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The 'Small Room' Rules Explained

We often hear references to the 'small room' rule but there are some common misunderstandings that go along with its use and application. This article will examine the 'small room' rules - there are two of them - and some of the issues that come up about them in NFSA's Expert of the Day program.

What is a 'Small Room' anyway?

Before we talk about the 'small room' rules themselves, we need to take moment to review the NFPA 13 definition of a 'small room' because it is very specific:

3.3.22 Small Room.

A compartment of light hazard occupancy classification having unobstructed construction and a floor area not exceeding 800 ft² (74 m²).

A compartment...

NFPA 13 doesn't define a 'room' anywhere except for its common usage by reference to the Merriam-Webster Collegiate Dictionary but it does have a very specific definition for a 'compartment'. So, the first thing it is telling us is that a small room must meet that definition; completely enclosed with specifically limited openings.

3.3.6 Compartment. *A space completely enclosed by walls and a ceiling. Each wall in the compartment is permitted to have openings to an adjoining space if the openings have a minimum lintel depth of 8 in. (200 mm) from the ceiling and the total width of the openings in each wall does not exceed 8 ft (2.4 m). A single opening of 36 in. (900 mm) or less in width without a lintel is permitted when there are no other openings to adjoining spaces.*

...of light hazard occupancy classification...

These compartments must also be designated as light hazard which typically limits our use of the small room rules to occupancies like offices, assembly areas, classrooms, and so forth.

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5.2* Light Hazard Occupancies. *Light hazard occupancies shall be defined as occupancies or portions of other occupancies where the quantity and/or combustibility of contents is low and fires with relatively low rates of heat release are expected.*

...having unobstructed construction...

The ceiling construction must be unobstructed to allow for unimpeded heat flow and water distribution.

3.7.2* Unobstructed Construction. *Construction where beams, trusses, or other members do not impede heat flow or water distribution in a manner that materially affects the ability of sprinklers to control or suppress a fire. Unobstructed construction has horizontal structural members that are not solid, where the openings are at least 70 percent of the cross-section area and the depth of the member does not exceed the least dimension of the openings, or all construction types, with the exception of panel construction, where the spacing of structural members exceeds 7½ ft (2.3 m) on center.*

... and a floor area not exceeding 800 ft²

So, having carefully defined what kind of 'room' is applicable, 'small' is defined as 800 square feet or less in area - which is still large enough to be a fairly substantial room!

As common misunderstandings go, one of the most common is the misapplication of the 'small room' rules to rooms that are sufficiently small but do not meet one or more of the other requirements. The 'small room' rules cannot be applied if the room in question does not meet all the requirements listed in the definition.

To recap, a 'small room' must:

- meet the definition of a compartment
- be a light hazard occupancy
- have unobstructed construction
- be 800 square feet or less in area

Also, 'small room' rules have nothing to do with the 'room design method' although the two are sometimes confused. The room design method can be applied to any size room or even to an entire building level!

11.2.3.3 Room Design Method.

11.2.3.3.1* *The water supply requirements for sprinklers only shall be based upon the room that creates the greatest demand.*

....

The Small Room Rules, What Are They?

There are two 'small room' rules and they both apply exclusively to standard upright (SSU) and pendent (SSP)



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sprinklers.

Area of Coverage

The first relates to area of coverage which is typically based on the general S x L rule.

8.5.2.1.2

The protection area of coverage of the sprinkler shall be established by multiplying the S dimension by the L dimension, as follows:

$$A_s = S \times L \quad [8.5.2.1.2]$$

When SSU/SSP sprinklers are installed in a small room, the standard requires the area of coverage to be calculated differently; the area of the room is simply divided by the number of sprinklers installed.

8.6.2.1.2.1 The protection area of coverage for each sprinkler in the small room shall be the area of the room divided by the number of sprinklers in the room.

The practical implications here are:

- The S x L calculated area of coverage for any given sprinkler may exceed the 225 square feet typically permitted by **Table 8.6.2.2.1(a)** but this is permissible as long as the average area of coverage per sprinkler does not exceed that value.
- When performing hydraulic calculations, the minimum required flow from each sprinkler in the 'small room' will be the same based on the room averaged flow.

A common misunderstanding that arises here is that this is an option to the general S x L rule. Some AHJs are concerned that design areas with many 'small rooms' should be calculated more conservatively based on the individual operating areas of each sprinkler, but the language used in the standard is a clear 'shall' without any exceptions. If the rules defining a 'small room' have been applied correctly, the required compartmentation, hazard, and ceiling configuration justifies the less conservative calculation method.

Maximum Distance to Walls

The second 'small room' rule involves a relaxation of the usual limits on maximum distances to walls from one-half of the allowable distance between sprinklers.

8.6.3.2.1

The distance from sprinklers to walls shall not exceed one-half of the allowable distance between sprinklers as indicated in Table 8.6.2.2.1(a) through Table 8.6.2.2.1(d).

When SSU/SSP sprinklers are installed in a small room, the

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standard permits the distance to the wall to be increased from 7 ½ feet to 9 feet provided that the other spacing and area limits are not exceeded.

8.6.3.2.4*

The requirements of 8.6.3.2.1 shall not apply within small rooms as defined in 3.3.22.

8.6.3.2.4.1

Sprinklers shall be permitted to be located not more than 9 ft (2.7 m) from any single wall.

8.6.3.2.4.2

Sprinkler spacing limitations of 8.6.3 and area limitations of Table 8.6.2.2.1(a) shall not be exceeded.

Once again, if the rules defining a 'small room' have been applied correctly, the required compartmentation, hazard, and ceiling configuration justifies the extended allowance to the wall.

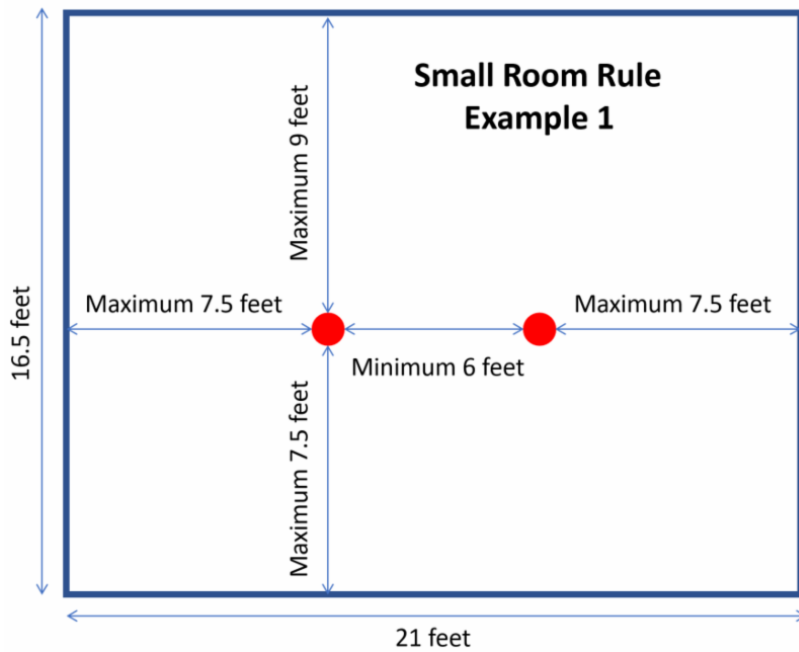
Common misapplications of this 'small room' rule include trying to use extended spacing from more than one single wall within the room. The layout technician is permitted to select one wall and one wall only from which extended spacing is permitted by **8.6.3.2.4.1** - typically a long wall potentially allowing more than one sprinkler to take advantage of the exception.

Another misconception is that the 9-foot extended spacing allowance must be balanced by a 6-foot reduced allowance to the opposite wall, but this is not necessarily the case. Some of this misunderstanding can be attributed to the four examples provided in the annex.

In three of the four examples provided, the rooms are conveniently sized in multiples of 15 feet and provided with the minimum number of sprinklers permitted, this forces the short spacing on the side opposite the 9-foot exception. Even in the fourth example, the wall chosen for the 9-foot exception is conveniently 30 feet from its opposite wall. This gives a misleading impression that there will always be reduced 6-foot spacing opposite the 9-foot extended spacing allowance, but this is not the case.

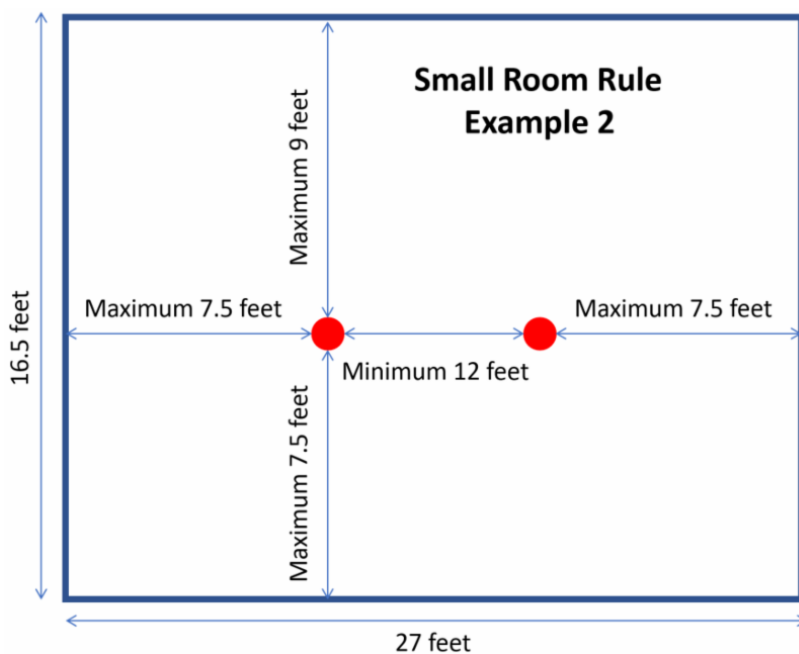
In a room that is *not* dimensioned in multiples of 15, such as the 'small room' examples below, it is possible to space off the opposite wall up to the usual 7 ½ feet because the spacing in the other direction has been reduced in compensation instead.

In the case of Example 1, the 'small room' rule allows sprinklers to be spaced 9 feet away from the north wall and 7 ½ feet from the south wall. (At 16½ feet, this is the maximum room width that can be covered with a single row of SSU/SSP sprinklers.) The area compensating reduced dimension can be found in the 21-foot long east to west direction where the two sprinklers can be placed up to 7 ½ feet from their nearest wall as long as the distance between them is not reduced to less than 6 feet. The two sprinklers could also be placed as much as the usual 15 feet apart with greatly shortened distances to the wall at one or both ends of the room.



Example 1: With a total area of , each sprinkler has an area of coverage of $346.5\text{ft}^2/2\text{sprinklers} = 173.25\text{ft}^2$, well below the allowable 225ft^2 maximum. If the $S \times L$ method was used, each sprinkler would have an area of coverage of 270ft^2 .

In the case of Example 2, the same 'small room' has been stretched to 27 feet, nearly the maximum length that can be covered by two SSU/SSP sprinklers at this width. The area compensating reduced dimension in the east to west spacing allows the two sprinklers to still be placed up to $7\frac{1}{2}$ feet from their nearest wall with a minimum of 12 feet between them. As before, the two sprinklers could also be placed as much as the usual 15 feet apart with shortened distances to the wall at one or both ends of the room.



Example 2: With a total area of $16.5\text{ft} \times 27\text{ft} = 445.5\text{ft}^2$, each sprinkler has an area of coverage of $445.5\text{ft}^2/2\text{sprinklers} = 222.75\text{ft}^2$, just below the allowable 225ft^2 maximum. If the $S \times L$

L method was used, each sprinkler would have an area of coverage of 270ft².

Summary

Properly applied, the 'small room' rules provide flexible options for sprinkler placement. They can be applied to reduce the number of sprinklers required by the usual spacing constraints or to position sprinklers more favorably when obstacles like light fixtures or HVAC vents occupy the desired sprinkler location. The layout technician must be sure to apply the definition of a 'small room' carefully and remember that the flexible maximum distance from walls rule is optional but that the area of coverage rule is not. When optional 9-foot spacing is used, that extended spacing must be made up somewhere in the room - either in the same direction as the 9-foot spacing or in the perpendicular spacing to ensure that a sufficient number of sprinklers is present in the room to meet the average area of coverage requirement.

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