



Editor-Kenneth E. Isman, P.E.
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Shadow Area Summary 2010 and 2013 Editions of NFPA 13, NFPA 13R and NFPA 13D

The term “Shadow Area” is not defined in any of the NFPA sprinkler standards, nor is it used in most of the standard, yet it has become a subject of a great deal of discussion. The question is frequently asked if shadow areas are permitted by the standards. The answer is that each of the three sprinkler standards permits shadow areas, but does not specifically call them by this name (although that is changing for the new editions). This article will be a summary and explanation of the situation for the 2010 and 2013 editions of NFPA 13, NFPA 13R and NFPA 13D.

The term could be defined as, “The apparently dry space within the area of coverage of a sprinkler that is behind an obstruction where water might not directly spray from a sprinkler.” There are two important points to this definition. First, the area in question must be within the protection area of a sprinkler. The shadow area discussion is not intended to allow space in a building that is beyond the protection area of a sprinkler. If the obstruction was removed, a legitimate “Shadow Area” would disappear and the area in question would obviously get direct water spray from a sprinkler.

The second part of the proposed “Shadow Area” definition is that the area on the other side of the obstruction from the sprinkler is “apparently dry” and that water “might not” get to the space from the sprinkler. The use of the words “apparently” and “might” is intentional because of the complex turbulence to the air currents in a room during a fire. Water does not just travel in a straight line from a sprinkler and it is entirely possible that water will be entrained within the air going to a fire and will be drawn into the fire even if the straight line between the fire and the sprinkler contains an obstruction. See Figure 1 for an example of a shadow area created by two walls in an unusually shaped room protected by a pendent sprinkler.

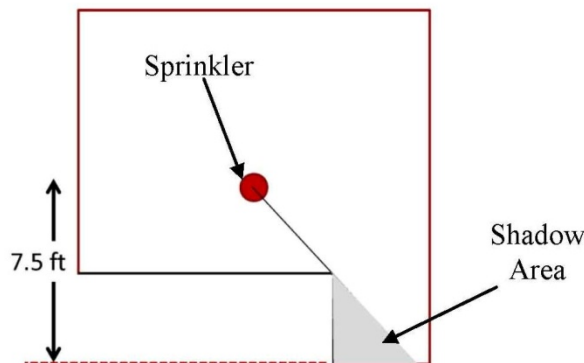


Figure 1 – Example of a Shadow Area

Note that in Figure 1, the shadow area is within the coverage area of the sprinkler, making the situation

legitimate. If the small alcove in which the shadow area resides had been farther from the sprinkler, it might not have been acceptable (although situation such as the small room rule or the use of extended coverage or residential sprinklers might have made the situation acceptable)

NFPA 13-2010 and Shadow Areas

The 2010 edition of NFPA 13 does not use the term “Shadow Area”, but does allow such areas through a combination of sections 8.5.3.2 and 8.6.5.2.1.3 (commonly known as the “three-times rule”) for standard spray sprinklers. Shadow areas are permitted for sidewall sprinklers, extended coverage sprinklers and residential sprinklers using the “three-times rule” or “four-times rule” as applicable in sections 8.7, 8.8, 8.9 and 8.10.

Section 8.5.3.2 states that the maximum allowable distance from a sprinkler to a wall is always one-half of the maximum allowable distance between sprinklers. This means that walls are always allowed to be closer to sprinklers than this distance. For light and ordinary hazard occupancies, standard spray sprinklers are allowed to be as far as 15 ft apart, so that a wall is allowed to be a maximum of 7.5 ft away (measured in a line that is a right angle to the wall). But the wall is always allowed to be closer than 7.5 ft (to a minimum of 4 inches).

Section 8.6.5.2.1.3 says that obstructions are permitted, with apparent dry spaces behind them, as long as the distance from the obstruction to the sprinkler is at least three times the maximum dimension (length or width) of the obstruction. An apparent dry space behind an obstruction is permitted as shown in Figure 2 in accordance with this rule.

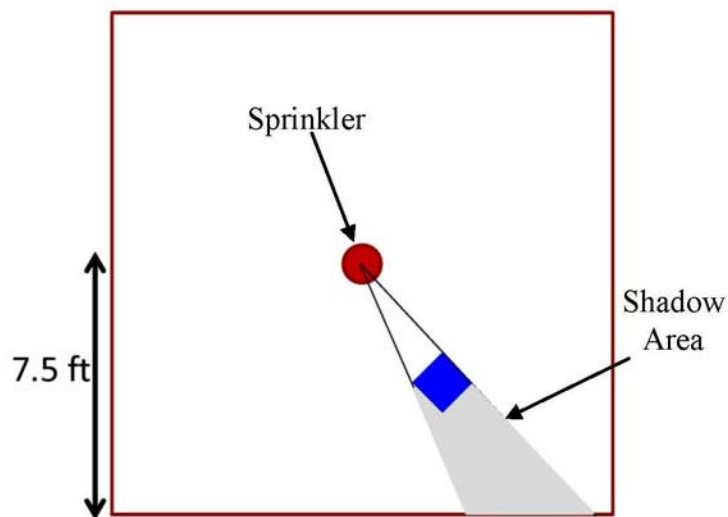
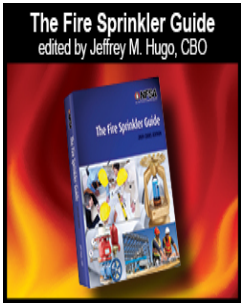


Figure 2 - Shadow Area Using Three-Times Rule

Calculations have been performed (using trigonometry) to show that the maximum shadow area permitted by NFPA 13 for standard spray sprinklers using the three times rule with an 8 inch wide obstruction between a sprinkler in the middle of a room at a 15 ft x 15 ft spacing and a corner of a room is about 15 sq ft when the sprinkler is 24 inches away from the obstruction. Since this meets the rules of section 8.6.5.2.1.3, this establishes a minimum baseline of acceptable dry spaces (or shadow areas) that can be applied to other situations using the equivalency clauses of NFPA 13 (sections 1.5 and 1.6).

Since the shadow area in Figure 2 is clearly permitted by section 8.6.5.2.1.3, and since section 8.5.3.2 allows walls to be closer to sprinklers, then the walls in Figure 2 can be moved closer to the sprinkler to the locations shown in Figure 3 by the dotted lines.

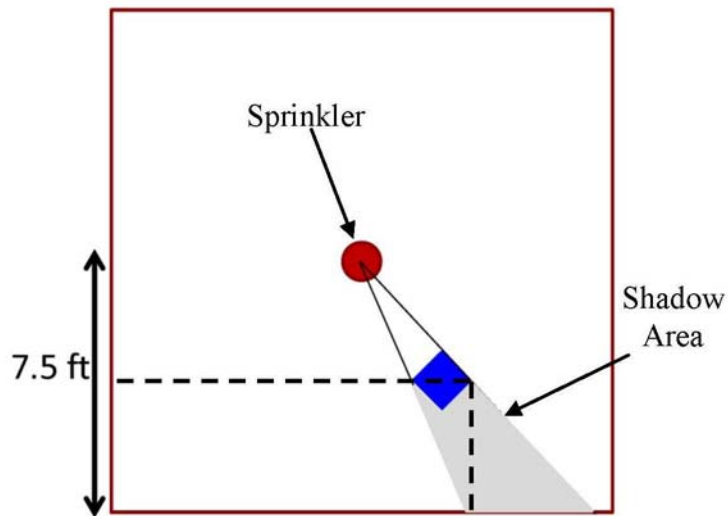
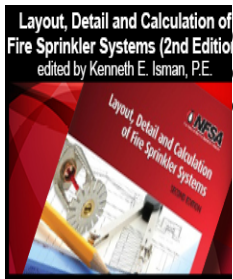


Figure 3 – Walls Moved Closer



Once the walls have been moved closer to the sprinkler, as shown in Figure 3, the shadow area does not encompass any different space than what we already agreed was allowed by section 8.6.5.2.1.3. The final room ends up as shown in Figure 4 and is permitted by NFPA 13.

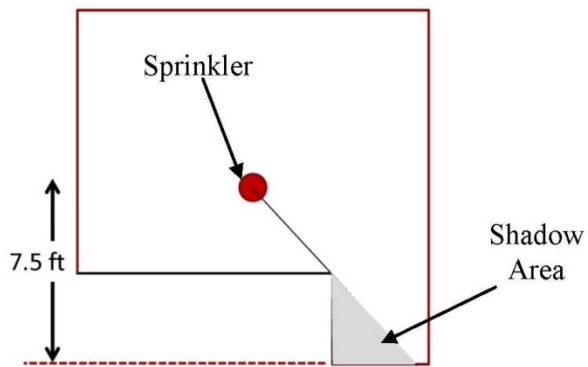


Figure 4 – Acceptable Shadow Area

The dimension of 15 sq ft that was calculated with standard spray sprinklers at 15 x 15 spacing would not be the same in an ordinary hazard occupancy with sprinklers spaced closer and would also not be the same in a room using extended coverage or residential sprinklers at larger spacings. The calculation has been performed using an extended coverage sprinkler at a 20 ft x 20 ft spacing in the middle of a room with a 9 inch obstruction and the sprinkler positioned 36 inches from the obstruction (using the four-times rule). This resulted in an apparent dry area (shadow area) of 21 sq ft behind the obstruction. For the math on this calculation, see the May/June 2008 edition of Sprinkler TechNotes.

NFPA 13-2013 and Shadow Area

The 2013 edition of NFPA 13 will be the same as the 2010 edition on the subject of shadow areas. The committee assigned a task group to the subject that tried to come up with specific language for the standard, but every variation that the committee developed could have been abused in some way.

For example, if the committee had just come out with a specific statement that shadow areas of 15 sq ft are allowed in light hazard occupancies, they were worried that people would use this as a way to ignore the three-times rule and put sprinklers closer to obstructions than they really should be. The task group is still trying to

work something out for the 2016 edition of the standard, but it is difficult to develop language that is easy to understand and enforce while at the same time does not invite abuse.

NFPA 13R-2010 and Shadow Areas

The 2010 edition of NFPA 13R is the only one of the 2010 editions of the sprinkler standards that directly uses the term “shadowed” in referring to an allowable apparent dry area within the coverage area of a sprinkler. This term is referred to in section 6.2.3.5.4, which permits “partially blocked or shadowed floor areas” in rooms up to 800 sq ft in size as long as the individual area does not exceed 3 sq ft, the summation of the areas in any compartment do not exceed 12 sq ft and the summation of the areas in the whole dwelling unit do not exceed 30 sq ft.

This section was new to the 2010 edition of NFPA 13R and was not based on any water flow analysis or fire testing. Instead, this section was purely placed in the standard due to the extreme frustration that many sprinkler contractors were having with AHJ’s and the desire to keep NFPA 13R systems affordable. AHJ’s have been particularly stubborn on this issue and even though NFPA 13 has allowed shadow areas as described above, since the term “shadow area” does not appear in NFPA 13, and since the linkage from NFPA 13 to NFPA 13R is not clear on this subject, the committee believed that something needed to be said directly in the standard to eliminate the arguments that were occurring between contractors and AHJ’s.

Due to the fact that the information was put in the standard without any fire tests or water distribution tests, the allowable areas are extremely small. It should also be pointed out that the intent of the committee responsible for NFPA 13R is not to make it more stringent than NFPA 13. The intent was to allow the position of sprinklers in accordance with the same spacing rules as NFPA 13, but to use the specific guidance of section 6.2.3.5.4 to settle disputes with AHJ’s over small areas without having to get into a legal debate about the rules of NFPA 13 and how they are referenced by NFPA 13R.

There is another section from NFPA 13R that is frequently quoted when looking at shadow areas. Section 6.2.3.5.2 lays out areas such as bay windows and planter box window and other similar architectural features that are permitted without additional sprinkler protection. These areas are allowed to be as large as 18 sq ft with limitations on certain dimensions. While these are similar to the shadow area concept, these are technically not shadow areas as we have defined them because the intent of this section is not to count these areas for the hydraulic calculation of the system (see part (3) of 6.2.3.5.2). So while the user might use this section to justify a shadow area up to 18 sq ft, the rule was intended to be slightly different. In the end, the rule is less stringent than the concept of a shadow area, so it should be considered in allowing shadow areas larger than the 3 sq ft discussed in section 6.2.3.5.2.

NFPA 13R-2013 and Shadow Areas

The 2013 edition of NFPA 13R does away with the rules of 6.2.3.5.2 discussed above in the 2010 edition and has one simple rule for shadow areas that makes NFPA 13R similar to NFPA 13. Interestingly, the simple rule appears twice in the standard, once in a general section applying to all residential sprinklers (6.4.6.3.3.1) and then again in a section devoted to sidewall sprinklers (6.4.6.3.5.5). Both of these sections allow shadow areas as long as the apparent dry area does not exceed 15 sq ft.

NFPA 13D-2010 and Shadow Areas

The concept of shadow areas is not directly addressed in the 2010 edition. In the annex (A.8.2.5) is a discussion of architectural features such as bay windows and planter boxes with the 18 sq ft limitation on the area and other dimensional limitations. As stated in the discussion on the 2010 edition of NFPA 13R, this was not really intended to apply to shadow areas directly since it applies to situations where the water demand will not be based on this extra area. But it is not bad guidance since it permits an area where water is clearly not intended to fall.

NFPA 13D-2013 and Shadow Areas

The 2013 edition of NFPA 13D will be very much like the 2013 edition of NFPA 13R with one simple rule regarding shadow areas. Section 8.2.5.7 will permit shadow areas up to 15 sq ft in area for all sprinkler situations.

Upcoming NFSA "Technical Tuesday" Seminar - October 9

Topic: Storage Configuration and Classification

Instructors: Kevin Kelly P.E.

Date: Tuesday, October 9, 2012- 10:30 am EST

Before the proper criteria in NFPA 13 can be applied to a storage occupancy, the correct storage configuration and commodity classification need to be identified. If the storage is on a structure, is the structure a rack, shelf, back-to-back shelf, or bin-box arrangement? If the storage is not on a structure, is it solid-piled or palletized? What are the commodity classifications and what effect does an exposed, or expanded, or free-flowing plastic have on that classification? These questions will be answered with lots of hands-on examples, pictures and video.

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

Layout Technician Training Course (2-week course)

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:

Oct 2	Glenwood Sprgs, CO	Fire Service Mains & Their Appurtenances
Oct 3	Glenwood Sprgs, CO	Sprinkler System Installation Requirements
Oct 4	Glenwood Sprgs, CO	Designing with Fire Sprinklers
Oct 16-17	Brea, CA	2-Day NFPA 13 Overview
Oct 18	Brea, CA	Plan Review Procedures & Policies
Oct 23-25	Las Vegas, NV	3-Day Inspection & Testing for the Sprinkler Industry

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.

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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 Paterson, N.Y., NFSA has regional operations offices throughout the country. www.nfsa.org.

