permit some hydraulic and general information signage to be consolidated in a single sprinkler area; usually at the lowest floor level. **NFPA 13 (2016) 6.2.9.1***, for instance, permits spare sprinklers to be kept "on the premises" rather than requiring them to be kept each sprinkler system. Some have argued for permitting both the building's supply of spare sprinklers and the appropriate informational signage to be consolidated in a single sprinkler maintenance area serving the whole building. It should be understood, however, that this may give rise to confusion during periodic **NFPA 25** inspections when inspecting contractors are expecting to find signage at each system as required by the letter of the standard.

> **6.2.9.1*** A supply of at least six spare sprinklers shall be maintained on the premises so that any sprinklers that have operated or been damaged in any way can be promptly replaced. (NFPA 13)

**ITM**

Ultimately, most of the consequences affecting the installation of the system under **NFPA 13** will be reflected in periodic inspections. The products of individual sprinkler system hydraulic calculations and acceptance testing will be reflected in the presence and placement of accurate signage in the expected locations with all the information required by **NFPA 25**.

One significant consequence of the 2013 edition change in the sprinkler system definition is that it allows buildings with multiple wet pipe sprinkler systems to alternate internal piping inspections between one half of the systems and the other in alternate inspection cycles as permitted by **NFPA 25 (2014) 14.2.2***. In our hypothetical building for instance, we might perform internal inspections of the sprinkler systems on the first and third floors during one cycle and the second and fourth floors during the next on the basis that all the systems are exposed to similar conditions.

> **NFPA 25 (2014) 14.2.2*** In buildings having multiple wet pipe systems, every other system shall have an assessment of the internal condition of piping as described in 14.2.1.
> **14.2.2.1** During the next inspection frequency required by 14.2.1.1 or 14.2.1.2, the alternate systems not assessed during the previous assessment shall be assessed as described in 14.2.1.
> **14.2.2.2** If foreign organic and/or inorganic material is found in any system in a building, all systems shall be assessed. (NFPA 25)

**Summary**

Sometimes innocuous small changes lead to consequences we did not expect. In this case, those changes as they effect hydraulic calculations, acceptance testing, signage, and ITM are proportionally small but important. All together



### *Did You Know??*

The NFSA keeps a member of the Engineering Department staff on duty every business day to answer your technical questions live. We call this the Expert of the Day (EOD) program and it is available to our members by phone, fax or e-mail. Call us at (845) 878-4200 and press 2, or you can send a fax to (845) 878-4215, or you can e-mail us at eod@nfsa.org. Last year we answered more than 2600 requests for assistance.

they serve to improve the **NFPA 13** installation standard.

## References


NFPA 13. *Standard for the Installation of Sprinkler Systems.* 2016. Quincy, MA: National Fire Protection Association, 2015.

NFPA 25. *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.* 2014. Quincy, MA: National Fire Protection Association, 2013.