



HEAT TRACE DESIGN GUIDE

PIPE HEAT LOSS CALCULATIONS

1. Basic Heat Loss: After determining the difference between the ambient and desired pipe maintenance temperature, T_m , use Table 1 to figure the basic heat loss for the pipe size and insulation thickness.

2. Insulation Adjustment: Using Table 2, find the type of insulation being used and its insulation factor.

TABLE 1: Pipe Heat Loss QP in W/ft Based on Temperature Differential and Insulation Thickness

Nominal Pipe Size In. (ID)	TEMPERATURE DIFFERENCE BETWEEN PIPE & AMBIENT															
	Deg°F	40°F	50°F	60°F	70°F	80°F	90°F	100°F	120°F	140°F	160°F	180°F	200°F	220°F	240°F	260°F
1" INSULATION THICKNESS																
½"	W/ft	1.4	1.8	2.1	2.5	2.8	3.2	3.5	4.2	5.1	5.9	6.6	7.7	8.5	9.2	10.0
¾"	W/ft	1.6	2.0	2.4	2.8	3.2	3.6	4.0	4.8	5.9	6.7	7.6	8.8	9.7	10.6	11.4
1"	W/ft	1.8	2.3	2.8	3.2	3.7	4.1	4.6	5.5	6.8	7.7	8.7	10.1	11.1	12.1	13.2
1½"	W/ft	2.4	3.1	3.7	4.3	4.9	5.5	6.1	7.3	9.0	10.2	11.5	13.4	14.8	16.1	17.4
2"	W/ft	2.8	3.5	4.1	4.8	5.5	6.2	6.9	8.3	10.1	11.6	13.0	15.2	16.7	18.2	19.7
2½"	W/ft	3.2	4.0	4.8	5.6	6.4	7.2	8.0	9.6	11.8	13.4	15.1	17.6	19.4	21.1	22.9
3"	W/ft	3.7	4.7	5.6	6.5	7.4	8.4	9.3	11.2	13.7	15.6	17.6	20.5	22.5	24.6	26.6
4"	W/ft	4.6	5.8	6.9	8.1	9.2	10.4	11.5	13.8	16.9	19.3	21.7	25.3	27.8	30.4	32.9
6"	W/ft	6.4	8.0	9.6	11.2	12.8	14.4	16.0	19.2	23.5	26.9	30.2	35.2	38.7	42.2	45.8
8"	W/ft	8.1	10.1	12.1	14.1	16.2	18.2	20.2	24.2	29.7	33.9	38.2	44.4	48.9	53.3	57.8
10"	W/ft	9.9	12.4	14.8	17.3	19.8	22.2	24.7	29.6	36.3	41.5	46.7	54.3	59.8	65.2	70.6
12"	W/ft	11.6	14.5	17.4	20.3	23.2	26.1	29.0	34.8	42.6	48.7	54.8	63.8	70.2	76.6	82.9
14"	W/ft	12.6	15.8	19.0	22.1	25.3	28.4	31.6	37.9	46.5	53.1	59.7	69.5	76.5	83.4	90.4
16"	W/ft	14.3	17.9	21.5	25.1	28.7	32.3	35.9	43.0	52.7	60.2	67.8	78.9	86.8	94.6	102.5
18"	W/ft	16.0	20.1	24.1	28.1	32.1	36.1	40.1	48.1	58.9	67.4	75.8	88.2	97.0	105.9	114.7
20"	W/ft	17.7	22.2	26.6	31.0	35.4	39.9	44.3	53.2	65.1	74.4	83.7	97.5	107.2	117.0	126.7
22"	W/ft	19.4	24.3	29.1	34.0	38.8	43.7	48.5	58.2	71.3	81.5	91.7	106.7	117.4	128.0	138.7
24"	W/ft	21.1	26.4	31.6	36.9	42.2	47.4	52.7	63.2	77.5	88.5	99.6	115.9	127.5	139.1	150.7
1.5" INSULATION THICKNESS																
½"	W/ft	1.1	1.4	1.7	2.0	2.2	2.5	2.8	3.5	4.1	4.7	5.5	6.2	6.8	7.4	8.0
¾"	W/ft	1.2	1.6	1.9	2.2	2.5	2.8	3.1	3.9	4.6	5.2	6.1	6.8	7.5	8.2	8.9
1"	W/ft	1.4	1.8	2.2	2.5	2.9	3.2	3.6	4.5	5.3	6.0	7.1	7.9	8.7	9.5	10.3
1½"	W/ft	1.8	2.3	2.8	3.2	3.7	4.1	4.6	5.8	6.8	7.7	9.1	10.1	11.1	12.1	13.2
2"	W/ft	2.1	2.6	3.1	3.6	4.2	4.7	5.2	6.6	7.6	8.7	10.3	11.4	12.6	13.7	14.9
2½"	W/ft	2.4	3.0	3.5	4.1	4.7	5.3	5.9	7.4	8.7	9.9	11.7	13.0	14.3	15.6	16.9
3"	W/ft	2.7	3.4	4.1	5.0	5.4	6.1	6.8	8.6	10.0	11.4	13.5	15.0	16.5	18.0	19.4
4"	W/ft	3.3	4.2	5.0	6.8	6.6	7.5	8.3	10.5	12.2	13.9	16.4	18.3	20.1	21.9	23.7
6"	W/ft	4.5	5.7	6.8	8.5	9.0	10.2	11.3	14.2	16.6	19.0	22.4	24.9	27.3	29.8	32.3
8"	W/ft	5.6	7.1	8.5	10.3	11.3	12.7	14.1	17.8	20.7	23.7	27.9	31.0	34.1	37.2	40.3
10"	W/ft	6.8	8.0	10.3	12.0	13.7	15.4	17.1	21.5	25.1	28.7	33.9	37.6	41.4	45.1	48.9
12"	W/ft	8.0	10.0	12.0	14.0	16.0	18.0	20.0	25.2	29.4	33.6	39.6	44.0	48.4	52.8	57.2
14"	W/ft	8.7	10.9	13.0	15.2	17.4	19.5	21.7	27.3	31.9	36.5	43.0	47.7	52.5	57.3	62.1
16"	W/ft	9.8	12.3	14.8	17.2	19.7	22.1	24.6	31.0	36.2	41.3	48.7	54.1	59.5	64.9	70.4
18"	W/ft	11.0	13.7	16.4	19.2	21.9	24.7	27.5	34.5	40.3	46.0	54.3	60.3	66.3	72.3	78.4
20"	W/ft	12.1	15.1	18.1	21.1	24.2	27.2	30.2	38.1	44.4	50.7	59.8	66.4	73.1	79.7	86.4
22"	W/ft	13.2	16.5	19.8	26.4	26.4	29.7	33.0	41.6	48.5	55.4	65.3	72.6	79.9	87.1	94.4
24"	W/ft	14.3	17.9	21.5	28.6	28.6	32.2	35.8	45.1	52.6	60.1	70.9	78.8	88.6	94.5	102.4

Nominal Pipe Size In. (ID)	TEMPERATURE DIFFERENCE BETWEEN PIPE & AMBIENT															
	Deg°F	40°F	50°F	60°F	70°F	80°F	90°F	100°F	120°F	140°F	160°F	180°F	200°F	220°F	240°F	260°F
2" INSULATION THICKNESS																
½"	W/ft	1.0	1.2	1.4	1.7	1.9	2.2	2.4	3.0	3.5	4.0	4.8	5.3	5.8	6.3	7.2
¾"	W/ft	1.1	1.4	1.6	1.9	2.2	2.4	2.7	3.4	4.0	4.5	5.3	5.9	6.5	7.1	8.1
1"	W/ft	1.2	1.5	1.8	2.1	2.4	2.7	3.0	3.8	4.4	5.0	5.9	6.6	7.3	7.9	9.0
1½"	W/ft	1.5	1.9	2.3	2.7	3.0	3.4	3.8	4.8	5.6	6.4	7.5	8.4	9.2	10.0	11.4
2"	W/ft	1.7	2.2	2.6	3.0	3.4	3.9	4.3	5.4	6.3	7.2	8.5	9.5	10.4	11.4	12.9
2½"	W/ft	1.9	2.4	2.9	3.4	3.8	4.3	4.8	6.0	7.1	8.1	9.5	10.6	11.6	12.7	14.4
3"	W/ft	2.2	2.8	3.3	3.9	4.4	5.0	5.5	6.9	8.1	9.2	10.9	12.1	13.3	14.5	16.4
4"	W/ft	2.6	3.3	4.0	4.6	5.3	5.9	6.6	8.3	9.7	11.1	13.1	14.5	16.0	17.4	19.7
6"	W/ft	3.6	4.5	5.3	6.2	7.1	8.0	8.9	11.2	13.1	15.0	17.6	19.6	21.5	23.5	26.6
8"	W/ft	4.4	5.6	6.7	7.8	8.9	10.0	11.1	14.0	16.3	18.6	22.0	24.4	26.9	29.3	33.2
10"	W/ft	5.3	6.7	8.0	9.3	10.6	12.0	13.3	16.8	19.6	22.3	26.3	29.3	32.2	35.1	39.8
12"	W/ft	6.2	7.8	9.3	10.9	12.4	14.0	15.5	19.5	22.8	26.0	30.7	34.1	37.5	40.9	46.3
14"	W/ft	6.7	8.4	10.1	11.8	13.4	15.1	16.8	21.2	24.7	28.2	33.3	37.0	40.7	44.4	50.2
16"	W/ft	7.6	9.5	11.3	13.2	15.1	17.0	18.9	23.8	27.8	31.8	37.4	41.6	45.7	49.9	56.5
18"	W/ft	8.4	10.5	12.6	14.7	16.8	18.9	21.0	26.5	30.9	35.3	41.6	46.2	50.8	55.4	62.8
20"	W/ft	9.2	11.6	13.9	16.2	18.5	20.8	23.1	29.1	34.0	38.8	46.2	50.8	55.9	61.0	69.1
22"	W/ft	10.1	12.6	15.2	17.7	20.2	22.7	25.3	31.8	37.1	42.4	50.0	55.6	61.1	66.7	75.5
24"	W/ft	11.0	13.7	16.4	19.2	21.9	24.7	27.4	34.5	40.3	46.0	54.3	60.3	66.3	72.3	81.9
3" INSULATION THICKNESS																
½"	W/ft	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.5	2.9	3.4	4.0	4.4	4.8	5.5	6.0
¾"	W/ft	0.9	1.1	1.3	1.5	1.8	2.0	2.2	2.8	3.2	3.7	4.4	4.8	5.3	6.1	6.67
1"	W/ft	1.0	1.3	1.5	1.8	2.0	2.3	2.5	3.2	3.7	4.2	5.0	5.5	6.1	6.9	7.5
1½"	W/ft	1.2	1.5	1.8	2.1	2.4	2.7	3.0	3.8	4.4	5.0	5.9	6.6	7.3	8.3	9.0
2"	W/ft	1.3	1.7	2.0	2.3	2.6	3.0	3.3	4.2	4.9	5.5	6.5	7.3	8.0	9.1	9.9
2½"	W/ft	1.5	1.9	2.2	2.6	3.0	3.3	3.7	4.7	5.4	6.2	7.3	8.1	9.0	10.2	11.1
3"	W/ft	1.7	2.1	2.5	2.9	3.4	3.8	4.2	5.3	6.2	7.1	8.3	9.2	10.2	11.6	12.6
4"	W/ft	2.0	2.5	3.0	3.5	4.0	4.5	5.0	6.3	7.4	8.4	9.9	11.0	12.1	13.8	15.0
6"	W/ft	2.6	3.3	3.9	4.6	5.2	5.9	6.5	8.2	9.6	10.9	12.9	14.3	15.7	17.9	19.4
8"	W/ft	3.2	4.0	4.8	5.6	6.4	7.2	8.0	10.1	11.8	13.4	15.8	17.6	19.4	22.1	23.9
10"	W/ft	3.8	4.8	5.7	6.7	7.6	8.6	9.5	12.0	14.0	16.0	18.8	20.9	23.0	26.2	28.4
12"	W/ft	4.4	5.5	6.5	7.6	8.7	9.8	10.9	13.7	16.0	18.3	21.6	24.0	26.4	30.1	32.6
14"	W/ft	4.7	5.9	7.1	8.3	9.4	10.6	11.8	14.9	17.3	19.8	23.4	26.0	28.6	32.6	35.3
16"	W/ft	5.3	6.7	8.0	9.3	10.6	12.0	13.3	16.8	19.6	22.3	26.3	29.3	32.2	36.7	39.8
18"	W/ft	5.9	7.4	8.8	10.3	11.8	13.2	14.7	18.5	21.6	24.7	29.1	32.3	35.6	40.6	44.0
20"	W/ft	6.4	8.1	9.7	11.3	12.9	14.5	16.1	20.3	23.7	27.0	31.9	35.4	39.0	44.4	48.1
22"	W/ft	7.0	8.8	10.5	12.3	14.9	15.8	17.5	22.1	25.7	29.4	34.7	38.5	42.4	48.3	52.3
24"	W/ft	7.6	9.5	11.3	13.2	15.1	17.0	18.9	23.8	27.8	31.8	37.4	41.6	45.7	52.2	56.5

TABLE 2: Insulation Adjustment Factors

PIPE INSULATION TYPE	INSULATION FACTOR
Glass fiber (ASTM C547)	1.00
Calcium silicate (ASTM C533)	1.48
Cellular glass (ASTM C522)	1.48
Rigid cellular urethane (ASTM C591)	0.64

PIPE INSULATION TYPE	INSULATION FACTOR
Foamed elastomer (ASTM C534)	1.16
Mineral fiber blanket (ASTM C553)	1.16
Expanded perlite (ASTM C610)	1.90

CHROMALOX CABLE SELECTION

1. ELECT HEATING CABLE FAMILY: Based on the maximum maintenance temperature rating, maximum exposure temperature rating, and area classification, select the heating cable family from Table 3. (See Chromalox Heat Trace Cable Product Information Sheets for cable construction options, voltage ratings, and wattage outputs available.)

2. SELECT THERMAL OUTPUT RATING:

(A) For Metal Pipes – Use Figures 1, 2 or 4

(B) For Plastic Pipes – Use Figure 3 by finding the intersection of the calculated heat loss, QF, and pipe maintenance temperature, Tm. Select the cable with a thermal output that equals or exceeds QF at Tm.

3. DETERMINE TOTAL CABLE LENGTH: In addition to pipe length, in-line components such as valves, flanges, and pipe supports require additional heat tracing to maintain Tm. See Table 4. Calculate the total cable required by combining the pipe length with additional lengths needed for all other components.

TABLE 3: Heating Cable Families

Heating Cable Family	Area Classification	Pipe Material	Maximum Maintenance Temperature	Maximum Maintenance Temperature (Power Off)	Approvals	
					U.S.	Other
SRL (Self-Regulating Low Temperature)	Ordinary	Plastic/Metal	150°F / 65°C	185°F / 85°C	UL, CSA, FM	CE, ATEX, IECEx
	Class I, Div. 2, Gr. B, C, D				CSA, FM, (Gr. A, CSA Only)	CE, ATEX, IECEx
	Class II, Div. 2, E, F, G				CSA, FM, (Gr. A, CSA Only)	CE, ATEX, IECEx
	Class III, Div. 2				FM Only	CE, ATEX, IECEx
SRM/E (Self-Regulating Med Temperature)	Ordinary	Metal Only	302°F / 150°C	420°F / 215°C	UL, CSA, FM	CE, ATEX, IECEx
	Class I, Div. 2, A, B, C, D				CSA, FM, (Gr. A, CSA Only)	CE, ATEX, IECEx
	Class II, Div. 2, Gr. F, G				CSA Only	CE, ATEX, IECEx
HSRL (Hazardous-Self-Regulating Low Temperature)	Class I, Div. 1, Gr. B, C, D	Plastic/Metal	150°F / 65°C	185°F / 85°C	CSA, FM	
	Class II, Div. 1, Gr. E, F, G				CSA, FM	
	Class III, Div. 1				CSA, FM	
HSRM (Hazardous-Self-Regulating Med Temperature)	Class I, Div. 1, Gr. B, C, D	Metal Only	302°F / 150°C	420°F / 215°C	CSA, FM	
	Class II, Div. 1, Gr. E, F, G				CSA, FM	
	Class III, Div. 1				CSA, FM	

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

Piping Size	Gate Valve	Globe Valve	Ball Valve	Butterfly Valve	Shoe Support	Hanger Support	Sleeper Support	Flange Pair
FT								
½ in.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.30
¾ in.	1.50	1.00	1.00	1.00	1.50	1.00	1.00	0.30
1 in.	2.00	1.00	1.00	1.00	1.50	1.00	1.00	0.30
1½ in.	2.50	1.50	1.50	1.50	2.00	2.00	2.00	0.30
2 in.	2.50	2.00	2.00	2.00	2.00	2.00	2.00	0.30
2½ in.	2.50	2.00	2.00	2.00	2.00	2.00	2.00	0.30
3 in.	3.00	2.50	2.50	2.50	2.00	2.00	2.00	0.50
4 in.	4.00	3.00	3.00	3.0	2.50	2.50	2.50	0.50
6 in.	5.00	3.50	3.50	3.50	2.50	2.50	2.50	0.80
8 in.	7.00	4.00	4.00	4.00	2.50	2.50	2.50	0.80
10 in.	8.00	4.50	4.50	4.50	3.00	3.00	3.00	0.80
12 in.	9.00	5.00	5.00	5.00	3.00	3.00	3.00	0.80
14 in.	10.00	5.50	5.50	5.50	3.00	3.00	3.00	1.00
16 in.	11.00	6.00	6.00	6.00	3.50	3.50	3.50	1.00
18 in.	12.00	7.00	7.00	7.00	3.50	3.50	3.50	1.00
20 in.	13.00	7.50	7.50	7.50	3.50	3.50	3.50	1.00
22 in.	13.00	7.50	7.50	7.50	3.50	3.50	3.50	1.00
24 in.	15.00	8.00	8.00	8.00	4.00	4.00	4.00	1.00

FIG. 1: SRL & HSRL – Thermal Output Ratings on Insulated Metal Pipe

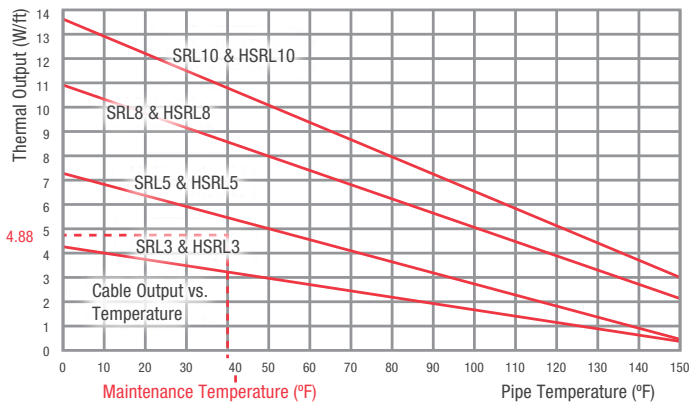


FIG. 2: SRM/E & HSRM – Thermal Output Ratings on Insulated Metal Pipe

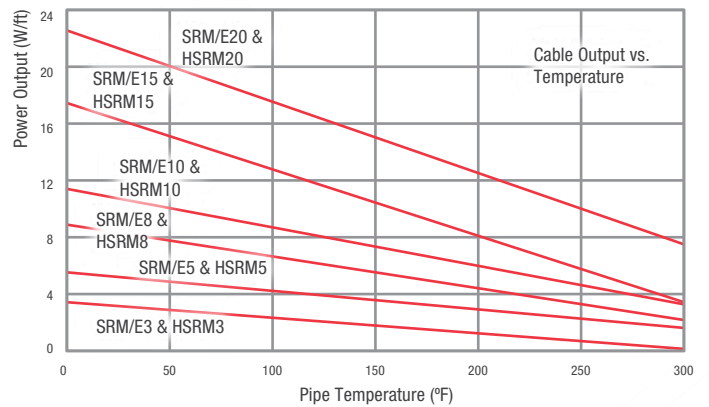
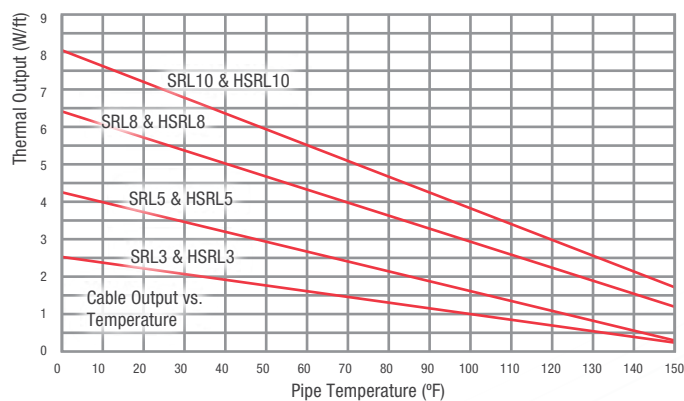


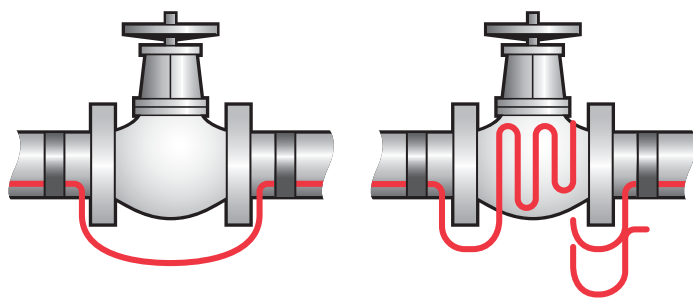
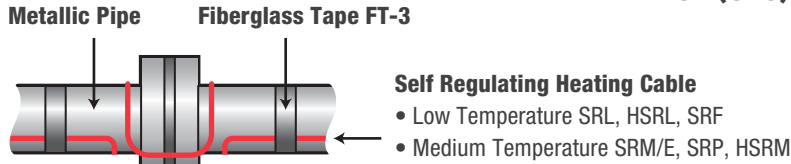
FIG. 3: SRL & HSRL – Thermal Output Ratings on Plastic Pipe w/ Aluminum Tape



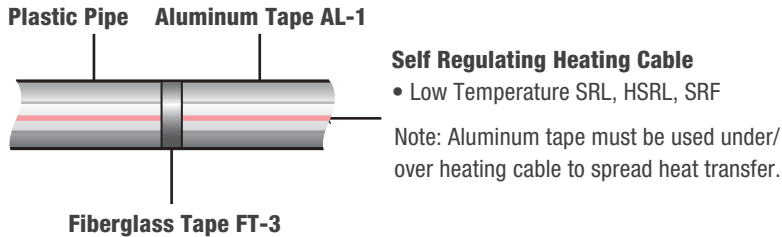
ELECTRIC HEAT TRACE QUICK INSTALL GUIDE

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

METAL PIPE INSTALLATION

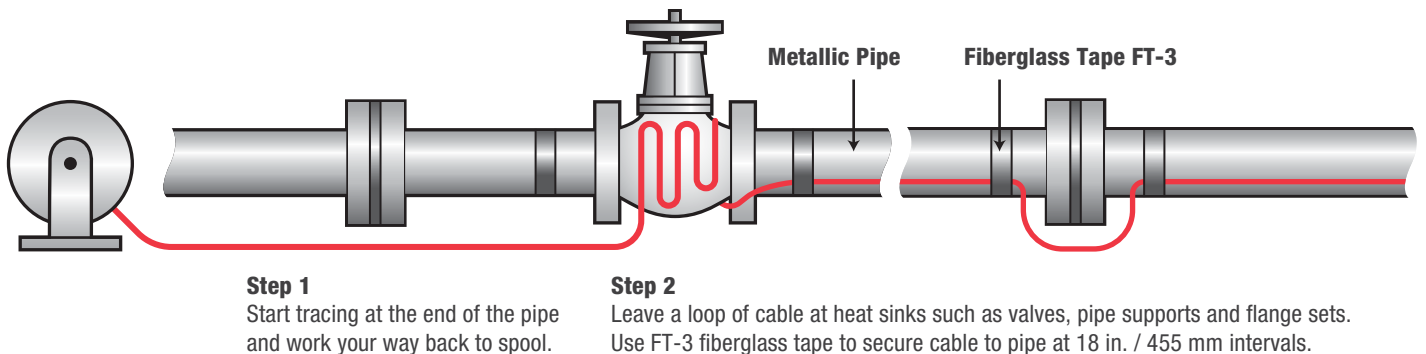
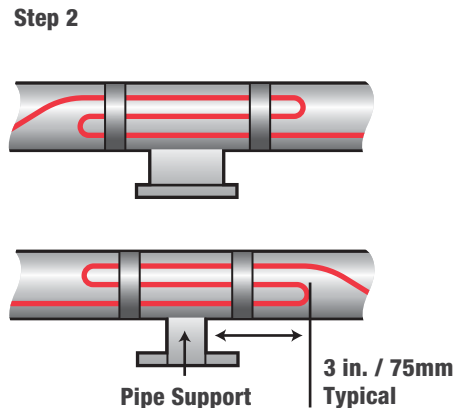
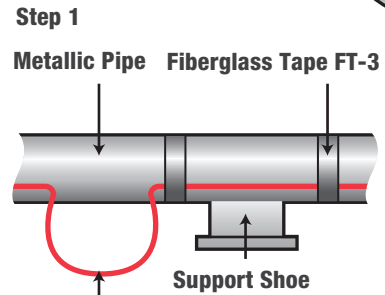
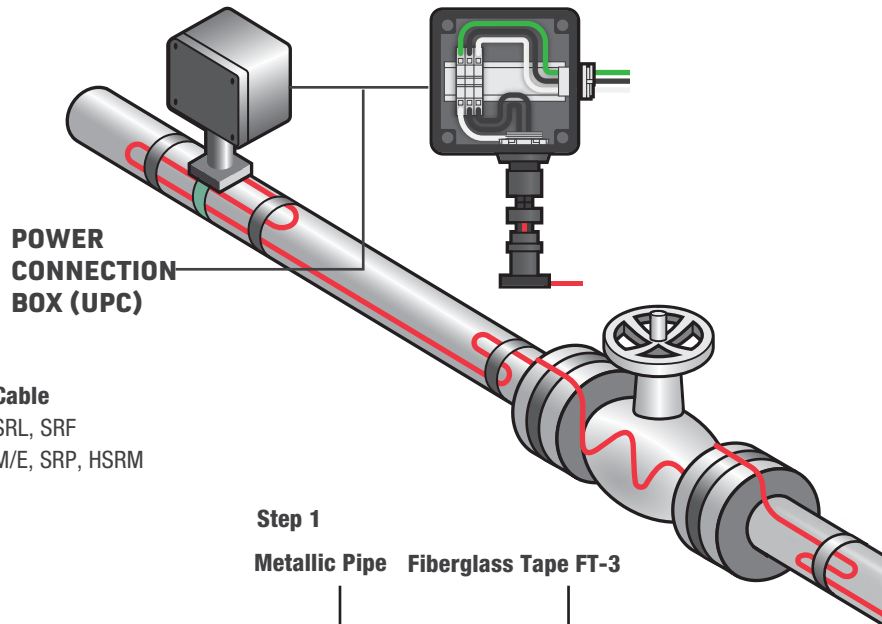


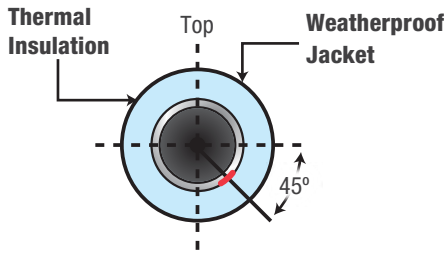
PLASTIC PIPE INSTALLATION



Installation Tips

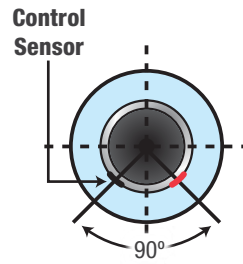
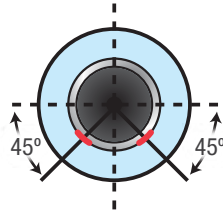
- Temporary position cable on pipe and equipment to ensure proper distribution
- Leave a loop of cable at heat sinks such as valves, pipe supports, and flange sets. Use FT-3 fiberglass tape to secure cable to pipe at 18 in. / 445 mm (nom) intervals using recommended method.
- Always observe minimum bend radius.





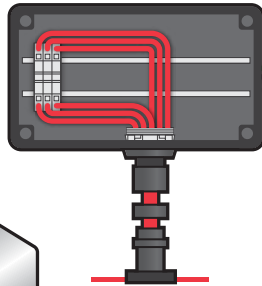
Cable located at nominal 45° below horizontal centerline.

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

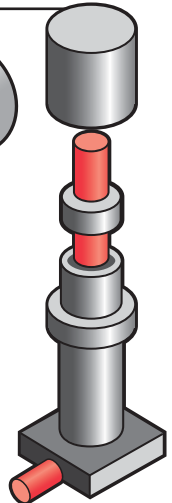


For multiple heaters place control sensor 90° from nearest heater or centered between equally spaced heaters.

MULTIPLE ENTRY CONNECTION (UMC)



ABOVE INSULATION CABLE END SEAL (UES)



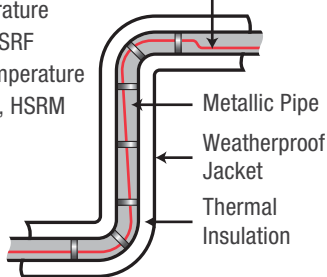
PIPE STRAP

Insulation

Caution Labels

Self Regulating Heating Cable

- Low Temperature SRL, HSRL, SRF
- Medium Temperature SRM/E, SRP, HSRM



Fiberglass Tape FT-3

Ask about Chromalox Class 1 Division 1. Cables & Accessories as well as a full line of High-Temperature Cables.

FOR TECHNICAL SUPPORT CALL 888-996-9258.

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INSTALLATION TIPS

- Do not twist buss wires together at end of circuit
- Insulate all conductive parts
- Seal all electrical connections against moisture
- Seal ends of exposed cable during installation
- Do not expose cables to temperatures above their maximum ratings
- Install cable with aluminum tape for use on plastic pipes
- Locate ambient temperature sensors in coldest expected area
- Locate pipe temperature
- Use sufficient cable to trace additional heat sinks
- Install cable so that valves can be removed without removing cable



SRL CABLE

- 150°F / 65°C Maximum Maintenance
- 185°F / 85°C Maximum Exposure
- 3 to 10 W/ft / 10 to 33 W/m
- 16 AWG with Optional TPE or Fluoropolymer Jacket



SRL CABLE

- 302°F / 150°C Maximum Maintenance
- 420°F / 215°C Maximum Exposure
- 5 to 20 W/ft / 16 to 66 W/m
- 16 AWG with Optional Fluoropolymer Jacket

IMPORTANT SAFEGUARDS

Mechanical Inspections

- Inspect all insulation and weatherproofing
- Inspect all junction box, connection box, and sensor connections
- Verify all circuits have been properly grounded
- Verify all circuits are connected in proper panel locations
- Verify proper circuit breakers are in place (always use 30 mA trip GFI-type breakers)
- Verify all circuit lengths are within manufacturer's specified limits
- Verify all proper safety warnings are in place
- Verify all end seal, splice/tee locations are marked on lagging

Electrical Tests

- Insulation Resistance (Megger)
 - Before tracing pipes
 - After installing terminations
 - Before insulating pipes
 - After insulating pipes
 - Before energizing system
- Circuit Voltage
- Initial Current
 - Note ambient temp / pipe temp
- Stabilized Current (15 minutes of operation)
 - Note ambient temp / pipe temp
- Always use ground fault circuit breakers (30 mA trip level)

Tools Needed

- Circuit Voltage
- Wire Cutters/Strippers
- Megger
- Phillips Head Screwdriver
- Standard Screwdriver
- Voltmeter
- Utility Knife
- Hammer

HEAT TRACE CONTROLS



IntelliTrace

- Up to 72 Loops at 0 A/circuit
- Full monitoring, powerful sensor mapping, Modbus RS485 or Ethernet communication & supervisory control
- Extremely intuitive programming via large touch screen HMI, ordinary or hazardous (Divisions 2) areas



WeatherTrace

- Up to 40 loops
- Pre-wired and assembled monitoring and distribution (saves time on installation)
- Includes the sentinel monitoring system



ITC Controller

- 1 or 2 circuits, 40 A/circuit, 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. /203x254x203 mm, Division 2 hazardous area



DTS-HAZ Digital ThermoStat

- 30 A/120 to 277 Vac, SSR control, large LED display
- Programming w/ soft start, alarm contact, Class 1, Division 2 & ATEX
- Applications: freeze protection process temperature maintenance



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