

Technical Services: Tel: (800) 381-9312 / Fax: (800) 791-5500

## Models BB, SD, HIP, and AP "Specific Application Sprinklers for Protecting Attics"

### General Description

The Tyco® Peak™ Performance Models BB™ (Back to Back), SD™ (Single Directional), HIP™, and AP™ (Attic Plus) "Specific Application Sprinklers for Protecting Attics" are fire sprinklers for combustible and non-combustible sloped attic spaces. The Model BB, SD, and HIP are Specific Application Attic Sprinklers, whereas the Model AP is a Specific Application Combustible Concealed Space Sprinkler having specific application criteria for its use with the Model BB, SD, and HIP in attic spaces. Specific Application Attic Sprinklers provide superior fire protection in attic spaces and, when compared to Standard Spray Sprinklers, cost savings are achieved by eliminating branchline materials and the associated installation labor. "The Specific Application Sprinklers for Protecting Attics" have undergone the most extensive fire testing ever performed for sloped attic spaces. They are UL Listed with their specific application guidelines for use as special sprinklers as defined by the NFPA.

The Specific Application Attic Sprinklers provide an extended coverage spacing alternative to the restricted spacing of Standard Spray Sprinklers. The restricted spacings of Standard Spray Sprinklers used within attics is described in the 2007 edition of NFPA

#### **IMPORTANT**

*Always refer to Technical Data Sheet TFP700 for the "INSTALLER WARNING" that provides cautions with respect to handling and installation of sprinkler systems and components. Improper handling and installation can permanently damage a sprinkler system or its components and cause the sprinkler to fail to operate in a fire situation or cause it to operate prematurely.*

13, Table 8.6.2.2.1(a) and Section 8.6.4.1.4.

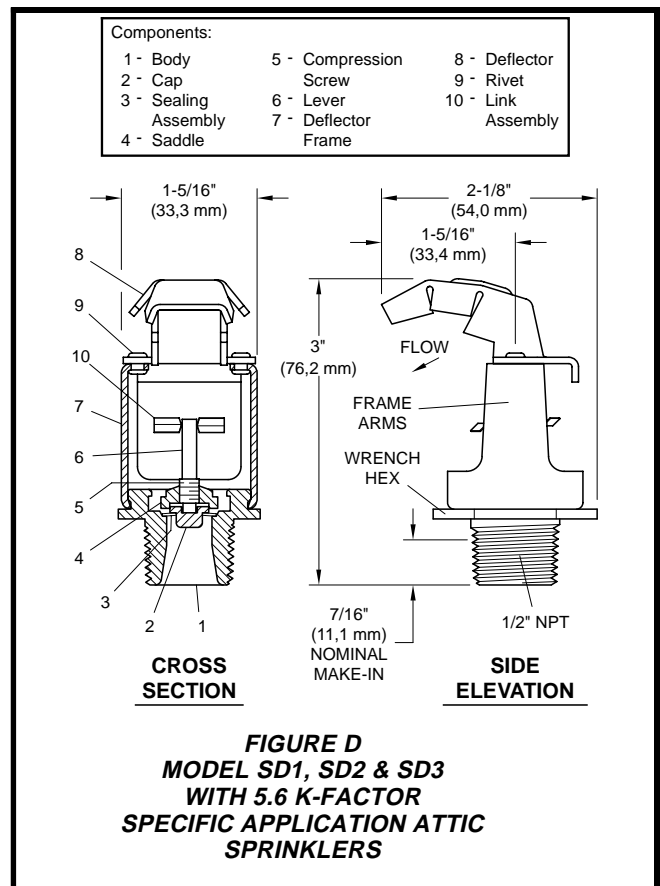
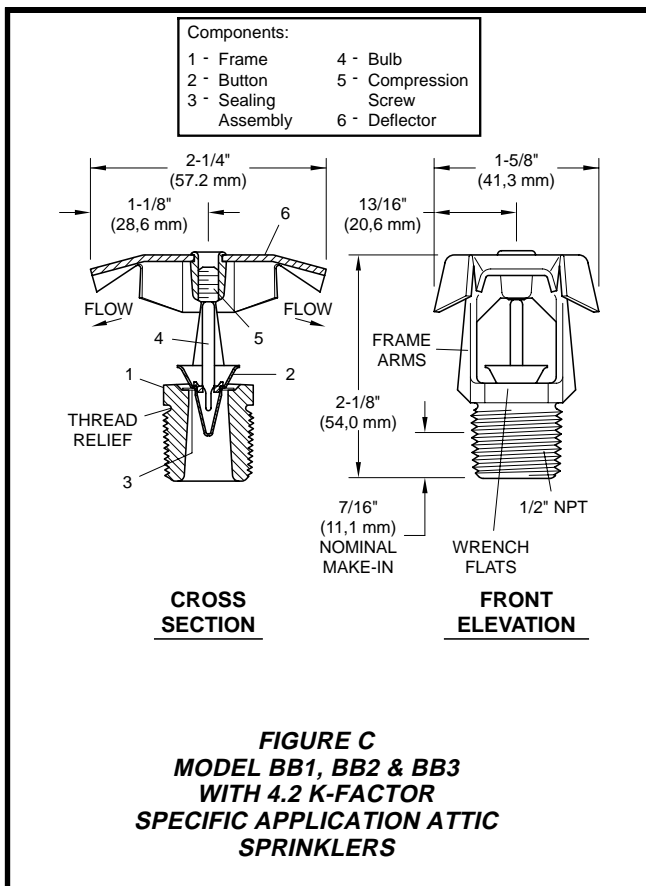
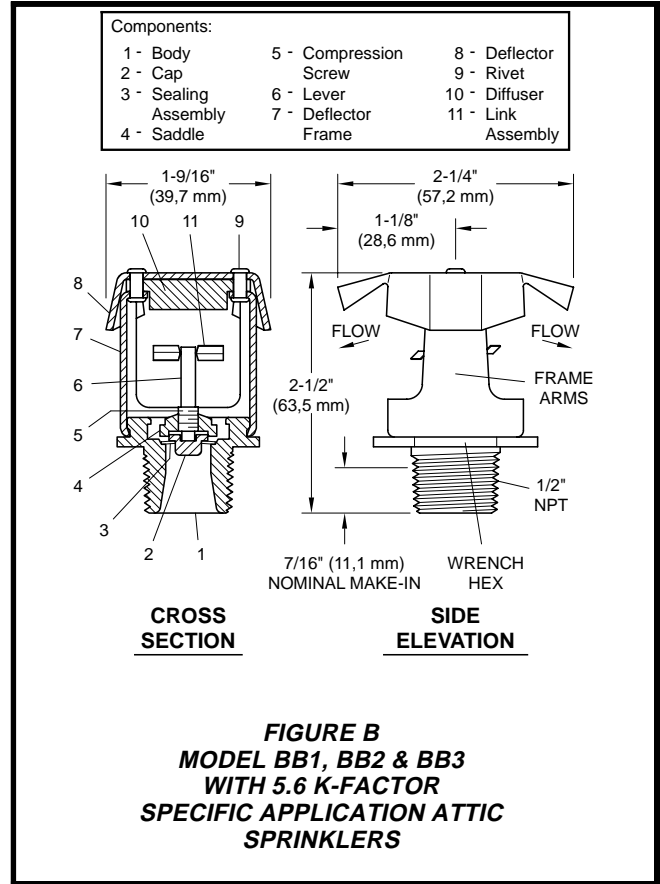
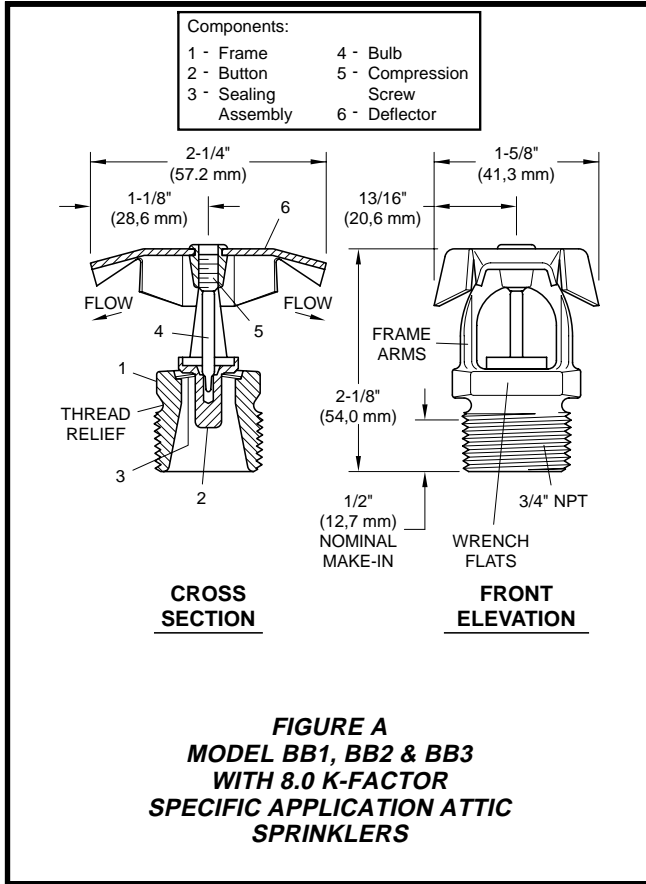
The Specific Application Attic Sprinklers are the first sprinklers to be:

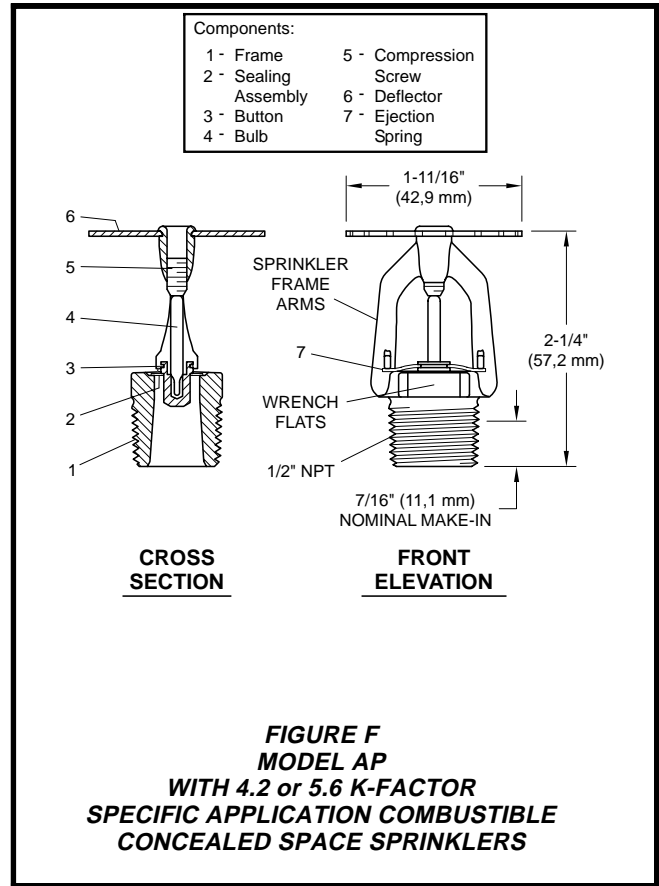
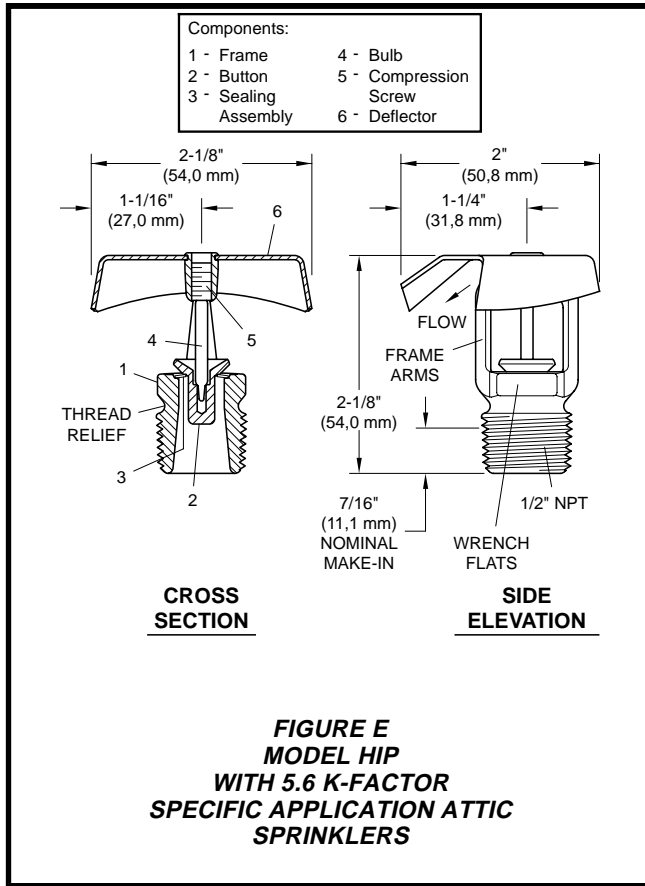
- Listed for extended coverage in combustible construction.
- Full-scale fire tested in both wet and dry system scenarios.
- Full-scale fire tested, for use in wood truss construction.
- Listed for specific roof slopes (Refer to Table A).

The Specific Application Attic Sprinklers provide the best level of protection and control cost by eliminating the need for additional sprinklers and branchline piping. In many cases, an attic can be entirely protected with just one line of piping located below the peak of the roof using Model BB (Back to Back) Sprinklers. If there is a need for Model SD (Single Directional) or Model HIP Sprinklers, one line of either of these sprinkler types is usually sufficient at each area being covered. For example and assuming the use of Standard Spray Sprinklers, a system in a 60 foot (18,3 m) wide attic, with up to a 12:12 roof pitch, designed to the 2007 edition of NFPA 13, would require seven branchlines to cover the main portion of the attic and several additional branchlines to cover the hip areas. With the Specific Application Attic Sprinklers, the required coverage can be obtained with just one branchline below the peak and one down each slope of the hip beam. This would result in approximately 90% less pipe needed for installation. This reduction in the number of branchlines saves the cost of the pipe, fittings, hangers, and associated labor by eliminating up to five branchlines.

Another important aspect of the Specific Application Attic Sprinkler technology is the reduction in system volume. This volume reduction may result in reducing the size of a dry pipe valve (and air compressor) and possibly al-







low for quicker water delivery times, eliminating the need for an accelerator.

The other cost reduction is the Listing of BlazeMaster® CPVC for use in attic spaces to supply the wet system “Specific Application Sprinklers for Protecting Attics”, as well as the wet system sprinklers below the ceiling. Traditionally BlazeMaster CPVC has been used on the lower floors in the joist space above a ceiling that does not require sprinklers. The savings of using CPVC on those floors can now be translated to the upper floor even if sprinklers are required in the attic.

There are four (4) models of the “Specific Application Sprinklers for Protecting Attics” — BB™ (Back to Back Dual Directional), SD™ (Single Directional), HIP™, and AP™ (Attic Plus). The BB and SD Sprinklers have three separate versions that are used for different roof pitches. The pitches, as applicable, can vary from a minimum of 3:12 to a maximum of 12:12 (Ref. Table A).

**BB Sprinkler (Back to Back Dual Directional)**

The Tyco® Model BB™ Specific Application Attic Sprinkler (Figure A, B & C) throws a narrow but long pattern. The

narrow spacing along the ridge serves two purposes. The response time is reduced by placing the sprinklers no farther than 6 feet (1,8 m) apart, and the spray can be concentrated in the throw direction to obtain a pattern that will cover up to 30 feet (9,1m) in each direction when measured horizontally. There are three different models (i.e., BB1, BB2 & BB3) that account for different roof slopes, and each model is available in one of three different orifice sizes (K=4.2, 5.6, or 8.0).

**SD Sprinkler (Single Directional)**

The Tyco® Model SD™ Specific Application Attic Sprinkler (Figure D), like the Model BB, throws a narrow but long pattern. However, unlike the Model BB the Model SD only discharges in one direction. These sprinklers are primarily used where shear walls or draft curtains have been installed within an attic space. Another use is when the framing direction is parallel with the outside wall in the hip area (Ref. Figure 13). In this case, the SD would be used on one side of the slope, and AP Sprinklers or Standard Spray Sprinklers would be used to protect the other side. The Model SD Sprinklers must be installed in a vertical upright orientation and not angled with the slope. (Achieving the vertical

upright orientation may require the use of a swing joint if the SD Sprinklers are being supplied from a line running along and parallel to the roof hip.) Three different models (i.e., SD1, SD2 & SD3) are available for different roof slopes.

**HIP Sprinkler**

The Tyco® Model HIP™ Specific Application Attic Sprinkler (Figure E) covers the area of the hip in the attic. This is a slightly different concept than the BB (Back to Back) or SD (Single Directional). The HIP Sprinkler is located along the slope running down the hip, and throws a 90° pattern toward the outside eaves. This pattern allows the water to “corner” and control the fire. The HIP Sprinkler does not discharge much water directly up or down the hip, but rather it discharges most of the pattern out to each side (90°) down the slope of the roof. This sprinkler is typically spaced 6 feet (1,8 m) to 3 feet (0,9 m) on center down the slope. To use the HIP Sprinkler, the framing must be perpendicular to the outside wall (Ref. Figure 12) and the maximum throw cannot exceed 28 feet (8,5 m) measured horizontally. The HIP, unlike the BB and SD, is installed with the deflector parallel with the slope. A single model is available with flow and

\*registered trademark of Lubrizol Advanced Materials, Inc.

pressure requirements for two different spacings.

**AP Sprinkler (Attic Plus)**

Installed in the upright orientation with their deflector parallel to the roof, the Tyco® Model AP™ Sprinklers (Figure F) are intended to be used to provide protection of attic areas outside the scope of application for the BB, SD, or HIP Sprinklers. When used, the AP Sprinklers in most cases will provide a hydraulic advantage over Standard Spray Sprinklers for the protection of attic areas outside the scope of application for the BB, SD, or HIP Sprinklers (Ref. Figures 21 and 22 for examples).

**WARNING**

*The “Specific Application Sprinklers for Protecting Attics” described herein must be installed and maintained in compliance with this document, as well as with the applicable standards of the National Fire Protection Association, in addition to the standards of any other authorities having jurisdiction. Failure to do so may impair the performance of these devices.*

*The owner is responsible for maintaining their fire protection system and devices in proper operating condition. The installing contractor or manufacturer should be contacted with any questions.*

## Sprinkler Identification Number

- TY4180\* - BB1, K=8.0
- TY4181\* - BB2, K=8.0
- TY4182\* - BB3, K=8.0
- TY3180\* - BB1, K=5.6
- TY3181\* - BB2, K=5.6
- TY3182\* - BB3, K=5.6
- TY2180 - BB1, K=4.2
- TY2181 - BB2, K=4.2
- TY2182 - BB3, K=4.2
- TY3183\* - SD1, K=5.6
- TY3184\* - SD2, K=5.6
- TY3185\* - SD3, K=5.6
- TY3187\* - HIP, K=5.6
- TY3190 - AP, K=5.6
- TY2190 - AP, K=4.2

\*The “TY” prefix is a redesignation of the previous “C” prefix (e.g., TY4180 is a redesignation for C4180).

## Technical Data

**Approvals**

UL & C-UL Listed.  
(The approvals only apply to the service conditions indicated in the Design Criteria section on Page 6 and the Design Guidelines section on Page 8.)

**Pipe Thread Connection**

1/2 inch NPT for K=4.2 & 5.6  
3/4 inch NPT for K=8.0

**Discharge Coefficient**

K = 4.2 GPM/psi<sup>1/2</sup> (60,5 LPM/bar<sup>1/2</sup>)  
K = 5.6 GPM/psi<sup>1/2</sup> (80,6 LPM/bar<sup>1/2</sup>)  
K = 8.0 GPM/psi<sup>1/2</sup> (115,5 LPM/bar<sup>1/2</sup>)

**Temperature Rating**

Intermediate Temperature as follows:  
- 200°F/93°C for BB (K4.2 & K8.0), HIP, AP  
- 212°F/100°C for BB (K5.6), SD

**Finish**

Natural Brass

**Physical Characteristics (Figures A, C & E)**

Frame . . . . . Bronze  
Button . . . . . Bronze/Copper  
Sealing Assembly . . . . .  
. . . . . Beryllium Nickel w/Teflon†  
Bulb . . . . . Glass (3 mm dia.)  
Link . . . . . Monel  
Compression Screw . . . . . Brass  
Deflector . . . . . Brass/Bronze  
† DuPont Registered Trademark

**Physical Characteristics (Figures B & D)**

Body . . . . . Brass  
Cap . . . . . Bronze  
Sealing Assembly . . . . .  
. . . . . Beryllium Nickel w/Teflon†  
Saddle . . . . . Brass  
Link Assembly . . . . . Nickel  
Compression Screw . . . . . Brass  
Deflector . . . . . Brass/Bronze  
Lever . . . . . Bronze  
Deflector Frame . . . . . Bronze  
Diffuser . . . . . Brass  
Rivet . . . . . Brass  
† DuPont Registered Trademark

**Physical Characteristics (Figure F)**

Frame . . . . . Brass  
Button . . . . . Bronze  
Sealing Assembly . . . . .  
. . . . . Stainless Steel w/Teflon†  
Bulb . . . . . Glass (3 mm dia.)  
Compression Screw . . . . . Brass  
Deflector . . . . . Bronze  
† DuPont Registered Trademark

**Patents**

U.S.A. 5,669,449; patent pending

## Operation

**BB (K=8.0 & 4.2), HIP (K=5.6) & AP (5.6 & 4.2)**

The glass bulb contains a fluid that expands when exposed to heat. When the rated temperature is reached, the fluid expands sufficiently to shatter the glass bulb, allowing the sprinkler to activate and water to flow.

**BB (K=5.6) & SD (K=5.6)**

The fusible link assembly is comprised of two link halves which are joined by a thin layer of solder. When the rated temperature is reached, the solder melts and the two link halves separate, allowing the sprinkler to activate and water to flow.

# Installation

The Tyco® Peak™ Performance Models BB™, SD™, HIP™, and AP™ “Specific Application Attic Sprinklers for Protecting Attics” must be installed in accordance with the following instructions:

## NOTES

*Do not install any bulb type sprinkler if the bulb is cracked or there is a loss of liquid from the bulb. With the sprinkler held horizontally, a small air bubble should be present. The diameter of the air bubble is approximately 1/16 inch (1,6 mm).*

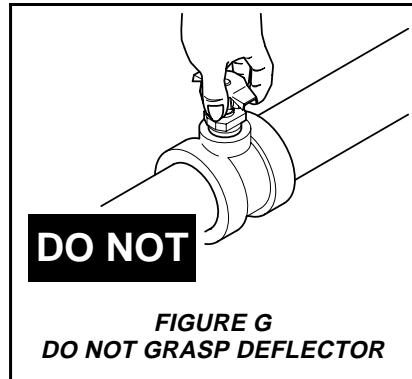
*A 1/2 inch NPT sprinkler joint should be obtained with a minimum to maximum torque range of 7 to 14 ft.lbs. (9,5 to 19,0 Nm). A 3/4 inch NPT sprinkler joint should be obtained with a minimum to maximum torque range of 10 to 20 ft.lbs. (13,4 to 26,8 Nm). Higher levels of torque may distort the sprinkler inlet with consequent leakage or impairment of the sprinkler.*

**Step 1.** Sprinklers must be oriented correctly:

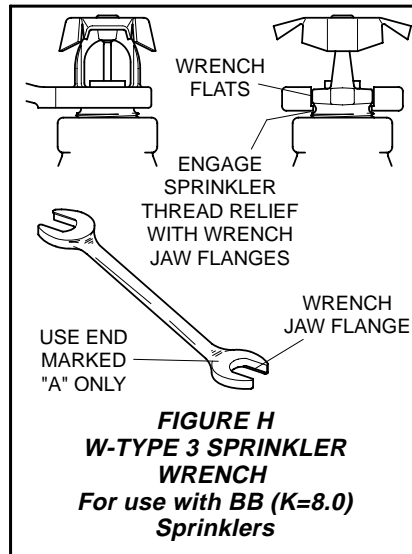
- Model BB Sprinklers are to be installed in the upright vertical position with the flow arrows on the deflector pointing down the two opposing slopes.
- Model SD Sprinklers are to be installed in the upright vertical position with the flow direction arrow on the deflector pointing down the slope.
- The Model HIP Sprinklers are to be installed with the deflector at the top and with the sprinkler centerline perpendicular to the ridge of the hip roof and with the flow direction arrows on the deflector pointing down the two opposing slopes. (Unlike the Model BB and Model SD, the Model HIP is installed at an angle so that its deflector is parallel with the slope of hip ridge line.)
- The Model AP Sprinklers are to be installed in the upright position with the deflector parallel to the roof slope.

**Step 2.** With pipe thread sealant applied to the pipe threads, hand tighten the sprinkler into the sprinkler fitting. **With reference to Figure G, do not grasp the sprinkler by the deflector.**

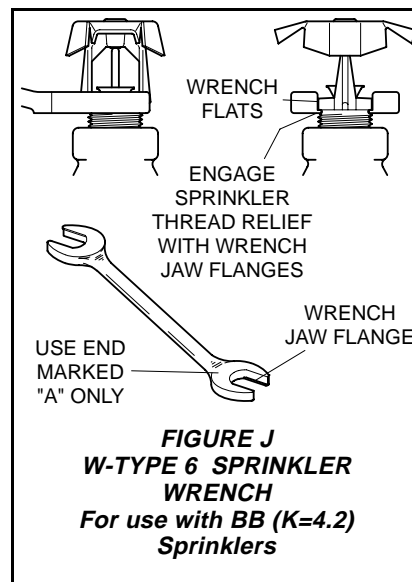
**Step 3.** Wrench tighten the sprinkler using only the wrenches shown in Figures H thru M. Wrenches are only to be applied to the sprinkler wrench flats or wrench hex, as applicable.



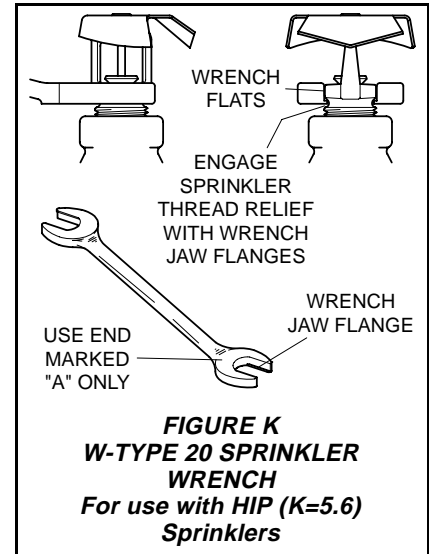
**FIGURE G**  
**DO NOT GRASP DEFLECTOR**



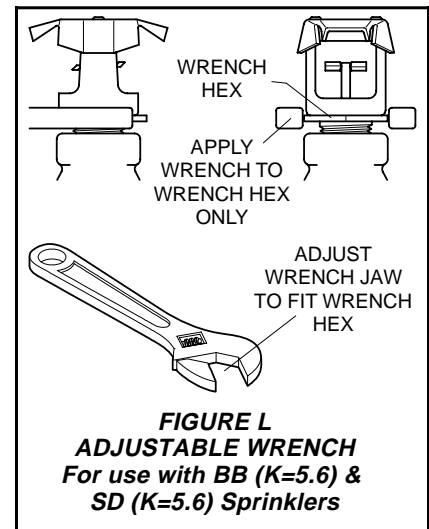
**FIGURE H**  
**W-TYPE 3 SPRINKLER**  
**WRENCH**  
**For use with BB (K=8.0)**  
**Sprinklers**



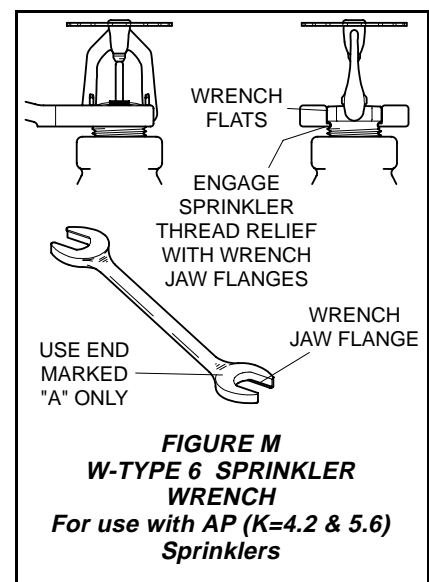
**FIGURE J**  
**W-TYPE 6 SPRINKLER**  
**WRENCH**  
**For use with BB (K=4.2)**  
**Sprinklers**



**FIGURE K**  
**W-TYPE 20 SPRINKLER**  
**WRENCH**  
**For use with HIP (K=5.6)**  
**Sprinklers**



**FIGURE L**  
**ADJUSTABLE WRENCH**  
**For use with BB (K=5.6) &**  
**SD (K=5.6) Sprinklers**



**FIGURE M**  
**W-TYPE 6 SPRINKLER**  
**WRENCH**  
**For use with AP (K=4.2 & 5.6)**  
**Sprinklers**

# Design Criteria

## Area Of Use:

Roof structures, combustible and non-combustible, including wood joist/rafters and wood trussed attics, with a ceiling below.

## System Type for BB, SD, HIP, or AP:

Wet using CPVC pipe.  
Wet or dry using steel pipe.

### NOTE

Use of the 4.2 K sprinklers in dry pipe systems is permitted by section 8.3.4.3 of NFPA 13 (2007 edition) where piping is corrosion resistant or internally galvanized.

## Hazard:

Light hazard.

## BB, SD, or HIP Allowable Roof Span (Coverage) and Roof Pitch:

Refer to Table A for allowable roof spans and roof pitches, as well as for the associated minimum sprinkler flows and pressures. Figures 1, 2, 11, and 12 illustrate where the roof span is to be measured.

## Coverage Beyond BB, SD or HIP Allowable Roof Spans:

Up to 10 feet (3,1 m) of coverage at the eave(s) beyond the allowable roof spans for BB, SD, or HIP Sprinklers may be obtained by using a single row of AP Sprinklers (Ref. Figures 14A, 14B, and 15).

## BB, SD, HIP, or AP Minimum Distance Between Sprinklers:

4 feet (1,2 m) as measured along branchline for BB and SD (Ref. Figure 3).

3 feet (0,9 m) as measured along branch line for HIP (Ref. Figure 12).

7 feet (2,1 m) between AP Sprinklers.

## BB, SD, HIP, or AP Maximum Distance Between Sprinklers:

6 feet (1,8 m) on center along the branch line (Ref. Figure 3 and 12) for BB, SD, and HIP.

For AP, the maximum spacing is 10 feet (3,1 m) perpendicular to slope and 12 feet (3,6 m) parallel to slope. When there is more than one row of AP Sprinklers, the sprinklers must be staggered per Figure 20-B-3.

## BB, SD, HIP, or AP Minimum Distance To AP Sprinklers or Standard Spray Sprinklers:

As measured along the peak/ridge direction (Ref. Figure 4), 6 feet (1,8 m) from BB, SD, and HIP to Standard Spray Sprinklers.

As measured along the peak/ridge direction (Ref. Figure 4), 7 feet (2,1 m) from AP to Standard Spray Sprinklers.

In the slope direction (Ref. Figure 6), 26 feet (7,9 m) from BB, SD, or HIP Sprinklers to AP Sprinklers or Standard Spray Sprinklers.

**BB, SD, or HIP Deflector Installation Position Below Peak/Ridge or Deck:**  
For roof pitches of 4:12 (33%) to 12:12 (100%), 22 inches (558,8 mm) maximum, 16 inches (406,4 mm) minimum (Ref. Figures 2 and 5).

For roof pitches of 3:12 (25%) up to 4:12 (33%) [only 4.2K Model BB], 12 inches (304,8 mm) maximum below the peak and a minimum of 1 inch (25,4 mm) below the bottom of top chord or solid wood rafter.

## AP Deflector Position and Roof Pitch:

1 to 3 inches (25,4 to 75,6 mm) below the bottom of the top chord or bottom of solid wood rafter, where the roof pitch is 3:12 to 12:12 and the top chord or solid wood rafter is nominal 12 inch (600 mm) or less.

## BB or SD Deflector Installation Position Above Scissor Truss

18 inches (457,2 mm) minimum (Ref. Figure 5).

## BB, SD, or HIP Minimum Distance Away From Trusses:

Attic Sprinklers must be installed 6 inches (152,4 mm) from the face of trusses (Ref. Figure 7).

## SD Distance From Shear Wall Or Draft Curtain:

4 to 6 inches (101,6 to 152,4 mm) from face, and minimum 8 inches (203,2 mm) above bottom of draft curtain (Ref. Figure 2).

## Draft Curtains:

Draft curtains installed to permit the installation of Attic Sprinklers shall be constructed so as to not allow heat to escape through or above the draft curtain. The draft curtain may be constructed of 1/2 inch (12,7 mm) plywood.

## BB Or HIP Maximum Distance From The Center Line Of The Ridge:

6 inches (152,4 mm) (Ref. Figure 8) with the deflector located 16 inches (406,4 mm) to 22 inches (558,8 mm) from the peak.

## Use Of UL Listed BlazeMaster CPVC Piping With "Specific Application Sprinklers For Protecting Attics" (Wet Systems Only):

TFPB BlazeMaster CPVC piping may be used in a combustible concealed attic space requiring sprinklers when installed in accordance with the following guidelines:

## NOTES

Where the use of non-combustible insulation is specified, verify with the insulation manufacturer as to the non-combustibility of the insulation. The non-combustible insulation (e.g., fiberglass) may be faced or unfaced. Where faced, the facing need not be non-combustible. The insulation is to have a flame spread index of not more than 25.

Verify chemical compatibility of the insulation with BlazeMaster CPVC by consulting [www.lubrizol.com](http://www.lubrizol.com).

- TFBP BlazeMaster CPVC may be used to supply the wet system ceiling sprinklers on the floor below. There must be 6 inches (152,4 mm) of non-combustible insulation covering the pipe extending 12 inches (304,8 mm) on each side away from the centerline of the pipe, and the area above the CPVC must be protected by Model BB, SD, HIP, or AP Sprinklers (Ref. Figure 9A). If the pipe is located inside the ceiling joist, the joist channel must be covered or filled with 6 inches (152,4 mm) of non-combustible insulation on top of the pipe and the area above must be protected by BB, SD, HIP, or AP Sprinklers (Ref. Figure 9B). **Insulation is for fire protection purposes. It is not freeze protection.** BlazeMaster CPVC must be installed in accordance with the BlazeMaster installation guide instructions.
- With reference to Figure 19, TFBP BlazeMaster CPVC may be used exposed to supply wet system BB, SD, or HIP Sprinklers where
  - \* Risers are vertical and protected by a BB, SD, or HIP Sprinkler located at a maximum lateral distance of 12 inches (300 mm) from the riser centerline.
  - \* BB, SD, or HIP Sprinklers are directly mounted on the branchline.
  - \* BB, SD, or HIP Sprinklers are on armovers and located at a maximum lateral distance of 6 inches (150 mm) from the branchline centerline.
  - \* BB, SD, or HIP Sprinklers are on vertical sprigs attached to the branchline.
  - \* BB, SD, or HIP Sprinklers are on armover or angled sprigs, and located at a maximum lateral distance of 6 inches (150 mm) from the branchline centerline.
  - \* A minimum lateral distance of 18 inches (450 mm) is maintained between the CPVC pipe and a

MODEL	K	SIN	ALLOWABLE ROOF SPAN, <sup>(a)</sup> <sup>(b)</sup> <sup>(e)</sup> Feet (m)	MINIMUM FLOW, GPM (lpm)	MINIMUM PRESSURE, PSI (bar)	PITCH, Rise Over Run (%)	DRY PIPE SYSTEM MAXIMUM WATER DELIVERY TIME, Seconds
BB1	8.0	TY4180	≤60 (18,3)	38 (144)	22.6 (1,5)	4:12 (33) to less than 7:12 (58)	(c)
BB2	8.0	TY4181	≤60 (18,3)	38 (144)	22.6 (1,5)	7:12 (58) to less than 10:12 (83)	(c)
BB3	8.0	TY4182	≤60 (18,3)	40 (152)	25.0 (1,7)	10:12 (83) to 12:12 (100)	(c)
BB1	5.6	TY3180	>40 (12,2) to ≤60 (18,3)	38 (144)	46.0 (3,2)	4:12 (33) to less than 7:12 (58)	(c)
BB2	5.6	TY3181	>40 (12,2) to ≤60 (18,3)	38 (144)	46.0 (3,2)	7:12 (58) to less than 10:12 (83)	(c)
BB3	5.6	TY3182	>40 (12,2) to ≤60 (18,3)	38 (144)	46.0 (3,2)	10:12 (83) to 12:12 (100)	(c)
BB1	5.6	TY3180	≤40 (12,2)	25 (95)	20.0 (1,4)	4:12 (33) to less than 7:12 (58)	(c)
BB2	5.6	TY3181	≤40 (12,2)	25 (95)	20.0 (1,4)	7:12 (58) to less than 10:12 (83)	(c)
BB3	5.6	TY3182	≤40 (12,2)	25 (95)	20.0 (1,4)	10:12 (83) to 12:12 (100)	(c)
BB1	4.2	TY2180	≤20 (6,1)	13 (49)	9.6 (0,7)	3:12 (25) to less than 7:12 (58)	45 (d)
BB2	4.2	TY2181	≤20 (6,1)	13 (49)	9.6 (0,7)	7:12 (58) to less than 10:12 (83)	45 (d)
BB3	4.2	TY2182	≤20 (6,1)	13 (49)	9.6 (0,7)	10:12 (83) to 12:12 (100)	45 (d)
SD1	5.6	TY3183	>30 (9,1) to ≤40 (12,2)	35 (132)	39.0 (2,7)	4:12 (33) to less than 7:12 (58)	(c)
SD2	5.6	TY3184	>30 (9,1) to ≤40 (12,2)	35 (132)	39.0 (2,7)	7:12 (58) to less than 10:12 (83)	(c)
SD3	5.6	TY3185	>30 (9,1) to ≤40 (12,2)	35 (132)	39.0 (2,7)	10:12 (83) to 12:12 (100)	(c)
SD1	5.6	TY3183	>10 (3,0) to ≤30 (9,1)	25 (95)	20.0 (1,4)	4:12 (33) to less than 7:12 (58)	(c)
SD2	5.6	TY3184	>10 (3,0) to ≤30 (9,1)	25 (95)	20.0 (1,4)	7:12 (58) to less than 10:12 (83)	(c)
SD3	5.6	TY3185	>10 (3,0) to ≤30 (9,1)	25 (95)	20.0 (1,4)	10:12 (83) to 12:12 (100)	(c)
SD1	5.6	TY3183	≤10 (3,0)	19 (72)	11.5 (0,8)	4:12 (33) to less than 7:12 (58)	(c)
SD2	5.6	TY3184	≤10 (3,0)	19 (72)	11.5 (0,8)	7:12 (58) to less than 10:12 (83)	(c)
SD3	5.6	TY3185	≤10 (3,0)	19 (72)	11.5 (0,8)	10:12 (83) to 12:12 (100)	(c)
HIP	5.6	TY3187	>20 (6,1) to ≤28 (8,5)	34 (129)	36.9 (2,5)	4:12 (33) to 12:12 (100)	(c)
HIP	5.6	TY3187	≤20 (6,1)	25 (95)	20.0 (1,4)	4:12 (33) to 12:12 (100)	(c)
AP	5.6	TY3190	10 (3,1) x 12 (3,6)	Minimum 7 psi (0,48 bar) Minimum 0.10 gpm/sq. ft.	3:12 (25) to 12:12 (100)	60 (d)	
AP	4.2	TY2190	- See note (e) - (4,1 mm/min.) Design Density	3:12 (25) to 12:12 (100)			60 (d)

NOTES:

- (a) The BB and SD roof span is measured horizontally (not along the slope) as shown in Figure 1 and 2.
- (b) The HIP roof span is measured horizontally as shown in Figure 12.
- (c) Refer to 2007 edition of NFPA 13, Section 7.2.3.
- (d) Maximum water delivery time for all size of systems.
- (e) The AP roof span is measured along the slope. Maximum 10 feet (3,1 m) perpendicular to slope by maximum 12 feet (3,6 m) parallel to slope.

**TABLE A**  
**ALLOWABLE ROOF SPAN, FLOW, PRESSURE, AND PITCH FOR**  
**“SPECIFIC APPLICATION SPRINKLERS FOR PROTECTING ATTICS”**

heat producing device such as heat pumps, fan motors, lights, and heat lamps.

- TFBP BlazeMaster CPVC may be used exposed to provide wet system, vertical or angled, sprigs to AP Sprinklers (Ref. Figures 17A and 17B) where

\* The exposed portion of an angled sprig is a maximum length of 3 feet (0,9 m), the sprig is supported

within 12 inches (0,3 m) of the AP Sprinkler, and pipe hangers are provided using the CPVC hanger support for horizontal pipe runs.

\* Vertical sprigs have a maximum exposed length of 10 feet (3,05 m), the AP Sprinkler is located at a maximum lateral distance of 12 inches (300 mm) from the sprig centerline, and the sprig is supported at the swing joint to the AP Sprinkler.

\* A minimum 6 inches (152,4 mm) deep of non-combustible insulation extending 12 inches (304,8 mm) on each side away from the centerline of the CPVC branchline feeding the AP sprigs (Ref. Figures 17A). If the CPVC branchline is located inside the ceiling joist, the joist channel must be covered or filled with a minimum of 6 inches (152,4 mm) deep of non-combustible insulation on top of

the branchline supplying the AP sprigs (Ref. Figure 17B). **Insulation is for fire protection purposes. It is not freeze protection.** Additional depth of non-combustible insulation may be added to reduce the exposed length of the AP sprigs.

- \* A minimum lateral distance of 18 inches (450 mm) is maintained between the CPVC pipe and a heat producing device such as heat pumps, fan motors, lights and heat lamps.

#### Mismatched Slopes:

For mismatched slopes refer to Figure 10.

#### Obstructions:

For BB, SD, and HIP, refer to Figure 16. For AP Sprinklers, refer to Figure 18. BB, SD, HIP, and AP Sprinklers may be installed directly on maximum 2-1/2 inch NPS (DN65) branchlines without the need for sprigs. See the 2007 edition of NFPA 13, 8.8.5.2 for requirements when installed on pipe greater than 2-1/2 inch NPS (DN65).

#### Hydraulic Requirements:

For hydraulic requirements refer to Figure 20.

#### To Determine The Correct Flow And Pressure:

For BB, SD, or HIP Sprinklers, determine the roof span (measured horizontally) and the slope of the roof, and refer to Table A. There is no interpolation of the flow and pressure shown. Round all cases to the next higher spacing. For example, a 45 feet (13,7 m) span with the BB1 (K=8.0) would be calculated at the 60 feet (18,3 m) span.

For the AP Sprinklers, the minimum design pressure is 7 psi, and the minimum design density is 0.10 gpm/ft<sup>2</sup> (4,1 mm/min). *The NFPA 13, 20 psi (1,4 bar) minimum operating pressure for Standard Spray Sprinkler spacings parallel to the ridge that are above 8 feet (2,4 m) does not apply to the AP.*

#### Coverage Area:

- Coverage area for **BB (Back to Back) Sprinklers** is determined by twice the distance of the furthest throw measured along the slope, multiplied by the distance along the branchline (maximum distance along branchline is 6 feet (1,8 m) regardless of the length of the throw).

#### NOTE

*The distance along the branchline may have to be reduced to less than the maximum of 6 feet (1,8 m) to remain under 400 ft<sup>2</sup> (37,2 m<sup>2</sup>) maximum depending on the slope and the span. In*

*no case can the span exceed 60 feet (18,3 m) without the use of additional Model AP Sprinklers or Standard Spray Sprinklers.*

- Coverage area for the **SD (Single Directional) Sprinklers** is the distance along the branchline multiplied by the distance of the throw down the slope. Regardless of the throw, the maximum distance along the branchline is 6 feet (1,8 m), the maximum throw, measured horizontally is 40 feet (12,2 m), and the maximum coverage per sprinkler is 400 ft<sup>2</sup> (37,2 m<sup>2</sup>).
- Coverage area for the **HIP Sprinklers** is the distance down the larger slope multiplied by two, then multiplied by the distance between the sprinklers as measured along the slope of the hip.
- Coverage area for the **AP (Attic Plus) Sprinklers** is the distance along the branchline multiplied by the distance between the branchlines. The maximum spacing is 10 feet (3,1 m) perpendicular to the slope and 12 feet (3,6 m) parallel to slope, and as measured on the slope. When there is more than one row of AP Sprinklers, the sprinklers must be staggered per Figure 20-B-3. The maximum spacing per sprinkler is 120 ft<sup>2</sup> (11,1 m<sup>2</sup>).

## Design Guidelines

To design a project with attic sprinklers use these steps as a guideline:

- Determine if Model BB, SD, or HIP Sprinkler is needed.
- Determine if the roof slope is between 3:12 to 12:12. If more than one slope is being used on a project, select the correct sprinkler for each area.
- Follow the guidelines for each type of sprinkler.
- Calculate the sprinkler system in accordance with the appropriate flow and pressure information provided in Table A, as well as Figure 20. There is no interpolation of the flows and pressures shown on the chart.

#### For BB Sprinklers (Back to Back Dual Directional)

- Determine the throw needed (see spacing requirements in Table A). If over 20 feet (6,1 m) and up to 60 feet (18,3 m) is required, use the 8.0

K-factor, BB Sprinklers to reduce the pressure required. If pressure is not a concern, use the 5.6 K-factor, BB Sprinklers to minimize over discharge.

- If less than 20 feet (6,1 m) is required, use the 4.2 K-factor, Back to Back Dual Directional to minimize pressure and flow requirements
- Determine the distance along the slope. If the distance is not equal, use the longer side. Multiply the longer side by two to determine the spacing down the slope. Four hundred divided by this value will determine the maximum spacing along the ridge. The maximum distance is 6 feet (1,8 m). For example, a 12:12 slope at the maximum span of 60 feet (18,3 m) will produce a slope length of approximately 42.5 feet (13,0 m). That number multiplied by two produces an 85 feet (25,9 m) throw. Four hundred square feet maximum divided by an 85 feet (25,9 m) throw only allows a 4 feet - 8 inches (1,4 m) spacing along the ridge. Using the maximum spacing, space the sprinklers along the ridge.
- Avoid obstructions as shown in Figure 16. If necessary, add Model AP Sprinklers or Standard Spray Sprinklers to maintain coverage around obstructions.

#### For SD Sprinklers (Single Directional)

- Determine the throw needed.
- As the 400 ft<sup>2</sup> (37,2 m<sup>2</sup>) is not a factor with the SD Sprinklers, the maximum spacing is 6 feet (1,8 m) and the minimum is 4 feet (1,2 m) (Ref. Figures 2 & 11). (400 ft<sup>2</sup> is not an issue with the single directional because at its maximum spacing of 6 foot (1,8 m) on center/covering 40 feet (12,2 m) flat / a 12:12 slope / and the discharge being 56.5 feet (17,2 m), the 400 ft<sup>2</sup> (37,2 m<sup>2</sup>) maximum would not be exceeded.)
- Avoid obstructions as shown in Figure 16. If necessary, add Model AP Sprinklers or Standard Spray Sprinklers to maintain coverage around obstructions.

#### For HIP Sprinklers

- Verify framing direction is perpendicular to outside wall (Ref. Figure 12). If not, protect that area with AP Sprinklers or Standard Spray Sprinklers (Ref. Figure 13)
- From the intersection of the top of the hip and the ridge, the maximum



distance down the slope of the hip is 3 feet (0,9 m). Start the layout with the first sprinkler as close to that point as possible, but no further, while staying 6 inches (152,4 mm) away from the face of the trusses. Remember the slope of the hip is not equal to the slope of the roof from the ridge to the outside wall. Continue to space sprinklers down the hip at a maximum of 6 feet (1,8 m) on center as measured along the slope of the hip. When the bottom of the hip is reached, the last sprinkler must be within 7-1/2 feet (2,3 m) of the outside wall as measured flat (plan view). If this pipe is "cut to fit", the different slopes of the hip and the roof, as well as distances measured along the slope verses horizontal in plan view, must be accounted for.

- Avoid obstructions as shown in Figure 16. If necessary, add Model AP Sprinklers or Standard Spray Sprinklers to maintain coverage around obstructions.

## Care and Maintenance

The Tyco® Peak™ Performance Models BB™, SD™, HIP™, and AP™ "Specific Application Sprinklers for Protecting Attics" must be maintained and serviced in accordance with the following instructions:

### NOTE

*Before closing a fire protection system main control valve for maintenance work on the fire protection system that it controls, permission to shut down the affected fire protection systems must be obtained from the proper authorities and all personnel who may be affected by this action must be notified.*

Sprinklers that are found to be leaking or exhibiting visible signs of corrosion must be replaced.

Automatic sprinklers must never be painted, plated, coated, or otherwise altered after leaving the factory. Modified sprinklers must be replaced.

Over-heated solder type sprinklers must be replaced. Bulb-type sprinklers that have been exposed to corrosive products of combustion, but have not operated, should be replaced if they cannot be completely cleaned by wiping the sprinkler with a cloth or by brushing it with a soft bristle brush.

Care must be exercised to avoid damage to the sprinklers - before, during, and after installation. Sprinklers damaged by dropping, striking, wrench twist/slippage, or the like, must be re-

placed. Also, replace any sprinkler that has a cracked bulb or that has lost liquid from its bulb. (Ref. Installation Section).

The owner is responsible for the inspection, testing, and maintenance of their fire protection system and devices in compliance with this document, as well as with the applicable standards of the National Fire Protection Association (e.g., NFPA 25), in addition to the standards of any other authorities having jurisdiction. The installing contractor or sprinkler manufacturer should be contacted relative to any questions.

Automatic sprinkler systems should be inspected, tested, and maintained by a qualified Inspection Service in accordance with local requirements and/or national codes.

## Limited Warranty

Products manufactured by Tyco Fire & Building Products (TFBP) are warranted solely to the original Buyer for ten (10) years against defects in material and workmanship when paid for and properly installed and maintained under normal use and service. This warranty will expire ten (10) years from date of shipment by TFBP. No warranty is given for products or components manufactured by companies not affiliated by ownership with TFBP or for products and components which have been subject to misuse, improper installation, corrosion, or which have not been installed, maintained, modified or repaired in accordance with applicable Standards of the National Fire Protection Association, and/or the standards of any other Authorities Having Jurisdiction. Materials found by TFBP to be defective shall be either repaired or replaced, at TFBP's sole option. TFBP neither assumes, nor authorizes any person to assume for it, any other obligation in connection with the sale of products or parts of products. TFBP shall not be responsible for sprinkler system design errors or inaccurate or incomplete information supplied by Buyer or Buyer's representatives.

In no event shall TFBP be liable, in contract, tort, strict liability or under any other legal theory, for incidental, indirect, special or consequential damages, including but not limited to labor charges, regardless of whether TFBP was informed about the possibility of such damages, and in no event shall TFBP's liability exceed an amount equal to the sales price.

The foregoing warranty is made in lieu of any and all other warranties, express or implied, including warranties of merchantability and fitness for a particular purpose.

This limited warranty sets forth the exclusive remedy for claims based on failure of or defect in products, materials or components, whether the claim is made in contract, tort, strict liability or any other legal theory.

This warranty will apply to the full extent permitted by law. The invalidity, in whole or part, of any portion of this warranty will not affect the remainder.

## Ordering Procedure

Contact your local distributor for availability.

### Sprinkler Assemblies with NPT Thread Connections:

Specify: Model (specify), K-factor (specify), SIN (specify), Specific Application Attic Sprinkler, P/N (specify).

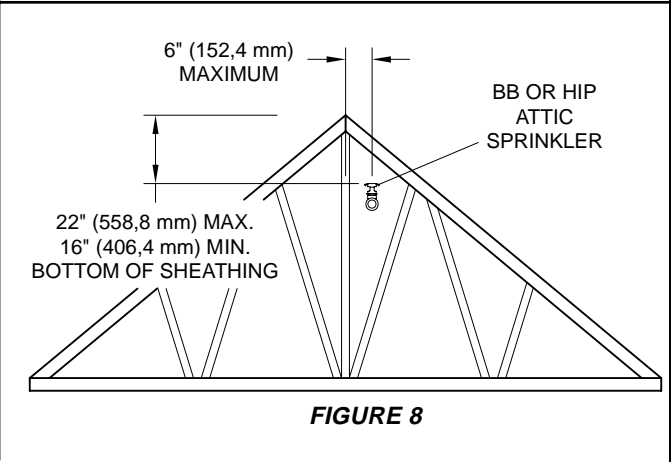
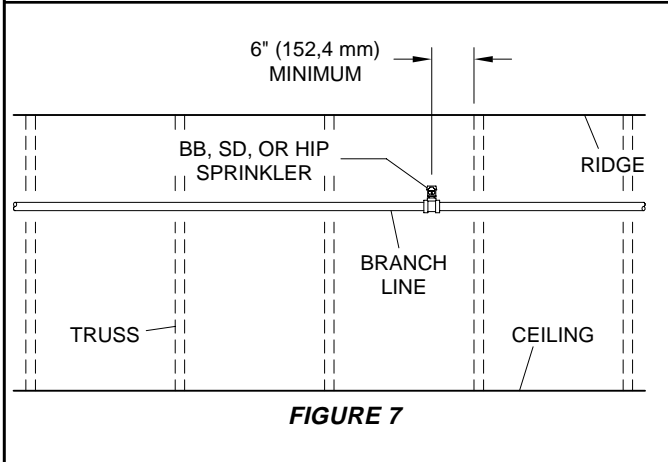
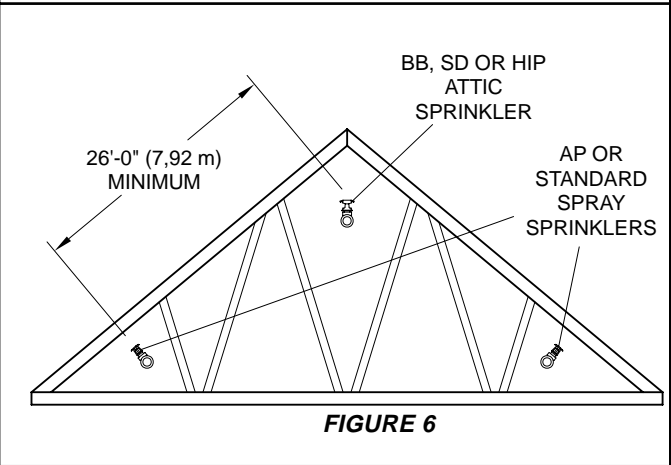
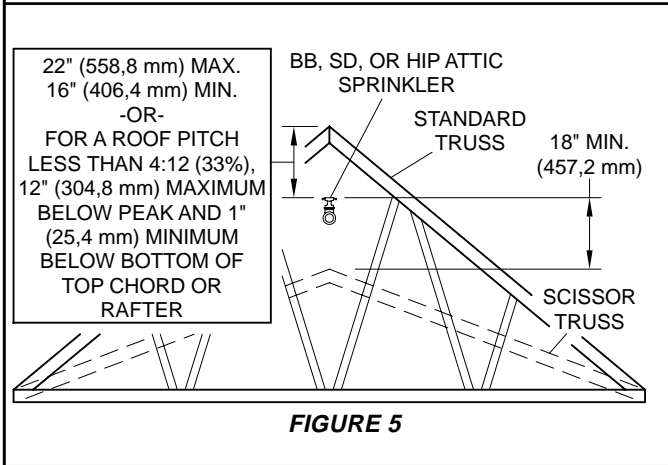
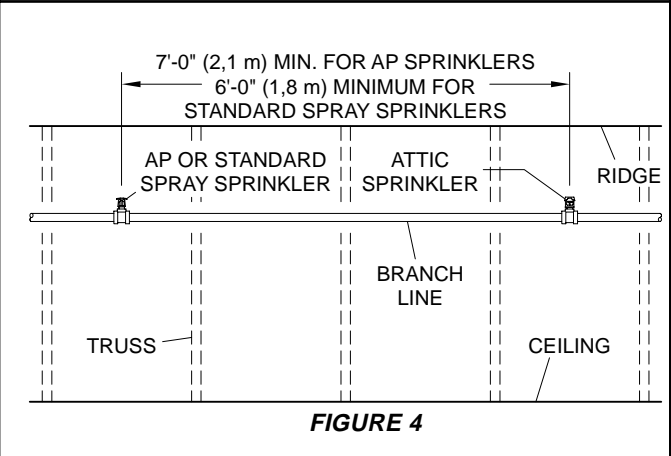
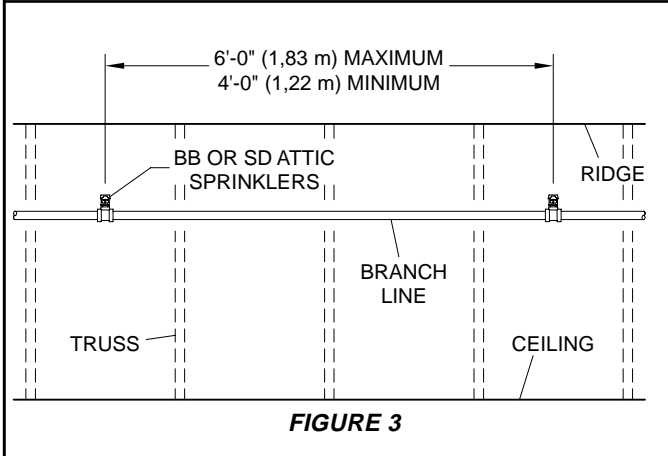
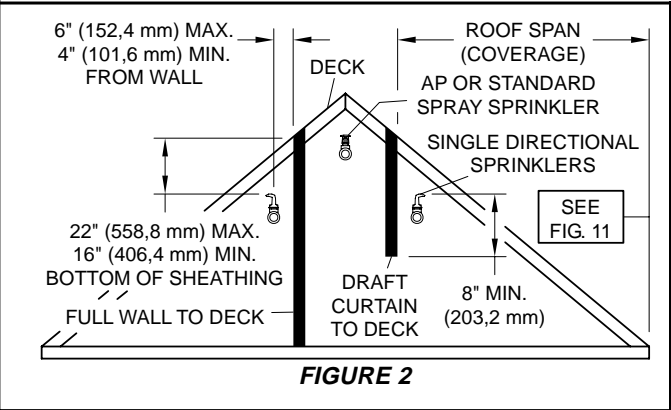
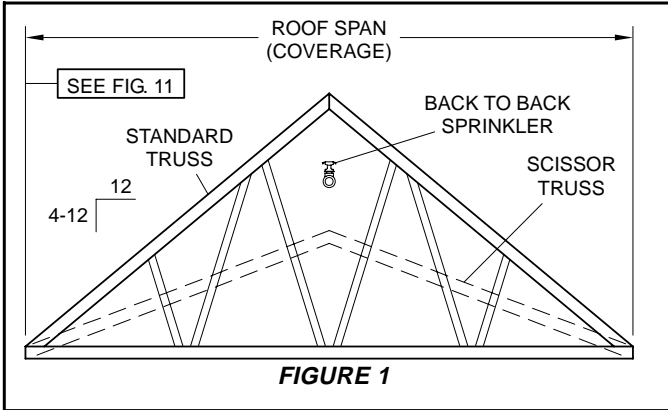
BB1 (K=8.0), TY4180 .....	P/N 51-623-1-200
BB2 (K=8.0), TY4181 .....	P/N 51-621-1-200
BB3 (K=8.0), TY4182 .....	P/N 51-622-1-200
BB1 (K=5.6), TY3180 .....	P/N 50-601-1-212
BB2 (K=5.6), TY3181 .....	P/N 50-602-1-212
BB3 (K=5.6), TY3182 .....	P/N 50-603-1-212
BB1 (K=4.2), TY4180 .....	P/N 50-620-1-200
BB2 (K=4.2), TY4181 .....	P/N 50-621-1-200
BB3 (K=4.2), TY4182 .....	P/N 50-622-1-200
SD1 (K=5.6), TY3183 .....	P/N 50-611-1-212
SD2 (K=5.6), TY3184 .....	P/N 50-612-1-212
SD3 (K=5.6), TY3185 .....	P/N 50-613-1-212
HIP (K=5.6), TY3187 .....	P/N 51-620-1-200
AP (K=5.6), TY3190 .....	P/N 50-625-1-200
AP (K=4.2), TY2190 .....	P/N 50-624-1-200

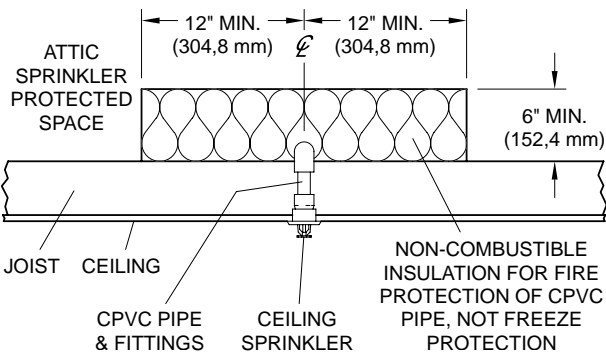
### Sprinkler Wrench:

Specify: W-Type 3 Sprinkler Wrench, P/N 56-895-1-001.

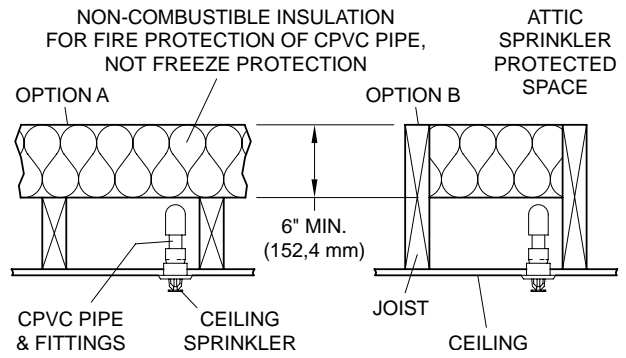
Specify: W-Type 20 Sprinkler Wrench, P/N 56-000-1-106.

Specify: W-Type 6 Sprinkler Wrench, P/N 56-000-6-387.



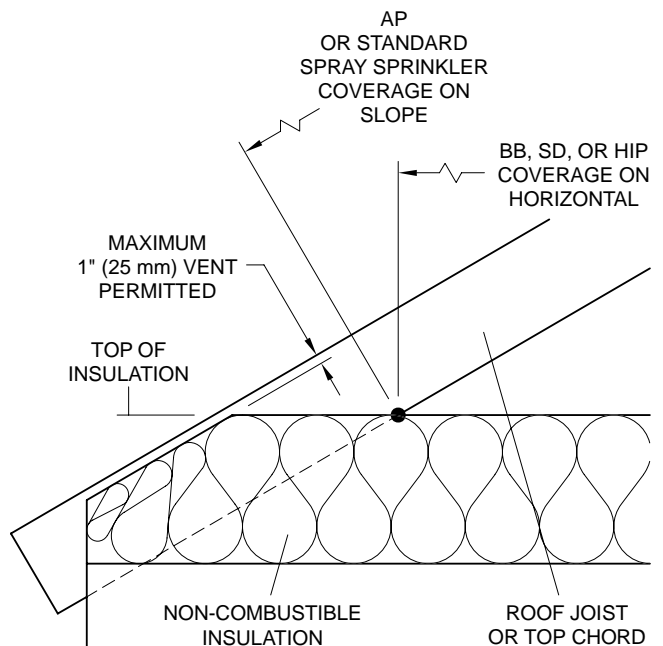
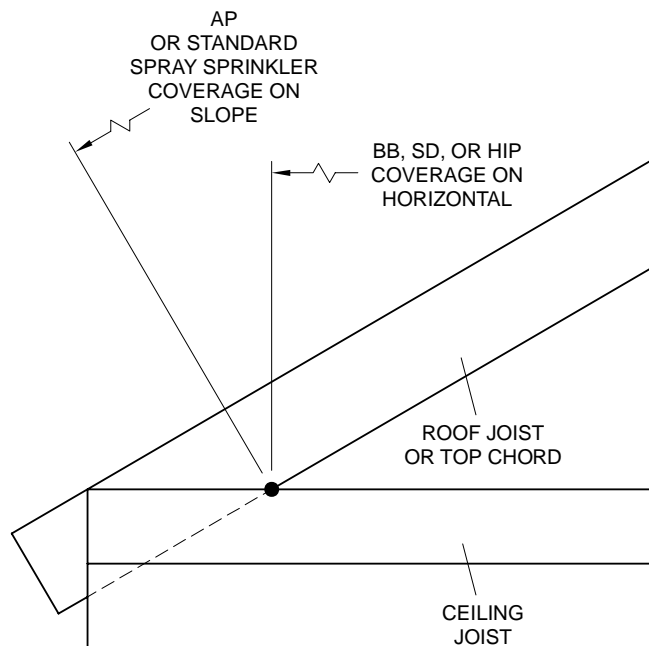
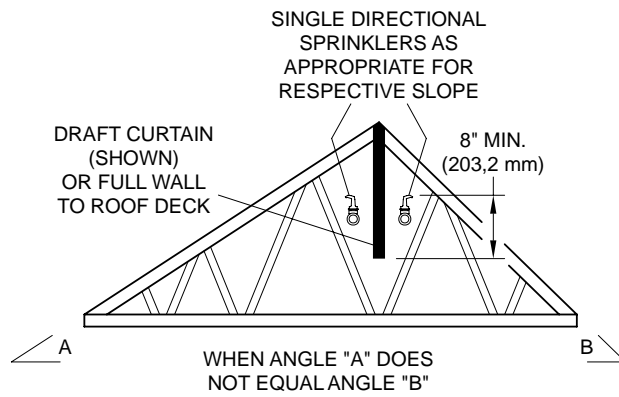


**FIGURE 9A**



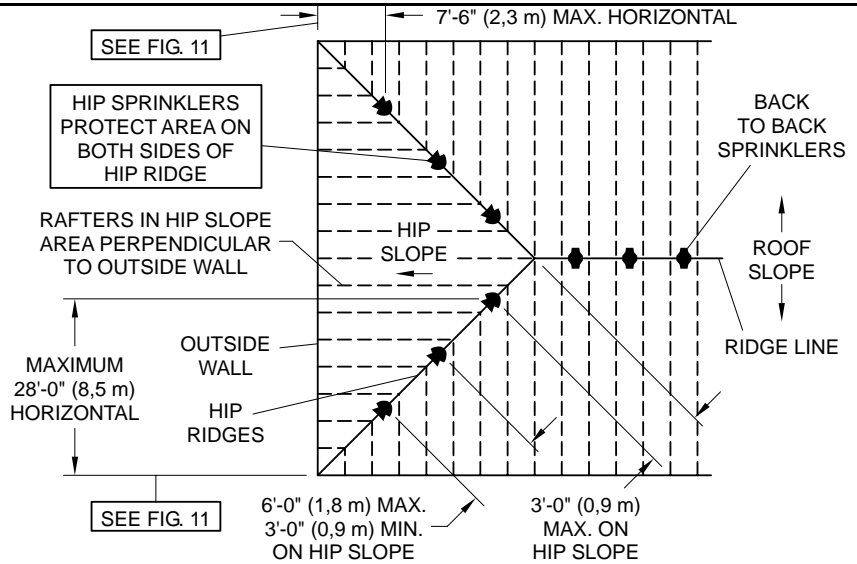
**FIGURE 9B**

**FIGURE 10**  
*Permitted Use Of Attic Sprinklers For Mismatched Slopes*

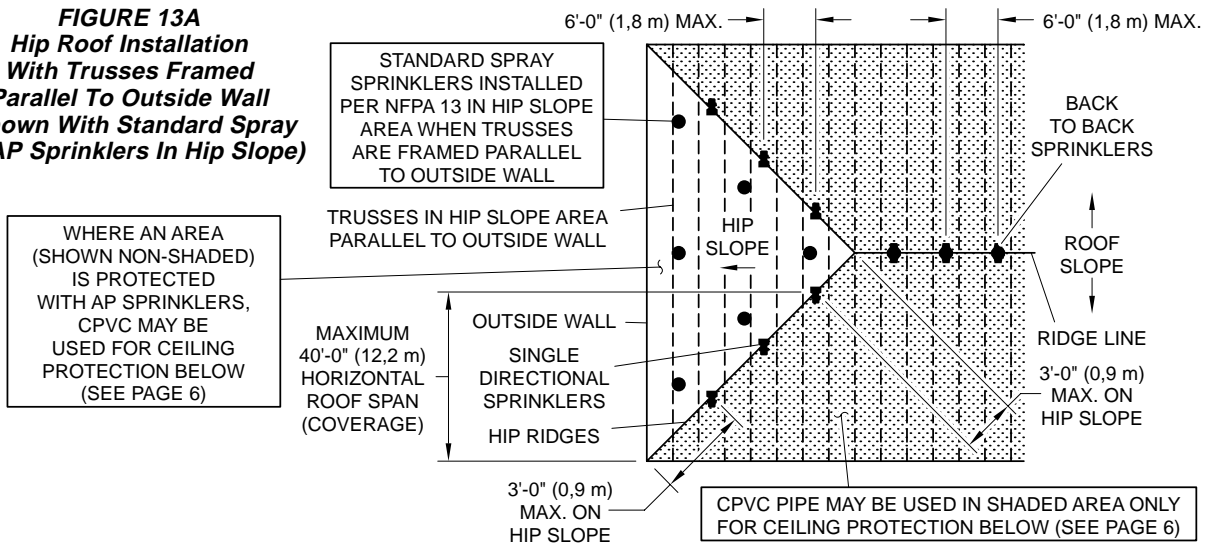


**FIGURE 11**  
*Coverage Starting Point At Eave*

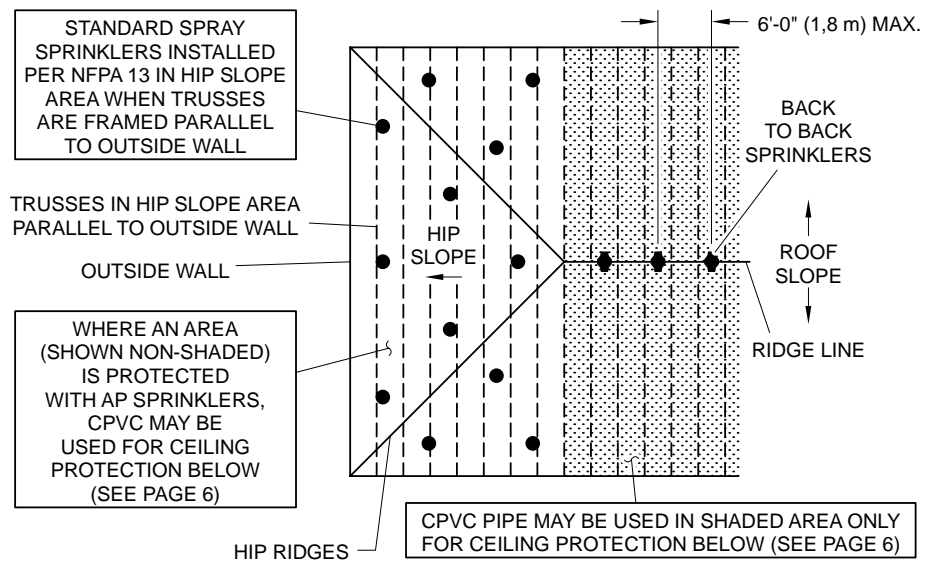
**FIGURE 12**  
**Hip Roof Installation**  
**With Rafters Framed**  
**Perpendicular To**  
**Outside Wall**  
**(Shown With HIP**  
**Sprinklers Protecting**  
**Hip Slope & Adjacent**  
**Areas To Hip Slope)**



**FIGURE 13A**  
**Hip Roof Installation**  
**With Trusses Framed**  
**Parallel To Outside Wall**  
**(Shown With Standard Spray**  
**Or AP Sprinklers In Hip Slope)**



**FIGURE 13B**  
**Hip Roof Installation**  
**With Trusses Framed**  
**Parallel To Outside Wall**  
**(Shown With Standard Spray**  
**Or AP Sprinklers In Hip Slope**  
**& Adjacent Areas To Hip Slope)**



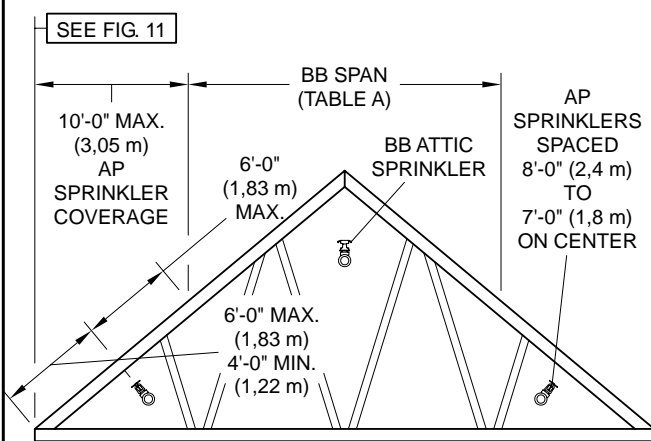
**Coverage Beyond BB, SD, or HIP Allowable Roof Spans**

**A.** For single ridge construction (Ref. Figure 14A), AP Sprinklers can be used to protect up to 10 feet (3,1 m) of width at the eaves beyond the maximum allowable 60 foot (18,3 m), 40 foot (12,2 m), or 20 foot (6,1 m) spans of the BB Sprinklers (Ref. Table A).

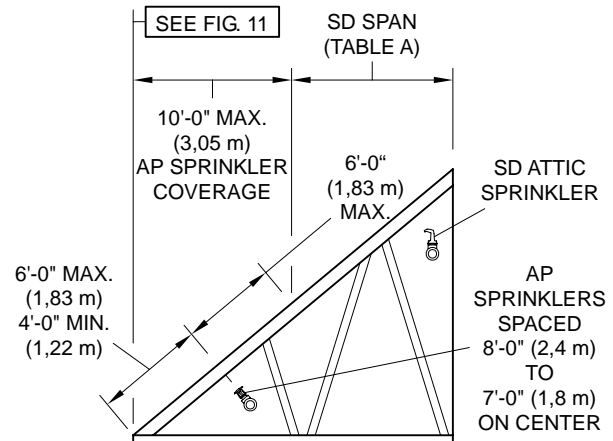
**B.** Where SD Sprinklers are used (Ref. Figure 14B), AP Sprinklers can be used to protect up to 10 feet (3,1 m) of width at the eaves beyond the maximum allowable 40 foot (12,2 m), 30 foot (9,1 m), or 10 foot (3,0 m) spans of the SD Sprinklers (Ref. Table A).

**C.** Where HIP Sprinklers are used for hip roof construction (Ref. Figure 15), use BB Sprinklers in the center portion and HIP Sprinklers down the entire hip. AP Sprinklers can then used to protect the eaves beyond the BB Sprinklers as described in Paragraph A. Also, AP Sprinklers can be used to protect up to 10 feet (3,1 m) of width beyond the maximum allowable 28 foot (8,5 m) or 20 foot (6,1 m) horizontal coverage of the HIP Sprinklers (Ref. Table A). Spacing of the AP Sprinklers is to be as detailed for their use with the BB Sprinklers in Figure 14A.

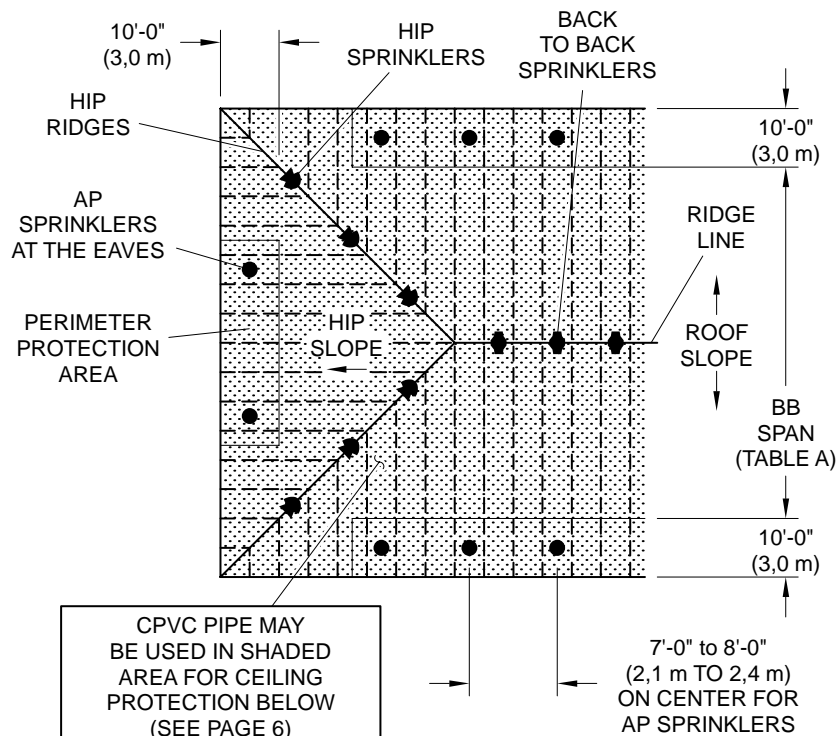
**NOTE:** The use of Attic Sprinklers CANNOT be considered for attics over 80 feet (24,4 m) wide.



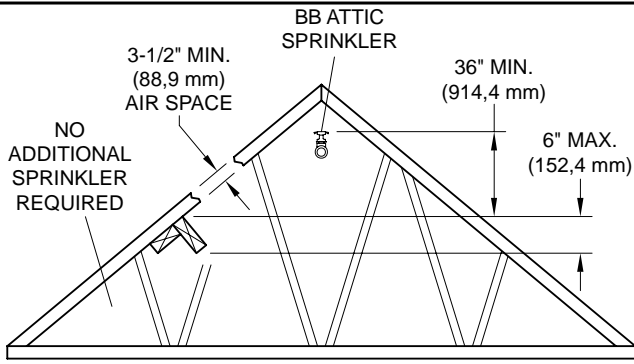
**FIGURE 14A — BB w/ AP SPRINKLERS**



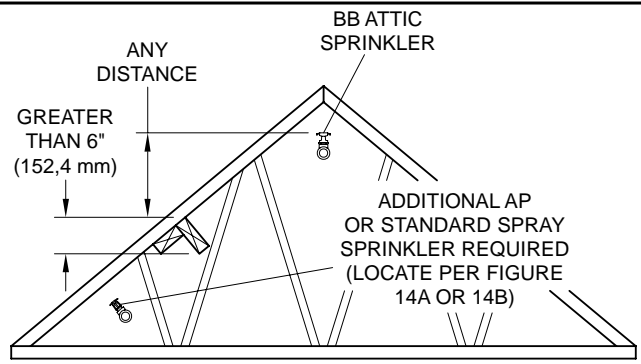
**FIGURE 14B — SD w/ AP SPRINKLERS**



**FIGURE 15 — HIP w/ AP SPRINKLERS**

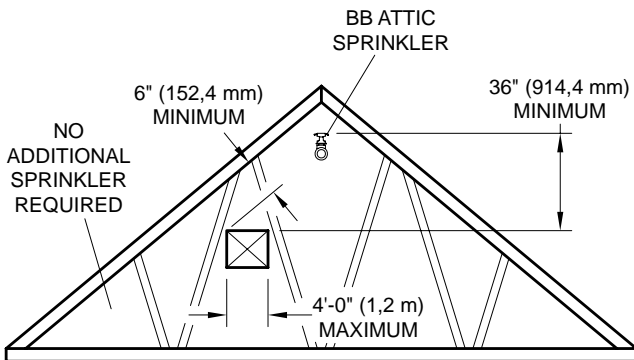


**FIGURE 16A**

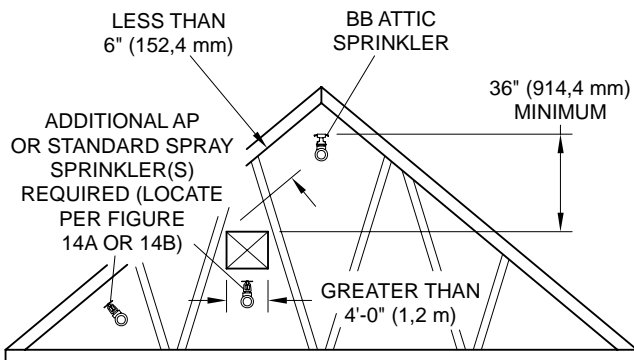


**FIGURE 16B**

There can be a maximum 6 inch (152,4 mm) high Horizontal Obstruction as long as it is 36 inches (914,4 mm), measured vertically, below the Attic Sprinkler. If the obstruction is closer or larger, there must be a sprinkler on the other side of the obstruction. Reference Figures 16A and 16B. This criteria does not limit the top chord of the trusses or the depth of the rafter, but does limit the obstructions that run across the trusses or rafters.



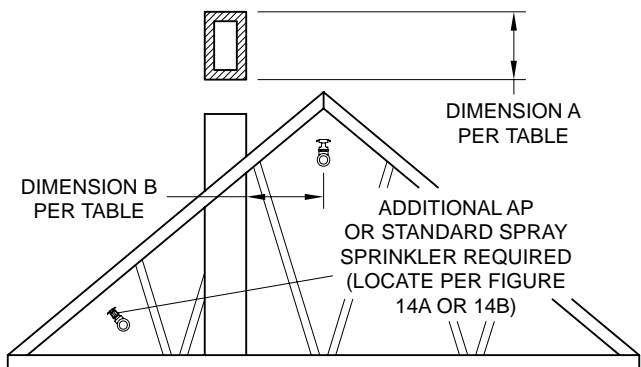
**FIGURE 16C**



**FIGURE 16D**

If the Horizontal Obstruction is below the sprinkler, there must be 6 inches (152,4 mm) clearance over the top of the obstruction, and the obstruction must be 4 feet (1,2 m) or less in width to allow water to pass both over and under the obstruction. The clearance is measured perpendicular to and from the bottom of the rafter. If there is not 6 inches (152,4 mm) of clearance above the obstruction, a sprinkler must be located on the other side of the obstruction. If the obstruction is greater than 4 feet (1,2 m) in width, a sprinkler must be added below the obstruction. Reference Figures 16C and 16D, where the maximum spacing for AP Sprinklers is 12 feet (3,7 m) and Standard Spray Sprinklers is 15 feet (4,6 m).

Dimension A	Distance B	Additional Sprinkler Required Beyond Obstruction
Maximum Horizontal Dimension of Obstruction	Minimum Horizontal Distance to Obstruction	
All Vertical Obstructions	< 6" (152,4 mm)	YES
1/2"-1" (12,7 mm-25,4 mm)	6" (152,4 mm)	NO
1"-4" (25,4 mm-101,6 mm)	12" (304,8 mm)	NO
4"-8" (101,4 mm-203,2 mm)	24" (609,6 mm)	NO
8"-10" (203,2 mm-254,0 mm)	5'-0" (1,52 m)	NO
10"-20" (254,0 mm-508,0 mm)	10'-0" (3,05 m)	NO
20"-30" (508,0 mm-762,0 mm)	15'-0" (4,57 m)	NO
30"-40" (762,0 mm-1016,0 mm)	20'-0" (6,10 m)	NO
40"-48" (1016,0 mm-1219,2 mm)	25'-0" (7,62 m)	NO
> 48" (1219,2 mm)	Any Distance	YES



**FIGURE 16E**

For Vertical Obstructions, the maximum dimension of the obstruction is its width and the horizontal distance away from the obstruction is measured horizontally.

**FIGURE 16 — PART 1 of 2 — OBSTRUCTIONS TO WATER DISTRIBUTION — BB, SD & HIP**  
*(Obstructions to water distribution for Attic Sprinklers differ from standard sprinklers as shown)*

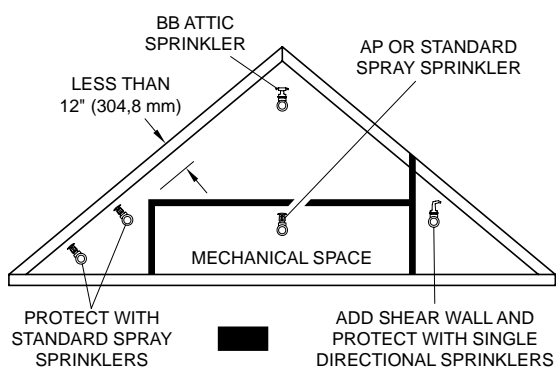
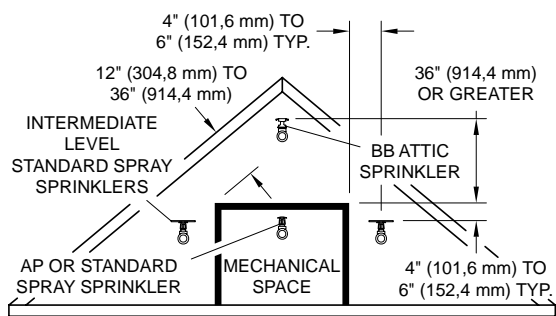
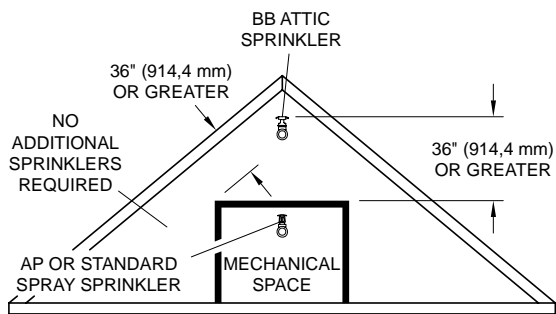
**FIGURE 16F**  
**Area Outside Of Mechanical Space**  
**Or Similar Compartmented Space**

When a BB Sprinkler is 36 inches (914,4 mm) or greater above the space, and 36 inches (914,4 mm) or greater clearance above the space is present, additional sprinklers are not needed.

When a BB Sprinkler is a 36 inches (914,4 mm) or greater above the space, and a 12 to 36 inches (304,8 mm to 914,4 mm) clearance above the space is present, Intermediate Level Standard Sprinklers are to be installed to protect the obstructed area.

Otherwise, the area beyond the mechanical space is to be protected as shown by installing Standard Spray Sprinklers as necessary — OR — by constructing a shear wall and installing SD Sprinklers.

**NOTE: In all cases, the mechanical space or similar compartmented space is to be sprinklered per its respective hazard rating and separated from the light hazard attic space by construction that has a fire resistance rating based on the water supply duration required for the hazard rating within the mechanical space or similar compartmented space.**

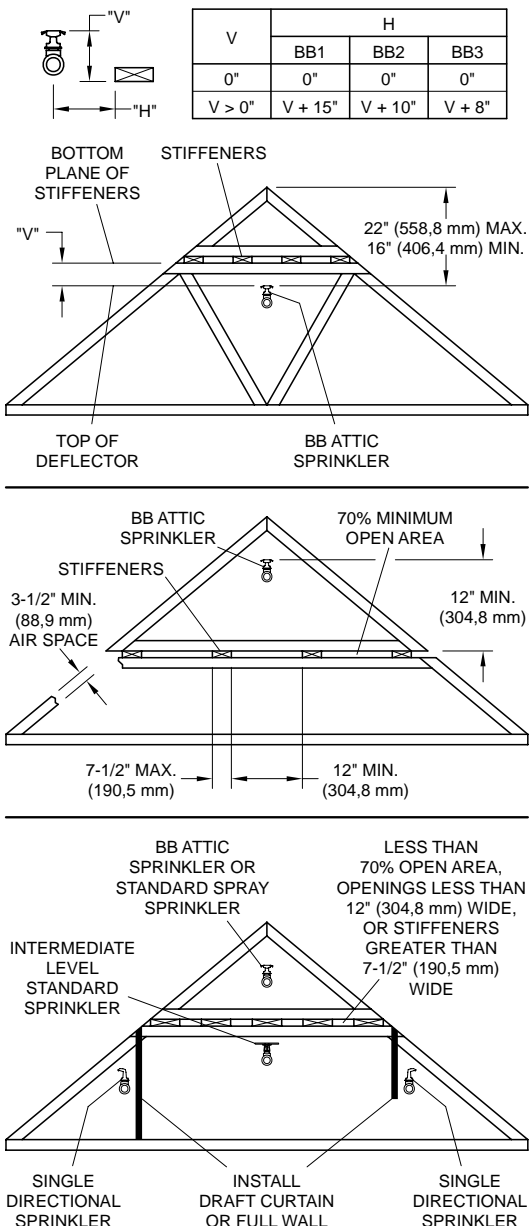


**FIGURE 16G**  
**Piggyback**  
**Trusses**

When a BB Sprinkler can be installed below or between stiffeners and maintain the 16 to 22 inch (404,4 to 558,8 mm) distance to the peak, as well as the "V" and "H" clearance to the stiffeners, additional sprinklers are not required.

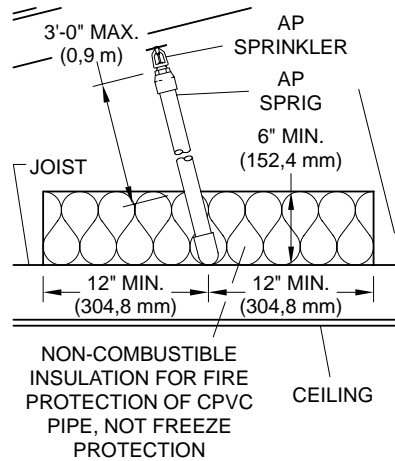
When the stiffeners are located a minimum of 12 inches (304,8 mm) below the BB Sprinkler, the stiffeners are 7-1/2 inches (190,5 mm) maximum in width, the openings are 12 inches (304,8 mm) minimum, and there is 70% minimum open area, additional sprinklers are not required.

Otherwise, additional sprinklers are required as shown.

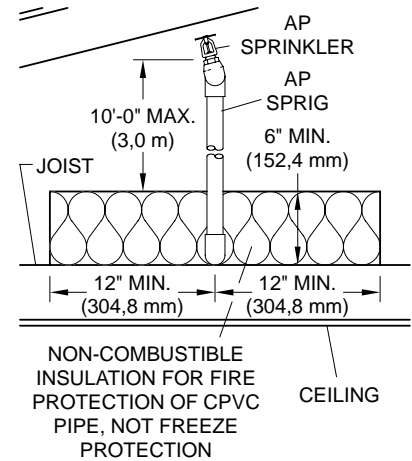


**FIGURE 16 — PART 2 of 2 — OBSTRUCTIONS TO WATER DISTRIBUTION — BB, SD & HIP**  
**(Obstructions to water distribution for Attic Sprinklers differ from standard sprinklers as shown)**

**FIGURE 17A  
EXPOSED CPVC  
WITH AP SPRINKLERS  
AND  
BRANCHLINE OVER JOISTS**

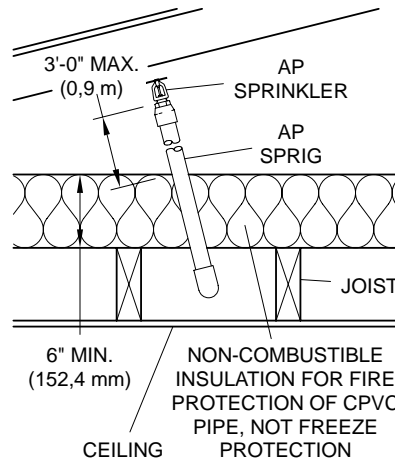


OPTION A

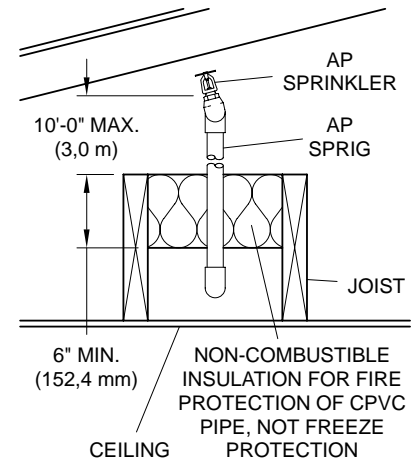


OPTION B

**FIGURE 17B  
EXPOSED CPVC WITH AP  
SPRINKLERS  
AND BRANCHLINE WITHIN  
JOISTS**

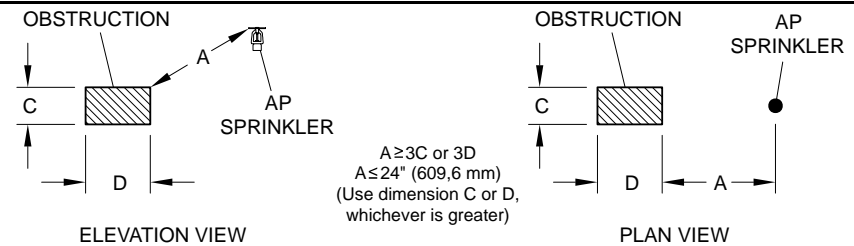


OPTION A



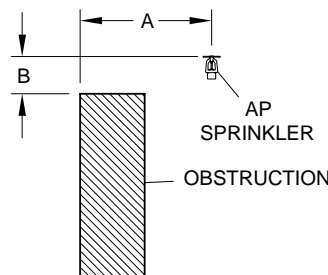
OPTION B

**FIGURE 18  
OBSTRUCTIONS TO WATER  
DISTRIBUTION FOR  
MODEL AP SPRINKLERS**



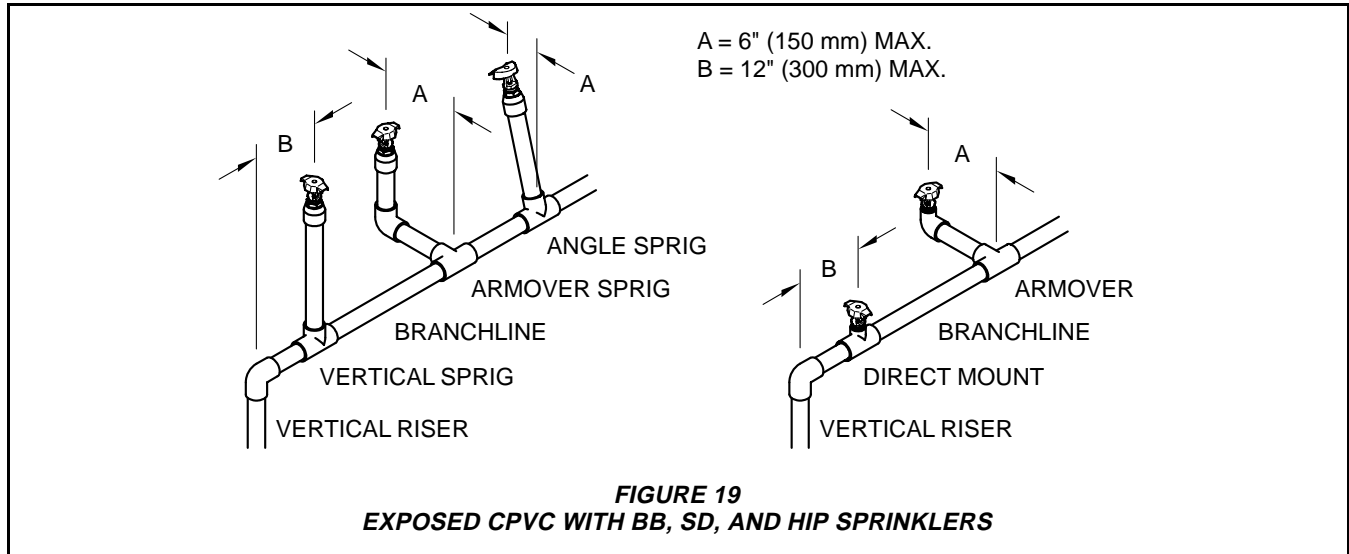
ELEVATION VIEW

PLAN VIEW



Horizontal Distance (A)	Minimum Vertical Distance Below Deflector (B)
≤6" (≤152,4 mm)	3" (76,2 mm)
>6" to 9" (>152,4 to 228,6 mm)	4" (101,6 mm)
>9" to 12" (>228,6 mm to 304,8 mm)	6" (88,9 mm)
>12" to 15" (>304,8 mm to 381,0 mm)	8" (203,2 mm)
>15" to 18" (>381,0 to 457,2 mm)	9-1/2" (241,3 mm)
>18" to 24" (457,2 mm to 609,6 mm)	12-1/2" (317,5 mm)
>24" to 30" (>609,6 mm to 762,0 mm)	15-1/2" (393,7 mm)
>30" (>762,0 mm)	18" (457,2 mm)





### HYDRAULIC CALCULATIONS

Attic sprinklers must be calculated in conformance with these guidelines. In all cases, the design area shall include the most hydraulically demanding sprinklers. More than one set of calculations may be required to prove different situations.

For individual areas requiring more than four AP Sprinklers, the maximum area of attic protected by AP Sprinklers is limited to 3000 ft<sup>2</sup> (279 m<sup>2</sup>) in any single area. Areas must be separated by a minimum of 15 feet (4,6 m) by an area protected by BB, SD, or HIP Sprinklers, in order to be considered separate areas.

The hydraulic calculations have been divided into three parts as follows:

- **FIGURE 20-A: “Attics Protected Entirely By BB, SD, and HIP Attic Sprinklers”.**

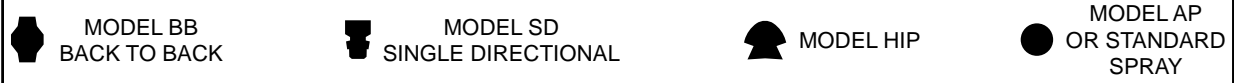
- 20-A-1 (Page 18) BB Sprinklers
- 20-A-2 (Page 18) BB and HIP Sprinklers
- 20-A-3 (Page 19) BB and SD Sprinklers
- 20-A-4 (Page 19) SD Sprinklers
- 20-A-5 (Page 19) SD and HIP Sprinklers
- 20-A-6 (Page 19) HIP Sprinklers

- **FIGURE 20-B: “Attics Protected With A Mixture Of BB, SD, and HIP Attic Sprinklers And AP Sprinklers”.**

- 20-B-1 (Page 20) SD Sprinklers & AP Sprinklers At The Ridge
- 20-B-2 (Page 20) BB Sprinklers & AP Sprinklers At The Eaves or Beyond An Obstruction
- 20-B-3 (Page 21) BB Sprinklers & AP Sprinklers At The Hip
- 20-B-4 (Page 21) BB Sprinklers, SD Sprinklers, HIP Sprinklers, & AP Sprinklers At The Hip
- 20-B-5 (Page 22) BB, SD, or HIP Sprinklers & AP Sprinklers in a Dormer, at a Cross, or at an Ell
- 20-B-6 (Page 22) BB,SD, or HIP Sprinklers & AP Sprinklers Separated By Compartmentalization

- **FIGURE 20-C: “Attics Protected With A Mixture Of BB, SD, and HIP Attic Sprinklers And Standard Spray Sprinklers”.**

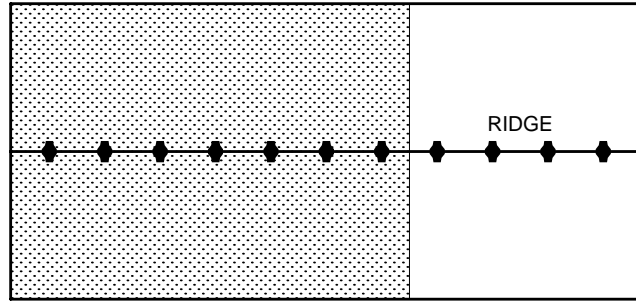
- 20-C-1 (Page 23) SD Sprinklers & Standard Spray Sprinklers At The Ridge
- 20-C-2 (Page 23) BB Sprinklers & Standard Spray Sprinklers At The Eaves or Beyond An Obstruction
- 20-C-3 (Page 24) BB Sprinklers & Standard Spray Sprinklers At The Hip
- 20-C-4 (Page 25) BB Sprinklers, SD Sprinklers, HIP Sprinklers, & Standard Spray Sprinklers At The Hip
- 20-C-5 (Page 26) BB, SD, or HIP Sprinklers & Standard Spray Sprinklers in a Dormer, at a Cross, or at an Ell
- 20-C-6 (Page 26) BB, SD, or HIP Sprinklers & Standard Sprinklers Separated By Compartmentalization



**FIGURE 20 — HYDRAULIC CALCULATIONS**

**Figure 20-A-1. BB Sprinklers**

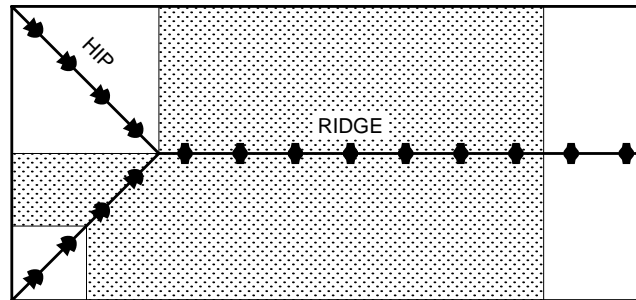
- Wet Systems — Calculate the most demanding five sprinklers.
- Dry Systems — Calculate the most demanding seven sprinklers (see adjacent figure).



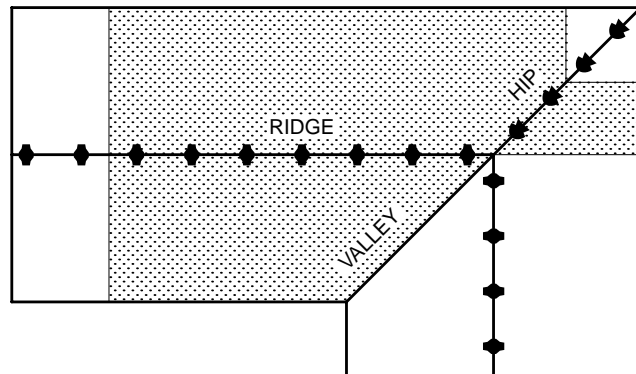
DRY SYSTEM SHOWN

**Figure 20-A-2. BB and HIP Sprinklers**

- Wet Systems — Calculate the most demanding five sprinklers.
- Dry Systems — Calculate the most demanding seven sprinklers, and then calculate the most demanding contiguous nine sprinklers with a maximum of seven to be BB Sprinklers (see adjacent figures). Use the most demanding calculation.



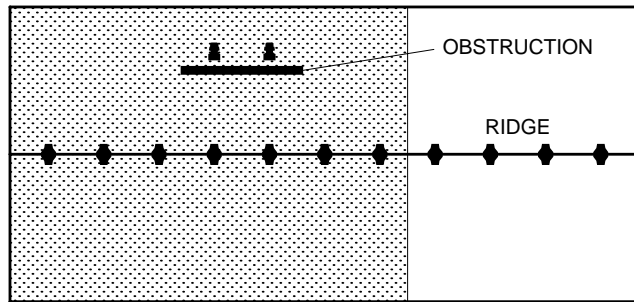
DRY SYSTEM SHOWN



DRY SYSTEM SHOWN

**Figure 20-A-3. BB and SD Sprinklers**

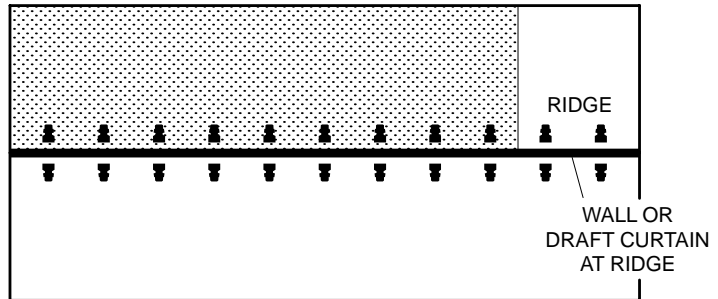
- Wet Systems — Calculate the most demanding five BB Sprinklers plus two SD Sprinklers.
- Dry Systems — Calculate the most demanding seven BB Sprinklers plus up to two SD Sprinklers (see adjacent figure).



DRY SYSTEM SHOWN

**Figure 20-A-4. SD Sprinklers**

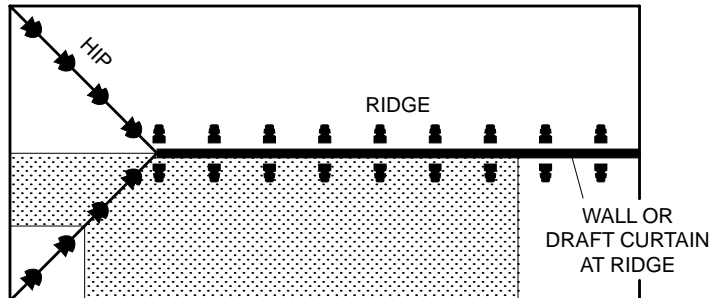
- Wet Systems — Calculate the most demanding five SD Sprinklers.
- Dry Systems — Calculate the most demanding nine SD Sprinklers (see adjacent figure).



DRY SYSTEM SHOWN

**Figure 20-A-5. SD and HIP Sprinklers**

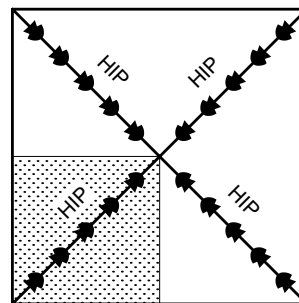
- Wet Systems — Calculate the most demanding five sprinklers.
- Dry Systems — Calculate the most demanding nine sprinklers with a maximum of seven to be SD Sprinklers (see adjacent figure).



DRY SYSTEM SHOWN

**Figure 20-A-6. HIP Sprinklers**

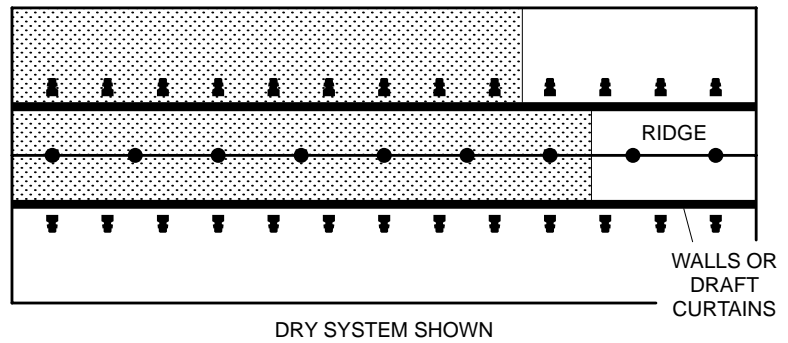
- Wet Systems — Calculate the most demanding five sprinklers (see adjacent figure).
- Dry Systems — Calculate the most demanding nine sprinklers.



WET SYSTEM SHOWN

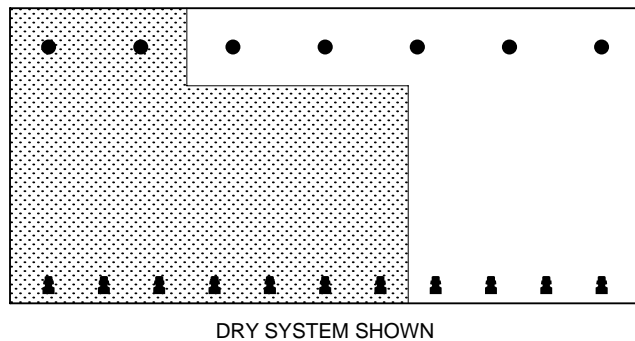
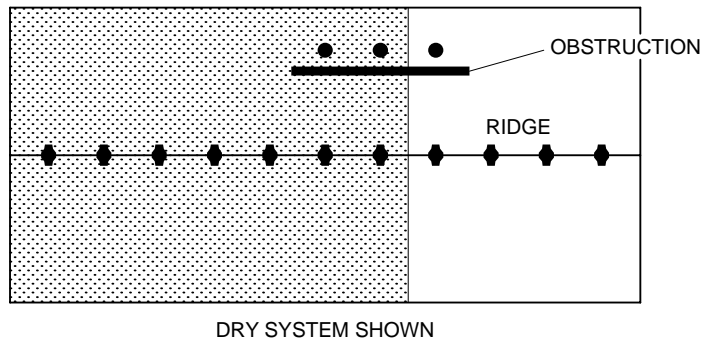
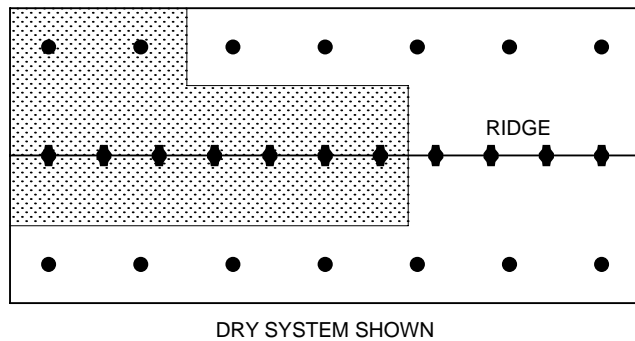
**Figure 20-B-1. SD Sprinklers & AP Sprinklers At The Ridge**

- Wet Systems — Calculate the most demanding five sprinklers of one type. Use the most demanding calculation.
- Dry Systems — Calculate the most demanding nine SD Sprinklers, and then calculate the most demanding seven AP Sprinklers. Use the most demanding calculation (see adjacent figure).



**Figure 20-B-2. BB or SD Sprinklers & AP Sprinklers At The Eaves or Beyond An Obstruction**

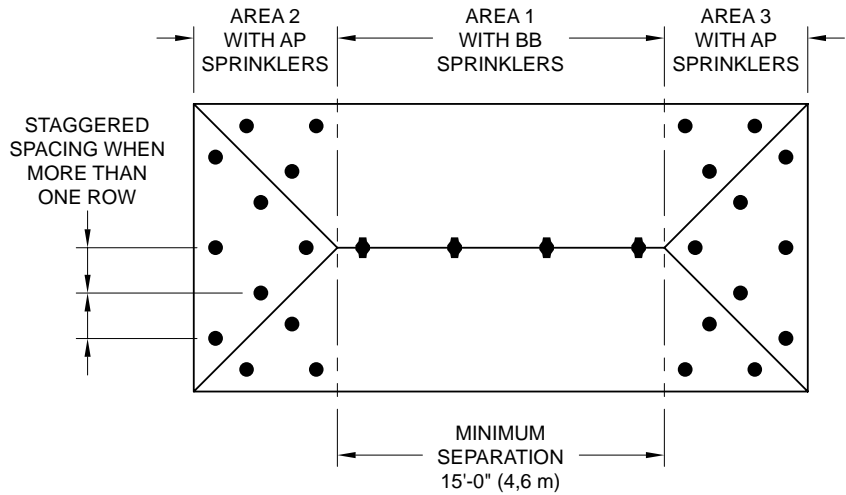
- Wet Systems — Calculate the most demanding five BB or SD Sprinklers plus up to two most demanding AP Sprinklers.
- Dry Systems — Calculate the most demanding seven BB or SD Sprinklers plus up to two most demanding AP Sprinklers (see adjacent figures).



**Figure 20-B-3. BB Sprinklers & AP Sprinklers At The Hip**

Where the total number of AP Sprinklers at the hip is greater than four:

- Wet Systems — Calculate the most demanding five BB Sprinklers plus the two most demanding AP Sprinklers, and then calculate the most demanding area up to 1500 ft<sup>2</sup> (137 m<sup>2</sup>) having AP Sprinklers (e.g., Area 2 in adjacent upper figure). Use the most demanding calculation.
- Dry Systems — Calculate the most demanding seven BB Sprinklers plus the two most demanding AP Sprinklers, and then calculate the most demanding area up to 1950 ft<sup>2</sup> (181 m<sup>2</sup>) having AP Sprinklers (e.g., Area 2 in adjacent upper figure). Use the most demanding calculation.

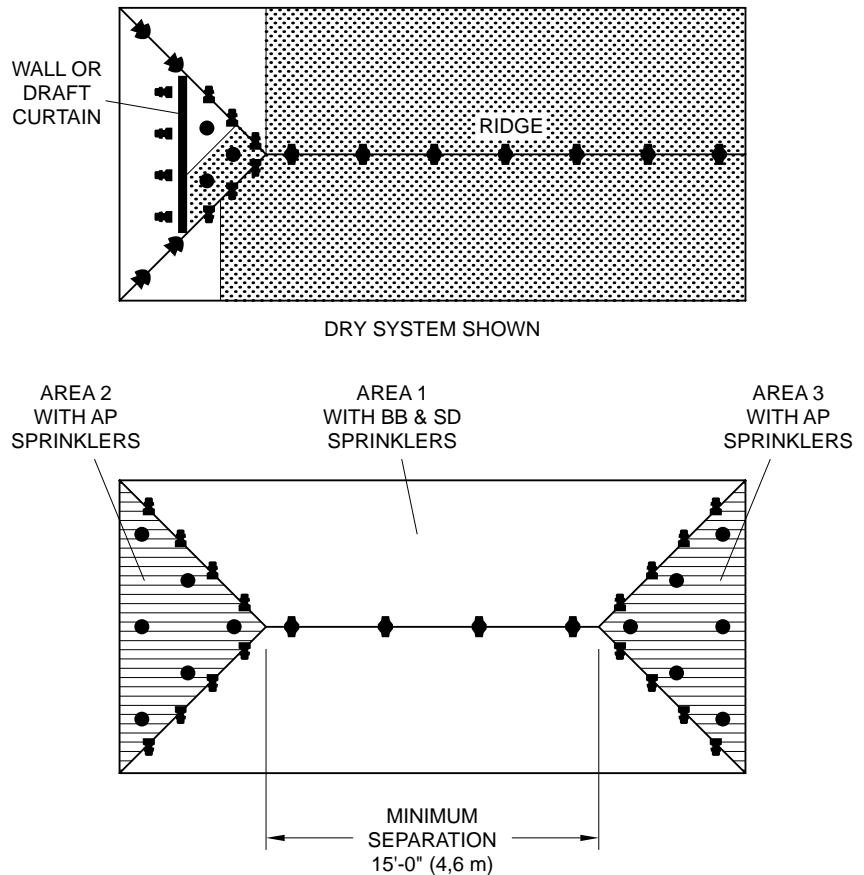


SEE ALSO FIGURES 21 AND 22

**Figure 20-B-4. BB Sprinklers, SD Sprinklers, HIP Sprinklers, & AP Sprinklers At The Hip**

Where the total number of AP Sprinklers at the hip is four or less:

- Wet Systems — Calculate the most demanding five BB, SD, or HIP Sprinklers plus up to two most demanding AP Sprinklers.
- Dry Systems — Calculate the most demanding nine BB, SD, or HIP Sprinklers plus up to two most demanding AP Sprinklers (Of the nine BB, SD, or HIP Sprinklers, calculate up to a maximum of seven BB Sprinklers, see adjacent upper figure).



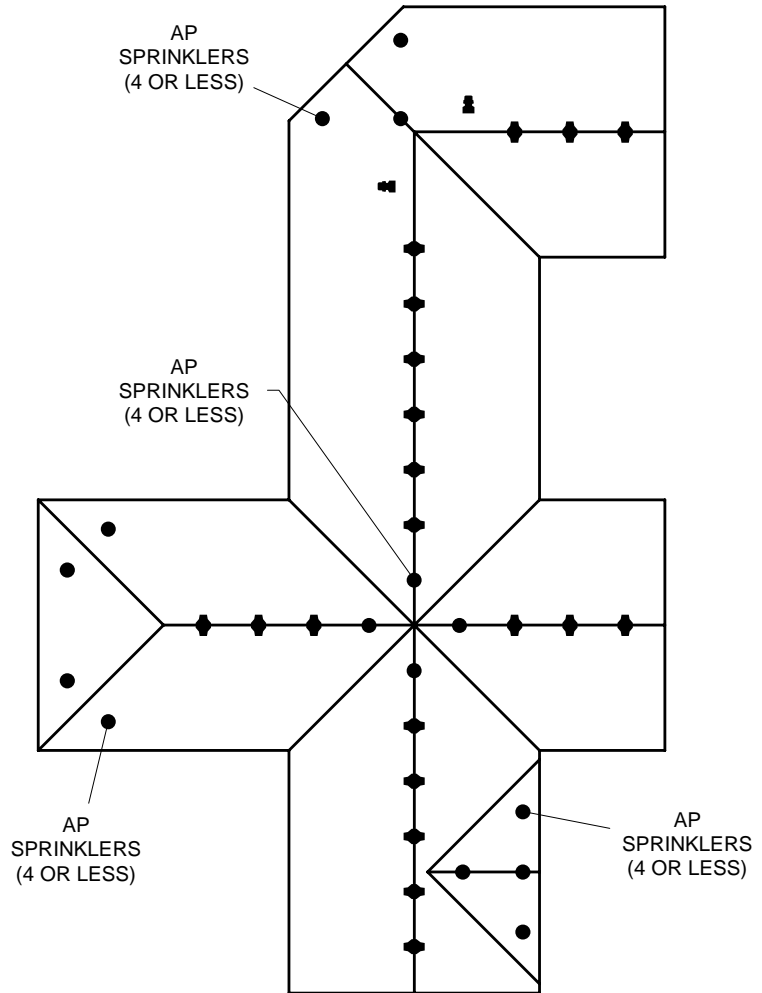
Where the total number of AP Sprinklers at the hip is greater than four:

- Wet Systems — Calculate up to the most demanding five BB, SD, or HIP Sprinklers plus the two most demanding AP Sprinklers, and then calculate the most demanding area up to 1500 ft<sup>2</sup> (137 m<sup>2</sup>) having AP Sprinklers (e.g., Area 2). Use the most demanding calculation.
- Dry Systems — Calculate up to the most demanding nine BB, SD, or HIP Sprinklers plus the two most demanding AP Sprinklers, and then calculate the most demanding area up to 1950 ft<sup>2</sup> (181 m<sup>2</sup>) having AP Sprinklers (e.g., Area 2). Use the most demanding calculation.

**Figure 20-B-5. BB, SD, or HIP Sprinklers & AP Sprinklers in a Dormer, at a Cross, at a Hip, or at an Ell**

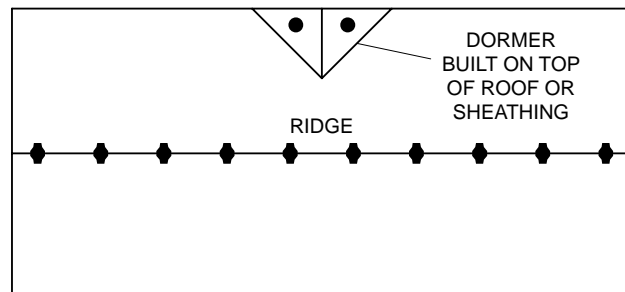
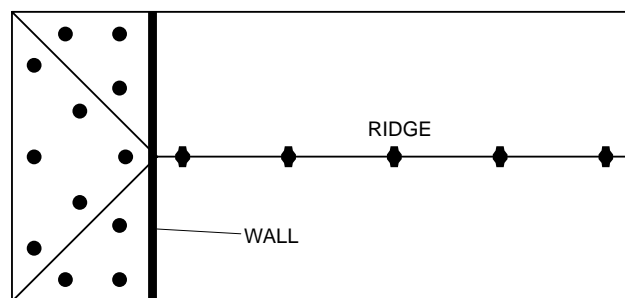
Where the quantity of AP Sprinklers in each dormer, cross, or ell is four or less (see adjacent figure) and all of the dormers, crosses and ells meet the maximum four AP Sprinkler criteria, calculate the BB, SD, or HIP Sprinkler demand as described in Part A-1 thru A-6 or Part B-1 thru B-4, plus up to two of the most demanding AP Sprinklers in the dormer, cross, or ell that is adjacent to the BB, SD, or HIP Sprinklers that are being included in the demand calculation.

Where the quantity of AP Sprinklers in any dormer, cross, or ell is greater than four, refer to Figure B-3.



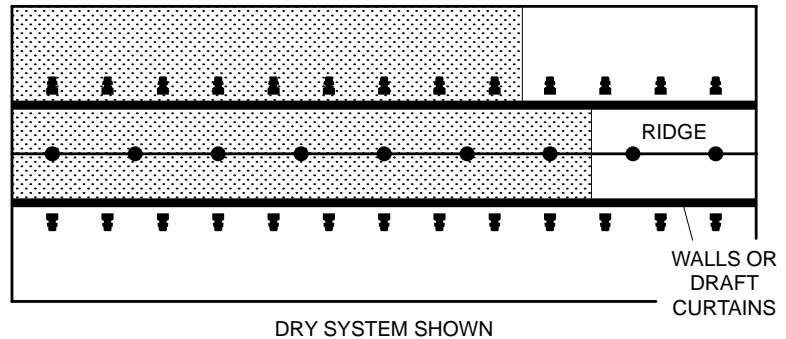
**Figure 20-B-6. BB,SD, or HIP Sprinklers & AP Sprinklers Separated By Compartmentalization**

- Wet Systems— Calculate the BB, SD, or HIP Sprinkler demand as described in Part A-1 thru A-6 or Part B-1 thru B-4, and then calculate the most demanding area up to 1500 ft<sup>2</sup> (137 m<sup>2</sup>) having AP Sprinklers. Use the most demanding calculation (see adjacent figure).
- Dry Systems— Calculate the BB, SD, or HIP Sprinkler demand as described in Part A-1 thru A-6 or Part B-1 thru B-4, and then calculate the most demanding area up to 1950 ft<sup>2</sup> (181 m<sup>2</sup>) having AP Sprinklers. Use the most demanding calculation (see adjacent figure).



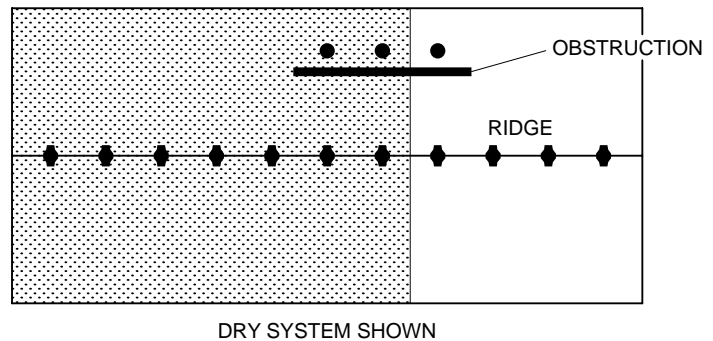
**Figure 20-C-1. SD Sprinklers & Standard Spray Sprinklers At The Ridge**

- Wet Systems — Calculate the most demanding five sprinklers of one type. Use the most demanding calculation.
- Dry Systems — Calculate the most demanding nine SD Sprinklers, and then calculate the most demanding seven Standard Spray Sprinklers. Use the most demanding calculation (see adjacent fig-



**Figure 20-C-2. BB Sprinklers & Standard Spray Sprinklers Beyond An Obstruction**

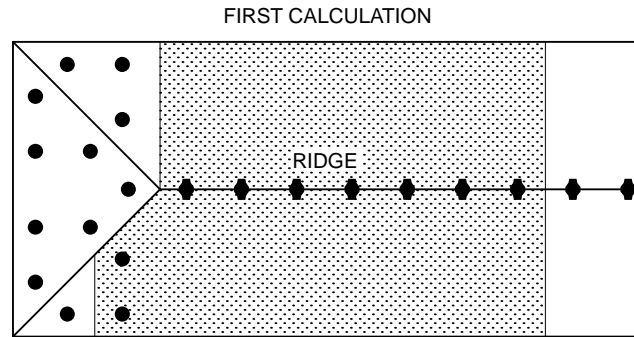
- Wet Systems — Calculate the most demanding five BB Sprinklers plus up to two most demanding Standard Spray Sprinklers.
- Dry Systems — Calculate the most demanding seven BB Sprinklers plus up to two most demanding Standard Spray Sprinklers (see adjacent figures).



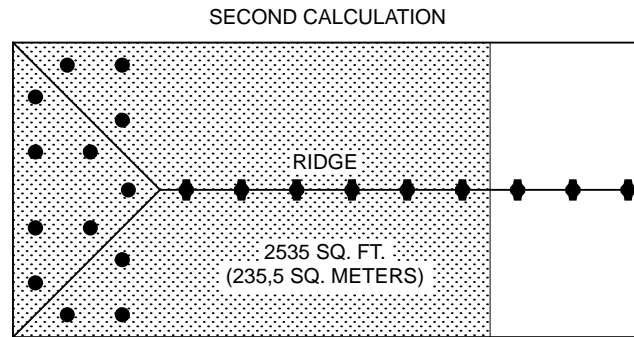
**Figure 20-C-3. BB Sprinklers & Standard Spray Sprinklers At The Hip**

Where the total number of standard spray sprinklers at the hip is greater than four:

- Wet Systems — Calculate the most demanding five BB Sprinklers plus up to two most demanding Standard Spray Sprinklers, and then calculate the most demanding remote design area (including all sprinkler types) per NFPA 13 (i.e., area reduction for quick response & 30% increase for sloped ceilings). Use the most demanding calculation.
- Dry Systems — Calculate the most demanding seven BB Sprinklers plus up to two most demanding Standard Spray Sprinklers, and then calculate the most demanding design area (including all sprinkler types) per NFPA 13 (i.e., 30% increase for sloped ceilings & 30% increase for dry systems). Include all sprinkler types within this area (see adjacent figure). Use the most demanding calculation.



DRY SYSTEM SHOWN



DRY SYSTEM SHOWN

NOTE:  
 Dry Pipe = 1500 SQ. FT. (NFPA Light Hazard) x 1.3 x 1.3 = 2535 SQ. FT.

**SEE ALSO FIGURES 21 AND 22**



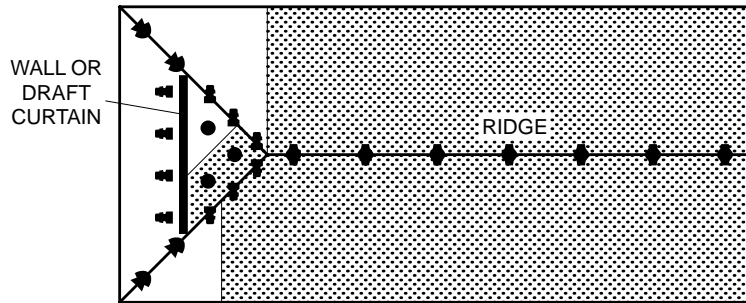
**Figure 20-C-4. BB Sprinklers, SD Sprinklers, HIP Sprinklers, & Standard Spray Sprinklers At The Hip**

Where the total number of Standard Spray Sprinklers at the hip is four or less:

- Wet Systems — Calculate the most demanding five BB, SD, or HIP Sprinklers plus up to two most demanding Standard Spray Sprinklers.
- Dry Systems — Calculate the most demanding nine BB, SD, or HIP Sprinklers plus up to two most demanding Standard Spray Sprinklers (Of the nine BB,SD, or HIP Sprinklers, calculate up to a maximum of seven BB Sprinklers, see adjacent upper figure).

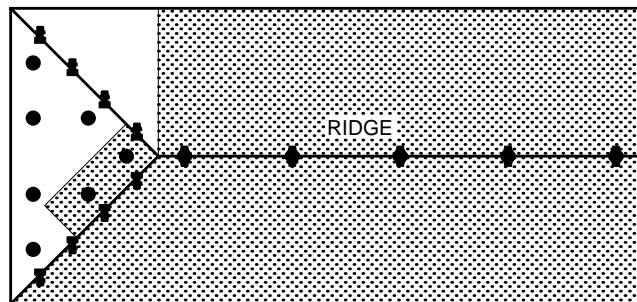
Where the total number of standard spray sprinklers at the hip is greater than four:

- Wet Systems — Calculate the most demanding five BB, SD, or HIP Sprinklers plus up to two most demanding Standard Spray Sprinklers, and then calculate the most demanding remote design area (Including all sprinkler types) per NFPA 13 (i.e., area reduction for quick response & 30% increase for sloped ceilings). Use the most demanding calculation.
- Dry Systems — Calculate the most demanding nine BB, SD, or HIP Sprinklers plus up to two most demanding Standard Spray Sprinklers (Of the nine BB,SD, or HIP Sprinklers, calculate up to a maximum of seven BB Sprinklers, see adjacent upper figure), and then calculate the most demanding design area (including all sprinkler types) per NFPA 13 (i.e., 30% increase for sloped ceilings & 30% increase for dry systems). Include all sprinklers types within this area (see adjacent figure).



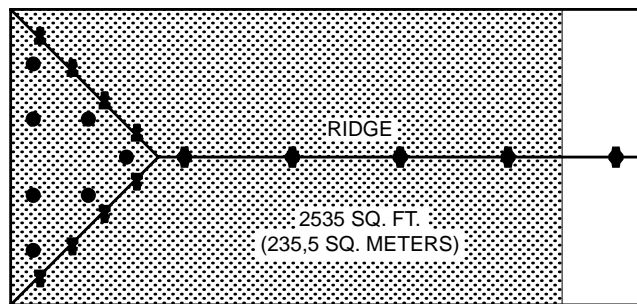
DRY SYSTEM SHOWN

FIRST CALCULATION



DRY SYSTEM SHOWN

SECOND CALCULATION



DRY SYSTEM SHOWN

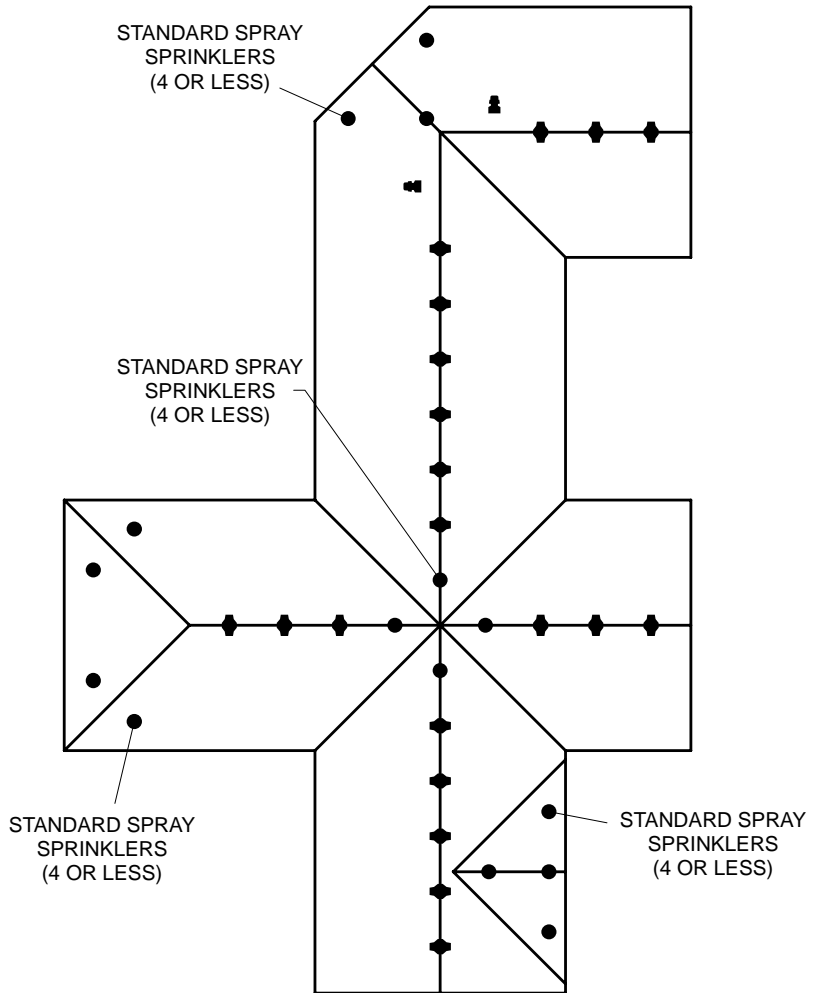
NOTE:

Dry Pipe = 1500 SQ. FT. (NFPA Light Hazard) x 1.3 x 1.3 = 2535 SQ. FT.

**Figure 20-C-5. BB, SD, or HIP Sprinklers & Standard Spray Sprinklers in a Dormer, at a Cross, at a Hip, or at an Ell**

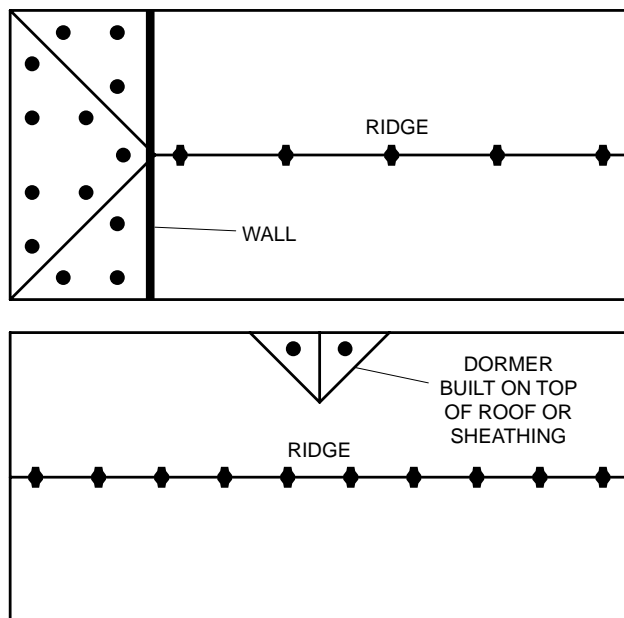
Where the quantity of standard spray sprinklers in each dormer, cross, or ell is four or less (see adjacent figure) and all of the dormers, crosses and ells meet the maximum four standard sprinkler criteria, calculate the Attic Sprinkler demand as described in Part A-1 thru A-6 or Part B-1 thru B-4, plus up to two of the most demanding standard spray sprinklers in the dormer, cross, or ell that is adjacent to the Attic Sprinklers that are being included in the demand calculation.

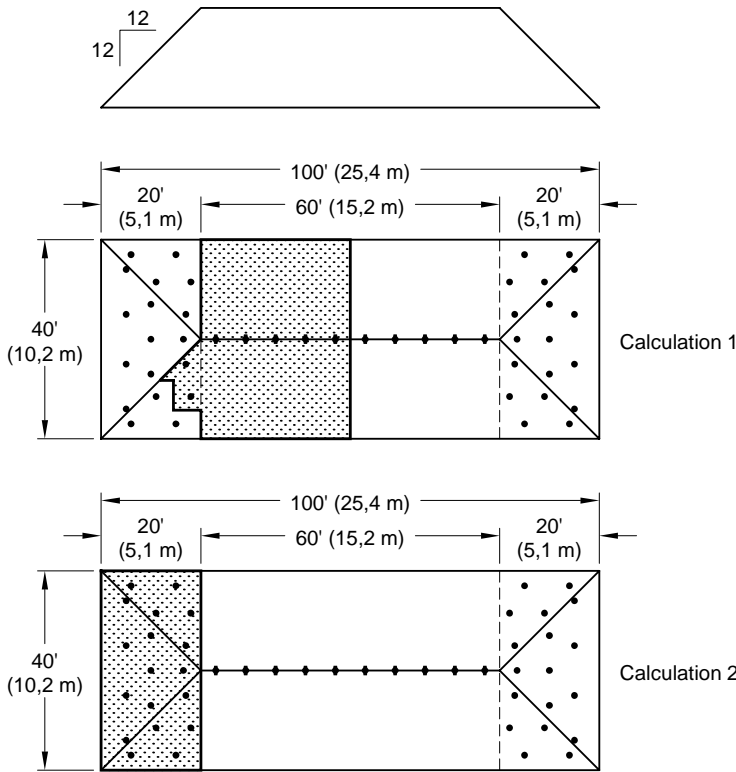
Where the quantity of standard spray sprinklers in any dormer, cross, or ell is greater than four, refer to Figure C-3.



**Figure 20-C-6. BB, SD, or HIP Sprinklers & Standard Sprinklers Separated By Compartmentalization**

Calculate the Attic Sprinkler demand as described in Part A-1 thru A-6 or Part C-1 thru C-4, and then calculate the Standard Spray Sprinklers per NFPA 13. Use the most demanding calculation (see adjacent figure).





**MODEL AP SPRINKLERS**

**WET PIPE SYSTEM**

(Ref. Figure 20-B-3)

**Calculation 1:**

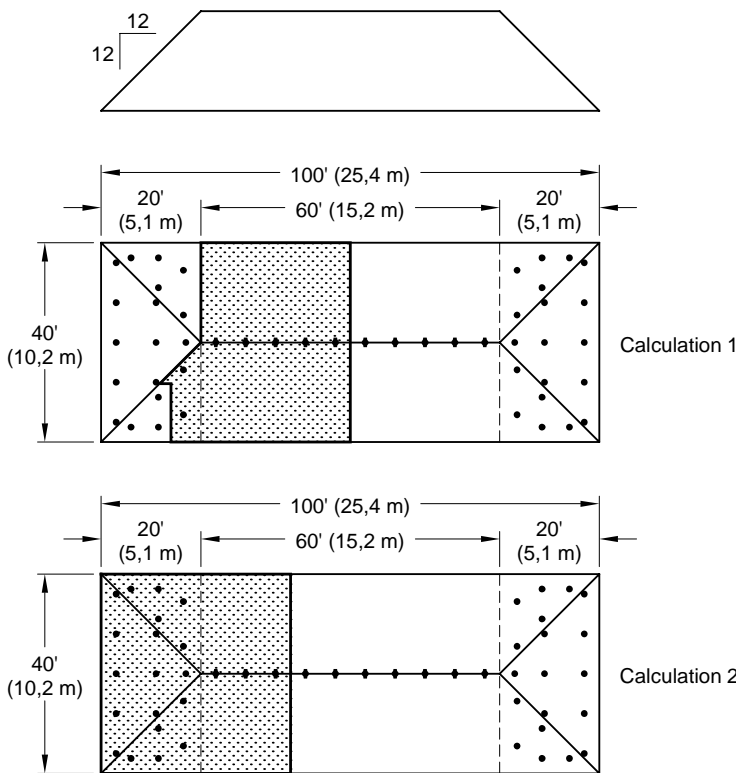
Calculate the most demanding five BB Sprinklers plus the two most demanding AP Sprinklers.

**Calculation 2:**

Calculate the most demanding area up to 1500 ft<sup>2</sup> having AP Sprinklers. In this case the design area will be 800 ft<sup>2</sup> (40 ft. x 20 ft.).

Use the most demanding calculation (i.e., for proving the adequacy of the water supply).

Where AP Sprinklers are utilized, CPVC pipe may be used to supply the AP Sprinklers, as well as the ceiling sprinklers below the AP Sprinklers (See Page 6).



**STANDARD SPRAY SPRINKLERS**

**WET PIPE SYSTEM**

(Ref. Figure 20-C-3)

**Calculation 1:**

Calculate the most demanding five BB Sprinklers plus the two most demanding Standard Spray Sprinklers.

**Calculation 2:**

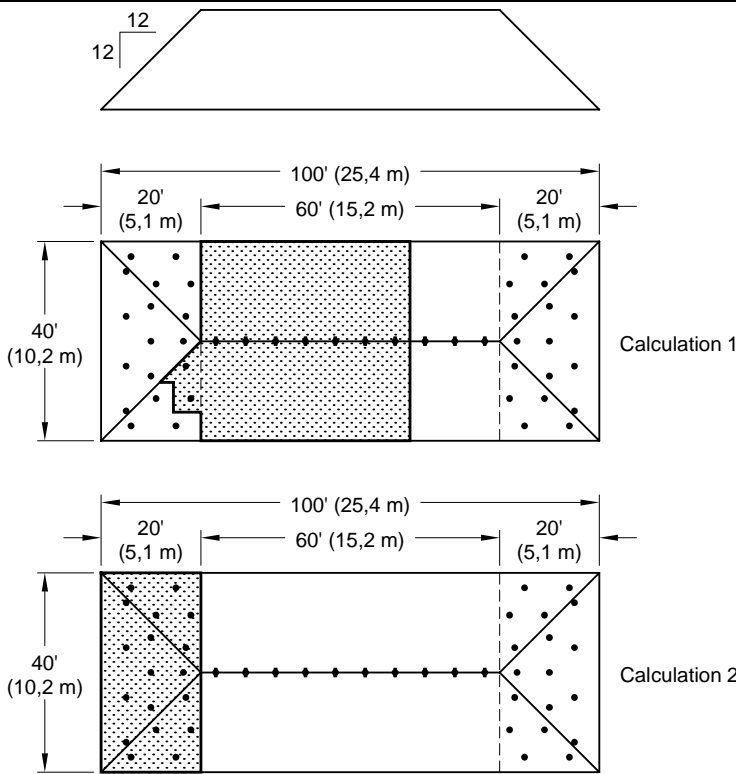
Calculate the most demanding remote design area (Including all sprinklers types) per NFPA 13 (i.e., area reduction for quick response & 30% increase for sloped ceilings). In this case the theoretical design area is 1463 ft<sup>2</sup> (1500 ft<sup>2</sup> x 0.75\* x 1.3). The actual design area, however, will need to be 1520 ft<sup>2</sup> to pick up the entire coverage area of the last BB Sprinkler.

Use the most demanding calculation (i.e., for proving the adequacy of the water supply).

Where Standard Sprinklers are utilized, CPVC pipe CANNOT be used to supply the Standard Spray Sprinklers or the ceiling sprinklers below the Standard Spray Sprinklers.

\* A 25% reduction for 20 ft. ceiling.

**FIGURE 21**  
**EXAMPLE FOR A WET PIPE SYSTEM HYDRAULIC DESIGN AREA COMPARISON**  
**OF MODEL AP SPRINKLERS VERSES STANDARD SPRAY SPRINKLERS**  
**WHERE MODEL AP OR STANDARD SPRAY SPRINKLERS ARE USED IN HIP AREAS**  
**OUTSIDE THE SCOPE OF APPLICATION FOR MODEL BB BACK-TO-BACK SPRINKLERS**



**MODEL AP SPRINKLERS**

**DRY PIPE SYSTEM**

(Ref. Figure 20-B-3)

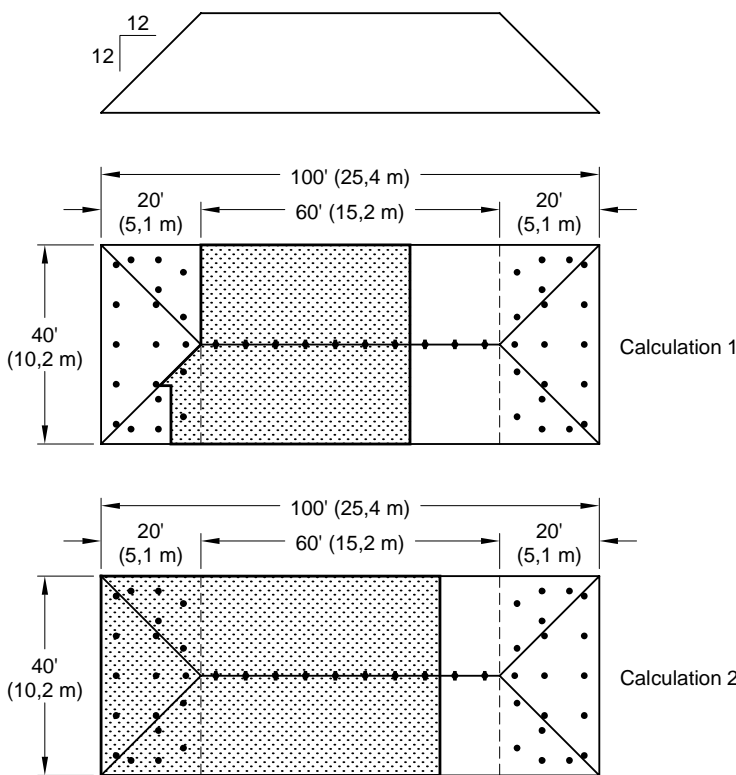
**Calculation 1:**

Calculate the most demanding seven BB Sprinklers plus the two most demanding AP Sprinklers.

**Calculation 2:**

Calculate the most demanding area up to 1950 ft<sup>2</sup> having AP Sprinklers. In this case the design area will be 800 ft<sup>2</sup> (40 ft. x 20 ft.)

Use the most demanding calculation (i.e., for proving the adequacy of the water supply).



**STANDARD SPRAY SPRINKLERS**

**DRY PIPE SYSTEM**

(Ref. Figure 20-C-3)

**Calculation 1:**

Calculate the most demanding seven BB Sprinklers plus the two most demanding Standard Spray Sprinklers.

**Calculation 2:**

Calculate the most demanding remote design area (Including all sprinklers types) per NFPA 13 (i.e., 30% increase for sloped ceilings & 30% increase for dry systems). In this case the theoretical design area will be 2535 ft<sup>2</sup> (1500 ft<sup>2</sup> x 1.3 x 1.3). The actual design area, however, will need to be 2720 ft<sup>2</sup> to pick up the entire coverage area of the last BB Sprinkler.

Use the most demanding calculation (i.e., for proving the adequacy of the water supply).

**FIGURE 22**  
**EXAMPLE FOR A DRY PIPE SYSTEM HYDRAULIC DESIGN AREA COMPARISON**  
**OF MODEL AP SPRINKLERS VERSES STANDARD SPRAY SPRINKLERS**  
**WHERE MODEL AP OR STANDARD SPRAY SPRINKLERS ARE USED IN HIP AREAS**  
**OUTSIDE THE SCOPE OF APPLICATION FOR MODEL BB BACK-TO-BACK SPRINKLERS**