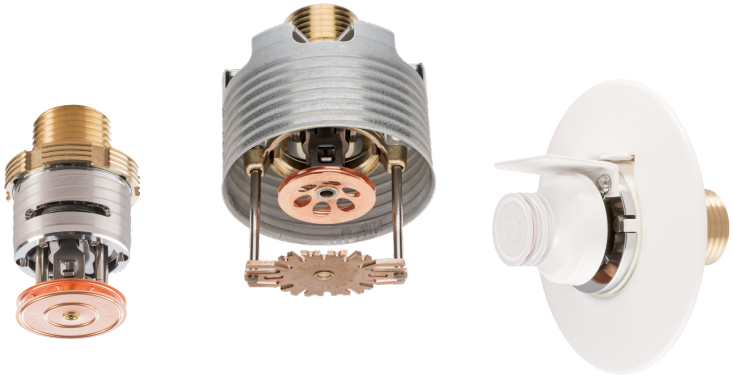


Senju Sprinkler
Residential Sprinkler Design Guide

DESCRIPTION

Senju Residential Sprinklers are of the automatic type and are equipped with a fast-response thermal sensitive element. Senju residential sprinklers are listed by UL LLC (UL) and designed for use in wet pipe sprinkler systems in accordance with NFPA 13D, NFPA 13R, and NFPA 13 requirements for residential occupancies or residential portions of occupancies where applicable. Residential Fire Sprinkler Systems should only be designed and installed by individuals who are completely familiar with automatic sprinkler system design, installation procedures, and techniques.

⚠ WARNING: Cancer and Reproductive Harm www.P65Warnings.ca.gov

INSTALLATION

Senju Residential Sprinklers must be installed in accordance with its appropriate Data Sheet that is located on Senju Sprinkler's website (www.senjusprinkler.com).

Do not use any sprinklers which have been subjected to potential mechanical damage. Do not use any sprinklers which show deformation or cracking in either the Sprinkler or the Protective Cap.

Prior to installation, sprinklers should be maintained in the original cartons and packaging until used to minimize the potential for damage to the sprinklers that could cause improper operation or non-operation.

The Protective Cap must remain on the sprinkler during installation. After the installation is completed, the Protective Cap must be removed to place the sprinkler in service.

Residential sprinklers must be installed with their specific torque requirements listed on their Data Sheet. If you exceed the recommended maximum torque, this could result in damage to the sprinkler inlet, which may lead to leakage from the sprinkler.

Use only model specific wrench socket or spanner for installation of sprinklers. Use of any other wrench, socket or spanner is prohibited and may cause damage to the sprinkler.

In case of insufficient adjustment, do not over or under tighten the sprinkler. Readjust the sprinkler fitting for a better fit.

Permitted Sprinklers for Residential Sprinkler Systems

Quick-response sprinklers may be used in certain residential applications in accordance with NFPA guidelines.

CARE AND MAINTENANCE

Senju Residential Sprinklers must be serviced, tested, and maintained in accordance with its Data Sheet.

The owner is responsible for the maintenance of the sprinkler system, including inspection and testing of its compliance with this document, as well as the standards of the National Fire Protection Association (e.g., NFPA 25), and the regulations of any other authorities having jurisdiction. The owner should direct any questions regarding the above rules and regulations to the installing contractors or the sprinkler manufacturer. It is recommended that automatic sprinkler systems be inspected, tested, and maintained by a qualified Inspection Service in accordance with NFPA 25.

LIMITED WARRANTY

See “Terms and Conditions” for limited warranty information at www.senjusprinkler.com.

DESIGN

POSITIONING AND SPACING

Residential sprinklers must be located with care given to sprinkler spacing, obstructions, temperature rating, sensitivity, and closeness to heat sources.

For spacing guidelines with reference to sprinklers in beams, near beams, sloped ceilings, obstructions, and heat sources, refer to the appropriate Senju data sheet, the applicable NFPA standard, and the Authority Having Jurisdiction.

Measurement

For a sloped ceiling, the maximum distance between sprinklers is to be measured along the slope and the minimum distance is to be measured horizontally between sprinklers.

Distance from Walls

Installation shall not be less than 4″ (102 mm) from walls, partitions, or obstructions as defined in the NFPA standards. Sprinklers shall be installed not more than one-half the listed sprinkler spacing.

Minimum Sprinkler Spacing

The minimum distance between Senju residential sprinklers is 8 feet (2.44 m) to prevent cold soldering. Cold soldering occurs when the water spray from one sprinkler affects the adjacent sprinkler's heat responsive element from reaching its operating temperature. This causes the adjacent sprinkler to not operate or delay its operation.

Maximum Sprinkler Spacing

Sprinklers shall be positioned no farther apart than its listed spacing. See Data Sheets for maximum sprinkler spacing.

Highest Sprinkler Position

The highest sprinkler must not be located more than 3 feet (0.91 m) down from the peak measured vertically.

Proximity to A Heat Source

Sprinklers must be located in such a manner to prevent an unintentional operation due to heat sources other than fire. Refer to the applicable NFPA standard for closeness to heat sources for each temperature rating.

Compartment

A space that is completely enclosed by walls and a ceiling is a compartment. A compartment enclosure may have openings to an adjoining space, provided the openings so not exceed 8 ft (2.44 m) in width and have a minimum lintel depth of 8 inches (203 mm) from the ceiling. One opening of 36 inches (914 mm) or less in width with no lintel is permitted with no other openings to adjacent spaces.

Sloped Ceilings

Coverage areas are listed for sloped ceilings up to an 8 in 12 pitch (33.7°). Follow applicable design criteria as listed in NFPA 13D, 13R, or 13 for sloped ceilings. Consult with the local Authority Having Jurisdiction for sloped ceilings having a slope greater than 2" rise for a 12" run (9.5°) for the number of "design sprinklers" required.

Obstruction to Water Distribution

Obstructions to water distribution patterns of sprinklers are referenced by the applicable NFPA standard. If a sprinkler's water distribution pattern is obstructed, the obstruction will be deemed the maximum distance of coverage for a given sprinkler and additional sprinklers beyond the obstruction will be required. Consideration must be given to both the size of the obstruction and the allowable deflector-to ceiling distance.

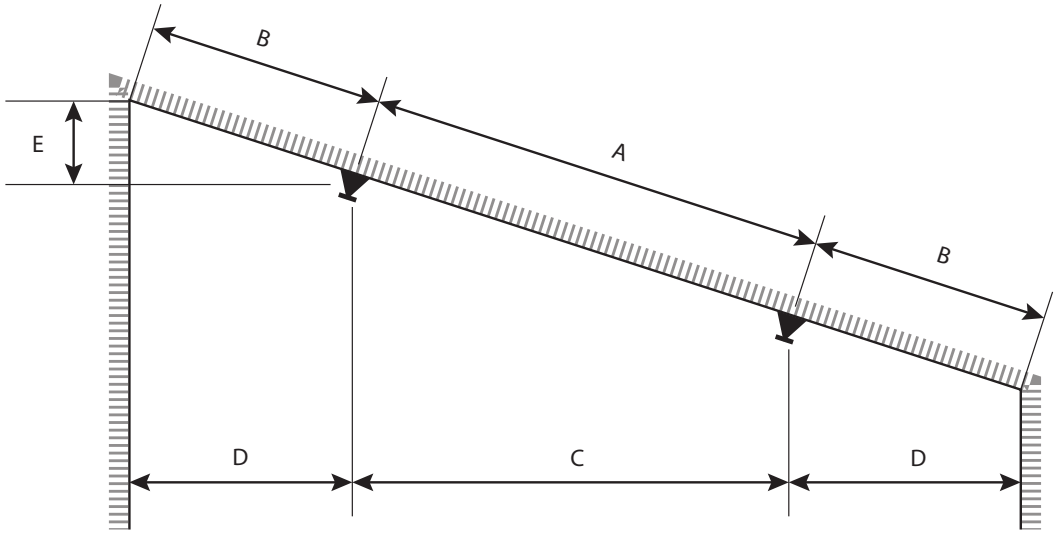
HYDRAULIC DESIGN

Hydraulic calculations are necessary to confirm sufficient water supply at the hydraulically most remote sprinkler operating at the minimum listed flow and pressure. A sprinkler can operate with the minimum flow and pressure listed on its data sheet for each coverage area. Compartments with more than one sprinkler require sprinkler calculations for each sprinkler using the flow rates per coverage area. Flowing multiple sprinklers does not lower the minimum flow requirements. Consult with the local Authority Having Jurisdiction for any conditions that are not in the NFPA standards as more design sprinklers may be required. These conditions include ceilings with heights over 24' (7.32 m), sloped ceiling with a pitch greater than 8 in 12 (33.7°), and/or beamed ceiling greater than 600 ft2 (56 m2) in area.

Minimum operating pressure of a sprinkler is specified in each sprinkler's data sheet and can be 7 psi (0.5 bar) or greater. Our residential sprinklers are listed with a maximum operating pressure of 175 psi (12.1 bar).

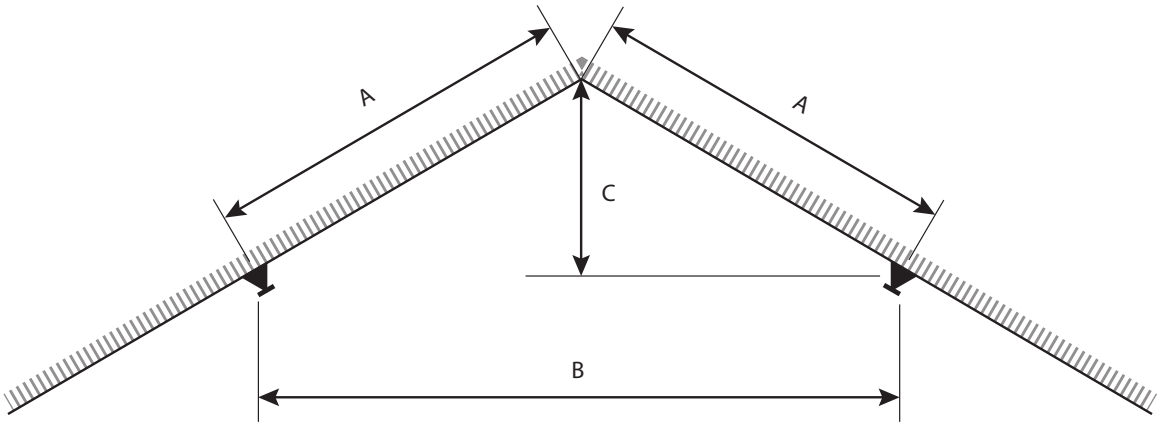
The minimum required sprinkler flow rates for systems designed to NFPA 13D or 13R are given in the sprinkler's data sheet under Table A as a function of temperature rating and the maximum allowable coverage area. The sprinkler flow rate is the minimum required discharge from the most hydraulically demanding sprinkler from each of the total number of "design sprinklers" as specified in NFPA 13D or 13R. For systems designed to NFPA 13, the number of designed sprinklers is to be the four most hydraulically demanding sprinklers. The minimum required discharge from each of the four sprinklers is to be the greater of the following:

- The flow rates given in Table A for NFPA 13D and 13R as a function of temperature rating and maximum allowable coverage area.
- A minimum discharge of 0.1GPM/sq.ft. [4.07LPM/sq.m] over the "design area" comprised of the four most hydraulically demanding sprinklers for the actual coverage area being protected by the four sprinklers.



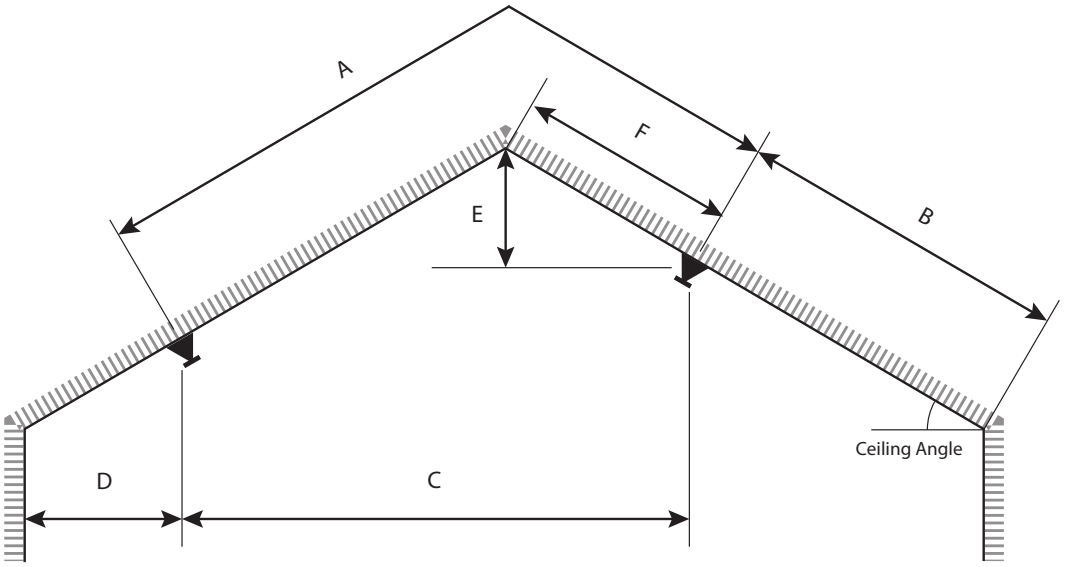
A - Maximum: Maximum Spacing
B - Maximum: One-Half of Maximum Spacing
C - Minimum: Minimum Spacing (Not less than 8′)
D - Minimum: 4″
E - Maximum: 3′

Figure 1
Multiple Sprinklers on Single Sloped Ceiling



A - Maximum: One-Half of Maximum Spacing
B - Minimum: Minimum Spacing (Not less than 8′)
C - Maximum: 3′

Figure 2
Symmetric Sprinklers on Oppsing Sloped Ceilings



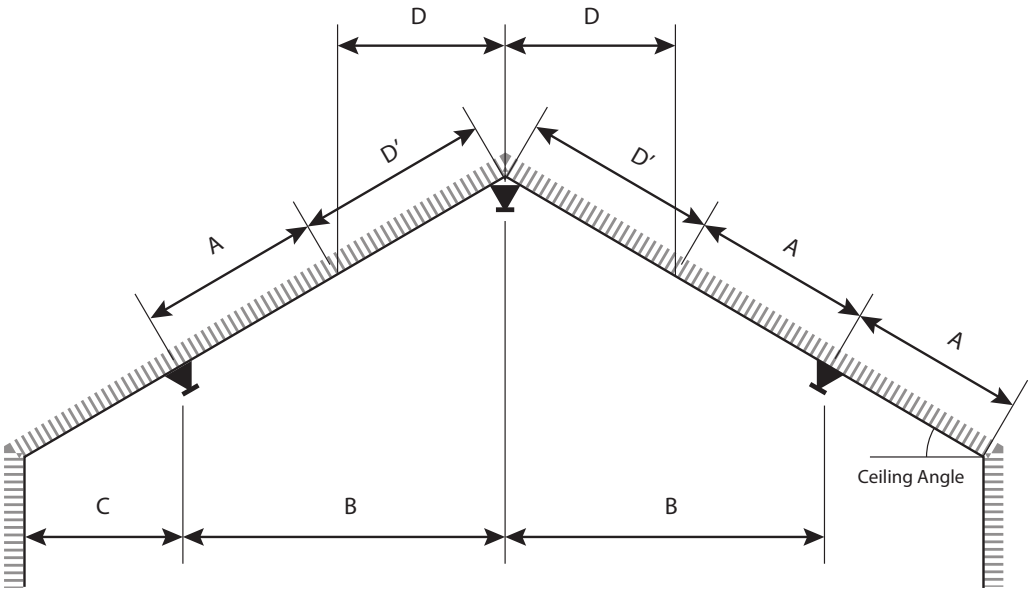
A - Maximum: Maximum Spacing
B - Maximum: One-Half of Maximum Spacing
C - Minimum: Minimum Spacing (Not less than 8')
D - Minimum: 4"
E - Maximum: 3'
F - Minimum: Refer to the tables below

Ceiling Angle	Sprinkler Spacing	Minimum Distance F
10°	12'	1' 0"
	14'	1' 0"
	16'	1' 0"
	18'	1' 0"
	20'	1' 0"
15°	12'	1' 0"
	14'	1' 0"
	16'	1' 0"
	18'	1' 0"
	20'	2' 0"
20°	12'	1' 0"
	14'	1' 0"
	16'	1' 0"
	18'	1' 0"
	20'	3' 0"

Ceiling Angle	Sprinkler Spacing	Minimum Distance F
25°	12'	1' 0"
	14'	1' 0"
	16'	1' 0"
	18'	2' 4"
	20'	3' 10"
30°	12'	1' 0"
	14'	1' 0"
	16'	2' 0"
	18'	3' 2"
	20'	4' 4"
33.7°	12'	1' 0"
	14'	1' 6"
	16'	2' 8"
	18'	3' 8"
	20'	4' 8"

Figure 3

Non-Symmetric Sprinklers on Sloped Ceiling

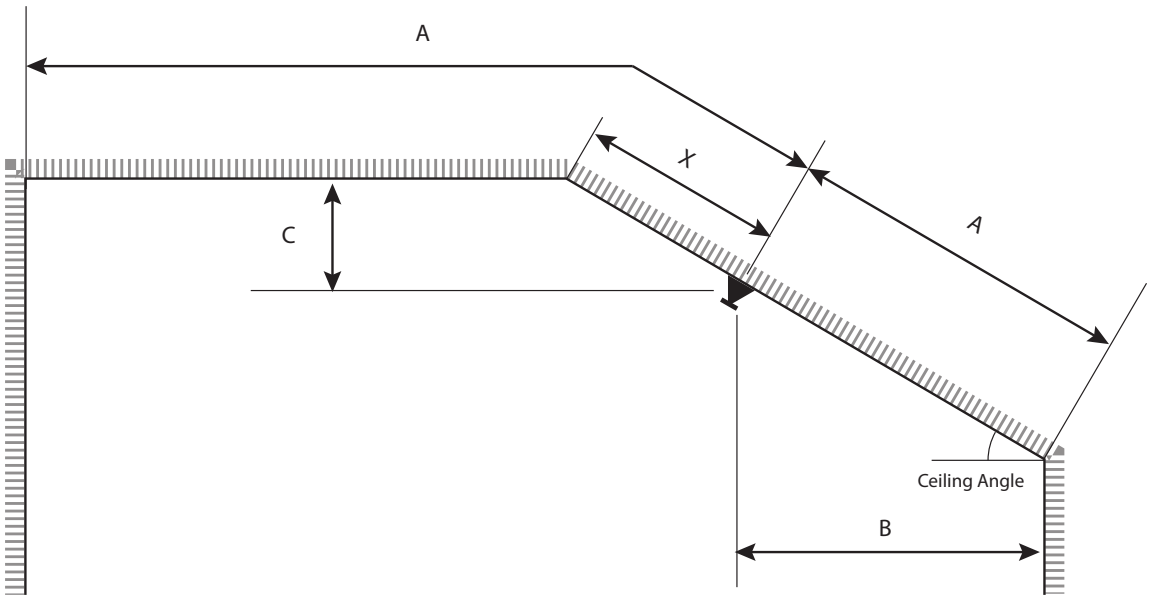


A - Maximum: One-Half of Maximum Spacing
B - Minimum: Minimum Spacing (Not less than 8')
C - Minimum: 4"
D - Maximum: Refer to the table below
or D' (One-Half of Maximum Spacing)

Ceiling Angle	Maximum Distance D
10°	10' 0"
15°	9' 6"
20°	9' 0"
25°	8' 0"
30°	7' 0"
33.7°	6' 2"

Figure 4

Pendent Sprinkler at Peak

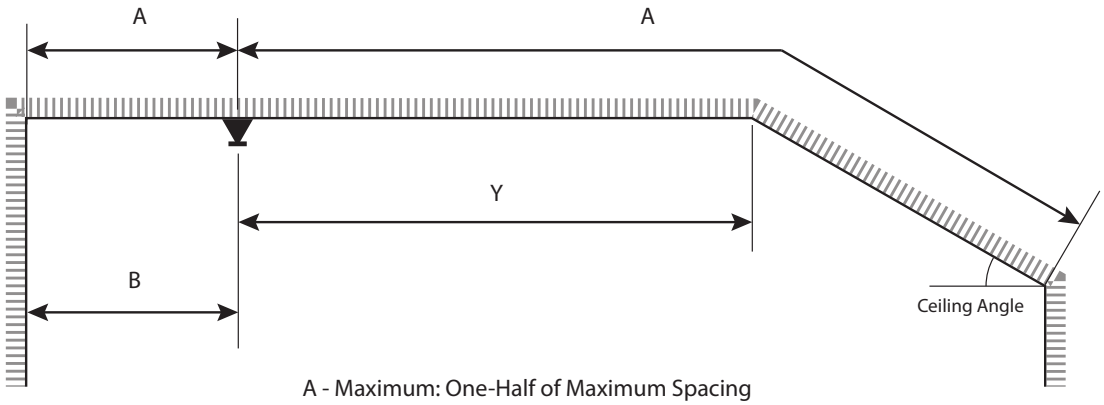


A - Maximum: One-Half of Maximum Spacing
B - Minimum: 4″
C - Maximum: 3′
X - Minimum: Refer to the tables below

Ceiling Angle	Sprinkler Spacing	Minimum Distance X
10°	12'	0' 6"
	14'	0' 6"
	16'	0' 6"
	18'	0' 10"
	20'	1' 0"
15°	12'	0' 6"
	14'	0' 6"
	16'	0' 6"
	18'	1' 4"
	20'	2' 2"
20°	12'	0' 6"
	14'	0' 6"
	16'	0' 6"
	18'	2' 8"
	20'	3' 8"

Ceiling Angle	Sprinkler Spacing	Minimum Distance X
25°	12'	0' 6"
	14'	0' 6"
	16'	0' 6"
	18'	3' 6"
	20'	4' 6"
30°	12'	0' 6"
	14'	0' 6"
	16'	0' 10"
	18'	4' 0"
	20'	4' 10"
33.7°	12'	0' 8"
	14'	0' 8"
	16'	1' 2"
	18'	4' 4"
	20'	5' 0"

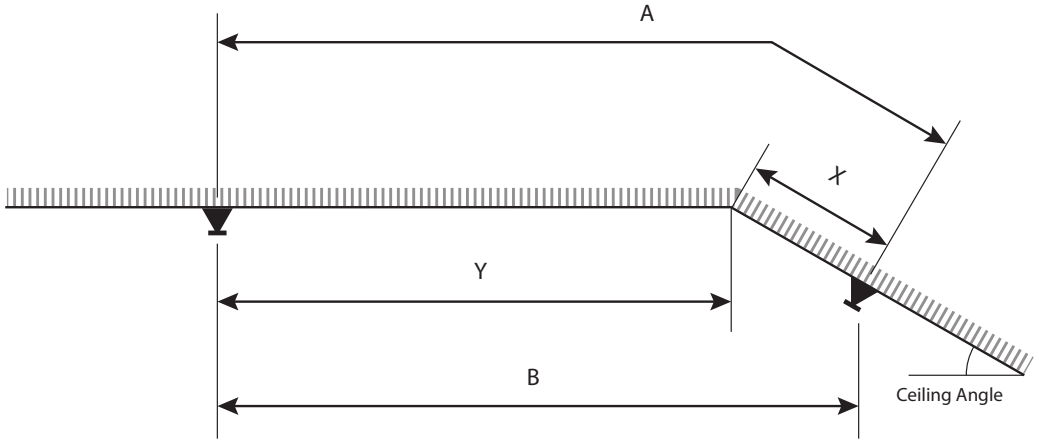
Figure 5
Sprinkler on Sloped Ceiling
Distance to Horizontal Ceiling



A - Maximum: One-Half of Maximum Spacing
B - Minimum: 4″
Y - Minimum: Refer to the table below

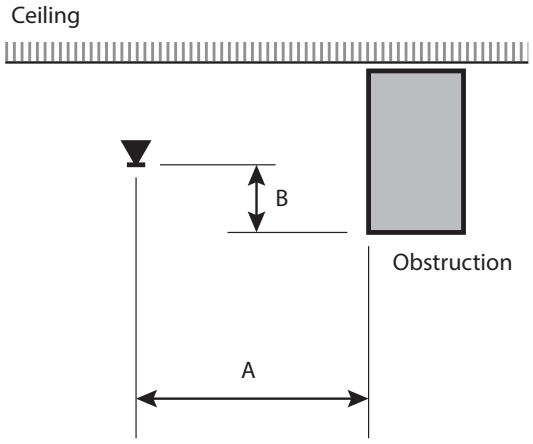
Ceiling Angle	Minimum Distance Y
10°	1' 0"
20°	1' 0"
30°	1' 6"
40°	1' 8"
50°	2' 0"
60°	2' 0"

Figure 6
Sprinkler on Horizontal Ceiling
Distance to Sloped Ceiling



A - Maximum: Maximum Spacing
B - Minimum: Minimum Spacing (Not less than 8')
X - Minimum: Refer to Distance X in Figure 5
Y - Minimum: Refer to Distance Y in Figure 6

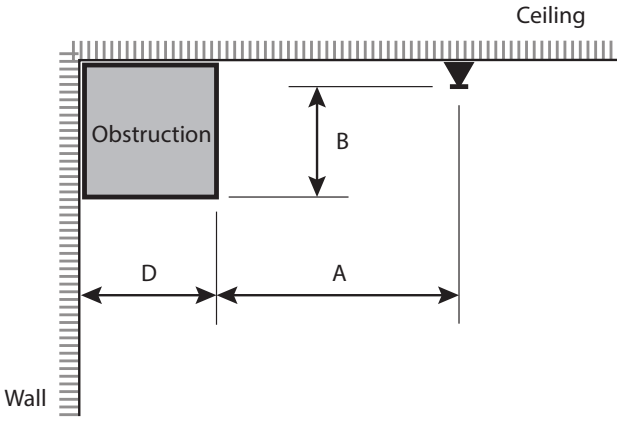
Figure 7
Sprinklers on Intersecting Horizontal and Sloped Ceiling



Distance A from Sprinker to Side of Obstruction	Maximum Distance B Deflector above Bottom of Obstruction
Less than 1'	0"
1' to less than 1' 6"	0"
1' 6" to less than 2'	1"
2' to less than 2' 6"	1"
2' 6" to less than 3'	1"
3' to less than 3' 6"	3"
3' 6" to less than 4'	3"
4' to less than 4' 6"	5"
4' 6" to less than 5'	7"
5' to less than 5' 6"	7"
5' 6" to less than 6'	7"
6' to less than 6' 6"	9"
6' 6" to less than 7'	11"
7' and greater	14"

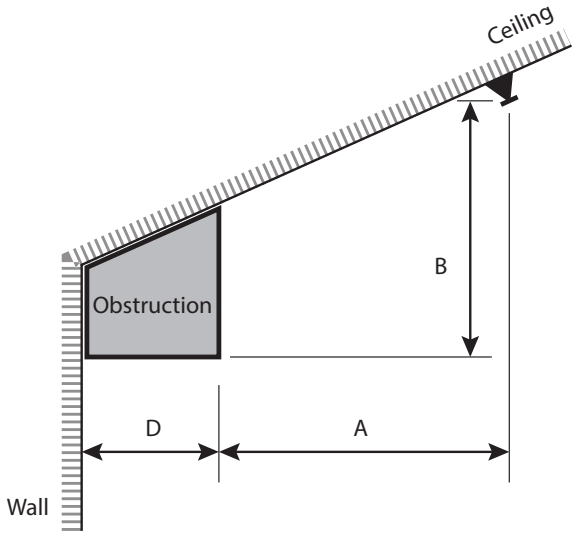
Figure 8

Pendent Sprinkler to Avoid Obstruction to Discharge



Distance A >= (Distance D - 8″) + Distance B
where: Distance D <= 30″

(a)

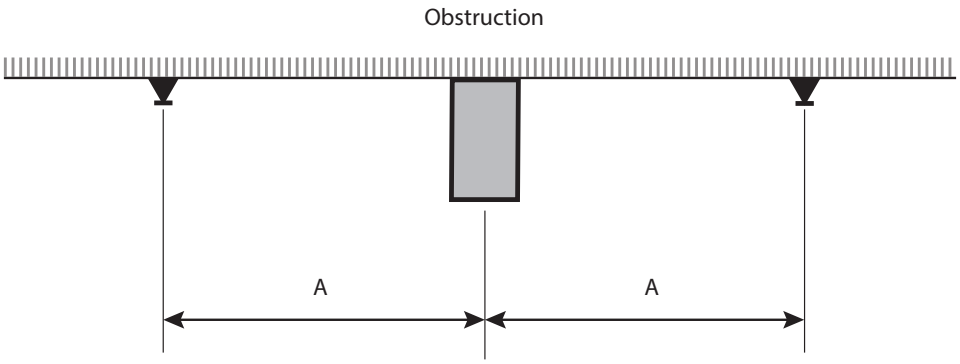


Distance A >= (Distance D - 8″) + Distance B
where: Distance D <= 30″

(b)

Figure 9

Pendent Sprinkler to Avoid Obstruction Against Walls



A - Maximum: One-Half of Maximum Spacing

Obstructions not exceeding 4 feet in width may have pendent sprinklers located on opposite sides provided that the sprinklers do not exceed on-half of the maximum spacing from the centerline of the obstruction to the sprinklers.

Figure 10

Pendent Sprinklers on Ceiling with Obstruction