**Chapter 8 Sprinkler Position and Location**

8.1 Design Criteria

8.1.1 Sloped Ceilings

8.1.1.1

Where the ceiling is sloped, the maximum S dimension shall be measured along the slope of the ceiling to the next sprinkler, as shown in Figure 8.1.1.1.

FIGURE 8.1.1.1 Measuring S Dimension.

8.1.1.2

The sprinklers shall maintain the minimum listed spacing, but no less than 8 ft (2.4 m), measured in the plan view from one sprinkler to another, as shown in Figure 8.1.1.1.

8.1.2 Nonresidential Sprinklers

Sprinklers other than residential sprinklers shall be installed in accordance with the coverage criteria specified by NFPA 13.

8.1.3 Sprinkler Coverage

8.1.3.1 Residential Sprinklers

8.1.3.1.1

Sprinklers shall be installed in accordance with their listing where the type of ceiling configuration is referenced in the listing.

8.1.3.1.2\*

Where construction features or other special conditions exist that are outside the scope of sprinkler listings, listed sprinklers shall be permitted to be installed beyond their listing limitations.

8.1.3.1.3

Where a physical barrier exists between the sprinklers that prevents each sprinkler from directly spraying on the other, there shall be no minimum distance between sprinklers.

8.1.4 Operating Pressure

The minimum operating pressure of any sprinkler shall be the higher of the minimum operating pressure specified by the listing or 7 psi (0.5 bar).

8.2 Position of Sprinklers

8.2.1 Residential Pendent and Upright Sprinklers

8.2.1.1

Pendent and upright sprinklers that have not been listed with specific deflector to ceiling distances shall be positioned so that the deflectors are within 1 in. to 4 in. (25 mm to 100 mm) from the ceiling unless otherwise permitted by 8.2.7 or 8.2.1.2.

8.2.1.2\*

Pendent-type residential sprinklers located under or adjacent to beams in accordance with 10.2.1 shall be installed in accordance with one of the following:

Pendent, recessed pendent, and flush-type pendent sprinklers shall be permitted to be installed directly under a beam having a maximum depth of 14 in. (350 mm) with the sprinkler deflector 1 in. to 2 in. (25 mm to 50 mm) below the beam, or in accordance with the manufacturer's instructions for recessed or flush sprinklers if the deflector is less than 1 in. (25 mm) below the beam, as shown in Figure 8.2.1.2(a).

Pendent sprinklers shall be permitted to be installed adjacent to beams where the vertical centerline of the sprinkler is no greater than 2 in. (50 mm) from the edge of the beam and with the sprinkler deflector 1 in. to 2 in. (25 mm to 50 mm) below the beam, or in accordance with the manufacturer's instructions for flush sprinklers if the deflector is less than 1 in. (25 mm) below the beam, as shown in Figure 8.2.1.2(b).

FIGURE 8.2.1.2(a) Position of Sprinkler Under a Beam.

FIGURE 8.2.1.2(b) Position of Sprinkler Adjacent to a Beam.

8.2.1.3

Concealed sprinklers shall be permitted to be installed in beams up to 4 in. (100 mm) in depth.

8.2.1.4

Pendent and upright sprinklers that have been listed with specific positioning criteria shall be positioned in accordance with their listing unless permitted otherwise by 8.2.7.

8.2.2 Residential Sidewall Sprinklers

8.2.2.1

Sidewall sprinklers that have not been listed with specific positioning criteria shall be positioned so that the deflectors are within 4 in. to 6 in. (100 mm to 150 mm) from the ceiling.

8.2.2.2

Sidewall sprinklers that have been listed with specific positioning criteria shall be installed in accordance with their listing.

8.2.2.3

Residential horizontal sidewall sprinkler deflectors shall be located no more than 6 in. (150 mm) from the face of the wall or soffit on which they are mounted.

8.2.3 Nonresidential Sprinklers

Sprinklers other than residential sprinklers shall be positioned in accordance with the positioning criteria specified by NFPA 13.

8.2.4 Basements Without Ceilings

In basements where ceilings are not required for the protection of piping or where metallic pipe is installed, residential sprinklers shall be permitted to be positioned in a manner that anticipates future installation of a finished ceiling.

8.2.5\* Obstructions to Residential Sprinklers

8.2.5.1 Pendent Sprinklers

8.2.5.1.1

Pendent sprinklers shall be located at least 36 in. (900 mm) away from obstructions such as ceiling fans and light fixtures unless the requirements of 8.2.5.3 are met.

8.2.5.1.2

The distance shall be measured from the center of the sprinkler to the center of the obstruction.

8.2.5.1.3

Where the sprinkler cannot be located 36 in. (900 mm) away from the obstruction (as measured from the center of the obstruction), an additional sprinkler shall be located on the other side of the obstruction.

8.2.5.1.4

Where the area of the fan blades encompass more than 50 percent of the area of the plan view, the sprinkler shall be installed in accordance with 8.2.5.3.

8.2.5.2 Sidewall Sprinklers

8.2.5.2.1

Sidewall sprinklers shall be located at least 5 ft (1.5 m) away from obstructions such as ceiling fans and light fixtures unless the requirements of 8.2.5.4 are met.

8.2.5.2.2

The distance shall be measured from the center of the sprinkler to the center of the obstruction.

8.2.5.2.3

Where the sprinkler cannot be located 5 ft (1.5 m) away from the obstruction (as measured to the center of the obstruction), an additional sprinkler shall be installed on the other side of the obstruction.

8.2.5.2.4

Where the area of the fan blades encompasses more than 50 percent of the area of the plan view, the sprinkler shall be installed in accordance with 8.2.5.4.

8.2.5.3 Continuous Obstructions to Pendent Sprinklers

8.2.5.3.1

Sprinklers shall be positioned with respect to continuous obstructions in accordance with 8.2.5.3.2, 8.2.5.3.3, or 8.2.5.3.4.

8.2.5.3.2

Sprinklers shall be positioned with respect to continuous obstructions in accordance with Table 8.2.5.3.2 and Figure 8.2.5.3.2.

Table 8.2.5.3.2 Positioning of Sprinklers to Avoid Obstructions to Discharge (Residential Upright and Pendent Spray Sprinklers)

Distance from Sprinklers to Side of Obstruction (A) Maximum Allowable Distance of Deflector Above Bottom of Obstruction (in.) (B)

Less than 1 ft (300 mm) 0

1 ft (300 mm) to less than 1 ft 6 in. (450 mm)

0

1 ft 6 in. (450 mm) to less than 2 ft (600 mm)

1 (25 mm)

2 ft (600 mm) to less than 2 ft 6 in. (750 mm)

1 (25 mm)

2 ft 6 in. (750 mm) to less than 3 ft (900 mm)

1 (25 mm)

3 ft (900 mm) to less than 3 ft 6 in. (1050 mm)

3 (75 mm)

3 ft 6 in. (1050 mm) to less than 4 ft (1200 mm)

3 (75 mm)

4 ft (1200 mm) to less than 4 ft 6 in. (1350 mm)

5 (125 mm)

4 ft 6 in. (1350 mm) to less than 5 ft (1500 mm)

7 (175 mm)

5 ft (1500 mm) to less than 5 ft 6 in. (1650 mm)

7 (175 mm)

5 ft 6 in. (1650 mm) to less than 6 ft (1800 mm)

7 (175 mm)

6 ft (1800 mm) to less than 6 ft 6 in. (1950 mm)

9 (225 mm)

6 ft 6 in. (1950 mm) to less than 7 ft (2100 mm)

11 (275 mm)

7 ft and greater (2100 mm) 14 (350 mm)

Note: For A and B, refer to Figure 8.2.5.3.2.

FIGURE 8.2.5.3.2 Positioning of Sprinkler to Avoid Obstruction to Discharge (Residential Upright and Pendent Spray Sprinklers).

8.2.5.3.3

Sprinklers shall be positioned with respect to an obstruction against a wall in accordance with Figure 8.2.5.3.3(a) or Figure 8.2.5.3.3(b).

FIGURE 8.2.5.3.3(a) Positioning of Sprinkler to Avoid Obstruction Against Walls (Residential Upright and Pendent Spray Sprinklers).

FIGURE 8.2.5.3.3(b) Positioning of Sprinkler to Avoid Obstruction Against Walls (Residential Upright and Pendent Spray Sprinklers).

8.2.5.3.4

A sprinkler shall be installed on the other side of the obstruction.

8.2.5.4 Continuous Obstructions to Sidewall Sprinklers

8.2.5.4.1

Sprinklers shall be positioned with respect to continuous obstructions in accordance with 8.2.5.4.2 or 8.2.5.4.3.

8.2.5.4.2

Sprinklers shall be positioned with respect to continuous obstructions in accordance with Table 8.2.5.4.2(a), Figure 8.2.5.4.2(a), Table 8.2.5.4.2(b), Figure 8.2.5.4.2(b), and Figure 8.2.5.4.2(c).

Table 8.2.5.4.2(a) Positioning of Sprinklers to Avoid Obstructions (Residential Sidewall Sprinklers)

Distance from Sidewall Sprinkler to Side of Obstruction (A) Maximum Allowable Distance of Deflector Above Bottom of Obstruction (in.) (B)

Less than 8 ft (2400 mm) Not allowed

8 ft (2400 mm) to less than 10 ft (3000 mm)

1 (25 mm)

10 ft (3000 mm) to less than 11 ft (3300 mm)

2 (50 mm)

11 ft (3300 mm) to less than 12 ft (3600 mm)

3 (75 mm)

12 ft (3600 mm) to less than 13 ft (3900 mm)

4 (100 mm)

13 ft (3900 mm) to less than 14 ft (4200 mm)

6 (150 mm)

14 ft (4200 mm) to less than 15 ft (4500 mm)

7 (175 mm)

15 ft (4500 mm) to less than 16 ft (4800 mm)

9 (225 mm)

16 ft (4800 mm) to less than 17 ft (5100 mm)

11 (275 mm)

17 ft (5100 mm) or greater 14 (350 mm)

Note: For A and B, refer to Figure 8.2.5.4.2(a).

Table 8.2.5.4.2(b) Positioning of Sprinklers to Avoid Obstructions Along Wall (Residential Sidewall Sprinklers)

Distance from Sidewall Sprinkler to Side of Obstruction (A) Maximum Allowable Distance of Deflector Above Bottom of Obstruction (in.) (B)

Less than 1 ft 6 in. (450 mm) 0

1 ft 6 in. (450 mm) to less than 3 ft (900 mm)

1 (25 mm)

3 ft (900 mm) to less than 4 ft (1200 mm)

3 (75 mm)

4 ft (1200 mm) to less than 4 ft 6 in. (1350 mm)

5 (125 mm)

4 ft 6 in. (1350 mm) to less than 6 ft (1850 mm)

7 (175 mm)

6 ft (1850 mm) to less than 6 ft 6 in. (1950 mm)

9 (225 mm)

6 ft 6 in. (1950 mm) to less than 7 ft (2100 mm)

11 (275 mm)

7 ft to (2100 mm) less than 7 ft 6 in. (2250 mm)

14 (350 mm)

Note: For A and B, refer to Figure 8.2.5.4.2(b).

FIGURE 8.2.5.4.2(a) Positioning of Sprinkler to Avoid Obstruction (Residential Sidewall Sprinklers).

FIGURE 8.2.5.4.2(b) Positioning of Sprinkler to Avoid Obstruction Along Wall (Residential Sidewall Sprinklers).

FIGURE 8.2.5.4.2(c) Positioning of Sprinkler to Avoid Obstructions Against Wall (Residential Sidewall Sprinklers).

8.2.5.4.3

A sprinkler shall be installed on the other side of the obstruction.

8.2.5.5 Soffits and Cabinets

Where soffits are used for the installation of sidewall sprinklers, the sprinklers and soffits shall be installed in accordance with 8.2.5.5.1, 8.2.5.5.2, or 8.2.5.5.3.

8.2.5.5.1

Where soffits exceed more than 8 in. (200 mm) in width or projection from the wall, sprinklers shall be installed under the soffit.

8.2.5.5.2

Sidewall sprinklers shall be permitted to be installed in the face of a soffit located directly over cabinets, without requiring additional sprinklers below the soffit or cabinets, where the soffit does not project horizontally more than 12 in. (300 mm) from the wall.

8.2.5.5.3

Where sidewall sprinklers are more than 3 ft (0.91 m) above the top of cabinets, the sprinkler shall be permitted to be installed on the wall above the cabinets where the cabinets are no greater than 12 in. (300 mm) from the wall.

8.2.5.6

Shadow areas in corridors up to 2 ft (0.61 m) in depth and up to 9 ft (2.7 m) in length behind sidewall sprinklers shall be permitted as shown in Figure 8.2.5.6. [13R:Figure 6.4.6.3.3.2]

FIGURE 8.2.5.6 Shadow Areas Behind Sidewall Sprinklers in Corridors.

8.2.5.7\* Shadow Areas

Shadow areas shall be permitted in the protection area of a sprinkler as long as the cumulative dry areas do not exceed 15 ft2 (1.4 m2) per sprinkler.

8.2.5.8

Small areas created by architectural features, such as planter box windows, bay windows, and similar features, shall be evaluated as follows:

Where no additional floor area is created by the architectural feature, no additional sprinkler protection is required.

Where additional floor area is created by an architectural feature, no additional sprinkler protection is required, provided all of the following conditions are met:

The floor area shall not exceed 18 ft2 (1.7 m2).

The floor area shall not be greater than 24 in. (600 mm) in depth at the deepest point of the architectural feature to the plane of the primary wall where measured along the finished floor.

The floor shall not be greater than 9 ft (2.7 m) in length where measured along the plane of the primary wall.

Measurement from the deepest point of the architectural feature to the sprinkler shall not exceed the maximum listed spacing of the sprinkler.

The hydraulic design shall not be required to consider the area created by the architectural feature.

8.2.6\* Exposed Barrel Lengths for Dry Sprinklers

8.2.6.1

Where dry sprinklers are connected to wet pipe sprinkler systems protecting areas subject to freezing temperatures, the minimum exposed length of the barrel of the dry sprinkler shall be in accordance with Table 8.2.6.1(a) or Table 8.2.6.1(b).

Table 8.2.6.1(a) Exposed Barrel Lengths for Dry Sprinklers (U.S. Customary Units)

Ambient Temperature Exposed to Discharge End of Sprinkler (°F) Minimum Exposed Barrel Length when Exposed to 40°F (in.) Minimum Exposed Barrel Length when Exposed to 50°F (in.) Minimum Exposed Barrel Length when Exposed to 60°F (in.)

40 0 0 0

30 0 0 0

20 4 0 0

10 8 1 0

0 12 3 0

-10 14 4 1

-20 14 6 3

-30 16 8 4

-40 18 8 4

-50 20 10 6

-60 20 10 6

Table 8.2.6.1(b) Exposed Barrel Lengths for Dry Sprinklers (Metric Units)

Ambient Temperature Exposed to Discharge End of Sprinkler (°C) Minimum Exposed Barrel Length when Exposed to 4°C (mm) Minimum Exposed Barrel Length when Exposed to 10°C (mm) Minimum Exposed Barrel Length when Exposed to 16°C (mm)

4 0 0 0

-1 0 0 0

-7 100 0 0

-12 200 25 0

-18 300 75 0

-23 350 100 25

-29 350 150 75

-34 400 200 100

-40 450 200 100

-46 500 250 150

-51 500 250 150

8.2.6.2

The minimum barrel length shall be measured from the face of the fitting to which the dry sprinkler is installed to the inside surface of the insulation, wall, or ceiling leading to the cold space, whichever is closer to the fitting.

8.2.7 Closets and Compartments

In all closets and compartments that are smaller than 400 ft3 (11 m3), including those housing mechanical equipment, pendent, upright, and sidewall residential sprinklers shall be permitted to be installed in either of the following situations:

Within 18 in. (450 mm) of the ceiling to avoid obstructions near the ceiling where the compartment is enclosed by walls and a door

At the highest ceiling level without regard to obstructions or minimum distances to wall

8.3 Location of Sprinklers

8.3.1

Sprinklers shall be installed in all areas except where omission is permitted by 8.3.2 through 8.3.8.

8.3.2

Sprinklers shall not be required in bathrooms of 55 ft2 (5.1 m2) and less.

8.3.3

Sprinklers shall not be required in clothes closets, linen closets, and pantries that meet all of the following conditions:

The area of the space does not exceed 24 ft2 (2.2 m2).

The walls and ceilings are surfaced with noncombustible or limited-combustible materials as defined in NFPA 220.

8.3.4\*

Sprinklers shall not be required in garages, open attached porches, carports, and similar structures.

8.3.5

Sprinklers shall not be required in attics with or without storage, penthouse equipment rooms, elevator machine rooms, concealed spaces dedicated exclusively to and containing only dwelling unit ventilation equipment, floor/ceiling spaces, elevator shafts, crawl spaces, and other concealed spaces that are not used or intended for living purposes.

8.3.5.1

Such spaces that contain fuel-fired equipment shall also comply with 8.3.5.1.1 or 8.3.5.1.2.

8.3.5.1.1

Where the fuel-fired equipment is above all of the occupied areas of the dwelling unit, no sprinkler protection shall be required in the concealed space.

8.3.5.1.2\*

Where fuel-fired equipment is below or on the same level as occupied areas of the dwelling unit, at least one quick-response intermediate temperature sprinkler shall be installed above the equipment or at the wall separating the space with the fuel-fired equipment from the occupied space.

8.3.6\*

Sprinklers shall not be required in unheated enclosures at the building at entrances/exits as long as the dwelling unit has another entrance/exit.

8.3.7

Sprinklers shall not be required for ceiling pockets that meet the following conditions:

The total volume of all unprotected ceiling pockets in a compartment does not exceed 100 ft3 (2.8 m3).

The entire floor under the unprotected ceiling pocket is protected by the sprinklers at the lower ceiling elevation.

Skylights not exceeding 32 ft2 (3 m2) shall be permitted to have a plastic cover.

8.3.8

Sprinklers shall not be required in closets in garages and exterior closets (regardless of size) located on exterior balconies, exterior breezeways/corridors, or accessed from outdoors where the closet does not have doors or unprotected penetrations directly into the dwelling unit.

8.3.9

Sprinklers shall be installed in any closet used for heating and/or air-conditioning equipment, washers and/or dryers, or water heaters except as allowed by 8.3.8.