Reliable®

Model KFR-CCS 56 Combustible Concealed Space Upright Sprinkler Sprinkler Identification Number (SIN): RA4454

Bulletin 044 Rev. A

Features

1. cULus Listed for areas of coverage up to 256 square feet.
2. Six foot minimum installation distance between sprinklers.
3. Sprinkler may be installed on the same branch line that supplies sprinklers below ceiling.
4. Nominal K-factor of 5.6.
5. Quick Response Sprinkler.
6. 212°F (100°C) Temperature Rating
7. ½" NPT Installation Thread

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 non-combustible concealed spaces requiring sprinkler protection. The KFR-CCS sprinkler complies with NFPA 13 criterion for the protection of combustible concealed spaces.

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 (12" to 36" deep)
- Non-Combustible Bar Joist (12" to 36" deep)
- Solid Wood (12" Maximum depth) or Composite Wood Joist (12" maximum depth)
- All systems are limited to an above-sprinkler (ceiling) horizontal slope of 2:12.

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

Model KFR-CCS

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 will provide fire-protection of combustible concealed areas where the construction methods consist of:

1. Wood trusses or non-combustible bar joists (Refer to Fig. 2)
2. Non-combustible, 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 Ratting		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

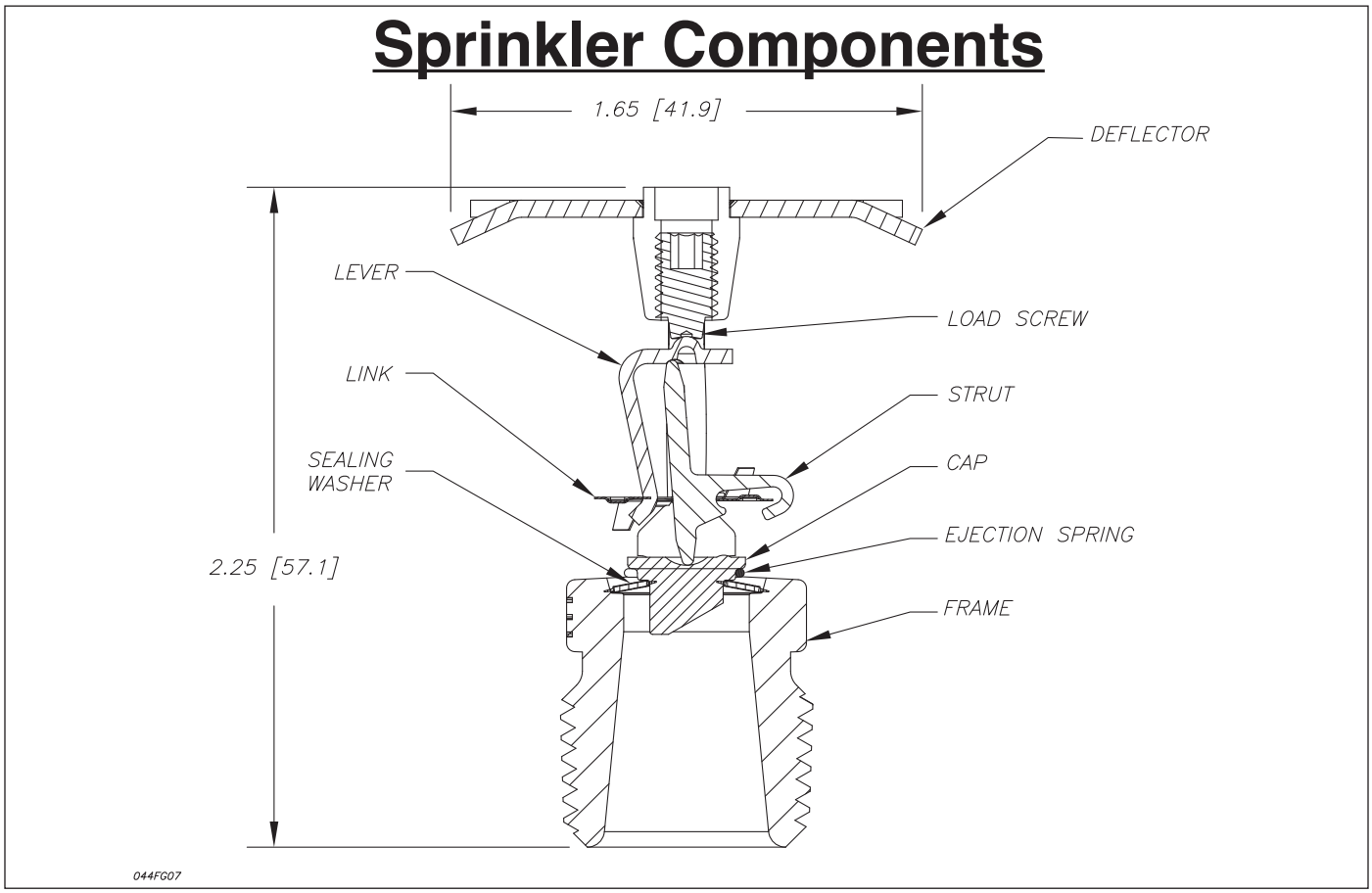


Fig. 1

****Note:** In order to be considered "non-combustible, 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. Also, the insulation 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 (0.15 m) 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 (0.30 m) 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 (0.46 m) 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 ft^2 (93 m^2) areas. This draft curtain shall be at least 1/3 the depth of the concealed space or 8 in (0.2 m), 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 depth of the concealed space is limited to 12 in (0.30 m) minimum and 36 in (0.91 m) maximum.

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 constructed of wood trusses or non-combustible bar joists that are between 12 in (0.30 m) and less than 18 in (0.46 m) in depth.

14 ft (4.27 m) for concealed spaces constructed of solid wood joists or composite wood joists where the concealed space is in between 12 in (0.30 m) and 36 in (0.91 m) in depth.

16 ft (4.88 m) for concealed spaces constructed of wood trusses or non-combustible bar joists that are between 18 in (0.46 m) and to 36 in (0.91 m) in depth.

Maximum Coverage Area Per Sprinkler:
196 ft^2 (18.21 m^2) for concealed spaces constructed of wood trusses or non combustible bar joists that are between 12 in (0.30 m) and less than 18 in (0.46 m) in depth.

196 ft^2 (18.21 m^2) for concealed spaces constructed of solid wood joist or composite wood joist where the concealed space is in between 12 in (0.30 m) and 36 in (0.91 m) in depth.

256 ft^2 (23.78 m^2) for concealed spaces constructed of wood trusses or non-combustible bar joists that are between 18 in (0.46 m) and to 36 in (0.91 m) in 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:
1.5 in (0.04 m) minimum to 4 in (0.10 m) maximum below upper deck or underside of insulation in insulation-filled solid joist and composite joist construction (Refer to Figs. 2 & 3)

Minimum Distance Away From Face of Wood Truss or Top Chord of Bar Joist
4.5 in (0.11 m) (Refer to Fig. 2)

Remote Area:
1,000 ft^2 (92.90 m^2)
(**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/ft^2 (4.08 Lpm/m^2)

Minimum Operating Pressure:

7 psi (0.48 bar)

Obstruction Rules:
All obstruction criteria per the applicable version of NFPA 13 for standard spray sprinklers apply, unless modified by this Technical Data Sheet (Refer to Fig. 7).

B. <u>Steel Pipe Systems (Refer to Figs. 4, 5 & 6)</u>
The Model KFR-CCS Sprinkler is designed to be installed into steel pipe sprinkler systems. It will provide fire-protection of combustible concealed areas where the construction methods consist of:

1. Wood trusses or non-combustible bar joists (Refer to Fig. 4)
2. Solid wood joist construction where the upper deck and ceiling joists may have a maximum depth of 12 in (0.30 m) and typical on-center joist spacing of a minimum of 16 in (0.41 m). (Refer to Fig. 5).
3. Non-combustible, insulation-filled, solid wood or composite wood joists** (Refer to Fig. 6)

****Note:** In order to be considered "non-combustible, 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. Also, the insulation 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 ft^2 (93 m^2) areas. This draft curtain shall be at least 1/3 the depth of the concealed space or 8 in (0.2 m), 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), 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 non-combustible material. Draft curtains must be protrude below the joist a minimum of 6 in (0.15 m) 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 ft^2 (93 m^2). The draft curtain may be constructed of ¼ in (6.4 m) plywood to prevent heat from escaping beyond the area.

For non-combustible, 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:

For wood truss construction or non-combustible bar joist construction the depth of the concealed space is limited to 12 in (0.30 m) minimum and 36 in (0.91 m) maximum (Refer to Fig. 4).

For solid wood joist, non-combustible, insulation-filled solid wood or composite wood joist construction the depth of the concealed space is limited to 6 in (0.15 m) minimum and 36 in (0.91 m) maximum. This distance is measured from the top of the ceiling joists to the bottom of the upper deck joists (Refer to Figs. 5 & 6).

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 constructed of wood trusses or non-combustible bar joists that are between 12 in (0.30 m) and less than 18 in (0.46 m) in depth.

14 ft (4.27 m) for concealed spaces constructed of solid wood joists or composite wood joists where the concealed space is in between 6 in (0.15 m) and 36 in (0.91 m) in depth.

16 ft (4.88 m) for concealed spaces constructed of wood trusses or non-combustible bar joists that are between 18 in (0.46 m) and to 36 in (0.91 m) in depth.

Maximum Coverage Area Per Sprinkler:

196 ft^2 (18.21 m^2) for concealed spaces constructed of wood trusses or non combustible bar joists that are between 12 in (0.30 m) and less than 18 in (0.46 m) in depth.

196 ft^2 (18.21 m^2) for concealed spaces constructed of solid wood joist or composite wood joist where the concealed space is in between 6 in (0.15 m) and 36 in (0.91 m) in depth.

256 ft^2 (23.78 m^2) for concealed spaces constructed of wood trusses or non-combustible bar joists that are between 18 in (0.46 m) and to 36 in (0.91 m) 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:

1.5 in (0.04 m) minimum to 4 in (0.10 m) maximum below the upper deck for concealed spaces constructed of wood trusses or non-combustible bar joists (Fig. 4).

1.5 in (0.04 m) minimum to 2 in (0.05 m) maximum below the bottom of the upper joist for concealed spaces constructed of solid wood joists (Fig. 5).

1.5 in (0.04 m) minimum to 4 in (0.10 m) maximum below the bottom of the upper joist for concealed spaces constructed of non-combustible insulation filled solid wood or composite wood joists (Fig. 6).

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

4.5 in (0.11 m) (Refer to Fig. 4)

Remote Area:

The remote area for wood truss construction, non-combustible bar joist construction (Refer to Fig. 4) and solid wood joist construction (Refer to Fig. 5) is 1,000 ft^2 (92.90 m^2) for wet pipe systems or 1,300 ft^2 (120.77 m^2) for dry pipe systems.

The remote area for non-combustible 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/ft^2 (4.08 Lpm/m^2)

Minimum Operating Pressure:

7 psi (0.48 bar)

Obstruction Rules:

All obstruction criteria per the applicable version of NFPA 13 for standard spray sprinklers apply, unless modified by this Technical Data Sheet (Refer to Fig. 7).

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 D 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. Remove 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.

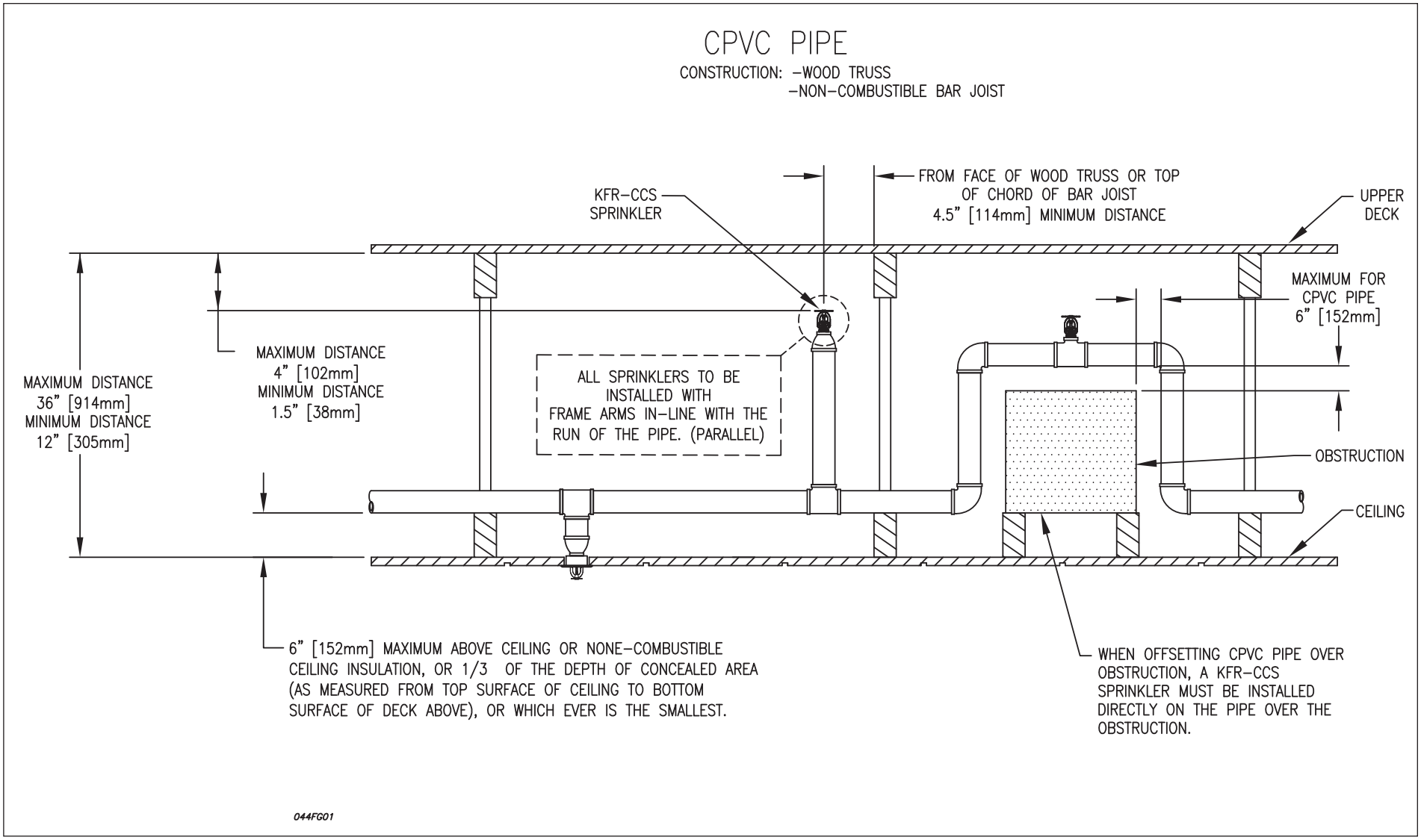

CPVC PIPE
CONSTRUCTION: –WOOD TRUSS
–NON–COMBUSTIBLE BAR JOIST
KFR–CCS SPRINKLER
FROM FACE OF WOOD TRUSS OR TOP OF CHORD OF BAR JOIST 4.5" [114mm] MINIMUM DISTANCE
UPPER DECK
MAXIMUM FOR CPVC PIPE 6" [152mm]
MAXIMUM DISTANCE 36" [914mm] MINIMUM DISTANCE 12" [305mm]
MAXIMUM DISTANCE 4" [102mm] MINIMUM DISTANCE 1.5" [38mm]
ALL SPRINKLERS TO BE INSTALLED WITH FRAME ARMS IN–LINE WITH THE RUN OF THE PIPE. (PARALLEL)
OBSTRUCTION
CEILING
6" [152mm] MAXIMUM ABOVE CEILING OR NONE–COMBUSTIBLE CEILING INSULATION, OR 1/3 OF THE DEPTH OF CONCEALED AREA (AS MEASURED FROM TOP SURFACE OF CEILING TO BOTTOM SURFACE OF DECK ABOVE), OR WHICH EVER IS THE SMALLEST.
WHEN OFFSETTING CPVC PIPE OVER OBSTRUCTION, A KFR–CCS SPRINKLER MUST BE INSTALLED DIRECTLY ON THE PIPE OVER THE OBSTRUCTION.
044FG01

Fig. 2

CPVC PIPE

CONSTRUCTION:
–NONCOMBUSTIBLE INSULATION FILLED UPPER DECK
SOLID WOOD OR COMPOSITE WOOD JOIST CONSTRUCTION

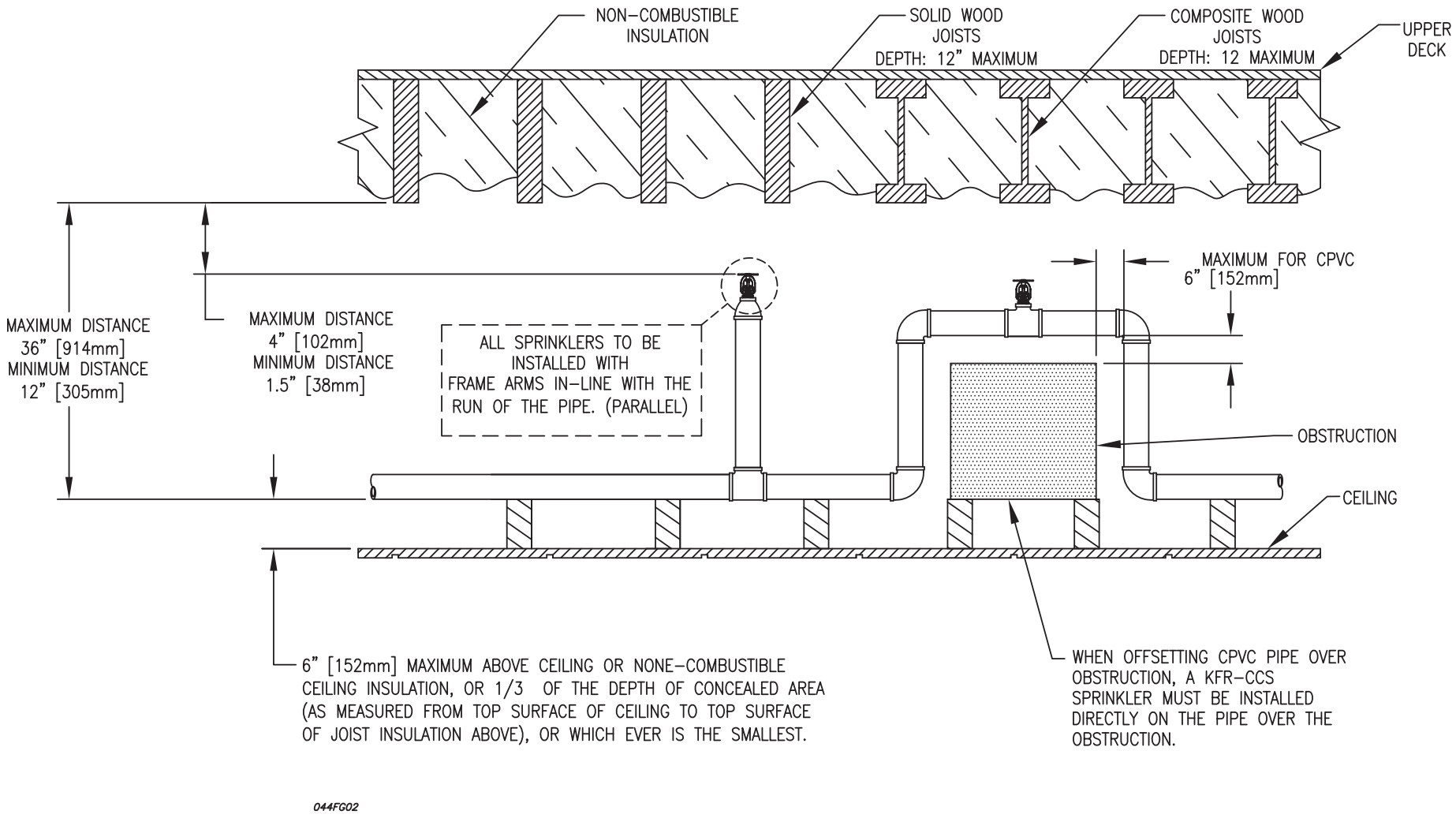


Fig. 3

STEEL PIPE

CONSTRUCTION:
–WOOD TRUSS
–NON COMBUSTIBLE BAR JOIST

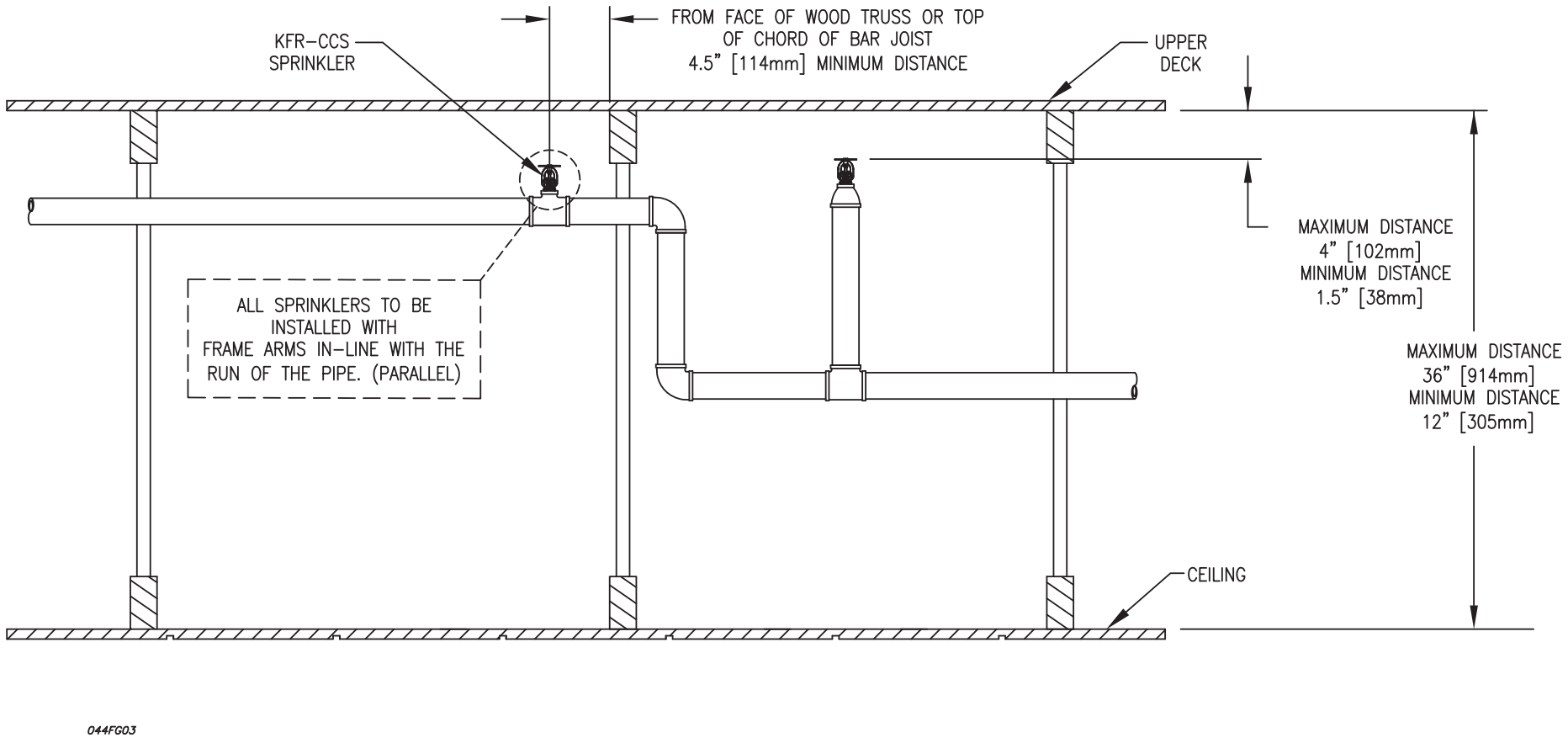


Fig. 4

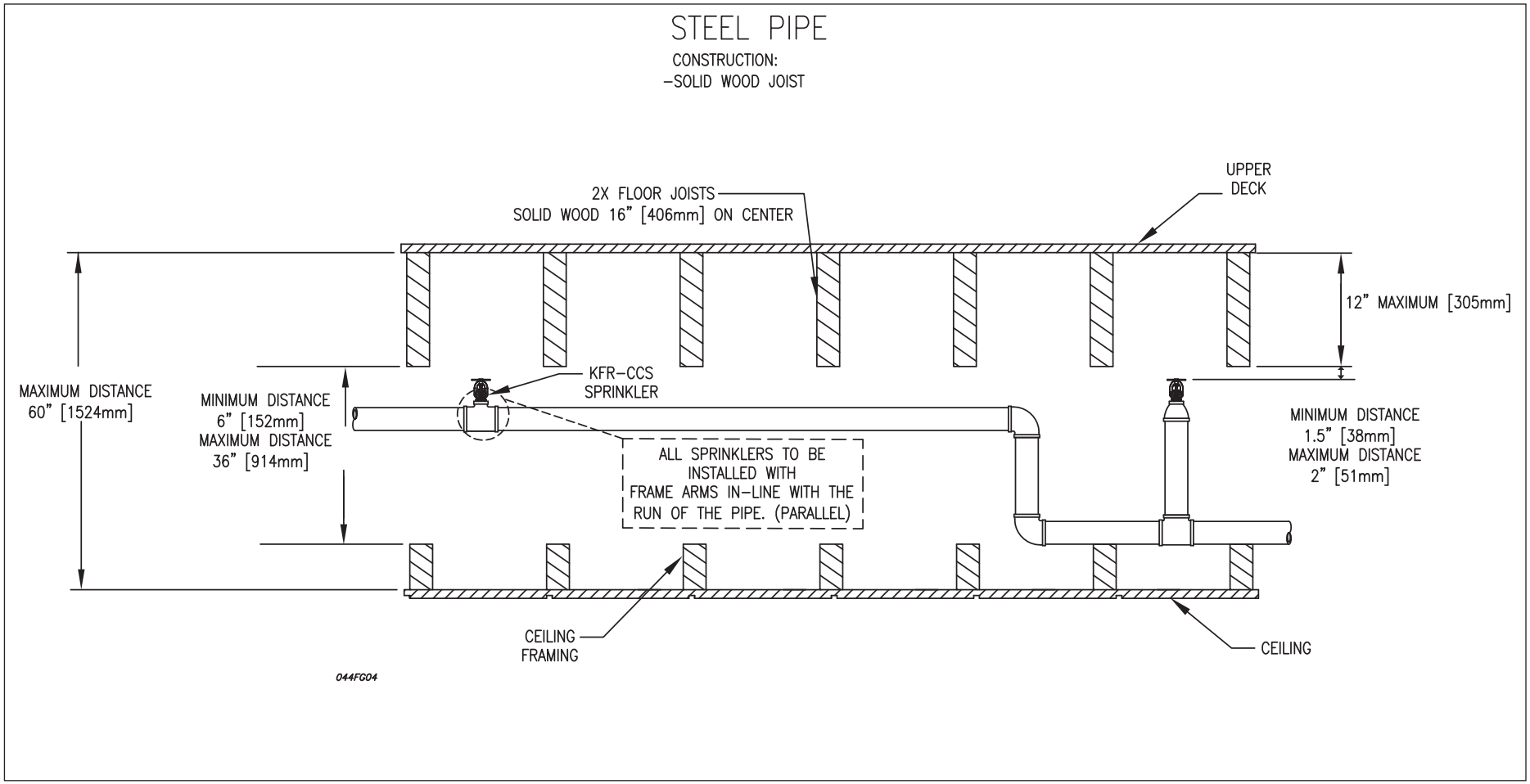

STEEL PIPE
CONSTRUCTION:
–SOLID WOOD JOIST
2X FLOOR JOISTS
SOLID WOOD 16" [406mm] ON CENTER
UPPER
DECK
12" MAXIMUM [305mm]
MAXIMUM DISTANCE
60" [1524mm]
MINIMUM DISTANCE
6" [152mm]
MAXIMUM DISTANCE
36" [914mm]
KFR–CCS
SPRINKLER
ALL SPRINKLERS TO BE
INSTALLED WITH
FRAME ARMS IN–LINE WITH THE
RUN OF THE PIPE. (PARALLEL)
MINIMUM DISTANCE
1.5" [38mm]
MAXIMUM DISTANCE
2" [51mm]
CEILING
FRAMING
CEILING
044FG04

Fig. 5

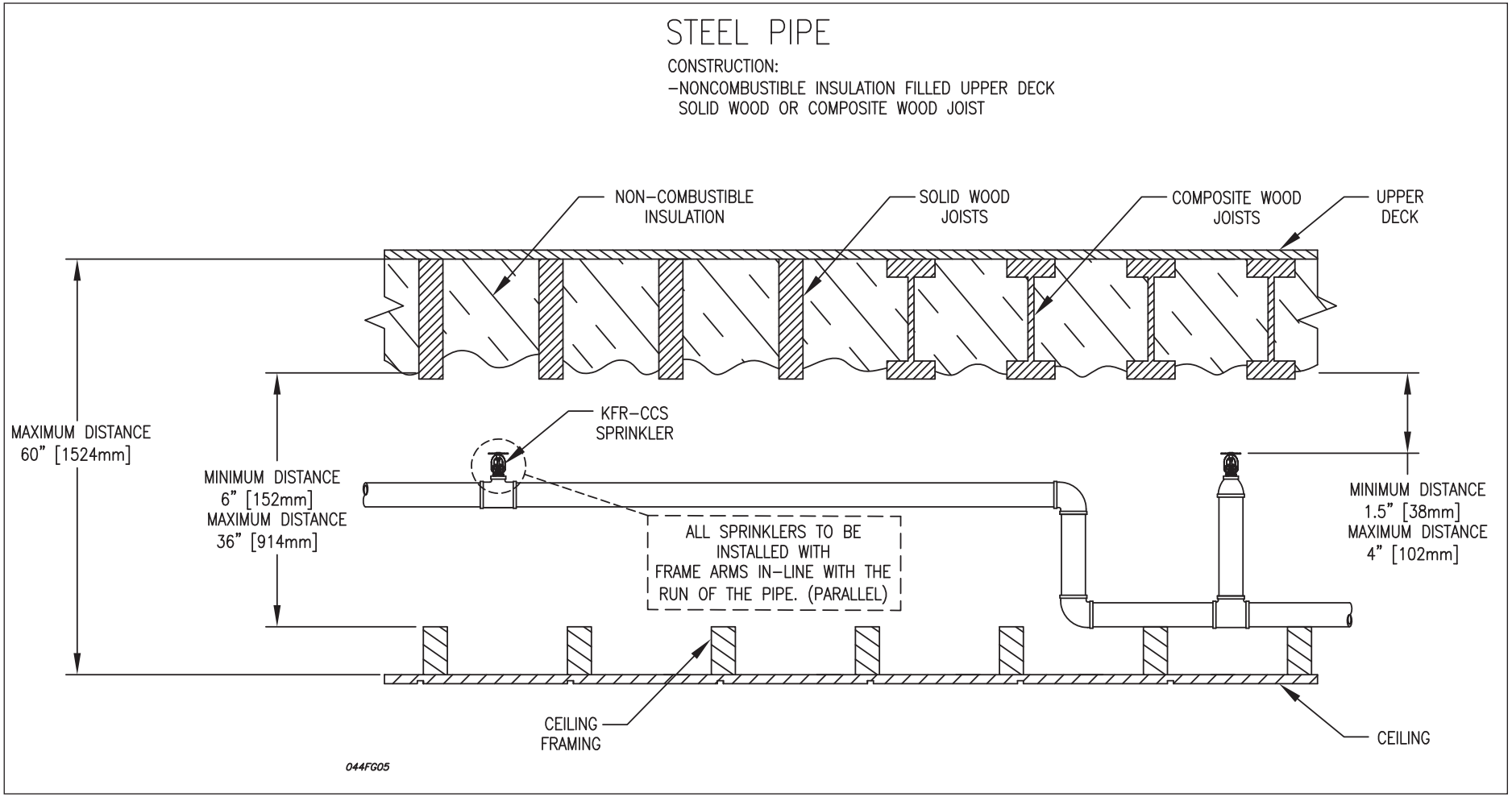
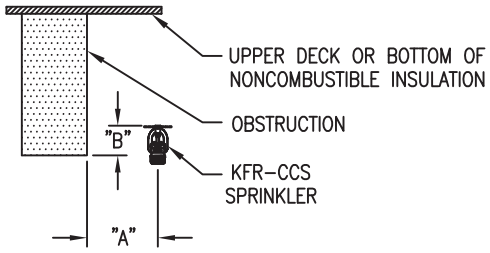
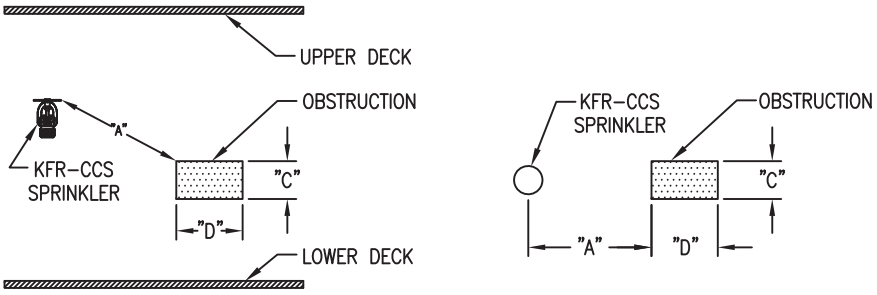

STEEL PIPE
CONSTRUCTION:
–NONCOMBUSTIBLE INSULATION FILLED UPPER DECK
SOLID WOOD OR COMPOSITE WOOD JOIST
NON–COMBUSTIBLE INSULATION
SOLID WOOD JOISTS
COMPOSITE WOOD JOISTS
UPPER DECK
MAXIMUM DISTANCE 60" [1524mm]
KFR–CCS SPRINKLER
MINIMUM DISTANCE 6" [152mm]
MAXIMUM DISTANCE 36" [914mm]
ALL SPRINKLERS TO BE INSTALLED WITH FRAME ARMS IN–LINE WITH THE RUN OF THE PIPE. (PARALLEL)
MINIMUM DISTANCE 1.5" [38mm]
MAXIMUM DISTANCE 4" [102mm]
CEILING FRAMING
CEILING
044FG05

Fig. 6



NOTE:
WEB MEMBERS AND GUSSETS SHALL NOT BE CONSIDERED OBSTRUCTIONS PROVIDED THE MINIMUM 4–1/2" LATERAL DISTANCE (FIG. 2 & FIG. 4) REQUIRED BY THE SPECIFIC APPLICATION LISTING IS MAINTAINED.

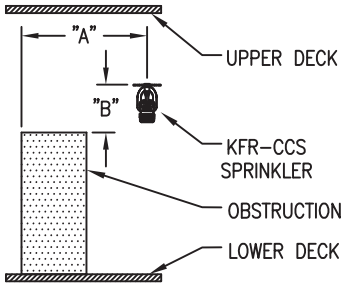
DISTANCE FROM CENTERLINE OF SPRINKLER TO SIDE OF OBSTRUCTION. DIMENSION "A"	MAXIMUM ALLOWABLE DISTANCE OF DEFLECTOR ABOVE BOTTOM OF OBSTRUCTION. DIMENSION "B"
<12" [<305mm]	0" [0mm]
12" TO <18" [305mm TO <457mm]	2.5" [64mm]
18" TO <24" [457mm TO <610mm]	3.5" [89mm]
24" TO <30" [610mm TO <762mm]	5.5" [140mm]
30" TO <36" [762mm TO <914mm]	7.5" [191mm]
36" TO <42" [914mm TO <1067mm]	9.5" [241mm]
42" TO <48" [1067mm TO <1219mm]	12" [305mm]
48" TO <54" [1219mm TO <1372mm]	14" [356mm]
54" TO <60" [1372mm TO <1524mm]	16.5" [419mm]



ELEVATION VIEW

PLAN VIEW

A≥3C OR 3D
A≤24" [610mm]
(USE DIMENSION C OR D, WHICHEVER IS GREATEST



HORIZONTAL DISTANCE DIMENSION "A"	MINIMUM VERTICAL DISTANCE BELOW DEFLECTOR DIMENSION "B"
≤6" [≤152mm]	3" [76mm]
>6" TO 9" [>152mm TO 229mm]	4" [102mm]
>9" TO 12" [>229mm TO 305mm]	6" [152mm]
>12" TO 15" [>305mm TO 381mm]	8" [203mm]
>15" TO 18" [>381mm TO 457mm]	9.5" [241mm]
>18" TO 24" [>457mm TO 610mm]	12.5" [318mm]
>24" TO 30" [>610mm TO 762mm]	15.5" [394mm]
>30" [>762mm]	18" [457mm]

044FG06

Fig. 7

STEEL PIPE

CONSTRUCTION:
–WOOD TRUSS
–NON COMBUSTIBLE BAR JOIST

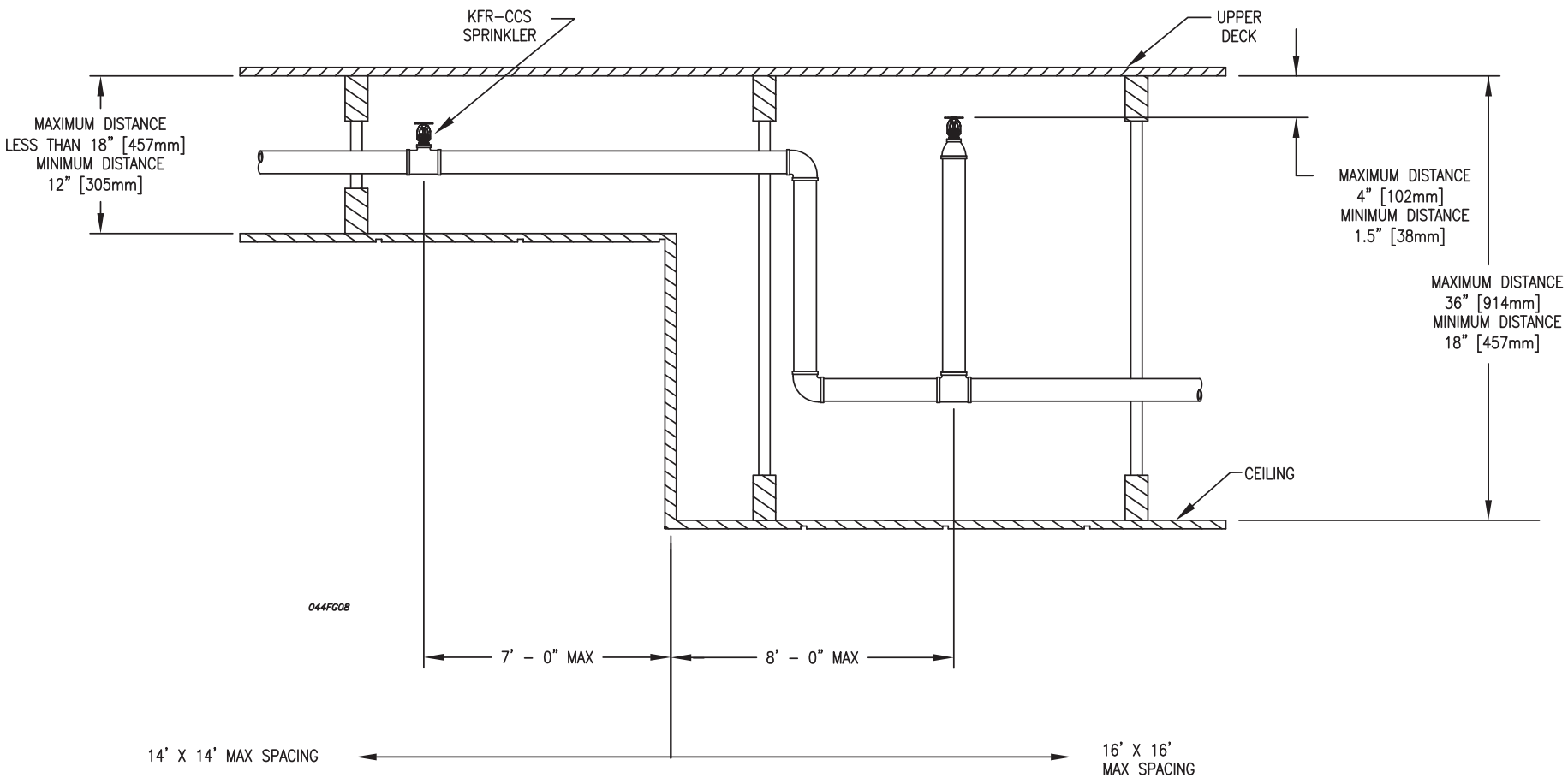


Fig. 8

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 over 90 years, and are installed and serviced by the most highly qualified and reputable sprinkler contractors located throughout the United States, Canada and foreign countries.

Manufactured by

Reliable®

The Reliable Automatic Sprinkler Co., Inc.
(800) 431-1588 Sales Offices
(800) 848-6051 Sales Fax
(914) 829-2042 Corporate Offices
www.reliablesprinkler.com Internet Address

Recycled Paper

Revision lines indicate updated or new data.

EG. Printed in U.S.A. 12/13 P/N 9999970449