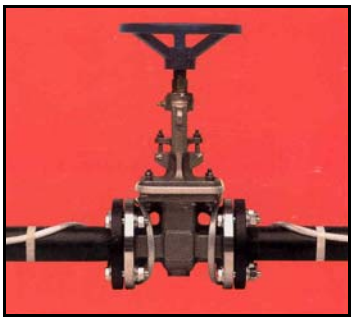
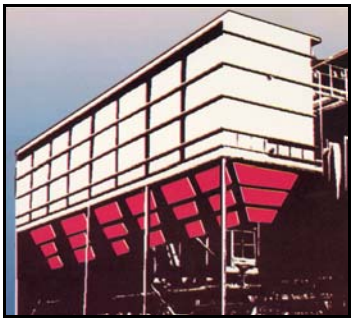
HTD HEAT TRACE

Established in 1974 as the Heat Tracing Division of Cooperheat and incorporated in 1996 as HTD Heat Trace, Inc.

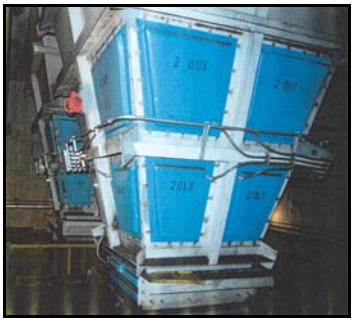


PIPE TRACING CABLES & SYSTEMS

METAL & PLASTIC TANK HEATING SYSTEMS



HOPPER HEATING SYSTEMS



COAL AND MATERIAL HANDLING SYSTEM WINTERIZATION

CUSTOM HEATING JACKETS AND BLANKETS

HEAT TRACE

PIPE TRACING PRODUCTS AND SYSTEMS

A complete line of flexible heating cable products and systems for applications ranging from simple freeze protection to process maintenance temperatures of 400° F (204° C)

Pipe Tracing

For freeze protection and process heating applications up to 400°F.

Thermal Design Guide

PURPOSE

Pipe Tracing (a.k.a heat tracing) is commonly used to ensure that process, fluid, or material temperatures within pipes and piping systems are *maintained* above ambient temperatures during static flow conditions.

Under certain conditions, pipe tracing systems may be designed to increase (heat up) process, fluid, or material temperatures within pipes and piping systems.

This guide provides design information for conventional temperature maintenance applications only. For design information relating to heat raise applications, please contact HTD .

INDUSTRY STANDARDS AND PUBLICATIONS

Pipe and Heat Tracing design considerations, heat loss calculations, installation and maintenance requirements are extensively covered by IEEE Standard 515-1997. Additional information and requirements are also published in NFPA National Electrical Code under Article 427.

The material used in this design guide is consistent with the information, requirements and recommendations of both of these industry standards and publications. This design guide is intended to provide supplementary information only and the reader should consult IEEE Std 515-1997 and NEC NFPA 70-1996 for full and accurate details on all topics.

PRODUCTS

The information contained within this Thermal Design Guide is intended for use with Therma-Linx, WinterSafe, WinterSafe Plus, AutoWatt Xtra, PermaWatt and VersaTrace heating cables as manufactured by HTD Heat Trace, Inc. Whitehouse, New Jersey

PIPE HEAT LOSS FACTORS

The calculation to determine heat losses from a pipe are shown in Annex A of the IEEE Std 515-1997. (The factors listed in this calculation that can significantly affect the rate of heat loss for each application are shown following). This is the minimum information required to determine heat losses for all pipe tracing applications.

- Desired Fluid Maintain Temperature (Tm)
- Minimum Ambient Temperature (Ta)
- Pipe size
- Thermal insulation thickness
- Thermal insulation type
- Location (Indoors or Outdoors)
- Desired safety factor

The selection of the best heater for an application depends upon factors discussed later in this guide. Heater selection is not directly related to the heat loss calculation.

PIPE HEAT LOSS CALCULATION STEPS 1 THROUGH 5

STEP 1
Determine the application ΔT. This is the difference between the desired Fluid Maintain Temperature (Tm) and the Minimum Ambient Temperature (Ta).

STEP 2
Refer to Table 1 "Base Heat Loss Table for Insulated Pipes" and determine the base heat loss for the application using the appropriate pipe size, thermal insulation thickness and application ΔT.

STEP 3
The base heat losses shown in Table 1 have been calculated using the K factor for fiberglass insulation. Use Table 2 "Insulation Adjustment Factors" and multiply the base heat losses by the Adjustment Factor for the insulation being used.

STEP 4
Multiply the value determined in Step 3 by 0.9 for all indoor applications.

STEP 5
A safety factor of 10% has been used throughout the above calulations. If a different value is desired, adjust the value calculated in Step 4 accordingly.

TABLE 1
BASE HEAT LOSS TABLE FOR INSULATED PIPES
(Watts per Foot)

INSULATION THICKNESS (in.)	DELTA T °F	NOMINAL PIPE SIZE (in.) .50	.75	1	1.25	1.50	2	2.50	3	4	6	8	10	12	14	16	18	20	24	30
		ACTUAL O.D. (in.) .68	.84	1.32	1.66	1.90	2.38	2.88	3.50	4.50	6.63	8.63	10.75	12.75	14	16	18	20	24	30
.50	50	2.1	2.4	3.3	3.9	4.4	5.3	6.2	7.3	9.1	13.0	16.6	20.4	24.0	26.2	29.8	33.4	37.0	44.1	54.7
.50	150	4.1	4.8	6.6	7.9	8.8	10.5	12.3	14.6	18.3	26.0	33.2	40.8	48.0	52.5	59.6	66.8	73.9	88.1	109.7
.50	150	6.2	7.1	9.9	11.8	13.1	15.8	18.5	22.0	27.4	39.0	49.8	61.3	72.0	78.7	89.5	100.2	110.9	132.2	164.1
.50	200	8.2	9.5	13.1	15.7	17.5	21.0	24.7	29.3	36.6	52.0	66.4	81.7	96.0	105.0	119.3	133.6	147.8	176.3	218.8
.50	250	10.3	11.9	16.4	19.7	21.9	26.3	30.9	36.6	45.7	65.0	83.0	102.1	120.0	131.2	149.1	167.0	184.8	220.3	273.5
.50	300	12.3	14.3	19.7	23.6	26.3	31.5	37.0	43.9	54.8	78.0	99.6	122.5	144.1	157.5	178.9	200.4	221.7	264.4	328.2
1.00	50	1.4	1.6	2.0	2.4	2.6	3.1	3.6	4.2	5.1	7.1	9.0	10.9	12.8	14.0	15.8	17.7	19.5	23.2	28.7
1.00	100	2.8	3.1	4.1	4.8	5.2	6.2	7.1	8.3	10.2	14.2	17.9	21.9	25.6	27.9	31.6	35.3	39.0	46.4	57.5
1.00	150	4.1	4.7	6.1	7.2	7.9	9.3	10.7	12.5	15.3	21.3	26.9	32.8	38.4	41.9	47.4	53.0	58.5	69.6	86.2
1.00	200	5.5	6.2	8.2	9.5	10.5	12.3	14.3	16.6	20.4	28.4	35.9	43.8	51.2	55.8	63.2	70.6	78.0	92.8	114.9
1.00	250	6.9	7.8	10.2	11.9	13.1	15.4	17.8	20.8	25.5	35.5	44.8	54.7	64.0	69.8	79.0	88.3	97.5	116.0	143.7
1.00	300	8.3	9.3	12.3	14.3	15.7	18.5	21.4	25.0	30.6	42.6	53.8	65.6	76.8	83.7	94.9	106.0	117.1	139.2	172.4
1.50	50	1.1	1.3	1.6	1.8	2.0	2.3	2.7	3.1	3.7	5.1	6.3	7.7	8.9	9.7	10.9	12.2	13.4	15.9	19.7
1.50	100	2.2	2.5	3.2	3.7	4.0	4.6	5.3	6.1	7.4	10.1	12.6	15.3	17.8	19.4	21.9	24.4	26.9	31.9	39.4
1.50	150	3.4	3.8	4.8	5.5	6.0	7.0	8.0	9.2	11.1	15.2	19.0	23.0	26.7	29.1	32.8	36.6	40.3	47.8	59.0
1.50	200	4.5	5.0	6.4	7.4	8.0	9.3	10.6	12.2	14.8	20.2	25.3	30.6	35.6	38.8	43.8	48.8	53.8	63.8	78.7
1.50	250	5.6	6.3	8.0	9.2	10.0	11.6	13.3	15.3	18.5	25.3	31.6	38.3	44.6	48.5	54.7	61.0	67.2	79.7	98.4
1.50	300	6.7	7.5	9.6	11.0	12.0	13.9	15.9	18.4	22.2	30.3	37.9	45.9	53.5	58.2	65.7	73.2	80.7	95.6	118.1
2.00	50	1.0	1.1	1.4	1.6	1.7	1.9	2.2	2.5	3.0	4.0	5.0	6.0	6.9	7.5	8.5	9.4	10.4	12.2	15.1
2.00	100	2.0	2.2	2.7	3.1	3.4	3.9	4.4	5.0	6.0	8.0	9.9	12.0	13.9	15.1	16.9	18.8	20.7	24.5	30.1
2.00	150	3.0	3.3	4.1	4.7	5.0	5.8	6.5	7.5	9.0	12.0	14.9	18.0	20.8	22.6	25.4	28.2	31.1	36.7	45.2
2.00	200	3.9	4.4	5.5	6.2	6.7	7.7	8.7	10.0	11.9	16.1	19.9	23.9	27.7	30.1	33.9	37.7	41.4	49.0	60.3
2.00	250	4.9	5.4	6.8	7.8	8.4	9.6	10.9	12.5	14.9	20.1	24.9	29.9	34.7	37.6	42.4	47.1	51.8	61.2	75.3
2.00	300	5.9	6.5	8.2	9.3	10.1	11.6	13.1	15.0	17.9	24.1	29.8	35.9	41.6	45.2	50.8	56.5	62.2	73.5	90.4
2.50	50	.9	1.0	1.2	1.4	1.5	1.7	1.9	2.1	2.5	3.4	4.2	5.0	5.7	6.2	7.0	7.7	8.5	10.0	12.3
2.50	100	1.8	2.0	2.4	2.7	3.0	3.4	3.8	4.3	5.1	6.8	8.3	9.9	11.5	12.4	13.9	15.5	17.0	20.0	24.6
2.50	150	2.7	3.0	3.6	4.1	4.4	5.0	5.7	6.4	7.6	10.1	12.5	14.9	17.2	18.6	20.9	23.2	25.5	30.0	36.8
2.50	200	3.6	3.9	4.9	5.5	5.9	6.7	7.6	8.6	10.2	13.5	16.6	19.9	22.9	24.8	27.9	30.9	34.0	40.0	49.1
2.50	250	4.5	4.9	6.1	6.9	7.4	8.4	9.5	10.7	12.7	16.9	20.8	24.9	28.7	31.1	34.9	38.7	42.5	50.0	61.4
2.50	300	5.4	5.9	7.3	8.2	8.9	10.1	11.3	12.9	15.3	20.3	24.9	29.8	34.4	37.3	41.8	46.4	50.9	60.0	73.7
3.00	50	.8	.9	1.1	1.2	1.3	1.5	1.7	1.9	2.2	3.0	3.6	4.3	4.9	5.3	6.0	6.6	7.2	8.5	10.4
3.00	100	1.7	1.8	2.2	2.5	2.7	3.0	3.4	3.8	4.5	5.9	7.2	8.6	9.9	10.7	11.9	13.2	14.5	17.0	20.8
3.00	150	2.5	2.7	3.3	3.7	4.0	4.5	5.1	5.7	6.7	8.9	10.8	12.9	14.8	16.0	17.9	19.8	21.7	25.5	31.2
3.00	200	3.3	3.6	4.5	5.0	5.4	6.1	6.8	7.6	9.0	11.8	14.4	17.2	19.7	21.3	23.9	26.4	28.9	34.0	41.6
3.00	250	4.2	4.6	5.6	6.2	6.7	7.6	8.5	9.5	11.2	14.8	18.0	21.4	24.6	26.6	29.8	33.0	36.2	42.5	52.0
3.00	300	5.0	5.5	6.7	7.5	8.0	9.1	10.2	11.5	13.5	17.7	21.6	25.7	29.6	32.0	35.8	39.6	43.4	51.0	62.4

Heat loss caclulations used in Table 1 are based upon an outdoor application using Fiberglass Insulation with a K Factor of 0.25 BTU/hr-Ft²-°F/in and a 10% safety factor.

TABLE 2
THERMAL INSULATION ADJUSTMENT FACTORS

Insulation Type	Insulation k Factor	Adjustment Factor
Polyurethane	0.165	0.66
Polyisocyanurate	0.180	0.67
Polystyrene	0.220	0.88
Fiberglass	0.250	1.00
Foamed Elastomer	0.290	1.16
Mineral Wool	0.300	1.20
Expanded Perlite	0.375	1.50
Calcium Silicate	0.375	1.50
Cellular Glass	0.400	1.60

ALLOWANCE FOR VALVES STEP 6

STEP 6
Additional heat will be required to offset the higher levels of heat loss associated with valves. Calculate the heat loss for each valve within the piping system by multiplying the final base heat loss calculated in Step 5 by the appropriate Heat Loss Factor shown in Table 3.

TABLE 3
ADJUSTMENT FACTORS - VALVES

Type of Valve	Heat Loss Factor
Gate	4.3
Ball	2.6
Butterfly	2.3
Globe	3.9
Check	2.0

ALLOWANCE FOR PIPE SUPPORTS STEP 7

STEP 7
Use the following formula to determine the heat loss f or each size of support within the piping system.

Heat loss per support = 0.7L (ΔT), where L equals the length of the support in feet and the ΔT equals Tm - Ta as per Step 1.

HEAT LOSS EXAMPLE

Desired Fluid Maintain Temperature (Tm) = 80°F
Minimum Expected Ambient Temperature = -20°F
Pipe Size = 6 inches diameter
Pipe Length = 100 ft
Heat Sinks = Four Gate Valves
Pipe Supports = Ten, each 1 ft long
Thermal Insulation Thickness = 2 inches
Thermal Insulation Type = Polyurethane
Location = Outdoors
Desired Safety Factor = 20%

Step 1 Application ΔT (Tm - Ta)
80 - -20 = 100°F
Step 2 From Table 1, base heat loss
8.0 w/ft
Step 3 Adjust base heat loss using Table 2
8.0 x 0.67 = 5.36 w/ft
Step 4 Outdoor application, no adjustment required
Step 5 Add desired Safety Factor (10% already inc)
5.36 x 1.1 = 5.9 w/ft
Step 6 Total adder per Valve using Table 3
5.9 x 4.3 = 23.37 w
Step 7 Total adder per Pipe Support
0.7 x 1 x 100 = 70 w

Total heat losses from Piping System
Total pipe losses = 5.9 x 100 = 549.0
Total valve losses = 23.37 x 4 = 93.48
Total pipe support losses = 70 x 10 = 700.0

TOTAL HEAT LOSS (WATTS) = 1,342.48

HEATING CABLE SELECTION GUIDE

HTD HEAT TRACE

PT-HCSG-F-12/04

Pipe Tracing

For freeze protection and process heating applications up to 400°F.

Heating Cable Selection Guide

PURPOSE

Pipe Tracing (a.k.a heat tracing) is commonly used to ensure that process, fluid, or material temperatures within pipes and piping systems are *maintained* above ambient temperatures during static flow conditions.

Under certain conditions, pipe tracing systems may also be designed to increase (heat up) process, fluid, or material temperatures within pipes and piping systems.

This guide provides information and data for the correct selection a particular type or style of heating cable to meet the specific requirements of conventional temperature maintenance applications only. For heating cable selection information relating to heat raise applications, please contact HTD .

INDUSTRY STANDARDS AND PUBLICATIONS

Pipe and Heat Tracing design considerations, heat loss calculations, installation and maintenance requirements are extensively covered by IEEE Standard 515-1997. Additional information and requiremnents are also published in NFPA National Electrical Code under Article 427.

The material used in this selection guide is consistent with the information, requirements and recommendations of both of these industry standards and publications.

PRODUCTS

The information contained within this Heating Cable Selection Guide is intended for use with Therma-Linx, WinterSafe, WinterSafe Plus, AutoWatt Xtra, PermaWatt and VersaTrace heating cables as manufcatured by HTD Heat Trace, Inc. Whitehouse, New Jersey.

SELECTION PROCEDURE

STEP 1
Use the maximum temperature that the process is expected to reach (MPT) to determine the Maximum Intermittent Temperature (Te) that the heating cable will be exposed to. When applicable, steam cleaning temperatures must be considered part of the maximum expected process temperature (MPT)
Select only the cables with a Te value greater than your MPT

STEP 2
Identify the desired Fluid Maintain Temperature (Tm).
Select only cables with a Maximum Maintenance Temperature greater than your Tm

---

STEP 3
Identify the Minimum Expected Ambient Temperature (Ta).
Select only cables with a Minimum Temperature Exposure value that is lower than your Ta

---

STEP 4 (see Note 1a)
Determine the required watts per foot of pipe that must be installed on the pipe to offset the heat loss figure calculated using Steps 1 through 5 of the Thermal Design Guide.
Select only cables with a watts/ft output that is greater than the calculated rate of heat loss

---

STEP 5
Identify the operating voltage for the heating system.
Select only cables that can operate on the available voltage

STEP 6A
Determine the total allowance of cable to be installed on the pipe.
Length of pipe (ft) plus 5 to 10%

STEP 6B
Determine the total allowance of cable to be installed on each valve within the system.
Divide the value (watts) determined in Step 6 of the Thermal Design Guide by the watts/ft rating of the cable selected in Step 4 (above) to determine the length of cable (ft) required to trace each valve. Multiply this length (ft) by the total number of valves involved.

STEP 6C
Determine the total allowance of cable to be installed on each pipe support within the system.
Divide the value (watts) determined in Step 7 of the Thermal Design Guide by the watts/ft rating of the cable selected in Step 4 (above) to determine the length of cable (ft) required to trace each pipe support Multiply this length (ft) by the total number of supports involved.

STEP 7
Determine the total length of cable to be installed.
Add all of the cable lengths determined in 6A, 6B and 6C together.

STEP 8 (see Notes 2a, 2b and 2c)
Consider the heating circuit requirements
Whenever possible, select only the cable that offers a Maximum Circuit Length that is greater than the value (ft) determined in STEP 7 above.

STEP 9 (see Note 3a)
Consider the process and environmental design features unique to the application and area of installation.
Select only the cable that offers resistance to the fluid within the pipe and the chemicals / atmospheres for the environment surrounding the installation.
Select cables with an overbraid or overbraid and over jacket for piping systems that require frequent maintenance.

STEP 10
Consider the classification for the area of installation
Select only the cables that offer approved ratings and classifications that meet or exceed the specific requirements of your application and/or installation.

NOTES

NOTE 1a
When selecting a self-regulating heating cable, use the appropriate Power Output Graph for the cable being considered to determine the watts per foot available at the Maintenance Temperature (Tm) for your application.

NOTE 2a
When a single length of cable determined in STEP 7 exceeds the Maximum Circuit Length of the cable being considered, divide the single length into two (or more) runs and design multiple (shorter) circuits.

NOTE 2b
Refer to the data sheet specific to each cable to evaluate the maximum lengths of cable that can be installed on standard size circuit breakers.

NOTE 2c
HTD and the 2002 National Electric Code, Sections 426 and 427 require the use of ground fault equipment protection . Square D type QO-EPD and QOB-EPD circuit breakers with 30mA trip levels are recommended.

NOTE 3a
The 2002 National Electric Code, Article 427-23A requires that all heating cables, after July 1, 1996 must be supplied with a grounded metal covering. To comply with this requirement, all US customers must select, as a minimum, the overbraided version of each style of heating cable discussed in this Heating Cable Selection Guide and the following Heating Cable Selection Matrix.

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HEATING CABLE SELECTION MATRIX

HEATING CABLE SELECTION MATRIX

Use the following tables to compare the chararcteristics and qualifications of several styles of heating cables with the specific requirements of your application. HTD Heat Trace, Inc offers free engineering design service and technical support. Please contact us if you require additional help in selecting the most suitable heating cable to meet your application requirements.

SELF REGULATING CABLES

PRODUCT FAMILY	WinterSafe				WinterSafe Plus			AutoWatt Xtra		
PRODUCT REFERENCES	WSR	WSR C	WSR CR	WSR CT	WSP	WSP C	WSP CT	AWX	AWX C	AWX CT
CONSTRUCTION STYLE	1	2	3	4	1	2	4	1	2	4
MAX MAINTAIN TEMP	150° F (65° C)				250° F (120° C)			375° F (190° C)		
MAX EXPOSURE TEMP	185° F (85° C)				366° F (185° C)			450° F (232° C)		
POWER RATINGS	3 , 5, 8 & 10 w/ft				5, 10 & 15 w/ft			5,10,15,20,25 & 30w/ft		
VOLTAGE RATINGS	110, 115 & 120 208, 220, 240 & 277									
MAX CIRCUIT LENGTHS 120 VAC	from 180 to 330 ft				from 135 to 240 ft			from 70 to 335 ft		
240 VAC	from 360 to 660 ft				from 200 to 480 ft			from 140 to 540 ft		
480 VAC	N/A				N/A			N/A		
600 VAC	N/A				N/A			N/A		
T RATINGS	N/A	T5			N/A	T3		N/A	T2C	
FM APPROVALS CONSULT HTD FOR SPECIFIC INFORMATION ON ALL DIVISION 1 (D1) HAZARDOUS LOCATION SYSTEMS	N/A	Unclassified Areas CI, D 1, B,C,D CI,D 2, ,B,C,D CII, D 2, F,G CIII, D 1 CIII, D 2			N/A	Unclassified Areas CI, D1, B,C,D CI, D2, B,C,D CII, D 2, F,G CIII, D 2		N/A	Unclassified Areas CI, D1, B,C,D CI, D2,A, B,C,D CII, D 1, E,F,G CI, D2, F,G CIII, D1, E,F,G CIII, D2, E,F,G	
CSA APPROVALS CONSULT HTD FOR SPECIFIC INFORMATION ON ALL DIVISION 1 (D1) HAZARDOUS LOCATION SYSTEMS	N/A	Unclassified Areas 2E,3A,3B,3C,5A,5B CI, D 1, A,B,C,D CI,D 2, ,A,B,C,D CII, D 1, E,F,G CII, D 2, E,F,G CIII, D 1 CIII, D 2			N/A	Unclassified Areas 3A,3B,3C,5A,5B CI, D 1, A,B,C,D CI,D 2, ,A,B,C,D CII, D 1, E,F,G CII, D 2, E,F,G CIII, D 1 CIII, D 2		N/A	Unclassified Areas 3A,3B,3C,5A,5B CI, D 1, A,B,C,D CI,D 2, ,A,B,C,D CII, D 1, E,F,G CII, D 2, E,F,G CIII, D 1 CIII, D 2	

NOTES

CONSTRUCTION STYLE 1 Plain (base) heating cable

Does not meet the requirements of NEC Sections 426 and 427 for usage and installation in the USA. Strictly for use in unclassified areas only and well protected applications where potential damage to the heating cable is minimal. Not recommended for installations involving excessive moisture. Cannot be used on plastic, stainless steel, painted pipes or any surface that does not provide an effective ground path.

CONSTRUCTION STYLE 2 Base cable + Tinned Copper overbraid

For use in general industrial applications in both hazardous and unclassified areas (see specific details above). Not recommended for installations involving excessive moisture, corrosive chemicals or corrosive atmospheres.

HEATING CABLE SELECTION MATRIX

Use the following tables to compare the chararcteristics and qualifications of several styles of heating cables with the specific requirements of your application. HTD Heat Trace, Inc offers free engineering design service and technical support. Please contact us if you require additional help in selecting the most suitable heating cable to meet your application requirements.

	CONSTANT WATTAGE					SERIES RESISTANCE CABLES								
PRODUCT FAMILY	PermaWatt					VersaTrace								
PRODUCT REFERENCES	PWT	PWT C	PWF	PWF C	PWF CT	VT 20	VT 20 B	VT 20 BF	VTN	VTN B	VTN BF	VTC	VTC B	VTC BF
CONSTRUCTION STYLE	1	2	1	2	4	1	2	4	1	2	4	1	2	4
MAX MAINTAIN TEMP	200°F (93°C)		350°F (177°C)			400° F (204° C)								
MAX EXPOSURE TEMP	257°F (125°C)		400°F (204°C)			500° F (260° C)								
POWER RATINGS	2 & 4 w/ft		4, 8 & 10 w/ft			Up to 30 w/ft								
VOLTAGE RATINGS	110, 115 & 120		208, 220, 240 & 277			Up to 600 VAC								
MAX CIRCUIT LENGTHS 120 VAC	260 to 365 ft		254 to 402 ft			60 to 120 ft			93 to 196 ft			612 to 865 ft		
240 VAC	515 to 730 ft		508 to 803 ft			120 to 240 ft			393 to 786 ft			1223 to 1730 ft		
480 VAC	N/A		N/A			240 to 481 ft			786 to 1571 ft			2446 to 3460 ft		
600 VAC	N/A		N/A			300 to 601 ft			982 to 1964 ft			3058 to 4324 ft		
RATINGS	N/A					Consult HTD								
FM APPROVALS CONSULT HTD FOR SPECIFIC INFORMATION ON ALL DIVISION 1 (D1) HAZARDOUS LOCATION SYSTEMS	N/A					Unclassified Areas CI D2 , B,C,D CII CIII N/A								
CSA APPROVALS CONSULT HTD FOR SPECIFIC INFORMATION ON ALL DIVISION 1 (D1) HAZARDOUS LOCATION SYSTEMS	N/A					N/A								

CONSTRUCTION STYLE 3 Base cable + Tinned Copper overbraid and Thermoplastic outer jacket

For use in general industrial applications in both hazardous and unclassified areas (see specific details above). Recommended for use in wet installations and installations that may involve rough handling or mechanical abuse during installation and/or operation. Intended for use in applications involving aqueous inorganic chemicals.

CONSTRUCTION STYLE 4 Base cable + Tinned Copper overbraid and Fluoropolymer outer jacket

For use in general industrial applications in both hazardous and unclassified areas (see specific details above). Recommended for use in wet installations and installations that may involve rough handling or mechanical abuse during installation and/or operation. Intended for use in applications involving organic chemicals, solvents, hydrocarbons etc

HEATING CABLES -
TYPICAL USAGE AND APPLICATIONS

PRODUCT	PRODUCT	TYPICAL USAGE AND APPLICATIONS
WinterSafe	WSR - C, WSR - CR WSR - CT	General purpose freeze protection and temperature maintenance applications up to 150°F. on small to medium size pipes (¼ to 10 inch dia.) that will not be steamed cleaned. *This cable is ideal for use on plastic and fiberglass piping*. WinterSafe is simple to install on complex piping systems, valves, instruments etc and can be used in both hazardous and unclassified areas
WinterSafe Plus	WSP-C, WSP-CT	Freeze protection and *low to medium temperature maintenance applications up to 250°F.* on small, medium and large metal pipes (½ to 30 inch dia.) that may require periodic steam cleaning or purging with (max.) 150 psig steam. Simple to install on complex piping systems, valves, instruments etc. and can be used in both hazardous and unclassified areas.
AutoWatt Xtra	AWX-C, AWX-CT	Freeze protection, *low , medium and high temperature maintenance applications up to 375°F.* on medium to large size metal pipes (½ to 30 inch dia). With ratings up to 30 w/ft, this product is ideal for use on applications with high levels of heat loss AutoWattXtra can be used on piping that may be steam cleaned or purged with (max.) 190 psig steam in both hazardous and unclassified areas. Simple to install on complex piping systems, valves, instruments etc.
PermaWatt	PWT-C	General purpose, *low cost freeze protection* in unclassified areas only.
	PWF-C, PWF-CT	Freeze protection and *medium to high temperature maintenance applications up to 350°F* in unclassified areas. This product is primarilly used for process heating applications that may require precise control and monitoring features. Simple to install and can be used on steam cleaned and steam purged piping up to 190 psig
VersaTrace	VT 20B, VT 20BF	Temperature maintenance and process heating applcations up to 400°F on medium to large size metal pipes (2 to 30 inch dia). Ideal for high voltage and/or high power applications in both hazardous and unclassified areas. Very flexible, extremely robust, simple to install and easy to control and monitor. *Individual circuit lengths up to 600 ft long*.
	VTNB, VTNBF	Temperature maintenance and process heating applcations up to 400°F on medium to large size metal pipes (2 to 30 inch dia). Ideal for high voltage and/or high power applications up to 30 w/ft in both hazardous and unclassified areas. Very flexible, extremely robust, simple to install and easy to control and monitor. *Individual circuit lengths up to 1964 ft long*.
	VTCB, VTCBF	Temperature maintenance and process heating applcations up to 400°F on medium to large size metal pipes (2 to 30 inch dia). Ideal for high voltage and/or long, single pipeline heating applications in both hazardous and unclassified areas. Very flexible, extremly robust, simple to install and easy to control and monitor. *Individual circuit lengths up to 4324 ft long*.

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www.htdheattrace.com

HEAT TRACE

Therma-LinX

PRE-TERMINATED, INTER-LINKABLE SELF-REGULATING HEATING CABLE SYSTEM

PT-TLINX-F-12/04

c UL us LISTED

TLX

For freeze protection of metal and plastic pipes and piping systems.

INTRODUCTION

Self-regulating heating cables were first introduced in the early 1970s. For the last 30 years, self-regulating technology has advanced to the point where this style of heating cable is commonly recognized worldwide as one of the safest and most reliable forms of heating cable. Self-regulating cables will not overheat or burn out even when operated without any form of temperature control.

Field installation of all forms of self-regulating heating cable requires the use of end seals and termination kits and the inherent safety built into the design of the cable is lost unless all terminations are completed properly.

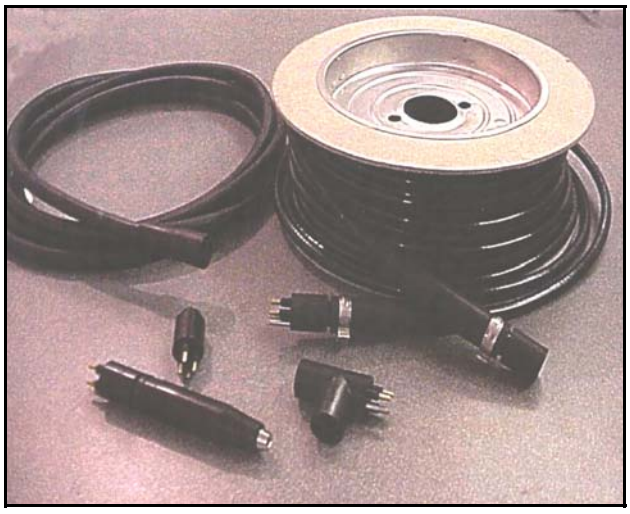
Therma-LinX is not just another self-regulating heating cable *IT IS A COMPLETE SELF- REGULATING SYSTEM*

The Therma-LinX product and system combines self-regulating cable technology with factory made, pressure sealed, end, splice and tee terminations that can be plugged together in seconds to form a heating circuit that is 100% waterproof throughout its entire length.

The need, expense and uncertainty of field made terminations is eliminated. The system is simple to design, simple to use, simple to install and, whenever necessary, simple to change. Most importantly, the safety and reliability of the entire system no longer depends upon the skill and integrity of the installer.

Therma-LinX has taken self-regulating heating cable to a whole new level in technolgy, simplicity and reliability.

THE THERMA-LINX SYSTEM



The Therma-LinX system consists of the following components:

- Therma-LinX heating cable with male and female end connections.
- Power Cord with a female connection
- End Cap with a male connection
- Tee Splice connector with one male and two female connections
- LED Light Stick with a male connection

Even the most complex piping systems can be quickly and easily freeze protected using one or more lengths of Therma-Linx and a combination of the unique "plug in" connectors shown in the opposite photograph.

TLX

For freeze protection of metal and plastic pipes and piping systems.

FACTORY MADE TERMINATIONS

The key design feature that makes Therma-LinX different from all other types of self-regulating heating cable is that Therma-LinX is supplied with ***factory-made terminations***

These rugged terminations are marine grade plug-and-socket style connectors that can be joined together in seconds to provide ***completely watertight connections throughout the entire heating circuit***

Factory-made terminations assembled under precisely controlled manufacturing conditions are much safer and more reliable than any termination that has to be made at the job site. ***They are also less costly !***

The Therma-LinX system arrives at site ready for immediate installation.

Therma-LinX is also an ideal inventory item and a small stock of cable lengths and components can be held to address the inevitable emergency freeze protection needs that seem to arise every winter.

Male end of heating cable

Tee Splice connection

MODULAR LENGTH DESIGN

Therma-LinX is manufactured in five modular, inter-linkable lengths of 5, 10, 20, 50 and 100 feet. Therma-LinX cables can be used individually as one heating circuit or they can be joined together in any combination of lengths to match the design of a complex piping system that includes valves, instruments and branch lines.

Therma-LinX heating cables can be overlapped without fear of hot spots or overheating and they can be straight traced or spiral wrapped to ensure uniform coverage on any given length of pipe.

Additionally, each modular length of Therma-LinX cable is offered with a power rating of 5, 8 or 10 watts per foot, such that each different size of pipe within the piping system can be traced with the correct level of power to meet its individual freeze protection needs.

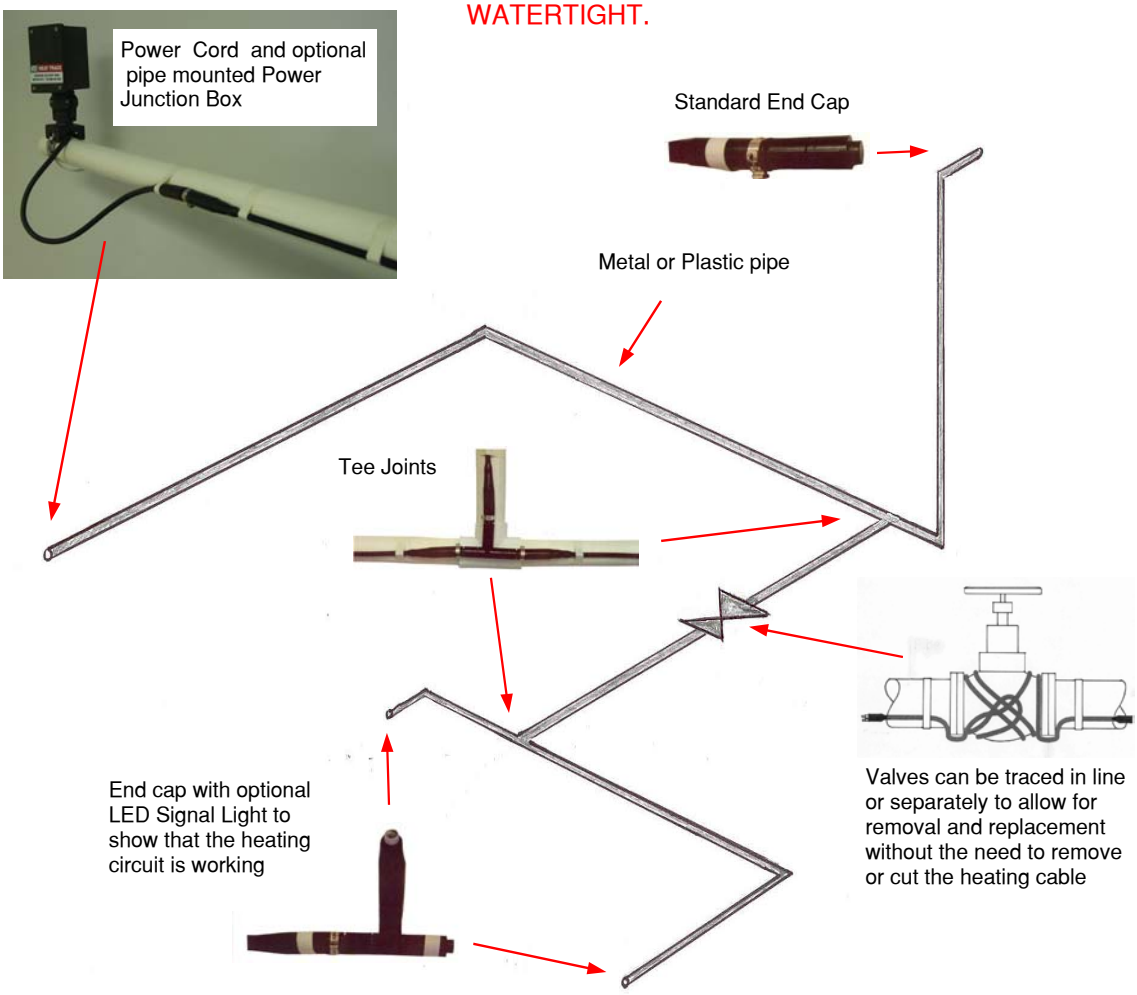
TLX

For freeze protection of metal and plastic pipes and piping systems.

SIMPLE, USER FRIENDLY, LOW COST INSTALLATION

The design of a Therma-LinX heating cable system is extremely simple. Just match each individual run of pipe within the piping system with one or more modular lengths of heating cable and join each section of the heating circuit together using the appropriate "plug in" connection component.

ALL ITEMS ARE INTER-LINKABLE AND COMPLETELY WATERTIGHT.



Therma-Linx heating cable is also manufactured with a unique round shape that is flexible through 360°. Unlike conventional flat self regulating heating cables, Therma-LinX is quickly and easily installed on irregularly shaped objects such as elbows, valves and instruments.

THERMA-LINX IS THE MOST PRACTICAL AND ADAPTABLE SOLUTION FOR THE FREEZE PROTECTION OF INDUSTRIAL PIPES AND PIPING SYSTEMS.

TLX

For freeze protection of metal and plastic pipes and piping systems.

c UL us LISTED

Therma-LinX

PRODUCT SPECIFICATIONS

Product family	Therma-LinX
Product type	Inter-linkable, self-regulating heating cable system
Maximum operating temperature	150°F (65°C)
Primary application	Freeze protection of metal and plastic pipes and piping systems
Power ratings	5, 8 or 10 w/ft (16, 26 or 33 w/m)
Voltage	120 vac
Approvals	Underwriters Laboratories listed in the USA and Canada for use in unclassified areas

PRODUCT RANGE AND ORDER REFERENCES

Heating cable lengths	*5 ft heating cable*	TLX 5
	10 ft heating cable	TLX 10
	20 ft heating cable	TLX 20
	50 ft heating cable	TLX 50
	100 ft heating cable	TLX 100
Power ratings	*5 w/ft*	Add 5 to heating cable reference
	8 w/ft	Add 8 to heating cable reference
	10 w/ft	Add 10 to heating cable reference
		(example - a 10 ft heating cable at 8 w/ft is TLX 10 - 8)
Inter-linking System Components	*10 AWG Power Cord*	PC 10
	12 AWG Power Cord	PC 12
	14 AWG Power Cord	PC 14
	End Cap	EC 1
	Tee Splice Connector	TSC 1
	LED Light Stick	LS 1

MAXIMUM HEATING CIRCUIT LENGTH (ft) ON STANDARD CIRCUIT BREAKER SIZES

(The 2002 National Electric Code section 427-22 requires the use of a ground-fault breaker with this and other styles of heating cable)

SWITCH ON TEMP (°F)	5 WATTS /FT			8 WATTS / FT			10 WATTS / FT		
	15A	20A	30A	15A	20A	30A	15A	20A	30A
-40	100	135	205	65	85	130	40	55	80
-20	130	175	220	75	105	150	50	65	100
0	150	190	235	85	115	170	60	80	120
20	170	210	250	100	130	200	75	100	150
40	200	235	270	135	180	210	105	140	180

For further information on the revolutionary Therma-LinX self-regulating heating cable system, please contact HTD.

HTD HEAT TRACE

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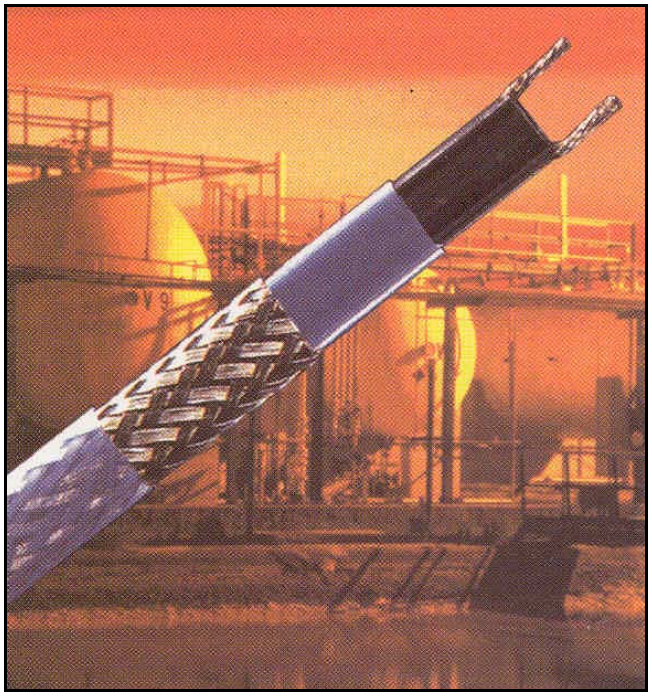
HEAT TRACE

INDUSTRIAL GRADE SELF-REGULATING HEATING CABLES



WinterSafe
WinterSafe Plus
AutoWatt Xtra

FM and CSA Approved

FM APPROVED

PT-SRLIT-F-12/04

WSR

For freeze protection and process heating applications up to 150°F (65°C).

WinterSafe®

Self-Regulating Heating Cable

FM APPROVED

- *Automatically adjusts heat output in response to increasing or decreasing pipe temperature*
- *Can be cut to length without any waste*
- *Will not overheat or burn out even when overlapped*
- *Available in 120 and 240 volt versions*
- *FM and CSA approved for use in unclassified, hazardous and corrosive areas and environments*
- *Standard range of power connection kits, splice and tee splice kits, connection hardware and controls*

INTRODUCTION

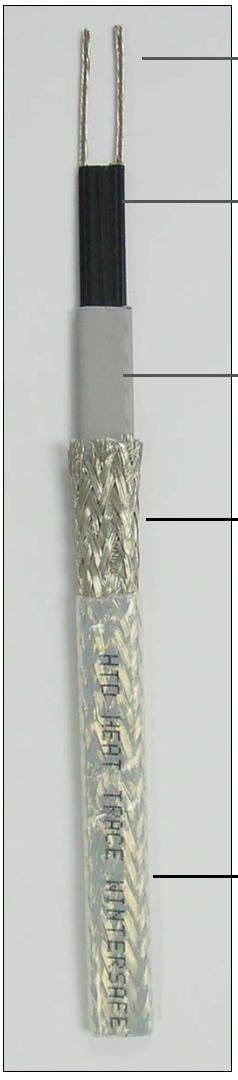
WinterSafe is an industrial grade, self-regulating heating cable that can be used on many applications ranging from freezeprotection to process temperature maintenance of 150°F (65°C).

The self-regulating characteristics of WinterSafe ensure complete safety and reliability. WinterSafe heating cable cannot overheat or burnout even when overlapped upon itself.

WinterSafe heating cable can be cut to length at the job site to automatically match the exact length of pipe to be traced. Use only what is needed. There is no waste and any leftover cable can be stored and kept ready for use on future applications.

The installation of WinterSafe heating cable is quick, simple and requires no special tools, knowledge or skills. A complete range of standard power connection kits, splice kits, tee splice kits and controls are readily available.

WinterSafe heating cable is third party approved by both FM and CSA for use in unclassifiedareas, hazardous areas and corrosive environments (see Specification on the opposite page).



16 AWG Nickel plated copper bus wires

Electically conductive, self-regulating heating matrix

Rugged thermoplastic outer jacket

Tinned copper overbraid to comply with NEC Article 427-23 (a)

Corrosion resistant thermoplastic or FEP overjackets for additional mechanical protection in hazardous area applications and / or harsh operating environments

SPECIFICATION

WinterSafe

MAXIMUM TEMPERATURE

Maintenance 150° F (65°C)
Exposure 185° F (85°C)

TEMPERATURE CLASSIFICATION

T5 (10 w/ft)
T6 (3, 5, and 8)

OPERATING VOLTAGES

110 / 120
208 / 220 / 240 / 277

APPROVALS AND CERTIFICATIONS

FM Approval (Factory Mutual)

Class I Div 1* Groups B, C & D
Class I Div 2 Groups B, C & D
Class II Div 2 Groups F & G
Class III Div 2

Canadian Standards Association (CSA)

Class I Div 1* & 2 Groups A,B,C & D
Class II Div 1* & 2 Groups E, F & G
Class III Div 1* & 2

* Consult HTD Heat Trace, Inc. for specific information on all Division 1 applications and systems.

PRODUCT RANGE

Product Ref	Watts/ft	Voltage	Max Circuit
WSR 31	3	120	330
WSR 51	5	120	270
WSR 81	8	120	210
WSR 101	10	120	180
WSR 32	3	240	660
WSR 52	5	240	540
WSR 82	8	240	420
WSR 102	10	240	360

ACCESSORIES

HTD Heat Trace, Inc supplies a full range of accessories for use with the WinterSafe product range. Accessories include termination kits, splice kits, tee splice kits, fixing tape, heat transfer tape, junction boxes and thermostats. Please consult HTD for full details.

MAX LENGTH (FT) vs. CIRCUIT BREAKER SIZE

Ref	Start up temp	120				240			
		15A	20A	30A	40A	15A	20A	30A	40A
WSR 3	50°F	300	-	-	-	660	-	-	-
	0°F	200	270	330	-	410	560	660	-
	-20°F	180	230	330	-	360	480	660	-
WSR 5	50°F	230	270	-	-	460	540	-	-
	0°F	150	200	270	-	300	400	540	-
	-20°F	130	175	260	270	260	345	520	540
WSR 8	50°F	150	200	210	-	295	390	420	-
	0°F	95	125	190	210	195	250	375	420
	-20°F	85	100	170	210	170	225	340	420
WSR 10	50°F	115	150	180	-	230	305	360	-
	0°F	70	95	145	180	150	200	300	360
	-20°F	60	85	120	165	130	175	260	360

Note:

HTD Heat Trace Inc and the 2002 National Electric Code, Sections 426 and 427 require the use of ground fault equipment protection .

Square D type QO-EPD and QOB-EPD circuit breakers with 30mA trip levels are recommended.

POWER ADUSTMENT FACTORS WITH ADJUSTED RATINGS

Cable type	208 volts	277 volts
WSR 32	0.75 2. 25 w/ft	1.28 3. 84 w/ft
WSR 52	0.86 4. 30 w/ft	1.16 5. 80 w/ft
WSR 82	0.91 7. 28 w/ft	1.10 8. 80 w/ft
WSR 102	0.93 9. 30 w/ft	1.08 10. 80 w/ft

ORDERING INFORMATION

Feature	Designation
Product Code	WSR
Watts / ft	3, 5, 8 and 10
Voltage 120 240	1 2
Tinned Copper Overbraid	C
Optional Overjackets	Thermoplastic (R) Fluoropolymer (T)

EXAMPLE

To order a 5 watts/ft cable for operation on 120 volts, complete with overbraid and fluoropolymer overjacket, the final product and ordering code should read .

WSR 51CT

WSP

For freeze protection and process heating applications up to 250°F (120°C)

WinterSafe Plus®

Self Regulating Heating Cable

- *Automatically adjusts heat output in response to increasing or decreasing pipe temperature*
- *Can be cut to length without any waste*
- *Will not overheat or burn out even when overlapped*
- *Available in 120 and 240 volt versions*
- *FM and CSA approved for use in unclassified, hazardous and corrosive areas and environments*
- *Can be used safely on piping that is routinely steam cleaned*

INTRODUCTION

WinterSafe Plus is a high temperature, industrial grade self-regulating heating cable that can be used for applications ranging from simple freeze protection up to process temperature maintenance of 250°F.

With a maximum exposure temperature rating of 366°F, WinterSafe Plus is ideal for installation on piping systems that may need to be routinely or periodically steam cleaned.

The self-regulating feature of WinterSafe Plus ensures complete safety and reliability. WinterSafe Plus heating cable cannot overheat or burnout even when overlapped upon itself.

WinterSafe Plus can be cut to length at the job site automatically matching the exact piping length being traced. The need to pre-plan and layout the cable routing is unnecessary. Use only what is needed. There is no waste and any leftover cable can be stored and kept ready for use on future applications.

The installation of WinterSafe Plus heating cable is quick, simple and requires no special tools, skills or knowledge. A complete range of standard power connection kits, splice kits, tee splice kits and controls are readily available.

WinterSafe Plus heating cable is third party approved by both FM and CSA for use in unclassified areas, most hazardous areas and corrosive environments (see Specification shown on the opposite page)

SPECIFICATION

WinterSafe Plus

MAXIMUM TEMPERATURE

Maintenance	250° F (120°C)
Exposure	366° F (185°C)

TEMPERATURE CLASSIFICATION

T3

OPERATING VOLTAGES

110 / 120
208/220/240/277

APPROVALS AND CERTIFICATIONS

FM Approvals (Factory Mutual)	Class I	Div 1* Groups B, C & D
	Class I	Div 2 Groups B, C & D
	Class II	Div 2 Groups F & G
	Class III	Div 2
Canadian Standards Association (CSA)	Class I	Div 1* & 2 Groups A,B,C & D
	Class II	Div 1* & 2 Groups E, F & G
	Class III	Div 1* & 2

* Consult HTD Heat Trace, Inc for specific information on all Division 1 applications and systems

PRODUCT RANGE

Product Ref	Watts/ft	Voltage	Max Circuit
WSP 51	5	120	240
WSP 101	10	120	180
WSP 151	15	120	135
WSP 52	5	240	480
WSP 102	10	240	280
WSP 152	15	240	200

ACCESSORIES

HTD Heat Trace, Inc supplies a full range of accessories for use with the WinterSafe Plus product range. Accessories include termination kits, splice kits, tee splice kits, fixing tape, heat transfer tape, junction boxes and thermostats. Please consult HTD for full details

MAX LENGTH (FT) vs. CIRCUIT BREAKER SIZE

Ref	Start up temp	120			240		
WSP 5	50°F	150	200	240	250	330	480
	0°F	135	180	220	230	305	440
	-40°F	130	170	210	220	295	420
WSP 10	50°F	90	120	180	140	190	280
	0°F	85	110	165	130	175	260
	-40°F	80	105	160	125	170	250
WSP 15	50°F	70	90	135	100	135	200
	0°F	65	85	125	95	125	185
	-40°F	60	80	120	90	120	180

Note:

HTD Heat Trace Inc and the 2002 National Electric Code, Sections 426 and 427 require the use of ground fault equipment protection .

Square D type QO-EPD and QOB-EPD circuit breakers with 30 mA trip levels are recommended.

POWER ADJUSTMENT FACTORS WITH ADJUSTED RATINGS

Cable type	208 volts	277 volts
WSP 52	0.78 3.90 w/ft	1.25 6.25 w/ft
WSP 102	0.86 8.60 w/ft	1.16 11.60 w/ft
WSP 152	0.92 13.80 w/ft	1.09 16.35 w/ft

ORDERING INFORMATION

Feature	Designation
Product Code	WSP
Watts / ft	5, 10 or 15
Voltage 120 240	1 2
Tinned Copper Overbraid	C
Optional Overjacket	Fluoropolymer (T)

EXAMPLE

To order a 5 watts/ft cable for operation on 120 volts, complete with overbraid and fluoropolymer, overjacket, the final product and ordering code should read:

WSP 51CT

AWX

For freeze protection and process heating applications up to 375°F (190°C).

AutoWatt Xtra®

Self-Regulating Heating Cable

- *Automatically adjusts heat output in response to increasing or decreasing pipe temperature*
- *Will not overheat or burn out even when overlapped*
- *Available with power ratings up to 30 w/ft (99 w /m)*
- *Suitable for applications with exposure temperatures up to 450°F (232°C)*
- *Extensive power range, available in both 110 -120 VAC and 208 - 277 VAC versions*
- *FM, CSA and SEMCO approved for use in unclassified areas, most hazardous areas and corrosive environments*

INTRODUCTION

AutoWatt Xtra encompasses the very latest self-regulating technology combined with the use of high temperature PFA insulating materials to offer one heating cable that is superior to all others.

Consider the following competitive facts:

- AutoWatt Xtra can provide process temperature maintenance up to 375°F.*- nearest competitive capability is 300°F*
- AutoWatt Xtra can be used on applications with exposure temperatures up to 450°F *- nearest competitive capability is 420°F*
- AutoWatt Xtra can provide up to 30 watts per foot of power - *nearest competitive capability is 20 watts per foot.*

AutoWatt Xtra heating cables provide an ideal solution for industrial freeze protection and process maintenance applications that require high temperature qualifications. With power ratings up to 30 watts/ft, AutoWatt Xtra heating cables are also perfect for heating large diameter pipes with high levels of heat loss.

The self-regulating feature of AutoWatt Xtra ensures complete safety and reliability. AutoWatt Xtra cannot overheat or burnout even when overlapped upon itself.

AutoWatt Xtra heating cables are third party approved by FM Approval, CSA and SEMCO for use in unclassified areas, most hazardous areas and corrosive environments (see Specification shown on the opposite page)

SPECIFICATION

AutoWatt Xtra

MAXIMUM TEMPERATURES	Maintenance 375°F (190°C) Exposure 450°F (232°C)
TEMPERATURE CLASSIFICATION	T4 5-15 w/ft T5 20-30 w/ft
OPERATING VOLTAGES	110 / 120 208/220/240/277

APPROVALS AND CERTIFICATIONS

FM Approvals (Factory Mutual)	Unclassified locations Class I Div 1* Groups B, C & D Class I Div 2 Groups A, B, C & D Class I I / I I I Div 1* Groups E, F & G Class I I / I I I Div 2 Groups F & G Class I , Zone 1* Group IIB + H2 Class I Zone 2, Group IIC
Canadian Standards Association (CSA)	Unclassified locations 3(A,B,C), 5(A,B) Class I Div 1* / 2 Groups B, C, & D Class I Div 2 Groups B, C & D Class II Div 2 Groups F,G

* Contact HTD Heat Trace, Inc for specific information on all Div 1 applications and systems.

MAX LENGTH (FT) vs. CIRCUIT BREAKER SIZE

Ref	Start up temp	120 VAC			240 VAC		
		15A	20A	30A	15A	20A	30A
AWX 5	50°F	180	240	335	360	480	540
	0°F	165	220	330	325	430	540
	-50°F	150	200	300	290	385	540
AWX 10	50°F	120	160	180	240	320	360
	0°F	105	140	180	230	305	360
	-50°F	90	120	180	225	300	360
AWX 15	50°F	80	105	135	160	210	270
	0°F	70	90	135	140	185	270
	-50°F	60	80	120	120	160	240
AWX 20	50°F	60	90	120	115	150	230
	0°F	55	70	110	110	145	220
	-50°F	50	65	100	105	140	210
AWX 25	50°F	45	60	85	90	120	170
	0°F	40	50	80	80	100	160
	-50°F	40	50	80	80	100	160
AWX 30	50°F	40	50	70	80	100	140
	0°F	35	45	70	70	90	140
	-50°F	35	45	70	70	90	140

Note:

HTD Heat Trace Inc and the 2002 National Electric Code, Sections 426 and 427 require the use of ground fault equipment protection .

Square D type QO-EPD and QOB-EPD circuit breakers with 30mA trip levels are recommended.

PRODUCT RANGE

Product Ref	Watts/ft	Voltage	Max Circuit
AWX 51	5	120	335
AWX 101	10	120	180
AWX 151	15	120	135
AWX 201	20	120	120
AWX 251	25	120	85
AWX 301	30	120	70
AWX 52	5	240	540
AWX 102	10	240	360
AWX 152	15	240	270
AWX 202	20	240	230
AWX 252	25	240	170
AWX 302	30	240	140

ORDERING INFORMATION

Feature	Designation
Product Code	AWX
Watts / ft	5, 10,15, 20 or 30
Voltage 120 240	1 2
Tinned Copper Overbraid	C
Optional Overjacket	Fluoropolymer (T)

EXAMPLE

To order a 15 watts/ft cable for operation on 120 volts, complete with overbraid and fluoropolymer overjacket, the final product and ordering code should read:

AWX 151CT

ACCESSORIES

HTD Heat Trace, Inc supplies a full range of accessories for use with the AutoWatt Xtra product range. Accessories include termination kits, splice kits, tee splice kits, fixing tape, heat transfer tape, junction boxes and thermostats. Please consult HTD for full details.

SUPPORTING LITERATURE

POWER OUTPUT GRAPHS

The power ouput (watts/ft) of all types of self-regulating heating cables vary with operating temperature. To determine the power output of all WinterSafe, WinterSafe Plus and AutoWatt Xtra heating cables, please see the supporting document titled *"Power Output Graphs".*

SYSTEM ACCESSORIES

Details of the End Termination, Splice and Tee Splice Kits for use with WinterSafe, WinterSafe Plus and AutoWatt Xtra heating cables are shown in the supporting document titled *"Heating Cable Accessories"*. Please consult the applicable page for the specific kit required.

For details of the pipe mounted Power Junction Box and End of Line Signal Light Kits, please consult the supporting document titled *"Heating Cable Accessories"* and then consult the applicable page for the specific kit required.

Fixing tape, heat transfer tape and Caution Labels can also be found on the final two pages of the supporting document titled *"Heating Cable Accessories".*

CONTROLS

Unclassified area and hazardous area rated thermostats, controllers and control systems for use with WinterSafe, WinterSafe Plus and AutoWatt Xtra heating cables can be found in the supporting document titled *"Thermostats, Controllers and Control Systems".*

INSTALLATION

The correct methods and procedures applicable to the installation of WinterSafe, WinterSafe Plus and AutoWatt Xtra heating cables are shown in the supporting document titled *"Self-Regulating Heating Cables - Installation Instructions".*

Please contact HTD at the address shown below if you have any questions or if you require any of the above referenced support documentation.

HTD HEAT TRACE

8 Bartles Corner Road, Unit 104
Flemington
New Jersey 08822
USA

Tel (908) 788 5210
Fax (908) 788 5204
E Mail: sales@htdheattrace.com

HEAT TRACE

INDUSTRIAL GRADE
SELF-REGULATING
HEATING CABLES

POWER OUTPUT GRAPHS

WinterSafe
WinterSafe Plus
AutoWatt Xtra

FM and CSA Approved

FM APPROVED

PT-SRGRAPHS-F-12/04

WinterSafe®

Self-Regulating Heating Cable

WSR

POWER OUTPUT GRAPH

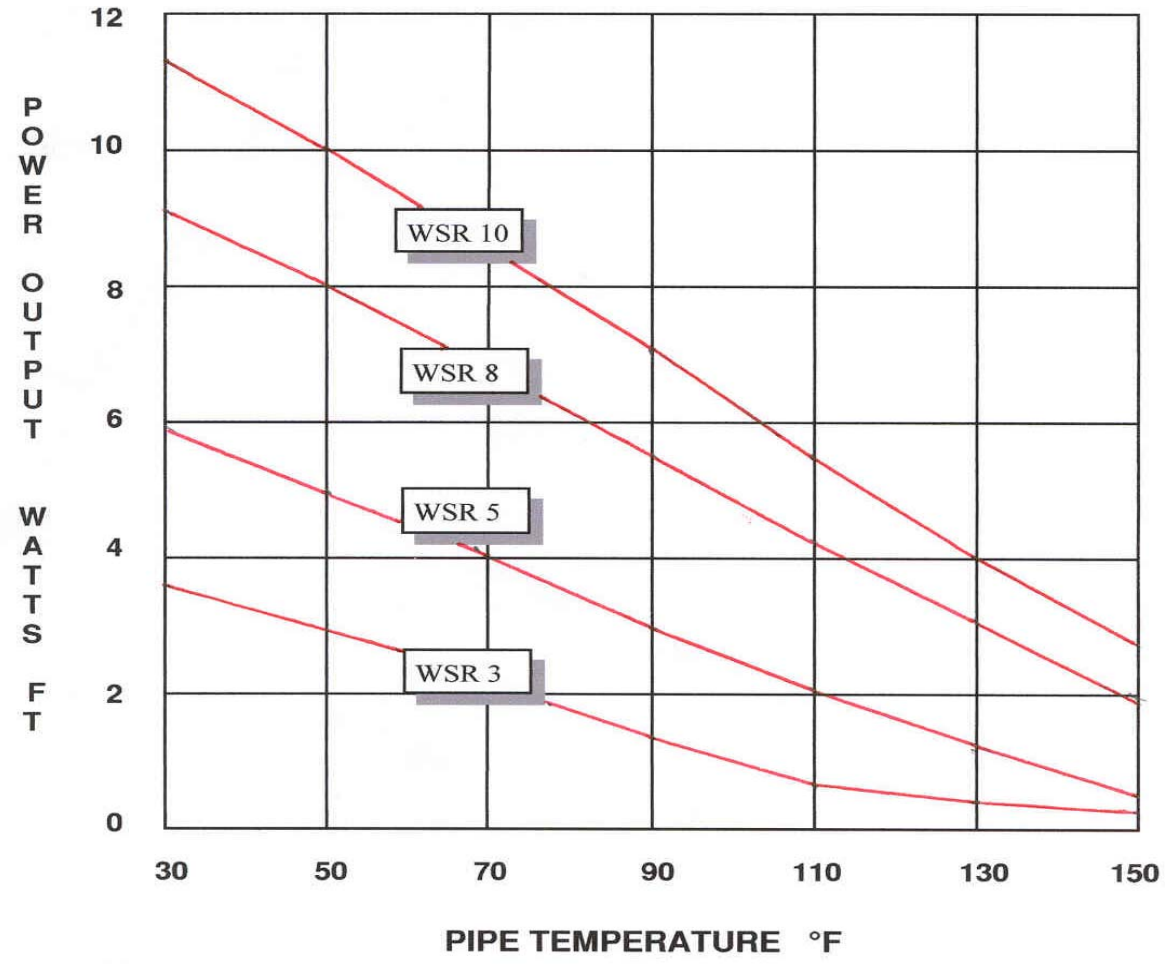
METAL PIPES

INTRODUCTION

WinterSafe is an industrial grade, self-regulating heating cable that may be used safely and reliably on both metal and plastic piping for applications ranging from simple freeze protection to process maintenance temperatures of 150° F.

The power output (watts/ft) of the heating cable varies with operating temperature. Use the graph below to determine the actual power output on each application based upon the operating temperature of the metal pipe. (Power output curves for WSR cables operating on plastic pipes are shown opposite).

POWER OUTPUT RATINGS
ON INSULATED METAL PIPES



WinterSafe®

Self Regulating Heating Cable

WSR

POWER OUTPUT GRAPH

PLASTIC PIPES

INTRODUCTION

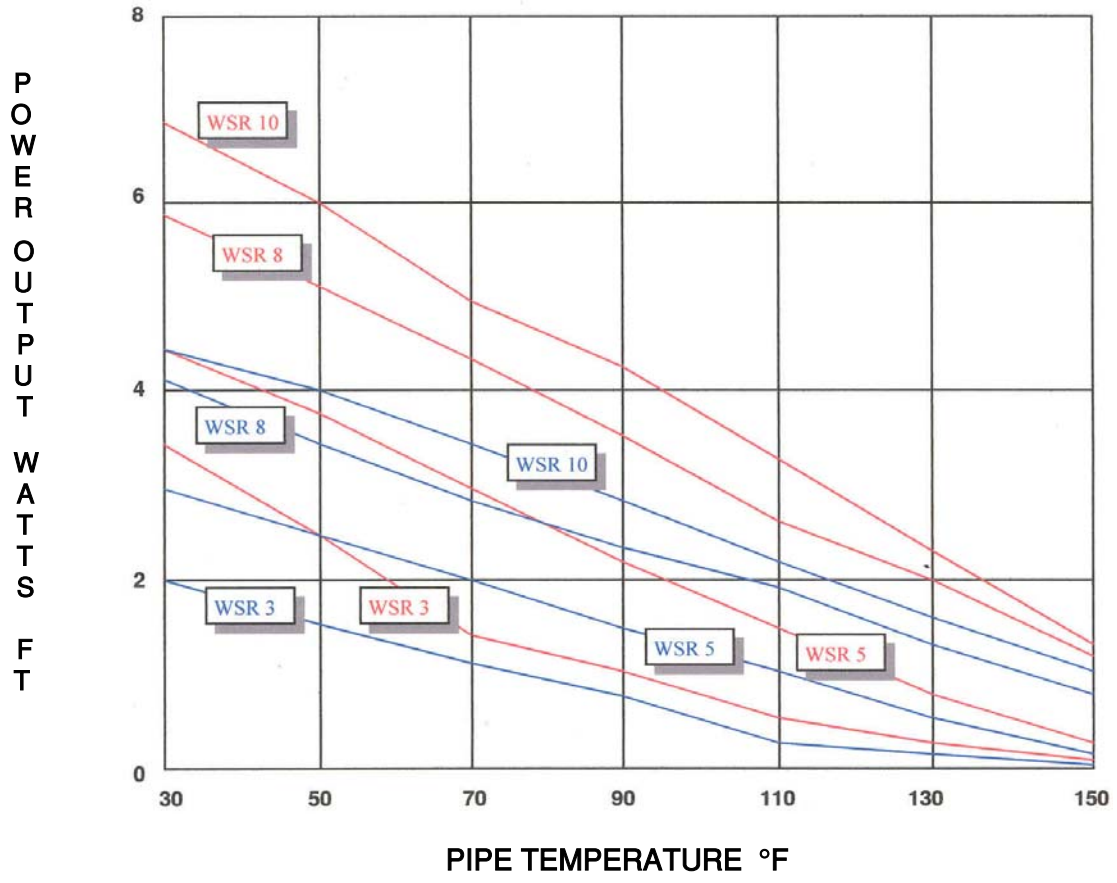
The thermal conductivity of plastics is roughly 150 times less than that of carbon steel. This lower thermal conductivity does not appreciably affect the steady state heat loss from the pipe; however, it does affect the thermal environment in the immediate vicinity of the WSR heating cable. The wall temperature of the pipe tends to increase locally and the self regulating design of the cable responds to this increased temperature by decreasing its power output.

This decreased power output from the heating cable must be taken into consideration when d esigning systems for plastic pipes. Use the following graph to determine the power output of WSR cables operating on plastic pipes.

The **BLUE** curves show power outputs of cables installed directly on plastic pipe **WITHOUT** IAAT3 aluminum heat transfer tape.

The **RED** curves show power outputs of cables installed directly on plastic pipe and covered **WITH** IAAT3 aluminum heat transfer tape

POWER OUTPUT RATINGS ON INSULATED PLASTIC PIPES WITH AND WITHOUT THE USE OF IAAT3 ALUMINUM TAPE



WinterSafe Plus®

Self Regulating Heating Cable

WSP

POWER OUTPUT GRAPH

METAL PIPES

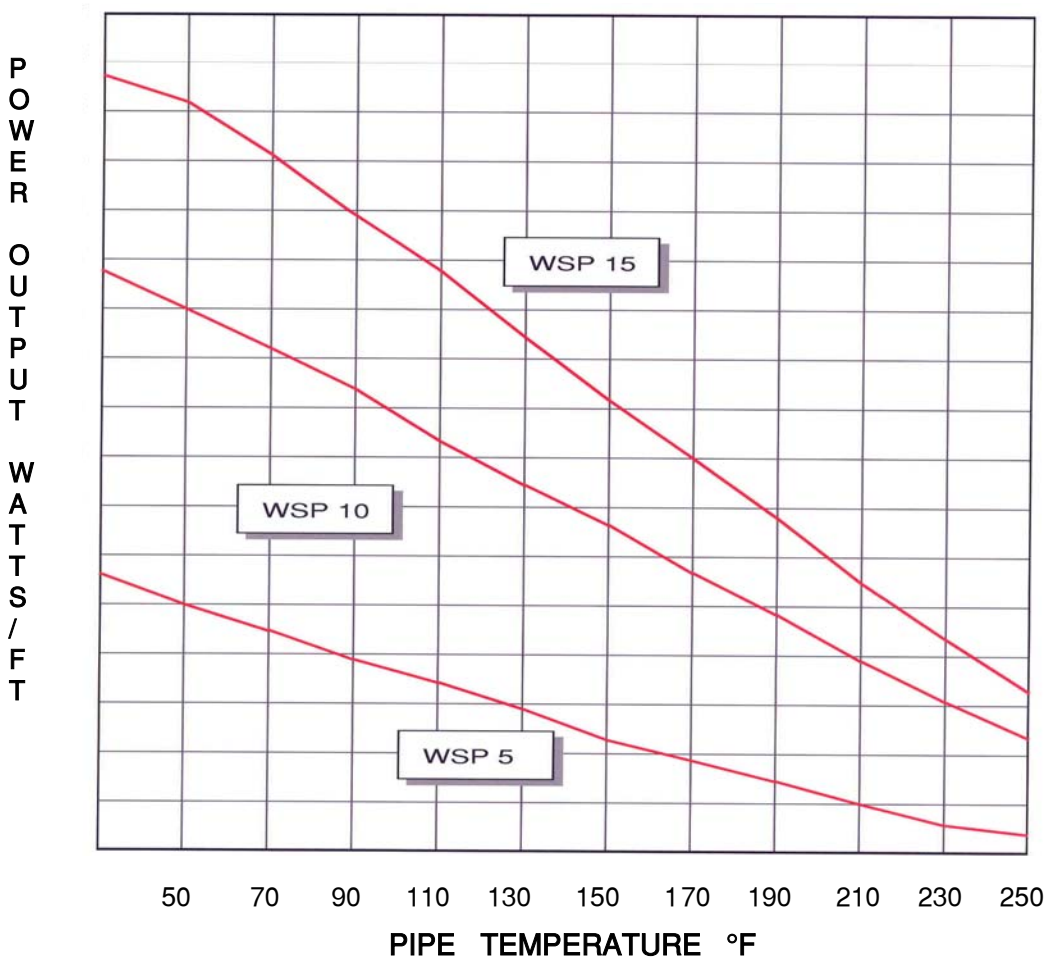
INTRODUCTION

WinterSafe Plus is a high temperature, industrial grade, self-regulating heating cable that can be used on metal pipe applications ranging from simple freeze protection to process temperature maintenance of 250° F.

WinterSafePlus, with its high temperature exposure rating of 366°F, can be installed and used safely on piping that may require routine or periodic steam cleaning or purging.

The power output (watts/ft) of a self-regulating heating cable varies with operating temperature. Use the graph shown below to determine the actual power output on each application based upon the operating temperature of the pipe.

POWER OUTPUT RATINGS
ON INSULATED METAL PIPES



AutoWatt Xtra®

Self Regulating Heating Cable

AWX

POWER OUTPUT GRAPH

METAL PIPES

INTRODUCTION

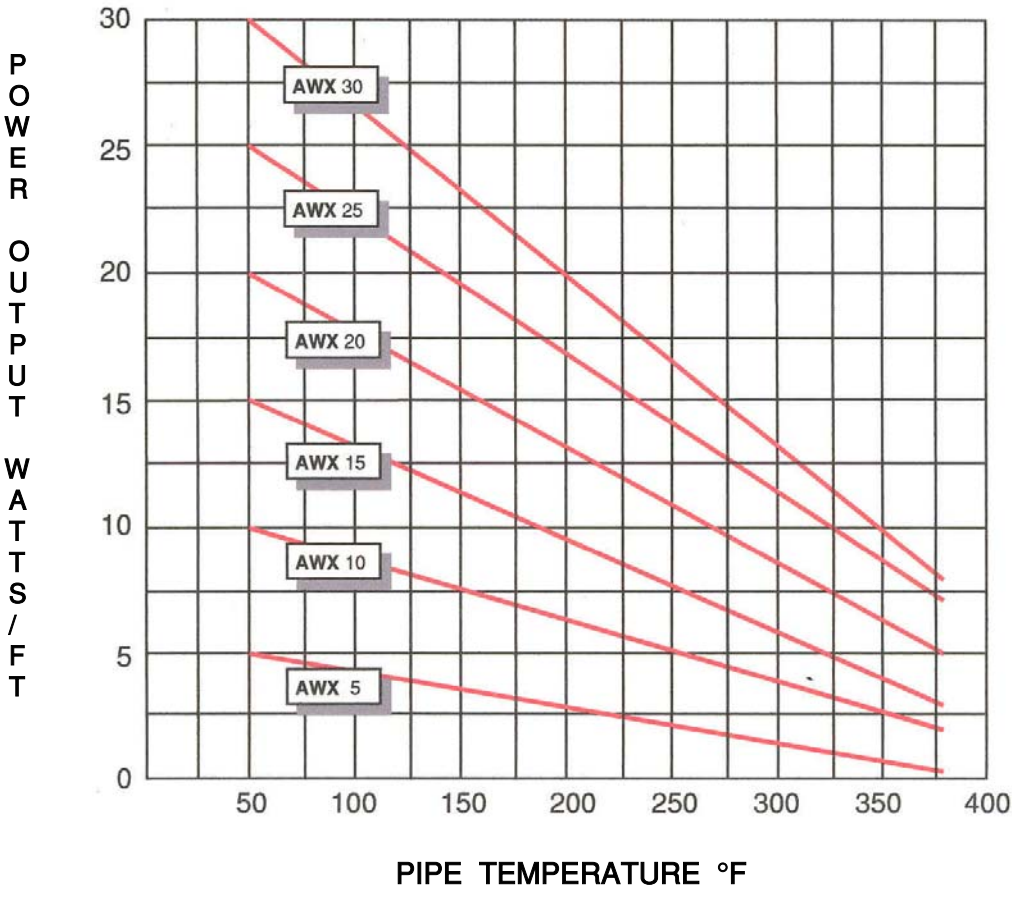
AutoWatt Xtra is a high temperature, industrial grade, self-regulating heating cable with exceptional design and application capabilities. The product can be used on all sizes of metal piping for applications ranging from basic freeze protection to process maintenance temperatures of 375° F.

AutoWatt Xtra safely tolerates intermittent exposure temperatures of 450°F.

This product is ideal for use on process piping that may require routine or periodic steam cleaning or purging.

The power output (watts / ft) of a self-regulating heating cable varies with operating temperature. Use the graph shown below to determine the actual power output on each application based upon the operating temperature of the pipe.

POWER OUTPUT RATINGS
ON INSULATED METAL PIPES



HTD HEAT TRACE

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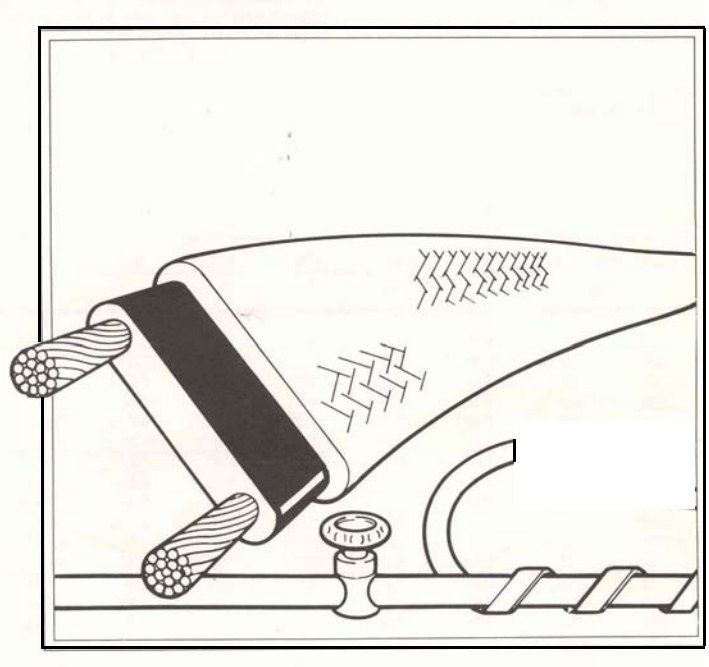
www.htdheattrace.com

HEAT TRACE

Self-Regulating Heating Cables

INSTALLATION INSTRUCTIONS



WinterSafe
WinterSafe Plus
AutoWatt Xtra

FM APPROVED

For installation in unclassified and hazardous areas (see Product Sheets for exact details)

PT-INSTSR-F-6/03

WARNING

All electric heat tracing systems must be installed correctly to ensure safe, proper operation and to prevent shock and fire. Read and follow these instructions carefully.

- To minimize the danger of fire from sustained electrical arcing if the heating cable is damaged or improperly installed, use a ground-fault protection device (GFPD). Arcing may not be stopped by conventional style circuit breakers.

  The 2002 National Electric Code, Sections 426 and 427 require the use of ground-fault equipment protection on heating cable installations. Consult the last section of this document (labeled *Ground-Fault Protection*) for the recommended circuit breakers to use with all self-regulating cables supplied by HTD.
- Failure to properly install the correct component kits can cause arcing and fire. Do not use other kits or substitute parts. Do not use vinyl electrical tape. Use only the specified HTD termination and connection kits and follow the installation instructions supplied with them.
- Damaged heating cable or components can cause electrical shock, arcing and fire. Do not attempt to repair or energize damaged heating cable. Remove damaged sections at once and replace them with a new length of heating cable using the appropriate HTD splice kit. Replace damaged components.
- The black heating cable core within all styles of self-regulating heating cable supplied by HTD is electrically conductive and can short. The heating cable core must be properly insulated and kept dry.
- Damaged bus wires can overheat or short. Do not break bus wire strands when stripping the heating cable.
- Do not use metal attachments such as pipe straps or tie wires. Use only HTD approved tapes and cable ties to secure the heating cables to the pipe.

INTRODUCTION

These instructions cover the installation requirements for WinterSafe, WinterSafe Plus and AutoWatt Xtra self-regulating heating cables as supplied by HTD Heat Trace, Inc.

The instructions assume that the proper heat tracing design has been completed according to the HTD *Thermal Design Guide*.

Use the proper HTD self-regulating heating cable for the specific application as shown in the HTD *Heating Cable Selection Guide* and *Heating Cable Selection Matrix*

ELECTRICAL CODES

Sections 426, 427 and 500 of the 2002 National Electrical Code (NEC) and Part 1 of the Canadian Electrical Code Sections 18 and 62 govern the installation of electrical heat tracing systems. All heat tracing system installations must be in compliance with these and any other national, state, provincial or local codes.

HEATING CABLE STORAGE

Store all heating cables and components in a clean dry place.

Store all heating cables and components at temperatures between -40°F and 140°F (-40°C and 60°C).

Do not store heating cables and components in high traffic areas where potential damage may occur.

PREINSTALLATION CHECKS

Check the materials received.

- Check the heating cable catalog number and quantity received against the Purchase Order or Bill of Materials.
  The heating cable catalog number is printed directly on the outside of the heating cable jacket.
- Verify that the correct components and quantities are present for use with the selected heating cable.
- Inspect the heating cable and components for any damage that may have occured during transit.

Check the pipe to be heat traced.

- Verify that the pipe has been pressure-tested and that all equipment and supports are installed.
- Verify that any paint or coatings used on the pipe are dry.
- Walk the piping system and plan the routing of the heating cable on the pipe.
- Remove any sharp edges or burrs that could damage the heating cable.

Plan the installation. Compare the design drawings or sketches with the actual pipe and note any differences in:

- Pipe length and size.
- The number of valves, flanges, gauges, and other equipment.
- The number of pipe supports. These items are frequently not shown on drawings but there should be some form of notation on the drawing to indictate the amount of heating cable that is included in the circuit for the pipe supports.

Identify the location of the heating cable terminations.

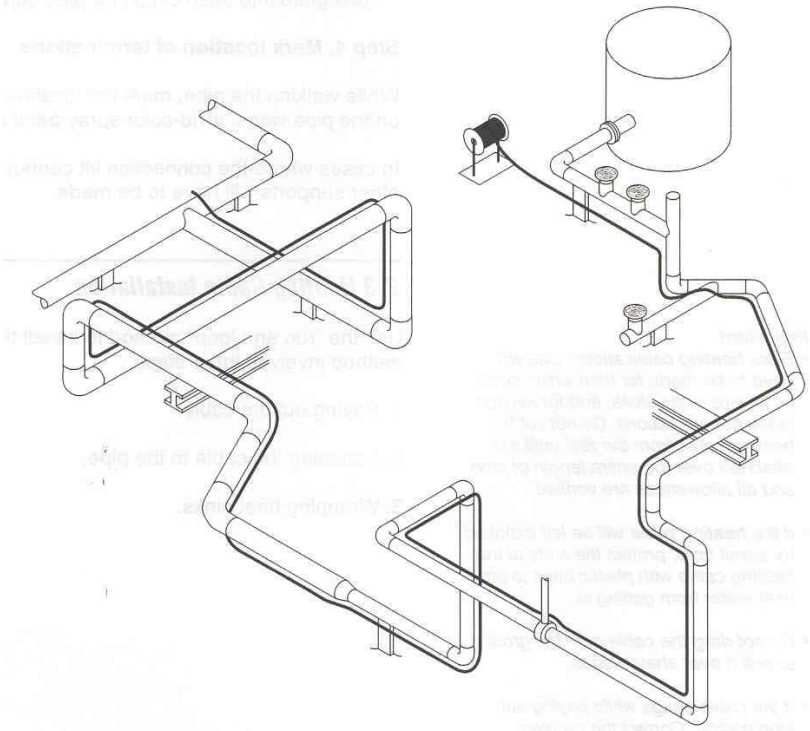
- Mark the location of all power connections, splices, tee splices and end terminations on the pipe using a vivid color spray paint or marker.

HEATING CABLE INSTALLATION

Pay out heating cable (see Figure 1).

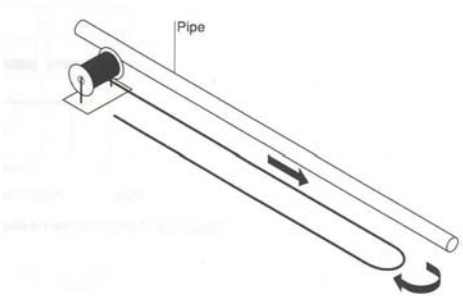
- Mount the cable spool on a holder near either end of the pipe to be traced. Do not apply excessive pulling or jerking on the cable as it is being unrolled.
- Pay out the heating cable and loosely string it along the pipe. Make sure that the cable is always next to the pipe when crossing obstacles. If the cable is on the wrong side of the obstacle (eg. a support beam, crossing pipe etc) it may have to be removed and reinstalled or cut and spliced.
- For installations that require two or more heating cables, use two or more holders to pay out the cables, essentially replicating the procedure shown in Figure 1.

Figure 1



- Alternatively, for installations that require two heating cables, use one holder, secure the end of the cable to the pipe and pull one large loop as shown in Figure 2.

Figure 2



ATTACHING THE HEATING CABLE

The heating cable may be straight traced along the pipe, spiral wrapped around the pipe or straight traced in multiple runs along the pipe, as required by the design.

Straight tracing along the pipe

- Whenever possible, position the heating cable or cables on the lower section of pipe as shown in Figure 3. This helps to protect the heating cable from mechanical damage during the installation, pre-insulation and insulation phases of the project.

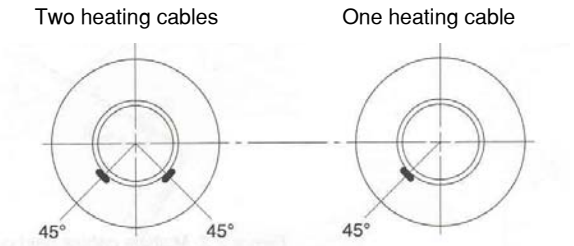
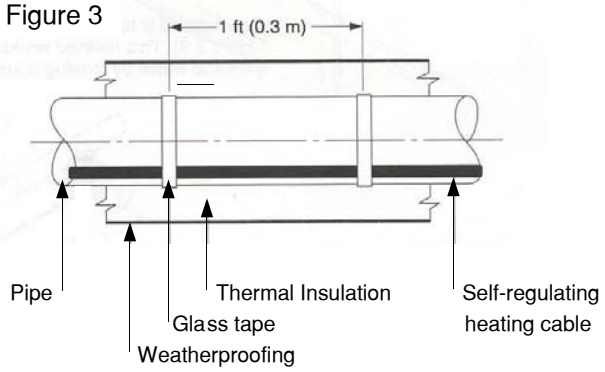


Figure 3

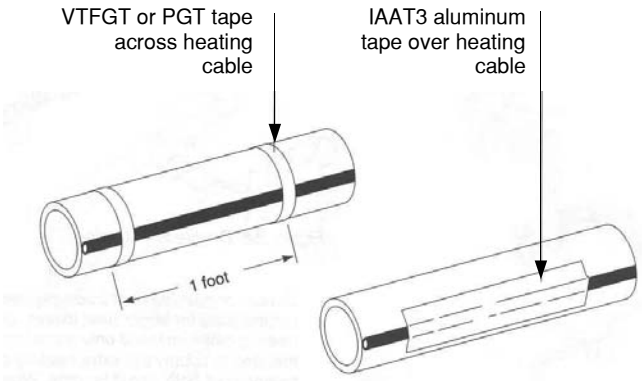


FIXING / TYING TAPES

Use type VTFGT adhesive backed glass tape on all WSR cable installations. This product may also be used on all WSP and AWX cable installations when the highest exposure and/or operating temperature of the application is below 310°F (155°C) VTFGT glass tape may be used in low ambient temperatures down to -40°F (-40°C).

- Use type PGT glass tape on all WSP and AWX cable installations when the maximum exposure and/or operating temperature of the application is above 310°F (155°C).
- Type IAAT3 adhesive backed aluminum heat transfer tape is recommended as a heat-transfer aid for wrapping heat traced pump bodies, valves and other odd-shaped devices on applications up to 200°F (93°C). This product should also be applied over the entire length of heating cable when the pipe being heat traced is non metallic (eg, PVC, FRP, Polyethylene, etc). IAAT3 tape must be applied when ambient temperatures are above 32°F (0°C)
- Cable ties may be used to secure the heating cable to the pipe on installations below 180°F (82°C) when the surface of the pipe prevents proper adhesion of the VTFGT tape. Cable ties must be hand-tightened only.

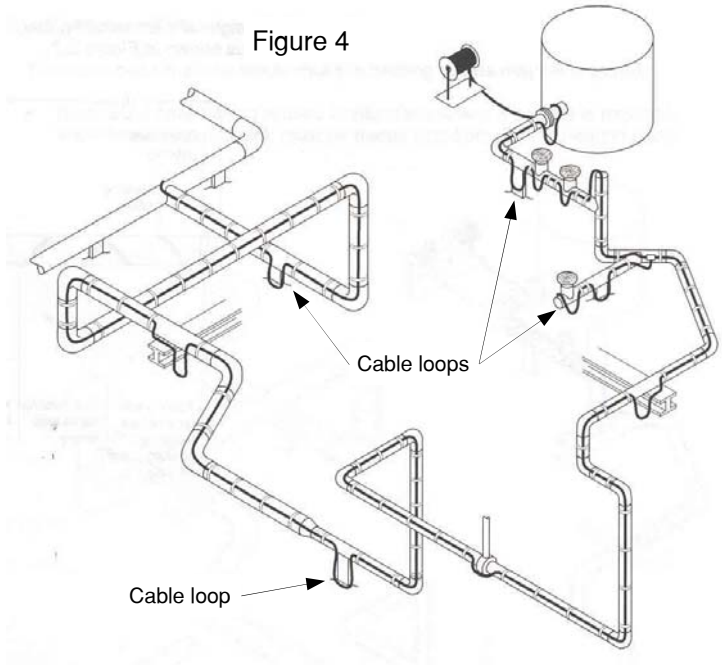
SECURING THE HEATING CABLE



ATTACHING THE HEATING CABLE (cont)

- Starting from the end opposite to the cable spool and holder, secure the heating cable to the pipe using wraps of glass tape at 1 foot intervals as shown in Figure 3. If type IATT3 aluminum tape is being used, apply it longitudinally over the entire length of heating cable after the cable has first been secured with glass tape.
- Work back towards the cable spool and holder, repeating the above procedure.
- Leave an extra 18" (0.48m) of heating cable at the power connection, at all sides of splices and tee splices and at the end seal location to provide sufficient cable to complete the required terminations.
- Extra heating cable must be allowed and pulled for each heat sink (flange, pipe support, valve, instrument etc). The extra heating cable should be taped immediately before and after the heat sink and left in a loop as shown in Figure 4. To obtain the required loop length for the type of heat sink being traced, consult the design drawing or the HTD Thermal Design Guide.

Figure 4



ATTACHING THE HEATING CABLE (cont)

Spiral tracing of pipe

- When the design calls for spiral tracing or wrapping of the heating cable on the pipe, begin by suspending a loop of heating cable for every 10 ft (3.04m) section of pipe as shown in Figure 5.

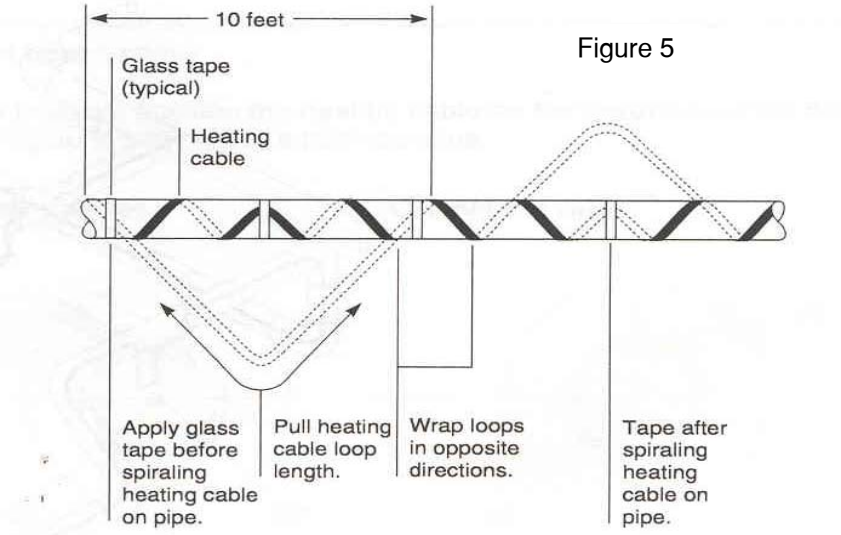


Figure 5

- To determine the loop length, multiply the spiral factor from the drawing by ten (eg if the spiral factor is 1.3, leave a 13ft loop of heating cable for every 10ft of pipe).
- Pull the required amount of heating cable for the 10ft section of pipe, attach the cable to the pipe at each end and let it hang in a loop. Grasp the loop in the center and wrap it around the pipe. Even out the distances between each spiral by sliding the wraps along the pipe. Use glass tape to secure the center of the loop to the pipe. Ensure that the heating cable is flat to the pipe for good heat transfer.

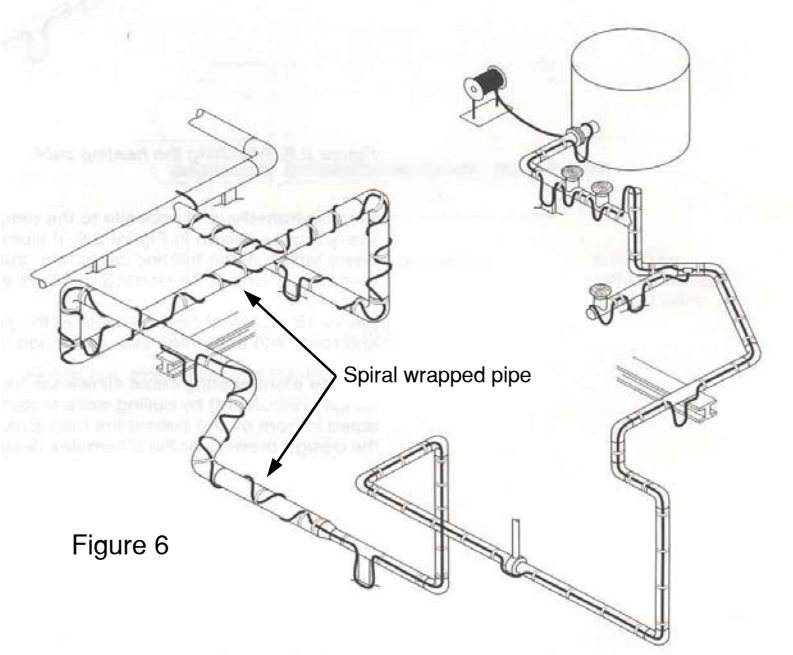


Figure 6

ATTACHING THE HEATING CABLE (cont)

Double or Multiple tracing runs

There are two design situations that dictate the use of two or more runs of cable on the pipe. These are:

- Critical processes sometimes require redundant heating circuits. In this type of design, heat sinks must be traced with both runs of cable.
- Double or multiple runs of heating cable may be required to compensate for high heat losses that cannot be offset by the use of one cable. When using two or more spools of cable to supply runs to one pipe, it is important to take the extra cable required for tracing heat sinks from alternate spools. This will help to equalize the heating cable lengths in each circuit. Access loops should also be left on each heat sink that may require future service or maintenance.

CABLE ROUTING ON TYPICAL HEAT SINKS

The cable attachment portion of the installation is completed by wrapping each of the loops shown in Figure 4 onto the heat sink. Route the cable path of each loop as shown in the following drawings.

Flange

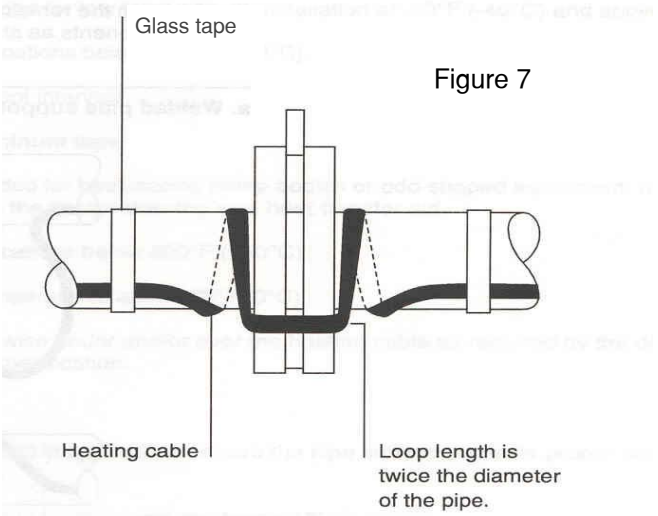


Figure 7

Elbow

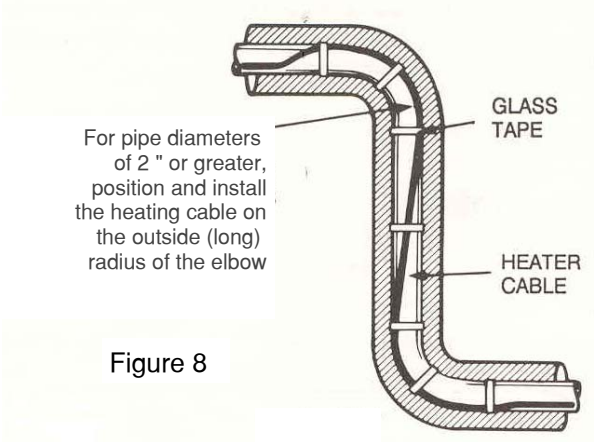


Figure 8

CABLE ROUTING ON TYPICAL HEAT SINKS (cont)

Welded pipe support

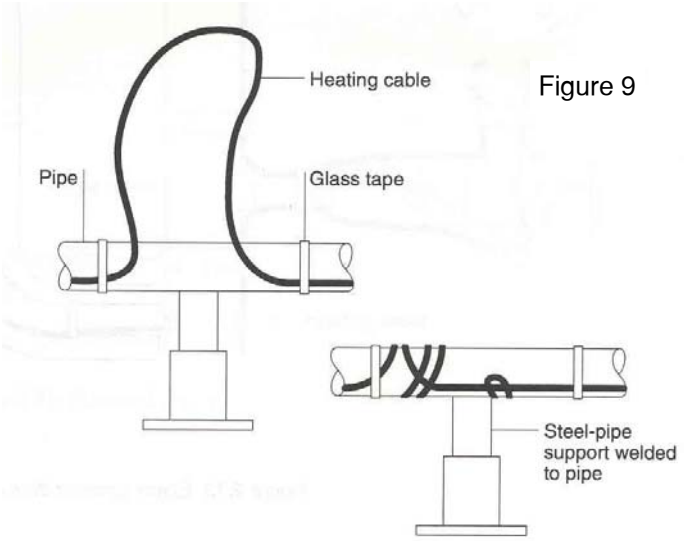


Figure 9

Welded pipe support with shoe

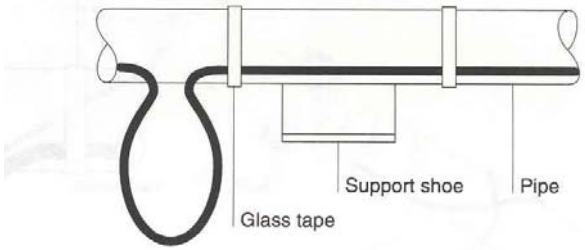


Figure 10

Valve (typical)

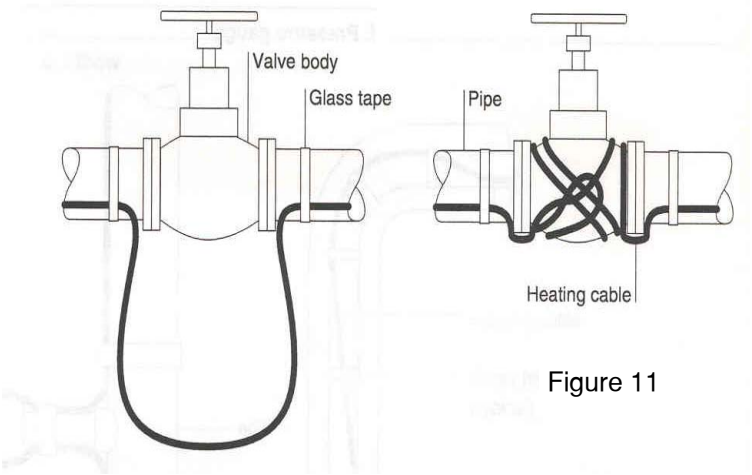
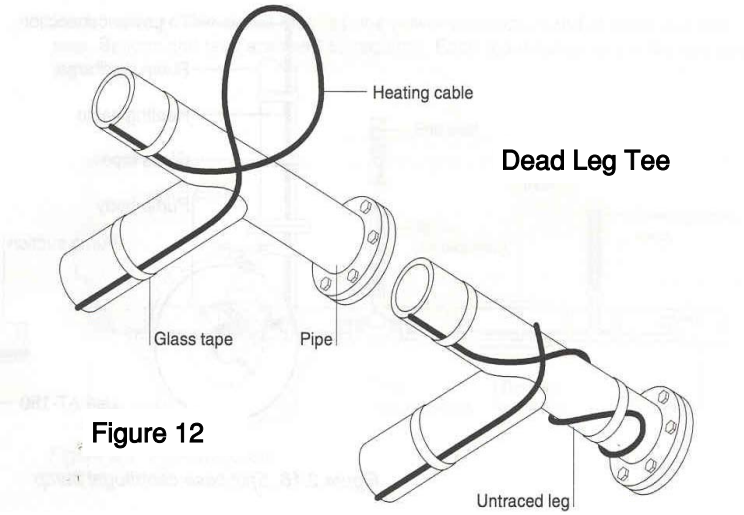


Figure 11

CABLE ROUTING
ON TYPICAL
HEAT SINKS (cont)



Dead Leg Tee

Figure 12

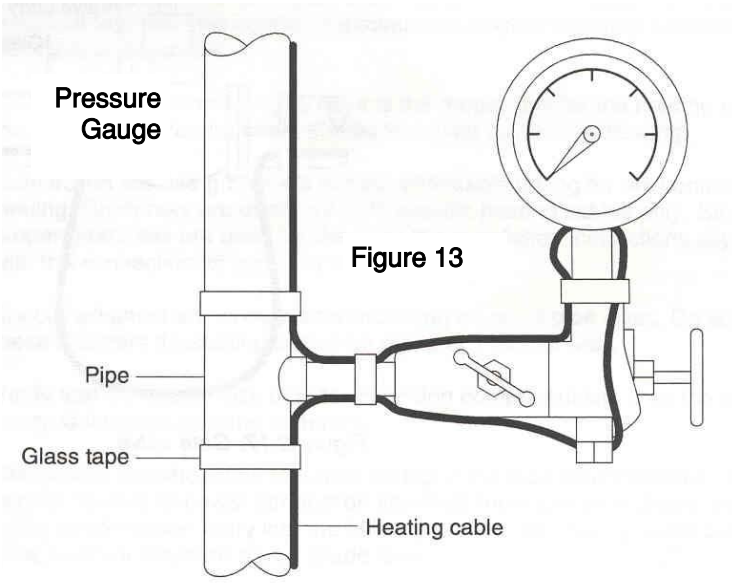
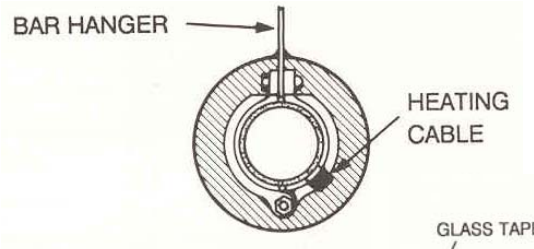


Figure 13



Pipe Hanger

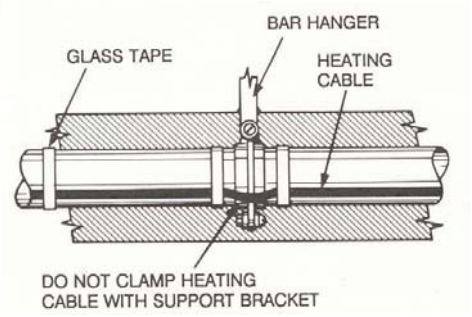


Figure 14

SYSTEM COMPONENTS

Detailed installation instructions are supplied with each kit. Follow these instructions carefully when installing each kit.

Before installing any kits, please consider the following important points:

- The black heating cable core is an electrically conductive heating matrix and can short. It must be properly insulated and kept dry.
- Damaged bus wires can overheat or short. Do not break bus wire strands when stripping the heating cable.
- Never connect or twist the heating cable bus wires together. This will cause a short.
- Failure to properly install the correct component kits can cause arcing and fire. Do not use other kits or substitute parts. Do not use vinyl electrical tape. Use only the specified HTD termination and connection kits.
- Termination and connection kits should be positioned on top of the pipe when practical. Electrical conduit leading to power connection kits must have low-point drains installed to avoid condensation entry into the heating system. All heating cable connections must be mounted above grade.

Each heating circuit requires a minimum of one power connection box assembly and end seals for both ends of the heating cable. Splice kits and Tee splice kits are used as required. Consult the following list to ensure that you have the correct component kits to meet your installation requirements.

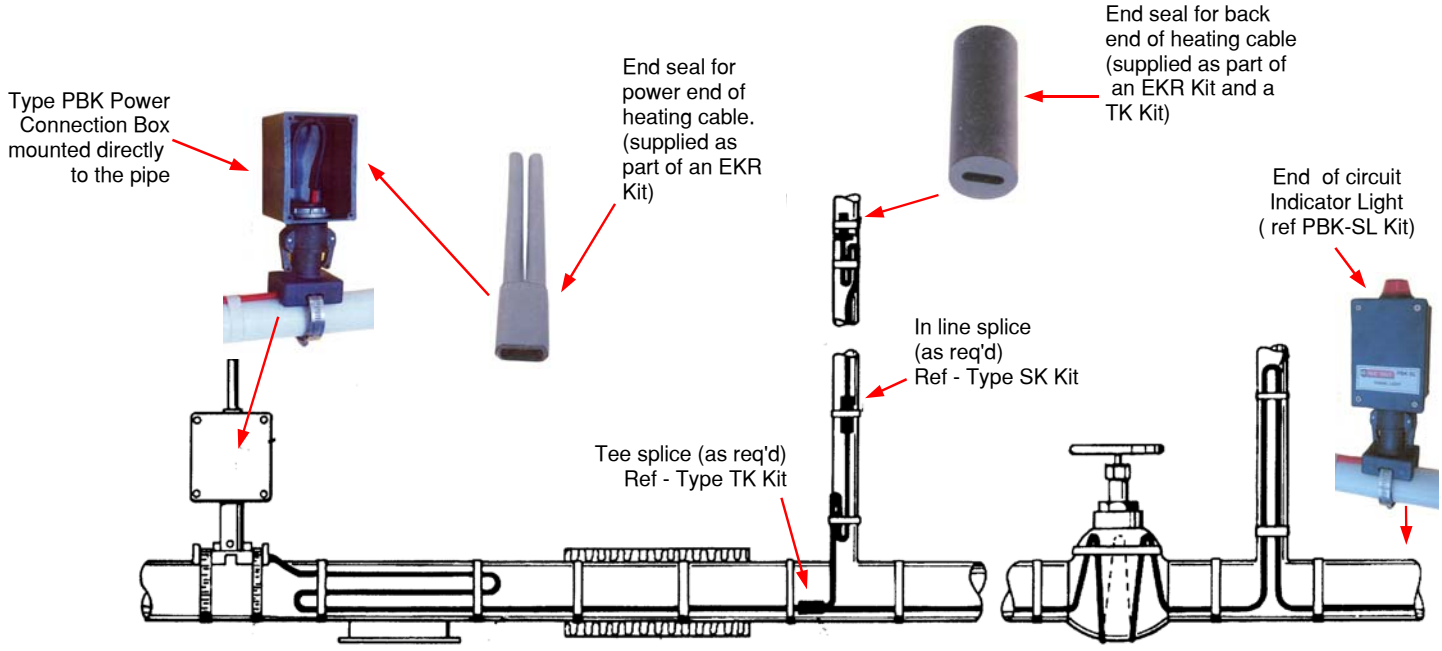
Type PBK
Power Connection Box,
complete with pipe
mounting assembly
(one per heating circuit)

Type EKR
End Termination Kit
(one per heating circuit)

Type SK
Splice Kit
(as required)

Type TK
Tee Splice Kit
(as required)

SYSTEM COMPONENTS



TESTING

Following the correct installation of the required kits, and before the pipe is insulated, it is important to apply an Insulation Resistance (IR) test to each heating circuit. Insulation Resistance testing is a reliable indicator of the electrical integrity of the heating circuit when all of the installation instructions are properly followed. Insulation Resistance Testing is more commonly known as "meggering". The following test must be completed on each heating circuit.

- As per ANSI IEEE Standard 141-1986, megger testing should be done at 500, 1,000 and 2,500 Vdc. Significant problems may not be detected if testing is only done at 500 or 1,000 volts.
- The megger test for braided versions of heating cable should be conducted between the heating cable bus wires and the heating cable braid.
- The megger test for braided and overjacketed versions of heating cable requires the above test plus a second megger test taken between the heating cable braid and the pipe.

All Insulation Resistance values should be greater than 1,000 megohms.

Apply thermal insulation to pipe and *repeat above tests*

GROUND-FAULT PROTECTION

NEC Article 427-22 requires ground fault protection on all heating cable systems. Additionally, IEEE Std 515-1997 recommends the use of ground fault breakers with a 30-mA trip level.

To comply with these requirements and reduce the risk of fire caused by damage or improper installation, HTD recommends the use of Square D QO-EPD and QOB-EPD circuit breakers or equivalent for use with all heating circuits. Alternative designs that provide comparable levels of ground-fault protection may also be acceptable. Contact HTD for further information.

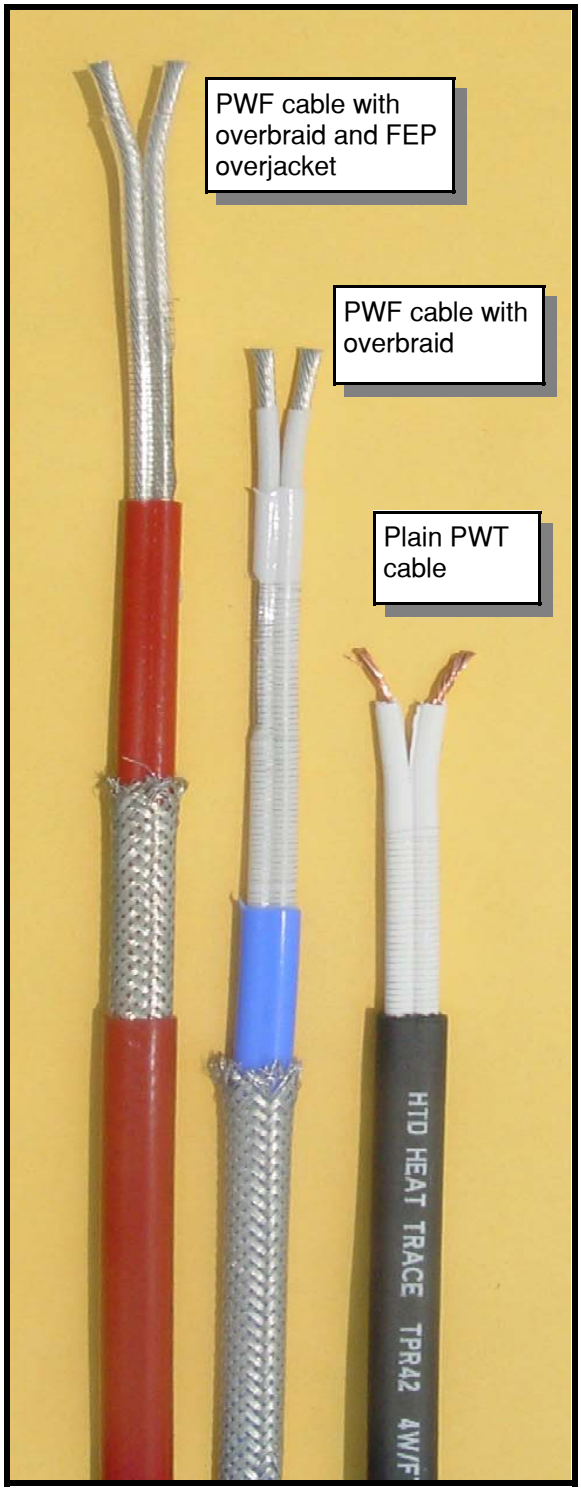
PWT, PWF

For freeze protection and process heating applications up to 350°F (177°C)

PermaWatt®

Constant Wattage Heating Cables

- *Zone parallel circuitry for increased safety and reliability.*
- *Power ratings up to 10 watts/ft.*
- *Rugged construction for industrial and corrosive environments.*
- *Low Cost.*



PermaWatt PWT and PWF heating cables are industrial grade pipe tracing products that can be used on many applications ranging from simple freeze protection to process temperature maintenance applications of 350°F.

PermaWatt products are zone parallel, constant wattage style heating cables, that can be cut to length at the job site to match the exact length of piping being traced. There is no waste. Unused cable can be stored and saved indefinitely ready for immediate use on future applications.

PWT cable is specifically manufactured and offered as a *low cost* freeze protection cable.

PWF cables are offered for both freeze protection and process temperature maintenance applications. With its high temperature exposure rating of 400°F, PWF heating cable can be used safely on process piping systems that may be routinely or periodically steam cleaned.

PermaWatt heating cables are *industrial grade tough* but they are also flexible enough to be easily installed on small diameter pipes, valves, flanges and instruments. Installation is quick, simple and no special tools, knowledge or skills are required. A complete range of standard power connection kits, splice kits and tee splice kits are available to minimize power supply points and simplify cable routing on even the most complex piping systems.

Exact product features and capabilities are shown on the following page.

HTD HEAT TRACE

ELECTRIC HEAT TRACING PRODUCTS AND SYSTEMS

SPECIFICATIONS

		PWT	PWF
POWER RATINGS		Up to 6 w / ft	Up to 10 w/ / ft
TEMPERATURE RATINGS		PWT	PWF
	Continuous (power on)	200°F	350°F
	Intermittent (power off)	257°F	400°F
HEATING ELEMENT MATERIAL		PWT Nickel Chrome Wire	PWF Nickel Chrome Wire
BUS WIRE SIZES & MATERIALS		PWT 16 AWG Copper	PWF 12 AWG Tinned Copper
JACKET MATERIALS		PWT Thermoplastic Rubber (TPR)	PWF Fluoropolymer (FEP)
STANDARD VOLTAGES		120 and 240 VAC (all 240 VAC cables can also be used on 208 or 277 VAC)	

PRODUCT RANGE

Product Ref	Watts / ft	Voltage	Max Circuit
PWT 21	2	120	365
PWT 41	4	120	260
PWT 22	2	240	730
PWT 42	4	240	515
PWF 41	4	120	402
PWF 81	8	120	284
PWF 101	10	120	254
PWF 42	4	240	803
PWF 82	8	240	568
PWF 102	10	240	508

Power adjustments:

The power output of a 240 VAC cable on 208 VAC equals the watts / ft at 240 VAC multiplied by 0.75
The power output of a 240 VAC cable on 277 VAC equals the watts / ft at 240 VAC multiplied by 1.33

STANDARD POWER RATINGS, VOLTAGES AND CIRCUIT LENGTHS

	Max Circuit length (ft) by Circuit Breaker Size								
	110 / 120 VAC			208/220/240VAC			277 VAC		
Cable Ref	15A	20A	30A	15A	20A	30A	15A	20A	30A
PWT 21	365	-	-	-	-	-	-	-	-
PWT 41	260	-	-	-	-	-	-	-	-
PWT 22	-	-	-	730	-	-	730	-	-
PWT 42	-	-	-	515	-	-	515	-	-
PWF 41	360	402	-	-	-	-	-	-	-
PWF 81	180	240	284	-	-	-	-	-	-
PWF 101	144	192	254	-	-	-	-	-	-
PWF 42	-	-	-	720	803	-	625	803	-
PWF 82	-	-	-	360	480	568	312	416	568
PWF 102	-	-	-	288	384	508	250	332	508

ORDERING INFORMATION

Feature		Order
Product Codes		PWT PWF
Watts / ft	PWT PWF	2 or 4 4, 8 or 10
Voltage	120 240	1 2
Tinned Copper Overbraid		C
Optional FEP Overjacket	PWT PWF	Not available T

Example:
To order a PWF cable, rated at 8 watts / ft on 240 VAC, complete with overbraid and FEP overjacket, the final product and ordering code should read PWF82 CT.

ACCESSORIES

HTD Heat Trace, Inc supplies a full range of accessories for use with the PermaWatt product range. Accessories include termination kits, splice kits, tee splice kits, fixing tape, heat transfer tape, junction boxes and thermostats. Please contact HTD for full details.

HTD HEAT TRACE

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www.htdheattrace.com

HEAT TRACE

Constant Wattage Heating Cables

INSTALLATION INSTRUCTIONS

PermaWatt PWT
PermaWatt PWF

PT-INST PW-F-12/04

WARNING

All electric heat tracing systems must be installed correctly to ensure safe, proper operation and to prevent shock and fire. Read and follow these instructions carefully.

- To minimize the danger of fire from sustained electrical arcing if the heating cable is damaged or improperly installed, use a ground-fault protection device (GFPD). Arcing may not be stopped by conventional style circuit breakers.

  The 2002 National Electric Code, Sections 426 and 427 require the use of ground-fault equipment protection on heating cable installations. Consult the section labeled *Ground-Fault Protection* on the last page of this brochure for the recommended circuit breakers to use with all Permawatt heating cables supplied by HTD.
- Failure to properly install the correct component kits can cause arcing and fire. Do not use other kits or substitute parts. Do not use vinyl electrical tape. Use only the specified HTD termination and connection kits and follow the installation instructions supplied with them.
- Damaged heating cable or components can cause electrical shock, arcing and fire. Do not attempt to repair or energize damaged heating cable. Remove damaged sections at once and replace them with a new length of heating cable using the appropriate HTD splice kit. Replace damaged components.
- Damaged bus wires can overheat or short. Do not break bus wire strands when stripping the heating cable.
- Do not use metal attachments such as pipe straps or tie wires. Use only HTD approved fixing tapes and cable ties to secure the heating cables to the pipe.

INTRODUCTION

These instructions cover the installation requirements for PermaWatt type PWT and PWF Constant Wattage heating cables as supplied by HTD Heat Trace, Inc.

The instructions assume that the proper heat tracing design has been completed according to the HTD *Thermal Design Guide*.

Use the proper HTD constant wattage heating cable for the specific application as shown in the HTD *Heating Cable Selection Guide* and *Heating Cable Selection Matrix.*

ELECTRICAL CODES

Sections 426, 427 and 500 of the 2002 National Electrical Code (NEC) and Part 1 of the Canadian Electrical Code Sections 18 and 62 govern the installation of electrical heat tracing systems. All heat tracing system installations must be in compliance with these and any other national, state, provincial or local codes.

HEATING CABLE STORAGE

Store all heating cables and components in a clean dry place.

Store all heating cables and components at temperatures between -40°F and 140°F (-40°C and 60°C).

Do not store heating cables and components in high traffic areas where potential damage may occur.

PREINSTALLATION CHECKS

Check the materials received.

- Check the heating cable catalog number and quantity received against the Purchase Order or Bill of Materials.
- Verify that the correct components and quantities are present for use with the selected heating cable.
- Inspect the heating cable and components for any damage that may have occured during transit.

Check the pipe to be heat traced.

- Verify that the pipe has been pressure-tested and that all equipment and supports are installed.
- Verify that any paint or coatings used on the pipe are dry.
- Walk the piping system and plan the routing of the heating cable on the pipe.
- Remove any sharp edges or burrs that could damage the heating cable.

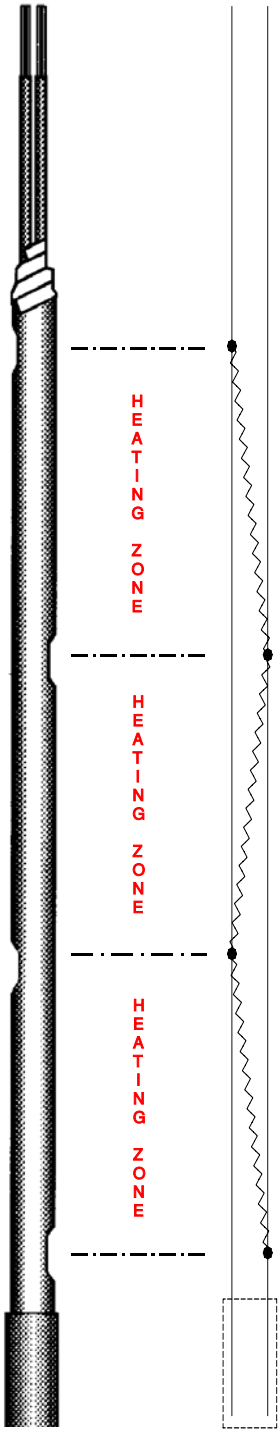
Plan the installation. Compare the design drawings or sketches with the actual pipe and note any differences in:

- Pipe length and size
- The number of valves, flanges, gauges, and other equipment.
- The number of pipe supports. These items are frequently not shown on drawings but there should be some form of notation on the drawing to indictate the amount of heating cable that is included in the circuit for the pipe supports.

Identify the location of the heating cable terminations.

- Mark the location of all power connections, splices, tee splices and end terminations on the pipe using a vivid color spray paint or marker

HEATING CIRCUIT FABRICATION

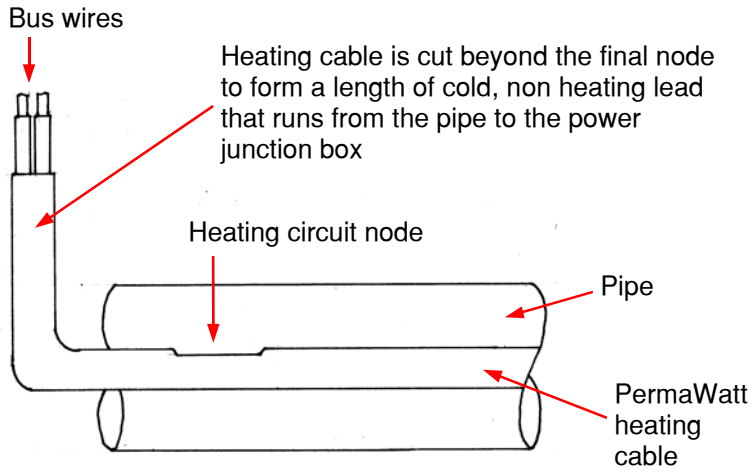


Permawatt heating cables are constant wattage, parallel resistance type heating strips. The construction consists of

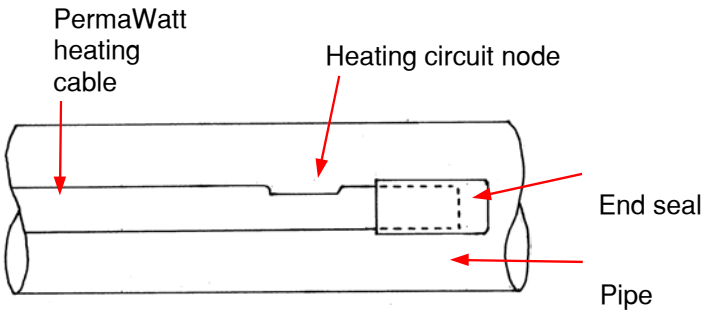
- an internal insulating sheath that is extruded over two 12AWG, multi-stranded copper bus wires
- a Ni-chrome heating element spirally wound around the above assembly
- a series of nodes at alternating locations along the strip where the heating element is soldered to the bus wires to form a heating zone
- a primary outer insulating jacket
- overbraid for grounding purposes and optional overjacket for addditional mechanical, moisture and corrosion protection

A heating circuit is fabricated by cutting the cable as shown below such that the required number of heating zones remain intact and functional along the entire length of cable being applied to the pipe.

POWER END OF HEATING CIRCUIT



BACK (non power) END OF HEATING CIRCUIT



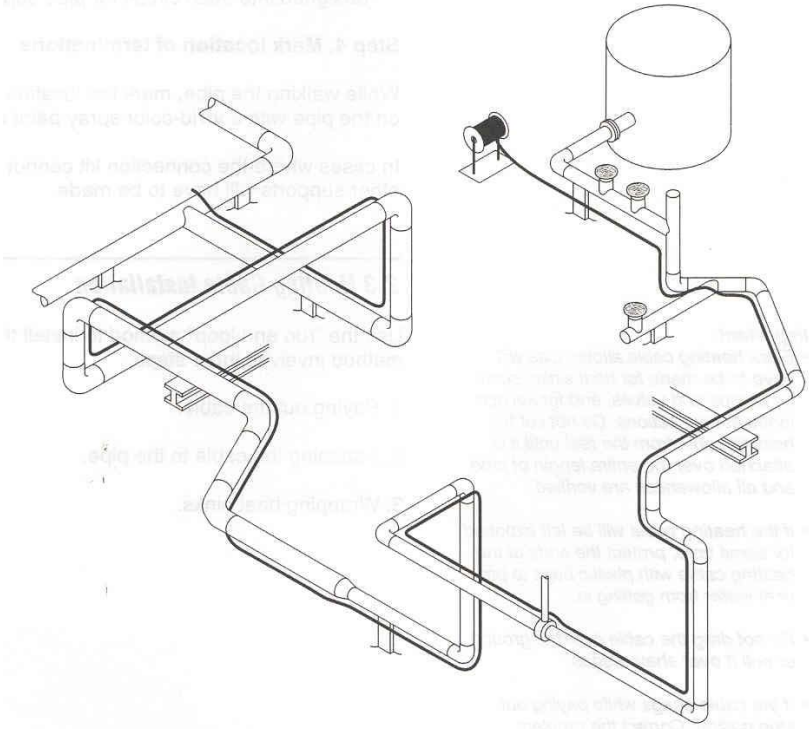
Termination and cable stripping instructions are supplied with each shipment.

HEATING CABLE INSTALLATION

Pay out heating cable (see Figure 1)

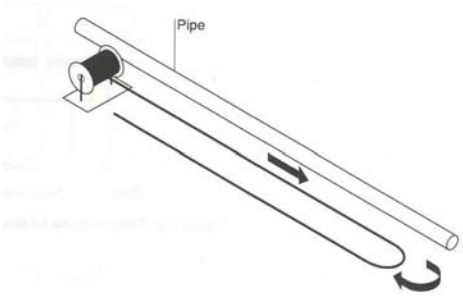
- Mount the cable spool on a holder near either end of the pipe to be traced. Do not apply excessive pulling or jerking on the cable as it is being unrolled.
- Pay out the heating cable and loosely string it along the pipe. Make sure that the cable is always next to the pipe when crossing obstacles. If the cable is on the wrong side of the obstacle (eg. a support beam, crossing pipe etc) it may have to be removed and reinstalled or cut and spliced.
- For installations that require two or more heating cables, use two or more holders to pay out the cables, essentially replicating the procedure shown in Figure 1.

Figure 1



- Alternatively, for installations that require two heating cables, use one holder, secure the end of the cable to the pipe and pull one large loop as shown in Figure 2

Figure 2



ATTACHING THE HEATING CABLE

The heating cable may be straight traced along the pipe, spiral wrapped around the pipe or straight traced in multiple runs along the pipe, as required by the design.

Straight tracing along the pipe

- Whenever possible, position the heating cable or cables on the lower section of pipe as shown in Figure 3. This helps to protect the heating cable from mechanical damage during the installation, pre-insulation and insulation phases of the project.

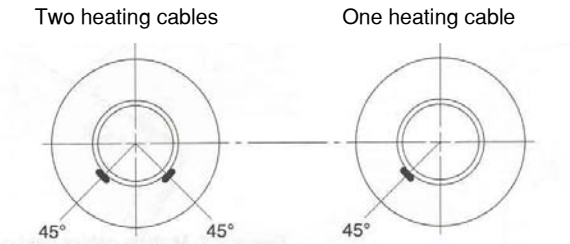
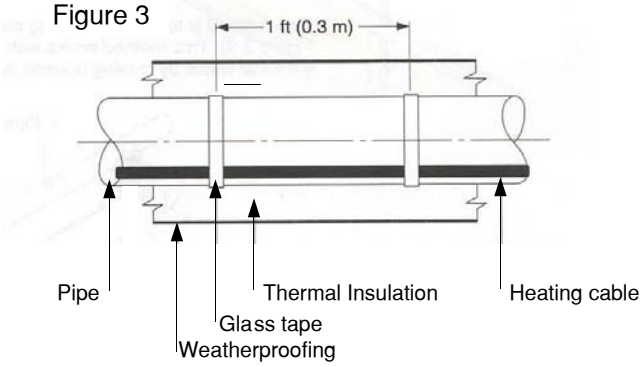


Figure 3

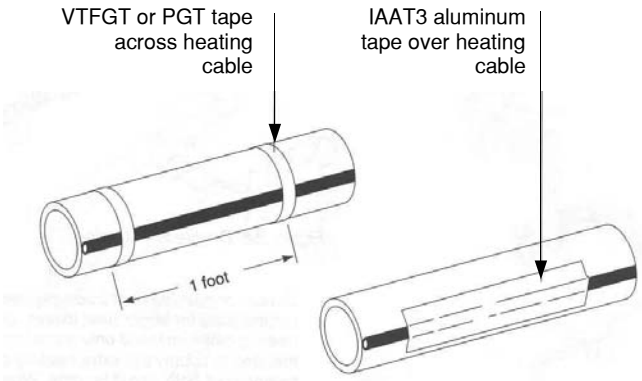


FIXING / TYING TAPES

Use type VTFGT adhesive backed glass tape on all PWT and PWF heating cable installations. VTFGT glass tape may be used in low ambient temperatures down to -40°F (-40°C).

- Use type PGT glass tape on all PWF heating cable installations when the maximum exposure and/or operating temperature of the application is above 310°F (155°C)
- Type IAAT3 adhesive backed aluminum heat transfer tape is recommended for wrapping heat traced pump bodies, valves and other odd-shaped devices as a heat-transfer aid. This product should also be applied over the entire length of the heating cable when the pipe being heat traced will carry any type of heat sensitive fluid. IAAT3 tape may be used on all applications up 200°F (93°C) and must be applied when ambient temperatures are above 32°F (0°C)
- Cable ties may be used to secure the heating cable to the pipe on installations below 180°F (82°C) when the surface of the pipe prevents proper adhesion of the VTFGT tape. Cable ties must be hand-tightened only.
- PermaWatt heating cables should not be installed on any form of non-metallic piping unless each heating cable circuit is protected by an over temperature thermostat or controller.

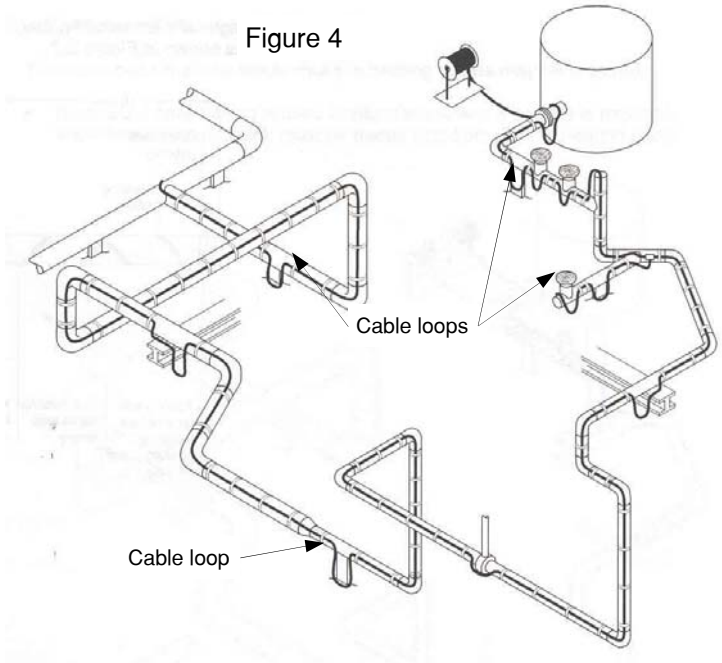
SECURING THE HEATING CABLE



ATTACHING THE HEATING CABLE (cont)

- Starting from the end opposite to the cable spool and holder, secure the heating cable to the pipe using wraps of glass tape at 1 foot intervals as shown in Figure 3. If type IAAT3 aluminum tape is being used, apply it longitudinally over the entire length of heating cable after the cable has first been secured with glass tape.
- Work back towards the cable spool and holder, repeating the above procedure.
- Leave one complete heating zone of extra heating cable at the power connection, at all sides of splices and tee splices and at the end seal location to provide sufficient cable to complete the required terminations. (consult Termination Instruction drawings for exact details)
- Extra heating cable must be allowed and pulled for each heat sink (flange, pipe support, valve, instrument etc). The extra heating cable should be taped immediately before and after the heat sink and left in a loop as shown in Figure 4. To obtain the required loop length for the type of heat sink being traced. consult the design drawing or the HTD Thermal Design Guide.

Figure 4



ATTACHING THE HEATING CABLE (cont)

Spiral tracing of pipe

- When the design calls for spiral tracing or wrapping of the heating cable on the pipe, begin by suspending a loop of heating cable for every 10 ft (3.04m) section of pipe as shown in Figure 5

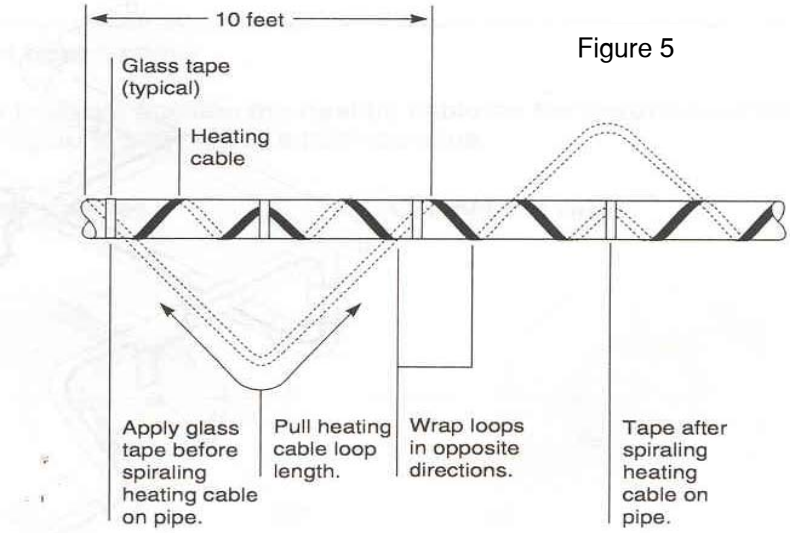


Figure 5

- To determine the loop length, multiply the spiral factor from the drawing by ten (eg if the spiral factor is 1.3, leave a 13ft loop of heating cable for every 10ft of pipe)
- Pull the required amount of heating cable for the 10ft section of pipe, attach the cable to the pipe at each end and let it hang in a loop. Grasp the loop in the center and wrap it around the pipe. Even out the distances between each spiral by sliding the wraps along the pipe. Use glass tape to secure the center of the loop to the pipe. Ensure that the heating cable is flat to the pipe for good heat transfer. *Do not overlap the heating cable*.

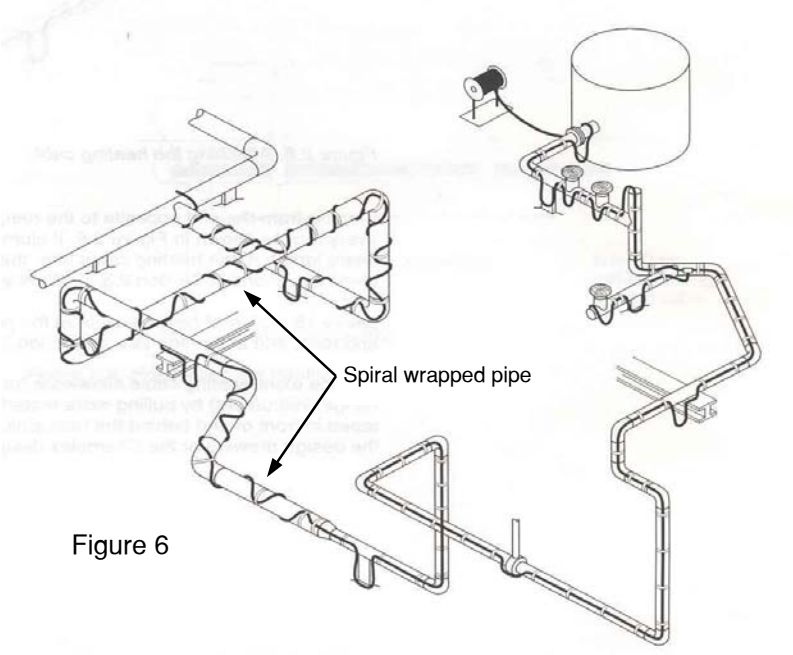


Figure 6

ATTACHING THE HEATING CABLE (cont)

Double or Multiple tracing runs

There are two design situations that dictate the use of two or more runs of cable on the pipe. These are:

- Critical processes sometimes require redundant heating circuits. In this type of design, heat sinks must be traced with both runs of cable. *Do not overlap the heating cables.*
- Double or multiple runs of heating cable may be required to compensate for high heat losses that cannot be offset by the use of a one cable. When using two or more spools of cable to supply runs to one pipe, it is important to take the extra cable required for tracing heat sinks from alternate spools. This will help to equalize the heating cable lengths in each circuit. Access loops should also be left on each heat sink that may require future service or maintenance.

CABLE ROUTING ON TYPICAL HEAT SINKS

The cable attachment portion of the installation is completed by wrapping each of the loops shown in Figure 4 onto the heat sink. Route the cable path of each loop as shown in the following drawings. *Do not overlap the heating cable.*

Flange

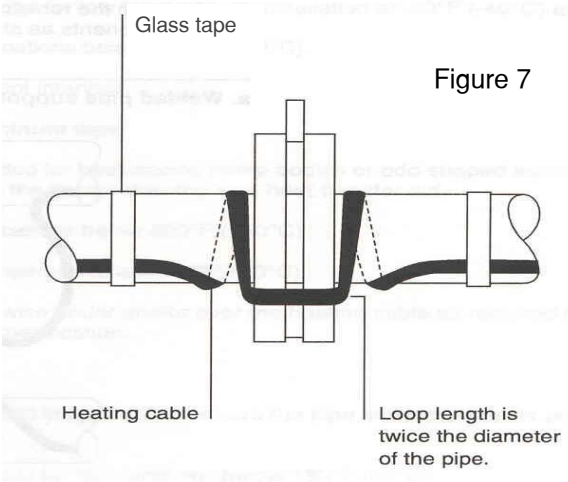


Figure 7

Elbow

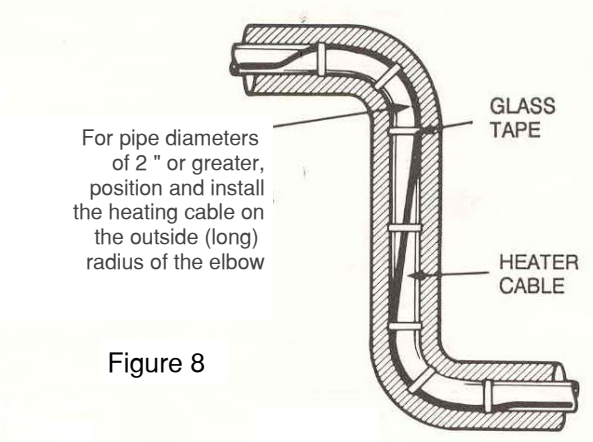


Figure 8

CABLE ROUTING ON TYPICAL HEAT SINKS (cont)

Expansion Joint

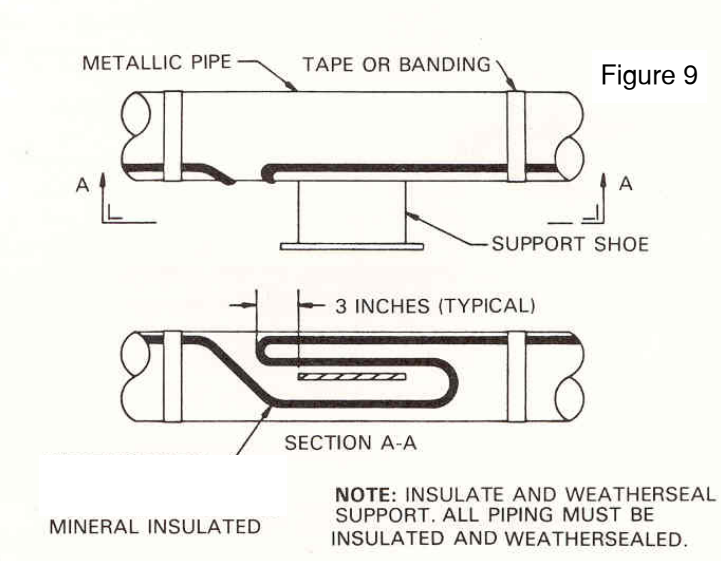


Figure 9

Welded pipe support with shoe

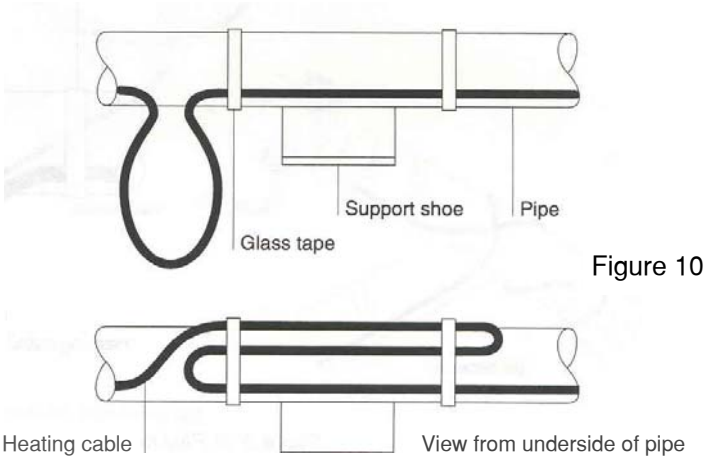


Figure 10

Valve (typical)

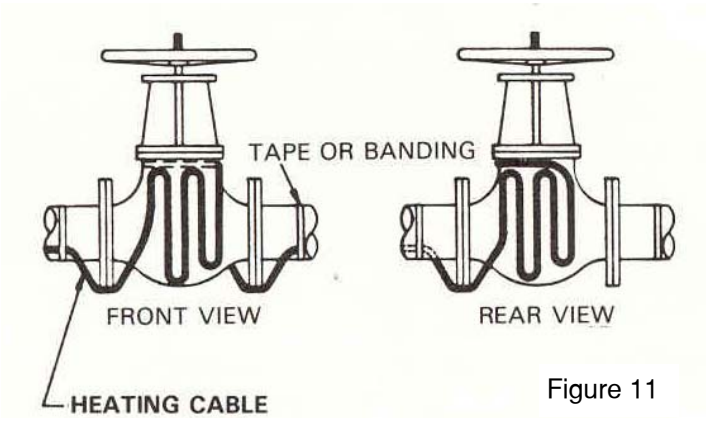


Figure 11

CABLE ROUTING ON TYPICAL HEAT SINKS (cont)

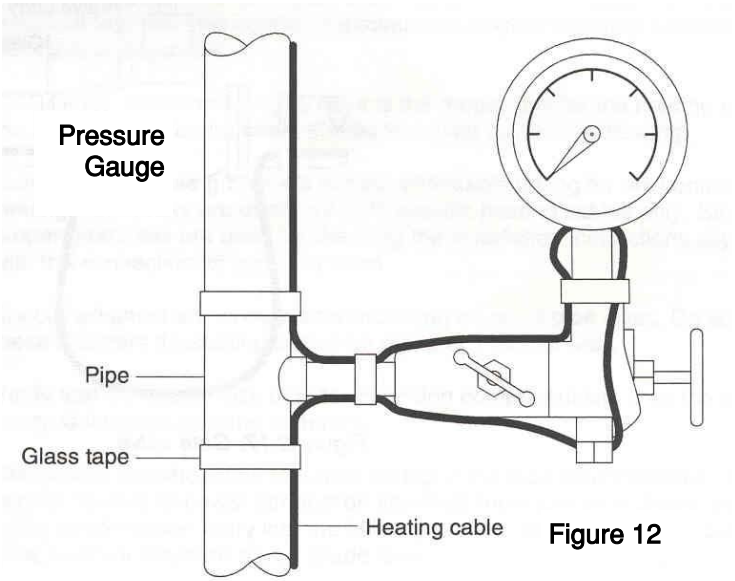


Figure 12

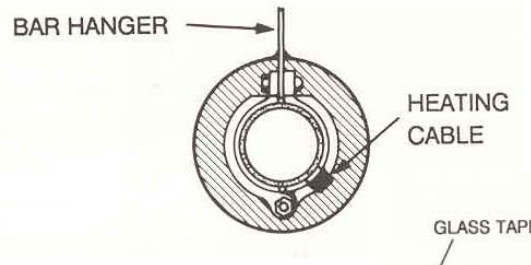
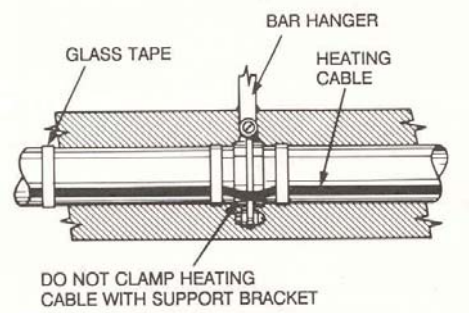


Figure 13



Pipe Hanger

CAUTION

Types PWT and PWF are constant wattage heating cables. They cannot be installed with adjacent passes of heating touching and they must not be overlapped or crossed over upon each other. Cables that touch, overlap or cross can overheat and burn out.

TESTING

Following the correct installation of the required kits, and before the pipe is insulated, it is important to apply an Insulation Resistance (IR) test to each heating circuit. Insulation Resistance testing is a reliable indicator of the electrical integrity of the heating circuit when all of the installation instructions are properly followed. Insulation Resistance Testing is more commonly known as "meggering". The following test must be completed on each heating circuit.

- As per ANSI IEEE Standard 141-1986, megger testing should be done at 500, 1,000 and 2,500 Vdc. Significant problems may not be detected if testing is only done at 500 or 1,000 volts.
- The megger test for braided versions of heating cable should be conducted between the heating cable bus wires and the heating cable braid.
- The megger test for braided and overjacketed versions of heating cable requires the above test plus a second megger test taken between the heating cable braid and the pipe.

All Insulation Resistance values should be greater than 1,000 megohms.

Apply thermal insulation to pipe and *repeat above tests*

GROUND-FAULT PROTECTION

NEC Article 427-22 requires ground fault protection on all heating cable systems. Additionally, IEEE Std 515-1997 recommends the use of ground fault breakers with a 30-mA trip level.

To comply with these requirements and reduce the risk of fire caused by damage or improper installation, HTD recommends the use of Square D QO-EPD and QOB-EPD circuit breakers or equivalent for use with all heating circuits. Alternative designs that provide comparable levels of ground-fault protection may also be acceptable. Contact HTD for further information.

HTD HEAT TRACE

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e-mail: sales@htdheattrace.com
www.htdheattrace.com

VT20, VTN, VTC

For freeze protection and process heating applications up to 400°F (204°C)

VersaTrace ™

Series Circuit Heating Cable

FM APPROVED

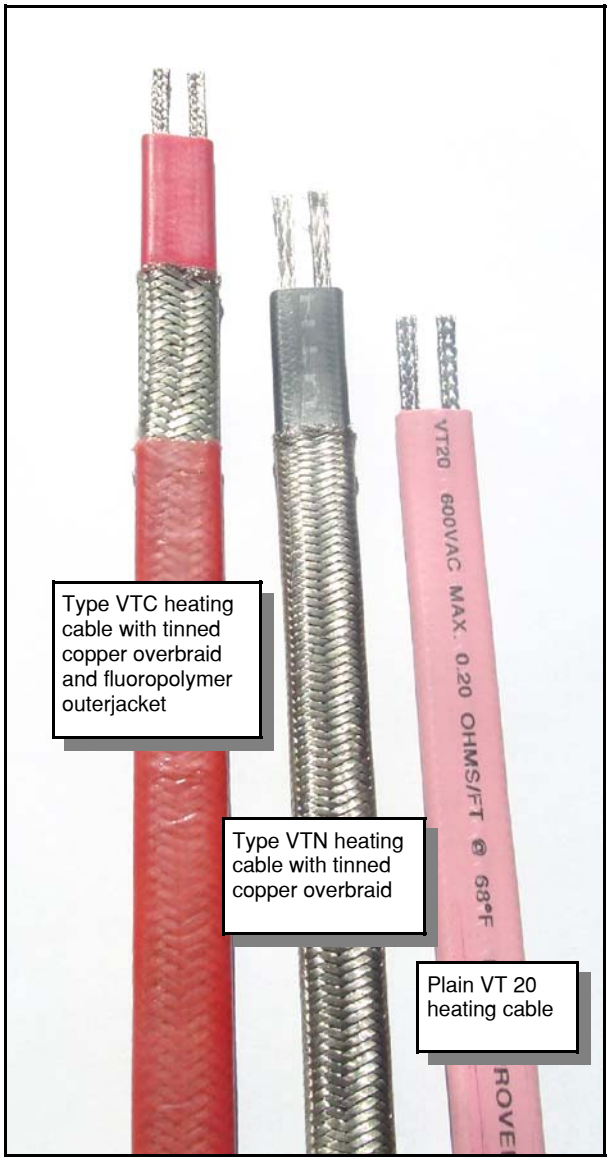
- *Designed and constructed to handle the very toughest heat tracing applications*
- *Voltage ratings up to 600 VAC*
- *Power ratings up to 20 watts/ft*
- *Highly flexible, simple and quick to install*
- *Patented, proven, effective and reliable*
- *Factory Mutual Approved for use in unclassified, hazardous and corrosive environments*
- *Can be used safely on piping that is routinely steam cleaned*

VersaTrace VT heating cables are high temperature, industrial grade heating cables that can be used on many applications ranging from simple freeze protection to process temperature maintenance applications of 400°F (204°C).

The VT product range are fixed resistance, series circuit style heating cables, that can be cut to length at the job site and designed to provide power outputs up to 20 watts/ft on operating voltages up to 600 VAC. With exceptionally high temperature exposure ratings of 500°F (260°C), all VT heating cables can be used safely on process piping systems that may need to be routinely or periodically steam cleaned.

VT heating cables are *RUGGED* and constructed to handle the highest levels of mechanical and environmental abuse without failure or any loss of performance. Applications that immediately destroy conventional heating cables are handled with complete safety and reliability. Without exception, VT cables are the *TOUGHEST*, industrial grade heating cables available.

VT heating cables are tough, but they are also amazingly flexible. They can be cut to length at the job site to match the exact lengths of pipes to be traced and they are easily wrapped around valves, pumps and fittings. The installation of all VT heating cables is quick, simple and requires no special tools, knowledge or skills. A complete range of standard power connection kits, splice kits, tee splice kits and controls are readily available.



HTD HEAT TRACE

ELECTRIC HEAT TRACING PRODUCTS AND SYSTEMS

SPECIFICATIONS

POWER RATING	Up to 20 watts / ft (Maximum power output restricted by desired maintenance temperature)

TEMPERATURE RATING	Continuous (power on)	400°F
	Intermittent (power off)	500°F

	VT 20	VTN	VTC
HEATING ELEMENT MATERIALS & SIZE	Nickel Chrome (13 AWG)	Pure Nickel (13 AWG)	Nickel plated Copper (13 AWG)

	VT 20	VTN	VTC
HEATING ELEMENT RESISTANCE	0.2 Ω / ft @ 68°F ±10 %	0.02 Ω / ft @ 68°F ±10 %	0.004 Ω / ft @ 68°F ±10 %

	VT 20	VTN	VTC
RESISTANCE / TEMPERATURE ADJUSTMENT FORMULA	Ω / ft = 0.19723 + (°F X 0.00004)	Ω / ft = 0.01486 + (°F X 0.000076)	Ω / ft = 0.00335 + (°F X 0.00001)

DIELECTRIC RATINGS	VT 20	VTN	VTC
Material	Silicone Rubber	Silicone Rubber	Silicone Rubber
Voltage	2200 VAC	2200 VAC	2200 VAC
Color	Pink	Black	Red

	VT 20	VTN	VTC
MAXIMUM DESIGN VOLTAGE	600 VAC	600 VAC	600 VAC

APPROVALS AND CERTIFICATIONS	For types "B" and "BF" only. Plain versions of VT20, VTN and VTC do not carry FM Approval
Factory Mutual Approvals (FM)	Unclassified Areas Class I Div 2 Groups B, C & D Class II Class III

ACCESSORIES

HTD Heat Trace, Inc. supplies a full range of accessories for use with the VersaTrace VT product range. Accessories include termination kits, splice kits, tee splice kits, fixing tape, heat transfer tape, junction boxes and thermostats. Please consult HTD for full details.

STANDARD POWER RATINGS, VOLTAGES AND CIRCUIT LENGTHS

	120 V	240 V	480 V	600 V
VT 20	Circuit lengths (ft)			
5 w / ft	120	240	481	601
10 w / ft	85	170	340	425
20 w / ft	60	120	240	300
VTN	Circuit lengths (ft)			
5 w / ft	393	786	1571	1964
10 w / ft	278	556	1111	1389
20 w / ft	196	393	786	982
VTC	Circuit lengths (ft)			
5 w / ft	865	1730	3460	4324
10 w / ft	612	1223	2446	3058

ORDERING INFORMATION

Feature	Order
Product Codes	VT 20 VTN VTC
Tinned Copper Overbraid	B
Optional FEP Overjacket and sequential footage marker	F

Example:

To order VT 20 heating cable, complete with overbraid and FEP overjacket, the final product and ordering code should read:

VT20BF

HTD HEAT TRACE

8 Bartles Corner Road, Unit # 104
Flemington
New Jersey 08822-5758
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e-mail: sales@htdheattrace.com
www.htdheattrace.com

HEAT TRACE

VersaTrace ™

Series Circuit
Heating Cable

TERMINATION & CONNECTION KITS

VT20
VTN
VTC

FM APPROVED

PT-VTKITLIT-F-12/04

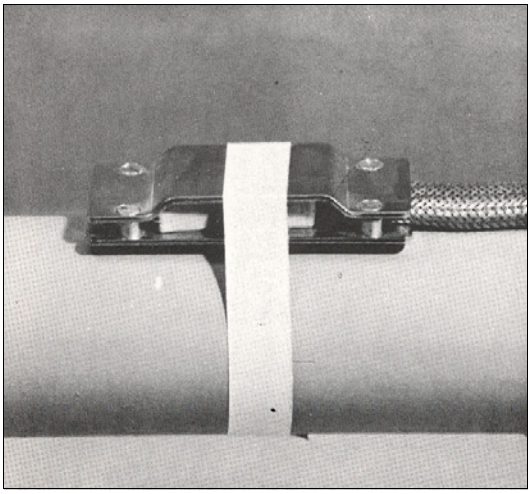
For use with braided or braided and overjacketed versions of VersaTrace heating cables.

VTHE

Hot End Termination Kits

KIT CONTENTS

- Silicone Rubber Insulating Boot
- Nickel plated Copper Crimps
- Metal Connecting Plates with screws
- RTV Sealant



USAGE

The VTHE End Termination Kit provides all of the necessary components to complete the series circuit of a VT overbraided or overbraided and overjacketed heating cable by connecting the heating elements together at the non-powered end of the circuit.

When completed, this low profile splice lays directly on the pipe surface , under the thermal insulation.

VTHE End Termination Kits are designed for use with VT20B, VT20BF, VTNB, VTNBF, VTCB and VTCBF heating cables

APPROVALS

FM APPROVED

Unclassified areas
Class I Div 2, Groups B, C & D
Class I
Class III

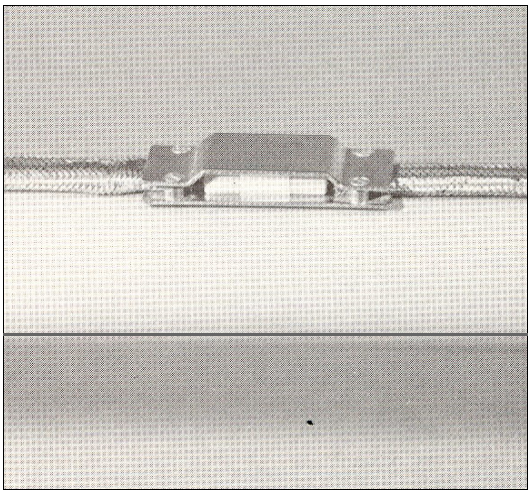
For use with braided or braided and overjacketed versions of VersaTrace heating cables.

VTHS

Splice Connection Kits

KIT CONTENTS

- Silicone Rubber Insulating Boot
- Nickel plated Copper Crimps
- Metal Connecting Plates with screws
- RTV Sealant
- Caution Label



USAGE

The VTHS Splice Connection Kit provides all of the necessary components to join two segments of VT overbraided or VT overbraided and overjacketed heating cable together.

When completed, this low profile splice lays directly on the pipe surface , under the thermal insulation.

VTHS Splice Connection Kits are designed for use with VT20B, VT20BF, VTNB, VTNBF, VTCB and VTCBF heating cables

APPROVALS

FM APPROVED

Unclassified areas
Class I Div 2, Groups B, C & D
Class I
Class III

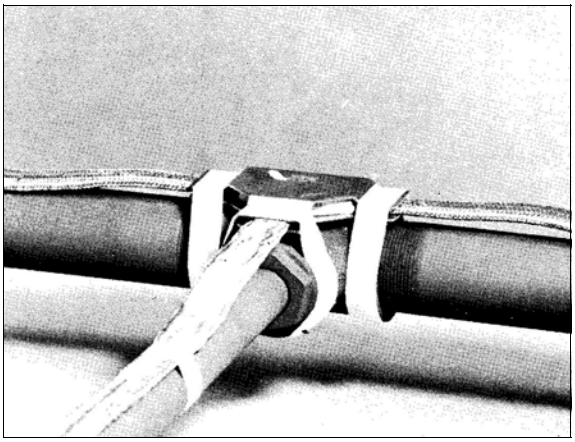
For use with braided or braided and overjacketed versions of VersaTrace heating cables.

VTHT

Tee Splice Connection Kits

KIT CONTENTS

- Silicone Rubber Insulating Boot
- Nickel plated Copper Crimps
- Metal Connecting Plates with screws
- RTV Sealant
- Caution Label



USAGE

The VTHT Tee Splice Connection Kit provides all of the necessary components to allow a branch segment of VT overbraided or overbraided and overjacketed heating cable to be connected into the main heating circuit.

Although this is commonly known as a "tee splice", the VTHT Tee Spice Connection Kit may also be used to supply power to a VT heating cable circuit at any point along its length other than the ends.

When completed, this low profile tee splice lays directly on the pipe surface under the thermal insulation.

VTHT Tee Splice Connection Kits are designed for use with VT20B, VT20BF, VTNB, VTNBF, VTCB and VTCBF heating cables.

APPROVALS

FM APPROVED

Unclassified areas
Class I Div 2, Groups B, C & D
Class I
Class III

HTD HEAT TRACE

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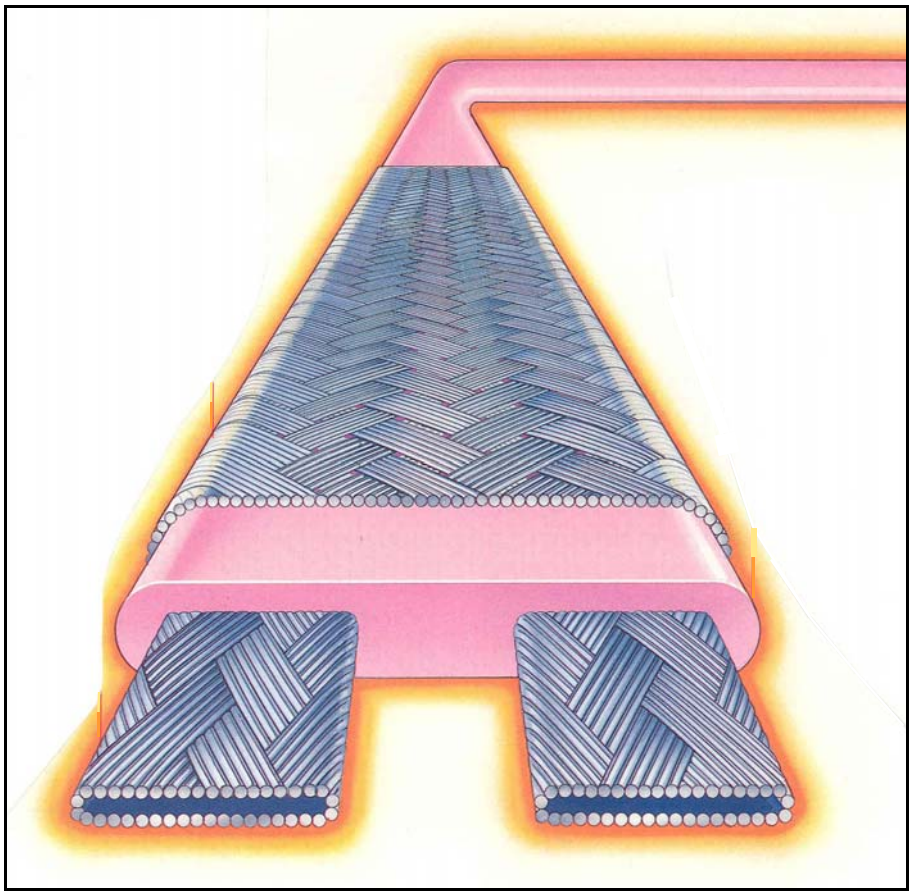
www.htdheattrace.com

HEAT TRACE

Long Pipeline Heating Systems



VTC
LPC-3C
LPC-1C

PT-LONGLINE-F-12/04

INTRODUCTION

WHAT is a long pipeline ?

In the context of heat tracing system designs, a long pipeline is essentially one single run of pipe that may be 500 ft (152 m) long to many thousands of feet long.

WHY is there a need to heat some long pipelines ?

Many types of pipelines must be heated to ensure that the fluid or product being carried within the pipeline is maintained at an optimum temperature and viscosity for pumping purposes. Occasionally, pipeline heating systems are needed to raise the temperature of the fluid or product being carried within the pipeline.

Thermal insulation alone cannot completely eliminate heat loss from the pipeline. Continuous levels of heat loss from the pipeline result in cooling of the fluid or product. When the level of cooling becomes sufficient to create viscosity and pumping problems, heat must be applied directly to the pipeline to address the problem. The most common design example of a long pipeline heating system is one that prevents the fluid being transported from freezing during winter operation.

WHEN is there a need to heat some pipelines ?

Several factors may influence the need to heat a pipeline Some of the factors are:

The fluid or product being transported in the pipeline.

- Certain fluids and products cannot be transported if they cool.
- Certain products may crystalize or spoil if they are allowed to cool.

The pipe size and length of the pipeline.

- Small diameter pipes cool faster than larger pipes.
- The extent of cooling experienced by the fluid or product increases with length of the pipeline.

The actual usage of the pipeline.

- The flow rate of the fluid or product being transported may be low.
- Infrequent use of the pipeline may neccessitate preheating before usage.

The need to heat a pipeline, as opposed to leaving the pipeline bare or just insulating the pipeline, is most commonly seen when two or more of the above factors must be considered.

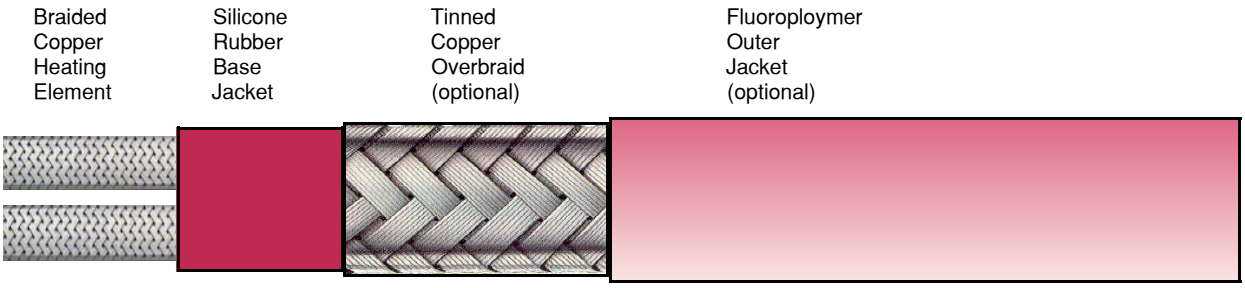
HTD Heat Trace, Inc specializes in the engineering and design of pipeline heating systems. We can offer you technical and commercially viable solutions for either buried or above-ground pipeline heating systems that can perform safely and reliably in climates ranging from the Artic winter to Sahara summer. Please contact us to address the specific needs of your application.

VTC, LPC-3C, LPC-1C

Long Pipeline Heating Systems

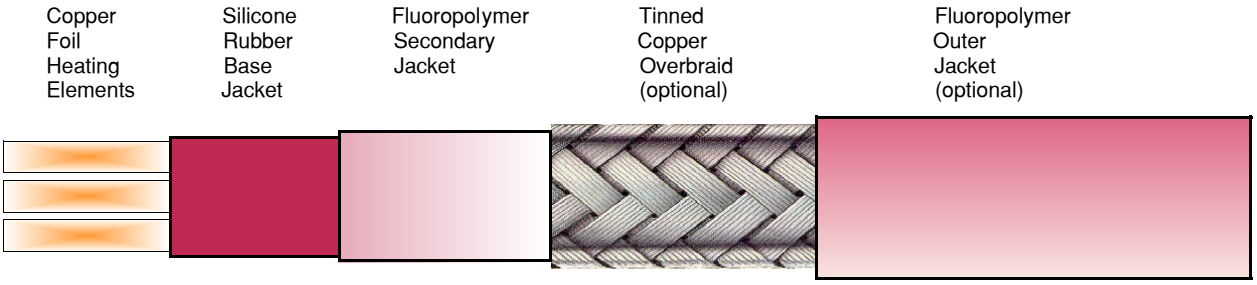
PRODUCTS AND USAGE

Three types of heating cable design and construction are used to meet the power, voltage, distance and environmental considerations associated with the design of a long pipeline heating system.



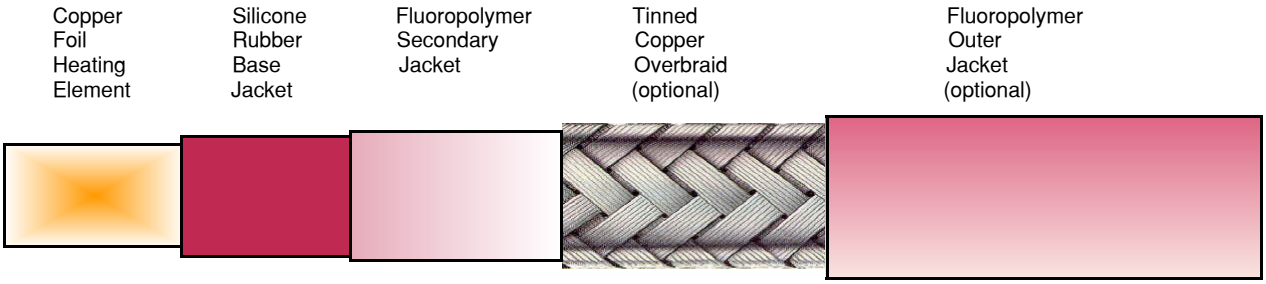
VTC

VTC heating cable is part of the patented VersaTrace family of products. This is a two conductor, single phase, fixed resistance heating cable with circuit lengths from 500 to 3,300 feet long (150 m to 1 km).



LPC-3C

LPC-3C is a three conductor, three phase, fixed resistance heating cable with circuit lengths up to 6,500 feet (2 km).



LPC-1C

LPC-1C is a single conductor, fixed resistance heating cable with circuit lengths up to 16,400 feet (5 km) when used as part of a three cable, three phase heating system.

VTC, LPC-3C, LPC-1C

Long Pipeline Heating Systems

SYSTEM CONFIGURATIONS

The three types of heating cable can be configured in several different designs to provide a wide range of power outputs on all conventional single phase and three phase power supplies.

The following table details the standard systems that can be engineered and supplied.

System Ref	# cables on Pipe	Heating Cable Ref	Voltage Range	Voltage type	Max Watts per ft of pipe	Circuit Range (ft)	Max Pipeline length *
1CSP	1	VTC	110-600	1ø	10	500 to 3,300	1.25 miles
2CSP	2	VTC	110-600	1ø	20	500 to 3,300	1.25 miles
3CSP	3	VTC	110-600	1ø	30	500 to 3,300	1.25 miles
1CTP	1	LPC-3C	208-600	3ø	20	700 to 6,500	2.5 miles
2CTP	2	LPC-3C	208-600	3ø	40	700 to 6,500	2.5 miles
3CTP	3	LPC-1C	208-1000	3ø	50	2,800 to 16,400	6.2 miles

* Maximum pipeline lengths are based upon one power supply at both ends of the pipeline or one power supply at the center of the pipeline.

MAJOR SYSTEM FEATURES

- Robust, completely waterproof, corrosion-resistant heating cables.
- Simple, low cost installation. Cables can be field installed directly onto the pipeline or pulled into channel troughs fitted onto factory pre-insulated pipes.
- Minimal electrical power supply points, power cabling and conduit required.
- Safe and reliable operation in all climatic conditions.
- Systems can be engineered for above-ground or buried pipelines.
- Custom control, monitoring and energy management systems available.

For further information on this unique, well proven method of electrically heating long, single runs of pipeline, please contact HTD at the following address.

HTD HEAT TRACE

8 Bartles Corner Road, Unit # 104
Flemington
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USA

Tel (908) 788 5210
Fax (908) 788 5204
e-mail: sales@htdheattrace.com
www.htdheattrace.com

End Termination Kits

For WinterSafe, WinterSafe Plus, AutoWatt Xtra, PermaWatt and VersaTrace heating cables

Heating Cable Accessories

- *Low cost, standard, pre-packaged, off - the-shelf kits*
- *One kit contains all of the necessary components to terminate one heating circuit*
- *Easy to use, quick and simple to install*
- *Supplied complete with step-by-step, easy to understand instructions*

TYPE EKR

For use with all versions of WinterSafe, WinterSafe Plus and AutoWatt Xtra self-regulating heating cables

Applicable cable references are WSR, WSR-C, WSR-CR, WSR-CT, WSP, WSP-C, WSP-CT, AWX, AWX-C and AWX-CT

Kit contents:

One Power End Seal (P/N H 07100)
One Back End Seal (P/N H07110)
One tube of RTV Sealant (P/N H07700)
One set of Terminating Instructions

Kit Ordering Ref EKR

TYPE PWE

For use with all versions of PermaWatt constant wattage heating cables

Applicable cable references are PWT, PWT-C, PWF, PWF-C and PWF-CT

Kit contents:

One Back End Seal (P/N H07110)
One tube of RTV Sealant (P/N H 07700)
One set of Terminating Instructions

Note: PermaWatt heating cables do not require a termination seal for the power end of the heating circuit.

Kit Ordering Ref PWE

HTD HEAT TRACE

ELECTRIC HEAT TRACING PRODUCTS AND SYSTEMS

End Termination Kits

TYPE VTHP

For use with certain versions of VersaTrace, Series Circuitry heating cables.

Applicable cable references are VT 20, VT 20B, VT 20BF, VTN, VTNB, VTNBF.

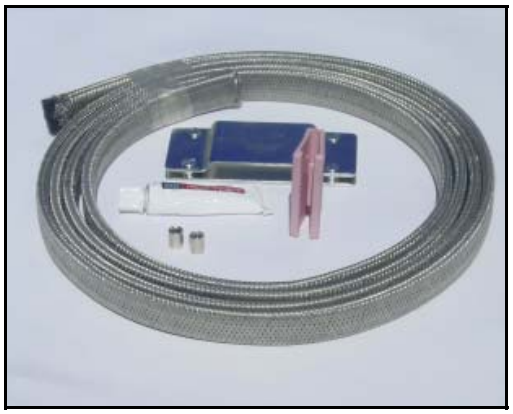
One kit is required to terminate the power connection end of one heating circuit.

Kit Contents:

One Metal Power End Cover (P/N H07160)
One Power End Seal (P/N H07150)
Two crimps (P/N H07204)
One tube of RTV Sealant (P/N H07700)
Three feet of VTCB cold lead cable (P/N VTCB)
One set of Instructions (ref VTHP Instructions)

Note: To include a custom length of VTCB cold lead cable in this kit, please contact HTD.

Kit Ordering Ref VTHP



TYPE VTHE

For use with all versions of VersaTrace, Series Circuitry heating cables

Applicable cable references are VT 20, VT 20B, VT 20BF, VTN, VTNB, VTNBF, VTC, VTCB and VTCBF.

One kit is required to terminate the back (non-power end) of one heating circuit.

Kit Contents:

One Metal Power End Cover (P/N H07160)
One Back End Seal (P/N H07140)
One crimp (P/N H07204)
One tube of RTV Sealant (P/N H07700)
One set of Instructions (ref VTHE Instructions)

Kit Ordering Ref VTHE

ADDITIONAL KITS

Splice Kits, Tee Splice Kits, Power Connection Boxes and End of Circuit Signal Light Kits are also available to complete you system design and requirements. Please contact HTD for full details.

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www.htdheattrace.com

Splice Kits

For WinterSafe, WinterSafe Plus, AutoWatt Xtra, PermaWatt and VersaTrace heating cables

Heating Cable Accessories

- *Low cost, standard, pre-packaged, off-the-shelf kits*
- *One kit contains all of the necessary components to splice two lengths of heating cable together.*
- *Easy to use, quick and simple to install*
- *Supplied complete with step-by-step, easy to understand instructions*

TYPE SK

For use with WinterSafe, WinterSafe Plus, AutoWatt Xtra self-regulating heating cables and PermaWatt constant wattage heating cables

Applicable cable references are WSR, WSR-C, WSR-CR, WSR-CT, WSP, WSP-C, WSP-CT, AWX, AWX-C, AWX-CT, PWT, PWT-C, PWF, PWF-C and PWF-CT

Kit contents:

Two #10-12 uninsulated parallel splice crimps
Two fiberglass insulating sleeves
One #8 uninsulated parallel splice crimp
One roll of self fusing silicone tape
One Splice Caution Label
One set of Instructions

Kit Ordering Ref SK

Splice Kits

TYPE VTHS

For use with all versions of VersaTrace, Series Circuitry heating cables.

Applicable cable references are VT 20, VT 20B, VT 20BF, VTN, VTNB, VTNBF, VTC, VTCB and VTCBF

One kit is required to splice two lengths of heating cable together.

Kit Contents;

One Metal Splice Cover (P/N H07160)
One Splice (P/N H07150)
Two stainless steel crimps (P/N H07204)
One tube of RTV Sealant (P/N H07700)
One Caution Label (ref Splice Label)
One set of Instructions (ref VTHS Instructions)

Kit Ordering Ref VTHS

ADDITIONAL KITS

End Termination Kits, Tee Splice Kits, Power Connection Boxes and End of Circuit Signal Light Kits are also available to complete your system design and requirements. Please contact HTD for full details.

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www.htdheattrace.com

Tee Splice Kits

For WinterSafe, WinterSafe Plus, AutoWatt Xtra, PermaWatt and VersaTrace heating cables

Heating Cable Accessories

- *Low cost, standard, pre-packaged, off-the-shelf kits*
- *Contains all of the necessary components to splice three lengths of heating cable together to make one tee splice*
- *Easy to use, quick and simple to install*
- *Supplied complete with step by step, easy to understand instructions*

TYPE TK

For use with WinterSafe, WinterSafe Plus, AutoWatt Xtra self-regulating heating cables and PermaWatt constant wattage heating cables.

Applicable cable references are WSR, WSR-C, WSR-CR, WSR-CT, WSP, WSP-C, WSP-CT, AWX, AWX-C, AWX-CT, PWT, PWT-C, PWF, PWF-C and PWF-CT

Kit contents:

Two #10-12 uninsulated parallel splice crimps
Two fiberglass insulating sleeves
One # 8 uninsulated parallel splice crimp
One roll of self fusing silicone tape
One Back End Seal (P/N H07110)
One tube of RTV Sealant (P/N H 07700)
One Tee Splice Caution Label
One set of Instructions

Kit Ordering Ref **TK**

Tee Splice Kits

TYPE VTHT

For use with all versions of VersaTrace, Series Circuitry Heating Cables.

Applicable cable references are VT 20, VT 20B, VT 20BF, VTN, VTNB, VTNBF, VTC, VTCB and VTCBF

One kit is required to make one tee splice in one heating circuit.

Kit Contents:

One metal Tee Splice Cover (P/N 68004500)
One rubber Tee Splice Boot (P/N 68004300)
Two stainless steel crimps (P/N H07204)
One tube of RTV Sealant (P/N H07700)
One Caution Label (ref Tee Splice Label)
One set of Instructions (ref VTHT Instructions)

Kit Ordering Ref VTHT

ADDITIONAL KITS

End Termination Kits, Splice Kits, Power Connection Boxes and End of Circuit Signal Light Kits are also available to complete your system design and requirements. Please contact HTD for full details.

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www.htdheattrace.com

Connection Box Kits

For WinterSafe, WinterSafe Plus, AutoWatt Xtra PermaWatt and VersaTrace heating cables

Heating Cable Accessories

- *Industrial grade, corrosion resistant, polymer and metal junction boxes complete with mounting hardware*
- *Convenient, direct attachment to the piping*
- *Designed to route heating cables safely through the pipe insulation*
- *Ideal for all indoor and outdoor applications in both hazardous and unclassified areas*

TYPE PBK

Specifically designed to provide a low cost, convenient termination and power connection system for all versions of WinterSafe, WinterSafe Plus, AutoWatt Xtra and PermaWatt heating cables.

Applicable cable references are WSR, WSR-C, WSR-CR, WSR-CT, WSP*, WSP-C*, WSP-CT*, AWX*, AWX-C*, AWX-CT*, PWT, PWT-C, PWF*, PWF-C* and PWF-CT*.

*with these cables, the use of the PBK Kit is limited to applications that involve a Maximum Exposure Temperature less than 290°F.

Kit contents:

One, 4½ by 3 inch, NEMA 4X enclosure
One Mounting Base Assembly Unit
One lock nut and sealing washer
Two sealing grommets
Wire tie wrap
One set of Instructions (ref PBK)

Kit Ordering Reference PBK

(One hose clamp is required to attach the PBK box to the pipe. This item is not supplied as part of the kit)

RATING AND APPROVALS

NEMA 4X
Class I, Div 2, Groups B, C & D
Class II, Div 2, Groups F & G
Class III

FM APPROVED

HTD HEAT TRACE

ELECTRIC HEAT TRACING PRODUCTS AND SYSTEMS

Connection Box Kits

With Terminal Blocks

TYPE PBK -TB

Specifically designed with factory installed terminal blocks to provide a convenient termination and power connection system for all versions of WinterSafe, WinterSafe Plus, AutoWatt Xtra and PermaWatt heating cables.

Applicable cable references are WSR, WSR-C, WSR-CR, WSR-CT, WSP*, WSP-C*, WSP-CT*, AWX*, AWX-C*, AWX-CT*, PWT, PWT-C, PWF*, PWF-C* and PWF-CT*.

*with these cables, the use of the PBK-TB Kit is limited to applications that involve a Maximum Exposure Temperature less than 290°F.

Kit contents:

One, 4¾ by 4¾ inch, ExE II T6 rated enclosure
One Mounting Base Assembly Unit
One lock nut and sealing washer
Two sealing grommets
Wire tie wrap
One set of Instructions (ref PBK-TB)

Kit Ordering Reference PBK-TB

(One hose clamp is required to attach the PBK box to the pipe. This item is not supplied as part of the kit)

RATING AND APPROVALS

Class I, Zone 1, AExe II T6, ExE II T6

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www.htdheattrace.com

Connection Box Kits

With Terminal Blocks

TYPE VTBK

For use with all versions of VersaTrace Series Circuitry heating cables as either a :-

Power Connection Box for up to three heating circuits,
A Splice Connection Box
A Tee Splice Connection Box, or
An End Termination Box

Applicable cable references are VT 20, VT 20B, VT 20BF, VTN, VTNB, VTNBF, VTC, VTCB and VTCBF

Kit Contents:

One NEMA 4X Enclosure with factory wired terminal blocks (see below)
One Pipe Mounting Bracket,
Heating cable Entry Conduits (as req'd)

Kit Ordering Refs - *Fiberglass Enclosures only*

F-VTBK-P (1, 2 or 3) Power Connection Box. Specify P1, P2 or P3 to identify the number of heating circuits to be connected within the box.
F-VTBK-S Spice Connection Box
F-VTBK-T Tee Splice Connection Box
F-VTBK-E End Connection Box

Kit Ordering Refs - *Aluminum Enclosures only*

A-VTBK-P (1, 2 or 3) Power Connection Box. Specify P1, P2 or P3 to identify the number of heating circuits to be connected within the box.
A-VTBK-S Spice Connection Box
A-VTBK-T Tee Splice Connection Box
A-VTBK-E End Connection Box

(Two hose clamps are required to attach the VTBK assemble to the pipe. Hose clamps are not supplied with the above kits).

Example shown is a Splice Connection Box using the NEMA 4X fiberglass style of enclosure
Order ref F-VTBK-S

Example shown is a Power Connection Box for one heating circuit, using the optional NEMA 4X aluminum enclosure.
Order ref A-VTBK-P1.

ADDITIONAL KITS

An alternate range of low profile termination kits is also available for installation under the pipe insulation. This range also includes End Termination Kits, Splice Kits and Tee Splice Kits. Please contact HTD for details.

Signal Light

For WinterSafe, WinterSafe Plus, AutoWatt Xtra and PermaWatt heating cables

Heating Cable Accessories

- *Industrial grade, corrosion-resistant, polymer junction box with pipe mounting hardware*
- *Direct, convenient attachment to the piping. Provides protected heating cable route through thermal insulation*
- *Can be used at either end of the heating cable circuit to provide visual indication of voltage*
- *Ideal for all indoor and outdoor applications in both hazardous and unclassified areas*

TYPE PBK-SL

Specifically designed to provide visual indication and monitoring of voltage to all versions of WinterSafe, WinterSafe Plus, AutoWatt Xtra and PermaWatt heating cables. The Signal Light can be positioned at either end of the heating circuit.

Applicable cable references are WSR, WSR-C, WSR-CR, WSR-CT, WSP*, WSP-C*, WSP-CT*, AWX*, AWX-C*, AWX-CT*, PWT, PWT-C, PWF*, PWF-C* and PWF-CT*.

*with these cables, the use of the PBK-SL Signal Light Kit is limited to applications that involve a Maximum Exposure Temperature less than 290°F.

Kit contents:

One, 4½ by 3 inch, NEMA 4X enclosure
One Mounting Base Assembly Unit
One 30mm Red Pilot Light
One lock nut and sealing washer
Two sealing grommets
Wire tie wrap
One set of Instructions (ref PBK-SL)

Kit Ordering Reference PBK-SL (1 or 2)
(specify 1 for 120 vac or 2 for 240 vac)

(One hose clamp is required to attach the PBK box to the pipe. This item is not supplied as part of the kit)

RATING AND APPROVALS

Enclosure/Connection Assembly
-NEMA4X
-FM Approved Class I, Div. 2, Gr. A, B, C &D
Class II/III, Div 2, Gr. F & G

Pilot Light
-UL Listed Class I, Div. 2, Gr. A, B, C & D

HEAT TRACE

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www.htdheattrace.com

Fixing / Tying Tapes

For WinterSafe, WinterSafe Plus, AutoWatt Xtra, PermaWatt and VersaTrace heating cables

Heating Cable Accessories

- *Low cost, standard fixing tapes to permanently attach heating cables to pipes based upon application temperature*
- *Heat transfer tape for plastic piping and heat sensitive applications*

TYPE VTFGT

Adhesive backed, fiberglass tape.

For use on all applications up to a maximum temperature of 350°F, with WinterSafe, WinterSafe Plus, AutoWatt Xtra, PermaWatt and VersaTrace heating cables

½ inch wide by 180 ft rolls. (P/N H07600)

Order reference VTFGT

TYPE PGT

Non Adhesive, woven fiberglass tape.

For use on all applications up to a maximum temperature of 850°F
Recommended for the installation of all flexible type heaters used as part of an HB Hopper Heating Module System

½ inch wide by 60 ft rolls. (P/N H07607)

Order reference PGT

TYPE IAAT3

Adhesive backed, aluminum heat transfer tape, with "peel off" protective liner.

For use on all applications up to a maximum temperature of 200°F, with WinterSafe, WinterSafe Plus, AutoWatt Xtra, PermaWatt and VersaTrace heating cables.
Recommended for use on all plastic pipe and tank heating applications.
Also recommended for sealing heating panel edges to tank surfaces on all Eagle and SilcoPad tank heating applications.

3 inch wide by 180 ft rolls. (P/N H01029)

Order reference IAAT3

Caution Label

For WinterSafe, WinterSafe Plus, AutoWatt Xtra, PermaWatt and VersaTrace heating cable systems

Heating Cable Accessories

- *Strong vinyl construction, will not fade or deteriorate from permanent outdoor installation*
- *Helps to prevent potential accidents*
- *Required by National Electric Code*

TYPE CL

Adhesive backed, Caution Label.

For use on all indoor and outdoor pipe tracing and tank heating applications.

Label is applied to the exterior surface of the thermal insulation.

Usage of this type of Caution Label is required by Article 427-13 of the National Electric Code, installed at frequent intervals on the pipe or vessel insulation surface

(Recommended usage on pipe tracing applications is one label every 20 ft.)

Label size is 6 by 4 inches

Order reference CL (P/N H03001)

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HEAT TRACE

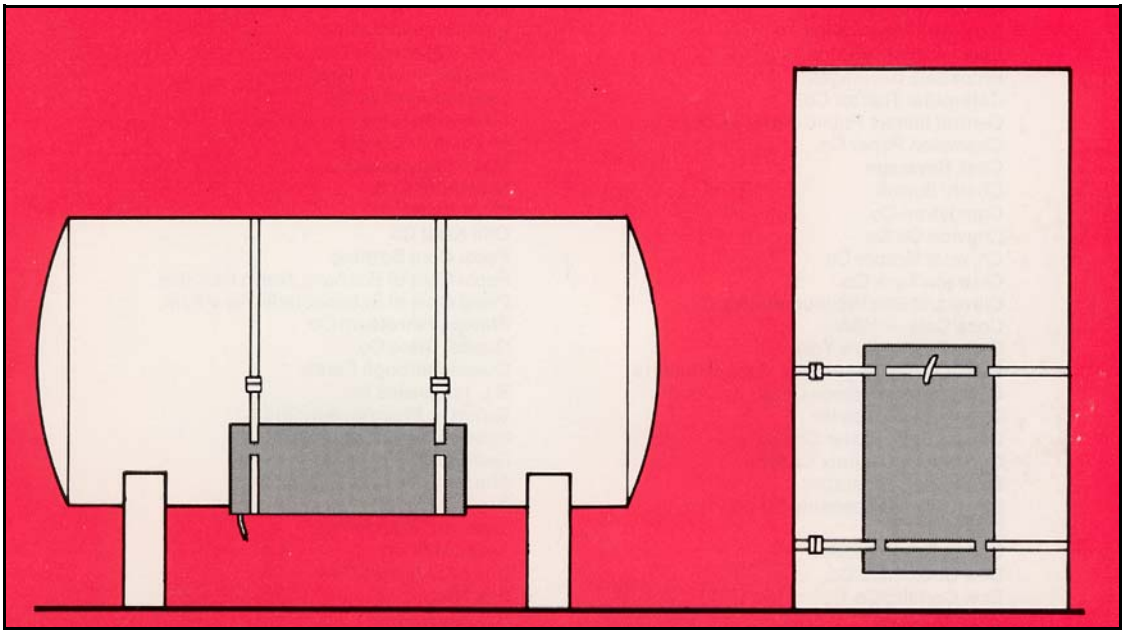
EAGLE TANK HEATING PANEL SYSTEM

A complete range of flexible heating panels for use on Metal and Fiberglass (FRP) tank heating applications ranging from simple freeze protection up to process maintenance temperatures of 200°F (92°C)

HEAT TRACE

EAGLE

Thermal DesignGuide



HEATING PANELS FOR METAL AND FIBERGLASS TANKS

FM APPROVED

Class I, Div 2, Groups B, C & D
Class II, Div 2
Class III, Div 2
Retested and recertified to current IEEE and NEC Standards in 2003

EGLX-DG-F-12/04

Tank Heating

Thermal Design Guide

For freeze protection and process temperature maintenance applications up 200°F on Metal Tanks and 150°F on Fiberglass (FRP Tanks).

PURPOSE

Tank heating panels or pads, installed on the outside surfaces of tanks, are commonly used to ensure that fluid temperatures within the tanks are *maintained* above ambient temperatures during storage. These low watt density type heaters are safe, reliable alternatives to immersion heaters.

Under certain conditions, tank heating systems may be designed to increase (heat raise) the fluid temperature within a tank.

This Thermal Design Guide provides basic design information for conventional *temperature maintenance applications only* on Metal and Fiberglass (FRP) Tanks.

For design information relating to heat raise applications, or applications involving other types of Plastic Tanks(eg. polyethtylene, polypropylene etc), please consult HTD .

Additionally, HTD offers a free engineering design service for all Tank Heating applications. This service utilizes computerized versions of this Thermal Design Guide and allows the user to quickly review and evaluate many options.These options can only be evalauated after repeated calculations when manually using this guide. If the reader prefers to use our free engineering service please complete the Design Worksheet at the end of this document and fax or e-mail it to HTD at the addresses shown.

INDUSTRY STANDARDS AND PUBLICATIONS

Design considerations, heat loss calculations, installation and maintenances requirements for this type of product and system are extensively covered by IEEE Standard 515-1997. Additional information and requirements are also published in NFPA National Electrical Code under Article 427.

INDUSTRY STANDARDS AND PUBLICATIONS (con't)

The material used in this Thermal Design Guide is consistent with the information, requirements and recommendations of both of these industry standards and publications. This Thermal Design Guide is intended to provide supplementary information only and the reader should consult IEEE Std 515- 1997 and NEC NFPA 70-2002 for full and accurate details on all topics.

PRODUCTS

The material used in this Thermal Design Guide is intended for use with Eagle Tank Heating Panels, reference EGLX 400 and EGLX 500. These products are exclusively manufactured by HTD Heat Trace, Inc

HEAT LOSS FACTORS

The calculation to determine heat losses from a tank is shown in Annex B of the IEEE Std 515-1997. The factors listed in this calculation that can significantly affect the rate of heat loss for each application are shown following. This is the minimum information required to determine the Final Design Heat Loss (*Qtotal*) for all tank heating applications.

- Base heat losses from the insulated tank surface (*Qins*)
- Desired Fluid Maintain Temperature (*Tp*)
- Minimum Ambient Temperature (*Ta*)
- Insulated Tank Area (*A*)
- Thermal Insulation thickness (*x*)
- Thermal Insulation type (*k*)
- Location (Indoors or Outdoors)
- Desired safety factor
- Regional heat losses (slab, supports, manholes)

TANK HEAT LOSS CALCULATION STEPS 1 THROUGH 10

STEP 1
Determine the total insulated surface area of the tank (*A*) using Table 1. The total insulated surface area of a horizontal tank or a vertical tank that is standing above ground level is calculated by adding the areas of both tank ends to the area of the tank barrel. The total insulated area of a vertical tank that is standing on the ground or on a slab is calculated by using the area of one end of the tank plus the area of the tank barrel.

STEP 2
Determine the application ΔT. This is the difference between the desired Fluid Maintain Temperature (*Tp*) and the Minimum Ambient Temperature (*Ta*).

TANK HEAT LOSS CALCULATION STEPS 1 THROUGH 10 (con't)

STEP 3
Refer to Table 2 "Base Heat Losses - Insulated Tanks" and determine the base heat loss(*Qins*) in watts per sq.ft for the application ΔT determined in Step 1. Interpolate to determine the base heat loss values for all applications with ΔT parameters that fall between the values shown in Table 2.

STEP 4
The base heat losses shown in Table 2 have been calculated using the *K* factor for fiberglass insulation. Use Table 3 "Insulation Correction Factors" to determine the appropriate correction factor for the insulation being used.

STEP 5
Use a value 0.9 for all indoor applications. Ignore this Step for all outdoor applications

STEP 6

Use Table 4 to select the Windage Factor applicable to your outdoor application. If no specific Wind Speed Data is available, use the factor of 1.17 for 31 to 50 mph wind speeds.

STEP 7

Determine the Base Heat Loss (*Qins*) for the Insulated Tank by multiplying Steps 1, 3, 4, 5 and 6 together.

STEP 8

HTD recommends a 20% safety factor to satisfy the requirements of IEEE 515 and manufacturing tolerances. Multiply STEP 7 by 1.2 to determine the Base Heat Loss (*Qins*) for your tank.

Before the design can be completed and the number of EGLX Tank Heating Panels to be used can be determined, individual heat loss values must be included for all heat sinks that are integral to the tank body. Typical integral heat sinks are :

- (only when appropriate) the ground or slab that the tank is resting upon
- tank saddles, supports or skirts
- manways or manholes

STEP 9

Using Tables 5A, 5B, 5C, 5D and 5E, determine individual heat loss values (shown in watts) for all heat sinks that are integral to the tank body.

STEP 10

Calculate the Final Design Heat Loss (*Qtotal*) by adding each value determined in Step 9 to the final Base Heat Loss (*Qins*) determined in Step 8.

REFERENCE TABLES

TABLE 1. TANK SURFACE AREAS - USE IN STEP 1

TWO END AREAS FT²		6.3	9.8	14.1	19.2	25.1	31.8	39.3	47.5	56.5	66.3	77.0	88	101	113	127	142	157	226	308	402	503
TANK DIAMETER		2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	12	14	16	18
HEIGHT OR LENGTH	.5	3.1	3.9	4.7	5.5	6.3	7.1	7.8	8.5	9.4	10	10.9	12	12.6	13	14	15	15.7	18.8	21.9	25.1	28.3
	1	6.3	7.8	9.4	11	12.6	14.1	15.7	17	18.8	20	22	24	25.1	27	28	30	31.4	37.7	43.9	50.2	56.5
	2	12.6	15.7	18.8	25.1	27	28	32	35	37.7	41	44	47	50.2	53	57	60	62.8	75.5	87.9	101	113
	3	18.9	23.5	28.3	33	37.7	42	47	52	56.5	61	66	71	75.4	80	85	90	94.2	113	132	151	170
	4	25.1	31.4	37.7	44	50.2	57	63	69	75.4	82	88	94	101	107	114	119	126	151	176	201	220
	5	31.4	39.3	47.1	55	62.8	71	79	86	94.2	102	110	118	126	133	141	149	157	188	220	251	283
	6	37.7	47.1	56.5	66	75.7	85	95	104	113	123	132	141	151	160	170	179	188	226	264	301	339
	7	44.0	54.9	65.9	77	87.9	99	110	121	132	143	154	165	176	187	198	209	220	264	308	352	396
	8	50.2	62.8	75.4	88	101	113	126	138	151	163	176	188	201	213	226	239	251	301	352	402	452
	9	56.5	70.6	84.8	99	113	127	142	155	170	184	198	212	226	240	254	268	283	339	396	452	509
	10	62.8	78.5	94.2	110	126	141	158	173	188	204	220	236	251	267	283	298	314	377	440	502	565
	12	75.4	94.2	113	132	151	170	189	207	226	245	264	283	301	320	339	358	377	452	515	603	618
	14	87.9	110	132	154	176	198	221	242	264	286	305	330	352	374	396	418	440	528	615	703	791
	16	101	126	151	176	201	226	252	276	301	327	352	377	402	427	452	477	502	618	703	804	904
	18	113	141	170	198	226	254	284	311	339	367	396	424	452	486	509	537	545	663	719	904	1017
	20	126	157	188	220	251	283	315	354	377	408	440	471	502	534	565	597	628	754	879	1005	1130
	30	188	236	287	330	377	424	473	518	565	612	659	707	754	800	848	895	942	1130	1319	1507	1702
	40	251	314	377	440	502	565	630	691	754	816	879	942	1005	1108	1130	1193	1256	1507	1758	2010	2260
	50	314	393	471	550	628	707	788	864	942	1021	1099	1178	1256	1335	1413	1492	1570	1884	2198	2512	2825

TABLE 2. BASE HEAT LOSSES (W/SQ.FT) - USE IN STEP 3

Δ T	THERMAL INSULATION THICKNESS				
(° F)	1 "	1½"	2"	3"	4"
50	3.4	2.3	1.7	1.2	0.9
75	5.3	3.6	2.7	1.8	1.4
100	7.1	4.8	3.6	2.4	1.8
125	9.1	6.2	4.6	3.1	2.3
150	11.0	7.5	5.6	3.7	2.8
175	13.2	8.9	6.7	4.5	3.4
200	15.3	10.3	7.7	5.2	3.9
225	17.7	11.9	9.0	6.0	4.5
250	20.0	13.5	10.2	6.8	5.1

TABLE 3. INSULATION CORRECTION FACTORS - USE IN STEP 4

INSULATION TYPE	CORRECTION FACTOR
FIBERGLASS	1.0
POLYURETHANE	0.66
POLYISOCYANURATE	0.67
POLYSTYRENE	0.88
CELLULAR GLASS	1.6
CALCIUM SILICATE	1.5

REFERENCE TABLES (cont)

TABLE 4. WINDAGE FACTORS - USE IN STEP 6

WIND SPEED	WINDAGE
0 - 10	1.03
11 - 20	1.07
21 - 30	1.12
31 - 50	1.17

TABLE 5A . CONCRETE SLAB OR EARTH FOUNDATION - USE IN STEP 9

	APPLICATION Δ T (° F)				
TANK DIA (FT)	50	100	150	200	250
5	137	278	451	566	711
10	283	573	864	1154	1452
20	566	1163	1760	2325	2922
30	848	1767	2616	3535	4383
40	1131	2388	3518	4649	5906
50	1374	2945	4320	5891	7265

TABLE 5B . CONCRETE SADDLES - USE IN STEP 9

	APPLICATION Δ T (° F)				
TANK DIA (FT)	50	100	150	200	250
5	93	186	275	368	461
10	145	290	430	576	721
15	198	395	586	783	981
20	250	500	741	991	1241

TABLE 5C . UNINSULATED SKIRT - USE IN STEP 9

	APPLICATION Δ T (° F)				
TANK DIA (FT)	50	100	150	200	250
5	402	805	1193	1595	1998
10	806	1612	2389	3195	4000
15	1209	2419	3585	4794	6003
20	1613	3225	4780	6393	8006

TABLE 5D . SUPPORT LEGS (PER LEG) - USE IN STEP 9

	APPLICATION Δ T (° F)				
TANK DIA (FT)	50	100	150	200	250
5	26	52	77	103	129
10 & ABOVE	85	169	351	336	420

TABLE 5E . MANHOLE - USE IN STEP 9 (based upon an uninsulated 24" dia cover and 12" tall base)

APPLICATION Δ T (° F)				
50	100	150	200	250
564	1120	1680	2237	2807

HEAT LOSS EXAMPLE

APPLICATION PARAMETERS

Desired Fluid Maintain Temperature (*Tp*)	80°F
Minimum Ambient Temperature (*Ta*)	-20°F
Tank Size	8ft dia by 12ft high
Tank Material	Fiberglass (FRP)
Thermal Insulation type	Polyurethane
Thermal Insulation Thickness	2"
Tank Location	Outdoors
Maximum Wind Speed	40 mph
Safety Factor	20%
Tank Support	Concrete Pad
Tank Accessories	Two Manholes

CALCULATION

Step 1 Total Surface Area of the Tank (*A)* from Table 1
Barrel Area + One End
301 + 50.5 = 351.5 sq.ft

Step 2 Application Δ T
80 - -20 = 100° F

Step 3 Base Heat Loss from Table 2
3.6 watts/sq.ft

Step 4 Thermal Insulation Correction Factor from Table 3
0.66

Step 5 Tank Location - Outdoors
No adjustment required

Step 6 Windage Factor from Table 4
1.17

Step 7 Base Heat Losses for Tank (*Qins*)
Multiply Steps 1,3,4,5 and 6
351.5 x 3.6 x 0.66 x 1.17
Qins = 977.1 watts

Step 8 Apply Safety Factor to *Qins*
977.1 x 1.2 = 1,172.5 watts

Step 9 Determine losses for heat sinks from Tables 5A and 5E
Concrete Pad (interpolated value) = 248.4 w
Manholes = 2 x 1,120 = 2,240 w

Step 10 Final Design Heat Loss *(Qtotal)*
Step 8 + Step 9
1,172.5 + 248.4 + 2,240

Qtotal = 3,660.9 watts

EGLX HEATING PANEL SELECTION PROCEDURE

Selecting the correct type of EGLX Tank Heating Panel and the correct number of heating panels to use to meet the requirements of the above example is simple.

First, consult the Heating Panel Selection Chart shown in the Eagle Tank Heating Panel sales literature or the EGLX Data Sheet. This shows that the EGLX 500 heating panel is recommeded for use on Fiberglass Tanks with application temperatures up to 120° F.

The EGLX 500 is a 500 watt heating panel. To meet the requirements shown in the above example, divide the Final Design Heat Loss (*Qtotal*) by 500 to determine the number of EGLX heating panels required

3,660.9 / 500 = 7.32

In all instances when the above calculation yeilds a fractionalized number greater than 0.25, always add one more heating panel. In this example, the requirement (0.32) is greater than than 0.25, the correct quantity of heating panels, therefore, will increase to 8.

The final design is completed by specifying the supply voltage for the heating panels and the type of cold lead cable termination that is most suited for your installation. Consult the EGLX Data Sheet for details or contact HTD to discuss your choices.

DESIGN WORKSHEET

HTD Heat Trace, Inc. offers a free engineering design service for all tank heating applications. This service includes all of the calculations shown in this Thermal Design Guide plus :

- Investigation and recommendations for optimum type and thickness of thermal insulation
- Choosing the best style of heating panel to meet the installation requirements
- Heating panel layout and orientation considerations
- Control System choices for each application
- System Pricing and equipment availability

The use of this service is recommended for all hazardous area applications.

Please copy this page, complete the information sections shown and fax to **(908) 534 8023** or scan this page and e-mail to **sales@htdheattrace.com** Designs and proposals are normally completed and returned within 24 hours.

YOUR NAME : _____
TITLE : _____
COMPANY NAME : _____
ADDRESS : _____
_____
_____
TEL # and EXT: _____
FAX # : _____
E MAIL ADDRESS : _____

APPLICATION DETAILS :
Fluid being stored _____
Is the Fluid sensitive to heat _____ (identify max temp if applicable)
Desired Maintain Temperature _____
Minimum Ambient Temerature _____

TANK DETAILS :
Tank Material _____ (identify max temp if applicable)
Tank Thickness _____
Liner Material _____ (identify max temp if applicable)
Tank Style _____ (horizontal, vertical)
Tank Diameter _____
Tank Height (or Length) _____
Tank Support System _____ (concrete pad, legs, skirt, saddles etc)
Specify Tank Base _____ (flat, dished, conical etc)
Specify Tank Top (or Ends) _____ (flat, domed)
Tank Accessories _____ (manholes, ladders etc)
Thermal Insulation Type _____ (HTD can recommend if desired)
Thermal Insulation Thickness _____ (HTD can recommend if desired)
Is the tank fitted with Agitation _____

TANK LOCATION :
Indoors or Outdoors _____
Hazardous area _____ (if YES, specify area Class, Div, Group and T Rating)
Corrosive Environment _____ (specify type of chemicals present)

ELECTRICAL DETAILS :
Supply Voltage _____

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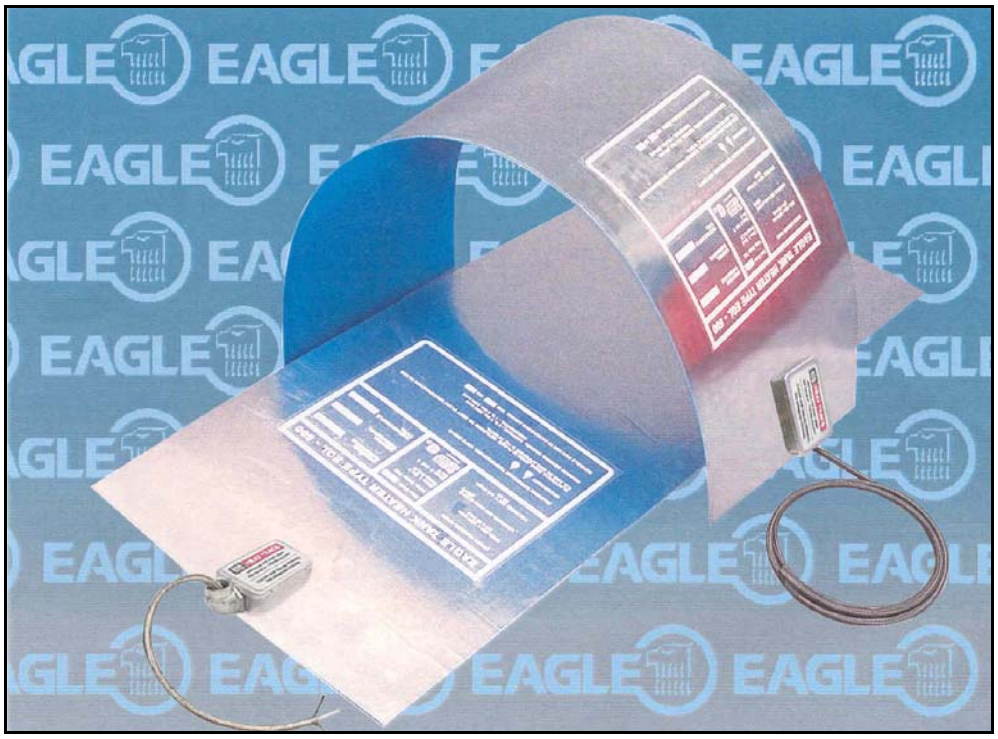
HTD HEAT TRACE

EAGLE



HEATING PANELS FOR METAL AND FIBERGLASS TANKS

FM APPROVED

Class I, Div 2, Groups B, C & D
Class II, Div 2
Class III, Div 2
Retested and reapproved to current IEEE and NEC Standards in 2003

EGLX-SALESLIT-F-12/04

EGLX TANK HEATING PANELS

INTRODUCTION

The Eagle Tank Heating Panel was first introduced in 1984 by Cooperheat, Inc. Since then, this unique product and system has been used on several thousand tank heating applications around the world. The Heat Tracing Division of Cooperheat, which developed and marketed the original Eagle panel along with many other engineered heat tracing products, was purchased by HTD Heat Trace, Inc in 1996.

Eagle Tank Heating Panels and systems have an unrivalled record of safe, reliable performance and many of the early Cooperheat installations are still operating successfully after 18 years.

Each Eagle Tank Heating Panel now incorporates an aluminum grounding shield that covers the entire back surface of the heater and improved termination features to comply with the most recent revisions to the National Electric Code. Article 427-23 b of the National Electric Code now mandates that all tank heating panels must be fitted with a full coverage ground shield.

FEATURES

- Proprietary, multi-path, parallel circuit heating element that is virtually impossible to burn out.
- Uniform, low watt density design to avoid hot spots and overheating.
- Pressure laminated epoxy composite that provides an incredibly strong, flexible, waterproof and corrosion-resistant NEMA Grade G-10/FR-4 construction.
- Cold leads can be either routed under the tank insulation or taken directly through the tank insulation for connection to the power supply and control system.
- Low and ultra low power density heating panels are available for very heat sensitive applications.
- FM Approved for use in hazardous, unclassified, wet and corrosive environments

EGLX TANK HEATING PANELS

ADVANCED HEATING ELEMENT DESIGN

The Eagle (EGLX) Tank Heating Panel incorporates a proprietary, multi-path heating element that provides an evenly distributed flow of current across many **parallel connected paths**. See Figure 1 opposite.

If one or more element paths are broken or damaged, *the current flow is instantaneously, automatically and evenly re-routed around the damaged area into the remaining undamaged element paths*. See Figure 2 opposite.

This uniform redistribution of current prevents the development of hot spots and burn outs that lead to the total failure of the heating panel. Hot spots and localized overheating are also potentially disasterous failure modes that can significantly damage the structure and integrity of any fiberglass tank, or spoil, tarnish or ruin any heat-sensitive products contained within a tank.

Eagle Tank Heating Panels are the safest and most reliable form of tank heater available.

PARALLEL vs SERIES CIRCUITRY

Competitive styles of heating panels, heating pads and inferior copies of the Eagle Tank Heating Panel all use an outdated technology that offers a foil or wire heating element in a **series circuit path**.

As Figure 3 shows, a series type design is one continuous run of foil or wire element throughout the heating panel. If this single run of foil or wire is damaged at any one point over it's entire length, the damaged area overheats and the foil or wire path is destroyed. *The destruction caused at this one single point in the whole circuit path results in the immediate and total failure of the heating panel.*

The parallel connected, multi-path circuit design unique to the Eagle Tank Heating Panel offers a durable, robust, safe and *reliable heat source* that is clearly superior to all types of series circuit designs. Thermal aging, electrical and mechanical stress and destruction testing of the Eagle Tank Heating Panel have shown that *over 70% of the circuit paths within the element must be completely destroyed and broken before total heater failure can occur.*

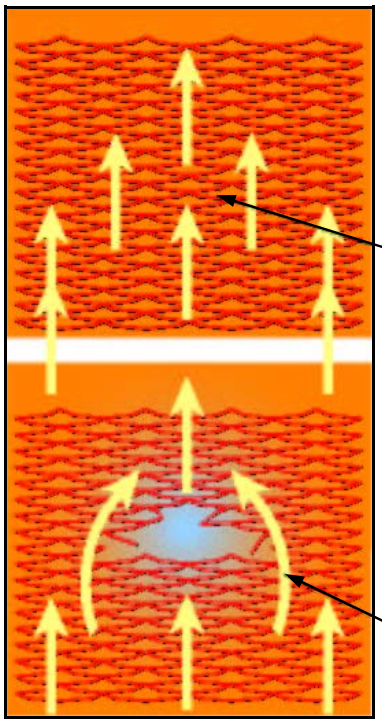


Figure 1

Multi-path heating element construction provides a uniform flow of current across many parallel connected circuit paths.

Figure 2

Current is automatically and evenly re-routed around damaged area. Integrity of the heating circuit remains intact and the heating panel continues to function normally.

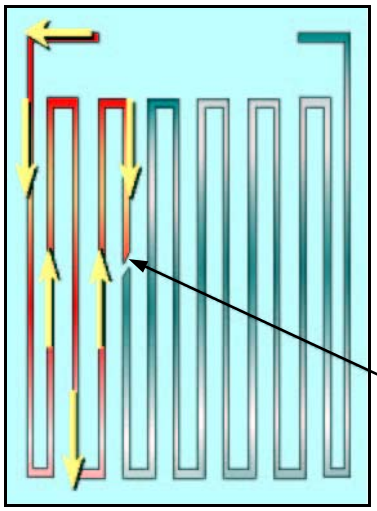


Figure 3

Damage at any one point over the entire circuit length of a foil or wire type element, leads to localized overheating, burn out of the circuit path and TOTAL FAILURE OF THE HEATING PANEL.

EGLX TANK HEATING PANELS

HEATING PANEL SELECTION

There are two standard types and sizes of Eagle Tank Heating Panels. These are the EGLX 500 and the EGLX 400.

The EGLX 500, with a power density of 0.58 w/sq.in, is ideal for most applications that involve metal, fiberglass or lined tanks. Consult Table 1 to verify suitability.

The EGLX 400, with a reduced power density of 0.37 w/sq.in, is recommended for use on stainless steel and fiberglass tanks that have above average application temperature requirements. EGLX 400 heating panels are also ideal for applications involving very heat sensitive products. Consult Table 1 to verify suitability

EGLX 500 and 400 are available for usage on standard 120 or 240 vac single phase power supplies. Consult HTD for system designs involving 208, 277 and 480 single and three phase power supplies.

HEATING PANEL INSTALLATION

Eagle Tank Heating Panels can be easily and quickly installed on either flat or cylindrical tanks.

Applications on cylindrical tanks may involve horizontal or vertical style tanks with any diameter greater than 36 inches.

As shown in the opposite photograph, heating panels are normally banded into permanent position on the tank surface and they can be oriented and installed in either a vertical or horizontal plane.

The installation procedure is quick and simple and requires no special skills, knowledge or tools.

TABLE 1

TANK	APPLICATION	EGLX	EGLX
Mild Steel Copper Aluminum	Up to 200° F	YES	
Above tanks with liner *	Up to 160° F 160 to 200° F	YES	 YES
Stainless Steel	Up to 160° F 160 to 200° F	YES	 YES
Stainless Steel with liner *	Up to 120° F 120 to 200° F	YES	 YES
Fiberglass (FRP)	Up to 120° F 120 to 150° F	YES	 YES

* Application ranges shown above are only typical and do not take into account the maximum exposure or operating temperature of the liner. Consult the tank and/or liner manufacturer to obtain this important design information before selecting the type of heating panel that is most appropriate for your usage.

48 by 18 inch, type EGLX 500 Heating Panels, installed on 16 ft diameter, mild steel surfactant tanks to maintain a constant temperature of 130° F in minimum ambient temperatures down to -10° F. Photograph shows the heating panels banded directly to the tank surface in a vertical plane, prior to the application of 3 inch thick thermal insulation.

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EGLX TANK HEATING PANEL

FM APPROVED

EAGLE

For temperature maintenance applications on Metal and Fiberglass (FRP) tanks.

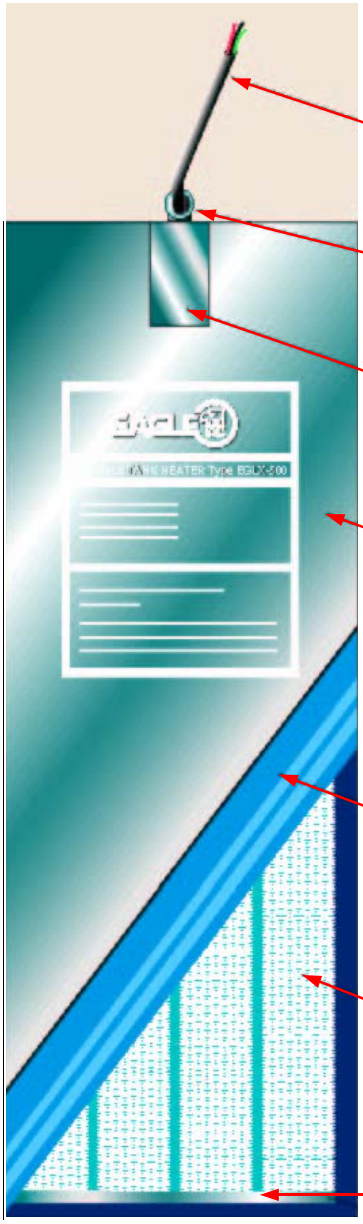
- *Specifically designed for safe, reliable operation on Metal and Fiberglass storage tanks*
- *Low watt density, high efficiency, flexible heating panels*
- *Two power densities for normal and very heat-sensitive applications*
- *Quick, simple, low cost installation*
- *Proven performance, with over 1,000 major installations worldwide*
- *FM approved to all current IEEE and NEC Standards*

The Eagle Tank Heating Panel was originally developed in 1984 by the Heat Tracing Division of Cooperheat, Inc. The original product was known as the EGL Tank Heating Panel and it was specifically designed to maintain elevated temperatures within Metal and Fiberglass (FRP) storage tanks.

HTD Heat Trace, Inc. purchased the Heat Tracing Division of Cooperheat in 1996. The original EGL Tank Heating Panel has since been modified and upgraded to meet IEEE Standard 515 and Article 427 of the National Electric Code. This upgraded version of the Eagle Tank Heating Panel is now known as the EGLX Tank Heating Panel.

Since 1984, Cooperheat and HTD have successfully designed, engineeered and supplied over one thousand Eagle Tank Heating Systems to worldwide users in the Chemical, Petrochemical, Water Treatment, Power, Mining, Steel, Coal and Food Industries. The EGLX Tank Heating Panel is routinely specified by many engineering companies and it is also the product and system of choice for many metal and fiberglass tank fabricators who offer heated and insulated tanks as part of their own product portfolio.

The Eagle Tank Heating panel was originally FM Approved in 1985 and retested and reapproved to current FM, IEEE and NEC standards in 2003.



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SPECIFICATIONS

PRODUCT FEATURES

LOW WATT DENSITY	EGLX Tank Heating Panels have a maximum power rating of 0.58 w/sq.in for ultra safe operation and reliability on normal and heat-sensitive applications
LAMINATED CONSTRUCTION	With its laminated, epoxy composite construction, the EGLX Tank Heating is superbly qualified to meet the rigorous requirements for use in all industrial and climatic environments. It is extremley rugged, completely waterproof, dust-tight and corrosion-resistant.
MULTI-PATH PARALLEL CIRCUIT HEATING ELEMENT	EGLX Tank Heating Panels are built with unique, multi-path, parallel circuit heating elements that are significantly safer and more reliable than the series type elements used in competitive versions and inferior copies of this unique product.

PRODUCT REFERENCES, RATINGS AND SIZES

EGLX 500	500 Watts (0.58 w/sq.in) 48" long by 18" wide
EGLX 400	400 Watts (0.37 w/sq.in) 60" long by 18" wide

APPLICATIONS AND USAGE

TANK	APPLICATION	EGLX	EGLX
Mild Steel Copper Aluminum	Up to 200° F	YES	
Above tanks with liner *	Up to 160° F	YES	
	160 to 200° F		YES
Stainless Steel	Up to 160° F	YES	
	160 to 200° F		YES
Stainless Steel with liner *	Up to 120° F	YES	
	120 to 200° F		YES
Fiberglass (FRP)	Up to 120° F	YES	
	120 to 150° F		YES

** Application ranges shown are only typical and do not take into account the maximum exposure or operating temperature of the liner. Consult the tank and/or liner manufacturer before selecting the type of heating panel that is most suited for your usage.*

DESIGN RATINGS

MAX MAINTAIN TEMP	200°F (93° C)
MAX EXPOSURE TEMP	250°F (121° C)
MIN INSTALLATION TEMP	0 °F (-18°C)
MINIMUM BENDING RADIUS	18" (do not install EGLX panels on any tank that is less than 36 " diameter)
VOLTAGE RATINGS	120 and 240 Vac

CONSTRUCTION

HEATING ELEMENTS	Multi-path, parallel circuitry
CIRCUIT CONNECTIONS	Stainless steel bridge pieces continuous spot welded with triple welding passes
DIELECTRIC CONSTRUCTION	Multi-layer glasscloth composite encapsulated within a 0.07" thick epoxy lamination
LAMINATE PROPERTIES	Density - 0.069 lbs/cu.in Rockwell Hardness - 115 Flexural Strength - 50,000 psi Dielectric Strength - 550 vpm Flammability Rating - UL-94.V.O
GROUND SHIELD	5 mil thick aluminum foil
TERMINATION METHOD	Epoxy encapsulated aluminum termination box
COLD LEAD CABLE	3-16 AWG, silicone insulated conductors with silicone rubber outer jacket and Nickel-Plated Copper overbraid
COLD LEAD LENGTHS	Standard type "CL" panel - 10ft Custom "CL" - Specify length "PC" type - ½" NPT, 90° elbow fitting with 2ft cold lead cable

APPROVALS & STANDARDS

FM APPROVED

FM APPROVED

Unclassified areas
Class I, Div 2 Groups B, C&D
Class II, Div 2
Class III, Div 2

Retested and recertified in 2003 to current IEEE and NEC standards

ORDERING DETAILS

EGLX _ _ _ _ _ _

PRODUCT REF
RATING (400 or 500w)
VOLTAGE (120 or 240)
STYLE (CL or PC)
CUSTOM COLD LEAD LENGTH (type "CL only)

EXAMPLE To order an EGLX 500 panel for operation on 120 volts with a "PC" type termination, specify:
EGLX 500-120-PC

INSTALLATION INSTRUCTIONS

FM APPROVED

Class I, Div 2, Groups B, C & D
Class II, Div 2
Class III, Div 2
Retested and reapproved to current IEEE and NEC Standards in 2003

Previously known as the Cooperheat EGL heating panel, the EGLX Tank Heating Panel now incorporates recent design improvements and safety features to fully comply with the latest edition of the National Electric Code. The installers of this and other forms of electric heat tracing equipment should familiarize themselves with the relevant section of the National Electrical Code before commencing any work.

EGLX Tank Heating Panels are suitable for applications on metal tanks up to 200° F and on fiberglass (FRP) tanks up to 150°F.

Two types of EGLX Tank Heating Panel are available. The EGLX 500 heating panel, with a power rating of 0.58 w/sq.in is recommended for most applications. The EGLX 400 heating panel, with a reduced power rating of 0.37 w/sq.in. is available for very heat-sensitive applications. Before installing any EGLX Tank Heating Panel, it is important to compare the application requirements with the appropriate Product Data Sheet to ensure that the correct equipment selection has been made. Alternatively, contact HTD to discuss the installation before proceeding.

EGLX Tank Heating Panels are easily installed on either horizontal, vertical, flat or cylindrical tanks. Do not attempt to install EGLX panels on cylindrical tanks smaller than 36 inches diameter. Attempting to install EGLX Tank Heating Panels on a cylindical tank less than 36 inches diameter or on the dish, domed or conical base of tanks where the heating panel must be flexed over varying curvatures in order to maintain surface contact, can lead to heating panel damage, unsafe operation, overheating and/or thermal destruction of the heater.

If the installer or End User has any questions or concerns about the correct usage of this product, please contact us at the following address

8 Bartles Corner Rd, Unit 104
Flemington, NJ 08822-5758. USA
Tel (908) 788 5210 Fax (908) 788 5204

GENERAL INFORMATION

EGLX Tank Heating panels are most commonly installed in one of four orientations. The illustrations on the right show the two orientations that may be used on both horizontal and vertical tanks.

Heating panels may be installed in either the horizontal or vertical plane. When installed in the horizontal plane, the heating panel termination box and cold leads may be at either end. In the vertical plane, the heating panel termination box may be at the top or the bottom.

The selected orientation of the heating panel and the location of the heating panel termination box and cold leads should always be predetermined by the location of the system control / junction box.

When using type "CL" heating panels, the position and orientation of each heater must be made such that the heater cold leads can be run around the tank surface to the control / junction box. Standard cold lead lengths on the "CL" panel are 10 feet. Custom length cold leads can be ordered if required.

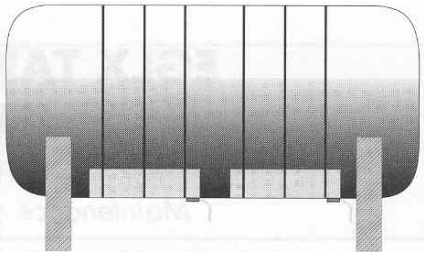
When the "PC" type panel is being used heating panel and termination box orientation is determined by where the installer wants the elbow fitting and cold lead to exit the thermal insulation.

The effectiveness of the heating system is enhanced by an even distribution of heating panels around the tank's circumference. EGLX Tank Heating Panels should be installed with equal spacing between each heater. Mark the location of each heating panel on the tank surface prior to installation.

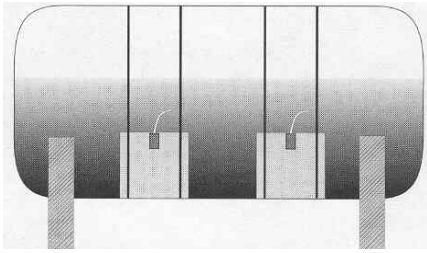
TOOLS AND EQUIPMENT

- ¾" wide metal bands, banding tool and retention clips. Use Stainless Steel bands on all tanks greater than 8 ft. dia.
- Type IAAT3 adhesive backed aluminum sealing tape (consult HTD)
- Pliers
- A piece of strong rope, cord or strapping that is long enough to wrap around the circumference of the tank.

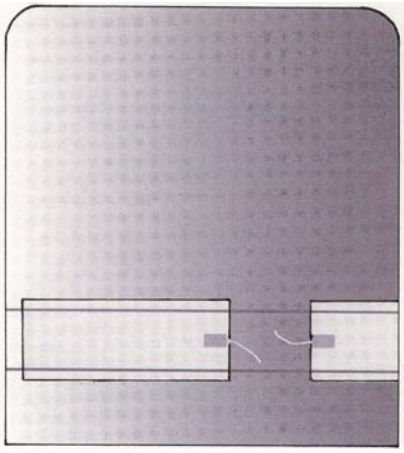
HEATING PANEL ORIENTATIONS



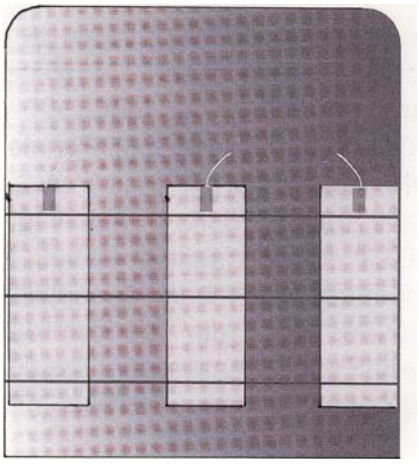
Horizontal tank with Horizontal Heating Panel Installation (3 bands per heating panel)



Horizontal tank with Vertical Heating Panel Installation (2 bands per heating panel)



Vertical tank with Horizontal Heating Panel Installation (2 bands per tank as shown)



Vertical tank with Vertical Heating Panel Installation (3 bands per tank as shown)

STEP 1

Determine the location of the Control / Junction Box on the tank surface.

Mark the location of each heating panel on the tank surface, relative to the Control / Junction Box location. When using "CL" type panels, heating panel locations must allow for the cold leads to run across the tank surface to the Control / Junction Box.

Run a length of strong rope, cord or strapping around the circumference of the tank and tie or clamp the ends together to form a tight band. (**Fig 1**). Horizontal heating panel installations may require two such bands.

STEP 2

Slide the EGLX Tank Heating Panel between the band and the tank at each premarked location. (**Fig 2**). All EGLX Tank Heating Panels should be provisionally located during this Step and the installer may adjust the distance between panels to gain optimum spacing. Each heating panel must have unobstructed and direct contact with the tank surface. Heating panels cannot be installed over tank fittings, nozzels, tank outlets, flanges etc. One EGLX Tank Heating Panel may be installed slightly higher than the other heating panels in the system. (see *Dual Sensor Installations* and **Fig 10**)

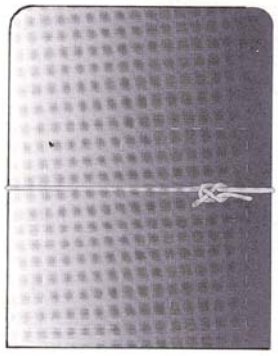
STEP 3

Return to each EGLX Tank Heating Panel, adjust the position to the exact location desired and apply two 30" long strips of IAAT3 sealing tape as shown in **Fig 3**. When all panels are taped into position, the rope, cord or stapping can be removed.

STEP 4

Using strips of IAAT3 sealing tape, seal the edges of each EGLX Tank Heating Panel as shown in **Fig 4.** This step will prevent thermal insulation and debris from migrating between the heating panel and tank surface. Thermal insulation or debris between the heating panel and tank may lead to unsafe operating conditions and overheating. **This is a critical and essential step on all installations that will involve the use of any type of thermal insulation that is sprayed or foamed into position.**

Fig. 1



STEP 5

Run the steel bands around the tank and over the back of the EGLX Tank Heating Panels, as shown in **Fig 5**. Tighten the bands and use a rentention clip on each band to provide a secure, permanent attachment of the heating panels to the tank surface. Vertically installed heating panels require a minimum of three bands and horizontally installed heating panels require at least two bands (**Fig 5**).

Fig. 5

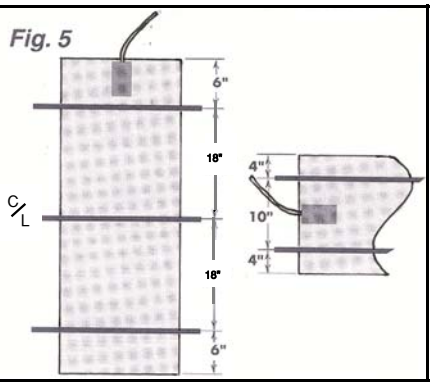
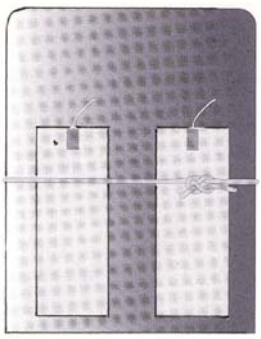


Fig. 2



STEP 6

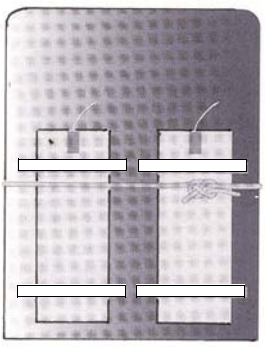
Use an Ohm Meter to check the resistance of each heating panel. The readings taken should be within ± 10% of the values shown in **Fig 6**. These values should be recorded in the Maintenance Log Record (supplied with the EGLX Maintenance and Operation Guide). Use a 500 vdc Megger to measure the Insulation Resistance (IR) value of each heating panel. Readings in excess of 20MΩ are acceptable. Any heating panel with an unacceptable resistance or IR reading should be removed and replaced.

Fig. 6

Nominal Resistance Values

	EGLX 500	EGLX400
120 V	29 Ω	36 Ω
240 V	115 Ω	144 Ω

Fig. 3



STEP 7

For EGLX type "CL" heating panels in unclassified areas the cold lead cable, as supplied, may be run across the tank surface and routed directly into the Control / Junction box.

In hazardous area locations, the cold lead cable should be run in flexible conduit in all areas where the cable is on the outside of the thermal insulation.

Cold lead cables should be taped to the tank surface using IAAT3 sealing tape as shown in **Fig 7.**

Fig. 7

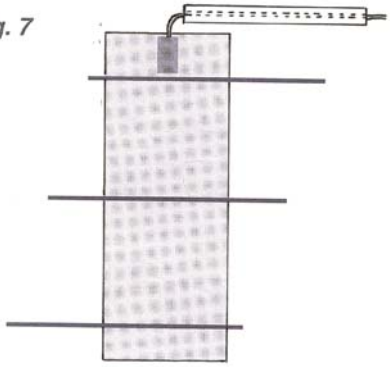
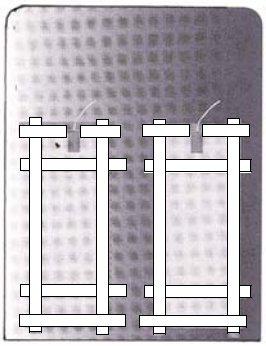


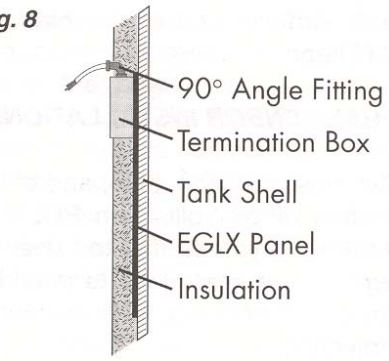
Fig. 4



STEP 8

The EGLX type "PC" heating panel is fitted with a 90° elbow that routes a short length of cold lead cable safely through the tank insulation (**Fig 8**). This design allows the installer to hook up the heating panels with conventional electrical wiring and conduit around the outside of the tank insulation to the Control / Junction Box. Interconnecting wiring and conduit should meet the requirements of the NEC for the type of installation being undertaken.

Fig. 8



TEMPERATURE CONTROL

Some form of temperature control device must be used with all EGLX Tank Heating Panels and Systems.

The most common type of temperature controllers used are either thermostats or electronic type instruments, each of which uses a sensor to measure temperature by physical contact with the outside surface of the tank. These devices may be a bulb & capillary, RTD, or thermocouple.

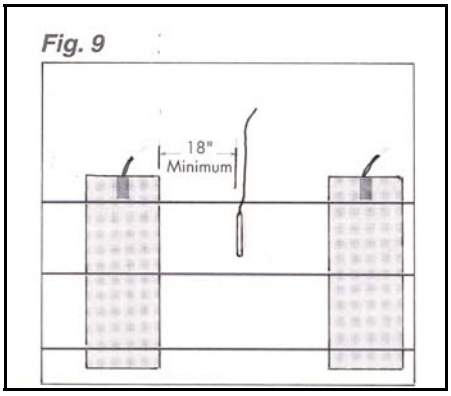
Several standard temperature controllers and systems specifically designed for use with the EGLX Tank Heating Panels are available from HTD Heat Trace, Inc. If the installer and/or end user is considering using any form of temperature control that is not being supplied by HTD, please contact us before purchasing the device(s) and commencing the installation to ensure compliance and compatibility with the requirements and approvals for the EGLX Tank Heating Panel and System.

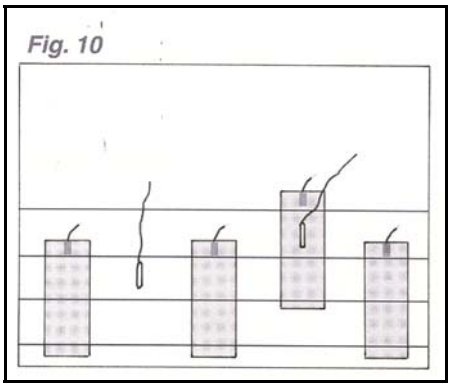
SINGLE SENSOR FOR PROCESS CONTROL

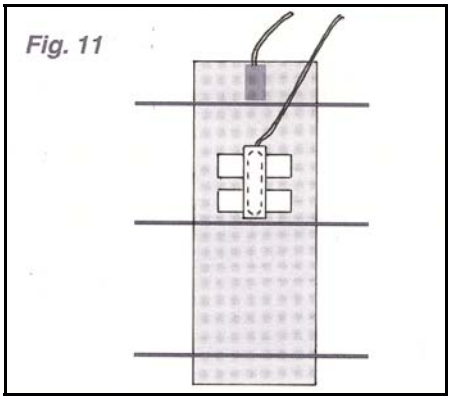
The use of one temperature controller and sensor to monitor and control the process temperature of the tank is limited to unclassified area applications only. This type of control system is also limited to applications that involve metal tanks (without linings) and tanks that do not contain heat-sensitive materials. Typical examples of such applications are metal tanks that require simple freeze protection.

For these type of applications, the single temperature sensor should be located directly on the outside surface of the tank, approximately 12 to 24 inches above the base of the tank and at least 18 inches away from the nearest heating panel, as shown in **Fig 9.** The sensor may be mechanically fixed to the surface of the tank or taped in position with IAAT3 sealing tape.

For protection and security, thermostat capillaries, RTD or thermocouple leads are best routed to the controller across the tank surface and under the thermal insulation. Capillaries or leads can be held in position on the tank surface with strategically placed 6 inch long strips of IAAT3 sealing tape.







HTD Heat Trace, Inc offers a very cost effective range of modular NEMA 4X and NEMA 7 control packages to provide accurate process temperature control, over-temperature protection, alarm and monitoring options for the EGLX Tank Heating Panels and System

Please contact us if we can assist you with these important design and equipment considerations.

HTD HEAT TRACE

Tel (908) 788 5210 Fax (908) 788 5204
e-mail address sales@htdheattrace.com
www.htdheattrace.com

DUAL SENSORS FOR PROCESS CONTROL AND OVER - TEMPERATURE PROTECTION.

The most common, safe, efficient and effective method of controlling EGLX Tank Heating Systems is the use of a Dual Thermostat Controller to provide process temperature control and over-temperature protection of the system.

This approach is mandatory for all hazardous area installations, irrespective of the type of tank being used or the nature of the materials being stored within the tank.

The dual thermostat control approach is also strongly recommended for all applications that involve fiberglass (FRP) tanks, other types of non-metallic tanks, tanks with non-metallic linings and tanks that will contain heat-sensitive products.

When using a Dual Thermostat Controller, the sensor that is connected to the Process Control Thermostat should be located exactly as described in the previous section titled "Single Sensor for Process Control" and **Fig 9.**

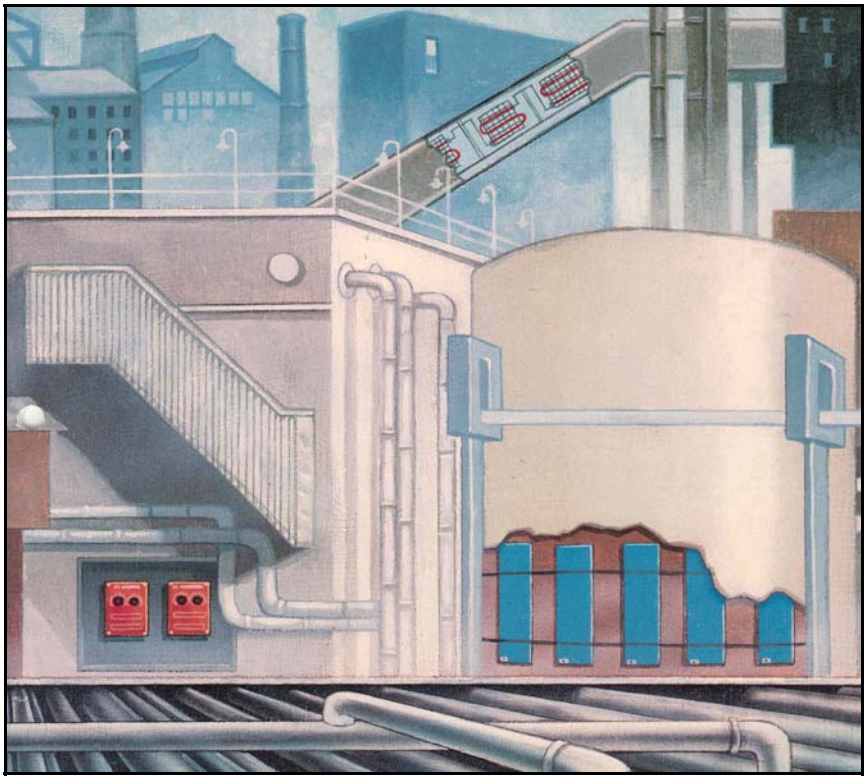
The second sensor, which is connected to the Overtemperature Thermostat should be located directly on the back of one EGLX Tank Heating Panel. *As shown in **Fig 10**, the specific heating panel being used to monitor potential over-temperature is physically located approximately 18 inches higher on the tank surface than all of the other heating panels within the system.* This simple installation method ensures that falling liquid levels within the tank, which may result in increased heating panel operating temperatures, are immediately detected and the heating panel system operation is automatically controlled at a temperature that is safe for the tank, tank contents and/or the environment surrounding the installation

The Over-Temperature Sensor should be located directly on the vertical center line of the selected EGLX Tank Heating Panel, as shown in **Fig 10**. The sensor should be attached to the back of the EGLX heating panel using three strips of IAAT3 sealing tape, as shown in **Fig 11**. Secure all capillaries or sensor leads to the tank surface with 6 inch long strips of IATT3 sealing tape.

HTD HEAT TRACE

EAGLE

USER AND CLIENT LIST



HEATING PANELS FOR METAL AND FIBERGLASS TANKS

FM APPROVED

Class I, Div 2, Groups B, C & D
Class II, Div 2
Class III, Div 2
Retested and reapproved to current IEEE and NEC Standards in 2003

EGLX-USERLIST-F-6/03

EGLX TANK HEATING PANEL

For temperature maintenance applications on Metal and Fiberglass (FRP) tanks.

INTRODUCTION

Eagle Tank Heating Panels were originally developed by the Heat Tracing Division of Cooperheat in 1984. This unique, low watt density heating panel has been successfully used on several thousand installations involving metal and fiberglass (FRP) tanks.

In 1996, this Cooperheat Division was incorporated under the HTD name and the basic heating panel design was upgraded to include a proprietary, parallel circuit heating element and ground shield to comply with NEC code revisions.

EGLX Tank Heating Panels are used in many industries for many applications.

Following is a partial User and Client List detailing a few of the many repeat customers using this unrivalled product.

Users and Clients	Users and Clients	Tank Fabricators
Alcoa	Great Lakes Dredging Co	Advance Tank & Construction
Amoco Oil Corp	Hamon Research Cottrell, Inc	American Fiberglass
Ashland Chemical Co	Hercules Chemical	Ashworth Plastics
Alliance Forest Products	International Paper	Augusta Fiberglass
Baker Petrolite	Lion Oil Co	Belding Tank Technologies
BASF Corp	Monsanto Chemical	Buffalo Tank
Bethlehem Steel	Morton International	Chicago Bridge & Iron Company
Black Hills Power & Light	Nalco Chemical Co	Clawson Tank
Borden Chemical	PEPCO	Delta Fiberglass
Calgon Corp	Phillips Alaska	Diamond Fiberglass
Chevron USA, Inc	Polaroid Corp	Ershigs
Consolidated Edison Co	Powder River Coal Co	Hasbrouck Plastics
Detroit Edison Co	Rust Engineering	Justin Tanks. Inc
DSM Copolymer	Siemens Power	Kennedy Tank & Manufacturing
Dupont	Southern Indiana Gas & Electric	Kentucky Tank
Exxon Mobil Corp	Tesoro Alaska Petroleum	Modern Welding
Formosa Plastics	Union Camp	Palmer Manufacturing & Tank
Futura Industries	Uniroyal Chemical	Plas-Tanks
G E Betz	U S Steel Corp	Smith Tank
Georgia Pacific	W. R. Grace	Tankinetics
Graybar Electric	Xerox Corp	Viatec

HEAT TRACE

SILCOPAD TANK HEATING SYSTEMS

A complete range of ultra low watt density flexible heating pads, controls & accessories supplied in kit form for use on Polyethylene, Polypropylene, IBC, Tote and Bin style chemical storage tanks.

LITERATURE & KIT SELECTION

INSTALLATION INSTRUCTIONS

IBC TANK HEATING KITS

SP

For freeze protection and process heating applications on Plastic Tanks

FM APPROVED

SilcoPad®

Super low watt density heater pad

- *Specifically designed for safe operation on polyethylene, polypropylene and other types of heat-sensitive tanks*
- *Two sizes fit both horizontal and vertical tanks*
- *Will not overheat or burn out*
- *Super low watt density heat source will not harm the tank or tank contents*
- *Installation is quick, simple and effective*
- *FM approved for use in unclassified, hazardous and corrosive environments*

SilcoPad heaters are specifically designed to provide the unique product and system features essential for the safe and reliable application of heat to the surface of plastic tanks and other types of heat-sensistive, non-metallic tanks. SilcoPad heaters are most commonly used on polyethylene and polypropylene tanks for freeze protection and temperature maintenance applications up to 120° F. (When used on metal tanks, SilcoPad systems can be designed for temperature maintenance applications up to 160° F)

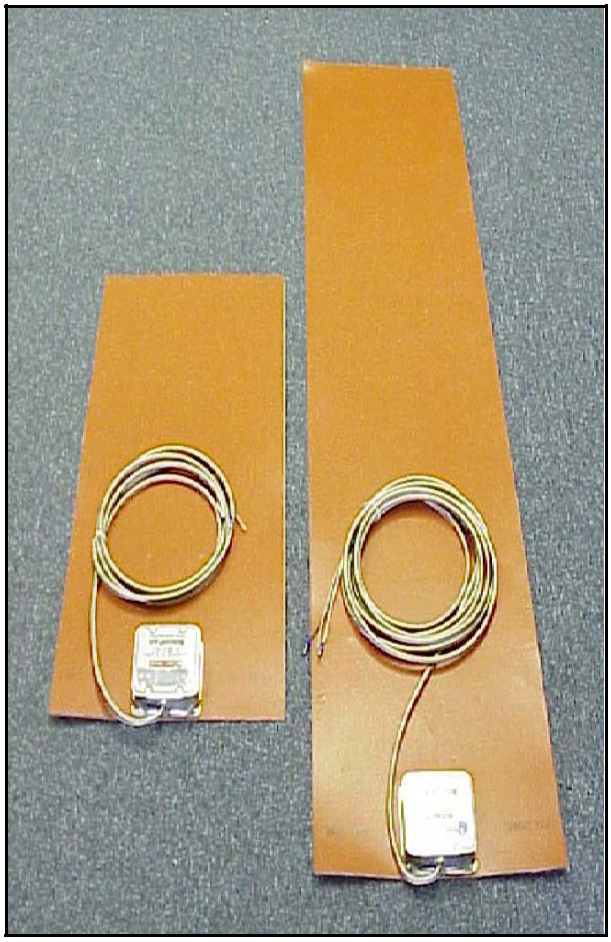
The SilcoPad design uses a *super low watt density*, parallel circuit heating element that is pressure laminated into a multi-layer silicone rubber dielectric construction to form a flexible, lightweight water-proof heater pad. Each SilcoPad heater is supplied with a rugged, encapsulted, factory made termination complete with a standard length of over-braided cold lead.

SilcoPad tank heaters are extremely safe, reliable and cannot overheat or burnout.

The gentle heat output of 0.5 w/sq.inch will not harm a plastic tank or contents. Additional security is also incorporated into every SilcoPad heater by the inclusion of a preset, automatic safety switch that is built directly into the pad. This factory installed device completely eliminates all potential for over-heating, even if the heating system should remain energized while the tank is empty.

The SilcoPad heater construction also includes an aluminum ground shield for full compliance with the latest requirements of the National Electrical Code.

Factory applied adhesive backing is used to bond the heater pad directly to the tank surface, allowing one person to complete a simple and effective installation in a matter of just a few minutes.



HTD HEAT TRACE

8 Bartles Corner Road, Unit # 104
Flemington
New Jersey 08822-5758
USA

Tel (908) 788 5210
Fax (908) 788 5204
e-mail: sales@htdheattrace.com
www.htdheattrace.com

PRODUCT SPECIFICATIONS

PHYSICAL, ELECTRICAL & THERMAL

PRODUCT FAMILY	SilcoPad
PRODUCT REFERENCES	SP 210 SP 420 & SP 420-16
SIZES	SP 210 14 x 30 inches SP 420 14 x 60 inches
PAD THICKNESS	0.1 inches
WEIGHTS	SP 210 3 LBS SP 420 5½ LBS
POWER RATINGS	SP 210 210 watts SP 420 420 watts
POWER DENSITY	0.5 watts.sq.inch
OPERATING VOLTAGE	120 VAC
NOMINAL CURRENT	SP 210 1.75 A SP 420 3.50 A
LEAKAGE CURRENT ON 120VAC	SP 210 0.2 mA SP 420 0.4 mA
TYPICAL MAXIMUM APPLICATION TEMPERATURES	Polyethylene 120° F Polypropylene 120° F PVC 140° F CPVC 150° F FRP 150° F

The above maximum application temperatures are only typical for the materials listed. Service temperature ratings for each tank material depend upon operating pressure and may be lower. Maximum permissible operating temperatures for each specific type of tank must be determined by the Tank Manufacturer and/or end user.

MAXIMUM EXPOSURE TEMPERATURE	200° F
MINIMUM INSTALLATION TEMPERATURE	40° F
MINIMUM BENDING RADIUS	6 inches
MINIMUM TANK SIZE	12 inches diameter

ACCESSORIES

SEALING TAPE	Use type IAAT 3 adhesive backed aluminum tape to seal the four edges of each SilcoPad to the tank surface. This simple procedure prevents any thermal insulation from migrating between the tank surface and the heater pad.

CONSTRUCTIONAL

HEATING ELEMENT	Nichrome resistance wires
HEATING ELEMENT DESIGN	Parallel circuit
DIELECTRIC MATERIALS	3 plys of 0.026 inch thick silicone / glass bond
DIELECTRIC STRENGTH	1.48KV for one minute
INTEGRAL GROUND PLANE	0.005 inch thick aluminum foil
GROUND PLANE RESISTANCE	3.26 mΩ/ft
TERMINATION BOX	4 x 4 inch steel enclosure
COLD LEAD CABLE	3 conductor # 16 AWG tinned copper with silcone rubber insulation and nickel-plated copper overbraid
STANDARD COLD LEAD LENGTHS	SP 210 10 ft SP 420 10 ft SP 420-16 16 ft

Custom cold lead lengths can be supplied as special order

INSTALLATION METHOD	Factory applied adhesive backing with peel off protective paper

APPROVALS

FACTORY MUTUAL 	Unclassified areas Class I Div 2 B, C, D Class II Div 2 F, G Class III Div 2
T-RATING	T4A

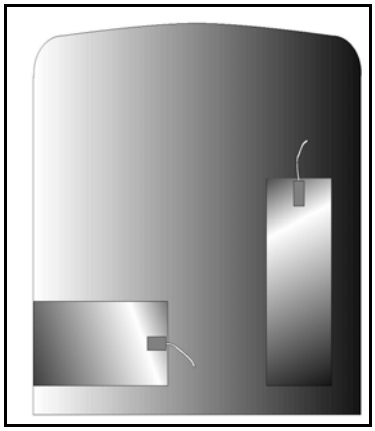
CONTROLS

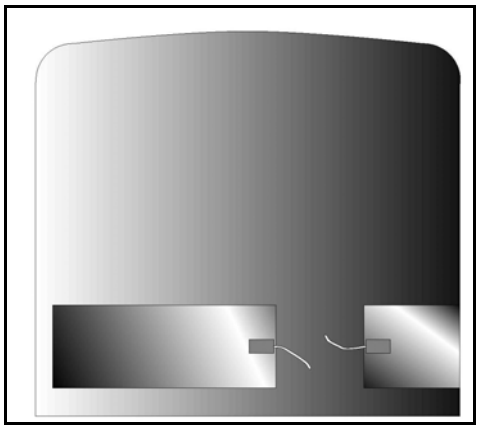
PLASTIC TANKS	The recommended controller for unclassified, non-hazardous area installations is type 2SPCP with dual electronic thermostats for process control and high temperature cut out. Use type 2HSPCP controller to provide the same features on all hazardous area installations.

HEAT TRACE

SilcoPad

Heating Pad Kit Selection Guide





HEATING PAD KITS FOR PLASTIC TANKS

FM APPROVED

Approved for use in unclassified, non-hazardous areas and hazardous areas with the following classifications:
Class I, Div 2, Groups B, C & D
Class II, Div 2
Class III, Div 2
Tested and certified to current IEEE and National Electrical Code Standards

SP-GUIDE-F-12/04

Kit Selection Guide

Silcopad

INTRODUCTION

SilcoPad heaters are designed with very low watt density power ratings for safe, reliable operation on plastic tanks. These products are predominantly used to maintain temperatures up to 120° F on polyethylene and polypropylene tanks in both hazardous and (unclassified) non-hazardous areas.

This selection guide provides a simple method for selecting, specifying and ordering the correct SilcoPad Heating Kit to maintain the design temperature desired on the size of tank that is being used.

This Heating Pad Kit Selection Guide can be used to determine and order heating kits for both indoor and outdoor applications.

The heating load used in each kit has been based upon the design assumption that the entire surface area of the tank being heated will be thermal insulated with a minimum thickness of 2 inches of polyurethane foam or board type insulation. This is the industry standard used by most plastic tank manufacturers. *If your tank is being insulated with a different type or thickness of thermal insulation, consult HTD to verify the correct heating kit that is suitable for use on your specific application.*

HEATING KIT COMPONENTS

A combination of the following products are used in every SilcoPad Heating Kit:

- Type SP 210 Heating Pad, 14" w x 30" lg, 210 watts, 120 volts
- Type SP 420 Heating Pad, 14" w x 60" lg, 420 watts, 120 volts
- Type 2SPCP dual thermostat , unclassified (non-hazardous) rated temperature controller
- Type 2HSPCP dual thermostat, hazardous rated temperature controller
- Type IAAT3 adhesive backed aluminum sealing tape

Each kit is supplied with all of the necessary components for one complete system, including installation instructions and wiring diagrams.

HOW TO USE THIS SELECTION GUIDE

Selecting the correct and specific SilcoPad Heating Kit to meet the requirements of most plastic tank heating applications is simple.

Just three basic steps are required.

STEP 1 Determine the Δ T (°F) for the application. This is calculated by subtracting the lowest anticipated ambient temperature from the desired maintenance temperature of the tank.

STEP 2 Identify the tank diameter, the length (or height) in inches and the tank orientation (horizontal or vertical)

STEP 3 Determine if the area where the tank is located is rated as a hazardous or unclassified area.

With these three very basic pieces of information, the reader first locates the Kit Table that corresponds to the tank diameter and orientation being used. Read down the first vertical column to locate the length (or height) of the tank and read across to locate the Kit reference that corresponds to the Δ T for your application.

In all instances, when any value determined in either Step 1 or Step 2 is not shown exactly in the Kit Table, simply use the nearest value above the one in question.

For instance, a 39" diameter tank falls between the kit sizes developed for standard 36 and 42" diameter tanks. In this example, use the table for a standard 42" dia tank.

A 66" long horizontal tank or a 66" high vertical tank falls between the standard 60" and 72" dimensions shown in the tables. Choose the 72" dimension in this example.

The same procedure is adopted with Δ T values that fall between the five Δ T columns shown in the tables. For example, a calculated Δ T of 48°F uses the kit shown in the Δ T 60°F column.

Examples of how to use this Kit Selection Guide and how to specify and/or order both hazardous and non-hazardous area SilcoPad Heating Kits are shown on the final page of this document.

HTD offers a free design and engineering service on all applications. Please contact us directly if you want us to verify your kit selection or recommend a kit for any special application you may be considering.

HEATING KIT TABLES FOR 12" DIA. TANKS

TANK LENGTH (INCHES)	12 INCH DIAMETER HORIZONTAL TANKS				
	SILCOPAD HEATING KIT REFERENCES				
	Δ T 40° F	Δ T 60° F	Δ T 80° F	Δ T 100° F	Δ T 120° F
24	12L	12L	12L	12L	12L
36	12L	12L	12L	12L	12L
48	12L	12L	12L	12L	12L
60	12L	12L	12L	12L	12L
72	12L	12L	12L	12L	12L
84	12L	12L	12L	12L	12L

TANK HEIGHT (INCHES)	12 INCH DIAMETER VERTICAL TANKS				
	SILCOPAD HEATING KIT REFERENCES				
	Δ T 40° F	Δ T 60° F	Δ T 80° F	Δ T 100° F	Δ T 120° F
24	12L	12L	12L	12L	12L
36	12L	12L	12L	12L	12L
48	12L	12L	12L	12L	12L
60	12L	12L	12L	12L	12L
72	12L	12L	12L	12L	12L
84	12L	12L	12L	12L	12L

HEATING KIT TABLES FOR 18" DIA. TANKS

TANK LENGTH (INCHES)	18 INCH DIAMETER HORIZONTAL TANKS				
	SILCOPAD HEATING KIT REFERENCES				
	Δ T 40° F	Δ T 60° F	Δ T 80° F	Δ T 100° F	Δ T 120° F
24	12L	12L	12L	12L	12L
36	12L	12L	12L	12L	12L
48	12V	12V	12V	12V	12V
60	12V	12V	12V	12V	12V
72	12V	12V	12V	12V	12V
84	12V	12V	12V	12V	12V

TANK HEIGHT (INCHES)	18 INCH DIAMETER VERTICAL TANKS				
	SILCOPAD HEATING KIT REFERENCES				
	Δ T 40° F	Δ T 60° F	Δ T 80° F	Δ T 100° F	Δ T 120° F
24	12L	12L	12L	12L	12L
36	12L	12L	12L	12L	12L
48	12L	12L	12L	12L	12L
60	12L	12L	12L	12L	12L
72	12L	12L	12L	12L	12L
84	12L	12L	12L	12L	12L

HEATING KIT TABLES FOR 24" DIA. TANKS

TANK LENGTH (INCHES)	24 INCH DIAMETER HORIZONTAL TANKS				
	SILCOPAD HEATING KIT REFERENCES				
	Δ T 40° F	Δ T 60° F	Δ T 80° F	Δ T 100° F	Δ T 120° F
24	12L	12L	12L	12L	12L
36	12L	12L	12L	12L	12L
48	12V	12V	12V	12V	12V
60	12V	12V	12V	12V	12V
72	12V	12V	12V	12V	12V
84	12V	12V	12V	12V	12V
96	12V	12V	12V	12V	12V

TANK HEIGHT (INCHES)	24 INCH DIAMETER VERTICAL TANKS				
	SILCOPAD HEATING KIT REFERENCES				
	Δ T 40° F	Δ T 60° F	Δ T 80° F	Δ T 100° F	Δ T 120° F
24	12L	12L	12L	12L	12L
36	12L	12L	12L	12L	12L
48	12L	12L	12L	12L	12L
60	12L	12L	12L	12L	12L
72	12L	12L	12L	12L	12L
84	12L	12L	12L	12L	12L
96	12L	12L	12L	12L	12L

HEATING KIT TABLES FOR 30" DIA. TANKS

TANK LENGTH (INCHES)	30 INCH DIAMETER HORIZONTAL TANKS				
	SILCOPAD HEATING KIT REFERENCES				
	Δ T 40° F	Δ T 60° F	Δ T 80° F	Δ T 100° F	Δ T 120° F
30	12L	12L	12L	12L	12L
36	12L	12L	12L	12L	12L
48	12V	12V	12V	12V	12V
60	12V	12V	12V	12V	12V
72	12V	12V	12V	12V	12V
84	12V	12V	12V	12V	12V
96	12V	12V	12V	12V	22V

TANK HEIGHT (INCHES)	30 INCH DIAMETER VERTICAL TANKS				
	SILCOPAD HEATING KIT REFERENCES				
	Δ T 40° F	Δ T 60° F	Δ T 80° F	Δ T 100° F	Δ T 120° F
30	12L	12L	12L	12L	12L
36	12L	12L	12L	12L	12L
48	12L	12L	12L	12L	12L
60	12L	12L	12L	12L	12L
72	12L	12L	12L	12L	12L
84	12L	12L	12L	12L	12L
96	12L	12L	12L	12L	22L

HEATING KIT TABLES FOR 36" DIA. TANKS

TANK LENGTH (INCHES)	36 INCH DIAMETER HORIZONTAL TANKS				
	SILCOPAD HEATING KIT REFERENCES				
	Δ T 40° F	Δ T 60° F	Δ T 80° F	Δ T 100° F	Δ T 120° F
36	12L	12L	12L	12L	12L
48	12V	12V	12V	12V	12V
60	12V	12V	12V	12V	12V
72	12V	12V	12V	12V	22VP
84	12V	12V	12V	22VS	22VS
96	12V	12V	12V	22VS	22VS
108	12V	12V	22VS	22VS	22VS
120	12V	12V	22VS	22VS	22VS

TANK HEIGHT (INCHES)	36 INCH DIAMETER VERTICAL TANKS				
	SILCOPAD HEATING KIT REFERENCES				
	Δ T 40° F	Δ T 60° F	Δ T 80° F	Δ T 100° F	Δ T 120° F
36	12L	12L	12L	12L	12L
48	12L	12L	12L	12L	12L
60	12L	12L	12L	12L	12L
72	12L	12L	12L	12L	22L
84	12L	12L	12L	22L	22L
96	12L	12L	12L	22L	22L
108	12L	12L	22L	22L	22L
120	12L	12L	22L	22L	22L

HEATING KIT TABLES FOR 42" DIA. TANKS

TANK LENGTH (INCHES)	42 INCH DIAMETER HORIZONTAL TANKS				
	SILCOPAD HEATING KIT REFERENCES				
	Δ T 40° F	Δ T 60° F	Δ T 80° F	Δ T 100° F	Δ T 120° F
36	12L	12L	12L	12L	12L
48	12V	12V	12V	12V	22VP
60	12V	12V	12V	22L	22VP
72	12V	12V	12V	22L	22VP
84	12V	12V	14V	14V	14V
96	12V	12V	14V	14V	14V
108	12V	14V	14V	14V	14V12L
120	12V	14V	14V	14V	14V12V

TANK HEIGHT (INCHES)	42 INCH DIAMETER VERTICAL TANKS				
	SILCOPAD HEATING KIT REFERENCES				
	Δ T 40° F	Δ T 60° F	Δ T 80° F	Δ T 100° F	Δ T 120° F
36	12L	12L	12L	12L	12L
48	12L	12L	12L	12L	22L
60	12L	12L	12L	22L	22L
72	12L	12L	12L	22L	22L
84	12L	12L	22L	22L	22L
96	12L	12L	22L	22L	22L
108	12L	22L	22L	22L	32L
120	12L	22L	22L	22L	32L

HEATING KIT TABLES FOR 48" DIA. TANKS

TANK LENGTH (INCHES)	48 INCH DIAMETER HORIZONTAL TANKS				
	SILCOPAD HEATING KIT REFERENCES				
	Δ T 40° F	Δ T 60° F	Δ T 80° F	Δ T 100° F	Δ T 120° F
48	12V	12V	12V	22L	22L
60	12V	12V	12V	22L	22L
72	12V	12V	22L	22L	22L
84	12V	12V	14V	14V	14V
96	12V	14V	14V	14V	32L
108	12V	14V	14V	14V	32L
120	12V	14V	14V	14V	14V12VS

TANK HEIGHT (INCHES)	48 INCH DIAMETER VERTICAL TANKS				
	SILCOPAD HEATING KIT REFERENCES				
	Δ T 40° F	Δ T 60° F	Δ T 80° F	Δ T 100° F	Δ T 120° F
48	12L	12L	12L	22L	22L
60	12L	12L	12L	22L	22L
72	12L	12L	22L	22L	22L
84	12L	12L	22L	22L	22L
96	12L	22L	22L	22L	32L
108	12L	22L	22L	22L	32L
120	12L	22L	22L	22L	32L

HEATING KIT TABLES FOR 60" DIA. TANKS

TANK LENGTH (INCHES)	60 INCH DIAMETER HORIZONTAL TANKS				
	SILCOPAD HEATING KIT REFERENCES				
	Δ T 40° F	Δ T 60° F	Δ T 80° F	Δ T 100° F	Δ T 120° F
48	12V	12V	22VP	22VP	22VP
60	12V	12V	22VP	22VP	22VP
72	12V	22VP	22VP	22VP	32L
84	12V	14V	14V	14V	32L
96	12V	14V	14V	32L	32L
108	12V	14V	14V	32L	32L
120	14V	14V	14V12VS	14V12VS	24VP

TANK HEIGHT (INCHES)	60 INCH DIAMETER VERTICAL TANKS				
	SILCOPAD HEATING KIT REFERENCES				
	Δ T 40° F	Δ T 60° F	Δ T 80° F	Δ T 100° F	Δ T 120° F
48	12L	12L	22L	22L	22L
60	12L	12L	22L	22L	22L
72	12L	22L	22L	22L	32L
84	12L	22L	22L	22L	32L
96	12L	22L	22L	32L	32L
108	12L	22L	22L	32L	32L
120	12L	22L	32L	32L	24L

HEATING KIT TABLES FOR 72" DIA. TANKS

TANK LENGTH (INCHES)	72 INCH DIAMETER HORIZONTAL TANKS				
	SILCOPAD HEATING KIT REFERENCES				
	Δ T 40° F	Δ T 60° F	Δ T 80° F	Δ T 100° F	Δ T 120° F
60	12V	22VP	22VP	32L	32L
72	12V	22VP	22VP	32L	32L
84	14V	14V	32L	32L	24VP
96	14V	14V	32L	32L	24VP
108	14V	14V	32L	24VP	24VP
120	14V	14V	14V12VS	24VP	24VP
132	14V	14V12VS	14V12VS	24VP	24VP12S
144	14V	14V12VS	14V12VS	24VS	24VP12S

TANK HEIGHT (INCHES)	72 INCH DIAMETER VERTICAL TANKS				
	SILCOPAD HEATING KIT REFERENCES				
	Δ T 40° F	Δ T 60° F	Δ T 80° F	Δ T 100° F	Δ T 120° F
60	12L	22L	22L	32L	32L
72	12L	22L	22L	32L	32L
84	22L	22L	32L	32L	24L
96	22L	22L	32L	32L	24L
108	22L	22L	32L	24L	24L
120	22L	22L	32L	24L	24L
132	22L	32L	32L	24L	24L12L
144	22L	32L	32L	24L	24L12L

HEATING KIT TABLES FOR 84" DIA. TANKS

TANK LENGTH (INCHES)	84 INCH DIAMETER HORIZONTAL TANKS				
	SILCOPAD HEATING KIT REFERENCES				
	Δ T 40° F	Δ T 60° F	Δ T 80° F	Δ T 100° F	Δ T 120° F
60	22L	22L	32L	32L	24L
72	22L	22L	32L	32L	24L
84	14V	14V	32L	24VP	24L
96	14V	32L	32L	24VP	24VP
108	14V	32L	32L	24VP	24VP12VL
120	14V	14V12VS	24VP	24VP	24VP12VS
132	14V	14V12VS	24VP	24VP12VS	24VP12VS
144	14V	14V12VS	24VS	24VP12VS	24VP14VS
156	14V12VS	14V12VS	24VS	24VS12VL	24VP14VS
168	14V12VS	14V12VS	24VS	24VS12VL	24VP14VS

TANK HEIGHT (INCHES)	84 INCH DIAMETER VERTICAL TANKS				
	SILCOPAD HEATING KIT REFERENCES				
	Δ T 40° F	Δ T 60° F	Δ T 80° F	Δ T 100° F	Δ T 120° F
60	22L	22L	32L	32L	24L
72	22L	22L	32L	32L	24L
84	22L	22L	32L	24L	24L
96	22L	32L	32L	24L	24L
108	22L	32L	32L	24L	24L12L
120	22L	32L	24L	24L	24L12L
132	22L	32L	24L	24L12L	24L12L
144	22L	32L	24L	24L12L	34L
156	32L	32L	24L	24L12L	34L
168	32L	32L	24L	24L12L	34L

HEATING KIT TABLES FOR 96" DIA. TANKS

TANK LENGTH (INCHES)	96 INCH DIAMETER HORIZONTAL TANKS				
	SILCOPAD HEATING KIT REFERENCES				
	Δ T 40° F	Δ T 60° F	Δ T 80° F	Δ T 100° F	Δ T 120° F
72	22L	32L	32L	24L	24L12VS
84	22VS	32L	32L	24VP	24L12VS
96	22VS	32L	24VP	24VP	24L12VS
108	22VS	32L	24VP	24VP12VL	34VP
120	22VS	14V12VS	24VP	24VP12VS	34VP
132	14V12VS	14V12VS	24VP	24VP12VS	34VP
144	14V12VS	24V	24VP12VS	24VP14VS	24VP14VP12VP
156	14V12VS	24V	24V12VL	24VP14VS	24VP14VP12VP
168	14V12VS	24V	24V12VL	24VP14VS	24VP14VP12VP

TANK HEIGHT (INCHES)	96 INCH DIAMETER VERTICAL TANKS				
	SILCOPAD HEATING KIT REFERENCES				
	Δ T 40° F	Δ T 60° F	Δ T 80° F	Δ T 100° F	Δ T 120° F
72	22L	32L	32L	24L	24L12L
84	22L	32L	32L	24L	24L12L
96	22L	32L	24L	24L	24L12L
108	22L	32L	24L	24L12L	34L
120	22L	32L	24L	24L12L	34L
132	32L	32L	24L	24L12L	34L
144	32L	24L	24L12L	34L	34L12L
156	32L	24L	24L12L	34L	34L12L
168	32L	24L	24L12L	34L	34L12L

HEATING KIT TABLES FOR 108" DIA TANKS

TANK LENGTH (INCHES)	108 INCH DIAMETER HORIZONTAL TANKS				
	SILCOPAD HEATING KIT REFERENCES				
	Δ T 40° F	Δ T 60° F	Δ T 80° F	Δ T 100° F	Δ T 120° F
84	22VS	32L	24VP	24VL12L	34VP
96	22VS	32L	24VP	24VP12L	34VP
108	14V12L	24VP	24VP12L	34VP	34VP
120	14V12VS	24VP	24VP12VS	34VP	34VP12VS
132	14V12VS	24VP	24VP12VS	34VP	34VP12VS
144	14V12VS	24VS	24VP12VS	34VP12VS	24VP24VP
156	14V12VS	24VS12VL	24VP14VS	24VP14VS12L	24VP24VP
168	14V12VS	24VS12VL	24VP14VS	24VP14VS12L	24VP24VP

TANK HEIGHT (INCHES)	108 INCH DIAMETER VERTICAL TANKS				
	SILCOPAD HEATING KIT REFERENCES				
	Δ T 40° F	Δ T 60° F	Δ T 80° F	Δ T 100° F	Δ T 120° F
84	22L	32L	24L	24L12L	34L
96	22L	32L	24L	24L12L	34L
108	14L12L	24L	24L12L	34L	34L
120	14L12L	24L	24L12L	34L	34L12L
132	14L12L	24L	24L12L	34L	34L12L
144	14L12L	24L	24L12L	34L12L	44L
156	14L12L	24L12L	34L	34L12L	44L
168	14L12L	24L12L	34L	34L12L	44L

HEATING KIT TABLES FOR 120" DIA. TANKS

TANK LENGTH (INCHES)	120 INCH DIAMETER HORIZONTAL TANKS				
	SILCOPAD HEATING KIT REFERENCES				
	Δ T 40° F	Δ T 60° F	Δ T 80° F	Δ T 100° F	Δ T 120° F
96	14V12L	24VP	24VP12L	34VP	34VP12L
108	14V12L	24VP	24VP12L	34VP	34VP12L
120	14V12V	24VP	24VP12V	34VP12V	44L
132	14V12V	24VP12V	34VP	34VP12V	44L
144	14V12V	24VP12V	34VP	34VP12V	24VP24VP12L
156	24VP12V	24VS12L	24VP14V	24VP24VP	24VP24VP12L
168	24VP12V	24VS12L	24VP14V12L	24VP24VP	24VP24VP14L
192	24VP12V	24VP14V	24VP14V12V	24VP24VP12V	24VP24VP14L

TANK HEIGHT (INCHES)	120 INCH DIAMETER VERTICAL TANKS				
	SILCOPAD HEATING KIT REFERENCES				
	Δ T 40° F	Δ T 60° F	Δ T 80° F	Δ T 100° F	Δ T 120° F
96	24L12L	24L	24L12L	34L	34L12L
108	24L12L	24L	24L12L	34L	34L12L
120	24L12L	24L	24L12L	34L12L	44L
132	24L12L	24L12L	34L	34L12L	44L
144	24L12L	24L12L	34L	34L12L	44L12L
156	34L	24L12L	34L	44L	44L12L
168	34L	24L12L	34L12L	44L	44L14L
192	34L	34L	34L12L	44L12L	44L14L

HEATING KIT TABLES FOR 144" DIA. TANKS

TANK LENGTH (INCHES)	144 INCH DIAMETER HORIZONTAL TANKS				
	SILCOPAD HEATING KIT REFERENCES				
	Δ T 40° F	Δ T 60° F	Δ T 80° F	Δ T 100° F	Δ T 120° F
120	24VP	24VP12V	34VP12V	44L	54L
132	24VP	34VP	34VP12V	44L12V	54L
144	24V	24VP14V	24VP24VP	44L12L	54L12L
156	24V	24VP14V	24VP24VP	24VP24VP14L	34VP24VP12L
168	24V12L	24VP14V	24VP24VP	24VP24VP14L	34VP34VP
192	24V12V	24VP14V12V	24VP24VP12V	34VP24VP12V	N/A

TANK HEIGHT (INCHES)	144 INCH DIAMETER VERTICAL TANKS				
	SILCOPAD HEATING KIT REFERENCES				
	Δ T 40° F	Δ T 60° F	Δ T 80° F	Δ T 100° F	Δ T 120° F
120	24L	24L12L	34L12L	44L	54L
132	24L	34L	34L12L	44L12L	54L
144	24L	34L	44L	44L12L	54L12L
156	24L	34L	44L	54L	54L12L
168	24L12L	34L	44L	54L	64L
192	24L12L	34L12L	44L12L	54L12L	N/A

SELECTION EXAMPLES

DESIGN REQUIREMENTS MATCH SELECTION TABLE

Example: Maintain a 60°FΔT on a 72" dia. x 96" high vertical tank

From the 72" diameter Vertical Tank Table, read across from the 96" height to the 60°FΔT column and select :

SilcoPad Kit ref: 22L

TANK DIAMETER DOES NOT MATCH SELECTION TABLE

Example: Maintain a 80°FΔT on a 54" dia. x 108" long horizontal tank

Nearest tank diameter up from the example is 60". From the 60" diameter Horizontal Tank Table, read across from the 108" length to the 80°FΔT column and select :

SilcoPad Kit ref: 14V

TANK DIAMETER, LENGTH AND ΔT DO NOT MATCH SELECTION TABLES

Example: Maintain a 49°FΔT on a 64" dia. x 128" high vertical tank

Nearest tank diameter up from the example is 72", the nearest height to the example is 132" and the nearest ΔT shown in the tables is 60°F.

From the 72" diameter Vertical Tank Table, read across from the 132" height to the 60°FΔT column and select :

SilcoPad Kit ref: 32L

ORDERING AND / OR SPECIFYING CODES

To order or specify any SilcoPad Tank Heating Kit for operation in an **unclassified (non-hazardous area)** si mply add the letter **"N"** in front of the kit reference.

Example.....N44L

To order or specify any SilcoPad Tank Heating Kit that will operate in a **hazardous area** that is covered by the FM Approval for the SilcoPad heater, simply add the letter **"H"**in front of the kit reference.

Example.....H24VP12L

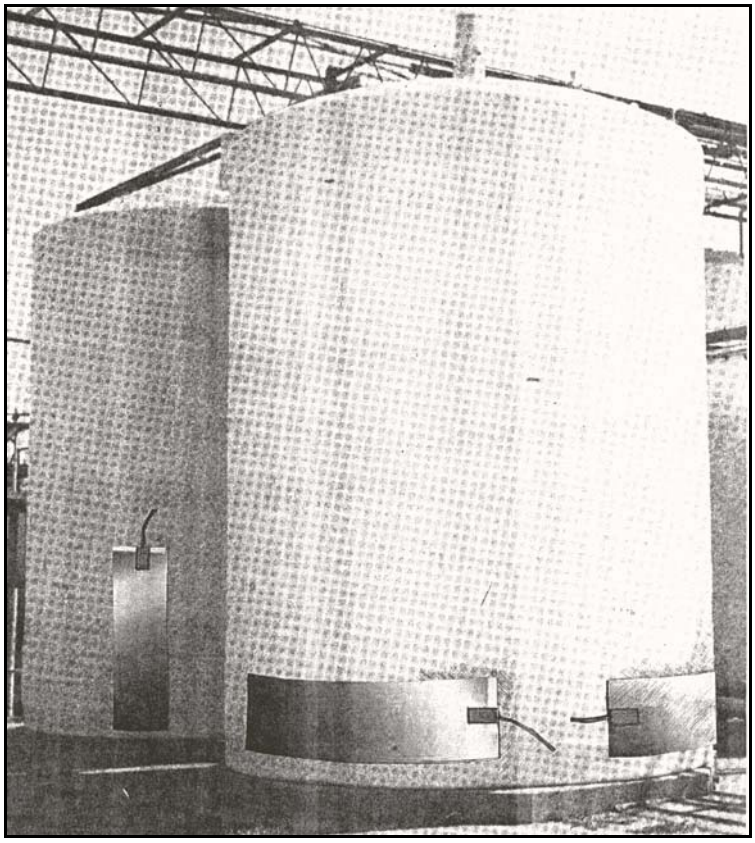
Full details of the FM Approvals covering the use of S ilcoPad heaters in hazardous areas are shown on the front cover of this Kit Selection Guide.

HTD HEAT TRACE
8 Bartles Corner Road, Unit # 104
Flemington
New Jersey 08822-5758
USA
Tel (908) 788 5210
Fax (908) 788 5204
e-mail: sales@htdheattrace.com
www.htdheattrace.com

HEAT TRACE

SilcoPad

INSTALLATION INSTRUCTIONS



HEATING PADS FOR PLASTIC TANKS

FM APPROVED

Class I, Div 2, Groups B, C & D
Class II, Div 2
Class III, Div 2
Tested and approved to IEEE 515 and NEC Standards.

SP-INST-F-12/04

INTRODUCTION

The SilcoPad heater and the SilcoPad Tank Heating System are specifically designed for maintaining temperatures up to 120°F on plastic tanks. The product and system are predominantly used on polyethylene and polypropylene tanks. SilcoPad heaters and systems may also be safely used on metal and fiberglass (FRP) tanks if the application requirements dictate the need for a very low watt density heat source.

This guide outlines the general installation procedures that must be completed to successfully install the SilcoPad heater, temperature sensing devices and the Temperature Controller.

All SilcoPad heater installations on plastic tanksrequ ire the use of a dual thermostat controller as specified in this guide. This type of controller mu st also be used on fiberglass tank applications. Single thermostat controllers may be used on metal tank applications and, in these instances, the reader should contact HTD to discuss the appropriate instrumentation.

Please read all instructions carefully before attempting any installation procedures.

THERMAL INSULATION

All tanks must be thermally insulated for the SilcoPad Tank Heating System to work safely, effectively and reliably. Most systems are designed and / or specified based upon the entire tank being covered with a 2 inch thick layer of sprayed polyurethane foam. This is the industry standard used by most plastic tank manufacturers. If your installation is not using this type and thickness of insulation and you did not specify the type and thickness of insulation you intend to use before purchasing your SilcoPad Tank Heating System, consult HTD before installing any products.

The use of different types and thickness of thermal insulation other than 2" thick polyurethane foam or board may require the useof a dditional heater pads.

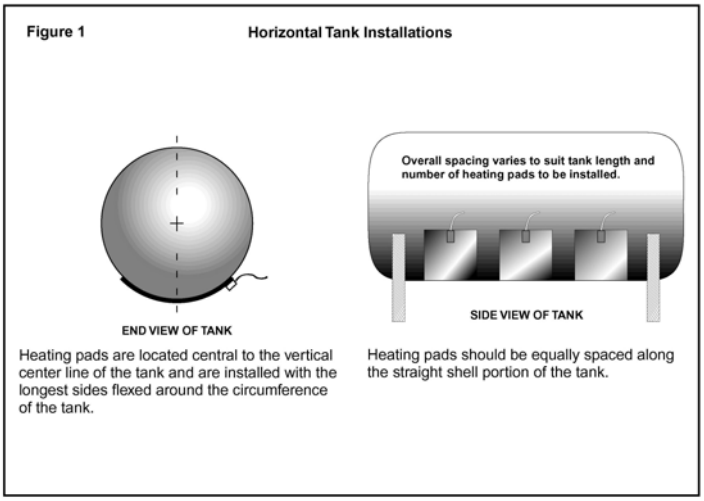
PREPARATORY STEPS

STEP 1

Review your drawings or the actual tank to determine the provisional locations for the heater pads based upon the style and type of tank being used. Figures 1 and 2 show the basic positioning and orientation for SilcoPad heaters on both horizontal and vertical tanks.

SilcoPad heaters may also be installed vertically on vertical tanks that are over 120" high as shown in Figure 2a.

Do not install the SilcoPad heaters at this time. Mark the provisional heater pad locations on the tank and complete Steps 2 and 3 first.



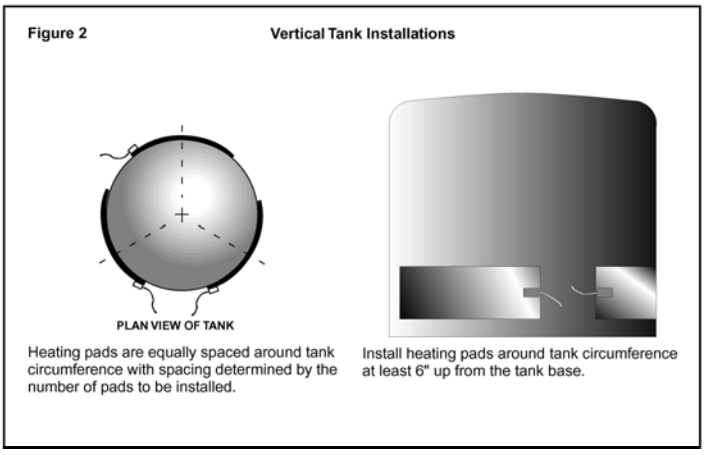
STEP 2

Review the Temperature Controller to be used on the installation and determine a position on or near the tank, where this controller can best be located.

SP 210 heater pads are supplied with 10 ft long cold lead cables. SP 420 heater pads are supplied with either 10 or 16 ft long cold lead cables.

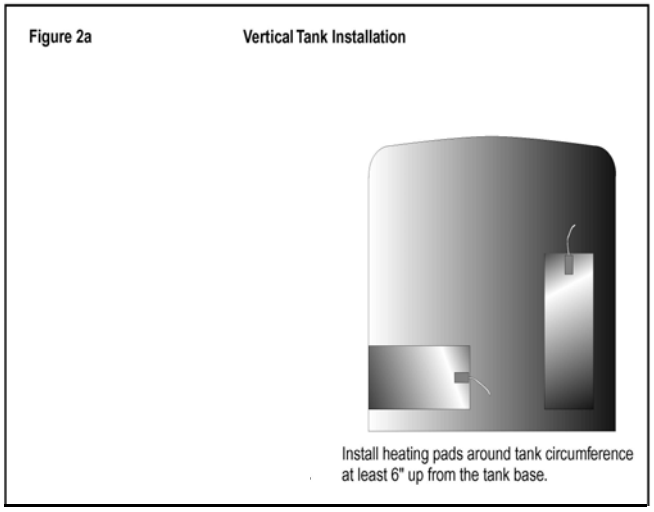
It is very important to ensure that the distances between the Temperature Controller and the provisional locations of each heater pad take into account the individual cold lead cable lengths on the SilcoPad heaters being used.

If necessary, adjust and mark the final locations of the SilcoPad heaters to ensure that each cold lead cable is long enough to reach the location selected for the Temperature Controller.



STEP 3

Ensure that the tank surface is clean, dry, and free of any dirt, rust, grease, oil or any other substance that may interfere with the self-adhesive bonding material on the SilcoPad heater.



INSTALLATION TASKS

Do not attempt the installation of the SilcoPad heaters if the ambient temperature is below 40° F. The self-adhesive surface of the SilcoPad heater uses an aggressive adhesive which bonds permanently to all tank surfaces. Do not attempt to move or reposition the heating pad after it has adhered to the tank.

STEP 4

Remove one heating pad from the shipping box and carefully peel back a 6" to 8" portion of the protective paper backing to expose the adhesive surface. *Start this process at the junction box end of the heater pad.*

STEP 5

Align the exposed portion of the heater pad with the final heater pad location marked in Step 2 and begin carefully sticking the pad to the tank surface.

STEP 6

Continue peeling back 6" to 8" portions of the backing paper and, with smooth hand strokes and uniform pressure, continue to carefully stick the heating pad to the tank surface. *As each portion is adhered to the tank, ensure that no creases are formed in the heater pad and also ensure that no air gaps form between the heater pad and the tank surface.*

Continue repeating this process until all of the protective paper backing has been removed and the entire inner surface of the heater pad is bonded to the tank surface.

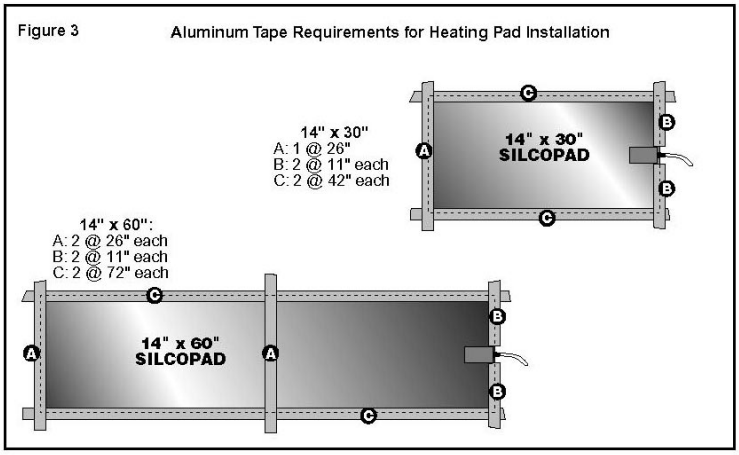
STEP 7

3" wide type IAAT3 aluminum tape is used to seal the outer edges of the heater pad to the tank. This step will prevent polyurethane insulation from foaming between the heater pad and the tank surface during the insulation process. This step also prevents dirt, moisture and other contaminants from migrating between the heater pad and tank during the lifetime of the installation.

Consult Figure 3 and cut the IAAT3 tape into the required lengths. Remove the protective paper backing and apply each length as shown in Figure 3.

Repeat Steps 4 through 7 for each additional heating pad being used.

Figure 3 Aluminum Tape Requirements for Heating Pad Installation



TEMPERATURE CONTROLS

An appropriate form of temperature control must be used with all SilcoPad Tank Heating Systems. This is particularly important for all plastic tank applications and installations located in hazardous areas.

SilcoPad Tank Heating Systems installed on plastic tanks must be temperature controlled with a dual thermostat system. The primary thermostat controls the required tank temperature and the secondary thermostat acts as a high temperature cut out switch to prevent overheating and potential damage to the tank.

Use a type 2SPCP Controller for all un-classified area installations.

Use a type 2HSPCP Controller for all hazardous area installations *(consult cover page for details of hazardous area approvals and classifications).*

STEP 8

Mount the Temperature Controller as per Step 2. Actual mounting may require the installer to supply a suitable bracket, strapping or banding.

STEP 9

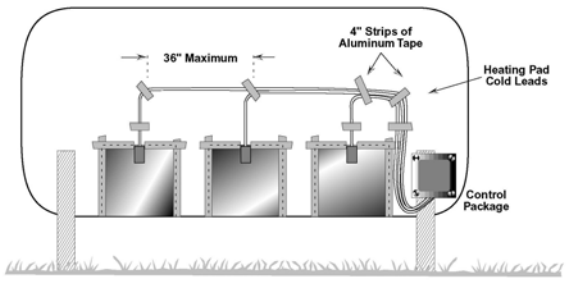
Run the cold lead cables from each heater pad to a common point below the Temperature Controller as shown in Figure 4. Cold lead cables can be routed in any direction across the tank surface. Do not route cold lead cables across the back surface of any heater pad(s). Cold lead cables should be securred to the tank surface using small strips of IAAT3 tape as shown in Figure 4.

STEP 10

Install one plastic entry fitting onto each cold lead cable and secure the fitting into the base of the Temperature Controller using one of pre-drilled holes. Approximately 6" of cold lead cable is required inside of the Temperature Controller for wiring and terminating purposes.

Repeat this procedure until all heater pad cold lead cables are securred in the Temperature Controller. Hole seals are provided to reseal any unused holes.

Figure 4 **Typical Routing and Installation of Heating Pad Cold Leads**



STEP 11

Use an Ohmmeter to check the resistance (Ω) of each SilcoPad heater. Table 1 shows the acceptable values for each type of SilcoPad heater.

STEP 12

Using a 500 VDC Megger, measure the insulation resistance (IR) value between the heater pad and the ground wire. Insulation resistance value must be 20MΩ minimum.

Do not proceed with any heater pad that records a resistance value outside of the tolerance values shown in Table 1.

Do not proceed with any heating pad that records an IR value less than 20MΩ.

Contact HTD in either instance before proceeding.

WIRING OF TEMPERATURE CONTROLLER

STEP 13

Consult Figures 5 and 6 to identify the correct wiring daigram for the Temperature Controller being used on your installation.

Connect the cold lead cables from each heater pad into the heater terminal blocks as shown in either Figure 5 or 6. Ensure all connections are tight.

The black (hot) lead and the white (neutral) lead on each SilcoPad heater are supplied with factory installed ring terminals. Connect ring terminals to designated terminal blocks as per the Wiring Diagram. The green (ground) lead should be connected to the grounding bar as per the Wiring Diagram.

STEP 14

Connect the incoming 120 VAC single phase power supply to the designated terminal blocks as per the Wiring Diagram.

No further "on site" wiring is required.

Type 2SPCP and 2HSPCP Temperature Controllers supplied by HTD are factory pre-wired, tested and all connections and wiring, other than those described in Steps 13 and 14, should not be touched or changed.

TABLE 1 - SilcoPad Resistance Values and Tolerances					
Pad size	Pad Ref	Watts	Volts	Nom Ω	Acceptable Ω range
14 x 30	SP 210	210	120	68.6	65.2 to 72.0
14 x 60	SP 420	420	120	34.3	32.6 to 36.0

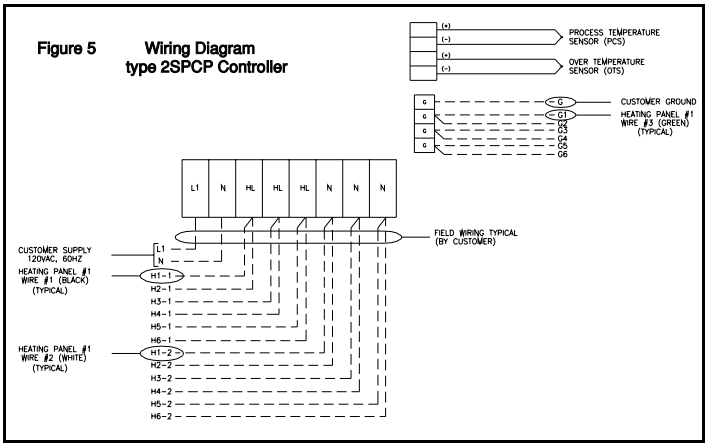


Figure 5 **Wiring Diagram type 2SPCP Controller**

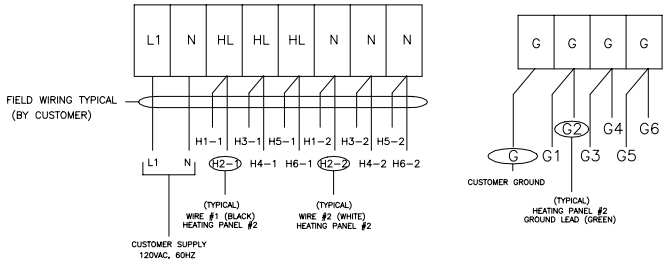


Figure 6 **Wiring Diagram for type 2HSPCP Controller**

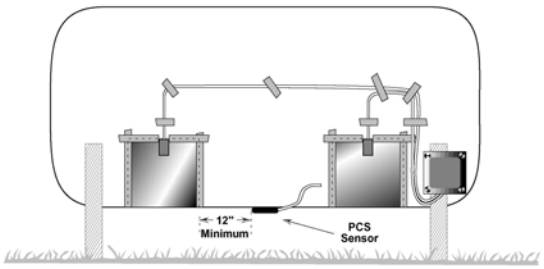
TEMPERATURE SENSOR LOCATIONS

Type 2SPCP Temperature Controllers are supplied with two thermocouple type sensors. Type 2HSPCP Temperature Controllers are supplied with two hazardous rated thermostats, each of which has a stainless steel capillary and sensing bulb.

The thermocouple sensors and the thermostat sensing bulbs must be correctly located and installed for the SilcoPad Tank Heating System to work effectively, efficiently and safely.

The reference "PCS" identifies the "Process Control Sensor". The reference "OTS" identifies the "Over Temperature Sensor". In Steps 15, 16 and 17 the references "PCS" and "OTS" can apply to either the thermocouple or bulb type sensor, depending upon which type of Temperature Controller is being used.

Figure 7 **PCS Temperature Sensor Location (Horizontal Tanks)**



Locate the PCS Temperature Sensor on the vertical center line of the tank, equidistant between two heating pads, but no closer than 12" to any heating pad.

STEP 15

The Temperature Sensor designated "PCS" (Process Control Sensor) must be located as per Figure 7 on horizontal tanks and Figure 8 for vertical tanks. Install the sensor as a shown in the Attachment Method detail below.

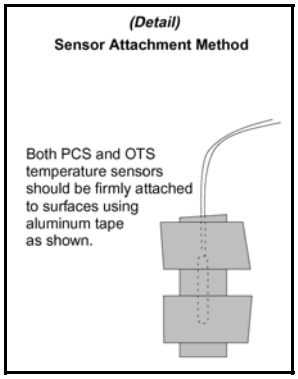
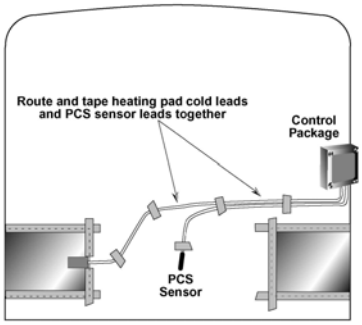


Figure 8 **PCS Temperature Sensor Location (Vertical Tanks)**

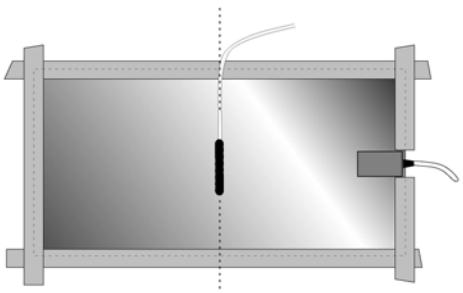


For vertical steel tank installations, locate the temperature sensor 15" from the base of the tank, equidistant between two heating pads but not closer than 12" to any one pad. For poly tanks, locate the sensor between 6" and 8" from any heating pad and 15" from the base of the tank.

STEP 16

The Temperature Sensor designated "OTS" (Over Temperature Sensor) must be located directly on the back of one of the installed SilcoPad heaters, in a central location as shown in Figure 8a. Install the sensor as shown in the Attachment Method detail above.

Figure 8a **OTS Temperature Sensor Location**



The OTS Temperature Sensor should be located in a central position directly on the back face of the selected heating pad and secured with aluminum tape. (See Detail opposite).

STEP 17

Route the leads / capillary tubes from the sensors as shown in Figures 7 and 8. Secure the leads / capillary tubes to the tank using strips of IAAT3 tape. Excess sensor lead or capillary tubing should be coiled neatly under the Temperature Controller and protected.

TEMPERATURE SETTINGS & OPERATION

TYPE 2SPCP

The PCS Controller should be set to the desired maintain temperature for the tank. The upper setting on the dial of this instrument is restricted to 100°F. Do not remove the restricting screw and set this dial past 100° F, unless your application requires a maintenance temperature higher than 100° F. **Do not set this dial past 120°F on any polyethylene or p olypropylene tank application.**

The OTS Controller has been factory set at 150° F. **Do not attempt to adjust this controller without prior discussion with HTD.**

TYPE 2HSPCP

The PCS Thermostat should be set at the desired maintain temperature for the tank. **On plastic tank applications, this setting must never be higher than 120° F.**

The OTS Thermostat should be set at 150° F for all applications.

After setting the PCS and OTS Thermostats, replace the "tamperproof cover" that fits over the thermostat dial and screw this into place such that further adjustments to the thermostats are restricted.

HEATING SYSTEM - ON / OFF INDICATION

The type 2SPCP and 2HSPCP Temperature Controllers are supplied with "Heat On" indicating lights. This light will only stay illuminated when the OTS Controller/Thermostat is permitting safe operation of the system and the PCS Controller / Thermostat is calling for heat. The "Heat On" light will not be illuminated when:

- The tank and tank contents have reached the desired maintain temperature and the PCS Controller/Thermostat is not calling for additional heat.
- The OTS Controller/Thermostat has sensed unusually high heater pad temperatures and has switched off the system
- There is no 120 vac power to the system
- The bulb inside of the "Heat On" indicating light has failed and requires replacing

The final two items on the above list will require site attention before normal safe operation of the system can resume.

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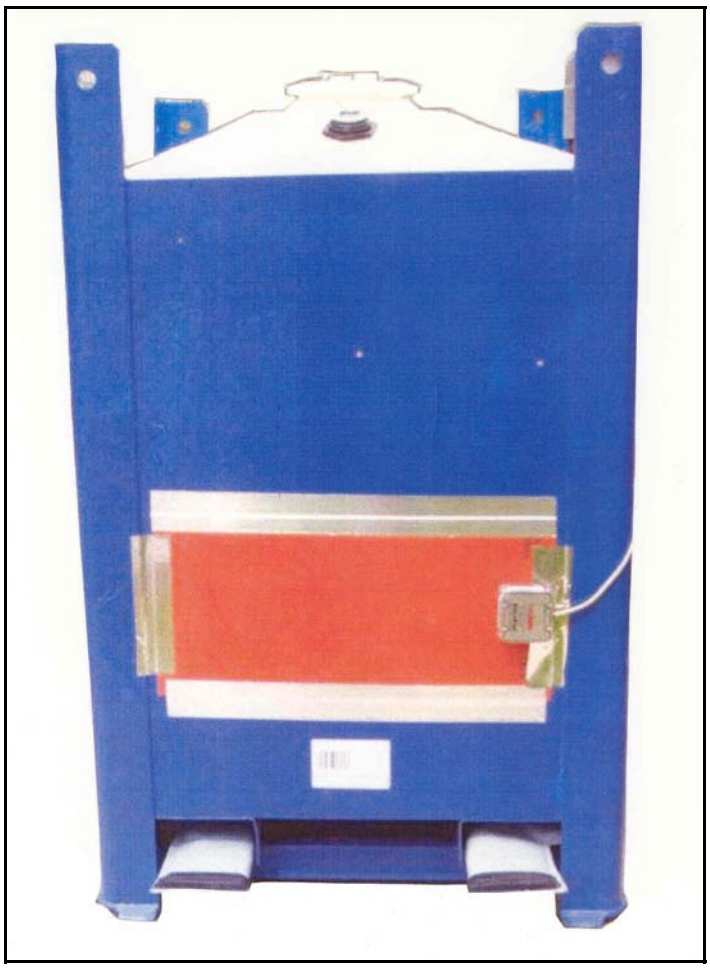
HEAT TRACE

SilcoPad



HEATER PADS FOR IBC TANKS

MADE IN THE U.S.A.

FM APPROVED

Class I, Div 2, Groups B, C & D
Class II, Div 2
Class III, Div 2
Tested and approved to IEEE 515 and NEC Standards.

SP-IBC-F-12/04

IBC Heating Kits

Silcopad

INTRODUCTION

Intermediate Bulk Containers (IBCs) are rapidly becoming the sensible alternative to the 55-gallon drum. This innovative, low cost fluid handling and storage system is easily transported from site to site and easily manouvered around a plant site for convenient positioning and usage.

IBCs are reusable, returnable and recylable, providing manufacturers, suppliers, distributors and end users with a flexible, cost effective, environmentally responsible fluid storage system.

IBCs are manufactured by several companies in several different styles. Some IBCs are simply a rectangular stainless steel tank on legs and some are polyethylene bottles held within a steel or mesh frame. Standard sizes with capacities up to 400 gallons are common.

IBCs are frequently located outdoors or in unheated warehouses. Many of the products, fluids or chemicals that are stored in IBCs will freeze during cold periods. HTD Heat Trace, Inc has developed a low watt density, safe and reliable heating kit that can be fitted directly to most standard sizes of IBC. This heating kit, used in conjunction with a thermal insulating blanket, will maintain IBC temperatures at or above 40°F (4°C) in ambient temperatures down to 0°F (-18°C).

STANDARD IBC HEATING KIT

The standard IBC Heating Kit consists of

- Four (4) SP 210 SilcoPad heater pads
- Fourty five feet (45') of IAAT3 sealing tape
- One (1) temperature controller

The standard IBC Heating Kit requires a 120 vac, 7 amp, single phase power feed.

CONTROLLER / KIT SELECTION

Use the following list to select the correct temperature controller for your application.

IBC design or style	Controller/Kit Ref Unclassified	Controller /Kit Ref Hazardous
All metal bin	1SPCP Kit Ref - IBC 1N	1HSPCP Kit Ref - IBC 1H
All metal bin with plastic storage liner	2SPCP Kit Ref - IBC 2N	2HSPCP Kit ref - IBC 2H
Metal mesh bin with plastic storage liner	2SPCP Kit Ref - IBC 3N	2HSPCP Kit Ref - IBC 3H
All plastic bin	2SPCP Kit Ref - IBC 2N	2HSPCP Kit ref - IBC 2H

* SilcoPad heaters and the 1HSPCP and 2HSPCP thermostats are FM approved for use in the following hazardous area classifications
Class I, Div 2, Groups B, C & D
Class II, Div 2
Class III, Div 2

INSTALLATION

Installation of an IBC Heating Kit is very simple. No special tools, knowledge or experience is needed and all four SilcoPad heaters can be installed by one person in less than one hour.

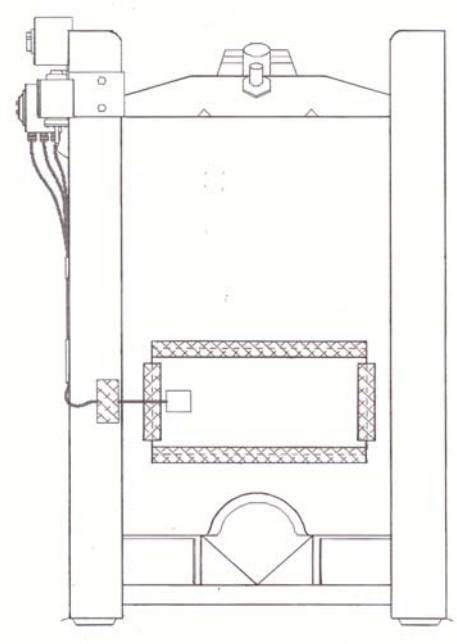
The 14 by 30 inch SilcoPad heater is supplied with adhesive backing protected by a "peel off" paper film. In the case of IBC Kits reference IBC -1N, 1H, 2N and 2H, the SilcoPad heater is positioned as shown in the Installation Instructions, the protective paper film is removed and the heater is stuck directly to the surface of the IBC bin. Strips of IAAT3 adhesive backed sealing tape are applied to all four edges of the installed pads and the heater pad cold leads are routed to location chosen for the temperature controller (see Sketch1).

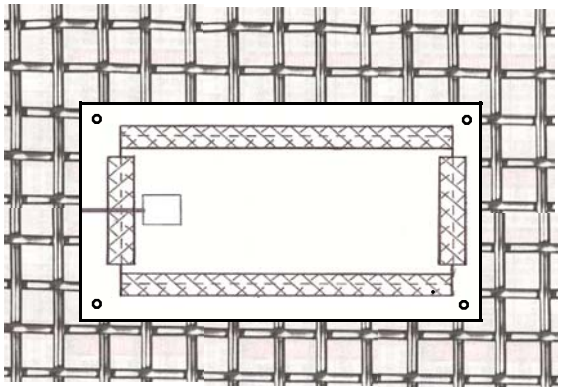
When using kit references IBC 3N or 3H, which are designed for installation on IBC's with an outer structure of metal mesh, the SilcoPad heaters are supplied pre-installed on aluminum plates and installer simply bolts the aluminum plate to the mesh structure of the IBC (see Sketch 2).

The temperature controller must be securely mounted to the IBC. HTD offers several mounting bracket designs for various styles of IBC. Alternatively, many customers use Unistrut components to attach the temperature controller to the IBC. After the temperature controller enclosure is mounted, the sensing bulb (or bulbs) from the controller are positioned as shown in the Installation Instructions and secured to the IBC surface with short strips of IAAT3 tape. Heater pad cold leads are connected into the designated terminal blocks inside of the temperature controller and installation of the kit is now complete.

Before using the IBC Heating Kit, the installer must connect a 120 vac 1ø power supply to the designated power terminal blocks inside of the temperature controller and the exterior of the IBC must be thermally insulated (discussed on following page).

SKETCH 1 Heater installed directly on IBC surface.





SKETCH 2. Heater pre-installed on aluminum plate for attachment to mesh structure of IBC

IBC Heating Kits

Silcopad

THERMAL INSULATION

IBC Heating Kits work in conjunction with thermal insulation. The number of heater pads used in the IBC Heating kit and the heating load applied to the tank are sized to compensate for the natural heat losses that take place through the thermal insulation from the tank surface to the surrounding ambient. Covering the IBC with an appropriate type and thickness of thermal insulation is an essential part of the heating system. Two basic approaches can be taken to thermally insulating the IBC:

- A simple and permanent method of thermally insulating the IBC is to spray the entire surfaces with polyurethane foam. A 2 inch thickness of polyurethane is ideal and this type of insulation system is normally applied by a local contractor. This is a permanent insulation syetm and should only be used on permanent IBC installations. Foam insulation should also not be used on IBC containors that have the mesh type support (cage) exterior.
- The most common and convenient method of insulating the IBC is to use a flexible insulation jacket. This is a factory fabricated, lightweight insulation bag system that covers the exterior of the IBC. The insulation jacket pieces are shaped to fit specific areas of the IBC and they attach to each other with Velcro straps to form one complete removable and reusable insulation system.

HTD Heat Trace, Inc manufacters several types and sizes of insulation jackets specifically designed as part of the overall IBC Heating Kit. Please discuss this with us when you are ordering the basic heating kit.

The opposite photograph shows the top and side sections of a flexible Insulation Jacket being fitted together onto a 400 gallon IBC Containor. This particular insulation jacket uses a 1 inch thickness of soft fiberglass insulation combined with a flexible outer bag of industrial grade, siliconized glass cloth. Other types of insulation and bag materials are available to meet the technical, environmental and cost considerations of your specific application.

Jacket installation is a simple, one-man job.

The mating edges of each section of the Insulation Jacket are fitted with Velcro fastening strips. As shown in the photograph and insert, each section is simply placed into position on the IBC and literally "zipped" together in seconds.

Removal and replacement is just as quick and simple.

Please contact us if we can help you with your future IBC heating and thermal insulation requirements.

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HEAT TRACE

HOPPER HEATING PRODUCTS AND SYSTEMS

Flyash, dust and powder hopper heating systems for temperature maintenance applications up to 700° F (371° C)

HEAT TRACE

TYPE HB HEATING MODULE SYSTEMS

AN INTRODUCTION TO THE APPLICATION AND REQUIRMENTS FOR THE HEATING OF FLYASH COLLECTION HOPPERS ON ELECTROSTATIC PRECIPITATORS AND FABRIC FILTERS

FM APPROVED

CSA®

HB-OVERVIEW-F-12/04

HEAT TRACE

HOPPER HEAT TRACING

A short overview of the Problem, the Results and the Solution

General

The inclusion of high performance air pollution control equipment is a mandatory consideration in the design of new fossil-fired power plants or the upgrading and retrofitting of existing fossil-fired power plants. Identical considerations are also mandatory for most industrial boiler installations that burn fossil fuels. The two major Air Pollution Control equipment choices are:

- The Electrostatic Precipitator
- The Baghouse or Fabric Filter

The following discourse centers around the Electrostatic Precipitator. The problem and solution, however, are applicable to Baghouses, Fabric Filters and other forms of Air Pollution Control Equipment.

The Problem

The hot flue gases from the boiler enter the Precipitator at temperatures ranging from 250 to 400° F. The hot flue gases are carrying particles of dust known as flyash, which are the remains of burning fossil fuels. The flyash-laden gases are directed by mechanical veins over a series of electrically charged collecting plates. The electrical charge causes the flyash to adhere to the collecting plates.

The cleaned gases exit the Precipitator and enter the plant stack for eventual release into the atmosphere.

Thermal profiles from the top to the bottom of several Precipitator casings were measured and each thermal profile showed a reducing temperature gradient. This is caused by:

- *Natural Convection* - hot gases are naturally carried upwards within the Precipitator casing.
- *Induced Convection* - resulting from the hot gases being redirected by baffles and veins away from the collection hoppers and upwards into the Precipitator casing.

The net effect of the natural and induced convection creates a stagnant gas condition within the flyash collection hoppers

The application of thermal insulation to the exterior of the flyash collection hoppers cannot prevent the stagnant gases from cooling. As the gas temperature falls the "dew point" is reached and condensation begins to form on the flyash collection hopper walls. Continued cooling of the flue gases may also result in the temperature falling to the "moisture dew point" which results in increased levels of condensation. Typical flue gas dew point temperatures range from 250 to 350°F with coal fired boilers and 300 to 400°F with oil fired boilers. Moisture dew points vary between 100 to 180°F.

Once condensation has taken place, two problems exist:

- The condensate is usually a mild sulfuric acid resulting in corrosion and pitting of the collection hoppers.
- The flyash falling into the collection hoppers is a very hygroscopic material and as it mixes with the condensate, it quickly changes from a free-flowing, dry dust into a thick, immobile mud.

The second problem listed is by far the most serious, expensive and far-reaching for plant operators.

When the flyash agglomerates, it quickly builds up in the lower areas of the collection hopper and quickly blocks the hopper outlet (throat). This blockage must be immediately removed because continued build up of flyash can cause:

- Structural damage to the Precipitator due to increased and unanticipated weight factors (*hoppers have been torn from casings).*
- Arcing and shorting of the high voltage electrode system, resulting in reduced operating efficiencies, fires within the Precipitator and significant and expensive repairs *(several Precipitators have been completely destroyed by hopper fires*).

It is, therefore, imperative that collection hoppers always remain clear, essentially acting as a funnel to carry the collected flyash directly into the flyash conveying system.

The obvious solution to this overall problem is to *eliminate the condensation.* If this is achieved, the flyash remains in a dry, free-flowing state and can be easily evacuated from the hoppers and moved through the ash conveying system.

The elimination of condensation cannot be achieved by merely insulating the collection hoppers. The answer is very basic - **HEAT THE HOPPERS**.

Before any type of heater can be selected, there is one major consideration to be made: How much heat is required to prevent the condensation?

Computerized heat loss programs have been developed and used by HTD for over twenty years. These programs include allowances for hopper manways, strike plates, vibrators and other forms of protuberances that are directly attached to the hopper surfaces. Empirically established data also allows for hopper preheating prior to start up of the Precipitator.

HTD Heat Trace, Inc. offers free consultancy, design and engineering services on all flyash hopper heating applications. Please consult HTD to determine the correct kW load for your hopper heating application.

The Product.

Over the last 40 years there have been four major styles of heating equipment used on flyash hopper heating applications. These are:

- Mineral Insulated (MI) Heating Cable.
- Rod or Hairpin style heaters.
- Strip Heaters and rigid metal heating modules.
- Flexible faced heating modules.

The Mineral Insulated or MI Heating Cable is a semi rigid, metal sheathed cable with a single or dual, round resistance wire element that is packed in magnesium oxide. It is suitable for the application temperatures, it can be purchased in fixed circuit lengths to suit various system designs and it can be applied to the hopper surfaces such that all heating cable circuits can be routed to terminate at one point on the hopper.

Experience has shown that MI Heating Cables are not the ideal type of heater for use on flyash hopper heating applications. The heating cable is round, and at best, only offers tangential point contact with the hopper surface. Lack of surface contact results in overheating and hot spots on the cable. MI Heating Cables are also very difficult to install on flat hopper surfaces and fixing clips are required every 6 to 12 inches. The crossing of hopper stiffeners is a particularly acute problem and heater failure due to stress or overheating is common when the cable does not have intimate contact with a highly conductive metal heat sink.

The Rod or Hairpin style heater is essentially an MI Heating Cable in a rigid form. These heaters are available in lengths from 12 to 60 inches with various kW ratings and voltage options. The Rod or Hairpin style heater can meet the temperature requirements for flyash hopper heating applications.

The major drawback with the Rod or Hairpin style heater is it must be installed in the air cavity between the hopper surfaces and the inner face of the hopper insulation. The thermal design concept is convective, and the Rod or Hairpin heater is used to create an oven, with air being convected across and around the exterior of the hopper. Energy consumption and operating costs are extremely high and heat is continually being convected away from the lower areas of the hopper where condensation and pluggage are most likely to occur. To compensate for this inefficiency, the heating system operates continually, resulting in frequent heater burnouts and replacements

The Strip Heater and the rigid metal heating module are basically resistance alloy heating elements contained within a rigid metal enclosure. Both heater styles are suitable for the application temperature and conditions and they are available in varying lengths, widths, ratings and voltages to suit individual applications.

The major problem with this style of heater is the rigid construction only permits effective surface contact when the installation surface is completely flat. Flyash hopper surfaces are never completely flat. Plate distortions and weld seams are common examples of the surface irregularities found on flyash hoppers. The installation of Strip Heaters and rigid metal modules on conventional Precipitator, Baghouse and Fabric Filter hoppers will always involve locations where air gaps between heater and hopper exist. The thermal design concept of the Strip Heater and rigid metal heating module is conduction and any lack of contact between the heater and the hopper will result in reduced efficiency, increased heater operating temperatures, hot spots and potential heater failures.

The flexible faced heating module, exclusively known as the **Type HB Heating Module** was developed by the Heat Tracing Division of Cooperheat, Inc. in 1976. The product and system were specifically engineered and developed to address and eliminate the known problems identified with the four other styles of hopper heaters described previously.

The HB Heating Module System has now been successfully used on many hundreds of major power and industrial flyash hopper heating projects around the world. Many of our earlier installations have over 20 years of satisfactory, trouble free operation.

The HB Heating Module and System

The heat source of the HB Heating Module is a flat foil, low watt density heating element. The flat foils are sewn into a multi-layer construction of high temperature glass cloth to form a heating blanket. The heating blanket is combined with thermal insulation and aluminum mounting pan to form one, easily installed modular unit.

The right image shows the aluminum back surface of the HB Heating Module, complete with a letter designation to identify heater location within the system.

The left image shows the flexible heater face that is unique to the HB Heating Module.

The ***flexible, cushion-like heater face*** completely eliminates the single point contact problem inherent with the use of MI Heating Cable and the air gap problems consistently found with the use of Strip Heaters and rigid metal heating modules. The ability of the flexible heater face to conform to the uneven hopper surface guarantees continual and intimate contact between heater and hopper surface. ***Heat conduction is maximized*** over the entire heater area and the HB Heating Module operates at optimum efficiency, eliminating the high energy consumption and operating costs associated with the Rod or Hairpin style heaters.

The thermal design concept of the heater and system is based exclusively on conduction. ***Each HB Heating Module is customized to cover the maximum hopper plate area between stiffeners.*** Optimum levels of conduction are achieved throughout the entire heating system and the potential for cold spots and condensation in the lower areas of the hopper is eliminated.

The use of standard sized heating modules is not recommended on flyash hopper heating applications. Failure to provide maximum levels of direct heater coverage in the lower areas of the hopper will result in cold spots and the potential for condensation in the area of the hopper most prone to "bridging and pluggage"

The reliability and life expectancy of hopper heaters is directly related to their power density.

An (externally) insulated hopper that is (internally) full of flyash, basically creates a totally insulated and sealed operating environment for the hopper heater. Flyash has a K factor that is comparable to many types of low grade insulation material, therefore, the hopper heater is basically sandwiched between layers of thermal insulation.

Conventional heaters quickly fail under these unique and severe operating conditions. Normal heater power densities must be reduced to a level that will permit safe heater operation even when conduction through the hopper skin is severely limited. (i.e. when the hopper is full or partially full of flyash).

The HB Heating Module has a maximum design power density of 2.5 w/sq.in. for all flyash hopper heating applications. Extensive testing in 1976 established that this level of power is not harmful to the construction or materials of the HB Heating Module ***even when the heater is operating under completely uncontrolled conditions***.

The HB Heating Module is an ULTRA LOW WATT DENSITY heating product and system that is specifically rated for safe reliable operation on EMPTY, PARTIALLY FULL OR FULL flyash collection hoppers.

The Heat Tracing Division of Cooperheat, Inc was purchased in 1995, as part of a management buyout program. Type HB Heating Module Systems are now designed and manufactured *exclusively* in the USA by HTD Heat Trace, Inc at our Whitehouse, NJ headquarters. All design and manufacturing is conducted in complete accordance with IEEE Standard 1069-1991 and the HB Heating Module was retested, certified and approved by Factory Mutual in 2003 to this current industry standard . The HB Heating Module is also CSA approved to the current Canadian standards.

The problem of hopper pluggage due to flue gas condensation is recognized as one of biggest maintenance expenditures associated with the operation of Precipitators, Baghouses and Fabric Filters at fossil fired power and industrial plants.

HTD Heat Trace, Inc and the HB Heating Module System can help you eliminate such problems and expenditures.

Please contact us for further details, information and engineering support.

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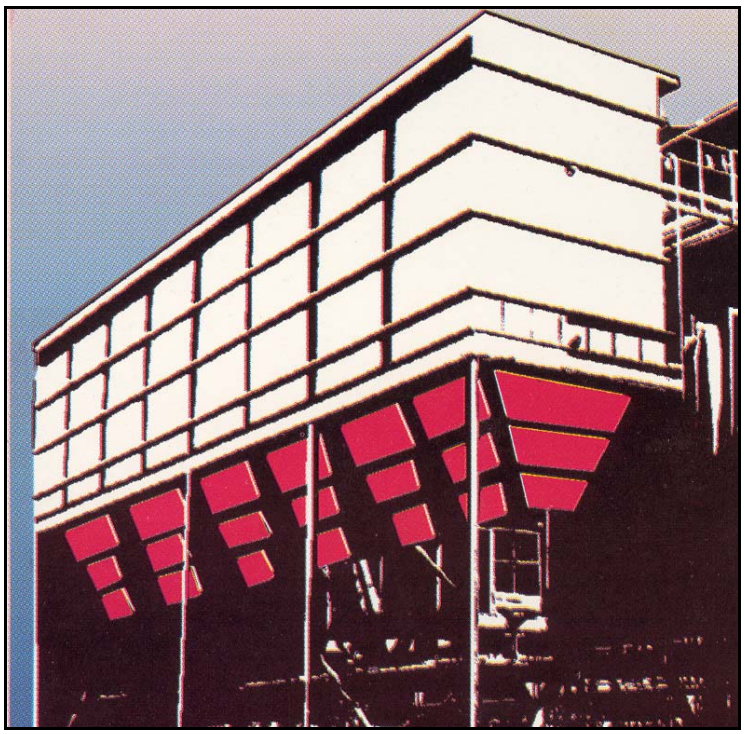
HEAT TRACE

HB HEATING MODULE



FLYASH HOPPER HEATING SYSTEMS

FM APPROVED

CSA®

HB-SALESLIT-F-12/04

INTRODUCTION

The objective of this brochure is to outline HTD's solution to a very serious and expensive problem that exists for most power plants and industrial boiler installations that burn fossil fuels.

These plants typically use Electrostatic Precipitators, Baghouses, Fabric Filters or other forms of Air Pollution Control Equipment to clean the dirty flue gases from the boiler before they can be vented to the atmosphere.

During the gas cleaning process, flyash is extracted from the gas stream and directed to collection hoppers prior to disposal. The problem outlined in this brochure and addressed by this product and system is HOPPER PLUGGAGE due to condensation in the flyash collection hoppers.

Condensation occurs in the flyash collection hoppers when the hot flue gases are allowed to cool to temperatures below dew point. Flue gas dew point temperatures vary between 250 to 350° F for coal fired boilers and between 300 to 400° F for oil fired boilers. When condensation forms in the collection hoppers, the dry, normally smooth-flowing flyash quickly turns into a thick, pastelike, immobile mud. The hopper throat area rapidly becomes blocked and evacuation of the flyash from the hopper becomes impossible. Depending upon the style of Air Pollution Control Equipment being used, continued build up of flyash within collection hoppers that are "blocked" can result in :

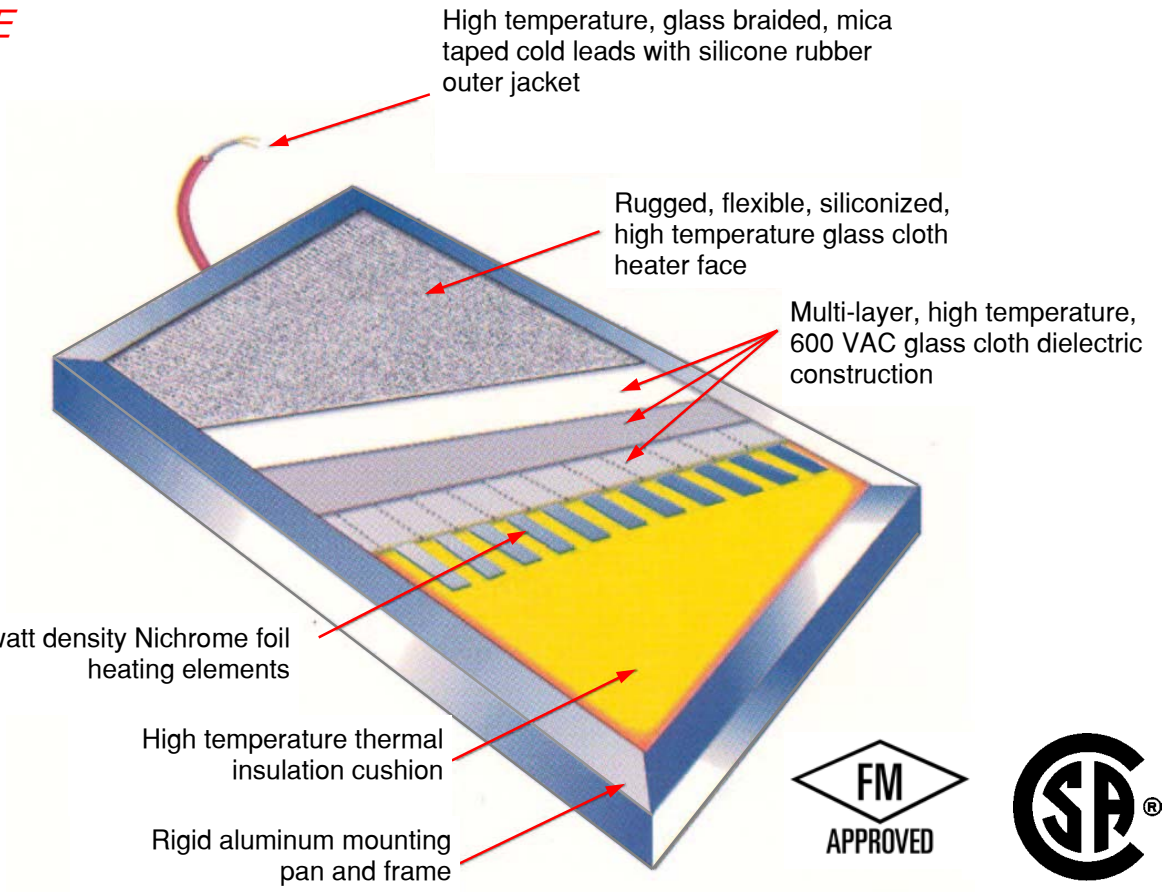
- *Shorting of high voltage buss sections*
- *Hopper fires*
- *Structural damage to, or actual destruction of the collection unit (Precipitator, Baghouse etc)*
- *The necessity to use plant personnel to manually clean out the collection hoppers.*

The HB Heating Module System was developed and introduced in 1976 when HTD Heat Trace, Inc operated as the Heat Tracing Division of Cooperheat. The product and heating system were exclusively developed to address the unique and specific requirements for the prevention of condensation in flyash hoppers.

The HB Heating Module System has been successfully used on hundreds of major power and industrial Air Pollution Control Projects around the world. Many HB Heating Module Systems installed over 25 years ago are still performing perfectly today without any heater failures.

There is no competitive heater or system that can offer or rival the EFFECTIVE and PROVEN performance of the HB Heating Module and System.

THE H B HEATING MODULE



PRODUCT SPECIFICATIONS

Maximum operating temperature	850° F
Service voltage	Up to 600 VAC
Power Density	Up to 360 w/sq.ft
Module sizing	Customized to suit area being heated

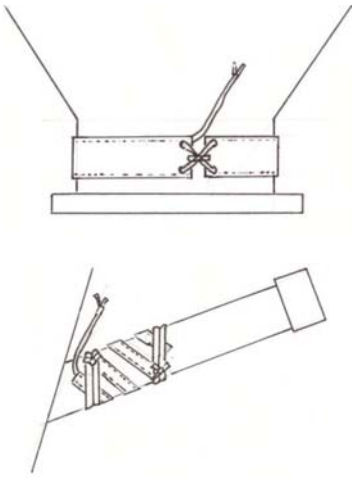
SYSTEM COMPONENTS

HB Heating Module Systems can be designed and engineered for any size and number of hoppers. No application is too small or too large. HTD has successfully engineered and supplied hundreds of small industrial installations involving just one or two hoppers and a few kilowatts. Equally, HTD has engineered and supplied most of the largest hopper heating installations in the world, involving several hundred individual systems and connected loads up to 4 Megawatts.

Every system is custom engineered to meet the exact needs of each project and the complete hopper heating package may consist of HB Heating Modules, mounting hardware, flexible throat and poke tube heaters, power junction boxes, temperature controllers, control and monitoring panels and power distribution cabinets.

HB HEATING MODULE

FLEXIBLE HEATERS

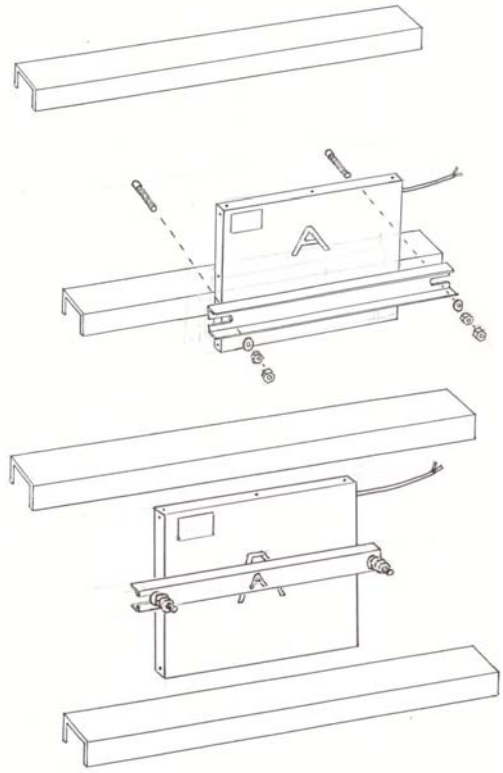


The coldest and narrowest part of any hopper is the throat. Frequently, this is the first part of the hopper to experience condensation and it is the first area within the hopper to be plugged with wet flyash. HTD designs and manufactures flexible, wrap-around heaters to provide supplemental heat directly to this critical area. Arguably, the flexible Throat Heater may be the most important single heater in the total heating system.

Poke tubes are also significant heat sinks that promote condensation near to the hopper throat area. Flexible, wrap-around Poke Tube Heaters are also offered to address this specific area and problem.

Throat and Poke Tube Heaters are custom sized for each application and they are supplied with custom length cold leads that route directly to the main Hopper Heater Power Junction Box for connection into the HB Heating Module System.

LOW COST, EFFECTIVE INSTALLATION



The installation of HB Heating Modules systems is quick and simple, requiring no special tools, equipment or knowledge.

Depending upon size, each HB Heating Module is supplied with one or more aluminum mounting channels that are pre-slotted to fit over mounting studs that are spot welded to the hopper surface. Templates are provided to pinpoint exact stud locations and each mounting channel is marked to match the HB Heating Module being installed. All mounting hardware, including studs, nuts and washers are supplied with the system.

The installation method used with the HB Heating Module is a very effective factor in the performance of the heating system. As the nuts are tightened, pressure is exerted on the mounting channel, which in turn presses the flexible face of the HB Heating Module onto the hopper surface. This uniform compression forces the "cushion-like" heater face to conform to any and all dents and undulations in the hopper surface such that intimate contact between heater face and hopper surface is continually maintained. This continual contact between heater and hopper ensures fast, high levels of heat conduction directly into the hopper.

Uniform conduction of heat through and across the skin of the hopper is fundamental to the elimination of cold spots on the inside surfaces of the hopper. If there are no cold spots within the hopper, condensation cannot take place, the flyash stays dry and the potential for hopper pluggage is eliminated

Since 1976, through every facet from conceptual design, physical design, material and manufacturing quality to installation simpicity, the HB Heating Module System continues to prove why it is the most viable, safe, effective and reliable solution to flyash hopper pluggage.

Please contact us if we can help you with this problem.

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HB

HB Heating Module

For temperature maintenance applications of Flyash hoppers on Electrostatic Precipitators, Baghouses, Fabric Filters and other forms of dust collectors

- *Specifically designed for safe, reliable operation on Flyash and dust collection hoppers*
- *Low watt density, high efficiency, flexible faced heating system*
- *Custom sized heaters to provide uniform heating in the lower areas of the hopper*
- *Quick, simple, low cost installation*
- *Proven performance, with over 300 major installations worldwide*
- *FM and CSA approved to all current IEEE, NEC and Canadian Standards*

The type HB Heating Module and HB Heating Module System were initially developed in 1976 by the Heat Tracing Division of Cooperheat, Inc.

The product and system are specifically designed to maintain elevated temperatures within Flyash collection hoppers on Electrostatic Precipitators, Baghouses, Fabric Filiters and other forms of dust collectors.

The HB Heating Module System is custom designed to provide low watt density, unifom heating over the lower areas of the hopper. Thermal sizing is based upon maintaining a temperature above the dew point of the incoming flue gases such that condensation cannot occur. The elimination of condensation ensures that the Flyash (or dust) being collected will remain in a dry, free-flowing condition such that the hoppers do not plug.

HTD Heat Trace, Inc. purchased the Heat Tracing Division of Cooperheat in 1996.

Since 1976, Cooperheat and HTD have successfully designed, engineeered and supplied over three hundred HB Heating Module Systems for use on many major power and Industrial projects around the world. Many of these installations have now been operating successfully and effectively for over 25 years.

The HB Heating Module was initially FM Approved in 1980 and retested and reapproved to current FM, IEEE and NEC standards in 2003. This product was also approved by CSA in 2003 to current Canadian standards.

The above photograph shows the front and back surfaces of the HB Heating Module. The lower image shows the unique flexible heater face of gray, siliconized glass cloth . The upper image shows the aluminum back face with 2 " high letter designation that will identify the specific location of this module within the heating system design and layout.

For further information, please contact us at our New Jersey, USA headquarters.

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SPECIFICATIONS

PRODUCT FEATURES

FLAT FOIL HEATING ELEMENTS	To provide uniform and efficient heat distribution over the total area of the heating module.
LOW WATT DENSITY	HB Heating Modules can operate safely and reliably on insulated hoppers full of Flyash without fear of overheating or burnout.
FLEXIBLE HEATER FACE	Hopper surfaces are never completely flat. Unlike metal faced heating modules, the flexible heater face of the HB Heating Module will easily conform to surface irregularities such that intimate contact between the heater and the hopper is always maintained. Air gaps between the heater face and the hopper surface result in reduced heat transfer capability, heating module overheating and heater failures.

SYSTEM FEATURES

CUSTOM SIZING	HB Heating modules are custom sized to fit each individual area of the hopper being heated. Standard size heating modules leave cold spots on the inner surface of the hopper resulting in random areas of condensation, Flyash build up and potential hopper pluggage.
PARALLEL CIRCUITRY	The majority of H B Heating Modules within the system will be designed as single phase heaters for direct connection in parallel with the 3 phase power supply. In this type of system design, damage to one heater only results in the loss of one heater. Competitive style systems use several heating modules that are connected in a series chain. In a series connected system, damage to just one heater results in the loss of all of the heaters connected in the series chain.
CUSTOM COLD LEAD LENGTHS	Each HB Heating Module is supplied with a custom length of cold lead cable that will reach directly to the hopper heater junction box. Standard length cold leads require the use of splices which can result in overheating and burnout problems.
FLEXIBLE HEATERS	Flexible , wrap-around throat and poke tube heaters are used to heat critical heat loss areas where heating modules cannot be fitted.

MECHANICAL CONSTRUCTION

MOUNTING PAN	22 gauge aluminum
MODULE FRAME	¾ by ¾ inch aluminum angle
MOUNTING CHANNELS	1 by 2 inch aluminum channel

ELECTRICAL CONSTRUCTION

HEATING ELEMENTS	80/20 Nichrome foils
CIRCUIT CONNECTIONS	Stainless steel bridge pieces continuous spot welded with triple welding passes
INTERNAL DIELECTRIC CONSTRUCTION	Five individulal layers of high temperature woven glass cloth
EXTERNAL DIELECTRIC CONSTRUCTION	One layer of woven glass cloth with impregnated silicone rubber moisture barrier
COLD LEAD CONDUCTORS	Two 16 AWG, stranded, nickel coated copper conductors with 600 vac rated, mica tape wrapped and fiberglass braided insulation
COLD LEAD JACKET	Extruded silicone rubber

DESIGN RATINGS

TEMPERATURE RANGE	-40°F to 850°F
VOLTAGE RANGE	Up to 600 VAC
POWER DENSITY	Up to 2.5 w/sq.in (360 w/sq.ft) (dependent upon application)

PHYSICAL FEATURES

CUSTOM SIZING	From 6 by 6 inches up to 24 by 72 inches
WEIGHT	Approximately 2 lbs/sq/ft

APPROVALS & STANDARDS

FM APPROVED

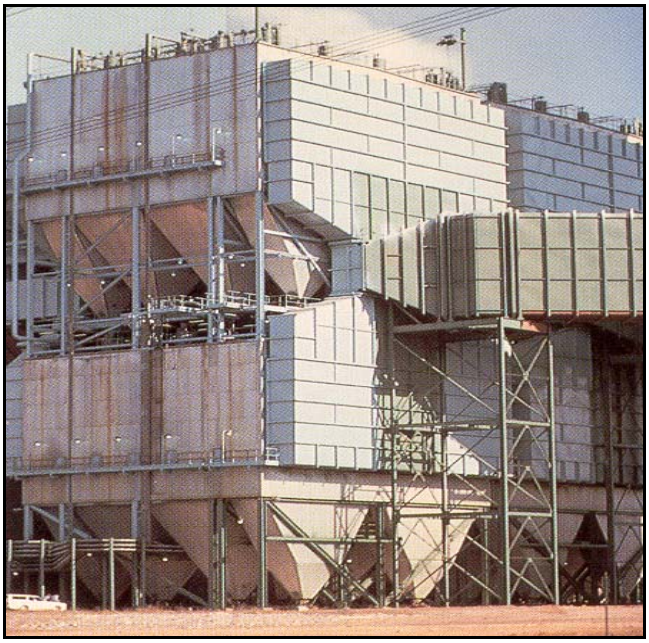
CSA

Dry, protected un-classified areas
Retested and recertified in 2003 to current IEEE, NEC and Canadian standards

HEAT TRACE

HB HEATING MODULE SYSTEMS

RECOMMENDED SPECIFICATION



FLY ASH HOPPER HEATING APPLICATIONS ON ELECTROSTATIC PRECIPITATORS, BAGHOUSES, FABRIC FILTERS AND OTHER TYPES OF DUST COLLECTORS

FM APPROVED

CSA®

HB SPEC-F-12/04

RECOMMENDED SPECIFICATION

FLYASH HOPPER HEATING SYSTEMS

For normal temperature maintenance and 150°F start up conditions

1.0 Scope

This specification is intended to define the parameters for the design of flyash hopper heating systems for flue gas particulate (flyash) removal equipment.

2.0 Hopper Heating System General

The vendor shall design, specify and provide a heating system for the particulate (flyash) collection hoppers that is capable of meeting the criteria in all sections of this specification.

The heating equipment and system shall be FM (Factory Mutual) and CSA approved and comply with the requirements of IEEE Standard 1069-1991, IEEE Standard 515-1997 and the current requirements of the US and Canadian National Electric Codes.

3.0 System Design Requirements

The hopper heating system shall be capable of maintaining a hopper skin temperature of (*insert*) ºF, as measured 30 inches above the hopper throat during normal operation.

During start up and shutdown periods, the heating system shall also be capable of preheating the hoppers to a ΔT of 150°F above ambient in all areas directly covered by heating modules. *Preheat temperature requirements shall be reached in a maximum of 8 hours*.

The heating system shall be designed for operation in a minimum ambient temperature of (*insert*)°F

The normal flue gas temperature will be (*insert*)°F

The anticipated dew point of the flue gas will be (*insert*)°F.

The maximum anticipated hopper excursion temperature will be (*insert*) °F.

The hopper shall be thermally insulated with a (*insert*) inch thickness of (*insert*)type insulation.

The maximum anticipated wind speed will be (*insert*) mph.

The design safety factor shall be (*insert*) %

The heating system shall be designed to provide a balanced load, operating directly on a (*insert*) VAC (*insert*) phase power supply.

Heater sizes shall be customized to provide maximum heater coverage and eliminate cold spots.

The heating system shall include a flexible throat heater to provide direct heat to the hopper outlet.

4.0 Equipment Specifications

The equipment shall be low watt density surface heating equipment, as specified in Section 5.0

The equipment shall be modular in design to simplify installation and minimize installation costs.

The equipment shall have a flexible heater face to ensure continuous and intimate contact with the irregular hopper surfaces.

The equipment shall be designed to withstand the natural and induced vibration associated with the normal operation of flyash collection systems, including the shock loading generated by operator actions on strike plates and pounding anvils.

Heating equipment, including heater cold leads shall be moisture resistant.

Heating systems shall be individually packed such that all of the heaters for one hopper are contained within one carton. *This requirement will simplify installation, reduce erection times and costs and avoid excessive handling and potential damage.*

The equipment shall be designed and rated to provide a service life in excess of 20 years.

5.0 Heater Design

Each heater shall be of the modular design, with heating element, electrical insulation materials, thermal insulation, heater cold leads and mounting pan assembled and supplied as one unit. *Strip Heaters, Rod Heaters, MI Cable and Rigid Metal Module style heaters are unacceptable.*

The heating module shall be constructed of high temperature materials capable of withstanding 850°F.

The heating element material shall be a Ni-Chrome resistance alloy, used in a flat foil or ribbon configuration to provide maximum and uniform distribution of heat across the entire heating surface in contact with the hopper. *Wire and mesh type heating elements are not acceptable.*

Heating element circuitry shall be configured and connected to provide a low watt density, uniformly distributed heat source within each heating module. Low watt density design is a critical qualification for reliable heater operation on flyash hoppers and *heating module watt densities in excess of 360 watts/sq.ft (2.5 w/sq.in) are totally unacceptable.*

Each heating module shall have a high temperature, *non metallic*, glass cloth heater face, designed and constructed such that continuous and intimate contact between the heater face and the uneven and irregular hopper surface can be guaranteed. *Strip Heaters and heating modules with any form of rigid metal heater face are not acceptable*.

Heating module cold lead cables shall consist of two 600 volt rated, fiberglass insulated conductors, combined within an outer (sacrificial) jacket of silicone rubber *that provides moisture and climatic protection during storage, pre-installation and pre-commissioning periods. Non - jacketed, fiberglass insulated conductors are not acceptable.*

Heating module cold leads shall be customized lengths that extend from the heating module to the power junction box *without splices*.

Each heating module shall have a 2 inch high designation letter that shall be used to identify the heating module characteristics, values and installation position on the hopper, as shown on the system layout drawing.

Heating modules shall be supplied with one (or more) aluminum mounting channels, mounting studs, nuts and washers. Each mounting channel shall also be labeled with a 2 inch high letter that matches the letter designation of the heating module to be installed.

6.0 System Design

The heating module system design and layout shall provide *maximum heater coverage in the lower areas of the hopper, including a flexible throat heater for direct heating of the hopper outlet*.

The total kW installed on each hopper shall be uniformly distributed over the total area of heating module being supplied. The heating modules shall provide *uniform power output and evenly distributed heating throughout the system.*

The heating module system shall be designed with the *maximum number of individual heating modules operating directly on the line voltage*. Series connected heating modules are acceptable only in limited instances. *Under no circumstances shall the combined total kW load on one complete chain of series connected heating modules exceed 15% of the total system load.*

All series connections shall be completed within the Power Junction Box. Splice type series connections under the hopper insulation are not acceptable.

Heating systems that consist exclusively of heating modules connected in series chains are totally unacceptable.

Heating system vendor shall be responsible for the design and supply of a complete system, including heating modules, heating module mounting hardware and heating module mounting stud location templates.

Each hopper heating system shall be supplied with (a minimum of) one Power Junction Box to facilitate the connection of the heating modules to the power supply.

A custom designed mounting bracket shall be supplied with each Power Junction Box. This bracket shall be welded to the hopper surface to support the Power Junction Box at its designated location outside of the hopper insulation. Each mounting bracket shall incorporate conduit tubes that provide safe, protected routing for the heating module cold leads to pass from the hopper surface, through the hopper insulation and cladding and into the Power Junction Box.

Heating system layout drawings and wiring diagrams shall be supplied by the vendor. These drawings shall show the physical size of each heating module complete with ohm, watts and voltage values. Layout drawings must also show each heating module located in its designated position on the hopper, complete with the cold lead exit point and cold lead length.

The system wiring diagram shall show how each heating module is connected with the specified power supply, including individual phase connections and balancing details for 3Ø power supplies.

All 3Ø power supplies shall be balanced as closely as possible.

The contents of this document have been used by many Engineering Companies and End Users to specify the unique product and system featureses sential for the purchase, supply and installation of safe, effective and reliable flyash and dust hopper heating sys tems.

The HB Heating Module System has been specified and successfully used on many hundreds of major Power and Industrial installations around the world.

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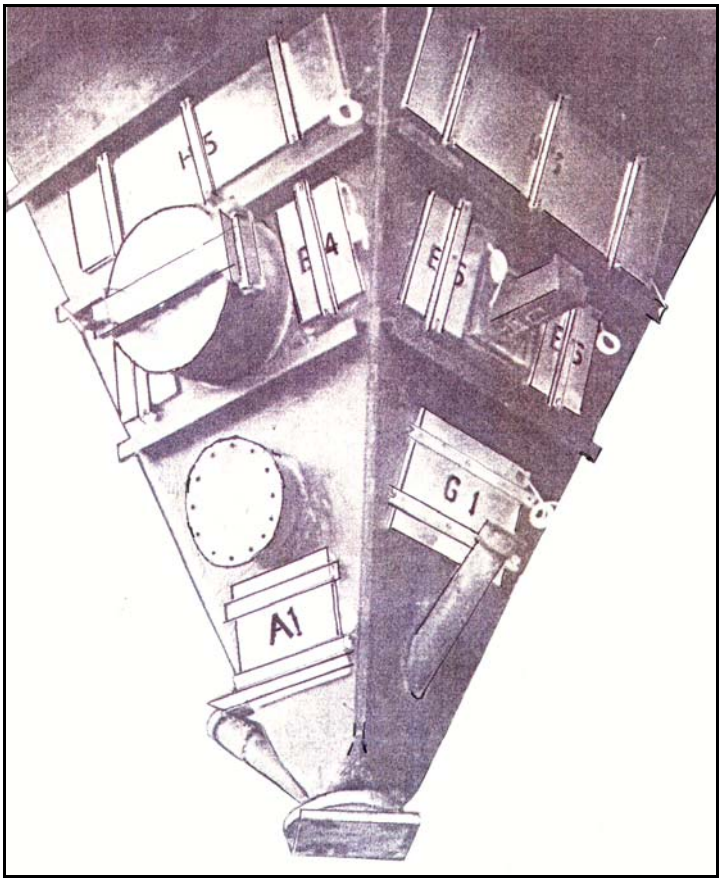
HEAT TRACE

HB HEATING MODULE

INSTALLATION INSTRUCTIONS



FLYASH HOPPER HEATING SYSTEMS

FM APPROVED

When installed in accordance with the National Electrical Code.

When installed in accordance with the Canadian Electric Code

HB INST INSTRUCTIONS-F-12/04

INTRODUCTION

Type HB Heating Modules and Systems are custom designed to fit the configuration of the hopper to be heated. A *basic* system will consist of heating modules, aluminum mounting channels , mounting studs, nuts and washers. Flexible throat heaters to fit cylindrical throat outlets or poke tubes may also be part of the system design. Optional accessories such as Power Junction Boxes, Thermostats, Control and Monitoring Panels and Distribution Panels are all available to provide a package design to meet the needs of each client, application and budget.

The following instructions are guidelines for the installation of a *basic* HB Heating Module System. *Before commencing any installation, the installer must also consult the Heating System Layout drawings, Wiring Diagrams and Operation and Maintenance Manuals supplied by HTD Heat Trace on every project.*

STORAGE AND HANDLING

Individual HB Heating Modules and / or systems must be stored indoors in dry, clean conditions in their original shipping carton(s) until the installer is ready to commence the actual installation.

HB Heating Module Systems are normally packed and shipped in their own individual shipping and storage carton, such that each system can be taken directly to the hopper and installed. Remaining systems should be left in storage until needed. Any heating modules that cannot be installed by the end of the working day should be returned to their shipping carton and placed back into storage until needed.

Do not leave any heating modules (either installed or un-installed) outdoors without adequate climatic protection.

PRELIMINARY STEPS

Compare the Heating System Layout drawing to the actual hopper. Ensure that all hopper accessories/appurtenances such as manways, poke tubes, strike plates, fluidizers, etc. are all physically located as shown on the Heating System Layout drawing. Also ensure that there are no additional hopper accessories or appurtenances that will interfere with the HB Heating Module locations as shown on the Heating System Layout drawing.

Identify the location for the Power Junction Box. At this time (if this optional accessory has been purchased as part of the HB system), weld the Power Junction Box Mounting Bracket into the position shown on the Heating System Layout drawing. All HB Heating Modules and their custom cold lead cable lengths are oriented to the location of the Power Junction Box. *If the Power Junction Box cannot be located in the exact position shown on the Heating System Layout drawing, please contact HTD before proceeding with the installation.*

Use the Heating System Layout drawing to provisionally identify the location of each heating module on the hopper. Most HB Heating Modules are positioned horizontally or vertically in the zone being heated. At this stage of the installation, it is useful to mark each area of the hopper to show the centerline of the module being installed and the module designation letter shown on the drawing. Chalked centerlines for horizontally installed modules are normally midway between hopper stiffeners and the centerline for vertically installed modules is frequently the centerline of the hopper.

Identify the aluminum mounting channels and (when applicable) the stud location templates that are to be used with each size and location of heating module. Mounting channels are marked with the same letter designation as the module they are to be used with. Likewise, stud location templates are also marked with the same letter designation of the modue they are to be used with.

HB HEATING MODULE MOUNTING PROCEDURE

The Heating System Layout drawing shows the number of mounting channels to be used with each size of heating module and their orientation.

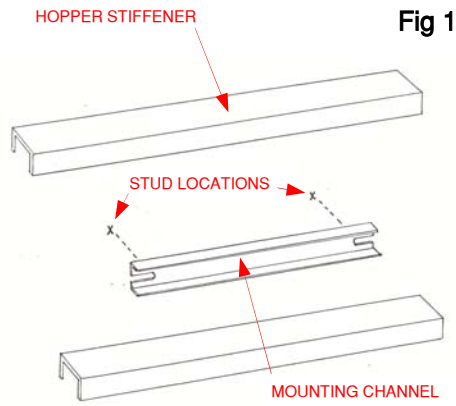


Fig 1

To locate the mounting stud positions for any HB Heating Module that uses ONE mounting channel, the installer uses the actual mounting channel as a template to pinpoint and mark the two stud locations on the hopper surface **(Fig 1).**

HB Heating Modules that require TWO or MORE mounting channels are supplied with a specific template that will pinpoint the location of the four (or more) studs to be used.

Always centralize the mounting channel or template within the hopper plate area being heated before marking the stud locations **(Fig 1).**

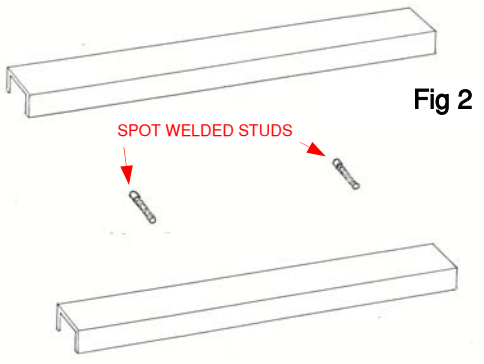


Fig 2

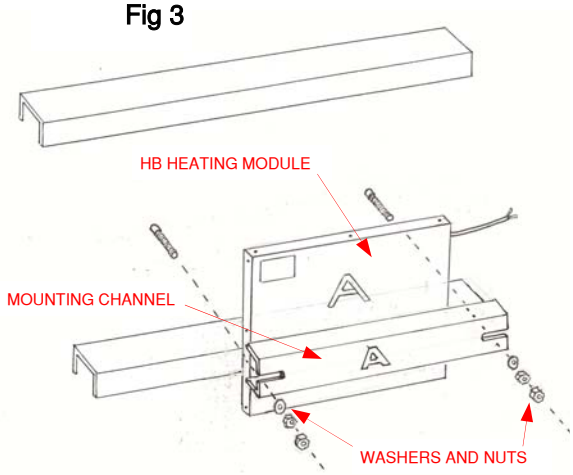
Wipe the hopper surface to remove any moisture, dust, rust or foreign material that may impede the stud welding process or the installation of the HB Heating Module.

Securely spot weld one mounting stud at each of the marked locations **(Fig 2).**

Each stud is 3½ inches long by 3/8 inches diameter and each stud is supplied with two nuts and one washer.

Studs should be spot welded to the hopper surface using a capacitor discharge or full weld type spot welding machine.

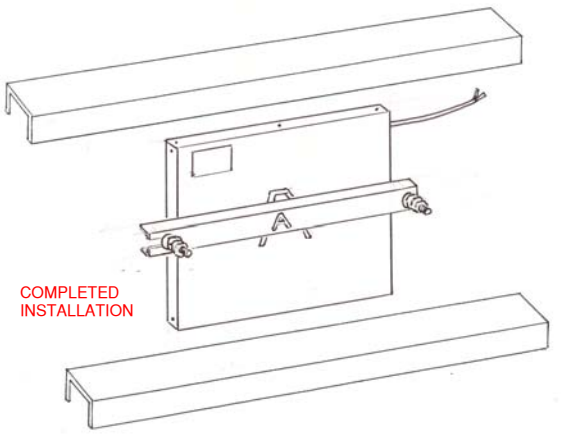
Fig 3



Wipe the hopper surface to remove all moisture, dirt / dust. Offer the HB Heating Module up to the hopper with the gray siliconized glasscloth heater face towards the hopper surface. The heating module must be oriented with the cold lead cable exiting to the correct side of the hopper, as shown on the Heating System Layout drawing. Failure to orient the heating module correctly will result in incorrect routing of the cold lead cable, which, in turn, may result in the cable being too short to reach the Power Junction Box.

Place the aluminum mounting channel(s) over the studs and the back face of the HB Heating Module (**Fig 3**). *Each mounting channel must be installed with the two flanged edges in contact with the back face of the HB Heating Module as shown in* **Fig 3.** Do not install any mounting channel with the flat surface of the channel in contact with the HB Heating Module.

Fig 4



Apply a washer and one nut to each stud and tighten until the HB Heating Module is held lightly in position against the hopper surface. If necessary, carefully adjust the position of the HB Heating Module until it is symmetrically located with the mounting channel or channels (**Fig 4**).

Wrench tighten each nut until the HB Heating Module is clamped securely to hopper surface. Compression of the flexible heater face should take place, such that intimate contact between heater face and hopper surface is continually maintained.

Apply a second nut to each stud and tighten (**Fig 4**). Always apply the second nut to each stud to eliminate the potential of the first nut becoming loose due to hopper vibrations.

Repeat all of the procedures shown in Figures 1 through 4 on each HB Heating Module until the entire heating system is installed exactly as shown on the Heating System Layout drawing supplied by HTD. *If one or more HB Heating Modules cannot be fitted in the locations shown on the Heating System Layout drawing, consult HTD immediately.*

SYSTEM WIRING

Each HB Heating Module System is designed to operate on a specific power supply and each heating module within the system must be connected to the power supply exactly as shown in the system wiring diagram section of the Heating System Layout drawing. *Failure to follow this wiring procedure exactly will void all warranties and may lead to heater failures, unbalanced system loadings and system performance problems.* In event of questions or concerns, contact HTD immediately.

SYSTEM PROTECTION

Each HB Heating Module System must be protected by an appropriately sized fuse or circuit breaker. Recommended sizing of these overcurrent protection devices is shown on the Heating System Layout drawing.

GROUNDING

Following the installation of each HB Heating Module within the heating system as shown in the previous sections of this document, the heating system must be grounded to comply with all appropriate National, Federal and Local electrical codes and requirements.

As shown in **Fig 5**, each individual HB Heating Module is fitted with grounding brackets. There are two brackets on each heating module and they are normally located in diagonally opposite corners. Each bracket is permanently anchored to the heating module frame and supplied with a washer and screw.

As shown in **Fig 6**, each HB Heating Module can be individually grounded. The installer provides a suitably sized length of grounding wire with a crimped ring terminal that must be sized for use with the screw of the grounding bracket. The ring terminal is applied over the screw and washer, inserted into the grounding assembly and securely tightened. This procedure is repeated with every heating module within the system and the individual grounding wires are all routed to the nearest ground point to be securred and bonded.

Alternatively, as shown in **Fig 7**, two or more HB Heating Modules can be interconnected with appropriately sized lengths of grounding wire to provide one complete grounding path that will ground all or part of the total heating system. In this instance, interconnecting ground wires must be fitted with two crimped ring terminals such that each end can be attached to the individual heating modules that are being linked together. The final run(s) of grounding wire are routed to the nearest ground point to be securred and bonded.

Grounding wire and ring terminals are not supplied by HTD as part of the heating system package.

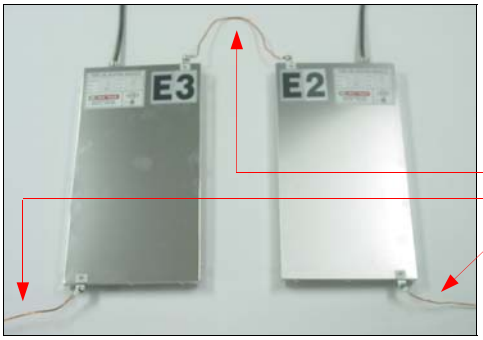
Due to the elevated operating temperatures and corrossive environments associated with most flyash hopper heating applications, the use of a non jacketed, nickel plated or coated grounding wire is recommended. Grounding wire should be selected based upon the corrosive conditions of each application. The use of bare stranded copper grounding wire is not recommended.

Fig 5

Fig 6

Single ground wire attached to HB Heating Module

Fig 7



Interconnecting ground wires to link adjacent heating modules together throughout the system

TESTING

Before connecting each HB Heating Module into the Power Junction Box, thermally insulating the hopper and/or energizing the system, the installer should check the resistance (Ω) of each HB Heating Module using an Ohmmeter. Each reading should be compared with the corresponding nominal value shown on the Heating System Layout drawing. *Do not connect any HB Heating Module that has an ohm reading that is either 10% higher or 10% lower than the nominal value shown on the Heating System Layout drawing.* Record all readings for reference and comparison with readings taken during future routine maintenance checks.

Using a 1000 vdc Megger, the installer should measure the Insulation Resistance (IR) for each HB Heating Module. All readings greater than 1M Ω are acceptable. Record all acceptable readings for reference and comparison with readings taken during future routine maintenance checks. *Do not connect and / or energize any HB Heating Module that has an IR value less than 1M Ω and contact HTD to discuss the situation.*

The two above tests should also be repeated after the hopper has been thermally insulated and weather-proofed as described in the following section.

HOPPER INSULATION, DRAFT BARRIERS AND CONVECTION STOPS.

The kW sizing of each HB Heating Module System is designed to maintain a specified temperature under specific ambient and operating conditions. Sizing calculations have been based upon a specified type and thickness of thermal insulation being applied over the entire surface area of the hopper and all appurtenances. *To avoid system performance problems, always check that the specified type and thickness of thermal insulation is being used*. Consult HTD if there are any questions.

Whenever possible, hopper insulation should always be applied directly onto the face of the hopper stiffeners essentially forming a series of sealed cavities throughout the areas of the hopper that are being heated. This will prevent heat from being convected away from the lower areas of the hopper. In instances when the insulation cannot be attached directly to the hopper stiffeners the installer / insulation contractor must install draft barriers or convection stops at and completely around each stiffener and stiffener level within the hopper area being heated. Special attention must be paid to the corners where two stiffeners meet and any gaps left by the formation of the converging stiffeners must be plugged and sealed with insulation. Examples of typical draft barriers and convection stops are shown in Fig 8.(opposite) and specific details are also shown on HTD drawing D 096. Contact HTD if you do not have a copy of this drawing.

Failure to install draft barriers or convection stops may lead to reduced hopper temperatures and heating system performance problems.

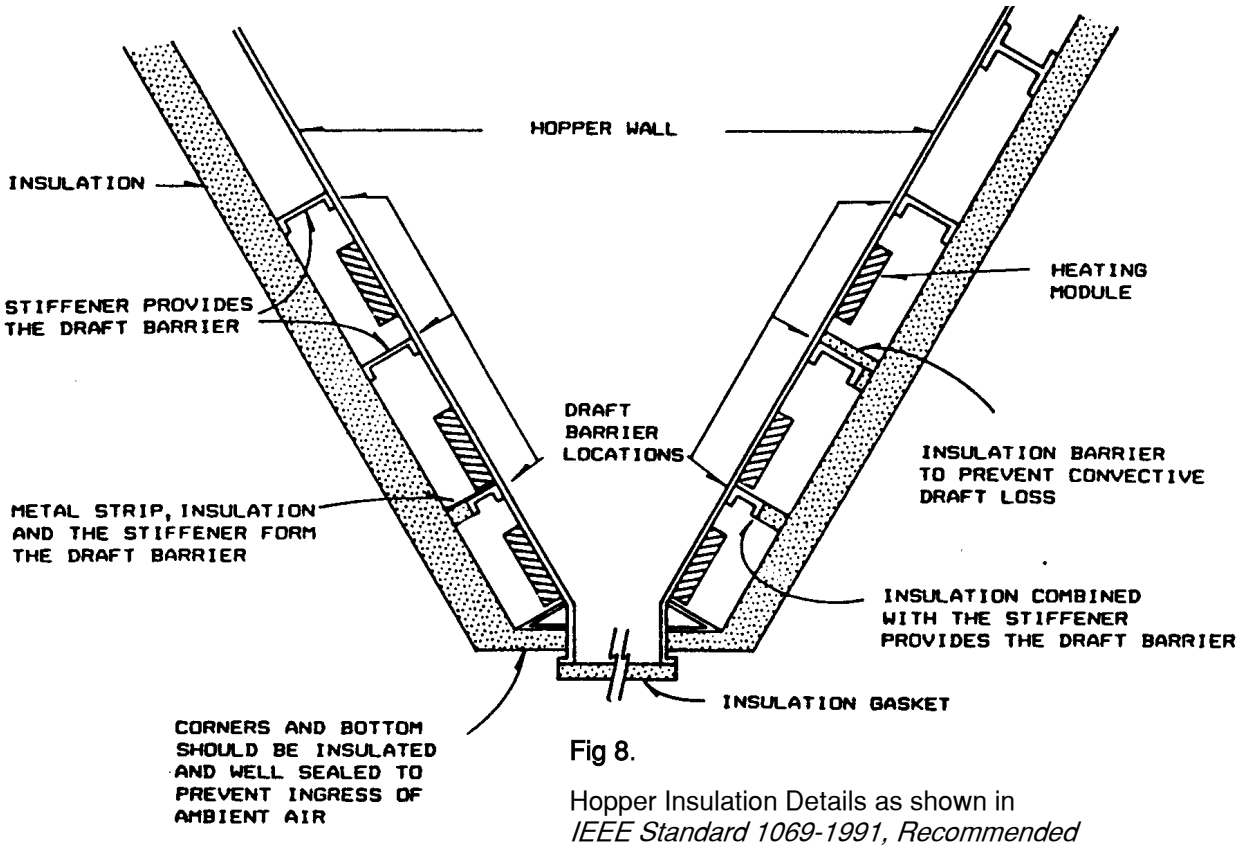


Fig 8.

Hopper Insulation Details as shown in *IEEE Standard 1069-1991, Recommended Practice for Precipitator and Baghouse Hopper Heating Systems.*

HOPPER INSULATION PROTECTION AND WEATHER-PROOFING

To avoid contamination, deterioration and significant reductions in efficiency, the thermal insulation applied to the hopper surfaces and appurtenances must also be protected from the ingress of water, moisture and dust by the application of a suitable weather-proofing barrier. Additionally, the HB Heating Module is third party approved by both FM and CSA for use in unclassified, dry, protected areas. Compliance with the requirements of these approvals requires that all exterior surfaces of the hopper insulation must be covered (aka lagged or clad) with a suitable weather-proof barrier.

The most common industry standard used to provide this essential climatic, environmental and heating system protection is metal cladding with corner flashings, corked joints and corking around all penetrations.

FLEXIBLE HEATERS

The installation of flexible throat and poke tube heaters is detailed in HTD Publication FLEXHTR INST-F-6/03.

Please contact HTD to request copies if this type of heater is included as part of your HB Heating Module System.

HB HEATING MODULE

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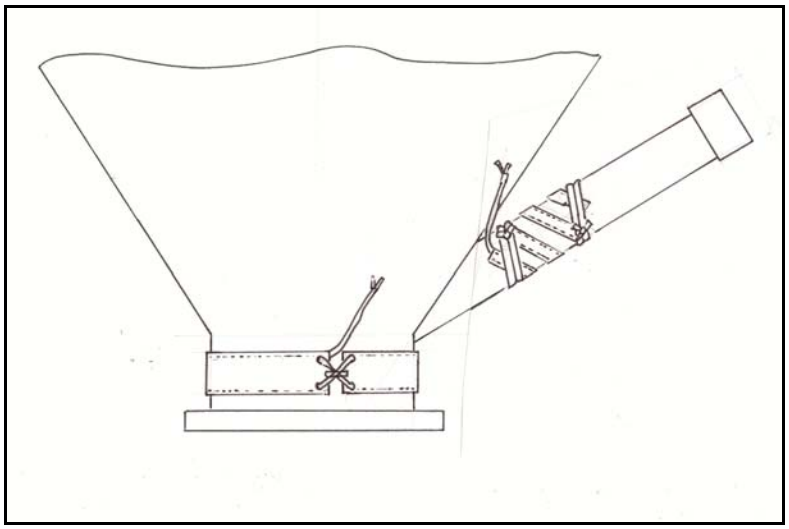
HEAT TRACE

HB HEATING MODULE SYSTEMS

INSTALLATION INSTRUCTIONS

FLEXIBLE HEATERS



FLYASH HOPPER HEATING APPLICATIONS

FLEXHTR INST-F-12/04

SUPPLEMENTAL FLEXIBLE HEATERS.

Flyash hopper throats and poke tubes are significant heat sinks and, due to their physical location on the hopper, they are also critical areas that must be kept free from condensation. Condensation in these narrow sections of the hopper will promote the rapid build up of Flyash which can quickly lead to total pluggage of the hopper

Cylindrical hopper throat outlets and poke tubes cannot b e effectively heated with heating modules. These areas can only be heated effectively with a "wraparound" type heater and HTD offers custom sized Flexible Heaters to provide the all important supplemental heat required at these critical locations.

Flexible Heaters are designed to be an integral part of the overall hopper heating system. Custom length cold lead cables are included such that all Flexible Heaters and HB Heating Modules connect to the power supply within the same Power Junction Box.

THROAT HEATERS.

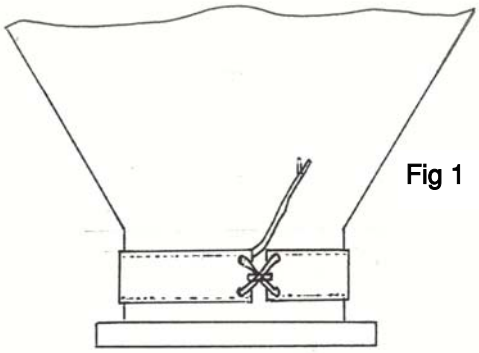


Fig 1

Wipe the throat area of the hopper to remove any water, moisture, rust or foreign material that may impede the installation of the Throat Heater. Wrap the Throat Heater around the hopper throat. Smooth out any wrinkles and creases. Thread 2 feet of fiberglass tying tape in a criss-cross pattern using the eyelits at each end of the Throat Heater. Pull on both ends of the tying tape to tension the the Throat Heater and hold it firmly in contact with the hopper throat. Tie both ends of the tying tape in a double knot to maintain permanent tension on the Throat Heater (**Fig 1**). Overwrap the Throat Heater with several wraps of tying tape until it is completely covered. Tie off the tying tape to complete the installation.

Do not overlap the Throat Heater upon itself and ensure that all wrinkles and creases are smoothed out before insulating the hopper.

POKE TUBE HEATERS.

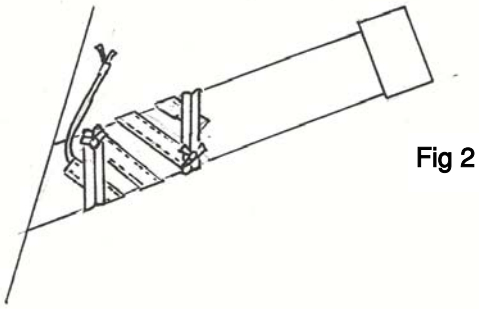


Fig 2

Wipe the poke tube to remove any water, moisture, dust, rust or foreign material that may impede the installation of the Poke Tube Heater. Spiral the Poke Tube Heater into postion with 1 inch spacings between wraps. **Do not overlap the heater**. Smooth out any wrinkles and creases. Use one wrap of fiberglass tying tape to hold each end of the Poke Tube Heater in position. Tie the ends of the tying tape using double knots (**Fig 2).**

Overwrap the PokeTube Heater with tying tape until it is completely covered and tie off the tying tape to complete the installation.

Meter test all Flexible Heaters as shown in the HB Heating Module Installation Guide.

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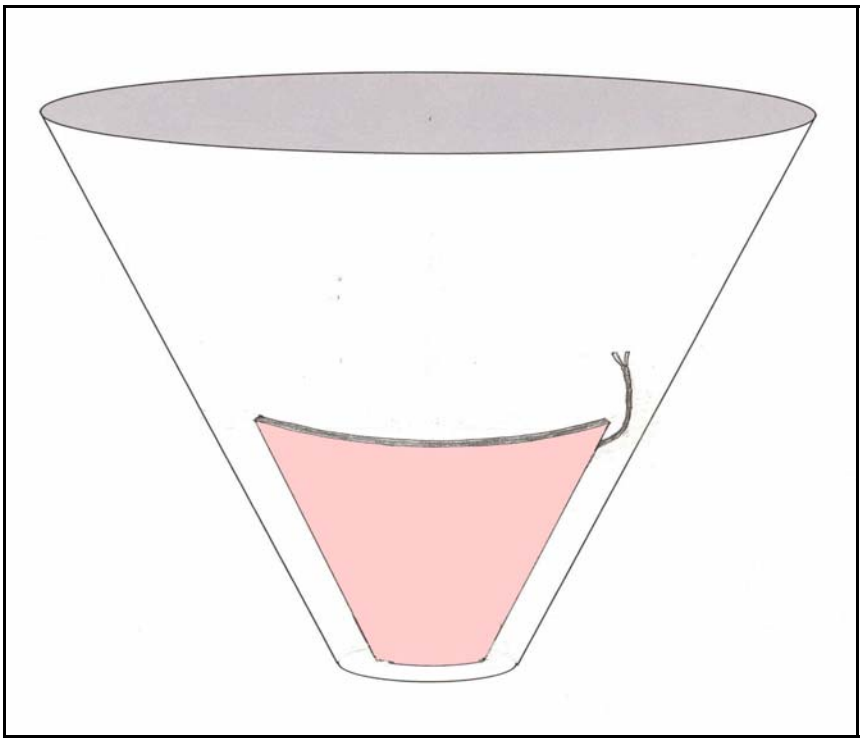
HEAT TRACE

TYPE G HEATING BLANKETS



FLEXIBLE HEATING BLANKETS FOR CONICAL HOPPERS

CONICAL HPR LIT-F-12/04

INTRODUCTION

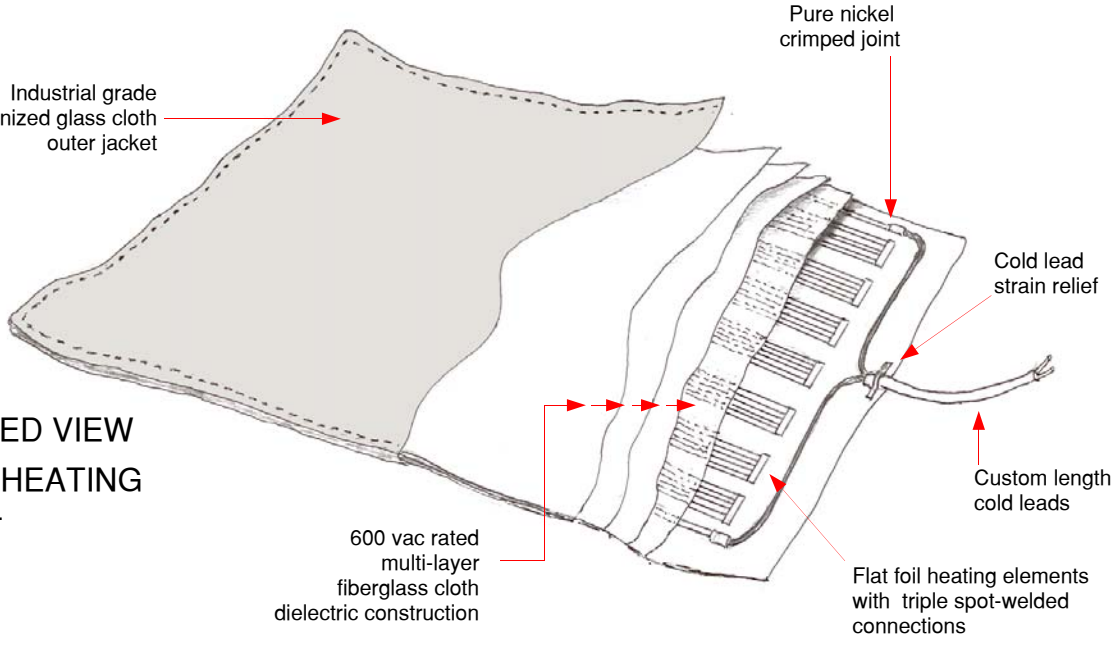
Some styles of Air Pollution Control Equipment are designed with conical shaped hoppers to collect the particulate. Unlike flat pyramidal hoppers, the curved surfaces of conical hoppers cannot be effectively heated with type HB Heating Modules.

Conical hoppers are most effectively heated with a flexible style of heater that can follow the varying curvatures of the cone while continuously maintaining the essential heater - hopper contact. To meet these unique design requirements, HTD Heat Trace, Inc offers the type G Heating Blanket.

The type G Heating Blanket is the exact same heat source that is used inside of the HB Heating Module. This low watt density heater has been successfully used in the manufacture of thousands of heating modules, heating blankets and heating jackets, and repeatedly proves to be the most reliable heat source for use on Flyash, dust and powder applications.

As shown in the following sketch, flat foil heating elements are sewn into a multi-layer, high temperature, fiberglass cloth dielectric construction. This 600 volt rated construction is further protected by an additional outer layer of siliconized glass cloth to provide moisture and water resistance.

Type G Heating Blankets are custom sized and shaped to suit each application and they can be manufactured with power ratings up to 300 watts/sq.ft on voltages from 120 to 600 vac.



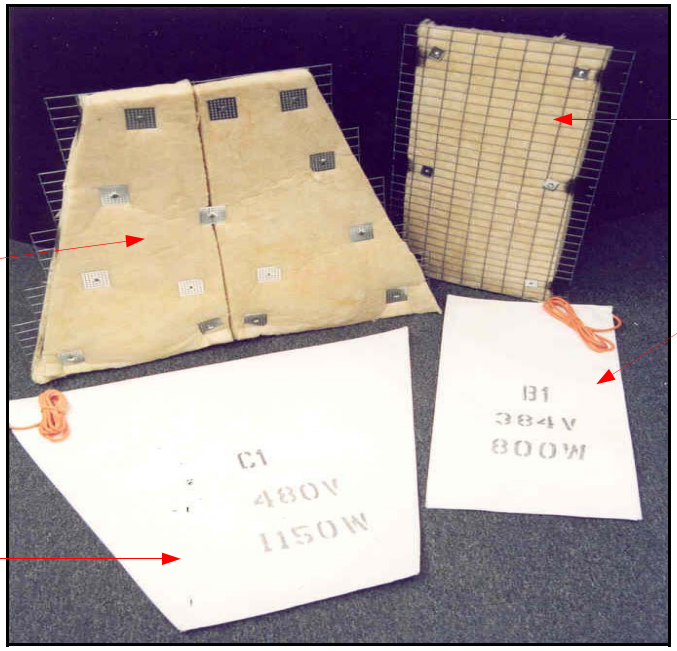
SECTIONED VIEW TYPE G HEATING BLANKET

INSTALLATION

Type G Heating Blankets are supplied with a very simple, effective mounting kit that ensures that the flexible heater blanket follows the exact contours and curvatures of the cone while maintaining continuous and intimate contact with the surface of the hopper. Intimate heater - hopper contact ensures maximum conduction of heat into the hopper and optimizes the reliability and life expectancy of the heater.

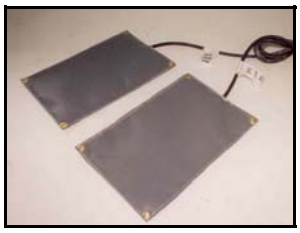
The Mounting Kit for each size and shape of heating blanket consists of a soft, cushion-like insulation pad combined with a mesh backing plate (see photograph), mounting studs, nuts and washers. Installation is quick and simple:

- The installer spot welds studs to the hopper surface using the mesh backing plate as a template to locate the exact stud positions.
- The G Heating Blanket is positioned and initially held to the hopper surface with strips of glass tape that are laced in a criss-cross pattern from stud to stud.
- The insulation / mesh mounting pad is placed over the heating blanket and impaled onto the studs.
- Pressure is applied to the mesh backing plate, forcing the "soft" insulation to compress, which, in turn, forces the heating blanket to conform to the shape of the hopper.
- Large washers are applied over the mesh and double nuts are used to apply the final compressive pressure that permanently holds the heating blanket in contact with the hopper surface.



TYPE G HEATING BLANKETS AND MOUNTING PADS

CUSTOM SIZES & SHAPES



Type G Heating Blankets are custom sized and shaped to fit the lower areas of the hopper being heated.

System designs and heater layouts may included:

- Rectangular shaped heaters that spread in a "petal" formation from the hopper throat area up the sides of the hopper.
- Trapezoidal shaped blankets tailored to fit the hopper throat and lower third of the hopper.
- Poke tubes, transition pipes and the cylindrical throat outlets that connect to the evacuation valves below the hoppers are frequently heated with strips of G Heating Blanket.

SYSTEM DESIGN AND ENGINEERING

HTD offers a complete design and engineering service for all hopper heating applications.

The hopper heating system will be designed exclusively for your hopper size and configuration. Thermal engineering and calculations will be based upon maintaining your specified temperature with worst case, winter operating conditions. Thermal insulation type and thickness can be specified or we can recommend optimum choices based upon your application needs.

System designs include heating blankets, power junction boxes and all mounting brackets and hardware. Layout drawings and wiring diagrams are standard with each system.

Control systems can be as simple as local mounted thermostats with integral contactors all the way up to PLC based, Control, Monitoring, Alarm and Energy Management Panels and Systems.

Please contact HTD for further information.

HTD HEAT TRACE

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Distribution, Control and Alarm Systems

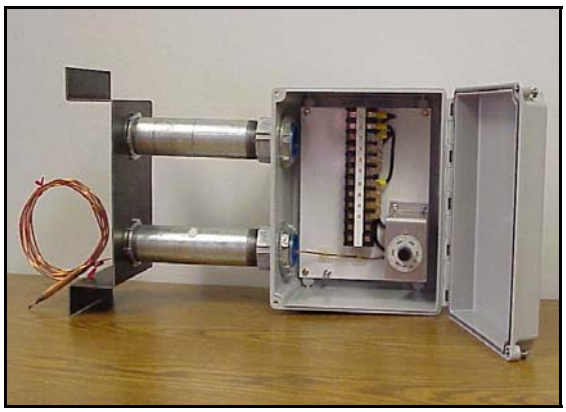
HB Heating Module System Accessories

- *Local mounted thermostats*
- *Centralized contactor and circuit breaker panels*
- *All NEMA ratings, materials and styles are available*
- *Custom designed electronic, SCR or PLC based control , monitoring, alarm and energy management systems*

THERMOSTATS

NEMA 4 and NEMA 4X mechanical thermostats, suitable for local mounting at each hopper. These items can be supplied as single instruments which may be wired back to a centrally located distribution panel that contains contactors, circuit breakers and alarm lights (see below). HTD can also customize a thermostat such that one enclosure, mounted directly at the hopper, can house all of the basic control, switching and alarm equipment for one system.This design approach is particularly useful on small installations of one to four hoppers.

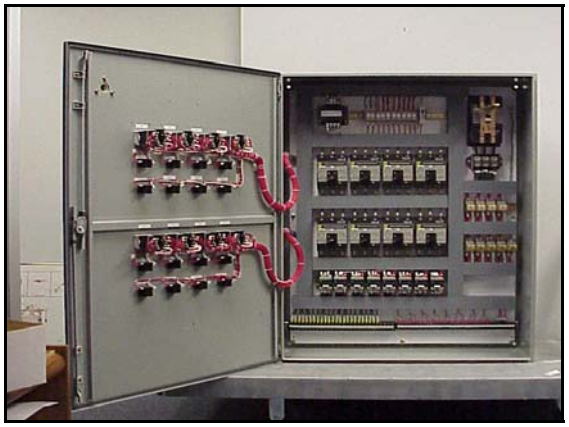
One thermostat provides the minimum level of temperature control for one hopper heating system. Two or more additional thermostats per hopper are frequently specified to provide high or low temperature alarms and/or control capabilities.



DISTRIBUTION AND ALARM PANELS

These custom designed and built panels can provide centralized power distribution, switching, circuit protection and alarm functions for a group of hopper heating systems that are individually temperature controlled by local mounted thermostats or temperature controllers.

Distribution Panels are typically sized to handle from four to sixteen hopper heating systems. "Power On" plus low and high temperature indication lights are frequently included such that plant personnel can oversee the operation of all of the hopper heating systems from one location.



HTD HEAT TRACE

ELECTRIC HEAT TRACING PRODUCTS AND SYSTEMS

Distribution, Control and Alarm Systems

ELECTRONIC CONTROL SYSTEMS

Custom designed and built Electronic Control Systems are available to provide individual temperature control, monitoring and alarm functions at one location. Systems can be sized to handle up to twenty hopper heating systems within one enclosure.

Electronic temperature controllers can provide proportional control and digital display of the operating temperatures for each hopper. Multiple alarm functions are easily built into this type of system. Main and branch circuit breakers are included to provide one, multi-functional, centralized control system.

SCR AND PLC BASED CONTROL AND ENERGY MANAGEMENT SYSTEMS

HTD offers a complete temperature control, monitoring, alarm and energy management system that can handle up to twenty individual hopper heating systems.

This design provides all of the instrumentation, distribution and protection equipment in one enclosure and the complete system can include remote alarm annunciation and PLC, DCS or PC based communication capabilities.

The custom designed panels and systems shown in this brochure can be completely tailored to meet your exact requirements. Enclosures, components and equipment preferences can be specified for uniformity with other plant systems. Design, manufacturing and testing are all completed at our Whitehouse, NJ facility and complete drawing packages, Operation and Maintenance Manuals are included with every system.

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Junction Boxes and Custom Mounting Brackets

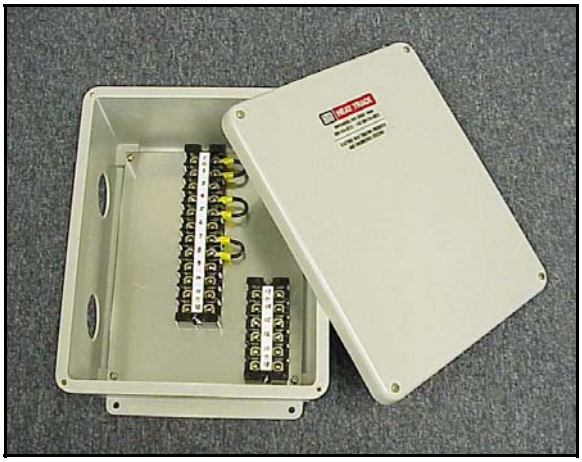
HB Heating Module System Accessories

- *Low cost enclosures, installed outside of the hopper insulation for easy, convenient access*
- *All NEMA ratings, materials and styles are available*
- *Custom designed mounting hardware to simplify installation and provide protection for the system wiring that must pass through the hopper insulation and cladding to enter the enclosure*

TYPE PJB

PJB enclosures are located outside of the hopper insulation and are designed and sized to provide a convenient and protected environment where the hopper heater cold leads can be terminated and connected to the system power supply. The use of PJB enclosures also greatly simplifies future routine maintenance checks and testing of the hopper heaters by providing access to all heater cold leads without the need to remove any hopper insulation or cladding.

PJB enclosures are supplied with factory installed terminal blocks and system wiring diagrams. All NEMA ratings, enclosure styles, enclosure materials and terminal block preferences can be offered.



10 x 8 x 6" NEMA 4X, fiberglass example shown with pre-jumpered, 600 vac rated Marathon terminal blocks. This size and design of PJB enclosure is typically used on systems that involve twelve or fewer heating modules per hopper.

TYPE SJB

This enclosure is required when RTD or thermocouple type sensors are being used as part of the hopper heating control / monitoring system.

The SJB enclosure provides a convenient and protected environment where the sensor leads can be terminated and connected to the control system wiring.

Factory mounted terminal blocks are supplied and all NEMA ratings, materials and terminal block preferences can be specified.

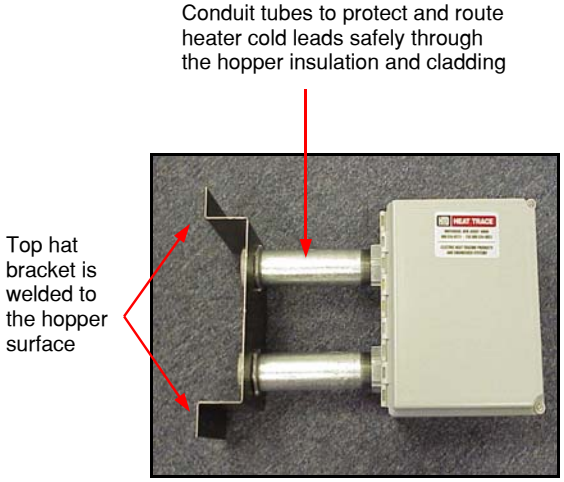
Standard 6 x 6 x 4" NEMA 4X, fiberglass example shown with Omega terminal blocks for connection of one sensor. SJB enclosures can be also designed and supplied with terminal block arrangements for dual or multiple sensor termination and connection.

Custom Mounting Brackets

Heating system and control system components that are installed directly on the hopper surface *should never be terminated under the hopper insulation.* Heating module cold lead cables, temperature sensor leads and thermostat capillaries should all be terminated *outside* of the hopper insulation such that they can be easily accessed at all times. These items must, therefore, be protected and safely routed from the surface of the hopper through the hopper insulation and cladding and into the wiring enclosure being used.

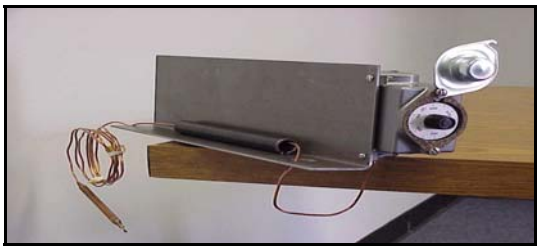
The custom mounting brackets shown in the first two photographs provide structural support for the enclosure being mounted PLUS essential protection and safe routing for all of the cables and wiring associated with the heating and control system.

TYPE EMB Consists of a mild steel, top hat style base with one (or more) conduit protection tubes. The flanges on the base are welded to the hopper surface and the conduit tubes penetrate the hopper insulation and cladding to screw directly into a PJB Power Junction Box or SJB Sensor Junction Box. Fully protecyed cables / wires pass directly from the hopper surface through the conduit tubes and into the enclosure.



EMB bracket with PJB Power Junction Box

TYPE TMB Mild steel angle bracket with single conduit tube for protection and routing of thermostat capillary tubing. This bracket is welded directly to a hopper stiffener.



TMB bracket with type E55 H thermostat

TYPE SMC Mild steel mounting clip to hold an RTD, thermocouple or thermostat sensing bulb in permanent contact with the hopper surface. Clip is held in position by using a 1¼" stud that is spot welded tothe hopper surface.

SMC clip with RTD sensor

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HEAT TRACE

HB HEATING MODULE

CLIENT & PROJECT REFERENCES

FLYASH HOPPER HEATING SYSTEMS

FM APPROVED

CSA®

INTRODUCTION

The development and use of the type HB Heating module was *exclusively* pioneered by the Heat Tracing Division of Cooperheat, Inc. in Piscataway, NJ. Early Cooperheat designs and installations date back to 1976.

Many of these installations are now over 20 years old and still operating with no heater failures.

The following lists show some of the successful Power and Industrial projects that we have completed over the last 26 years. Projects are shown by client name, plant name, # of hoppers and installation size

HTD Heat Trace, Inc. purchased the Heat Tracing Division of Cooperheat in 1996. Since this time, HTD has continued to engineer and sell HB Heating Module Systems based upon the proven application technology and product reliability that we established as Cooperheat.

These partial lists show over 100 projects, involving some 2,837 individual HB systems, 27.9 MW of installed load and several BILLION hours of successful performance and maintenance-free operation.

UTILITY	PLANT	# HOPPERS HEATED	TOTAL INSTALLED KW
Alabama Power	Barry Station Unit # 4	16	194
Arizona Public Service	Four Corners	2	12
Associated Electric Co-op	New Madrid	48	490
Atlantic City Electric	B.L. England Station	8	104
Basin Electric	Antelope Valley Unit # 1	28	1,120
Big Rivers Electric Cooperative Inc	Reid Station Unit # 2 Reid Station Unit # 3	16 16	190 195
Cajun Electric Power Cooperative Inc	Cajun	60	804
Central Illinois Public Service Co	Newton Station Unit # 2	16	320
Colorado Ute Electric Association, Inc	Craig Station	40	478
Commonwealth Edison	Kincaid Station Will County	64 16	480 155
Consumers Energy Co	J H.Campbell Unit # 2 J.H.Campbell Unit # 3	48 112	192 560
Cooperative Power Assoc.	Coal Creek	10	80
The Dayton Power & Light Co.	J.M.Stuart Station Unit # 2 J.M.Stuart Station Unit # 4	8 46	46 206
Delmarva Power & Light Co	Indian River Station	8	96
Detroit Edison Co	Belle River Unit # 1 Belle River Unit # 2 St. Clair Unit # 6	72 72 48	691 691 370
Duke Power Company	Allen Unit # 1 Allen Unit # 2 Allen Unit # 3 Allen Unit # 4 Allen Unit # 5	12 12 16 16 16	44 44 58 58 58

END USER	PLANT / PROJECT	# HOPPERS HEATED	TOTAL INSTALLED KW
Duke Power Company	Belews Creek Marshall Station Unit # 1 Marshall Station Unit # 2 Marshall Station Unit # 3 Marshall Station Unit # 4	2 16 16 16 16	17 125 109 40 46
Empire District Electric Co	Asbury Station Unit # 1	8	54
Houston Light & Power Co	W.A.Parish Station	40	600
Minnesota Power & Light Co	Clay Boswell Steam Station	4	40
Muscatine Power & Water	Muscatine	8	102
Nevada Power Co	Reid Gardner Station Unit # 4	16	75
New England Power Co	Brayton Point Units # 1 & 2 Brayton Point Unit # 3	32 24	221 199
Northern Indiana Public Service Co	Baily Station R.M.Schafer	36 64	504 755
Northern States Power Co	Riverside	12	185
Ohio Edison	W.H.Sammis Unit # 1,2,3 & 4 W.H.Sammis Unit # 5,6 & 7	48 150	1024 1680
Otter Tail Power	Coyote Station	44	370
Pennsylvania Power & Light	Brunner Island	38	483
Public Service Electric & Gas	Mercer Station	8	20
Public Service-New Hamp-shire	Newington Station	32	144
Public Service of Oklahoma	Northeastern Station	84	780
Sask Power	Poplar River Station	22	319
Savannah Electric	Effingham Station	14	150
Seminole Electric	Seminole Units 1 & 2	64	512
Southern Indiana Gas & Electric	A.B. Brown Station Unit # 2 Warrick Unit # 1	16 24	166 250
Southwestern Public Service	Harrington Station Unit #2 &3	56	619
Texas Municipal	Gibbons Creek	40	440
Toledo Edison Co	Bayshore Station	32	288
Union Electric Co	Meramec Units # 1, 2, 3a,3b, 4a and 4b	96	700
Virginia Electric Power Co	Possum Point Yorktown	8 24	34 370

CLIENT & PROJECT REFERENCES

END USER	PLANT / PROJECT	# HOPPERS HEATED	TOTAL INSTALLED KW
Illinois Power	Hennepin Station Units 1 & 2	12	108
SaskPower	Boundary Dam	6	64
Alcan Industries	Alcan Ingot & Recycling Plant	5	27
Savannah Energy Systems	President Street Extension	2	1
American Refuel	Semass Units 1 & 2	6	75
Georgia Power	Plant Hammond Unit # 2	9	98
Fibrowatt Thetford Ltd	Thetford Power Station	8	45
Glens Falls Cement	Glens Falls Plant	12	50
Callidus Tech		3	10
Degussa	Catalyst Recovery of LA	1	20
American Refuel	Semass Units 1 & 2 Stilt Heater Project	16	10
Savannah Energy Systems	President Street Extension	10	5
Saline Water Conversion Corp	Yambu Refinery	6	48
PECO Energy	Cromby Station	2	25
Queensland Power Australia	Millmerran Power Project	28	300
Consumers Energy	J H Campbell Plant Unit # 1	32	240
National Thermal Power Corporation Ltd-India	Simhadri	256	2,895
Sask Power	Boundary Dam Unit # 2 Boundary Dam Unit # 5	12 6	128 64
Corning	Concord III	5	70
National Thermal Power Corporation Ltd - India	Talcher	16	165
Olmstead County	Waste to Energy Facility	6	19
Constellation Power Services	Herbert A Wagner Plant Unit # 2	20	188
City of Ames	Unit # 7	6	52
Tri State G & T Association	Craig Station Unit # 2	32	339
Duke Energy Corp	Allen Station Units # 3 & 4	32	678
United Power Association	Stanton Station	10	124
U S Steel Corp	Bethlehem Steel	4	48

CLIENT & PROJECT REFERENCES

END USER	PLANT / PROJECT	# HOPPERS HEATED	TOTAL INSTALLED kW
US Army	Aberdeen Proving Grounds	8	85
Carolina Power & Light	Asheville Steam Electric Plant Unit # 2	12	128
Saline Water Conversion Corp	Yambu Refinery	8	64
Muscatine Power & Water	Muscatine	6	60
Duke / Fluor Daniel	Batu Hijau	24	175
U S Steel Corp	Gary Works	18	138
Duke Energy Corp	Allen Station Unit # 5	16	139
Saline Water Conversion Corp	Yambu Refinery	12	96
SaskPower	Boundary Dam Unit # 4	6	64
Ogden Martin	Hillsborough County	21	153
Fujian Pacific Electric Co Ltd	Meizhou Wan Power Plant Units 1 & 2	80	672
Hebei Hanfeng Power Generation Co Ltd	Hanfeng Power Plant Units 1 & 2	64	755
Dynergy Midwest	Wood River Station Unit # 4	16	96
University of Eau Claire	Unit # 1	4	18
Wynnewood Refining Corp	Wynnewood Refinery	3	27
Chevron	Pasagoula Refinery Kapolel Refinery	6 4	57 35
Mirant Mid Atlantic, LLC	Dickerson Station	10	111
Lansing Water & Light	Erickson Station Unit # 1	20	142

As a testimonial and endorsement of its proven reputation and reliability, the HB Heating Module System has been specified and used on many of the largest power plants constructed around the world. The precipitators and baghouses used in these plants are considered critical components and essential equipment for unit availability and continual generation of power. These clients and plants selected the HB Heating Module System because it has repeatedly proven to be a design, product and system that will perform with complete safety and total reliability.

Many of the HB Heating Module System installations shown on the previous lists operate in the critical operational environment of very large, coal fired power plants.

Examples of these plants are identifed in red. These particular HB installations are operating in plants with steam turbine generating capacities in excess of 1,000 MW.

HB Heating Modules are FM and CSA approved to all current IEEE, NEC and Canadian standards.

CONSULTING / ARCHITECT ENGINEERS

Most new power and large industrial boiler projects involve the services of Consulting Engineers that specialize in the design and construction of such plants. In the twenty five plus years that HTD has specialized in flyash hopper heating systems, we have provided design, engineering and specification support for the HB Heating Module System to the following engineering companies:

- Bechtel Power Corporation
- Black and Veatch
- Brown and Root, Inc
- Burns and McDonnell Engineering Company
- Burns and Roe
- Duke/Fluor Daniel
- Ebasco Services, Inc
- Fluor Engineers, Inc
- Ford, Bacon and Davis, Inc
- Gibbs and Hill, Inc
- Gilbert/Commonwealth, Inc
- Sargent and Lundy
- Stanley Consultants, Inc
- Southern Company Services
- Stone and Webster Engineering Corporation
- Tippett and Gee
- United Engineers and Constructors International, Inc

AIR POLLUTION CONTROL EQUIPMENT MANUFACTURERS

Since 1976, type HB Heating Module Systems have been successfully used by most of the major air pollution control equipment manufacturers on many major precipitator and baghouse projects. Following is a partial list of our cients from this market segment:

- Alstom Power, Inc
- Alstom Power (Canada) Inc
- Amerex Industries, Inc
- American Air Filter
- Babcock & Wilcox
- Belco Pollution Control Corp
- Bharat Heavy Electricals Ltd - India
- CEA Carter Day
- CE Power
- Donaldson Company, Inc
- Dustex Corporation
- Environmental Elements Corporation
- FLS miljo, Inc
- Hamon Research Cottrell, Inc
- Joy Manufacturing
- Marsulex Environmental Technologies
- Mikropul, Inc
- Wheelabrator Air Pollution Control, Inc

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HEAT TRACE

WINTERIZATION SYSTEMS FOR COAL AND MATERIAL HANDLING EQUIPMENT

Custom designed FRP Heating Panel System for the freeze protection of hoppers, silos, transfer chutes and conveyors

PRODUCT & SYSTEM INFORMATION

USER & CLIENT LISTS

HEAT TRACE

FRP HEATING PANELS

FM APPROVED

COAL AND MATERIAL HANDLING WINTERIZATION SYSTEMS

CHWS SALESLIT-F-12/04

FOREWORD

This brochure specifically addresses the freeze protection of coal handling systems within power plants. However, the problem is not unique to this material or type of plant, and the solution can be used with many other raw materials in many different types of processing facilities.

Please contact HTD Heat Trace, Inc to discuss how the FRP Heating Panel System may help you to eliminate your specific winterization problems.

INTRODUCTION

Coal presents unique conveying problems as it passes from the mine mouth to the boiler. Its inherent moisture content, combined with the rain, snow and condensation encountered during shipping and storage, causes the coal to instantaneously bond and freeze to the metal surfaces of conveying and handling equipment during winter plant operation.

This instantaneous bonding process is known as **FLASH FREEZING**.

FLASH FREEZING can result in:

- Fuel starvation to the boiler and possible unit shutdown.
- Damage to bulk handling, transfer and storage equipment.
- Decreased unloading and conveying capabilities.
- Excessive labor costs and dangerous working conditions

Previously known as the Heat Tracing Division of Cooperheat, HTD Heat Trace, Inc. has addressed this specific problem with the development of a unique surface heating system that completely *eliminates flash freezing.*

APPLICATION RESEARCH

The obvious answer to any freezing problem is heat, but HOW MUCH?..... and..... WHERE DO YOU APPLY IT?

HTD researched this specific application by simulating the exact conditions that exist at site. It was found that:

- Flash freezing can be prevented if the surface exposed to the moving or stored coal is maintained at or above 40° F.
- Maintaining a steel temperature of 40°F in ambients as low as -20° F requires only moderate heat input (60 to 100 w/sq.ft)
- There is no appreciable lateral conduction of heat across areas of steel that are not directly heated; therefore, successfull freeze protection of problematic areas in a coal handling system (hoppers, transfer chutes, slide gates, etc) must involve the use of a full coverage heating system.

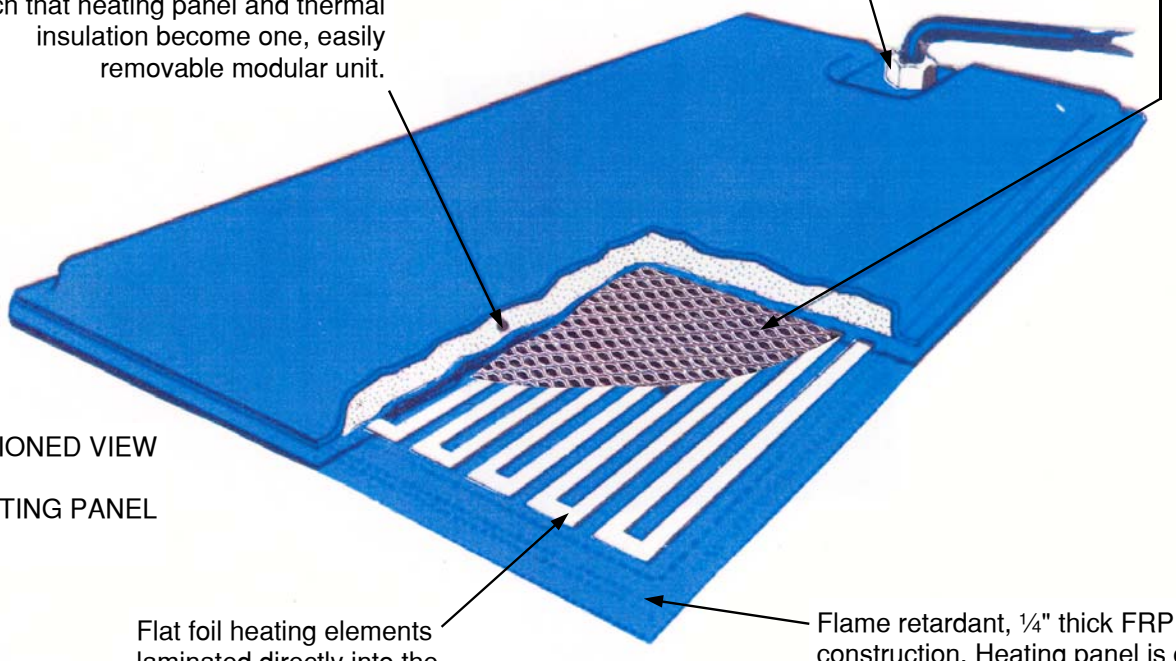
PRODUCT DEVELOPMENT

Over and above the technical requirements, HTD also researched the actual field requirements by discussing the problem with numerous operators of coal handling systems. From this investigation the following requirements were established:

- The heater must be extremely robust, vibration proof, dust-tight and completely waterproof.
- The heater must be manufacturable in irregular shapes and sizes to fit the myriad of areas to be heated throughout the handling system.
- All electrical equipment, especially the actual heater, must be approved for use in hazardous areas as defined by the National Electric Code.
- The heater must be designed for simple installation, removal and quick re-installation due to the frequent maintenance attention required on most handling systems.
- Thermal insulation and heater must be built as one modular unit to minimize installation and removal costs.

From this information and research Cooperheat, now renamed as HTD Heat Trace, Inc. developed the **FRP Coal Handling Winterization System.**

THE PRODUCT



SECTIONED VIEW

FRP HEATING PANEL

FRP HEATING PANEL FEATURES

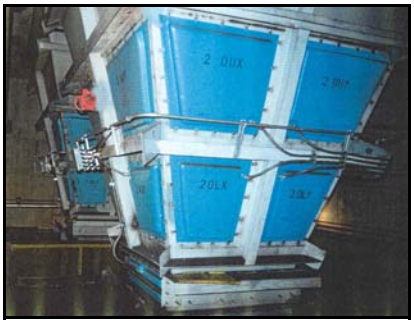
INSTALLATION EXAMPLE

MODULAR HEATING PANEL WITH BUILT IN THERMAL INSULATION CLIPPED DIRECTLY TO THE FACE OF A COAL TRANSFER CHUTE. EACH CLIP SWIVELS TO PERMIT IMMEDIATE REMOVAL OF THE HEATING PANEL.

To address the essential application and field requirements discussed earlier in this brochure, the FRP Heating Panel incorporates the following features:

- The FRP Heating Panel uses a low watt density, flat foil heating element to supply the exact power ratings needed to prevent flash freezing.
- Full coverage FRP Heating Panels can be manufactured in any shape or size and in flat or curved form to fit the exact area being heated.
- The FRP Heating Panel is also dust-tight, vibration-proof and completely waterproof. The laminated construction is extremely strong, corrosion-resistant, and does not burn or support combustion.
- FRP Heating Panels are Factory Mutual Approved for use in hazardous and unclassified (non hazrdous) areas.
- FRP Heating Panels are lightweight, simple to install and equally as simple to remove and re-install.
- Every FRP Heating Panel is built as a modular unit, that incorporates its own thermal insulation encapsulated within the construction. This design allows plant personnel to remove and re-apply heaters and insulation at the same time such that emergency or routine maintenance can be performed on the coal handling system with minimum inconvenience and cost.

THE SYSTEM



FULL COVERAGE EXAMPLE

TRAPEZOIDAL HEATING PANELS ARE USED TO REACH INTO THE CORNERS ON EACH FACE OF THIS MAIN DISCHARGE HOPPER.

HTD offers a **"complete engineered system approach"** forall Coal Handling Winterization applications.

- Heating Panels are custom sized from your drawings or field measured to provide the essential FULL COVERAGE HEATING SYSTEM.
- Systems are designed for operation on standard plant voltages, no special transformers or electrical hook-ups are needed
- Each system is supplied with a Control Package that will automatically switch on the system based upon the prevailing climatic conditions at site.
- Engineering drawings, schematics and Operation and Maintenance Manuals are supplied with every system.

APPROVALS

FM APPROVED

M.S.H.A.

FRP Heating Panels are M.S.H.A. Accepted and third party approved by FM (previously known as Factory Mutual) for the use in the following areas:

Unclassified areas
Class I, Division 2, Groups C & D
Class II, Divisions 1 & 2, Groups F & G
Class III, Divisions 1 & 2

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HEAT TRACE

FRP HEATING PANELS

CONTROLS AND ACCESSORIES

FM APPROVED

FREEZE-PROTECTION OF HOPPERS, CHUTES AND TRANSFER POINTS WITHIN COAL, CEMENT, POWDER AND OTHER TYPES OF MATERIAL HANDLING / CONVEYING SYSTEMS

CHWS CONT-ACCESS0RIES-F-12/04

SYSTEM ACCESSORIES

FRP Heating Panels are factory fabricated heaters that are fully tested and supplied ready for immediate installation. This unique heater is custom sized and shaped to fit the exact area being heated. The FRP Heating Panel is attached and held in position by mounting clips that are located around its perimeter. FRP Heating Panels are supplied complete with mounting clips, mounting studs, nuts and washers.

This mounting clip attachment system provides a simple and quick, low cost method of installation that also permits removal and re-installation of the heating panel when maintenance needs to be performed on the conveying equipment.

Photograph 1

FRP Heating Panel

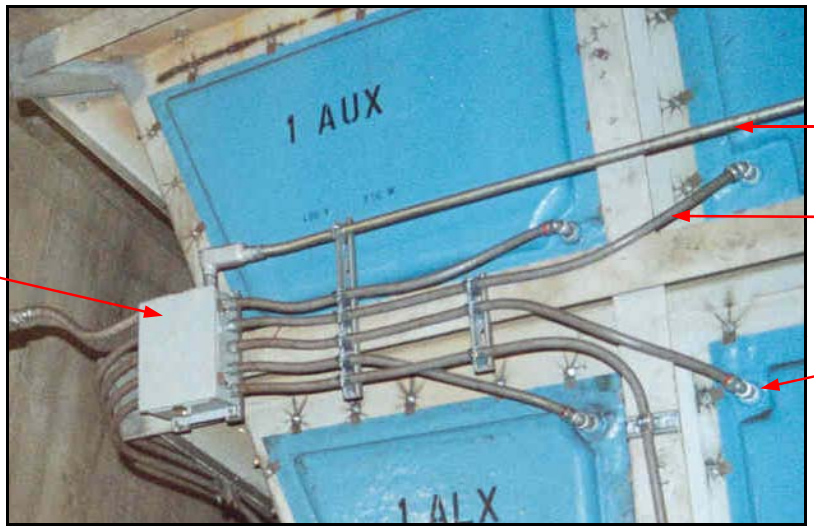
Mounting clips to clamp the edges of the FRP Heating Panel directly to the area being heated.

FRP Heating Panels can be supplied with a conduit hub and custom length cold leads that may be routed to a local mounted junction box. Alternatively, FRP Heating Panels can be supplied with hazardous rated junction boxes molded directly onto the heating panel.

As shown in the Photograph 2, local mounted junction boxes provide a convenient method and location for connecting several heating panels to the specified power supply.

Photograph 2

Local mounted junction box to accommodate the connection of all of the heating panels installed on two sides of a hopper



Incoming power supply in rigid metal conduit

Flexible conduit covered cold leads from each heating panel to the local junction box

½ inch conduit hub built directly into the FRP Heating Panel to accept flexible conduit

CONTROLS

The FRP Heating Panel System is designed to maintain the inside surfaces of hoppers, transfer chutes and other parts of conveying systems above freezing during winter operation. Holding the inner surfaces above freezing will eliminate flash freezing of the frozen or wet coal as it moves through the conveying system. To ensure continuous protection, the heating system must be energized and operational at all times when the ambient air temperarture falls below 40° F.

Control of this type of system is simple. The system is switched on and off by a thermostat that is set to monitor the rise and fall in ambient air temperature.

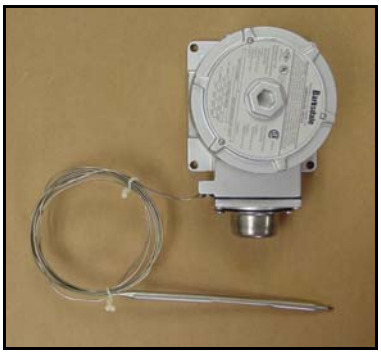
Photograph 3 shows the type B 121 ambient sensing thermostat. This is the standard thermostat used to energize FRP Heating Panel Systems in both hazardous and unclassified (non hazardous) areas.

Photograph 3

Type B 121 ambient sensing thermostat

All hazardous area applications also require the use of an over-temperature thermostat. This operational requirement is achieved with the use of a bulb and capillary style thermostat that senses the actual operating temperature of one of the FRP Heating Panels within the system.

Photograph 4 shows the TXR bulb and capillary style thermostat which has an adjustable range of 25-325°F. The sensing bulb of this thermostat fits into a phial pocket that is built into the heating panel selected to monitor over-temperature conditions.



Photograph 4

Type TXR 25 - 325°F over-temperature thermostat

Photograph 5

Indicator Panels are optional accessories available for use with the FRP Heating Panel System. This type of enclosure is normally mounted adjacent or near to the heating system to provide plant personnel with an immediate and continuous overview of the operating status of the heating system.

A "Power On" indicator light identifies that there is power available to the system. A "Power Required" indicator light identifes when the ambient thermostat is calling for power and the system should be energized and a "System On" indicator light confirms that the heating system is operational.

Photograph 5 shows a typical NEMA 4 Indicator Panel used in unclassified area installations (see next page for hazardous rated version). When required, this panel may also include contactors to switch the heating load, circuit breakers and alarms.

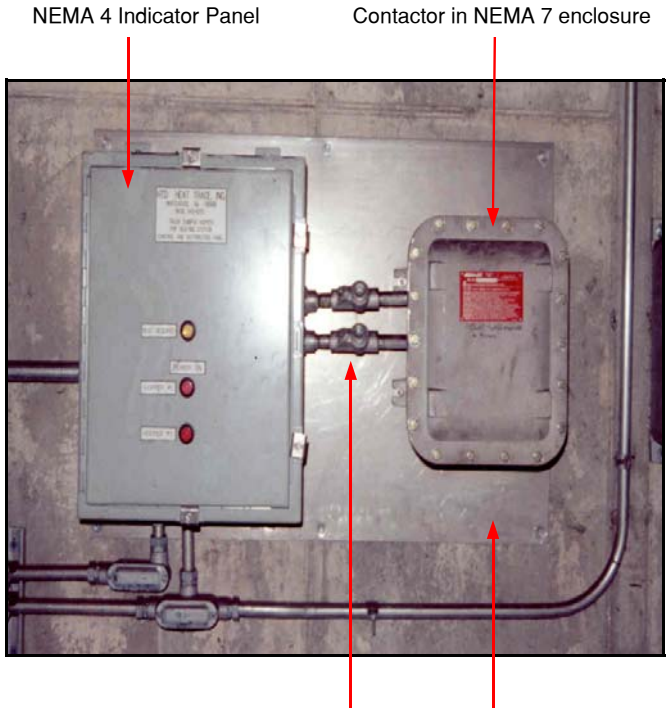
CONTROLS (cont)

Hazardous area regulations require all *arcing and sparking devices* to be housed in a suitably rated explosion-proof and/or dust-ignition proof enclosure. These regulations apply to items such as thermostats and contactors.

The standard ambient sensing and over-temperature thermostats used with the FRP Heating Panel System are fully qualified for use in both hazardous and unclassified area installations. When the total size (amps) of the FRP Heating Panel System exceeds the switching capability of these thermostats, a contactor must be used to switch the total heating load.

To meet these system requirements in unclassified areas, the required contactor can be supplied as a separate item in a NEMA 4 enclosure or it can be included in the Indicator Panel that is shown in Photograph 5.

In hazardous area installations, the contactor can be supplied in a NEMA 9 enclosure as a separate item or, as shown in Photograph 6, it can combined with an Indicator Panel into one modular, wall mounted package.



Photograph 6

This photograph shows a typical Indicator Panel and Contactor installed in a Class I Div 2 hazardous area application.

As required by the National Electric Code, the switching device (contactor) is sealed off from the non switching devices (Indicator Panel) by rigid conduit and sealing fittings.

All components are factory assembled, factory pre-wired and plate-mounted to form one modular easily installed unit.

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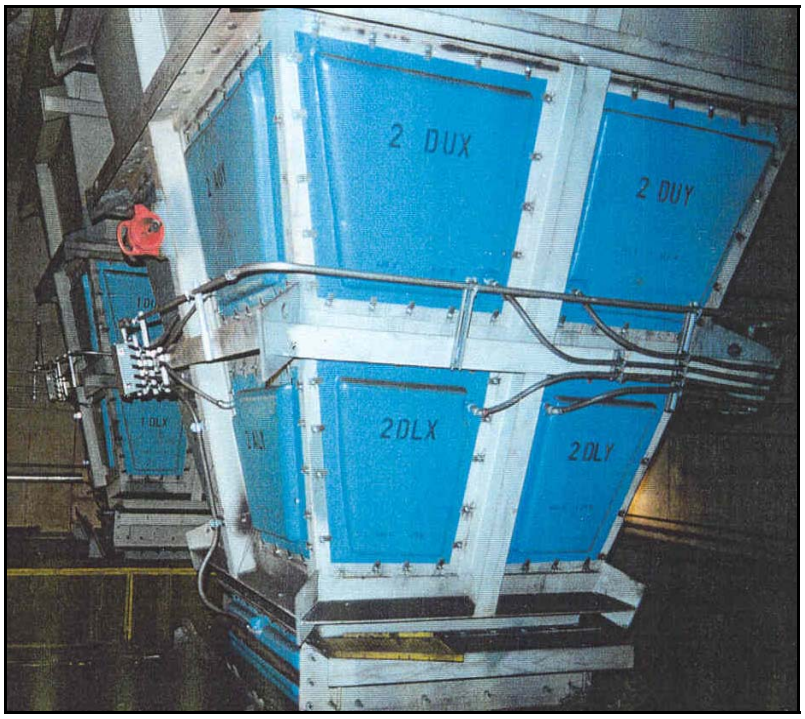
RECOMMENDED SPECIFICATION



FM APPROVED

FREEZE-PROTECTION OF HOPPERS, CHUTES AND TRANSFER POINTS WITHIN COAL, CEMENT, POWDER AND OTHER TYPES OF MATERIAL HANDLING / CONVEYING SYSTEMS

CHWS SPEC-F-12/04

RECOMMENDED SPECIFICATION - WINTERIZATION SYSTEMS

For COAL , CEMENT, POWDER AND OTHER TYPES OF MATERIAL CONVEYING SYSTEMS

FOREWORD

The text and terminology of this recommended specification is written around applications involving the freeze-protection of coal conveying equipment within Power Plants.

The approach and solution is applicable to many other bulk materials that are conveyed throughout many other types of plants. The reader should make the appropriate substitutions and revisions to text and terminology when using this document to assist with the writing of specifications that involve any materials other than coal

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SPECIFICATION

1.0 SCOPE

This specification is intended to define the minimum parameters for the design of an electric heat tracing system suitable for winterization (freeze-protection) of the silos, hoppers, chutes and critical transfer points of a coal handling and conveying system.

In this specification, the term "winterization" and/or "freeze-protection" defines the requirement for the heating system to prevent wet or frozen coal from freezing, sticking, bonding and building up on the internal metal surfaces of the specified items and areas of the coal handling and conveying systems during winter operation.

2.0 GENERAL

The vendor shall design, specify and provide an electric heat tracing system that shall meet the criteria detailed in all sections of this specification.

3.0 DESIGN SPECIFICATIONS

3.1 The electric heat tracing system shall be capable of maintaining the internal metal surfaces of all coal silos, hoppers, chutes and critical transfer points at a minimum of 40°F *(writer to specify exact items and areas to be heated).*

3.2 The system shall be capable of maintaining the specified temperature in minimum ambient temperatures of _____°*F (writer to specify lowest anticipated winter temperature).*

3.3 Calculations shall include a wind factor of ____ mph *(writer to specify maximum anticipated wind speed).*

3.4 The heating system shall be FM Approved for use Class _____, Division ____, Group ____ hazardous areas, as defined in Article 500 of the National Electrical Code *(writer to specify hazardous area designations).*

3.5 Temperature Control of the heating system shall be automatic, with the heating system being energized by the fall in ambient air temperature and de-energized by actual heating system operating temperatures. Temperature Controllers shall be suitable for use in the areas detailed in 3.4.

3.6 Vendor shall supply a complete set of heater layout drawings, wiring diagrams, control system schematics and ____ copies of a System Operation and Maintenance Manual. *(writer to specify number of copies).*

4.0 EQUIPMENT SPECIFICATIONS

4.1 The heat tracing equipment and system shall be of low watt density design with a maximum power density of 0.7 w/sq.in.

4.2 Individual heaters shall be custom sized and shaped to provide 100% heater coverage of the area or object being winterized.

4.3 Individual heaters shall be fabricated complete with a suitable thickness and type of thermal insulation to meet the requirements of 3.1, 3.2 and 3.3.

4.4 Heaters and thermal insulation shall be modular in design such that they can be easily removed and re-installed without damage *(essential feature for applications with liner plates).*

4.5 Heaters and thermal insulation shall be totally encapsulated such that the complete construction is waterproof, hoseproof, corrosion-resistant and dust-tight.

4.6 Modular heater construction must be extremely robust and suitable for safe, reliable operation under high levels of vibration in hazardous, wet, dusty and dirty conditions.

4.7 Heaters shall be individually labelled to show type, reference, wattage and voltage. All heaters shall be supplied with an FM Approval stamp or label that confirms suitability for installation and operation in the area defined in 3.4.

4.8 Heating system designer and manufacturer shall be HTD Heat Trace, Inc. Whitehouse, New Jersey.

4.9 Vendor shall provide documentation and literature identifying a product and system that meets all the requirements of this complete section.

5.0 HEATER DESIGN

5.1 Heaters shall be panel type, suitable for direct attachment to the outside of the item or object being heated

5.2 Heating source shall be a low watt density heating blanket that is laminated into a solid ¼" thick construction of Fiberglass Reinforced Plastic (FRP).

5.3 Heaters shall be fabricated to fit the exact size and shape of the item or object being heated. Items or objects with irregular or curved surfaces shall be heated with molded heating panels that have duplicate features of the irregularities or curvatures.

5.4 Heating panels shall be fabricated with a layer of polyurethane insulation covering the complete back face of the heater. External edges and surfaces of this insulation shall be encapsulated with FRP, such that heating panel and insulation become one, lightweight, modular, laminated, waterproof, dust-tight construction.

5.5 Heaters shall be type FRP Heating Panels as manufactured by HTD Heat Trace, Inc. Whitehouse, New Jersey.

5.6 Heating panels and system shall be designed for operation on a ____ vac, ___ phase power supply *(writer to specify desired voltage and phase requirements).*

5.7 Each heating panel shall be fitted with flexible cold leads of sufficient length to reach a local mounted junction box. Cold lead shall exit the heating panel through a ½" NPT fitting suitable for attachment of flexible conduit *(writer to specify this approach on small, unclassified installations involving less than 10 heating panels)*

OR

Each heater shall be connected to the power supply within a NEMA 7 / 9 conduit box, fabricated directly into the construction of the heating panel. Conduit box shall be approved for use in the area specified in 3.4 and sized to accept ¾" rigid or flexible conduit *(writer to specify this approach for hazardous area installations and systems involving 10 or more heating panels).*

6.0 CONTROL SYSTEM DESIGN

6.1 Each heating area shall be controlled separately.

6.2 A suitably rated ambient sensing thermostat shall be used to switch on the heating panels when ambient air temperatures fall to 45°F.

6.3 A suitably rated bulb and capillary style thermostat shall be used to limit the operating temperature of the heaters and switch off the system at a safe operating temperature *(vendor to specify temperature).*

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HEAT TRACE

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TYPICAL APPLICATIONS

FM APPROVED

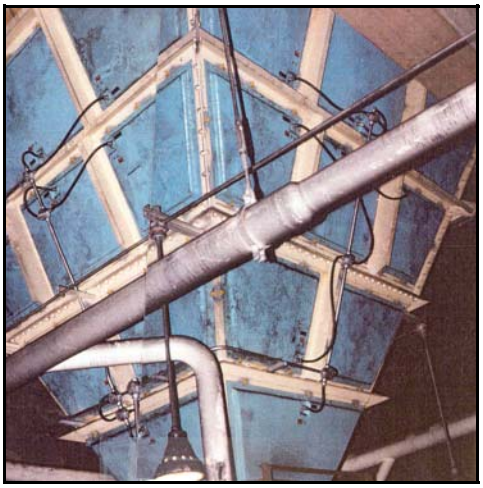
FREEZE-PROTECTION OF HOPPERS, CHUTES AND TRANSFER POINTS WITHIN COAL, CEMENT, POWDER AND OTHER TYPES OF MATERIAL HANDLING / CONVEYING SYSTEMS

HOPPERS

Preventing flash-freezing in hoppers and silos is a common application for the FRP Heating Panel System. Typical installations are Rail Car Dumper Hoppers and Truck Dumper Hoppers in coal fired power plants, coal terminals and coal mines. The FRP Heating Panel System has also been sucessfully used to prevent material build up and freezing in wood chip hoppers in the Pulp and Paper Industry and to prevent freezing in cement, lime, ore, dust and powder hoppers in material bulk handling and general industrial plants

Following are a few examples of FRP Heating Panel System installations involving hoppers that are critical to plant operation and performance.

Photograph 1



FRP Heating Panels installed on a Rotary Car Dumper Hopper at the Port of Conneaut Dock facility of the Bessemer and Lake Eire Railroad Company in Conneaut, Ohio.

This bulk storage and transfer facility is located directly on Lake Eire approximately 68 miles east of Cleveland. The facility is designed to handle 25 million tons per year of metalurgical and steam coals, direct shipping ore, fine ores, concentrates, pellets, limestone and dolomite.

The two main Rotary Car Dumper hoppers handling all incoming coal shipments are freeze protected with FRP Heating Panels to prevent flash-freezing and hopper blockage during the long, harsh Lake Eire winter periods.

This installation was originally commissioned in 1979 and upgraded in 2002 after 23 years of successfull operation.

Photograph 2

This photograph shows the FRP Heating Panel installations on the main Truck Dumper Hoppers at the Colver Power Project located in Cambria County, PA.

The Colver Power Project is a 102.5 MW waste bituminous coal fired power plant that has won several prestigious awards including the Power Magazine 1996 Powerplant Award, Power Engineering 1996 Project of the Year and the Environmental Protection Magazine 1998 Facility of the Year.

During the initial winter operations of 1995 / 96, this plant experienced significant flash-freezing problems as the fine, wet, bituminous coal was dumped from the delivery trucks into the only two hoppers that feed the plant. FRP Heating Panel Systems were designed and installed on each hopper in early 1996. ***Since this time, winter operation of these critical hoppers has continued without any form of disruption from freezing or hopper blockage.***

CHUTES

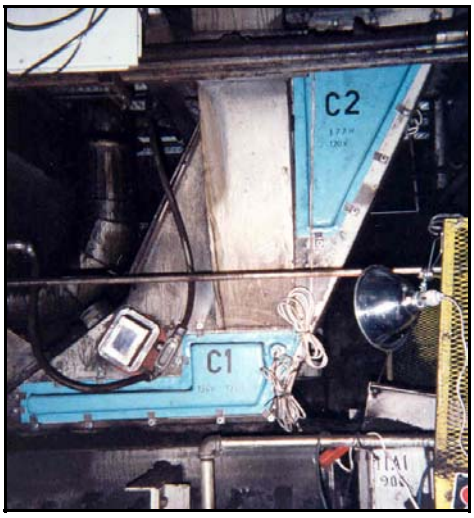
Steel chutes are commonly used to direct the flow of coal and other bulk materials from one conveyor to another. During winter operations, the coal being conveyed may be wet, snow covered or frozen. As transfers from conveyor to conveyor take place, this wet or frozen coal is thrown into contact with the inner steel surfaces of the transfer chutes. If this steel is at or below 32°F, the moving coal may instantly stick or bond to the inside of the chute. This instantaneous sticking, bonding and build up process is known as *flash-freezing*. Continued coal flow and freezing accelerates the build up process until the transfer capabilities of the chute are reduced to the point that the conveyor must be shut down and the chute must be manually unblocked.

FRP Heating Panels, custom sized to fit *the critical impact faces* of the transfer chutes will maintain the inner steel surfaces above 32°F. As the coal leaves the conveyor and enters the chute, it now contacts a warm surface to which it cannot stick or freeze. Instead, the free flowing coal is able to slide and drop through the chute and the potential for build up and blockage within the chute is completely eliminated.

The photographs show examples of how the FRP Heating Panel System has been successfully applied to prevent *flash-freezing* in various styles of conveyor transfer chutes.

Photograph 3

Photograph 4



Photograph 3. A 1979 full coverage installation on a Drop Chute

Photograph 4. Custom shaped "spot heaters" positioned to freeze protect specific problems areas at the base of an underground transfer chute.

Photograph 5

This is a just a small portion of the largest Coal Handling Winterization System in the world, installed in 1985 on the Intermountain Power Project in Delta,Utah.

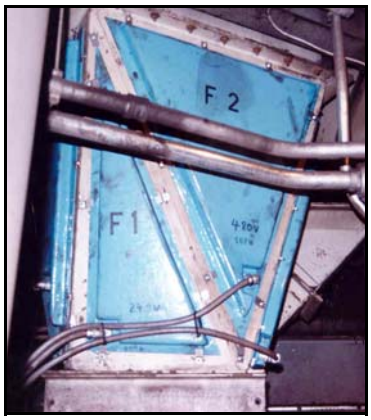
The photograph shows adjacent transfer chutes designed to provide alternating coal flow patterns to several conveyors.

FRP Heating Panels are positioned directly on the chute faces that carry the coal and they are sized to fit between liner bolts such that the chute liners can be removed and replaced without the need to disturb the heating system.

CHUTES (cont)

Photograph 7

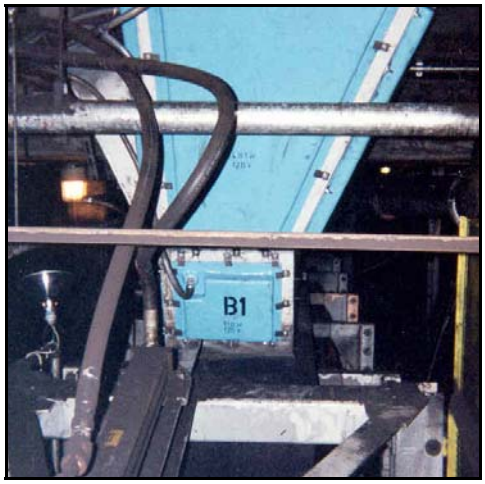
Photograph 8



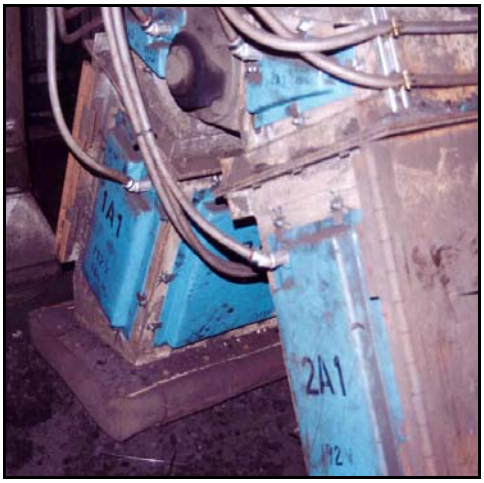
Photograph 9

Photograph 10

Photograph 11



Photograph 12



Photograph 7

Full coverage heating panels fitted to the sides and back faces of a sloping transfer chute.

Photograph 8

Triangular shaped FRP Heating Panels designed to fit a complex shaped transfer chute.

Photograph 9

Single heating panel located on the back impact face of a Drop Chute directly above conveyor.

Photograph 10

Full coverage heating panel design to ensure that there is no freezing and blockage at this tapering entrance above a conveyor.

Photograph 11

Trapezoidal shaped heating panel on a pyramidal style feed chute.

Photograph 12

Back and side face heating panel coverage on a bifurcated transfer chute.

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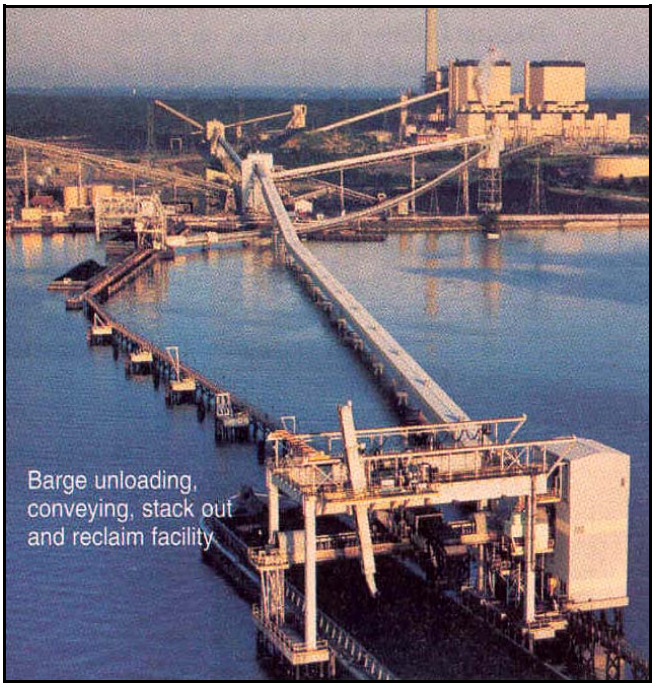
HEAT TRACE

FRP HEATING PANELS

CLIENT & PROJECT REFERENCES



MADE IN THE U.S.A.

FM APPROVED

COAL AND MATERIAL HANDLING WINTERIZATION SYSTEMS

INTRODUCTION

The development and use of the FRP Heating Panel System was exclusively pioneered by the Heat Tracing Division of Cooperheat in 1976.

Many of our original designs and installations are now over 25 years old, and winter after winter they continue to perform with complete reliability.

In 1996, this Cooperheat division was incorporated as HTD Heat Trace, Inc.

The FRP Heat Panel System has been specified, installed and used successfully to prevent *flash freezing* in many Coal Fired Power and Industrial Plants throughout North America.

The system can also be successfully applied to applications in the Pulp & Paper, Mining, Cement and Bulk Material Handling industries.

Following is a partial list of clients and projects that have successfully used this unique system to eliminate material flow problems during winter operations.

CLIENT	PROJECT	APPLICATION / USAGE
A / C Power Company	Colver Power Project Cambria County, PA	Truck Dumper Hoppers C2 Chute Transfer House Chutes
American Colloid Corporation	Upton Plant Upton, WY	Replacement Feed Hoppers
Atcon Corporation	Pontiac, MI	Conveyor Feeds
Barns and Tucker	Tanoma Mine	Coal Chutes
Beaumont Birch Co	Quantico, VA	Transfer Chutes
Bethlehem Mines Corporation	Drennen, WV	Chutes
Bethlehem Steel Corporation	Sparrows Point Nr Baltimore, MD	C2,C3,M1 and M2 Hoppers Breeze Chutes Battery Flop Gates
Cincinnati Gas & Electric Co	East Bend Station Nr. Cincinnati, OH	Hoppers
Clevland Electric Illuminating Co	Astubula Plant Avon Lake Plant Eastlake Plant	Coal Sled Hoppers Drain Trays Coal Dumper Hoppers
Cooperative Power Association	Coal Creek Station Underwood, ND	Drop Chutes Reclaim Hoppers
Dayton Power & Light Co	J. M. Stuart Station Aberdeen, OH	Belt Discharge Chutes Chutes 7C & 8C

CLIENT	PROJECT	APPLICATION / USAGE
Detroit Edison Company	Monroe Plant Monroe, MI	Breaker House Dust Collector
Dravo Lime Co		Coal Bin
E. I. Dupont Company	Fayetteville Plant, NC Washington Works, WV	DISF Cryogenic Tanks
Fairfield Engineering Co	Caterpillar Tractor, Peoria, IL E. I. Dupont Project 2613 J.M. Stuart St, Aberdeen, OH Miller Brewing Company Miller Brewing Company	Reclaim Hopper PMK - 1 Hopper Discharge Chutes Reclaim Hopper Reclaim Hopper
Flakt Incorporated	Grand River Dam Authority GRDA # 1 & 2, Choteau, OK	Spray Dryer Hoppers
Freeman United Coal Mining Co	Industry Mine	Coal Hopper
Illinois Power & Light Co	Havana Station Unit # 6 Havana, IL	Coal Reclaim Hopper
Iowa Power & Light Co	Council Bluffs Power Station Council Bluffs, IA	Coal Hoppers
Kansas Power & Light Co	Jeffrey Energy Center St. Marys, KS	Yard Hoppers
Lake Eire Railroad Company	P & C Dock Conneaut, OH	Dumper Hoppers
Los Angeles Dept of Water and Power	Intermountain Power Project Delta, UT	Installed in 1985 / 86, this is the largest Coal Handling Winterization System in the world
Louisville Gas & Electric Co	Mill Creek Station Nr. Louisville, KY	Transfer Chutes
McNally Pittsburg Co	Desorado Mine Western Fuels, Bonanza Pwr Proj Rangely, CO	Coal Hopper Chutes 2 & 12 Transfer Station Dribble Chutes Surge Bin
Monongahela Power Co	Harrison Station Haywood, WV	Coal Lowering Well # 2

CLIENT	PROJECT	APPLICATION / USAGE
Pennsylvania Electric Company	Homer City Plant, Homer City, PA Williamsburg St. Williamsburg, PA	Silos 1.2.3 & 4 Portable Coal Auger Sampler
Penntech Paper Inc	Johnsonburg, PA	Coal Feed Bin
Pikesville Coal Company	Chisholm Mine	500 Ton Bin and Feeder Chute
Piitsburgh & Conneaut Dock Co	Port of Conneaut Terminal Conneaut, OH	Rotary Car Dumper Hoppers
Reliant Energy	Seward Plant, New Florence, PA	Head Chute 01HC1 Coal Chute to 03C1
Sauer Industrial Contracting Inc	Homer City Plant Homer City, PA	Uncoaler
Siemens Corporation	Portland Generating Station Portland, PA	Expansion Bottle Heaters
Stephens & Adamson Co	Salt River Stacker	Transfer Chutes
Tri-State G & T Association	Craig Station 1 & 2 Craig, CO	Chutes 3A / 3B
Truesdale Company		Bio - X Filter Heaters
Virginia Electric & Power Co	Project 4602	Coal Chutes
Watkins Engineering Company	IES Utilities Project	Flop Gate Chutes
West Elk Coal Company	Mount Gunnison Mine Somerset, CO	Chutes Flop Gates and Slide Gates
Wyodak Resources	Gillette, WY	Discharge Chute

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HEAT TRACE

HIGH TEMPERATURE HEATING JACKETS, BLANKETS AND TAPES

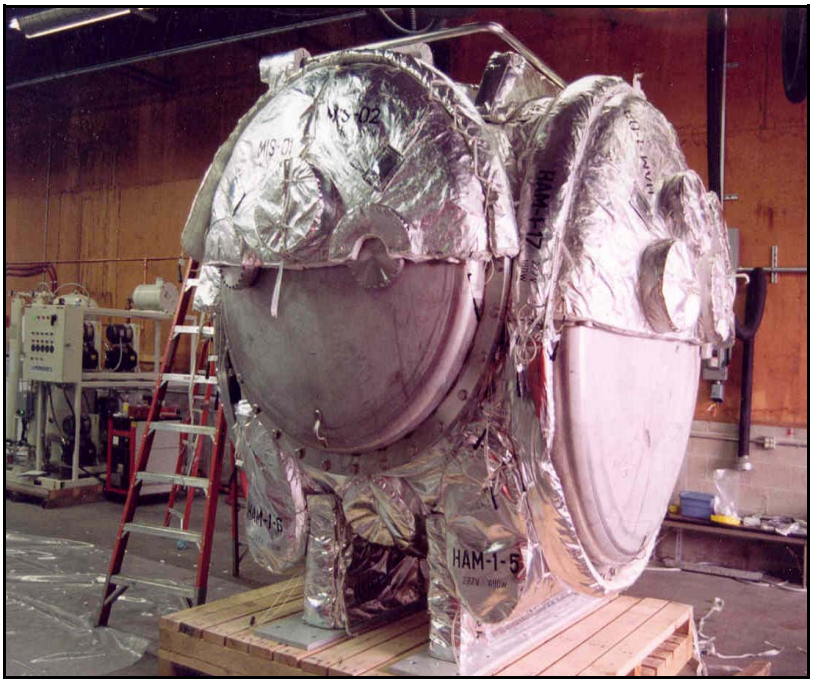
Custom designed Heating Jackets, Insulation Jackets, Heating Blankets and and Heating Tapes for applications up to 1650° F (900° C)

HEATING JACKETS

HEATING BLANKETS & HEATING TAPES

HEAT TRACE

HEATING JACKETS



CUSTOM DESIGNED HEATING JACKETS

HEATING JACKETS

HTD Heat Trace, Inc is a long established designer, manufacturer and supplier of custom built heating jackets. Applications for this type of specialized heater range from industrial pump or valve heating to high vacuum bakeout systems used in the worldwide scientific community.

Heating jackets may be custom manufactured from drawings and photographs, molds or patterns or from the actual item being heated.

HTD offers several different material constructions based upon the environmental, temperature and power requirements of the application. Heating elements used within the jacket designs may be heating cable, Ni-chrome resistance foils or wires or flat, flexible heating blankets. HTD has the versatility, design experience and manufacturing capabilities to satisfy most application requirements up to 1,650°F (900°C)

TYPE LTJ HEATING JACKETS

The LTJ style of heating jackets are normally used for freeze protection and temperature maintenance applications up to 150°F (66°C). This low temperature type of jacket incorporates the heating element, from1 to 3 inches of soft fiberglass insulation and an outer bag that is manufactured from industrial grade, silicone coated glass cloth. Type LTJ Heating Jackets can be designed and supplied for both indoor and outdoor applications.

The opposite photographs show a small pump which required temperature maintenance at 120°F (49°C). The pump was shipped to HTD and used as a pattern for the fabrication of the LTJ Heating Jacket.

This second photograph shows the final LTJ Heating Jacket fitted to the pump body. The jacket is simply wrapped from the underside of the pump until opposite faces meet. Straps and "D" rings are used to tie the mating edges together and seal up the jacket. Lacing eyelits, hooks or Velcro strips are also popular fastening methods offered with the LTJ Heating Jacket.

Temperature control of this type of heating jacket is normally handled by a bulb and capillary type thermostat or an electronic temperature controller with thermocouple or RTD type sensor.

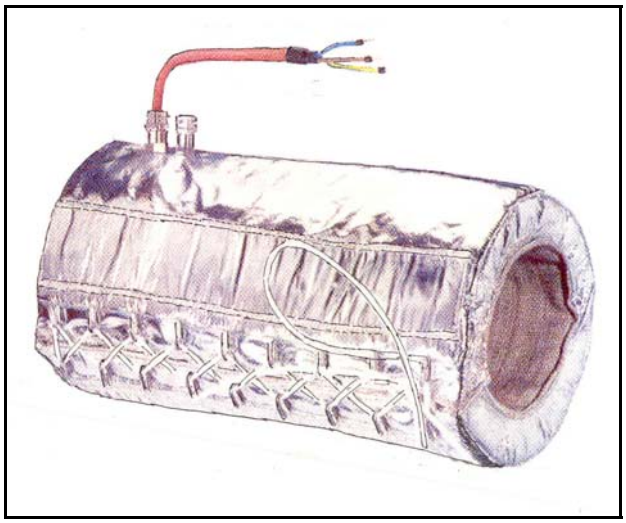
TYPE MTJ HEATING JACKETS

This is our medium temperature heating jacket that is suitable for indoor applications up to 450°F (232°C). As shown in the photographs, this style of heating jacket can be manufactured to fit all shapes and sizes of applications

Type MTJ Heating Jackets normally combine a Ni-chrome foil, ribbon or wire type element with high temperature insulation and an outer bag of aluminized glass cloth.

Photographic examples are:

- (*top left*) A very complex Valve Heating Jacket.
- (*middle left*) A Flowmeter Jacket
- (*bottom left*) A vertical Pump Heating Jacket
- (*below*) A Tube Heating Jacket



TYPE VBJ HEATING JACKETS

For many years, HTD Heat Trace, Inc has specialized in the design and manufacture of high vacuum bakeout heating jackets. This unique syle of heating jacket is suitable for operation up to 850°F (454°C) and is custom designed to heat metal structures and components in High Energy Physics research facilities and laboratories around the world

In 1997, HTD Heat Trace, Inc. was exclusively selected to design and supply all of the high vacuum bakeout jacket requirements on the Laser Interferometer Gravitational Observatories (LIGO) Projects in Hanford, WA and Livingstone, LA. This multi-million dollar project, funded by the National Science Foundation through collaborative agreements with California Institute of Technology (Caltech) and Massachusetts Institute of Technolgy (MIT), required HTD to design and supply over 1,300 individual, custom designed heating jackets. Each heating jacket was designed to heat raise a specific part or component within the LIGO system from ambient to over 300°C in 48 hours. System parts and components are maintained at this elevated temperature for many hours until the required bakeout cycle is completed. This bakeout process is required to create the 1 x 10^{-8} torr vacuum needed for the scientific experiments being conducted.

The opposite photographs show several sections of this massive project, which is believed to be the largest single high vacuum bakout installation and program ever completed in the world.

TYPE VHTJ HEATING JACKETS.

The design of the VHTJ Heating Jackets is very similar to that of the MTJ Heating Jackets, with the exception that Quartz Fabrics, and Ceramic Insulation are used throughout the construction. The use of these materials, combined with high temperature Ni-chrome resistance elements, offers the end user a flexible heating jacket construction that can be used on indoor heating applications up to 1,650°F (900°C).

Type VHTJ Heating Jackets are normally used in laboratory and research type environments to provide high temperature and / or high power heating solutions.

A pictorial impression of this uniquely qualified heating jacket is shown opposite.

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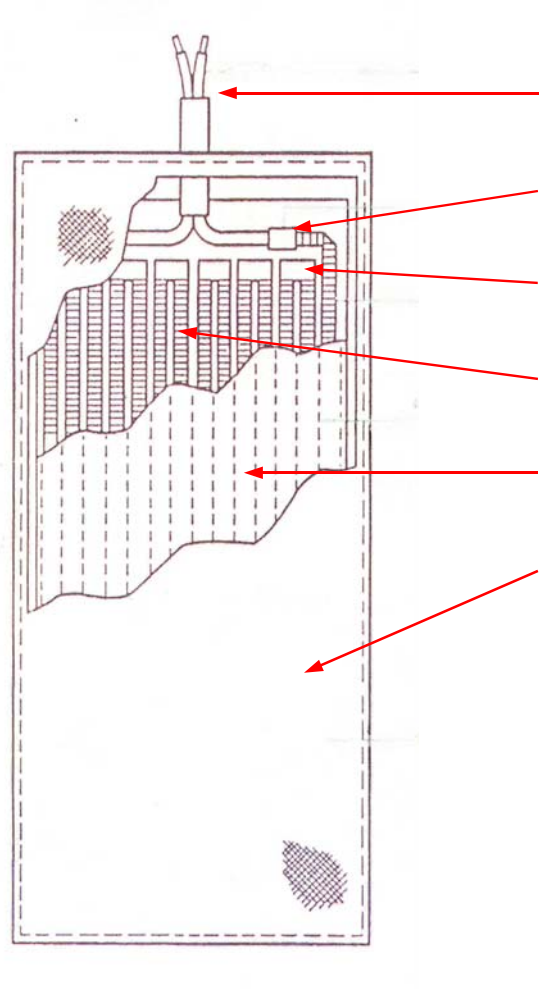
HEAT TRACE

HEATING BLANKETS AND HEATING TAPES

HIGH TEMPERATURE HEATING BLANKETS AND HEATING TAPES

HEATING BLANKETS

Flexible Heating Blankets are ideal surface heating devices for providing precise levels of heat to flat or irregular shaped objects. HTD Heat Trace, Inc. manufactures several styles of heating blankets that are suitable for applications up to 850°F (454°C). All styles can be made to virtually any shape or size and can be designed for any voltage (up to 600 vac) and power rating (up to 500 watts/sq.ft, 5.38 kW/sq.mtr).



GENERAL BLANKET CONSTRUCTION

- Custom length cold lead cable, suitable for the application temperature and voltage.
- Pure nickel, non-corroding cold crimped joints between heating elements and cold lead conductors.
- Triple spot welded stainless steel bridge pieces for ultra reliable heating circuit path connections.
- High temperature Ni-Chrome heating elements in flat foil, ribbon or wire form.
- Multi-layer, high temperature glass cloth dielectric construction.
- Outer jacket materials selected to meet the temperature and environmental requirements of the application.

TYPE G HEATING BLANKETS

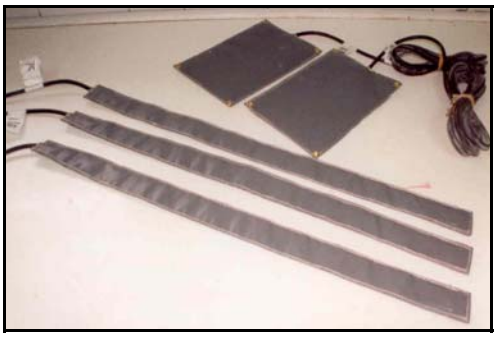
Type G Heating Blankets are general purpose, industrial grade heating blankets that are suitable for both indoor and outdooor applications. They can be manufactured in any shape or size and they can be designed for use on any voltage up to 600 vac.

Maximum application temperature 450°F (232°C)

Maximum exposure temperature850°F (454°C)

Maxium power denisty 250 w/sq.ft.

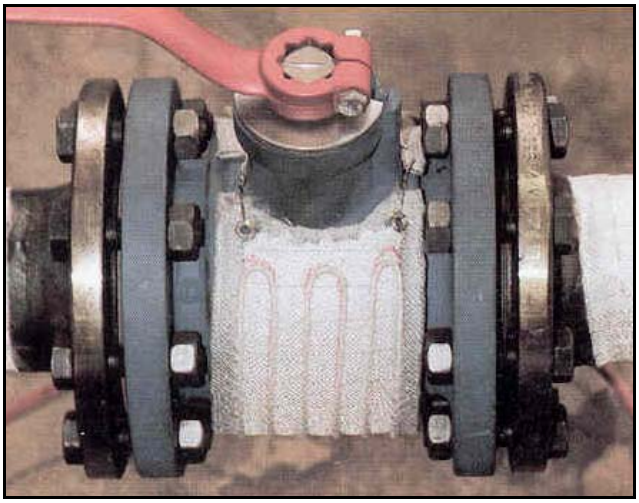
The type G Heating Blanket is typically used for heating conical hoppers, plattens, bins and irregular shaped objects. The product is highly flexible and can be supplied with various fastening designs for quick and simple installation. (e.g lacing eyelits, lacing hooks or Velcro strips).

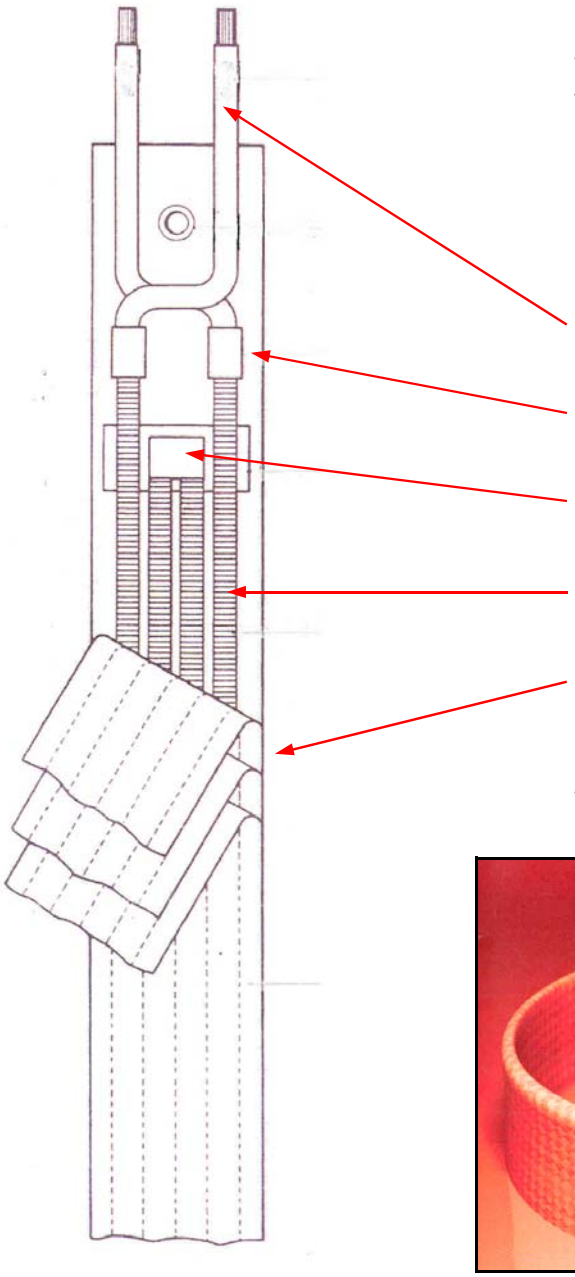


All G Heating Blankets are manufactured with an outer bag of industrial grade, high temperature glass cloth that is impregnated with silicone rubber. This outer bag is water and moisture-resistant such that the product can be used safely under thermal insulation on outdoor applications.

Photographs show just a few of the different shapes that can be manufactured with this versatile surface heater.

- Rectangular blankets and strips (upper left)
- Circular petal shapes with cut outs (center left)
- Trapezoidal blanket (bottom left)
- Valve blanket (bottom right)





Flexible Heating Heating Tapes can be wrapped around pipes, laboratory apparatus, vessels and most forms of cylindrical objects to deliver precise levels of heat. This form of heating is frequently required in laboratories and research environments to provide high levels of power in small, concentrated areas.

HTD Heat Trace, Inc manufactures a total range of high temperature, high power heating tapes that are available in lengths from 2 to 25 feet long and widths from 1 to 3 inches.

These products are suitable for dry, indoor applications up to 1650°F (900°C).

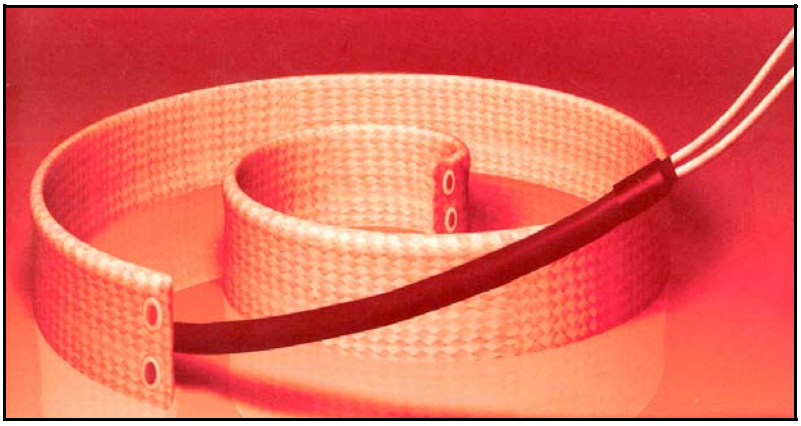
HEATING TAPE CONSTRUCTIONS

Type G - All glass construction - 850°F (450°C) max

Type Q - All quartz construction - 1650°F (900°C) max

- Custom length cold lead cables, suitable for the application temperature and voltage.
- Pure nickel, non-corroding cold crimped joints between heating elements and cold lead conductors.
- Triple spot welded stainless steel bridge pieces for ultra reliable heating circuit path connections.
- High temperature Ni-Chrome heating elements in flat foil, ribbon or spiral wire form.
- Multi-layer, high temperature glass or quartz cloth dielectric construction.

Please contact us for further details on standard lengths, voltages and power ratings.



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HEAT TRACE

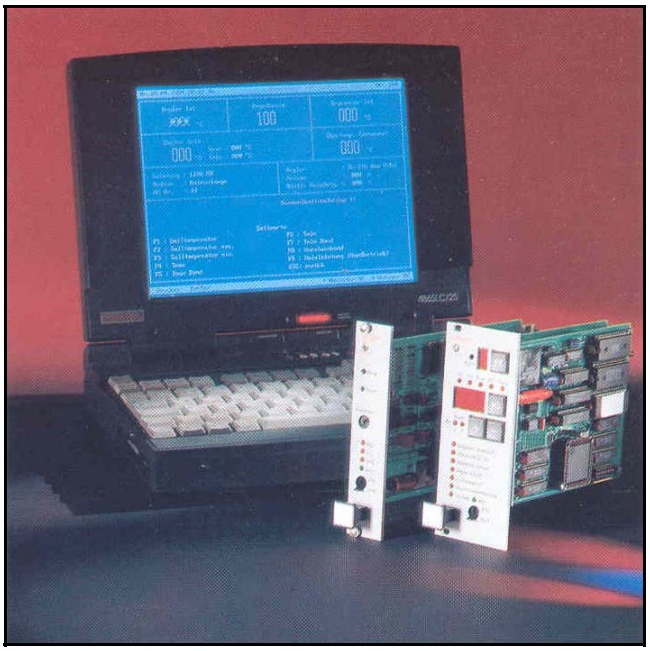
CONTROLS AND CONTROL SYSTEMS

Thermostats, Controllers and Control Panels for use in hazardous and unclassified (non hazardous) area applications

THERMOSTATS, CONTROLLERS & CONTROL SYSTEMS

HEAT TRACE

THERMOSTATS, CONTROLLERS AND CONTROL SYSTEMS



FOR PIPE TRACING,
TANK HEATING,
HOPPER HEATING
AND OTHER
GENERAL HEAT TRACING
APPLICATIONS

CONTROLS LIT-F-12/04

MADE IN THE U.S.A.

B 100 Ambient sensing thermostat

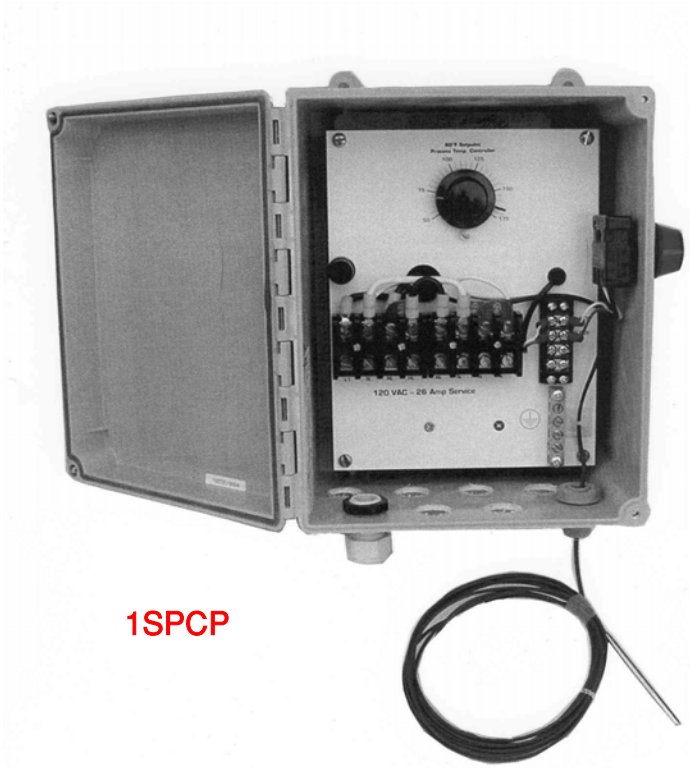
USAGE:	Freeze protection
RANGE:	15 to140°F (-10 to 60°C)
ENCLOSURE:	Die cast aluminum
CLASSIFICATION:	NEMA 4X
SENSOR MATERIAL:	Stainless steel
SWITCH:	One SPDT, snap action
WIRING:	Direct to thermostat
ELECTRICAL RATING:	22A / 480 VAC
APPROVALS:	

E 100 Process sensing thermostat

USAGE:	General pipe tracing
RANGE:	25 to 325°F (-5 to 163°C)
ENCLOSURE:	Die cast aluminum
CLASSIFICATION:	NEMA 4X
SENSOR MATERIAL:	Stainless steel, 10' capillary
SWITCH:	One SPDT snap action
WIRING:	Direct to thermostat
ELECTRICAL RATING:	22A / 480 VAC
APPROVALS:	

E 55 Process sensing thermostat

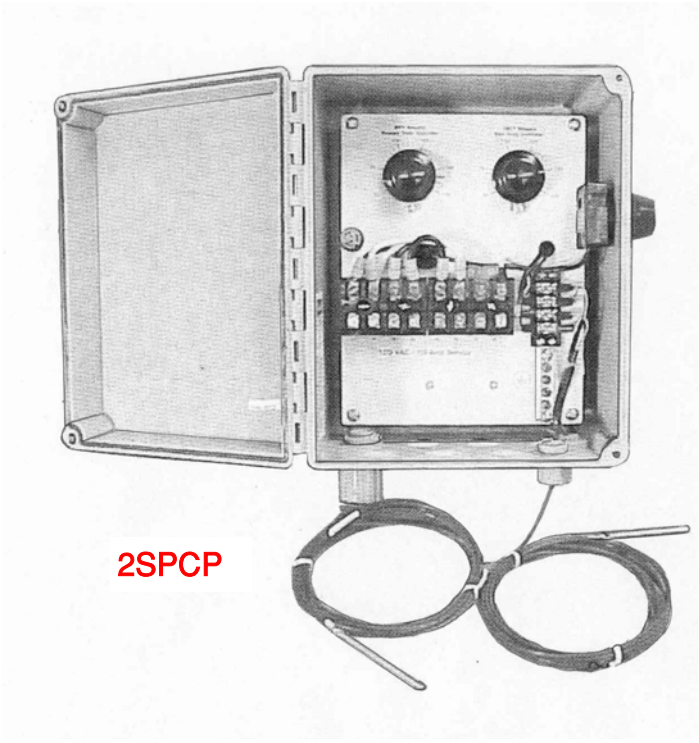
USAGE:	Hopper heating
RANGE:	150 to 650°F (66 to 343°C)
ENCLOSURE:	Die cast aluminum
CLASSIFICATION:	NEMA 4X
SENSOR MATERIAL:	Stainless steel, 10' capillary
SWITCH:	One or two SPDT snap action
WIRING:	Direct to thermostat
ELECTRICAL RATING:	15A or 20A / 480 VAC
APPROVALS:	



1SPCP

1SPCP Electronic process sensing controller

USAGE:	Tank heating (Metal Tanks)
RANGE:	50 to175°F (10 to 80°C)
ENCLOSURE:	Fiberglass
CLASSIFICATION:	NEMA 4X
SENSOR MATERIAL:	Stainless steel "J" thermocouple with 10' leads, SS braid and FEP jacket
SWITCH:	Solid State Relay
WIRING:	Terminal block
ELECTRICAL RATING:	26A, 120VAC or 26A, 240VAC
APPROVALS:	Major components used throughout this assembly are UL and CSA listed products



2SPCP

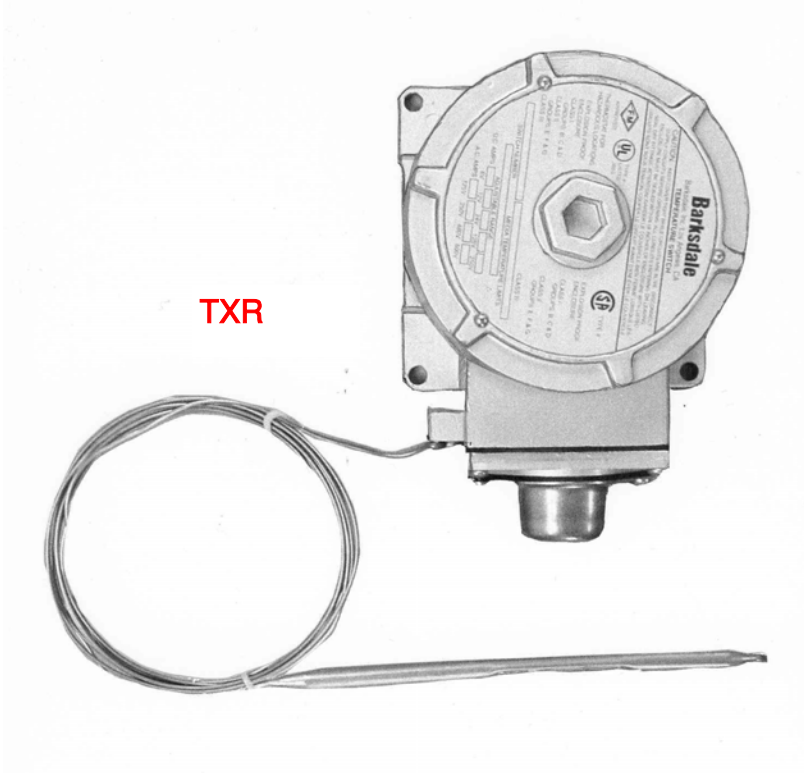
2SPCP Dual electronic process sensing controller

USAGE:	Tank heating (FRP & Plastic Tanks)
RANGE: (process) (high-limit)	50 to175°F (10 to 80°C) 50 to175°F (10 to 80°C)
ENCLOSURE:	Fiberglass
CLASSIFICATION:	NEMA 4X
SENSOR MATERIAL:	Two Stainless steel "J" thermocouples with10' leads, SS braid and FEP jacket
SWITCH:	Solid State Relay
WIRING:	Terminal block
ELECTRICAL RATING:	26A, 120VAC or 26A, 240VAC
APPROVALS:	Major components used throughout this assembly are UL and CSA listed products

B 121

B 121 Ambient sensing thermostat

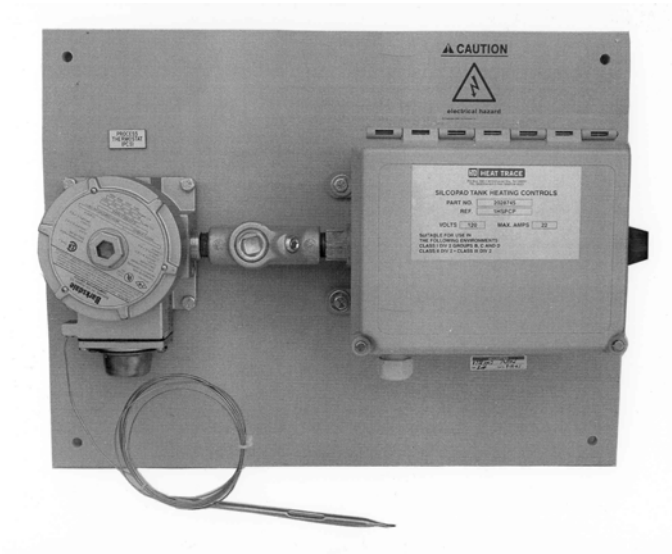
USAGE:	Freeze protection
RANGE:	15 to140°F (-10 to 60°C)
ENCLOSURE:	Die cast aluminum
CLASSIFICATION:	NEMA 4X, 7 & 9, IP66
SENSOR MATERIAL:	Stainless steel
SWITCH:	One SPDT, snap action
WIRING:	Direct to thermostat
ELECTRICAL RATING:	22A / 480 VAC
APPROVALS:	Class I, Div I, Groups B, C & D Class II, Div I, Groups E, F & G



TXR

TXR Process sensing thermostat

USAGE:	General pipe tracing
RANGE:	25 to 325°F (-5 to 163°C)
ENCLOSURE:	Anodized, silver painted aluminum
CLASSIFICATION:	NEMA 4, 7 & 9
SENSOR MATERIAL:	Stainless steel, 10' capillary
SWITCH:	One SPDT, snap action
WIRING:	Direct to thermostat
ELECTRICAL RATING:	22A / 480 VAC
APPROVALS:	Class I, Div I, Groups B, C & D Class II, Div I, Groups E, F & G



1HSPCP Process sensing controller

USAGE: Tank heating (Metal Tanks)

RANGE: 25 to 325°F (-5 to 163°C)
Factory preset at 60°F (16°C)

HEATER JUNCTION BOX: Fiberglass

JUNCTION BOX CLASSIFICATION: NEMA 4X

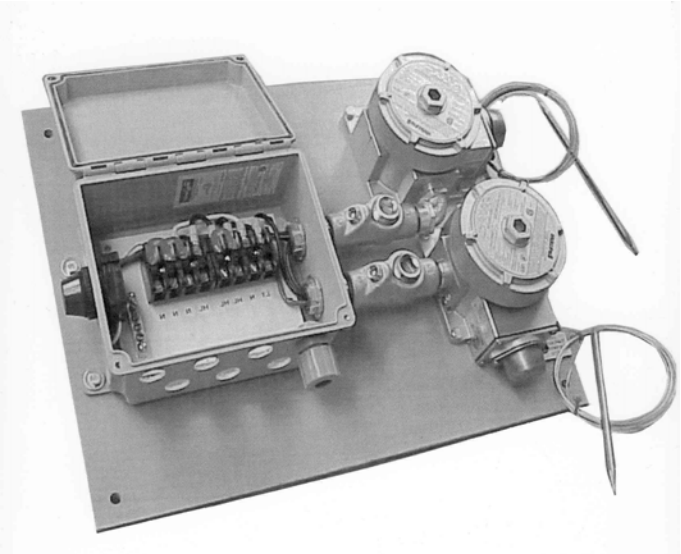
SENSOR MATERIAL: Stainless steel, 10' capillary

SWITCH: One SPDT, snap action

WIRING: Terminal block

ELECTRICAL RATING: 22A / 480 VAC

APPROVALS: Interconnecting conduit and wiring meets NEC requirements and thermostat is UL, CSA, and FM approved for hazardous area usage



2HSPCP Dual thermostat process sensing controller

USAGE: Tank heating (FRP & Plastic Tanks)

RANGE: (process) 25 to 325°F (-5 to 163°C)
Factory preset at 60°F (16°C)
(high-limit) 25 to 325°F (-5 to 163°C)
Factory preset at 150°F (66°C)

HEATER JUNCTION BOX: Fiberglass

JUNCTION BOX CLASSIFICATION: NEMA 4X

SENSOR MATERIALS: Stainless steel, 10' capillaries

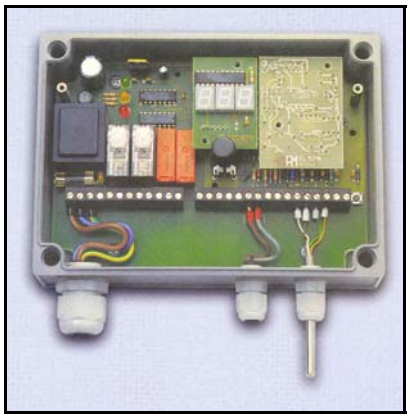
SWITCHES: One SPDT, snap action (each t'stat)

WIRING: Terminal block

ELECTRICAL RATINGS: 22A / 480 VAC (each t'stat)

APPROVALS: Interconnecting conduit and wiring meets NEC requirements and thermostats are UL, CSA and FM approved for hazardous area usage

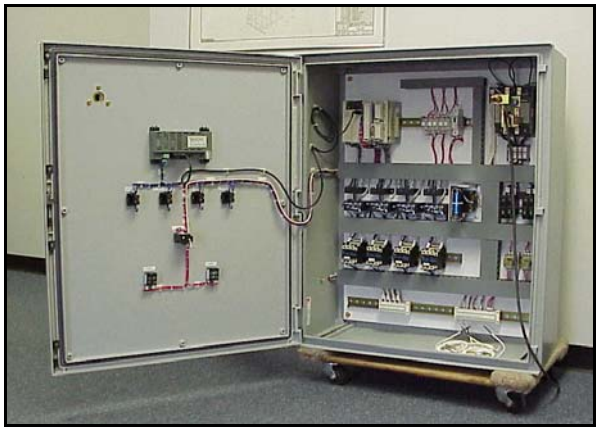
DESIGN AND MANUFACTURING CAPABILITIES

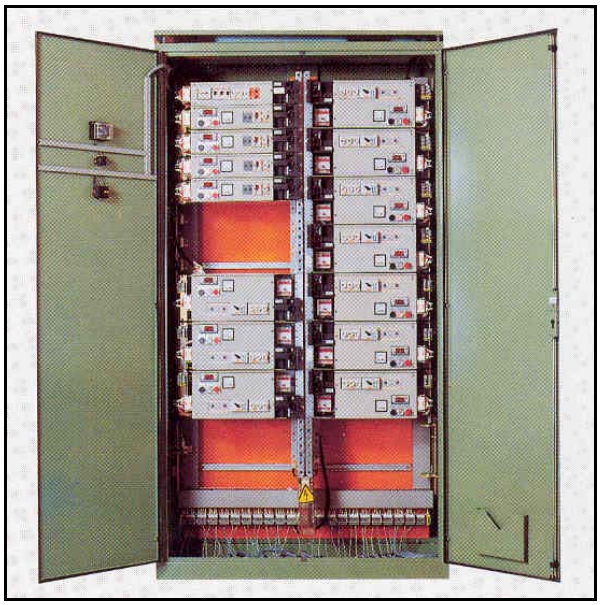


HTD Heat Trace, Inc. designs, engineers and manufactures custom control, alarm, monitoring, distribution and energy management panels and systems for all types of heat tracing applications.

Custom panels, controllers and systems for indoor, outdoor, hazardous and unclassified (non-hazardous) applications are designed and manufactured at our Whitehouse, NJ manufacturing facility. All types and sizes of custom panels can be offered, ranging from single circuit controllers with a thermostat, contactor and indicating light to PLC based multi-branch control and alarm systems.

Following are a few photographic examples of special controllers and control panels designed and manufactured by HTD. Please contact us for further information.





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