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Pipe-Insert Immersion Heaters - MX

Application

For heating asphalt, molasses, tar, paint, glue or any viscous fluids. When heating corrosive liquids the pipe enclosing the heater must be resistant to corrosion. Tank fabricator to supply and install pipes. Heater can be removed without draining the liquid.

Heat is transferred safely from the heating element to the inner wall of the pipe by a combination of convection and radiation. Note that filling the pipe with a heat transfer fluid is neither required nor recommended.

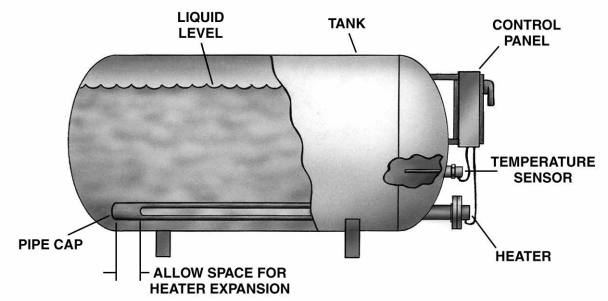


Figure 28 – Typical application of pipe-insert immersion heater for viscous fluids

Construction

Standard heaters have heavy duty alloy sheathed element(s) fitted to either a 3" 150 lb. steel flange or a 2" NPT screwplug. The terminal box is moisture resistant for outdoor applications. One 1" NPT conduit fitting is provided on units without thermocouple, and an additional 1/2" NPT conduit fitting is provided on units with built-in thermocouples.

Heaters with Type K thermocouples (one per tank) are used for detecting low liquid levels. If the level drops below the uppermost heater, the temperature inside the heater pipe will rise. The thermocouple will detect this temperature rise, and, when this signal is fed through an electronic temperature limit control, it will automatically trip the system off. CCI Thermal can provide a packaged control panel or ship the control components individually.

Refer to Section D for information on Caloritech™ control panels for this application.

Refer to Section F for information on thermostat and thermocouple assemblies with attached wells.

Installation

Install heaters in a suitable metal pipe with a 2" (51 mm) minimum inside diameter. Fit 3" standard pipe flanges or 2" (51 mm) couplings where pipes extend outside the tank wall and cap the pipe ends inside the vessel.

It is best to leave one pipe a few inches higher than the others. This pipe will receive the heater with the built-in thermocouple or limit device to provide fast response under low liquid level conditions.

Selection and Sizing

Use the graphs (Figure 29 and Figure 30) and the explanation on the following page to determine the kilowatts necessary to maintain the tank at the required temperature. Next, select the required number of heaters with an insert length long enough to provide good heat distribution.

Normally the one element and two element style heaters are used in groups of three so that they can be wired in a three phase balanced system.

When the application entails heating an extremely viscous liquid from a cold start, the one element heater should be selected since the lower resulting watt density on the pipe surface will prevent coking (see Table 38 on page B40).

Table 38 –Watt Density on Pipe Surface vs. Heater Type

Pipe Size		Element Type					
in	mm	1	2	3	1	2	3
		W/in² on Pipe			W/cm² on Pipe		
2	51	5.5	7.4	6.8	0.9	1.1	1.1
2 1/2	64	4.6	6.2	5.7	0.7	1.0	0.9
3	76	3.8	5.1	4.7	0.6	0.8	0.7
4	102	3.0	4.0	3.7	0.5	0.6	0.6

Special Features

- Packaged control systems
- Special voltage
- Special wattage
- Explosion resistant terminal housings
- Built-in thermostats/limits
- Special lengths
- Special flange or screwplug sizes
- Extra conduit fittings

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Solving Heating Problems: Figure 29 through Figure 31

Step 1: Use tank diameter and length and Figure 29 to determine tank surface area.

Step 2: Using Figure 30, surface area, and maximum design temperature difference between tank contents and surroundings, the heat loss can be determined for 2" (51 mm) or 4" (102 mm) of insulation.

Step 3: Figure 31for asphalt or heavy oil, is used to determine the additional energy required for heat-up from a cold start if cold loads are added. Use maximum heat-up times to minimize installed kW requirements.

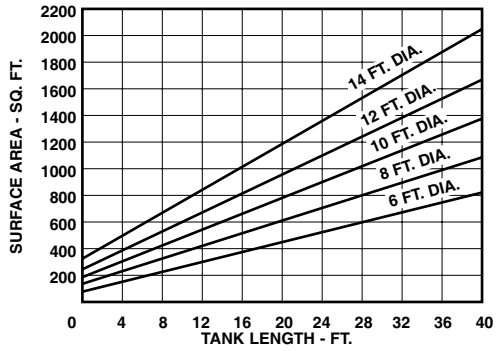


Figure 29 – Tank Surface Area vs. Length

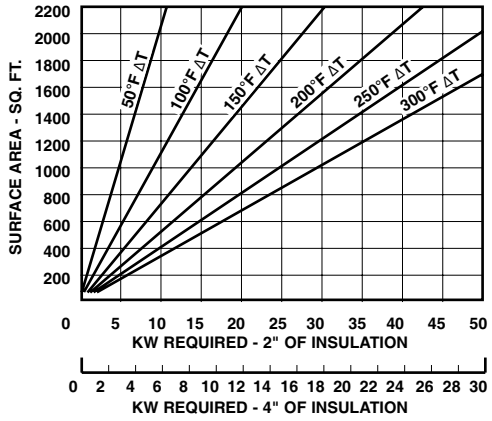


Figure 30 – Tank Surface Area vs. Recommended (Installed Kilowatts)

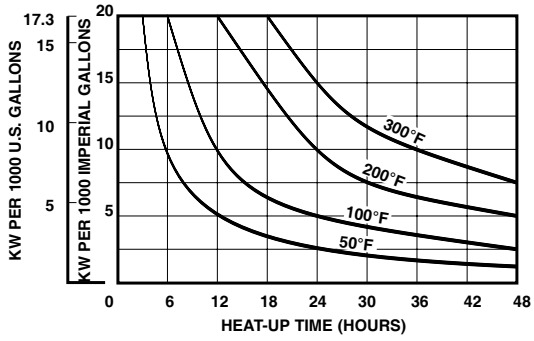


Figure 31 – Tank Capacity vs. Heat-Up Time for Asphalt

Control Systems

CCI Thermal manufactures standard and custom designed control panels for pipe insert heating systems. See Section D for listings of CPA, CPB and CPP panels.

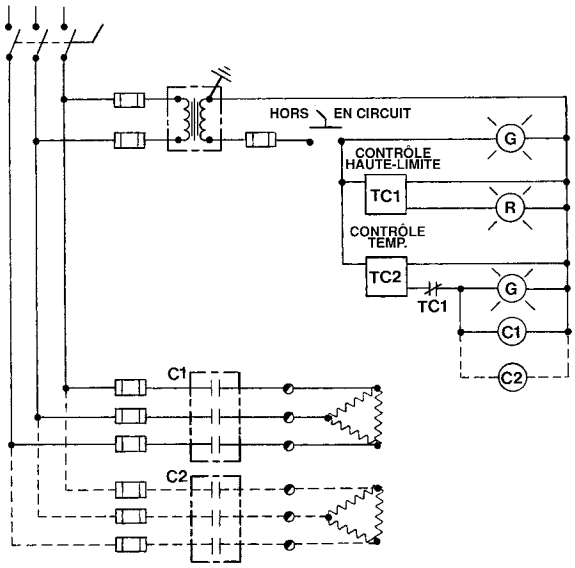


Figure 32 – Typical Control System



Special Pipe Heaters Assemblies

Some applications may require a higher kW rating than can be achieved with individual pipe heaters. Special assemblies of closely spaced pipes mounted to a common header are available. Each pipe in the header is fitted with a special heating element.

Another advantage of this system is that, in the event that an element has to be removed for servicing, draining is not required.

This type of heater is particularly suitable for suction heating in large bunker oil storage tanks.

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Pipe-Insert Heaters MX Series

Pipe-insert heaters are listed with a choice of flange or screwplug mount. Special mounting types and sizes are available on request.

Many storage tanks containing high viscosity liquids require a method of heating which will uniformly distribute the heat and will not cause charring or coking. Electric insert heaters installed in pipe wells with large surface areas in contact with the product have proven to be a cost effective and virtually maintenance free solution to these heating problems.

Application

Heat transfer in liquids is mainly by convection as opposed to conduction. Because of their high viscosities, heavy liquids such as asphalt, molasses, tar, paint, wax and some oils have poor heat transfer at low temperatures.

If these liquids require heating, careful consideration must be given to the rate at which heat is being introduced into the product since coking of the liquid at the heating surface could spoil the entire tank contents. Electric pipe-insert heaters eliminate the need for high maintenance pumps or open flames which may present a fire hazard, especially when the liquid being heated is flammable.

Refer to page B40 and page B41for detailed information on the construction and use of pipe-insert heaters. Table 38 on page B40 gives the resultant watt density (watts per sq. in. of surface area) on 2" (51 mm) to 4" (102 mm) pipes when fitted with any one of the three basic heater types offered.

When heating highly viscous liquids select a pipe size large enough to match the pipe surface watt density with the ability of the liquid to carry the heat away. Table 38 on page B40 gives an explanation of watt density which also applies to pipe heater pipe well surfaces.

Built-in Thermocouples and Thermostats as Limit Devices

If there is even the slightest chance that the liquid level could fall below the uppermost surface of any pipe well, an overtemperature control is recommended. Units listed with built-in thermocouples are intended for use with a Caloritech™ control system.



Explosion-Proof Housing With Externally Adjustable Thermostat For Limit Sensing

Figure 33

The Type MXI heater can also be factory fitted with a built-in thermostat as a limit device with the sensing bulb installed in a thermostat well. Note that the temperature inside the pipe is much hotter than the pipe itself and varies with the system parameters. It is recommended that you consult the nearest CCI Thermal sales office for assistance with the thermostat selection.

Construction

The heaters are available with single hairpin element, double hairpin elements, or three straight elements. The double hairpin element type can be wired in single phase or three phase, open delta. The three element type is suitable for three phase wiring only.

The heaters can be coiled to a six-foot diameter to permit installation or removal where space restrictions exist.

Special Features

- Special voltage
- Special wattage
- Explosion resistant terminal housings
- Built-in thermostats/limits
- Special lengths
- Special flange sizes
- Extra conduit fittings
- Control systems

Table 39 – 3" - 150 lb Flange (One Hairpin Element)

kW	Std. Volts (1Ø Only)	Insert Length		Without T/C		With 'K' Type T/C	
		in	mm	Catalog No.	Part No.	Catalog No.	Part No.
3	208 240 480 600	74.8	1900	MXI103F3	TMP-3-103	MXIK103F3	TMP-3-103-2
4		98.4	2500	MXI104F3	TMP-3-104	MXIK104F3	TMP-3-104-2
5		122.0	3100	MXI105F3	TMP-3-105	MXIK104F3	TMP-3-105-2
6	480 600	133.9	3400	MXI106F3133	TMP-3-106	MXIK106F3133	TMP-3-106-2
6	480 600	145.7	3700	MXI106F3	—	MXIK106F3	—
7		169.3	4300	MXI107F3169	TMP-3-107	MXIK107F3169	TMP-3-107-2
7		181.1	4600	MXI107F3	—	MXIK107F3	—
8		192.9	4900	MXI108F3	TMP-3-108	MXIK108F3	TMP-3-108-2
9	480 600	216.5	5500	MXI109F3	TMP-3-109	MXIK109F3	TMP-3-109-2
10		240.2	6100	MXI110F3	TMP-3-110	MXIK110F3	TMP-3-110-2
11		263.8	6700	MXI111F3	TMP-3-111	MXIK111F3	TMP-3-111-2
12		287.4	7300	MXI112F3	TMP-3-112	MXIK112F3	TMP-3-112-2
13	600	311.0	7900	MXI113F3	TMP-3-113	MXIK113F3	TMP-3-113-2
14		334.6	8500	MXI114F3	—	MXIK114F3	—
15		358.3	9100	MXI115F3	—	MXIK115F3	—
15		425.2	10800	MXI115F3425	—	MXIK115F3425	—

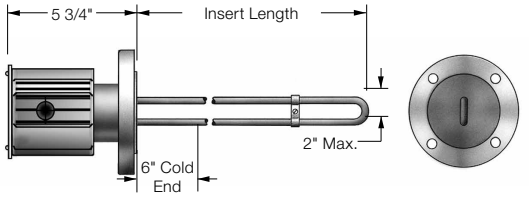


Figure 34 – 3"- 150 lb Flange (One Hairpin Element)

To Order Specify

- Quantity
- Catalog number
- Voltage
- Wattage
- Special features

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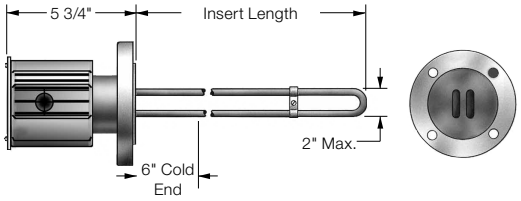


Figure 35 - 3" - 150 lb Flange (Two Hairpin Elements)

Table 40 – 3" - 150 lb Flange (Two Hairpin Elements)

kW	Std. Volts (1Ø Only)	Insert Length		Without T/C		With 'K' Type T/C	
		in	mm	Catalog No.	Part No.	Catalog No.	Part No.
3	208 240 480 600	55.1	1400	MXI203F3	–	MXIK203F3	–
4		70.9	1800	MXI204F3		MXIK204F3	
5		86.6	2200	MXI205F3		MXIK205F3	
6		102.4	2600	MXI206F3		MXIK206F3	
7		118.1	3000	MXI207F3		MXIK207F3	
8		133.9	3400	MXI208F3		MXIK208F3	
10	480 600	165.4	4200	MXI210F3		MXIK210F3	
12		196.9	5000	MXI212F3		MXIK212F3	
14		228.3	5800	MXI214F3		MXIK214F3	
16		259.8	6600	MXI216F3		MXIK216F3	

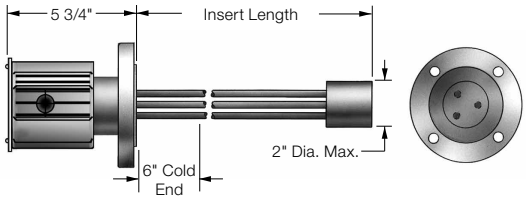


Figure 36 – 3" - 150 lb Flange (Three Straight Elements)

Table 41 – 3" - 150 lb Flange (Three Straight Elements)

kW	Std. Volts (1Ø Only)	Insert Length		Without T/C		With 'K' Type T/C	
		in	mm	Catalog No.	Part No.	Catalog No.	Part No.
2	208 240 480 600	45.3	1150	MXI302F3	–	MXIK302F3	–
3		64.0	1625	MXI303F3		MXIK303F3	
4		82.7	2100	MXI304F3		MXIK304F3	
5		101.4	2575	MXI305F3		MXIK305F3	
6		120.1	3050	MXI306F3		MXIK306F3	
7	480 600	138.8	3525	MXI307F3		MXIK307F3	
8		157.5	4000	MXI308F3		MXIK308F3	
9		176.2	4475	MXI309F3		MXIK309F3	
10		194.9	4950	MXI310F3		MXIK310F3	
11		213.6	5425	MXI311F3		MXIK311F3	
12		232.3	5900	MXI312F3		MXIK312F3	
13		251.0	6375	MXI313F3		MXIK313F3	
14		269.7	6850	MXI314F3		MXIK314F3	
15		288.4	7325	MXI315F3		MXIK315F3	

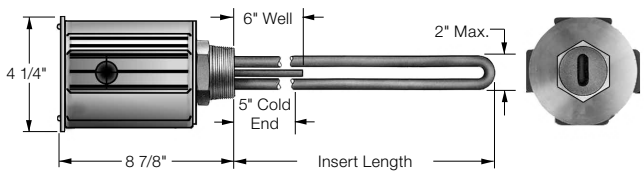


Figure 37 – 2" NPT Screwplug (One Hairpin Element)

Table 42 – 2" NPT Screwplug (One Hairpin Element)

kW	Std. Volts (1Ø Only)	Insert Length		Without T/C		With 'K' Type T/C	
		in	mm	Catalog No.	Part No.	Catalog No.	Part No.
3	208 240 480 600	74.8	1900	MXI130P2	MTP-230-1	MXIK130P2	MTP-230-2
4		98.4	2500	MXI140P3	MTP-240-1	MXIK140P2	MTP-240-2
5		122.0	3100	MXI150P2	MTP-250-1	MXIK150P2	MTP-250-2
6	480 600	133.9	3400	MXI160P2	–	MXIK160P2	–

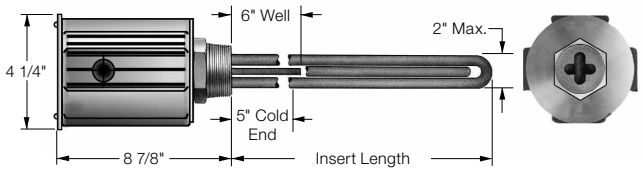


Figure 38 – 2" NPT Screwplug - Two Hairpin Elements

Table 43 – 2" NPT Screwplug (Two Hairpin Elements)

kW	Std. Volts (1Ø Only)	Insert Length		Without T/C		With 'K' Type T/C	
		in	mm	Catalog No.	Part No.	Catalog No.	Part No.
3	208 240 480 600	74.8	1900	MXI130P2	MTP-230-1	MXIK130P2	MTP-230-2
4		98.4	2500	MXI140P3	MTP-240-1	MXIK140P2	MTP-240-2
5		122.0	3100	MXI150P2	MTP-250-1	MXIK150P2	MTP-250-2
6	480 600	133.9	3400	MXI160P2	–	MXIK160P2	–

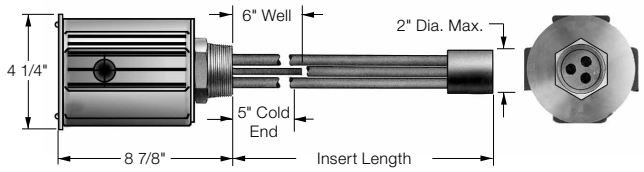


Figure 39 – 2" NPT Screwplug (Three Straight Elements)

Table 44 – 2" NPT Screwplug (Three Straight Elements)

kW	Std. Volts (1Ø Only)	Insert Length		Without T/C		With 'K' Type T/C	
		in	mm	Catalog No.	Part No.	Catalog No.	Part No.
2	208 240 480 600	45.3	1150	MXI320P2	–	MXIK320P2	–
3		64.0	1625	MXI330P2		MXIK330P2	
4		82.7	2100	MXI340P2		MXIK340P2	
5		101.4	2575	MXI350P2		MXIK350P2	
6		120.1	3050	MXI360P2		MXIK360P2	

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