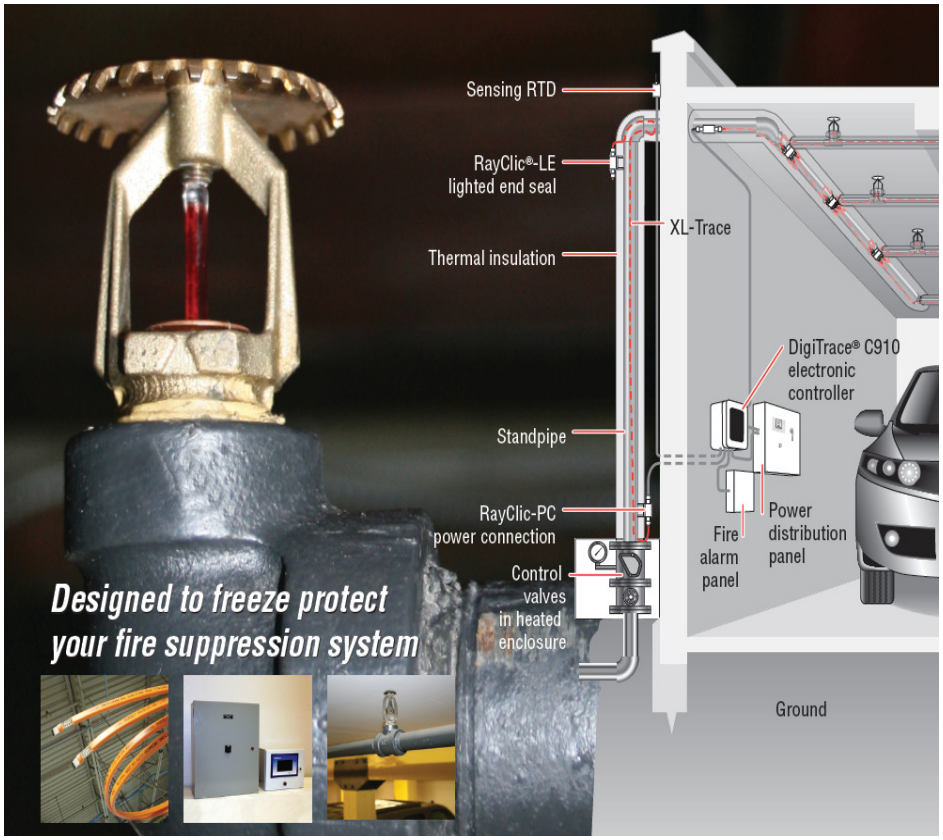
Freeze Protection of Fire Suppression systems with Electric Heat-tracing

Raychem Pyrotenax eti DigiTrace TRACER

Agenda

- Market needs/applications
- NFPA Standards
- Heat-tracing system overview
- Heat-tracing system control and supervision




San Diego Union-Tribune 10-28-10©
CREATORS.COM
"NO, YOU CAN'T BE CHARLIE SHEEN FOR HALLOWEEN!"

Heat Trace Cable Applications

Providing Thermal Solutions…

Freeze Protection

Fire Sprinkler
Freeze Protection

Greasy Waste

Roof & Gutter
De-Icing

Concealed
Roof De-icing

Hot Water
Temperature Maint.

Surface Snow
Melting

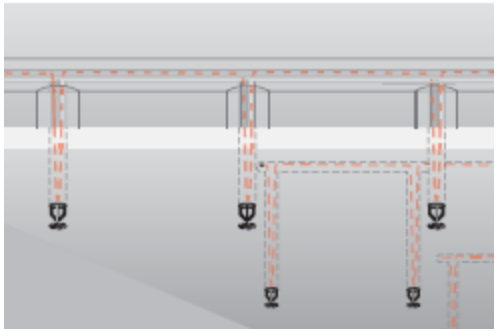
Freezer Frost
Heave Prevention

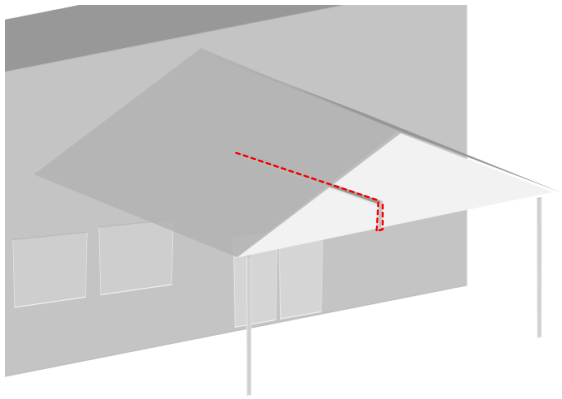
Market need:
New Construction

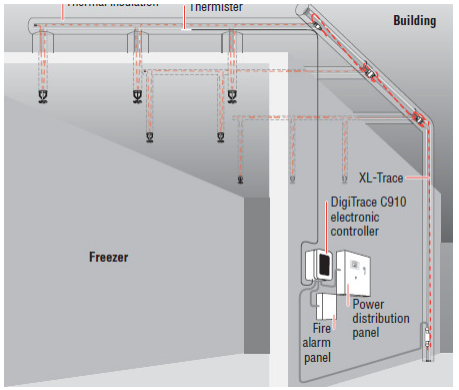
Garage and Portico

Other Applications

- Unconditioned attics
- Small freezers
- Carports

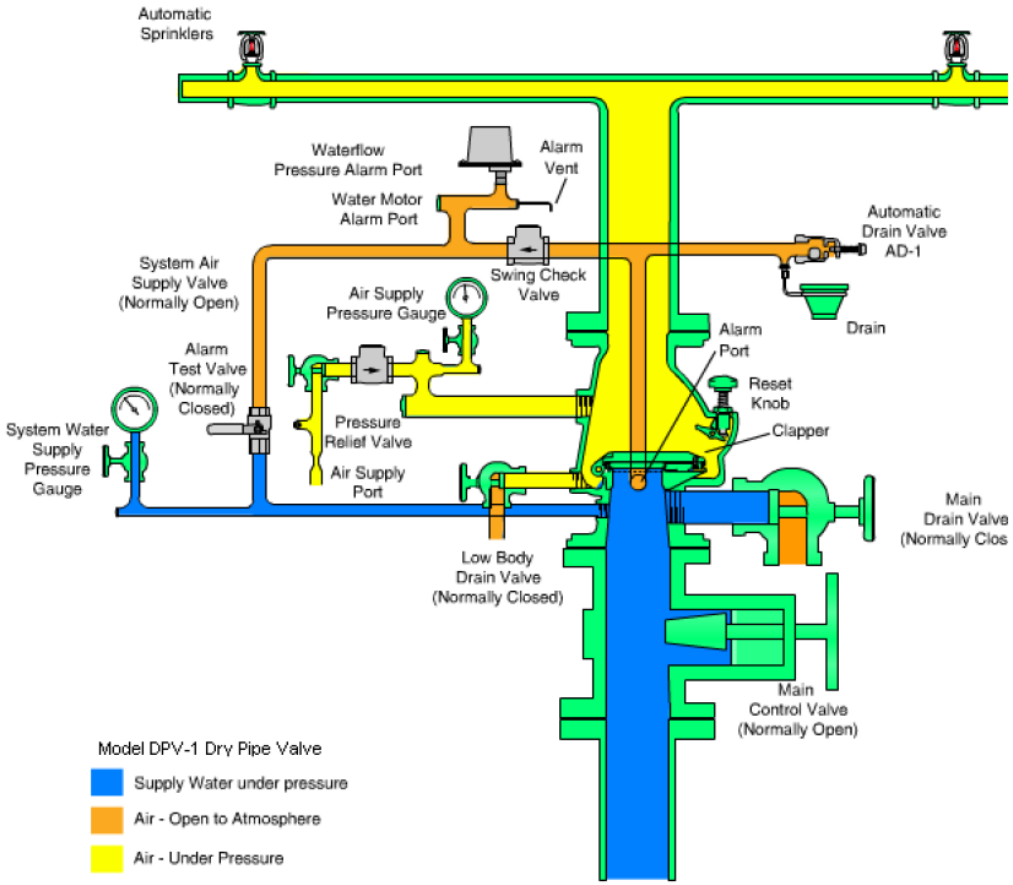






Presently used Dry Systems

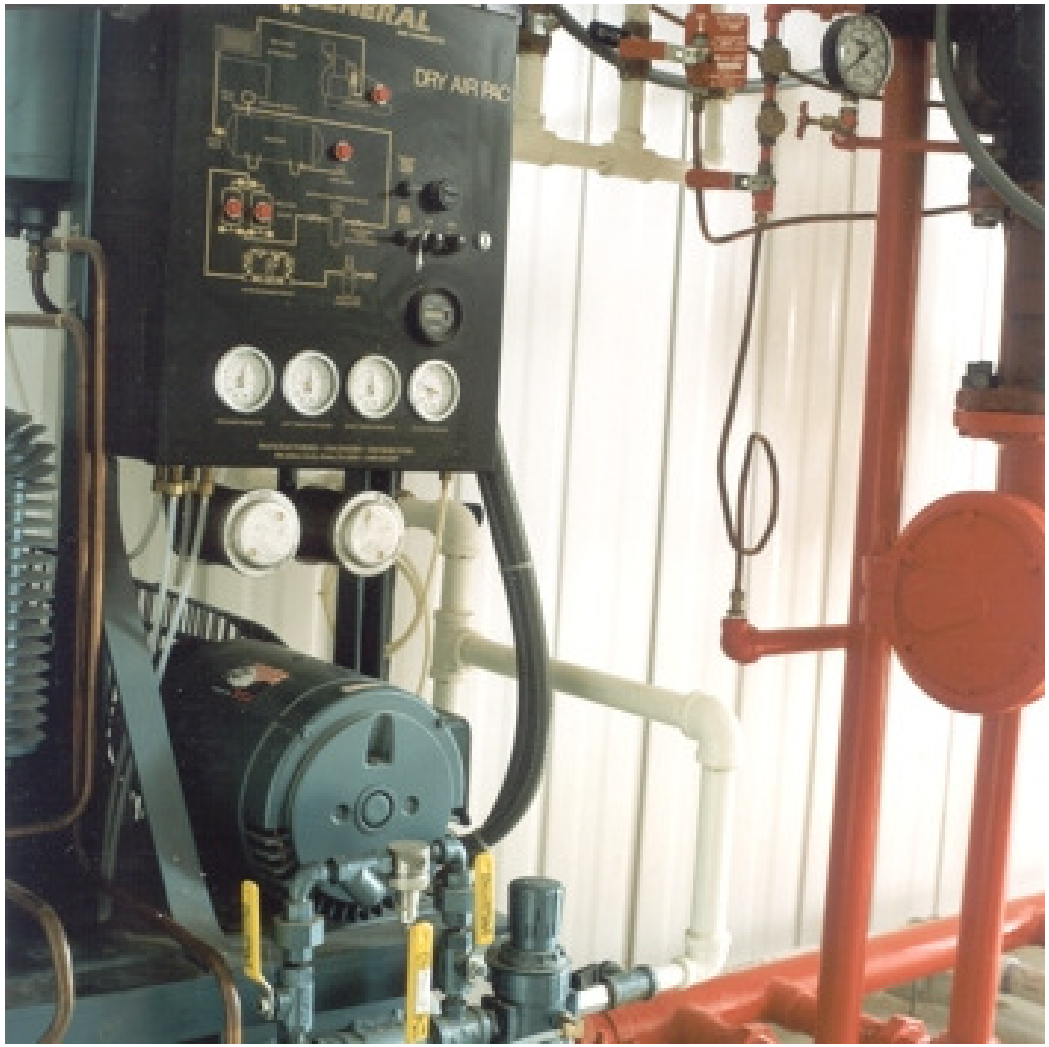
A typical Dry System



Disadvantages of using dry pipe fire sprinkler systems compared to a wet system

- Increased complexity.
- Higher installation cost.
- Higher maintenance cost.
- Lower design flexibility
- Increased fire response time
- Increased corrosion from trapped moisture in the pipes.

Dry-Pipe Fire Sprinkler Systems



Antifreeze Systems

- Glycol Issues
- Recent fire incidents have raised questions regarding the effectiveness of sprinkler systems with certain antifreeze solutions in controlling fire conditions.
- NFPA Status

Fire Sprinkler Applications

- Why all the interest in Heat Trace Freeze Protection?

1. NFPA – clarified the Standard 13 - in 2007 with expanded sections on freeze protection

2. Approval for Heat Trace freeze protection on the fire sprinkler lines all the way to the sprinkler head.

NFPA – 13 2007 Edition

- What does the new standard say?
  - 8.16.4 – Protection of Piping Against Freezing
    - 8.16.4.1.2 “ Unheated areas are permitted to be protected by antifreeze systems or by other systems specifically listed for this purpose, including but not limited to LISTED HEAT TRACING SYSTEMS.”
  - Heat Tracing Systems are approved for Protection of Fire Sprinkler Piping Against Freezing.

NFPA – 13 2007 Edition

- What else does the new standard say?
  - 8.16.4.1.3 – "Where above ground water-filled supply pipes, risers, system risers, or feed mains passing through open areas, cold rooms, passageways or other areas exposed to temperatures below 40F, the pipe shall be protected against freezing by insulating coverings, frostproof casings, listed heat tracing systems, or other reliable means capable of maintaining a minimum temperature between 40 and 120F."

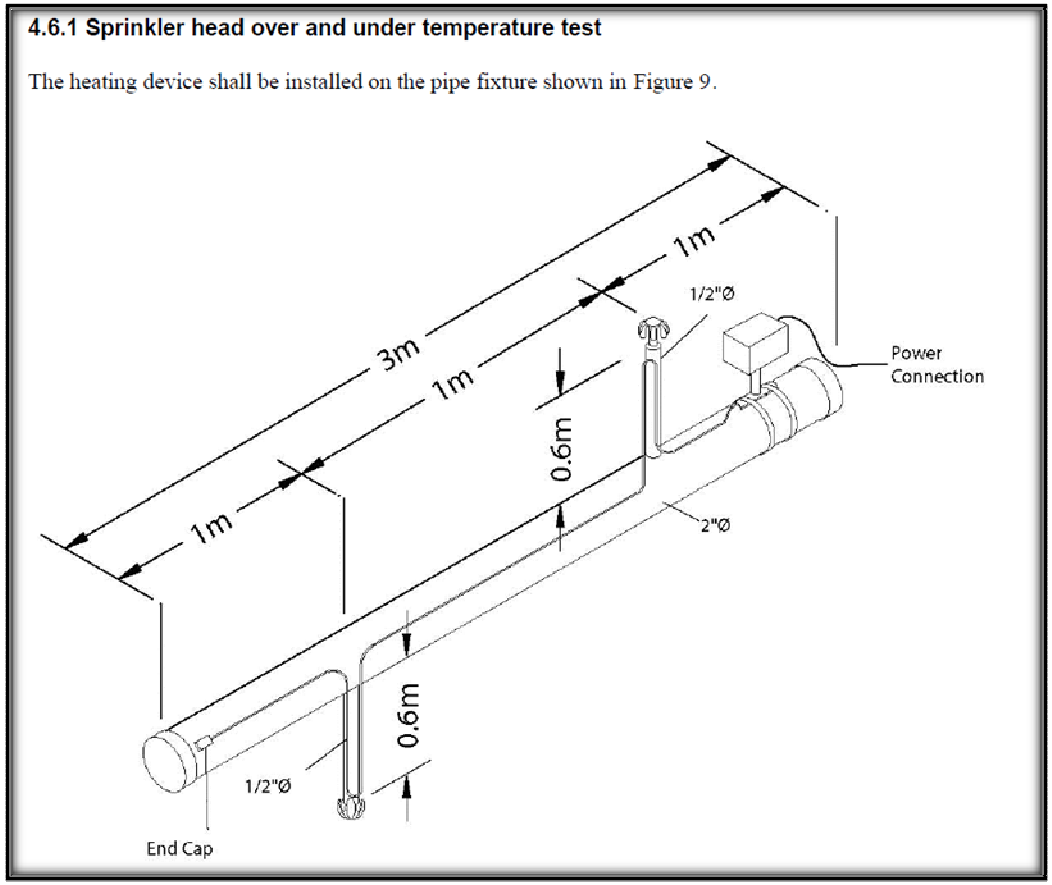
NFPA – 13 2007 Edition

- Additionally the new standard says:
  - **8.16.4.1.4**
    - "Where listed heat tracing systems are used, they shall be supervised"
  - No distinction on the type of application which means all systems that use heat tracing shall be supervised.
  - No further clarification on "Supervised" from NFPA

US IEEE 515.1 Standard

Testing standard for US:

- Specify required testing for branch lines with sprinklers.
- Defines supervision (monitoring) requirements.



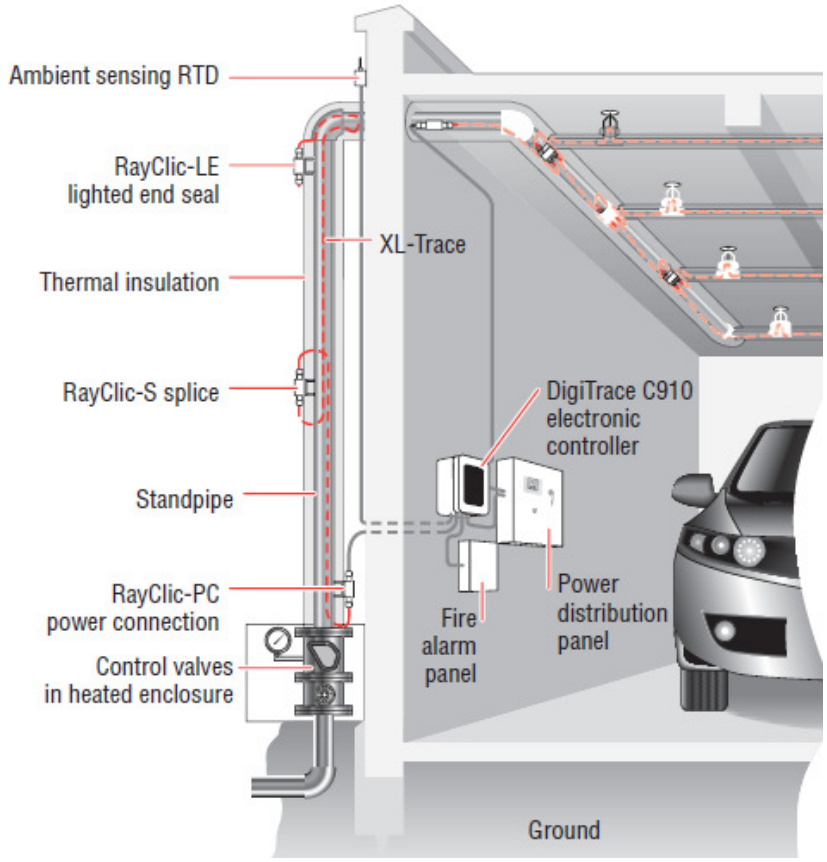
What is supervision?

NFPA 13 requires that the heating cable system is “supervised”.

IEEE 515.1 -2005:” Requires electronic controllers with alarm contacts connected to the fire control panel

Minimum Alarms conditions:

- Low/high pipe temperature
- Loss of power
- Ground-fault trip



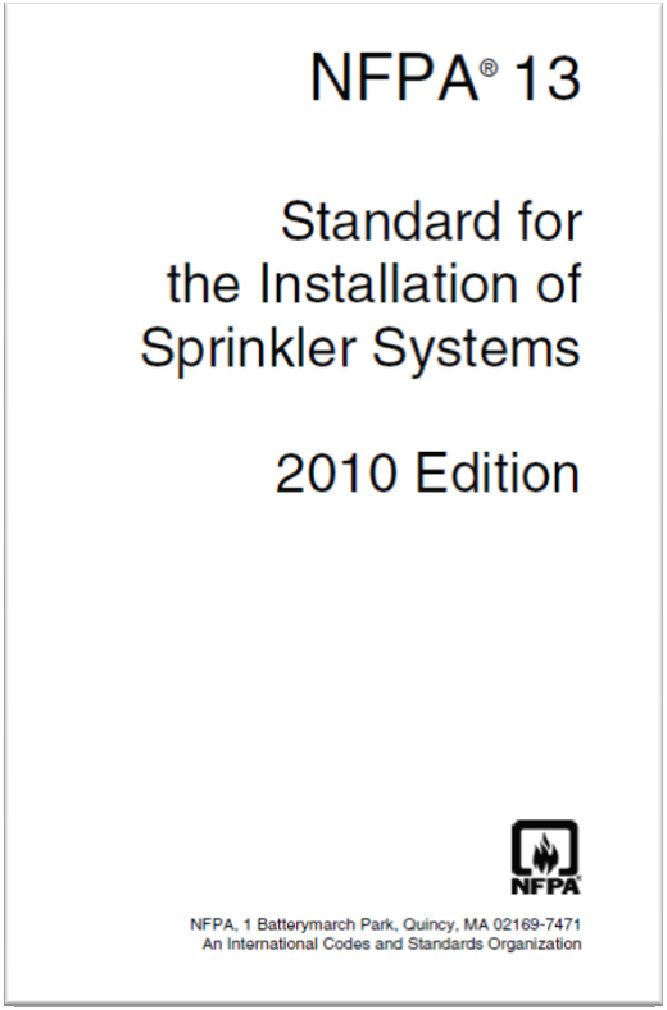
Supervised Controller

- Supervised with an intelligent electronic controller which is capable of monitoring the following conditions:
  - Loss of Supply Power
  - Ground Fault (also replaces a G/F breaker at panel)
  - Loss of Control Power (RTD)
  - Current (if a section of cable is removed)
  - Voltage (too much installed cable will induce a low V)
  - Temperature
  - Switch Failure

Supervised Controller

- Supervised Controller:
  - The ability to communicate the alarm conditions in TWO (2) ways:
    - A set of alarm contacts directly hard wire to the fire alarm panel
    - The ability to communicate to the Building Management System the status & type of alarm conditions of your heat trace system.

NFPA-13 2010

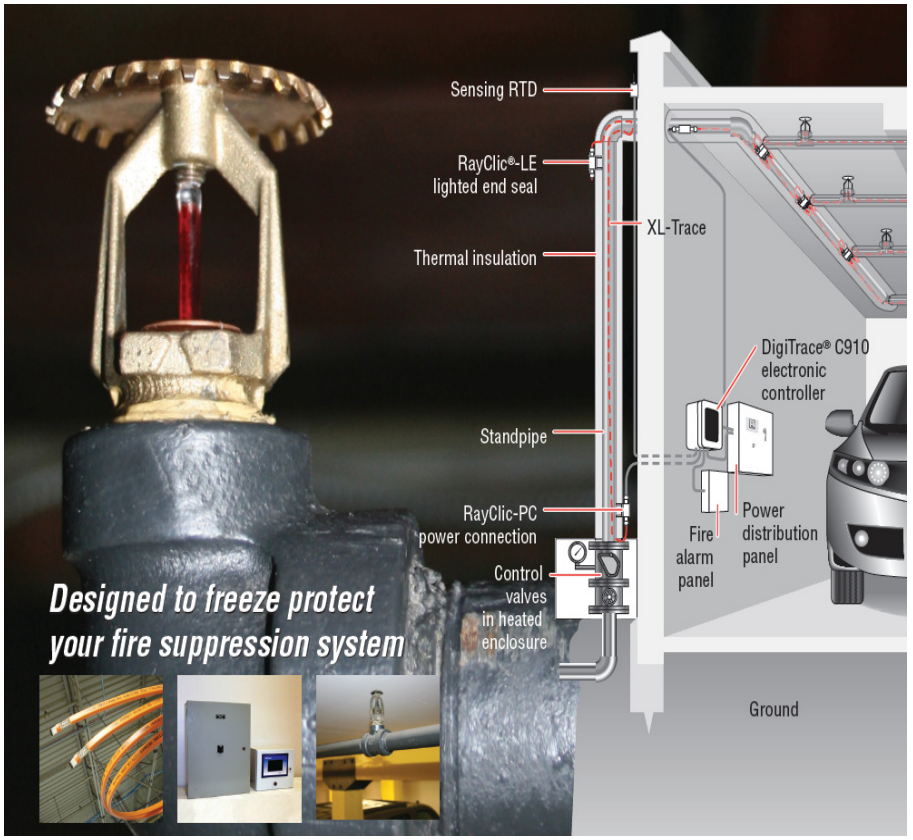


Since 2007, NFPA-13 allows listed electric heat-tracing to freeze protect fire sprinkler systems, including sprinkler heads.

Simplify complex sprinkler applications.

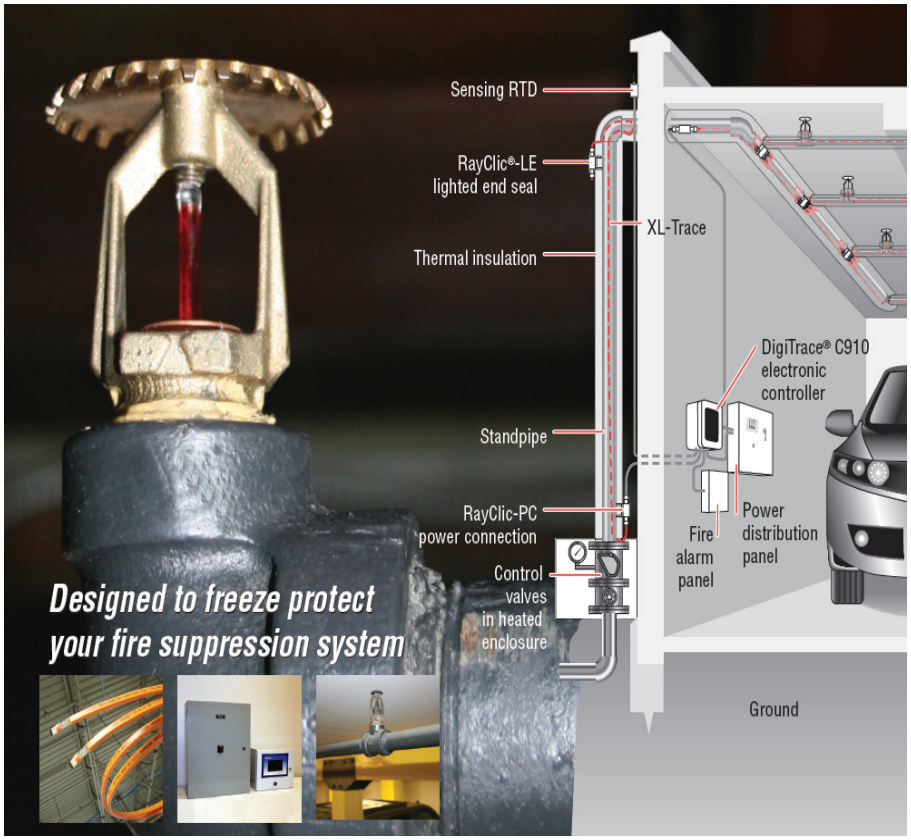
Heat Trace System Benefits

- Eliminates complicated dry system control valves.
- Dry systems are roughly 25% more than wet systems
- Provides one simple system throughout a building, inside and outdoors.
- Simplifies future building expansion.
- Allows faster response time.
- Eliminates the pipe corrosion from trapped moisture in dry systems.
- Prevents frozen condensate in freezer dry pendant sprinklers.
- Is compatible with metal or plastic sprinkler pipe systems
- Glycol systems are about the same price and Heat Traced is preferred.



Heat Trace System Benefits

- Lower cost piping compared to galvanized pipe recommended for dry systems.
- Complete sprinkler pipe monitoring in case of system power loss or malfunction.
- BMS integration allowing the system to be monitored remotely or as part of the BMS.



Design and Installation Manual

Listing requires that heat tracing systems must have design and installation instructions specific to fire sprinkler systems.

The System Overview

Heating cable:

- 5, 8, and 12W/ft

Connection Kits:

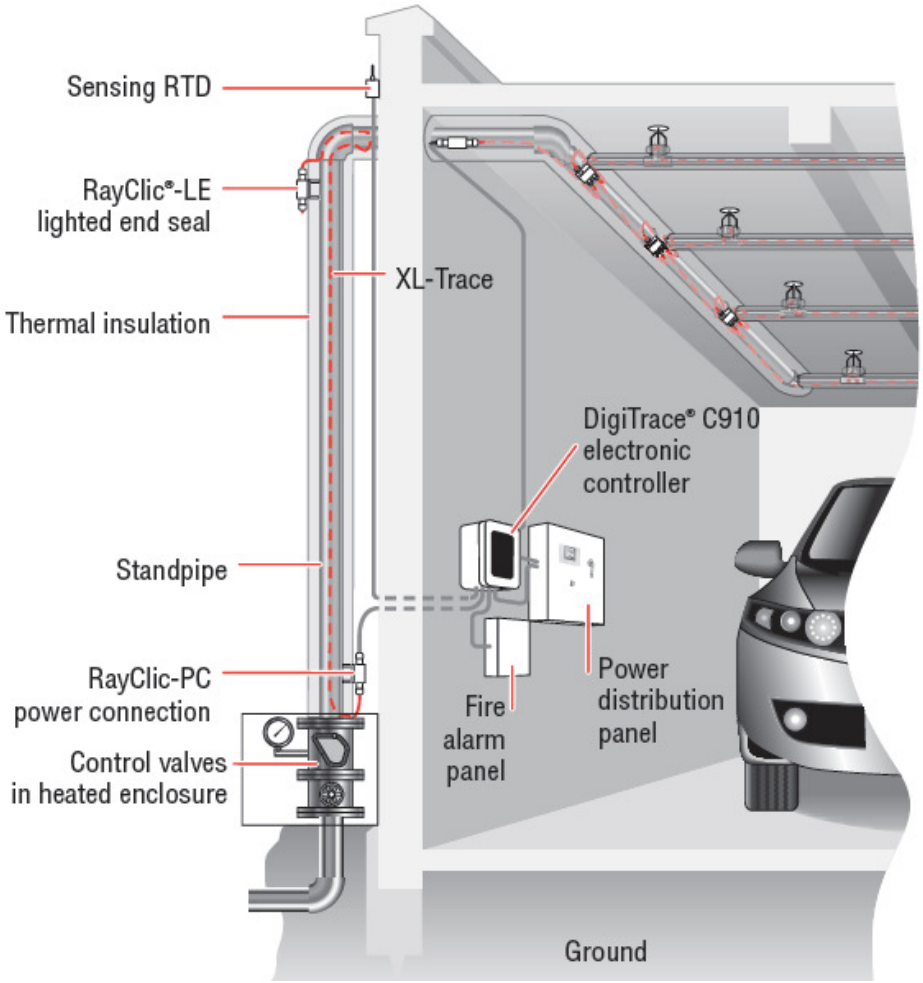
- Power or T's, Splices, etc.

Electronic Controllers

- Single Circuit
- Multiple circuit control system.

Power Distribution

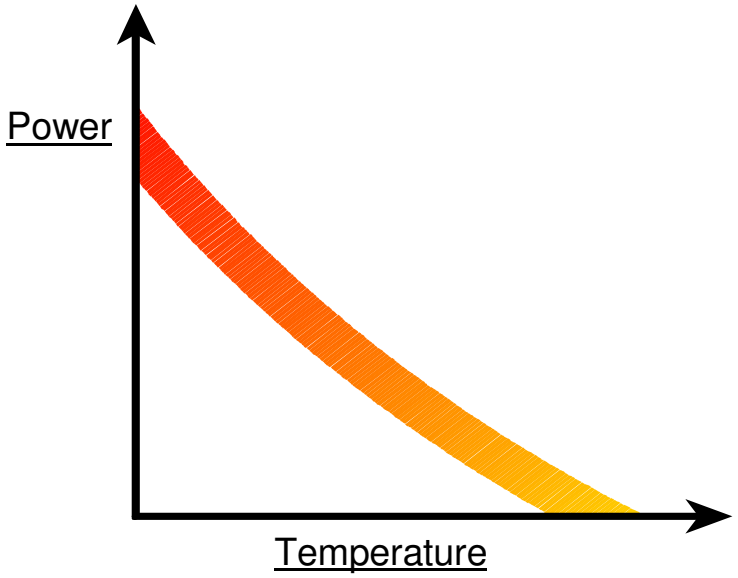
- Power panels.

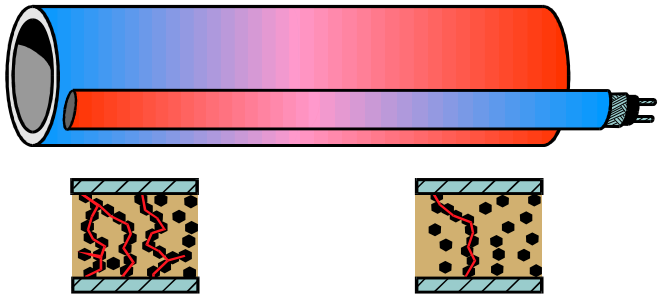


The heating cable

Self-regulating heating cables are essential to prevent under- and over-heating the sprinkler heads.

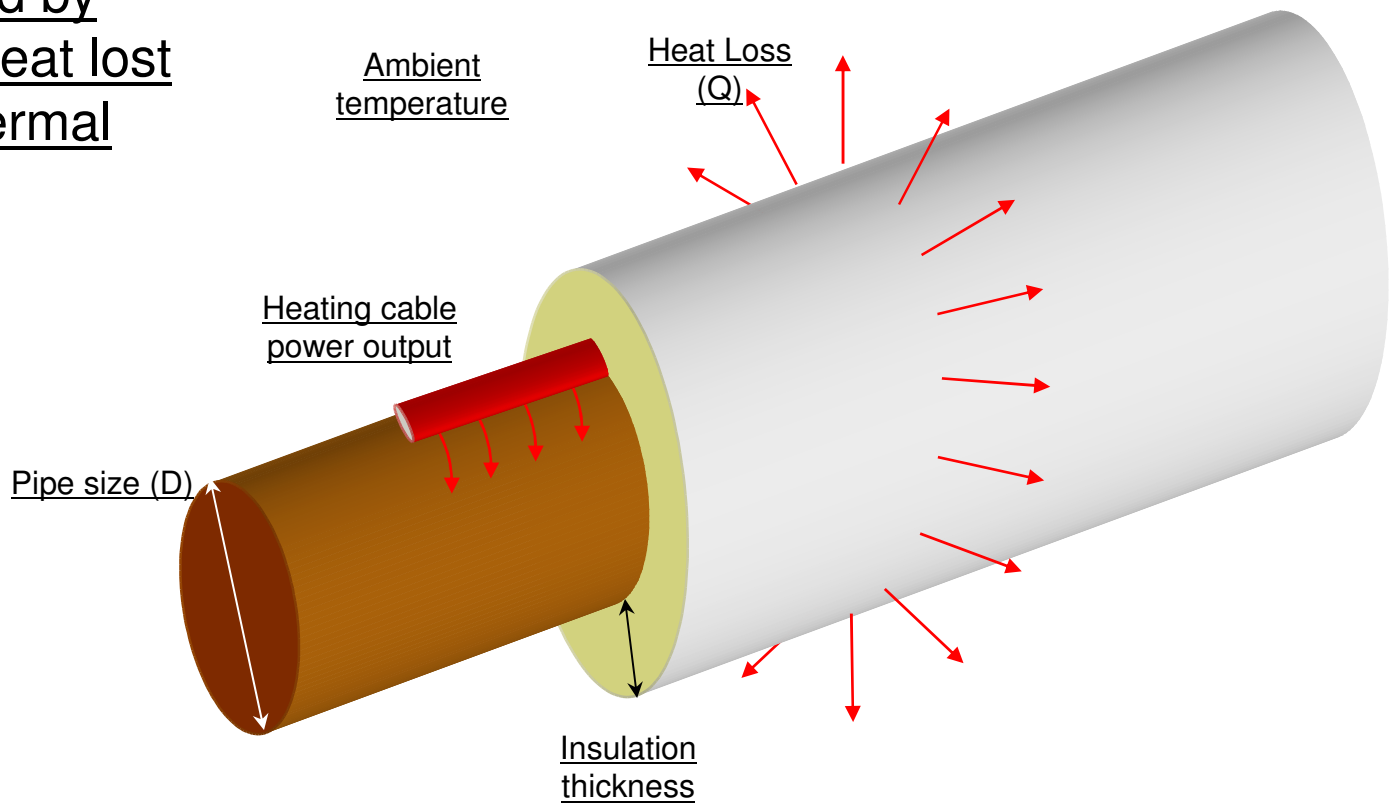
Compatible with metal or plastic supply/branch lines.





How Heat-Tracing is designed to work.

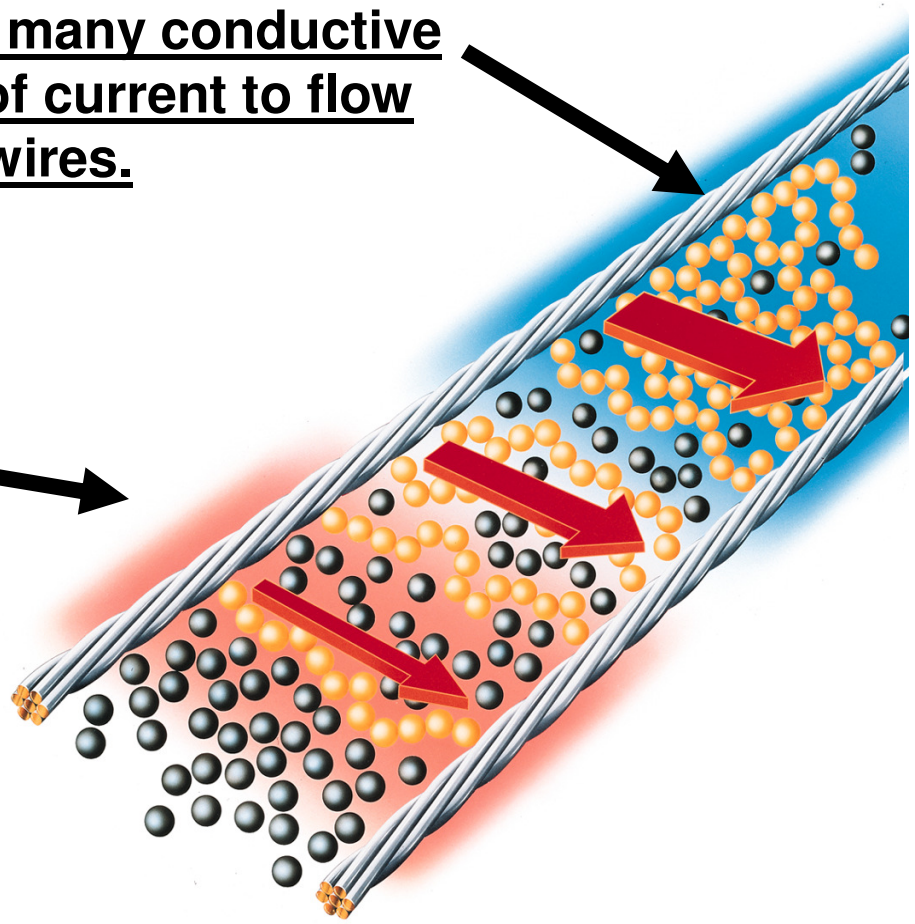
The heating cable only maintains the temperature of stagnant fluid by replacing the heat lost through the thermal insulation.



Self-Regulating Technology

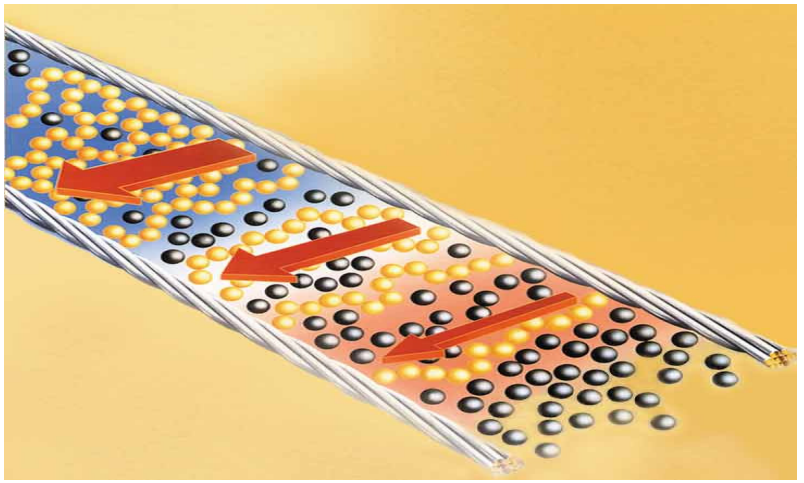
At low temperatures there are many conductive paths, allowing higher level of current to flow between the bus wires.

At high temperature the polymer expands, reducing the number of paths – thereby reducing the power output of the cable



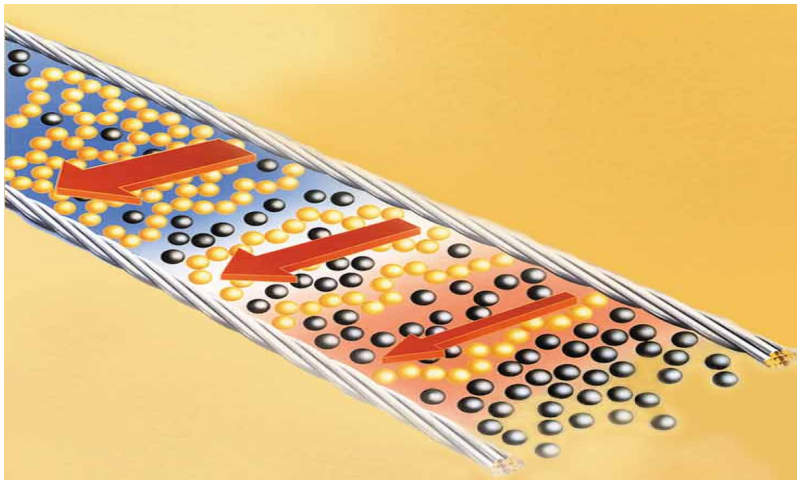
Self Regulating Heating Cable

- Nickel Plated Copper Bus Wires – carries current to heater core
- Self Regulating Conductive Core - heater
- Polyolefin wrap - insulation
- Aluminum Foil Wrap – heater core protective layer (Plasticizer barrier)
- Tinned Copper Braid – ground wire for circuit and mechanical protection
- Protective Outer Jacket – protect heater cable from abuse



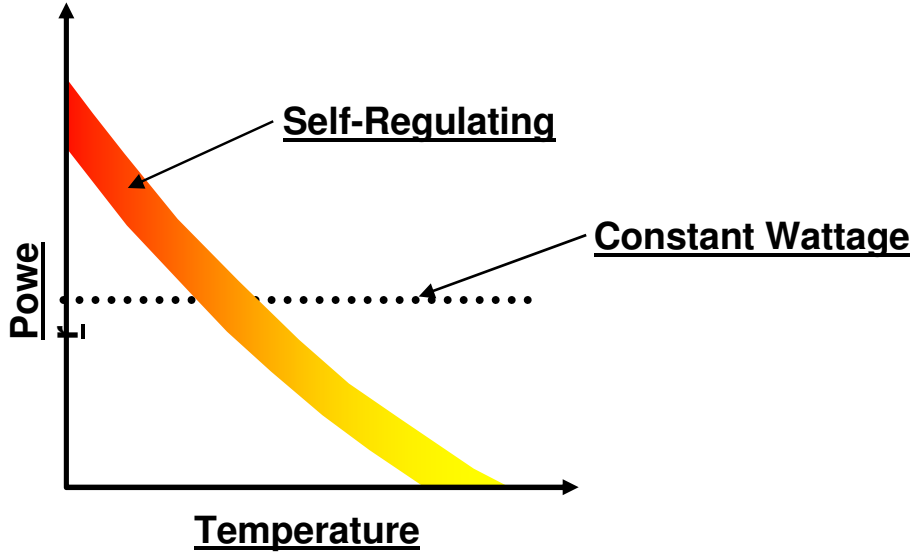
Self Regulating Heating Cable

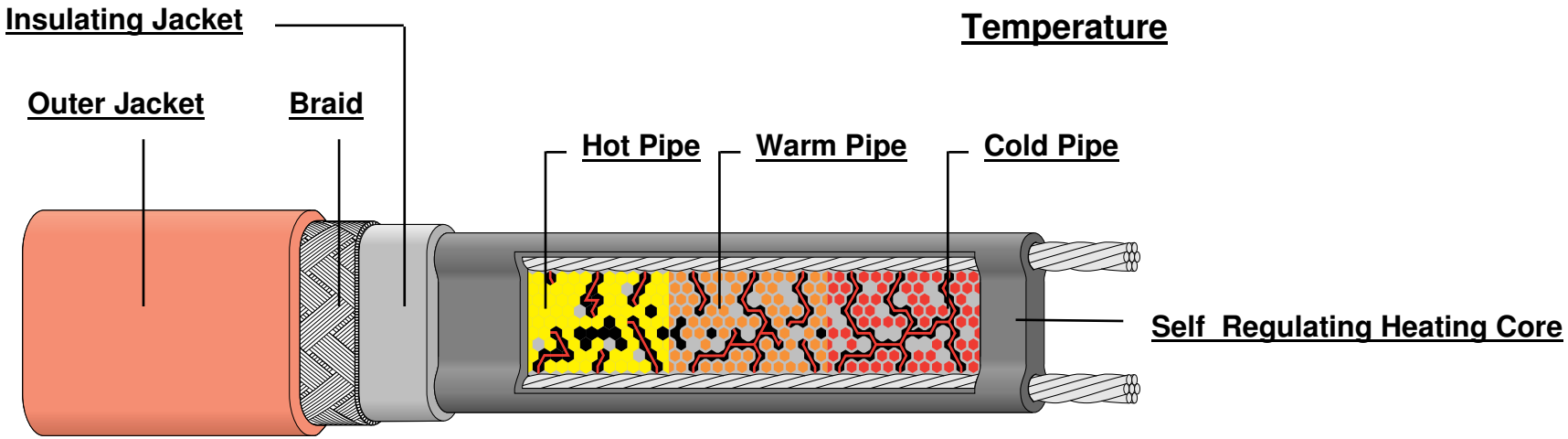
- The Conductive polymer heating core regulates its power output in response to the pipe temperature along its entire length.
  - Heater core output is inversely related to the pipe temperature
  - Cable can be overlapped
  - No overheating or burnouts
  - No thermostats required



Self-Regulating

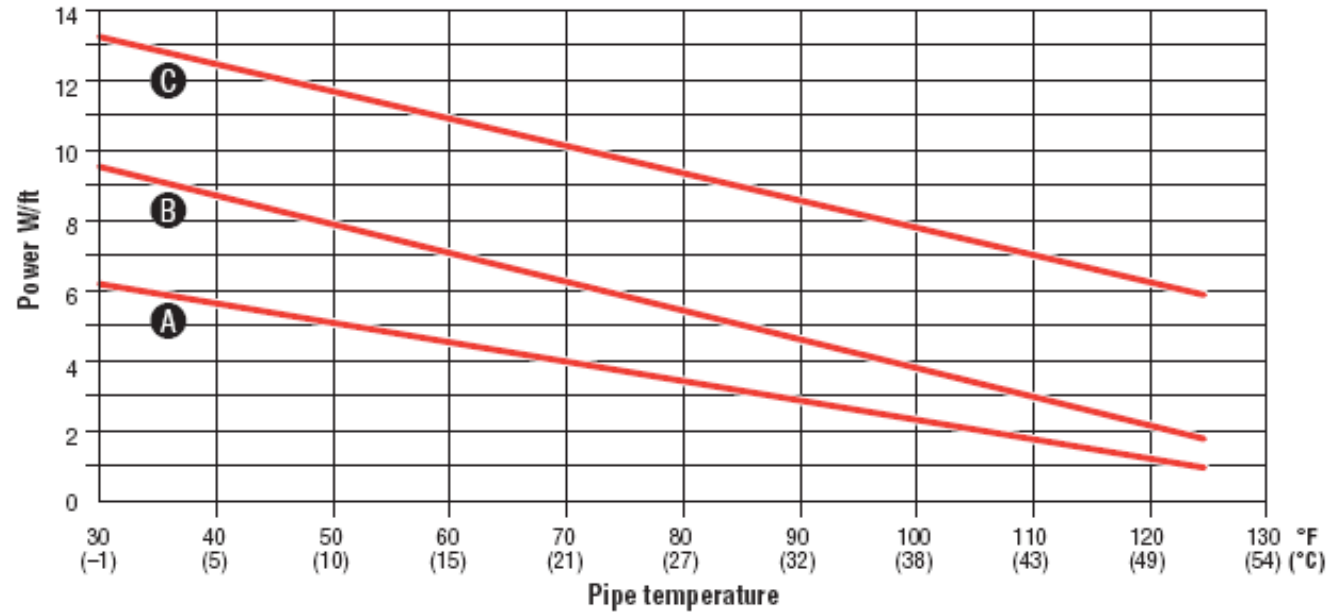
- Parallel circuit
- Output varies in response to temperature all along its length





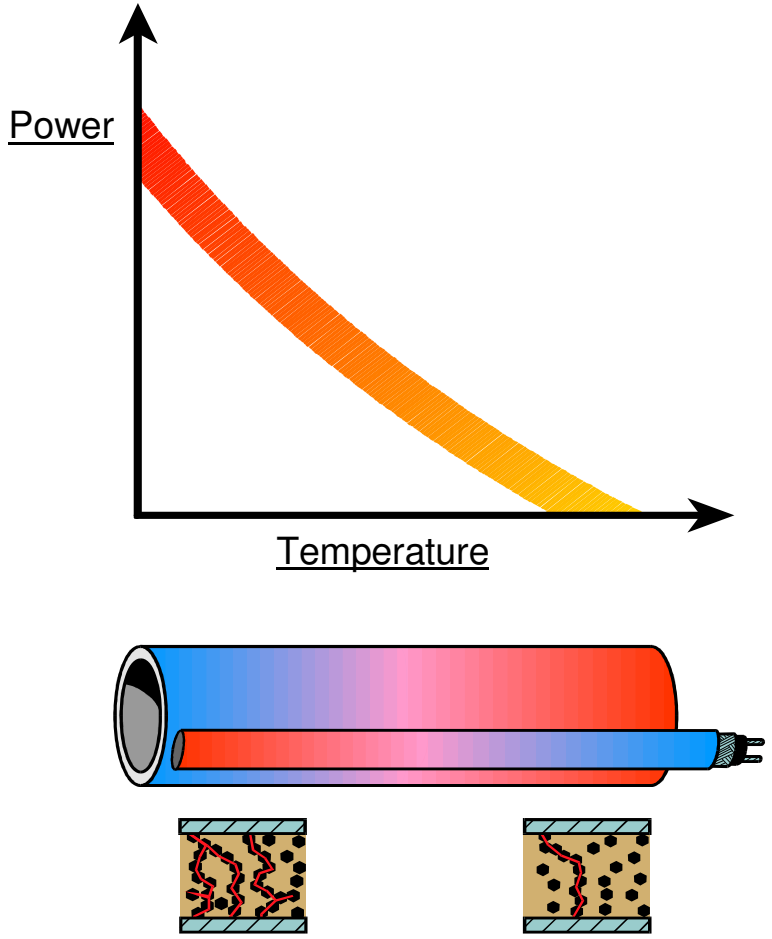
What is Self-Regulating?

Self-regulating heating cables are polymer-core heating cables which have inherent capability to inversely vary their power output in response to an increase or decrease in the actual temperature in their immediate vicinity.



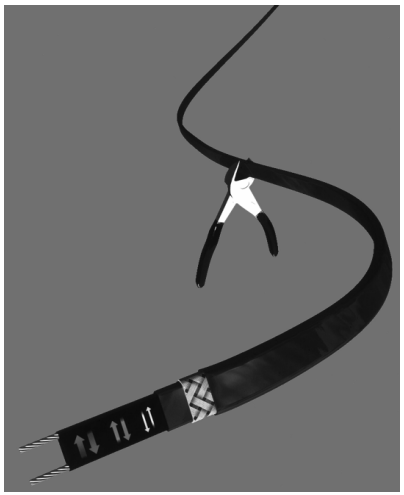
Right Amount of Heat

- Power output varies with temperature
  - as pipe or surface temperature increases, power output decreases
- The right amount of heat is supplied to the application
  - cold sections of the pipe or surface get more heat input
  - warm sections of the pipe or surface get less heat input

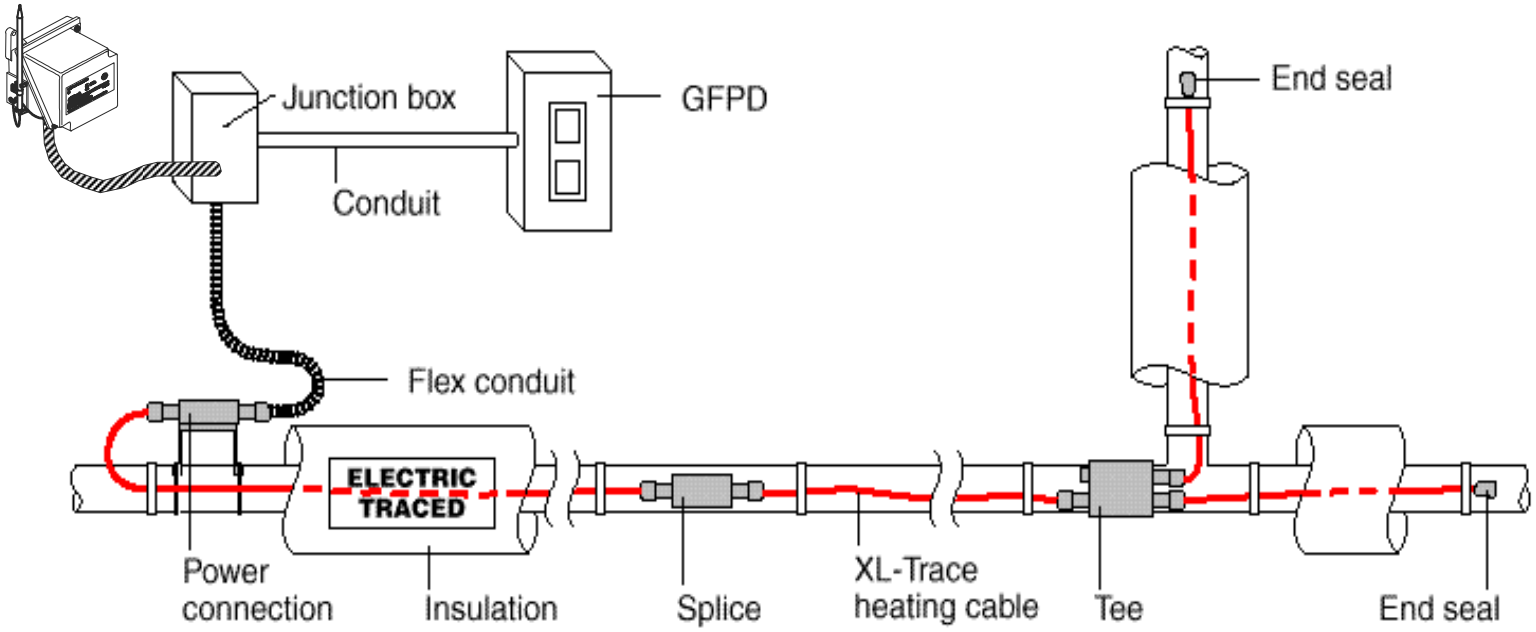


Advantages of Self-Regulating

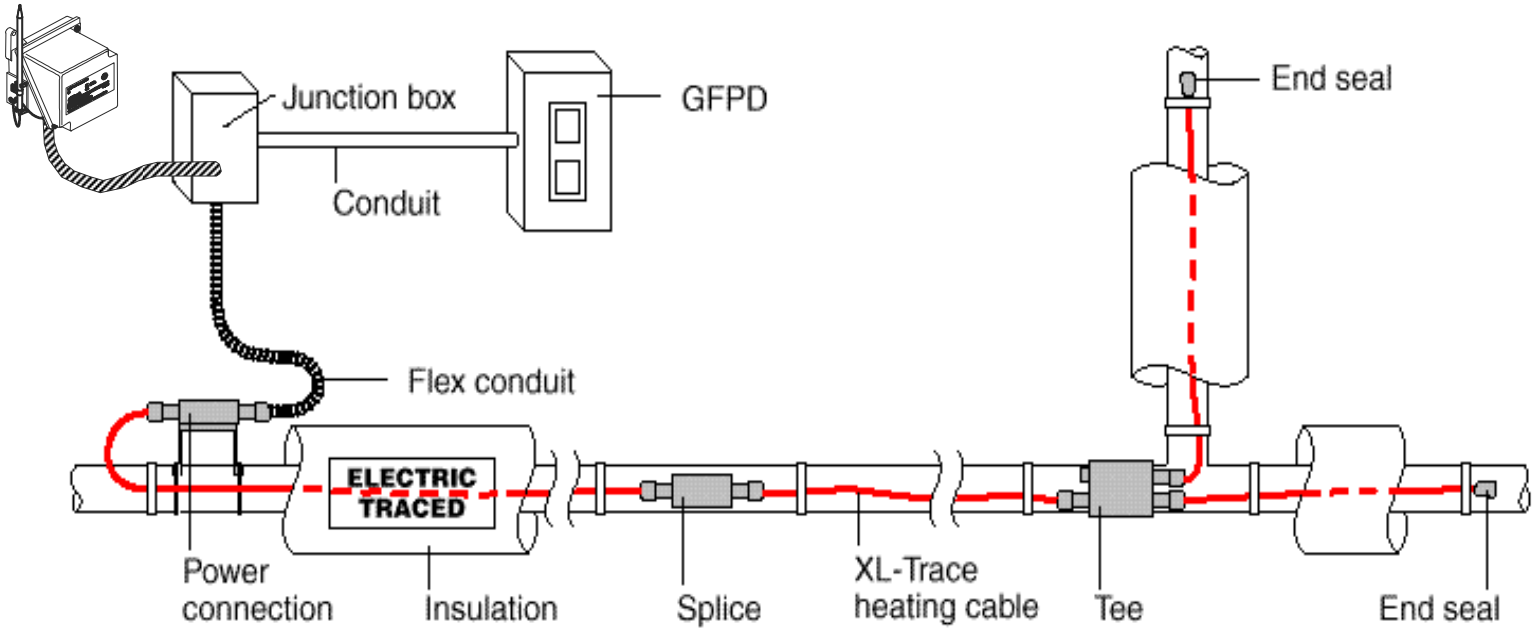
- High Reliability
  - Cannot burn itself out
  - Can be overlapped
- Easy to design
  - Cut to length (parallel circuit)
  - No redesign on field changes
- Low installed and operating cost
  - Easy to tee, splice, repair and install
- Saves Energy
  - Generates heat only where it is needed



System Overview

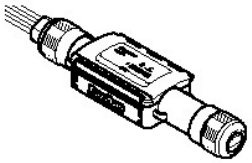


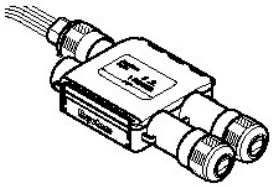
Heating Cable is NOT Wrapped!

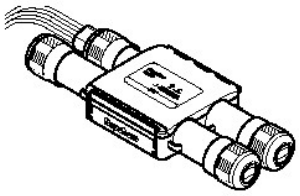


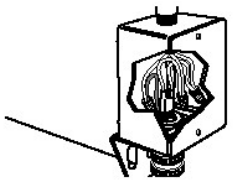
Connection Kits for SR Cable

Power Connection

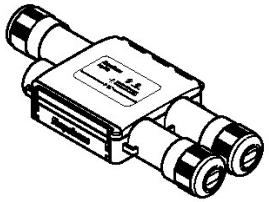




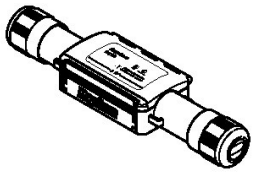


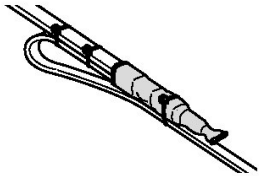


Tee Connection



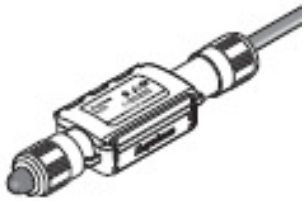
Splice Connection





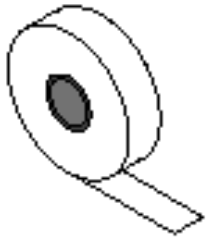
End Seal

Lighted End Seal

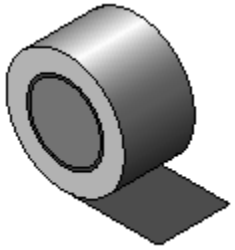


Accessories

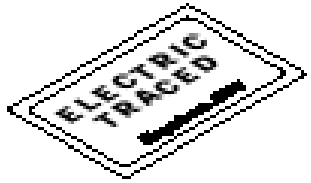
- Glass tape



- Aluminum tape

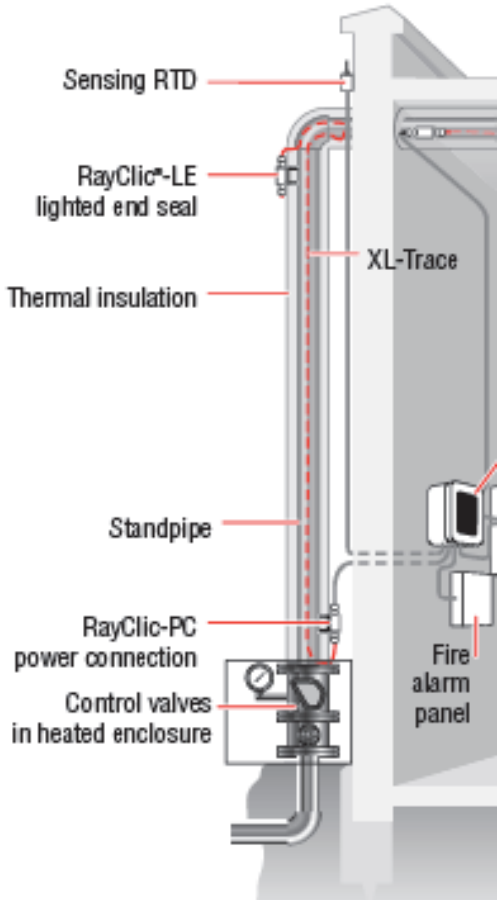


- Warning labels (every 10’)



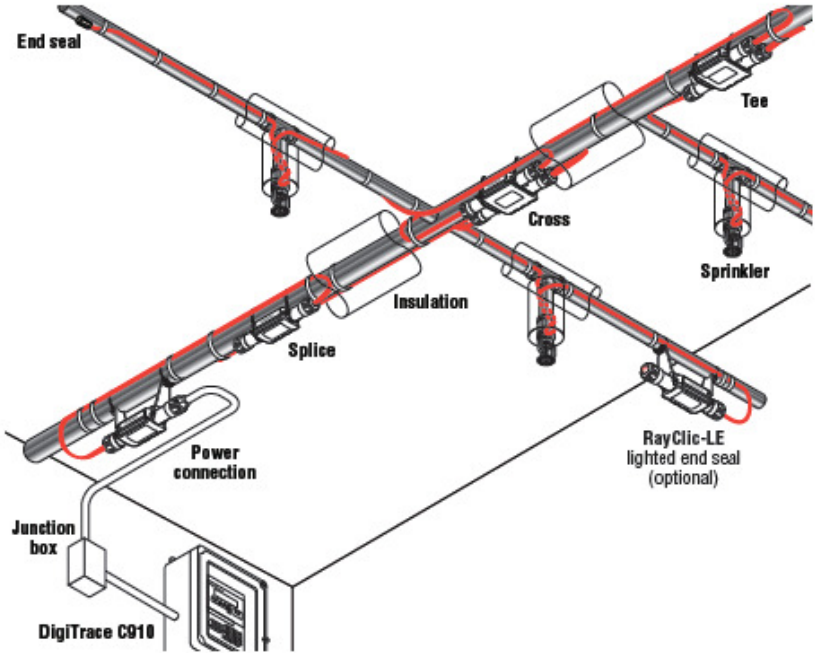
Standpipe and Supply pipe Application

- Schedule 5, 10, 20, or 40 steel sprinkler standpipe ≤20 inches in diameter.
- Buried supply pipes.
- Flame retardant fiberglass insulation with weatherproof cladding.
- Controllers with integrated ground-fault protection and alarm contacts connected to a fire control panel.



Branch line and Sprinkler Heads

- Install additional heating cable to compensate for sprinkler heads.
- Flame retardant fiberglass insulation with weatherproof cladding.
- Controllers with integrated ground-fault protection and alarm contacts connected to a fire control panel.



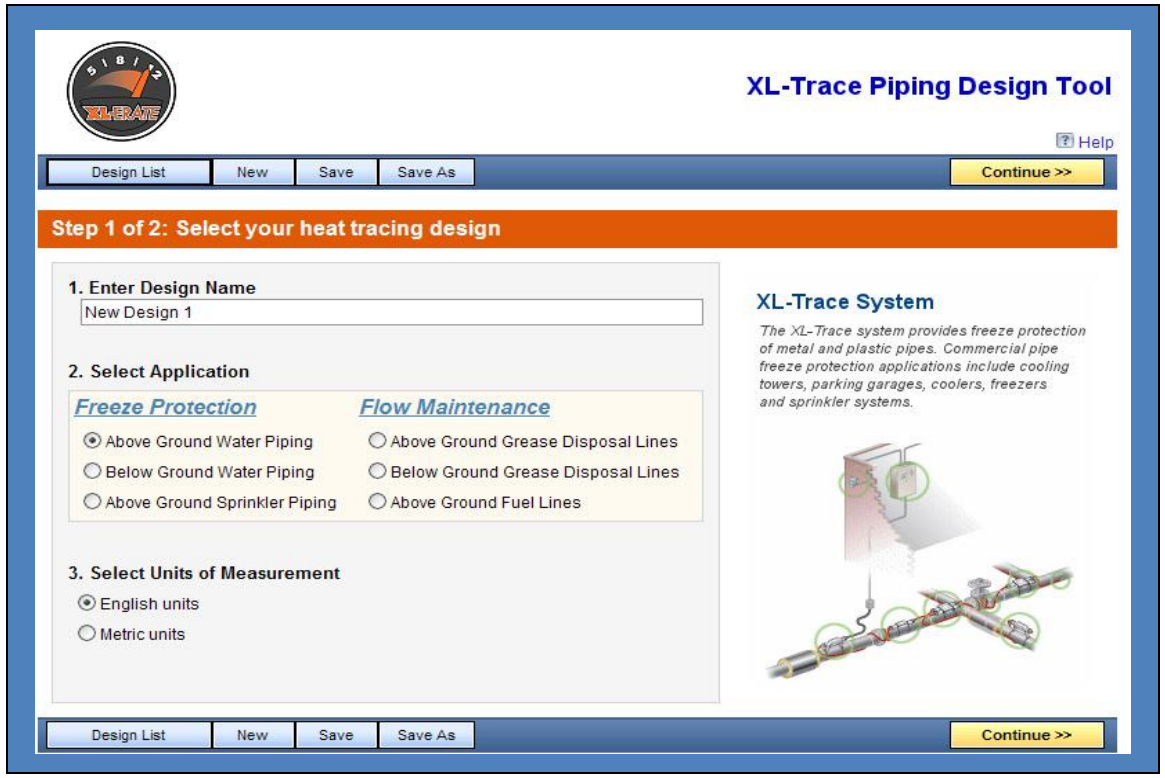
How to design the heating cable system

- Design Guide and Installation Manual.

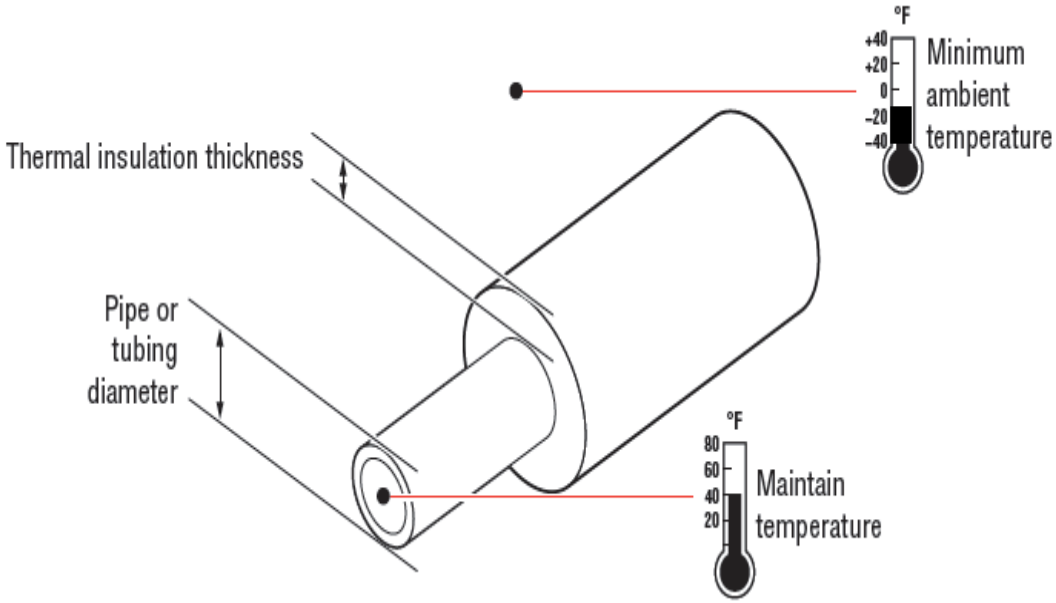
- On-line design tool.

Software on public site

- Software will be accessible on manufactures websites:

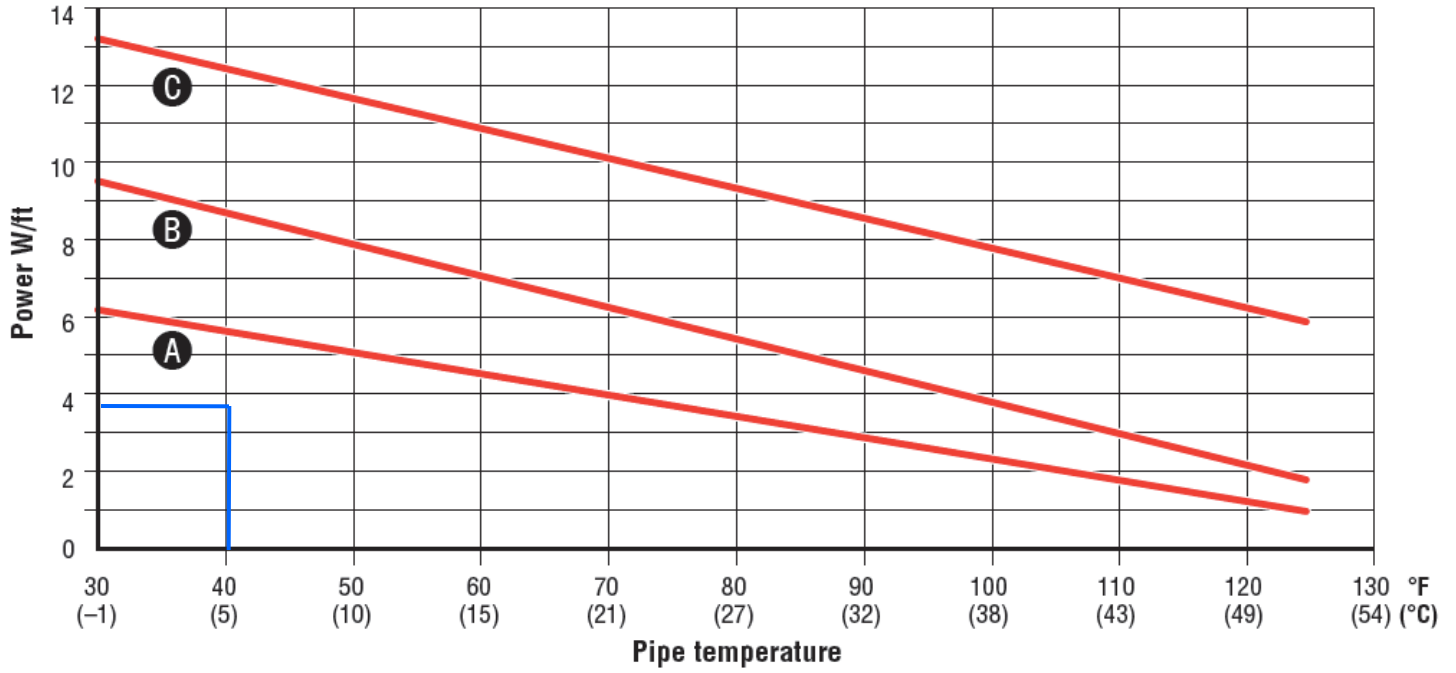


Determine heat loss



Insulation thickness	(ΔT)		Pipe diameter (IPS) in inches					
(in)	°F	°C	1/2	3/4	1	1-1/4	1-1/2	2
0.5	20	11	1.0	1.2	1.4	1.6	1.8	2.2
	50	28	2.5	2.9	3.5	4.1	4.6	5.5
	100	56	5.2	6.1	7.2	8.6	9.6	11.5
	150	83	8.1	9.5	11.2	13.4	14.9	17.9
1.0	20	11	0.6	0.7	0.8	1.0	1.1	1.3
	50	28	1.6	1.9	2.2	2.5	2.8	3.2
	100	56	3.4	3.9	4.5	5.2	5.8	6.8
	150	83	5.3	6.1	7.0	8.2	9.0	10.6

Select heating cable



A 5XL1-CR and 5XL1-CT (120 V)
5XL2-CR and 5XL2-CT (208 V)

B 8XL1-CR and 8XL1-CT (120 V)
8XL2-CR and 8XL2-CT (208 V)

C 12XL2-CR and 12XL2-CT (208 V)

Control Method

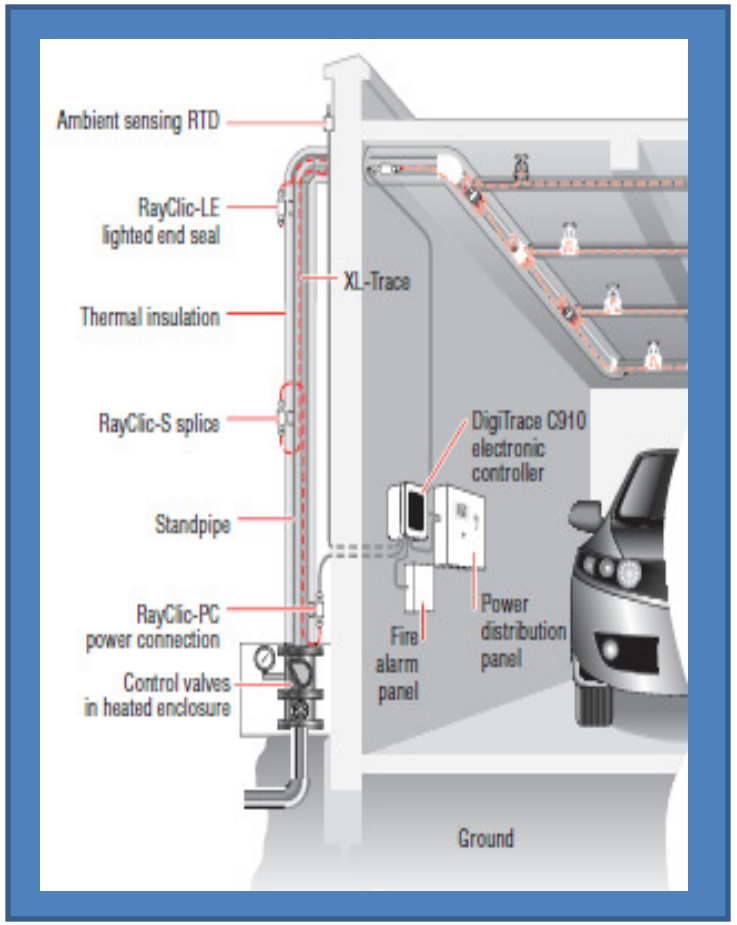
– **Ambient Control**
  - Energize system when ambient temperature drops below 40F.

- **Proportional Ambient Control**:

– Energy savings feature.
  - Provides only power that is needed for the measured ambient temperature.

- **Line Sensing control:**

– Used for buried fire supply pipes.



Controller Options

Two different electronic controllers that satisfy the NPFA-13 supervision requirement.

- Single Circuit Controller
- Multi Circuit Controller

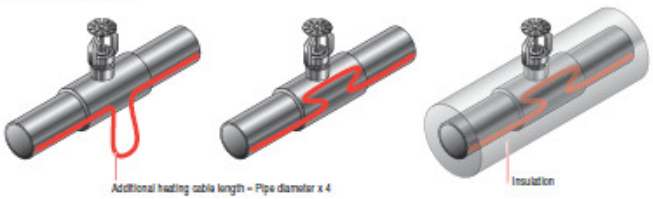
Installation Details

Installation and Maintenance

Follow the installation and maintenance procedures in the XL-Trace System Installation and Operation Manual (H58033) when installing XL-Trace on fire suppression systems with the following additional instructions:

- When installing XL-Trace on sprinklers follow the methods shown below:

Sprinkler head without sprig



Sprinkler head with sprig

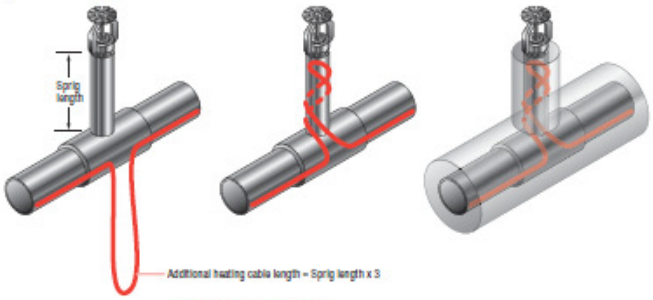


Fig. 15 XL-Trace on sprinklers

When installing XL-Trace on dry pendant sprinklers used in freezer applications follow the methods show below:

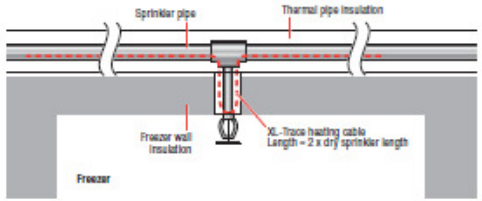


Fig. 16 XL-Trace on extended pendant sprinklers

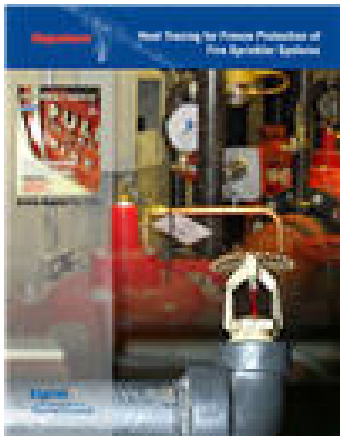
Installation Photos

Installation Photos

Fire Sprinkler Freezer Protection

- Fire Sprinkler Design Guide

- New article reprint available on a link from our website.



Specifications

- More than likely it will be a performance specification
- In almost all cases the AHJ's will be involved.
- Sprinkler contractors most likely will install.
- Specifications available on manufactures website.

Questions?