Features
1. UL Listed for areas of coverage up to 256 square feet.
2. Sprinkler may be installed on the same branch line that supplies sprinklers below ceiling.
3. Nominal K-factor of 5.6 (80 metric).
4. Fusible link operating element.
5. Quick Response Sprinkler.
6. 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)

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)
**Sprinkler Identification Number (SIN):** RA4454

**Discharge Coefficient (K factor):** 5.6

**Response:** Quick Response

**Thread Size:** ½ NPT

**Max. Working Pressure:** 175 psi (12 bar)

**Min. Working Pressure:** 7 psi (0.48 bar)

**Temperature Rating:** 212°F (100°C)

**Fusible Element Color:** Green

**Finish:** Bronze

**Approvals:** cULus Listed*

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**Technical Data**

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

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**Material Data (Refer to Fig. 1):**

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<th>Sealing Washer</th>
<th>Strut</th>
<th>Lever</th>
<th>Fusible Element</th>
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**Sprinkler Components**

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) maximum 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. (914 mm) 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 (b) where the 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. (102 mm) 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. (102 mm) 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)
(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.)

Hydraulic Design Area:
Calculate all sprinklers within the draft curtain area, up to the 1,000 ft² (93 m²) maximum draft curtain 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 noncombustible 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 provided 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 mm) 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)

Hydraulic Design Area:
For wood truss construction (Fig. 4), solid wood joist construction (Fig. 5), or obstructed wood truss construction (Fig. 7), calculate all sprinklers within the draft curtain area, up to the 1,000 ft² (93 m²) maximum draft curtain area for both wet and dry pipe systems.

For noncombustible insulation-filled solid wood joist or composite wood joist construction (Fig. 6) where draft curtains are not required, calculate per the requirements of NFPA 13.

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 manufacturer’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.
Note 1: Deflector 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).
CPVC PIPE
CONSTRUCTION:
NONCOMBUSTIBLE INSULATION FILLED SOLID WOOD OR COMPOSITE WOOD JOINT

PIPE SHALL BE LOCATED A MAXIMUM OF 6" ABOVE THE TOP OF THE CEILING (OR INSULATION), OR A MAXIMUM OF ONE-THIRD (1/3) THE DEPTH OF THE CONCEALED SPACE ABOVE THE TOP OF THE CEILING, WHICHEVER IS SMALLER.

WHEN OFFSETTING CPVC PIPE OVER OBSTRUCTION, A RFR-CCS SPRINKLER MUST BE INSTALLED DIRECTLY ON THE PIPE OVER THE OBSTRUCTION.

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

Note 2: Distance evaluated as part of lultr 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 lultr Listing: 60" (1524 mm).

Fig. 3
STEEL PIPE
CONSTRUCTION:
WOOD TRUSS OR WOOD BAR JOIST (TOP CHORD 4" OR LESS IN DEPTH)

FROM FACE OF WOOD TRUSS OR TOP
OF CHORD OF BAR JOIST
4.5" [114mm] MINIMUM DISTANCE

KFR-CCS SPRINKLERS TO BE
INSTALLED WITH FRAME ARMS
IN-LINE (PARALLEL) WITH PIPE.

LOCATION OF STEEL
PIPE IN CONCEALED
SPACE IS NOT
RESTRICTED

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).
STEELE 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
STEEL PIPE
CONSTRUCTION:
OBSTRUCTED WOOD TRUSS OR BAR JOIST (TOP CHORD MORE THAN 4 IN. DEPTH)

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
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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