CHROMALOX
Advanced Thermal Technologies

DESIGN GUIDE FOR FREEZE PROTECTION OF FIRE SPRINKLER PIPING

CHROMALOX OFFERS EASY-TO-INSTALL, ENERGY-EFFICIENT PRODUCTS FOR THE BUILDING AND CONSTRUCTION MARKET.

With thousands of products in stock and ready to ship, we can provide the perfect solution for your application. Our applications engineering team stands ready to help design a system that meets your specification, code approval, cost and installation schedule needs.

Our Fire Sprinkler Pipe Freeze Protection System is listed and approved to the latest NFPA 13, IEEE 515.1 and UL 515A Standard for installation of heating cable on wet fire sprinkler piping. Chromalox heating cables are designed to minimize energy usage by using self-regulating heating cable technology and simplify installation with a cut to length heating cable. Our ITC-FS controllers provide monitoring and communication of the system to your building management system and provide years of trouble free, protection for your fire sprinkler piping.

At Chromalox, our focus is on solving customer's problems quickly and economically, minimize energy use and maximize the useful life of the heating cable system.

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INTRODUCTION

Chromalox's Fire Sprinkler Design Guide will assist the user with the proper selection of Chromalox heating cables, connection kits, controls and communication equipment. This design guide covers heating cables with a voltage range of 120-277V and for non-hazardous areas only. It does NOT assist with the design of the fire sprinkler system or its components. The user should consult a licensed fire protection engineer for guidance on the design of the fire sprinkler system. In addition to this design guide, the user should reference Chromalox's individual data sheets & installation instructions for further information on the products selected. All data sheets and installation instructions can be found on our website: www.chromalox.com.

SAFETY

Chromalox recognizes that electrical safety is an important aspect of every project and we recommend that all of our installation instructions and warnings are followed during the design, installation & service of our heating cable systems. All final electrical connections should be performed by a licensed electrical contractor only. Chromalox installation instructions require power be disconnected to all heating cable systems & controls before installing or servicing the heating cable system. Failure to do so could result in personal injury or property damage. To minimize the danger of a fire from sustained electrical arching if the heating cable system is damaged or if it has been improperly installed and to comply with agency certifications and National Electric Codes, Chromalox recommends ground fault equipment protection be installed on every heating cable circuit.

APPROVAL

NFPA 13 permits listed heat-tracing systems to be used on fire sprinkler piping to prevent freezing. Chromalox CPR-CR/CT heating cables, DL series components and ITC-FS Controllers are listed and approved for use on mains, standpipes and branch fire sprinkler piping. Our freeze protection system for fire sprinkler piping is UL515A listed and approved. Chromalox Pipe Freeze Protection System meets the applicable requirements of the following standards:

- IEEE Standard for the Testing, Design, Installation, and Maintenance of Electrical Resistance Trace Heating for Industrial Applications, IEEE 515
- IEEE Standard for the Testing, Design, Installation, and Maintenance of Electrical Resistance Trace Heating for Commercial Applications, IEEE 515.1
- Standard for the Installation of Sprinkler Systems, ANSI/NFPA 13
- Standard for the Installation of Standpipe and Hose Systems, ANSI/NFPA 14
- National Electrical Code, ANSI/NFPA 70
- CSA C22.2 No.130-16 Requirements for Eelectrical Eesistance Trace Heating and Heating Device Sets

CHROMALOX'S FREEZE PROTECTION SYSTEM OVERVIEW

DESCRIPTION

Chromalox's Fire Sprinkler Pipe Freeze Protection System is designed to protect wet sprinkler piping from freezing when piping is run in unconditioned air spaces. Chromalox's Fire Sprinkler Pipe Freeze Protection System is comprised of seven parts that make up the complete solution.

- CPR Heating Cable
- DL Series Connection Accessories
- ITC-FS Series Controls
- DL Series Controls
- RTD Temperature Sensors
- DL Attachment Accessories (including attachment tape, pipe straps and Caution Labels)
- Thermal Insulation & Sealed Exterior Cover (provided by others)

NOTE: Electric Heat Trace systems require thermal insulation to limit pipe heat loss and provide energy efficient pipe temperature maintenance.

CONTROLLERS & TEMPERATURE SENSORS

The Chromalox intelliTrace ITC-FS Series controllers are designed for pipe freeze protection and process temperature maintenance and have passed the rigorous testing requirements of the UL515A standard. These controllers are approved for Freeze Protection of Fire Sprinkler Piping including main standpipes and branch sprinkler piping.

The Chromalox ITC-FS Series IntelliTRACE Controller will control one or two heat trace circuits for fire sprinkler application and can be used for line and/or ambient sensing applications in non-hazardous areas.

The design and monitoring of Pipe Freeze Protection Systems for Fire Sprinkler shall be in accordance with IEEE 515.1. The ITC-FS Series Controllers are compliant with IEEE515.1 Fire Sprinkler Pipe Freeze Protection requirements and provide the following capabilities.

- One RTBC power connection/thermostat is required for overtemp protection per circuit
- Controller can protect multiple pipe segments using an ambient temperature sensor.
- Heat Trace Controller shall be permanently connected to the power supply.
- If backup power is being provided for the building electrical systems, it shall also provide backup power for the Pipe Freeze Protection System.
- A set of dry contacts shall be provided to connect the heat trace controller to the fire alarm control panel.
- Local audible & visual alarms and a supervisory signal to the fire alarm control panel shall be provided for each of the following conditions:
  - Ground Fault
  - Low Fire Sprinkler Pipe Temperature
  - High Fire Sprinkler Pipe Temperature
  - Temperature Sensor Failure
  - Controller Failure
  - Loss of Continuity
  - Loss of Supply Voltage

SYSTEM COMPONENTS

CPR HEATING CABLE

Chromalox's CPR Cable is designed to keep metal fire sprinkler piping from freezing by replacing the heat loss of the piping through the insulation. Our CPR cable is constructed of a self-regulating polymer core that automatically & efficiently adjust its heat output to changes in pipe temperature along the length of the fire sprinkler piping. Chromalox's CPR Cable can be cut-to-length to easily follow fire sprinkler piping of your project to protect it from freezing temperatures. Chromalox's CPR Heating Cable is available in four watt densities - 3, 5, 8 & 10 watts/ft and is approved for use on carbon steel. Chromalox's CPR Heating Cable is available for 120V or 208-277V and features 16 gauge copper bus wires to permit maximize circuit lengths. Our CPR Heating Cable is available with either a modified polyolen or fluoropolymer jacket to protect the cables from abrasion and abuse.

DL SERIES CONNECTION KITS

Chromalox's DL Series Connection Kits are approved for use on fire sprinkler pipe freeze protection systems. The DL Series Connection Kits are designed for pipe freeze protection in ordinary area applications and feature waterproof, corrosion resistant wiring enclosure in power connections, tee, splices & end seals.

INSTALLATION ACCESSORIES

All Fire Sprinkler Freeze Protection Systems require installation accessories for a complete installation including pipe straps, glass tape and identification labels.

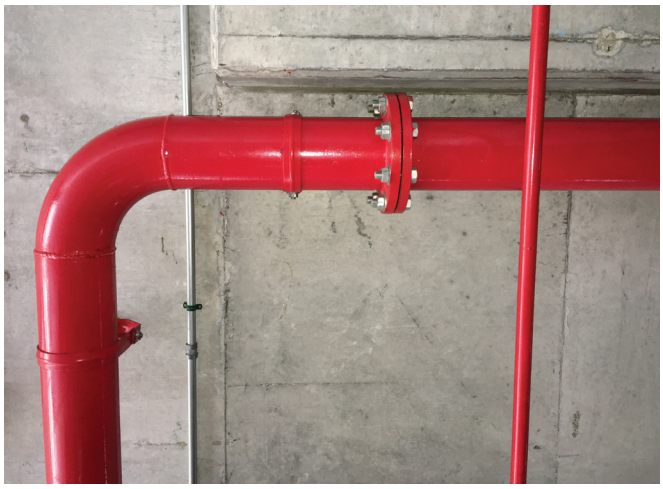
THERMAL INSULATION

All Fire Sprinkler Pipe Freeze Protection Systems require thermal insulation to minimize heat loss of the piping and assist with the protection of the fire sprinkler piping. Per IEEE 515.1, the thermal insulation shall be non-combustible and protected with a sealed exterior, non-combustible cover that will maintain its integrity when exposed to water discharge.

FIRE SPRINKLER PIPE FREEZE APPLICATIONS

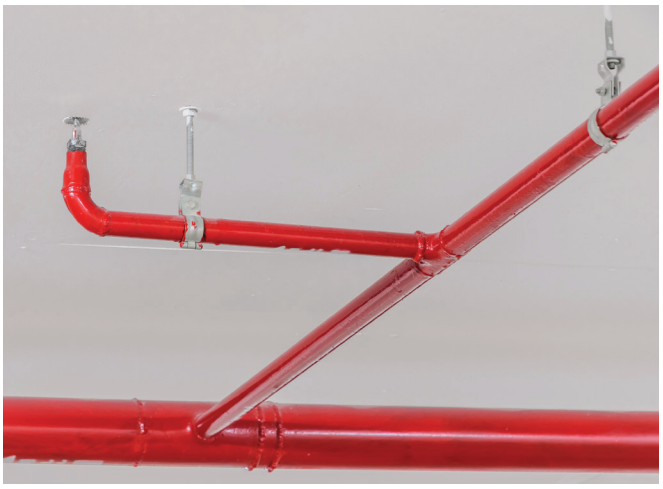
FIRE SPRINKLER MAINS

Wet Fire Sprinkler Water Supply Mains which are exposed to freezing temperatures prior to entering a building's conditioned air space. This includes above ground, backflow prevention devices which are also exposed to the elements and freezing temperatures. In certain cases, the fire sprinkler main is buried but still subject to freezing conditions.



FIRE SPRINKLER BRANCH LINES WITH SPRINKLER HEADS

Wet Fire Sprinkler Systems with Branch Piping which is exposed to freezing temperatures. Typical applications include parking garages, Porte Cochere, Atriums, Elevated Walkways and Unheated Stairwells. These applications allows the user to design a wet fire sprinkler system without the use of anti-freeze or glycol fluids.

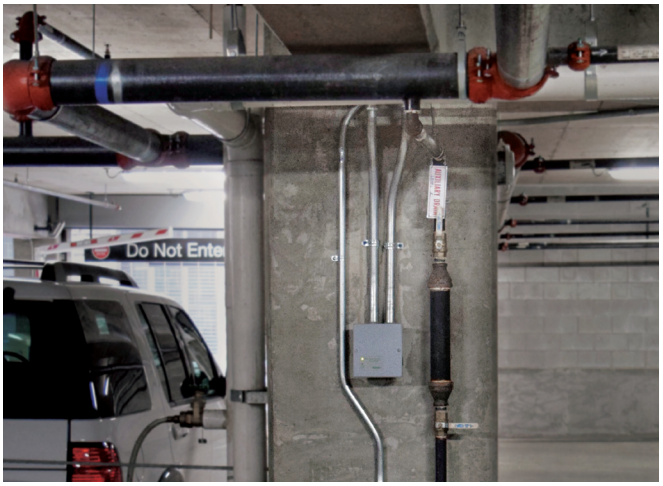


FIRE SPRINKLER STANDPIPES

Wet Fire Sprinkler Standpipes are another components of a fire protection system which might be exposed to freezing temperatures if located outside of the building or in unheated stairwells.

FIRE SPRINKLER AUXILIARY DRAINS

The "drum drip" is an auxiliary drain for dry pipe and preaction systems which is subject to freezing. Water that has entered the system, either because the valve has tripped or from condensation of moisture from the pressurized air in the system, must be protected from freezing temperatures.



FIRE SPRINKLER CABINETS

TYPICAL APPLICATIONS

COVERED LOADING DOCKS

REFRIGERATED WAREHOUSES

GLASS STAIRWELLS & ATRIUMS

PARKING GARAGES

PORTE COCHERE

QUICK INSTALLATION GUIDE

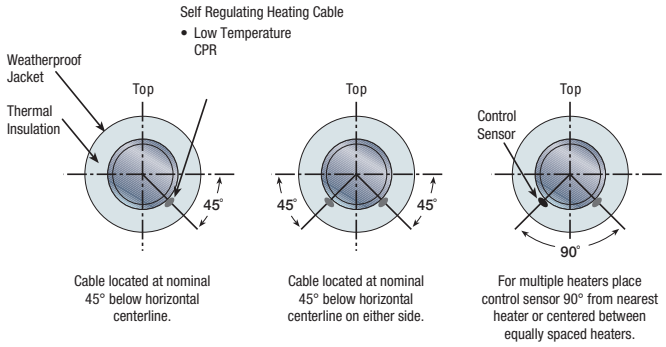
Quick Install Guide is a specification tool only. Always refer to proper installation instructions when installing heat trace cable.

CONTROL SYSTEMS

ITC-FS CONTROLLER

- 1 or 2 circuits, 22 A, SSR control
- Full monitoring, RS485 or Ethernet communications, up to 2 RTD inputs/circuit, soft start, alarms
- Bright display & easy to program, only 8x10x8 in./203x254x203mm

HEATING CABLE INSTALLATION TIPS



Cable located at nominal 45° below horizontal centerline.

Cable located at nominal 45° below horizontal centerline on either side.

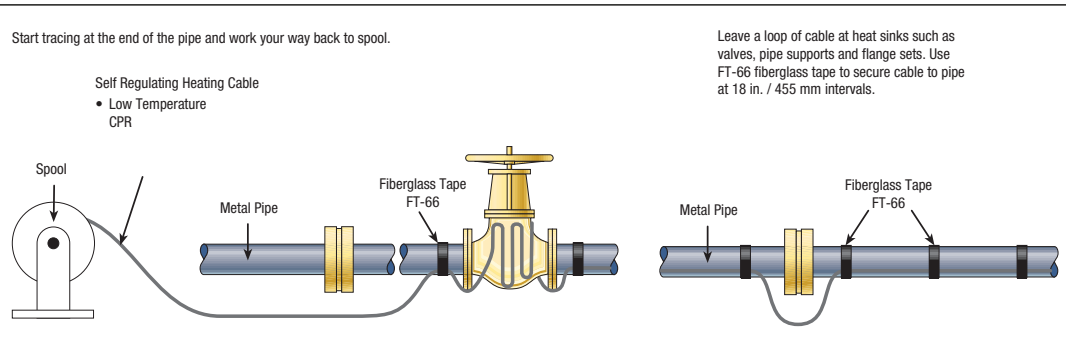
For multiple heaters place control sensor 90° from nearest heater or centered between equally spaced heaters.

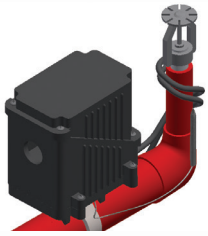
INSTALLATION TIPS

- Temporarily position cable on pipe and equipment to ensure proper distribution
- Leave a loop of cable at heat sinks such as valves, pipe supports, and flange sets.
- Use FT-66 fiberglass tape to secure cable to pipe at 18 in./455 mm (nom) intervals using recommended method.

Start tracing at the end of the pipe and work your way back to spool.

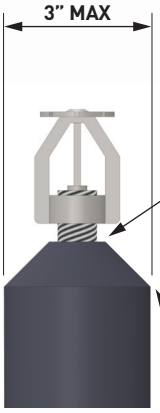
Leave a loop of cable at heat sinks such as valves, pipe supports and flange sets. Use FT-66 fiberglass tape to secure cable to pipe at 18 in. / 455 mm intervals.



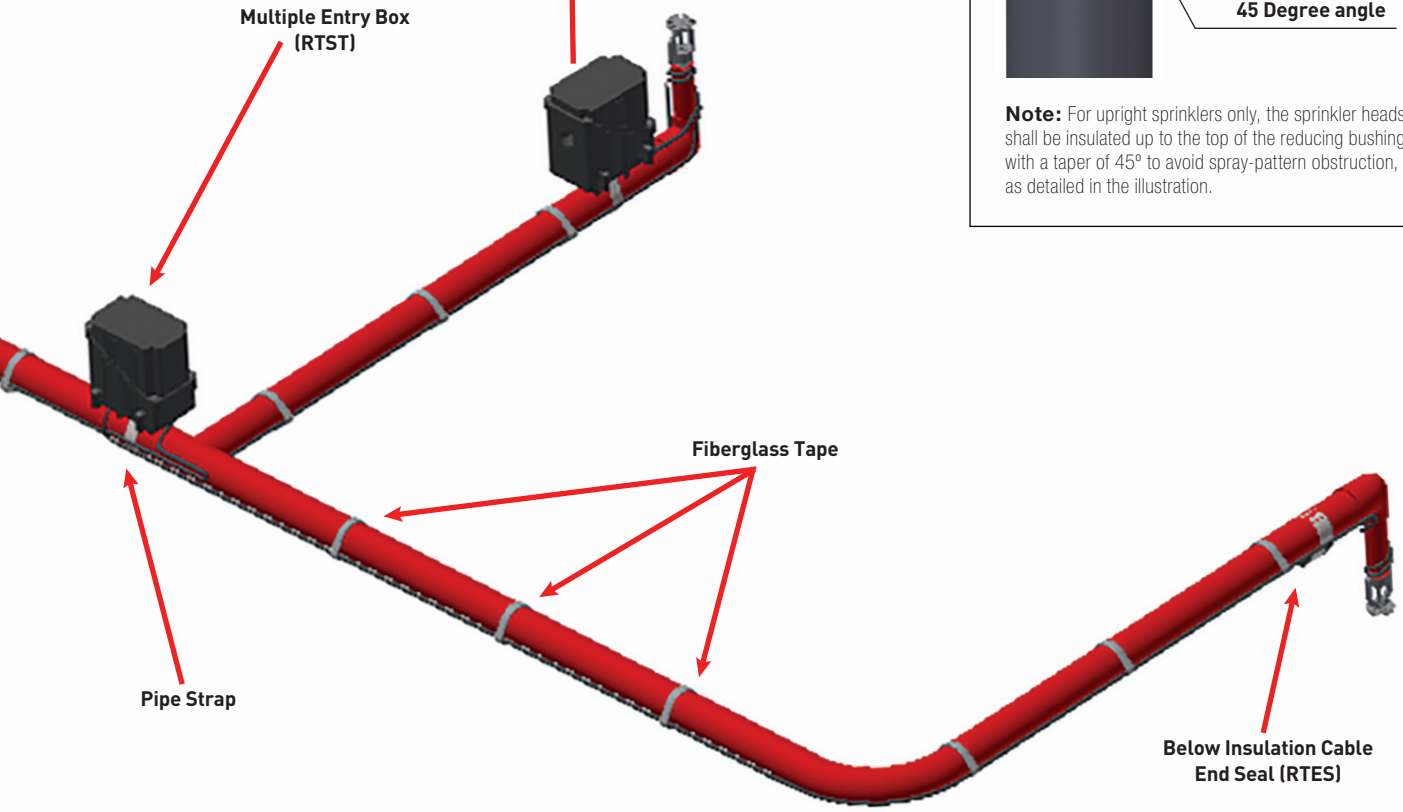


DL CONTROLS (RTBC)

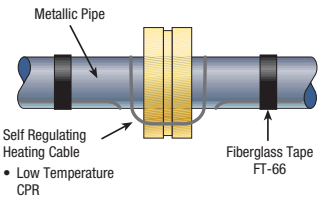
- Integral power connection and temp control
- RTBC to be used as overtemp device and power connection
- Bulb must be placed on sprig piping near the sprinkler head

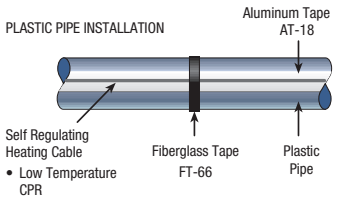


Note: For upright sprinklers only, the sprinkler heads shall be insulated up to the top of the reducing bushing with a taper of 45° to avoid spray-pattern obstruction, as detailed in the illustration.

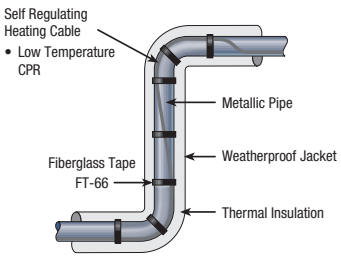


HEATING CABLE INSTALLATION TIPS





Note: Aluminum tape must be used under or over heating cable to spread heat transfer.



DESIGN STEP 1: **PROJECT INFORMATION**

PROJECT DATA *This first step in designing your Fire Sprinkler Pipe Freeze Protection Solution is to gather the necessary project information which will enable you to do the heat loss calculations. The following information is needed to complete the system design:*

DESCRIPTION	VALUE	EXAMPLE
Project Information		
Name		Chromalox
Location		Nashville, TN
Fire Sprinkler Maintain Temperature = Tm		40˚
Minimum Ambient Temperature = Ta		10˚
Startup Temperature		40˚
Backup Generator (Y/N)		Y
Mains & Standpipe (Y/N)		Y
Branch Sprinkler Piping (Y/N)		Y
Sprig Length		2'-0"
Area Classification		Non-Hazardous
Piping		
Material - Copper, Carbon Steel		Carbon Steel
Pipe Diameter		2"
Length - Diameter		
Length - Diameter		
Length - Diameter		
Length - Diameter		
Length - Diameter - Branch		2"-50'
Length - Diameter - Branch		
Hangers - Uninsulated		None
Riser Clamps - Uninsulated		None
Insulation		
Type		Fiberglass
Thickness		1"
Insulation Cladding / Jacket (Y/N)		Y
Electrical Information		
Voltage		277V
Circuit Breaker Size		40A
Panel Location		Electrical Room
BMS Interface (Y/N)		Not Required
BMS Protocol		N/A

DESIGN STEP 2: **HEAT TRACE SELECTION TABLES**

FIRE SPRINKLER HEAT TRACE SELECTION TABLES *These charts are designed to speed the selection of cable for fire sprinkler freeze protection applications. Find the diameter of pipe below and cross reference with the minimum ambient temp Ta from design step 1. This will give you the recommended cable and trace ratio for that condition.*

- Selections suitable for 120V and 208 to 277V applications.
- Designs are based on straight runs of cable and pipe.
- Spiraling is not required.
- Heat loss is based on 40°F maintenance temperature (Tm), Fiberglas® insulation k = 0.25 BTU in/h ft °F at 50°F and a windspeed of 20 mph.
- If the maintenance temperature, insulation thickness, insulation type orwindspeed is different than stated above or below in the tables please consult the Chromalox design software Chromatrace for heat loss calculations.

INSULATION THK., INCHES	MIN. AMBIENT TEMPERATURE															
	Deg°F	-40°F	-30°F	-20°F	-10°F	0°F	10°F	20°F		-40°F	-30°F	-20°F	-10°F	0°F	10°F	20°F
		½" PIPE								¾" PIPE						
½"	CABLE TYPE / TRACE RATIO	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CABLE TYPE / TRACE RATIO	CPR 5 X1	CPR 5 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1
1"		CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1		CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1
1-½"		CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1		CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1
2"		CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1		CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1

INSULATION THK., INCHES	MIN. AMBIENT TEMPERATURE															
	Deg°F	-40°F	-30°F	-20°F	-10°F	0°F	10°F	20°F		-40°F	-30°F	-20°F	-10°F	0°F	10°F	20°F
		1" PIPE								1-¼" PIPE						
½"	CABLE TYPE / TRACE RATIO	CPR 5 X1	CPR 5 X1	CPR 5 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CABLE TYPE / TRACE RATIO	CPR 5 X1	CPR 5 X1	CPR 5 X1	CPR 5 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1
1"		CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1		CPR 5 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1
1-½"		CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1		CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1
2"		CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1		CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1

INSULATION THK., INCHES	MIN. AMBIENT TEMPERATURE															
	Deg°F	-40°F	-30°F	-20°F	-10°F	0°F	10°F	20°F		-40°F	-30°F	-20°F	-10°F	0°F	10°F	20°F
		1-½" PIPE								2" PIPE						
½"	CABLE TYPE / TRACE RATIO	CPR 8 X1	CPR 5 X1	CPR 5 X1	CPR 5 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CABLE TYPE / TRACE RATIO	CPR 8 X1	CPR 8 X1	CPR 5 X1	CPR 5 X1	CPR 5 X1	CPR 3 X1	CPR 3 X1
1"		CPR 5 X1	CPR 5 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1		CPR 5 X1	CPR 5 X1	CPR 5 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1
1-½"		CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1		CPR 5 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1
2"		CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1		CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1

The above table complies ASHRAE 90.1-2013 as well as U.S. Department of Energy recommendations for Energy Efficiency and Renewable Energy.

DESIGN STEP 2: **HEAT TRACE SELECTION TABLES CONTINUED**

INSULATION THK., INCHES	MIN. AMBIENT TEMPERATURE															
	Deg°F	-40°F	-30°F	-20°F	-10°F	0°F	10°F	20°F		-40°F	-30°F	-20°F	-10°F	0°F	10°F	20°F
		2-½" PIPE								3" PIPE						
½"	CABLE TYPE / TRACE RATIO	CPR 8 X1	CPR 8 X1	CPR 8 X1	CPR 5 X1	CPR 5 X1	CPR 3 X1	CPR 3 X1	CABLE TYPE / TRACE RATIO	CPR 10 X1	CPR 8 X1	CPR 8 X1	CPR 8 X1	CPR 5 X1	CPR 5 X1	CPR 3 X1
1"		CPR 5 X1	CPR 5 X1	CPR 5 X1	CPR 5 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1		CPR 8 X1	CPR 5 X1	CPR 5 X1	CPR 5 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1
1-½"		CPR 5 X1	CPR 5 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1		CPR 5 X1	CPR 5 X1	CPR 5 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1
2"		CPR 5 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1		CPR 5 X1	CPR 5 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1

INSULATION THK., INCHES	MIN. AMBIENT TEMPERATURE															
	Deg°F	-40°F	-30°F	-20°F	-10°F	0°F	10°F	20°F		-40°F	-30°F	-20°F	-10°F	0°F	10°F	20°F
		4" PIPE								6" PIPE						
½"	CABLE TYPE / TRACE RATIO	CPR 8 X2	CPR 10 X1	CPR 10 X1	CPR 8 X1	CPR 8 X1	CPR 5 X1	CPR 3 X1	CABLE TYPE / TRACE RATIO	CPR 8 X2	CPR 8 X2	CPR 8 X2	CPR 5 X2	CPR 10 X1	CPR 8 X1	CPR 5 X1
1"		CPR 8 X1	CPR 8 X1	CPR 8 X1	CPR 5 X1	CPR 5 X1	CPR 3 X1	CPR 3 X1		CPR 10 X1	CPR 10 X1	CPR 8 X1	CPR 8 X1	CPR 5 X1	CPR 5 X1	CPR 3 X1
1-½"		CPR 8 X1	CPR 5 X1	CPR 5 X1	CPR 5 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1		CPR 8 X1	CPR 8 X1	CPR 8 X1	CPR 5 X1	CPR 5 X1	CPR 3 X1	CPR 3 X1
2"		CPR 5 X1	CPR 5 X1	CPR 5 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1		CPR 8 X1	CPR 5 X1	CPR 5 X1	CPR 5 X1	CPR 3 X1	CPR 3 X1	CPR 3 X1

INSULATION THK., INCHES	MIN. AMBIENT TEMPERATURE															
	Deg°F	-40°F	-30°F	-20°F	-10°F	0°F	10°F	20°F		-40°F	-30°F	-20°F	-10°F	0°F	10°F	20°F
		8" PIPE								10" PIPE						
½"	CABLE TYPE / TRACE RATIO	CPR 10 X2	CPR 10 X2	CPR 8 X2	CPR 8 X2	CPR 8 X2	CPR 8 X1	CPR 8 X1	CABLE TYPE / TRACE RATIO	CPR 10 X3	CPR 8 X3	CPR 10 X2	CPR 8 X2	CPR 8 X2	CPR 10 X1	CPR 8 X1
1"		CPR 8 X2	CPR 8 X2	CPR 10 X1	CPR 8 X1	CPR 8 X1	CPR 5 X1	CPR 5 X1		CPR 8 X2	CPR 8 X2	CPR 8 X2	CPR 10 X1	CPR 8 X1	CPR 8 X1	CPR 5 X1
1-½"		CPR 10 X1	CPR 8 X1	CPR 8 X1	CPR 8 X1	CPR 5 X1	CPR 5 X1	CPR 3 X1		CPR 8 X2	CPR 10 X1	CPR 10 X1	CPR 8 X1	CPR 8 X1	CPR 5 X1	CPR 3 X1
2"		CPR 8 X1	CPR 8 X1	CPR 8 X1	CPR 5 X1	CPR 5 X1	CPR 3 X1	CPR 3 X1		CPR 10 X1	CPR 8 X1	CPR 8 X1	CPR 8 X1	CPR 5 X1	CPR 5 X1	CPR 3 X1

The above table complies ASHRAE 90.1-2013 as well as U.S. Department of Energy recommendations for Energy Efficiency and Renewable Energy.

DESIGN STEP 2: **HEAT TRACE SELECTION TABLES CONTINUED**

INSULATION THK., INCHES	MIN. AMBIENT TEMPERATURE															
	Deg°F	-40°F	-30°F	-20°F	-10°F	0°F	10°F	20°F		-40°F	-30°F	-20°F	-10°F	0°F	10°F	20°F
		12" PIPE								14" PIPE						
½"	CABLE TYPE / TRACE RATIO	CPR 10 X3	CPR 10 X3	CPR 8 X3	CPR 10 X2	CPR 8 X2	CPR 8 X2	CPR 8 X1	CABLE TYPE / TRACE RATIO	CPR 8 X4	CPR 10 X3	CPR 8 X3	CPR 10 X2	CPR 10 X2	CPR 8 X2	CPR 10 X1
1"		CPR 10 X2	CPR 8 X2	CPR 8 X2	CPR 8 X2	CPR 10 X1	CPR 8 X1	CPR 5 X1		CPR 10 X2	CPR 10 X2	CPR 8 X2	CPR 8 X2	CPR 10 X1	CPR 8 X1	CPR 5 X1
1-½"		CPR 8 X2	CPR 8 X2	CPR 10 X1	CPR 8 X1	CPR 8 X1	CPR 5 X1	CPR 5 X1		CPR 8 X2	CPR 8 X2	CPR 8 X2	CPR 10 X1	CPR 8 X1	CPR 8 X1	CPR 5 X1
2"		CPR 10 X1	CPR 10 X1	CPR 8 X1	CPR 8 X1	CPR 5 X1	CPR 5 X1	CPR 3 X1		CPR 8 X2	CPR 10 X1	CPR 10 X1	CPR 8 X1	CPR 8 X1	CPR 5 X1	CPR 3 X1

INSULATION THK., INCHES	MIN. AMBIENT TEMPERATURE															
	Deg°F	-40°F	-30°F	-20°F	-10°F	0°F	10°F	20°F		-40°F	-30°F	-20°F	-10°F	0°F	10°F	20°F
		16" PIPE								18" PIPE						
½"	CABLE TYPE / TRACE RATIO	CPR 10 X4	CPR 8 X4	CPR 10 X3	CPR 8 X3	CPR 10 X2	CPR 8 X2	CPR 10 X1	CABLE TYPE / TRACE RATIO	CPR 10 X4	CPR 10 X4	CPR 8 X4	CPR 10 X3	CPR 8 X3	CPR 8 X2	CPR 8 X2
1"		CPR 8 X3	CPR 10 X2	CPR 8 X2	CPR 8 X2	CPR 8 X2	CPR 10 X1	CPR 8 X1		CPR 8 X3	CPR 8 X3	CPR 10 X2	CPR 8 X2	CPR 8 X2	CPR 10 X1	CPR 8 X1
1-½"		CPR 8 X2	CPR 8 X2	CPR 8 X2	CPR 10 X1	CPR 8 X1	CPR 8 X1	CPR 5 X1		CPR 10 X2	CPR 8 X2	CPR 8 X2	CPR 8 X2	CPR 10 X1	CPR 8 X1	CPR 5 X1
2"		CPR 8 X2	CPR 8 X2	CPR 10 X1	CPR 8 X1	CPR 8 X1	CPR 5 X1	CPR 5 X1		CPR 8 X2	CPR 8 X2	CPR 5 X2	CPR 10 X1	CPR 8 X1	CPR 8 X1	CPR 5 X1

INSULATION THK., INCHES	MIN. AMBIENT TEMPERATURE															
	Deg°F	-40°F	-30°F	-20°F	-10°F	0°F	10°F	20°F		-40°F	-30°F	-20°F	-10°F	0°F	10°F	20°F
		16" PIPE								18" PIPE						
½"	CABLE TYPE / TRACE RATIO	CPR 10 X5	CPR 10 X4	CPR 10 X4	CPR 10 X3	CPR 8 X3	CPR 10 X2	CPR 8 X2	CABLE TYPE / TRACE RATIO	CPR 10 X5	CPR 10 X5	CPR 10 X4	CPR 8 X4	CPR 10 X3	CPR 10 X2	CPR 8 X2
1"		CPR 10 X3	CPR 8 X3	CPR 10 X2	CPR 10 X2	CPR 8 X2	CPR 5 X2	CPR 8 X1		CPR 10 X3	CPR 10 X3	CPR 8 X3	CPR 10 X2	CPR 8 X2	CPR 8 X2	CPR 8 X1
1-½"		CPR 10 X2	CPR 10 X2	CPR 8 X2	CPR 8 X2	CPR 10 X1	CPR 8 X1	CPR 5 X1		CPR 8 X3	CPR 10 X2	CPR 8 X2	CPR 8 X2	CPR 8 X2	CPR 8 X1	CPR 8 X1
2"		CPR 8 X2	CPR 8 X2	CPR 8 X2	CPR 10 X1	CPR 8 X1	CPR 8 X1	CPR 5 X1		CPR 8 X2	CPR 8 X2	CPR 8 X2	CPR 8 X2	CPR 10 X1	CPR 8 X1	CPR 5 X1

The above table complies ASHRAE 90.1-2013 as well as U.S. Department of Energy recommendations for Energy Efficiency and Renewable Energy.

DESIGN STEP 3:
DETERMINE HEATING CABLE LENGTH

DETERMINE TOTAL CABLE LENGTH

1. *In addition to pipe length, in-line components such as valves, pipe sprigs, sprinkler tees and pipe supports require additional heat tracing to maintain, TM.*
2. *Using Table 4 and 5, calculate the total cable length required by combining the pipe length with the additional lengths needed for all of the other components.*

TABLE 4 Additional Cable Lengths Required for In-Line Components Based on Pipe IPS (Iron Pipe Size)

ADDITIONAL CABLE LENGTHS REQUIRED FOR IN-LINE COMPONENTS								
Pipe Size (in.)	Gate Valve	Glove Valve	Ball Valve	Butterfly Valve	Shoe Support	Hanger Support	Sleeper Support	Flange Pair
	Additional Cable Length Required (ft.)							
1/2”	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.30
3/4”	1.50	1.00	1.00	1.00	1.50	1.00	1.00	0.30
1”	2.00	1.00	1.00	1.00	1.50	1.00	1.00	0.30
1-1/4”	2.50	1.50	1.50	1.50	2.00	2.00	2.00	0.30
1-1/2”	2.50	1.50	1.50	1.50	2.00	2.00	2.00	0.30
2”	2.50	2.00	2.00	2.00	2.00	2.00	2.00	0.30
2-1/2”	2.50	2.00	2.00	2.00	2.00	2.00	2.00	0.30
3”	3.00	2.50	2.50	2.50	2.00	2.00	2.00	0.50
4”	4.00	3.00	3.00	3.00	2.50	2.50	2.50	0.50
6”	5.00	3.50	3.50	3.50	2.50	2.50	2.50	0.80
8”	7.00	4.00	4.00	4.00	2.50	2.50	2.50	0.80
10”	8.00	4.50	4.50	4.50	3.00	3.00	3.00	0.80
12”	9.00	5.00	5.00	5.00	3.00	3.00	3.00	0.80
14”	10.00	5.50	5.50	5.50	3.00	3.00	3.00	1.00
16”	11.00	6.00	6.00	6.00	3.50	3.50	3.50	1.00
18”	12.00	7.00	7.00	7.00	3.50	3.50	3.50	1.00
20”	13.00	7.50	7.50	7.50	3.50	3.50	3.50	1.00
22”	13.00	7.50	7.50	7.50	3.50	3.50	3.50	1.00

TABLE 5 Additional Heating Cable required for Fire Sprinkler Piping based on IPS Pipe Size

ADDITIONAL HEATING CABLE LENGTH IN FEET FOR FIRE SPRINKLERS		
Sprinkler Head without Sprig	Sprinkler Head with Sprig	Dry Sprinkler for Freezers
4X Pipe Diameter	2X Sprig Length	2X Drop Length
see Figure 3 - Details Page	see Figure 4 - Details Page	see Figure 5 - Details Page

DESIGN STEP 4: **DETERMINE ELECTRICAL LOAD**

DETERMINE NUMBER OF CIRCUITS / CIRCUIT PROTECTION

1. *Use Table 5, to determine your maximum circuit length allowed.*
2. *Divide your total cable length calculated from Step 4 by the maximum circuit length to determine the number of circuits required. Round up to the next whole number.*
3. *To reduce distribution costs, select the smallest branch circuit breaker rating possible.*
4. *Use Minimum Self-Regulating Heating Cable Length table below to ensure no nuisance tripping of low current alarm.*

MAXIMUM CIRCUIT LENGTH									
Cable Rating	40°F Start-Up (Ft.)			0°F Start-Up (Ft.)			-40°F Start-Up (Ft.)		
	20A	30A	40A	20A	30A	40A	20A	30A	40A
CPR 3-1CR/CT	350	360	NR	270	360	NR	220	325	340
CPR 3-2CR/CT	660	NR	NR	555	660	NR	445	595	625
CPR 5-1CR/CT	230	270	NR	180	270	NR	145	220	255
CPR 5-2CR/CT	450	540	NR	360	540	NR	290	440	510
CPR 8-1CR/CT	180	215	NR	145	215	NR	115	180	195
CPR 8-2CR/CT	330	420	NR	265	395	420	210	315	400
CPR 10-1CR/CT	105	160	210	90	135	180	85	125	170
CPR 10-2CR/CT	210	315	420	185	275	365	145	215	300

NR = Not Required. Maximum circuit length has been reached in a smaller breaker size.
Note - Thermal magnetic circuit breakers are recommended since magnetic circuit breakers could “nuisance trip” at low temperature.

NOTES:

Circuit breakers are sized per National Electric Code NEC requires ground-fault equipment protection for each branch circuit supply electric heating cables.

MINIMUM SR HEATING CABLE LENGTH					
Cable Model	W/ft @ 50˚F (10˚C)	120V	208V	240V	277V
CPR 3-1CT	3	12	x	x	x
CPR 3-2CT	3	x	21	24	28
CPR 5-1CT	5	8	x	x	x
CPR 5-2CT	5	x	13	16	17
CPR 8-1CT	8	5	x	x	x
CPR 8-2CT	8	x	8	10	11
CPR 10-1CT	10	4	x	x	x
CPR 10-2CT	10	x	7	8	9

DESIGN STEP 5:
CONNECTION KITS & ACCESSORIES

DETERMINE QUANTITY OF CONNECTION KITS & ACCESSORIES

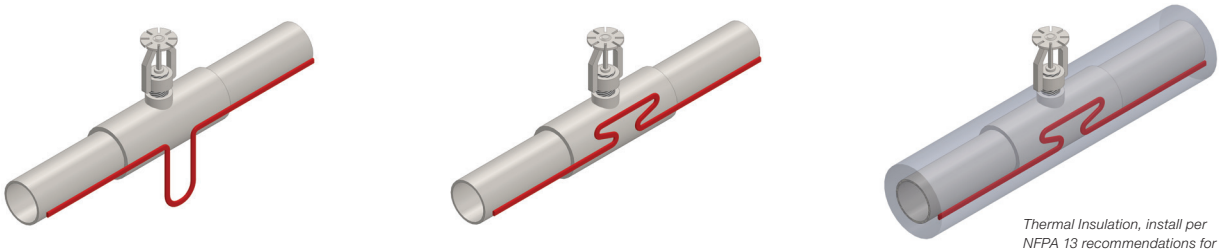
1. *Chromalox's connection kits - DL Series are UL & CSA Approved for use in Fire Sprinkler Pipe Freeze Protection Systems when used with Chromalox CPR Heat tracing cable.*
2. *Determine the number of power connections*
   - *Multiple Power Connection Kits may be connected to a single heat trace circuit. The limiting factor is the aggregate length of heating cable attached to the circuit which was calculated in Step 4.*
   - *Count the number of Power Connection Kits required by Circuit*
3. *Determine the number of non-powered connection kits*
   - *Chromalox offers both splice and tee connection kits to assist the installer with a method to easily follow the fire sprinkler piping path*
   - *Count the quantity of pipe Tees and Splices on the fire sprinkler piping to be freeze protected.*
   - *It is a recommended practice to always include at least one splice kit in your projects bill of materials in order to join pieces of heating cable on your project.*
4. *Glass Tape is used to attach the heating cable to the fire sprinkler piping at 12" intervals. See table below to get the rolls of tape needed.*
5. *Labels - The NEC requires the exterior of the piping which contains heat tracing cables to be identified with a warning label every 10' on opposite sides of the pipe. Take the total length of heating cable calculated in Step 5 and divide by 10. Round to the nearest whole number for the total number of labels required.*

CONNECTION KITS			
Component	**Quantity**	**Location**	**Circuit #**
Tee			
Splice			
End Seal			

Tape Type	Pipe Diameter (in.)	Rolls Needed per 100' of Pipe
FT-66	1/2" (21.3 mm)	1.00
	3/4" (26.7 mm)	1.00
	1" (33.4 mm)	1.00
	1 1/4" (42.2 mm)	1.00
	2" (60.3 mm)	2.00
	2 1/2" (73.0 mm)	2.00
	3" (88.9 mm)	3.00
	4" (114.3 mm)	3.00
	6" (168.3 mm)	4.00
	8" (219.1 mm)	6.00
	10" (273.1 mm)	7.00
	12" (323.9 mm)	8.00
	14" (355.6 mm)	9.00
	16" (406.4 mm)	10.00
	18" (457.2 mm)	11.00
	20" (508.0 mm)	12.00
	22" (558.8 mm)	15.00

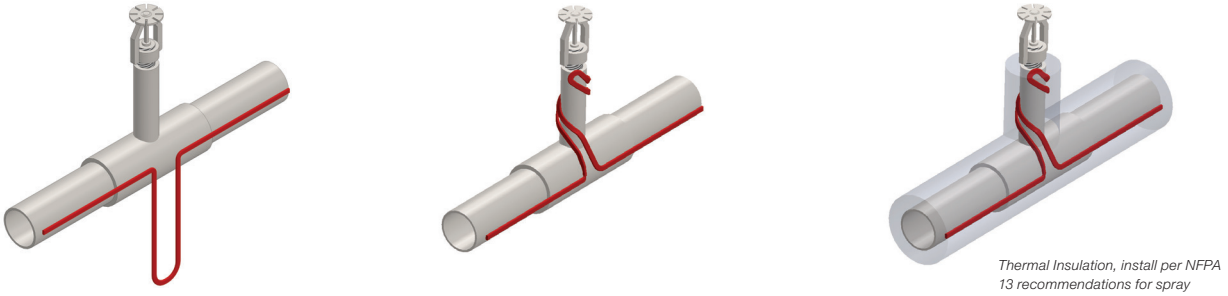
** Additional heating cable, see TABLE 4 for specific requirements*

FIGURE 1: SPRINKLER HEAD WITHOUT SPRIG



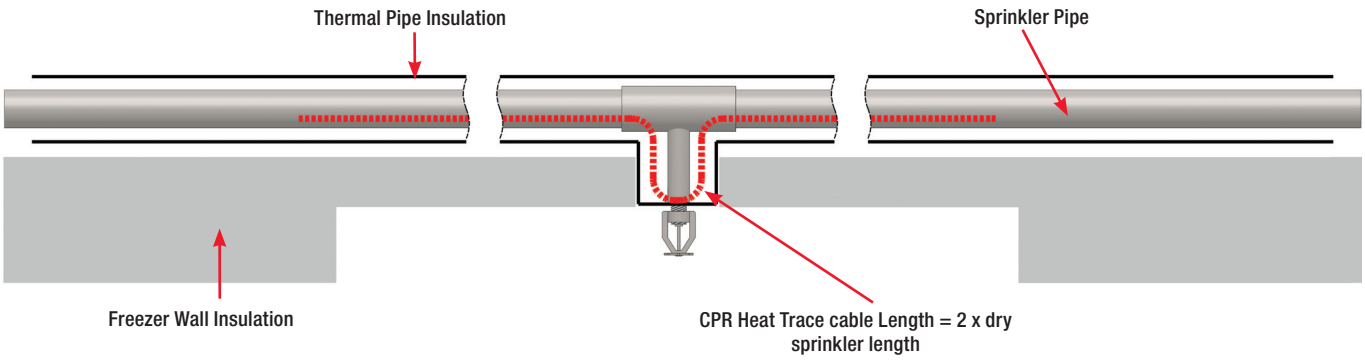
Thermal Insulation, install per NFPA 13 recommendations for spray shadowing

FIGURE 2: SPRINKLER HEAD WITH SPRIG



Thermal Insulation, install per NFPA 13 recommendations for spray shadowing

FIGURE 3: DRY PENDANT SPRINKLER IN FREEZERS



NOTES:

- The illustrations in Figures 1-3 are examples of various fire sprinkler piping installation and are for reference only. For additional information on detail not contained herein, contact your local Chromalox Representative for optional recommendations.
- For Fire Sprinkler Systems outside or in buildings where the temperature is –40°F or greater
- For use in Ordinary Areas only as specified in NFPA 13 Standard for the Installation of Sprinkler Systems.
- The Fire Sprinkler Pipe Freeze Protection System must comply with the obstruction requirement of NFPA 13 so that the thermal insulation over the heat trace does not unacceptably obstruct the sprinkler or cover the wrench boss.
- For use with Sprinkler Heads with a Temperature Rating of 68°C or 155°F.
- Sprinkler Systems with trace heating shall be properly grounded.

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