

Reliable®

Model KFR-CCS K5.6 (80 metric) Combustible Concealed Space Upright Sprinkler (SIN RA4454)

Features

1. cULus Listed for areas of coverage up to 256 square feet.
2. 1,000 ft² (92.9 m²) hydraulic design area for wet-pipe and most dry-pipe systems.
3. Sprinkler may be installed on the same branch line that supplies sprinklers below ceiling.
4. Nominal K-factor of 5.6 (80 metric).
5. Fusible link operating element.
6. Quick Response Sprinkler.
7. 212°F (100°C) Temperature Rating

Product Description

Reliable's Model KFR-CCS Combustible Concealed Space Sprinkler is a quick response, upright, specific-application sprinkler designed to provide protection of specific light hazard combustible and noncombustible concealed spaces requiring sprinkler protection. The KFR-CCS sprinkler is specifically listed for the protection of combustible concealed spaces described in NFPA 13 (2016) section 8.15.1.6.

The Model KFR-CCS Sprinkler utilizes a fast response solder-link fusible element. It has demonstrated response times in laboratory tests which are five to ten times faster than standard response sprinklers. This feature enables the sprinkler to apply water to a fire much faster than standard sprinklers of the same temperature rating.

Application

The Model KFR-CCS Sprinkler is designed for installation into:

- A. CPVC Pipe** – Wet Sprinkler Systems
- B. Steel Pipe – Wet or Dry Sprinkler Systems

**The Model KFR-CCS Sprinkler is UL Listed for use with UL Listed CPVC Pipe and UL Listed CPVC Fittings.

The allowable system construction types include:

- Wood truss and wood bar joist
- Noncombustible insulation-filled solid or composite wood joist
- Exposed solid wood joist; maximum 12 in. (305mm) depth (steel pipe only)
- Obstructed wood truss; top chord greater than 4 in. (102 mm) depth (steel pipe only)



Model KFR-CCS

The performance of the Model KFR-CCS Sprinkler in combustible concealed spaces was clearly evident during the full scale fire testing of this product.

Concealed spaces between floors, as well as low pitch attics (slope of 2:12 or less) are inherently shallow. Standard spray sprinklers, by design, have an umbrella-like spray pattern that poses a difficult challenge when trying to achieve effective coverage within a shallow space. The Model KFR-CCS Sprinkler addresses the difficult "above ceiling" fire challenge for both wet pipe and dry pipe sprinkler systems.

WARNING

Model KFR-CCS Combustible Concealed Sprinklers 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 (NFPA), in addition to the standards of any other authorities having jurisdiction. **Failure to do so may impair the performance of these devices.** The property 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.

Design Specifications

A. CPVC Pipe Sprinkler Systems (Refer to Figs. 2 & 3)

The Model KFR-CCS Sprinkler is designed to be installed into CPVC pipe sprinkler systems. It is listed to provide fire sprinkler protection of combustible concealed areas where the construction methods consist of:

1. Wood trusses or wood bar joist (Refer to Fig. 2)
2. Noncombustible insulation-filled solid wood or composite wood joists** (Refer to Fig. 3)

Technical Data

Sprinkler Identification Number (SIN)	Discharge Coefficient (K factor)		Response	Thread size	Max. Working Pressure		Min. Working Pressure		Temperature Rating		Fusible Element Color	Finish	Approvals
	English	Metric			English	Metric	English	Metric	English	Metric			
RA4454	5.6	80	Quick Response	½ NPT	175psi	12bar	7psi	0.48 bar	212°F	100°C	Green	Bronze	cULus Listed*

*cULus Listing applies only for the installations and conditions indicated in the "Design Specifications" Section of this bulletin.

Material Data (Refer to Fig. 1):

Frame	Deflector	Load Screw	Cup	Sealing Washer	Strut	Lever	Fusible Element	Ejection Spring
Brass	Brass	Brass	Bronze	Nickel Alloy coated with PTFE Adhesive Tape	Stainless Steel	Stainless Steel	Nickel Alloy	Stainless Steel

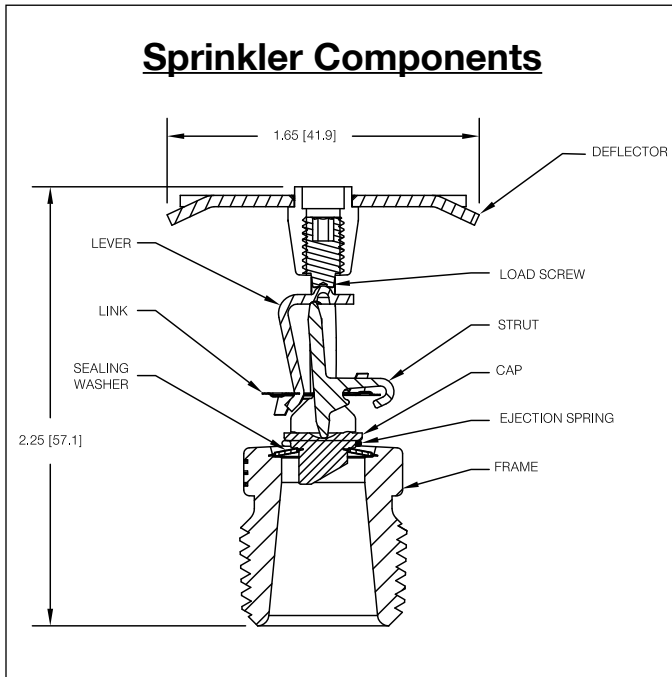


Fig. 1

****Note:** In order to be considered "noncombustible insulation-filled, solidwood or composite wood joists" construction, the insulation (including insulation provided with a combustible vapor barrier), must completely fill the pockets between the joists to the bottom of the joists. Insulation installed above the elevation of Model KFR-CCS sprinklers in wood truss, solid wood joist or composite wood joist must be secured into place with metal wire netting. The metal wire netting is intended to hold the insulation in place should the insulation become wet by the operation of Model KFR-CCS Sprinklers in the event of a fire.

In order to use the CPVC pipe and fittings, the horizontal runs of pipe must be a maximum of 6 in. (152 mm) above the ceiling or noncombustible ceiling insulation, or 1/3 the depth of concealed space (as measured from the top surface of the ceiling to the bottom of the deck above), whichever is smaller (Refer to Figs. 2 & 3).

The CPVC piping can then be used to supply the Model KFR-CCS Sprinklers, as well as the sprinklers installed below the ceiling. Unless modified by this technical data sheet, all other guidelines provided by the CPVC pipe and fittings manufactures must be followed.

When using 1 in. (DN25) or larger pipe, a hanger must be located at the truss nearest a sprig for purposes of restraint. If using 3/4 in. (DN19) piping, all sprigs over 12 in. (305 mm) must be laterally braced using methods described in the NFPA standards. Where the CPVC must be offset up and over an obstruction and the pipe exceeds the allowed horizontal positioning requirements specified above as well as shown in Figs. 2 and 3, additional Model KFR-CCS Sprinklers are to be installed to protect the CPVC products. A minimum lateral distance of 18 in. (457 mm) must be maintained between the CPVC pipe and heat pumps, fan motors, and heat lamps.

Concealed Space Area:

The area of the concealed space is not limited; however, for both Figs. 2 and Fig. 3 where CPVC pipe is being utilized, draft-curtains or full height walls must be provided at 1,000 ft² (93 m²) areas. This draft curtain shall be at least 1/3 the depth of the concealed space or 8 in. (203 mm), whichever is greater, and be constructed using a material that will not allow heat to escape through or above the draft curtain.

Concealed Space Size:

The Model KFR-CCS sprinkler is specifically listed for use in horizontal combustible concealed spaces with a slope not exceeding 2 in 12 with combustible wood truss, wood joist construction, or bar joist construction having a combustible upper surface and where the depth of the space is less than 36 in (914 mm) from deck to deck, from deck to ceiling, or with double wood joist construction with a maximum of 36 in. (914mm) between the top of the bottom joist and the bottom of the upper joist. NFPA 13 permits the use of the Model KFR-CCS sprinkler (a) where the space is less than 12 in (305 mm) from deck to deck or deck to ceiling, and/or (b) where a portion of the protected space exceeds 36 in. (900 mm).

System Type:

Light hazard, wet pipe system.

Minimum Installation Distance (Spacing) Between Sprinklers:

6 ft. (1.83 m)

(Note: This minimum spacing does not apply to any additional sprinklers that are required for protection of CPVC piping that is offset over an obstruction)

Maximum Distance (Spacing) Between Sprinklers:

14 ft. (4.27 m) for concealed spaces that are less than 18" (457 mm) in depth.

16 ft. (4.88 m) for concealed spaces that are 18" (457 mm) or more in depth

Maximum Coverage Area Per Sprinkler:

196 ft² (18.2 m²) for concealed spaces are less than 18 in (457 mm) in depth.

256 ft² (23.8 m²) for concealed spaces constructed that are 18" (457 mm) or more in depth.

Note: Sprinkler spacing is determined by the depth of the concealed space at the location of the installation.

When transitions occur in the concealed space, the sprinklers may immediately be spaced at the largest approved coverage area per the listing for the concealed space depth (Refer to Fig. 8)

Deflector Position:

At or below the bottom of the top chord; 1.5 in. (38 mm) minimum to 4 in. (102mm) maximum below upper deck (or insulation if present) for wood truss construction or wood bar joist construction (Fig. 2).

1.5 in. (38 mm) minimum to 4 in. (102mm) maximum below bottom of insulation for noncombustible insulation-filled solid or composite joist construction (Fig. 3).

Minimum Distance Away From Face of Wood Truss or Top Chord of Bar Joist

4.5 in. (114 mm) (Refer to Fig. 2)

Remote Area:

1,000 ft² (92.90 m²)

(Note: Additional sprinklers that are required for protection of CPVC piping that is offset over an obstruction do not need to be included in the remote area.)

Required Density:

0.10 gpm/ft² (4.08 Lpm/m²)

Minimum Operating Pressure:

7 psi (0.48 bar)

Obstruction Rules:

All obstruction criteria per the applicable version of NFPA 13 apply, unless modified by this Bulletin (Refer to Fig. 7). The KFR-CCS is classified as an Extended Coverage Upright Spray Sprinkler when installed in locations where the maximum coverage area per sprinkler exceeds 225 ft² (20.9 m²). The KFR-CCS is classified as a Standard Upright Spray Sprinkler when installed in locations where the maximum coverage area per sprinkler is 225 ft² (20.9 m²) or less.

B. Steel Pipe Systems (Refer to Figs. 4, 5, 6, & 7)

The Model KFR-CCS Sprinkler is designed to be installed into steel pipe sprinkler systems. It is listed to provide fire sprinkler protection of combustible concealed areas where the construction methods consist of:

1. Wood trusses or wood bar joists (Refer to Fig. 4)
2. Solid wood joist construction where the upper ceiling joists may have a maximum depth of 12 in. (305 mm). (Refer to Fig. 5).
3. Noncombustible insulation-filled, solid wood or

composite wood joists** (Refer to Fig. 6)

4. Obstructed wood trusses; top chord more than 4" deep (Refer to Fig. 7).

****Note:** In order to be considered "noncombustible insulation-filled, solid wood or composite wood joists" construction, the insulation (including insulation provided with a combustible vapor barrier), must completely fill the pockets between the joists to the bottom of the joists. Insulation installed above the elevation of Model KFR-CCS sprinklers in wood truss, solidwood joist or composite wood joist must be secured into place with metal wire netting. The metal wire netting is intended to hold the insulation in place should the insulation become wet by the operation of Model KFR-CCS Sprinklers in the event of a fire.

Concealed Space Area:

The area of the concealed space is not limited; however, for wood truss construction or concealed spaces of non-combustible bar joist construction (Refer to Fig. 4) draft-curtains or full height walls must be provided at 1,000 ft² (93 m²) areas. This draft curtain shall be at least 1/3 the depth of the concealed space or 8 in. (203 mm), whichever is greater, and be constructed using a material that will not allow heat to escape through or above the draft curtain.

For solid wood joist construction (Refer to Fig. 5) and obstructed wood truss construction (Refer to Fig. 7), blocking must be provide in each upper deck and ceiling joist channel at a maximum 32 ft. (9.75 m) intervals. This blocking shall be installed to the full depth of the joist and be installed so as to not allow heat to escape through or above the blocking. The blocking must be constructed using a noncombustible material. Draft curtains must be protrude below the joist a minimum of 6 in. (152 mm) or 1/3 the space, whichever is greatest and run parallel with the joist spaced at 31 ft. (9.45 m) width maximum to limit the area to a maximum of 1,000 ft² (93 m²). The draft curtain may be constructed of ¼ in. (6.4 m) plywood to prevent heat from escaping beyond the area.

For noncombustible insulation-filled, solid wood joist or composite wood joist construction (Refer to Fig. 6), the requirement for draft curtains or blocking does not apply.

Concealed Space Size:

The Model KFR-CCS sprinkler is specifically listed for use in horizontal combustible concealed spaces with a slope not exceeding 2 in 12 with combustible wood truss, wood joist construction, or bar joist construction having a combustible upper surface and where the depth of the space is less than 36 in (914 mm) from deck to deck, from deck to ceiling, or with double wood joist construction with a maximum of 36 in. (914 m) between the top of the bottom joist and bottom of the upper joist. NFPA 13 permits the use of the Model KFR-CCS sprinkler (a) where the space is less than 12 in (305 mm) from deck to deck or deck to ceiling, and/or (b) where a portion of the protected space exceeds 36 in. (914 mm).

System Type:

Light hazard, wet or dry pipe system.

Minimum Installation Distance (Spacing) Between Sprinklers:

6 ft. (1.83 m)

Maximum Distance (Spacing) Between Sprinklers:

14 ft. (4.27 m) for concealed spaces that are less than 18" (457 mm) in depth.

16 ft. (4.88 m) for concealed spaces that are 18" (0.46 m) or more in depth

Maximum Coverage Area Per Sprinkler:

196 ft² (18.2 m²) for concealed spaces are less than 18 in (457 mm) in depth.

256 ft² (23.8 m²) for concealed spaces constructed that are 18" (457 mm) or more in depth.

Note: Sprinkler spacing is determined by the depth of the concealed space at the location of the installation. When transitions occur in the concealed space, the sprinklers may immediately be spaced at the largest approved coverage area per the listing for the concealed space depth (Refer to Fig. 8)

Deflector Position:

At or below the bottom of the top chord; 1.5 in. (38 mm) minimum to 4 in. (102mm) maximum below upper deck (or insulation if present) for wood truss construction or wood bar joist construction (Fig. 4).

1.5 in. (38 mm) minimum to 2 in. (51 mm) maximum below the bottom of the upper joist for concealed spaces constructed of exposed solid wood joists (Fig 5).

1.5 in. (38 mm) minimum to 4 in. (102mm) maximum below bottom of insulation for noncombustible insulation-filled solid or composite joist construction (Fig. 6).

1.5 in. (38 mm) minimum to 2 in. (51 mm) maximum below the bottom of the top chord for spaces constructed of obstructed wood trusses (Fig. 7).

Minimum Distance Away From Face of Wood Truss or Top Chord of Bar Joist

4.5 in. (114 mm) (Refer to Fig. 4)

Remote Area:

The remote area for wood truss construction, noncombustible bar joist construction (Refer to Fig. 4) and solid wood joist construction (Refer to Fig. 5) is 1,000 ft² (92.90 m²) for wet pipe systems and dry pipe systems.

The remote area for noncombustible insulation-filled solid wood joist or composite wood joist construction is to be calculated per the requirements of the applicable version of NFPA 13 (Refer to Fig. 6).

Required Density:

0.10 gpm/ft² (4.08 Lpm/m²)

Minimum Operating Pressure:

7 psi (0.48 bar)

Obstruction Rules:

All obstruction criteria per the applicable version of NFPA 13 apply, unless modified by this Bulletin (Refer to Fig. 7). The KFR-CCS is classified as an Extended Coverage Upright Spray Sprinkler when installed in locations where the maximum coverage area per sprinkler exceeds 225 ft² (20.9 m²). The KFR-CCS is classified as a Standard Upright Spray Sprinkler when installed in locations where the maximum coverage area per sprinkler is 225 ft² (20.9 m²) or less.

Installation Instructions

Model KFR-CCS Sprinklers are to be installed in the upright position with their frames arms parallel with the pipe's run (Refer to Figs. 2 through 6). When installing the Model KFR-CCS sprinkler use only the Reliable Model W2 installation wrench. Usage of any other type of installation wrench may damage the sprinkler and will immediately void the manufacture's warranty.

Note: A leak tight ½" NPT (R1/2) sprinkler joint can be obtained with an installation torque of approximately 8 -18 ft-lbs (10.8 – 24.4 N-m). Do not tighten sprinklers over these recommended limits. Doing so may cause premature leakage and or operation.

Maintenance

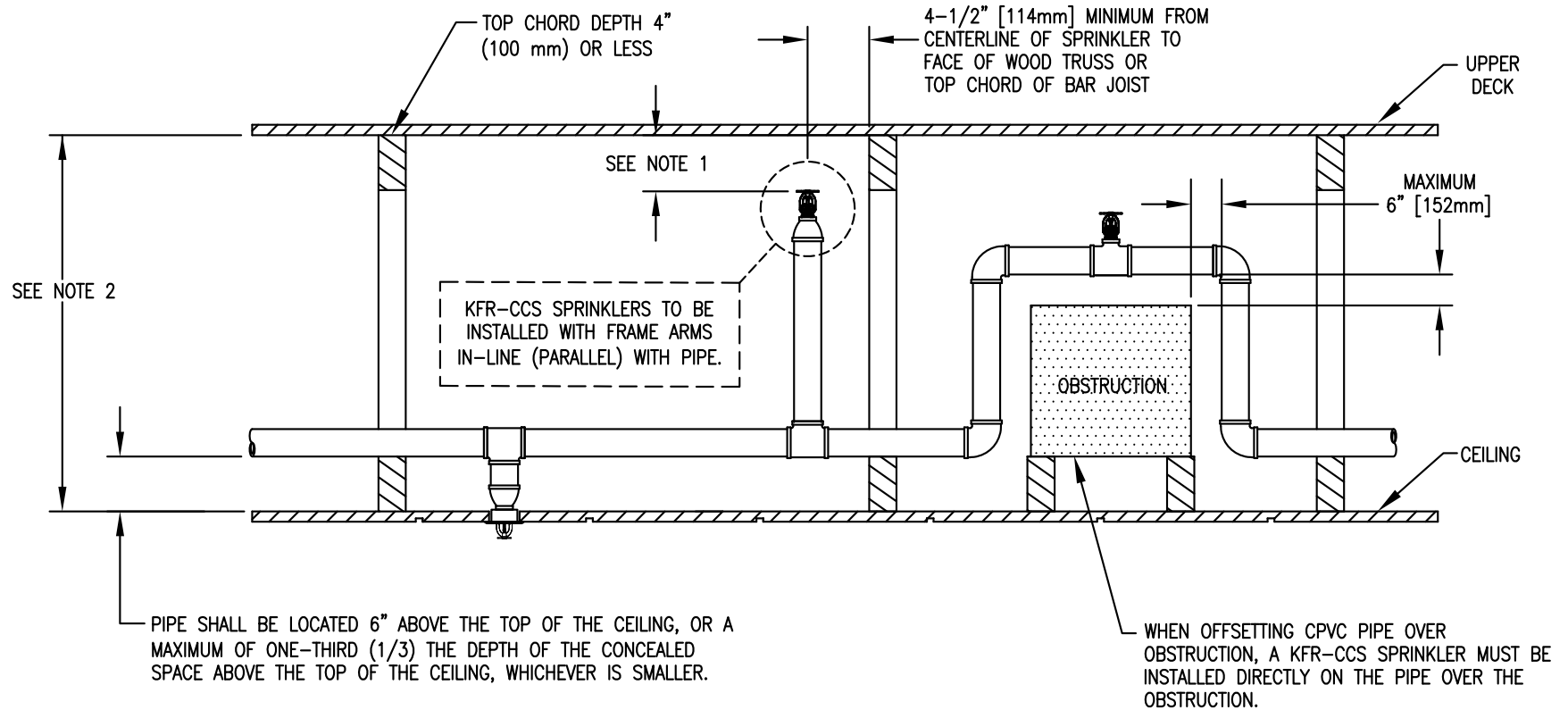
Model KFR-CCS Sprinklers should be inspected and maintained in accordance with the applicable version of NFPA 25. Do not clean sprinklers with soap and water, ammonia or any other cleaning fluids. Remove dust by using a soft brush or gentle vacuuming. Replace any sprinkler which has been painted (other than factory applied) or damaged in any way. A stock of spare sprinklers should be maintained to allow quick replacement of damaged or operated sprinklers. Prior to installation, sprinklers should be maintained in the original cartons and packaging to minimize the potential for damage to sprinklers that would cause improper operation or non-operation.

Guarantee

For Reliable Automatic Sprinkler Co., Inc. guarantee, terms, and conditions, visit www.reliablesprinkler.com.

CPVC PIPE

CONSTRUCTION:
WOOD TRUSS OR WOOD BAR JOIST



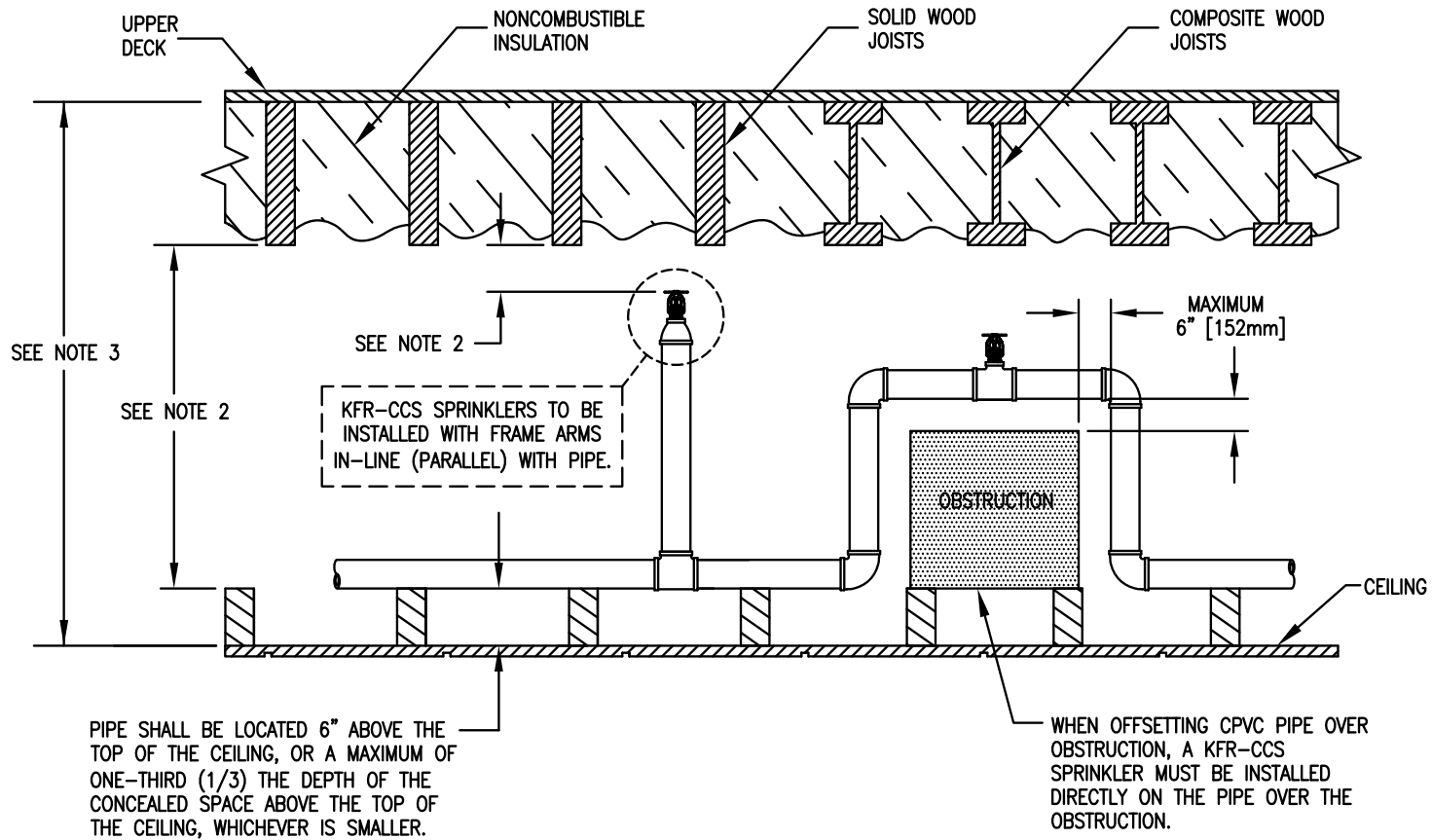
Note 1: Deflector at or below bottom of top chord; 1-1/2" (38 mm) minimum to 4" (102 mm) maximum below bottom of roof deck or insulation.

Note 2: Distance evaluated as part of cULus Listing: 12" to 36" (305 to 914 mm). NFPA 13 permits the installation of these sprinklers in combustible concealed spaces where (a) the distance from deck to deck or deck to ceiling is less than 12" (305 mm) and/or (b) a portion of the protected area exceeds a depth of 36" (914 mm).

Fig. 2

CPVC PIPE

CONSTRUCTION:
NONCOMBUSTIBLE INSULATION FILLED SOLID WOOD OR COMPOSITE WOOD JOIST



Note 1: Deflector distance below bottom of joist/insulation to be 1-1/2" to 4" (38 mm to 102 mm).

Note 2: Distance evaluated as part of cULus Listing: 6" to 36" (152 to 914 mm). NFPA 13 permits the installation of these sprinklers in combustible concealed spaces where a portion of the protected area exceeds a depth of 36" (914 mm).

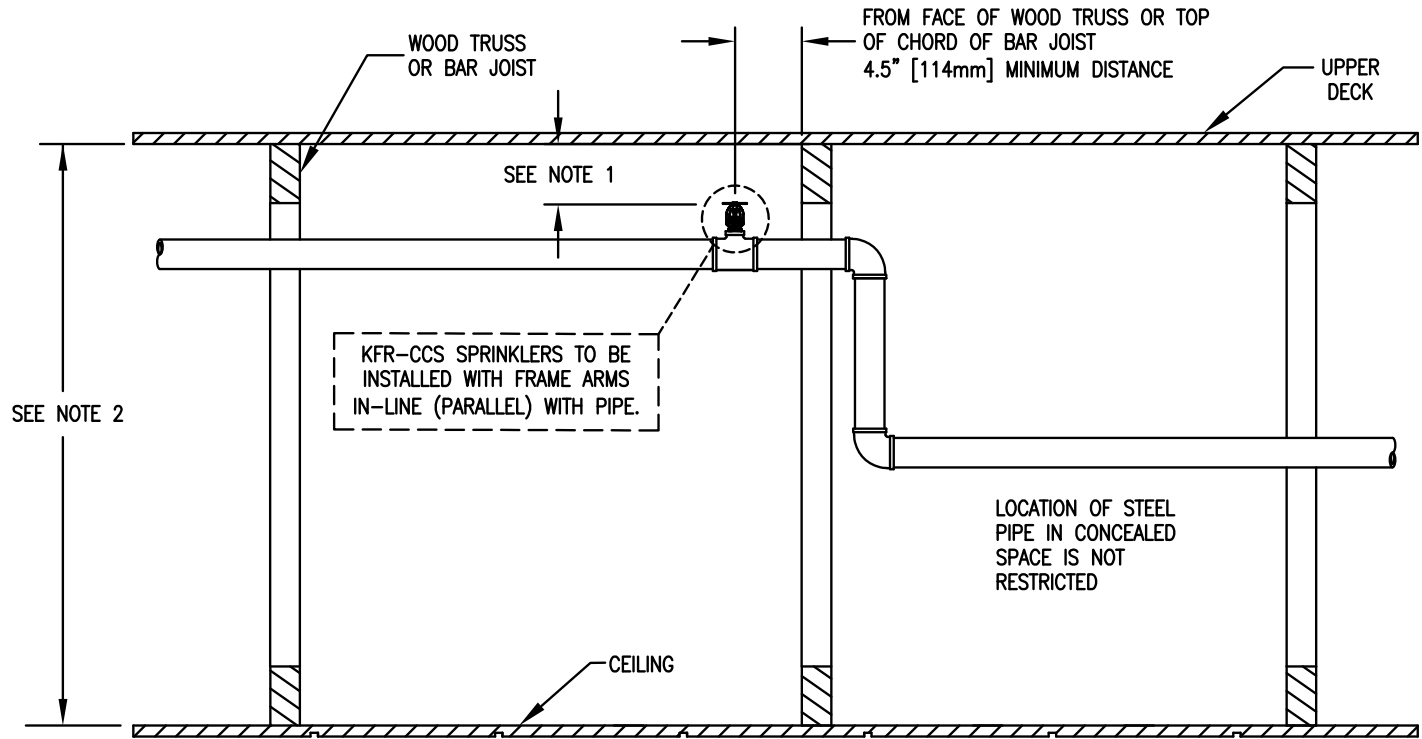
Note 3: Maximum distance evaluated as part of cULus Listing: 60" (1524 mm).

Fig. 3

STEEL PIPE

CONSTRUCTION:

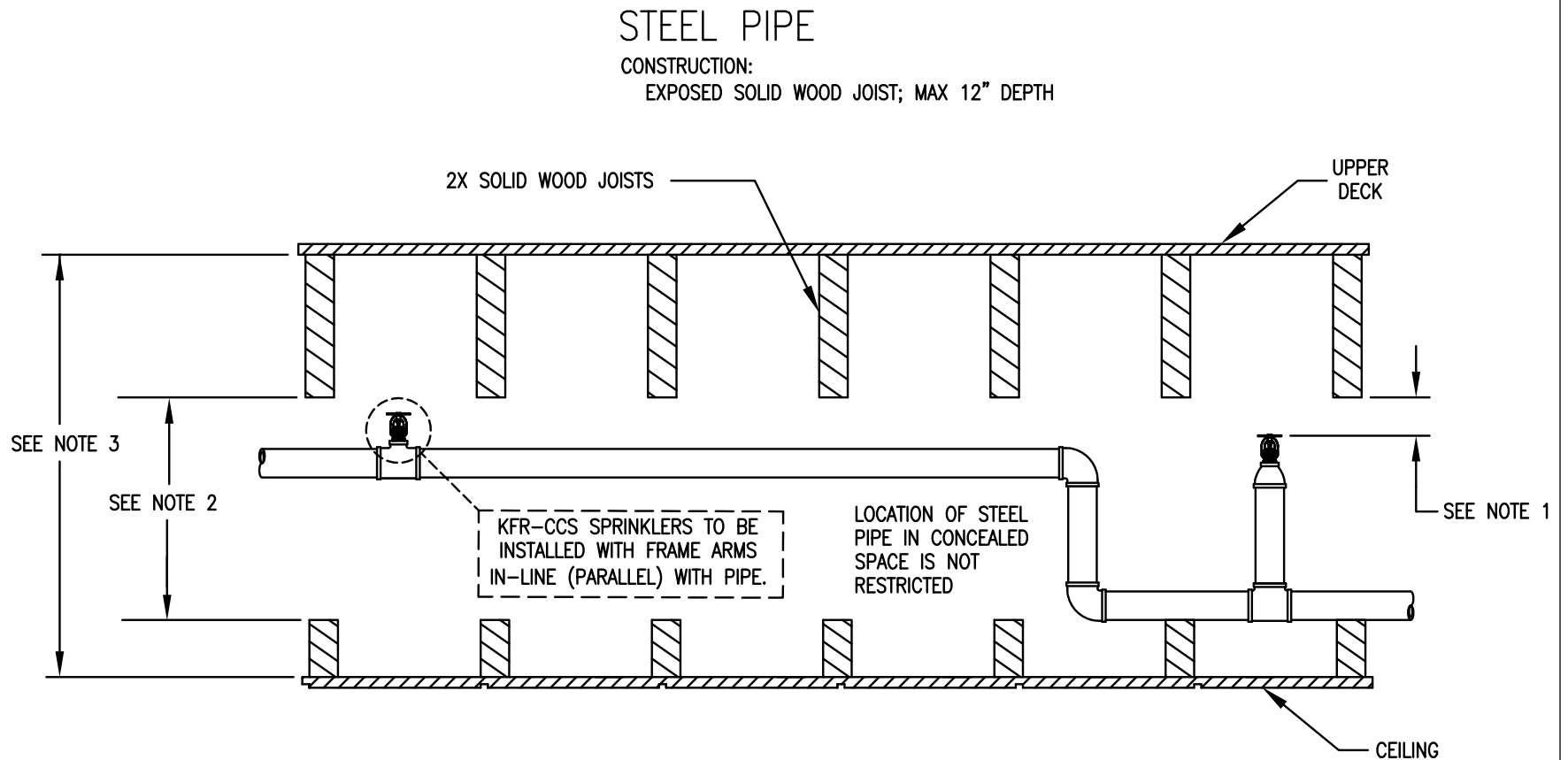
WOOD TRUSS OR WOOD BAR JOIST (TOP CHORD 4" OR LESS IN DEPTH)



Note 1: Deflector at or below the bottom of the top chord; 1-1/2" (38 mm) to 4" (102 mm) below bottom of roof deck or insulation.

Note 2: Distance evaluated as part of cULus Listing: 12" to 36" (305 to 914 mm). NFPA 13 permits the installation of these sprinklers in combustible concealed spaces where (a) the distance from deck to deck or deck to ceiling is less than 12" (305 mm) and/or (b) a portion of the protected area exceeds a depth of 36" (914 mm).

Fig. 4



Note 1: Deflector distance below bottom of joist to be 1-1/2" to 2" (38 mm to 51 mm).

Note 2: Distance evaluated as part of cULus Listing: 6" to 36" (152 to 914 mm). NFPA 13 also permits the installation of these sprinklers in combustible concealed spaces where a portion of the protected area exceeds a depth of 36" (914 mm).

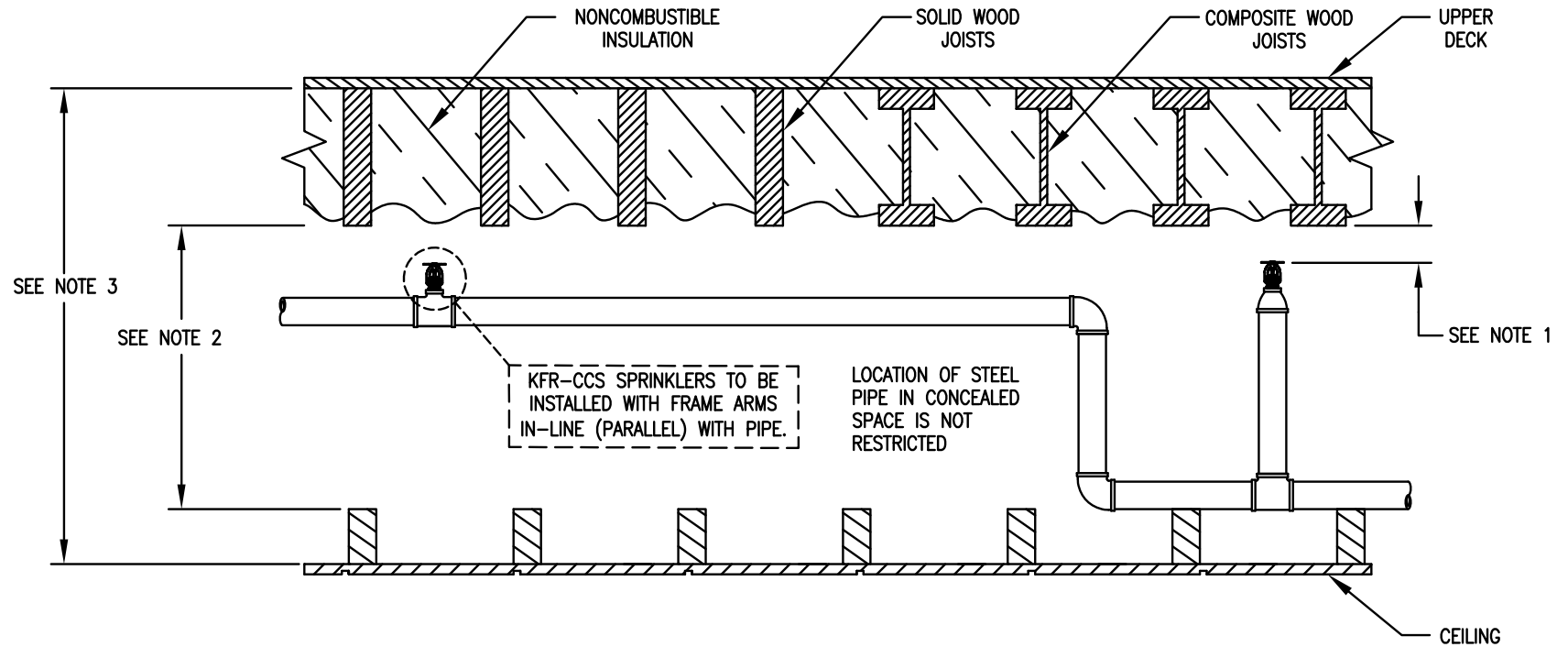
Note 3: Maximum distance evaluated as part of cULus Listing: 60" (1524 mm).

Fig. 5

STEEL PIPE

CONSTRUCTION:

NONCOMBUSTIBLE INSULATION FILLED SOLID WOOD OR COMPOSITE WOOD JOIST

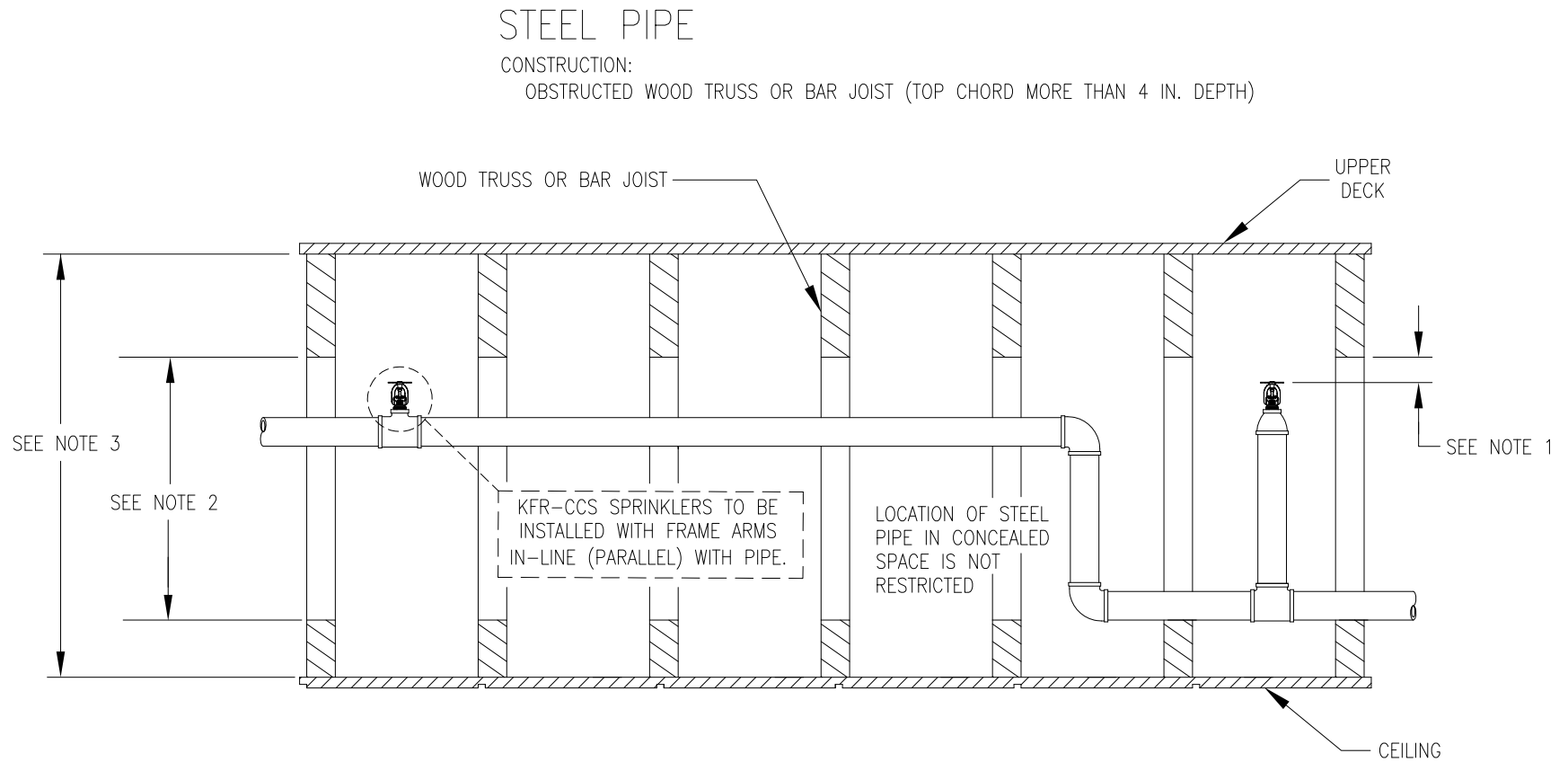


Note 1: Deflector distance below bottom of joist/insulation to be 1-1/2" to 4" (38 mm to 102 mm).

Note 2: Distance evaluated as part of cULus Listing: 6" to 36" (152 to 914 mm). NFPA 13 permits the installation of these sprinklers in combustible concealed spaces where a portion of the protected area exceeds a depth of 36" (914 mm).

Note 3: Maximum distance evaluated as part of cULus Listing: 60" (1524 mm).

Fig. 6



Note 1: Deflector distance below bottom of joist to be 1-1/2" to 2" (38 mm to 51 mm).

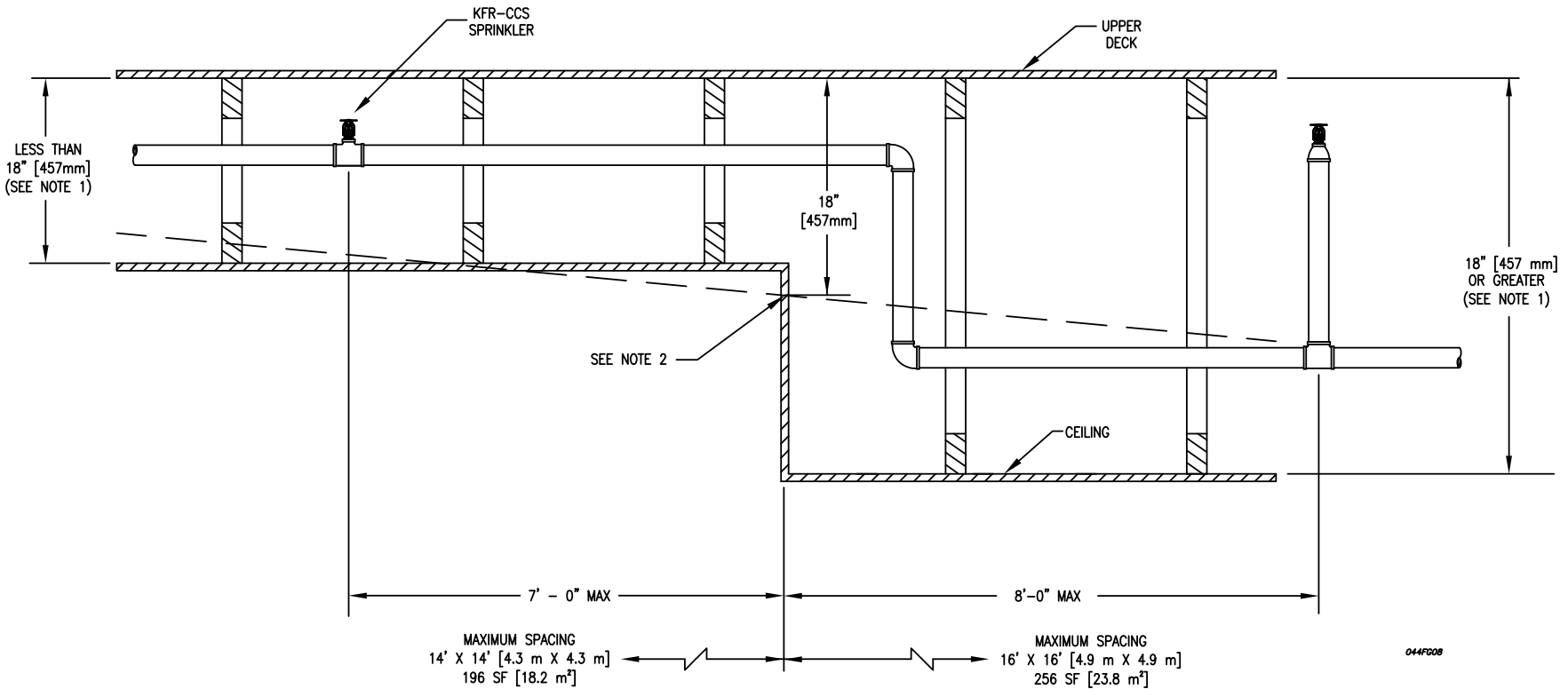
Note 2: Distance evaluated as part of cULus Listing: 6" to 36" (152 to 914 mm). NFPA 13 also permits the installation of these sprinklers in combustible concealed spaces where a portion of the protected area exceeds a depth of 36" (914 mm).

Note 3: Maximum distance evaluated as part of cULus Listing: 60" (1524 mm).

Fig. 7

SPRINKLER SPACING AT CHANGE IN CONCEALED SPACE DEPTH

CONSTRUCTION:
WOOD TRUSS OR WOOD BAR JOIST (SEE NOTE 1)



Note 1: Measuring points for solid wood joist, composite wood joist, and obstructed wood truss or bar joist construction are the bottom of the upper chord and top of the lower chord.
 Note 2: For sloping concealed spaces, break point between sprinkler spacings is the point where the depth of the space equals 18" [457 mm].

Fig. 8

11.

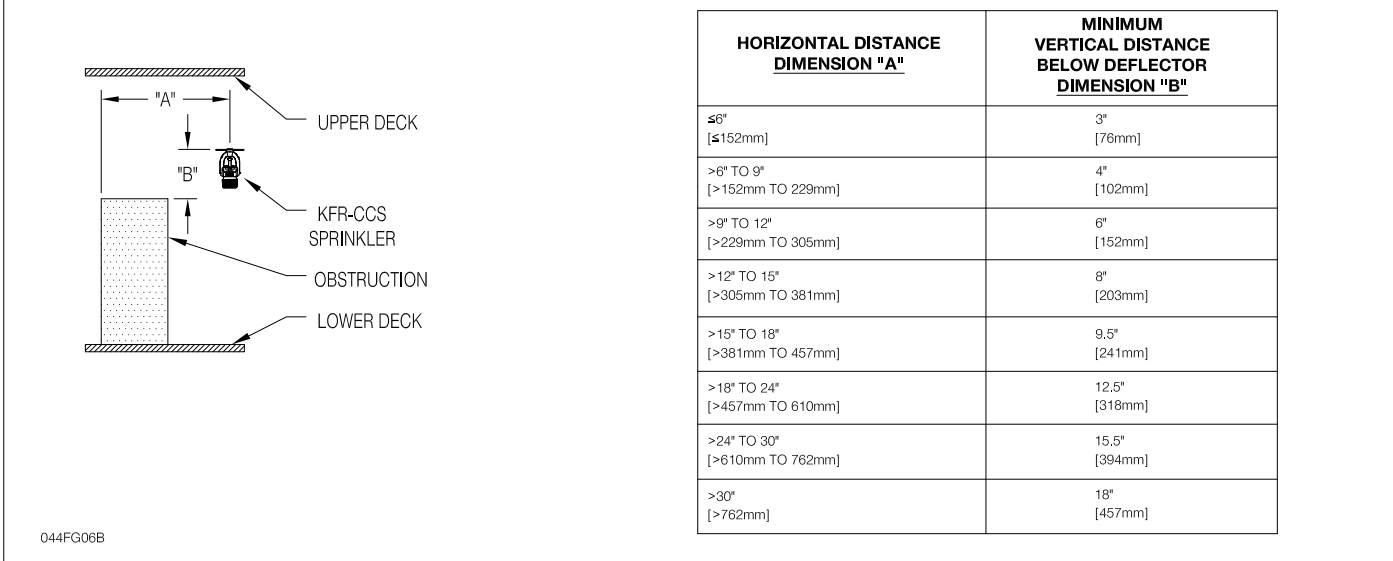
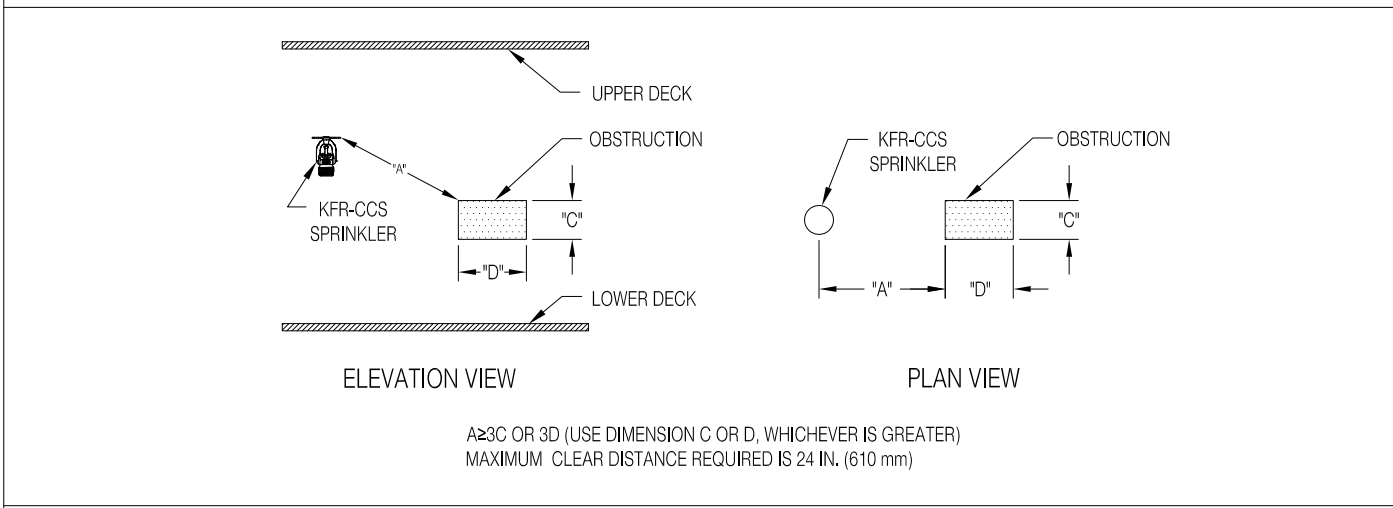
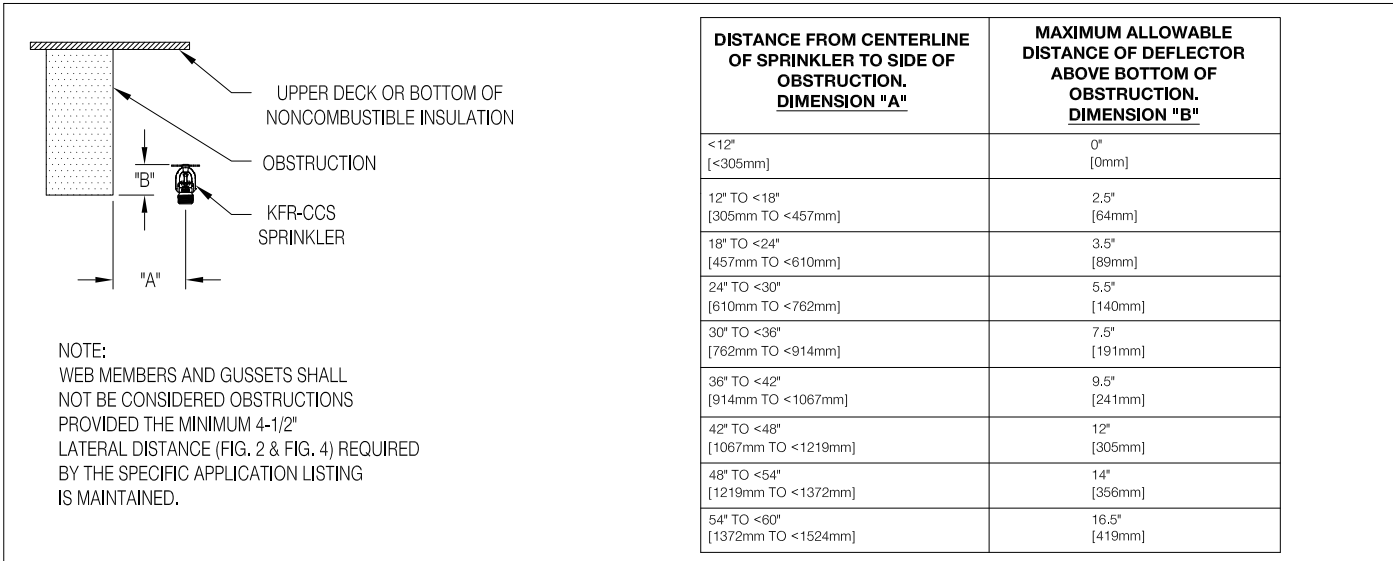


Fig. 9

Reliable...For Complete Protection

Reliable offers a wide selection of sprinkler components. Following are some of the many precision-made Reliable products that guard life and property from fire around the clock.

- Automatic sprinklers
- Flush automatic sprinklers
- Recessed automatic sprinklers
- Concealed automatic sprinklers
- Adjustable automatic sprinklers
- Dry automatic sprinklers
- Intermediate level sprinklers
- Open sprinklers
- Spray nozzles
- Alarm valves
- Retarding chambers
- Dry pipe valves
- Accelerators for dry pipe valves
- Mechanical sprinkler alarms
- Electrical sprinkler alarm switches
- Water flow detectors
- Deluge valves
- Detector check valves
- Check valves
- Electrical system
- Sprinkler emergency cabinets
- Sprinkler wrenches
- Sprinkler escutcheons and guards
- Inspectors test connections
- Sight drains
- Ball drips and drum drips
- Control valve seals
- Air maintenance devices
- Air compressors
- Pressure gauges
- Identification signs
- Fire department connection

The equipment presented in this bulletin is to be installed in accordance with the latest published Standards of the National Fire Protection Association, Factory Mutual Research Corporation, or other similar organizations and also with the provisions of governmental codes or ordinances whenever applicable.

Products manufactured and distributed by Reliable have been protecting life and property for almost 100 years.

Manufactured by

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Reliable Automatic Sprinkler Co., Inc.

(800) 431-1588

(800) 848-6051

(914) 829-2042

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