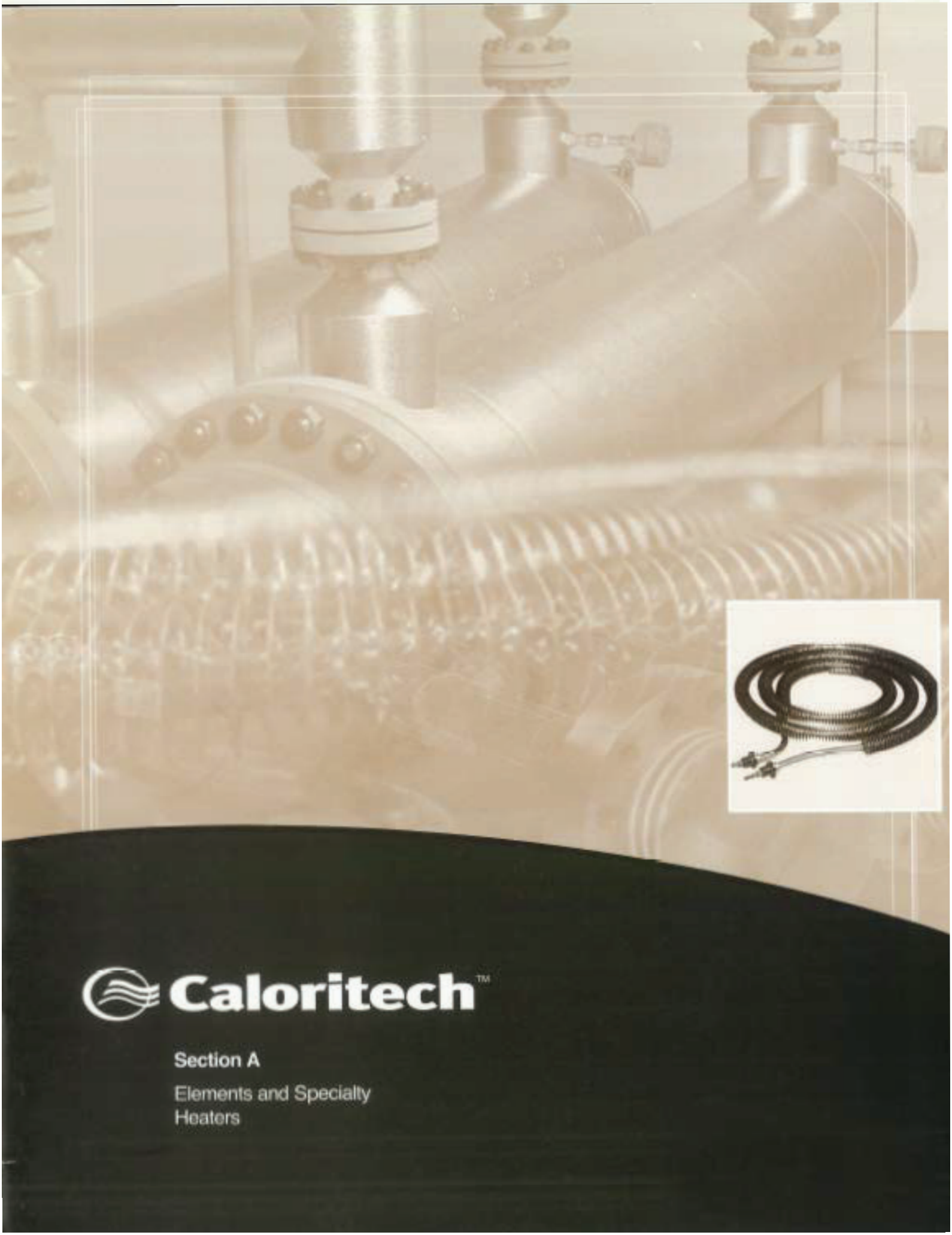


Caloritech™

Section A

Elements and Specialty Heaters

Contents

Section A

Catalog ML350 - Section Listings

Section A - Elements and Specialty Heaters:
calvane heaters, tubular heaters, bolt heaters, tubular band heaters, mitosis heaters, finned tubular heaters, cartridge heaters, strip and finned strip heaters, hot plate / drum heaters, cast-in heaters.

Section B - Immersion Heaters:
screwplug heaters, domestic immersion heaters, urn heaters, flange heaters, over-the-side heaters, pipe insert heaters, gate and gain heaters.

Section C - Air and Space Heaters:
infrared radiant heaters, panel heaters, convection heaters, duct heaters, unit heaters, gate and gain heaters.

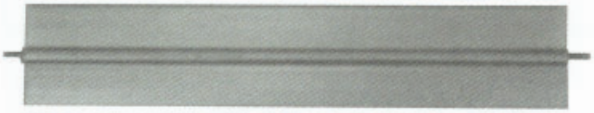
Section D - Engineered Products:
circulation heaters, heat transfer systems, custom engineered products, panel heaters, control panels, technical data.

Section E - Boilers:
boiler flange heaters, packaged circulation heaters, boilers, calorifiers.

Section F - Controls:
controls, housings.

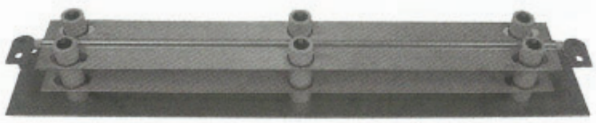
Compact and Lightweight for Space, Economy and Comfort

Calvane heaters combine compact size with lightweight Calrod® construction for an efficient and easily installed electrical heating source. They are designed for installations requiring size and weight control, where heater sheath temperatures below 600°F can be maintained. The heaters are used primarily in natural and forced convection heating applications such as aircraft and transit car comfort heating.



Construction

The Calvane heating element features an aluminum sheath with integrally extruded fins for an extended heat transfer surface. Nickel chromium resistance wire and high grade magnesium oxide insulation combine to provide maximum life expectancy. With lengths up to 120" and widths of 2.25" and 3.25", Calvane heaters are exceptionally well suited for air heating for comfort and dehumidification purposes in aircraft or transit cars. Quick connect or screw type projection welded connectors are available, and elements can be supported on studs.



Standard Product Features

- Two standard widths: 2.25" & 3.25"
- Lightweight: 2.25" wide = 0.2 lbs/ft
  3.25" wide = 0.3 lbs/ft
- Extended heat transfer area: 2.25" wide = 5 sq. in / in
  3.25" wide = 7 sq. in / in
- Low watt density
- Calrod® construction for long life
- Low thermal emissivity
- No magnetic noise
- Low pressure drop
- Resistance to damage from shock and vibration
- Easily isolated for high voltage applications

Transit Car Baseboard Applications

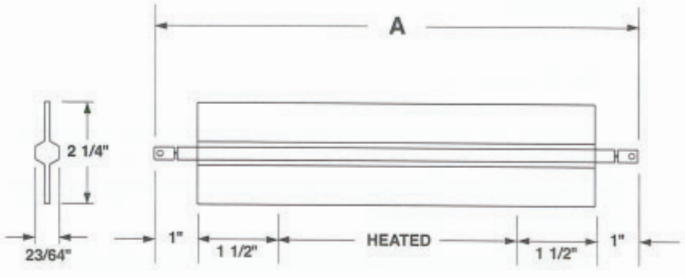
Calvane heating elements in lengths up to 120" can be purchased factory-mounted to stainless steel sub panels, ready for easy installation. These lengths reduce the number of field interconnections and allow series-connected elements to be powered at car ends or mid-car, thus minimizing assembly and wiring costs during car building. Calvane heaters also offer more even heat output and resultant lower casing temperatures than steel case strip heaters in similar applications. Calvane element weight is approximately 25% of steel case strip heater weight.

Transit Car Specifications

Transit car applications typically require floor installed heaters and even heat distribution. Heaters are normally installed in enclosures that take in air at the bottom and discharge air at the top or at the base of the window. Enclosure surfaces which can be contacted should not exceed temperatures of 125°F. For transit car applications with supply voltages in the 600 volt nominal range, ceramic stand-off insulator systems are available. These insulators provide the required creepage and clearance distance for operation at over 240 volts. They also allow for expansion and contraction of the elements with minimal noise.

Forced Convection Use

Calvane units may be mounted in ducts for forced convection applicatons. They provide effective heat transfer with minimal weight and pressure drop. Consult factory for application data.



A. DIM. (in.)	A. DIM. (mm)	WATTS	CATALOG NUMBER
29	737	500	FV1241
41	1041	750	FV1361
53	1346	1000	FV1481
65	1651	1250	FV1601
77	1956	1500	FV1721
89	2261	1750	FV1841

Tubular Heaters Types HX and IX

Has one factory dedicated to the production of the highest quality tubular heating elements. We use only the best commercially available materials and we use design parameters proven to maximize element life expectancy.

Operating Principles

Refer to Fig. 1 page A5 for typical heating element construction. The coil and terminal pins are electrically isolated from the outer metal sheath with highly compacted magnesium oxide which also serves as a conductor for the heat generated by the coil.

When voltage is applied to the heating element terminals, an electric current passes through the heating element resistance coil. Heat is produced as wattage in accordance with Ohm's law where the wattage equals I^2R (current squared x coil resistance).

Watt Density

Watt density is defined as the watts per unit of surface area of the heated section of the heating element. The selection of the ideal watt density for a particular application is the most important parameter affecting heating element service life.

All heat generated by the element resistance coil must be transferred from its sheath so that a balance is maintained. If the transferring medium is poor, the element may reach a high temperature before a sufficient temperature gradient is developed to reach thermal balance.

Since watt density also determines the temperature gradient between the sheath and the resistance coil, it is essentially the watt density that sets the resistance coil temperature.

Life Expectancy

Normal life expectancy depends mainly on the resistance coil operating temperature (see Fig. 1) which is a function of the sheath operating temperature and the wattage per unit heated length of element.

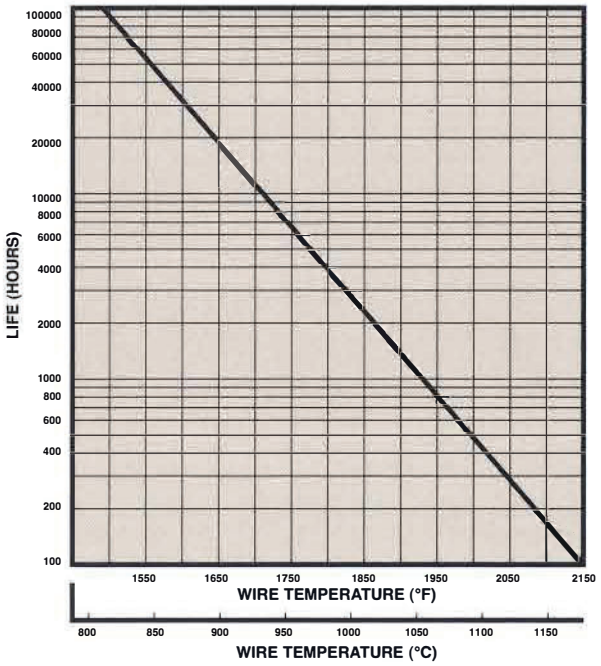
Factors such as cycling frequency will also affect life.

Sheath Materials

Sheath material selection ranks next to watt density in importance. The sheath must withstand the corrosive and temperature effects of its environment. For instance, elements designed for operation in water will generally fail if operated in air.

Fortunately, many different sheath materials are available, making the tubular heater suitable for the vast majority of heating applications.

FIG. 1 - Life vs. Coil Temperature (Typical)



Sizes and Shapes

We offer a broad selection of element sizes and shapes to suit most any requirement. Larger diameter elements must be used for high voltage applications. Although practical considerations limit length, we can splice selected diameter elements to achieve continuous lengths in excess of 50 meters (2000 ins.).

In most applications, the elements are formed at the factory in a series of loops or coils. Elements require furnace annealing prior to bending.

Insulation Resistance

If an unsealed element is to be installed in a damp area, the element insulation resistance to ground may decrease and, in severe cases, approach zero ohms. Elements with low insulation resistance have high leakage currents which, under certain circumstances, could be hazardous. Factory installed seals which prevent moisture from entering at the terminal ends of the element are available.

Dielectric Strength Tests

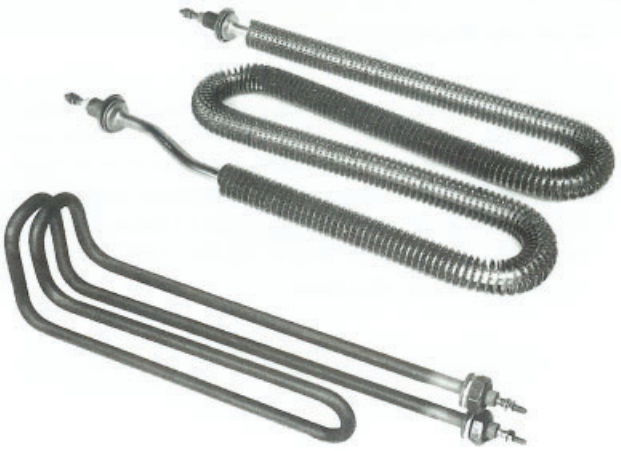
One hundred percent (100%) of the elements we manufacture are dielectric strength tested before they are released for shipment. This test, conducted at many times the intended operating voltage of the element, insures that the heater will not "short-out" during normal life.

Application

Tubular elements of proper rating, material and shape can be used in most heating applications requiring process temperatures to 750°C (1382°F).

Many of the heaters listed in this catalog utilize tubular elements as the heat source.

Tubular elements may be clamped, immersed, cast into metal or spaced away from the work as radiant heaters. Elements can also be positioned in ducts or vessels for heating air or other gases.



Features

- Easy to install
- Available in a wide variety of sheaths, diameters and ratings
- Heat can be located exactly where required
- Can be formed to practically any shape
- Compact
- Easy to control to provide heat only when required
- Low maintenance and long life
- Excellent internal electrical insulation and heat conduction
- Electrically isolated sheath

Catalog Numbers

We assign a unique catalog number to all elements we manufacture (where practical). One of three prefixes is used to designate which type of element has been supplied as follows:

PREFIX	TYPE
HX	straight, unfinned
IX	formed unfinned
KX	any finned element

Construction

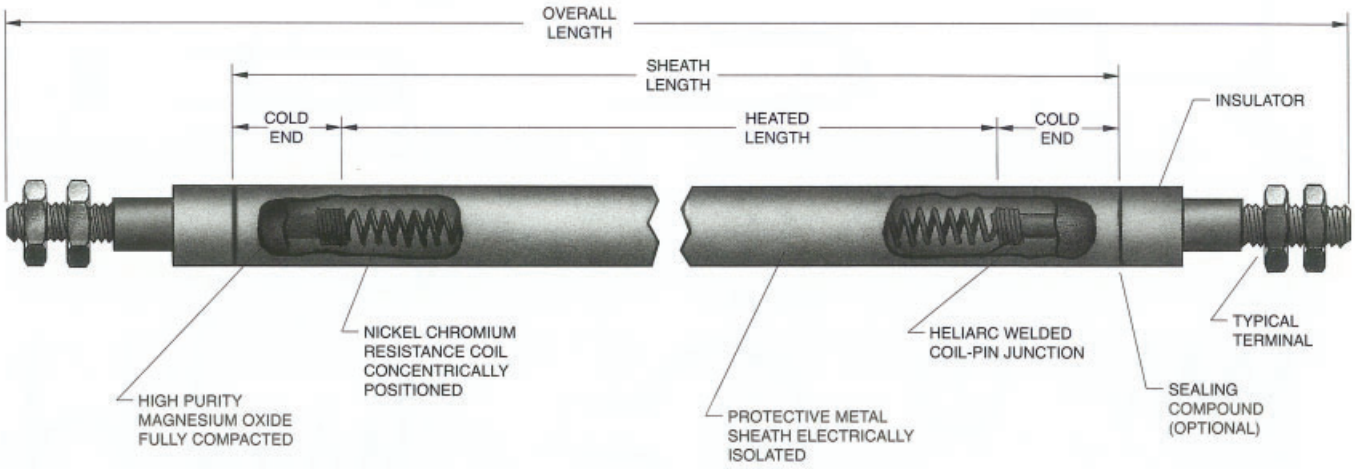


FIG. 1 - Tubular Element Features and Components

Factory Bending

Tubular heaters can be factory formed to virtually any shape. Inside bending diameters as small as one element diameter are sometimes possible. Figures 1 to 11 illustrate some of the most commonly used element shapes. If your application can be satisfied with one of these shapes, you may wish to refer to these figures when ordering or requesting pricing information.

FIG. 1

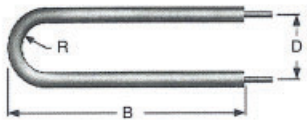


FIG. 2

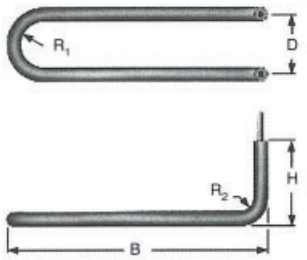


FIG. 3

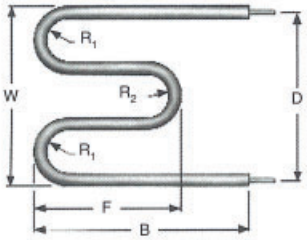


FIG. 4

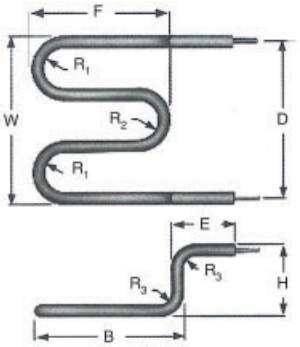


FIG. 5

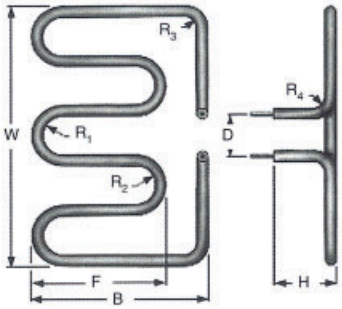


FIG. 6

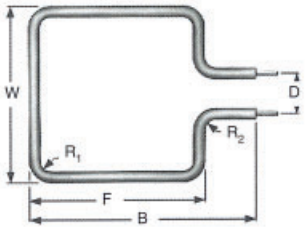


FIG. 7

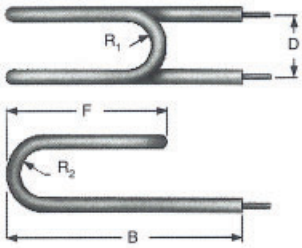


FIG. 8

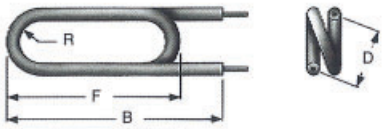


FIG. 9

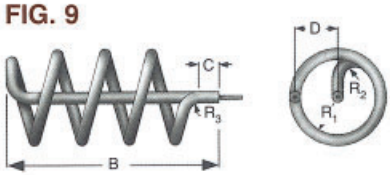


FIG. 10

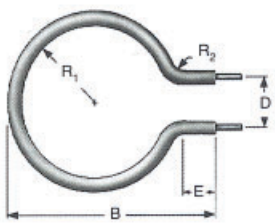
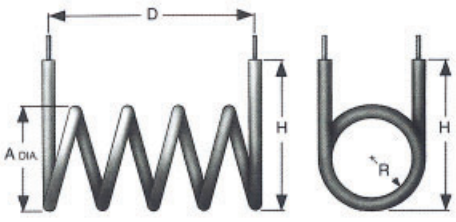


FIG. 11



N = Number of turns

FIG. 12 - In ovens or cabinets

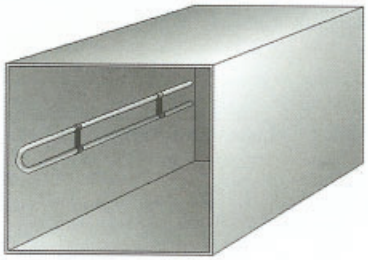


FIG. 13 - In ducts

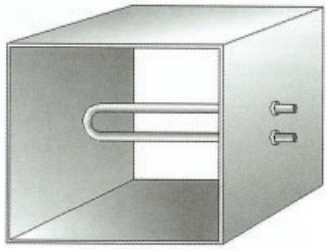


FIG. 14 - In pipe wells

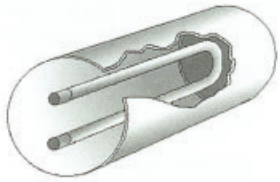


FIG. 15 - High wattage resistors or load banks

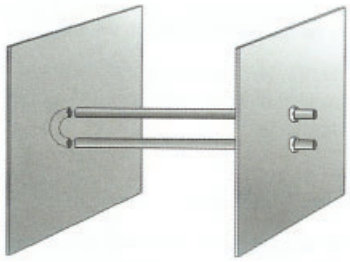


FIG. 16 - To radiate heat

FIG. 17 - Immersed in liquids

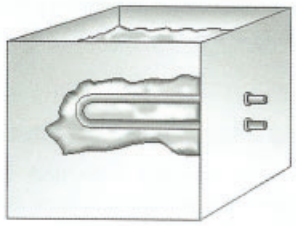


FIG. 18 - Clamped to walls, hoppers and pipes

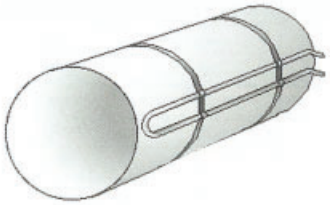


FIG. 19 - In drilled holes in plates or cylinders

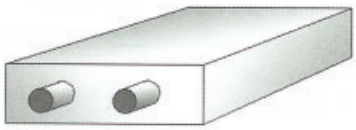


FIG. 20 - Sandwiched between plates

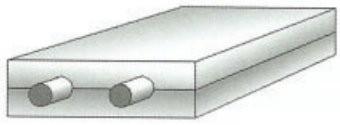


FIG. 21 - Cast-in to iron, aluminum or copper

FIG. 22 - Bent to conform to system geometry

FIG. 23 - In finned heater assemblies

Selection

Most tubular elements are made-to-order. The following procedure (Step 1 to Step 9) will simplify the selection of the element best suited to your needs. If you need assistance we will, without obligation, determine your kW requirements and provide design sketches.

STEP 1 - Determination of wattage requirements.

Refer to Section D of the Caloritech™ catalog for technical data and sample calculations.

STEP 2 - Selection of voltage rating and phase.

Remember that, for any fixed voltage, the higher the wattage rating, the higher will be the current. If you have a choice of available voltages try to specify the higher voltage, especially if the required wattage is above 6 kW.

STEP 3 - Selection of sheath material.

Sheath material selection is based on the highest expected sheath temperature and also the ability of the metal to withstand corrosion.

COPPER - For immersion heating of water and noncorrosive aqueous solutions.

STEEL - For immersion heating of oil or paraffin or casting into iron.

INCOLOY® - For heating air and other gases; clamping-on to tanks and platens; immersion into salt solutions, soft metals, oils, most mildly corrosive chemical solutions; for radiant heating.

OTHER MATERIALS - Refer to the Corrosion Guide recommendations in Section D of the Caloritech™ catalog.

See Table 1 for common sheath materials and maximum allowable sheath temperatures.

TABLE 1 - Sheath Materials vs. Temperature

STANDARD SHEATHS	MAX. ALLOWABLE TEMP. °C	°F
Copper	185	365
Bundy®	400	750
Incoloy®	815	1500
Stainless 304, 321	760	1400
Steel	400	750
SPECIAL SHEATHS	**MAX. ALLOWABLE TEMP. °C**	**°F**
Inconel®	870	1600
Monel	540	1000
Stainless 316	760	1400
Titanium	540	1000

STEP 4 - Selection of sheath diameter.

Select sheath diameter from Table 2. Remember that smaller diameter sheaths are the most economical, but their use is restricted at the higher voltages.

TABLE 2 - Sheath Diam. vs. Max. Allowable Voltage

STANDARD DIA. mm	(in.)	MAX. VOLTS	SPECIAL DIA. mm	(in.)	MAX. VOLTS
6.6	(.260)	250	2.8	(.112)	120
8.0	(.315)	600*	4.1	(.160)	250
10.9	(.430)	600	5.2	(.205)	250
12.1	(.475)	600	9.5	(.375)	600
			13.7	(.540)	600

***NOTE:** .315 dia. elements above 300V require special terminals.

STEP 5 - Determination of allowable watt density.

Below is a partial listing of maximum recommended watt densities. Refer to Section D for a more complete listing encompassing most applications.

MAXIMUM WATT DENSITY RATINGS

These are suggested ratings only and will differ when flow velocity, heat transfer rate, or operating temperature vary.

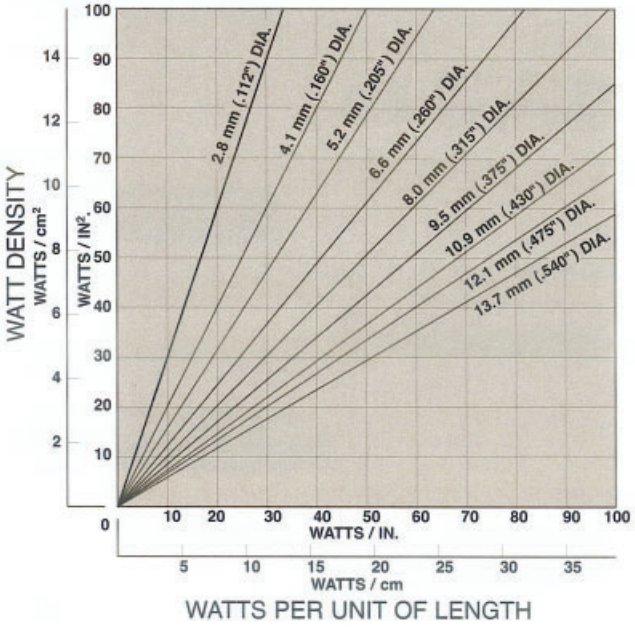
TABLE 3 - Maximum Watt Density Ratings

MATERIAL BEING HEATED		MAXIMUM WATTS PER SQUARE INCH	OPERATING TEMP. (°F)
Acid Solution		40	180
Alkaline Solution		40	212
Ammonia Plating Solution		25	50
Degreasing Solution, Vapor		20	275
Electroplating Solution		40	180
Fatty Acids		20	150
Freon		3	300
Gasoline		25	300
Glycerine		40	50
Lead-Stereotype Pot		35	600
Linseed Oil		50	150
Molasses		4-5	100
Oils	Bunker C Fuel	8	160
	Dowtherm A	20	600
	Dowtherm E	12	400
	Fuel Preheating	9-14	180
	Machine (SAE 30)	18-24	250
	Mineral	20-26 16-18	200 400
	Vegetable	30-50	400
Paraffin or Wax		16-22	150
Potassium Hydroxide		25	160
Water		55-80	212

STEP 6 - Determination of total required heated length.

Using the maximum allowable watt density from Step 5 and the selected diameter from Step 4 refer to Figure 1 below to determine the wattage per unit of length.

FIGURE 1 - SURFACE WATTS vs. LINEAR WATTS



Next divide this number into the required wattage as determined in Step 1. This gives you the total heated length required.

STEP 7 - Determination of the cold end length

Ideally, the cold end should not be less than 40 mm (1-1/2") for sheath lengths up to 2000 mm (80") and 65 mm (2-1/2") for sheath lengths over 2000 mm. It shall not terminate within a bent section of the element. For immersion, the cold end must always terminate below the minimum liquid level. For higher temperature, "clamp-on", or air heating applications, increasing the cold length will result in lower terminal temperatures.

STEP 8 - Determination of element configuration and total sheath length.

Refer to page A6 for some of the more common shapes for elements. For other shapes, forward to us a hand sketch showing all critical dimensions. In selecting an element shape you may have to use more than one element to meet the following conditions:

(a) to distribute heat over a large surface or tank;

(b) if required sheath length is greater than maximum available length shown in Table 4;

(c) if element heated length, voltage and wattage selected are outside of minimum and maximum ohms per unit of length as shown in Table 4.

$$\text{OHMS/UNIT LENGTH} = \frac{\text{VOLTS}^2}{\text{WATTS x HEATED LENGTH}}$$

TABLE 4 - SHEATH DIAMETER VS. MAXIMUM LENGTH AND OHMS/UNIT LENGTH

SHEATH DIAMETER mm (in.)	MAXIMUM LENGTH mm (in.)	OHMS PER HEATED LENGTH MINIMUM OHMS/mm (in.)	MAXIMUM OHMS/mm (in.)
2.8 (.112)	1400 (55)	.0118 (.300)	.126 (3.2)
4.1 (.160)	3050 (120)	.0090 (.230)	.354 (9.0)
5.2 (.205)	3940 (155)	.0066 (.170)	.472 (12.0)
6.6 (.260)	2590 (102)	.0022 (.056)	.395 (10.0)
8.0 (.315)	3835 (151)	.0014 (.035)	.512 (13.0)
9.5 (.375)	3710 (146)	.0016 (.040)	.512 (13.0)
10.9 (.430)	7240 (285)	.0010 (.025)	.551 (14.0)
12.1 (.475)	7240 (285)	.0010 (.025)	.551 (14.0)
13.7 (.540)	2700 (106)	.0010 (.025)	.551 (14.0)

NOTES: (1) .260 & .315 Diam. elements are available in lengths up to 7240 mm (285") in low volume runs (check factory).
(2) Lengths beyond maximums shown above can be increased by splicing. Check factory for limitations.

STEP 9 - Selection of element terminal and optional hardware.

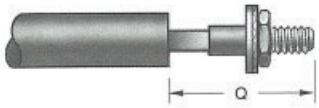
Refer to page A10 for standard element terminal types and to page A14 for optional hardware.

Types AA and AB terminals can be supplied with 1" length on request.

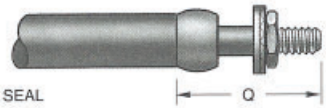
WHEN ORDERING SPECIFY:

- number of elements
- element voltage
- element wattage
- sheath diameter
- sheath length
- sheath material
- length of cold ends
- terminal type
- optional hardware
- forming dimensions (send sketch)

TYPE A



TYPE AA



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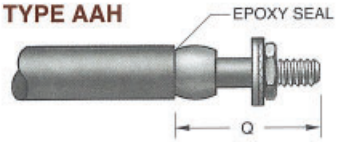
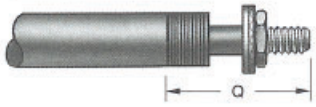
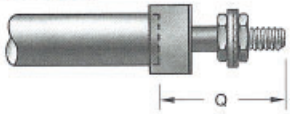


TYPE AB



TYPE AC



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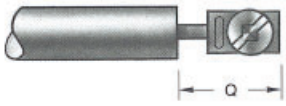

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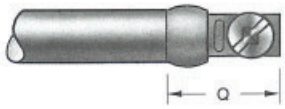

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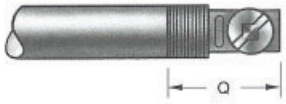

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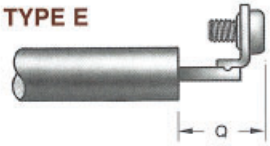

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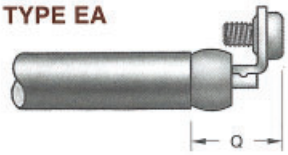

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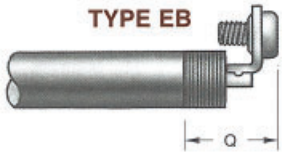

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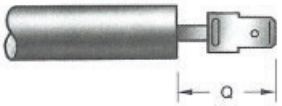

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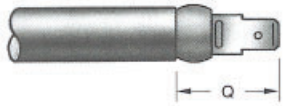

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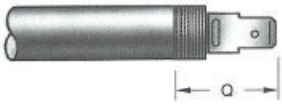
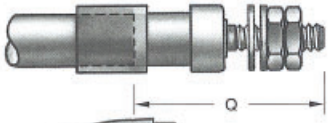
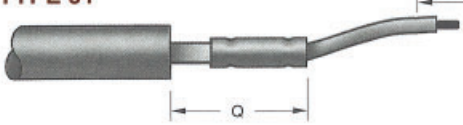


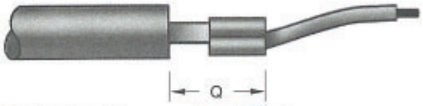
TYPE G



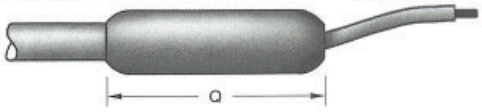
TYPE J1



TYPE J2



TYPE JF



NOTE: ALLOWABLE CURRENT FOR EACH TERMINAL TYPE DEPENDS, IN PART, ON THE APPLICATION - CHECK FACTORY FOR DETAILS

TABLE 1 - TERMINAL TYPE SPECIFICATIONS

TERM. TYPE	DIM. 'Q'	THD. SIZE	MAX. VOLTS	MAX. TEMP.	SUITABLE FOR ELEMENT DIAMETERS (in.) 0.112	0.160	0.205	0.260	0.315	0.375	0.430	0.475	0.540
A	1 1/8"*	#10-32*	600	400°C	✔	✔	✔	✔	✔	✔	✔	✔	–
AA	1 1/8"*	#10-32*	600	200°C	–	–	–	✔	✔	✔	✔	✔	–
AAH	1 1/8"*	#10-32*	600	150°C	–	–	–	✔	✔	✔	✔	✔	–
AB	1 1/8"*	#10-32*	600	400°C	–	✔	✔	✔	✔	✔	✔	✔	–
AC	1 1/8"*	#10-32*	600	400°C	–	–	–	–	–	–	✔	–	✔
D	13/16"	#10-32*	250	400°C	✔	✔	✔	✔	✔	✔	✔	✔	–
DA	13/16"	#10-32*	250	200°C	–	✔	✔	✔	✔	✔	✔	✔	–
DB	13/16"	#10-32*	250	400°C	–	✔	✔	✔	✔	✔	✔	✔	–
E	11/16"	#10-32*	250	400°C	✔	✔	✔	✔	✔	✔	✔	✔	–
EA	11/16"	#10-32*	250	200°C	–	✔	✔	✔	✔	✔	✔	✔	–
EB	11/16"	#10-32*	250	400°C	–	✔	✔	✔	✔	✔	✔	✔	–
F	15/16"	N/A	250	250°C	✔	✔	✔	✔	✔	✔	✔	✔	–
FA	15/16"	N/A	250	200°C	–	✔	✔	✔	✔	✔	✔	✔	–
FB	15/16"	N/A	250	250°C	–	–	–	✔	✔	✔	✔	✔	–
G	1 1/8"	#8-32	250	400°C	–	–	–	✔	–	–	–	–	–
G	1 3/8"	#10-32	250	400°C	–	–	–	–	✔	–	–	–	–
G	1 3/8"	#10-32	250	400°C	–	–	–	–	–	✔	–	–	–
G	1 5/8"	1/4"-28	250	400°C	–	–	–	–	–	–	✔	–	–
J1	1	N/A	300	200°C	✔	✔	✔	✔	✔	✔	✔	✔	–
J2	1/2"	N/A	300	200°C	✔	✔	✔	✔	✔	✔	✔	✔	–
JF*	1 5/8"	N/A	300	90°C	–	–	–	✔	✔	✔	✔	–	–

* 1 1/8" available as 1"; #10-32 available in #8-32; type JF, Q = 2 1/4" for 0.375 and 2 3/4" for 0.430.

FIG. 1 - Watt density vs. sheath temperature of tubular elements in 70°F air.

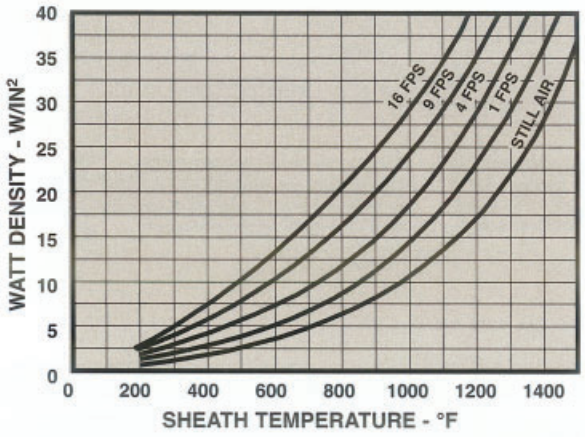


FIG. 2 - Allowable watt density on tubular elements in distributed air velocity of 1 ft. / sec.

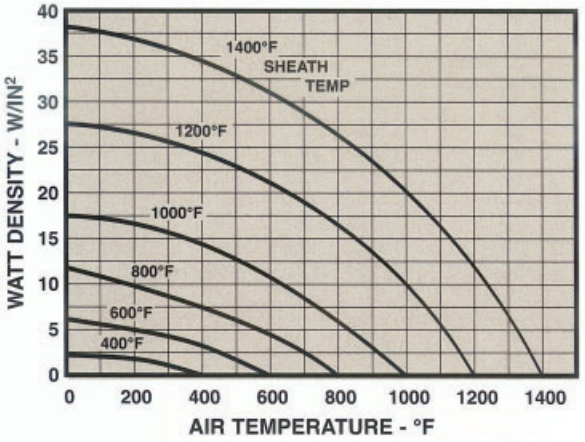


FIG. 3 - Allowable watt density on tubular elements in distributed air velocity of 4 ft. / sec.

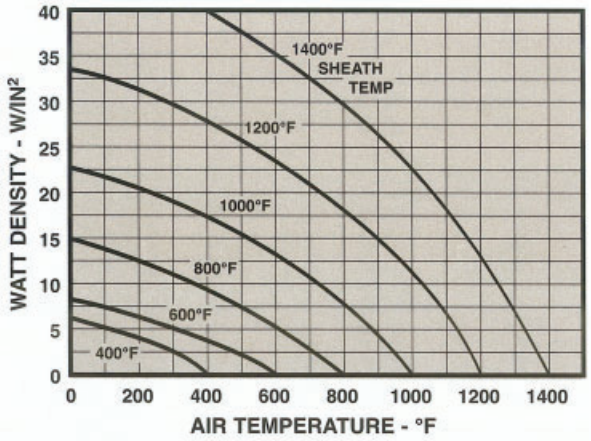


FIG. 4 - Allowable watt density on tubular elements in distributed air velocity of 9 ft. / sec.

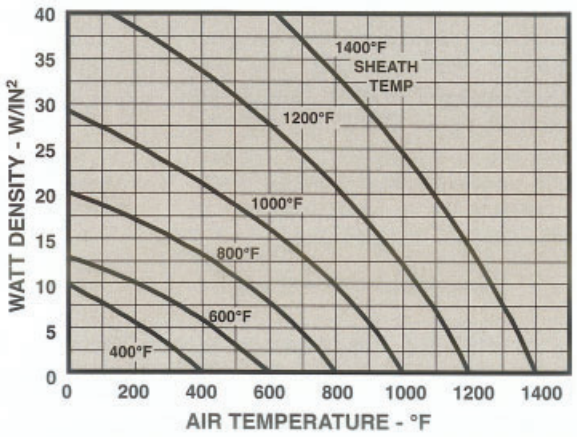


FIG. 5 - Allowable watt density on tubular elements in distributed air velocity of 16 ft. / sec.

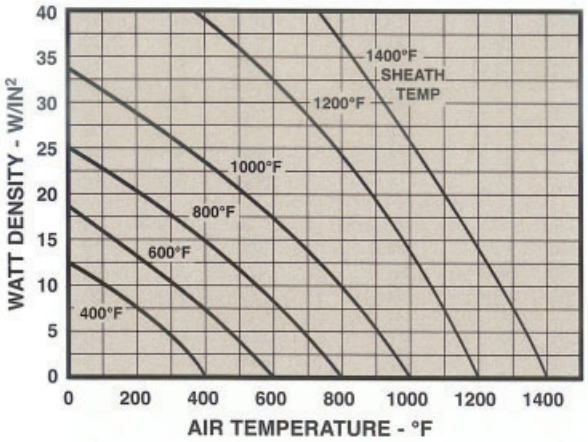
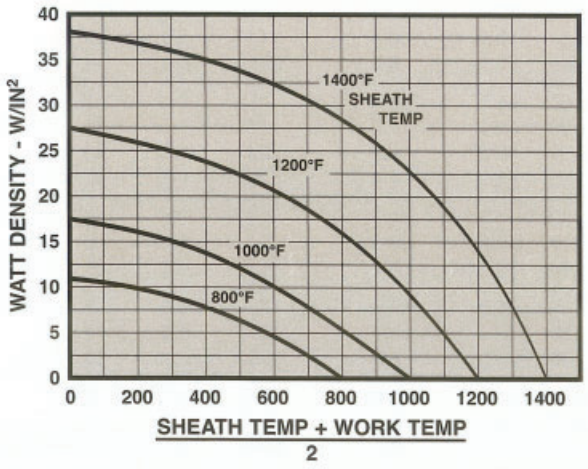


FIG. 6 - Allowable watt density for clamped-on tubular elements based on work temperature.



Listed Elements - .315 (8.0 mm) and .430 (10.9 mm) Diameters

Tables 1 and 2 list typical incoloy sheathed elements. The .315 diameter elements are generally for use at supply voltages of 240V and less. The .430 diameter elements listed in Table 2 can be used at up to 600V. An unlimited number of combinations of length, wattage, voltage rating and heated length are available in a wide selection of sheath materials (check factory).

continued on next page ...

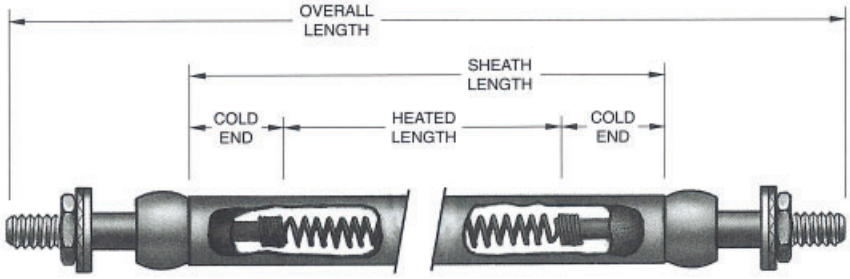


Table 1 - .315" (8.0 mm) Diameter Incoloy Sheathed Elements

HEATED LENGTH		RESISTANCE	WATTAGE AND WATT DENSITY AT VARIOUS VOLTAGES									CATALOG
			120V			208V			240V			
mm	in.	(ohms)	WATTS	W/cm²	W/in.²	WATTS	W/cm²	W/in.²	WATTS	W/cm²	W/in.²	NUMBER
400	15.7	90.0	160	1.6	10	470	4.7	30	620	6.2	40	HXI10480-01
400	15.7	46.5	310	3.1	20	940	9.3	60	1250	12.4	80	HXI10480-02
400	15.7	23.2	620	6.2	40	—	—	—	—	—	—	HXI10480-03
600	23.6	120.0	120	0.8	5	350	2.3	15	470	3.1	20	HXI10480-04
600	23.6	62.6	230	1.6	10	700	4.7	30	940	6.2	40	HXI10480-05
600	23.6	30.6	470	3.1	20	1400	9.3	60	1870	12.4	80	HXI10480-06
600	23.6	15.3	940	6.2	40	—	—	—	—	—	—	HXI10480-07
800	31.5	90.0	160	0.8	5	470	2.3	15	620	3.1	20	HXI10480-08
800	31.5	46.5	310	1.6	10	940	4.7	30	1250	6.2	40	HXI10480-09
800	31.5	23.2	620	3.1	20	1870	9.3	60	2490	12.4	80	HXI10480-10
800	31.5	11.5	1250	6.2	40	—	—	—	—	—	—	HXI10480-11
1000	39.4	75.8	190	0.8	5	580	2.3	15	780	3.1	20	HXI10480-12
1000	39.4	36.9	390	1.6	10	1170	4.7	30	1560	6.2	40	HXI10480-13
1000	39.4	18.5	780	3.1	20	2340	9.3	60	3120	12.4	80	HXI10480-14
1000	39.4	9.2	1560	6.2	40	—	—	—	—	—	—	HXI10480-15
1200	47.2	62.6	230	0.8	5	700	2.3	15	940	3.1	20	HXI10480-16
1200	47.2	30.6	470	1.6	10	1400	4.7	30	1870	6.2	40	HXI10480-17
1200	47.2	15.3	940	3.1	20	2810	9.3	60	3740	12.4	80	HXI10480-18
1200	47.2	7.7	1870	6.2	40	—	—	—	—	—	—	HXI10480-19
1500	59.1	49.7	290	0.8	5	880	2.3	15	1170	3.1	20	HXI10480-20
1500	59.1	24.8	580	1.6	10	1750	4.7	30	2340	6.2	40	HXI10480-21
1500	59.1	12.3	1170	3.1	20	3510	9.3	60	4680	12.4	80	HXI10480-22
1500	59.1	6.2	2340	6.2	40	—	—	—	—	—	—	HXI10480-23
1800	70.9	41.1	350	0.8	5	1050	2.3	15	1400	3.1	20	HXI10480-24
1800	70.9	20.6	700	1.6	10	2100	4.7	30	2810	6.2	40	HXI10480-25
1800	70.9	10.3	1400	3.1	20	4210	9.3	60	5610	12.4	80	HXI10480-26
1800	70.9	5.1	2810	6.2	40	—	—	—	—	—	—	HXI10480-27
2100	82.7	35.1	410	0.8	5	1230	2.3	15	1640	3.1	20	HXI10480-28
2100	82.7	17.6	820	1.6	10	2450	4.7	30	3270	6.2	40	HXI10480-29
2100	82.7	8.8	1640	3.1	20	4910	9.3	60	6550	12.4	80	HXI10480-30
2100	82.7	4.4	3270	6.2	40	—	—	—	—	—	—	HXI10480-31
2400	94.5	30.6	470	0.8	5	1400	2.3	15	1870	3.1	20	HXI10480-32
2400	94.5	15.3	940	1.6	10	2810	4.7	30	3740	6.2	40	HXI10480-33
2400	94.5	7.7	1870	3.1	20	5610	9.3	60	7480	12.4	80	HXI10480-34
2700	106.3	27.2	530	0.8	5	1580	2.3	15	2100	3.1	20	HXI10480-35
2700	106.3	13.7	1050	1.6	10	3160	4.7	30	4210	6.2	40	HXI10480-36
2700	106.3	6.9	2100	3.1	20	6310	9.3	60	8420	12.4	80	HXI10480-37
3000	118.1	24.8	580	0.8	5	1750	2.3	15	2340	3.1	20	HXI10480-38
3000	118.1	12.3	1170	1.6	10	3510	4.7	30	4680	6.2	40	HXI10480-39
3000	118.1	6.2	2340	3.1	20	7010	9.3	60	9350	12.4	80	HXI10480-40

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These elements are stocked in limited quantities (181.1 and shorter). We can add the terminal type you require, adjust the cold end length anywhere from 40 - 150 mm (1.6" - 5.9") and ship within three or four working days. Multiple elements can be field wired in series or parallel to meet your application requirements.

If a lead time of three or four weeks is available, it is always best to order a custom element to meet your specific needs. A word of caution... regardless of the element you choose, since it can get very hot, it may prove hazardous to people or property if it is improperly selected and applied. Pages A8 and A9 discuss the selection process. If you are even the least bit uncertain of your choice or if you require any type of assistance, contact our agent or nearest sales office.

TO ORDER SPECIFY:

- quantity
- catalog no.
- voltage
- wattage
- cold end length; 40 mm (1.6") to 150 mm (5.9")
- terminal type (see page A10)

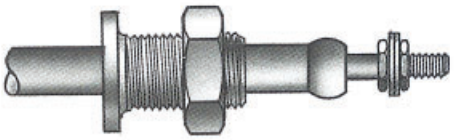
Table 2 - .430" (10.9 mm) Diameter Incoloy Sheathed Elements

HEATED LENGTH		RESISTANCE	WATTAGE AND WATT DENSITY AT VARIOUS VOLTAGES									CATALOG
			240V			480V			600V			
mm	in.	(ohms)	WATTS	W/cm²	W/in.²	WATTS	W/cm²	W/in.²	WATTS	W/cm²	W/in.²	NUMBER
600	23.6	180.0	320	1.6	10	1280	6.2	40	1980	9.6	62	HXI10481-01
600	23.6	120.0	480	2.3	15	1910	9.3	60	2970	14.4	93	HXI10481-02
600	23.6	60.0	960	4.7	30	—	—	—	—	—	—	HXI10481-03
900	35.4	240.0	240	0.8	5	960	3.1	20	1480	4.8	31	HXI10481-04
900	35.4	120.0	480	1.6	10	1910	6.2	40	2970	9.6	62	HXI10481-05
900	35.4	80.0	720	2.3	15	2870	9.3	60	4450	14.4	93	HXI10481-06
900	35.4	40.0	1440	4.7	30	—	—	—	—	—	—	HXI10481-07
1200	47.2	180.0	320	0.8	5	1280	3.1	20	1980	4.8	31	HXI10481-08
1200	47.2	90.0	640	1.6	10	2550	6.2	40	3960	9.6	62	HXI10481-09
1200	47.2	60.0	960	2.3	15	3830	9.3	60	5940	14.4	93	HXI10481-10
1200	47.2	30.2	1910	4.7	30	—	—	—	—	—	—	HXI10481-11
1600	63.0	134.0	430	0.8	5	1700	3.1	20	2640	4.8	31	HXI10481-12
1600	63.0	67.8	850	1.6	10	3400	6.2	40	5280	9.6	62	HXI10481-13
1600	63.0	45.0	1280	2.3	15	5110	9.3	60	7910	14.4	93	HXI10481-14
1600	63.0	22.6	2550	4.7	30	—	—	—	—	—	—	HXI10481-15
2000	78.7	108.7	530	0.8	5	2130	3.1	20	3300	4.8	31	HXI10481-16
2000	78.7	54.3	1060	1.6	10	4250	6.2	40	6590	9.6	62	HXI10481-17
2000	78.7	36.0	1600	2.3	15	6380	9.3	60	9890	14.4	93	HXI10481-18
2000	78.7	18.1	3190	4.7	30	—	—	—	—	—	—	HXI10481-19
2400	94.5	90.0	640	0.8	5	2550	3.1	20	3960	4.8	31	HXI10481-20
2400	94.5	45.0	1280	1.6	10	5110	6.2	40	7910	9.6	62	HXI10481-21
2400	94.5	30.2	1910	2.3	15	7660	9.3	60	11870	14.4	93	HXI10481-22
2400	94.5	15.0	3830	4.7	30	—	—	—	—	—	—	HXI10481-23
2800	110.2	77.8	740	0.8	5	2980	3.1	20	4620	4.8	31	HXI10481-24
2800	110.2	38.7	1490	1.6	10	5960	6.2	40	9230	9.6	62	HXI10481-25
2800	110.2	25.8	2230	2.3	15	8930	9.3	60	13850	14.4	93	HXI10481-26
2800	110.2	12.9	4470	4.7	30	—	—	—	—	—	—	HXI10481-27
3400	133.9	64.0	900	0.8	5	3620	3.1	20	5610	4.8	31	HXI10481-28
3400	133.9	31.8	1810	1.6	10	7230	6.2	40	11210	9.6	62	HXI10481-29
3400	133.9	21.3	2710	2.3	15	10850	9.3	60	16820	14.4	93	HXI10481-30
3400	133.9	10.6	5420	4.7	30	—	—	—	—	—	—	HXI10481-31
4000	157.5	54.3	1060	0.8	5	4250	3.1	20	6590	4.8	31	HXI10481-32
4000	157.5	27.0	2130	1.6	10	8510	6.2	40	13190	9.6	62	HXI10481-33
4000	157.5	18.1	3190	2.3	15	12760	9.3	60	19780	14.4	93	HXI10481-34
4000	157.5	9.0	6380	4.7	30	—	—	—	—	—	—	HXI10481-35
4600	181.1	47.2	1220	0.8	5	4890	3.1	20	7580	4.8	31	HXI10481-36
4600	181.1	23.5	2450	1.6	10	9790	6.2	40	15170	9.6	62	HXI10481-37
4600	181.1	15.7	3670	2.3	15	14680	9.3	60	22750	14.4	93	HXI10481-38
4600	181.1	7.8	7340	4.7	30	—	—	—	—	—	—	HXI10481-39

THREADED FITTING (FIG. 1)

Threaded fittings can be factory brazed or welded to the element cold section. These fittings provide a leak tight joint in applications where the heater is installed in open tanks or vessels. Fittings are available in brass, steel or stainless. (Check factory.)

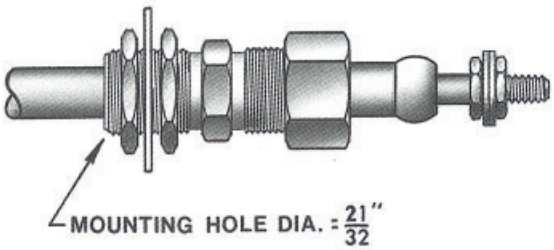
FIG. 1



COMPRESSION FITTING (FIG. 2)

Compression fittings (in nickel plated brass) can be provided for field installation on .430 diam. elements only.

FIG. 2

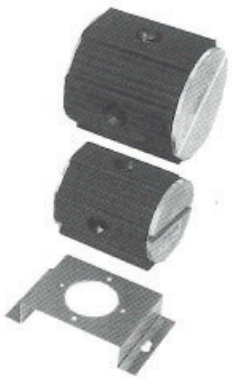


TERMINAL BOX (FIG. 3)

Moisture resistant terminal boxes can be supplied loose or factory installed.

Boxes supplied for field installation can be provided with predrilled holes to accept the element. Note that the element will require fittings for connection to the box.

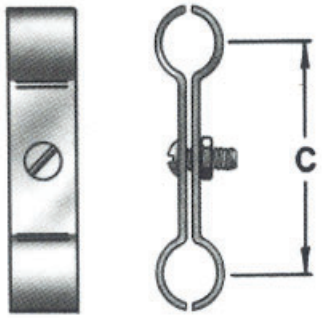
FIG. 3



ELEMENT CLAMP (FIG. 4)

These two piece stainless steel clamps can be used as element standoffs in ovens or tanks. One half of the clamp is ideal for clamp-on applications when used with a stud welded to the tank or plate. "C" dim. is available at 1 1/4", 1 7/16", 1 5/8" or 1 15/16".

FIG.4



MOUNTING BRACKETS (FIGS. 5-7)

Standard mounting brackets can be factory crimped to elements to facilitate installation. Special brackets are available for high volume orders.

FIG. 5

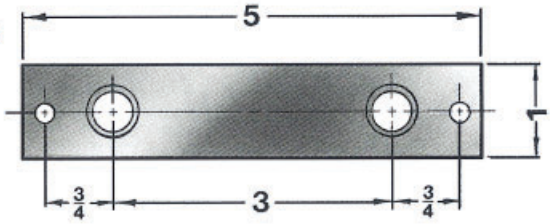


FIG. 6

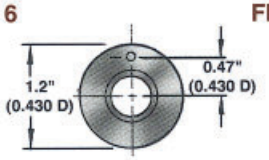
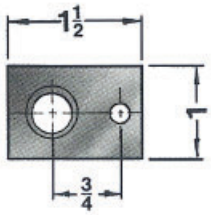


FIG. 7



PART NUMBERS

Refer to these part numbers when ordering special features.

FIG.	DESCRIPTION	PART NO.
1	Threaded Fitting	Check Factory
2	Compression Fitting	A11300
3	Terminal Box (small diam.)	XH1B2M
3	Terminal Box (large diam.)	XH2B1M
4	Element Clamp	A10619
5	Bracket	A10783
6	Bracket	A50100
7	Bracket	A10860

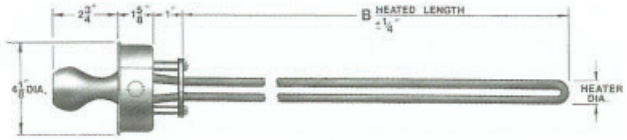
Bolt or Stud Heaters

APPLICATION

Bolt heaters are for insertion into large hollow studs. When energized, the heater is intended to expand the length of the stud to facilitate wrench tightening of the nut.

Heaters are generally used in pairs or sets to achieve uniform bolt tension. Applications include assembly and disassembly of turbines, engine heads, dies, cylinders and large flanged connections.

Special lengths, diameters and wattages are available (check factory).



NOTE: Because of the elevated element sheath temperatures experienced in these applications, expect heater life to be relatively brief. Service life can be improved if the heater "on" time during a heating cycle is kept to the minimum required.

Although heaters are of premium quality *Inc. does not warranty the service life of these heaters since life is essentially user dependent.*

TABLE 1 - BOLT HEATERS

HOLE DIA. MM (IN.)	APPROX. HEATER DIA. MM (IN.)	"B" HEATED LENGTH MM (IN.)	STANDARD VOLTAGES	WATTAGE	CATALOG NUMBER	NET WEIGHT LBS (KG)
12.7 (.500)	12.4 (.490)	305 (12)	120, 208, 240	850	IXS12600-01	4 (2)
		457 (18)	"	1250	IXS12600-02	4 (2)
		610 (24)	"	1700	IXS12600-03	7 (3)
		762 (30)	"	2100	IXS12600-04	7 (3)
14.3 (.563)	14.0 (.550)	305 (12)	120, 208, 240	850	IXS12600-05	4 (2)
		457 (18)	"	1250	IXS12600-06	4 (2)
		610 (24)	"	1700	IXS12600-07	7 (3)
		762 (30)	"	2100	IXS12600-08	7 (3)
15.9 (.625)	15.6 (.615)	305 (12)	120, 208, 240	1700	IXS12600-09	7 (3)
		457 (18)	"	2500	IXS12600-10	7 (3)
		610 (24)	"	3400	IXS12600-11	9 (4)
		762 (30)	208, 240	4200	IXS12600-12	9 (4)
17.5 (.688)	17.1 (.673)	305 (12)	120, 208, 240	1700	IXS12600-13	7 (3)
		457 (18)	"	2500	IXS12600-14	7 (3)
		610 (24)	"	3400	IXS12600-15	9 (4)
		762 (30)	208, 240	4200	IXS12600-16	9 (4)
19.0 (.750)	18.7 (.736)	457 (18)	120, 208, 240	2500	IXS12600-17	4 (2)
		610 (24)	"	3400	IXS12600-18	4 (2)
		762 (30)	208, 240	4200	IXS12600-19	7 (3)
		1067 (42)	"	5900	IXS12600-20	9 (4)
22.5 (.875)	21.9 (.863)	610 (24)	120, 208, 240, 480, 600	3500	IXS12600-21	7 (3)
		914 (36)	208, 240, 480, 600	5000	IXS12600-22	7 (3)
		1219 (48)	"	6500	IXS12600-23	9 (4)
		1524 (60)	"	8000	IXS12600-24	9 (4)
25.4 (1.00)	25.0 (.984)	610 (24)	120, 208, 240, 480, 600	3500	IXS12600-25	7 (3)
		914 (36)	208, 240, 480, 600	5000	IXS12600-26	7 (3)
		1219 (48)	"	6500	IXS12600-27	9 (4)
		1524 (60)	"	8000	IXS12600-28	9 (4)

TO ORDER: Specify quantity, catalog number, voltage, and wattage

Tubular Band Heaters
Types TBH & TBW

Types TBH and TBW tubular band heaters can be clamped to extruder barrels, nozzles, pipes or vessels requiring highly concentrated heating. Heaters can be mounted side-by-side and wrapped with high temperature insulation to improve efficiency.

Some installations may require high temperature wiring or bus bar. If in doubt, check factory.

Two choices of watt densities are listed for some models. To improve service life in high temperature applications greater than 800°F (425°C), select the unit with the lower watt density and consider using multiple heaters.

CONSTRUCTION

The band heater consists of two heating elements held in place by a stainless steel band with a threaded swivel type clamping device.

Two standard widths, 2" (51 mm) Type TBH and 5" (127 mm) Type TBW, are available. The TBW unit has two tension bolts and two double hairpin elements.

Incoloy elements suitable for up to 600V are used in the larger models.

Terminal housings are available on special order.

SPECIAL FEATURES

- Other wattages, diameters and widths are available on special order. Check factory.
- Terminal housings.

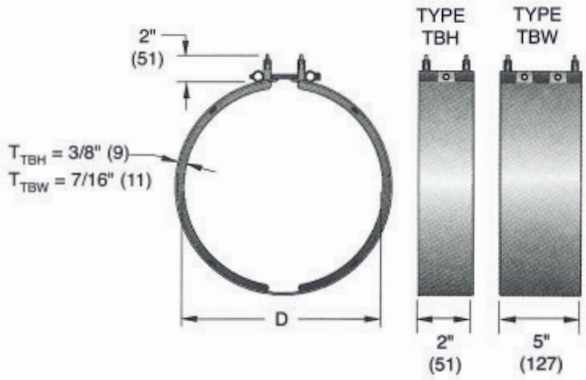


TABLE 1 - TBH BAND HEATERS

USED ON STANDARD PIPE SIZE	INSIDE DIAMETER IN (MM)	DIAMETER TOLERANCE ± IN (MM)	WATTAGE AT 120V, 240V	WATTAGE AT 208V	WATTS / SQ. IN AT 120V, 240V	WATTS / SQ. IN AT 208V	CATALOG NUMBER	WEIGHT LBS (KG)
3"	3 1/2 (89)	1/8 (3)	400	300	25	19	TBH03-040	1.6 (0.7)
3"	3 1/2 (89)	1/8 (3)	600	450	37	28	TBH03-060	1.6 (0.7)
4"	4 1/2 (114)	1/8 (3)	550	412	24	18	TBH04-055	1.8 (0.8)
4"	4 1/2 (114)	1/8 (3)	700	525	31	23	TBH04-070	1.8 (0.8)
5"	5 9/16 (141)	1/8 (3)	700	525	24	18	TBH05-070	2.0 (0.9)
5"	5 9/16 (141)	1/8 (3)	850	637	29	22	TBH05-085	2.0 (0.9)
6"	6 5/8 (168)	1/8 (3)	850	637	24	18	TBH06-085	2.2 (1.0)
6"	6 5/8 (168)	1/8 (3)	1000	750	28	21	TBH06-100	2.2 (1.0)
8"	8 5/8 (219)	1/4 (6)	1100	825	23	17	TBH08-110	2.4 (1.1)
8"	8 5/8 (219)	1/4 (6)	1350	1012	29	22	TBH08-135	2.4 (1.1)
10"	10 3/4 (273)	1/4 (6)	1450	1087	24	18	TBH10-145	2.5 (1.2)
10"	10 3/4 (273)	1/4 (6)	1700	1275	28	21	TBH10-170	2.5 (1.2)

TABLE 2 - TBW BAND HEATERS

USED ON STANDARD PIPE SIZE	INSIDE DIAMETER IN (MM)	DIAMETER TOLERANCE ± IN (MM)	WATTS	WATTS/ SQ. IN	STANDARD VOLTAGES	CATALOG NUMBER	WEIGHT LBS (KG)
6"	6 5/8 (168)	1/8 (3)	1500	18	120, 208, 240, 480, 600	TBW06-150	4 (2)
6"	6 5/8 (168)	1/8 (3)	2000	25	"	TBW06-200	4 (2)
8"	8 5/8 (219)	1/4 (6)	1500	14	"	TBW08-150	4 (2)
8"	8 5/8 (219)	1/4 (6)	2500	23	"	TBW08-250	4 (2)
10"	10 3/4 (273)	1/4 (6)	2000	14	"	TBW10-200	5 (2)
10"	10 3/4 (273)	1/4 (6)	3000	21	"	TBW10-300	5 (2)
12"	12 3/4 (324)	1/4 (6)	2500	15	"	TBW12-250	6 (3)
12"	12 3/4 (324)	1/4 (6)	3500	20	"	TBW12-350	6 (3)
14"	14 (356)	1/4 (6)	3000	16	"	TBW14-300	7 (3)
14"	14 (356)	1/4 (6)	4000	21	"	TBW14-400	7 (3)
16"	16 (406)	1/4 (6)	3500	16	"	TBW16-350	8 (4)
16"	16 (406)	1/4 (6)	4500	20	"	TBW16-450	8 (4)

TO ORDER: Specify quantity, catalog number, voltage, wattage, and special features.

Specialty Tubular/Cartridge
Type MH

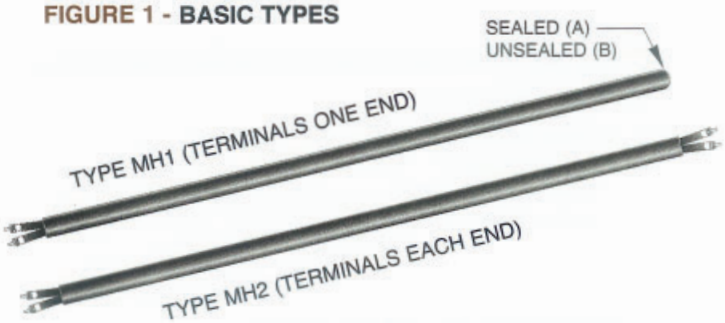
Type MH (mitosis) heaters are custom designed tubulars to meet special process conditions. Because of their unique construction, they are capable of withstanding much higher operating temperatures than conventional tubular heaters.

TYPE MH1A has two, four or six terminals at one end with the opposite end hermetically sealed.

TYPE MH1B is similar to the MH1A except that the end opposite the terminals is not hermetically sealed.

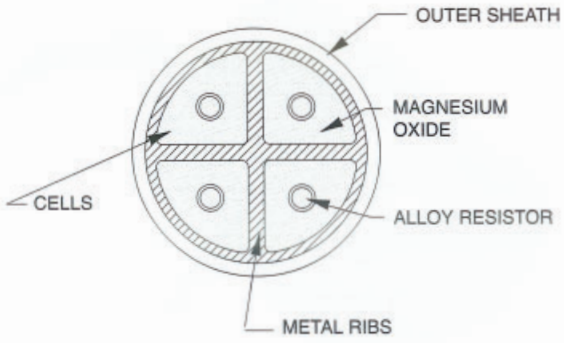
TYPE MH2 has three or four terminals at each end.

FIGURE 1 - BASIC TYPES



The ideal mitosis shape of Figure 2 is subject to variation depending on the specific heater requirements which determine the number and size of individual "cells".

FIGURE 2 - TYPE MH MITOSIS HEATER CROSS SECTION



APPLICATION

- Inserted in machined holes to heat dies and platens
- High temperature furnaces
- Simulated fuel elements for nuclear reactors
- Pressurizer heaters
- Dryout heaters in large generators
- Multizone heating

OPERATING TEMPERATURE

Excellent service life at process temperatures up to 1600°F (875°C) is achievable using a custom designed mitosis heater. Above 1600°F it is generally advisable to utilize other technologies.

Controls for high temperature mitosis heaters should utilize solid state switching for maximum life.

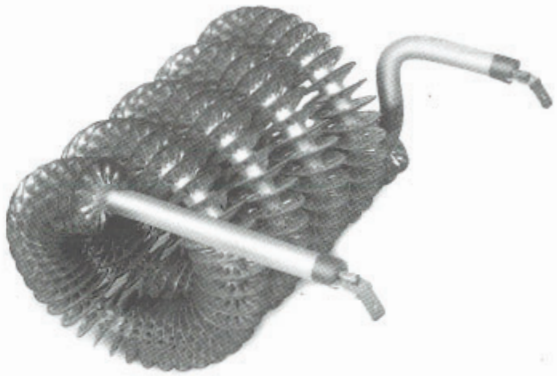
TABLE 1 - TYPICAL DESIGN AND CONSTRUCTION DETAILS

DESCRIPTION	TYPE MH1 SINGLE ELEMENT FOLD-BACK WITH THE TERMINALS AT ONE END (1Ø)	TYPE MH2 THREE STRAIGHT THROUGH ELEMENTS WITH TERMINALS AT BOTH ENDS (1Ø) OR AT ONE END (3ØY)
AVAILABLE MATERIALS	STAINLESS STEEL, INCOLOY 800, INCONEL 600	
STANDARD DIAMETER (in)*	.725 ±.005	.735±.005
IN^2/IN (STANDARD DIAMETER)	2.23	2.31
AVAILABLE LENGTH	UP TO 150"	UP TO 260"
FUSED END (HERMETICALLY SEALED)	AVAILABLE	NOT AVAILABLE
EMBEDDED THERMOCOUPLE	AVAILABLE	
BENDING RADIUS	2 1/4" INSIDE RADIUS ON COLD SECTION ONLY	
MAXIMUM SHEATH TEMPERATURE		
STAINLESS STEEL	1400°F (760°C)	
INCOLOY 800, INCONEL 600	1600°F (871°C)	

* OTHER DIAMETERS AVAILABLE, CONSULT FACTORY.

Finned Tubular Heaters Type KXF

Most of the finned tubular heaters we manufacture are custom designed to suit a particular need. This section is intended to explain the various finned heater features and the importance you should place on each of them. Refer to pages A20 and A21 for listed finned elements in the most popular shapes.



FINNED HEATER VS. NON-FINNED HEATER

Finned heaters are normally used for forced convection heating with outlet air temperatures of 300°C (572°F) or less. Steel finned heaters are standard with surface temperatures limited to about 425°C (797°F) compared to 815°C (1500°F) for an alloy sheathed non-finned heater. If a high surface temperature and the high radiation heat transfer that accompanies it is not detrimental to the remaining system components, a non-finned heater may prove to be the more economical choice.

Some applications require stainless steel materials for corrosion resistance. The most efficient finned heaters are made with steel sheath and steel fins. Keep in mind that stainless heaters with stainless fins are very inefficient since the heat transfer rate of stainless is less than one quarter of that for steel.

FINNED TUBULARS VS. OPEN COIL

Finned tubular heaters are more expensive than open coil heaters and have a slower thermal response.

Other than the above, the finned tubular offers distinct advantages over the open coil:

(i) it is safer to operate in that the risk of fire or electrical shock is minimized;
(ii) it has a much longer service life; and
(iii) it is more rugged requiring less maintenance than an open coil heater.

Open coil heaters generally have less static pressure drop, but the static pressure drop offered by a finned tubular heater is seldom high enough to matter.

FIN EFFICIENCY

Steel fins are spirally wound over the heating element and then metallurgically bonded by furnace brazing leaving negligible thermal resistance at the joint. Brazed fins transfer heat at about double the efficiency of unbrazed designs.

Various combinations of fin thickness, width and pitch are available as shown in Table 1 page A19. Fin combinations which give higher heat transfer areas do not necessarily transfer heat more effectively than similar elements with a bit less area. Fin efficiency is lower for wide fins, thin fins or fins made from a low conductivity metal.

COATINGS

Four choices of surface finish are available. (Check factory for selection assistance).

- bare steel
- nickel plated
- aluminum painted
- black enamel

TEMPERATURE VS. AIR VELOCITY

Finned element operating temperatures will vary depending on air velocity, air temperature and watts per square inch of finned element.

FIG. 1 - WATT DENSITY VS. AIR TEMPERATURE FOR 797°F (425°C) FIN TEMPERATURE

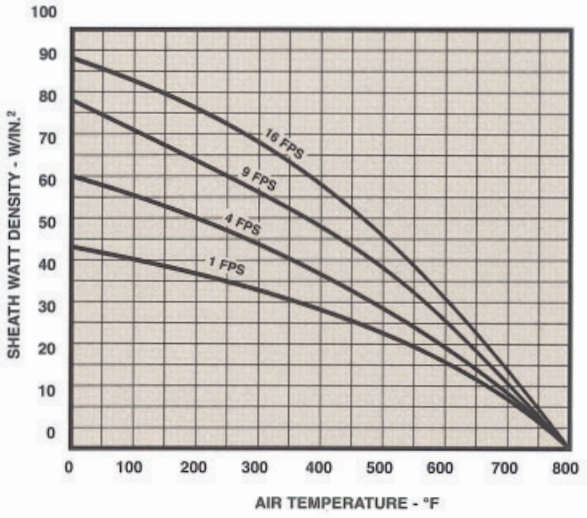


Figure 1 shows the combination of these factors that would develop a sheath temperature of 425°C (797°F). These are approximate only since fin efficiencies and element spacing may cause the temperature to vary.

Selection

In general, specify an element with a minimum .375" diameter if the power supply voltage exceeds 300V. In some cases we can install special terminals on the .315" diameter elements which will also allow their use up to 600V.

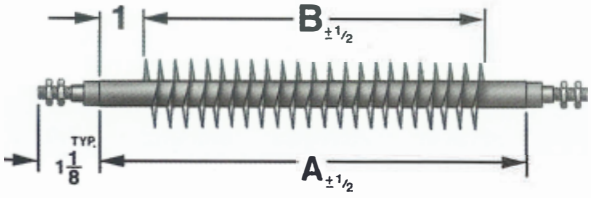
Table 1 below shows the standard fin sizes and pitches available from . We will consider other sizes on special order. Also refer to this table for information on maximum lengths and forming limitations for the various element diameters.

Figure 1 will give the recommended sheath watt density for any combination of velocity and temperature. This recommended density when multiplied by the element surface area per lineal inch from the table will allow you to determine the recommended wattage for each heated inch of element.

It is then a simple matter to determine the number of heated inches of element that would be required for any particular wattage output. Larger wattage or three phase installations will require more than one element.

Factory Assistance

We invite you to phone or fax your local Caloritech™ representative or nearest factory sales department to assist you in your selection since many factors other than those mentioned above require consideration.



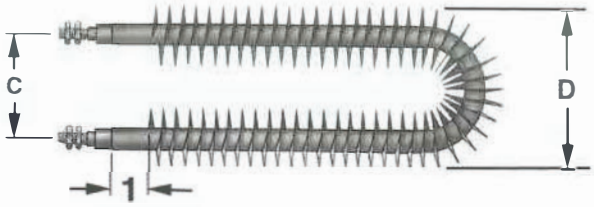


TABLE 1 - FINNING SPECIFICATIONS - STEEL SHEATH WITH FURNACE BRAZED STEEL FINS

ELEMENT DIAMETER in. (mm)	ELEM. SQ. IN. SURFACE PER LINEAL IN.	FIN MATERIAL WIDTH in. (mm)	FIN OUTSIDE DIAMETER in. (mm)	TOTAL SQ. IN. SURFACE PER LINEAL IN.	DIMENSIONS (in.) MAX. 'A'	MAX. 'B'	MIN. 'C'	MIN. 'D'
22 GAUGE (.030") FIN MATERIAL - 4 FINS PER INCH								
0.260 (6.6)	0.82	5/16 (7.9)	0.83 (21.1)	5.4	102*	100	1.375	2.20
0.315 (8.0)	0.99	5/16 (7.9)	0.89 (22.6)	6.0	151*	149	1.500	2.40
0.315 (8.0)	0.99	3/8 (9.5)	1.01 (25.7)	7.6	151*	149	1.625	2.65
0.375 (9.5)	1.18	5/16 (7.9)	0.95 (24.1)	6.6	146	144	1.750	2.70
0.375 (9.5)	1.18	3/8 (9.5)	1.07 (27.2)	8.2	146	144	1.875	2.90
0.430 (10.9)	1.35	5/16 (7.9)	1.01 (25.7)	7.1	285	283	1.875	2.90
0.430 (10.9)	1.35	3/8 (9.5)	1.13 (28.7)	8.8	285	283	2.000	3.15
0.475 (12.1)	1.49	3/8 (9.5)	1.20 (30.5)	9.5	102*	100	2.000	3.20
0.540 (13.7)	1.70	3/8 (9.5)	1.25 (31.8)	10.2	106	104	2.000	3.25
26 GAUGE (.022") FIN MATERIAL - 5 FINS PER INCH								
0.260 (6.6)	0.82	5/16 (7.9)	0.85 (21.6)	6.9	102*	100	2.000	2.85
0.315 (8.0)	0.99	5/16 (7.9)	0.91 (23.1)	7.6	151*	149	2.250	3.15
0.375 (9.5)	1.18	5/16 (7.9)	0.97 (24.6)	8.3	146	144	2.500	3.50
0.430 (10.9)	1.35	5/16 (7.9)	1.02 (25.9)	8.8	285	283	2.750	3.80

*Elements up to 285 inches can be fabricated with special setup

Applications

Listed finned tubular heaters are designed for use in forced circulation, air or gas heating systems such as ducts, fan forced electric heaters, recirculating ovens, loading resistors, etc. Standard terminals are type AA shown on page A10. Heaters are available with most of the other terminal types shown.

Watt Density

Listed heaters have 10 watts per square inch of total heated surface area. Other watt densities are available for lower velocities or higher outlet temperatures. See pages A18 and A19.

Selection of a safe wattage rating depends upon air velocity over heater, temperature of outlet air and allowable sheath temperatures. The graph shown on page A21 indicates air velocity necessary to avoid overheating.

Mounting

Heaters shown on this page can be installed using brazed, crimped or welded plates (see figures 5 to 7 on page A14). Standard elements having factory installed fittings for installation are shown on page A21.

FIG. 1

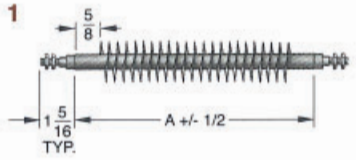


FIG. 2

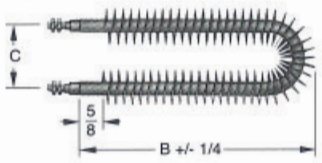


FIG. 3

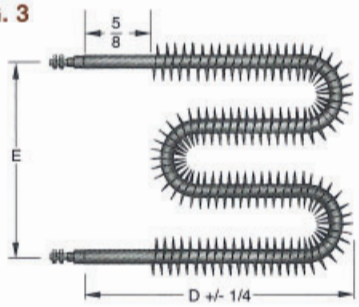


TABLE 1 - FINNED ELEMENTS WITHOUT FITTINGS

kW	STANDARD VOLTAGES	DIM. A mm (in.)	CAT. NO. FIG. 1	DIM. B mm (in.)	DIM. C mm (in.)	CAT. NO. FIG. 2	DIM. D mm (in.)	DIM. E mm (in.)	CAT. NO. FIG. 3
.540 DIA. ELEMENT: $1^1/_4$" O.D. FIN - 10W/in²									
2	240,600	540 (21.3)	KXF502S	275 (10.9)	50 (2.0)	KXF502H	150 (6.0)	150 (6.0)	KXF502W
3	"	795 (31.3)	KXF503S	405 (15.9)	"	KXF503H	215 (8.5)	"	KXF503W
4	"	1045 (41.3)	KXF504S	530 (20.9)	"	KXF504H	280 (11.0)	"	KXF504W
5	"	1305 (51.3)	KXF505S	660 (25.9)	"	KXF505H	345 (13.5)	"	KXF505W
6	"	1555 (61.3)	KXF506S	785 (30.9)	"	KXF506H	405 (16.0)	"	KXF506W
7	"	1810 (71.3)	KXF507S	910 (35.9)	"	KXF507H	470 (18.5)	"	KXF507W
8	"	2065 (81.3)	KXF508S	1040 (40.9)	"	KXF508H	535 (21.0)	"	KXF508W
9	"	2320 (91.3)	KXF509S	1165 (45.9)	"	KXF509H	595 (23.5)	"	KXF509W
10	"	2575 (101.3)	KXF510S	1290 (50.9)	"	KXF510H	660 (26.0)	"	KXF510W
.430 DIA. ELEMENT: $1^1/_8$" O.D. FIN - 10W/in²									
2	240,480,600	675 (26.5)	KXF402S	330 (13.1)	50 (2.0)	KXF402H	185 (7.3)	150 (6.0)	KXF402W
3	"	990 (39.0)	KXF403S	490 (19.4)	"	KXF403H	265 (10.4)	"	KXF403W
4	"	1310 (51.5)	KXF404S	650 (25.6)	"	KXF404H	345 (13.5)	"	KXF404W
5	"	1625 (64.0)	KXF405S	810 (31.9)	"	KXF405H	420 (16.6)	"	KXF405W
6	"	1945 (76.5)	KXF406S	970 (38.1)	"	KXF406H	505 (19.8)	"	KXF406W
7	"	2260 (89.0)	KXF407S	1130 (44.4)	"	KXF407H	580 (22.8)	"	KXF407W
8	"	2580 (101.5)	KXF408S	1285 (50.6)	"	KXF408H	660 (26.0)	"	KXF408W
.315 DIA. ELEMENT: 1" O.D. FIN - 10W/in²									
1	120,208,240	480 (18.9)	KXF301S	225 (8.9)	40 (1.5)	KXF301H	140 (5.5)	115 (4.5)	KXF301W
2	"	865 (34.0)	KXF302S	415 (16.4)	"	KXF302H	235 (9.3)	"	KXF302W
3	"	1245 (49.0)	KXF303S	610 (23.9)	"	KXF303H	330 (13.0)	"	KXF303W
4	208,240	1625 (64.0)	KXF304S	800 (31.4)	"	KXF304H	425 (16.8)	"	KXF304W
5	"	2005 (78.9)	KXF305S	990 (38.9)	"	KXF305H	520 (20.5)	"	KXF305W
6	"	2385 (93.9)	KXF306S	1180 (46.4)	"	KXF306H	615 (24.3)	"	KXF306W

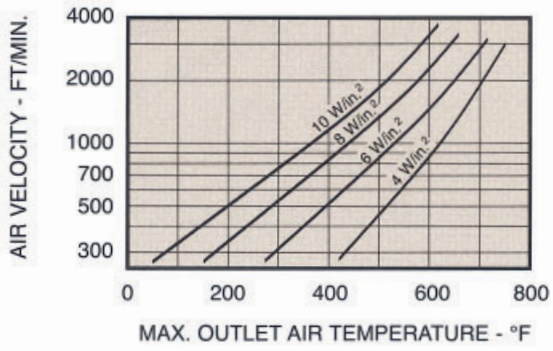
SPECIAL FEATURES: See pages A10 and A14

TO ORDER SPECIFY: Quantity, catalog no., voltage, wattage and special features.

Special Wattage

For low air velocities and/or high outlet air temperatures, a special watt density (watts/sq.in. of heated surface area) may be required.

FIG. 4 - VELOCITY VS. AIR TEMPERATURE FOR 800°F (425°C) FIN TEMPERATURE



Listed heaters are available in lower wattage ratings.

For example - assume an air velocity of 800 ft./min. and an outlet air temperature of 500°F. Reference to Figure 4 indicates that 6 watts/sq.in. is the maximum recommended watt density. Since the listed heaters are 10 watts/sq.in., you would require special elements with 6/10 or 60% of the kW ratings shown in Tables 1 or 2.

FIG. 5

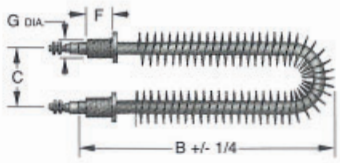


FIG. 6

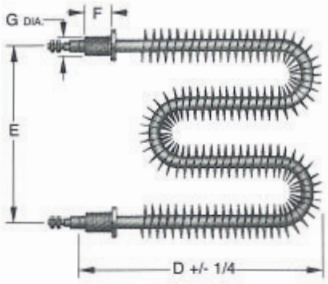


TABLE 2 - FINNED ELEMENTS WITH FITTINGS

kW	STANDARD VOLTAGES	DIM. F mm (in.)	DIM. G mm (in.)	DIM. B mm (in.)	DIM. C mm (in.)	CAT. NO. FIG. 5	DIM. D mm (in.)	DIM. E mm (in.)	CAT. NO. FIG. 6
.540 DIA. ELEMENT: $1^1/_4$" O.D. FIN - 10W/in²									
2	240,600	30 (1.1)	23 (0.90)	310 (12.3)	50 (2.0)	KXF502HM	185 (7.4)	150 (6.0)	KXF502WM
3	"	"	"	440 (17.3)	"	KXF503HM	250 (9.9)	"	KXF503WM
4	"	"	"	565 (22.3)	"	KXF504HM	315 (12.4)	"	KXF504WM
5	"	"	"	695 (27.3)	"	KXF505HM	380 (14.9)	"	KXF505WM
6	"	"	"	820 (32.3)	"	KXF506HM	440 (17.4)	"	KXF506WM
7	"	"	"	945 (37.3)	"	KXF507HM	505 (19.9)	"	KXF507WM
8	"	"	"	1075 (42.3)	"	KXF508HM	570 (22.4)	"	KXF508WM
9	"	"	"	1200 (47.3)	"	KXF509HM	630 (24.9)	"	KXF509WM
10	"	"	"	1325 (52.3)	"	KXF510HM	695 (27.4)	"	KXF510WM
.430 DIA. ELEMENT: $1^1/_8$" O.D. FIN - 10W/in²									
2	240,480,600	30 (1.1)	16 (0.63)	365 (14.5)	50 (2.0)	KXF402HM	220 (8.7)	150 (6.0)	KXF402WM
3	"	"	"	525 (20.8)	"	KXF403HM	300 (11.8)	"	KXF403WM
4	"	"	"	685 (27.0)	"	KXF404HM	380 (14.9)	"	KXF404WM
5	"	"	"	845 (33.3)	"	KXF405HM	455 (18.0)	"	KXF405WM
6	"	"	"	1005 (39.5)	"	KXF406HM	540 (21.2)	"	KXF406WM
7	"	"	"	1165 (45.8)	"	KXF407HM	615 (24.2)	"	KXF407WM
8	"	"	"	1320 (52.0)	"	KXF408HM	695 (27.4)	"	KXF408WM
.315 DIA. ELEMENT: 1" O.D. FIN - 10W/in²									
1	120,208,240	30 (1.1)	13 (0.52)	260 (10.3)	40 (1.5)	KXF301HM	175 (6.9)	115 (4.5)	KXF301WM
2	"	"	"	450 (17.8)	"	KXF302HM	270 (10.7)	"	KXF302WM
3	"	"	"	645 (25.3)	"	KXF303HM	365 (14.4)	"	KXF303WM
4	208, 240	"	"	835 (32.8)	"	KXF304HM	460 (18.2)	"	KXF304WM
5	"	"	"	1025 (40.3)	"	KXF305HM	555 (21.9)	"	KXF305WM
6	"	"	"	1215 (47.8)	"	KXF306HM	650 (25.7)	"	KXF306WM

SPECIAL FEATURES: See pages A10 and A14

TO ORDER SPECIFY: Quantity, catalog no., voltage, wattage and special features.

Cartridge Heaters Type C

Caloritech™ type C cartridge heaters represent the highest commercial grade of heaters available anywhere. We sell only swaged heaters which provide maximum life expectancy and optimum value.

Unswaged heaters, not available from , may be less expensive initially but will not provide reasonable service life in severe applications.

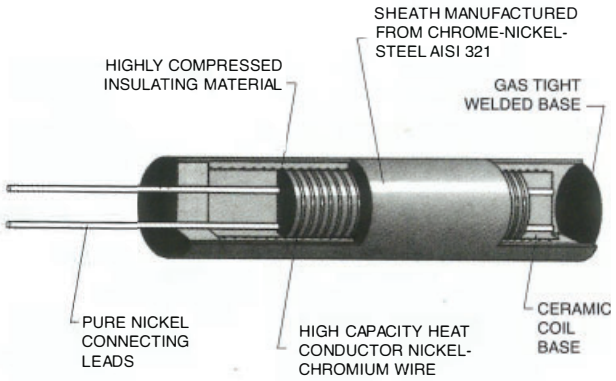
Application

Cartridge heaters offer a convenient and efficient means of heating for metal dies, platens, molds, heat sealing tools, hot plates, etc. Most heaters can be factory fitted with threaded bushings for liquid heating applications. Metal temperatures up to 1400°F (760°C) can be achieved with proper selection of materials, watt density and fit. (See Figure 2).

Construction

High grade nickel chromium resistance wire is uniformly wound on a premium quality MgO core and welded to termination points. The core is then carefully centered in a stainless steel casing which is MgO filled and compacted. Stranded leads with silicon-impregnated mica glass insulation are fixed to termination points.

FIG. 1 - CARTRIDGE HEATER CONSTRUCTION



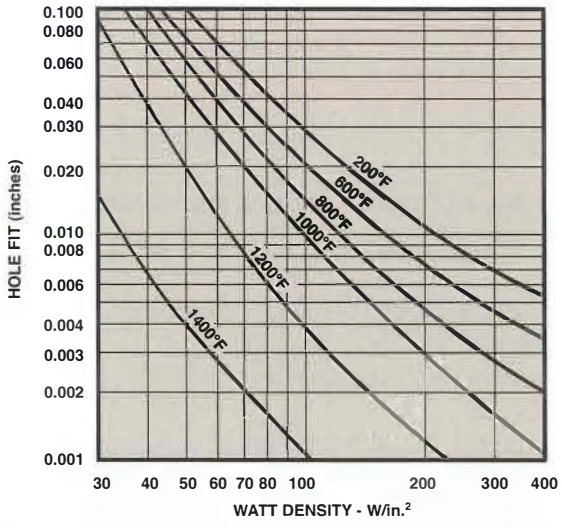
Installation

To install a cartridge heater it is necessary only to provide a hole in the part to be heated. The hole diameter and tolerance are determined from Figure 2. Wherever possible, it is advisable to extend the hole entirely through the part, so that the unit can be driven out readily if the necessity for removing it ever arises.

If a through hole is impractical it is best to increase the hole size a bit but not beyond the tolerances indicated by Figure 2.

To prolong life, minimize vibration and flexing of the lead wires and protect the end of the heater from contamination, especially by liquids.

FIG. 2 - ALLOWABLE WATT DENSITY VS. FIT TOLERANCE AND WORK TEMPERATURE



Manufacturing Tolerances

Wattage tolerance (at rated voltage) ..... +5%, -10%
Diameter tolerance ..... ±.0008"
Length tolerances .....±1/16" or 1.5% of length

Construction

Caloritech™ high quality Type C cartridge heaters are swaged for maximum life expectancy.

Sheath is high temperature 321 stainless steel.

TO ORDER SPECIFY:

Caloritech™ catalog number, quantity, voltage, wattage and special features.

TABLE 1 - STANDARD WATT DENSITY CARTRIDGE HEATERS, TYPE C

SHEATH LENGTH in.	SHEATH LENGTH mm	WATTS	WATT DENSITY W/in.²	WATT DENSITY W/cm²	CALORITECH™ CAT. NO. 120V	CALORITECH™ CAT. NO. 240V	CHROMALOX CAT. NO. 120V	CHROMALOX CAT. NO. 240V	WATLOW CAT. NO. 120V	WATLOW CAT. NO. 240V
1/4" HOLE DIAMETER (0.247" SHEATH DIAMETER)										
1	25.4	80	208	32.2	C1025801	—	CIR10110	—	E1A51	—
1	25.4	100	260	40.3	C1025101	C1025103	CIR10111	CIR10111	E1A52	E1A66
1	25.4	150	390	60.5	C1025151	—	CIR10112	—	E1A53	—
1 1/4	31.8	225	390	60.5	—	C1031223	—	CIR10121	—	E1E61
1 1/2	38.1	125	140	21.7	C1038121	—	CIR1015	—	—	—
1 1/2	38.1	175	228	35.3	C1038171	C1038173	CIR1019	CIR1019	—	E1J49
1 1/2	38.1	250	325	50.4	—	C1038253	—	CIR10153	—	E1J35
2	50.8	100	87	13.5	C1050101	—	CIR1021	—	E2A55	—
2	50.8	150	130	20.2	C1050151	C1050153	CIR1020	CIR1020	E2A56	E2A77
2	50.8	200	173	26.8	C1050201	C1050203	CIR1023	CIR1023	E2A57	E2A50
2	50.8	250	215	33.3	C1050251	C1050253	CIR1024	CIR1024	E2A72	E2A76
2	50.8	300	260	40.3	—	C1050303	—	CIR10201	—	E2A83
3	76.2	200	104	16.1	C1076201	C1076203	CIR1030	CIR1030	E3A49	E3A60
3	76.2	300	156	24.2	C1076301	C1076303	CIR1032	CIR1032	E3A50	E3A51
4	101.6	300	111	17.2	C1101301	C1101303	CIR1040	CIR1040	E4A30	E4A6
5	127.0	350	101	15.7	—	C1127353	—	CIR1050	—	E5A45
6	152.4	400	94	14.6	—	C1152403	—	CIR1060	—	E6A46
3/8" HOLE DIAMETER (0.372" SHEATH DIAMETER)										
1	25.4	55	95	14.7	C2025551	—	CIR20110	—	G1A71	—
1	25.4	100	172	26.7	C2025101	—	CIR20112	—	G1A29	—
1	25.4	150	259	40.1	C2025151	—	CIR20113	—	G1A38	—
1	25.4	200	344	53.3	—	C2025203	—	CIR20114	—	G1A83
1 1/4	31.8	125	144	22.3	C2031121	—	CIR20131	—	G1E74	—
1 1/4	31.8	150	172	26.7	C2031151	C2031153	CIR2012	CIR2012	G1E92	G1E93
1 1/2	38.1	30	32	5.0	C2038301	—	—	—	—	—
1 1/2	38.1	50	53	8.2	C2038501	—	CIR2018	CIR2018	G1J25	—
1 1/2	38.1	85	68	10.5	C2038851	—	CIR2016	—	G1J66	—
1 1/2	38.1	100	86	13.3	C2038101	C2038103	CIR20151	CIR20151	G1J59	G1J110
1 1/2	38.1	150	129	20.0	C2038151	C2038153	CIR2019	CIR2019	G1J31	G1J39
1 1/2	38.1	200	173	26.8	C2038201	C2038203	CIR2015	CIR2015	G1J85	G1J73
1 1/2	38.1	250	216	33.5	C2038251	C2038253	CIR20191	CIR20191	G1J86	G1J54
2	50.8	50	29	4.5	C2050501	—	CIR20201	—	G2A53	—
2	50.8	75	42	6.5	C2050751	C2050753	CIR20209	—	—	G2A192
2	50.8	100	57	8.8	C2050101	C2050103	CIR20202	CIR20202	G2A84	G2A76
2	50.8	150	86	13.3	C2050151	C2050153	CIR2021	CIR2021	G2A56	G2A81
2	50.8	200	115	17.8	C2050201	C2050203	CIR20203	CIR20203	G2A127	G2A37
2	50.8	250	144	22.3	C2050251	C2050253	CIR2020	CIR2020	G2A47	G2A73
2	50.8	300	172	26.7	C2050301	C2050303	CIR20204	CIR20204	G2A139	G2A98
2	50.8	400	230	35.7	C2050401	C2050403	CIR20206	CIR20206	G2A153	G2A146
2 1/2	63.5	500	216	33.5	C2063501	C2063503	CIR20252	CIR20252	G2J109	G2J52
3	76.2	100	34	5.3	C2076101	C2076103	CIR2032	CIR2032	G3A55	G3A137
3	76.2	150	52	8.1	C2076151	C2076153	CIR2033	CIR2033	G3A121	—
3	76.2	200	69	10.7	C2076201	C2076203	CIR2031	CIR2031	G3A61	G3A39
3	76.2	250	86	13.3	C2076251	C2076253	CIR2034	CIR2034	G3A52	G3A54
3	76.2	300	104	16.1	C2076301	C2076303	CIR20301	CIR20301	G3A73	G3A92
3	76.2	400	138	21.4	C2076401	C2076403	CIR20302	CIR20302	G3A44	G3A65
3	76.2	500	173	26.8	C2076501	C2076503	CIR2030	CIR2030	G3A119	G3A120
3 1/2	88.9	300	87	13.5	C2088301	C2088303	CIR2038	CIR2038	G3J87	G3J68
3 1/2	88.9	500	144	22.3	C2088501	C2088503	CIR2035	CIR2035	G3J22	G3J63
4	101.6	150	37	5.7	C2101151	C2101153	—	—	—	—
4	101.6	250	62	9.6	C2101251	C2101253	CIR2042	CIR2042	G4A40	G4A87
4	101.6	400	99	15.3	C2101401	C2101403	CIR2047	CIR2047	G4A48	G4A44
4	101.6	500	123	19.1	C2101501	C2101503	CIR2043	CIR2043	G4A96	G4A92
4 1/2	114.3	300	65	10.1	C2114301	C2114303	CIR20401	CIR20401	G4J54	G4J33
5	127.0	150	29	4.5	C2127151	C2127153	CIR2055	CIR2055	G5A68	G5A56
5	127.0	200	39	6.0	C2127201	C2127203	—	—	—	—
5	127.0	500	96	14.9	C2127501	C2127503	CIR2053	CIR2053	G5A38	G5A71
5	127.0	750	144	22.3	—	C2127753	—	CIR2054	—	G5A67
6	152.4	200	31	4.8	C2152201	—	CIR2064	—	G6A80	—

Table 1 is continued on page A24

Construction

Caloritech™ high quality Type C cartridge heaters are swaged for maximum life expectancy.

Sheath is high temperature 321 stainless steel.

TO ORDER SPECIFY:

Caloritech™ catalog number, quantity, voltage, wattage and special features.

TABLE 1 - STANDARD WATT DENSITY CARTRIDGE HEATERS, TYPE C ... continued

SHEATH LENGTH in.	SHEATH LENGTH mm	WATTS	WATT DENSITY W/in.²	WATT DENSITY W/cm²	CALORITECH™ CAT. NO. 120V	CALORITECH™ CAT. NO. 240V	CHROMALOX CAT. NO. 120V	CHROMALOX CAT. NO. 240V	WATLOW CAT. NO. 120V	WATLOW CAT. NO. 240V
3/8" HOLE DIAMETER (0.372" SHEATH DIAMETER)										
6	152.4	250	39	6.0	C2152251	C2152253	CIR2061	CIR2061	G6A40	G6A92
6	152.4	400	63	9.8	C2152401	C2152403	CIR2065	CIR2065	G6A81	G6A82
6	152.4	600	94	14.6	C2152601	C2152603	CIR2066	CIR2066	G6A56	G6A51
6	152.4	750	117	18.1	—	C2152753	—	CIR2062	—	G6A46
6	152.4	1000	157	24.3	—	C2152103	—	CIR2063	—	G6A83
7	177.8	250	33	5.1	C2177251	C2177253	CIR2070	CIR2070	G7A40	G7A32
7	177.8	600	80	12.4	C2177601	C2177603	CIR2076	CIR2076	G7A41	G7A42
7	177.8	1000	133	20.6	—	C2177103	—	CIR2079	—	G7A43
8	203.2	300	34	5.3	C2203301	C2203303	CIR2081	CIR2081	G8A54	G8A47
8	203.2	500	58	9.0	C2203501	C2203503	CIR2085	CIR2085	G8A81	G8A32
8	203.2	1000	115	17.8	—	C2203103	—	CIR2089	—	G8A45
10	254.0	600	54	8.4	C2254601	C2254603	CIR2100	CIR2100	G10A35	G10A31
10	254.0	1000	91	14.1	—	C2254103	—	CIR2101	—	G10A32
12	304.8	400	30	4.7	C2304401	—	CIR2122	—	G12A45	—
12	304.8	600	45	7.0	C2304601	C2304603	CIR2123	CIR2123	G12A29	G12A46
12	304.8	1000	75	11.6	—	C2304103	—	CIR2121	—	G12A47
1/2" HOLE DIAMETER (0.497" SHEATH DIAMETER)										
1	25.4	50	65	10.1	C3025501	—	CIR3010	—	J1A30	—
1	25.4	150	193	29.9	C3025151	—	CIR3011	—	J1A31	—
1 ¼	31.8	125	107	16.6	C3031121	C3031123	CIR3019	CIR3019	J1E51	J1E58
1 ¼	31.8	200	172	26.6	—	C3031203	—	CIR30121	—	J1E52
1 ½	38.1	150	97	15.0	C3038151	C3038153	CIR3015	CIR3015	J1J48	J1J96
1 ½	38.1	200	128	19.8	C3038201	C3038203	CIR3018	CIR3018	J1J59	J1J38
2	50.8	200	86	13.3	C3050201	C3050203	CIR3021	CIR3021	J2A49	J2A75
2	50.8	250	108	16.7	C3050251	C3050253	CIR30202	CIR30202	J2A85	J2A71
2	50.8	300	128	19.8	C3050301	C3050303	CIR30203	CIR30203	J2A95	J2A96
2	50.8	400	171	26.5	C3050401	C3050403	CIR3020	CIR3020	J2A81	J2A82
2 ¼	57.2	75	28	4.3	C3057751	—	CIR30221	—	J2E86	—
2 ¼	57.2	125	46	7.1	C3057121	—	CIR30222	—	J2E87	—
2 ¼	57.2	250	92	14.3	C3057251	C3057253	CIR3022	CIR3022	J2E56	J2E69
2 ¼	57.2	400	147	22.8	C3057401	C3057403	CIR30223	CIR30223	J2E114	J2E115
2 ⅜	60.3	100	34	5.3	C3060101	C3060103	CIR3026	CIR3026	J2G35	J2G28
2 ⅜	60.3	250	86	13.3	C3060251	C3060253	CIR3023	CIR3023	J2G34	J2G37
2 ½	63.5	100	32	5.0	C3063101	C3063103	CIR30255	CIR30255	J2J67	J2J57
2 ½	63.5	300	96	14.9	C3063301	C3063303	CIR3028	CIR3028	J2J109	J2J110
2 ½	63.5	400	128	19.8	C3063401	C3063403	CIR30253	CIR30253	J2J81	J2J82
2 ½	63.5	500	161	25.0	C3063501	C3063503	CIR30254	CIR30254	J2J66	J2J70
3	76.2	125	32	5.0	C3076121	C3076123	CIR30302	CIR30302	J3A108	J3A109
3	76.2	250	64	9.9	C3076251	C3076253	CIR3031	CIR3031	J3A107	J3A89
3	76.2	400	104	16.1	C3076401	C3076403	CIR3033	CIR3033	J3A132	J3A29
3	76.2	500	129	20.0	C3076501	C3076503	CIR3030	CIR3030	J3A110	J3A111
3	76.2	600	154	23.9	C3076601	C3076603	CIR3034	CIR3034	J3A51	J3A127
3	76.2	750	193	29.9	C3076751	C3076753	CIR30301	CIR30301	J3A137	J3A112
3 ½	88.9	250	54	8.4	C3088251	C3088253	CIR3035	CIR3035	J3J44	J3J64
3 ½	88.9	500	107	16.6	C3088501	C3088503	CIR3037	CIR3037	J3J45	J3J46
4	101.6	150	28	4.3	C3101151	C3101153	CIR3045	CIR3045	J4A117	J4A122
4	101.6	250	46	7.1	C3101251	C3101253	CIR30402	CIR30402	J4A118	J4A90
4	101.6	350	65	10.1	C3101351	C3101353	CIR3046	CIR3046	J4A1	J4A103
4	101.6	400	74	11.5	C3101401	C3101403	CIR3043	CIR3043	J4A139	J4A68
4	101.6	500	92	14.3	C3101501	C3101503	CIR3041	CIR3041	J4A16	J4A92
4	101.6	750	138	21.4	C3101751	C3101753	CIR3044	CIR3044	J4A198	J4A119
4	101.6	1000	184	28.5	—	C3101103	—	CIR30401	—	J4A73
5	127.0	250	38	5.9	C3127251	C3127253	—	—	—	—
5	127.0	350	50	7.8	C3127351	C3127353	CIR3051	CIR3051	J5A86	J5A63
5	127.0	400	58	9.0	C3127401	C3127403	CIR3054	CIR3054	J5A98	J5A46
5	127.0	500	72	11.2	C3127501	C3127503	CIR30501	CIR30501	J5A52	J5A45

Table 1 is continued on page A25

Construction

Caloritech™ high quality Type C cartridge heaters are swaged for maximum life expectancy.

Sheath is high temperature 321 stainless steel.

TO ORDER SPECIFY:

Caloritech™ catalog number, quantity, voltage, wattage and special features.

TABLE 1 - STANDARD WATT DENSITY CARTRIDGE HEATERS, TYPE C ... continued

SHEATH LENGTH in.	SHEATH LENGTH mm	WATTS	WATT DENSITY W/in.²	WATT DENSITY W/cm²	CALORITECH™ CAT. NO. 120V	CALORITECH™ CAT. NO. 240V	CHROMALOX CAT. NO. 120V	CHROMALOX CAT. NO. 240V	WATLOW CAT. NO. 120V	WATLOW CAT. NO. 240V
1/2" HOLE DIAMETER (0.497" SHEATH DIAMETER)										
5	127.0	750	108	16.7	C3127751	C3127753	CIR3050	CIR3050	J5A121	J5A72
5	127.0	1000	143	22.2	—	C3127103	—	CIR30502	—	J5A87
5 ½	139.7	500	64	9.9	C3139501	C3139503	CIR3055	CIR3055	J5J43	J5J33
5 ½	139.7	750	97	15.0	C3139751	C3139753	CIR3057	CIR3057	J5J44	J5J45
6	152.4	300	35	5.4	C3152301	C3152303	CIR3061	CIR3061	—	J6A66
6	152.4	500	59	9.1	C3152501	C3152503	CIR3062	CIR3062	J6A115	J6A94
6	152.4	750	88	13.6	C3152751	C3152753	CIR3063	CIR3063	J6A99	J6A90
6	152.4	1000	117	18.1	C3152101	C3152103	CIR3064	CIR3064	J6A53	J6A36
6 ½	165.1	1000	108	16.7	—	C3165103	—	CIR30601	—	J6J27
7	177.8	500	50	7.8	C3177501	C3177503	CIR3071	CIR3071	J7A80	J7A57
7	177.8	1000	99	15.3	—	C3177103	—	CIR3075	—	J7A81
8	203.2	300	26	4.0	C3203301	C3203303	CIR3085	CIR3085	J8A71	J8A111
8	203.2	500	43	6.7	C3203501	C3203503	CIR3084	CIR3084	J8A64	J8A66
8	203.2	1000	86	13.3	C3203101	C3203103	CIR3080	CIR3080	J8A84	J8A60
8	203.2	1500	129	20.0	—	C3203153	—	CIR3082	—	J8A100
8	203.2	2000	172	26.7	—	C3203203	—	CIR3086	—	J8A101
9	228.6	500	38	5.9	—	C3228503	—	CIR3090	—	J9A35
9	228.6	1000	76	11.8	—	C3228103	—	CIR3091	—	J9A58
10	254.0	500	34	5.3	C3254501	C3254503	CIR3103	CIR3103	J10A61	J10A62
10	254.0	1000	68	10.5	C3254101	C3254103	CIR3101	CIR3101	J10A63	J10A42
10	254.0	1500	102	15.8	—	C3254153	—	CIR3102	—	J10A33
10	254.0	2000	136	21.1	—	C3254203	—	CIR3105	—	J10A64
12	304.8	550	30	4.7	C3304551	C3304553	CIR3121	CIR3121	J12A63	J12A76
12	304.8	1000	56	8.7	C3304101	C3304103	CIR3122	CIR3122	J12A40	J12A49
12	304.8	1500	84	13.0	—	C3304153	—	CIR3120	—	J12A37
12	304.8	2000	112	17.4	—	C3304203	—	CIR3125	—	J12A89
14	355.6	2300	110	17.1	—	C3355233	—	CIR3142	—	J14A39
18	457.2	1700	62	9.6	—	C3457173	—	CIR3180	—	J18A23
5/8" HOLE DIAMETER (0.622" SHEATH DIAMETER)										
1 ¼	31.8	50	34	5.3	C4031501	—	CIR4011	—	L1E26	—
1 ¼	31.8	200	137	21.2	C4031201	—	CIR4012	—	L1E24	—
1 ¼	31.8	250	171	26.5	C4031251	—	CIR4013	—	L1E27	—
2	50.8	100	34	5.3	C4050101	—	CIR40201	—	L2A48	—
2	50.8	200	68	10.5	C4050201	C4050203	CIR4020	CIR4020	L2A49	—
2 ¼	57.2	100	29	4.9	C4057101	—	CIR4023	—	L2E49	—
2 ¼	57.2	350	103	16.0	C4057351	C4057353	CIR4029	CIR4029	L2E40	L2E51
2 ⅜	60.3	280	77	11.9	C4060281	C4060283	CIR4024	CIR4024	L2G18	L2G19
3	76.2	150	31	4.8	C4076151	—	CIR4035	—	L3A81	—
3	76.2	250	51	7.9	C4076251	C4076253	CIR4031	CIR4031	L3A82	L3A9
3	76.2	500	102	15.8	C4076501	C4076503	CIR4030	CIR4030	L3A113	L3A33
3	76.2	750	154	23.9	—	C4076753	—	CIR4034	—	L3A71
3 ¾	95.3	525	82	12.7	C4095521	C4095523	CIR4037	CIR4037	L3N12	L3N1
4	101.6	250	37	5.7	C4101251	C4101253	CIR4044	CIR4044	L4A99	L4A104
4	101.6	400	58	9.0	—	C4101403	—	CIR4045	—	L4A47
4	101.6	500	73	11.3	C4101501	C4101503	CIR4041	CIR4041	—	L4A53
4	101.6	600	88	13.6	C4101601	C4101603	—	CIR4046	—	L4A44
4	101.6	750	110	17.1	C4101751	C4101753	CIR4040	CIR4040	—	L4A100
4	101.6	1000	146	22.6	—	C4101103	—	CIR4042	—	L4A71
5	127.0	250	28	4.3	C4127251	C4127253	CIR4056	CIR4046	L5A76	L5A107
5	127.0	500	57	8.8	C4127501	C4127503	CIR4051	CIR4051	—	L5A24
5	127.0	750	86	13.3	C4127751	C4127753	CIR4050	CIR4050	—	L5A31
5	127.0	1000	114	17.7	—	C4127103	—	CIR4052	—	L5A77
5 ⅛	139.7	285	32	5.0	C4139281	C4139283	—	—	—	—
6	152.4	300	28	4.3	C4152301	C4152303	CIR4067	CIR4067	L6A28	L6A64
6	152.4	500	47	7.3	C4152501	C4152503	CIR4061	CIR4061	—	L6A73
6	152.4	1000	93	14.4	C4152101	C4152103	CIR4060	CIR4060	—	L6A71
6	152.4	1500	140	21.7	C4152151	C4152153	CIR4062	CIR4062	L6A163	L6A94

Table 1 is continued on page A26

Construction

Caloritech™ high quality Type C cartridge heaters are swaged for maximum life expectancy.

Sheath is high temperature 321 stainless steel.

TO ORDER SPECIFY:

Caloritech™ catalog number, quantity, voltage, wattage and special features.

TABLE 1 - STANDARD WATT DENSITY CARTRIDGE HEATERS, TYPE C ... continued

SHEATH LENGTH in.	SHEATH LENGTH mm	WATTS	WATT DENSITY W/in.²	WATT DENSITY W/cm²	CALORITECH™ CAT. NO. 120V	CALORITECH™ CAT. NO. 240V	CHROMALOX CAT. NO. 120V	CHROMALOX CAT. NO. 240V	WATLOW CAT. NO. 120V	WATLOW CAT. NO. 240V
5/8" HOLE DIAMETER (0.622" SHEATH DIAMETER)										
7	177.8	500	39	6.0	C4177501	C4177503	CIR4072	CIR4072	L7A42	L7A15
7	177.8	1000	79	12.2	—	C4177103	—	CIR4070	—	L7A37
7	177.8	1500	118	18.3	—	C4177153	—	CIR4071	—	L7A12
8	203.2	500	34	5.3	C4203501	C4203503	CIR4085	CIR4085	L8A96	L8A46
8	203.2	850	58	9.0	—	C4203853	—	CIR4088	—	L8A115
8	203.2	1000	68	10.5	—	C4203103	—	CIR4083	—	L8A10
8	203.2	1500	102	15.8	—	C4203153	—	CIR4084	—	L8A37
10	254.0	500	27	4.2	C4254501	C4254503	CIR4103	CIR4103	L10A51	L10A40
10	254.0	1000	54	8.4	—	C4254103	—	CIR4100	—	L10A52
10	254.0	1500	81	12.6	—	C4254153	—	CIR4101	—	L10A8
10	254.0	2000	108	16.7	—	C4254203	—	CIR4102	—	L10A50
12	304.8	500	22	3.4	C4304501	C4304503	CIR4125	CIR4125	L12A81	L12A80
12	304.8	1000	45	7.0	C4304101	C4304103	CIR4120	CIR4120	L12A82	L12A34
12	304.8	1500	67	10.4	C4304151	C4304153	CIR4121	CIR4121	L12A14	L12A39
14	355.6	3700	140	21.7	—	C4355373	—	CIR4140	—	L14A21
15	381.0	2400	84	13.0	—	C4381243	—	CIR4150	—	L15A20
16	406.4	4500	148	22.9	—	C4406453	—	CIR4167	—	L16A40
18	457.2	1500	44	6.8	—	C4457153	—	CIR4180	—	L18A32
18	457.2	3000	87	13.5	—	C4457303	—	CIR4182	—	L18A34
18	457.2	4700	137	21.2	—	C4457473	—	CIR4184	—	L18A36
20	508.0	4700	123	19.1	—	C4508473	—	CIR4205	—	L20A14
36	914.4	3000	43	6.7	—	C4914303	—	CIR4361	—	L36A8
3/4" HOLE DIAMETER (0.747" SHEATH DIAMETER)										
2 ¼	57.2	200	49	7.6	C5057201	—	CIR5022	—	N2E8	—
3	76.2	250	43	6.7	C5076251	—	CIR5031	—	N3A11	—
3	76.2	500	85	13.2	C5076501	C5076503	CIR5030	CIR5030	—	N3A12
4	101.6	500	61	9.5	—	C5101503	—	CIR5040	—	N4A17
4	101.6	1000	122	18.9	—	C5101103	—	CIR5041	—	N4A15
5	127.0	300	28	4.3	C5127301	—	CIR5052	—	N5A19	—
5	127.0	500	47	7.3	—	C5127503	—	CIR5051	—	N5A12
5	127.0	1000	95	14.7	C5127101	C5127103	CIR5050	CIR5050	—	N5A20
6	152.4	500	39	6.0	C5152501	C5152503	CIR5065	CIR5065	N6A19	N6A20
6	152.4	1000	78	12.1	—	C5152103	—	CIR5067	—	N6A21
6	152.4	1500	116	18.0	—	C5152153	—	CIR5068	—	N6A82
6	152.4	2000	155	24.0	—	C5152203	—	CIR5069	—	N6A22
7	177.8	500	33	5.1	C5177501	C5177503	CIR5075	CIR5075	N7A15	N7A1
7	177.8	1000	66	10.2	—	C5177103	—	CIR5072	—	N7A16
8	203.2	500	28	4.3	C5203501	C5203503	CIR5085	CIR5085	N8A19	N8A20
8	203.2	1000	57	8.8	—	C5203103	—	CIR5080	—	N8A21
8	203.2	2000	114	17.7	—	C5203203	—	CIR5082	—	N8A22
10	254.0	1000	45	7.0	—	C5254103	—	CIR5100	—	N10A15
10	254.0	2000	90	14.0	—	C5254203	—	CIR5102	—	N10A14
12	304.8	1000	37	5.7	—	C5304103	—	CIR5120	—	N12A15
12	304.8	2000	74	11.5	—	C5304203	—	CIR5121	—	N12A24
12	304.8	4000	148	22.9	—	C5304403	—	CIR5124	—	N12A25
15	381.0	1500	44	6.8	—	C5381153	—	CIR5150	—	N15A26
16	406.4	1800	49	7.6	—	C5406183	—	CIR5162	—	N16A26
18	457.2	2000	49	7.6	—	C5457203	—	CIR5182	—	N18A13
20	508.0	1150	25	3.9	—	C5508113	—	CIR5202	—	N20A21
20	508.0	2250	49	7.6	—	C5508223	—	CIR5203	—	N20A22
20	508.0	5000	115	17.8	—	C5508503	—	CIR5205	—	N20A10
24	609.6	1375	25	3.9	—	C5609133	—	CIR5243	—	N24A24
24	609.6	2750	50	7.8	—	C5609273	—	CIR5244	—	N24A23
36	914.4	2500	30	4.7	—	C5914253	—	CIR5362	—	N36A4
1 19/64" HOLE DIAMETER (1.293" SHEATH DIAMETER)										
5	127.0	600	35	5.4	C6127601	C6127603	C806	C806	—	—
8 ½	215.9	1000	32	5.0	C6215101	C6215103	C830	C830	—	—
8 ½	215.9	1200	39	6.0	C6215121	C6215123	C810	C810	—	—

Special Designs and Modifications

- **Mitosis heaters -** See page A17 for ultra high temperature custom designs.
- **Special voltages and wattages** - Cartridge heaters can be custom manufactured to voltages and wattages other than those listed. Series connecting cartridges on line voltages above 300 volts is not recommended. For details check factory.
- **Special lengths** - Cartridge heaters can be custom manufactured in lengths up to 100 inches. However, drilling and reaming holes accurately in long lengths requires special equipment. If possible shorter heaters from each side are a cost effective solution. An improper fit will reduce heater life.
- **Special sheath materials -** Caloritech™ cartridge heaters are manufactured from grade 321 stainless steel; which is suitable for most applications. For special requirements check factory.
- **Moisture-resistant** - The end cap of the Caloritech™ cartridge heater is welded to form a gas tight seal. Optional lead wire construction includes silicon potting, teflon seals and teflon leads. Check factory for application assistance.
- **Lead wire length -** Fibreglass insulated nickel leads, 10" in length, are standard. Cartridge heaters can be manufactured with longer leads or extended leads can be spliced to stock units.
- **Protective lead covering** - Armoured cable or wire mesh sleeving is available for additional mechanical protection over lead wires.
- **Thermocouple -** J or K thermocouples can be built into any cartridge heater.
- **Ground wire -** An additional wire for ground, fixed to the sheath, can be provided for special code requirements.
- **Threaded bushing -** Welded single-ended and double-ended stainless steel bushings are available for immersion applications. Check factory for suitable densities.

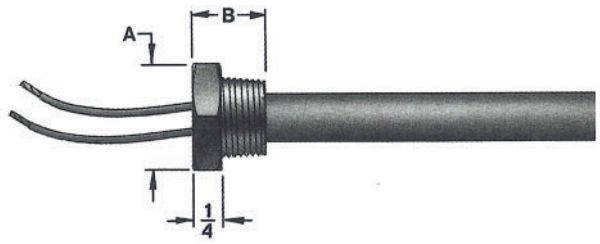
How to Order

Specify quantity and Caloritech™ catalog number when ordering, plus special features.

THREADED BUSHING (FIG. 1 & 2)

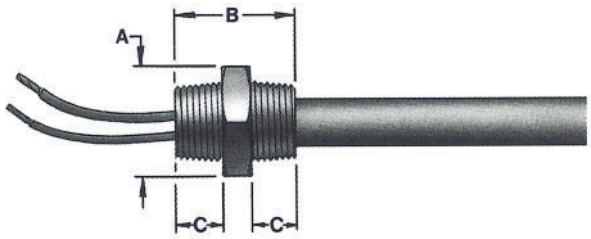
Brass for liquid immersion heating applications under 750°F. Stainless steel available for applications over 750°F.

FIG. 1



CART. DIA.	'A' DIM. mm	'B' DIM. mm	STD. TAPER PIPE THD.
1/4"	11.9	15.2	1/8" NPT
3/8"	15.7	17.2	1/4" NPT
1/2"	17.2	21.7	3/8" NPT
5/8"	22.5	24.2	1/2" NPT
3/4"	26.8	26.5	3/4" NPT
1 19/64"	44.5	34.9	1 1/4" NPT

FIG. 2



CART. DIA.	'A' DIM. mm	'B' DIM. mm	'C' DIM. mm	STD. TAPER PIPE THD.
1/4"	11.9	24.8	9.6	1/8" NPT
3/8"	15.7	27.6	10.4	1/4" NPT
1/2"	17.2	35.6	13.9	3/8" NPT
5/8"	22.1	38.2	16	1/2" NPT
3/4"	26.8	43.2	16.7	3/4" NPT
1 19/64"	44.5	60.3	25.4	1 1/4" NPT

Strip & Finned Strip Heaters
Type FS, SS & SD

Application

Strip Heaters have many applications, including: **surface heating** — on platens, dies, molds, tanks, piping and more; **process air heating** — both strip and finned strip heaters in drying cabinets, ovens, baking ovens and vacuum dehydrating ovens and for moisture protection for motors, etc.; **resistors** — as dropping resistors for line applications in railroads and load banks; **winterizing** — on hoppers, conveyors, ducts, car heating, thawing; **original equipment** — air conditioning, laboratory equipment, food packaging, ovens, presses and drying equipment.

TYPE SS

TYPE SD

TYPE FS

Construction

Caloritech™ strip heaters are constructed of specially selected high quality materials, beginning with the high-temperature alloy resistance wire uniformly coiled and spaced over the width of the heated length of the strip heater. This controlled coil process and placement assures uniform heat distribution over the entire active surface of the heater.

Special care is taken to secure the stud-type terminal to the high-temperature alloy resistance contact. The coiled resistance wire is embedded in a special refractory material which possesses excellent heat transfer characteristics and superior insulation properties.

The entire heater assembly is encased in either an aluminized steel or stainless steel sheath and is compressed under high pressure. The completed assembly is heated under controlled conditions to bake and semi-vitrify the refractory material for a rigid, vibration resistant, heavy-duty heating unit.

Features

Strip heaters are available with aluminized steel or stainless steel sheath. Aluminized steel strip heaters are suitable for applications where the maximum sheath temperature does not exceed 1000°F. Stainless steel strip heaters are suitable for applications where the maximum sheath temperature does not exceed 1200°F.

Caloritech™ strip heaters have slotted mounting tabs which allow for lineal expansion during the initial heatup period. The flat surface of the strip heater is suitable for clamp-on applications and provides uniform heat distribution for broad surfaces.

Finned Strip Heaters

Type SS strip heaters can be finned to improve heat transfer in free or forced air heating applications. See listings on page A34.

Benefits

- Aluminized steel sheath provides both corrosion resistance and an attractive appearance.
- Stainless steel sheath combines additional corrosion protection and excellent appearance.
- Vibration resistant — the compacted semi-vitrified refractory material with the rigid sheathed construction enable strip heaters to withstand severe vibration conditions.
- Rugged construction for long life.
- Application versatility — easy to use in a wide variety of surface and air heating applications.

Normal Limits

- Maximum Voltage (with Secondary Insulators)..... 600 volts
- Maximum Amps ..... 48 amps
- Overall Length Limit ..... 42 1/4 inches
- Effective Length Limit ..... 39 inches
- Approx. Weight/Inch of Length..... .08 lbs/inch
- Maximum Allowable Sheath Temperature..... Aluminized Steel 1000°F ..... Stainless Steel 1200°F
- Minimum Lengthwise Factory Bending Radius (Terminals on Outside) ..... 4 inches

Selection

Use the graphs shown on this page to assist in the selection of the strip heater or finned strip heater with the correct watt density so that the sheath temperature will not exceed 1000°F for aluminized steel and 1200°F for stainless steel. Consult factory for additional assistance.

FIG. 1 - STRIP HEATER SHEATH TEMPERATURE vs. WATT DENSITY FOR AIR HEATING APPLICATIONS

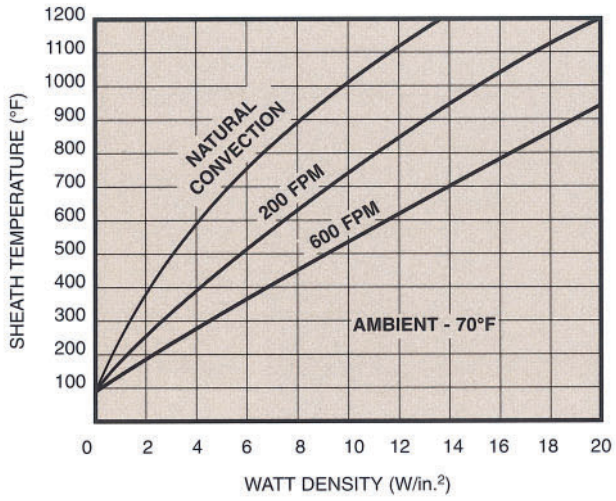


FIG. 2 - STRIP HEATER SHEATH TEMPERATURE vs. WATT DENSITY FOR CLAMPED-ON APPLICATIONS

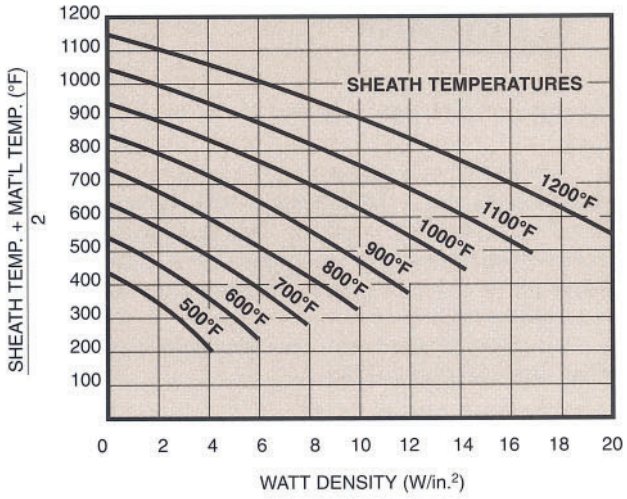
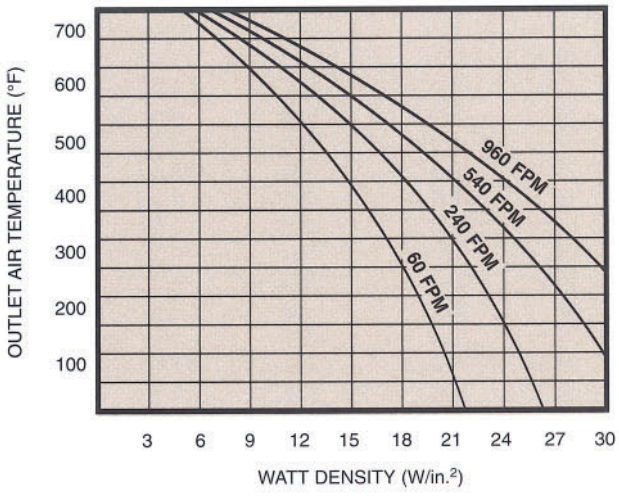
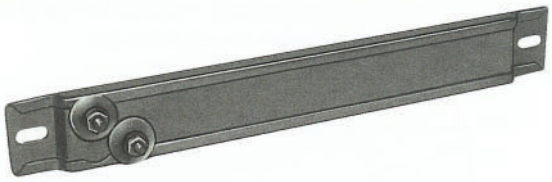


FIG. 3 - FINNED STRIP HEATER OUTLET AIR TEMPERATURE vs. WATT DENSITY FOR 700 - 750°F SHEATH OPERATING TEMPERATURE



Type SS Strip Heaters

Type SS strip heaters have two offset bolt type terminals at one end. Table 1 lists heaters having aluminized steel sheath.



ALUMINIZED STEEL SHEATH

The entire heater assembly is encased in an aluminized steel sheath and is compressed under high pressure. The sheath provides both corrosion resistance and an attractive appearance. Aluminized steel strip heaters are suitable for applications where the maximum sheath temperature does not exceed 1000°F.

If higher temperatures are anticipated, use stainless steel heaters listed in Table 2.

INSTALLATION

Standard strip heaters listed are rated at 120 and 240 volts. A limited selection of 287 V heaters is also tabled. All strip heaters can be used on voltages lower than listed for reduced wattage, and some designs can also be used on higher voltages — check factory.

Whenever voltage to ground exceeds 300V, secondary insulators must be used. See page A35.

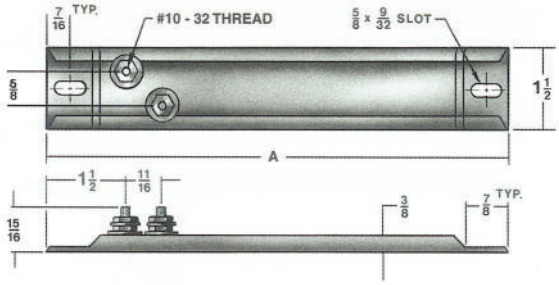


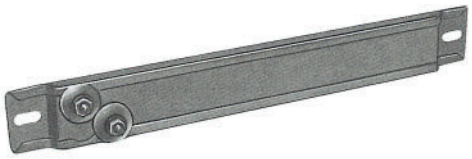
TABLE 1 - TYPE SS STRIP HEATERS - TERMINALS AT ONE END / ALUMINIZED STEEL SHEATH

A. DIM. (in.)	A. DIM. (mm)	WATTS	WATTS PER (in²)	WATTS PER (cm²)	CALORITECH™ CATALOG NO. 120V	CALORITECH™ CATALOG NO. 240V	CALORITECH™ CATALOG NO. 287V	CHROMALOX PART NO. 120V	CHROMALOX PART NO. 240V
5 ½	140	125	15.7	2.4	SS1001	—	—	PT512	—
6	152	150	15.2	2.4	SS1011	SS1022	—	PT615	—
7 ¼	184	100	8.2	1.3	SS1031	—	—	—	—
7 ¼	184	150	12.3	1.9	SS1041	SS1052	—	OT715	OT715
8	203	150	10.0	1.6	SS1061	SS1072	—	OT815	OT815
8	203	175	11.7	1.8	SS1081	SS1092	—	OT817	OT817
10 ½	267	250	10.3	1.6	SS1101	SS1112	—	OT1025	—
11 ¾	298	250	8.6	1.3	SS1141	SS1152	—	OT1225	OT1225
14	356	300	8.0	1.2	SS1181	SS1192	—	OT1430	OT1430
15	381	325	7.9	1.2	SS1201	SS1212	—	OT1532	OT1532
17 ¾	451	350	6.8	1.1	SS1221	SS1232	—	OT1835	OT1835
17 ¾	451	375	7.3	1.1	SS1241	SS1252	—	OT1837	OT1837
17 ¾	451	500	9.7	1.5	SS1261	SS1272	—	OT1850	OT1850
17 ¾	451	250	4.8	0.7	SS1281	SS1292	—	—	—
19 ½	495	350	6.0	0.9	SS1301	SS1312	—	—	OT1935
19 ½	495	500	8.6	1.3	SS1321	SS1332	—	OT1950	OT1950
21	533	500	7.8	1.2	SS1341	SS1352	—	OT2150	OT2150
23 ½	597	500	6.8	1.1	SS1361	SS1372	SS1386	OT2450	OT2450
23 ½	597	750	10.3	1.6	SS1391	SS1402	—	OT2475	OT2475
25 ½	648	500	6.2	1.0	SS1421	SS1432	—	OT2550	OT2550
25 ½	648	750	9.3	1.4	SS1441	SS1452	—	OT2575	OT2575
26 ¾	679	700	8.2	1.3	SS1461	SS1472	—	—	OT2670
30 ¼	768	750	7.6	1.2	SS1481	SS1492	2A830A706	OT3075	—
33 ½	851	750	6.8	1.1	SS1511	SS1522	—	—	OT3375
35 ¾	908	1000	8.4	1.3	SS1531	SS1542	2A835A703	OT3610	OT3610
38 ½	978	800	6.2	1.0	SS1561	SS1572	—	—	—
38 ½	978	1000	7.7	1.2	SS1581	SS1592	—	OT3810	—
42 ¼	1073	1250	8.7	1.3	SS1601	SS1612	—	—	—
42 ¼	1073	1500	10.5	1.6	SS1621	SS1632	—	—	—

TO ORDER SPECIFY: Quantity, catalog number, voltage, wattage and special features.

Type SS Strip Heaters (cont'd)

Heaters with high temperature stainless steel sheath are listed in Table 2.



STAINLESS STEEL SHEATH

The entire heater assembly is encased in a stainless steel sheath and is compressed under high pressure. The sheath combines additional corrosion protection and excellent appearance. Stainless steel strip heaters are suitable for applications where the maximum sheath temperature does not exceed 1200°F.

INSTALLATION

Standard strip heaters listed are rated at 120 and 240 volts. A limited selection of 287 V heaters is also tabled. All strip heaters can be used on voltages lower than listed for reduced wattage, and some designs can also be used on higher voltages — check factory.

Whenever voltage to ground exceeds 300V, secondary insulators must be used. See page A35.

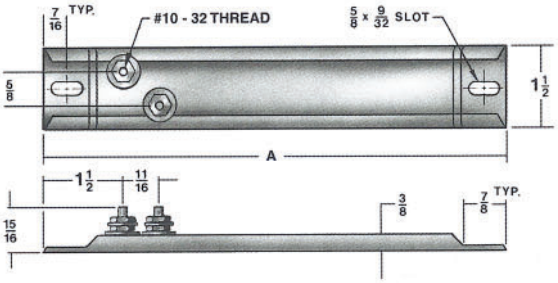


TABLE 2 - TYPE SS STRIP HEATERS - TERMINALS AT ONE END / STAINLESS STEEL SHEATH

A. DIM. (in.)	A. DIM. (mm)	WATTS	WATTS PER (in²)	WATTS PER (cm²)	CALORITECH™ CATALOG NO. 120V	CALORITECH™ CATALOG NO. 240V	CALORITECH™ CATALOG NO. 287V	CHROMALOX PART NO. 120V	CHROMALOX PART NO. 240V
5 ½	140	250	31.4	4.9	SS2001	—	—	—	—
6	152	300	30.5	4.7	SS2011	SS2022	—	—	—
7 ¼	184	100	8.2	1.3	SS2031	—	—	—	—
7 ¼	184	200	16.4	2.5	SS2041	SS2052	—	—	OT702
8	203	250	16.7	2.6	SS2061	SS2072	—	OT802	OT802
8	203	400	26.7	4.1	SS2081	SS2092	—	OT804	OT804
10 ½	267	350	14.4	2.2	SS2101	SS2112	—	OT1003	OT1003
10 ½	267	400	16.4	2.5	SS2131	SS2132	—	OT1004	OT1004
11 ¾	298	350	12.0	1.9	SS2141	SS2152	—	OT1203	OT1203
11 ¾	298	500	17.2	2.7	SS2161	SS2172	—	OT1205	OT1205
14	356	500	13.3	2.1	SS2181	SS2192	—	OT1405	OT1405
15	381	500	12.1	1.9	SS2201	SS2212	—	—	OT1505
17 ¾	451	350	6.8	1.1	SS2221	SS2232	—	—	—
17 ¾	451	500	9.7	1.5	SS2241	SS2252	2A917A707	—	—
17 ¾	451	750	14.5	2.2	SS2261	SS2272	—	OT1807	OT1807
17 ¾	451	1000	19.4	3.0	SS2281	SS2292	—	OT1801	OT1801
19 ½	495	500	8.6	1.3	SS2301	SS2312	—	OT1905	OT1905
19 ½	495	1000	17.2	2.7	SS2321	SS2332	—	—	OT1901
21	533	750	11.8	1.8	SS2341	SS2352	—	OT2107	OT2107
23 ½	597	500	6.8	1.1	SS2361	SS2372	—	OT2405	OT2405
23 ½	597	750	10.3	1.6	SS2381	SS2392	2A923A703	OT2407	OT2407
23 ½	597	1000	13.7	2.1	SS2401	SS2412	—	OT2401	OT2401
25 ½	648	750	9.3	1.4	SS2421	SS2432	—	OT2507	OT2507
25 ½	648	1000	12.4	1.9	SS2441	SS2452	—	—	OT2501
26 ¾	679	1000	11.7	1.8	SS2461	SS2472	—	—	OT2601
30 ¼	768	750	7.6	1.2	—	SS2482	—	—	OT3007
30 ¼	768	1000	10.2	1.6	SS2491	SS2502	2A930A701	—	—
33 ½	851	750	6.8	1.1	SS2511	SS2522	—	—	OT3307
35 ¾	908	1000	8.4	1.3	—	SS2532	—	—	—
35 ¾	908	1500	12.6	2.0	SS2541	SS2552	2A935A701	—	—
38 ½	978	1000	7.7	1.2	SS2561	SS2572	—	OT3801	—
42 ¼	1073	1250	8.7	1.3	SS2601	SS2612	—	—	—
42 ¼	1073	1500	10.5	1.6	SS2621	SS2632	—	—	OT4315

TO ORDER SPECIFY: Quantity, catalog number, voltage, wattage and special features.

Type SD Strip Heaters

Type SD strip heaters have two bolt type terminals at opposite ends. Table 3 lists heaters having aluminized steel sheath.

ALUMINIZED STEEL SHEATH

The entire heater assembly is encased in an aluminized steel sheath and is compressed under high pressure. The sheath provides both corrosion resistance and an attractive appearance. Aluminized steel strip heaters are suitable for applications where the maximum sheath temperature does not exceed 1000°F.

If higher temperatures are anticipated use stainless steel heaters listed in Table 4.

INSTALLATION

Standard strip heaters listed are rated at 120 and 240 volts. All strip heaters can be used on voltages lower than listed for reduced wattage, and some designs can also be used on higher voltages — check factory.

Whenever voltage to ground exceeds 300V, secondary insulators must be used. See page A35.

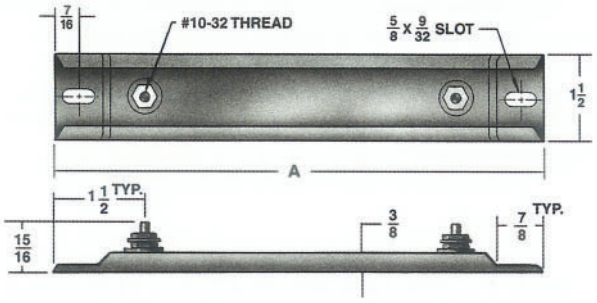


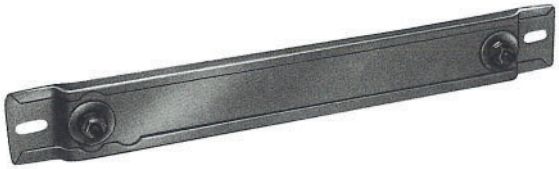
TABLE 3 - TYPE SD STRIP HEATERS - TERMINALS AT EACH END / ALUMINIZED STEEL SHEATH

A. DIM. (in.)	A. DIM. (mm)	WATTS	WATTS PER (in²)	WATTS PER (cm²)	CALORITECH™ CATALOG NO. 120V	CALORITECH™ CATALOG NO. 240V	CHROMALOX PART NO. 120V	CHROMALOX PART NO. 240V
7 ¼	184	100	8.2	1.3	SD1001	—	—	—
7 ¼	184	150	12.3	1.9	SD1011	—	—	—
8	203	150	10.0	1.6	SD1021	SD1032	S815	S815
9 ½	241	200	9.7	1.5	SD1041	SD1052	S920	—
11 ¾	298	250	8.6	1.3	SD1061	SD1072	S1225	S1225
14	356	300	8.0	1.2	SD1131	SD1142	S1430	—
15	381	325	7.9	1.2	SD1151	SD1162	—	—
17 ¾	451	350	6.8	1.1	SD1171	SD1182	—	—
17 ¾	451	375	7.3	1.1	SD1191	SD1202	—	—
17 ¾	451	500	9.7	1.5	SD1211	SD1222	S1850	S1850
19 ½	495	500	8.6	1.3	SD1231	SD1242	—	—
21	533	500	7.8	1.2	SD1291	SD1302	S2050	—
23 ½	597	250	3.4	0.5	SD1311	SD1322	—	S2425
23 ½	597	500	6.8	1.1	SD1331	SD1342	S2450	S2450
25 ½	648	750	9.3	1.4	SD1401	SD1412	—	—
26 ¾	679	700	8.2	1.3	SD1421	SD1432	—	—
30 ¼	768	750	7.6	1.2	SD1441	SD1452	—	S3075
33 ½	851	750	6.8	1.1	SD1461	SD1472	—	—
35 3/4	908	1000	8.4	1.3	SD1481	SD1492	—	S3610
38 ½	978	1000	7.7	1.2	SD1501	SD1512	—	—
42 ¼	1073	1250	8.7	1.3	SD1521	SD1532	—	—

TO ORDER SPECIFY: Quantity, catalog number, voltage, wattage and special features.

Type SD Strip Heaters (cont'd)

Heaters with high temperature stainless steel sheath are listed in Table 4.



STAINLESS STEEL SHEATH

The entire heater assembly is encased in a stainless steel sheath and is compressed under high pressure. The sheath combines additional corrosion protection and excellent appearance. Stainless steel strip heaters are suitable for applications where the maximum sheath temperature does not exceed 1200°F.

INSTALLATION

Standard strip heaters listed are rated at 120 and 240 volts. All strip heaters can be used on voltages lower than listed for reduced wattage, and some designs can also be used on higher voltages — check factory.

Whenever voltage to ground exceeds 300V, secondary insulators must be used. See page A35.

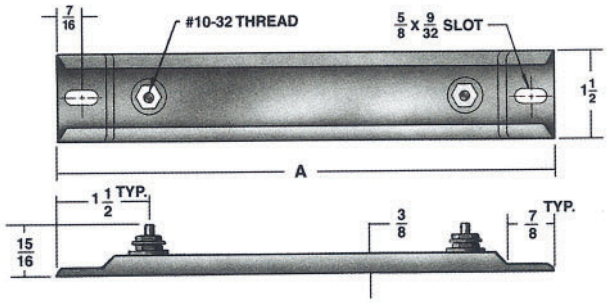


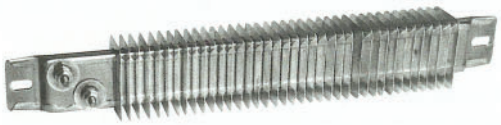
TABLE 4 - TYPE SD STRIP HEATERS - TERMINALS AT EACH END / STAINLESS STEEL SHEATH

A. DIM. (in.)	A. DIM. (mm)	WATTS	WATTS PER (in²)	WATTS PER (cm²)	CALORITECH™ CATALOG NO. 120V	CALORITECH™ CATALOG NO. 240V	CHROMALOX PART NO. 120V	CHROMALOX PART NO. 240V
7 ¼	184	100	8.2	1.3	SD2001	—	—	—
7 ¼	184	200	16.4	2.5	SD2011	—	—	—
8	203	250	16.7	2.6	SD2021	SD2032	—	—
9 ½	241	300	14.5	2.2	SD2041	SD2052	—	—
11 ¾	298	100	3.4	0.5	—	SD2062	—	—
11 ¾	298	250	8.6	1.3	SD2071	SD2082	S1202	S1202
11 ¾	298	350	12.0	1.9	SD2091	SD2102	—	—
11 ¾	298	500	17.2	2.7	SD2111	SD2122	—	S1205
14	356	500	13.3	2.1	SD2131	SD2142	—	—
15	381	500	12.1	1.9	SD2151	SD2162	—	—
17 ¾	451	500	9.7	1.5	SD2171	SD2182	S1805	S1805
17 ¾	451	750	14.5	2.2	SD2191	SD2202	—	S1807
17 ¾	451	1000	19.4	3.0	SD2211	SD2222	S1801	S1801
19 ½	495	500	8.6	1.3	SD2231	SD2242	—	—
19 ½	495	750	12.9	2.0	SD2251	SD2262	—	S1907
19 ½	495	1000	17.2	2.7	SD2271	SD2282	—	—
21	533	500	7.8	1.2	SD2291	SD2302	S2005	—
23 ½	597	500	6.8	1.1	SD2311	SD2322	S2405	S2404
23 ½	597	750	10.3	1.6	SD2341	SD2352	S2407	S2407
23 ½	597	1000	13.7	2.1	SD2361	SD2372	S2401	S2401
23 ½	597	1500	20.5	3.2	SD2381	SD2392	—	—
25 ½	648	1000	12.4	1.9	SD2401	SD2412	—	—
26 ¾	679	750	8.8	1.4	SD2421	SD2432	—	—
30 ¼	768	750	7.6	1.2	SD2441	SD2452	—	—
33 ½	851	1000	9.0	1.4	SD2461	SD2472	—	S3301
35 ¾	908	1000	8.4	1.3	SD2481	SD2492	—	S3601
38 ½	978	1000	7.7	1.2	SD2501	SD2512	—	—
42 ¼	1073	1500	10.5	1.6	SD2521	SD2532	—	—

TO ORDER SPECIFY: Quantity, catalog number, voltage, wattage and special features.

Type FS Strip Heaters

Type FS strip heaters have two offset bolt type terminals at one end.



ALUMINIZED STEEL SHEATH

The entire heater assembly is encased in an aluminized steel sheath and is compressed under high pressure. The sheath provides both corrosion resistance and an attractive appearance. Aluminized steel strip heaters are suitable for applications where the maximum sheath temperature does not exceed 1000°F.

Fins are .022" thick cadmium plated steel with a nominal four fins per inch. Fins are approximately 2" x 1 3/8".

INSTALLATION

Standard strip heaters listed are rated at 120 and 240 volts. All strip heaters can be used on voltages lower than listed for reduced wattage, and some designs can also be used on higher voltages — check factory.

Whenever voltage to ground exceeds 300V, secondary insulators must be used. See page A35.

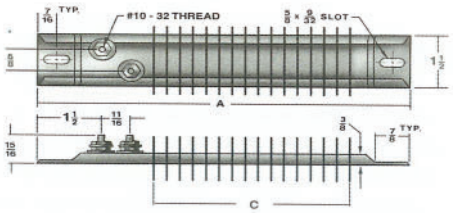


TABLE 5 - TYPE FS FINNED STRIP HEATERS - TERMINALS AT ONE END / ALUMINIZED STEEL SHEATH

'A' DIM. (in.)	'A' DIM. (mm)	'C' DIM. (in.)	'C' DIM. (mm)	WATTS	WATTS PER (in²)	WATTS PER (cm²)	CALORITECH™ CATALOG NO. 120V	CALORITECH™ CATALOG NO. 240V	CALORITECH™ PART NO. 120V	CALORITECH™ PART NO. 240V	CHROMALOX PART NO. 120V	CHROMALOX PART NO. 240V
HIGH WATT DENSITY												
10 ½	267	6 1/4	159	725	29.7	4.6	FS2001	FS2002	—	—	OTF-100	OTF-100
11 ¾	298	7 1/2	191	900	31.0	4.8	FS2011	FS2012	—	—	OTF-120	OTF-120
14	356	9 3/4	248	1100	29.3	4.5	FS2021	FS2022	—	—	OTF-140	OTF-140
15	381	10 3/4	273	1250	30.3	4.7	FS2031	FS2032	—	—	—	OTF-150
17 ¾	451	13 1/2	343	1550	30.1	4.7	FS2041	FS2042	—	—	—	OTF-180
19 ½	495	15 1/4	387	1700	29.2	4.5	FS2051	FS2052	—	—	—	OTF-190
21	533	16 3/4	425	1900	29.8	4.6	FS2061	FS2062	—	—	—	OTF-210
23 ½	597	19 1/4	489	2200	30.1	4.7	FS2071	FS2072	—	—	—	OTF-240
25 ½	648	21 1/4	540	2400	29.8	4.6	—	FS2142	—	—	—	OTF-250
26 ¾	679	22 1/2	572	2500	30.1	4.7	—	FS2082	—	—	—	OTF-260
30 ¼	768	26	660	2800	28.4	4.4	—	FS2092	—	—	—	OTF-300
33 ½	851	29 1/4	743	3150	28.5	4.4	—	FS2102	—	—	—	OTF-330
35 ¾	908	31 1/2	800	3450	29.0	4.5	—	FS2112	—	—	—	OTF-360
38 ½	978	34 1/4	870	3700	28.6	4.4	—	FS2122	—	—	—	OTF-380
42 ¼	1073	38	965	4150	28.9	4.5	—	FS2132	—	—	—	OTF-430
LOW WATT DENSITY												
7 ¼	184	3	76	150	12.3	1.9	FS1001	FS1002	† SS1041F	† SS1052F	—	—
8	203	3 3/4	95	175	11.7	1.8	FS1011	FS1012	† SS1081F	† SS1092F	—	—
10 ½	267	6 1/4	159	350	14.4	2.2	FS1021	FS1022	—	—	OTF-10	OTF-10
11 ¾	298	7 1/2	191	500	17.2	2.7	FS1031	FS1032	† SS2161F	† SS2172F	OTF-12	OTF-12
14	356	9 3/4	248	500	13.3	2.1	FS1041	FS1042	† SS2181F	† SS2192F	—	OTF-14
15	381	10 3/4	273	500	12.1	1.9	FS1051	FS1052	† SS2201F	† SS2212F	—	—
17 ¾	451	13 1/2	343	1000	19.4	3.0	FS1061	FS1062	† SS2281F	† SS2292F	OTF-18	OTF-18
19 ½	495	15 1/4	387	1000	17.2	2.7	FS1071	FS1072	† SS2321F	† SS2332F	—	OTF-19
21	533	16 3/4	425	1000	15.7	2.4	FS1081	FS1082	—	—	—	OTF-21
23 ½	597	19 1/4	489	1000	13.7	2.1	FS1091	FS1092	† SS2401F	† SS2412F	—	OTF-24
25 ½	648	21 1/4	540	1250	15.5	2.4	FS1151	FS1152	—	—	—	OTF-25
26 ¾	679	22 1/2	572	1350	15.8	2.4	FS1101	FS1102	—	—	—	OTF-26
30 ¼	768	26	660	1500	15.2	2.4	FS1111	FS1112	—	—	—	OTF-30
33 ½	851	29 1/4	743	1700	15.4	2.4	FS1121	FS1122	—	—	—	—
35 ¾	908	31 1/2	800	1800	15.1	2.3	FS1131	FS1132	—	—	—	OTF-36
38 ½	978	34 1/4	870	2000	15.5	2.4	—	FS1162	—	—	—	OTF-38
42 ¼	1073	38	965	2100	14.6	2.3	—	FS1142	—	—	—	—

TO ORDER SPECIFY: Quantity, catalog number, voltage, wattage and special features.

† Assembly stock (2 days)

SPECIAL WATTAGE, VOLTAGE AND LENGTHS

Check factory if you require a custom designed heater.

LENGTHWISE BENDING

Consult factory if lengthwise bending is required.

FINNED STRIP HEATERS—TYPE FS

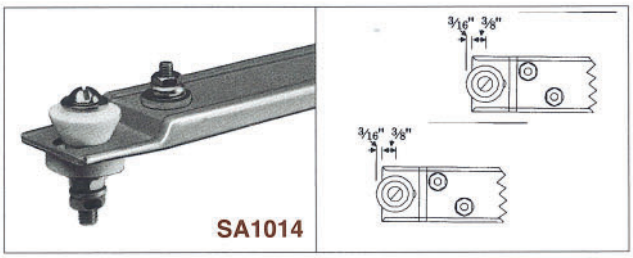
Type SS strip heaters (with offset terminals) can be supplied with fins on request. Also see page A34 for standard listings.

SECONDARY INSULATORS

Whenever the voltage to ground on the strip heater exceeds 300V secondary insulators must be used.

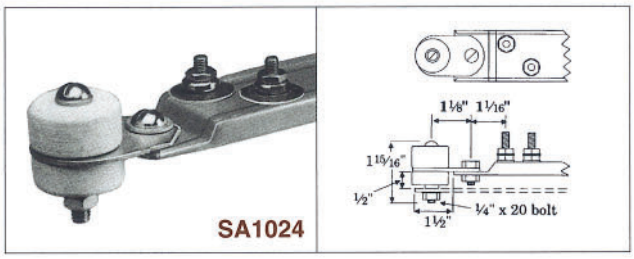
CAT. NO. SA1014

This insulator shown is for use where mounting space is limited to 1/2" longer than the strip heater. Strip heater mounting tabs must be factory punched to install insulator.



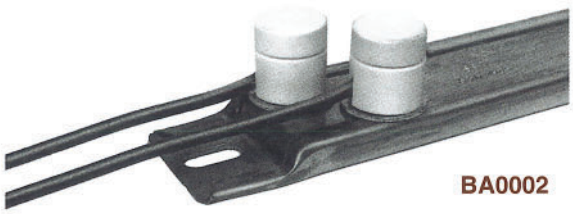
CAT. NO. SA1024

This secondary insulator is for use with stock strip heaters. The mounting space must be 3" longer than the strip heater.



CERAMIC POST TERMINAL COVER (BA0002)

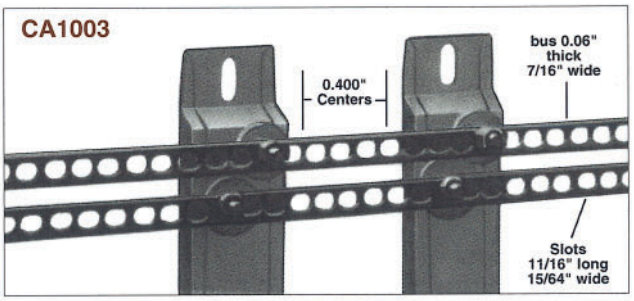
For heaters with standard 10-32 threaded terminals at both ends or with offset terminals at one end, these ceramic post terminal covers may be used with insulated wiring to provide protection against electrical shock.



BRASS BUS BAR - CAT. NO. CA1003

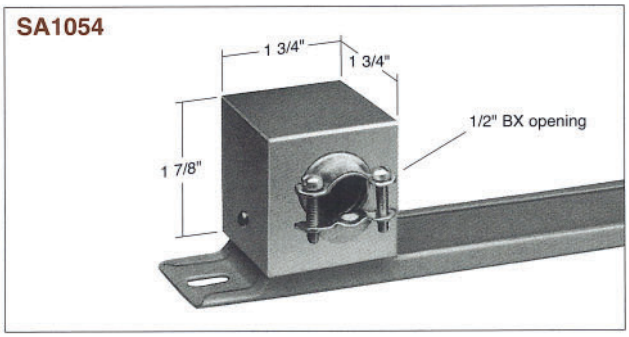
Perforated brass bus bar provides a sturdy conductor for connecting numerous strip heaters in series or parallel. Bus bars may be stacked for higher current-carrying capacities.

AMBIENT TEMP (°F)	CURRENT CAPACITY (AMPS) 1 BUS	2 BUSES
70	36	50
250	32	45
500	26	36
750	20	28



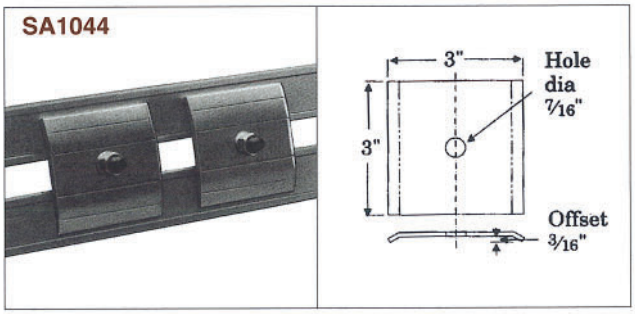
TERMINAL BOX—CAT. NO. SA1054

For type SS strip heaters the box is equipped with BX cable fitting and can be mounted in any of four directions.



SURFACE CLAMP—CAT. NO. SA1044

This heavy-gauge, nickel-plated steel clamp is used to mount strip heaters securely to broad surfaces such as tank walls, platens, dies. Threaded 3/8" diameter studs must be first welded, brazed or threaded into the work surfaces.

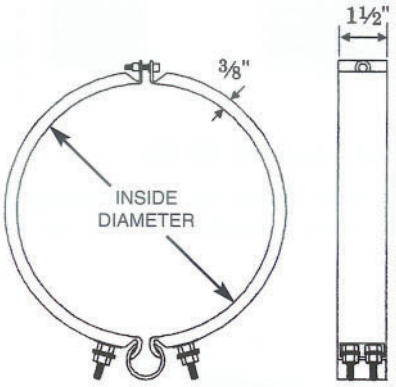


Band Heaters
Type BC

Caloritech™ band heaters are aluminized steel strip heaters formed to a semicircle and supplied in pairs. A spring at the terminal end keeps the heater halves in contact with the barrel and compensates for thermal expansion. The other end is fastened by a captive chrome plated allen screw for ease of installation.

Band heaters are used to heat the barrels of plastic injection and extrusion machines, kettles, pipes and other cylinders. Standard heaters are designed for 240 volt operation and insulated for 600 volts. Two can be connected to accomodate a 480 volt supply.

The selection procedure is the same as for aluminized steel strip heaters. Heaters are 1 1/2"± 1/64 wide and 3/8" ± 1/64 thick. Standard diameters are from 5" to 20" with outputs from 580 watts to 3 kW.



Inside dia.(in)	Watts	Catalog Number
5	580	BC4502
5	770	BC4502G100
5 1/2	600	BC4552
6 1/2	1000	BC4652
7	580	BC4702
7 1/2	900	BC4752
8	800	BC4802G100
8	1000	BC4802
9	1100	BC4902G100
9	1400	BC4902
9 1/2	1000	BC4952
10	1200	BC4102
11	1480	BC4112
13	1400	BC4132
20	3000	BC4202

Aluminized steel. MgO insulated. 240 volt.
Catalog number covers two heater halves, spring clamp and tighening clamp.

Cast-In Immersion Heaters
Type MC

Application

Caloritech™ cast-in heaters are used for melting soft metals such as solder, tin, lead and babbitt at temperatures up to 950°F. Standard heaters are cast in iron and are not recommended for babbitt alloys containing more than 4% copper, zinc, aluminum, or any other metal in which iron is soluble. Heaters rated at 30 W/in^2 of casting area are suitable for applications where the crucible is kept full. Heaters rated at 14 W/in^2 of casting area should be selected if the crucible is normally emptied and started with fragments of cold material.

Three types of heaters are available:
- Over-the-side (models 1 - 8)
- Through-the-bottom (model 9)
- Through-the-side (model 10)

Molten material must cover the heated portion of the casting during normal operation - de-energize if the molten metal level falls below dimension "H".

Construction

A heavy wall, large diameter element with long cold terminals is formed and braced as necessary. Following casting the element is terminated in a general purpose box.

Standard Specification

- **Element** - steel, large diameter, heavy wall
- **Casting** - iron
- **Terminal box** - general purpose
- **Watt density** - 30 W/in^2, 14W/in^2, and 20 W/in^2 (through-the-bottom only)
- **Rating** - up to 3 kW at 120 volts and 10 kW at 240 volts.
  Two 240 volt heaters rated 2 kW and above can be connected in series to a 480 volt supply.
- **Gasket** - through-the-side and through-the-bottom heaters are supplied with a non-asbestos, high temperature gasket.

Special Modifications

- Moisture resistant or horizontal terminal box (used for wide tank walls)
- Element design using a standard casting pattern

Custom Design

Aluminum and iron cast-in heaters for special applications including:

- Non-standard single phase and three phase metal melting heaters
- Heating plates
- Heat storage systems
- Corrosive fluid heaters

FIG. 1 - TYPE MC CAST-IN HEATERS

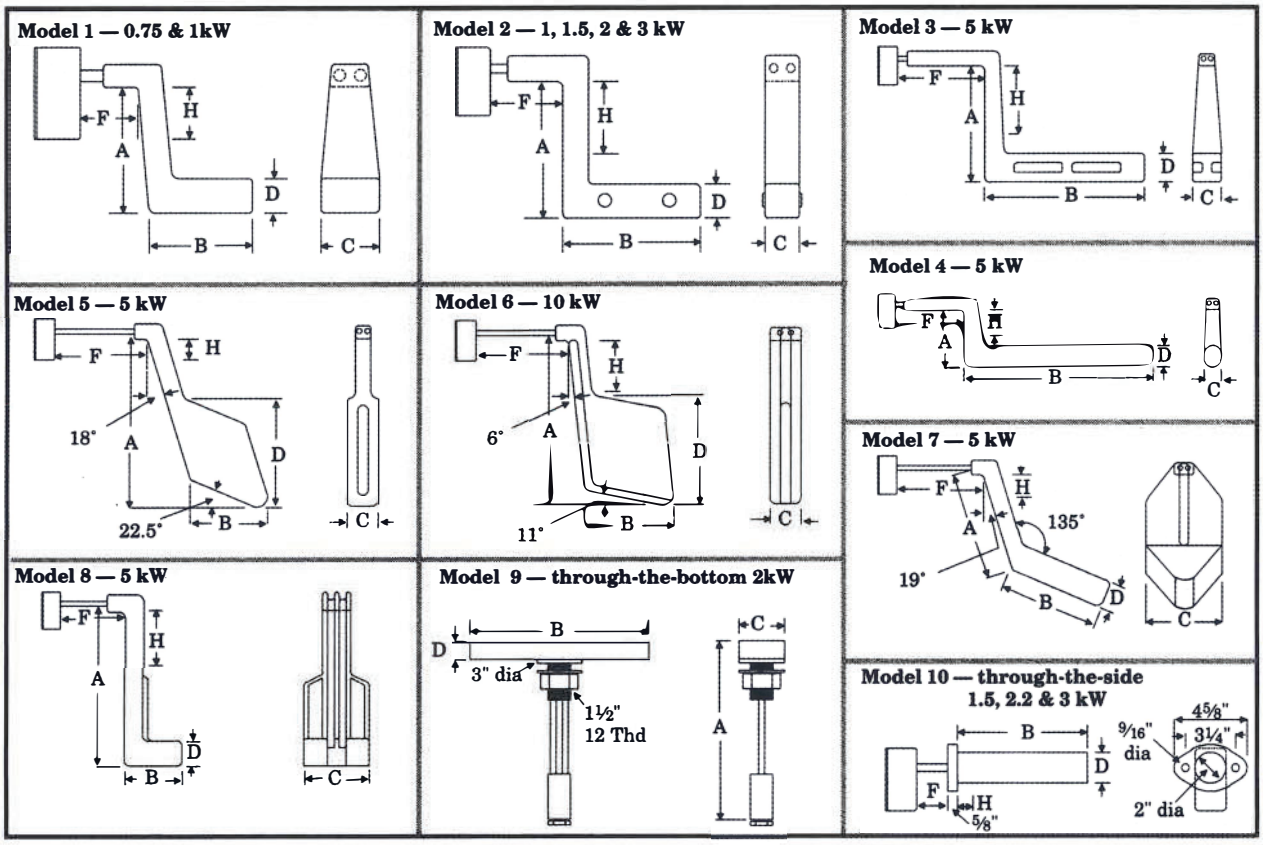


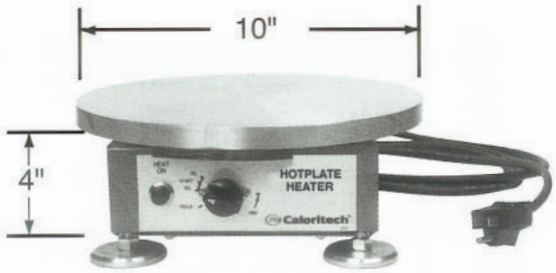
TABLE 1 - TYPE MC CAST-IN HEATERS

MODEL	KW	HALF HEAT	W/IN² OF CASTING SURFACE	CATALOG NUMBER		IMMERSED DISPLACEMENT VOLUME (IN³)	NOMINAL DIMENSIONS (INCHES)						APPROX. WEIGHT	
				120V	240V		A	B	C	D	F	H	LBS	KG
1. OVER-THE-SIDE	0.75 1	NO NO	23 30	MC1001 MC1101	MC1002 MC1102	26	5 1/2	4 1/2	2 1/2	1 1/2	2 1/2	2 1/4	12	5.5
2. OVER-THE-SIDE	1 1.5 2 3	YES YES YES YES	14 21 14 21	MC1111 MC1201 MC1301 MC1501	MC1112 MC1202 MC1302 MC1502	36 36 96 96	8 1/4 8 1/4 11 1/2 11 1/2	7 7/8 7 7/8 11 11	1 7/8 1 7/8 2 3/8 2 3/8	2 2 2 3/4 2 3/4	3 3/4 3 3/4 4 1/4 4 1/4	4 1/4 4 1/4 6 7/8 5 7/8	14 14 30 30	6.4 6.4 13.6 13.6
3. OVER-THE-SIDE	5	YES YES NO	30	MC1601 MC1611 -	MC1602 MC1612 MC1622	135 180 145	12 1/4 19 1/4 23 5/8	16 16 16	2 3/8 2 1/8 1	3 4 2 5/8	9 6 9	7 13 3/8 5	40 55 45	18.1 25 20.4
4. OVER-THE-SIDE	5	NO	30	-	MC1632	104	6 3/4	22	1 7/8	2 1/2	8	3	32	14.5
5. OVER-THE-SIDE	5	NO NO	30	- -	MC1642 MC1652	100 110	13 3/4 18 1/2	7 7	3 3	10 5/8 10 5/8	9 9	2 7 1/4	32 35	14.5 15.9
6. OVER-THE-SIDE	10	YES	30	-	MC1702	192	19	9	3	11	9	7 1/4	60	27.2
7. OVER-THE-SIDE	5	NO	14	-	MC2602	240	10	9 3/4	8	3	8	2 1/4	50	22.7
8. OVER-THE-SIDE	5	YES	14	-	MC2612	176	17	6	6 3/4	2 5/8	7	8	40	18.1
9. THROUGH-THE-BOTTOM	2	NO	19	-	MC4302	45	11 1/8	12	3	1 1/4	-	-	15	6.8
10.THROUGH-THE-SIDE	1.5 2.2 3	NO NO NO	27 27 26	- MC3401 -	MC3202 MC3402 MC3502	27 41 57	- - -	8 1/2 12 1/2 18	- - -	2 2 2	2 2 2	1 1 1	13 17 22	5.9 7.7 10

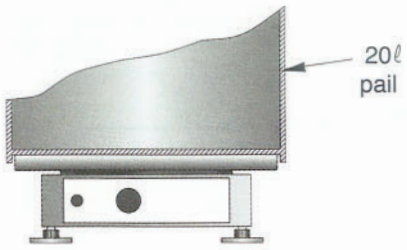
Industrial Heavy Duty Hot Plate Type HPH

APPLICATION

The HPH hot plate is designed for heavy duty use in industrial environments. The low watt density heating surface makes the HPH an ideal solution for heating viscous liquids or for holding the temperature of cleaning solutions, glues, waxes or epoxies during use.



The 10" (254 mm) plate diameter was selected to nest under a 20 litre pail optimizing contact of the heating surface with the pail.



Caution: When heating a container, be sure to loosen the lid or open a vent connection to prevent potentially dangerous pressure build-up.

FEATURES

Units are rated at 120V 1200 watts for plug-in to a standard 15 amp grounded wall receptacle. An 8 ft (2400 mm) cord facilitates placement.

The robust Caloritech™ heating element is pressed into a groove on the underside of the aluminum heating plate to provide efficient heat transfer and uniform surface temperatures. The element is end sealed to resist moisture and contamination during use.

Thermostat senses plate temperature and has an adjustable range from 150°F to 550°F (70 - 280°C). The built-in pilot light goes off after plate temperature reaches the set point.

WATTS	VOLTS	TEMP. RANGE	CATALOG NUMBER	WEIGHT LBS (KG)
1200	120	150 - 550°F (70 - 280°C)	HPH1200	10 (4.5)

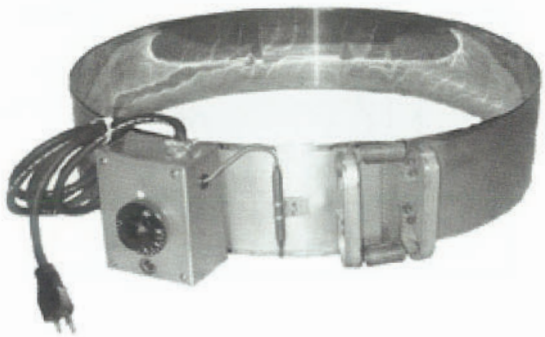
TO ORDER: Specify quantity and catalog number.

Drum Heater Type D

APPLICATION

Type D130 drum heaters are a portable lightweight heat source designed for a standard 45 gallon drum but versatile enough for use on any similar sized vessel where quick, adjustable heating is required. Other sizes are available as shown.

Type D130 drum heaters are not for use on pressure tight containers or in hazardous environments. The model D130 drum heater is rated at 8.5 W/in^2 which is approximately 6 to 7 W/in^2 on the inside drum surface. Ensure the material to be heated is compatible with this watt density rating.



FEATURES

- CSA certified
- Rust resistant aluminized steel
- Low maintenance
- Easy installation
- Thermostat
- Heavy duty cord and plug

Note: The 120 volt unit is a 20 amp configuration. Ensure the power supply will handle 20 amps before connecting this model.

DRUM CAPACITY	CATALOG NUMBER	VOLTS	WATTS	DIMENSIONS I.D.	DIMENSIONS WIDTH
45 IMP.	D130120	120	1900	22 1/2"	5"
55 U.S. GAL.	D130240	240	3000	22 1/2"	5"
25 IMP	D140120	120	1900	18"	5"
30 U.S. GAL.	D140240	240	2500	18"	5"
5 IMP.	D135120	120	1500	11 1/2"	5"
6 U.S. GAL.	D135240	240	1500	11 1/2"	5"

TO ORDER: Specify quantity, catalog number, voltage and wattage.

Mission Statement

To be recognized as a world-wide industry leader in heating technology. We will provide our customers with the broadest industry knowledge, expertise and products in space and process heating.

To create an internal environment promoting participation, teamwork, training and development for our employees.

To deliver the highest possible quality standards and continue to build a loyal customer base through dedicated customer service.

To promote continuous improvement in all existing product lines and develop and market a wide range of quality heating products through a commitment to research and development.

is known as a leader in advanced heating solutions. As a provider of industrial heating equipment we offer customers the broadest based industry knowledge, expertise and products in industrial heating. In addition to our focus on product quality we are setting a new industry standard for customer service.

At our facilities across North America we manufacture some of the top brands in industrial heating: Cata-Dyne™ Gas Catalytic Explosion-Proof Heaters; Norseman™ and Ruffneck™ Electric Explosion-Proof Heaters; DriQuik™ Oven Systems; and the Caloritech™ line of Electrical Heating Equipment and Tubular Elements.

This catalog presents the products manufactured by under the Caloritech™ brand name.

Caloritech™ products are built to any one of five nationally recognized quality control standards at our modern manufacturing facilities in Oakville and Orillia, Ontario, Canada. Both of these facilities are certified ISO 9001:2000, evidence of commitment to quality. The majority of Caloritech™ equipment (where applicable) is U.L. recognized/ listed or C.S.A. approved. At we manufacture most of our own pressure vessels, we have ASME U, S, and H stamps, and we can provide National Board registration. In addition to the standard product models listed in this catalog our team of experienced engineers and designers is well equipped to handle custom projects for specific and unique applications. We have accredited design expertise to complement the custom engineered aspect of our business and we hold a corporate Certificate of Authorization from P.E.O. to practice professional engineering in the design and application of our equipment.

We invite you to visit our website at to view the broad range of innovative industrial heating products manufactured by

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Section B

Immersion Heaters

Contents

Section B

Catalog ML350 - Section Listings

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calvane heaters, tubular heaters, bolt heaters, tubular band heaters, mitosis heaters, finned tubular heaters, cartridge heaters, strip and finned strip heaters, hot plate / drum heaters, cast-in heaters.

Section B - Immersion Heaters:
screwplug heaters, domestic immersion heaters, urn heaters, flange heaters, over-the-side heaters, pipe insert heaters, gate and gain heaters.

Section C - Air and Space Heaters:
infrared radiant heaters, panel heaters, convection heaters, duct heaters, unit heaters, gate and gain heaters.

Section D - Engineered Products:
circulation heaters, heat transfer systems, custom engineered products, panel heaters, control panels, technical data.

Section E - Boilers:
boiler flange heaters, packaged circulation heaters, boilers, calorifiers.

Section F - Controls:
controls, housings.

Screwplug Heaters Type CX

Application

Screwplug heaters are primarily used to heat liquids in tanks or vessels. To do so safely and reliably requires that the heating elements remain fully immersed in the liquid. Liquids such as water, oils, trichlorethylene, etc. can be heated through natural convection currents created by the immersed elements.

Although electricity costs are generally higher than gas or oil, it can be demonstrated that a Caloritech™ immersion heater is often your best choice. The electric heater provides close to 100% efficiency, is safer and easier to control and is usually cheaper to install.

Terminal Block Simplifies Wiring

All thermostat equipped screwplug heaters with moisture or explosion-proof housings feature a convenient terminal block mounted to a slide out trolley.

This unique Caloritech™ feature simplifies installation and reduces maintenance.

Installation

Listed heaters have standard 1" to 2 1/2" NPT tapered plugs. Any other size or type of plug is available on special order. The heater is installed through a threaded half coupling located in the vessel wall well below the minimum liquid level but spaced sufficiently above the bottom to allow for sludge build-up which should never be allowed to cover any part of the elements.

Horizontal installation is preferred even though heater replacement will require draining of the tank. Vertical installation is sometimes possible but it is best that you contact the factory for advice prior to purchase.

Operation

For an immersion heater to transfer heat it must establish a balance between convection currents and the temperature difference between itself and the liquid. Viscous liquids which retard convection currents are the most difficult to heat. Care must be exercised to ensure that the required rate of heat transfer from the heating elements is achieved without overheating the element and the liquid resulting in coking. This is generally achieved through the selection of heater watt density.

Heaters immersed in liquids, such as water with high calcium and magnesium content, phosphates or eluate solutions, have a tendency to precipitate their solids over the elements on heating. These heaters require scheduled maintenance to remove scale build up which may thermally insulate the elements and reduce their service life.

Selection

Proper selection of the screwplug heater is required to maximize service life. Once the wattage requirement is established decide on heater voltage and phase. Remember that unrealistic heat-up time requirements will increase equipment and operating costs.

The tables list, under "watt density", the required heat transfer rate from the various heaters. Refer to Section D of the Caloritech™ catalog for guidance on the acceptable watt density for your application. If a heater is not listed with the density you require we can fabricate to suit.

Of equal importance is the selection of the materials of construction which will resist corrosion and not wear away or contaminate the liquid. Refer to the corrosion guide in Section D for a list of the standard materials for various solutions. Also see page B14 for discussion on watt density.

The heaters are not guaranteed against corrosion since has no control over the liquid type, concentration or temperature of the solution. Consult your factory representative or your chemical supplier for recommendation on materials for your solution. Recommendations are not implied guarantees.

Warning - Fire Hazard

The heaters listed in the catalog may occasionally malfunction in normal use and if operated in the presence of explosive or combustible materials may cause fires. Do not operate in the presence of explosive or combustible materials. Observe fire prevention precautions and consult the local sales office or contact or proper application and installation instructions.

The thermostat controls function as temperature controls. Because they do not fail safe, an approved temperature and/or pressure safety control may be required for safe operation. Inclusion of consumer warnings on assembled products containing these elements and thermostats is recommended.

Heaters with 1" and 1 1/4" Plugs

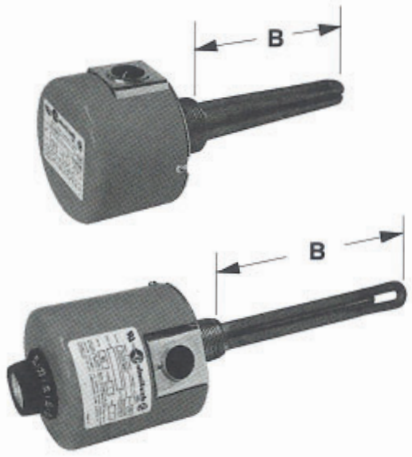
APPLICATION

Type CXC heaters are used primarily for water heating and have brass screwplugs and copper sheaths.

Type CXF are used primarily for oil heating and have steel screwplugs. Low watt density heaters are used in heavier, non-circulated oils. Higher watt density heaters are suitable for light oils or in forced oil circulation loops. Incoloy elements are silver brazed into a steel screwplug.

BUILT-IN THERMOSTATS

Standard built-in thermostat is a one pole device limited to 240V 25 amp. Whenever the heater voltage exceeds 240V or the heater current exceeds 25 amps or for three phase supply, the thermostat is intended for pilot duty only and is not factory wired to the elements. See Section F of the Caloritech™ catalog for selection of the contactor and control transformer you may require in these instances.



KILO-WATTS	IMMERSION LENGTH 'B' mm	IMMERSION LENGTH 'B' in.	STANDARD VOLTAGES 1 PHASE ONLY	WATT DENSITY W/cm²	WATT DENSITY W/in²	WITHOUT THERMOSTAT CAT. NO.	WITHOUT THERMOSTAT PART NO.	WITH THERMOSTAT 10 - 120°C (50 - 250°F) CAT. NO.	WITH THERMOSTAT 10 - 120°C (50 - 250°F) PART NO.	NET WT. (KG)
TABLE 1 - 1" NPT SCREWPLUG HEATERS (ONE ELEMENT)										
HIGH DENSITY - COPPER SHEATH / BRASS PLUG										
0.5	140	5.5	120,208,240	8.4	54	CXC105P1	MT1051B	CXCT105P1	—	1
0.75	140	5.5	"	12.4	80	CXC107P1	MT1076B	CXCT107P1	ARMT750	1
1.0	180	7.1	"	12.4	80	CXC110P1	MT1101B	CXCT110P1	ARMT1000	1
1.5	270	10.6	"	12.4	80	CXC115P1	MT1151B	CXCT115P1	ARMT1500	1
2.0	190	7.5	"	12.4	80	CXC120P1	MT1201BU	CXCT120P1	ARMT2000	1
3.0	275	10.8	"	12.4	80	CXC130P1	MT1301BU	CXCT130P1	ARMT3000	1
5.0	430	16.9	"	12.4	80	CXC150P1	MT1501BU	CXCT150P1	—	1
MEDIUM DENSITY - INCOLOY SHEATH / STEEL PLUG										
0.3	190	7.5	120,208,240	3.1	21	CXF103P1	MTO1036K	CXFT103P1	—	1
0.5	225	8.9	"	3.1	21	CXF105P1	MTO1051K	CXFT105P1	—	1
0.7	280	11.0	"	3.1	21	CXF107P1	MTO1076K	CXFT107P1	—	2
0.9	305	12.0	"	3.4	23	CXF109P1	MTO1091K	CXFT109P1	—	2
LOW DENSITY - INCOLOY SHEATH / STEEL PLUG										
0.2	190	7.5	120,208,240	2.2	14	CXF102P1	MTL1017	CXFT102P1	ARMTL1017	1
0.4	240	9.4	"	2.2	14	CXF104P1	MTL1040	CXFT104P1	ARMTL1040	2
0.6	280	11.0	"	2.2	14	CXF106P1	MTL1050	CXFT106P1	ARMTL1050	2
TABLE 2 - 1 1/4" NPT SCREWPLUG HEATERS (TWO ELEMENTS)										
HIGH DENSITY - COPPER SHEATH / BRASS PLUG										
1.5	145	5.7	120,208,240	12.4	80	CXC215P12	MT115	CXCT215P12	—	4
2.0	185	7.3	"	12.4	80	CXC220P12	MT120	CXCT220P12	—	4
MEDIUM DENSITY - INCOLOY SHEATH / STEEL PLUG										
1.0	280	11.0	120,208,240	3.9	25	CXF210P12	MTO110	CXFT210P12	—	4
2.0	540	21.2	"	3.9	25	CXF220P12	MTO120	CXFT220P12	—	5
LOW DENSITY - INCOLOY SHEATH / STEEL PLUG										
0.6	280	11.0	120,208,240	2.3	15	CXF206P12	MTL105	CXFT206P12	ARMTL105	4
1.2	540	21.2	"	2.3	15	CXF212P12	MTL110	CXFT212P12	ARMTL110	4

TO ORDER SPECIFY: Quantity, catalog number, voltage, wattage and special features.

Heaters with 2" Plugs

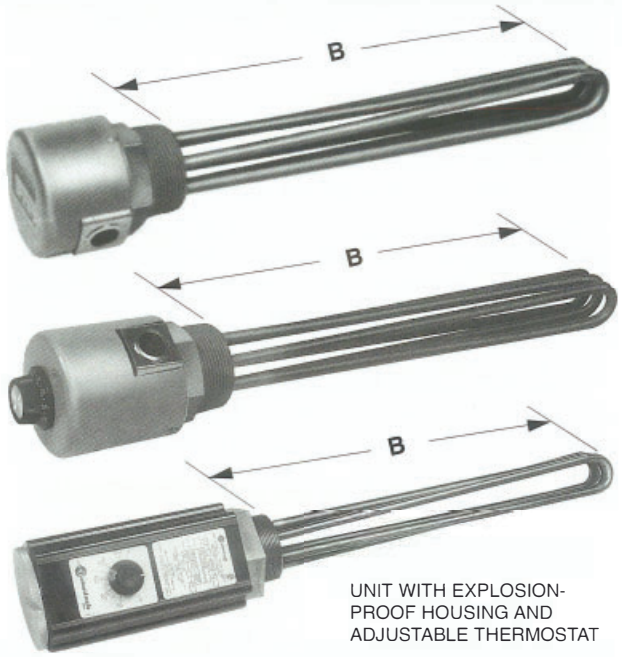
APPLICATION

Type CXC heaters are used primarily for water heating and have brass screwplugs and copper sheaths.

Type CXI heaters are used primarily for heating mildly corrosive solutions and use higher density incoloy elements welded into a stainless steel screwplug.

BUILT-IN THERMOSTATS

Standard built-in thermostat is a one pole device limited to 240V 25 amp. Whenever the heater voltage exceeds 240V or the heater current exceeds 25 amps or for three phase supply, the thermostat is intended for pilot duty only and is not factory wired to the elements. See Section F of the Caloritech™ catalog for selection of the contactor and control transformer you may require in these instances.



UNIT WITH EXPLOSION-PROOF HOUSING AND ADJUSTABLE THERMOSTAT

KILO-WATTS	IMMERSION LENGTH 'B' mm	in.	STANDARD VOLTAGES 1 PHASE ONLY	WATT DENSITY W/cm²	W/in²	WITHOUT THERMOSTAT CAT. NO.	PART NO.	WITH THERMOSTAT 10 - 120°C (50 - 250°F) CAT. NO.	PART NO.	NET WT. (KG)
TABLE 3 - 2" NPT SCREWPLUG HEATERS (TWO ELEMENTS)										
HIGH DENSITY - COPPER SHEATH (BRASS PLUG)										
1.5	200	7.9	120,208,240 416,480,600	6.1	39	CXC215P2	MT215	CXCT215P2	ARMT215	4
2.0	200	7.9	"	8.1	53	CXC220P2	MT2203	CXCT220P2	ARMT2203	4
3.0	300	11.8	"	7.8	51	CXC230P2	MT230	CXCT230P2	ARMT230	4
4.0	450	17.7	"	9.3	60	CXC240P2	MT240	CXCT240P2	ARMT240	5
5.0	550	21.7	"	8.8	57	CXC250P2	MT250	CXCT250P2	ARMT250	5
6.0	650	25.6	"	8.5	55	CXC260P2	MT260	CXCT260P2	ARMT260	6
8.0	825	32.5	208,240,416 480,600	8.4	54	CXC280P2	—	CXCT280P2	—	6
10.0	1000	39.4	"	8.4	54	CXC2100P2	MT2100	CXCT2100P2	ARMT2100	7
12.0	1200	47.2	"	8.2	53	CXC2120P2	—	CXCT2120P2	—	7
HIGH DENSITY - INCOLOY SHEATH (STAINLESS PLUG)										
1.5	200	7.9	120,208,240 416,480,600	6.1	39	CXI215P2	MTI215	CXIT215P2	ARMTI215	4
2.0	200	7.9	"	8.1	53	CXI220P2	MTI220	CXIT220P2	ARMTI2203	4
3.0	300	11.8	"	7.8	51	CXI230P2	MTI230	CXIT230P2	ARMTI230	4
4.0	450	17.7	"	9.3	60	CXI240P2	MTI240	CXIT240P2	ARMTI240	5
5.0	550	21.7	"	8.8	57	CXI250P2	MTI250	CXIT250P2	ARMTI250	5
6.0	650	25.6	"	8.5	55	CXI260P2	MTI260	CXIT260P2	ARMTI260	6
8.0	825	32.5	208,240,416 480,600	8.4	54	CXI280P2	—	CXIT280P2	—	6
10.0	1000	39.4	"	8.4	54	CXI2100P2	MTI2100	CXIT2100P2	ARMTI2100	7
12.0	1200	47.2	"	8.2	53	CXI2120P2	MTI2120	CXIT2120P2	—	7

TABLE 3 is continued on page B6

TO ORDER SPECIFY: Quantity, catalog number, voltage, wattage and special features.

Heaters with 2" Plugs (cont'd) and with 2 1/2" Plugs

APPLICATION

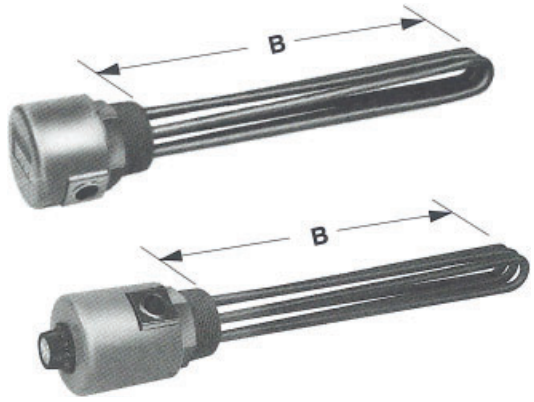
Type CXC heaters are used primarily for water heating and have brass screwplugs and copper sheaths.

Type CXF are used primarily for oil heating and have steel screwplugs. Low watt density heaters are used in heavier, non-circulated oils. Higher watt density heaters are suitable for light oils or in forced oil circulation loops. Incoloy elements are silver brazed into a steel screwplug.

Type CXI heaters are used primarily for heating mildly corrosive solutions and use higher density incoloy elements welded into a stainless steel screwplug.

BUILT-IN THERMOSTATS

Standard built-in thermostat is a one pole device limited to 240V 25 amp. Whenever the heater voltage exceeds 240V or the heater current exceeds 25 amps or for three phase supply, the thermostat is intended for pilot duty only and is not factory wired to the elements. See Section F of the Caloritech™ catalog for selection of the contactor and control transformer you may require in these instances.



KILO-WATTS	IMMERSION LENGTH 'B' mm	in.	STANDARD VOLTAGES 1 PHASE ONLY	WATT DENSITY W/cm²	W/in²	WITHOUT THERMOSTAT CAT. NO.	PART NO.	WITH THERMOSTAT 10 - 120°C (50 - 250°F) CAT. NO.	PART NO.	NET WT. (KG)
TABLE 3 - 2" NPT SCREWPLUG HEATERS (TWO ELEMENTS) ... continued										
MEDIUM DENSITY - INCOLOY SHEATH (STEEL PLUG)										
1.5	300	11.8	120,208,240 416,480,600	3.9	25	CXF215P2	MTO215	CXFT215P2	ARMTO215	4
2.0	450	17.7	"	4.6	30	CXF220P2	MTO220	CXFT220P2	ARMTO220	5
3.0	650	25.6	"	4.2	27	CXF230P2	MTO230	CXFT230P2	ARMTO230	5
4.0	825	32.5	"	4.2	27	CXF240P2	MTO240	CXFT240P2	ARMTO240	6
5.0	1000	39.4	"	4.2	27	CXF250P2	MTO250	CXFT250P2	ARMTO250	7
6.0	1200	47.2	208,240,416 480,600	4.1	26	CXF260P2	MTO260	CXFT260P2	ARMTO260	7
MEDIUM DENSITY - INCOLOY SHEATH (STAINLESS PLUG)										
1.5	300	11.8	120,208,240 416,480,600	3.9	25	CXI215P211	—	CXIT215P211	—	4
2.0	450	17.7	"	4.6	30	CXI220P217	—	CXIT220P217	—	5
3.0	650	25.6	"	4.2	27	CXI230P225	—	CXIT230P225	—	5
4.0	825	32.5	"	4.2	27	CXI240P232	—	CXIT240P232	—	6
5.0	1000	39.4	"	4.2	27	CXI250P239	—	CXIT250P239	—	7
6.0	1200	47.2	208,240,416 480,600	4.1	26	CXI260P247	—	CXIT260P247	—	7
LOW DENSITY - INCOLOY SHEATH (STEEL PLUG)										
1.0	450	17.7	120,208,240 416,480,600	1.7	11	CXF210P2	MTL210	CXFT210P2	ARMTL210	5
1.5	650	25.6	"	1.7	11	CXF215P225	MTL215	CXFT215P225	ARMTL215	5
2.0	825	32.5	"	2.1	14	CXF220P232	MTL220	CXFT220P232	ARMTL220	6
3.0	1000	39.4	"	2.5	16	CXF230P239	MTL230	CXFT230P239	ARMTL230	7
LOW DENSITY - INCOLOY SHEATH (STAINLESS PLUG)										
1.0	450	17.7	120,208,240 416,480,600	1.7	11	CXI210P2	—	CXIT210P2	—	5
1.5	650	25.6	"	1.7	11	CXI215P225	—	CXIT215P225	—	5
2.0	825	32.5	"	2.1	14	CXI220P232	—	CXIT220P232	—	6
3.0	1000	39.4	"	2.5	16	CXI230P239	—	CXIT230P239	—	7

TO ORDER SPECIFY: Quantity, catalog number, voltage, wattage and special features.

UNIT WITH EXPLOSION-PROOF HOUSING

UNIT WITH EXPLOSION-PROOF HOUSING AND ADJUSTABLE THERMOSTAT

KILO-WATTS	IMMERSION LENGTH 'B' mm	in.	STANDARD VOLTAGES 1 OR 3 PHASE	WATT DENSITY W/cm²	W/in²	WITHOUT THERMOSTAT CAT. NO.	PART NO.	WITH THERMOSTAT 10 - 120°C (50 - 250°F) CAT. NO.	PART NO.	NET WT. (KG)
TABLE 4 - 2" NPT SCREWPLUG HEATERS (THREE ELEMENTS)										
HIGH DENSITY - COPPER SHEATH (BRASS PLUG)										
3.0	200	7.9	120,208,240 416,480,600	8.1	53	CXC330P2	—	CXCT330P2	—	4
4.5	300	11.8	"	7.8	51	CXC345P2	—	CXCT345P2	—	4
6.0	450	17.7	"	9.3	60	CXC360P2	—	CXCT360P2	—	5
7.5	550	21.7	"	8.8	57	CXC375P2	—	CXCT375P2	—	5
9.0	650	25.6	"	8.5	55	CXC390P2	—	CXCT390P2	—	6
12.0	825	32.5	208,240,416 480,600	8.4	54	CXC3120P2	—	CXCT3120P2	—	7
MEDIUM DENSITY - INCOLOY SHEATH (STEEL PLUG)										
3.0	450	17.7	120,208,240 416,480,600	4.6	30	CXF330P2	—	CXFT330P2	—	5
6.0	825	32.5	"	4.2	27	CXF360P2	—	CXFT360P2	—	6
9.0	1200	47.2	208,240,416 480,600	4.1	26	CXF390P2	—	CXFT390P2	—	8
LOW DENSITY - INCOLOY SHEATH (STEEL PLUG)										
1.5	450	17.7	120,208,240 416,480,600	1.7	11	CXF315P2	—	CXFT315P2	—	5
3.0	825	32.5	"	2.1	14	CXF330P232	—	CXFT330P232	—	6
4.5	1000	39.4	"	2.5	16	CXF345P2	—	CXFT345P2	—	7
TABLE 5 - 2 1/2" NPT SCREWPLUG HEATERS (THREE ELEMENTS)										
HIGH DENSITY - COPPER SHEATH (BRASS PLUG)										
3.0	195	7.7	120,208,240 416,480,600	8.1	53	CXC330P25	MT330	CXCT330P25	ARMT330	4
4.5	295	11.6	"	7.8	51	CXC345P25	MT345	CXCT345P25	ARMT345	4
6.0	445	17.5	208,240,416 480,600	9.3	60	CXC360P25	MT360	CXCT360P25	ARMT360	5
7.5	545	21.5	"	8.8	57	CXC375P25	MT375	CXCT375P25	ARMT375	5
9.0	645	25.4	"	8.5	55	CXC390P25	MT390	CXCT390P25	ARMT390	6
12.0	820	32.3	"	8.4	54	CXC3120P25	—	CXCT3120P25	—	6
15.0	995	39.2	"	8.4	54	CXC3150P25	—	CXCT3150P25	—	7
18.0	1195	47.0	"	8.2	53	CXC3180P25	—	CXCT3180P25	—	7
HIGH DENSITY - INCOLOY SHEATH (STAINLESS PLUG)										
3.0	195	7.7	120,208,240 416,480,600	8.1	53	CXI330P25	MTS330	CXIT330P25	ARMTS330	4
4.5	295	11.6	"	7.8	51	CXI345P25	MTS345	CXIT345P25	ARMTS345	4
6.0	445	17.5	208,240,416 480,600	9.3	60	CXI360P25	MTS360	CXIT360P25	ARMTS360	5
7.5	545	21.5	"	8.8	57	CXI375P25	MTS375	CXIT375P25	ARMTS375	5
9.0	645	25.4	"	8.5	55	CXI390P25	MTS390	CXIT390P25	ARMTS390	6
12.0	820	32.3	"	8.4	54	CXI3120P25	MTS3120	CXIT3120P25	ARMTS3120	6
15.0	995	39.2	"	8.4	54	CXI3150P25	MTS3150	CXIT3150P25	ARMTS3150	7
18.0	1195	47.0	"	8.2	53	CXI3180P25	MTS3180	CXIT3180P25	ARMTS3180	7

TABLE 5 is continued on page B8

TO ORDER SPECIFY: Quantity, catalog number, voltage, phase, wattage and special features.

Heaters with 2 1/2" Plugs (cont'd)

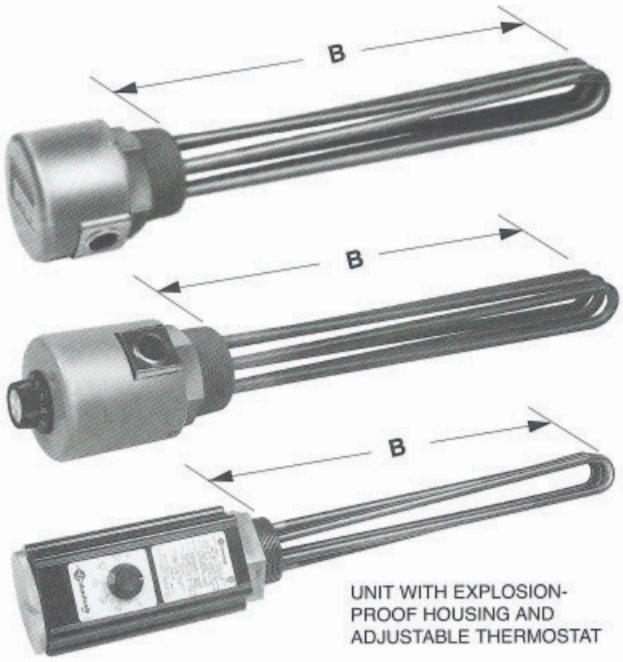
APPLICATION

Type CXF are used primarily for oil heating and have steel screwplugs. Low watt density heaters are used in heavier, non-circulated oils. Higher watt density heaters are suitable for light oils or in forced oil circulation loops. Incoloy elements are silver brazed into a steel screwplug.

Type CXI heaters are used primarily for heating mildly corrosive solutions and use higher density incoloy elements welded into a stainless steel screwplug.

BUILT-IN THERMOSTATS

Standard built-in thermostat is a one pole device limited to 240V 25 amp. Whenever the heater voltage exceeds 240V or the heater current exceeds 25 amps or for three phase supply, the thermostat is intended for pilot duty only and is not factory wired to the elements. See Section F of the Caloritech™ catalog for selection of the contactor and control transformer you may require in these instances.



UNIT WITH EXPLOSION-PROOF HOUSING AND ADJUSTABLE THERMOSTAT

TABLE 5 - 2 1/2" NPT SCREWPLUG HEATERS (THREE ELEMENTS) ... continued

KILO-WATTS	IMMERSION LENGTH 'B' mm	in.	STANDARD VOLTAGES 1 OR 3 PHASE	WATT DENSITY W/cm²	W/in²	WITHOUT THERMOSTAT CAT. NO.	PART NO.	WITH THERMOSTAT 10 - 120°C (50 - 250°F) CAT. NO.	PART NO.	NET WT. (KG)
MEDIUM DENSITY - INCOLOY SHEATH (STEEL PLUG)										
3.0	445	17.5	120,208,240 416,480,600	4.6	30	CXF330P25	MTO330	CXFT330P25	ARMTO330	5
4.5	645	25.4	"	4.2	27	CXF345P25	MTO345	CXFT345P25	ARMTO345	5
6.0	820	32.3	208,240,416 480,600	4.2	27	CXF360P25	MTO360	CXFT360P25	ARMTO360	6
7.5	995	39.2	"	4.2	27	CXF375P25	MTO375	CXFT375P25	ARMTO375	7
9.0	1195	47.0	"	4.1	26	CXF390P25	MTO390	CXFT390P25	ARMTO390	7
MEDIUM DENSITY - INCOLOY SHEATH (STAINLESS PLUG)										
3.0	445	17.5	120,208,240 416,480,600	4.6	30	CXI330P2517	—	CXIT330P2517	—	5
4.5	645	25.4	"	4.2	27	CXI345P2525	—	CXIT345P2525	—	5
6.0	820	32.3	208,240,416 480,600	4.2	27	CXI360P2532	—	CXIT360P2532	—	6
7.5	995	39.2	"	4.2	27	CXI375P2539	—	CXIT375P2539	—	7
9.0	1195	47.0	"	4.1	26	CXI390P2547	—	CXIT390P2547	—	7
LOW DENSITY - INCOLOY SHEATH (STEEL PLUG)										
3.0	820	32.3	120,208,240 416,480,600	2.1	14	CXF330P2532	—	CXFT330P2532	—	5
4.5	995	39.2	"	2.5	16	CXF345P2539	—	CXFT345P2539	—	7
6.0	1195	47.0	208,240,416 480,600	2.7	18	CXF360P2547	—	CXFT360P2547	—	7
LOW DENSITY - INCOLOY SHEATH (STAINLESS PLUG)										
3.0	820	32.3	120,208,240 416,480,600	2.1	14	CXI330P2532	—	CXIT330P2532	—	5
4.5	995	39.2	"	2.5	16	CXI345P2539	—	CXIT345P2539	—	7
6.0	1195	47.0	208,240,416 480,600	2.7	18	CXI360P2547	—	CXIT360P2547	—	7

TO ORDER SPECIFY: Quantity, catalog number, voltage, phase, wattage and special features.

Special Features (Check Factory)

HEATERS WITH BUILT-IN THERMOSTATS

All screwplug heaters listed are available with built-in thermostats. Heaters with thermostats have a "T" added to their catalog no. prefix.

Standard thermostat range is 10-120°C (50-250°F). Ratings are normally 25 amps at 240V single pole single throw. 600V thermostats and double pole thermostats are available on special order.

SPECIAL THERMOSTAT RANGES

Thermostats with the following temperature ranges are also available upon request:

-18 to 40 °C (0-100°F)
70 to 280 °C (150-550°F)
150 to 370 °C (300-700°F)

TERMINAL HOUSINGS

Shown below are the different types of terminal housings used with screwplug heaters.

FIG. 1

FIG. 2

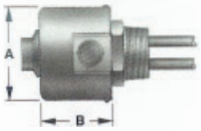


FIG. 3

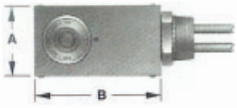


FIG. 4

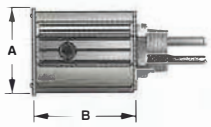
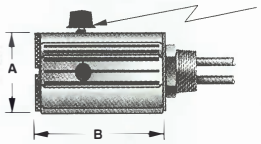


FIG. 5



SHOWN WITH OPTIONAL EXTERNALLY ADJUSTABLE THERMOSTAT

DESCRIPTION	FIG.	A mm	A (in.)	B mm	B (in.)
Standard Housing Without Thermostat	1	102 Dia.	(4)	70	(2 3/4)
Standard Thermostat Housing (1 pole)	2	102 Dia.	(4)	102	(4)
Special Thermostat Housing	3	105 Sq.	(4 1/8)	180	(7)
Moisture Resistant Housing With 1 Pole Thermostat or Without Thermostat	4	108	(4 1/4)	185	(7 1/4)
Moisture Resistant Housing With 2 Pole Thermostat	4	108	(4 1/4)	215	(8 1/2)
Explosion-Proof Housing With 1 Pole Thermostat or Without Thermostat	5	108	(4 1/4)	205	(8)
Explosion-Proof Housing With 2 Pole Thermostat	5	108	(4 1/4)	235	(9 1/4)

VOLTAGE

Custom built heaters are available in any special voltage rating up to 600V max.

WATTAGE

Heaters listed are standard wattage. Any reasonable wattage is available to replace your present heater with a similar Caloritech™ unit.

LENGTH

Heaters are available with immersed lengths up to 3430 mm (135"). Internal vessel support must be used when immersed length exceeds 1245 mm (49").

PLUG SIZES AND RATINGS

can install elements in virtually any size or rating of plug, special or standard.

SPECIAL MATERIALS

Special sheath, plug and terminal box materials are available on request.

WELDED ELEMENTS

While welded elements are standard for CXI heaters, CXF heaters listed have the elements silver brazed to the plug which suits most applications. CCI Thermal can provide listed CXF heaters with elements welded to the plug.

BUILT-IN THERMOSTAT WELL

Built-in thermostat wells are available. Specify length and internal diameter required.

Heaters ordered with explosion-proof or moisture resistant housings have built-in wells as standard.

PASSIVATION

Incoloy and stainless steel sheathed heaters are available with chemically passivated sheaths which will provide superior corrosion resistance in most applications. Passivation is achieved through an electropolishing technique.

Heaters with stainless steel plugs are available with all wetted surfaces passivated.

MOISTURE RESISTANT TERMINAL HOUSINGS

Moisture resistant terminal housings suitable for outdoor applications are available for all heater sizes. See Figure 4.

EXPLOSION-PROOF TERMINAL HOUSINGS

If the heater is to be operated in a hazardous environment an explosion-proof housing must be used. See Figure 5. Specify Class, Div. (or Zone), Group and Temp. Code for the hazardous location.

Domestic Immersion Heaters Type CX

Application

Caloritech™ domestic immersion heaters have been developed as high quality replacements for the most commonly used heater types.

In cases where the old style resistor type element is called for, choose a tin or zinc plated element. The plating reduces galvanic current within the tank, thus reducing corrosion and providing a longer heater and tank life. The elements are also epoxy sealed to protect the heater from moisture and other contaminants which could otherwise lead to premature element failure.

Choose a suitable element from the following tables or have your nearest Caloritech™ representative assist you in your selection.

FIG. 1 - CXC10632-XX and CXI10635-XX

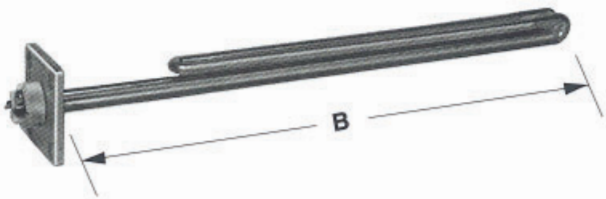


TABLE 1 - Domestic Immersion Heaters

'B' DIM. (in.)	WATTS	VOLTS	CATALOG NUMBER	REPLACEMENT CAT. NO. CHROM'X	GIANT	GSW
2 1/2" SQ. FLANGE - TINNED COPPER SHEATH (FIG.1)						
6 1/2	500	120	CXC10632-01	20200-010	—	—
6 1/2	750	120	CXC10632-04	20200-100	—	—
6 1/2	750	240	CXC10632-06	20200-120	9G7	—
8	1000	120	CXC10632-07	20200-160 / 20204-070	9G10	85075
8	1000	240	CXC10632-09	20200-180 / 20204-090	10G10	85079
15 3/4	1500	120	CXC10632-10	20200-580	9G1527	—
15 3/4	1500	240	CXC10632-12	20200-600	—	—
11	1500	120	CXC10632-13	20200-250 / 20204-130	9G15	85100
11	1500	240	CXC10632-15	20200-260 / 20204-150	10G15	85104
6 1/2	1500	120	CXC10632-16	—	—	—
6 1/2	1500	240	CXC10632-18	—	—	—
14 1/2	2000	120	CXC10632-19	20200-670	—	—
14 1/2	2000	208	CXC10632-20	20200-680	—	—
14 1/2	2000	240	CXC10632-21	20200-690	—	—
8	2000	120	CXC10632-22	20200-640 / 20204-430	9G20	—
8	2000	208	CXC10632-23	20200-650 / 20204-440	9AG20	—
8	2000	240	CXC10632-24	20200-660 / 20204-450	10G20	85151
11 1/4	3000	120	CXC10632-28	20200-760 / 20204-490	9G30	85202
11 1/4	3000	208	CXC10632-29	20200-770 / 20204-500	9AG30	85200
11 1/4	3000	240	CXC10632-30	20200-780 / 20204-510	10G30	85201
11	3000	120	CXC10632-31	—	—	—
11	3000	240	CXC10632-33	—	—	—

INVENTORY - THESE HEATERS ARE NORMALLY STOCKED IN LIMITED QUANTITIES

TABLE 1 - Domestic Immersion Heaters ... continued

'B' DIM. (in.)	WATTS	VOLTS	CATALOG NUMBER	REPLACEMENT CAT. NO. CHROM'X	GIANT	GSW
2 1/2" SQ. FLANGE - TINNED COPPER SHEATH (FIG.1)						
15 3/4	4500	208	CXC10632-35	20200-860 / 20204-560	9AG45	85302
15 3/4	4500	240	CXC10632-36	20200-870 / 20204-570	10G45	85304
16	4500	208	CXC10632-38	—	—	—
16	4500	240	CXC10632-39	—	—	—
17 1/2	5000	208	CXC10632-41	20200-890 / 20204-590	9AG50	85402
17 1/2	5000	240	CXC10632-42	20200-900 / 20204-600	10G50	85400
9 1/2	5000	208	CXC10632-44	—	—	—
9 1/2	5000	240	CXC10632-45	—	—	—
21	6000	208	CXC10632-47	20200-920 / 20204-680	9AG60	—
21	6000	240	CXC10632-48	20200-930 / 20204-690	10G60	85501
11 1/4	6000	208	CXC10632-50	—	—	—
11 1/4	6000	240	CXC10632-51	—	—	—
2 1/2" SQ. FLANGE - INCOLOY SHEATH (FIG.1)						
8 3/4	2000	600	CXI10635-03	20205-020	—	—
11 5/8	3000	600	CXI10635-06	20205-040	—	—
13 7/8	4500	600	CXI10635-09	20205-200	—	—
15 1/8	5000	600	CXI10635-12	20205-220	—	—
17 7/8	6000	600	CXI10635-15	20205-240	—	—
1" TAPERED BRASS PLUG - COPPER SHEATH (FIG.2)						
5 1/2	500	120	CXC10640-01	30201-070	—	—
5 1/2	500	240	CXC10640-03	30201-090	—	—
5 1/2	750	120	CXC10640-04	30201-130	—	—
5 1/2	750	240	CXC10640-06	30201-150	—	—
7	1000	120	CXC10640-07	30201-190	1G10	80469
7	1000	240	CXC10640-09	30201-210	2G10	80471
15 1/4	1500	208	CXC10640-11	—	—	—
15 1/4	1500	240	CXC10640-12	—	—	—
10 1/2	1500	120	CXC10640-13	30201-250	1G15	80470
10 1/2	1500	208	CXC10640-14	—	—	—
10 1/2	1500	240	CXC10640-15	30201-270	2G15	80472
6 1/2	1500	120	CXC10640-16	—	—	—
6 1/2	1500	208	CXC10640-17	—	—	—
6 1/2	1500	240	CXC10640-18	—	—	—
14	2000	208	CXC10640-20	—	—	—
14	2000	240	CXC10640-21	—	—	—
7 1/2	2000	120	CXC10640-22	30201-280	—	—
7 1/2	2000	208	CXC10640-23	—	—	—
7 1/2	2000	240	CXC10640-24	30201-300	—	—
9	2500	208	CXC10640-26	—	—	—
9	2500	240	CXC10640-27	—	—	—
10 3/4	3000	120	CXC10640-28	30201-340	—	—
10 3/4	3000	208	CXC10640-29	—	—	—
10 3/4	3000	240	CXC10640-30	30201-360	2G30	80473
6	3000	120	CXC10640-31	—	—	—
6	3000	208	CXC10640-32	—	—	—
6	3000	240	CXC10640-33	—	—	—
15 1/4	4500	208	CXC10640-35	—	—	—
15 1/4	4500	240	CXC10640-36	30201-420	—	—
8 1/4	4500	208	CXC10640-38	—	—	—
8 1/4	4500	240	CXC10640-39	—	—	—
17	5000	208	CXC10640-41	—	—	—
17	5000	240	CXC10640-42	30201-450	—	—
9	5000	208	CXC10640-44	—	—	—
9	5000	240	CXC10640-45	—	—	—
20 1/2	6000	208	CXC10640-47	—	—	—
20 1/2	6000	240	CXC10640-48	—	—	—
10 3/4	6000	208	CXC10640-50	—	—	—
10 3/4	6000	240	CXC10640-51	—	—	—
1" NON-TAPERED BRASS PLUG - COPPER SHEATH (FIG.3)						
6 1/2	500	120	CXC10642-01	20704-070	—	—
6 1/2	500	240	CXC10642-03	20704-090	—	—
6 1/2	750	120	CXC10642-04	—	—	—

Table 1 is continued on page B11

FIG. 2 - CXC10640-XX

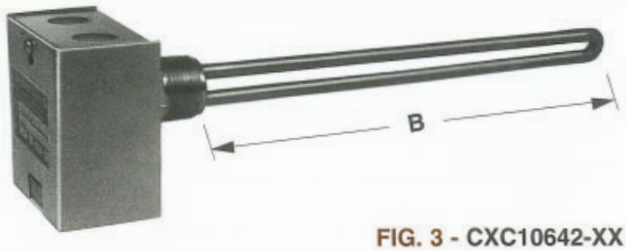


FIG. 3 - CXC10642-XX

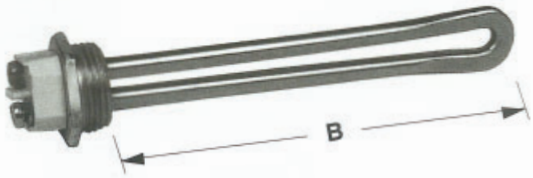


FIG. 4 - CXC10636-XX

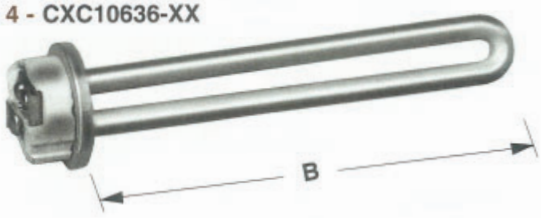


TABLE 1 - Domestic Immersion Heaters ... continued

'B' DIM. (in.)	WATTS	VOLTS	CATALOG NUMBER	REPLACEMENT CAT. NO. CHROM'X	GIANT	GSW
1" NON-TAPERED BRASS PLUG - COPPER SHEATH (FIG.3)						
6 1/2	750	240	CXC10642-06	–	–	–
8	1000	120	CXC10642-07	20704-190	3G10/80	–
8	1000	240	CXC10642-09	20704-210	04G10/80	–
15 3/4	1500	120	CXC10642-10	–	–	–
15 3/4	1500	240	CXC10642-12	–	–	–
11	1500	120	CXC10642-13	20704-580	3G15/80	80476
11	1500	240	CXC10642-15	20704-600	04G20/80	80474
6 1/2	1500	120	CXC10642-16	20704-640	–	–
6 1/2	1500	240	CXC10642-18	20704-660	–	–
14 1/2	2000	240	CXC10642-21	–	–	–
8	2000	120	CXC10642-22	20704-280	–	–
8	2000	208	CXC10642-23	20704-290	3AG20/80	–
8	2000	240	CXC10642-24	20704-300	04G20/80	–
9 1/2	2500	120	CXC10642-25	20704-310	–	–
9 1/2	2500	240	CXC10642-27	20704-330	–	–
11 1/4	3000	120	CXC10642-28	20704-340	–	–
11 1/4	3000	208	CXC10642-29	20704-350	3AG30/80	–
11 1/4	3000	240	CXC10642-30	20704-360	04G30/80	80475
6 1/2	3000	240	CXC10642-33	20704-690	–	–
15 3/4	4500	208	CXC10642-35	20704-410	3AG45/80	–
15 3/4	4500	240	CXC10642-36	20704-420	04G45/80	80477
8 3/4	4500	208	CXC10642-38	20704-710	–	–
8 3/4	4500	240	CXC10642-39	20704-720	–	–
17 1/2	5000	208	CXC10642-41	20704-440	3AG50/80	–
17 1/2	5000	240	CXC10642-42	20704-450	04G50/80	–
9 1/2	5000	208	CXC10642-44	–	–	–
9 1/2	5000	240	CXC10642-45	–	–	–
21	6000	240	CXC10642-48	20704-510	04G50/80	–
11 1/4	6000	240	CXC10642-51	–	–	–
ROUND FLANGE - ZINC PLATED COPPER SHEATH (FIG.4)						
11 1/4	4500	240	CXC10636-12	–	–	–

INVENTORY - THESE HEATERS ARE NORMALLY STOCKED IN LIMITED QUANTITIES

TYPE AW REPLACEMENT THERMOSTATS AND TYPE HLC1610 HIGH LIMIT CUTOUT

Type AW thermostats are replacement units for all storage-type domestic water heaters. They are for use with immersion or wrap around type elements and can be screw or clamp mounted.

Type HLC1610 high limit controls are specifically designed for domestic hot water heater protection.

TABLE 2 - Domestic Immersion Heater Thermostats and High Limit with Manual Reset

CATALOG NUMBER	ELECTRICAL RATING	CIRCUIT OPENS	TEMP. °F
AW7025	240 V 25 amp Single Pole Single Throw	on temp. rise	120 - 180
AW7135	240 V 25 amp Single Pole Double Throw	Circuit 1 on temp. rise Circuit 2 on temp. fall	120 - 180
HLC1610	240 V 25 amp Double Pole Double Throw	on temp. rise	190 ± 5

FIG. 5 - AW7025 THERMOSTAT

FIG. 6 - AW7135 THERMOSTAT

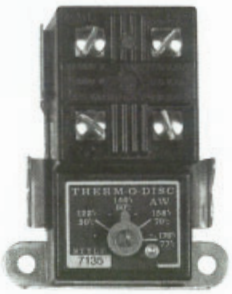


FIG. 7 - HLC1610 HIGH LIMIT

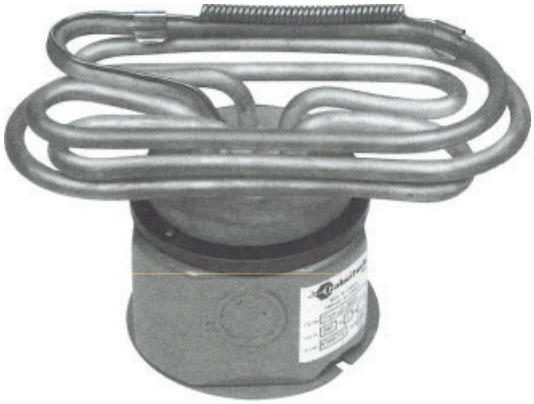
Urn Heaters Type TX

Application

Type TX immersion heaters are intended for use in steam tables, coffee urns, kettles, sterilizers, percolators and many other water heating applications where a bottom-mount heater is most practical.

The heaters are not guaranteed against corrosion since CCI Thermal has no control over the liquid type, concentration or temperature.

Heaters must be kept free of heavy scale build-up to prolong life. Most importantly, the heating elements must be fully immersed in liquid during operation. Units with built-in low water level cutouts are recommended. Units without cutout will fail under low water conditions. Cutouts are a safety device and should not be relied on as the only form of water level control.



Features

The type TX heater represents a complete redesign of the TTUH unit. All models have an O-ring sealing gasket with elements fully prewired.

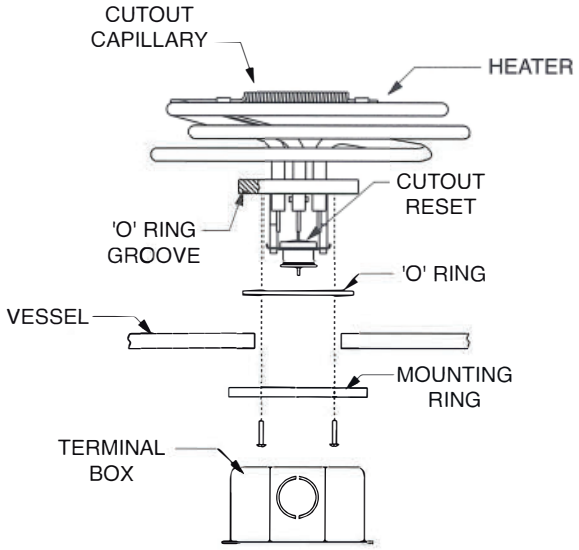
The most advanced feature, intended to provide extended life, is the **fast response low level trip** used on the built-in cutout models. Once the cutout trips (and after the water level is restored) it must be manually reset before the heater will energize.

Caution: This limit is not intended to function as a low level control. Repeated use as a low level control will result in premature failure of the heater.

For heaters which draw over 25 amps, or for three phase heaters, the cutout is intended for pilot duty only and is not factory prewired to the elements.

Installation

After removal of the terminal box and the mounting ring, the heater is inserted from the inside of the tank. A 2 7/16" (62 mm) diameter opening in the vessel (which is normally of thin walled construction) is required to receive the brass mounting flange.



To insert the heater into a closed or semi-closed tank, an opening at the top or side of the tank is required. Check Table 1 for the required size of this hand-hole.

TABLE 1 - HAND-HOLE REQUIREMENTS

HEATER TYPE	HAND-HOLE SIZE	
	INCHES	MM
1 ELEMENT	5 1/8	130
2 ELEMENT	5 1/2	140
3 ELEMENT	5 7/8	150

Construction

All units have a brass mounting flange and a copper sensing capillary for the low level cutout (when installed). Heaters without a factory installed cutout can only be retrofitted with a cutout at the factory since a special socket wrench is required for this purpose.

Standard element sheath material is copper. Other materials are available on custom orders. Special wattage and voltage ratings can be ordered.

Selection

Type TXC heaters are primarily for water heating and have copper sheathed heating elements. These units do not have a built-in low level cutout and should only be used where there is no chance that the water level will fall exposing the elements. Elements will fail if not completely immersed.

Type TXCC heaters are similar to the TXC models except that a built-in low level cutout is designed to trip the heater circuit in the event of low water. If there is even the slightest chance of a low water condition, the TXCC should be specified.

Special Sheath

These heaters are available with incoloy® sheath on special order.

TO ORDER SPECIFY: Quantity, catalog number, voltage, phase, wattage and special features.

FIG. 1 - One Element Unit

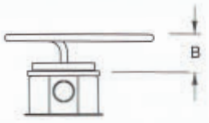


FIG. 2 - Two Element Unit

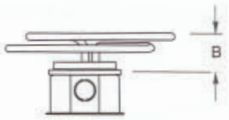


FIG. 3 - Three Element Unit

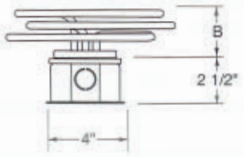


FIG. 4 - Bottom View

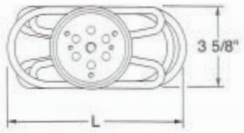


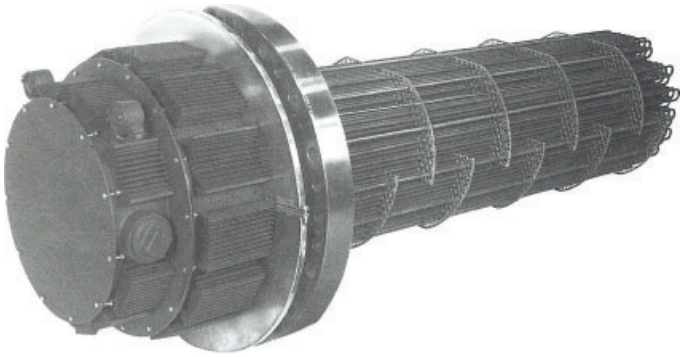
TABLE 2 - TYPE TX HEATERS

KW	STD. VOLTAGES 120	208	240	B DIM. IN. (MM)	L DIM. IN. (MM)	CATALOG NUMBER	PART NUMBER	FIG. NO.
TYPE TXC WITHOUT LOW LEVEL CUTOUT								
1.0	1ϕ			1 1/2 (3.8)	7 3/4 (19.7)	TXC110	TTUH-10R	1
1.5				1 1/2 (3.8)	7 3/4 (19.7)	TXC115	TTUH-15R	1
2.0	1ϕ or 3ϕ			1 1/2 (3.8)	7 3/4 (19.7)	TXC220	TTUH-20R	2
2.5	-	1ϕ		1 1/2 (3.8)	12 3/4 (32.4)	TXC125	TTUH-25R	1
3.0	1ϕ or 3ϕ			1 1/2 (3.8)	7 3/4 (19.7)	TXC230	TTUH-30R	2
4.0	-			1 1/2 (3.8)	12 3/4 (32.4)	TXC240	TTUH-40R	2
4.5	-			2 1/8 (5.4)	7 3/4 (19.7)	TXC345	TTUH-45R	3
5.0	-	1 or 3ϕ		1 1/2 (3.8)	12 3/4 (32.4)	TXC250	TTUH-50R	2
6.0	-			2 1/8 (5.4)	12 3/4 (32.4)	TXC360	TTUH-60R	3
7.5	-			2 1/8 (5.4)	12 3/4 (32.4)	TXC375	TTUH-75R	3
TYPE TXCC WITH BUILT-IN LOW LEVEL CUTOUT								
1.0	1ϕ			1 1/2 (3.8)	7 3/4 (19.7)	TXCC110	TTUH-CO-10R	1
1.5				1 1/2 (3.8)	7 3/4 (19.7)	TXCC115	TTUH-CO-15R	1
2.0	1ϕ or 3ϕ			1 1/2 (3.8)	7 3/4 (19.7)	TXCC220	TTUH-CO-20R	2
2.5	-	1ϕ		1 1/2 (3.8)	12 3/4 (32.4)	TXCC125	TTUH-CO-25R	1
3.0	1ϕ or 3ϕ			1 1/2 (3.8)	7 3/4 (19.7)	TXCC230	TTUH-CO-30R	2
4.0	-			1 1/2 (3.8)	12 3/4 (32.4)	TXCC240	TTUH-CO-40R	2
4.5	-			2 1/8 (5.4)	7 3/4 (19.7)	TXCC345	TTUH-CO-45R	3
5.0	-	1 or 3ϕ		1 1/2 (3.8)	12 3/4 (32.4)	TXCC250	TTUH-CO-50R	2
6.0	-			2 1/8 (5.4)	12 3/4 (32.4)	TXCC360	TTUH-CO-60R	3
7.5	-			2 1/8 (5.4)	12 3/4 (32.4)	TXCC375	TTUH-CO-75R	3

Flange Heaters Type CX

Application

Flange heaters are used to heat liquids or gases in tanks or in-line vessels. Safe and reliable service from the heater requires the correct selection of materials and heating element watt density.



Watt Density

Watt density refers to the wattage output of a heater divided by the total surface area of the heated sections of all heating elements in the heater.

It is important to understand the basic thermal difference between an electric immersion heater and a steam or liquid heat exchanger. Unlike the steam or liquid heat exchanger, all of the heat produced by an electric heater will leave the heater. Even though the surface area in contact with the work is fixed, the heating element sheath temperature will continue to rise until the heat produced is equal to the heat transferred to the process.

A detailed understanding of this behaviour and the system parameters will allow the design of a suitable heater to heat virtually any liquid or gas with the only limitation being its ability to resist corrosion in highly active solutions.

As a general rule, low watt density heaters will provide longer service life than high density heaters, especially when the fluid being heated is viscous or stagnant. However, low density heaters are initially more expensive and in larger systems it is best to check with the factory for assistance in optimizing the heater selection.

See Section D of the Caloritech™ catalog for recommended watt densities for some of the more common fluids.

A final word of caution... improper selection of watt density can result in damage to the product and failure of the heater.

Corrosion

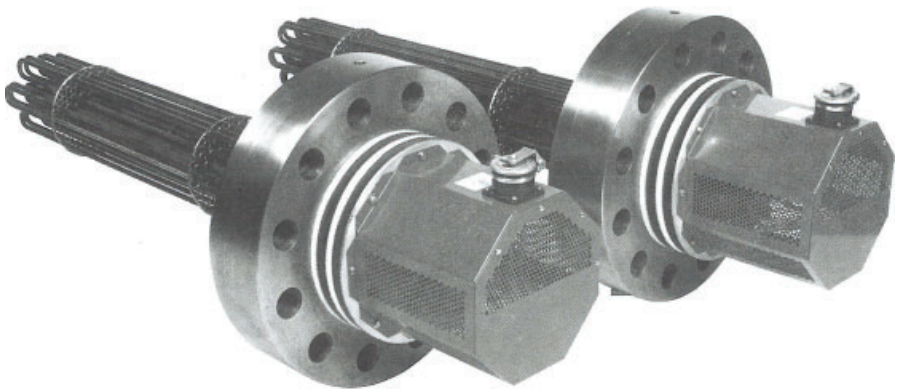
The heaters are not guaranteed against corrosion since has no control over the type, concentration and temperature of the solution. Our experience is that published corrosion guidelines are based on ideal situations which may prove to be a bit optimistic in actual practice. In some instances there is little alternative other than to accept reduced service life and keep a spare heater on hand as a standby replacement.

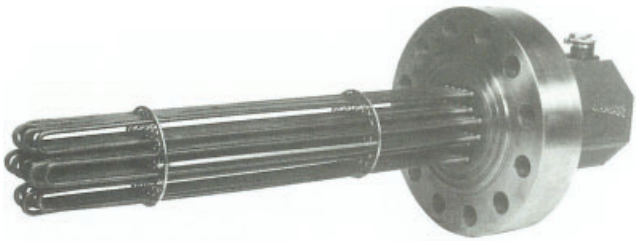
Passivation

Incoloy and stainless steel sheathed heaters are available with chemically passivated sheaths which will provide superior corrosion resistance in most applications. Passivation is achieved through an electropolishing technique.

Heaters with stainless steel flanges are available with all wetted surfaces passivated.

Since passivation is a relatively expensive procedure it should only be specified in highly corrosive applications and on the recommendation of the chemical supplier.





Wiring

High amperage heaters allow staging through 45 AMP subcircuits to allow the use of 50 AMP definite purpose magnetic contactors on each circuit.

Terminal lugs and grounding lugs are provided.

Refer to Section F of the Caloritech™ catalog for wiring and temperature control accessories available from .

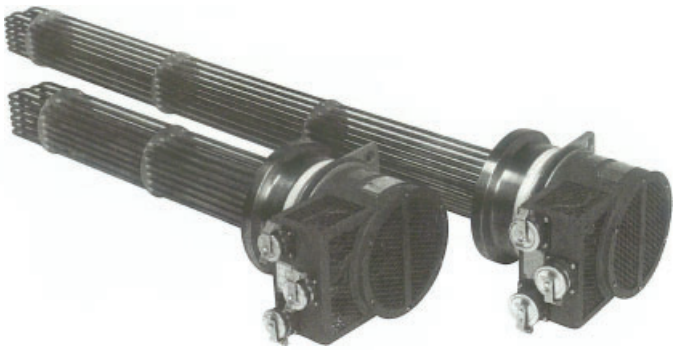
Control

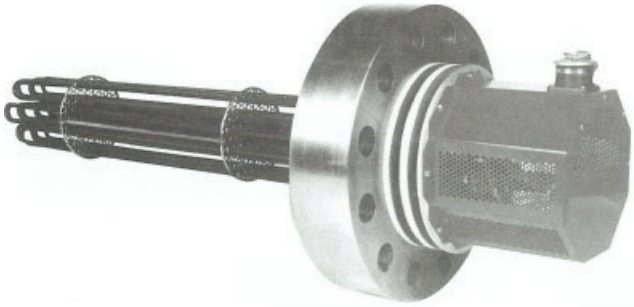
Most systems require some method of temperature and limit control. As heating control specialists we can provide state-of-the-art control systems to meet any process requirements.

Construction

Standard heaters listed have 150 lb. ANSI rated steel flanges and copper or incoloy sheathed elements silver brazed to the flange. Heaters pictured on these introductory pages are examples of some of the custom heaters we have produced to meet special process requirements.

It is important to note that the majority of flange heaters used in closed vessels require registration as ASME fittings from the local jurisdiction. If you are unsure as to whether or not your heater requires registration, check with the factory. Using a non-registered heater, besides violating the Pressure Vessels Act, places personnel and equipment at risk.





Moisture and Sealing

Standard flange heaters have unsealed heating element ends and utilize magnesium oxide for both electrical insulation and heat transfer. Magnesium oxide in contact with the atmosphere will hydrate ... absorb moisture — lowering the insulation resistance of the heater.

On start-up, this often results in small leakage currents which pose no hazard to operating personnel or equipment in properly grounded systems. However, these currents may be sufficient to trip a ground fault interruptor (G.F.I.) and shut down the system.

General procedure is to by-pass the G.F.I. until the heater dries itself out after a period of operation. If this is impractical, it is best to order a heater with special end seals at extra cost.

2 1/2" Flange Heaters

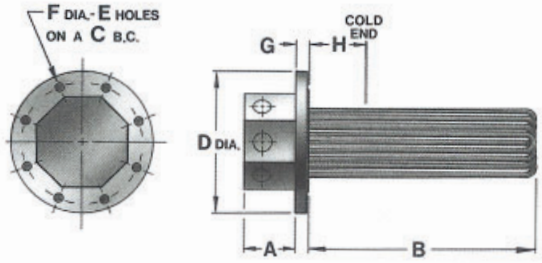
Selection

Type CXC heaters are used primarily for heating water and have copper sheathed elements silver brazed to a steel flange.

Type CXI heaters may also be used to heat water, especially in hot water and steam boilers. These heaters are also suitable for heating mildly corrosive solutions in rinse tanks, spray washers, etc.

Heaters consist of incoloy sheathed elements silver brazed to a steel flange.

Type CXF heaters are constructed of similar materials to CXI heaters except that the heating elements have much lower watt densities. These heaters are especially suited to heating oils, gases and mildly corrosive liquids. Select the lower density CXF heaters for stagnant or heavy oils or for high temperature, low flow gas heating.



HEATER DIMENSIONS IN INCHES

FLANGE SIZE	FLANGE RATING	A	C	D	E	F	G	H
2 1/2"	150 lb.	2 7/8	5 1/2	7	4	3/4	7/8	5 1/2
	300 lb.	2 7/8	5 7/8	7 1/2	8	7/8	1	5 1/2

TABLE 1 - 2 1/2" - 150 LB. STEEL FLANGE HEATERS

KILO-WATTS	IMMERSION LENGTH 'B' mm	in.	STANDARD VOLTAGES 208,240,416 480,600	WATT DENSITY W/cm²	W/in²	WITHOUT THERMOSTAT CAT. NO.	PART NO.	WITH THERMOSTAT 10 - 120°C (50 - 250°F) CAT. NO.	PART NO.	NET WT. LBS (KG)
2 1/2" - 150 LB. STEEL FLANGE HEATERS										
HIGH DENSITY - COPPER SHEATH										
6	460	18.1	1 or 3 Phase	9.3	60	CXC306F25	—	CXCT306F25	—	15.4 (7)
9	660	26.0	"	8.5	55	CXC309F25	—	CXCT309F25	—	15.4 (7)
12	835	32.9	"	8.4	54	CXC312F25	—	CXCT312F25	—	17.6 (8)
15	1010	39.8	"	8.4	54	CXC315F25	—	CXCT315F25	—	17.5 (8)
18	1210	47.6	"	8.2	53	CXC318F25	—	CXCT318F25	—	19.8 (9)
HIGH DENSITY - INCOLOY SHEATH										
6	460	18.1	1 or 3 Phase	9.3	60	CXI306F25	—	CXIT306F25	—	15.4 (7)
9	660	26.0	"	8.5	55	CXI309F25	—	CXIT309F25	—	15.4 (7)
12	835	32.9	"	8.4	54	CXI312F25	—	CXIT312F25	—	17.6 (8)
15	1010	39.8	"	8.4	54	CXI315F25	—	CXIT315F25	—	17.6 (8)
18	1210	47.6	"	8.2	53	CXI318F25	—	CXIT318F25	—	19.8 (9)
MEDIUM DENSITY - INCOLOY SHEATH										
3	460	18.1	1 or 3 Phase	4.6	30	CXF303F25	—	CXFT303F25	—	15.4 (7)
4.5	660	26.0	"	4.2	27	CXF304F25	—	CXFT304F25	—	15.4 (7)
6	835	32.9	"	4.2	27	CXF306F25	—	CXFT306F25	—	17.6 (8)
7.5	1010	39.8	"	4.2	27	CXF307F25	—	CXFT307F25	—	17.6 (8)
9	1210	47.6	"	4.1	26	CXF309F25	—	CXFT309F25	—	19.8 (9)
LOW DENSITY - INCOLOY SHEATH										
3	835	32.9	1 or 3 Phase	2.1	14	CXF303F2532	—	CXFT303F2532	—	17.6 (8)
4.5	1010	39.8	"	2.5	16	CXF304F2539	—	CXFT304F2539	—	17.6 (8)
6	1210	47.6	"	2.7	18	CXF306F2547	—	CXFT306F2547	—	19.8 (9)

TO ORDER SPECIFY: Quantity, catalog number, voltage, phase, wattage and special features.

3" Flange Heaters

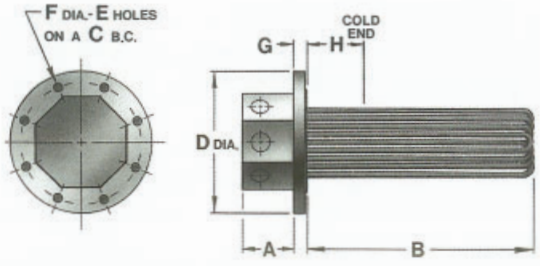
Selection

Type CXC heaters are used primarily for heating water and have copper sheathed elements silver brazed to a steel flange.

Type CXI heaters may also be used to heat water, especially in hot water and steam boilers. These heaters are also suitable for heating mildly corrosive solutions in rinse tanks, spray washers, etc.

Heaters consist of incoloy sheathed elements silver brazed to a steel flange.

Type CXF heaters are constructed of similar materials to CXI heaters except that the heating elements have much lower watt densities. These heaters are especially suited to heating oils, gases and mildly corrosive liquids. Select the lower density CXF heaters for stagnant or heavy oils or for high temperature, low flow gas heating.



HEATER DIMENSIONS IN INCHES

FLANGE SIZE	FLANGE RATING	A	C	D	E	F	G	H
3"	150 lb.	3 1/2	6	7 1/2	4	3/4	15/16	5 1/2
	300 lb.	3 1/2	6 5/8	8 1/4	8	7/8	1 1/8	5 1/2

TABLE 2 - 3" - 150 LB. STEEL FLANGE HEATERS

KILO-WATTS	IMMERSION LENGTH 'B' mm	in.	STANDARD VOLTAGES 208,240,416 480,600	WATT DENSITY W/cm²	W/in²	WITHOUT THERMOSTAT CAT. NO.	PART NO.	WITH THERMOSTAT 10 - 120°C (50 - 250°F) CAT. NO.	PART NO.	NET WT. LBS (KG)
3" - 150 LB. STEEL FLANGE HEATERS										
HIGH DENSITY - COPPER SHEATH										
6	455	17.9	1 or 3 Phase	9.3	60	CXC306F3	TM-3-306	CXCT306F3	—	15.4 (7)
9	655	25.8	"	8.5	55	CXC309F3	TM-3-309	CXCT309F3	—	15.4 (7)
12	830	32.7	"	8.4	54	CXC312F3	TM-3-312	CXCT312F3	—	17.6 (8)
15	1005	39.6	"	8.4	54	CXC315F3	TM-3-315	CXCT315F3	—	17.6 (8)
18	1205	47.4	"	8.2	53	CXC318F3	TM-3-318	CXCT318F3	—	19.8 (9)
18	655	25.8	"	8.5	55	CXC618F3	—	CXCT618F3	—	22.0 (10)
24	830	32.7	"	8.4	54	CXC624F3	—	CXCT624F3	—	24.3 (11)
30	1005	39.6	"	8.4	54	CXC630F3	—	CXCT630F3	—	26.5 (12)
HIGH DENSITY - INCOLOY SHEATH										
6	455	17.9	1 or 3 Phase	9.3	60	CXI306F3	TMI-3H-306	CXIT306F3	—	15.4 (7)
9	655	25.8	"	8.5	55	CXI309F3	TMI-3H-309	CXIT309F3	—	15.4 (7)
12	830	32.7	"	8.4	54	CXI312F3	TMI-3H-312	CXIT312F3	—	17.6 (8)
15	1005	39.6	"	8.4	54	CXI315F3	TMI-3H-315	CXIT315F3	—	17.6 (8)
18	1205	47.4	"	8.2	53	CXI318F3	TMI-3H-318	CXIT318F3	—	19.8 (9)
18	655	25.8	"	8.5	55	CXI618F3	—	CXIT618F3	—	22.0 (10)
24	830	32.7	"	8.4	54	CXI624F3	—	CXIT624F3	—	24.3 (11)
30	1005	39.6	"	8.4	54	CXI630F3	—	CXIT630F3	—	26.5 (12)
MEDIUM DENSITY - INCOLOY SHEATH										
3	455	17.9	1 or 3 Phase	4.6	30	CXF303F3	TMI-3-303	CXFT303F3	—	15.4 (7)
4.5	655	25.8	"	4.2	27	CXF304F3	TMI-3-304	CXFT304F3	—	15.4 (7)
6	830	32.7	"	4.2	27	CXF306F3	TMI-3-306	CXFT306F3	—	17.6 (8)
7.5	1005	39.6	"	4.2	27	CXF307F3	TMI-3-307	CXFT307F3	—	19.8 (9)
9	1205	47.4	"	4.1	26	CXF309F3	TMI-3-309	CXFT309F3	—	19.8 (9)
LOW DENSITY - INCOLOY SHEATH										
3	830	32.7	1 or 3 Phase	2.1	14	CXF303F332	TMI-3L-303	CXFT303F332	—	17.6 (8)
4.5	1005	39.6	"	2.5	17	CXF304F339	TMI-3L-304	CXFT304F339	—	17.6 (8)
6	1205	47.4	"	2.7	18	CXF306F347	TMI-3L-306	CXFT306F347	—	19.8 (9)

TO ORDER SPECIFY: Quantity, catalog number, voltage, phase, wattage and special features.

4" Flange Heaters

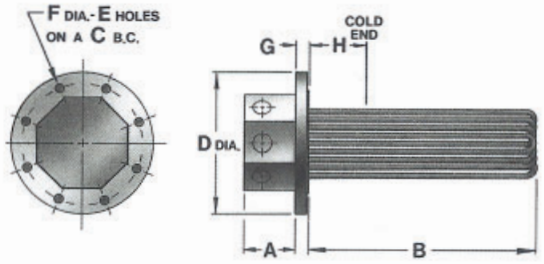
Selection

Type CXC heaters are used primarily for heating water and have copper sheathed elements silver brazed to a steel flange.

Type CXI heaters may also be used to heat water, especially in hot water and steam boilers. These heaters are also suitable for heating mildly corrosive solutions in rinse tanks, spray washers, etc.

Heaters consist of incoloy sheathed elements silver brazed to a steel flange.

Type CXF heaters are constructed of similar materials to CXI heaters except that the heating elements have much lower watt densities. These heaters are especially suited to heating oils, gases and mildly corrosive liquids. Select the lower density CXF heaters for stagnant or heavy oils or for high temperature, low flow gas heating.



HEATER DIMENSIONS IN INCHES

FLANGE SIZE	FLANGE RATING	A	C	D	E	F	G	H
4"	150 lb.	5	7 1/2	9	8	3/4	15/16	5 1/2
	300 lb.	5	7 7/8	10	8	7/8	1 1/4	5 1/2

TABLE 3 - 4" - 150 LB. STEEL FLANGE HEATERS

KILO-WATTS	IMMERSION LENGTH 'B' mm	IMMERSION LENGTH 'B' in.	STANDARD VOLTAGES 208,240,416 480,600	WATT DENSITY W/cm²	WATT DENSITY W/in²	WITHOUT THERMOSTAT CAT. NO.	WITHOUT THERMOSTAT PART NO.	WITH THERMOSTAT 10 - 120°C (50 - 250°F) CAT. NO.	WITH THERMOSTAT 10 - 120°C (50 - 250°F) PART NO.	NET WT. LBS (KG)
4" - 150 LB. STEEL FLANGE HEATERS										
HIGH DENSITY - COPPER SHEATH										
12	455	17.9	1 or 3 Phase	8.4	60	CXC612F4	—	CXCT612F4	—	26.5 (12)
15	555	21.9	"	8.8	57	CXC615F4	—	CXCT615F4	—	28.7 (13)
18	655	25.8	"	8.5	55	CXC618F4	—	CXCT618F4	—	28.7 (13)
24	830	32.7	"	8.4	54	CXC624F4	—	CXCT624F4	—	30.9 (14)
30	1005	39.6	"	8.4	54	CXC630F4	—	CXCT630F4	—	33.1 (15)
18	455	17.9	"	9.3	60	CXC918F4	—	CXCT918F4	—	37.5 (17)
27	655	25.8	"	8.5	55	CXC927F4	—	CXCT927F4	—	39.7 (18)
36	830	32.7	"	8.4	54	CXC936F4	—	CXCT936F4	—	39.7 (18)
45	1005	39.6	"	8.4	54	CXC945F4	—	CXCT945F4	—	44.1 (20)
HIGH DENSITY - INCOLOY SHEATH										
12	455	17.9	1 or 3 Phase	8.4	60	CXI612F4	—	CXIT612F4	—	26.5 (12)
15	555	21.9	"	8.8	57	CXI615F4	—	CXIT615F4	—	28.7 (13)
18	655	25.8	"	8.5	55	CXI618F4	—	CXIT618F4	—	28.7 (13)
24	830	32.7	"	8.4	54	CXI624F4	—	CXIT624F4	—	30.9 (14)
30	1005	39.6	"	8.4	54	CXI630F4	—	CXIT630F4	—	33.1 (15)
18	455	17.9	"	9.3	60	CXI918F4	—	CXIT918F4	—	37.5 (17)
27	655	25.8	"	8.5	55	CXI927F4	—	CXIT927F4	—	39.7 (18)
36	830	32.7	"	8.4	54	CXI936F4	—	CXIT936F4	—	39.7 (18)
45	1005	39.6	"	8.4	54	CXI945F4	—	CXIT945F4	—	44.1 (20)
MEDIUM DENSITY - INCOLOY SHEATH										
6	455	17.9	1 or 3 Phase	4.6	30	CXF606F4	—	CXFT606F4	—	28.7 (13)
9	655	25.8	"	4.2	27	CXF609F4	—	CXFT609F4	—	30.9 (14)
12	830	32.7	"	4.2	27	CXF612F4	—	CXFT612F4	—	33.1 (15)
9	455	17.9	"	4.6	30	CXF909F4	—	CXFT909F4	—	37.5 (17)
13.5	655	25.8	"	4.2	27	CXF913F4	—	CXFT913F4	—	39.7 (18)
18	830	32.7	"	4.2	27	CXF918F4	—	CXFT918F4	—	41.9 (19)
LOW DENSITY - INCOLOY SHEATH										
6	830	32.7	1 or 3 Phase	2.1	14	CXF606F432	—	CXFT606F432	—	30.9 (14)
9	830	32.7	"	2.1	14	CXF909F432	—	CXFT909F432	—	39.7 (18)

TO ORDER SPECIFY: Quantity, catalog number, voltage, phase, wattage and special features.

5" Flange Heaters

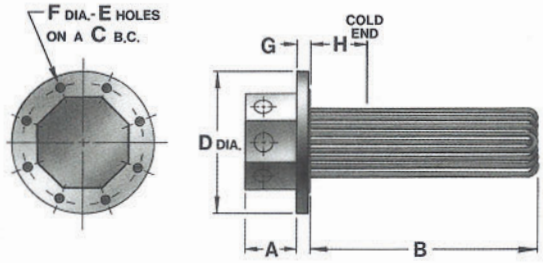
Selection

Type CXC heaters are used primarily for heating water and have copper sheathed elements silver brazed to a steel flange.

Type CXI heaters may also be used to heat water, especially in hot water and steam boilers. These heaters are also suitable for heating mildly corrosive solutions in rinse tanks, spray washers, etc.

Heaters consist of incoloy sheathed elements silver brazed to a steel flange.

Type CXF heaters are constructed of similar materials to CXI heaters except that the heating elements have much lower watt densities. These heaters are especially suited to heating oils, gases and mildly corrosive liquids. Select the lower density CXF heaters for stagnant or heavy oils or for high temperature, low flow gas heating.



HEATER DIMENSIONS IN INCHES

FLANGE SIZE	FLANGE RATING	A	C	D	E	F	G	H
5"	150 lb.	5	8 1/2	10	8	7/8	15/16	6 3/4
	300 lb.	5	9 1/4	11	8	7/8	1 3/8	6

TABLE 4 - 5" - 150 LB. STEEL FLANGE HEATERS

KILO-WATTS	IMMERSION LENGTH 'B' mm	in.	STANDARD VOLTAGES 208,240,416 480,600	WATT DENSITY W/cm²	W/in²	WITHOUT THERMOSTAT CAT. NO.	PART NO.	WITH THERMOSTAT 10 - 120°C (50 - 250°F) CAT. NO.	PART NO.	NET WT. LBS (KG)
5" - 150 LB. STEEL FLANGE HEATERS										
HIGH DENSITY - COPPER SHEATH										
12	455	17.9	1 or 3 Phase	9.3	60	CXC612F5	TM-5-612	CXCT612F5	—	26.5 (12)
15	555	21.9	"	8.8	57	CXC615F5	TM-5-615	CXCT615F5	—	28.7 (13)
18	655	25.8	"	8.5	55	CXC618F5	TM-5-618	CXCT618F5	—	28.7 (13)
24	830	32.7	"	8.4	54	CXC624F5	TM-5-624	CXCT624F5	—	30.9 (14)
30	1005	39.6	"	8.4	54	CXC630F5	TM-5-630	CXCT630F5	—	33.1 (15)
27	655	25.8	"	8.5	55	CXC927F5	TM-5-927	CXCT927F5	—	39.7 (18)
36	830	32.7	"	8.4	54	CXC936F5	TM-5-936	CXCT936F5	—	41.9 (19)
45	1005	39.6	"	8.4	54	CXC945F5	TM-5-945	CXCT945F5	—	44.1 (20)
HIGH DENSITY - INCOLOY SHEATH										
12	455	17.9	1 or 3 Phase	9.3	60	CXI612F5	TMI-5H-612	CXIT612F5	—	26.5 (12)
15	555	21.9	"	8.8	57	CXI615F5	TMI-5H-615	CXIT615F5	—	28.7 (13)
18	655	25.8	"	8.5	55	CXI618F5	TMI-5H-618	CXIT618F5	—	28.7 (13)
24	830	32.7	"	8.4	54	CXI624F5	TMI-5H-624	CXIT624F5	—	30.9 (14)
30	1005	39.6	"	8.4	54	CXI630F5	TMI-5H-630	CXIT630F5	—	33.1 (15)
27	655	25.8	"	8.5	55	CXI927F5	TMI-5H-927	CXIT927F5	—	39.7 (18)
36	830	32.7	"	8.4	54	CXI936F5	TMI-5H-936	CXIT936F5	—	41.9 (19)
45	1005	39.6	"	8.4	54	CXI945F5	TMI-5H-945	CXIT945F5	—	44.1 (20)
MEDIUM DENSITY - INCOLOY SHEATH										
6	455	17.9	1 or 3 Phase	4.6	30	CXF606F5	TMI-5-606	CXFT606F5	—	28.7 (13)
9	655	25.8	"	4.2	27	CXF609F5	TMI-5-609	CXFT609F5	—	30.9 (14)
12	830	32.7	"	4.2	27	CXF612F5	TMI-5-612	CXFT612F5	—	33.1 (15)
15	1005	39.6	"	4.2	27	CXF615F5	TMI-5-615	CXFT615F5	—	33.1 (15)
18	1205	47.4	"	4.1	26	CXF618F5	—	CXFT618F5	—	41.9 (19)
9	455	17.9	"	4.6	30	CXF909F5	TMI-5-909	CXFT909F5	—	37.5 (17)
13.5	655	25.8	"	4.2	27	CXF913F5	TMI-5-913	CXFT913F5	—	41.9 (19)
18	830	32.7	"	4.2	27	CXF918F5	TMI-5-918	CXFT918F5	—	41.9 (19)
27	1205	47.4	"	4.1	26	CXF927F5	—	CXFT927F5	—	50.7 (23)
LOW DENSITY - INCOLOY SHEATH										
6	830	32.7	1 or 3 Phase	2.1	14	CXF606F532	TMI-5L-606	CXFT606F532	—	30.9 (14)
12	1205	47.4	"	2.7	18	CXF612F547	—	CXFT612F547	—	41.9 (19)
9	830	32.7	"	2.1	14	CXF909F532	—	CXFT909F532	—	39.7 (18)
18	1205	47.4	"	2.7	18	CXF918F547	—	CXFT918F547	—	50.7 (23)

TO ORDER SPECIFY: Quantity, catalog number, voltage, phase, wattage and special features.

6" Flange Heaters

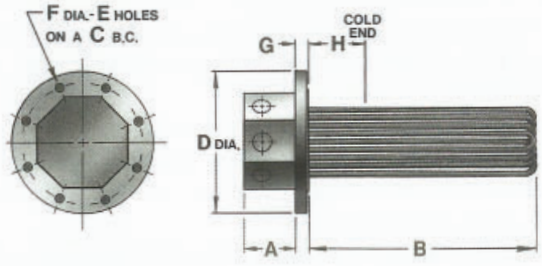
Selection

Type CXC heaters are used primarily for heating water and have copper sheathed elements silver brazed to a steel flange.

Type CXI heaters may also be used to heat water, especially in hot water and steam boilers. These heaters are also suitable for heating mildly corrosive solutions in rinse tanks, spray washers, etc.

Heaters consist of incoloy sheathed elements silver brazed to a steel flange.

Type CXF heaters are constructed of similar materials to CXI heaters except that the heating elements have much lower watt densities. These heaters are especially suited to heating oils, gases and mildly corrosive liquids. Select the lower density CXF heaters for stagnant or heavy oils or for high temperature, low flow gas heating.



HEATER DIMENSIONS IN INCHES

FLANGE SIZE	FLANGE RATING	A	C	D	E	F	G	H
6"	150 lb.	5	9 1/2	11	8	7/8	1	6 3/4
	300 lb.	5	10 5/8	12 1/2	12	7/8	1 7/16	6

TABLE 5 - 6" - 150 LB. STEEL FLANGE HEATERS

KILO-WATTS	IMMERSION LENGTH 'B' mm	in.	STD VOLTAGES 208, 240 1ϕ	208, 240 3ϕ	480, 600 1ϕ	480, 600 3ϕ	WATT DENSITY W/cm²	W/in²	WITHOUT THERMOSTAT CAT. NO.	PART NO.	WITH THERMOSTAT 10 - 120°C (50 - 250°F) CAT. NO.	PART NO.	NET WT. LBS (KG)
6" - 150 LB. STEEL FLANGE HEATERS													
HIGH DENSITY - COPPER SHEATH													
36	655	25.8	✓	✓	✓	✓	8.5	55	CXC1236F6	TM-6-1236	CXCT1236F6	–	44.1 (20)
48	830	32.7	-	✓	✓	✓	8.4	54	CXC1248F6	TM-6-1248	CXCT1248F6	–	48.5 (22)
60	1005	39.6	-	✓	✓	✓	8.4	54	CXC1260F6	TM-6-1260	CXCT1260F6	–	52.9 (24)
72	1205	47.4	-	✓	✓	✓	8.2	53	CXC1272F6	TM-6-1272	CXCT1272F6	–	57.3 (26)
45	655	25.8	-	✓	✓	✓	8.5	55	CXC1545F6	–	CXCT1545F6	–	50.7 (23)
60	830	32.7	-	✓	✓	✓	8.4	54	CXC1560F6	–	CXCT1560F6	–	55.1 (25)
75	1005	39.6	-	✓	✓	✓	8.4	54	CXC1575F6	–	CXCT1575F6	–	61.7 (28)
90	1205	47.4	-	-	✓	✓	8.2	53	CXC1590F6	–	CXCT1590F6	–	68.3 (31)
90	1005	39.6	-	-	✓	✓	8.4	54	CXC1890F6	–	CXCT1890F6	–	70.5 (32)
HIGH DENSITY - INCOLOY SHEATH													
36	655	25.8	✓	✓	✓	✓	8.5	55	CXI1236F6	TMI-6-1236	CXIT1236F6	–	44.1 (20)
48	830	32.7	-	✓	✓	✓	8.4	54	CXI1248F6	–	CXIT1248F6	–	48.5 (22)
60	1005	39.6	-	✓	✓	✓	8.4	54	CXI1260F6	–	CXIT1260F6	–	52.9 (24)
72	1205	47.4	-	✓	✓	✓	8.2	53	CXI1272F6	–	CXIT1272F6	–	57.3 (26)
45	655	25.8	-	✓	✓	✓	8.5	55	CXI1545F6	–	CXIT1545F6	–	50.7 (23)
60	830	32.7	-	✓	✓	✓	8.4	54	CXI1560F6	–	CXIT1560F6	–	55.1 (25)
75	1005	39.6	-	✓	✓	✓	8.4	54	CXI1575F6	–	CXIT1575F6	–	61.7 (28)
90	1205	47.4	-	-	✓	✓	8.2	53	CXI1590F6	–	CXIT1590F6	–	68.3 (31)
90	1005	39.6	-	-	✓	✓	8.4	54	CXI1890F6	–	CXIT1890F6	–	70.5 (32)
120	1205	47.4	-	-	-	✓	10.9	70	CXI15120F6	–	CXIT15120F6	–	72.8 (33)
144	1205	47.4	-	-	-	✓	10.9	70	CXI18144F6	–	CXIT18144F6	–	83.8 (38)
MEDIUM DENSITY - INCOLOY SHEATH													
18	655	25.8	✓	✓	✓	✓	4.2	27	CXF1218F6	TMI-6H-1218	CXFT1218F6	–	46.3 (21)
24	830	32.7	✓	✓	✓	✓	4.2	27	CXF1224F6	TMI-6H-1224	CXFT1224F6	–	50.7 (23)
30	1005	39.6	✓	✓	✓	✓	4.2	27	CXF1230F6	TMI-6H-1230	CXFT1230F6	–	55.1 (25)
36	1205	47.4	✓	✓	✓	✓	4.1	26	CXF1236F6	TMI-6H-1236	CXFT1236F6	–	59.5 (27)
48	1555	61.2	-	✓	✓	✓	4.1	26	CXF1248F6	–	CXFT1248F6	–	70.5 (32)
22.5	655	25.8	✓	✓	✓	✓	4.2	27	CXF1522F6	–	CXFT1522F6	–	52.9 (24)
30	830	32.7	✓	✓	✓	✓	4.2	27	CXF1530F6	–	CXFT1530F6	–	57.3 (26)
37.5	1005	39.6	✓	✓	✓	✓	4.2	27	CXF1537F6	–	CXFT1537F6	–	63.9 (29)
45	1205	47.4	-	✓	✓	✓	4.1	26	CXF1545F6	–	CXFT1545F6	–	70.5 (32)
60	1555	61.2	-	✓	✓	✓	4.1	26	CXF1560F6	–	CXFT1560F6	–	83.8 (38)
LOW DENSITY - INCOLOY SHEATH													
12	830	32.7	✓	✓	✓	✓	2.1	14	CXF1212F6	–	CXFT1212F6	–	48.5 (22)
18	1005	39.6	✓	✓	✓	✓	2.5	16	CXF1218F639	TMI-6L-1218	CXFT1218F639	–	57.3 (26)
24	1205	47.4	✓	✓	✓	✓	2.7	18	CXF1224F647	–	CXFT1224F647	–	66.1 (30)
15	830	32.7	✓	✓	✓	✓	2.1	14	CXF1515F6	–	CXFT1515F6	–	52.9 (24)
22.5	1005	39.6	✓	✓	✓	✓	2.5	16	CXF1522F639	–	CXFT1522F639	–	63.9 (29)
30	1205	47.4	✓	✓	✓	✓	2.7	18	CXF1530F647	–	CXFT1530F647	–	77.2 (35)

TO ORDER SPECIFY: Quantity, catalog number, voltage, phase, wattage and special features.

8" Flange Heaters

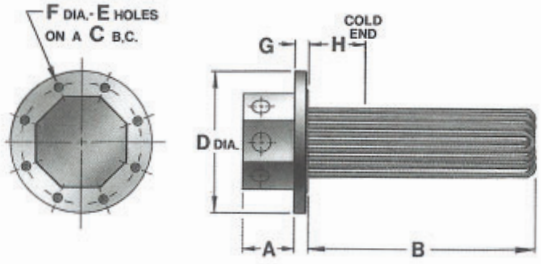
Selection

Type CXC heaters are used primarily for heating water and have copper sheathed elements silver brazed to a steel flange.

Type CXI heaters may also be used to heat water, especially in hot water and steam boilers. These heaters are also suitable for heating mildly corrosive solutions in rinse tanks, spray washers, etc.

Heaters consist of incoloy sheathed elements silver brazed to a steel flange.

Type CXF heaters are constructed of similar materials to CXI heaters except that the heating elements have much lower watt densities. These heaters are especially suited to heating oils, gases and mildly corrosive liquids. Select the lower density CXF heaters for stagnant or heavy oils or for high temperature, low flow gas heating.



HEATER DIMENSIONS IN INCHES

FLANGE SIZE	FLANGE RATING	A	C	D	E	F	G	H
8"	150 lb.	5	11 3/4	13 1/2	8	7/8	1 1/8	6 3/4
	300 lb.	5	13	15	12	1	1 5/8	6

TABLE 6 - 8" - 150 LB. STEEL FLANGE HEATERS

KILO-WATTS	IMMERSION LENGTH 'B' mm	in.	STD VOLTAGES 208, 240 1ϕ	208, 240 3ϕ	480, 600 1ϕ	480, 600 3ϕ	WATT DENSITY W/cm²	W/in²	WITHOUT THERMOSTAT CAT. NO.	PART NO.	WITH THERMOSTAT 10 - 120°C (50 - 250°F) CAT. NO.	PART NO.	NET WT. LBS (KG)
8" - 150 LB. STEEL FLANGE HEATERS													
HIGH DENSITY - COPPER SHEATH													
54	650	25.6	-	✓	✓	✓	8.5	55	CXC1854F8	TM-8-1850	CXCT1854F8	—	79.4 (36)
72	825	32.5	-	✓	✓	✓	8.4	54	CXC1872F8	TM-8-1872	CXCT1872F8	—	83.8 (38)
90	1000	39.4	-	✓	✓	✓	8.4	54	CXC1890F8	—	CXCT1890F8	—	90.4 (41)
108	1200	47.2	-	✓	✓	✓	8.2	53	CXC18108F8	TM-8-18100	CXCT18108F8	—	99.2 (45)
81	650	25.6	-	✓	✓	✓	8.5	55	CXC2781F8	—	CXCT2781F8	—	90.4 (41)
108	825	32.5	-	-	✓	✓	8.4	54	CXC27108F8	—	CXCT27108F8	—	101.4 (46)
135	1000	39.4	-	-	-	✓	8.4	54	CXC27135F8	—	CXCT27135F8	—	110.2 (50)
162	1200	47.2	-	-	-	✓	8.2	53	CXC27162F8	—	CXCT27162F8	—	125.7 (57)
HIGH DENSITY - INCOLOY SHEATH													
54	650	25.6	-	✓	✓	✓	8.5	55	CXI1854F8	TMI-8-1850	CXIT1854F8	—	79.4 (36)
72	825	32.5	-	✓	✓	✓	8.4	54	CXI1872F8	—	CXIT1872F8	—	83.8 (38)
90	1000	39.4	-	✓	✓	✓	8.4	54	CXI1890F8	—	CXIT1890F8	—	90.4 (41)
108	1200	47.2	-	✓	✓	✓	8.2	53	CXI18108F8	—	CXIT18108F8	—	99.2 (45)
81	650	25.6	-	✓	✓	✓	8.5	55	CXI2781F8	—	CXIT2781F8	—	90.4 (41)
108	825	32.5	-	-	✓	✓	8.4	54	CXI27108F8	—	CXIT27108F8	—	101.4 (46)
135	1000	39.4	-	-	-	✓	8.4	54	CXI27135F8	—	CXIT27135F8	—	110.2 (50)
162	1200	47.2	-	-	-	✓	8.2	53	CXI27162F8	—	CXIT27162F8	—	125.7 (57)
120	1200	47.2	-	-	-	✓	10.9	70	CXI15120F8	—	CXIT15120F8	—	92.6 (42)
144	1200	47.2	-	-	-	✓	10.9	70	CXI18144F8	—	CXIT18144F8	—	99.2 (45)
168	1200	47.2	-	-	-	✓	10.9	70	CXI21168F8	—	CXIT21168F8	—	110.2 (50)
192	1200	47.2	-	-	-	✓	10.9	70	CXI24192F8	—	CXIT24192F8	—	116.8 (53)
216	1200	47.2	-	-	-	✓	10.9	70	CXI27216F8	—	CXIT27216F8	—	125.7 (57)
240	1200	47.2	-	-	-	✓	10.9	70	CXI30240F8	—	CXIT30240F8	—	134.5 (61)
MEDIUM DENSITY - INCOLOY SHEATH													
36	825	32.5	✓	✓	✓	✓	4.2	27	CXF1836F8	TMI-8H-1830	CXFT1836F8	—	83.8 (38)
54	1200	47.2	-	✓	✓	✓	4.1	26	CXF1854F8	TMI-8H-1850	CXFT1854F8	—	101.4 (46)
63	1200	47.2	-	✓	✓	✓	4.1	26	CXF2163F8	—	CXFT2163F8	—	110.2 (50)
72	1200	47.2	-	✓	✓	✓	4.1	26	CXF2472F8	—	CXFT2472F8	—	116.8 (53)
81	1200	47.2	-	✓	✓	✓	4.1	26	CXF2781F8	—	CXFT2781F8	—	125.7 (57)
90	1200	47.2	-	✓	✓	✓	4.1	26	CXF3090F8	—	CXFT3090F8	—	134.5 (61)
LOW DENSITY - INCOLOY SHEATH													
27	1000	39.4	✓	✓	✓	✓	2.5	16	CXF1827F8	—	CXFT1827F8	—	90.4 (41)
31.5	1000	39.4	✓	✓	✓	✓	2.5	16	CXF2131F8	TMO-8-1830	CXFT2131F8	—	97.0 (44)
36	1000	39.4	✓	✓	✓	✓	2.5	16	CXF2436F8	TMO-8-1840	CXFT2436F8	—	101.4 (46)
36	1200	47.2	✓	✓	✓	✓	2.7	17	CXF1836F847	TMO-8L-2435	CXFT1836F847	—	101.4 (46)
40.5	1000	39.4	-	✓	✓	✓	2.5	16	CXF2740F8	—	CXFT2740F8	—	110.2 (50)
45	1000	39.4	-	✓	✓	✓	2.5	16	CXF3045F8	—	CXFT3045F8	—	116.8 (53)
54	1200	47.2	-	✓	✓	✓	2.7	17	CXF2754F8	TMO-8L-2450	CXFT2754F8	—	125.7 (57)

TO ORDER SPECIFY: Quantity, catalog number, voltage, phase, wattage and special features.

10" Flange Heaters

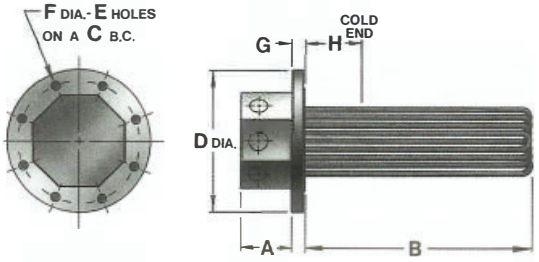
Selection

Type CXC heaters are used primarily for heating water and have copper sheathed elements silver brazed to a steel flange.

Type CXI heaters may also be used to heat water, especially in hot water and steam boilers. These heaters are also suitable for heating mildly corrosive solutions in rinse tanks, spray washers, etc.

Heaters consist of incoloy sheathed elements silver brazed to a steel flange.

Type CXF heaters are constructed of similar materials to CXI heaters except that the heating elements have much lower watt densities. These heaters are especially suited to heating oils, gases and mildly corrosive liquids. Select the lower density CXF heaters for stagnant or heavy oils or for high temperature, low flow gas heating.



HEATER DIMENSIONS IN INCHES

FLANGE SIZE	FLANGE RATING	A	C	D	E	F	G	H
10"	150 lb.	8	14 1/4	16	12	1	1 3/16	10
	300 lb.	8	15 1/4	17 1/2	16	1 1/8	1 7/8	9 1/4

TABLE 7 - 10" - 150 LB. STEEL FLANGE HEATERS

KILO-WATTS	IMMERSION LENGTH 'B' mm	in.	STD VOLTAGES 208, 240 1ϕ	208, 240 3ϕ	480, 600 1ϕ	480, 600 3ϕ	WATT DENSITY W/cm²	W/in²	WITHOUT THERMOSTAT CAT. NO.	PART NO.	WITH THERMOSTAT 10 - 120°C (50 - 250°F) CAT. NO.	PART NO.	NET WT. LBS (KG)
10" - 150 LB. STEEL FLANGE HEATERS													
HIGH DENSITY - COPPER SHEATH													
180	1000	39.4	-	-	-	✓	9.8	63	CXC36180F10	—	—	—	152.1 (69)
216	1200	47.2	-	-	-	✓	9.3	60	CXC36216F10	—	—	—	165.4 (75)
252	1200	47.2	-	-	-	✓	9.3	60	CXC42252F10	—	—	—	187.4 (85)
HIGH DENSITY - INCOLOY SHEATH													
180	1000	39.4	-	-	-	✓	9.8	63	CXI36180F10	—	—	—	152.1 (69)
216	1200	47.2	-	-	-	✓	9.3	60	CXI36216F10	—	—	—	165.4 (75)
252	1200	47.2	-	-	-	✓	9.3	60	CXI42252F10	—	—	—	187.4 (85)
288	1200	47.2	-	-	-	✓	12.3	80	CXI36288F10	—	—	—	165.4 (75)
336	1200	47.2	-	-	-	✓	12.3	80	CXI42336F10	—	—	—	187.4 (85)
384	1200	47.2	-	-	-	✓	12.3	80	CXI48384F10	—	—	—	205.0 (93)
MEDIUM DENSITY - INCOLOY SHEATH													
108	1200	47.2	-	-	✓	✓	4.6	30	CXF36108F10	—	—	—	165.4 (75)
126	1200	47.2	-	-	-	✓	4.6	30	CXF42126F10	—	—	—	187.4 (85)
144	1200	47.2	-	-	-	✓	4.6	30	CXF48144F10	—	—	—	205.0 (93)
LOW DENSITY - INCOLOY SHEATH													
72	1200	47.2	-	✓	✓	✓	3.1	20	CXF3672F10	—	—	—	165.4 (75)
84	1200	47.2	-	✓	✓	✓	3.1	20	CXF4284F10	—	—	—	187.4 (85)
96	1200	47.2	-	✓	✓	✓	3.1	20	CXF4896F10	—	—	—	205.0 (93)

TO ORDER SPECIFY: Quantity, catalog number, voltage, phase, wattage and special features.

12" Flange Heaters

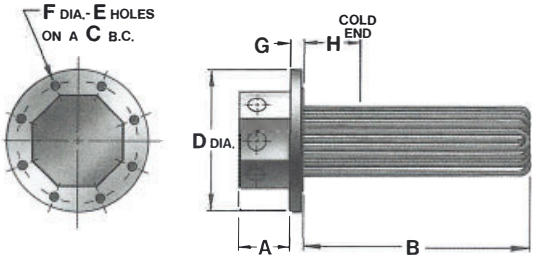
Selection

Type CXC heaters are used primarily for heating water and have copper sheathed elements silver brazed to a steel flange.

Type CXI heaters may also be used to heat water, especially in hot water and steam boilers. These heaters are also suitable for heating mildly corrosive solutions in rinse tanks, spray washers, etc.

Heaters consist of incoloy sheathed elements silver brazed to a steel flange.

Type CXF heaters are constructed of similar materials to CXI heaters except that the heating elements have much lower watt densities. These heaters are especially suited to heating oils, gases and mildly corrosive liquids. Select the lower density CXF heaters for stagnant or heavy oils or for high temperature, low flow gas heating.



HEATER DIMENSIONS IN INCHES

FLANGE SIZE	FLANGE RATING	A	C	D	E	F	G	H
12"	150 lb.	8	17	19	12	1	1 1/4	9 3/4
	300 lb.	8	17 3/4	20 1/2	16	1 1/4	2	9

TABLE 8 - 12" - 150 LB. STEEL FLANGE HEATERS

KILO-WATTS	IMMERSION LENGTH 'B' mm	in.	STD VOLTAGES 208. 240 1φ	208. 240 3φ	480. 600 1φ	480. 600 3φ	WATT DENSITY W/cm²	W/in²	WITHOUT THERMOSTAT CAT. NO.	PART NO.	WITH THERMOSTAT 10 - 120°C (50 - 250°F) CAT. NO.	PART NO.	NET WT. LBS (KG)
12" — 150 LB. STEEL FLANGE HEATERS													
HIGH DENSITY - COPPER SHEATH													
240	995	39.2	-	-	-	✓	9.8	63	CXC48240F12	—	—	—	218.3 (99)
288	1195	47.0	-	-	-	✓	9.3	60	CXC48288F12	—	—	—	238.1 (108)
324	1195	47.0	-	-	-	✓	9.3	60	CXC54324F12	—	—	—	255.7 (116)
360	1195	47.0	-	-	-	✓	9.3	60	CXC60360F12	—	—	—	246.9 (112)
HIGH DENSITY - INCOLOY SHEATH													
240	995	39.2	-	-	-	✓	9.8	63	CXI48240F12	—	—	—	218.3 (99)
288	1195	47.0	-	-	-	✓	9.3	60	CXI48288F12	—	—	—	238.1 (108)
324	1195	47.0	-	-	-	✓	9.3	60	CXI54324F12	—	—	—	255.7 (116)
360	1195	47.0	-	-	-	✓	9.3	60	CXI60360F12	—	—	—	246.9 (112)
432	1195	47.0	-	-	-	✓	12.3	80	CXI54432F12	—	—	—	255.7 (116)
480	1195	47.0	-	-	-	✓	12.3	80	CXI60480F12	—	—	—	271.2 (123)
MEDIUM DENSITY - INCOLOY SHEATH													
144	1195	47.0	-	-	-	✓	4.6	30	CXF48144F12	—	—	—	238.1 (108)
162	1195	47.0	-	-	-	✓	4.6	30	CXF54162F12	—	—	—	255.7 (116)
180	1195	47.0	-	-	-	✓	4.6	30	CXF60180F12	—	—	—	271.2 (123)
LOW DENSITY - INCOLOY SHEATH													
96	1195	47.0	-	✓	✓	✓	3.1	20	CXF4896F12	—	—	—	238.1 (108)
108	1195	47.0	-	-	✓	✓	3.1	20	CXF54108F12	—	—	—	255.7 (116)
120	1195	47.0	-	-	-	✓	3.1	20	CXF60120F12	—	—	—	271.2 (123)

TO ORDER SPECIFY: Quantity, catalog number, voltage, phase, wattage and special features.

14" Flange Heaters

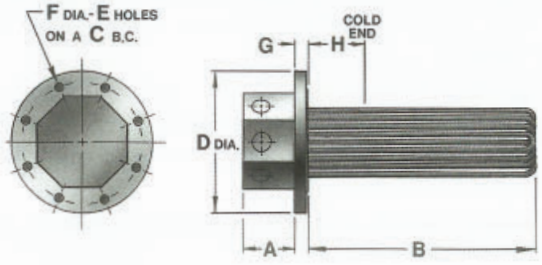
Selection

Type CXC heaters are used primarily for heating water and have copper sheathed elements silver brazed to a steel flange.

Type CXI heaters may also be used to heat water, especially in hot water and steam boilers. These heaters are also suitable for heating mildly corrosive solutions in rinse tanks, spray washers, etc.

Heaters consist of incoloy sheathed elements silver brazed to a steel flange.

Type CXF heaters are constructed of similar materials to CXI heaters except that the heating elements have much lower watt densities. These heaters are especially suited to heating oils, gases and mildly corrosive liquids. Select the lower density CXF heaters for stagnant or heavy oils or for high temperature, low flow gas heating.



HEATER DIMENSIONS IN INCHES

FLANGE SIZE	FLANGE RATING	A	C	D	E	F	G	H
14"	150 lb.	8	18 3/4	21	12	1 1/8	1 3/8	9 3/4
	300 lb.	8	20 1/4	23	20	1 1/4	2 1/8	9

TABLE 9 - 14" - 150 LB. STEEL FLANGE HEATERS

KILO-WATTS	IMMERSION LENGTH 'B' mm	in.	STD VOLTAGES 208, 240 1ϕ	208, 240 3ϕ	480, 600 1ϕ	480, 600 3ϕ	WATT DENSITY W/cm²	W/in²	WITHOUT THERMOSTAT CAT. NO.	PART NO.	WITH THERMOSTAT 10 - 120°C (50 - 250°F) CAT. NO.	PART NO.	NET WT. LBS (KG)
14" - 150 LB. STEEL FLANGE HEATERS													
HIGH DENSITY - COPPER SHEATH													
300	995	39.2	-	-	-	✓	9.8	63	CXC60300F14	—	—	—	286.6 (130)
360	1195	47.0	-	-	-	✓	9.3	60	CXC60360F14	—	—	—	313.1 (142)
432	1195	47.0	-	-	-	✓	9.3	60	CXC72432F14	—	—	—	343.9 (156)
504	1195	47.0	-	-	-	✓	9.3	60	CXC84504F14	—	—	—	377.0 (171)
HIGH DENSITY - INCOLOY SHEATH													
300	995	39.2	-	-	-	✓	9.8	63	CXI60300F14	—	—	—	286.6 (130)
360	1195	47.0	-	-	-	✓	9.3	60	CXI60360F14	—	—	—	313.1 (142)
432	1195	47.0	-	-	-	✓	9.3	60	CXI72432F14	—	—	—	343.9 (156)
504	1195	47.0	-	-	-	✓	9.3	60	CXI84504F14	—	—	—	377.0 (171)
576	1195	47.0	-	-	-	✓	12.3	80	CXI72576F14	—	—	—	343.9 (156)
672	1195	47.0	-	-	-	✓	12.3	80	CXI84672F14	—	—	—	377.0 (171)
MEDIUM DENSITY - INCOLOY SHEATH													
180	1195	47.0	-	-	-	✓	4.6	30	CXF60180F14	—	—	—	313.1 (142)
216	1195	47.0	-	-	-	✓	4.6	30	CXF72216F14	—	—	—	343.9 (156)
252	1195	47.0	-	-	-	✓	4.6	30	CXF84252F14	—	—	—	377.0 (171)
LOW DENSITY - INCOLOY SHEATH													
120	1195	47.0	-	-	-	✓	3.1	20	CXF60120F14	—	—	—	313.1 (142)
144	1195	47.0	-	-	-	✓	3.1	20	CXF72144F14	—	—	—	343.9 (156)
168	1195	47.0	-	-	-	✓	3.1	20	CXF84168F14	—	—	—	377.0 (171)

TO ORDER SPECIFY: Quantity, catalog number, voltage, phase, wattage and special features.

Special Features

VOLTAGE
Custom built flange heaters are available in any special voltage rating up to 600V max.

WATTAGE
Special wattage units are available to replace your present heater with a similar Caloritech™ unit.

LENGTH
Heaters are available with immersed lengths up to 3430 mm (135"). Internal vessel support is recommended when immersed length exceeds 1275 mm (50").

EXTRA HEAVY WALL SHEATH
Standard sheath wall thickness is .035". Heavy wall sheath with a thickness of .049" or .065" is available in incoloy, inconel, steel and stainless steel sheaths.

FLANGE SIZES AND RATINGS
Can install elements in virtually any size or rating of flange, special or standard.

FLEXITALLIC GASKET
Stainless steel flexitallic gaskets are available for all flange sizes.

SPECIAL MATERIALS
Special sheath, flange and terminal box materials are available on request.

PASSIVATION
Incoloy and stainless steel sheathed heaters are available with chemically passivated sheaths which will provide superior corrosion resistance in most applications. Passivation is achieved through an electropolishing technique.

Heaters with stainless steel flanges are available with all wetted surfaces passivated.

WELDED ELEMENTS
Standard flange heaters listed have the elements silver brazed to the flange which suits most applications. can provide heaters with elements welded to the flange for all sheath materials except copper.

BUILT-IN THERMOSTAT WELL
Built-in thermostat wells are available. Specify length and internal diameter required.

BUILT-IN LIMITS AND THERMOSTATS
Built-in high limits and thermostats are available.

Standard built-in thermostat is a one pole device limited to 240V 25 amp. Whenever the heater voltage exceeds 240V or the heater current exceeds 25 amps or for three phase supply, the thermostat is intended for pilot duty only and is not factory wired to the elements. See Section F of the Caloritech™ catalog for selection of the contactor and control transformer you may require in these instances.

BUILT-IN THERMOCOUPLES
Integrally mounted thermocouples can be provided for sheath limit protection or temperature control of the fluid.

VENTED OR STILTED HOUSINGS
Vented or stilted terminal housings are required in many high temperature applications to ensure that connection wire is not overheated.

SPECIAL TERMINAL HOUSINGS
Moisture resistant and/or explosion resistant terminal housings are available for all flange heater types. When ordering an explosion-proof housing specify Class, Div. (or Zone), Group and Temp. Code for the hazardous location. See Figs. 1 to 4.

FIG. 1

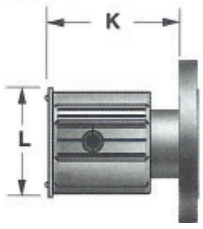


FIG. 2

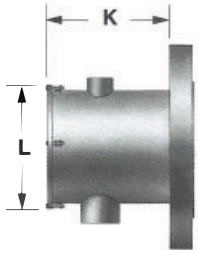
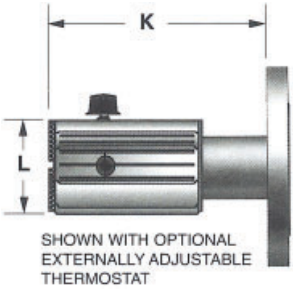
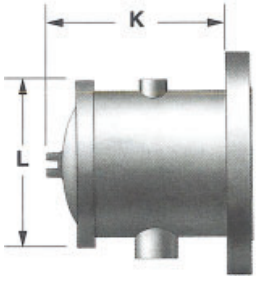


FIG. 3



SHOWN WITH OPTIONAL EXTERNALLY ADJUSTABLE THERMOSTAT

FIG. 4



	FLG. SIZE	FIG. NO.	NO THERMOSTAT K	NO THERMOSTAT L	WITH THERMOSTAT K	WITH THERMOSTAT L
MOISTURE RESISTANT	2 1/2"	1	4 3/4"	4 1/4"	8 1/2"	4 1/4"
	3 "	1	4 3/4"	4 1/4"	8 1/2"	4 1/4"
	4 "	1	5 1/8"	6 "	8 1/2"	6 "
	5 "	2	7 "	9 1/4"	—	—
	6 "	2	7 "	10 1/8"	—	—
	8 "	2	9 "	12 1/8"	—	—
	10 "	2	9 "	14 3/4"	—	—
	12 "	2	9 "	16 3/4"	—	—
	14 "	2	9 "	18 3/4"	—	—
EXPLOSION RESISTANT	2 1/2"	3	5 3/4"	4 "	9 1/4"	4 "
	3 "	3	5 3/4"	4 "	9 1/4"	4 "
	4 "	3	6 1/8"	5 5/8"	9 1/4"	5 5/8"
	5 "	4	7 1/2"	7 1/2"	—	—
	6 "	4	7 1/2"	9 "	—	—
	8 "	4	8 1/8"	11 "	—	—
	10 "	4	10 1/8"	13 1/2"	—	—
	12 "	4	10 1/8"	15 1/2"	—	—
	14 "	4	10 1/8"	17 1/2"	—	—

For S.I. conversion to metric multiply by 25.4

Over-the-Side Immersion Heaters Type DX

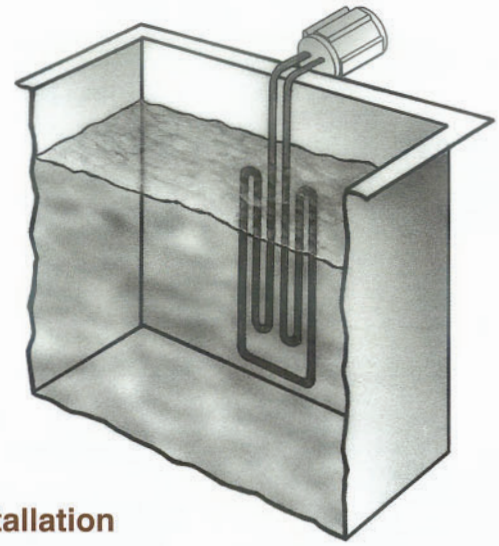
Application

Side mount immersion heaters are for use in solutions requiring easy removal of heaters for cleaning or inspection.

Single phase or three phase heaters are available. Refer to the Corrosion Guide (Section D) to assist in the selection of the heater most suited to your conditions.

Refer to Section D to select the heater with a watt density suitable to your application. Lower watt densities normally provide longer service life.

Also refer to pages B28 and B29 for quartz and teflon sheathed heaters for use in highly active solutions.



Installation

During installation the heated section (See Figure 1 and 2) of the heater must always remain totally immersed or the heater may fail.

When determining your minimum liquid level be sure to make allowance for loss of solution volume by evaporation and removal of work.

TYPE DXC - Used mainly for heating water or water solutions which will not corrode copper.

TYPES DXI, DXS - Type DXI heaters are used in water rinse tanks with contaminants which would be corrosive to copper. Type DXS and DXI are also suitable for use in oil based solutions or other chemical solutions which would not be corrosive to stainless or incoloy.

TYPES DXN, DXT - These high grade inconel® or titanium sheathed heaters are frequently used when copper, stainless or incoloy sheathed heaters are unsuitable. Check the Corrosion Guide in Section D for further information.

Note that the type DXT titanium sheathed heater does not have stand-off brackets.

TABLE 1 - SINGLE ELEMENT TYPE OVER-THE-SIDE IMMERSION (FIGURE 1)

STANDARD VOLTS: 208, 240, 480, 600 (1 PHASE)

KW	SHEATH	WATT DENSITY W/in²	WATT DENSITY W/cm²	CAT. NO.	PART NO.	NET WT. LBS (KG)
3	Copper	19	2.9	DXC1030	RTC-30	8.8 (4)
5	Copper	32	5.0	DXC1050	RTC-50	8.8 (4)
7.5	Copper	48	7.4	DXC1075	RTC-75	8.8 (4)
3	304 S.S.	19	2.9	DXS1030	RTSS-30	8.8 (4)
5	304 S.S.	32	5.0	DXS1050	RTSS-50	8.8 (4)
7.5	304 S.S.	48	7.4	DXS1075	RTSS-75	8.8 (4)
3	Incoloy	19	2.9	DXI1030	RTI-30	8.8 (4)
5	Incoloy	32	5.0	DXI1050	RTI-50	8.8 (4)
7.5	Incoloy	48	7.4	DXI1075	RTI-75	8.8 (4)
3	Inconel	19	2.9	DXN1030	RTIL-30	8.8 (4)
5	Inconel	32	5.0	DXN1050	RTIL-50	8.8 (4)
7.5	Inconel	48	7.4	DXN1075	RTIL-75	8.8 (4)
3	Titanium	19	2.9	DXT1030	RTT-30	8.8 (4)
5	Titanium	32	5.0	DXT1050	RTT-50	8.8 (4)
7.5	Titanium	48	7.4	DXT1075	RTT-75	8.8 (4)

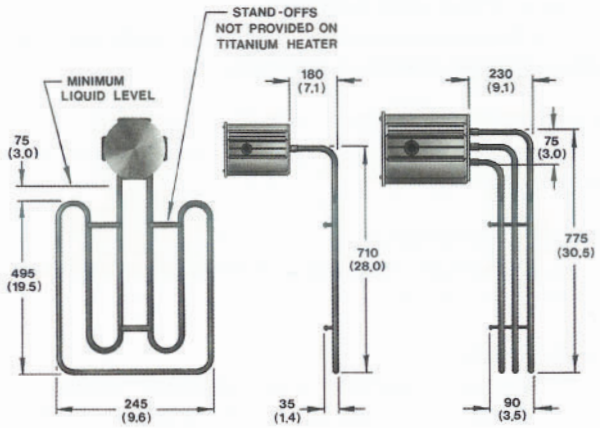


FIG. 1 FIG. 2

NOTE: Special dimensions are available.

TABLE 2 - THREE ELEMENT TYPE OVER-THE-SIDE IMMERSION (FIGURE 2)

STANDARD VOLTS: 208, 240, 480, 600 (1 or 3 PHASE)

KW	SHEATH	WATT DENSITY W/in²	WATT DENSITY W/cm²	CAT. NO.	PART NO.	NET WT. LBS (KG)
9	Copper	19	2.9	DXC3090	—	22.0 (10)
15	Copper	32	5.0	DXC3150	—	22.0 (10)
22.5	Copper	48	7.4	DXC3225	—	22.0 (10)
9	304 S.S.	19	2.9	DXS3090	—	22.0 (10)
15	304 S.S.	32	5.0	DXS3150	—	22.0 (10)
22.5	304 S.S.	48	7.4	DXS3225	—	22.0 (10)
9	Incoloy	19	2.9	DXI3090	—	22.0 (10)
15	Incoloy	32	5.0	DXI3150	—	22.0 (10)
22.5	Incoloy	48	7.4	DXI3225	—	22.0 (10)
9	Inconel	19	2.9	DXN3090	—	22.0 (10)
15	Inconel	32	5.0	DXN3150	—	22.0 (10)
22.5	Inconel	48	7.4	DXN3225	—	22.0 (10)

TO ORDER SPECIFY:
Quantity, catalog no., voltage, phase and wattage.

Type DX

Application

Caloritech™ bottom mount heaters are available as standard in copper or incoloy sheaths for use in most liquid heating applications. Check the construction details listed below and also Section D of the Caloritech™ catalog for watt density and sheath selection.

Construction

Types DXLC and DXRC heaters have copper sheathed heating elements silver brazed to a welded 304 stainless steel box and riser.

Types DXLI and DXRI heaters feature high density incoloy sheathed heating elements and 304 stainless steel immersed parts in a fully welded construction.

Types DXLF and DXRF heaters feature low density incoloy sheathed heating elements and steel immersed parts in a fully welded construction.

Special Features (ordered separately)

- Special wattage or voltage
- Special riser height
- Special materials
- Multiple rows of elements for higher wattages
- Built-in thermostat or high limit controller
- 4" sludge legs
- Passivation for incoloy and stainless steel sheath
- Explosion-proof construction

BOX TYPE	NO THERMOSTAT K	NO THERMOSTAT L	WITH THERMOSTAT K	WITH THERMOSTAT L
MOISTURE RESISTANT (STANDARD)	3 1/2"	4 1/4"	6 1/4"	6"
EXPLOSION-PROOF	4 3/4"	4"	7"	5 5/8"

FIG. 3

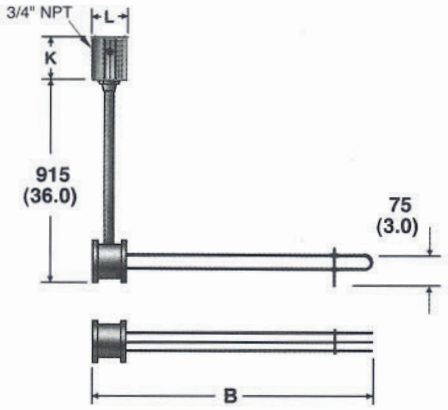


FIG. 4

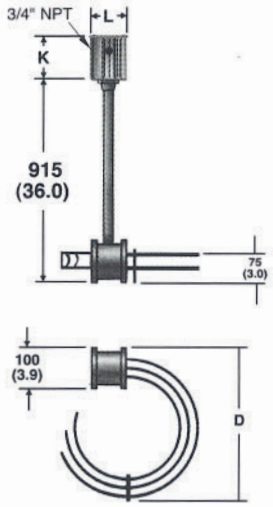


TABLE 3 - OVER-THE-SIDE HEATERS - FIGURES 3 & 4

STANDARD VOLTS: 208, 240, 480, 600 (1 or 3 PHASE)

KW	DIMENSIONS B (FIG. 3) mm	B (FIG. 3) in.	D (FIG. 4) mm	D (FIG. 4) in.	SHEATH MATERIAL	WATT DENSITY W/cm²	WATT DENSITY W/in.²	FIGURE 3 CATALOG NUMBER	FIGURE 3 PART NUMBER	FIGURE 4 CATALOG NUMBER	FIGURE 4 PART NUMBER	NET WT. LBS (KG)
3	315	12.4	—	—	Copper	8.1	53	DXLC3030	TLC-330-1	—	KTLC-330-1	11.0 (5)
6	565	22.2	400	15.7	Copper	9.3	60	DXLC3060	TLC-360-1	DXRC3060	KTLC-360-1	11.0 (5)
9	765	30.1	440	17.3	Copper	8.5	55	DXLC3090	TLC-390-1	DXRC3090	KTLC-390-1	13.2 (6)
12	940	37.0	480	18.9	Copper	8.4	54	DXLC3120	TLC-312-1	DXRC3120	KTLC-312-1	13.2 (6)
15	1115	43.9	520	20.5	Copper	8.4	54	DXLC3150	TLC-315-1	DXRC3150	KTLC-315-1	15.4 (7)
18	1315	51.8	560	22.0	Copper	8.2	53	DXLC3180	TLC-318-1	DXRC3180	KTLC-318-1	15.4 (7)
3	315	12.4	—	—	Incoloy	8.1	53	DXLI3030	TLI-330-1	—	KTLI-330-1	11.0 (5)
6	565	22.2	400	15.7	Incoloy	9.3	60	DXLI3060	TLI-360-1	DXRI3060	KTLI-360-1	11.0 (5)
9	765	30.1	440	17.3	Incoloy	8.5	55	DXLI3090	TLI-390-1	DXRI3090	KTLI-390-1	13.2 (6)
12	940	37.0	480	18.9	Incoloy	8.4	54	DXLI3120	TLI-312-1	DXRI3120	KTLI-312-1	13.2 (6)
15	1115	43.9	520	20.5	Incoloy	8.4	54	DXLI3150	TLI-315-1	DXRI3150	KTLI-315-1	15.4 (7)
18	1315	51.8	560	22.0	Incoloy	8.2	53	DXLI3180	TLI-318-1	DXRI3180	KTLI-318-1	15.4 (7)
3	565	22.2	400	15.7	Incoloy	4.6	30	DXLF3030	TLO-330-1	DXRF3030	KTLO-330-1	11.0 (5)
6	940	37.0	480	18.9	Incoloy	4.2	27	DXLF3060	TLO-360-1	DXRF3060	KTLO-360-1	13.2 (6)
9	1315	51.8	560	22.0	Incoloy	4.1	26	DXLF3090	TLO-390-1	DXRF3090	KTLO-390-1	15.4 (7)
3	940	37.0	480	18.9	Incoloy	2.1	14	DXLF3030-1	—	DXRF3030-1	—	11.0 (5)
4.5	1115	43.9	520	20.5	Incoloy	2.5	16	DXLF3045	—	DXRF3045	—	13.2 (6)
6	1315	51.8	560	22.0	Incoloy	2.7	18	DXLF3060-1	—	DXRF3060-1	—	15.4 (7)

TO ORDER SPECIFY: Quantity, catalog no., voltage, phase and wattage.

Type HX and 6HX - Teflon Sleeved

The HX and 6HX series electric immersion heaters feature the robust Caloritech™ incoloy sheathed heating element. The elements are covered with a tightly fitted 0.030" (0.76 mm) teflon® tube. The HX element is wound into a space saving spiral configuration, while the 6HX is made from six U-shaped elements to give single or three phase heating in a compact space.

A polypropylene guard is supplied as standard on all heaters. The easy-access terminal housing, made from flame retardant polypropylene, provides a vapour tight construction. The terminal box is fitted with a 36" (914 mm) liquid tight and acid resistant flexible conduit with lead wires. A positive metal ground is provided for a safe installation.

All quartz heaters are supplied with a field replaceable "one time" thermal fuse designed to protect the heater from burn-out on low liquid levels.

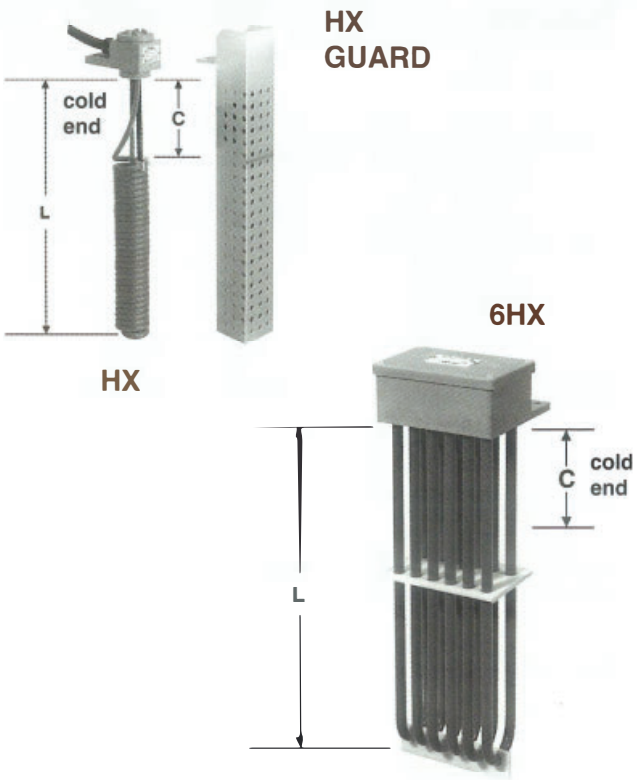


TABLE 1 - TYPE HX - 10 W/in.²

KW	cold section C in.	C (mm)	L in.	L (mm)	VOLTS	CATALOG NUMBER
1	5	(127)	11	(279)	120	HX-1111C
					240	HX-1211C
2	7	(178)	17	(432)	120	HX-2117C
					240	HX-2217C
					480	HX-2417C
					600	HX-2617C
3	9	(229)	23	(584)	240	HX-3223C
					480	HX-3423C
					600	HX-3623C
4	11	(279)	29	(737)	240	HX-4229C
					480	HX-4429C
					600	HX-4629C
5	12	(305)	35	(889)	240	HX-5235C
					480	HX-5435C
					600	HX-5635C
6	13	(330)	40	(1016)	240	HX-6240C
					480	HX-6440C
					600	HX-6640C

TO ORDER SPECIFY:
Quantity, catalog no., voltage, phase and wattage.

TABLE 2 - TYPE 6HX - 10 W/in.²

KW	cold section C in.	C (mm)	L in.	L (mm)	VOLTS	CATALOG NUMBER
2	8	(203)	17	(432)	240	6HX-2217C
					480	6HX-2417C
					600	6HX-2617C
3	8	(203)	23	(584)	240	6HX-3223C
					480	6HX-3423C
					600	6HX-3623C
4	8	(203)	29	(737)	240	6HX-4229C
					480	6HX-4429C
					600	6HX-4629C
6	8	(203)	35	(889)	240	6HX-6235C
					480	6HX-6435C
					600	6HX-6635C
8	9	(229)	47	(1194)	240	6HX-8247C
					480	6HX-8447C
					600	6HX-8647C
10	12	(305)	59	(1499)	240	6HX-10259C
					480	6HX-10459C
					600	6HX-10659C
12	13	(330)	68	(1727)	240	6HX-12268C
					480	6HX-12468C
					600	6HX-12668C

Type QM and 3QM Quartz Immersion Heaters

The QM and 3QM series immersion heaters feature robust Caloritech™ incoloy elements. The field replaceable element assembly is inserted into a quartz tube which is protected by a polypropylene guard. The 3QM has three element/quartz tube assemblies inside a common guard.

The easy access terminal housing, made from flame retardant polypropylene, provides a vapour tight construction. The terminal box is fitted with a 36" (914 mm) liquid tight and acid resistant flexible conduit with lead wires. A positive metal ground is provided for a safe installation. All quartz heaters are supplied with a "one time" thermal fuse designed to protect the heater from burn-out on low liquid levels.

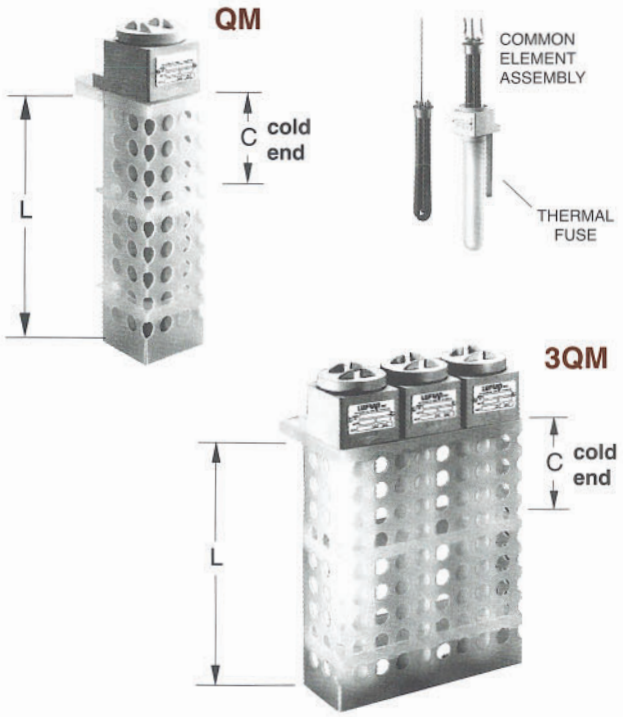


TABLE 3 - MODEL QM SINGLE ELEMENT - 26 W/in.²

KW	cold section C in.	C (mm)	L in.	L (mm)	VOLTS	CATALOG NUMBER
1	4	(102)	11	(279)	120 240	QM-1111C QM-1211C
2	5	(127)	17	(432)	240 480 600	QM-2217C QM-2417C QM-2617C
3	5	(127)	23	(584)	240 480 600	QM-3223C QM-3423C QM-3623C
3.5	8	(203)	29	(737)	240 480 600	QM-35229C QM-35429C QM-35629C
4	7	(178)	35	(889)	240 480 600	QM-4235C QM-4435C QM-4635C
5	8	(203)	41	(1041)	240 480 600	QM-5241C QM-5441C QM-5641C
6	8	(203)	47	(1194)	240 480 600	QM-6247C QM-6447C QM-6647C
8	10	(254)	59	(1499)	240 480 600	QM-8259C QM-8459C QM-8659C
10	9	(229)	71	(1803)	240 480 600	QM-10271C QM-10471C QM-10671C

TABLE 4 - MODEL 3QM TRIPLE ELEMENT - 26 W/in.²

KW	cold section C in.	C (mm)	L in.	L (mm)	VOLTS	CATALOG NUMBER
3	4	(102)	11	(279)	120 240	3QM-3111C 3QM-3211C
6	5	(127)	17	(432)	240 480 600	3QM-6217C 3QM-6417C 3QM-6617C
9	5	(127)	23	(584)	240 480 600	3QM-9223C 3QM-9423C 3QM-9623C
10.5	8	(203)	29	(737)	240 480 600	3QM-105229C 3QM-105429C 3QM-105629C
12	7	(178)	35	(889)	240 480 600	3QM-12235C 3QM-12435C 3QM-12635C
15	8	(203)	41	(1041)	240 480 600	3QM-15241C 3QM-15441C 3QM-15641C
18	8	(203)	47	(1194)	240 480 600	3QM-18247C 3QM-18447C 3QM-18647C
24	10	(254)	59	(1499)	240 480 600	3QM-24259C 3QM-24459C 3QM-24659C
30	9	(229)	71	(1803)	240 480 600	3QM-30271C 3QM-30471C 3QM-30671C

TO ORDER SPECIFY:
Quantity, catalog no., voltage, phase and wattage.

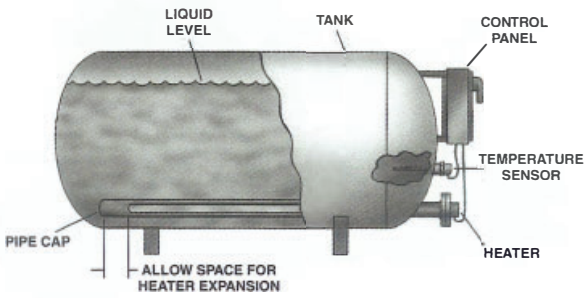
Pipe-Insert Heaters Type MX

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.

FIG. 1 - 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. 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" minimum inside diameter. Fit 3" standard pipe flanges or 2" 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 (Figures 2-4) 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 1).

TABLE 1 - WATT DENSITY ON PIPE SURFACE vs. HEATER TYPE

PIPE SIZE	WATTS/SQ.IN. ON PIPE		
	1 ELEM. TYPE	2 ELEM. TYPE	3 ELEM. TYPE
2"	5.5	7.4	6.8
2 1/2"	4.6	6.2	5.7
3"	3.8	5.1	4.7
4"	3.0	4.0	3.7

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

SOLVING HEATING PROBLEMS USING FIGS. 2 TO 4:

STEP 1 Use tank diameter and length and Figure 2 to determine tank surface area.

STEP 2 Using Figure 3, surface area, and maximum design temperature difference between tank contents and surroundings, the heat loss can be determined for 2" or 4" of insulation.

STEP 3 Figure 4 for 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.

FIG. 2 - TANK SURFACE AREA vs. LENGTH

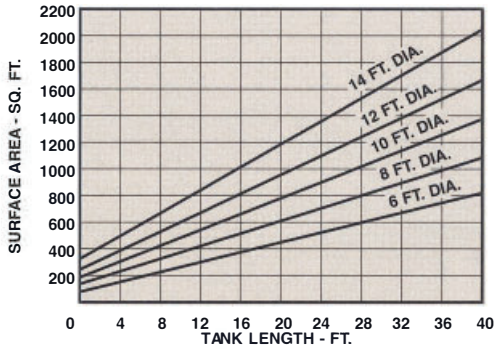


FIG. 3 - TANK SURFACE AREA vs. RECOMMENDED INSTALLED KILOWATTS

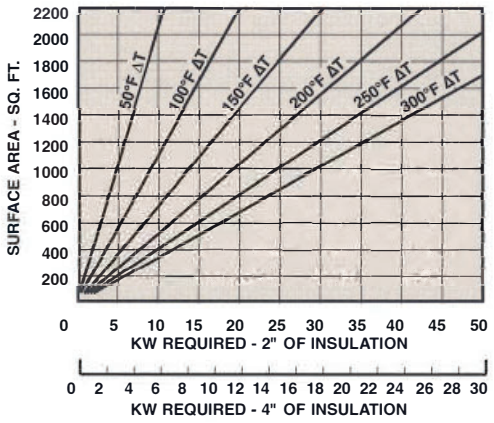
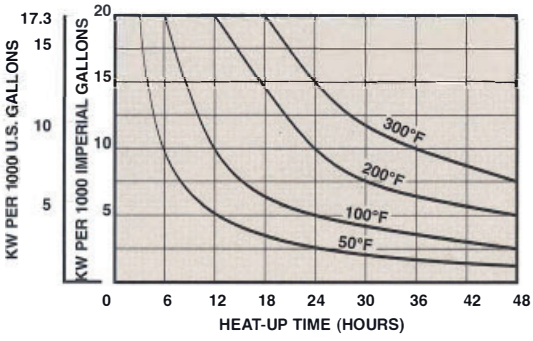


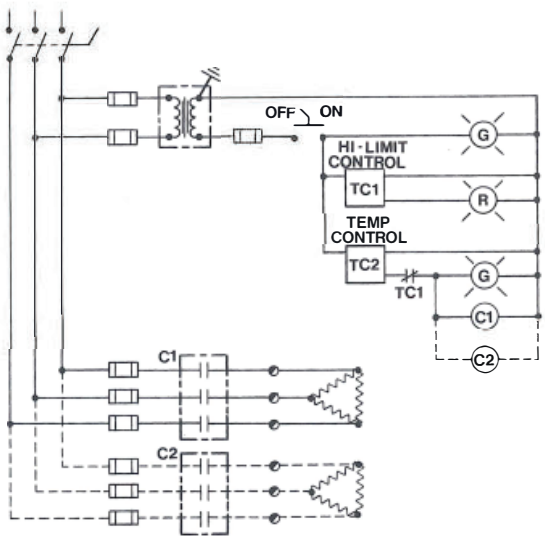
FIG. 4 - TANK CAPACITY vs. HEAT-UP TIME FOR ASPHALT



Control Systems

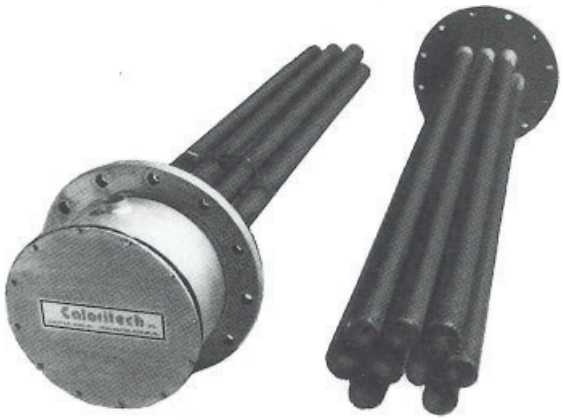
manufactures standard and custom designed control panels for pipe insert heating systems. See Section D for listings of CPA, CPB and CPP panels.

FIG. 5 - 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.

Pipe-Insert Heaters Type MX

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.

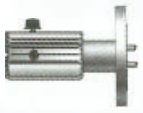
If these liquids require heating, careful consideration must be given to the rate at which heat is being introduced into the product since coking of the liquid at the heating surface could spoil the entire tank contents. Electric pipe-insert heaters eliminate the need for high maintenance pumps or open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

Refer to pages B30 and B31 for detailed information on the construction and use of pipe-insert heaters. Table 1 on page B30 gives the resultant watt density (watts per sq. in. of surface area) on 2" to 4" 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. Page B14 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

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 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

3" - 150 LB. FLANGE - ONE HAIRPIN ELEMENT

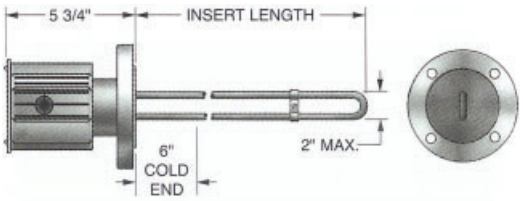


TABLE 1 - 3" - 150 LB. FLANGE - ONE HAIRPIN ELEMENT

KW	STD. VOLTS (1ϕ Only)	INSERT LENGTH mm (in.)	WITHOUT T/C CATALOG NUMBER	WITHOUT T/C PART NUMBER	WITH 'K' TYPE T/C CATALOG NUMBER	WITH 'K' TYPE T/C PART NUMBER
3	208, 240 480, 600	1900 (74.8)	MXI103F3	TMP-3-103	MXIK103F3	TMP-3-103-2
4	"	2500 (98.4)	MXI104F3	TMP-3-104	MXIK104F3	TMP-3-104-2
5	"	3100(122.0)	MXI105F3	TMP-3-105	MXIK105F3	TMP-3-105-2
6	480, 600	3400(133.9)	MXI106F3133	TMP-3-106	MXIK106F3133	TMP-3-106-2
6	"	3700(145.7)	MXI106F3	—	MXIK106F3	—
7	"	4300(169.3)	MXI107F3169	TMP-3-107	MXIK107F3169	TMP-3-107-2
7	"	4600(181.1)	MXI107F3	—	MXIK107F3	—
8	"	4900(192.9)	MXI108F3	TMP-3-108	MXIK108F3	TMP-3-108-2
9	"	5500(216.5)	MXI109F3	TMP-3-109	MXIK109F3	TMP-3-109-2
10	"	6100(240.2)	MXI110F3	TMP-3-110	MXIK110F3	TMP-3-110-2
11	"	6700(263.8)	MXI111F3	TMP-3-111	MXIK111F3	TMP-3-111-2
12	"	7300(287.4)	MXI112F3	TMP-3-112	MXIK112F3	TMP-3-112-2
13	"	7900(311.0)	MXI113F3	TMP-3-113	MXIK113F3	TMP-3-113-2
14	600	8500(334.6)	MXI114F3	—	MXIK114F3	—
15	"	9100(358.3)	MXI115F3	—	MXIK115F3	—
15	"	10800(425.2)	MXI115F3425	—	MXIK115F3425	—

TO ORDER SPECIFY:
Quantity, catalog no., voltage, wattage and special features.

3" - 150 LB. FLANGE - TWO HAIRPIN ELEMENTS

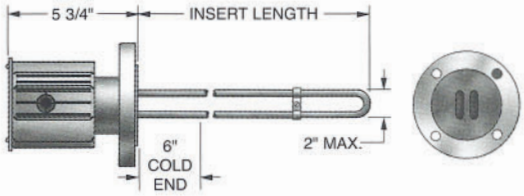


TABLE 2 - 3" - 150 LB. FLANGE - TWO HAIRPIN ELEMENTS

KW	STD. VOLTS (1ϕ Only)	INSERT LENGTH mm (in.)	WITHOUT T/C CATALOG NUMBER	WITHOUT T/C PART NUMBER	WITH 'K' TYPE T/C CATALOG NUMBER	WITH 'K' TYPE T/C PART NUMBER
3	208, 240 480, 600	1400 (55.1)	MXI203F3	—	MXIK203F3	—
4	"	1800 (70.9)	MXI204F3	—	MXIK204F3	—
5	"	2200 (86.6)	MXI205F3	—	MXIK205F3	—
6	"	2600(102.4)	MXI206F3	—	MXIK206F3	—
7	"	3000(118.1)	MXI207F3	—	MXIK207F3	—
8	"	3400(133.9)	MXI208F3	—	MXIK208F3	—
10	480, 600	4200(165.4)	MXI210F3	—	MXIK210F3	—
12	"	5000(196.9)	MXI212F3	—	MXIK212F3	—
14	"	5800(228.3)	MXI214F3	—	MXIK214F3	—
16	"	6600(259.8)	MXI216F3	—	MXIK216F3	—

3" - 150 LB. FLANGE - THREE STRAIGHT ELEMENTS

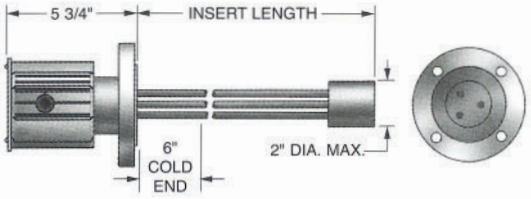


TABLE 3 - 3" - 150 LB. FLANGE - THREE STRAIGHT ELEMENTS

KW	STD. VOLTS (3ϕ Only)	INSERT LENGTH mm (in.)	WITHOUT T/C CATALOG NUMBER	WITHOUT T/C PART NUMBER	WITH 'K' TYPE T/C CATALOG NUMBER	WITH 'K' TYPE T/C PART NUMBER
2	208, 240 480, 600	1150 (45.3)	MXI302F3	—	MXIK302F3	—
3	"	1625 (64.0)	MXI303F3	—	MXIK303F3	—
4	"	2100 (82.7)	MXI304F3	—	MXIK304F3	—
5	"	2575(101.4)	MXI305F3	—	MXIK305F3	—
6	"	3050(120.1)	MXI306F3	—	MXIK306F3	—
7	480, 600	3525(138.8)	MXI307F3	—	MXIK307F3	—
8	"	4000(157.5)	MXI308F3	—	MXIK308F3	—
9	"	4475(176.2)	MXI309F3	—	MXIK309F3	—
10	"	4950(194.9)	MXI310F3	—	MXIK310F3	—
11	"	5425(213.6)	MXI311F3	—	MXIK311F3	—
12	"	5900(232.3)	MXI312F3	—	MXIK312F3	—
13	"	6375(251.0)	MXI313F3	—	MXIK313F3	—
14	"	6850(269.7)	MXI314F3	—	MXIK314F3	—
15	"	7325(288.4)	MXI315F3	—	MXIK315F3	—

TO ORDER SPECIFY: Quantity, catalog no., voltage, phase, wattage and special features.

2" NPT SCREWPLUG - ONE HAIRPIN ELEMENT

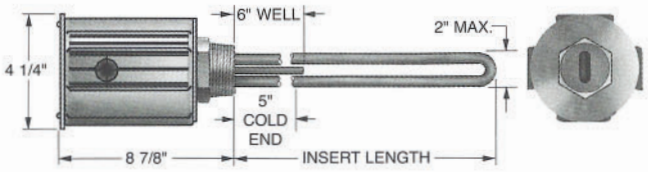


TABLE 4 - 2" NPT SCREWPLUG - ONE HAIRPIN ELEMENT

KW	STD. VOLTS (1ϕ Only)	INSERT LENGTH mm (in.)	WITH T'STAT WELL CAT NO.	WITH T'STAT WELL PART NO.	WITH 'K' TYPE T/C CAT NO.	WITH 'K' TYPE T/C PART NO.
3	208, 240 480, 600	1900 (74.8)	MXI130P2	MTP-230-1	MXIK130P2	MTP-230-2
4	"	2500 (98.4)	MXI140P2	MTP-240-1	MXIK140P2	MTP-240-2
5	"	3100(122.0)	MXI150P2	MTP-250-1	MXIK150P2	MTP-250-2
6	480, 600	3400(133.9)	MXI160P2	—	MXIK160P2	—

2" NPT SCREWPLUG - TWO HAIRPIN ELEMENTS

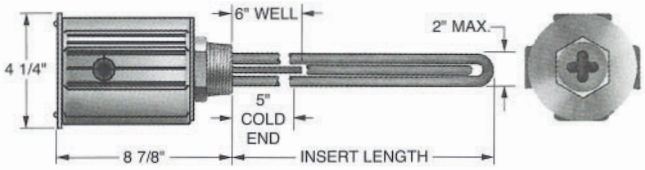


TABLE 5 - 2" NPT SCREWPLUG - TWO HAIRPIN ELEMENTS

KW	STD. VOLTS (1ϕ Only)	INSERT LENGTH mm (in.)	WITH T'STAT WELL CAT NO.	WITH T'STAT WELL PART NO.	WITH 'K' TYPE T/C CAT NO.	WITH 'K' TYPE T/C PART NO.
3	208, 240 480, 600	1400 (55.1)	MXI230P2	—	MXIK230P2	—
4	"	1800 (70.9)	MXI240P2	—	MXIK240P2	—
5	"	2200 (86.6)	MXI250P2	—	MXIK250P2	—
6	"	2600(102.4)	MXI260P2	—	MXIK260P2	—
7	"	3000(118.1)	MXI270P2	—	MXIK270P2	—
8	"	3400(133.9)	MXI280P2	—	MXIK280P2	—

2" NPT SCREWPLUG - THREE STRAIGHT ELEMENTS

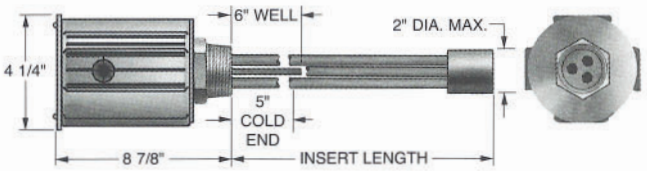


TABLE 6 - 2" NPT SCREWPLUG - THREE STRAIGHT ELEMENTS

KW	STD. VOLTS (3ϕ Only)	INSERT LENGTH mm (in.)	WITH T'STAT WELL CAT NO.	WITH T'STAT WELL PART NO.	WITH 'K' TYPE T/C CAT NO.	WITH 'K' TYPE T/C PART NO.
2	208, 240 480, 600	1150 (45.3)	MXI320P2	—	MXIK320P2	—
3	"	1625 (64.0)	MXI330P2	—	MXIK330P2	—
4	"	2100 (82.7)	MXI340P2	—	MXIK340P2	—
5	"	2575(101.4)	MXI350P2	—	MXIK350P2	—
6	"	3050(120.1)	MXI360P2	—	MXIK360P2	—

Gain and Gate Guide Heaters Type MXG

APPLICATION

These heaters are specifically designed to prevent ice build-up on sluice gate guides or bodies. The heater is usually installed in a vertical well or duct of round or square cross section having a round nozzle at the top for fastening.

CONSTRUCTION

The heaters are available in single or dual wattage, customized to specifically suit the application.

The heating elements are silver brazed into a water tight terminal housing having recessed base for mounting. Element ends are hermetically sealed to prevent moisture ingression over prolonged periods when the heaters are not in service.

Unlike open wire heaters with ceramic supports, Type MXG heaters can be coiled to a six foot diameter to facilitate shipping and handling.

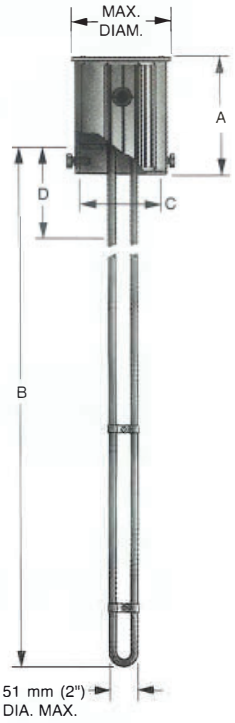


FIG. 1 - TYPE MXG HEATER

STANDARD BOX DIMENSIONS (not exactly as shown)

TYPE	DIMENSIONS A mm	A IN.	C mm	C IN.	MAXIMUM DIAMETER mm	MAXIMUM DIAMETER IN.
1	127	5	76	3	92	3 5/8
2	127	5	105	4 1/8	117	4 5/8
3	127	5	111	4 3/8	124	4 7/8

SPECIFY

Voltage and Wattage - wattage may range from 6 to 18 watts per lineal inch depending on the conditions. For extra long heaters, utilize 480V or 600V to ensure that the heater can be built.

If dual wattage is required, specify details.

Terminal Box - check the dimensions of the Fig. 1 standard terminal box shown for suitability. Other sizes and types are available.

Heating Element Dimensions - indicate insert length "B" and non-heated section "D". Allow 2% for manufacturing tolerance plus heater expansion when specifying "B" dimension.

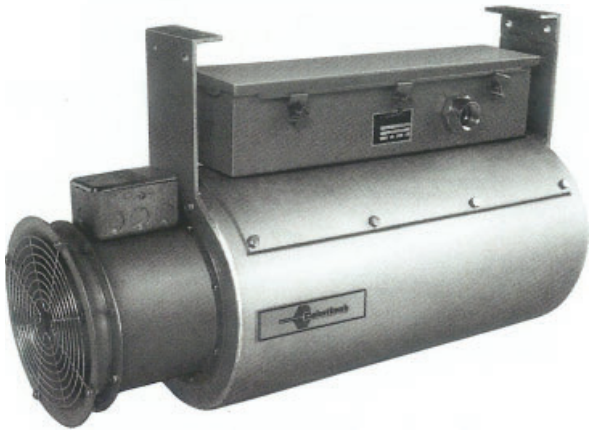
Gate Body Duct Heaters

APPLICATION

Gate body duct heaters are custom engineered by to heat the inside of the gate and prevent ice build-up on the gate walls, windseals and end members.

The heaters can be connected to a duct having outlets at various elevations within the gate.

FIG. 2 - TYPE WXG HEATER



INLET END

CONSTRUCTION

Gate body duct heaters feature a weather proof duct heater and matched motor and high static axial fan assembly installed within a galvanized heavy steel housing.

Heating elements are hermetically sealed to prevent moisture ingression over prolonged periods when the heaters are not in service.

Various control options are available such as ambient temperature sensing thermostat, outlet air temperature thermostat, limit control and differential pressure switch. Designs are available from 4.0 KW to 120 KW.

SPECIFY

Voltage, phase and wattage plus control options.

Also specify static pressure requirements of the fan assembly at the design air flow and the duct diameter.

Note that also builds control panels for sluice gate heating control. (See Section D).

Mission Statement

To be recognized as a world-wide industry leader in heating technology. We will provide our customers with the broadest industry knowledge, expertise and products in space and process heating.

To create an internal environment promoting participation, teamwork, training and development for our employees.

To deliver the highest possible quality standards and continue to build a loyal customer base through dedicated customer service.

To promote continuous improvement in all existing product lines and develop and market a wide range of quality heating products through a commitment to research and development.

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This catalog presents the products manufactured by under the Caloritech™ brand name.

Caloritech™ products are built to any one of five nationally recognized quality control standards at our modern manufacturing facilities in Oakville and Orillia, Ontario, Canada. Both of these facilities are certified ISO 9001:2000, evidence of CCI Thermal's commitment to quality. The majority of Caloritech ™ equipment (where applicable) is U.L. recognized/listed or C.S.A. approved. At we manufacture most of our own pressure vessels, we have ASME U, S, and H stamps, and we can provide National Board registration. In addition to the standard product models listed in this catalog our team of experienced engineers and designers is well equipped to handle custom projects for specific and unique applications. We have accredited design expertise to complement the custom engineered aspect of our business and we hold a corporate Certificate of Authorization from P.E.O. to practice professional engineering in the design and application of our equipment.

We invite you to visit our website at to view the broad range of innovative industrial heating products manufactured by

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Section C

Air and Space Heaters

Contents

Section C

Catalog ML350 - Section Listings

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Section B - Immersion Heaters:
screwplug heaters, domestic immersion heaters, urn heaters, flange heaters, over-the-side heaters, pipe insert heaters, gate and gain heaters.

Section C - Air and Space Heaters:
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Section D - Engineered Products:
circulation heaters, heat transfer systems, custom engineered products, panel heaters, control panels, technical data.

Section E - Boilers:
boiler flange heaters, packaged circulation heaters, boilers, calorifiers.

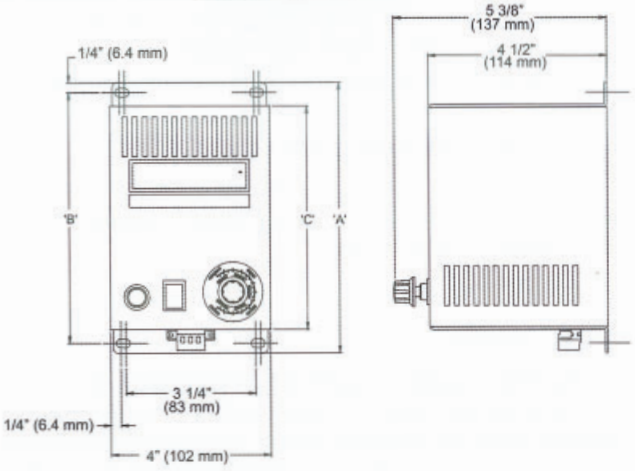
Section F - Controls:
controls, housings.

Fan-Forced Enclosure Heater Type PH

APPLICATION

Caloritech™ type PH fan-forced enclosure heaters are designed to control the environment within enclosures by maintaining a stable temperature.

Effects of low temperatures such as corrosion, freezing or condensation will adversely affect the components inside control panels. The Caloritech™ PH enclosure heater will provide optimal performance environment for the critical components contained within the control panel.



CATALOG NO.	DIMENSIONS					
	'A'		'B'		'C'	
	mm	INCH	mm	INCH	mm	INCH
PH125/PH200	140	5 1/2	127	5	105	4 1/8
PH400/PH800	191	7 1/2	178	7	157	6 3/16

FEATURES

- CSA C/US approved
- Light weight unit
- Low maintenance
- Aluminum alloy outer casing
- Externally adjustable thermostat -18°C to 38°C (0°F to 100°F)
- Pilot light for "heat-on" indication
- High temperature safety protection
- Fan on/auto switch to prolong motor life
- Terminal strip provides quick installation and accepts both stranded and solid wire
- Optional DIN rail mounts available

SELECTION

The wattage requirement is determined from a consideration of the surface area, insulation properties of the enclosure or space and the temperature difference between the ambient and the enclosure. For small enclosures (less than 100 ft^2 surface area) conservative values for heat losses areas shown in Table 1.

TABLE 1 - WATTS/FT^2 PER 10°F TEMP. DIFFERENCE

	INDOORS	OUTDOORS
UNINSULATED	5	7
INSULATED (MIN. 1")	1	1.2

Example: To find wattage requirements in an uninsulated enclosure 2' x 3' x 1', which must be held at 40°F in a 10°F outdoor ambient. Internal electrical components use 80 watts.

Surface Area = 2[(2' x 3') + (2' x 1') + (3' x 1')] = 22 ft^2
From Table 1, an uninsulated outdoor enclosure requires 7 watts for each 10°F temperature difference.

Temperature Difference = 40°F - 10°F = 30°F
Wattage Required = (30°F ÷ 10°F) x 7 x 22 = 462 watts
Heater Wattage = Wattage required less component wattage or 462 - 80 = 382 watts

Use one PH400 rated at 400 watts. For enclosures requiring more than 800 watts, two or more PH heaters may be used.

INSTALLATION

The Caloritech™ PH fan-forced enclosure heater should be installed in the center of the cabinet and as low as practicable for the best possible heat dissipation. The optimum efficiency is obtained when the unit is mounted in a vertical position allowing the top air vents to release the heated air in the most effective manner. The control panels should be sealed and free from dust and dirt. Do not install the heaters on wood, cardboard or other flammable panels. Heat sensitive components should not be placed near the heat discharge area. For larger enclosures, two or more heaters may be used.

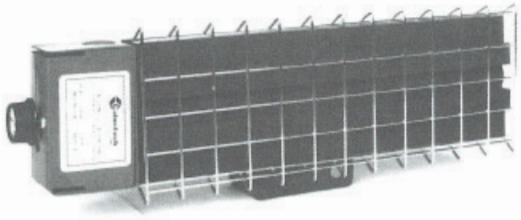
TABLE 2 - TYPE PH FAN-FORCED ENCLOSURE HEATER

Catalog Number	Watts	Voltage	Hertz	Phase	Weight Lbs.	Weight Kg
PH12511	125	120	60	1	2.2	1.0
PH12531	125	240	60	1	2.2	1.0
	105	220	50	1	2.2	1.0
PH20011	200	120	60	1	2.2	1.0
PH20031	200	240	60	1	2.2	1.0
	168	220	50	1	2.2	1.0
PH40011	400	120	60	1	3.0	1.4
PH40031	400	240	60	1	3.0	1.4
	336	220	50	1	3.0	1.4
PH80011	800	120	60	1	3.0	1.4
PH80031	800	240	60	1	3.0	1.4
	672	220	50	1	3.0	1.4

Control Panel and Pump House Heater Type PXFT

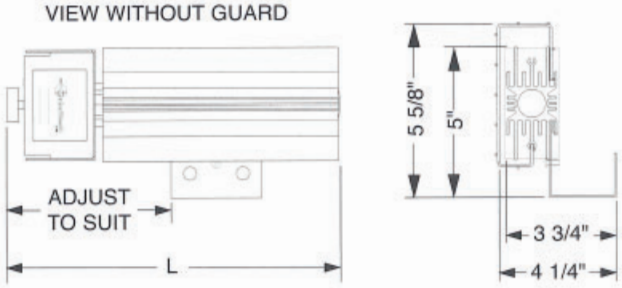
APPLICATION

The PXFT heater is designed to maintain a suitable temperature inside a control enclosure, pump house or similar space. The standard unit is not suitable for use outdoors, unprotected from the weather. All heaters have a built-in thermostat. The heater is also available without thermostat on special order.



GUARD OPTIONAL ON SOME UNITS

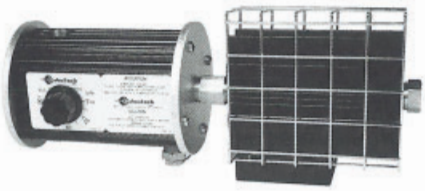
VIEW WITHOUT GUARD



FEATURES

The PXFT uses a high surface area aluminum heat emitter to eliminate the need for a fan while providing low radiation and high convection heating to the enclosure. The **thermostat rating** is 25A at 240V, S.P.S.T., adjustable from 30-120°F (0 to 50°C). A **movable bracket** allows the heater to be floor or wall mounted with the terminal box located on the left or right side, top or bottom. **Wire guards** are provided standard with the PXFT-300,400 and 600 watt heaters, and are available as an option on the PXFT-050, 125 and 200 watt units.

Moisture resistant heaters (shown below) are available on special order.



SELECTION

The wattage requirement is determined from a consideration of the surface area, insulation properties of the enclosure or space and the temperature difference between the ambient and the enclosure. For small enclosures (less than 100 ft^2 surface area) conservative values for heat losses are as shown in Table 1.

TABLE 1 - WATTS/FT^2 PER 10°F TEMP. DIFFERENCE

	INDOORS	OUTDOORS
UNINSULATED	5	7
INSULATED (MIN. 1")	1	1.2

EXAMPLE - To find wattage requirements in an uninsulated enclosure 2' x 3' x 1/2', which must be held at 40°F in a 10°F outdoor ambient.

- Surface Area = 2 (2 x 3 + 2 x 1/2 + 3 x 1/2) = 17 ft^2 From Table 1, an uninsulated outdoor enclosure requires 7 watts for each 10°F temperature difference.
- Temperature Diff. = 40°F - 10°F = 30°F
- Wattage Rating Required = (30°F / 10°F)x 7 x 17 = 357 watts

Use one PXFT400 rated at 400 watts

For enclosures requiring more than 600 watts, two or more PXFT heaters can be used. Higher wattage heaters are available. Check factory.

INSTALLATION

The PXFT heater is approved for horizontal or vertical mounting on the floor or lower wall of the enclosure. Heaters must be installed using the mounting bracket provided to ensure minimum spacing between the heater and the wall or floor. Try to maximize the spacing between the heater and temperature sensitive components.

Surface temperatures of the 50 watt and 125 watt units are about 100°C (212°F) and 170°C (338°F) respectively. The other units listed operate around 210°C (410°F).

TABLE 2 - TYPE PXFT CONTROL PANEL AND PUMP HOUSE HEATERS

WATTS	STANDARD VOLTAGES	LENGTH 'L' IN (MM)	CATALOG NUMBER*	NET WT. LBS (KG)
50	120	8 3/8 (213)	PXFT050	2.6 (1.1)
125	120	8 3/8 (213)	PXFT125	2.6 (1.1)
200	120	8 3/8 (213)	PXFT200	2.9 (1.3)
300	120, 240	15 (381)	PXFT300	3.5 (1.6)
400	120, 240	21 3/4 (553)	PXFT400	5.5 (2.5)
600	120, 240	28 1/2 (724)	PXFT600	7.5 (3.4)

* FOR UNITS WITHOUT THERMOSTAT, OMIT 'T' IN CATALOG NUMBER
INVENTORY - THESE HEATERS ARE NORMALLY STOCKED IN LIMITED QUANTITIES

TO ORDER: Specify quantity, catalog number, voltage, and special features.

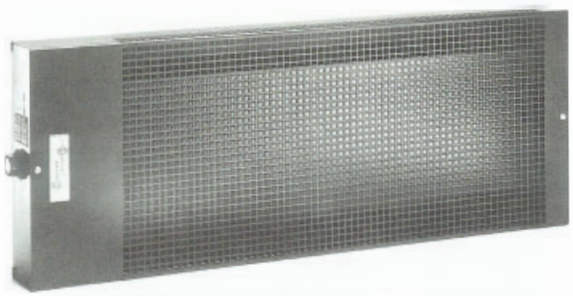
Heavy Duty Convection Heater
Type BX

APPLICATION

Caloritech™ BX type convection heaters are ideally suited for industrial applications where a rugged and dependable unit is required. Typical installations include:

- factory offices
- crane cabs
- ticket booths
- guard houses
- repair shops
- shipping rooms
- trains and streetcars

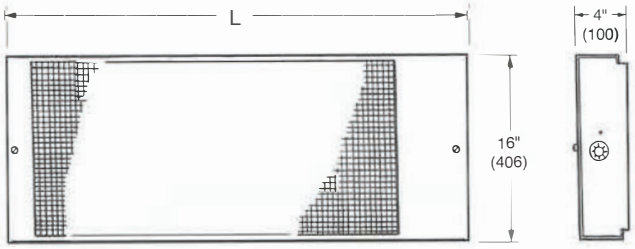
The unit is not for use in hazardous locations. manufactures heaters under the Ruffneck® and Norseman™ brand names that are approved for hazardous areas.



CONSTRUCTION

The BX heater features low density stainless steel sheathed Caloritech™ heating elements for extended life.

The perforated enclosure is **14 gauge steel** to withstand even the most hostile industrial environment. Standard finish is scratch resistant black wrinkle baked enamel.



Symmetrical design allows the terminal box to be located at the left or right side of the heater.

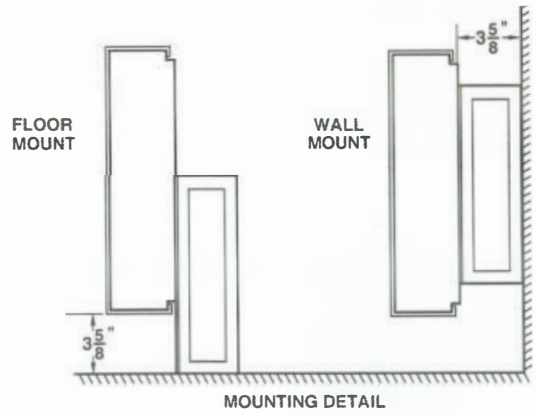
SPECIAL FEATURES

Heaters are available without controls for connection to a remote switch or with built-in thermostat.

INSTALLATION

In addition to the reversible terminal enclosure, as a further convenience, heaters include combination brackets (shipped separately) suitable for wall or floor mounting.

When installed, heaters must be spaced not less than 3 5/8" (92 mm) from floor or wall. Use supply wires suitable for 90°C.



MOUNTING DETAIL

TABLE 1 - BX CONVECTION HEATER

KW	Volts	PH	CATALOG NUMBER With Thermostat	CATALOG NUMBER Without Controls	'L' DIM	APPROX. SHIP WT.
2	120	1	BX2011ST	BX2011S		
2	208	1	BX2021ST	BX2021S		
2	240	1	BX2031ST	BX2031S	26 1/2"	30 LBS.
2	480	1	BX2071ST	BX2071S	(673)	(14 KG)
2	600	1	BX2081ST	BX2081S		
2	208	3	BX2023ST	BX2023S		
2	240	3	BX2033ST	BX2033S	26 1/2"	30 LBS.
2	480	3	BX2073ST	BX2073S	(673)	(14 KG)
2	600	3	BX2083ST	BX2083S		
2	208	1	BX2021T	BX2021		
2	240	1	BX2031T	BX2031	40"	44 LBS.
2	480	1	BX2071T	BX2071	(1016)	(20 KG)
2	600	1	BX2081T	BX2081		
2	208	3	BX2023T	BX2023		
2	240	3	BX2033T	BX2033	40"	44 LBS.
2	480	3	BX2073T	BX2073	(1016)	(20 KG)
2	600	3	BX2083T	BX2083		
3	208	1	BX3021T	BX3021		
3	240	1	BX3031T	BX3031	40"	44 LBS.
3	480	1	BX3071T	BX3071	(1016)	(20 KG)
3	600	1	BX3081T	BX3081		
3	208	3	BX3023T	BX3023		
3	240	3	BX3033T	BX3033	40"	44 LBS.
3	480	3	BX3073T	BX3073	(1016)	(20 KG)
3	600	3	BX3083T	BX3083		

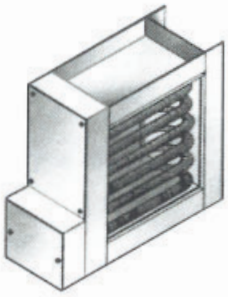
TO ORDER SPECIFY: Quantity, catalog no., voltage, phase and wattage.

Air Duct Heaters
Types DFF, DIF, DFT & DIT

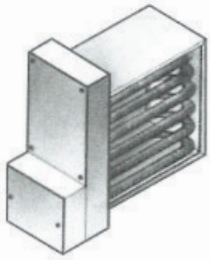
APPLICATION

Caloritech™ air duct heaters are for use in comfort heating applications. Typical applications include:

- make-up air heating
- air pre-heating
- air handling equipment
- fan coils
- terminal reheating
- multizone reheating
- heat pump auxiliary systems
- return air heating



TYPE DFF



TYPE DIF

TYPE DFF is a flanged duct heater with finned tubular heating elements.

TYPE DIF is an insert duct heater with finned tubular heating elements.

TYPE DFT is a flanged duct heater with incoloy (non-finned) tubular heating elements.

TYPE DIT is an insert duct heater with tubular heating elements.

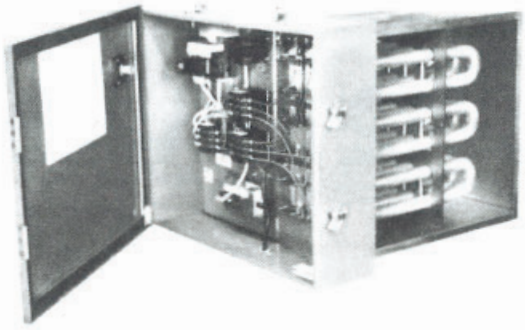
STANDARD FEATURES

- Primary linear cutout,
  160°F (71°C)
  277/600 VAC, 25/10 AMP non-inductive
- Secondary linear cutout - Manual reset complete with back-up magnetic contactor on units under 300V, 30 kW and less,
  225°F (107°C)
  277/600 VAC, 25/10 AMP non-inductive

OPTIONAL AUXILIARY DUCT HEATER CONTROLS

These controls are available as factory installed on the duct heater or as an EEMAC rated (specify) control panel for wall mount:

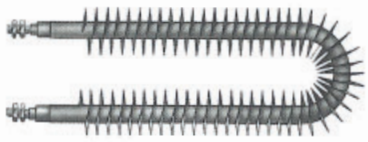
- wall thermostats
  T498A
  T6051A (1 stage)
  T6052A (2 stage)
  T921A (0-135 OHM)
- duct thermostats
  T675A (1 stage)
  T678A (2 stage)
  T991A (0-135 OHM)
- bulb holders
- silent contactors
- SCR controllers
- sail switch
- differential pressure switch
- main disconnect
- pneumatic electric switches
- on-off switch
- magnetic contactors
- step controllers
- HRC fusing
- control transformers
- fan interlock relay
- pilot lights



ELEMENT TYPES

The finned tubular element design is the most popular. It incorporates the highest wattage per cross sectional duct area thus making it more economical than the incoloy tubular design.

FIG. 1 - FINNED TUBULAR ELEMENT



Finned tubular elements are constructed using a steel tube with a corrugated steel fin wrapped around it and brazed together. This increases the heat transfer surface of the element resulting in a lower operating temperature than tubular designs.

Air Duct Heaters (continued)

ELEMENT TYPES (continued)

FIG. 2 - TUBULAR ELEMENT

Incoloy tubular elements are similarly constructed, but without the steel fin in order to increase the corrosion resistance.

The incoloy design should be chosen where high humidity or slightly corrosive chemical contaminants are present in the air stream. These units are made and approved on special order only.

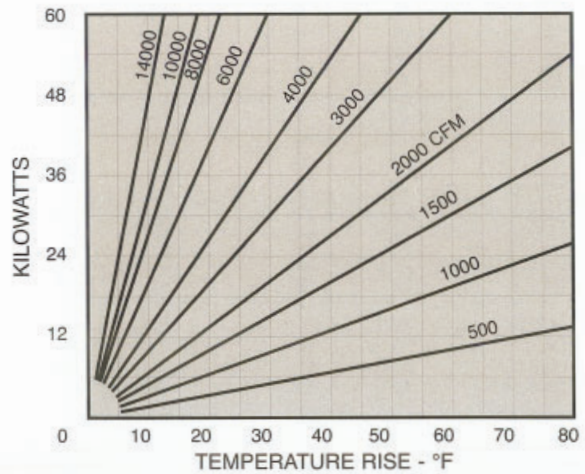
Both element types are designed to provide many years of maintenance free service.

Unlike open coil designs, duct heaters fitted with tubular elements are not subject to hazards of electrical shock which allows installation close to a register or grille.

RECOMMENDED KILOWATTS

In order to select the proper kW for your application, use Figure 3 below.

FIG. 3 - RECOMMENDED KILOWATTS



WIRING AND AUXILIARY CONTROLS

Caloritech™ electric duct heaters are available for supply voltages up to 600V, 3 phase. Multi-staging to provide increments of temperature rise can be incorporated where dimensional space and element spacing allows. Special electrical features are available providing simple or sophisticated temperature control to suit individual requirements. See optional controls on previous page.

CONSTRUCTION

Two basic heater frame constructions are available, flange type or insert type (see Figures 4 and 5 below).

FIG. 4 - INSERT TYPE

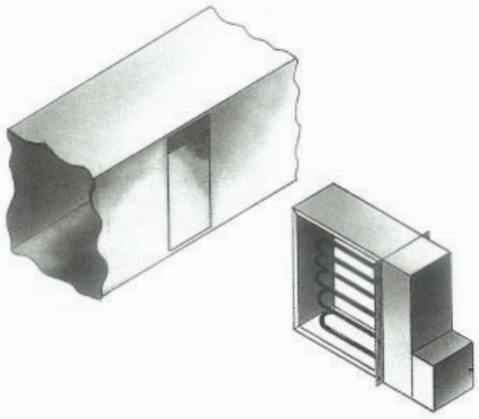
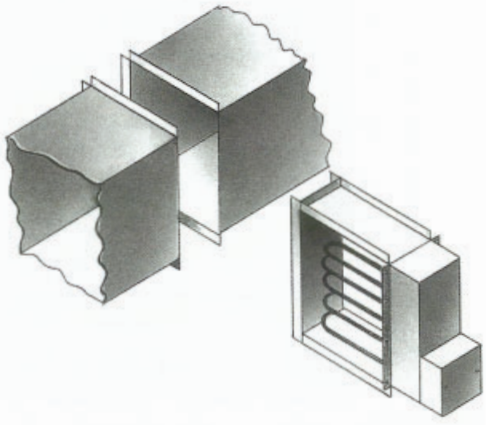


FIG. 5 - FLANGE TYPE



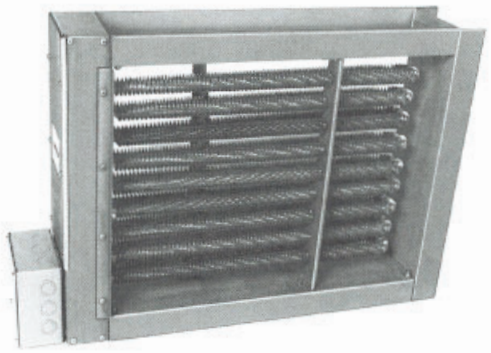
All frames are fabricated from 16 gauge satin coat steel. Specially constructed stainless steel frames are also available.

A unique modular construction using stock frame components is employed using vertical and horizontal dimensional increments of two inches, ensuring rapid delivery.

Air Duct Heaters (continued)

STANDARD DIMENSIONS

Insert type duct heaters are slightly undersized to permit installation in ducts having the A and B dimensions listed in Table 1.



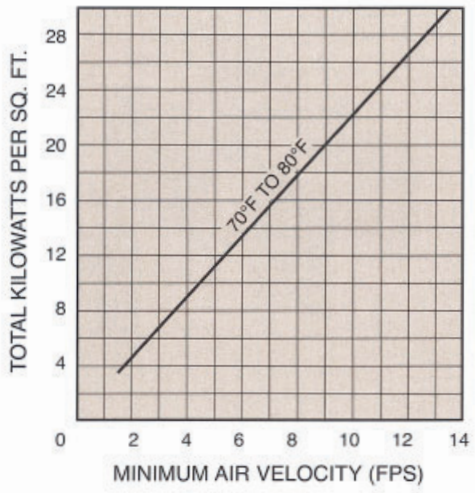
SELECTION AND INSTALLATION

Finned tubular duct heaters are approved for horizontal duct installation where the maximum inlet air temperature does not exceed 25°C (77°F) and the maximum rating does not exceed 120 kW.

Multiple heaters can be installed in tandem (series) provided that the inlet temperature to any heater section (one heater) is not more than 25°C (77°F) and the air velocity is not less than the requirements of Figure 6.

Check factory if you require assistance.

FIG. 6 - AIR VELOCITY REQUIREMENTS



See Table 1 below for typical duct heater sizes and kW ratings based on an air flow velocity of 500 ft/min or higher.

If the flow velocity is less than 500 ft/min, the typical maximum kW ratings in the table must be derated using Figure 7.

Multiply the kW ratings shown in Table 1 by the appropriate derating factor from Figure 7.

FIG.7 - DERATING FACTORS

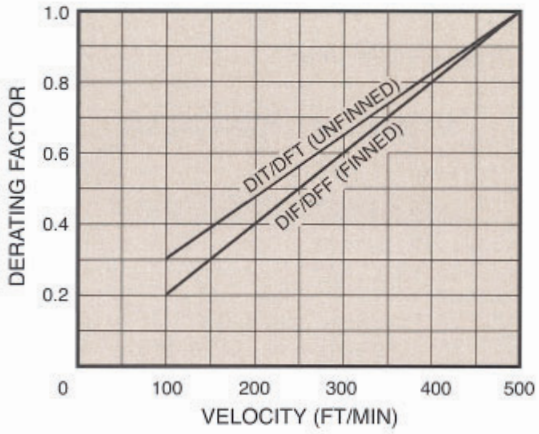


Table 1 below lists some of the more common heater sizes with maximum kilowatt ratings for each size. Stock modular frames allow quick delivery for other sizes in increments of 2".

TABLE 1 - MAXIMUM SINGLE HEATER KW RATING FOR TYPICAL DUCT HEATER SIZES

DIMENSIONS INCHES A x B	TYPES DIF/DFF MAX. KW	TYPES DIF/DFF MAX. NO. OF ELEMS.	TYPES DIT/DFT MAX. KW	TYPES DIT/DFT MAX. NO. OF ELEMS.
6 x 6	2.5	3	1.5	6
8 x 6	3	3	3.0	6
10 x 6	4	3	2.5	6
10 x 8	5.5	4	3.5	8
12 x 6	5	3	3.5	6
12 x 8	6.5	4	4.5	8
12 x 10	8	5	5.5	10
14 x 8	7.5	4	5.5	8
14 x 10	9.5	5	6.5	10
14 x 12	11.5	6	8.0	12
16 x 10	11	5	7.5	10
16 x 12	13	6	9.0	12
16 x 14	15.5	7	10.5	14
18 x 12	15	6	10.5	12
18 x 14	17.5	7	12	14
18 x 16	20	8	14	16
20 x 14	19	7	13.5	14
20 x 16	22	8	15.5	16
20 x 18	25	9	17.5	18
22 x 16	24	8	17	16
22 x 18	27.5	9	19	18
22 x 20	30.5	10	21	20
24 x 18	30	9	21	18
24 x 20	33	10	23	20
24 x 22	36.5	11	25.5	22
26 x 20	36	10	25	20
26 x 22	39.5	11	27.5	22
26 x 24	43	12	30	24
28 x 22	42.5	11	29.5	22
28 x 24	46.5	12	32.5	24
28 x 26	50.5	13	35	26
30 x 24	50	12	35	24
30 x 26	54	13	37.5	26
30 x 28	58	14	40.5	28
30 x 30	62.5	15	43.5	30

Air Duct Heaters (continued)

Types DFF and DIF duct heaters are designed and approved for comfort heating applications. Unit must be installed in a horizontal duct with the terminal housing at the side or bottom.

Tandem mounting (more than one heater in series) is permitted within certain limitations. See previous discussion.

Units listed in Table 2 are representative only. It is reasonably safe to specify any similar unit using this table as a guideline, and we will build to your specifications.

STANDARD FEATURES

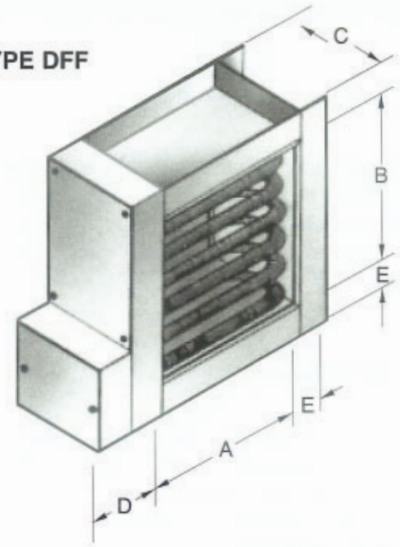
- Primary linear cutout,
  160°F (71°C)
  277/600 VAC, 25/10 AMP non-inductive
- Secondary linear cutout - Manual reset complete with back-up magnetic contactor on units under 300V, 30 kW and less,
  225°F (107°C)
  277/600 VAC, 25/10 AMP non-inductive

OPTIONAL FEATURES

See page C6.

NOTE: Incoloy tubular duct heaters, types DFT and DIT, are available on special order only.

TYPE DFF



DIM.	in.	mm
C	6 1/2	163
D	7	178
E	2	51

TYPE DIF

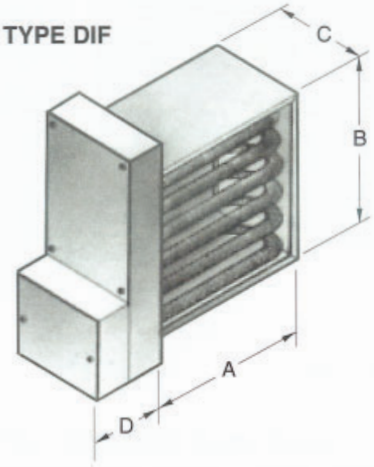


TABLE 2 - TYPES DFF/DIF DUCT HEATERS WITH FINNED ELEMENTS

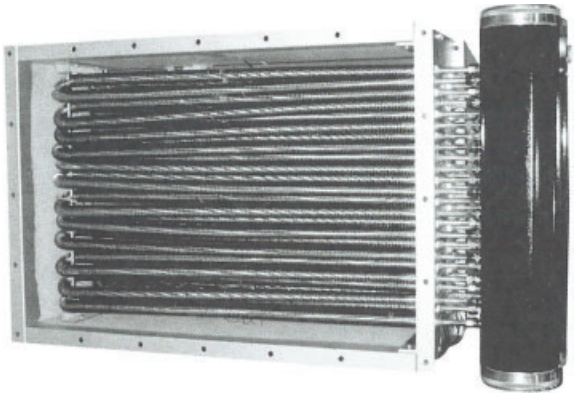
KW	STANDARD VOLTAGES 120V 1Ø	208V, 240V 1Ø	208V, 240V 3Ø	480V, 600V 1Ø	480V, 600V 3Ø	DIMENSIONS IN. (MM) A	DIMENSIONS IN. (MM) B	MINIMUM AIR FLOW CFM (M^3/MIN)	NO. OF ELEMS.	CATALOG NUMBERS FLANGE TYPE	CATALOG NUMBERS INSERT TYPE	APPROX. WEIGHT LBS (KG)
1	✔	✔	—	—	—	6 (152)	6 (152)	50 (1.4)	2	DFF06x06-01	DIF06x06-01	15 (7)
2.5	✔	✔	✔	—	—	6 (152)	6 (152)	150 (4.2)	3	DFF06x06-02.5	DIF06x06-02.5	15 (7)
7.5	—	✔	✔	✔	✔	14 (356)	8 (203)	390 (11.0)	4	DFF14x08-07.5	DIF14x08-07.5	20 (9)
10	—	✔	✔	✔	✔	14 (356)	12 (305)	500 (14.1)	6	DFF14x12-10	DIF14x12-10	25 (11)
12.5	—	✔	✔	✔	✔	16 (406)	12 (305)	625 (17.7)	6	DFF16x12-12.5	DIF16x12-12.5	30 (14)
15	—	✔	✔	✔	✔	18 (457)	12 (305)	750 (21.2)	6	DFF18x12-15	DIF18x12-15	30 (14)
17.5	—	✔	✔	✔	✔	18 (457)	14 (356)	875 (24.8)	6	DFF18x14-17.5	DIF18x14-17.5	35 (16)
20	—	✔	✔	✔	✔	18 (457)	16 (406)	1000 (28.3)	6	DFF18x16-20	DIF18x16-20	35 (16)
25	—	—	✔	✔	✔	20 (508)	18 (457)	1250 (35.4)	9	DFF20x18-25	DIF20x18-25	50 (23)
30	—	—	✔	✔	✔	24 (610)	18 (457)	1500 (42.4)	9	DFF24x18-30	DIF24x18-30	55 (25)
35	—	—	✔	✔	✔	24 (610)	22 (559)	1650 (46.7)	9	DFF24x22-35	DIF24x22-35	60 (27)
40	—	—	✔	✔	✔	26 (660)	24 (610)	2050 (58.0)	12	DFF26x24-40	DIF26x24-40	70 (32)
45	—	—	✔	✔	✔	28 (711)	24 (610)	2200 (62.2)	12	DFF28x24-45	DIF28x24-45	75 (34)
50	—	—	✔	✔	✔	28 (711)	26 (660)	2500 (70.7)	12	DFF28x26-50	DIF28x26-50	80 (36)
60	—	—	✔	✔	✔	30 (762)	30 (762)	3000 (84.9)	15	DFF30x30-60	DIF30x30-60	95 (43)
80	—	—	✔	✔	✔	36 (914)	32 (813)	4000 (113.1)	15	DFF36x32-80	DIF36x32-80	105 (48)
100	—	—	✔	✔	✔	42 (1067)	36 (914)	5250 (148.5)	18	DFF42x36-100	DIF42x36-100	130 (59)
120	—	—	✔	✔	✔	48 (1219)	36 (914)	6000 (170.0)	18	DFF48x36-120	DIF48x36-120	150 (68)

TO ORDER: Specify quantity, catalog number, volts, phase, kW, minimum CFM, duct dimensions, and optional features.

Explosion-Proof Duct Heaters Type XDF

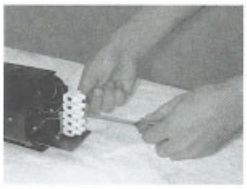
Caloritech™ type XDF duct heaters are designed for heating air or gases which contain potentially explosive substances. XDF heaters feature the unique Caloritech™ approach to explosion-proof electric heater design which embodies safety, reliability and economy.

The XDF is a factory pre-wired explosion-proof duct heater. Standard models are available in three duct sizes, with either a single or double bank of heating modules. XDF heaters are available as standard units with a T2D, T3A or T3B hazardous area temperature codes.



Construction

The XDF explosion-proof duct heater utilizes heavy walled carbon steel finned tubular elements with nickel plated finish to provide safe, efficient, low temperature heat transfer. Standard units have a painted steel duct with mounting holes provided for attachment to the duct section.



XDF heaters feature the unique copper free aluminum extruded x-Max® terminal housing (U.S. Pat. No. 5,798,910, CDN. Pat. No. 2,212,500). A track and trolley system and threaded covers at each end allow easy access to wiring terminal connections.

Units are approved for mounting in a horizontal duct section.

Wattage

Units are available in wattages up to 50kW.

Designed for Application in Hazardous Environments, Such as:

- oil refineries
- coal mines
- pulp and paper mills
- petrochemical plants
- grain elevators
- sewage treatment plants

Control Panels

Control panel options are shown on page C12.

Thermostats

offers a wide variety of explosion proof thermostats to suit most every need. All model XDF heaters are available with remote externally adjustable thermostats which are field convertible to tamper-proof.

Heater Selection

Standard Caloritech™ XDF duct heaters may be operated in hazardous areas where the ambient temperature does not exceed 104°F(40°C) and the maximum heater surface temperature does not exceed the temperature code rating.

Use the following steps for heater selection.

1. Determine temperature code rating Standard heaters are available for the T2D, T3A or T3B areas.

2. Determine kW rating Standard heaters are available up to 50kW.

3. Determine duct size Three standard sizes are available and transition sections can be provided for other duct sizes.

4. Verify air flow requirements Table 2 lists the minimum air flow (SCFM) required for each heater type.

5. Verify temperature rise using the following formula:

F° Temperature Rise

$$\text{F° temp. rise} = \frac{\text{kW} \times 3000}{\text{SCFM}}$$

C° Temperature Rise

$$\text{C° temp. rise} = \frac{\text{kW} \times 1667}{\text{SCFM}}$$

6. Determine power supply voltage and phase Standard units are available in 208, 240, 480 or 600V - 3 phase. Optional 1 phase units also available.

Standard Heater Features:

- T2D, T3A or T3B temperature code
- painted steel duct section
- differential pressure switch
- factory installed high limit sensing thermocouples

Optional Features:

- transition sections
- stainless steel duct section
- mechanical temperature control
- special temperature code
- outlet air thermostat
- outlet air thermocouple

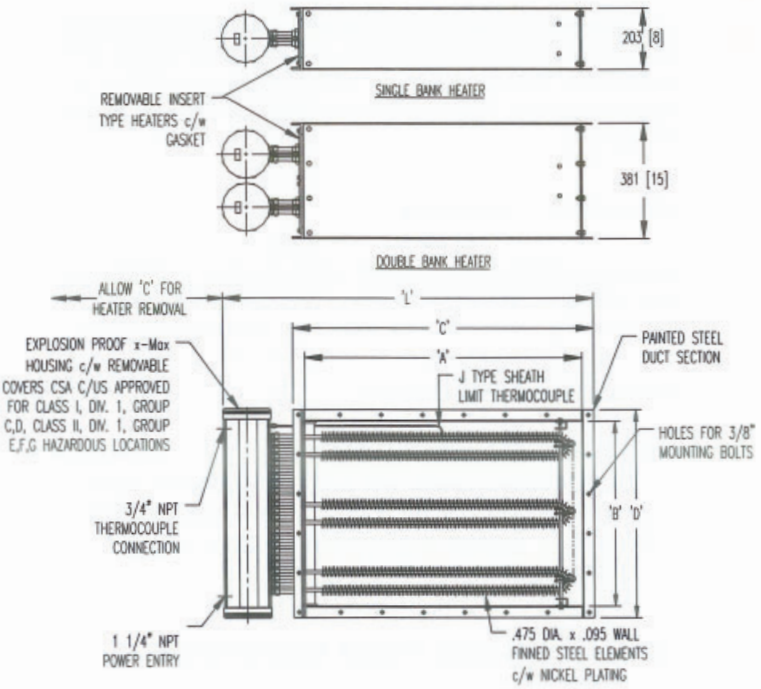


Table 1 - Dimensions Inches (mm)

DUCT SIZE	A	B	C	D	L
24" x 12" (610 x 305)	24 (610)	12 (305)	27 (686)	15 (381)	35 1/2 (927)
30" x 18" (762 x 457)	30 (762)	18 (457)	33 (838)	21 (533)	42 1/2 (1080)
36" x 24" (914 x 610)	36 (914)	24 (610)	39 (991)	27 (686)	48 1/2 (1232)

Table 2 - Heater Specifications

DUCT SIZE (A x B)	NUMBER OF HEATING BANKS	KW	AVAILABLE VOLTAGES				HIGH TEMP. RISE UNITS - T2D (215°C) Class I, Div. 1 & 2, Groups C,D				LOW TEMP. RISE UNITS - T3A (180°C) or T3B (165°C) Class I, Div. 1 & 2, Groups C,D Class II, Div. 1 & 2, Groups E,F Class II, Div. 1 & 2, Groups G (T3B units only)					NET WEIGHT LBS. (KG)
			208V 3Ø	240V 3Ø	480V 3Ø	600V 3Ø	TEMP CODE	CATALOG NO.	MAX. TEMP. RISE °F	MAX. TEMP. RISE °C	MIN. AIR FLOW (SCFM)	TEMP CODE	CATALOG NO.	MAX. TEMP. RISE °F	MAX. TEMP. RISE °C	MIN. AIR FLOW (SCFM)	
24" x 12" 610x305mm	1	2.5	✓	✓	✓	✓	T2D	XDF1-24x12-025T2D	13.9	7.7	540	T3B	XDF1-24x12-025T3B	6.8	3.8	1107	90 (41)
		3.75	✓	✓	✓	✓	T2D	XDF1-24x12-038T2D	20.8	11.6	540	T3B	XDF1-24x12-038T3B	8.4	4.7	1334	
		5	✓	✓	✓	✓	T2D	XDF1-24x12-050T2D	19.7	11.0	761	T3B	XDF1-24x12-050T3B	9.6	5.3	1562	
		7.5	✓	✓	✓	✓	T2D	XDF1-24x12-075T2D	18.0	10.0	1247	T3A	XDF1-24x12-075T3A	13.0	7.2	1728	
	2	5	✓	✓	✓	✓	T2D	XDF2-24x12-050T2D	27.8	15.4	540	T3B	XDF2-24x12-050T3B	13.6	7.5	1107	160 (73)
		7.5	✓	✓	✓	✓	T2D	XDF2-24x12-075T2D	41.7	23.2	540	T3B	XDF2-24x12-075T3B	16.9	9.4	1334	
		10	✓	✓	✓	✓	T2D	XDF2-24x12-100T2D	39.4	21.9	761	T3B	XDF2-24x12-100T3B	19.2	10.7	1562	
		15	✓	✓	✓	✓	T2D	XDF2-24x12-150T2D	36.1	20.1	1247	T3A	XDF2-24x12-150T3A	16.0	14.6	1728	
30" x 18" 762x457mm	1	5	✓	✓	✓	✓	T2D	XDF1-30x18-060T2D	14.8	8.2	1013	T3B	XDF1-30x18-060T3B	7.1	4.0	2109	135 (61)
		5.25	✓	✓	✓	✓	T2D	XDF1-30x18-063T2D	18.5	10.3	1013	T3B	XDF1-30x18-063T3B	8.0	4.5	2331	
		7.5	✓	✓	✓	✓	T2D	XDF1-30x18-075T2D	22.2	12.3	1013	T3B	XDF1-30x18-075T3B	8.8	4.9	2553	
		10	✓	✓	✓	✓	T2D	XDF1-30x18-100T2D	19.6	10.8	1538	T3B	XDF1-30x18-100T3B	10.0	5.6	2991	
		12.5	✓	✓	✓	✓	T2D	XDF1-30x18-125T2D	18.9	10.5	1989	T3B	XDF1-30x18-125T3B	10.9	6.1	3434	
		15	✓	✓	✓	✓	T2D	XDF1-30x18-150T2D	18.4	10.2	2440	T3A	XDF1-30x18-150T3A	13.5	7.5	3333	
	2	10	✓	✓	✓	✓	T2D	XDF2-30x18-100T2D	29.5	16.5	1013	T3B	XDF2-30x18-100T3B	14.2	7.9	2109	250 (114)
		12.5	✓	✓	✓	✓	T2D	XDF2-30x18-125T2D	37.0	20.6	1013	T3B	XDF2-30x18-125T3B	16.1	8.9	2331	
		15	✓	✓	✓	✓	T2D	XDF2-30x18-150T2D	44.5	24.7	1013	T3B	XDF2-30x18-150T3B	17.6	9.8	2553	
		20	✓	✓	✓	✓	T2D	XDF2-30x18-200T2D	39.0	21.7	1538	T3B	XDF2-30x18-200T3B	20.1	11.1	2991	
		25	✓	✓	✓	✓	T2D	XDF2-30x18-250T2D	37.7	21.0	1989	T3B	XDF2-30x18-250T3B	21.8	12.1	3434	
		30	✓	✓	✓	✓	T2D	XDF2-30x18-300T2D	36.9	20.5	2440	T3A	XDF2-30x18-300T3A	27.0	15.0	3333	
36" x 24" 914x610mm	1	7.5	✓	✓	✓	✓	T2D	XDF1-36x24-075T2D	13.9	7.7	1620	T3B	XDF1-36x24-075T3B	6.9	3.8	3256	180 (82)
		10	✓	✓	✓	✓	T2D	XDF1-36x24-100T2D	18.5	10.3	1620	T3B	XDF1-36x24-100T3B	8.1	4.5	3690	
		12.5	✓	✓	✓	✓	T2D	XDF1-36x24-125T2D	23.2	12.9	1620	T3B	XDF1-36x24-125T3B	9.1	5.1	4125	
		15	✓	✓	✓	✓	T2D	XDF1-36x24-150T2D	20.2	11.2	2230	T3B	XDF1-36x24-150T3B	9.9	5.5	4559	
		20	✓	✓	✓	✓	T2D	XDF1-36x24-200T2D	19.3	10.7	3115	T3B	XDF1-36x24-200T3B	11.1	8.1	5428	
		25	–	✓	✓	✓	T2D	XDF1-36x24-250T2D	18.8	10.4	4000	T3A	XDF1-36x24-250T3A	13.8	7.7	5427	
	2	15	✓	✓	✓	✓	T2D	XDF2-36x24-150T2D	27.8	15.4	1620	T3B	XDF2-36x24-150T3B	13.8	7.7	3256	325 (148)
		20	✓	✓	✓	✓	T2D	XDF2-36x24-200T2D	37.0	20.6	1620	T3B	XDF2-36x24-200T3B	16.3	9.0	3890	
		25	✓	✓	✓	✓	T2D	XDF2-36x24-250T2D	46.3	25.7	1620	T3B	XDF2-36x24-250T3B	18.2	10.1	4125	
		30	✓	✓	✓	✓	T2D	XDF2-24x12-300T2D	40.4	22.4	2230	T3B	XDF2-24x12-300T3B	19.7	11.0	4559	
		40	✓	✓	✓	✓	T2D	XDF2-24x12-400T2D	38.5	21.4	3115	T3B	XDF2-24x12-400T3B	22.1	12.3	5428	
		50	–	✓	✓	✓	T2D	XDF2-24x12-500T2D	37.5	20.8	4000	T3A	XDF2-24x12-500T3A	27.6	15.4	5427	

To Order: Specify quantity, catalog no., voltage and phase, wattage, hazardous location designation, temperature code, control package and optional features.

Control Panels for XDF Duct Heaters Type CPXD

Caloritech™ type XDF duct heaters are normally supplied with a type CPXD control panel. These control panels are available in two basic types - type 4 moisture resistant or explosion proof, and with four different control packages as listed.

Standard Features

All CPXD control panels are supplied with magnetic contactor, HRC fusing, fused 120V control transformer, high limit controls, control circuit, ON/OFF switch, control ON light, high limit indicator light, high limit push-to-reset, terminals for connection of temperature controls and differential air pressure switch.

Enclosure Types

CPXD control panels are available for either type 4 moisture resistant locations, or hazardous locations Class I, Div. 1 & 2, Groups B, C, D and Class II, Div. 1 & 2, Groups E, F, G.

Control Packages

Package #1 Basic Unit (ON/OFF Control)
All standard features. Terminals are provided for connection to a remote ON/OFF temperature control and connection of differential air pressure switch.

Package #2 Built-in Temperature Controller
Same features as Package #1 except with factory installed digital temperature controller for control of outlet air temperature.

Package #3 SCR with Remote Temperature Controller
All standard features and a factory installed full load zero fired SCR with terminals provided for remote 4-20 mA temperature control signal and connection of differential air pressure switch.

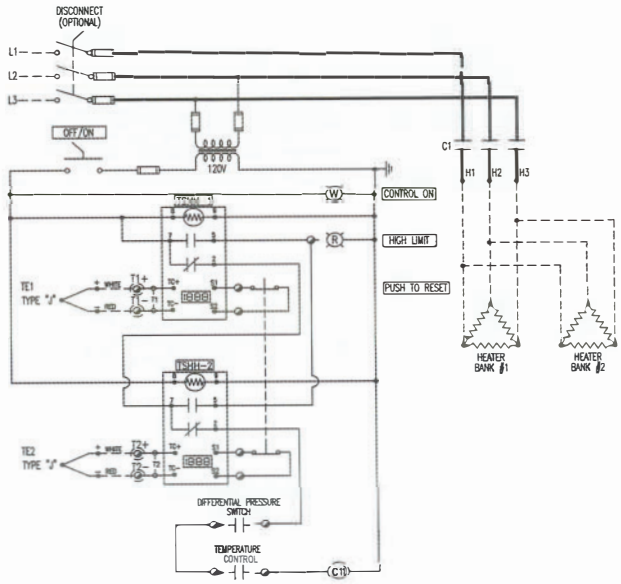
Package #4 SCR with Built-in Temperature Controller
Same features as Package #3 except with factory installed digital temperature controller for control of outlet air temperature.

Table 3 - Control Panel Specifications

ENCLOSURE TYPE	NUMBER OF CIRCUITS	KW	AVAILABLE VOLTAGES				CATALOG NUMBER			
			208V 3Ø	240V 3Ø	480V 3Ø	600V 3Ø	PACKAGE #1	PACKAGE #2	PACKAGE #3	PACKAGE #4
TYPE 4 MOISTURE RESISTANT	1	2.5	✓	✓	✓	✓	CPXD1-025R	CPXD1-025TR	CPXD1-025SR	CPXD1-025STR
		3.75	✓	✓	✓	✓	CPXD1-038R	CPXD1-038TR	CPXD1-038SR	CPXD1-038STR
		5	✓	✓	✓	✓	CPXD1-050R	CPXD1-050TR	CPXD1-050SR	CPXD1-050STR
		6.25	✓	✓	✓	✓	CPXD1-063R	CPXD1-063TR	CPXD1-063SR	CPXD1-063STR
		7.5	✓	✓	✓	✓	CPXD1-075R	CPXD1-075TR	CPXD1-075SR	CPXD1-075STR
		10	✓	✓	✓	✓	CPXD1-100R	CPXD1-100TR	CPXD1-100SR	CPXD1-100STR
		12.5	✓	✓	✓	✓	CPXD1-125R	CPXD1-125TR	CPXD1-125SR	CPXD1-125STR
		15	✓	✓	✓	✓	CPXD1-150R	CPXD1-150TR	CPXD1-150SR	CPXD1-150STR
		20	✓	✓	✓	✓	CPXD1-200R	CPXD1-200TR	CPXD1-200SR	CPXD1-200STR
		25	–	✓	✓	✓	CPXD1-250R	CPXD1-250TR	CPXD1-250SR	CPXD1-250STR
	2	5	✓	✓	✓	✓	CPXD2-050R	CPXD2-050TR	CPXD2-050SR	CPXD2-050STR
		7.5	✓	✓	✓	✓	CPXD2-075R	CPXD2-075TR	CPXD2-075SR	CPXD2-075STR
		10	✓	✓	✓	✓	CPXD2-100R	CPXD2-100TR	CPXD2-100SR	CPXD2-100STR
		12.5	✓	✓	✓	✓	CPXD2-125R	CPXD2-125TR	CPXD2-125SR	CPXD2-125STR
		15	✓	✓	✓	✓	CPXD2-150R	CPXD2-150TR	CPXD2-150SR	CPXD2-150STR
		20	✓	✓	✓	✓	CPXD2-200R	CPXD2-200TR	CPXD2-200SR	CPXD2-200STR
		25	–	✓	✓	✓	CPXD2-250R	CPXD2-250TR	CPXD2-250SR	CPXD2-250STR
		30	–	–	✓	✓	CPXD2-300R	CPXD2-300TR	CPXD2-300SR	CPXD2-300STR
		40	–	–	✓	✓	CPXD2-400R	CPXD2-400TR	CPXD2-400SR	CPXD2-400STR
		50	–	–	✓	✓	CPXD2-500R	CPXD2-500TR	CPXD2-500SR	CPXD2-500STR
EXPLOSION PROOF CLASS I, GROUP C,D CLASS II, GROUP E,F,G	1	2.5	✓	✓	✓	✓	CPXD1-025X	CPXD1-025TX	CPXD1-025SX	CPXD1-025STX
		3.75	✓	✓	✓	✓	CPXD1-038X	CPXD1-038TX	CPXD1-038SX	CPXD1-038STX
		5	✓	✓	✓	✓	CPXD1-050X	CPXD1-050TX	CPXD1-050SX	CPXD1-050STX
		6.25	✓	✓	✓	✓	CPXD1-063X	CPXD1-063TX	CPXD1-063SX	CPXD1-063STX
		7.5	✓	✓	✓	✓	CPXD1-075X	CPXD1-075TX	CPXD1-075SX	CPXD1-075STX
		10	✓	✓	✓	✓	CPXD1-100X	CPXD1-100TX	CPXD1-100SX	CPXD1-100STX
		12.5	✓	✓	✓	✓	CPXD1-125X	CPXD1-125TX	CPXD1-125SX	CPXD1-125STX
		15	✓	✓	✓	✓	CPXD1-150X	CPXD1-150TX	CPXD1-150SX	CPXD1-150STX
		20	✓	✓	✓	✓	CPXD1-200X	CPXD1-200TX	CPXD1-200SX	CPXD1-200STX
		25	–	–	✓	✓	CPXD1-250X	CPXD1-250TX	CPXD1-250SX	CPXD1-250STX
	2	5	✓	✓	✓	✓	CPXD2-050X	CPXD2-050TX	CPXD2-050SX	CPXD2-050STX
		7.5	✓	✓	✓	✓	CPXD2-075X	CPXD2-075TX	CPXD2-075SX	CPXD2-075STX
		10	✓	✓	✓	✓	CPXD2-100X	CPXD2-100TX	CPXD2-100SX	CPXD2-100STX
		12.5	✓	✓	✓	✓	CPXD2-125X	CPXD2-125TX	CPXD2-125SX	CPXD2-125STX
		15	✓	✓	✓	✓	CPXD2-150X	CPXD2-150TX	CPXD2-150SX	CPXD2-150STX
		20	✓	✓	✓	✓	CPXD2-200X	CPXD2-200TX	CPXD2-200SX	CPXD2-200STX
		25	–	✓	✓	✓	CPXD2-250X	CPXD2-250TX	CPXD2-250SX	CPXD2-250STX
		30	–	–	–	✓	CPXD2-300X	CPXD2-300TX	CPXD2-300SX	CPXD2-300STX
		40	–	–	–	–	CPXD2-400X	CPXD2-400TX	CPXD2-400SX	CPXD2-400STX
		50	–	–	–	–	CPXD2-500X	CPXD2-500TX	CPXD2-500SX	CPXD2-500STX

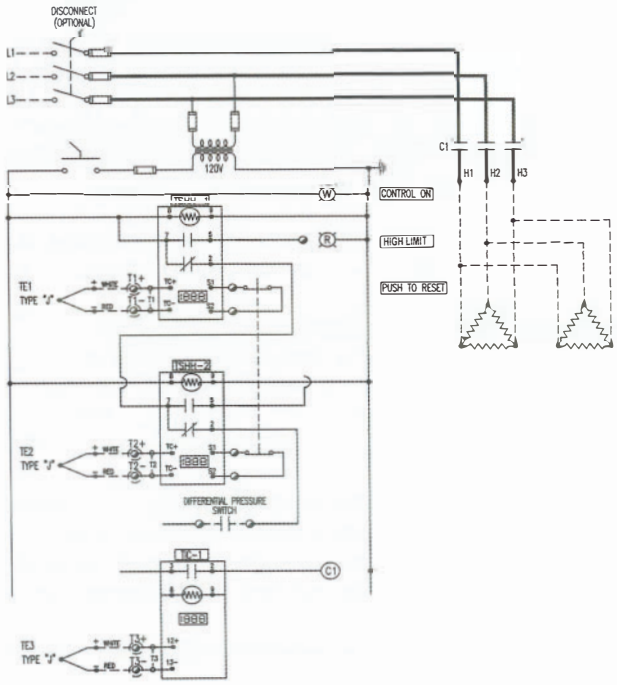
Note: For optional disconnect switch, add 'D' to end of catalog number.

Package #1 - Basic Unit (ON/OFF Control)



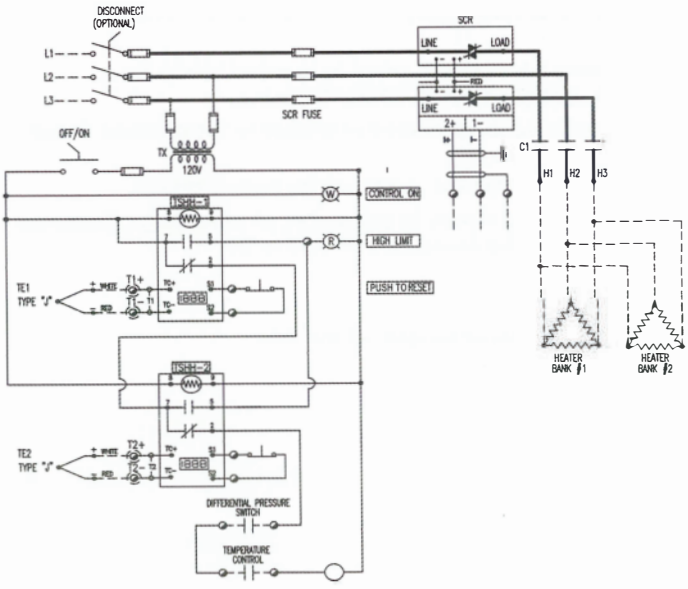
Notes:
ONE HIGH LIMIT CONTROL PROVIDED ON SINGLE BANK HEATERS.
TWO HIGH LIMIT CONTROLS PROVIDED ON DOUBLE BANK HEATERS.

Package #2 - Built-in Temperature Controller



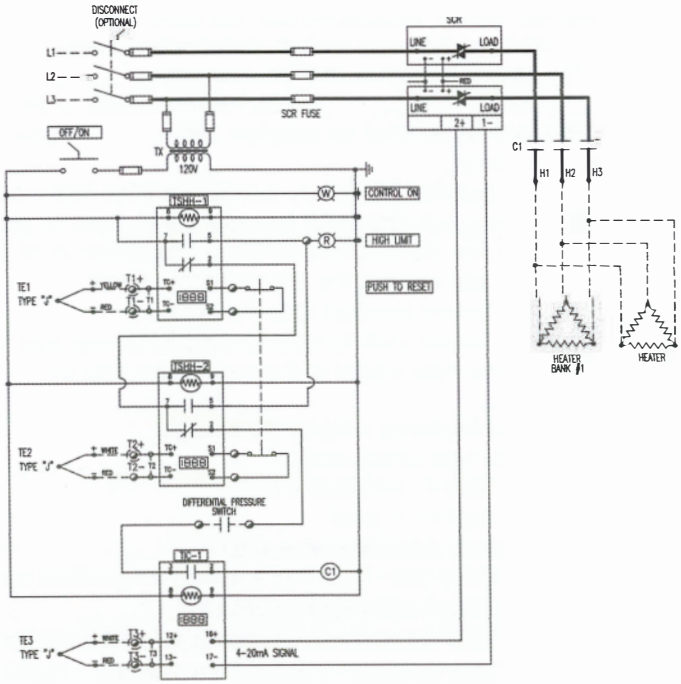
Notes:
ONE HIGH LIMIT CONTROL PROVIDED ON SINGLE BANK HEATERS.
TWO HIGH LIMIT CONTROLS PROVIDED ON DOUBLE BANK HEATERS.

Package #3 - SCR with Remote Temperature Controller



Notes:
ONE HIGH LIMIT CONTROL PROVIDED ON SINGLE BANK HEATERS.
TWO HIGH LIMIT CONTROLS PROVIDED ON DOUBLE BANK HEATERS.

Package #4 - SCR with Built-in Temperature Controller



Notes:
ONE HIGH LIMIT CONTROL PROVIDED ON SINGLE BANK HEATERS.
TWO HIGH LIMIT CONTROLS PROVIDED ON DOUBLE BANK HEATERS.

EXPLOSION-PROOF HEATERS TYPE XDF
SPECIFICATION SHEET

1.0 Scope
Electric explosion-proof duct heaters shall be Caloritech™ type XDF, from , complete with all standard equipment and optional features as specified below

2.0 General
2.1 The heater is to be CSA C/US certified with ratings as specified in 3.0.
2.2 The heater shall be provided with standard features and optional features as outlined in 4.0 and 6.0.

3.0 Specifications and Ratings
3.1 The duct heater shall be designed to heat air at _____ SCFM from _____ °F to _____°F (_____°C to _____°C).
3.2 The heater shall be of the explosion-proof, duct type, catalog number_____ ,
rated _____ V, _____ Ø, _____ Hz., _____ kW.
- ❒ Class _____, Divisions _____, Groups _____;
- ❒ Class _____, Divisions _____, Groups _____,

3.4 The duct heater shall be marked with a _____ temperature code, or maximum surface temperature of _____.
3.5 The minimum rated airflow through the duct heater shall be _____ SCFM.
3.6 The maximum outlet temperature of the duct heater shall not exceed _____°F (_____°C).
3.7 The duct heater is to be mounted in a horizontal duct section ❒ downstream / ❒ upstream from the customer supplied blower.
3.8 The duct heater shall be suitable for operation in a -40°F (-40°C) min. to 104°F (40°C) max. ambient temperature.

4.0 Standard Features – Duct Heater
4.1 The duct heater shall be supplied with a _____"(W) x _____" (H) x _____" (L) carbon steel duct section with 1" wide mounting flange and painted ASA61 gray epoxy outside and high temperature aluminum inside.
4.2 The heating elements shall be 0.475" dia., extra heavy wall (0.095") finned tubular steel with nickel plated finish. Fins are to be fully brazed to the element sheath for maximum performance and efficiency.
4.3 The heating elements shall extend through certified explosion-proof compression fittings into a patented ***x-Max***® explosion-proof, extruded copper-free aluminum terminal housing(s) with 1_ " NPT power conduit entry and _" NPT conduit entry for high limit thermocouple connection.
4.4 The heating elements shall be mounted as _____ removable heating bank(s) and wired to terminal blocks for _____ x _____ kW, ____ V, _____ phase heating circuits to be ❒ fully SCR controlled, or ❒ ON/OFF control.
4.5 The duct heater shall be supplied with _____ 'J' type sheathed thermocouples welded or brazed to the element sheath for connection to
❒ customer supplied / ❒ factory installed certified high limit controllers. High limit set points will be factory preset.
4.6 Explosion-proof differential pressure switch shall be factory installed on the heater to prove that air is moving. Customer must ensure that the minimum airflow is maintained at all times. The differential pressure switch is to be:
- ❒ field wired to the remote control panel;
- ❒ factory mounted onto the heater.

4.7 The duct heater shall be mounted in a horizontal duct section with the terminal box(es) at the side.
4.9 The approximate weight of the duct heater shall be _____ lbs.

5.0 Standard Features – Control Package
5.1 Enclosure type (check one):
- ❒ Type 4 - moisture-proof
- ❒ Explosion-proof

5.2 Temperature control (check one):
- ❒ Basic unit - customer supplied temperature control signal
- ❒ Built-in temperature controller
- ❒ SCR controller - customer supplied 4-20 mA control signal
- ❒ SCR controller with built-in temperature controller

6.0 Optional Features and Equipment (check as desired)
- ❒ Stainless steel duct section
- ❒ Transition sections to _____"(H) x _____" (W) duct or _____" round duct.
- ❒ Special temperature code of _____.

Gain and gate Guide Heaters Type MXG

APPLICATION

These heaters are specifically designed to prevent ice build-up on sluice gate guides or bodies. The heater is usually installed in a vertical well or duct of round or square cross section having a round nozzle at the top for fastening.

CONSTRUCTION

The heaters are available in single or dual wattage, customized to specifically suit the application.

The heating elements are silver brazed into a water tight terminal housing having recessed base for mounting. Element ends are hermetically sealed to prevent moisture ingression over prolonged periods when the heaters are not in service.

Unlike open wire heaters with ceramic supports, Type MXG heaters can be coiled to a six foot diameter to facilitate shipping and handling.

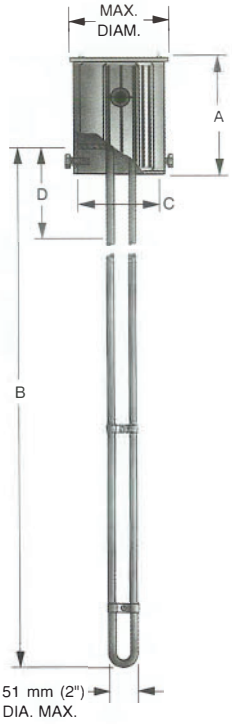


FIG. 1 - TYPE MXG HEATER

STANDARD BOX DIMENSIONS (not exactly as shown)

TYPE	DIMENSIONS A mm	A IN.	C mm	C IN.	MAXIMUM DIAMETER mm	MAXIMUM DIAMETER IN.
1	127	5	76	3	92	3 5/8
2	127	5	105	4 1/8	117	4 5/8
3	127	5	111	4 3/8	124	4 7/8

SPECIFY

Voltage and Wattage - wattage may range from 6 to 18 watts per lineal inch depending on the conditions. For extra long heaters, utilize 480V or 600V to ensure that the heater can be built.

If dual wattage is required, specify details.

Terminal Box - check the dimensions of the Fig. 1 standard terminal box shown for suitability. Other sizes and types are available.

Heating Element Dimensions - indicate insert length "B" and non-heated section "D". Allow 2% for manufacturing tolerance plus heater expansion when specifying "B" dimension.

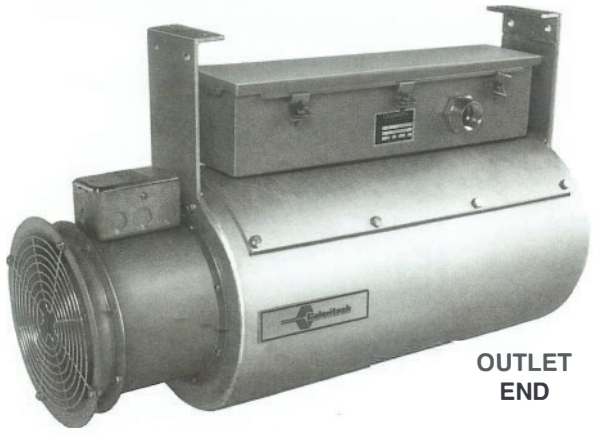
Gate Body Duct Heaters Type WXG

APPLICATION

Gate body duct heaters are custom engineered by Caloritech™ to heat the inside of the gate and prevent ice build-up on the gate walls, windseals and end members.

The heaters can be connected to a duct having outlets at various elevations within the gate.

FIG. 2 - TYPE WXG HEATER



CONSTRUCTION

Gate body duct heaters feature a weather proof duct heater and matched motor and high static axial fan assembly installed within a galvanized heavy steel housing.

Heating elements are hermetically sealed to prevent moisture ingression over prolonged periods when the heaters are not in service.

Various control options are available such as ambient temperature sensing thermostat, outlet air temperature thermostat, limit control and differential pressure switch. Designs are available from 4.0 kW to 120 kW.

SPECIFY

Voltage, phase and wattage plus control options.

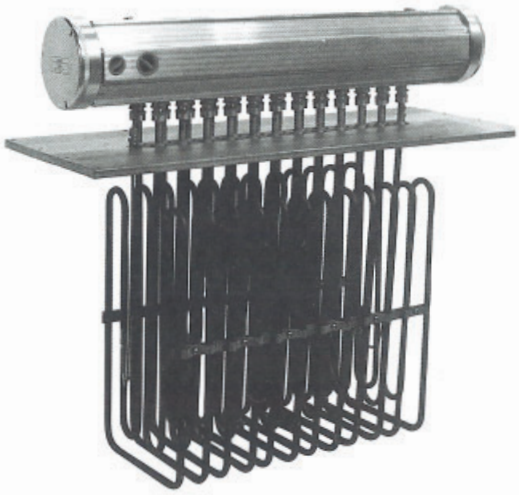
Also specify static pressure requirements of the fan assembly at the design air flow and the duct diameter.

Note that CCI Thermal also builds control panels for sluice gate heating control. (See Section D).

Process Duct Heaters
Type WX

APPLICATION

Type WX heaters are designed for installation in process ducts to heat air or other non-hazardous gases.



CONSTRUCTION

Standard heaters have replaceable "W" shaped incoloy elements each rated at 2kW. Multiple circuits are selected to limit the line current in each circuit to 48 AMPS.

TYPE WXL heaters have steel mounting plate and terminal box with a stainless steel element support plate.

TYPE WXH heaters have stainless steel mounting plate, terminal box and support plate suitable for high temperature operation.

INSTALLATION

Installation can be in any position; top, bottom or side mounting. The heater is inserted into the duct through a hole and secured with suitable bolts, studs or screws. For heavier units, duct work may require reinforcement.

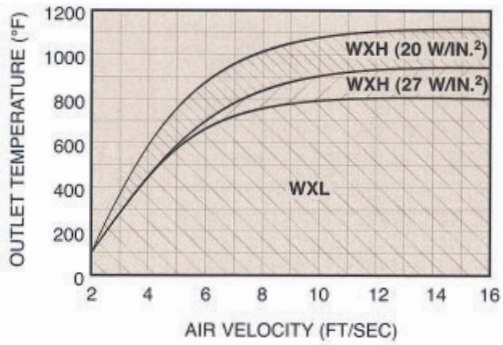
In larger ducts, internal duct baffles may be required to ensure that the minimum air velocity as shown in Fig. 1 passes over the elements.

All process duct heater installations must include a device such as a thermocouple control or a proximity high limit cutout to limit the outlet temperature in the event of fan failure or malfunction of the process temperature regulator.

SELECTION

WXL heaters are suitable for outlet air temperatures up to 425°C (797°F) providing the air velocity is not less than the required velocity shown on Fig. 1. If the air velocity is less, contact factory for a modified heater with a lower watt density to suit your conditions.

FIG. 1 - HEATER SELECTION

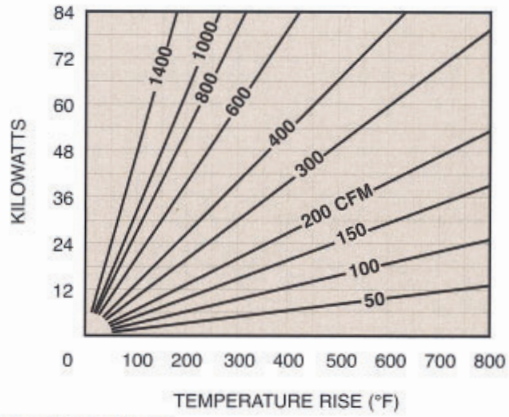


WXH heaters are suitable for outlet air temperatures up to 600°C (1112°F) providing the air velocity is not less than the required velocity shown on Fig. 1. Note that type WXH heaters are available as standard in two separate watt densities.

If the air velocity is less than indicated by Fig. 1 contact factory for a modified heater with a lower watt density to suit your conditions.

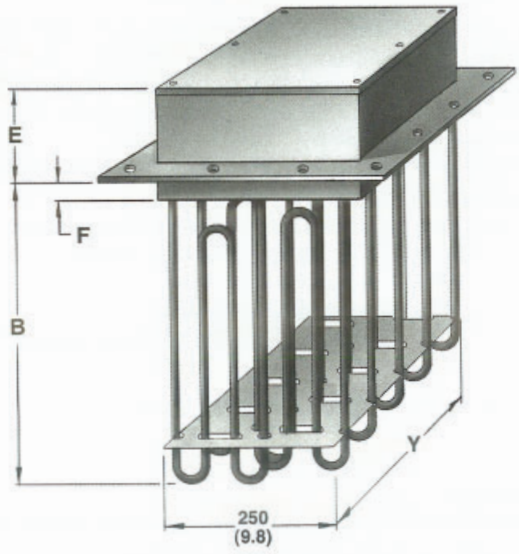
Use Fig. 2 to approximate kW requirements.

FIG. 2 - RECOMMENDED KILOWATTS

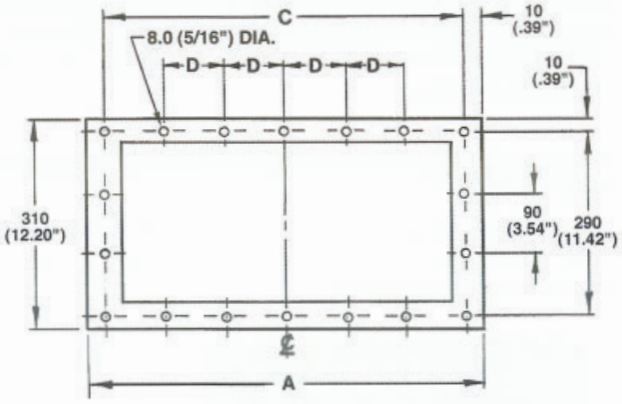


SPECIAL FEATURES

Type WX heaters are available in other sizes and ratings. Units can be supplied with duct section, fan assembly, and control panel. Consult factory for additional information.



MODEL	W/cm²	W/in.²	'B' DIM. mm (in.)	'E' DIM. mm (in.)	'F' DIM. mm (in.)
WXL	4.2	27	410 (16.1)	150 (5.9)	35 (1.4)
WXH	4.2	27	410 (16.1)	250 (9.8)	0
WXH	3.1	20	530 (20.9)	250 (9.8)	0



KW	STD. VOLTS 208, 240 1ϕ	208, 240 3ϕ	480, 600 1ϕ	480, 600 3ϕ	'A' DIM. mm (in.)	'C' DIM. mm (in.)	'D' DIM. mm (in.)	'Y' DIM. mm (in.)	SUPERCEDED CATALOG NUMBER	CATALOG NUMBER	NET WT. LBS (KG)
TYPE WXL - INTERMEDIATE TEMPERATURE DESIGN - 27 W/in.² (4.2 W/cm²)											
6	✓	✓	✓	✓	155 (6.1)	135 (5.3)	—	110 (4.3)	TDH-6C	**WXL-6**	15.4 (7)
12	✓	✓	✓	✓	235 (9.3)	215 (8.5)	—	190 (7.5)	TDH-12C	**WXL-12**	26.5 (12)
18	✓	✓	✓	✓	310 (12.2)	290 (11.4)	50 (1.97)	265 (10.4)	TDH-18C	**WXL-18**	39.7 (18)
24	-	✓	✓	✓	385 (15.2)	365 (14.4)	90 (3.54)	340 (13.4)	TDH-24C	**WXL-24**	48.5 (22)
30	-	✓	✓	✓	460 (18.1)	440 (17.3)	110 (4.33)	415 (16.3)	TDH-30C	**WXL-30**	57.3 (26)
36	-	✓	✓	✓	540 (21.3)	520 (20.5)	130 (5.12)	495 (19.5)	TDH-36C	**WXL-36**	63.9 (29)
42	-	✓	✓	✓	615 (24.2)	595 (23.4)	150 (5.90)	570 (22.4)	TDH-42C	**WXL-42**	72.8 (33)
48	-	✓	✓	✓	690 (27.2)	670 (26.4)	170 (6.69)	645 (25.4)	TDH-48C	**WXL-48**	79.4 (36)
54	-	✓	✓	✓	765 (30.1)	745 (29.3)	185 (7.28)	720 (28.3)	TDH-54C	**WXL-54**	86.0 (39)
60	-	✓	✓	✓	840 (33.1)	820 (32.3)	205 (8.07)	800 (31.5)	TDH-60C	**WXL-60**	92.6 (42)
72	-	✓	✓	✓	990 (39.0)	970 (38.2)	160 (6.30)	950 (37.4)	—	**WXL-72**	105.8 (48)
84	-	✓	✓	✓	1140 (44.9)	1120 (44.1)	185 (7.28)	1100 (43.3)	—	**WXL-84**	119.1 (54)
TYPE WXH - HIGH TEMPERATURE DESIGN (UP TO 950°F OUTLET TEMPERATURE) - 27 W/in.² (4.2 W/cm²)											
12	✓	✓	✓	✓	235 (9.3)	215 (8.5)	—	190 (7.5)	—	**WXH-12**	28.7 (13)
18	✓	✓	✓	✓	310 (12.2)	290 (11.4)	50 (1.97)	265 (10.4)	—	**WXH-18**	41.9 (19)
24	-	✓	✓	✓	385 (15.2)	365 (14.4)	90 (3.54)	340 (13.4)	—	**WXH-24**	55.1 (25)
36	-	✓	✓	✓	540 (21.3)	520 (20.5)	130 (5.12)	495 (19.5)	—	**WXH-36**	68.3 (31)
48	-	✓	✓	✓	690 (27.2)	670 (26.4)	170 (6.69)	645 (25.4)	—	**WXH-48**	81.6 (37)
60	-	✓	✓	✓	840 (33.1)	820 (32.3)	205 (8.07)	800 (31.5)	—	**WXH-60**	94.8 (43)
72	-	✓	✓	✓	990 (39.0)	970 (38.2)	160 (6.30)	950 (37.4)	—	**WXH-72**	108.0 (49)
84	-	✓	✓	✓	1140 (44.9)	1120 (44.1)	185 (7.28)	1100 (43.3)	—	**WXH-84**	121.3 (55)
TYPE WXH - HIGH TEMPERATURE DESIGN (UP TO 1100°F OUTLET TEMPERATURE) - 20 W/in.² (3.1 W/cm²)											
12	✓	✓	✓	✓	235 (9.3)	215 (8.5)	—	190 (7.5)	—	**WXH-1222**	30.9 (14)
18	✓	✓	✓	✓	310 (12.2)	290 (11.4)	50 (1.97)	265 (10.4)	—	**WXH-1822**	44.1 (20)
24	-	✓	✓	✓	385 (15.2)	365 (14.4)	90 (3.54)	340 (13.4)	—	**WXH-2422**	57.3 (26)
36	-	✓	✓	✓	540 (21.3)	520 (20.5)	130 (5.12)	495 (19.5)	—	**WXH-3622**	70.5 (32)
48	-	✓	✓	✓	690 (27.2)	670 (26.4)	170 (6.69)	645 (25.4)	—	**WXH-4822**	83.8 (38)
60	-	✓	✓	✓	840 (33.1)	820 (32.3)	205 (8.07)	800 (31.5)	—	**WXH-6022**	97.0 (44)
72	-	✓	✓	✓	990 (39.0)	970 (38.2)	160 (6.30)	950 (37.4)	—	**WXH-7222**	110.2 (50)
84	-	✓	✓	✓	1140 (44.9)	1120 (44.1)	185 (7.28)	1100 (43.3)	—	**WXH-8422**	123.5 (56)

TO ORDER SPECIFY: Quantity, catalog number, voltage, wattage and special features.

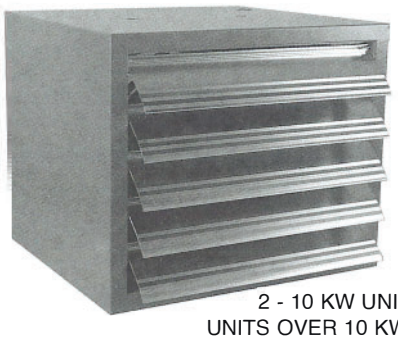
Forced Air Heaters - Regular Duty Type GE

APPLICATION

The Caloritech™ fan forced GE unit heater is designed for use in regular duty industrial and commercial space heating applications. This heater features a robust design which surpasses the standards of most competitive models.

If the environment is particularly demanding, the Caloritech™ model GX heater is recommended (see pages C20 and C21).

Also available are specially equipped 5 kW barn heaters which have been approved by Manitoba Hydro for use in buildings housing livestock.



2 - 10 KW UNIT WITH 5 LOUVRES
UNITS OVER 10 KW HAVE 7 LOUVRES

DESIGNED FOR APPLICATION IN NON-HAZARDOUS ENVIRONMENTS

- factories
- warehouses
- parking garages
- boiler rooms
- arenas
- grandstands
- mechanical rooms
- shopping malls
- display areas
- stores

FEATURES

- 2 kW to 40 kW output
- 208V to 600V - 1 or 3 phase
- field convertible from 1 to 3 phase
- tubular heating elements
- adjustable air flow louvres
- permanently lubricated motors
- overheat protection
- phosphate coated
- epoxy painted (ASA 61 Grey)
- optional thermostats and controls
- optional wall bracket
- motors mounted outside element bundle
- ceiling mounting bracket supplied

MOTORS

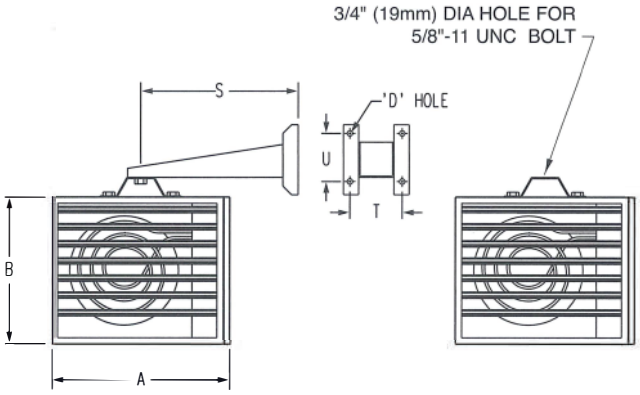
- 2 - 10 kW heaters are standard with dual rated motors; 208/240V single phase. Where necessary, transformers are used to provide proper motor voltage.
- 15 - 40 kW heaters are standard with single phase full voltage rated motors.
- standard motors have permanently lubricated bearings and built-in thermal overloads.
- totally enclosed ball bearing motors are standard.
- motor RPM - 1550 unless otherwise stated.
- motor HP - 2 to 10 kW - 1/20 HP
  - 15 to 40 kW - 1/10 HP
  - other ratings available, check factory.

CONTACTORS AND TRANSFORMERS

- Factory installed contactors are available when required.
- Transformers are standard when primary voltage is not suitable for motor operation or contactor coil ratings.
- Standard control voltage is 240V.

MOUNTING BRACKETS

WB210	Wall Mounting Bracket for 2 - 10 kW heaters
WB1540	Wall Mounting Bracket for 15 - 40 kW heaters



WALL MOUNT CEILING MOUNT

TABLE 1 - DIMENSIONS - in. (mm)

HEATER RATING KW	A	B	C DEPTH	D HOLE DIA.	S	T	U
2 - 10	17 (432)	14 (356)	15 1/2 (394)	1/2 (13)	12 1/2 (318)	4 1/2 (114)	4 1/2 (114)
15 - 40	24 (610)	19 1/2 (495)	22 (559)	5/8 (16)	17 1/2 (445)	6 (152)	6 (152)

TABLE 2 - HEIGHT & WEIGHT

KW	NORMAL MOUNTING HEIGHT - ft (m)	SHIPPING WEIGHT lbs. (kg)
2 - 10	6 - 8 (1.8 - 2.4)	59 (24)
15 - 40	8 - 12 (2.4 - 3.0)	104 (47)

TABLE 3 - SPECIFICATIONS

KW (B.T.U./HR)	VOLTS	PHASE	C.F.M.	TEMP. RISE °F	TEMP. RISE (°C)	MOTOR VOLTS	CATALOG NUMBER BASIC UNIT	BASIC UNIT WITH CONTACTOR	BASIC UNIT WITH THERMOSTAT (1 phase only)	BASIC UNIT WITH CONTACTOR & THERMOSTAT
2 (6824)	208 240	1 or 3 1	460	14	(8)	208/240	GE022 GE023	GE022C GE023C	GE022T GE023T	GE022CT GE023CT
3 (10236)	208 240 600	1 or 3 1 1 or 3	465	21	(12)	208/240	GE032 GE033 GE038	GE032C GE033C GE038C	GE032T GE033T GE038T	GE032CT GE033CT GE038CT
4 (13648)	208 240 480 600	1 or 3 1 1 or 3 1 or 3	475	28	(16)	208/240	GE042 GE043 GE047 GE048	GE042C GE043C GE047C GE048C	GE042T GE043T GE047T GE048T	GE042CT GE043CT GE047CT GE048CT
5 (17060)	208 240 480 600	1 or 3 1 1 or 3 1 or 3	480	40	(22)	208/240	GE052 GE053 GE057 GE058	GE052C GE053C GE057C GE058C	GE052T GE053T GE057T GE058T	GE052CT GE053CT GE057CT GE058CT
5 (17060)	208 240	1 1	550	35	(20)	208/240	- -	- -	GE052T/GX* GE053T/GX*	- -
7.5 (25590)	208 240 480 600	1 or 3	590	43	(24)	208/240	GE072 GE073 GE077 GE078	GE072C GE073C GE077C GE078C	- - - -	GE072CT GE073CT GE077CT GE078CT
10 (34120)	208 240 480 600	1 or 3	760	45	(25)	208/240	GE102 GE103 GE107 GE108	GE102C GE103C GE107C GE108C	- - - -	GE102CT GE103CT GE107CT GE108CT
15 (51180)	208 240 480 600	1 or 3	1040	50	(28)	208 240 480 600	GE152 GE153 GE157 GE158	GE152C GE153C GE157C GE158C	- - - -	GE152CT GE153CT GE157CT GE158CT
20 (68240)	208 240 480 600	1 or 3	1260	55	(31)	208 240 480 600	GE202 GE203 GE207 GE208	GE202C GE203C GE207C GE208C	- - - -	GE202CT GE203CT GE207CT GE208CT
25 (85300)	208 480 600	1 or 3	1500	61	(34)	208 480 600	GE252 GE257 GE258	GE252C GE257C GE258C	- - -	GE252CT GE257CT GE258CT
30 (102360)	480 600	1 or 3	1500	70	(39)	480 600	GE307 GE308	GE307C GE308C	- -	GE307CT GE308CT
40 (136480)	480 600	1 or 3	1500	80	(44)	480 600	GE407 GE408	GE407C GE408C	- -	GE407CT GE408CT

*Barn Heaters: Approved by Manitoba Hydro for use in buildings housing livestock: c/w low watt density elements, manual reset high limit, built-in thermostat.

OPTIONAL FACTORY INSTALLED FEATURES

- built-in thermostat 5°C to 38°C (41°F to 100°F)
- fused control circuit
- manual reset high limit
- "Fan Only" switch
- low voltage relay for remote 24V thermostat
- epoxy painted fan blade and motor
- special wattages and voltages
- special control voltages (standard is 240V)
- available in special finishes

ACCESSORIES FOR FIELD INSTALLATION

- FAT 8 thermostat kit 5°C to 38°C (41°F to 100°F)
- WB210 wall mount bracket (2-10 kW)
- WB1540 wall mount bracket (15-40 kW)
- line voltage and low voltage thermostats

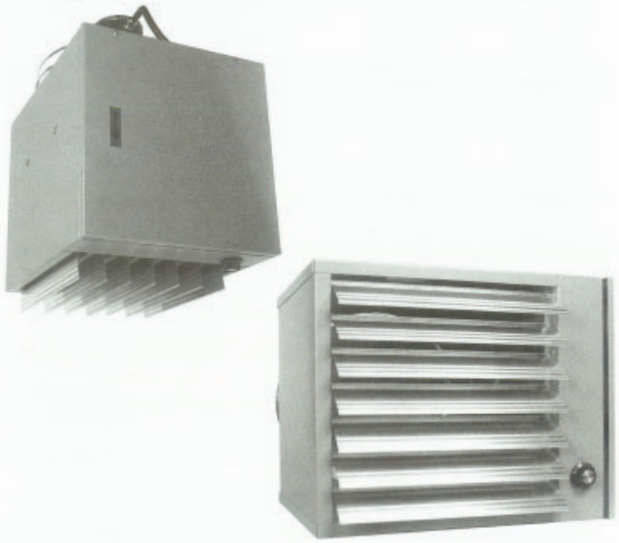
TO ORDER SPECIFY:

catalog number, voltage, phase, kilowatts, optional features, and accessories.

Forced Air Heaters - Heavy Duty
Type GX

Application

The Caloritech™ GX heater has been designed specifically for heavy duty use in industrial environments. This heater will reduce the downtime and maintenance costs normally experienced with heaters of standard design.



SPECIFICALLY DESIGNED FOR APPLICATION IN NON-HAZARDOUS ENVIRONMENTS

- mine shafts
- pulp and paper mills
- hoist houses
- welding shops
- maintenance shops
- sewage treatment plants
- chemical plants
- repair shops
- wash down areas
- weigh scale pits
- elevator shafts
- high humidity areas
- crane cabs

STANDARD GX PRODUCT FEATURES:

- CSA approved for horizontal and vertical air flow
- automatic reset high limit
- 15, 20, 25, 30, 40, 50 kw units
- 40 and 50 kw units incorporate split loads (50%) for remotely controlled energy management systems
- factory installed transformers, contactors, and thermostats where specified
- individually adjustable louvres
- factory balanced aluminum fan blade
- fan delay in "ON" and "OFF" cycles
- full sized control panel with hinged removable door, constructed to EEMAC 12 standards
- "Fan Only" terminals for connection to remote switch
- 14 Gauge steel cabinet
- epoxy painted (ASA 61 Grey) for superior resistance to corrosion
- 1/3 Hp motor with sealed ball bearings and totally enclosed construction
- ceiling mounting bracket supplied

STANDARD GX PRODUCT FEATURES (Cont'd):

- motor mounted outside of the element bundle eliminating premature failure due to overheating and providing easy access for motor maintenance
- elements are robust Caloritech™ type KX finned tubular sheathed type with epoxy sealed terminals to eliminate contamination from moisture and airborne impurities

Mounting Configurations

FIGURE 1 - HORIZONTAL AIR FLOW WALL MOUNT

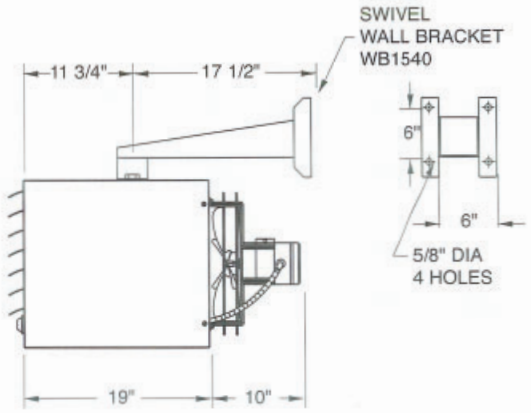


FIGURE 2 - HORIZONTAL AIR FLOW CEILING MOUNT

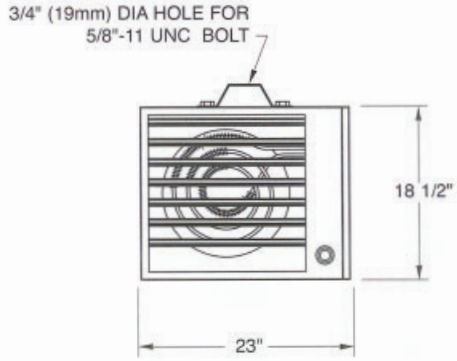
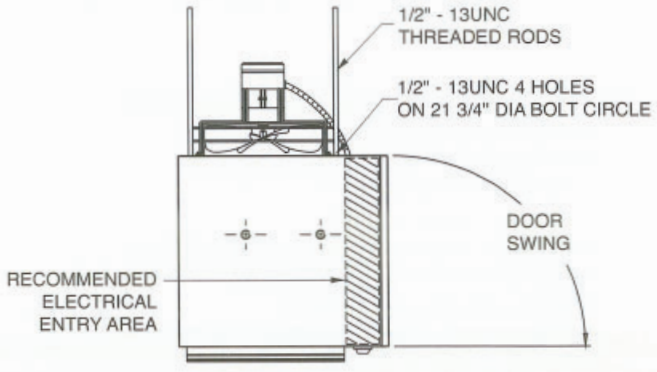


FIGURE 3 - VERTICAL AIR FLOW



Forced Air Heaters - Heavy Duty
Type GX (continued)

TABLE 1 - SPECIFICATIONS

KW (B.T.U./HR)	VOLTS	PHASE	C.F.M.	TEMP. RISE °F (°C)	CATALOG NUMBER WITHOUT CONTACTOR	CATALOG NUMBER WITH CONTACTOR	CATALOG NUMBER WITH T'STAT & CONTACTOR	NET WEIGHT
15 (51180)	208 240 480 600	3 1 3 3	1800	25 (14)	GX152 GX153 GX157 GX158	GX152C GX153C GX157C GX158C	GX152CT GX153CT GX157CT GX158CT	105 LBS. 47.6 KG
20 (68240)	208 240 480 600	3 1 3 3	1800	34 (19)	GX202 GX203 GX207 GX208	GX202C GX203C GX207C GX208C	GX202CT GX203CT GX207CT GX208CT	105 LBS. 47.6 KG
25 (85300)	208 240 480 600	3 1 3 3	1800	41 (24)	GX252 GX253 GX257 GX258	GX252C GX253C GX257C GX258C	GX252CT GX253CT GX257CT GX258CT	105 LBS. 47.6 KG
30 (102300)	480 600	3	2100	41 (24)	GX307 GX308	GX307C GX308C	GX307CT GX308CT	105 LBS. 47.6 KG
40 (136500)	480 600	3	2100	58 (32)	GX407 GX408	GX407C GX408C	GX407CT GX408CT	125 LBS. 56.7 KG
50 (170600)	480 600	3	2100	72 (40)	GX507 GX508	GX507C GX508C	GX507CT GX508CT	125 LBS. 56.7 KG

NOTES

1. Motor voltage and phase is same as heater supply.
2. Standard control voltage is 240V. A control transformer is included where required. Other control voltages are available (check factory).
3. 15, 20, 25, 30 kW units are pre-wired as one circuit. The split load feature (50%) is available as an option.
4. 40 and 50 kW units are pre-wired for split load (50%) control by customer unless specified otherwise.
5. All motors are 1/3 hp, totally enclosed ball bearing type, permanently lubricated, thermally protected.

OPTIONAL FACTORY INSTALLED FEATURES

- built-in thermostat 5°C to 38°C (41°F to 100°F)
- disconnect switch with door interlock
- HRC main load fuses
- fused control circuit
- manual reset high limit
- "Fan Only" switch
- low voltage relay for remote 24V thermostat
- epoxy painted fan blade and motor
- special wattages and voltages
- special control voltages (standard is 240V)
- available in special finishes
- split load feature - 15, 20, 25, 30 kW units
- nickel plated elements
- alloy elements with brazed alloy fins
- EEMAC 4 construction
- stainless steel cabinet

ACCESSORIES FOR FIELD INSTALLATION

- FAT 8A thermostat kit 5°C to 38°C (41°F to 100°F)
- WB1540 wall mount bracket (horizontal air flow)
- air diffuser (vertical air flow)
- "Fan Only" switch and cover plate
- line voltage and low voltage thermostats

TO ORDER SPECIFY:

catalog number, voltage, phase, kilowatts, optional features, and accessories.

Wash Down Unit Heaters Type AX

Application

The Caloritech™ type AX wash down forced air unit heater is specifically designed for operation in areas where the heater may be exposed to water and high humidity or in dirty areas requiring hosing down.

The AX is intended for use in non-hazardous environments such as car washes, food industry, waste water treatment facilities, pulp and paper mills and chemical plants.

Air Flow Flexibility

If desired, the AX unit heater can be tilted at a 30° angle below the horizontal. This mounting capability, provides maximum flexibility for directing air flow. Additionally, the entire louvre assembly can be conveniently rotated at increments of 90°, giving the user even more air flow options.

Standard Product Features

- CSA C/US approved
- moisture and corrosion resistant construction (heater can be hosed down)
- ratings from 5kW to 40kW
- 208V to 600V, 1 or 3 phase
- heavy duty low density corrosion resistant tubular heating elements with epoxy end seal to inhibit moisture and dirt contamination
- The patented ***x-Max***® housing with track and trolley system simplifies installation and servicing
- heavy duty 16 ga. stainless steel cabinet
- 1/3 hp, 1800 rpm totally enclosed air over ball bearing motor, epoxy painted for superior corrosion resistance
- epoxy painted factory balanced aluminum fan blade
- terminals for remote thermostat connection
- fan delay in ON and OFF cycles
- automatic reset over-temperature limit
- louvred outlet provides maximum range for outlet flow direction (air can be directed almost vertically)
- contactors derated for extended service life

Optional Factory Installed Features

- fan-only switch
- pilot light
- on-off switch
- built-in, externally adjustable thermostat
- manual reset high limit
- built-in disconnect
- outlet wire guard (instead of louvres)

Construction and Installation

The AX wash down unit heater utilizes Caloritech™ robust corrosion resistant tubular heating elements to provide safe efficient heat transfer to the environment. The AX also features a stainless steel cabinet, epoxy painted motor and fan, and the ***x-Max***® housing for superior moisture and corrosion resistance. The ***x-Max***® housing, with track and trolley system, simplifies installation and allows easy access to internal components for servicing.

Thermostats

offers a wide variety of thermostats to suit most every need. See Section F of the Caloritech™ catalog. Type AX heaters are available with optional built-in externally adjustable bulb type thermostats which are field convertible to tamper-proof.

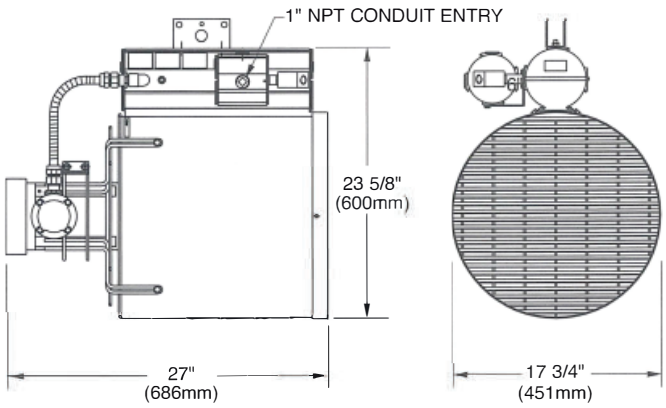
Thermostats for remote mounting can also be provided on request.

Motors

- totally enclosed air over ball bearing
- 1/3 hp, 1800 rpm
- motor voltage and phase same as heater voltage and phase
- thermally protected
- epoxy painted for enhanced corrosion resistance
- motor mounted outside of the element bundle simplifies maintenance

Construction

The type AX washdown heater is available in ratings from 5kW to 40kW. One compact cabinet size houses all standard heaters. Inlet wire guard and outlet louvre are supplied with all units. Control circuit voltage is 120V. Motor voltage and phase are the same as heater voltage and phase.



kW (BTU/hr)	Voltage	Phase 1ø	Phase 3ø	Approx. CFM (litres/s)	Approx. Temp. Rise °F	Approx. Temp. Rise °C	Catalog Number 1ø	Catalog Number 3ø	Approx. Weight lbs	Approx. Weight (kg)
	208	-	AS				-	AX05023	66	(30)
5	240	AS	AS	930	16	(9)	AX05031	AX05033		
(17060)	480	-	AS	(440)			-	AX05073		
	600	-	S				-	AX05083		
	208	-	AS				-	AX07523		
7.5	240	AS	AS	930	24	(13)	AX07531	AX07533	66	(30)
(25590)	480	-	AS	(440)			-	AX07573		
	600	-	S				-	AX07583		
	208	-	AS				-	AX10023		
10	240	AS	AS	930	32	(18)	AX10031	AX10033	66	(30)
(34120)	480	-	AS	(440)			-	AX10073		
	600	-	S				-	AX10083		
	208	-	AS				-	AX15023		
15	240	-	AS	1800	25	(14)	-	AX15033	75	(34)
(51180)	480	-	AS	(850)			-	AX15073		
	600	-	S				-	AX15083		
20	480	-	AS	1800	33	(19)	-	AX20073	75	(34)
(68240)	600	-	S	(850)			-	AX20083		
25	480	-	AS	1800	42	(23)	-	AX25073	75	(34)
(85300)	600	-	AS	(850)			-	AX25083		
30	480	-	AS	2100	43	(24)	-	AX30073	90	(41)
(102360)	600	-	S	(990)			-	AX30083		
40	480	-	AS	2100	57	(32)	-	AX40073	90	(41)
(136490)	600	-	S	(990)			-	AX40083		

S - Normally Stocked; AS - Assembly Stock

NOTES:

(1) Built-in externally adjustable thermostat is optional.
(2) Remote thermostat can be ordered separately. See Section F of the Caloritech™ catalog.
(3) Outlet wire guard is available in place of louvre assembly.
(4) Mounting accessories must be ordered separately.

TO ORDER SPECIFY:

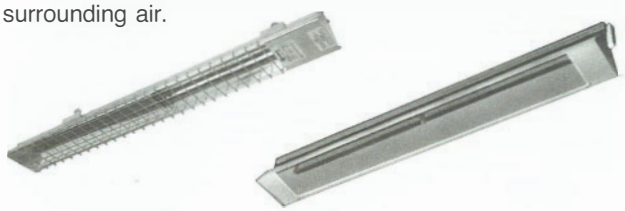
Quantity, catalog number, volts, phase, kilowatts, optional features, mounting accessories, and location of installation.

Mounting Accessories

Type	Catalog Number
Ceiling Mount Kit	CM - 01
Wall Mount Kit	WM - 01
Post Mount Kit	PM - 01

General Information

The major benefit of infrared heating is its ability to transfer heat to a person or object without heating the surrounding air.



As an example, a person doing heavy work requires an air temperature of 66-68°F to maintain the feeling of warmth, but to provide the same feeling of warmth with infrared heating requires an air temperature of only 55-60°F.

Type of Work	Normal Air Temperature	Equivalent Temperature with Infrared Heating
Heavy Work	66-68°F	55-60°F
Light Work	70-72°F	60-65°F
Seated	74-76°F	65-70°F
Swimming Pool	85-90°F	75-80°F

DANGER-HAZARD OF FIRE - AVOID DIRECT CONTACT OF HEATER CASE WITH ANY COMBUSTIBLE SURFACES. ENERGIZED HEATERS SHOULD BE SPACED SO THAT NO COMBUSTIBLE SURFACES EXCEED 194°F (90°C). ALL HEATING ELEMENTS AS THEY AGE WILL EVENTUALLY FAIL BY OPEN OR SHORT CIRCUITING. SHORT CIRCUITING MAY RESULT IN CATASTROPHIC RUPTURE OF THE ELEMENT SHEATH WHICH MAY EJECT RED HOT PARTICLES - CAPABLE OF IGNITING COMBUSTIBLES IN THEIR PATH. USE OF GROUND FAULT INTERRUPTORS IN THE CIRCUIT CAN MINIMIZE THIS RISK.

Features

Caloritech™ infrared heaters are available in a wide variety of fixtures with a choice of metal sheathed (type C), quartz tube (type T), or quartz lamp (type L) heating elements. Quartz lamp heaters are more efficient than quartz tube heaters which are in turn more efficient than metal tube heaters.

Where vibration or mechanical shock risk exists, do not use quartz tube or quartz lamp heaters. Quartz tubes and lamps must be mounted horizontal. Use metal sheathed heaters in these instances. Terminal ends must be protected from severe moisture or contaminating vapours. Use heaters with moisture resistant terminal housings (pages C24 and C27) in these environments.

Two fixture types are available. The deep reflector type gives better radiation at greater than normal mounting height.

Life Expectancy

The normal life expectancy of a radiant heater depends, in part, on heater watt density and operating conditions. Applications characterized by high ambient temperatures or frequent switching are the most demanding. Note that the heaters are warranted only for defects in material and workmanship. Estimates of life expectancy for a particular application are available on request.

Application

In general, the application of infrared heaters is complex and allowances must be made for in-field adjustments to output intensity and heater positioning.

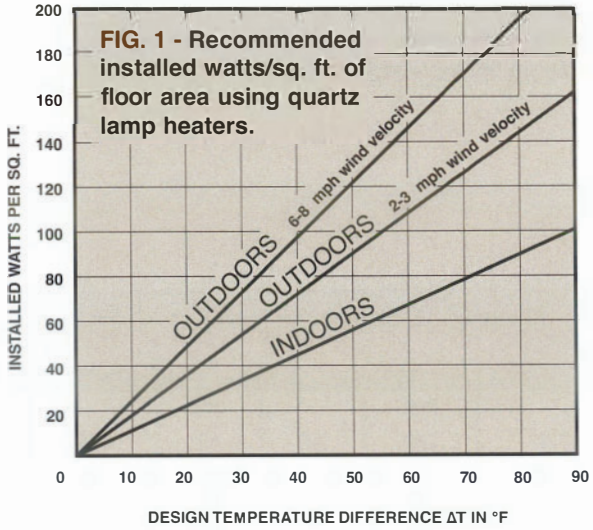


FIG. 1 - Recommended installed watts/sq. ft. of floor area using quartz lamp heaters.

Space heating applications are reasonably straight forward. Pay close attention to the energy spread to achieve maximum utilization.

For process heating applications, it may be necessary to run a series of tests to establish the most satisfactory heating method. Technical sales specialists can help you to achieve the best results.

Energy Spread

Use the table below to determine the effective energy spread for the 45°, 60° and 70° fixtures. Proper application of this information will help in establishing an efficient layout for uniform infrared coverage of the product or space.

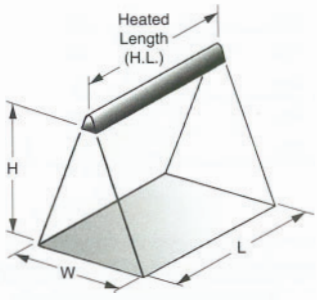


TABLE 1 - RADIANT COVERAGE AT VARIOUS HEIGHTS

SPREAD*	WIDTH (W)	LENGTH (L)
45°	.83H	H + H.L.*
60°	1.15H	"
70°	1.4H	"

* SEE LISTINGS FOR H.L. (HEATED LENGTH)

Selection

APPLICATION	Incoloy Tubular Element	Quartz Tube Element	Quartz Lamp Element
COMFORT HEATING APPLICATION			
Arenas	✔		
Assembly areas	✔		✔
Auditoriums	✔	✔	✔
Bathrooms		✔	
Booth	✔	✔	
Bowling alleys	✔	✔	✔
Brooders for chickens, etc.	✔	✔	
Building entrances	✔		✔
Bus stations and shelters	✔	✔	✔
Car washes especially coin operated	✔		✔
Churches (especially rural)	✔	✔	
Drive-ins (restaurants, banks, etc.)	✔	✔	✔
Entrances			✔
Exhibition halls	✔		✔
Factories	✔		✔
Farm animals	✔		✔
Farm sheds	✔	✔	
Garages	✔		✔
Gatehouses	✔		✔
Grandstands			✔
Gymnasiums	✔		✔
Hangars	✔		✔
Hospital emergency entrances			✔
Hotel entrances	✔		✔
Loading platforms			✔
Milk parlours	✔	✔	
Outdoor cafes		✔	✔
Skating shelters	✔		
Ski chalets	✔		
Snow melting (refer to factory)			✔
Spot heating, indoors	✔	✔	✔
Spot heating, outdoors	✔		✔
Stadiums			✔
Subway stations	✔		✔
PROCESS HEATING APPLICATIONS			
Baking (curing) paint on metal	✔	✔	
Baking (curing) paint on plastic or wood		✔	✔
Baking cakes, etc			✔
Blanching vegetables			✔
Boosting temperature in existing ovens	✔		
Broiling chickens, etc.			✔
Conveyorized systems	✔	✔	✔
Curing concrete	✔		✔
Dehydrating	✔		✔
Drying abrasive powder	✔		
Drying concentrates	✔		
Drying gum on powder (e.g. envelopes and textiles)			✔
Drying paint on textiles - heavy	✔	✔	✔
Drying paint on textiles - light		✔	✔
Drying paint or print on paper, plastic		✔	✔
Drying soil, clay, sand, etc.	✔		
Frit drying in ceramic processes	✔		
Ice-prevention in chutes, hoppers, etc.	✔		
Melting snow (in dump sites, etc.) refer to factory			✔
Mirror coatings	✔		
Paper machinery			✔
Peeling apples, etc.			✔
Preheating metal prior to welding	✔		
Silk screen drying			✔
Thawing frozen ore or coal in railroad cars for easier dumping	✔		✔
Thawing ice			✔
Thawing soil			✔
Vacuum forming	✔		

Control Options

PERCENTAGE TIMERS

Percentage timers (input controllers) are used mainly for pulsing power to metal tubular element type radiant heaters. Where load voltage and current ratings exceed the timer's contact rating, the timer can be used to switch contactors (see Section F). Percentage timers can not be effectively used on quartz lamp type radiant heaters and have restricted use on quartz tube type heaters.

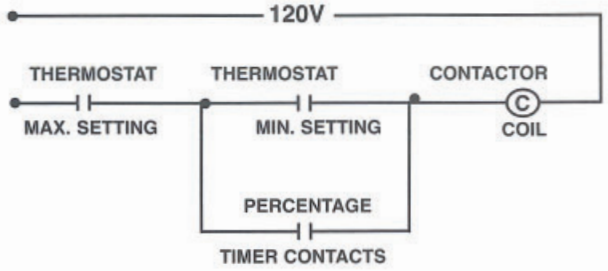
The OKT features a synchronous motor driven cam which closes a snap action switch for a percentage of 30 second "on" time. The adjustment knob sets the pointer to an "on" time of 0 to 100%. For instance, a timer set to 50% (mid scale) would allow full voltage to the heater(s) for 15 seconds and no voltage for 15 seconds thus reducing the average heat output. Standard features include a plug-in style mounting, an electrically isolated pilot light and a cycle progress pointer.

THERMOSTATIC CONTROL

Thermostatic control is used primarily for indoor applications and consists of an indoor thermostat, or an indoor thermostat combined with an outdoor thermostat. Rooms heated with infrared heaters can normally be maintained at lower temperatures and still be in the comfort range.

Thermostats should be located in the area to be heated but not directly exposed to the heater beam pattern. Thermostats may be shielded by placing a reflective cover over top.

Thermostatic controls can be used in conjunction with a percentage timer for cost efficient space heating. Two thermostats (or one two stage thermostat) are required.



In the above circuit, one thermostat is set at the maximum required room temperature and one is set at the minimum desired room temperature. The input controller is adjusted to provide modulated infrared heat when the space temperature is between the above limits.

STEP AND CONTINUOUS CONTROL

Larger installations may require custom control panels for more sophisticated zone control using staging and SCRs. Refer to Section D or consult your nearest Caloritech™ representative to aid you in selecting the proper type of control for your individual requirements.

OKA Series

APPLICATIONS

Caloritech™ series OKA infrared radiant heaters are primarily designed for industrial applications such as:

- conveyorized or batch type ovens
- degreasing
- weld preheating
- roll heating
- curing, drying, softening of resins, vinyls, and plastics
- baking, drying, curing of paint, lacquers and adhesives
- defrosting soil prior to pouring concrete
- curing concrete in winter construction
- thawing ore and coal in railroad cars for easier dumping

FEATURES

Available with a choice of single or dual incoloy tubular elements, quartz tubes, or quartz lamps. Anodized and chemically brightened extruded aluminum reflector. Custom mounting frames and carts to suit individual requirements can be provided upon request (check factory). Also see page C30.

For wiring, use standard 200°C supply wires.

TYPE C - SINGLE TUBULAR ELEMENT

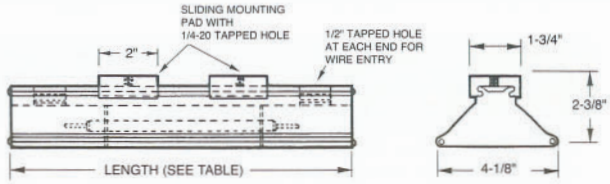
Generally used in conveyorized or batch type process heating applications requiring far infrared for drying or curing where a small economical unit is preferred. The mineral insulated alloy sheath heating element enables the unit to withstand splashing and vibration and is the most durable of the three heat sources.

TYPE C - 60° SPREAD

KW	STANDARD VOLTAGES	OVERALL LENGTH mm	OVERALL LENGTH in.	HEATED LENGTH mm	HEATED LENGTH in.	CATALOG NUMBER	SHIPPING WEIGHT kg	SHIPPING WEIGHT lb.
0.95	120, 208 240	737	29	508	20	OKA299C6	1.1	2.5
1.5	"	1041	41	813	32	OKA411C6	1.5	3.4
1.9	"	1194	47	965	38	OKA471C6	1.9	4.2
2.0	208, 240 480, 600	1041	41	813	32	OKA412C6	1.7	3.8
2.3	"	1194	47	965	38	OKA472C6	1.9	4.3
3.0	"	1499	59	1270	50	OKA593C6	2.4	5.2
3.8	"	1803	71	1575	62	OKA713C6	2.8	6.2

NOTE: For 45° spread, last number in catalog no. is changed from "6" to "4".

OKA SERIES



TYPE E - DOUBLE TUBULAR ELEMENT

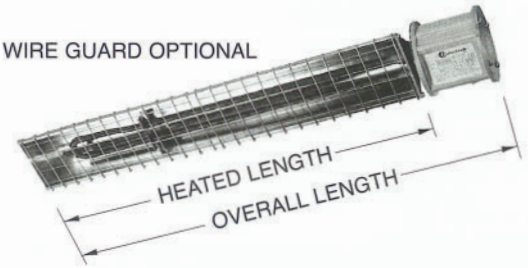
With two series wired heating elements in each reflector, these units are normally used in industrial applications where a rugged, efficient, high heat concentration is required. Applications include degreasing, weld preheating, roll heating, drying, sterilization, etc.

TYPE E - 60° SPREAD

KW	STANDARD VOLTAGES	OVERALL LENGTH mm	OVERALL LENGTH in.	HEATED LENGTH mm	HEATED LENGTH in.	CATALOG NUMBER	SHIPPING WEIGHT kg	SHIPPING WEIGHT lb.
1.8	208, 240 480, 600	737	29	508	20	OKA291E6	1.6	3.5
3.2	"	1041	41	813	32	OKA413E6	2.2	4.8
3.8	"	1194	47	965	38	OKA473E6	2.5	5.4
5.0	"	1499	59	1270	50	OKA593E6	3.0	6.7
6.2	"	1803	71	1575	62	OKA713E6	3.6	8.0

TYPE R - HAIRPIN TUBULAR ELEMENT WITH MOISTURE RESISTANT TERMINAL HOUSING

Type R heaters are for use in outdoor installations or areas subject to periodic washdown.



TYPE R - 60° SPREAD

KW	STANDARD VOLTAGES	OVERALL LENGTH mm	OVERALL LENGTH in.	HEATED LENGTH mm	HEATED LENGTH in.	CATALOG NUMBER	SHIPPING WEIGHT kg	SHIPPING WEIGHT lb.
1.1*	208, 240 480, 600	463	18 1/4	356	14	OKA141H6R	1.3	2.9
1.6	"	590	23 1/4	483	19	OKA191H6R	2.2	4.8
2.1	"	743	29 1/4	635	25	OKA252H6R	2.5	5.4
2.5	"	844	33 1/4	737	29	OKA292H6R	2.6	5.8
3.0	"	971	38 1/4	864	34	OKA343H6R	2.9	6.4
3.6	"	1149	45 1/4	1041	41	OKA413H6R	3.2	7.1
4.2	"	1301	51 1/4	1194	47	OKA474H6R	3.5	7.8
5.3	"	1606	63 1/4	1499	59	OKA595H6R	4.1	9.1
6.5	"	1911	75 1/4	1803	71	OKA716H6R	4.7	10.4

*1.1 kW unit also available in 120V

DANGER-HAZARD OF FIRE - AVOID DIRECT CONTACT OF HEATER CASE WITH ANY COMBUSTIBLE SURFACES. ENERGIZED HEATERS SHOULD BE SPACED SO THAT NO COMBUSTIBLE SURFACES EXCEED 194°F (90°C). ALSO SEE PAGE C24.

TO ORDER SPECIFY:

Quantity, catalog no., voltage and wattage.

OKA Series (continued)

TYPE T - QUARTZ TUBE ELEMENT

These units are commonly used in industrial applications where medium intensity infrared heat is required such as paint spray booths, curing, drying and softening of resins, vinyls, or plastics.

Quartz tube fixtures must be mounted horizontally.

TYPE T - 60° SPREAD

KW	STANDARD VOLTAGES	OVERALL LENGTH mm	OVERALL LENGTH in.	HEATED LENGTH mm	HEATED LENGTH in.	CATALOG NUMBER	SHIPPING WEIGHT kg	SHIPPING WEIGHT lb.
0.8	120, 208 240	635	25	406	16	OKA258T6	1.2	2.6
1.6	"	1041	41	813	32	OKA411T6	1.7	3.8
2.5	208, 240 480, 600	1499	59	1270	50	OKA592T6	2.3	5.0
3.1	"	1803	71	1575	62	OKA713T6	2.6	5.8

TYPE F - DOUBLE QUARTZ TUBE ELEMENTS

For use in applications where high intensity heat is required but the light emitted by quartz lamps would be objectionable.

Quartz tube fixtures must be mounted horizontally.

TYPE F - 60° SPREAD

KW	STANDARD VOLTAGES	OVERALL LENGTH mm	OVERALL LENGTH in.	HEATED LENGTH mm	HEATED LENGTH in.	CATALOG NUMBER	SHIPPING WEIGHT kg	SHIPPING WEIGHT lb.
1.6	120, 208 240	635	25	406	16	OKA251F6	1.5	3.2
3.2	"	1041	41	813	32	OKA413F6	2.1	4.6
5.0	208, 240 480, 600	1499	59	1270	50	OKA595F6	2.8	6.1
6.2	"	1803	71	1575	62	OKA716F6	3.2	7.1

TYPE L - QUARTZ LAMP ELEMENT

These are widely used in industrial applications where high intensity radiation is required and where it is essential to turn the heat on or off instantaneously. They are commonly used for baking, drying and curing items such as paint, varnishes, lacquers, and adhesives, for softening plastics and for food processing.

Quartz lamp fixtures must be mounted horizontally.

TYPE L - 60° SPREAD

KW	STANDARD VOLTAGES	OVERALL LENGTH mm	OVERALL LENGTH in.	HEATED LENGTH mm	HEATED LENGTH in.	CATALOG NUMBER	SHIPPING WEIGHT kg	SHIPPING WEIGHT lb.
0.5	120	356	14	127	5	OKA145L6	0.9	1.9
1.0	208, 240	483	19	254	10	OKA191L6	1.0	2.2
1.6	"	635	25	406	16	OKA251L6	1.2	2.6
2.5	480, 600	864	34	635	25	OKA342L6	1.5	3.3
3.8	600	1194	47	965	38	OKA473L6	1.9	4.2

OK3 Series

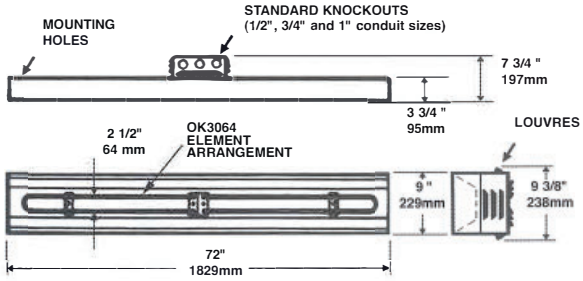
APPLICATION

The OK3 infrared radiant heater is used where an extra high density rugged heat source is required. It is suited for process or comfort heating.

FEATURES

This unit features two incoloy tubular elements which are designed for operation under severe working conditions. Thermal insulation decreases heat losses, increases efficiency, and reduces power required. Tarnish free, high lustre, aluminum reflector increases efficiency by concentrating energy on the area to be heated (energy spread approx. 60°).

Models are available with general purpose or weatherproof terminal boxes to meet a wide variety of special process heating applications.



TYPE OK3 - 60° SPREAD

KW	STANDARD VOLTAGES	CATALOG NUMBER GENERAL PURPOSE HOUSING	CATALOG NUMBER MOISTURE RESISTANT HOUSING	SHIPPING WEIGHT lb.	SHIPPING WEIGHT kg
6.4	208, 240, 480, 600	OK3064	OK3064R	38	17.4
8.0	"	OK3080	OK3080R	38	17.4
10.0	"	OK3100	OK3100R	38	17.4

DANGER-HAZARD OF FIRE - AVOID DIRECT CONTACT OF HEATER CASE WITH ANY COMBUSTIBLE SURFACES. ENERGIZED HEATERS SHOULD BE SPACED SO THAT NO COMBUSTIBLE SURFACES EXCEED 194°F (90°C).
ALSO SEE PAGE C24.

TO ORDER SPECIFY:

Quantity, catalog no., voltage and wattage.

OKB, OKH, AND OKD Series

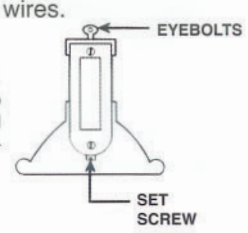
APPLICATIONS

- outdoor grandstands
- indoor arenas
- indoor pools
- churches and halls
- patios
- outdoor shelters
- spot heating in large unheated buildings and garages
- entry vestibules
- store front snow melting
- warehouse loading bays
- work areas in farm buildings

FEATURES

All units are available with incoloy tubular, quartz tube, or quartz lamp type elements. Extruded aluminum, anodized and chemically brightened reflectors are standard. Tilting accessories are not required; units come complete with swivel bracket and set screw adjustment. Eyebolts are supplied for chain mounting. Units may also be surface mounted to recessed outlet box on non-combustible surfaces. Use 90°C wires.

Tilting accessories are not required. Simply adjust set screw at one end to achieve desired degree horizontal tilting. Eyebolts with holes for chain-mounting are provided.



OKB Series

TYPE C - SINGLE TUBULAR ELEMENT

Commonly used for indoor spot heating applications where a great amount of heat is not required and where the mounting height is relatively low. Example installations would include churches, garages, and indoor pools.

TYPE C - 60° SPREAD

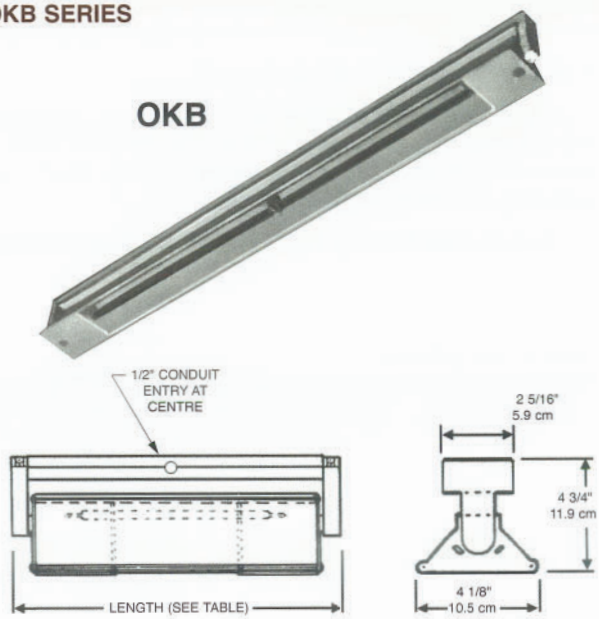
KW	STANDARD VOLTAGES	OVERALL LENGTH mm	OVERALL LENGTH in.	HEATED LENGTH mm	HEATED LENGTH in.	CATALOG NUMBER	SHIPPING WEIGHT kg	SHIPPING WEIGHT lb.
.95	120,208 240	800	31.5	508	20	OKB299C6	2.3	5.1
1.5	"	1105	43.5	813	32	OKB411C6	3.1	6.8
1.9	"	1257	49.5	965	38	OKB471C6	3.6	8.0
2.0	208, 240 480, 600	1105	43.5	813	32	OKB412C6	3.3	7.2
2.3	"	1257	49.5	965	38	OKB472C6	3.7	8.1
3.0	"	1562	61.5	1270	50	OKB593C6	4.5	9.9
3.8	"	1867	73.5	1575	62	OKB713C6	5.3	11.7

NOTE: For 45° spread, last number in catalog no. is changed from "6" to "4".

TO ORDER SPECIFY:
Quantity, catalog no., voltage and wattage.

OKB SERIES

OKB



TYPE E - DOUBLE TUBULAR ELEMENT

Ideal for heating small indoor areas where a more intense heat is required and where the light emitted by a quartz lamp would be objectionable.

TYPE E - 60° SPREAD

KW	STANDARD VOLTAGES	OVERALL LENGTH mm	OVERALL LENGTH in.	HEATED LENGTH mm	HEATED LENGTH in.	CATALOG NUMBER	SHIPPING WEIGHT kg	SHIPPING WEIGHT lb.
1.8	208, 240 480, 600	800	31.5	508	20	OKB291E6	2.7	6.0
3.2	"	1105	43.5	813	32	OKB413E6	3.7	8.2
3.8	"	1257	49.5	965	38	OKB473E6	4.2	9.2
5.0	"	1562	61.5	1270	50	OKB595E6	5.2	11.4
6.2	"	1867	73.5	1575	62	OKB716E6	6.1	13.5

TYPE T - QUARTZ TUBE

Ideal for indoor and outdoor applications where fast heat up and no light is required such as canopies, patios and garages.

Quartz tube fixtures must be mounted horizontally.

TYPE T - 60° SPREAD

KW	STANDARD VOLTAGES	OVERALL LENGTH mm	OVERALL LENGTH in.	HEATED LENGTH mm	HEATED LENGTH in.	CATALOG NUMBER	SHIPPING WEIGHT kg	SHIPPING WEIGHT lb.
0.8	120,208 240	699	27.5	406	16	OKB258T6	2.2	4.9
1.6	"	1105	43.5	813	32	OKB411T6	3.2	7.1
2.5	208, 240 480, 600	1562	61.5	1270	50	OKB592T6	4.4	9.7
3.1	"	1867	73.5	1575	62	OKB713T6	5.1	11.3

DANGER-HAZARD OF FIRE - AVOID DIRECT CONTACT OF HEATER CASE WITH ANY COMBUSTIBLE SURFACES. ENERGIZED HEATERS SHOULD BE SPACED SO THAT NO COMBUSTIBLE SURFACES EXCEED 194°F (90°C).
ALSO SEE PAGE C24.

TYPE L - QUARTZ LAMP

For use in indoor or outdoor comfort heating applications where the mounting height is greater than 15 ft. and a small compact unit is required.

Quartz lamp fixtures must be mounted horizontally.

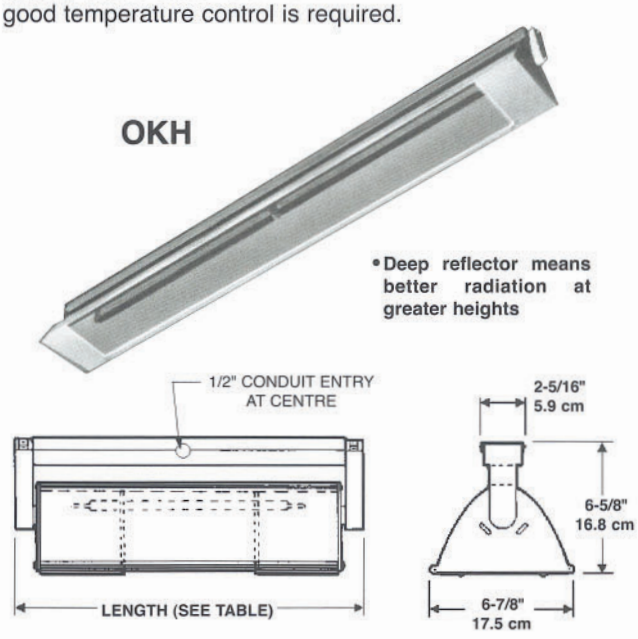
TYPE L - 60° SPREAD

KW	STANDARD VOLTAGES	OVERALL LENGTH mm	OVERALL LENGTH in.	HEATED LENGTH mm	HEATED LENGTH in.	CATALOG NUMBER	SHIPPING WEIGHT kg	SHIPPING WEIGHT lb.
0.5	120	419	16.5	127	5	OKB145L6	1.5	3.4
1.0	208, 240	547	21.5	254	10	OKB191L6	1.9	4.1
1.6	"	699	27.5	406	16	OKB251L6	2.2	4.9
2.5	480, 600	927	36.5	635	25	OKB342L6	2.8	6.2
3.8	600	1257	49.5	965	38	OKB473L6	3.6	8.0

OKH Series

TYPE C - INCOLOY TUBULAR ELEMENT

Ideal for arenas and other indoor applications where a larger, more rugged unit is required and where the light emitted from a quartz lamp would be objectionable. Excellent for indoor comfort heating applications such as factory work stations or isolated service booths where good temperature control is required.



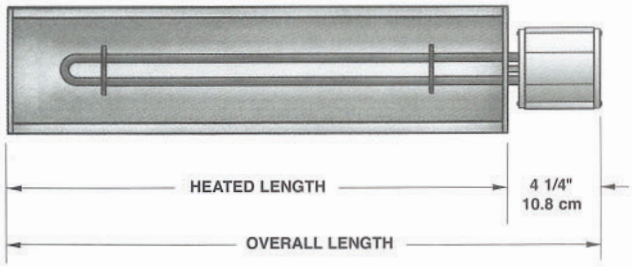
TYPE C - 45° SPREAD

KW	STANDARD VOLTAGES	OVERALL LENGTH mm	OVERALL LENGTH in.	HEATED LENGTH mm	HEATED LENGTH in.	CATALOG NUMBER	SHIPPING WEIGHT kg	SHIPPING WEIGHT lb.
.95	120, 208 240	800	31.5	508	20	OKH299C4	3.5	7.7
1.5	"	1105	43.5	813	32	OKH411C4	4.6	10.2
1.9	"	1257	49.5	965	38	OKH471C4	5.4	11.9
2.0	208, 240 480, 600	1105	43.5	813	32	OKH412C4	4.8	10.6
2.3	"	1257	49.5	965	38	OKH472C4	5.4	11.9
3.0	"	1562	61.5	1270	50	OKH593C4	6.6	14.6
3.8	"	1867	73.5	1575	62	OKH713C4	7.9	17.3

NOTE: For 70° spread, last number in catalog no. is changed from "4" to "7".

TYPE R - HAIRPIN TUBULAR ELEMENT WITH MOISTURE RESISTANT TERMINAL HOUSING

Type R heaters, featuring a hairpin shaped element in a moisture resistant housing, provide a high heat concentration minimizing the number of heaters required. Suitable for outdoor or indoor installation. Note that this model does not have the tilting fixture. Sliding mounting pads with hooks are provided.



TYPE R - 60° SPREAD

KW	STANDARD VOLTAGES	OVERALL LENGTH mm	OVERALL LENGTH in.	HEATED LENGTH mm	HEATED LENGTH in.	CATALOG NUMBER	SHIPPING WEIGHT kg	SHIPPING WEIGHT lb.
1.6	208, 240, 480, 600	590	23 1/4	483	19	OKH191H6R	2.9	6.3
2.1	"	742	29 1/4	635	25	OKH252H6R	3.4	7.4
3.0	"	971	38 1/4	864	34	OKH343H6R	4.1	9.0
4.2	"	1301	51 1/4	1194	47	OKH474H6R	5.1	11.3
5.3	"	1606	63 1/4	1499	59	OKH595H6R	6.1	13.5
6.5	"	1911	75 1/4	1803	71	OKH716H6R	7.1	15.6

TYPE T - QUARTZ TUBE ELEMENT

Used in applications similar to the quartz lamp where light emitted by the lamp would be undesirable. Maintains high density at greater than normal mounting heights.

Quartz tube fixtures must be mounted horizontally.

TYPE T - 45° SPREAD

KW	STANDARD VOLTAGES	OVERALL LENGTH mm	OVERALL LENGTH in.	HEATED LENGTH mm	HEATED LENGTH in.	CATALOG NUMBER	SHIPPING WEIGHT kg	SHIPPING WEIGHT lb.
0.8	120, 208 240	699	27.5	406	16	OKH258T4	3.3	7.2
1.6	"	1105	43.5	813	32	OKH411T4	4.8	10.6
2.5	208, 240 480, 600	1563	61.5	1270	50	OKH592T4	6.5	14.3
3.1	"	1867	73.5	1575	62	OKH713T4	7.6	16.8

NOTE: For 70° spread, last number in catalog no. is changed from "4" to "7".

DANGER-HAZARD OF FIRE - AVOID DIRECT CONTACT OF HEATER CASE WITH ANY COMBUSTIBLE SURFACES. ENERGIZED HEATERS SHOULD BE SPACED SO THAT NO COMBUSTIBLE SURFACES EXCEED 194°F (90°C).
ALSO SEE PAGE C24.

TO ORDER SPECIFY:

Quantity, catalog no., voltage and wattage.

OKH Series (continued)

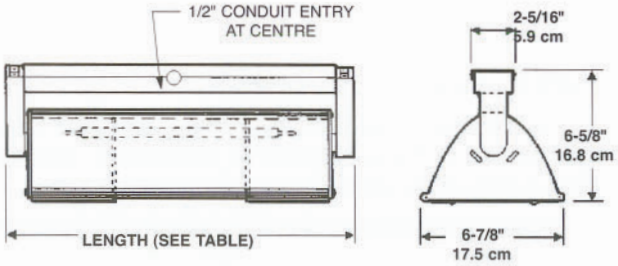
TYPE L - QUARTZ LAMP ELEMENT

Excellent for indoor and outdoor areas where increased density at high mounting heights is essential and light emitted could be used to an advantage. For example: racetracks and other outdoor stadiums, parking garage ramps, aircraft hangars and high bay industrial buildings.

Quartz lamp fixtures must be mounted horizontally.

OKH

- Deep reflector means better radiation at greater heights



TYPE L - 45° SPREAD

KW	STANDARD VOLTAGES	OVERALL LENGTH mm	OVERALL LENGTH in.	HEATED LENGTH mm	HEATED LENGTH in.	CATALOG NUMBER	SHIPPING WEIGHT kg	SHIPPING WEIGHT lb.
0.5	120	419	16.5	127	5	OKH145L4	2.2	4.9
1.0	208, 240	547	21.5	254	10	OKH191L4	2.7	6.0
1.6	"	699	27.5	406	16	OKH251L4	3.3	7.2
2.5	480, 600	927	36.5	635	25	OKH342L4	4.1	9.1
3.8	600	1257	49.5	965	38	OKH473L4	5.4	11.8

NOTE: For 70° spread, last number in catalog no. is changed from "4" to "7".

TO ORDER SPECIFY:
Quantity, catalog no., voltage and wattage.

OKD Series

- double reflector unit using OKH fixtures.
- contains one element per reflector to utilize maximum reflector efficiency.
- available in choice of 45° or 70° energy spreads.
- swivel mount.

OKD

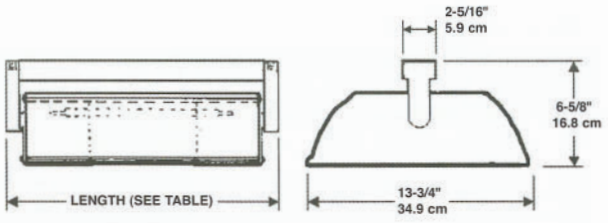
TYPE C - INCOLOY TUBULAR ELEMENT

Used in similar applications to OKH series except twice as much heat is emitted for harder to heat areas such as large unheated factories, sawmills, ice rinks and gymnasiums.

TYPE C - 45° SPREAD

KW	STANDARD VOLTAGES	OVERALL LENGTH mm	OVERALL LENGTH in.	HEATED LENGTH mm	HEATED LENGTH in.	CATALOG NUMBER	SHIPPING WEIGHT kg	SHIPPING WEIGHT lb.
1.9	120, 208 240	800	31.5	508	20	OKD291C4	6.5	14.3
3.0	"	1105	43.5	813	32	OKD413C4	8.6	19.0
3.8	"	1257	49.5	965	38	OKD473C4	10.1	22.2
4.0	208, 240 480, 600	1105	43.5	813	32	OKD414C4	9.0	19.8
4.6	"	1257	49.5	965	38	OKD474C4	10.1	22.3
6.0	"	1562	61.5	1270	50	OKD596C4	12.4	27.3
7.6	"	1867	73.5	1575	62	OKD717C4	14.7	32.4

NOTE: For 70° spread, last number in catalog no. is changed from "4" to "7".



DANGER-HAZARD OF FIRE - AVOID DIRECT CONTACT OF HEATER CASE WITH ANY COMBUSTIBLE SURFACES. ENERGIZED HEATERS SHOULD BE SPACED SO THAT NO COMBUSTIBLE SURFACES EXCEED 194°F (90°C).
ALSO SEE PAGE C24.

OKD Series (continued)

TYPE T - QUARTZ TUBE ELEMENT

Used for indoor and outdoor comfort heating at higher than normal heights (12 to 20 ft.) where light emitted from lamps would be undesirable such as auditoriums, bowling alleys and open air restaurants.

Quartz tube fixtures must be mounted horizontally.

TYPE T - 45° SPREAD

KW	STANDARD VOLTAGES	OVERALL LENGTH mm	OVERALL LENGTH in.	HEATED LENGTH mm	HEATED LENGTH in.	CATALOG NUMBER	SHIPPING WEIGHT kg	SHIPPING WEIGHT lb.
1.6	120, 208 240	699	27.5	406	16	OKD251T4	6.0	13.3
3.2	"	1105	43.5	813	32	OKD413T4	9.0	19.7
5.0	208, 240 480, 600	1563	61.5	1270	50	OKD595T4	12.2	26.8
6.2	"	1867	73.5	1575	62	OKD716T4	14.4	31.6

NOTE: For 70° spread, last number in catalog no. is changed from "4" to "7".

TYPE L - QUARTZ LAMP ELEMENT

Very good for indoor applications where the light emitted could be used to an advantage such as warehouses, hangars and loading docks. Also well suited for outdoor applications where a more intense heat is required, for example: snow melting, hotel entrances, inter building walkways.

Quartz lamp fixtures must be mounted horizontally.

TYPE L - 45° SPREAD

KW	STANDARD VOLTAGES	OVERALL LENGTH mm	OVERALL LENGTH in.	HEATED LENGTH mm	HEATED LENGTH in.	CATALOG NUMBER	SHIPPING WEIGHT kg	SHIPPING WEIGHT lb.
1.0	120	419	16.5	127	5	OKD141L4	4.1	9.0
2.0	208, 240	547	21.5	254	10	OKD192L4	5.0	11.0
3.2	"	699	27.5	406	16	OKD253L4	6.0	13.3
5.0	480, 600	908	36.5	635	25	OKD345L4	7.7	16.9
7.6	600	1258	49.7	965	38	OKD477L4	10.0	22.1

NOTE: For 70° spread, last number in catalog no. is changed from "4" to "7".

TO ORDER SPECIFY:

Quantity, catalog no., voltage and wattage (if applicable).

DANGER-HAZARD OF FIRE - AVOID DIRECT CONTACT OF HEATER CASE WITH ANY COMBUSTIBLE SURFACES. ENERGIZED HEATERS SHOULD BE SPACED SO THAT NO COMBUSTIBLE SURFACES EXCEED 194°F (90°C).
ALSO SEE PAGE C24.

PROTECTIVE WIRE GUARDS

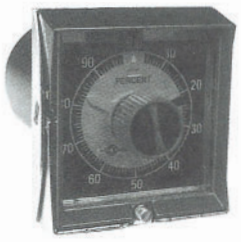
Protective wire guards can be factory installed on all styles of infrared heaters.

Guards are recommended when there is a danger of accidental contact with the heating element by a person, animal or object.

HEATED LENGTH (mm)	USED ON	CATALOG NUMBER OKA/OKB	OKD	OKH	OK3
127		WGA012	WGD012	WGH012	—
254		WGA025	WGD025	WGH025	—
356		WGA035	—	WGH035	—
406		WGA040	WGD040	WGH040	—
483		WGA048	—	WGH048	—
508		WGA050	WGD050	WGH050	—
635		WGA063	WGD063	WGH063	—
737		WGA073	—	WGH073	—
813		WGA081	WGD081	WGH081	—
864		WGA086	—	WGH086	—
965		WGA096	WGD096	WGH096	—
1041		WGA104	—	WGH104	—
1194		WGA119	—	WGH119	—
1270		WGA127	WGD127	WGH127	—
1499		WGA149	—	WGH149	—
1575		WGA157	WGD157	WGH157	—
1803		WGA180	—	WGH180	—
1829		—	—	—	WGT182

PERCENTAGE TIMERS

Percentage timers (input controllers) are used mainly for pulsing power to metal tubular element type radiant heaters. Where load voltage and current ratings exceed the timer's contact rating, the timer can be used to switch contactors (see Section F). Percentage timers can not be effectively used on quartz lamp type radiant heaters and have restricted use on quartz tube type heaters.



The OKT features a synchronous motor driven cam which closes a snap action switch for a percentage of 30 second "on" time. The adjustment knob sets the pointer to an "on" time of 0 to 100%. Standard features include a plug-in style mounting, an electrically isolated pilot light and a cycle progress pointer.

DESCRIPTION	CATALOG NUMBER
30 second cycle percentage timer 10 Amps 120/240 VAC S.P.S.T.	OKT3010M
type 1 surface mounting enclosure 6" x 6" x 6"	OKE666

Portable Radiant Heaters

Type OKP portable radiant heaters provide spot heating in areas not normally heated. Heaters can be used to heat workers, thaw pipes, dry paint, remove moisture, etc. The unit is not suitable for operation in the presence of combustible liquids or vapours.

CONSTRUCTION

Three OKA hairpin type radiant heaters with a single moisture resistant housing are mounted to an aluminized steel casing which is bolted to a rugged two wheel trolley.

Three standard sizes are available: 6.3 kW, 9.0 kW, and 13.5 kW. Special sizes can also be supplied on short notice.

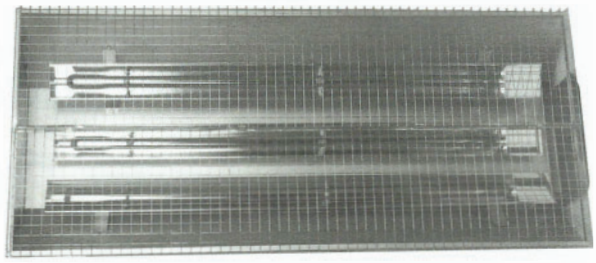
The heating elements are epoxy end sealed. The moisture resistant housing, when properly connected, allows the assembly to be hosed clean. A plated steel safety screen protects persons from accidental contact with hot surfaces.

Movable support legs allow the unit to be self supporting when laid on its left or right side for wider coverage.

The heavy duty construction of the OKP, built to resist weathering and rough handling, ensures extended service life.

WIRING

Terminals from each of the three radiant heating fixtures are wired to an internal trolley mounted terminal block. All units are suitable for connection of either single or three phase power.



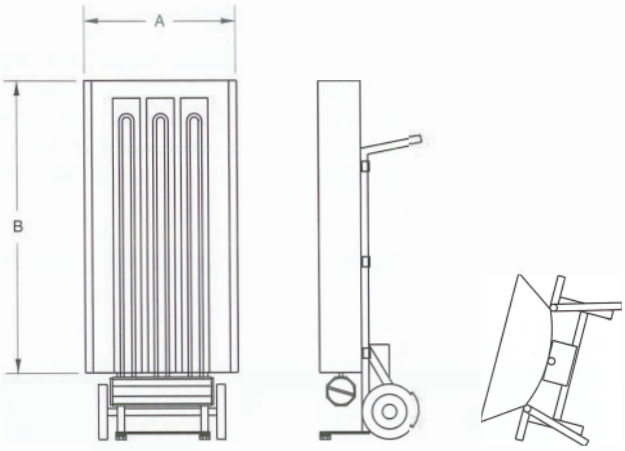
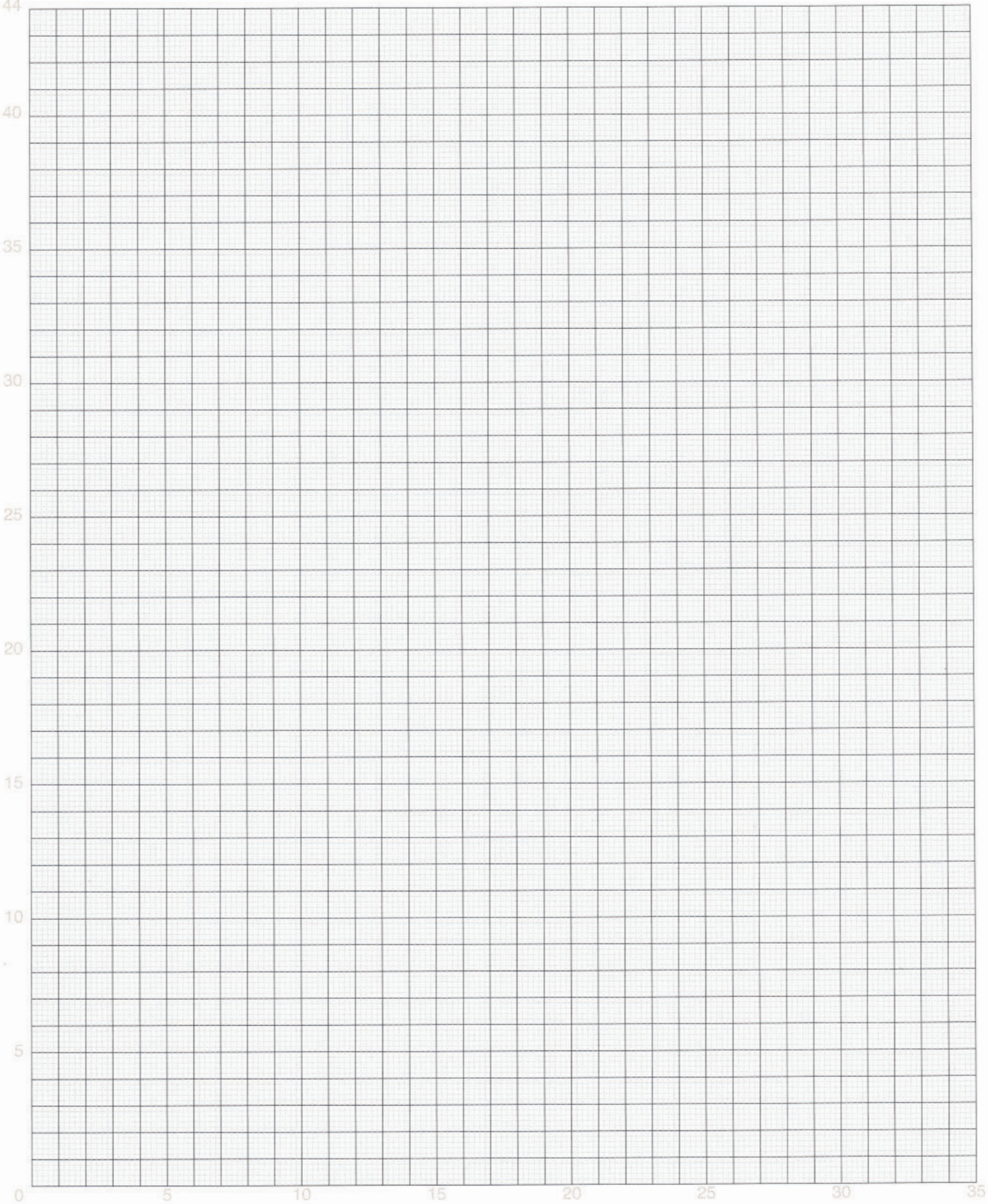


TABLE 1 - TYPE OKP PORTABLE RADIANT HEATERS

KW	STANDARD VOLTAGES	DIMENSIONS A IN	A mm	B IN	B mm	CATALOG NUMBER	SHIPPING WEIGHT LBS	KG
6.3	208, 240, 480, 600	26	660	40	1016	OKP063	40	18
9.0	"	26	660	49	1245	OKP090	48	22
13.5	"	26	660	62	1575	OKP135	58	26

TO ORDER - Specify quantity, catalog number, voltage, wattage.

NOTES:



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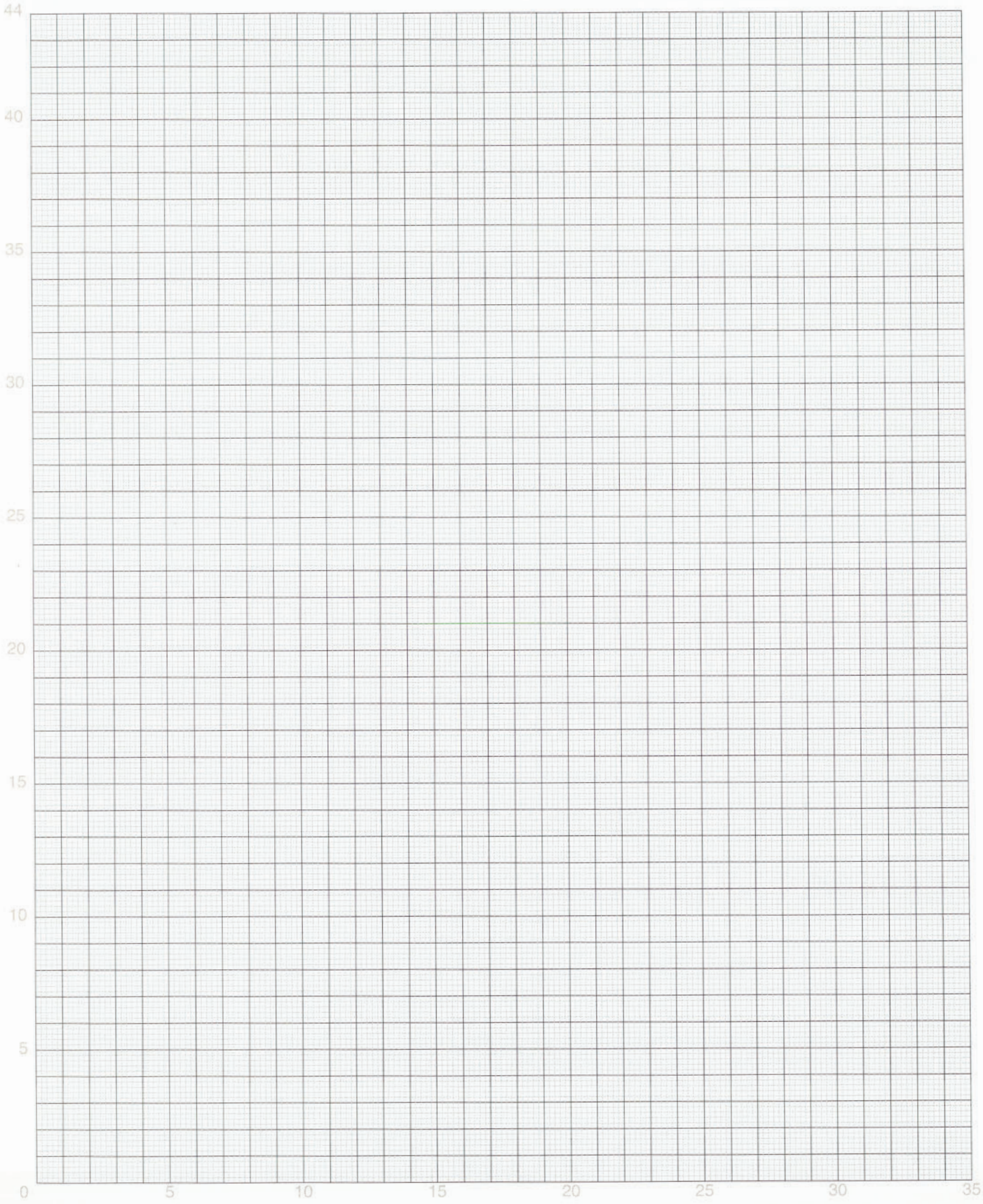

Mission Statement

To be recognized as a world-wide industry leader in heating technology. We will provide our customers with the broadest industry knowledge, expertise and products in space and process heating.

To create an internal environment promoting participation, teamwork, training and development for our employees.

To deliver the highest possible quality standards and continue to build a loyal customer base through dedicated customer service.

To promote continuous improvement in all existing product lines and develop and market a wide range of quality heating products through a commitment to research and development.

is known as a leader in advanced heating solutions. As a provider of industrial heating equipment we offer customers the broadest based industry knowledge, expertise and products in industrial heating. In addition to our focus on product quality we are setting a new industry standard for customer service.

At our facilities across North America we manufacture some of the top brands in industrial heating: Cata-Dyne™ Gas Catalytic Explosion-Proof Heaters; Norseman™ and Ruffneck™ Electric Explosion-Proof Heaters; DriQuik™ Oven Systems; and the Caloritech™ line of Electrical Heating Equipment and Tubular Elements.

This catalog presents the products manufactured by under the Caloritech™ brand name.

Caloritech™ products are built to any one of five nationally recognized quality control standards at our modern manufacturing facilities in Oakville and Orillia, Ontario, Canada. Both of these facilities are certified ISO 9001:2000, evidence of commitment to quality. The majority of Caloritech™ equipment (where applicable) is U.L. recognized/ listed or C.S.A. approved. At we manufacture most of our own pressure vessels, we have ASME U, S, and H stamps, and we can provide National Board registration. In addition to the standard product models listed in this catalog our team of experienced engineers and designers is well equipped to handle custom projects for specific and unique applications. We have accredited design expertise to complement the custom engineered aspect of our business and we hold a corporate Certificate of Authorization from P.E.O. to practice professional engineering in the design and application of our equipment.

We invite you to visit our website at to view the broad range of innovative industrial heating products manufactured by

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Section D

Engineered Products

Contents

Section D

Catalog ML350 - Section Listings

Circulation Heaters Type EX

Application

Caloritech™ circulation heaters are suitable for use in forced flow and natural flow heating loops where a safe, clean, reliable, and efficient heating source is required.

LIQUID HEATING

Virtually any liquid may be heated provided that the system design ensures that the heater vessel remains completely full of liquid when in use. Forced flow heating (with circulator pump) is mandatory when heating heavier liquids or heating liquids to high temperatures. Natural flow systems are generally limited to "side arm" water heating applications where the heater is mounted vertically and the top of the heater is well below the minimum tank liquid level.

GAS HEATING

In gas heating applications, such as steam superheating, heating compressed air, nitrogen, ammonia, etc., flow must be sufficient to ensure that the maximum allowable vessel and sheath temperatures are not exceeded. engineers will assist in the selection of the best heater for your particular application. Call or write factory, or contact your nearest Caloritech™ representative or distributor.

FIG. 1 - STANDARD EX UNIT MOUNTED ON OPTIONAL STAND

Registration

Circulation heaters may be classified as boilers or pressure vessels depending on fluid being heated, KW rating, vessel size, operating pressure and outlet temperature. Registration requirements are imposed by the jurisdiction where the heater is to be installed.

registered vessels are authorized to bear the S, H or U stamp depending on the Code classification.

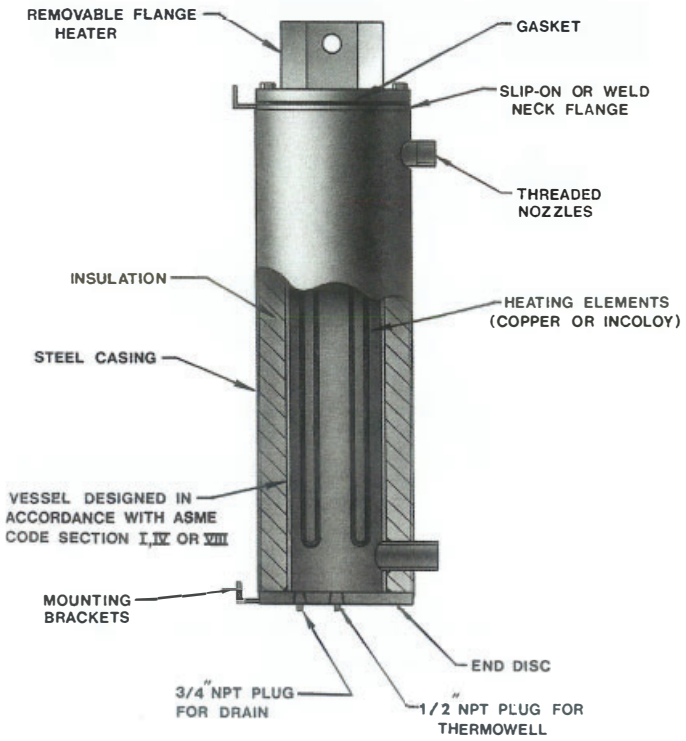


FIG. 2 - CONSTRUCTION DETAILS

Construction

Circulation heaters are essentially flange heaters mounted in welded vessels.

Standard sizes use steel vessels fitted with 150 lb. flanges. Units with larger vessels and heavier flanges are available.

For closed systems the heaters are designed to Sect. I, IV, or VIII of the ASME Code.

For high temperature use, heaters can be provided with stainless steel wetted parts and specially designed terminal boxes protected from excessive heat. Consult factory.

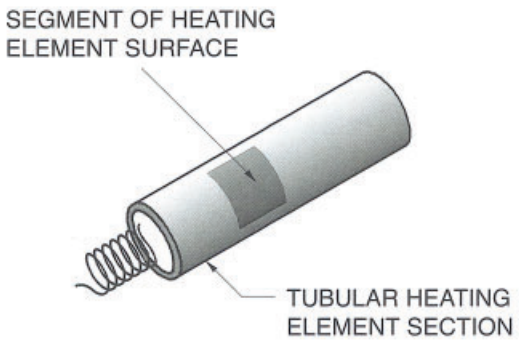
Built-In Limits and Thermostats

Built-in high limits and thermostats are available.

Standard built-in thermostat is a one pole device limited to 240V 25 amp. Whenever the heater voltage exceeds 240V or the heater current exceeds 25 amps or for three phase supply, the thermostat is intended for pilot duty only and is not factory wired to the elements. See Section F of the Caloritech™ catalog for selection of the contactor and control transformer you may require in these instances.

Watt Density

Watt density refers to the wattage output of a heater divided by the total surface area of the heated sections of all heating elements in the heater.



NOTE: All heat produced by the element is transferred to the work.

It is important to understand the basic thermal difference between an electric immersion heater and a steam or liquid heat exchanger. Unlike the steam or liquid heat exchanger, all of the heat produced by an electric heater will leave the heater. Even though the surface area in contact with the work is fixed, the heating element sheath temperature will continue to rise until the heat produced is equal to the heat transferred to the process.

A detailed understanding of this behaviour and the system parameters will allow the design of a suitable heater to heat virtually any liquid or gas with the only limitation being its ability to resist corrosion in highly active solutions.

As a general rule, low watt density heaters will provide longer service life than high density heaters, especially when the fluid being heated is viscous or stagnant. However, low density heaters are initially more expensive and in larger systems it is best to check with the factory for assistance in optimizing the heater selection.

See page D46 for recommended watt densities for some of the more common fluids.

A final word of caution... improper selection of watt density can result in damage to the product and failure of the heater.

Installation

The heaters are generally suitable for horizontal or vertical vessel orientation as shown in Figs. 3, 4 and 5.

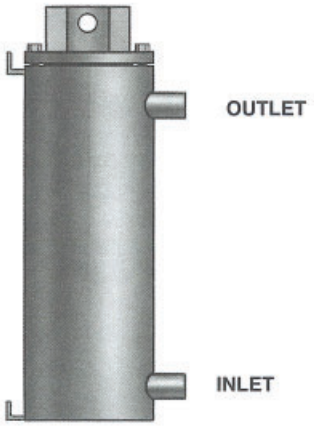


FIG. 3 - LIQUID HEATING or LOW TEMPERATURE GAS HEATING — VERTICAL INSTALLATION

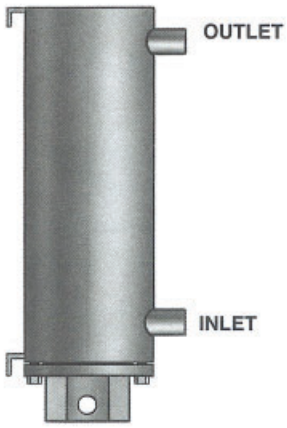


FIG. 4 - HIGH TEMPERATURE GAS HEATING — VERTICAL INSTALLATION

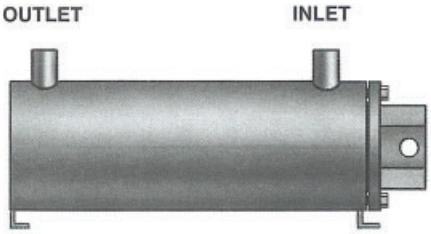
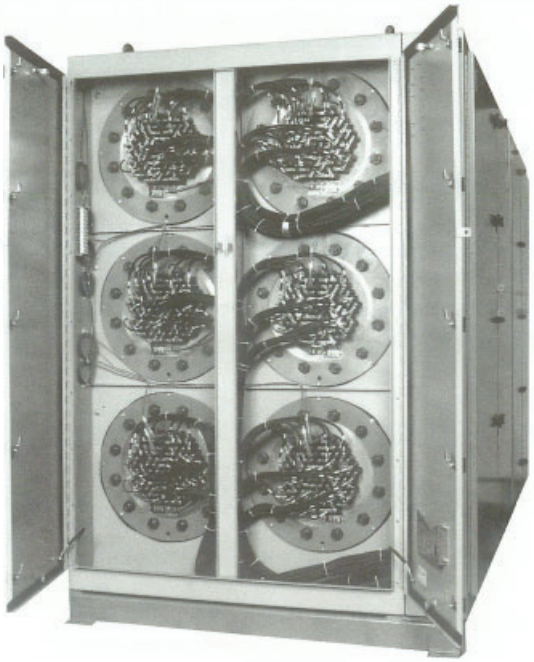


FIG. 5 - GAS or LIQUID HEATING — HORIZONTAL INSTALLATION

Circulation Heaters
Custom Designed Assemblies

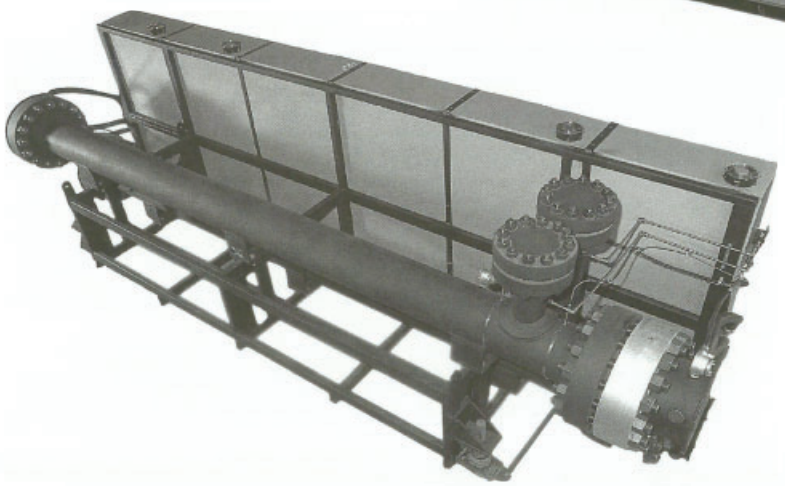
Skidded circulation heater assemblies are available for process heating in chemical processing, mining, refining, etc.



Our complete in-house capability... elements, vessels, CNC equipped machine shop, panel shop, CAD design... directed by a team of highly skilled professionals ensures that our products will provide value.

Registered engineers are available for start-up supervision anywhere in the world.

Multiple staged assemblies with control panel, valving, pumps or fans, chillers, expansion tanks, etc. can be engineered and fabricated by using state-of-the-art technology and manufacturing procedures.



If it can be done electrically, chances are we've done it before. Design proposals are submitted without cost or obligation on receipt of the bid request and specifications.

Miniature Circulation Heaters

Miniature circulation heaters provide an economical source of heat in many applications. In stationary systems, these heaters do not normally require mounting support other than the inlet and outlet piping connections.

Construction

The basic construction of this series of heaters is a one inch or one and a quarter inch pipe fitted with a pipe "T" to accept a suitable screwplug heater. The pipe is insulated with 1 1/4" - 1 1/2" of FSK insulation protected by a 20 ga. steel casing.

Units are available with or without thermostats and with general purpose, moisture resistant or explosion-proof terminal housings.

If the outlet liquid or gas temperature exceeds 150°C (300°F), use the end away from the terminal box as the outlet. Otherwise, use the outside threaded connection as the system inlet.

TYPE EXC - All wetted parts in brass or copper. Used for heating water, glycol water solutions or other liquids of low viscosity which will not corrode the heater materials.

TYPE EXF - Incoloy elements with steel screwplug and vessel. Used for heating oils, low pressure steam, preheating instrument air, etc. Select lower watt density listings for heavier liquids.

Special Features

- Stainless steel wetted parts
- Moisture resistant or explosion-proof housings
- Special wattage (length will increase for same watt density)
- Special thermostat range

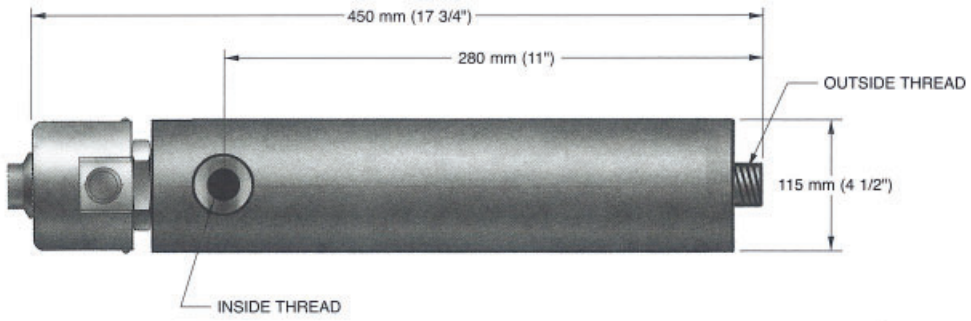


FIG. 1 - UNIT WITH BUILT-IN THERMOSTAT SHOWN

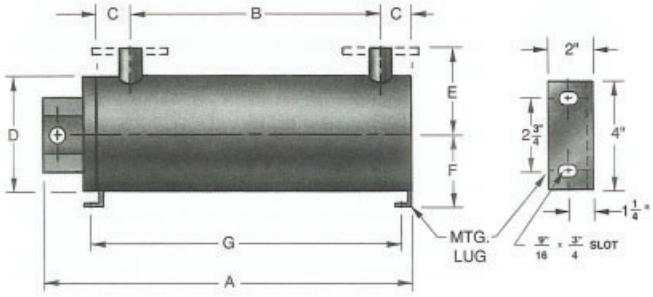
MINIATURE CIRCULATION HEATERS

KILO-WATTS	STANDARD VOLTAGES 1 PHASE ONLY	WATT DENSITY W/cm²	WATT DENSITY W/in²	WITHOUT THERMOSTAT CATALOG NUMBER	WITH THERMOSTAT 10 - 120°C (50 - 250°F) CATALOG NUMBER	NET WT. LBS (KG)
TYPE EXC - COPPER SHEATH (BRASS PLUG & VESSEL WITH 1" NPT CONNECTIONS)						
1.0	120,208,240	12.4	80	EXC110P1	EXCT110P1	13.2 (6)
1.5	"	12.4	80	EXC115P1	EXCT115P1	13.2 (6)
2.0	"	12.4	80	EXC120P1	EXCT120P1	13.2 (6)
3.0	208, 240	12.4	80	EXC130P1	EXCT130P1	13.2 (6)
TYPE EXF - INCOLOY SHEATH (STEEL PLUG & VESSEL WITH 1 1/4" NPT CONNECTIONS)						
0.6	120,208,240	2.3	15	EXF206P12	EXFT206P12	17.6 (8)
1.0	"	3.9	25	EXF210P12	EXFT210P12	17.6 (8)

TO ORDER SPECIFY: Quantity, catalog number, voltage, wattage and special features.

3" Circulation Heaters

DIMENSIONS - mm (in.)							
VESSEL SIZE	A	B	C	D	E	F	G
3"	1060 (41.7)	780 (30.7)	85 (3.3)	190 (7.5)	235 (9.3)	135 (5.3)	945 (37.2)



SELECTION

TYPE EXC - Used primarily for heating water or aqueous solutions which are not corrosive to the steel vessel or the copper sheathed elements.

TYPE EXI - May also be used to heat water, especially in rinse tanks and spray washing systems where the chemical additives would be corrosive to copper.

TYPE EXF - To heat circulated oils or process liquids which are not corrosive to steel and incoloy. To heat compressed air or other gases. Lower density heaters should be specified for high viscosity liquids or high temperature, low flow steam or gas heating systems. Consult factory for technical assistance.

KILO-WATTS	'B' DIM. INLET/OUTLET mm	in.	STD. VOLTAGES 208, 240 1ϕ	208, 240 3ϕ	480, 600 1ϕ	480, 600 3ϕ	WATT DENSITY W/cm²	W/in²	WITHOUT THERMOSTAT CAT. NO.	PART NO.	WITH THERMOSTAT 10 - 120°C (50 - 250°F) CAT. NO.	PART NO.	NET WT. LBS (KG)
3" - 150 LB. FLANGED STEEL VESSEL WITH 1" INLET AND OUTLET													
HIGH DENSITY - COPPER SHEATH													
6	780	30.7	✔	✔	✔	✔	9.3	60	EXC306F3	NWH-3-306	EXCT306F3	–	108.6 (47)
9	780	30.7	✔	✔	✔	✔	8.5	55	EXC309F3	NWH-3-309	EXCT309F3	–	105.8 (48)
12	780	30.7	✔	✔	✔	✔	8.4	54	EXC312F3	NWH-3-312	EXCT312F3	–	105.8 (48)
18	780	30.7	✔	✔	✔	✔	8.5	55	EXC618F3	–	EXCT618F3	–	112.4 (51)
24	780	30.7	✔	✔	✔	✔	8.4	54	EXC624F3	–	EXCT624F3	–	112.4 (51)
HIGH DENSITY - INCOLOY SHEATH													
6	780	30.7	✔	✔	✔	✔	9.3	60	EXI306F3	–	EXIT306F3	–	108.6 (47)
9	780	30.7	✔	✔	✔	✔	8.5	55	EXI309F3	–	EXIT309F3	–	105.8 (48)
12	780	30.7	✔	✔	✔	✔	8.4	54	EXI312F3	–	EXIT312F3	–	105.8 (48)
18	780	30.7	✔	✔	✔	✔	8.5	55	EXI618F3	–	EXIT618F3	–	112.4 (51)
24	780	30.7	✔	✔	✔	✔	8.4	54	EXI624F3	–	EXIT624F3	–	112.4 (51)
MEDIUM DENSITY - INCOLOY SHEATH													
3	780	30.7	✔	✔	✔	✔	4.6	30	EXF303F3	–	EXFT303F3	–	108.6 (47)
4.5	780	30.7	✔	✔	✔	✔	4.2	27	EXF304F3	–	EXFT304F3	–	105.8 (48)
6	780	30.7	✔	✔	✔	✔	4.2	27	EXF306F3	NWHO-3-306	EXFT306F3	–	105.8 (48)
LOW DENSITY - INCOLOY SHEATH													
3	780	30.7	✔	✔	✔	✔	2.1	14	EXF303F332	NWHO-3L-303	EXFT303F332	–	105.8 (48)

TO ORDER SPECIFY:

Quantity, catalog no., voltage, phase, wattage, special features, fluid to be heated, operating temperature and pressure, ultimate owner's name and address, installation location name and address.

4" Circulation Heaters

Selection

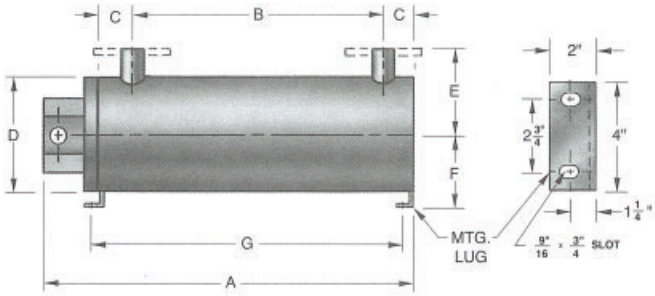
TYPE EXC - Used primarily for heating water or aqueous solutions which are not corrosive to the steel vessel or the copper sheathed elements.

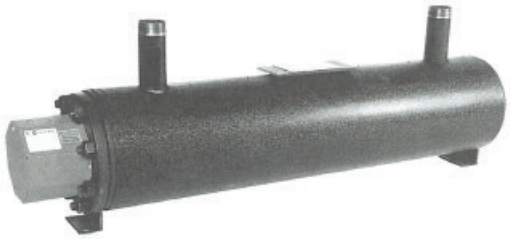
TYPE EXI - May also be used to heat water, especially in rinse tanks and spray washing systems where the chemical additives would be corrosive to copper.

TYPE EXF - To heat circulated oils or process liquids which are not corrosive to steel and incoloy. To heat compressed air or other gases. Lower density heaters should be specified for high viscosity liquids or high temperature, low flow steam or gas heating systems. Consult factory for technical assistance.

DIMENSIONS - mm (in.)

VESSEL SIZE	A	B	C	D	E	F	G
4"	1220 (48.0)	780 (30.7)	145 (5.7)	230 (9.1)	260 (10.2)	155 (6.1)	1065 (41.9)





KILO-WATTS	'B' DIM. INLET/OUTLET mm	in.	STD. VOLTAGES 208, 240 1φ	208, 240 3φ	480, 600 1φ	480, 600 3φ	WATT DENSITY W/cm²	W/in²	WITHOUT THERMOSTAT CAT. NO.	PART NO.	WITH THERMOSTAT 10 - 120°C (50 - 250°F) CAT. NO.	PART NO.	NET WT. LBS (KG)
4" - 150 LB. FLANGED STEEL VESSEL WITH 1 1/2" INLET AND OUTLET													
HIGH DENSITY - COPPER SHEATH													
12	780	30.7	✔	✔	✔	✔	8.4	60	EXC612F4	–	EXCT612F4	–	138.9 (63)
15	780	30.7	✔	✔	✔	✔	8.8	57	EXC615F4	–	EXCT615F4	–	141.1 (64)
18	780	30.7	✔	✔	✔	✔	8.5	55	EXC618F4	–	EXCT618F4	–	141.1 (64)
24	780	30.7	✔	✔	✔	✔	8.4	54	EXC624F4	–	EXCT624F4	–	141.1 (64)
18	780	30.7	✔	✔	✔	✔	9.3	60	EXC918F4	–	EXCT918F4	–	147.7 (67)
27	780	30.7	✔	✔	✔	✔	8.5	55	EXC927F4	–	EXCT927F4	–	149.9 (68)
36	780	30.7	✔	✔	✔	✔	8.4	54	EXC936F4	–	EXCT936F4	–	152.1 (69)
HIGH DENSITY - INCOLOY SHEATH													
12	780	30.7	✔	✔	✔	✔	8.4	60	EXI612F4	–	EXIT612F4	–	138.9 (63)
15	780	30.7	✔	✔	✔	✔	8.8	57	EXI615F4	–	EXIT615F4	–	141.1 (64
18	780	30.7	✔	✔	✔	✔	8.5	55	EXI618F4	–	EXIT618F4	–	141.1 (64
24	780	30.7	✔	✔	✔	✔	8.4	54	EXI624F4	–	EXIT624F4	–	141.1 (64
18	780	30.7	✔	✔	✔	✔	9.3	60	EXI918F4	–	EXIT918F4	–	147.7 (67)
27	780	30.7	✔	✔	✔	✔	8.5	55	EXI927F4	–	EXIT927F4	–	149.9 (68
36	780	30.7	✔	✔	✔	✔	8.4	54	EXI936F4	–	EXIT936F4	–	152.1 (69
MEDIUM DENSITY - INCOLOY SHEATH													
6	780	30.7	✔	✔	✔	✔	4.6	30	EXF606F4	–	EXFT606F4	–	138.9 (63)
9	780	30.7	✔	✔	✔	✔	4.2	27	EXF609F4	–	EXFT609F4	–	143.3 (65)
12	780	30.7	✔	✔	✔	✔	4.2	27	EXF612F4	–	EXFT612F4	–	143.3 (65)
9	780	30.7	✔	✔	✔	✔	4.6	30	EXF909F4	–	EXFT909F4	–	149.9 (68
13.5	780	30.7	✔	✔	✔	✔	4.2	27	EXF913F4	–	EXFT913F4	–	152.1 (69
18	780	30.7	✔	✔	✔	✔	4.2	27	EXF918F4	–	EXFT918F4	–	154.3 (70)
LOW DENSITY - INCOLOY SHEATH													
6	780	30.7	✔	✔	✔	✔	2.1	14	EXF606F432	–	EXFT606F432	–	143.3 (65)
9	780	30.7	✔	✔	✔	✔	2.1	14	EXF909F432	–	EXFT909F432	–	152.1 (69

TO ORDER SPECIFY:
Quantity, catalog no., voltage, phase, wattage, special features, fluid to be heated, operating temperature and pressure, ultimate owner's name and address, installation location name and address.

5" Circulation Heaters

Selection

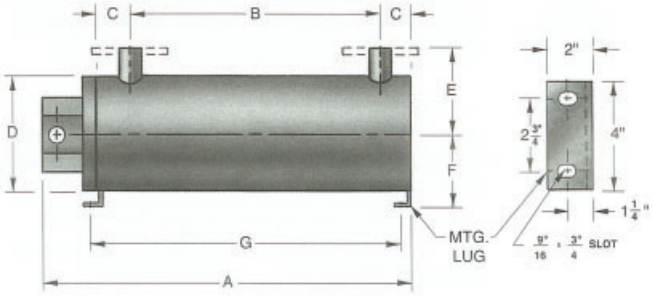
TYPE EXC - Used primarily for heating water or aqueous solutions which are not corrosive to the steel vessel or the copper sheathed elements.

TYPE EXI - May also be used to heat water, especially in rinse tanks and spray washing systems where the chemical additives would be corrosive to copper.

TYPE EXF - To heat circulated oils or process liquids which are not corrosive to steel and incoloy. To heat compressed air or other gases. Lower density heaters should be specified for high viscosity liquids or high temperature, low flow steam or gas heating systems. Consult factory for technical assistance.

DIMENSIONS - mm (in.)

VESSEL SIZE	A	B	C	D	E	F	G
5"	1220 (48.0)	780 (30.7)	145 (5.7)	255 (10.0)	270 (10.6)	170 (6.7)	1065 (41.9)



KILO-WATTS	'B' DIM. INLET/OUTLET mm	in.	STD. VOLTAGES 208, 240 1ϕ	208, 240 3ϕ	480, 600 1ϕ	480, 600 3ϕ	WATT DENSITY W/cm²	W/in²	WITHOUT THERMOSTAT CAT. NO.	PART NO.	WITH THERMOSTAT 10 - 120°C (50 - 250°F) CAT. NO.	PART NO.	NET WT. LBS (KG)
5" - 150 LB. FLANGED STEEL VESSEL WITH 2" INLET AND OUTLET													
HIGH DENSITY - COPPER SHEATH													
12	780	30.7	✔	✔	✔	✔	8.4	60	EXC612F5	—	EXCT612F5	—	138.9 (63)
15	780	30.7	✔	✔	✔	✔	8.8	57	EXC615F5	—	EXCT615F5	—	141.1 (64)
18	780	30.7	✔	✔	✔	✔	8.5	55	EXC618F5	—	EXCT618F5	—	141.1 (64)
24	780	30.7	✔	✔	✔	✔	8.4	54	EXC624F5	NWH-5-624	EXCT624F5	—	141.1 (64)
18	780	30.7	✔	✔	✔	✔	9.3	60	EXC918F5	—	EXCT918F5	—	147.7 (67
27	780	30.7	✔	✔	✔	✔	8.5	55	EXC927F5	—	EXCT927F5	—	149.9 (68)
36	780	30.7	✔	✔	✔	✔	8.4	54	EXC936F5	—	EXCT936F5	—	152.1 (69)
HIGH DENSITY - INCOLOY SHEATH													
12	780	30.7	✔	✔	✔	✔	8.4	60	EXI612F5	—	EXIT612F5	—	138.9 (63)
15	780	30.7	✔	✔	✔	✔	8.8	57	EXI615F5	—	EXIT615F5	—	141.1 (64)
18	780	30.7	✔	✔	✔	✔	8.5	55	EXI618F5	—	EXIT618F5	—	141.1 (64)
24	780	30.7	✔	✔	✔	✔	8.4	54	EXI624F5	—	EXIT624F5	—	141.1 (64)
18	780	30.7	✔	✔	✔	✔	9.3	60	EXI918F5	—	EXIT918F5	—	147.7 (67
27	780	30.7	✔	✔	✔	✔	8.5	55	EXI927F5	—	EXIT927F5	—	149.9 (68)
36	780	30.7	✔	✔	✔	✔	8.4	54	EXI936F5	—	EXIT936F5	—	152.1 (69)
MEDIUM DENSITY - INCOLOY SHEATH													
6	780	30.7	✔	✔	✔	✔	4.6	30	EXF606F5	—	EXFT606F5	—	138.9 (63)
9	780	30.7	✔	✔	✔	✔	4.2	27	EXF609F5	—	EXFT609F5	—	143.3 (65)
12	780	30.7	✔	✔	✔	✔	4.2	27	EXF612F5	NWHO-5-612	EXFT612F5	—	143.3 (65)
9	780	30.7	✔	✔	✔	✔	4.6	30	EXF909F5	—	EXFT909F5	—	149.9 (68)
13.5	780	30.7	✔	✔	✔	✔	4.2	27	EXF913F5	—	EXFT913F5	—	152.1 (69)
18	780	30.7	✔	✔	✔	✔	4.2	27	EXF918F5	—	EXFT918F5	—	154.3 (70
LOW DENSITY - INCOLOY SHEATH													
6	780	30.7	✔	✔	✔	✔	2.1	14	EXF606F532	—	EXFT606F532	—	143.3 (65)
9	780	30.7	✔	✔	✔	✔	2.1	14	EXF909F532	—	EXFT909F532	—	152.1 (69)

TO ORDER SPECIFY:
Quantity, catalog no., voltage, phase, wattage, special features, fluid to be heated, operating temperature and pressure, ultimate owner's name and address, installation location name and address.

6" Circulation Heaters

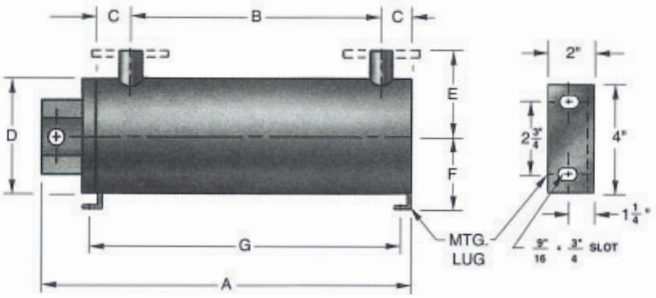
TYPE EXC - Used primarily for heating water or aqueous solutions which are not corrosive to the steel vessel or the copper sheathed elements.

TYPE EXI - May also be used to heat water, especially in rinse tanks and spray washing systems where the chemical additives would be corrosive to copper.

TYPE EXF - To heat circulated oils or process liquids which are not corrosive to steel and incoloy. To heat compressed air or other gases. Lower density heaters should be specified for high viscosity liquids or high temperature, low flow steam or gas heating systems. Consult factory for technical assistance.

DIMENSIONS - mm (in.)

VESSEL SIZE	A	B	C	D	E	F	G
6"	1220 (48.0)	780 (30.7)	145 (5.7)	280 (11.0)	290 (11.4)	180 (7.1)	1065 (41.9)
6"	1540 (60.6)	1100 (43.3)	145 (5.7)	280 (11.0)	290 (11.4)	180 (7.1)	1385 (54.5)



KILO-WATTS	'B' DIM. INLET/OUTLET mm	in.	STD. VOLTAGES 208, 240 1ϕ	208, 240 3ϕ	480, 600 1ϕ	480, 600 3ϕ	WATT DENSITY W/cm²	W/in²	WITHOUT THERMOSTAT CAT. NO.	PART NO.	WITH THERMOSTAT 10 - 120°C (50 - 250°F) CAT. NO.	PART NO.	NET WT. LBS (KG)
6" - 150 LB. FLANGED STEEL VESSEL WITH 2" INLET AND OUTLET													
HIGH DENSITY - COPPER SHEATH													
36	780	30.7	✔	✔	✔	✔	8.5	55	EXC1236F6	—	EXCT1236F6	—	200.6 (91)
48	780	30.7	-	✔	✔	✔	8.4	54	EXC1248F6	NWH-6-1248	EXCT1248F6	—	202.8 (92)
60	1100	43.3	-	✔	✔	✔	8.4	54	EXC1260F6	NWH-6-1260	EXCT1260F6	—	209.4 (95)
72	1100	43.3	-	✔	✔	✔	8.2	53	EXC1272F6	NWH-6-1272	EXCT1272F6	—	211.6 (96)
45	780	30.7	-	✔	✔	✔	8.5	55	EXC1545F6	—	EXCT1545F6	—	205.0 (93)
60	780	30.7	-	✔	✔	✔	8.4	54	EXC1560F6	—	EXCT1560F6	—	211.6 (96)
75	1100	43.3	-	✔	✔	✔	8.4	54	EXC1575F6	—	EXCT1575F6	—	240.3 (109)
90	1100	43.3	-	-	✔	✔	8.2	53	EXC1590F6	—	EXCT1590F6	—	246.9 (112)
90	1100	43.3	-	-	✔	✔	8.4	54	EXC1890F6	—	EXCT1890F6	—	246.9 (112)
HIGH DENSITY - INCOLOY SHEATH													
36	780	30.7	✔	✔	✔	✔	8.5	55	EXI1236F6	—	EXIT1236F6	—	200.6 (91)
48	780	30.7	-	✔	✔	✔	8.4	54	EXI1248F6	—	EXIT1248F6	—	202.8 (92)
60	1100	43.3	-	✔	✔	✔	8.4	54	EXI1260F6	—	EXIT1260F6	—	209.4 (95)
72	1100	43.3	-	✔	✔	✔	8.2	53	EXI1272F6	—	EXIT1272F6	—	211.6 (96)
45	780	30.7	-	✔	✔	✔	8.5	55	EXI1545F6	—	EXIT1545F6	—	205.0 (93)
60	780	30.7	-	✔	✔	✔	8.4	54	EXI1560F6	—	EXIT1560F6	—	211.6 (96)
75	1100	43.3	-	✔	✔	✔	8.4	54	EXI1575F6	—	EXIT1575F6	—	240.3 (109)
90	1100	43.3	-	-	✔	✔	8.2	53	EXI1590F6	—	EXIT1590F6	—	246.9 (112)
90	1100	43.3	-	-	✔	✔	8.4	54	EXI1890F6	—	EXIT1890F6	—	246.9 (112)
120	1100	43.3	-	-	-	✔	10.9	70	EXI15120F6	—	EXIT15120F6	—	251.3 (114)
144	1100	43.3	-	-	-	✔	10.9	70	EXI18144F6	—	EXIT18144F6	—	260.2 (118)
MEDIUM DENSITY - INCOLOY SHEATH													
18	780	30.7	✔	✔	✔	✔	4.2	27	EXF1218F6	NWHO-6-1218	EXFT1218F6	—	202.8 (92)
24	780	30.7	✔	✔	✔	✔	4.2	27	EXF1224F6	NWHO-6-1224	EXFT1224F6	—	207.2 (94)
30	1100	43.3	✔	✔	✔	✔	4.2	27	EXF1230F6	NWHO-6-1230	EXFT1230F6	—	233.7 (106)
36	1100	43.3	✔	✔	✔	✔	4.1	26	EXF1236F6	NWHO-6-1236	EXFT1236F6	—	238.1 (108)
22.5	780	30.7	✔	✔	✔	✔	4.2	27	EXF1522F6	—	EXFT1522F6	—	209.4 (95)
30	780	30.7	✔	✔	✔	✔	4.2	27	EXF1530F6	—	EXFT1530F6	—	213.85 (97)
37.5	1100	43.3	✔	✔	✔	✔	4.2	27	EXF1537F6	—	EXFT1537F6	—	240.3 (109)
45	1100	43.3	-	✔	✔	✔	4.1	26	EXF1545F6	—	EXFT1545F6	—	246.9 (112)
LOW DENSITY - INCOLOY SHEATH													
12	780	30.7	✔	✔	✔	✔	2.1	14	EXF1212F6	—	EXFT1212F6	—	202.8 (92)
18	1100	43.3	✔	✔	✔	✔	2.5	16	EXF1218F639	NWHO-6L-1218	EXFT1218F639	—	233.7 (106)
24	1100	43.3	✔	✔	✔	✔	2.7	18	EXF1224F647	—	EXFT1224F647	—	244.7 (111)
15	780	30.7	✔	✔	✔	✔	2.1	14	EXF1515F6	—	EXFT1515F6	—	209.4 (95)
22.5	1100	43.3	✔	✔	✔	✔	2.5	16	EXF1522F639	—	EXFT1522F639	—	242.5 (110)
30	1100	43.3	✔	✔	✔	✔	2.7	18	EXF1530F647	—	EXFT1530F647	—	253.5 (115)

TO ORDER SPECIFY:
Quantity, catalog no., voltage, phase, wattage, special features, fluid to be heated, operating temperature and pressure, ultimate owner's name and address, installation location name and address.

8" Circulation Heaters

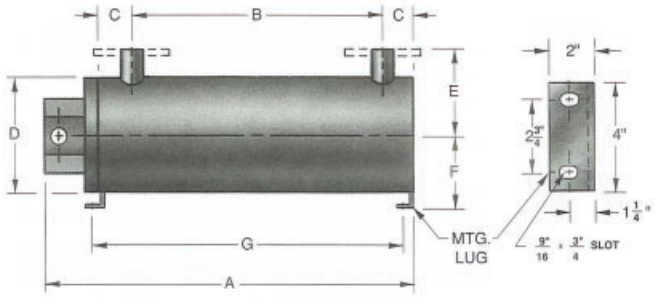
TYPE EXC - Used primarily for heating water or aqueous solutions which are not corrosive to the steel vessel or the copper sheathed elements.

TYPE EXI - May also be used to heat water, especially in rinse tanks and spray washing systems where the chemical additives would be corrosive to copper.

TYPE EXF - To heat circulated oils or process liquids which are not corrosive to steel and incoloy. To heat compressed air or other gases. Lower density heaters should be specified for high viscosity liquids or high temperature, low flow steam or gas heating systems. Consult factory for technical assistance.

DIMENSIONS - mm (in.)

VESSEL SIZE	A	B	C	D	E	F	G
8"	1580 (62.2)	1100 (43.3)	165 (6.5)	345 (13.6)	330 (13.0)	215 (8.5)	1425 (56.1)



KILO-WATTS	'B' DIM. INLET/OUTLET mm	in.	STD. VOLTAGES 208, 240 1φ	208, 240 3φ	480, 600 1φ	480, 600 3φ	WATT DENSITY W/cm²	W/in²	WITHOUT THERMOSTAT CAT. NO.	PART NO.	WITH THERMOSTAT 10 - 120°C (50 - 250°F) CAT. NO.	PART NO.	NET WT. LBS (KG)
8" - 150 LB. FLANGED STEEL VESSEL WITH 2 1/2" INLET AND OUTLET													
HIGH DENSITY - COPPER SHEATH													
54	1100	43.3	-	✔	✔	✔	8.5	55	EXC1854F8	–	EXCT1854F8	–	233.7 (106)
72	1100	43.3	-	✔	✔	✔	8.4	54	EXC1872F8	–	EXCT1872F8	–	240.3 (109)
90	1100	43.3	-	✔	✔	✔	8.4	54	EXC1890F8	–	EXCT1890F8	–	313.6 (142)
108	1100	43.3	-	✔	✔	✔	8.2	53	EXC18108F8	–	EXCT18108F8	–	317.5 (144)
81	1100	43.3	-	✔	✔	✔	8.5	55	EXC2781F8	–	EXCT2781F8	–	326.3 (148)
108	1100	43.3	-	-	✔	✔	8.4	54	EXC27108F8	–	EXCT27108F8	–	335.1 (152)
135	1100	43.3	-	-	-	✔	8.4	54	EXC27135F8	–	EXCT27135F8	–	346.1 (157)
162	1100	43.3	-	-	-	✔	8.2	53	EXC27162F8	–	EXCT27162F8	–	352.7 (160)
HIGH DENSITY - INCOLOY SHEATH													
54	1100	43.3	-	✔	✔	✔	8.5	55	EXI1854F8	–	EXIT1854F8	–	233.7 (106)
72	1100	43.3	-	✔	✔	✔	8.4	54	EXI1872F8	–	EXIT1872F8	–	240.3 (109)
90	1100	43.3	-	✔	✔	✔	8.4	54	EXI1890F8	–	EXIT1890F8	–	313.6 (142)
108	1100	43.3	-	✔	✔	✔	8.2	53	EXI18108F8	–	EXIT18108F8	–	317.5 (144)
81	1100	43.3	-	✔	✔	✔	8.5	55	EXI2781F8	–	EXIT2781F8	–	326.3 (148)
108	1100	43.3	-	-	✔	✔	8.4	54	EXI27108F8	–	EXIT27108F8	–	335.1 (152)
135	1100	43.3	-	-	-	✔	8.4	54	EXI27135F8	–	EXIT27135F8	–	346.1 (157)
162	1100	43.3	-	-	-	✔	8.2	53	EXI27162F8	–	EXIT27162F8	–	352.7 (160)
120	1100	43.3	-	-	-	✔	10.9	70	EXI15120F8	–	EXIT15120F8	–	313.6 (142)
144	1100	43.3	-	-	-	✔	10.9	70	EXI18144F8	–	EXIT18144F8	–	319.7 (145)
168	1100	43.3	-	-	-	✔	10.9	70	EXI21168F8	–	EXIT21168F8	–	326.3 (148)
192	1100	43.3	-	-	-	✔	10.9	70	EXI24192F8	–	EXIT24192F8	–	332.9 (151)
216	1100	43.3	-	-	-	✔	10.9	70	EXI27216F8	–	EXIT27216F8	–	339.5 (154)
240	1100	43.3	-	-	-	✔	10.9	70	EXI30240F8	–	EXIT30240F8	–	346.1 (157)
MEDIUM DENSITY - INCOLOY SHEATH													
36	1100	43.3	✔	✔	✔	✔	4.2	27	EXF1836F8	–	EXFT1836F8	–	304.2 (138)
54	1100	43.3	-	✔	✔	✔	4.1	26	EXF1854F8	–	EXFT1854F8	–	319.7 (145)
63	1100	43.3	-	✔	✔	✔	4.1	26	EXF2163F8	–	EXFT2163F8	–	328.5 (149)
72	1100	43.3	-	✔	✔	✔	4.1	26	EXF2472F8	–	EXFT2472F8	–	335.1 (152)
81	1100	43.3	-	✔	✔	✔	4.1	26	EXF2781F8	–	EXFT2781F8	–	341.7 (155)
90	1100	43.3	-	✔	✔	✔	4.1	26	EXF3090F8	–	EXFT3090F8	–	348.3 (158)
LOW DENSITY - INCOLOY SHEATH													
27	1100	43.3	✔	✔	✔	✔	2.5	16	EXF1827F8	–	EXFT1827F8	–	313.6 (142)
31.5	1100	43.3	✔	✔	✔	✔	2.5	16	EXF2131F8	–	EXFT2131F8	–	317.5 (144)
36	1100	43.3	✔	✔	✔	✔	2.5	16	EXF2436F8	–	EXFT2436F8	–	321.9 (146)
36	1100	43.3	✔	✔	✔	✔	2.7	17	EXF1836F847	–	EXFT1836F847	–	321.9 (146)
40.5	1100	43.3	-	✔	✔	✔	2.5	16	EXF2740F8	–	EXFT2740F8	–	328.5 (149)
45	1100	43.3	-	✔	✔	✔	2.5	16	EXF3045F8	–	EXFT3045F8	–	335.1 (152)
54	1100	43.3	-	✔	✔	✔	2.7	17	EXF2754F8	–	EXFT2754F8	–	343.9 (156)

TO ORDER SPECIFY:

Quantity, catalog no., voltage, phase, wattage, special features, fluid to be heated, operating temperature and pressure, ultimate owner's name and address, installation location name and address.

10" Circulation Heaters

Selection

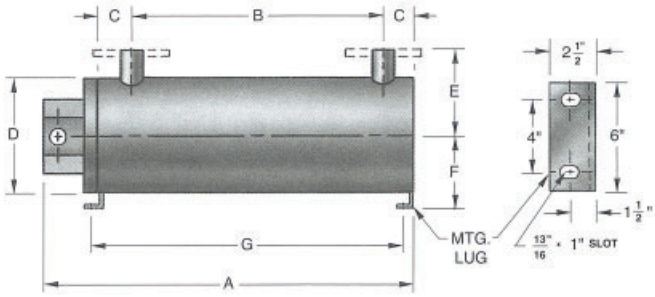
TYPE EXC - Used primarily for heating water or aqueous solutions which are not corrosive to the steel vessel or the copper sheathed elements.

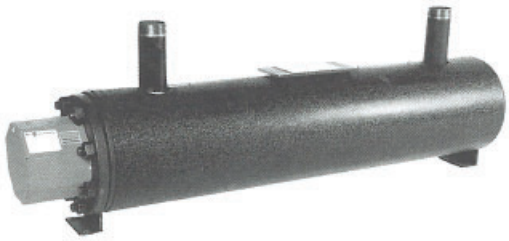
TYPE EXI - May also be used to heat water, especially in rinse tanks and spray washing systems where the chemical additives would be corrosive to copper.

TYPE EXF - To heat circulated oils or process liquids which are not corrosive to steel and incoloy. To heat compressed air or other gases. Lower density heaters should be specified for high viscosity liquids or high temperature, low flow steam or gas heating systems. Consult factory for technical assistance.

DIMENSIONS - mm (in.)

VESSEL SIZE	A	B	C	D	E	F	G
10"	1650 (65.0)	1100 (43.3)	180 (7.1)	405 (16.0)	375 (14.8)	250 (9.9)	1450 (57.1)





KILO-WATTS	'B' DIM. INLET/OUTLET mm	in.	STD. VOLTAGES 208, 240 1ϕ	208, 240 3ϕ	480, 600 1ϕ	480, 600 3ϕ	WATT DENSITY W/cm²	W/in²	WITHOUT THERMOSTAT CAT. NO.	PART NO.	WITH THERMOSTAT 10 - 120°C (50 - 250°F) CAT. NO.	PART NO.	NET WT. LBS (KG)
10" - 150 LB. FLANGED STEEL VESSEL WITH 3" INLET AND OUTLET													
HIGH DENSITY - COPPER SHEATH													
180	1100	43.3	-	-	-	✔	9.8	63	EXC36180F10	—	EXCT36180F10	—	485.0 (220)
216	1100	43.3	-	-	-	✔	9.3	60	EXC36216F10	—	EXCT36216F10	—	498.2 (226)
252	1100	43.3	-	-	-	✔	9.3	60	EXC42252F10	—	EXCT42252F10	—	520.3 (236)
HIGH DENSITY - INCOLOY SHEATH													
180	1100	43.3	-	-	-	✔	9.8	63	EXI36180F10	—	EXIT36180F10	—	485.0 (220)
216	1100	43.3	-	-	-	✔	9.3	60	EXI36216F10	—	EXIT36216F10	—	498.2 (226)
252	1100	43.3	-	-	-	✔	9.3	60	EXI42252F10	—	EXIT42252F10	—	520.3 (236)
288	1100	43.3	-	-	-	✔	12.3	80	EXI36288F10	—	EXIT36288F10	—	498.2 (226)
336	1100	43.3	-	-	-	✔	12.3	80	EXI42336F10	—	EXIT42336F10	—	520.3 (236)
384	1100	43.3	-	-	-	✔	12.3	80	EXI48384F10	—	EXIT48384F10	—	542.3 (246)
MEDIUM DENSITY - INCOLOY SHEATH													
108	1100	43.3	-	-	✔	✔	4.6	30	EXF36108F10	—	EXFT36108F10	—	498.2 (226)
126	1100	43.3	-	-	-	✔	4.6	30	EXF42126F10	—	EXFT42126F10	—	520.3 (236)
144	1100	43.3	-	-	-	✔	4.6	30	EXF48144F10	—	EXFT48144F10	—	537.9 (244)
LOW DENSITY - INCOLOY SHEATH													
72	1100	43.3	-	✔	✔	✔	3.1	20	EXF3672F10	—	EXFT3672F10	—	498.2 (226)
84	1100	43.3	-	✔	✔	✔	3.1	20	EXF4284F10	—	EXFT4284F10	—	520.3 (236)
96	1100	43.3	-	✔	✔	✔	3.1	20	EXF4896F10	—	EXFT4896F10	—	537.9 (244)

TO ORDER SPECIFY:
Quantity, catalog no., voltage, phase, wattage, special features, fluid to be heated, operating temperature and pressure, ultimate owner's name and address, installation location name and address.

12" Circulation Heaters

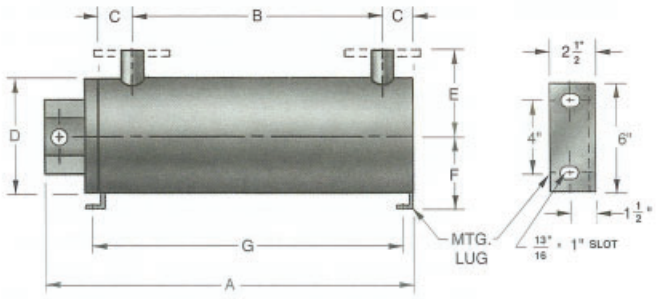
DIMENSIONS - mm (in.)							
VESSEL SIZE	A	B	C	D	E	F	G
12"	1655 (65.1)	1100 (43.3)	180 (7.1)	480 (19.0)	410 (16.1)	290 (11.5)	1450 (57.1)

Selection

TYPE EXC - Used primarily for heating water or aqueous solutions which are not corrosive to the steel vessel or the copper sheathed elements.

TYPE EXI - May also be used to heat water, especially in rinse tanks and spray washing systems where the chemical additives would be corrosive to copper.

TYPE EXF - To heat circulated oils or process liquids which are not corrosive to steel and incoloy. To heat compressed air or other gases. Lower density heaters should be specified for high viscosity liquids or high temperature, low flow steam or gas heating systems. Consult factory for technical assistance.



KILO-WATTS	'B' DIM. INLET/OUTLET mm	in.	STD. VOLTAGES 208, 240 1ϕ	208, 240 3ϕ	480, 600 1ϕ	480, 600 3ϕ	WATT DENSITY W/cm²	W/in²	WITHOUT THERMOSTAT CAT. NO.	PART NO.	WITH THERMOSTAT 10 - 120°C (50 - 250°F) CAT. NO.	PART NO.	NET WT. LBS (KG)
12" - 150 LB. FLANGED STEEL VESSEL WITH 3" INLET AND OUTLET													
HIGH DENSITY - COPPER SHEATH													
240	1100	43.3	-	-	-	✔	9.8	63	EXC48240F12	–	EXCT48240F12	–	690.1 (313)
288	1100	43.3	-	-	-	✔	9.3	60	EXC48288F12	–	EXCT48288F12	–	709.9 (322)
324	1100	43.3	-	-	-	✔	9.3	60	EXC54324F12	–	EXCT54324F12	–	727.5 (330)
360	1100	43.3	-	-	-	✔	9.3	60	EXC60360F12	–	EXCT60360F12	–	718.7 (326)
HIGH DENSITY - INCOLOY SHEATH													
240	1100	43.3	-	-	-	✔	9.8	63	EXI48240F12	–	EXIT48240F12	–	690.1 (313)
288	1100	43.3	-	-	-	✔	9.3	60	EXI48288F12	–	EXIT48288F12	–	709.9 (322)
324	1100	43.3	-	-	-	✔	9.3	60	EXI54324F12	–	EXIT54324F12	–	727.5 (330)
360	1100	43.3	-	-	-	✔	9.3	60	EXI60360F12	–	EXIT60360F12	–	718.7 (326)
432	1100	43.3	-	-	-	✔	12.3	80	EXI54432F12	–	EXIT54432F12	–	727.5 (330)
480	1100	43.3	-	-	-	✔	12.3	80	EXI60480F12	–	EXIT60480F12	–	743.0 (337)
MEDIUM DENSITY - INCOLOY SHEATH													
144	1100	43.3	-	-	-	✔	4.6	30	EXF48144F12	–	EXFT48144F12	–	709.9 (322)
162	1100	43.3	-	-	-	✔	4.6	30	EXF54162F12	–	EXFT54162F12	–	727.5 (330)
180	1100	43.3	-	-	-	✔	4.6	30	EXF60180F12	–	EXFT60180F12	–	743.0 (337)
LOW DENSITY - INCOLOY SHEATH													
96	1100	43.3	-	✔	✔	✔	3.1	20	EXF4896F12	–	EXFT4896F12	–	709.9 (322)
108	1100	43.3	-	-	✔	✔	3.1	20	EXF54108F12	–	EXFT54108F12	–	727.5 (330)
120	1100	43.3	-	-	-	✔	3.1	20	EXF60120F12	–	EXFT60120F12	–	743.0 (337)

TO ORDER SPECIFY:
Quantity, catalog no., voltage, phase, wattage, special features, fluid to be heated, operating temperature and pressure, ultimate owner's name and address, installation location name and address.

14" Circulation Heaters

Selection

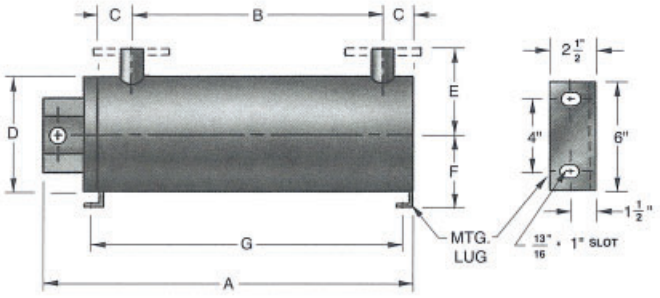
TYPE EXC - Used primarily for heating water or aqueous solutions which are not corrosive to the steel vessel or the copper sheathed elements.

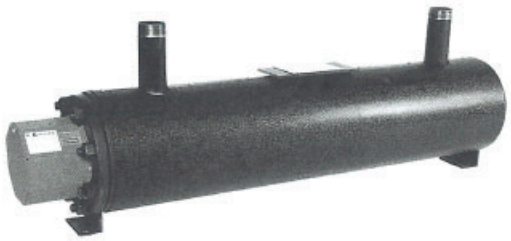
TYPE EXI - May also be used to heat water, especially in rinse tanks and spray washing systems where the chemical additives would be corrosive to copper.

TYPE EXF - To heat circulated oils or process liquids which are not corrosive to steel and incoloy. To heat compressed air or other gases. Lower density heaters should be specified for high viscosity liquids or high temperature, low flow steam or gas heating systems. Consult factory for technical assistance.

DIMENSIONS - mm (in.)

VESSEL SIZE	A	B	C	D	E	F	G
14"	1680 (66.2)	1100 (43.3)	200 (7.8)	535 (21.0)	445 (17.5)	320 (12.6)	1490 (58.6)





KILO-WATTS	'B' DIM. INLET/OUTLET mm	in.	STD. VOLTAGES 208, 240 1ϕ	3ϕ	480, 600 1ϕ	3ϕ	WATT DENSITY W/cm²	W/in²	WITHOUT THERMOSTAT CAT. NO.	PART NO.	WITH THERMOSTAT 10 - 120°C (50 - 250°F) CAT. NO.	PART NO.	NET WT. LBS (KG)
14" - 150 LB. FLANGED STEEL VESSEL WITH 3" INLET AND OUTLET													
HIGH DENSITY - COPPER SHEATH													
300	1100	43.3	-	-	-	✔	9.8	63	EXC60300F14	—	EXCT60300F14	—	877.4 (398)
360	1100	43.3	-	-	-	✔	9.3	60	EXC60360F14	—	EXCT60360F14	—	903.9 (410)
432	1100	43.3	-	-	-	✔	9.3	60	EXC72432F14	—	EXCT72432F14	—	934.8 (424)
504	1100	43.3	-	-	-	✔	9.3	60	EXC84504F14	—	EXCT84504F14	—	967.8 (439)
HIGH DENSITY - INCOLOY SHEATH													
300	1100	43.3	-	-	-	✔	9.8	63	EXI60300F14	—	EXIT60300F14	—	877.4 (398)
360	1100	43.3	-	-	-	✔	9.3	60	EXI60360F14	—	EXIT60360F14	—	903.9 (410)
432	1100	43.3	-	-	-	✔	9.3	60	EXI72432F14	—	EXIT72432F14	—	934.8 (424)
504	1100	43.3	-	-	-	✔	9.3	60	EXI84504F14	—	EXIT84504F14	—	967.8 (439)
576	1100	43.3	-	-	-	✔	12.3	80	EXI72576F14	—	EXIT72576F14	—	934.8 (424)
672	1100	43.3	-	-	-	✔	12.3	80	EXI84672F14	—	EXIT84672F14	—	967.8 (439)
MEDIUM DENSITY - INCOLOY SHEATH													
180	1100	43.3	-	-	-	✔	4.6	30	EXF60180F14	—	EXFT60180F14	—	903.9 (410)
216	1100	43.3	-	-	-	✔	4.6	30	EXF72216F14	—	EXFT72216F14	—	934.8 (424)
252	1100	43.3	-	-	-	✔	4.6	30	EXF84252F14	—	EXFT84252F14	—	967.8 (439)
LOW DENSITY - INCOLOY SHEATH													
120	1100	43.3	-	✔	✔	✔	3.1	20	EXF60120F14	—	EXFT60120F14	—	903.9 (410)
144	1100	43.3	-	✔	✔	✔	3.1	20	EXF72144F14	—	EXFT72144F14	—	934.8 (424)
168	1100	43.3	-	✔	✔	✔	3.1	20	EXF84168F14	—	EXFT84168F14	—	967.8 (439)

TO ORDER SPECIFY:

Quantity, catalog no., voltage, phase, wattage, special features, fluid to be heated, operating temperature and pressure, ultimate owner's name and address, installation location name and address.

Special Features

- **FLANGE HEATERS**

See Section B of the Caloritech™ catalog for special flange heater features for use in circulation heater vessels.

- **SPECIAL MATERIALS**

Stainless steel or special alloy construction available for corrosive liquids or high temperature gas heating when outlet temperatures are in excess of 475°C (887°F).

- **FLANGED INLET AND OUTLET**

- **FREE STANDING FRAME**

Circulation heaters may be mounted on factory supplied frame as shown.

- **FACTORY MOUNTED CONTROL PANEL**

Custom designed, fully prewired control panels are available. See pages D24 to D29 for details,

- **INLET AND OUTLET 180° APART**

To facilitate piping inlet and outlet piping may be positioned 180° apart or as required. Specify desired location of mounting lugs in relation to inlet and outlet. (Forward sketch to the factory to avoid mistakes.)

- **MULTISTAGE UNITS**

Circulation heaters can be supplied as multistage assemblies with either vertical or horizontal vessel orientation. See Figs. 1 and 2.

FIG. 1

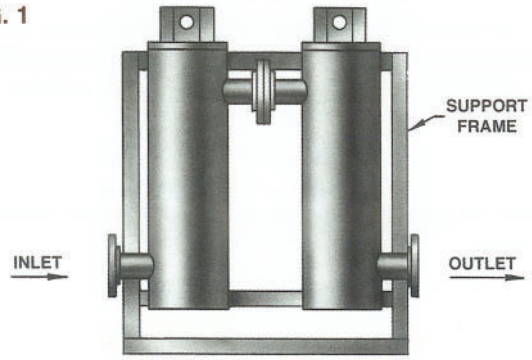
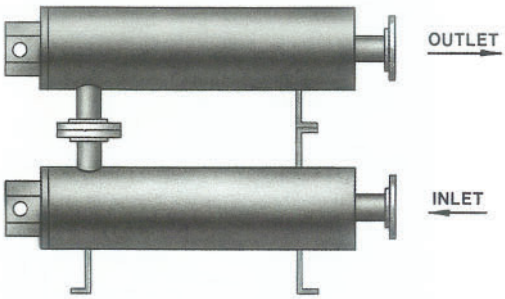


FIG. 2



- **HIGHER RATINGS**

Units are available for operation at higher pressures or kilowatt ratings.

- **CROSS FLOW BAFFLES**

Cross flow baffles improve heat transfer when heating viscous fluids and high temperature gases.

- **VALVES**

Pressure relief valves, bleed and drain valves are available.

- **FLOW SWITCH**

- **DIFFERENTIAL PRESSURE SWITCH**

- **THERMOCOUPLE**

A built-in type J or K thermocouple mounted in the outlet pipe.

- **BUILT-IN CONTROLS**

Mechanical or electronic high limit controls and temperature controls are available.

- **LARGER SIZES**

Vessel sizes to 36" diameter or larger are available with flanged inlets and outlets up to 16" diameter.

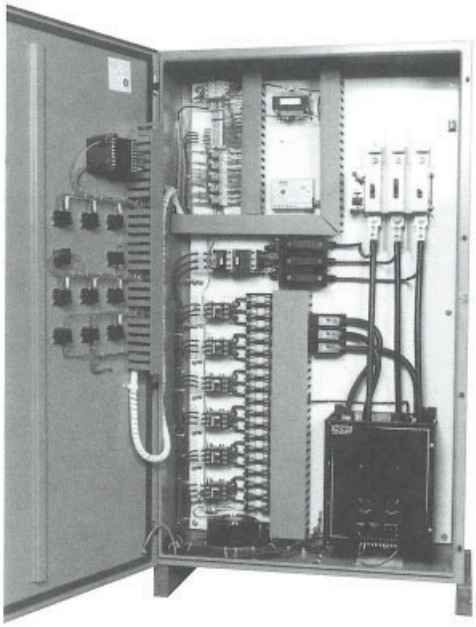
Liquid Heat transfer Systems Type FX

Applications

Caloritech™ hot oil heat transfer systems are custom designed to provide high temperature process heat without the necessity for high pressure design common to saturated steam transfer systems.

Accurate process temperatures up to 375°C (707°F) can be maintained in molds, platens, presses and jacketed vessels or pipes under practically negligible pressure conditions.

Ratings available up to 3000 kW at 600 V.



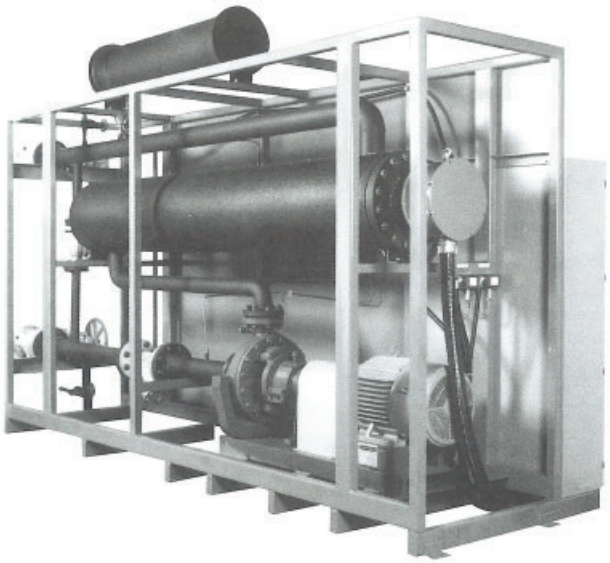
From the table below note the high steam operating pressures required whenever high process temperatures are needed. Even at 375°C (707°F) the Caloritech™ oil heat transfer system functions at a pressure less than 30 PSIG depending on the transfer fluid used.

SATURATED STEAM PRESSURE vs. TEMPERATURE

PRESSURE (PSIA)	°F	°C
250	400	205
500	467	242
750	510	265
1000	545	285
1500	596	313
2000	635	335
2500	668	353
3250	707	375

Construction

Type FX transfer systems are supplied as fully prewired and piped packaged assemblies customized to your specific application. You merely connect the process pipes to the system inlet and outlet, mount the separately supplied expansion tank, and connect to your electrical supply.



Each system comes equipped with low density EX type circulation heaters mounted on a structural steel frame. Centrifugal, direct drive pumps are standard. Positive displacement pumps are available on request.

Special inlet and outlet valves with high temperature packing and flanged connections are standard. Bypass, drain, fill and bleed valves are installed in the piping loop with all welded connections for 1/2" NPT pipes and larger.

A strainer is installed on the system inlet with an attached fill valve.

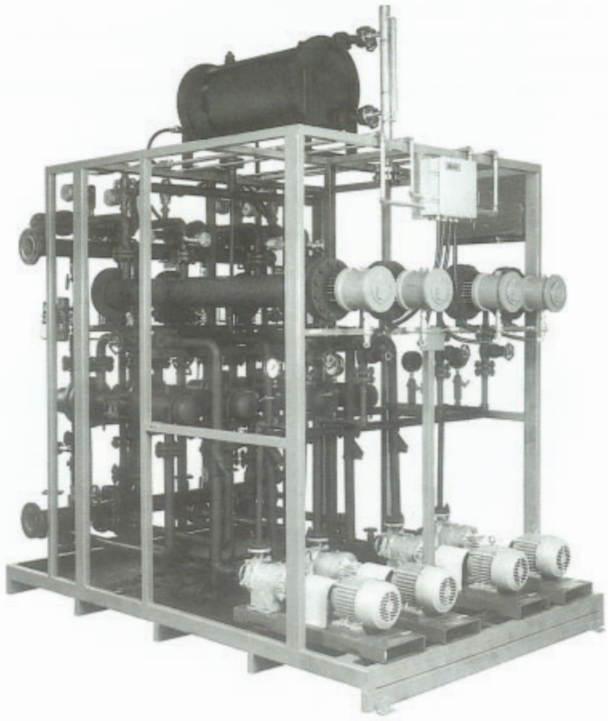
Other mechanical devices provided include an expansion tank with sight glass and vent, pressure gauge(s), low and high pressure switches or optional differential pressure switches.

Systems are available with motorized valves for heating and cooling applications.

Standard electrical controls include a fully prewired control panel with disconnect, HRC fusing, derated magnetic contactors, electronic indicating and fully adjustable temperature control, electronic high temperature limit control, optional step controller, switches and pilot lights.

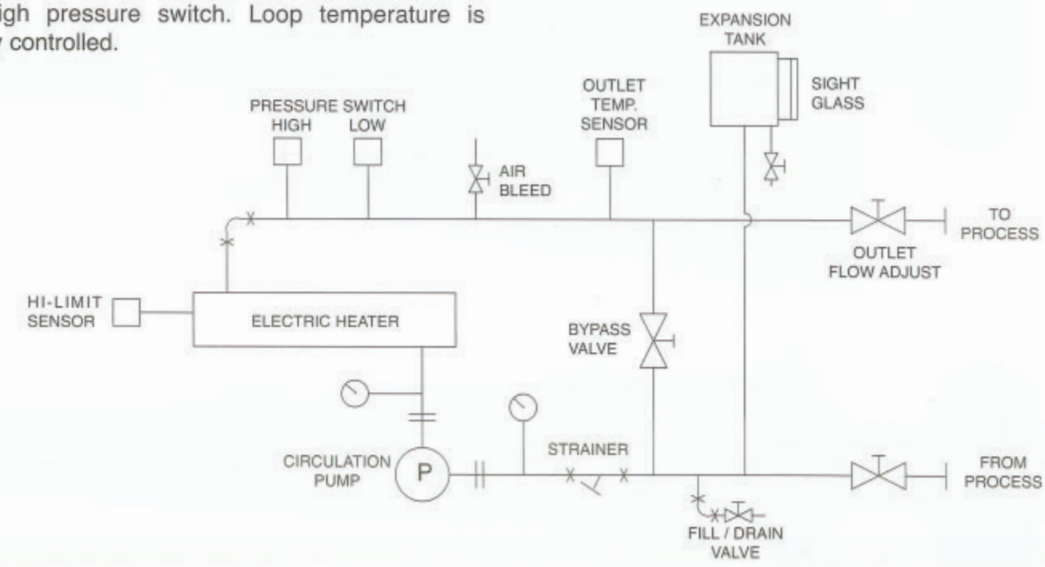
Selection

Contact the factory or your nearest Caloritech™ agent or distributor to obtain complete specifications and prices for an FX electric heat transfer system custom designed to your specific needs.



Flow Diagram

The heat transfer fluid is circulated through the electric heaters and the process in a closed loop. All components are connected with factory tested, leak proof joints. An expansion tank, vented to atmosphere and elevated above the system maintains a constant positive suction head on the pump. A bypass valve is used on cold start-up. The pump and heater are protected against external shut-off by an outlet high pressure switch. Loop temperature is automatically controlled.



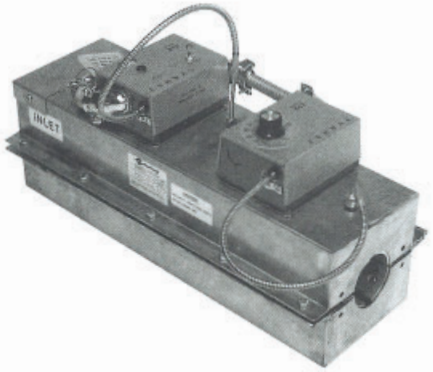
Custom Engineered Products

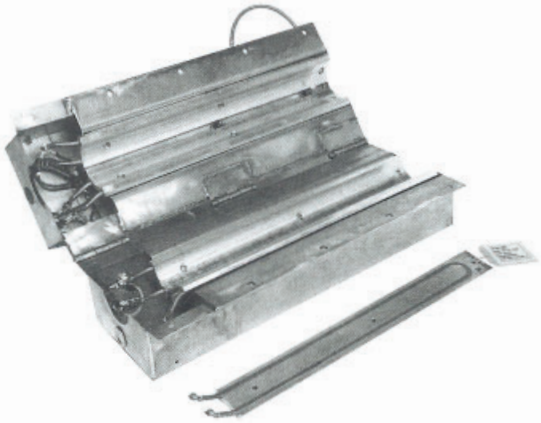
Electric heating technology can be applied to most applications where heat is required. Our corporate design experience began in 1920 and our body of knowledge has continued to build up since then.

We have many thousands of custom designs on file from which our heating expertise has evolved.

Custom engineered equipment is expected to work the first time and we can guarantee performance.

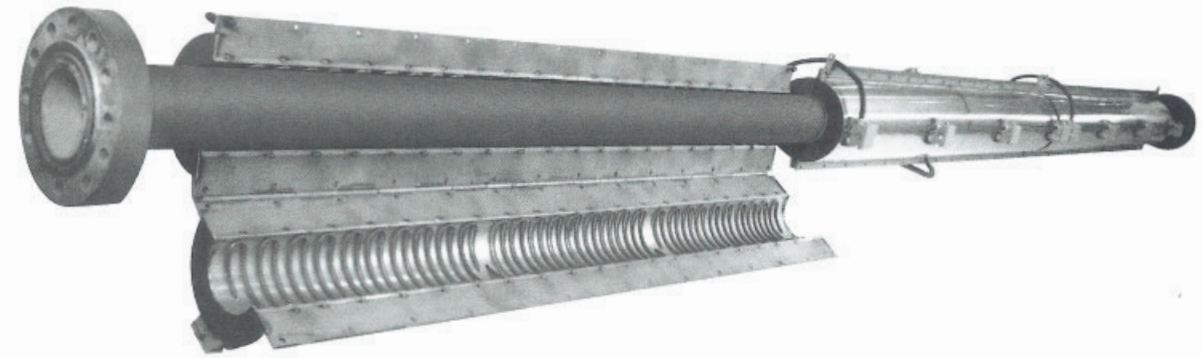
Almost all of the work is done in house; frames, vessels, control panels, heating elements, and CNC machining. Most important of all is the initial equipment design; our "design team" approach using experts in electrical, mechanical, chemical, mining, and metallurgical engineering, all graduate engineers, can be counted on to find the most reliable and effective method to get the job done.

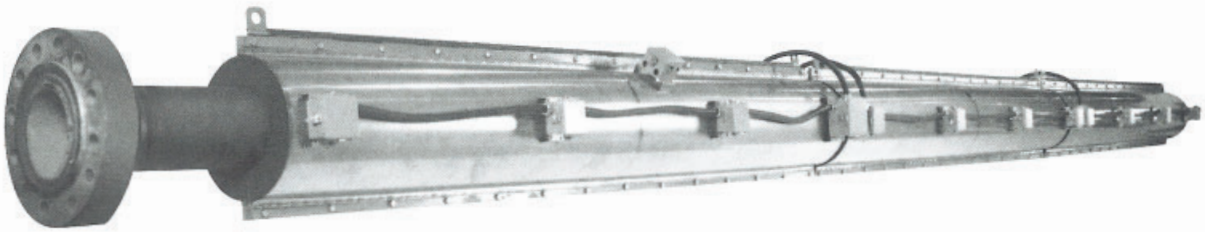




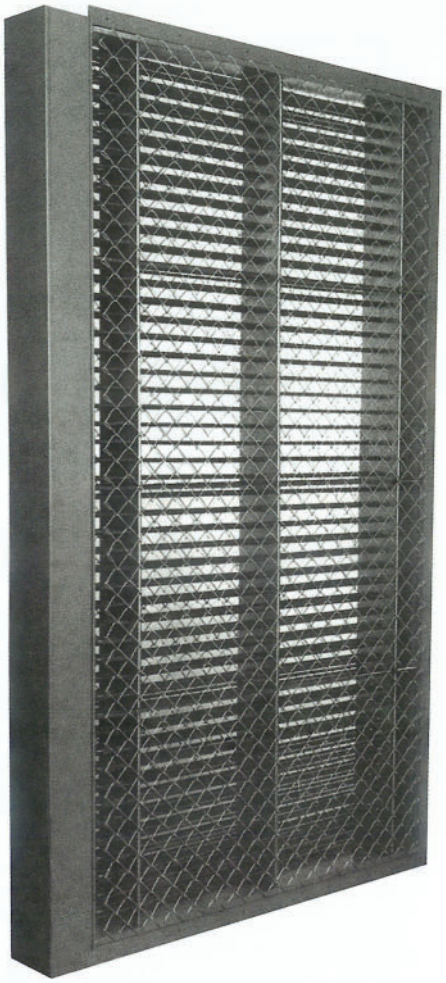
COVER GAS HEATER
CANDU REACTOR
WOLSONG 4, KOREA

HIGH PRESSURE GAS PREHEATER
480V 3Ø 58KW

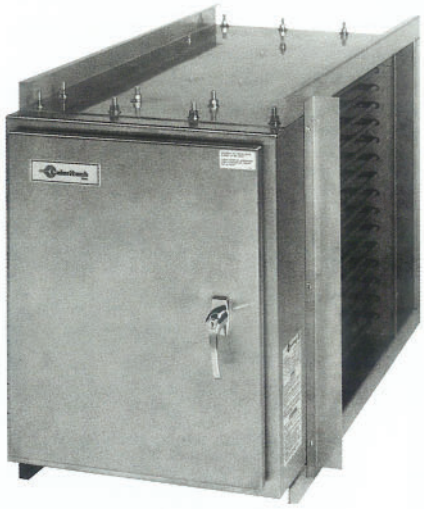




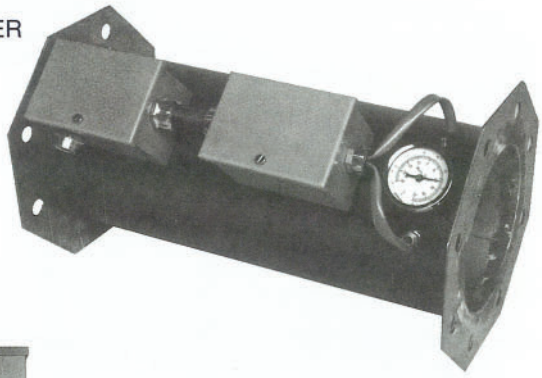
MINE VENT DUCT HEATER
600V 3Ø 320KW
21500 SCFM
9 FT x 5 FT

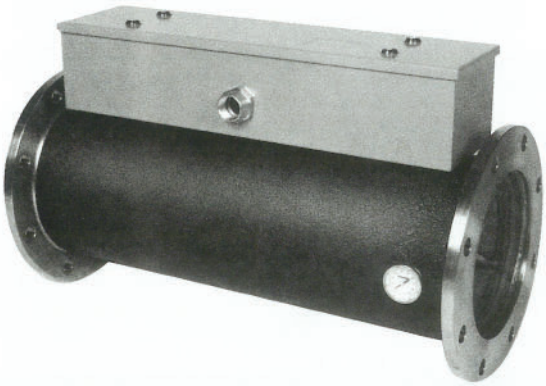


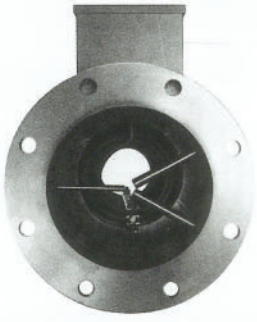
CUSTOM DUCT HEATER
ALL STAINLESS CONSTRUCTION
2000 CFM 70°F



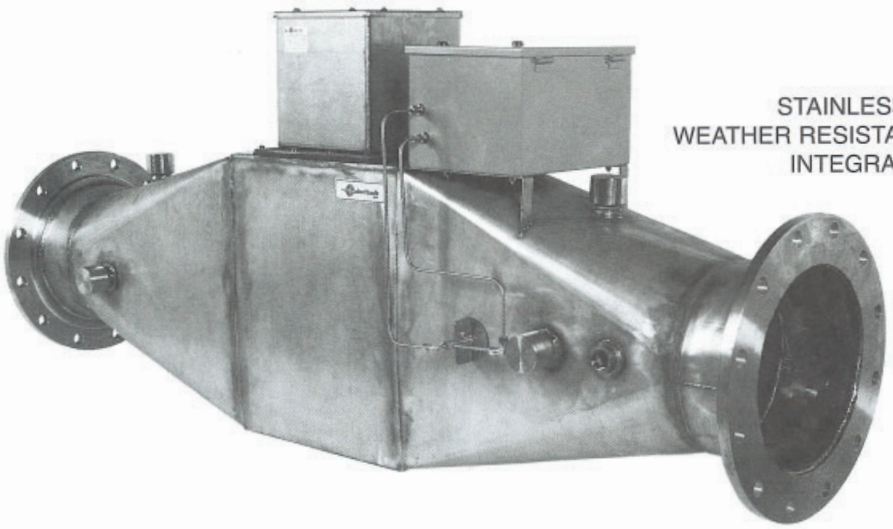
INLINE PACKAGED AIR DUCT HEATER
COMPLETE WITH CONTROLS
AND TEMPERATURE GAUGE
480V 3Ø 6.5KW 80°F





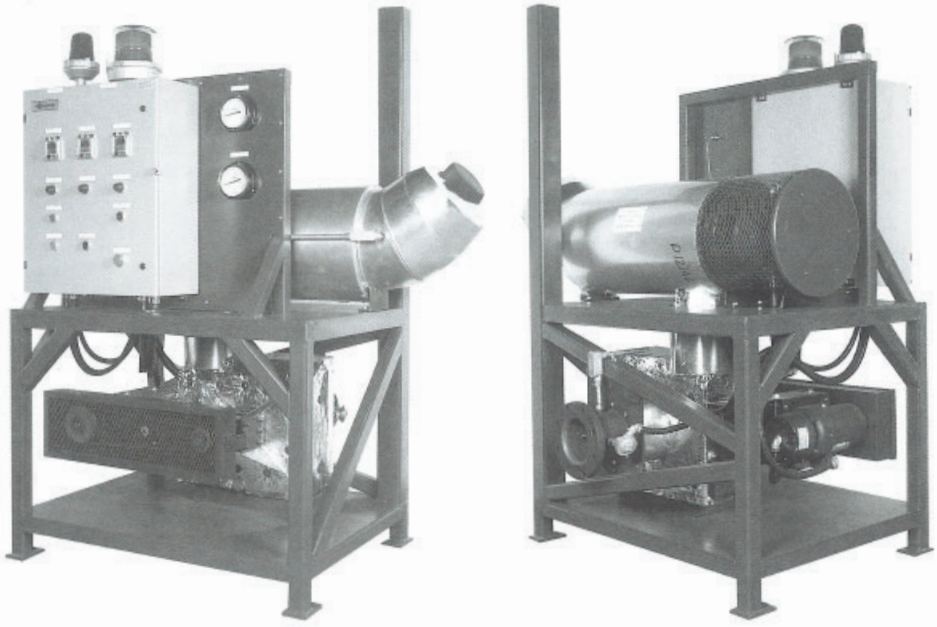


INLINE DEHUMIDIFICATION
DUCT HEATER
NUCLEAR QUALITY CONTROL
480V 3Ø 15KW



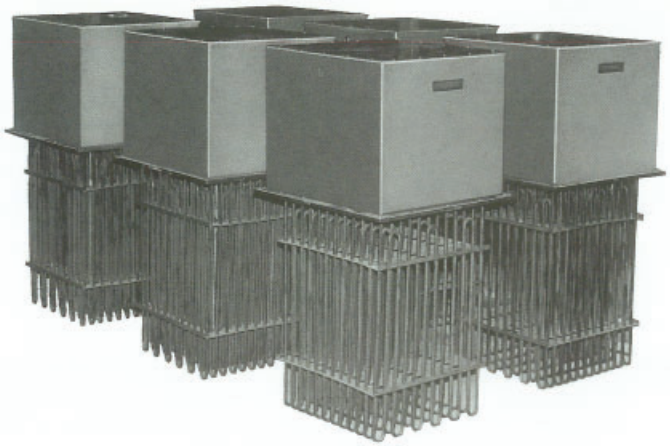
STAINLESS STEEL DUCT HEATER
WEATHER RESISTANT / AIR TIGHT CONSTRUCTION
INTEGRAL CONTROL PACKAGE

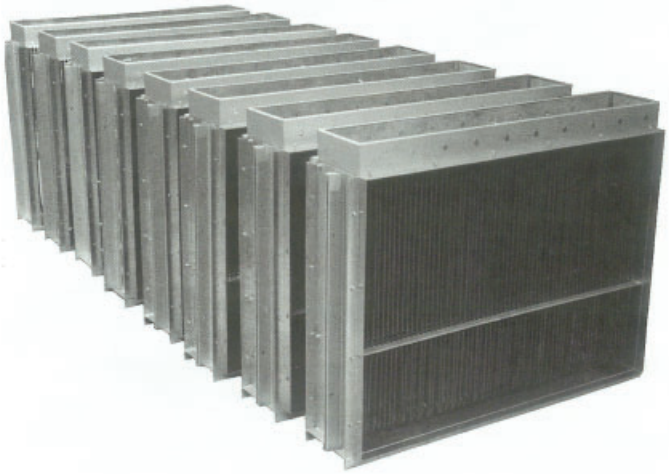
CRUCIBLE PREHEATER
600V 22KW
400 SCFM 250°C OUTLET



PORTABLE BLOWER HEATER
15KW 440V 3Ø 50HZ

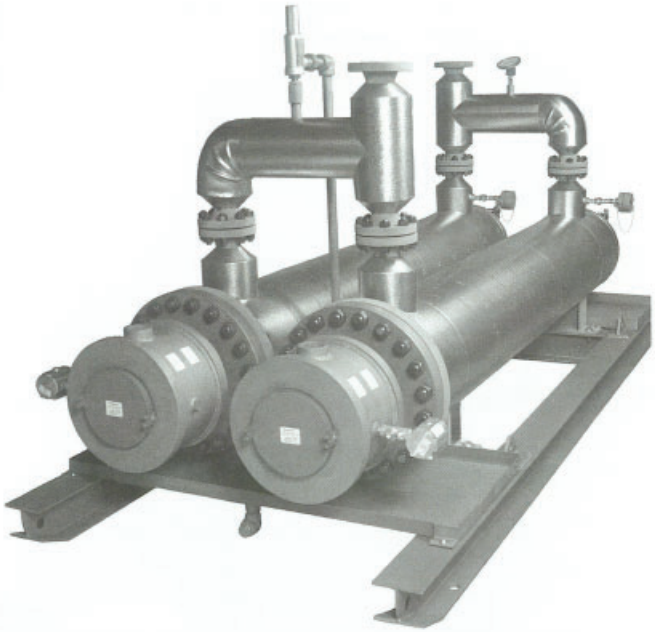
120 KW STAINLESS STEEL
HIGH TEMPERATURE
DUCT HEATERS

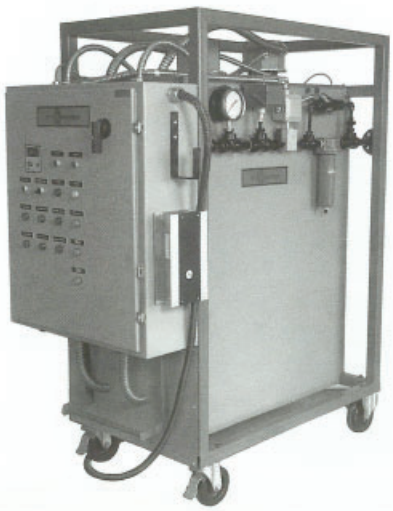




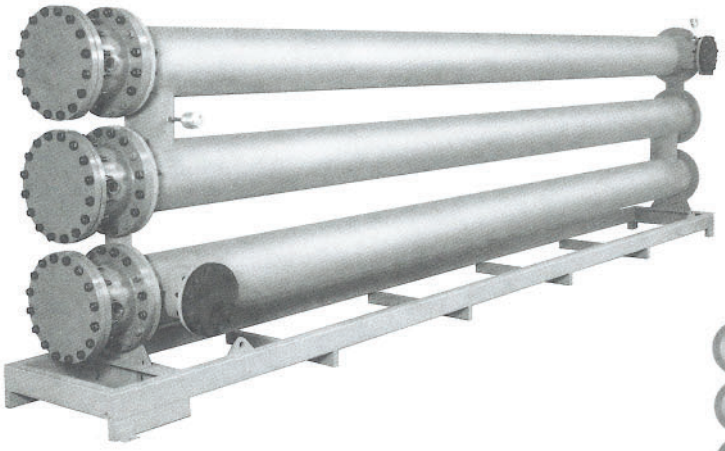
375 KW DUCT HEATERS
FOR GENERATING STATION

420 KW HOT OIL (THERMINOL 66)
HEATER ASSEMBLY (1 OF 3)

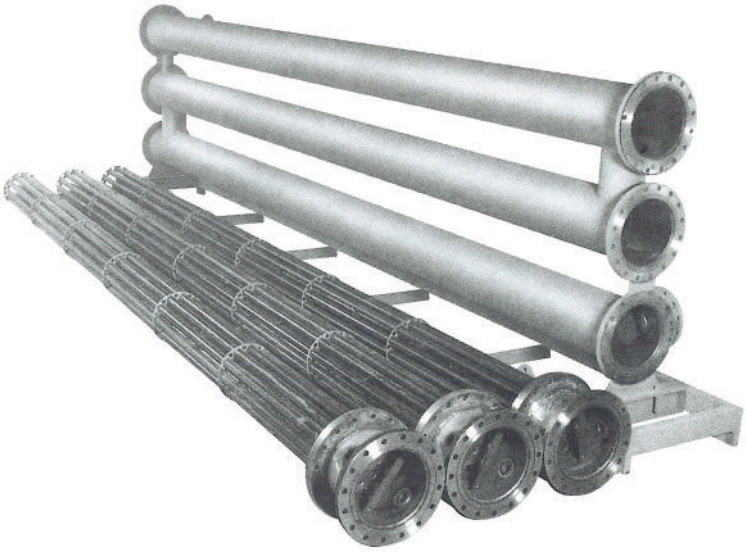


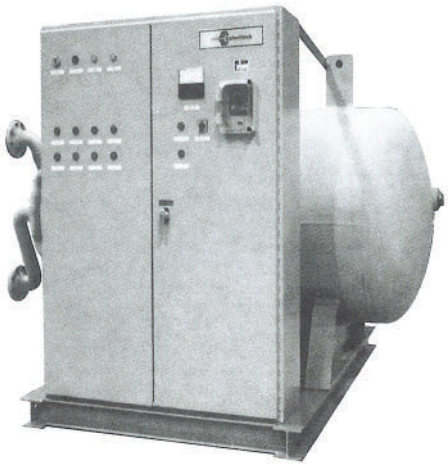


1250°F PORTABLE
SUPERHEATER

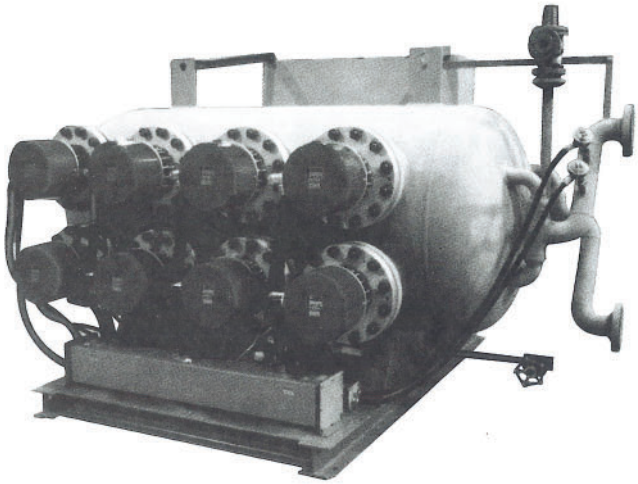


HEAVY OIL PIPE WELL HEATER
480V 3Ø 600KW

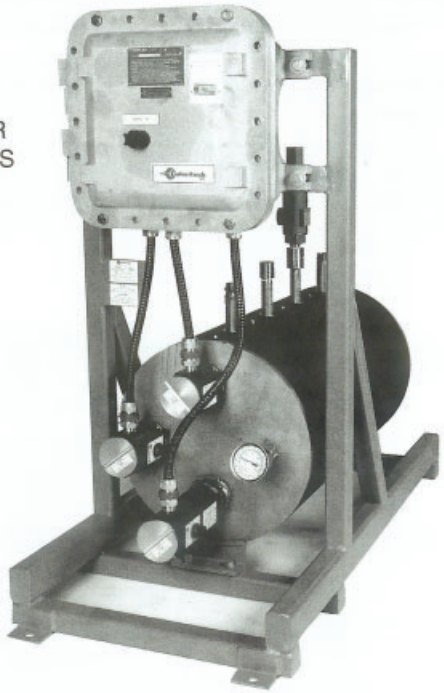


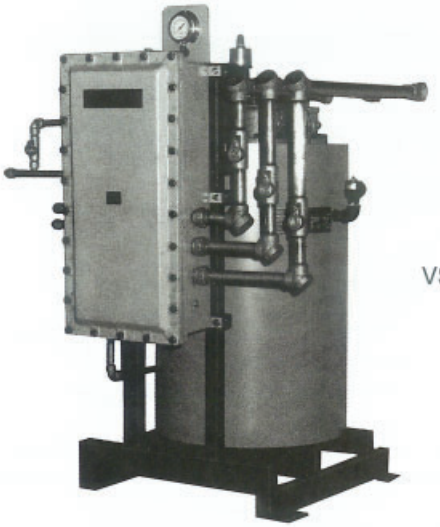


STEAM SUPERHEATER
600V 324KW 150 PSIG
OPERATING TEMP. 750°F

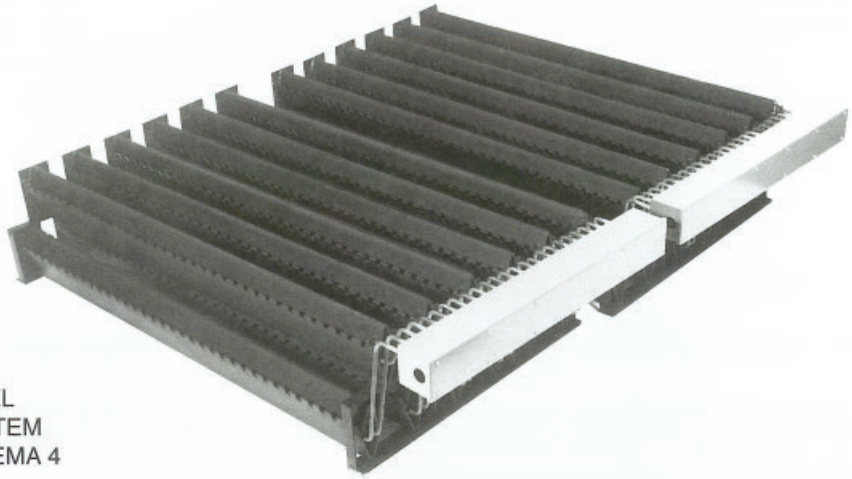


"DOMESTIC" WATER HEATER
FOR HAZARDOUS LOCATIONS
600V 6000W

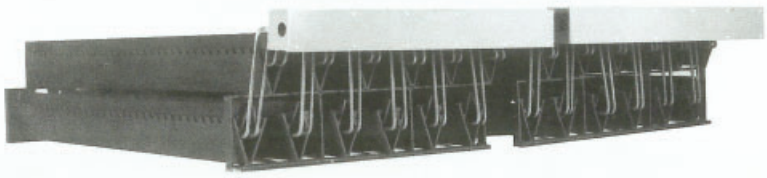




VSB-24-225X 600V 3PH 225KW
STEAM BOILER
EXPLOSION-PROOF
CLASS 1 DIV 1 GROUP D



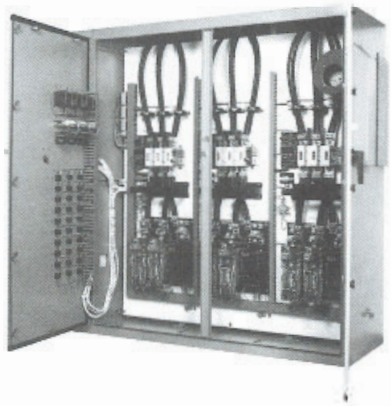
COAL TAR ENAMEL
GRID MELTING SYSTEM
4-30KW MODULES, NEMA 4



Electric Heating Control Panels

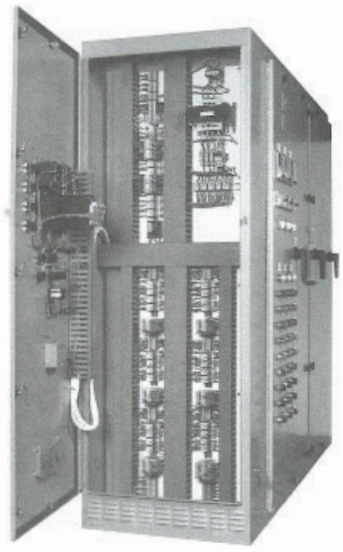
Caloritech™ control panels are designed for automatic control of electric heaters utilizing proven concepts and procedures developed from our experience with thousands of installations.

Our panels feature conservative designs with switching devices, fusing and internal wiring derated from the manufacturer's specified maximum allowable currents.



Approved panels are available up to 4000 Amps and 600V. We provide the design drawings, bills of material, replacement parts, operating instructions and component manuals.

The most basic model is the CPP/CPB which can accept remote mounted controls and make the balance of your wiring neat, reliable, and cost effective. Complete standard packages with contactor power switching (CPA) or staged contactor (CPS) or solid state switching (CPE) allow you to select the degree of sophistication required to meet process and budget requirements.



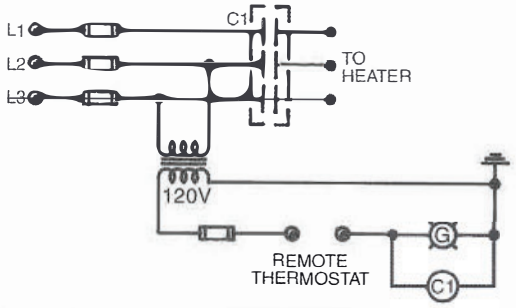
Control panels can be built to meet various environmental requirements including dust, oil, water, corrosive or hazardous materials.

Other optional features might include remote setpoint, proportioning, process variable retransmission, alarms, remote annunciation, dual energy and peak load controls, current/voltage/wattage metering and interfacing PLC's.

Type CPP Control Panels

The Caloritech™ Power Pack consists of a prewired contactor, transformer, pilot light and fuses in a Type 4 enclosure for a quick and convenient installation. Control circuits are 120 VAC.

Panels can be built to meet weather resistant or hazardous location specifications. Check factory for details.



TYPE CPP CONTROL PANELS

(Enclosure size 12" x 10" x 5" deep)

PRIMARY VOLTAGE	FUSED RATING (Amps)	LOAD RATING (Amps)	CATALOG NUMBER
600V	30	24	CPP308
480V	30	24	CPP307
600V	50	40	CPP508
480V	50	40	CPP507
600V	60	48	CPP608
480V	60	48	CPP607

TO ORDER: Specify catalog number and special features.

Type CPB Control Panels

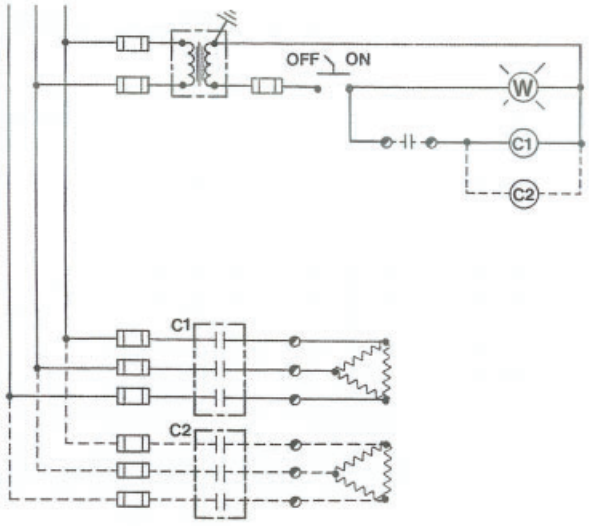
Type CPB panels are basic control units used to interface with electric heaters having remotely located thermostats, limit controls, percentage timers, or other control components. This series of panels does not include a disconnect switch but does include the following:

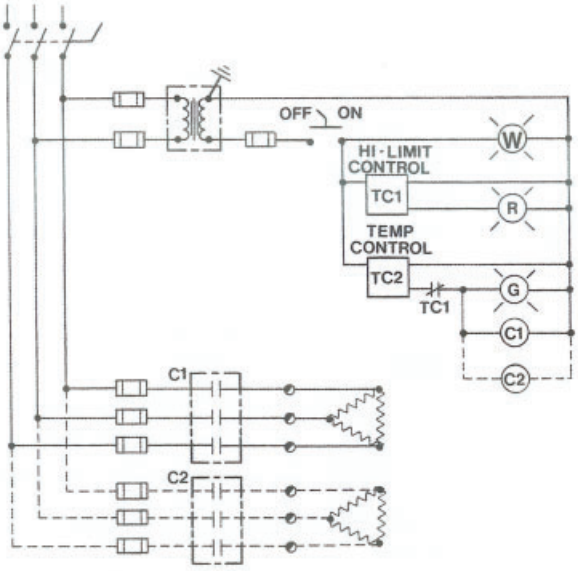
- Type 4 weather resistant enclosure with hinged door
- Fused magnetic contactor(s)
- On-off switch and pilot light
- Fused control circuit transformer with 120V secondary control voltage
- Terminal blocks for connection of externally located control devices

Type CPA Control Panels

Type CPA fully packaged control panels are suitable for use in a variety of electric heater installations. The CPA series includes:

- Type 4 weather resistant enclosures with hinged doors.
- Disconnect switch with door interlock
- Fused control circuit transformer with 120V secondary control voltage
- On-off switch
- Fused magnetic definite purpose contactor(s)
- Digital indicating configurable microprocessor based temperature control (Series UT320)
- Electronic high limit, manual or auto reset
- Pilot lights for "system on", "heat on", "high limit"





TYPE CPB CONTROL PANELS (Type 4 enclosures)
208V, 240V, 480V, 600V, (1 or 3 Phase)

FUSED RATING (Amps)	MAX. LOAD (Amps)	NO. OF CIRCUITS	AMPS PER CIRCUIT	PANEL SIZE (ins.)	CATALOG NUMBER
30	24	1	24	16X12X6	CPB30
40	32	1	32	16X12X6	CPB40
50	40	1	40	16X12X6	CPB50
60	48	1	48	16X12X6	CPB60
80	64	2	32	20X16X6	CPB80
100	80	2	40	20X16X6	CPB100
150	120	3	40	24X20X6	CPB150
200	160	4	40	24X20X6	CPB200

TYPE CPA CONTROL PANELS (Type 4 enclosures)
208V, 240V, 480V, 600V, (1 or 3 Phase)

DISCONNECT SIZE (Amps)	MAX. LOAD (Amps)	NO. OF CIRCUITS	AMPS PER CIRCUIT	PANEL SIZE (ins.)	CATALOG NUMBER
30	24	1	24	24X20X8	CPA30
60	48	1	48	24X20X8	CPA60
100	80	2	40	24X20X8	CPA100
200	160	4	40	36X24X8	CPA200

TO ORDER: Specify panel catalog number, voltage, phase, temp. range, type of sensor, optional high limits if required and any other special features

CPS Control Panels
(CONTACTOR STAGES)

The CPP, CPB and CPA panels on the previous pages switch all of the load(s) ON in one or optionally two stages as controlled from the main temperature control. If a greater amount of staging is required, the CPS panel is ideal. This series includes a modulating temperature control driving a step control which in turn brings on a number of contactor stages. Time delay between steps is adjustable to match the system dynamics.

normally sizes stages between 30-45 Amps for best control and to optimize contactor and wire sizes.

The standard process control is the UT350 series. This control is configured to a 4-20 mA proportioning output to drive the step control. Other controls are available as options.

The high limit is a 543 manual reset, with K thermocouple for -20 to +1100°C range.

CPS FEATURES:

- TYPE 12 DUST TIGHT ENCLOSURE
- TYPE 4 WEATHER RESISTANT ENCL. OPTIONAL
- DOOR INTERLOCKED DISCONNECT
- 2 to 12 FUSED CONTACTORS
- FUSED CONTROL CIRCUIT TRANSFORMER
- ON / OFF SELECTOR SWITCH & PILOT LIGHT
- PILOT LIGHTS FOR EACH STAGE
- HIGH LIMIT TRIP PILOT LIGHT
- UT350-00 DIGITAL INDICATING CONTROL, FIELD OR FACTORY CONFIGURABLE
- 54-302121-206 MANUAL RESET LIMIT

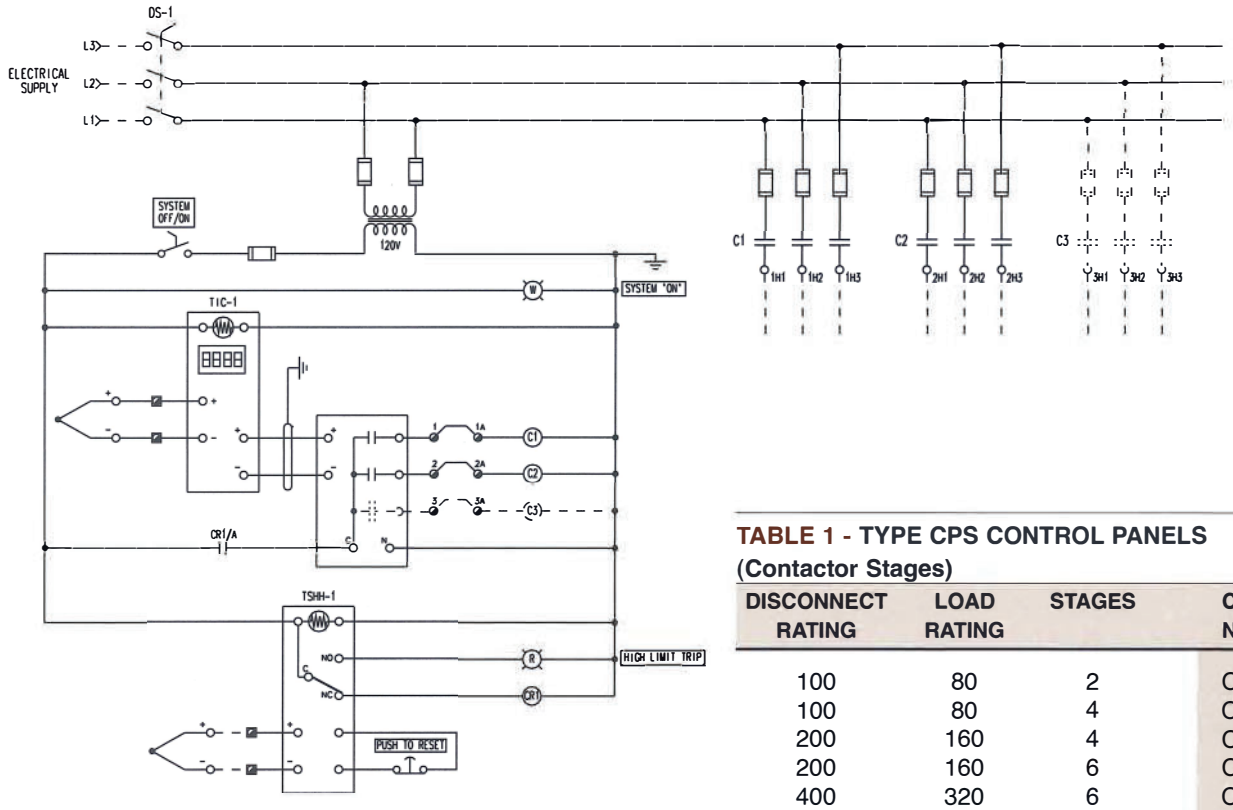


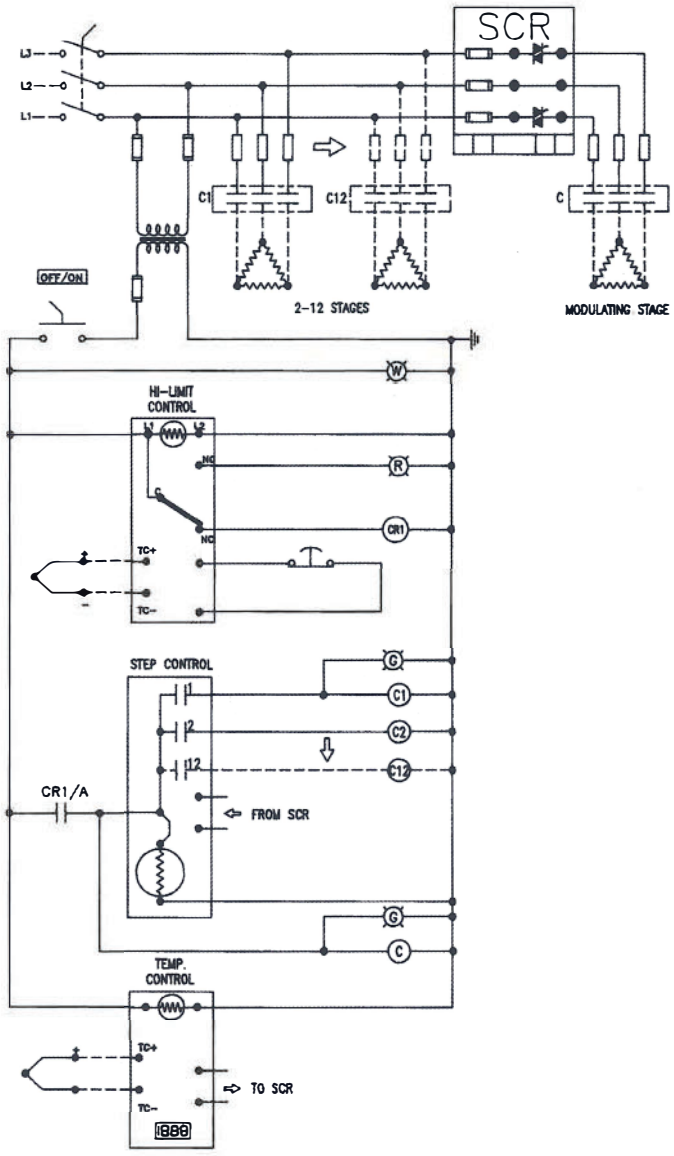
TABLE 1 - TYPE CPS CONTROL PANELS
(Contactor Stages)

DISCONNECT RATING	LOAD RATING	STAGES	CATALOG NUMBER
100	80	2	CPS1002
100	80	4	CPS1004
200	160	4	CPS2004
200	160	6	CPS2006
400	320	6	CPS4006
400	320	8	CPS4008
400	320	12	CPS40012

TO ORDER: Specify panel catalog number, voltage, phase, number of stages, optional features and 921 configuration.

CPSS Control Panels
(BASE LOAD - SCR)

The CPSS control panel uses a combination of contactor stages controlled by a step control and an SCR solid state power control for fine tuning. Typically the SCR stage switches 20 to 30% of the total load with contactors making up the balance.



Standard features are shown below but other components and features are available to meet specific process requirements.

The control package automatically determines when extra base load contactor steps need to be brought in or dropped out. Many adjustments such as proportioning band, zero and span, and time delay between stages are field adjustable to fine tune to the process.

CPSS FEATURES:

- TYPE 12 DUST TIGHT ENCLOSURE
- TYPE 4 WEATHER RESISTANT ENCL. OPTIONAL
- DOOR INTERLOCKED DISCONNECT SWITCH
- FUSED CONTACTORS
- FUSED CONTROL CIRCUIT TRANSFORMER
- ON / OFF SELECTOR SWITCH & PILOT LIGHT
- I^2t FUSED SCR
- HIGH LIMIT TRIP PILOT LIGHT
- HEATING STAGES PILOT LIGHT
- UT350-00 PROCESS CONTROL
- 54-302121-206 MANUAL RESET LIMIT

TABLE 1 - TYPE CPSS CONTROL PANEL (Baseload & SCR)

MAXIMUM STAGES & AMPS			
DISCONNECT RATING	BASE LOADS	SCR RATING	CATALOG NUMBER
175A	4X30A	60A	CPSS1704 60
400A	6X50A	90A	CPSS4006 90
600A	8X60A	120A	CPSS6008 12
800A	10X60A	180A	CPSS8010 18
800A	12X50A	180A	CPSS8012 18

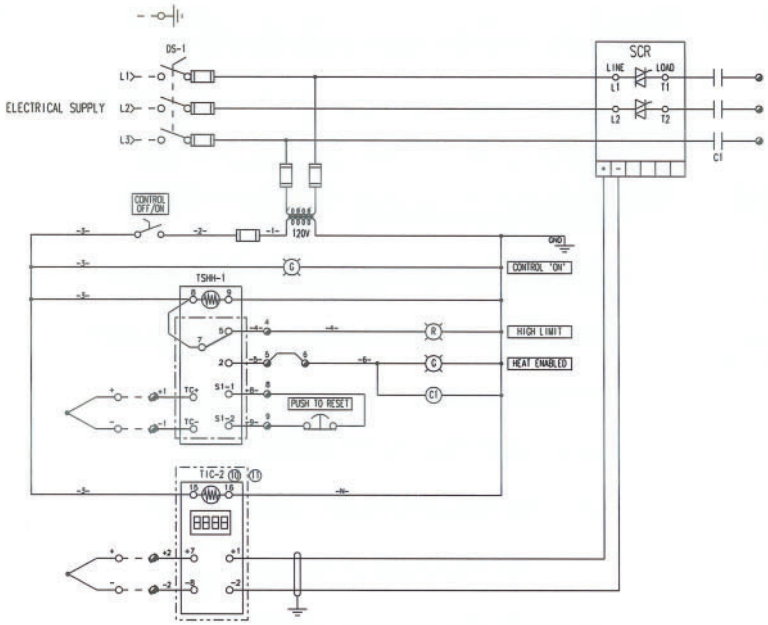
TO ORDER: Specify panel catalog number, voltage, phase, optional features or modifications, types of scans and control configuration.

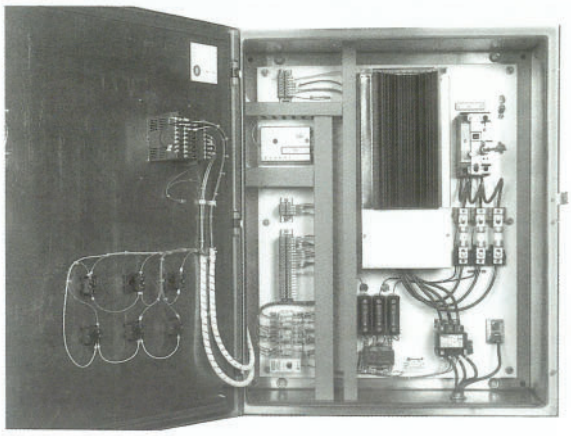
CPE Control Panels

The CPE control panel features full SCR control. Multiple backup contactors are used to protect and facillitate wiring to the process heater.

Where necessary, the type 12 enclosures include fans and vents to keep ambient temperatures to a safe level. For type 4 or weather resistant applications check factory.

Standard features are shown below but components and features are available to meet specific process requirements.





CPE STANDARD FEATURES:

- TYPE 12 DUST TIGHT ENCLOSURE
- DOOR INTERLOCKED DISCONNECT SWITCH
- FUSED BACKUP CONTACTORS
- FUSED CONTROL CIRCUIT TRANSFORMER
- ON / OFF SELECTOR SWITCH & PILOT LIGHT
- I^2T FUSED SCR
- HIGH LIMIT TRIP PILOT LIGHT
- UT350-00 PROCESS CONTROL
- 54-302121-206 MANUAL RESET LIMIT

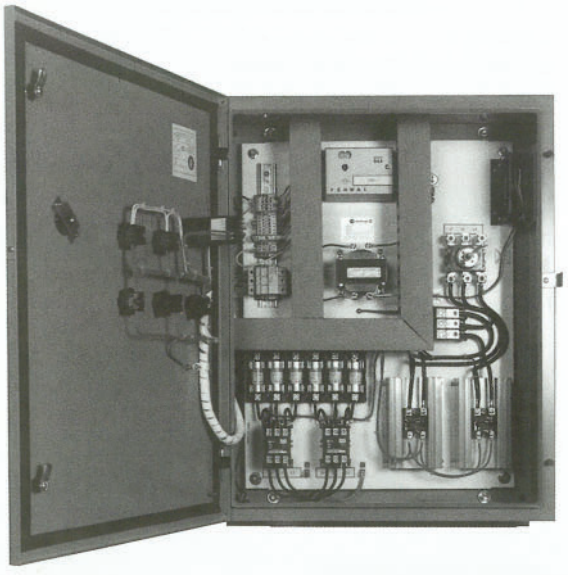


TABLE 1 - TYPE CPE CONTROL PANEL

DISCONNECT RATING	BACKUP CONTACTORS	SCR	CATALOG NUMBER
30A	1X30A	25A	CPE030
80A	2X30A	70A	CPE080
100A	2X50A	90A	CPE100
175A	3X50A	120A	CPE175
200A	4X50A	180A	CPE200
400A	8X50A	350A	CPE400
600A	10X60A	500A	CPE600
800A	14X60A	650A	CPE800

TO ORDER: Specify panel catalog number, voltage, phase, optional features or modifications, types of scans and control configuration.

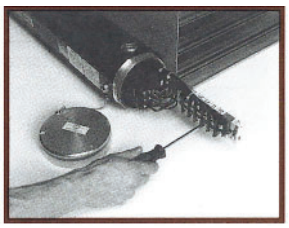
Optional Control Equipment

The panel configurations shown on the previous pages are some of the most popular variations has built. However, many specifications or process requirements dictate that we custom build a panel to suit. Caloritech™ panels are built under our ISO9001 quality program. All panels are fully tested and meet required electrical approvals. Panels may include drawings, bills of material, and depending on the customer requirements, may include specific operating manuals, replacement parts lists, startup assistance, etc. Some available options are listed below:

- Weather resistant enclosures
- Hazardous locations enclosures
- NEMA 4X or equivalent
- Breakers instead of disconnects or fuses
- Audible alarms or annunciation
- Input signals from transmitter, level or flow controls
- RTD sensors, different calibration thermocouples
- Retransmitted process variables
- Communications
- Remote set point
- Interface to PLC's
- Remote interlocks
- Time clocks
- Current, voltage, amperage, watt hour metering

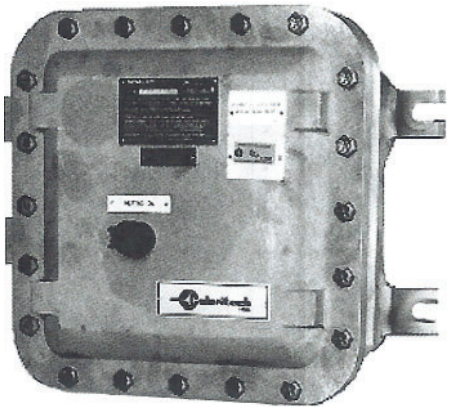
Hazardous Location Panels

With the ***x-Max***® line of enclosures (utilizing the unique "track and trolley" system), can build economical control systems suitable for all hazardous locations.

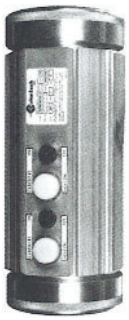


The available models include basic push button stations, transformers, contactors, solid state relays and even windows for viewing digital displays.

For larger systems, other approved enclosures are available.



Although many process components must be located in the hazardous area, control components can often be located outside this area. It is good engineering design to do so when feasible.



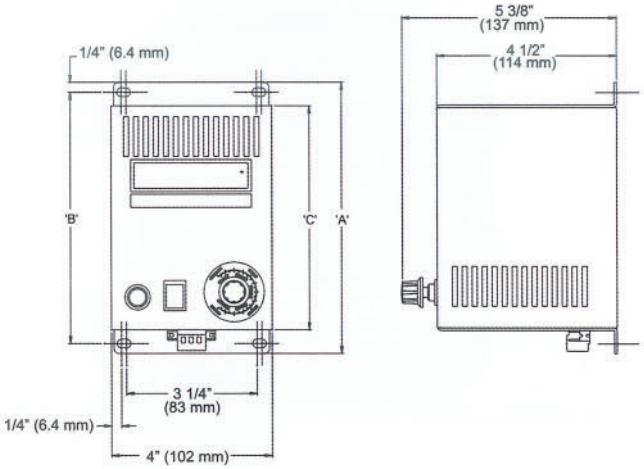
However, when the need arises has the experience and the capabilities to build safe, functional and cost effective systems for any location.

Fan-Forced Enclosure Heater Type PH

APPLICATION

Caloritech™ type PH fan-forced enclosure heaters are designed to control the environment within enclosures by maintaining a stable temperature.

Effects of low temperatures such as corrosion, freezing or condensation will adversely affect the components inside control panels. The Caloritech™ PH enclosure heater will provide optimal performance environment for the critical components contained within the control panel.



CATALOG NO.	DIMENSIONS					
	'A'		'B'		'C'	
	mm	INCH	mm	INCH	mm	INCH
PH125/PH200	140	5 1/2	127	5	105	4 1/8
PH400/PH800	191	7 1/2	178	7	157	6 3/16

FEATURES

- CSA C/US approved
- Light weight unit
- Low maintenance
- Aluminum alloy outer casing
- Externally adjustable thermostat -18°C to 38°C (0°F to 100°F)
- Pilot light for "heat-on" indication
- High temperature safety protection
- Fan on/auto switch to prolong motor life
- Terminal strip provides quick installation and accepts both stranded and solid wire
- Optional DIN rail mounts available

SELECTION

The wattage requirement is determined from a consideration of the surface area, insulation properties of the enclosure or space and the temperature difference between the ambient and the enclosure. For small enclosures (less than 100 ft^2 surface area) conservative values for heat losses areas shown in Table 1.

TABLE 1 - WATTS/FT² PER 10°F TEMP. DIFFERENCE

	INDOORS	OUTDOORS
UNINSULATED	5	7
INSULATED (MIN. 1")	1	1.2

Example: To find wattage requirements in an uninsulated enclosure 2' x 3' x 1', which must be held at 40°F in a 10°F outdoor ambient. Internal electrical components use 80 watts.

Surface Area = 2[(2' x 3') + (2' x 1') + (3' x 1')] = 22 ft^2
From Table 1, an uninsulated outdoor enclosure requires 7 watts for each 10°F temperature difference.

Temperature Difference = 40°F - 10°F = 30°F
Wattage Required = (30°F ÷ 10°F) x 7 x 22 = 462 watts
Heater Wattage = Wattage required less component wattage or 462 - 80 = 382 watts

Use one PH400 rated at 400 watts. For enclosures requiring more than 800 watts, two or more PH heaters may be used.

INSTALLATION

The Caloritech™ PH fan-forced enclosure heater should be installed in the center of the cabinet and as low as practicable for the best possible heat dissipation. The optimum efficiency is obtained when the unit is mounted in a vertical position allowing the top air vents to release the heated air in the most effective manner. The control panels should be sealed and free from dust and dirt. Do not install the heaters on wood, cardboard or other flammable panels. Heat sensitive components should not be placed near the heat discharge area. For larger enclosures, two or more heaters may be used.

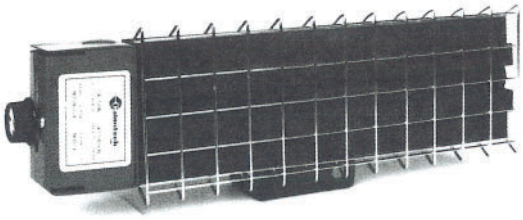
TABLE 2 - TYPE PH FAN-FORCED ENCLOSURE HEATER

Catalog Number	Watts	Voltage	Hertz	Phase	Weight Lbs.	Weight Kg
PH12511	125	120	60	1	2.2	1.0
PH12531	125	240	60	1	2.2	1.0
	105	220	50	1	2.2	1.0
PH20011	200	120	60	1	2.2	1.0
PH20031	200	240	60	1	2.2	1.0
	168	220	50	1	2.2	1.0
PH40011	400	120	60	1	3.0	1.4
PH40031	400	240	60	1	3.0	1.4
	336	220	50	1	3.0	1.4
PH80011	800	120	60	1	3.0	1.4
PH80031	800	240	60	1	3.0	1.4
	672	220	50	1	3.0	1.4

Control Panel and Pump House Heater Type PXFT

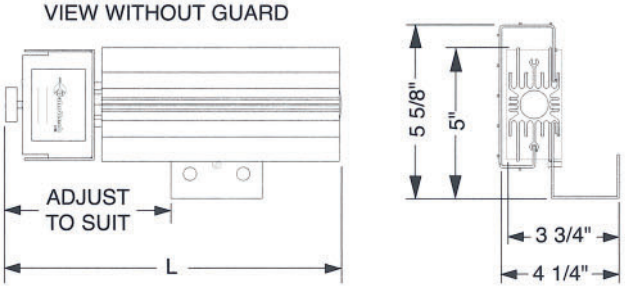
APPLICATION

The PXFT heater is designed to maintain a suitable temperature inside a control enclosure, pump house or similar space. The standard unit is not suitable for use outdoors, unprotected from the weather. All heaters have a built-in thermostat. The heater is also available without thermostat on special order.



GUARD OPTIONAL ON SOME UNITS

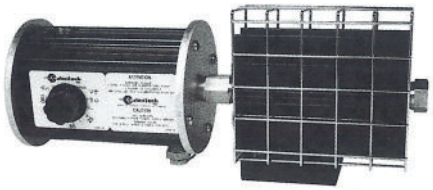
VIEW WITHOUT GUARD



FEATURES

The PXFT uses a high surface area aluminum heat emitter to eliminate the need for a fan while providing low radiation and high convection heating to the enclosure. The **thermostat rating** is 25A at 240V, S.P.S.T., adjustable from 30-120°F (0 to 50°C). A **movable bracket** allows the heater to be floor or wall mounted with the terminal box located on the left or right side, top or bottom. **Wire guards** are provided standard with the PXFT-300,400 and 600 watt heaters, and are available as an option on the PXFT-050, 125 and 200 watt units.

Moisture resistant heaters (shown below) are available on special order.



SELECTION

The wattage requirement is determined from a consideration of the surface area, insulation properties of the enclosure or space and the temperature difference between the ambient and the enclosure. For small enclosures (less than 100 ft^2 surface area) conservative values for heat losses are as shown in Table 1.

TABLE 1 - WATTS/FT^2 PER 10°F TEMP. DIFFERENCE

	INDOORS	OUTDOORS
UNINSULATED	5	7
INSULATED (MIN. 1")	1	1.2

EXAMPLE - To find wattage requirements in an uninsulated enclosure 2' x 3' x 1/2', which must be held at 40°F in a 10°F outdoor ambient.

- Surface Area = 2 (2 x 3 + 2 x 1/2 + 3 x 1/2) = 17 ft^2
  From Table 1, an uninsulated outdoor enclosure requires 7 watts for each 10°F temperature difference.
- Temperature Diff. = 40°F - 10°F = 30°F
- Wattage Rating Required = (30°F / 10°F)x 7 x 17 = 357 watts

Use one PXFT400 rated at 400 watts

For enclosures requiring more than 600 watts, two or more PXFT heaters can be used. Higher wattage heaters are available. Check factory.

INSTALLATION

The PXFT heater is approved for horizontal or vertical mounting on the floor or lower wall of the enclosure. Heaters must be installed using the mounting bracket provided to ensure minimum spacing between the heater and the wall or floor. Try to maximize the spacing between the heater and temperature sensitive components.

Surface temperatures of the 50 watt and 125 watt units are about 100°C (212°F) and 170°C (338°F) respectively. The other units listed operate around 210°C (410°F).

TABLE 2 - TYPE PXFT CONTROL PANEL AND PUMP HOUSE HEATERS

WATTS	STANDARD VOLTAGES	LENGTH 'L' IN (MM)	CATALOG NUMBER*	NET WT. LBS (KG)
50	120	8 3/8 (213)	PXFT050	2.6 (1.1)
125	120	8 3/8 (213)	PXFT125	2.6 (1.1)
200	120	8 3/8 (213)	PXFT200	2.9 (1.3)
300	120, 240	15 (381)	PXFT300	3.5 (1.6)
400	120, 240	21 3/4 (553)	PXFT400	5.5 (2.5)
600	120, 240	28 1/2 (724)	PXFT600	7.5 (3.4)

* FOR UNITS WITHOUT THERMOSTAT, OMIT 'T' IN CATALOG NUMBER
INVENTORY - THESE HEATERS ARE NORMALLY STOCKED IN LIMITED QUANTITIES

TO ORDER: Specify quantity, catalog number, voltage, and special features.

Thermocouples

The most common problems associated with thermocouple sensing controls are:

1) Using the wrong type of thermocouple

Each instrument is calibrated to work with a particular thermocouple type. Connecting a 'K' thermocouple to a 'J' instrument will result in severe overshoot and probable heater damage.

2) Reversing of lead wires

Thermocouple leads are polarized. The red wire is always negative. Reversing leads will cause reverse reading at the instrument and loss of control.

3) Using the wrong extension wire

The correct thermocouple extension wire must be used. For example: type J themocouple extension wire must be used with J thermocouples. Copper wire cannot be used. A mixture of copper and thermocouple wire creates extra thermocouple junctions which will cause unpredictable reading errors.

Refer to the following charts for proper physical identification:

Thermocouple Identification

TABLE 1 - Thermocouple Identification

ANSI TYPE	DESCRIPTION	COLOURS		JACKET
		POS+	NEG-	
J	Iron Constantan	White	Red	Black
K	Chromel Alumel	Yellow	Red	Yellow
T	Copper Constantan	Blue	Red	Blue
E	Chromel Constantan	Purple	Red	Purple
R	Platinum Rhodium 13%	Black	Red	Green
S	Platinum Rhodium 10%	Black	Red	Green
N	Nicrosil NISIL	Orange	Red	Brown

Thermocouple Output

TABLE 2 - Millivolt vs. Temperature

TEMP. °F	TEMP. °C	J (iron constantan) MILLIVOLTS	K (chromel alumel) MILLIVOLTS
0	-18	-0.885	-
32	0	-0.000	0.000
100	38	1.942	1.520
212	100	5.268	4.095
300	149	7.947	6.092
500	260	14.108	10.560
700	371	20.253	15.178
1000	538	29.515	22.251
1250	677	37.688	28.146
1500	816	46.503	33.913
2000	1093	63.392	44.856

Thermocouple Extension Wire Resistance

Thermocouple wires have the resistance outlined in the following chart (Table 3). Resistances should be kept as low as possible. Increase the gauge of wire for long runs. Although modern instrumentation will accept an input impedence up to 100 ohms or more, the signal degrades and the instrument becomes more susceptible to external interference.

For long runs between sensing point and instrumentation of 50 meters (150 feet) or more, a transmitter should be considered.

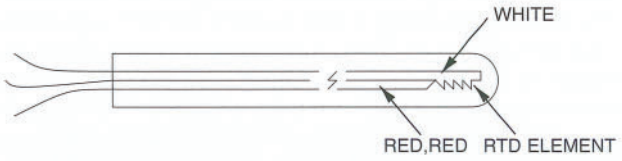
TABLE 3 - Loop Resistance (2 Wires)

CALIBRATION	Ohms per 33m (100') 8 GA	12 GA	14 GA	16 GA
JX Iron Constantan	2.15	5.42	8.63	13.71
KX Chromel Alumel	3.65	9.22	14.66	23.30
TX Copper Constantan	1.84	4.66	7.41	11.78
EX Chromel Constantan	4.36	11.01	17.51	27.83

CALIBRATION	Ohms per 33m (100') 18 GA	20 GA	22 GA	24 GA
JX Iron Constantan	21.80	35.69	55.11	87.66
KX Chromel Alumel	37.07	58.97	93.68	149.00
TX Copper Constantan	18.74	29.82	46.91	75.34
EX Chromel Constantan	44.27	70.43	111.90	178.00

RTD's

RTD's are available in 2, 3 and 4 wire construction. The most common (as shown) is 3 wire. With instrumentation designed to accept 3 wire RTD's, the second red wire is used in a circuit to calculate lead wire resistance. This resistance is automatically deducted from the sensor reading to eliminate potential errors.



RTD Output

TABLE 4 - 100Ω Platinum (.00385 Ω/Ω/°C) Resistance vs. Temperature

TEMP. °F	TEMP. °C	OHMS	TEMP. °F	TEMP. °C	OHMS
-40	-40	84.27	302	150	157.31
-4	-20	92.16	392	200	175.84
32	0	100.00	482	250	194.07
68	20	107.79	572	300	212.02
122	50	119.40	662	350	229.67
212	100	138.50	752	400	247.04

Electrical Equations

Single phase relationships:

$$V = \sqrt{WR} = W/I = IR$$

$$RW/I^2 = V^2/W = V/I$$

$$I = V/R = W/V = \sqrt{W/R}$$

$$W = V^2/R = I^2R = VI$$

For current in electrically balanced three phase A.C. circuits:

$$I = \frac{W}{V(\sqrt{3})}$$

NOTE: For circuits wired in 3 phase delta, wattage may be reduced to 1/3 by rewiring to a 3 phase wye connection.

FIG. 1 - THREE PHASE DELTA CONNECTION

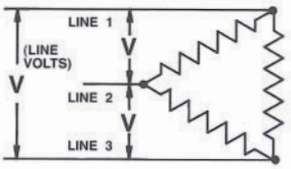


FIG. 2 - THREE PHASE WYE OR STAR CONNECTION

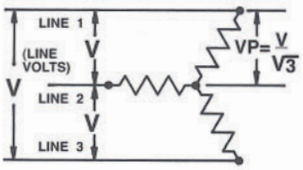


FIG. 3 - SPECIAL USE OF TWO POLE THERMOSTAT

Single phase circuit split with half of the current load across each thermostat contact.

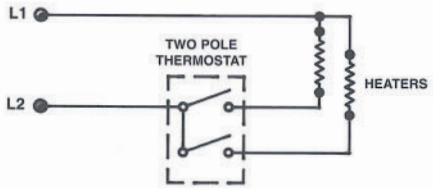


FIG. 4 - USE OF CONTACTOR (SINGLE PHASE)

Single phase circuit for conditions where the line current exceeds the thermostat rating and a contactor is added.

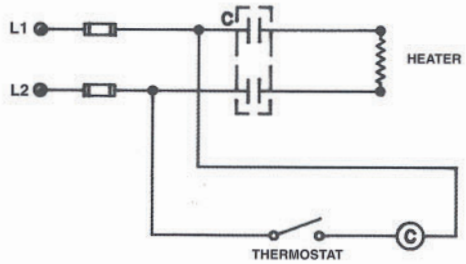


FIG. 5 - USE OF CONTACTOR (THREE PHASE)

Three phase circuit for conditions where the line current exceeds the thermostat rating and a contactor is added.

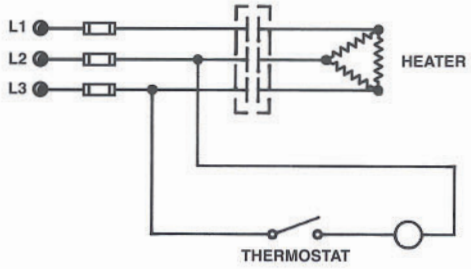


FIG. 6 - SERIES TO PARALLEL DELTA TRANSFORMATION

Special circuit with two thermostats and two contactors. When both contactors are closed, elements are wired in 3 phase parallel delta and circuit operates at full power. When only one of the contactors is closed, elements are wired in 3 phase series delta and the circuit operates at 1/4 power.

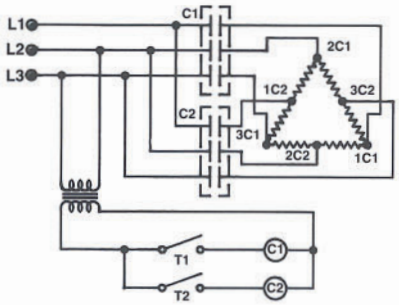
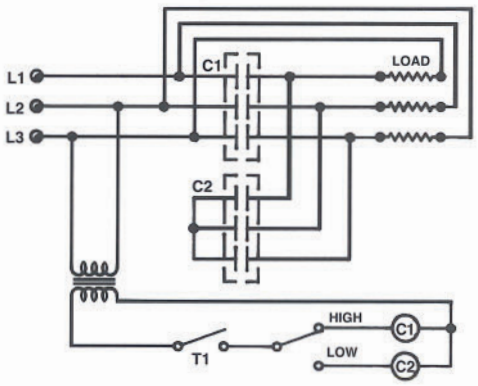


FIG. 7 - WYE TO DELTA TRANSFORMATION

Special circuit with two contactors, thermostat and two position switch.

When contactor 1 (C1) is closed, elements are wired in 3 phase delta and circuit operates at full power. When contactor 2 (C2) is closed, contactor 1 (C1) is opened, elements are wired in 3 phase wye and the circuit operates at 1/3 power. **CAUTION:** Contactors C1 and C2 must be mechanically interlocked in this configuration.

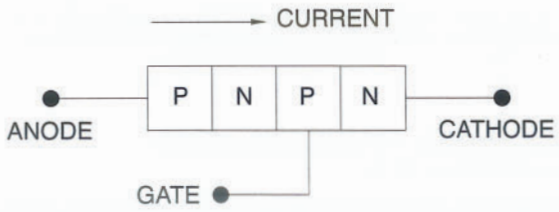


SCR'S, THYRISTORS, TRIACS & SSR'S

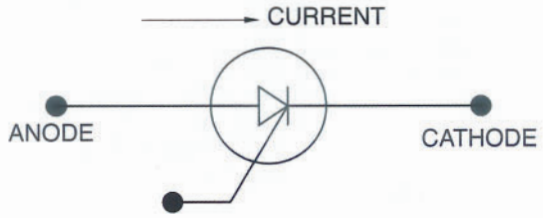
An SCR (Silicon Controlled Rectifier) as a component is one commonly used type of **thyristor**. Essentially, it consists of four layers of silicon which, in their normal state, are non-conductive.

The SCR can be made to conduct by applying a very small current to its "gate". This feature allows a combination of SCR's to have broad application, one of which is the switching of resistive loads characteristic of electric heating.

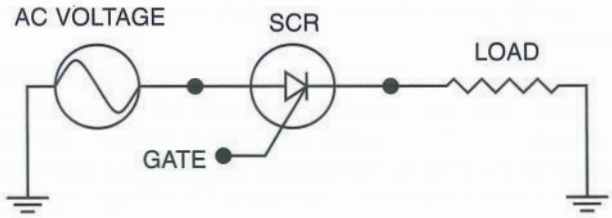
Diagramatically, the SCR is represented as follows:



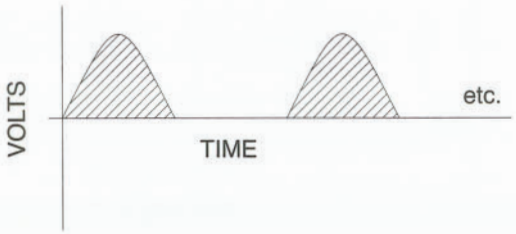
However, for electrical circuits, the SCR is depicted as follows:



If we connect a supply voltage and load (resistance) to the above circuit

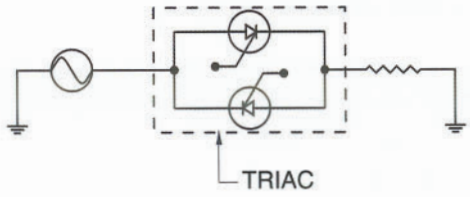


the single SCR will act as a half wave rectifier, and at best, it will only allow the positive (+) part of the AC voltage to reach the load.

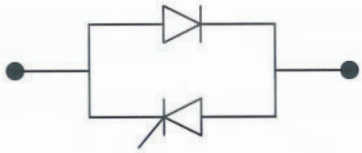


To allow the negative (-) part of the voltage waveform to get through to the load requires a second SCR of opposite polarity in parallel with the first.

For example, the circuit below will allow the full waveform or a part of it to reach the load. Two SCR's



combined in this fashion make up a **triac**. A triac is generally depicted as follows:



For single phase circuits, one triac will be sufficient to control the load. For three phase circuits, two triacs are normally used.

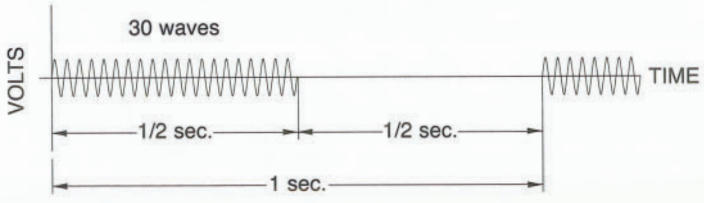
Controls are available which can apply a current to the gate at rapid intervals, blocking out some of the waveforms or a part of each waveform. The load output will then vary as a percentage of the blocked to the total cycles.

Two gate switching methods are in use to provide variable output from the load:

i) **Zero crossover fired** or **burst firing** where only full cycles of the voltage waveform are permitted to pass through the SCR to the load. Again, there are several variations as to how this can be done.

(a) **Fixed time base** where the cycle interval is built into the controller at the factory and the power is switched through only one "on" and one "off" cycle during that time. For example, if the time base is 1 second, at 60 cycles per second, any sequential number of the 60 voltage waves could be allowed to pass through to the load. At 50% demand the first 30 waves would pass and the last 30 would be blocked.

FIGURE 1 - Fixed (one second) time base at 50% output



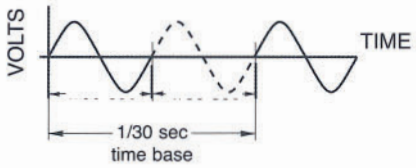
The SCR is equipped with circuitry (firing board) that will modify or proportion the "on" and "off" time during each subsequent cycle based on the amplitude of the temperature related signal it receives from an external controller.

Earlier SCR's employed fixed time bases up to 90 seconds. However, typical controls now in use tend to have time bases set at ten seconds or less. Most Caloritech™ SCR's have four second or one second fixed time bases.

SSR's (solid state relays) employ a similar method of control except that the time base is set by an external controller which signals the SSR's built-in firing circuitry when it should fire (conduct).

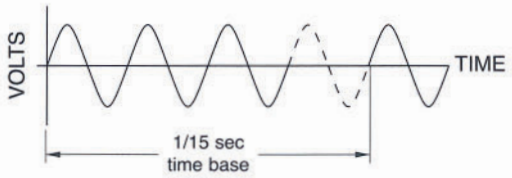
(b) **Variable time base** (also burst fired) where the time base depends on the demand. At 50% demand the time base would be 1/30 of a second or two cycles;

FIGURE 2 - Variable time base at 50% output



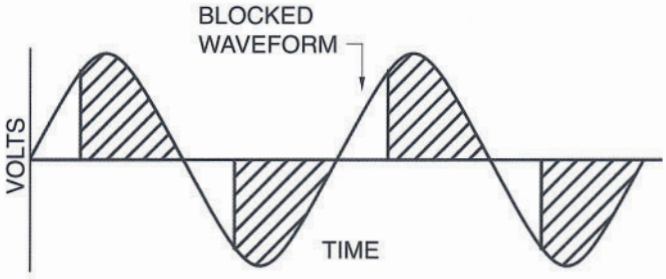
at 75% demand the time base would be 1/15 of a second or four cycles, etc.

FIGURE 3 - Variable time base at 75% output



Zero crossover firing is used to control resistive loads which change little with aging and temperature. Since the voltage is switched at zero amplitude, negligible radio frequency interference (RFI) is generated.

ii) A second method of gate switching is **phase angle firing** where a part of each waveform is blocked.



Phase angle firing is most frequently used on inductive loads with high inrush currents. If possible, it is best to avoid phase angle type SCR's since RFI may be generated.

Fortunately, with Caloritech™ equipment we seldom have to resort to this type of control.

ADVANTAGES

SCR switching has as its main advantage the ability to switch loads at high speed. Properly employed, they can contribute to excellent system temperature control and prolong heater service life.

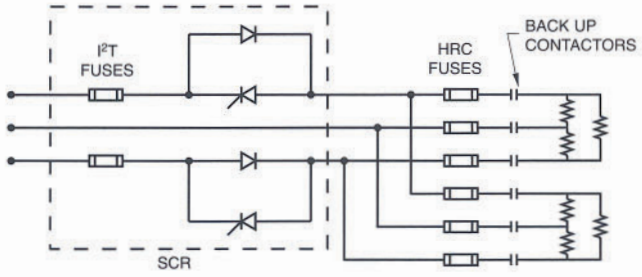
They are silent during operation and, if sized conservatively, will prove to be low maintenance devices.

PROTECTION

SCR's can fail "ON" and it is vital to protect the device against short circuits at the load. Special I^2t semi-conductor fuses are utilized for this purpose. Back-up fused magnetic contactors are frequently employed as in Figure 4. These contactors can be de-energized by a limit device but in the normal state they remain closed allowing the full load to be switched by the SCR.

With contactors, it is most economical to limit switching to 45 amps, and for this reason the load is usually divided into smaller circuits.

FIGURE 4 - SCR with back-up contactors



FIRING BOARDS

Packaged SCR's incorporate a firing board which is essentially an electronic circuit that accepts various inputs from a temperature controller and converts these inputs into a corresponding gate signal.

HEAT SINKS

All solid state switches have an internal resistance which is converted into heat when the SCR is in the conduction mode. High surface area aluminum heat sinks are used to transfer this heat away from the silicon wafer. For larger SCR's, cooling fans are also required for this purpose.

SCR - AS A PACKAGED CONTROL

As a matter of convenience, current practice is to call the combination of component SCR's, firing board, heat sink, fusing, fan, enclosure, interconnecting wiring, etc. an SCR! It's probably best to adopt this "control" meaning as opposed to the more limited (but more correct) "component" meaning.

A. Power Requirement for Initial Heat-up

1. Heat absorbed by all materials:

$$\frac{\text{Weight of material (lb)} \times \text{Specific heat (Btu/lb-°F)} \times \text{Temperature difference (final - initial) (°F)}}{3412\ (\text{Btu/kWh})} = \_\_\_\_\_\ \text{kWh}$$

Note: The above step must be repeated for each material heated. See Tables 1, 2, 3, and 4 on pages D38 and D39 for specific heats and weights.

2. Heat required for fusion or vaporization:

$$\frac{\text{Weight of material (lb)} \times \text{Heat of fusion or vaporization (Btu/lb)}}{3412\ (\text{Btu/kWh})} = \_\_\_\_\_\ \text{kWh}$$

Note: When the specific heat of a material changes at some temperature during the heat-up, due to melting (fusion) or evaporation (vaporization), perform Step 1 for the heat absorbed from the initial temperature up to the temperature at the point of change, add Step 2, then repeat Step 1 for heat absorbed from the point of change to the final operation temperature. See Tables 1, 2, 3, and 4 on pages D38 and D39 for heats of fusion and vaporization and temperatures at which these changes in state occur.

3. Heat required to replace average heat losses:

$$\frac{\text{Exposed surface area (sq. ft.)} \times \text{Heat loss at final operating temperature (W/sq. ft.)} \times \text{Time allowed for heat-up (hrs)}}{1000\ (\text{W/kW})} \times \frac{1}{2}\left(\text{to obtain an average loss}\right) = \_\_\_\_\_\ \text{kWh}$$

Note: See Figures 1 - 4 on pages D40 and D41 for normal heat losses

4. Heat to provide for contingencies, Safety Factor: 20% [Step 1 (kWh) + Step 2 (kWh) + Step 3 (kWh)] = _____ kWh

Total Heat Requirement for Initial Heat-up: = _____ kWh

Total Power Requirement for Initial Heat-up:

$$\frac{\text{Step 1 (kWh) + Step 2 (kWh) + Step 3 (kWh) + Step 4 (kWh)}}{\text{Time allowed for heat-up (hrs)}} = \_\_\_\_\_\ \text{kW}$$

B. Power Requirement for Operating Heat

1. Heat absorbed by all materials added to the process:

$$\frac{\text{Weight of material added (lb)} \times \text{Specific heat (Btu/lb-°F)} \times \text{Temperature difference (final - initial) (°F)}}{3412\ (\text{Btu/kWh})} = \_\_\_\_\_\ \text{kWh}$$

Note: The above step must be repeated for each material heated. See Tables 1, 2, 3, and 4 on pages D38 and D39 for specific heats and weights.

2. Heat required for fusion or vaporization during process:

$$\frac{\text{Weight of material (lb)} \times \text{Heat of fusion or vaporization (Btu/lb)}}{3412\ (\text{Btu/kWh})} = \_\_\_\_\_\ \text{kWh}$$

Note: When the specific heat of a material changes at some temperature during the heat-up, due to melting (fusion) or evaporation (vaporization), perform Step 1 for the heat absorbed from the initial temperature up to the temperature at the point of change, add Step 2, then repeat Step 1 for heat absorbed from the point of change to the final operation temperature. See Tables 1, 2, 3, and 4 on pages D38 and D39 for heats of fusion and vaporization and temperatures at which these changes in state occur.

3. Heat required to replace heat losses:

$$\frac{\text{Exposed surface area (sq. ft.)} \times \text{Heat loss at final operating temperature (W/sq. ft.)} \times \text{Working cycle time (hrs)}}{1000\ (\text{W/kW})} = \_\_\_\_\_\ \text{kWh}$$

Note: See Figures 1 - 4 on pages D40 and D41 for normal heat losses

4. Heat to provide for contingencies, Safety Factor: 20% [Step 1 (kWh) + Step 2 (kWh) + Step 3 (kWh)] = _____ kWh

Total Heat Requirement per Working Cycle: = _____ kWh

Total Power Requirement for Operating Heat:

$$\frac{\text{Step 1 (kWh) + Step 2 (kWh) + Step 3 (kWh) + Step 4 (kWh)}}{\text{Working cycle time (hrs)}} = \_\_\_\_\_\ \text{kW}$$

Heating Liquids (Water)

An open steel tank, 2 ft. wide, 3 ft. long, 2 ft. deep and weighing 270 lbs., is filled with water to within 6 inches of the top. Bottom and sides have 3 inches of insulation. Water is to be heated from 50°F to 150°F within 2 hours and, from then on, approximately 4 gallons per hour will be drawn off and replaced.

From Table 1 on page D38, Specific Heat of steel: 0.12 Btu/lb.-°F
From Table 3 on page D39, Specific Heat of water: 1.0 Btu/lb.-°F
From Table 3 on page D39, Weight of water: 62.5 lb./cu. ft. (8.3 lb./gal.)
Water in tank: (2 x 3 x 1.5)cu. ft. x 62.5 lb./cu. ft. = 563 lb.
From Fig. 3 on page D41, Water surface loss at 150°F: 270 W/sq. ft.
From Fig. 4 on page D41, Insulated wall loss at 100°F rise: 7 W/sq. ft.

A. INITIAL HEAT-UP REQUIREMENT

1a. To heat water:
$$\frac{563 \text{ lb.} \times 1.0 \text{ Btu/lb.-°F} \times (150 - 50)\text{°F}}{3412 \text{ Btu/kWh}} = 16.5 \text{ kWh}$$

1b. To heat tank:
$$\frac{270 \text{ lb.} \times 0.12 \text{ Btu/lb.-°F} \times (150 - 50)\text{°F}}{3412 \text{ Btu/kWh}} = 0.95 \text{ kWh}$$

2. Heat of fusion or vaporization: None

3a. Average water surface loss:
$$\frac{6 \text{ sq. ft.} \times 270 \text{ W/sq. ft.} \times 2 \text{ hrs.}}{1000 \text{ W/kW} \times 2} = 1.62 \text{ kWh}$$

3b. Average tank surface loss:
$$\frac{26 \text{ sq. ft.} \times 7 \text{ W/sq. ft.} \times 2 \text{ hrs.}}{1000 \text{ W/kW} \times 2} = 0.18 \text{ kWh}$$

4. Safety factor:
20% (16.5 + 0.95 + 1.62 + 0.18) = 3.85 kWh

Total Heat Requirement = 23.10 kWh

Power Required for Initial Heat-up:
23.10 kWh / 2 hrs. = 11.55 kW

B. OPERATING REQUIREMENT

1. To heat additional water
$$\frac{4 \text{ gal./hr.} \times 8.3 \text{ lb./gal.} \times 1.0 \text{ Btu/lb.-°F} \times (150 - 50)\text{°F}}{3412 \text{ Btu/kWh}} = 0.97 \text{ kW}$$

2. Heat of fusion or vaporization: None

3a. Water surface loss:
$$\frac{6 \text{ sq. ft.} \times 270 \text{ W/sq. ft.}}{1000 \text{ W/kW}} = 1.62 \text{ kW}$$

3b. Tank surface loss:
$$\frac{26 \text{ sq. ft.} \times 7 \text{ W/sq. ft.}}{1000 \text{ W/kW}} = 0.18 \text{ kW}$$

4. Safety factor:
20% (0.97 + 1.62 + 0.18) kW = 0.55 kW

Power Required for Operation = 3.32 kW

Melting Solids (Paraffin)

An open top uninsulated steel tank, $1^1/_2$ ft. wide, 2 ft. long, $1^1/_2$ ft. deep, and weighing 140 lb., contains 168 lb. of paraffin to be heated from 70°F to 150°F in 2 hours. Steel drills, each weighing 0.157 lb. are to be placed in a 60 lb. rack and dip coated in the melted paraffin. 1500 drills can be processed per hour with 20 lb. of paraffin.

From Table 1 pg. D38, Specific Heat of steel: 0.12 Btu/lb.-°F
From Table 2 pg. D38, Specific Heat of solid paraffin: 0.70 Btu/lb.-°F
From Table 2 pg. D38, Melting Point of paraffin: 133°F
From Table 2 pg. D38, Heat of Fusion of paraffin: 63 Btu/lb.
From Table 3 pg. D39, Specific Heat of melted paraffin: 0.71 Btu/lb.-°F
From Fig. 3 pg. D41, Paraffin surface loss at 150°F: 70 W/ft.^{2}
From Figs. 1 & 2 pg. D40, Steel surf. loss at 150°F: 55 W/ft.^{2}

A. INITIAL HEAT-UP REQUIREMENT

1a. To heat tank:
$$\frac{140 \text{ lb.} \times 0.12 \text{ Btu/lb.-°F} \times (150 - 70)\text{°F}}{3412 \text{ Btu/kWh}} = 0.39 \text{ kWh}$$

1b. To heat solid paraffin:
$$\frac{168 \text{ lb.} \times 0.70 \text{ Btu/lb.-°F} \times (133 - 70)\text{°F}}{3412 \text{ Btu/kWh}} = 2.17 \text{ kWh}$$

Fusion occurs at this point

1c. To heat melted paraffin:
$$\frac{168 \text{ lb.} \times 0.71 \text{ Btu/lb.-°F} \times (150 - 133)\text{°F}}{3412 \text{ Btu/kWh}} = 0.59 \text{ kWh}$$

2. Heat of fusion, to melt paraffin
$$\frac{168 \text{ lb.} \times 63 \text{ Btu/lb.}}{3412 \text{ Btu/kWh}} = 3.10 \text{ kWh}$$

3a. Average paraffin surface loss:
$$\frac{3 \text{ sq. ft.} \times 70 \text{ W/sq. ft.} \times 2 \text{ hrs.}}{1000 \text{ W/kW} \times 2} = 0.21 \text{ kWh}$$

3b. Average tank surface loss:
$$\frac{13.5 \text{ sq. ft.} \times 55 \text{ W/sq. ft.} \times 2 \text{ hrs.}}{1000 \text{ W/kW} \times 2} = 0.74 \text{ kWh}$$

4. Safety factor:
20% (0.39 + 2.17 + 0.59 + 3.10 + 0.21 + 0.74) = 1.44 kWh

Total Heat Requirement = 8.64 kWh

Power Required for Initial Heat-up:
8.64 kWh / 2 hrs. = 4.32 kW

B. OPERATING REQUIREMENT

1a. To heat drills and rack:
$$\frac{(1500 \times 0.157 + 60)\text{lb./hr.} \times 0.12 \text{ Btu/lb.-°F} \times (150 - 70)\text{°F}}{3412 \text{ Btu/kWh}} = 0.83 \text{ kW}$$

1b. To heat additional solid paraffin:
$$\frac{20 \text{ lb./hr.} \times 0.70 \text{ Btu/lb.-°F} \times (133 - 70)\text{°F}}{3412 \text{ Btu/kWh}} = 0.26 \text{ kW}$$

Fusion occurs at this point

1c. To heat additional melted paraffin:
$$\frac{20 \text{ lb./hr.} \times 0.71 \text{ Btu/lb.-°F} \times (150 - 133)\text{°F}}{3412 \text{ Btu/kWh}} = 0.07 \text{ kW}$$

2. Heat of fusion, to melt additional paraffin:
$$\frac{20 \text{ lb./hr.} \times 63 \text{ Btu/lb.}}{3412 \text{ Btu/kWh}} = 0.37 \text{ kW}$$

3a. Paraffin surface loss:
$$\frac{3 \text{ sq. ft.} \times 70 \text{ W/sq. ft.}}{1000 \text{ W/kW}} = 0.21 \text{ kW}$$

3b. Tank surface loss:
$$\frac{13.5 \text{ sq. ft.} \times 55 \text{ W/sq. ft.}}{1000 \text{ W/kW}} = 0.74 \text{ kW}$$

4. Safety factor:
20% (0.83 + 0.26 + 0.07 + 0.37 + 0.21 + 0.74) kW = 0.50 kW

Power Required for Operation = 2.98 kW

TABLE 1 - PROPERTIES OF METALS

Material	Average specific heat Btu/(lb.)(°F)	Latent heat of fusion Btu/lb.	Density lbs./in.^{3}	Melting point °F (lowest)	Thermal Conductivity K (Btu)(in.)/(hr.)(sq.ft.)(°F)	Thermal expansion in./in./°F x10^{-6}
Aluminum	.24	169	.098	1190	1540	13.1
Antimony	.049	69	.239	1166	131	
Babbit - lead base	.039		.370	470	165.6	
Babbit - tin base	.071		.267	465	278.4	
Barium	.068		.130	1562		
Beryllium	.052		.066	2345	1121.0	
Bismuth	.031	22.4	.353	520	59	
Boron	.309		.083	4172		
Brass (80-20)	.091		.310	1700	82	
Brass (70-30)	.10		.304	1700	672	
Brass (yellow)	.096		.306	1710	830	11.2
Bronze (75/25)	.082	75	.313	1832	180	
Cadmium	.055	23.8	.313	610	660	
Calcium	.149	140	.056	1564	912	
Carbon	.165		.080	6422	173	
Chromium	.11		.260	2822	484	
Cobalt	.099	115.2	.321	2696	499	
Constantan	.098		.321			
Copper	.095	91.1	.322	1981	2680	9.8
German silver	.109		.311	1761	168	
Gold	.032	29.0	.698	1945	2030	7.9
Incoloy 800	.13		.290	2500	80	7.9
Incoloy 600	.126		.304	2500	103	5.8
Inconel 600	.11		.304	2470	109	5.8
Iron, cast	.12		.260	2150	346	6.0
Iron, wrought	.12		.278	2800	432	
Lead, solid	.032	11.3	.410	620	240	16.4
Lead, liquid	.037		.387		108	
Linotype	.04		.363	480		
Lithium	.79	59	.212	367	516	
Magnesium	.27	160	.063	1202	1106	14
Manganese	.115	116	.268	2268	80.6	
Mercury	.033	5.0	.488	-38	60.8	
Molybdenum	.071	126	.369	4750	980	2.94
Monel 400	.11		.319	2400	151	6.4
Nickel 200	.12	133	.321	2615	520	5.8
Nichrome	.11		.302	2550	104	7.3
Platinum	.035	49	.775	3225	480	4.9
Potassium	.058	26.2	.434	146	720	
Rhodium	.059		.449	3570	636	
Silicon	.162		.008	2570	600	
Silver	.057	38	.379	1760	2900	10.8
Sodium	.295	49.5	.035	207	972	
Solder	.051	17	.323	361	310	13.1
Steel, mild	.122		.284	2760	460	6.7
Stn. Stl. 304	.12		.286	2550	105	9.6
Stn. Stl. 430	.11		.275	2650	155	6.0
Tantalum	.035		.60	5425	375	3.57
Tin, liquid	.052		.253		218	
Tin, solid	.065	26.1	.263	450	455	13
Titanium 99.0 %	.13		.164	3035	112	4.7
Tungsten	.040	79	.697	6170	1130	2.45
Type Metal	.040	14	.388	500	180	
Uranium	.028		.677	3075	193.2	
Zinc	.096	43.3	.258	787	740	22.1
Zirconium	.067	108	.234	3350	145	3.22

TABLE 2 - PROPERTIES OF NON-METALLIC SOLIDS

Material	Average specific heat Btu/(lb.)(°F)	Latent heat of fusion Btu/lb.	Average Density lbs./in.^{3}	Melting point °F (lowest)	Thermal Conductivity K (Btu)(in.)/(hr.)(sq.ft.)(°F)	Thermal expansion in./in./°F x10^{-6}
ABS Plastic	.35		.042		1.32	
					2.28	
Acrylic	.34		.041		1.0	
Alumina			.087			
Aluminum Silicate	.2		.086	3690	9.1	
Asbestos	.25		.021		.44	
Ashes	.2		.025		.49	
Asphalt	.40		.046		5.3	
Bakelight, Pure Resin	.3 - .4		.045			
Barium Chloride	.10		.139	1697		
Beeswax		75	.035	144	1.67	
Boron Nitride	.33		.082	5430	125	1 - 4

TABLE 2 - PROPERTIES OF NON-METALLIC SOLIDS (cont)

Material	Average specific heat Btu/(lb.)(°F)	Latent heat of fusion Btu/lb.	Average Density lbs./in.^{3}	Melting point °F (lowest)	Thermal Conductivity K (Btu)(in.)/(hr.)(sq.ft.)(°F)	Thermal expansion in./in./°F x10^{-6}
Brickwork	.22		.076		3 - 7	3 - 6
Calcium Chloride	.17	72	.091	1422		
Carbon	.28		.080	6700	165	0.3 - 2.4
Canauba Wax	.8		.036			
Cellulose Acetate	.3 - .5		.047		1.2 - 2.3	61 - 83
Cement	.19		.054		2.04	
Ceramic Fiber	.27		.007			
Chalk	.215		.083		5.76	
Clay	.224		.052	3160	9	
Coal (Coarse Anthercite)	.32		.046		11	
Coal Tars	.35 - .45		.045			
Coke	.265		.043			
Concrete (Cinder)	.16		.058		5.3	
Concrete (Stone)	.156		.083		9.5	
Cork	.5		.008		.36	
Cotton (Flax, Hemp)	.31		.053		.41	
Delrin	.35		.051		1.6	45
Diamond	.147		.127		13872	
Earth, Dry & Packed	.44		.054		.9	
Epoxy	.25 - .3		.045		1.2 - 2.4	
Ethyl Cellulose	.32 - .46		.041			
Fiberglass			.0004		.28	
Firebrick, Fireclay	.243		.083	2900	6.6	
Firebrick, Silica	.258		.089	3000	7.2	
Flourspar	.21					
Fluoroplastics	.28		.081		1.68	
Glass, crown	.161		.101		7.5	5
Granite	.192		.097		13 - 28	
Graphite	.20		.075		1.25	
Ice	.53	144	.0324	32	11	28.3
Isoprene	.48		.034		1.0	
Limestone	.217		.088		3.6-9	
Magnesia	.234		.130	5070	.48	
Magnesite Brick	.222		.092		10.8 - 30	
Magnesium Silicate			.101		15.6	
Marble	.21		.097		14.4	
Marinite I @ 400°F	.29		.027		.89	
Mica	.21		.102		3.0	18
MgO (Before Compacted)	.21		.085		3.6	
MgO (Compacted)	.209		.112		20	7.7
Nylon	.4		.040		1.5	61 - 63
Paper	.45		.034		.82	
Paraffin	.70	63	.032	133	1.6	
Phenolic Plastic	.35		.060		1.02	
Phenolic Resin, Cast	.3 - .4		.049		1.1	
Phenolic, Sheet or Tube Laminated	.3 - .5		.045		2.4	
Pitch, Hard			.048	300		
Polycarbonate	.3		.044		1.38	
Polyester	.2 - .35		.046		3.96 - 5	
Polyethylene	.55		.035		2.3	94
Polypropylene	.46		.032		1.72	
Polystyrene	.32		.038		.7 - 1.0	33 - 44
Polyvinyl Chloride Acetate	.2 - .3		.049		.84 - 1.2	
Porcelain	.26		.087		6 - 10	
Potassium Chloride	.17		.072	1454		
Potassium Nitrate	.26		.076	633		
Quartz	.26		.080		9.6	
Rock Salt	.219			1495		
Rubber	.44		.044		1.1	340

TABLE 2 - PROPERTIES OF NON-METALLIC SOLIDS (cont)

Material	Average specific heat Btu/(lb.)(°F)	Latent heat of fusion Btu/lb.	Average Density lbs./in.^{3}	Melting point °F (lowest)	Thermal Conductivity K (Btu)(in.)/(hr.)(sq.ft.)(°F)	Thermal expansion in./in./°F x10^{-6}
Sand, Dry	.191		.054		2.26	
Sandstone	.22		.081			
Silica (fused)	.316				10.0	
Silicon Carbide	.20 - .23		.069		105	
Silicone Rubber	.45		.045		1.5	
Soapstone	.22		.097		11.3	
Sodium Carbonate	.30		.078	520		
Sodium Chloride	.22		.078	1474		
Sodium Cyanide	.30		.054	1047		
Sodium Nitrate	.29		.082	584		
Sodium Nitrite	.30		.078	520		
Soil, Dry	.20		.094		17.5 - 23	4.5 - 5.5
Steatite	.20					
Stone	.30		.061	320		
Sugar	.175	17	.075	246	1.9	36
Sulfur			.035	90		
Tallow	.25		.078		1.7	55
Teflon						
Urea, Formaldehyde	.4		.056			
Vinyl	.3 - .5		.046		.8 - 2.0	28 - 100
Wood, Oak	.57		.029		1.1	

TABLE 3 - PROPERTIES OF LIQUIDS

Material	Average specific heat Btu/(lb.)(°F)	Heat of vaporization Btu/lb.	Density lbs./U.S. Gal.	Boiling point °F	Thermal Conductivity K (Btu)(in.)/(hr.)(sq.ft.)(°F)
Acetic acid, 20%	.91	810	8.6	214	3.7
Acetic acid, 100%	.48	175	8.7	245	1.14
Acetone, 100%	.514	225	6.5	133	1.15
Alcohol (allyl)	.665	293	7.4	207	
Alcohol (amyl)	.65	216	7.4	280	
Alcohol (butyl)	.687	254	6.1	244	
Alcohol (ethyl)	.60	367	6.6	173	1.3
Alcohol (propyl)	.57	295.2	6.7	208	
Ammonia, 100%	1.1	589	6.4	-27	3.48
Asphalt	.42		8.3		5.04
Benzene	.42	170	7.5	175	1.04
Brine (25% CaCl)	.689		10.2		3.36
Brine (25% NaCl)	.786	730	9.9	220	2.88
Brine (25% NiCi)	.81	728	9.9	221	4.0
Carbon Tetrachloride	.21		13.2	170	
Caustic soda (18%)	.84	795	10.0	221	3.9
Corn Syrup, Dextrose	.65		11.7	231	
Cottonseed Oil	.47		7.9		1.2
Dowtherm A	.44	42.2	8.8	496	.96
Ether	.503	160	6.1	95	.95
Ethyl Acetate	.475	183.5	6.9	180	
Ethyl Bromide	.215	108	12.1	101	
Ethyl Chloride	.367	166.5	7.6	54	
Ethyl Iodide	.161	81.3	15.1	160	
Ethylene Bromide	.172	83	16.0	270	
Ethylene Chloride	.299	139	9.6	240	
Ethylene Glycol	.555		9.4	387	
Formic Acid	.525	216	9.3	213	
Freon 11	.208		12.3	74.9	.600
Freon 12	.232	62	10.9	-21.6	.492
Freon 22	.300		10.0	-41.36	.624
Fuel Oil #1	.47	86	6.8	440	1.008
Fuel Oil #2	.44		7.2		.96
Fuel Oil #3, #4	.425	67	7.4	580	.918
Fuel Oil #5, #6	.41		7.9		.852
Gasoline	.53	116	5.5 - 5.7	280	.936
Glycerine	.61		10.5	556	2.0
Heptane	.49	137.1	5.1	210	
Hexane	.6	142.5	5.1	155	
Hydrochloric 10%	.93		8.9	221	3.9
Ice	.5		7.5		3.96
Lard	.64		7.7		
Linseed Oil	.44		7.7	552	
Mercury	.033	117	113.0	675	59.64
Methyl Acetate	.47	176.5	7.3	133	
Methyl Chloroform	.26	95	11.1	165	

TABLE 3 - PROPERTIES OF LIQUIDS (continued)

Material	Average specific heat, Btu/(lb.)(°F)	Heat of vaporization Btu/lb.	Density lbs./U.S. Gal.	Boiling point °F	Thermal Conductivity K (Btu)(in.)/(hr.)(sq.ft.)(°F)
Methylene Chloride	.288	142	11.0	104	
Molasses	.60		11.7	220	
NaK (78% K)	.21		6.2	1446	167.0
Napthalene	.396	103	7.2	424	
Nitric acid, 7%	.92	918	8.6	220	3.8
Nitric acid, 95%	.5	207	12.5	187	
Nitrobenzene	.35	142.2		412	
Oil (SAE10-30)	.43		7.4		
Oil (SAE40-50)	.43		7.4		
Olive Oil	.47		7.8	570	
Paraffin (melted)	.71		6.3		1.0
Perchlorethylene	.21	90	13.5	250	
Phenol	.56		8.9	346	
Phosphoric 10%	.93		8.7		
Phosphoric 20%	.85		9.2		
Potassium (K)	.18	893	6.0	1400	320.0
Propane (Comp)	.576		0.02	-48.1	1.81
Sea Water	.94		8.6		
Sodium (Na)	.30	1810	6.8	1621	580.0
Sodium Hydroxide 30% Solution	.84		11.1		
50% Solution	.78		12.8		
Soybean Oil	.24-.33		7.7		
Starch			12.8		
Sucrose, 40% Sugar	.66		9.8	214	
Sucrose, 60% Sugar	.74		10.7	218	
Sulfur, Melted 500°F	.24	120	15.0	832	
Sulfuric acid, 10%	.92		9.9	216	4.0
Sulfuric acid, 20%	.84		9.5	218	
Sulfuric acid, 60%	.52		12.5	282	2.88
Sulfuric acid, 98%	.35	219	15.3	625	1.8
Therminol FR-2	.30		12.1	648	.70
Toluene	.42		7.2		1.032
Trichloroethylene	.23	103	12.2	188	.84
Transformer Oils	.42		7.5		.9
Turpentine	.41	123	7.3	318	.90
Vegetable oil	.43		7.7		1.1
Water	1.0	970	8.3	212	4.2
Xylene	.411	149.2	7.2	288	

TABLE 4 - PROPERTIES OF GASES

Gas	Specific heat Btu/lb./°F	Density lbs./ft.^{3}	Thermal Conductivity K (Btu)(in.)/(hr.)(sq.ft.)(°F)
Acetylene	.35	.073	.129
Air at 80°F	.240	.073	.18
at 400°F	.245	.046	.27
Alcohol, Ethyl (Vapor)	.4534		
Alcohol, Methyl (Vapor)	.4580		
Ammonia	.523	.044	.16
Argon	.125	.102	.12
Butane		.1623	.0876
Butylene		.148	
Carbon dioxide	.199	.113	.12
Carbon monoxide	.248	.072	.18
Chlorine	.115	.184	.06
Chloroform	.1441		.046
Chloromethane	.24	.1309	.0636
Ethyl Chloride		.1703	.066
Ethyl Ether	.4380		.0924
Ethylene	.40	.0728	.1212
Helium	1.25	.011	1.10
Hydrochloric Acid	.191	.0946	
Hydrogen	3.39	.0052	.13
Hydrogen Sulfide	.2451	.096	.091
Methane	.528	.041	.25
Nitric Oxide	.231	.0779	.1656
Nitrogen	.248	.072	.19
Nitrous Oxide	.221	.1143	.1056
Oxygen	.218	.082	.18
Sulphur dioxide	.152	.172	.07
Water Vapor (212°F)	.482	.0372	.16

TABLE 1 - PROPERTIES OF AIR

Temp. (°F)	Specific Heat (BTU/lb.°F)	Density (lb./ft.^{3})
0	.240	.086
50	.240	.078
100	.240	.071
150	.241	.065
200	.242	.060
250	.243	.056
300	.244	.052
350	.245	.049
400	.247	.046
500	.249	.041
600	.252	.037
700	.254	.034
800	.257	.032
900	.260	.029
1000	.262	.027
1100	.265	.025
1200	.267	.024

TABLE 2 - THERMAL CONDUCTIVITY OF INDUSTRIAL INSULATION

Type of Insulation	Maximum Service Temp. (°F)	Typical K Values BTU/hr./sq.ft./°F/in. Mean Temp. (°F) Between Inner and Outer Insulation Surface 100	200	300	500	700	900
Mineral Wool Blanket flexible felt	450	.26	.34	.45			
Mineral Wool Block and Board resin binder	600	.28	.35	.43			
85% Magnesia Block and Board	600	.35	.38	.42	.46		
Foam Glass Block and Board	800	.41	.48	.55			
Calcium Silicate low density	1200	.38	.41	.44	.52	.62	.72
Mineral Wool Blanket metal reinforced	1200	.29	.35	.42	.56		
Silica Lime Block and Board	1200	.33	.38	.43	.53	.64	.75
Mineral Wool Block and Board inorganic binder	1600	.34	.39	.44	.54	.64	
Calcium Silicate high density	1800				.63	.74	.95

TABLE 3 - VISCOSITIES

Material	SSU 4.4°C 40°F	SSU 26.7°C 80°F	SSU 49°C 120°F	CENTIPOISE 4.4°C 40°F	CENTIPOISE 26.7°C 80°F	CENTIPOISE 49°C 120°F
Asphalt RS-1 MS-1 SS-1	400	160			86	34
Asphalt RC-0 MC-0 SC-0	950	340				
Asphalt RC-3 MC-3 SC-3	40000	7000				
Asphalt RC-5 MC-5 SC-5	500000	45000				
Asphalt 100-120 penetration	3500 at 250°F					
Asphalt 40-50 penetration	8000 at 250°F					
Benzene				.8	.62	.46
Gasoline				.7	.55	.44
No.1 Fuel Oil (Kerosene)	40	36		3.3	2.1	1.4
No.2 Fuel Oil - PS100	43	36	33	4.6	2.6	1.6
No.3 Fuel Oil - PS200	84	52	41	15.0	7.0	4.0
No.4 Fuel Oil	480	125	62	92.0	24.0	9.6
No.5 Fuel Oil - PS300		1600	370		390.0	75.0
No.6 Fuel Oil, Bunker C		4500	650		1000.0	155.0
Transformer Oil, Light	170	72	49	34.2	12.1	6.3
Transformer Oil, Medium	460	145	70	89.0	28.2	11.9
34°API Mid-continent crude	88	51	37	15	6.5	3.0
28°API gas oil	135	59	48	25	9.0	6.0
Quench and tempering Oil						
SAE-5W	550	160	74			
SAE-10W	1500	265	120	170	50	22
SAE-20	2900	500	170			
SAE-30	5000	870	260	1200	200	60
SAE-40	8500	1400	380			
SAE-50	23000	3600	720		400	100

Figure 1 - Heat losses from uninsulated smooth solid surfaces (60 - 180°F). Assumed external ambient temperature of 70°F.

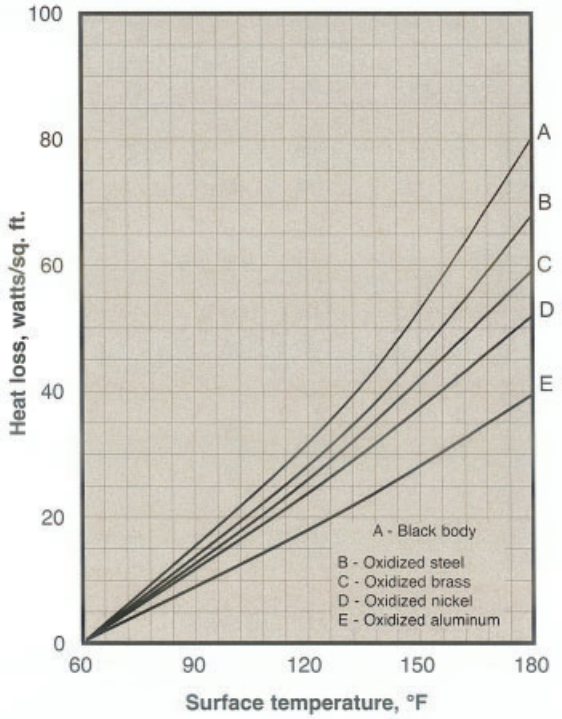


Figure 2 - Heat losses from uninsulated smooth solid surfaces (150 - 1000°F). Assumed external ambient temperature of 70°F.

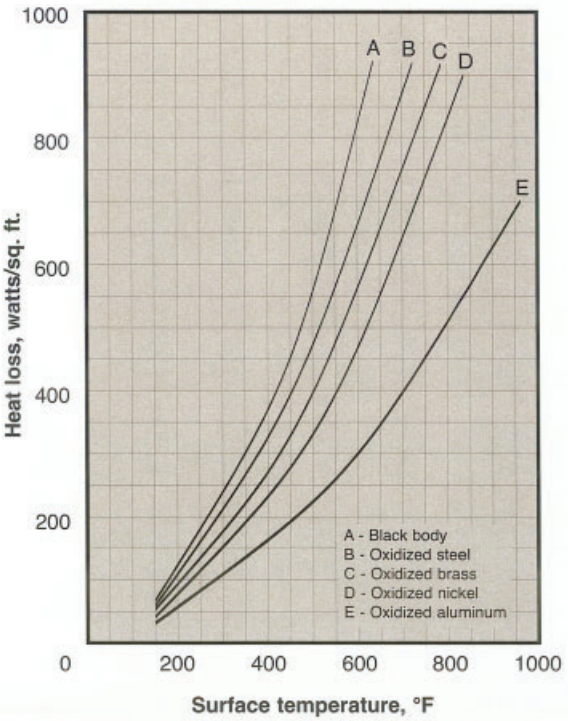


Figure 3 - Heat losses from liquid surfaces. Assumed external ambient temperature of 70°F.

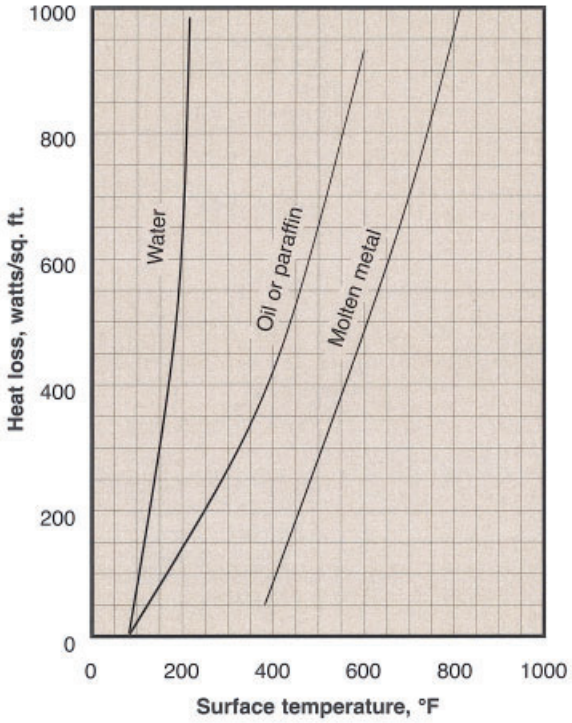
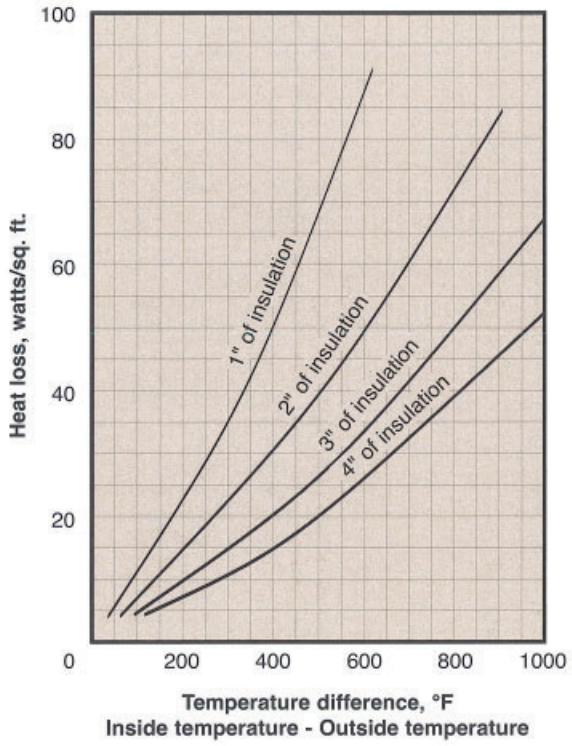


Figure 4 - Heat losses from insulated walls. Curves are for standard high-grade material, such as 85% magnesia, Rockwool, etc.



WIND VELOCITY AND HEAT LOSS

Wind velocity will increase surface heat losses. Table 1 can be used as a guide for estimating the factors to be applied to the still air heat losses from Figs. 1, 2 and 4.

TABLE 1 - WIND VELOCITY FACTORS

WIND VELOCITY	WELL SEALED INSULATED SURFACE			UNINSULATED SURFACE (TEMP. °F)		
(MPH)	1"	2"	3"	200	600	1000
5	-	-	-	1.7	1.5	1.3
10	-	-	-	2.1	1.7	1.4
15	1.1	-	-	2.4	2.0	1.6
20	1.2	1.1	-	2.7	2.3	1.7
25	1.3	1.2	1.1	3.0	2.6	1.8
30	1.4	1.3	1.2	3.3	3.0	1.9

HEAT LOSSES FROM INSULATED PIPES

To find the heat loss from the insulated pipes, in watts/ft. multiply the appropriate factor from Table 2 by the °F difference between the pipe holding temperature and the minimum ambient temperature.

If the pipe holding temperature is above 200°F, multiply the above answer by 1.2.

TABLE 2 - HEAT LOSS FACTORS FOR PIPE

PIPE SIZE	INSULATION THICKNESS AND FACTORS						
	1/2"	1"	1 1/2"	2"	2 1/2"	3"	4"
1/2	0.086	0.054	0.043	0.037			
1/4	0.102	0.062	0.048	0.041			
1	0.123	0.073	0.056	0.047			
1 1/4	0.142	0.083	0.063	0.052			
1 1/2	0.164	0.094	0.070	0.058			
2	0.192	0.109	0.081	0.066			
2 1/2	0.229	0.128	0.093	0.076			
3	0.259	0.142	0.107	0.083			
3 1/2	0.287	0.157	0.113	0.091			
4	0.316	0.172	0.123	0.098	0.083	0.073	0.060
4 1/2	0.347	0.189	0.134	0.107	0.090	0.079	0.065
5	0.417	0.219	0.155	0.121	0.103	0.089	0.073
6	0.472	0.250	0.174	0.136	0.114	0.099	0.080
7	0.526	0.275	0.192	0.151	0.126	0.109	0.088
8	0.571	0.305	0.212	0.166	0.137	0.119	0.095
9	0.634	0.338	0.234	0.183	0.151	0.130	0.104
10	0.634	0.338	0.234	0.183	0.151	0.130	0.104
12	0.776	0.397	0.275	0.212	0.175	0.149	0.119
14	0.834	0.431	0.298	0.230	0.190	0.162	0.128
16	0.961	0.498	0.334	0.258	0.212	0.181	0.142
18	1.088	0.555	0.379	0.289	0.236	0.200	0.156
20	1.190	0.598	0.416	0.319	0.260	0.219	0.171
24	1.430	0.731	0.490	0.374	0.305	0.259	0.200

Galvanic Corrosion

Table 1 is the galvanic series of commonly used metals when immersed in sea water. This list will vary slightly when a different electrolyte forms the galvanic couple.

Metals which are grouped show negligible corrosion when joined.

For galvanic corrosion to occur the following conditions must be met.

i) Two or more electrochemically dissimilar metals are present and in electrical contact (which is not necessarily physical contact).

ii) The metals must be in contact with an electrolyte.

Quite often other types of corrosion are incorrectly attributed to galvanic corrosion. If the foregoing conditions are met and the corrosion is localized near the junction of the metals, it was probably caused by galvanic effects. Otherwise, look elsewhere.

The best one can do is to try to avoid designs which involve electrically coupled metals. This is not always practical. However, the choice of metals can help to lessen corrosive effects. Try to select metals as close together as possible on the galvanic series.

Keep in mind that the least noble or more active metal will deplete during corrosion. Never couple a small anode with a large cathode.

Quite often it is practical to electrically insulate the metals from one another. If it is determined that dissimilar uninsulated metals must be used, make the anodic part of heavier material. Also, design the part for easy replacement.

TABLE 1 - GALVANIC SERIES OF COMMONLY USED METALS WHEN EXPOSED TO SEA WATER

ACTIVE OR LEAST NOBLE	Magnesium
	Magnesium Alloys
	Zinc
	Galvanized Steel
	Aluminum 1100
	Aluminum 6053
	Alclad
	Cadmium
	Aluminum 2024 (4.5 Cu, 1.5 Mg 0.6 Mn)
	Mild Steel
	Wrought Iron
	Cast Iron
	13% Chromium Stainless Steel Type 410 (Active)
	18-8 Stainless Steel Type 304 (Active)
	18-12-3 Stainless Steel Type 316 (Active)
	Lead-Tin Solders
	Lead
	Tin
	Manganese Bronze
	Naval Brass
	Nickel (Active)
	76 Ni - 16 Cr - 7 Fe Alloy (Active)
	60 Ni - 30 Mo - 6 Fe - 1 Mn
	Yellow Brass
	Admiralty Brass
	Aluminum Brass
	Red Brass
	Copper
	Silicon Bronze
	70:30 Cupro Nickel
	G-Bronze
	M-Bronze
	Silver Solder
	Nickel (Passive)
	76 Ni - 16 Cr - 7 Fe Alloy (Passive)
	67 Ni - 33 Cu Alloy (Monel)
	13% Chromium Stainless Steel Type 410 (Passive)
	Titanium
	18-8 Stainless Steel Type 304 (Passive)
	18-12-3 Stainless Steel Type 316 (Passive)
	Silver
	Graphite
PASSIVE OR MORE NOBLE	Gold
	Platinum

Useful Corrosion Terminology

BIMETALLIC CORROSION - Galvanic corrosion.

CORROSION-EROSION - Corrosion which is increased because of the abrasive action of a moving stream.

CREVICE CORROSION - Localized corrosion resulting from the formation of a concentration cell in a crevice formed between a metal and a nonmetal or between two metal surfaces.

FRETTING CORROSION - Fretting refers to metal deterioration caused by repetitive slip at the interface between two surfaces.

HYDROGEN EMBRITTLEMENT - Embrittlement of a metal caused by hydrogen.

IMPINGEMENT ATTACK - Erosion-corrosion caused by turbulence or impinging flow at certain points.

INTERGRANULAR CORROSION - Corrosion which occurs preferentially at grain boundaries.

PITTING - Highly localized corrosion resulting in deep penetration at only a few spots.

SCALING - High temperature corrosion resulting in formation of thick corrosion product layers.

STRESS CORROSION - Corrosion which is accelerated by stress.

Corrosion Guide

The sheath materials in the following tables are to be used as a guide only and not as a firm recommendation. Such factors as temperature of solution, percentage of concentration, watt density and contamination are all factors in corrosion rates which make it impossible to make an absolute recommendation. For further information on corrosiveness of a solution, check the supplier of your solution.

Due to the above factors which are beyond our control, CCI Thermal cannot be responsible for electric heater failure due to corrosion.

WARNING: Certain solutions, due to their viscosity or flammability are not suitable for heating with direct immersion heaters unless special precautions are taken. Check factory if you require assistance in the selection of a safe and reliable heating method for your application.

LEGEND: A - GOOD
F - FAIR
C - DEPENDS ON CONDITIONS
X - UNSUITABLE

SOLUTION	IRON AND STEEL	300 SERIES STAINLESS	MONEL	INCOLOY	INCONEL	COPPER	TITANIUM	ALUMINUM	QUARTZ	TEFLON
Acetaldehyde		A-316				A				
Acetic Acid, Crude	X	F	F	C	C	F		F		
Pure			A	C	C	F		A		
Vapors			F	C	C	F	F	C		
150 PSI; 400°F			F	C	C	F		C		
Aerated	X	F-316 X-304	X		X	X	A	C		
No Air		C	A		X	F	A	C		
Acetone	C	A	A	A	A	A	A	F	A	
Alboloy Process	A									
Allyl Alcohol		A	A	A	A	A	A	F		
Alcohol	F	A-316	A	A	A	A	A	F	A	
Alkaline Solutions	A	A-304								
Alkaline Cleaners		A-304								X
Alkaline Soaking Cleaners	A									
Alum										
Aluminum (molten)										
Aluminum Acetate	X	A-316	F		F	F	A			
Aluminum Bright Dip									A	A
Aluminum Chloride	X	X	X	X	X	X	X	X	A	A
Aluminum Cleaners	C	A	A	A	A	X	F	X	X	
Aluminum Potassium Sulphate (Alum)		C-316 X-304	F		F	A	F	X		
Aluminum Sulphate	X	F	F	X	X	F	A	X	A	
Ammonia	X	X	X	C	F	X	A	C	A	
Ammonia Gas, Cold	A	A	A		A	C	A	A		
Hot	C	C	C		A	X				
Ammonia and Oil	A									
Ammonium Acetate	A	A	A	A	A	X		A		
Ammonium Bifluoride	X	X	X	X	X	X	X	X	X	A
Ammonium Chloride	C	F	F	C	C	X	A	X	A	A
Ammonium Hydroxide	A	A	C	A	A	X	A	C	X	

SOLUTION	IRON AND STEEL	300 SERIES STAINLESS	MONEL	INCOLOY	INCONEL	COPPER	TITANIUM	ALUMINUM	QUARTZ	TEFLON
Ammonium Nitrate	A	A	C	X	X	X	X	F	A	
Ammonium Persulphate	X	F	X		X	X		X	A	A
Ammonium Sulphate	A	A	A	F	F	F	A	X	A	
Anhydrous Ammonia	A					X				
Aniline	F	A	F	F	F	X	A	F	A	
Aniline, Aniline Oil	A	A	A	F	F	X	A	X	A	
Aniline, Dyes		A	A							
Anodizing Solutions 10% Chromic Acid 96°F	C	A					A			
Sodium Hydroxide Alkaline	A			A			A			
Nickel Acetate			A							
Arsenic Acid	X	C	X	X	X	X	X	X	A	A
Asphalt	A	A	X	A	A	X	A	X	A	
Barium Chloride		F-304 X-316			A			X		
Barium Hydroxide		A		F	F	X	X	X	A	
Barium Sulphate	F	F	F	F	F	F	A		A	
Barium Sulphide		A	A			X				
Barium Sulphite		F-304								
Black Nickel									A	A
Black Oxide		A-304								
Bonderizing	C	A		C	C		A		A	A
Boric Acid	X	C	C	C	C	C	A	X	A	A
Brass Cyanide		A-304								
Bright Nickel							A		A	
Brine (Salt Water)			A		F					
Bronze Plating	A	A-304								
Butanol (Butyl Alcohol)	A	A	A	A	A	A	A	F	A	A
Cadmium Black									A	
Cadmium Fluoborate										A
Cadmium Plating				A	A					
Calcium Chlorate	F	F	F	F	F	C			A	
Calcium Chloride	F	F	F	F	F	F	A	C	A	A
Carbolic Acid, Phenol	C	A	A	F	F	X	A	F		
Carbon Dioxide, Dry	A	A	A	A	A	A	X	A	A	X
Wet	F	A	A	A	A	F	X	A	A	X
Carbon Tetrachloride	C	C	A	A	A	C	A	X	A	
Carbonic Acid	C	A-304	C	F	A	C	A	C	A	A
Castor Oil	A	A	A	A	A		A	A	A	A
Caustic Etch	A	A	A	X	X	X	A	X	A	X
Caustic Soda (Lye) (Sodium Hydroxide)	X	C-316 X-304	C	C	F	X	C	X	X	A
2%	F	F-316 X-304	A	A	A	F	A	X		
10 - 30%, 210°F	F	A	A	A	A	F	A	X		
76%, 180°F	X	F	F	A	A	X	F	X		
Chlorine, Dry	A	A	A	C	F	A	F	X	A	F
Wet	X	X	X	X	X	X	X	X	A	X
Chloroacetic Acid	X	X		C	C	X	A	X	A	A
Chromic Acetate									A	
Chromic Acid	C	A	F	X	X	X	A	X	A	X
Chrome Plating				X	X		A		A	X
Citric Acid	X	A	A	F	F	A	A	C	A	A
Clear Chromate		A-316								
Cobalt Acetate 130°F			A	F	F					
Cobalt Nickel									A	
Cobalt Plating		A-304							A	
Coconut Oil			F							
Cod Liver Oil		A		A	A			A		
Copper Acid							A		A	

Corrosion Guide (continued)

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Copper Bright		A								
Copper Bright Acid									A	
Copper Chloride	F	X	F	X	X	C	A	C	A	A
Copper Cyanide	A			X	X			X	A	A
Copper Fluoborate		F	F	F	F					A
Copper Nitrate	X	F	X	X	X	X		X	A	A
Copper Plating	A									
Copper Sulphate	X	A	A	F	F	C		X	A	
Creosote	A	A	A	F	F	A		C	A	
Deionized Water	X	A	A	A	A	X		X		
Deoxidine		A								
Deoxidizer (Etching)									A	
Diethylene Glycol	F	A	F	F	F	F	A	F	A	A
Diphenyl 300°-350°	A				A			A		
Disodium Phosphate 25% 180°F	A				A		A		A	A
Dowtherm A	A			A						
Electro Polishing									A	
Electroless Nickel							A		A	
Electroless Tin										
(Acid)									A	
(Alkaline)		A-316					A			
Ethers	A		A	F	F	A	A	F	A	
Ethyl Chloride	A	A	A	F	A	A	A	F	A	A
Ethylene Gycol 300°F		A	A	F	F		A	A	A	A
Fatty Acids	X	A-316	F	F	F	X	A	A	A	
Ferric Chloride	X	X	X	X	X	X	A	X	A	A
Ferric Nitrate	X	F	X	X	X	X		X	A	
Ferric Sulphate	X	F-304 A-316	X	C	C	X	A	X	A	
Fluorine Gas, Dry	C	C	A	C	A	X	A	X	C	
Formaldehyde	F	A	A	F	F	F	A	F	A	

SOLUTION	IRON AND STEEL	300 SERIES STAINLESS	MONEL	INCOLOY	INCONEL	COPPER	TITANIUM	ALUMINUM	QUARTZ	TEFLON
Formic Acid	X	F	C	F	C	F	X	X	A	
Freon	C	C	A	A	A	A		A		
Fuel Oil	A	A	A	F	F	A	A	A		
Fuel Oil, Acid	C	C	A	C	C	C	A	X		
Gasoline, Refined	A	A	A	F	F	A		A	A	
Gasoline, Sour	C	A	A	X	X	C		C	A	
Glycerine, Glycerol	A	A	A	A	A	F		A	A	
Gold - Acid	A						A		A	
Gold - Cyanide		A								
Grey Nickel							A		A	A
Hydrochloric Acid <150°F	X	X	C	X	X	X	X	X	A	
>150°F	X	X	C	X	X	X	X	X	A	A
Hydrocyanic Acid (No Air)	X	F	F	F	F	X		F	A	
Hydrofluoric Acid, Cold <65%	X	X	F	X	X	C	X	X	X	A
>65%	F	X	A	X	X	F	X	X		
Hot <65%	X	X	C			X		X		
>65%	C	X	A	X	X	F	X	X		
Hydrogen Peroxide	X	A	F	F	F	X	A	A	A	
Indium									A	A
Iron Phosphate (Parkerizing)	C	A								
Isopropanol	C		A		A	F				
Kerosene	A	A	A	A	A	A		A		
Lacquer Solvents	C	A	A	F	F	C	A	A	A	
Lard	F									
Lead Acetate	X	A	A	A	A	X	A	X	A	
Lead Acid Salts		A-304								
Lime Saturated Water	F	A-316	F	F	F	F		X	X	
Linseed Oil	A	A	A	F	F	A	A	F		
Magnesium Chloride	F	F	F	F	A	F	A	X	A	
Magnesium Hydroxide	A	A	A	A	A	X		F	A	
Magnesium Nitrate	F	F	F	F	X	F	F	F	A	
Magnesium Sulphate	A	A	A	F	A	A	A	F	A	
Mercuric Chloride	C	X	X	X	X	X	F	X	A	
Mercury	A	A	A	A	F	X	X	X	A	
Methyl Alcohol, Methanol	A	A	A	F	A	A	A	C	A	
Methyl Bromide	C	A	F	F	F	F	A	X	A	
Methyl Chloride	A		A	C	C	A	A	X	A	
Methylene Chloride	X	C	C	C	F	C	A	C	A	
Mineral Oils	A	A	A	A	A	A	A	A	A	
Muriato									A	A
Naptha	A	A	A	A	A	A	A	A	A	A
Napthalene	A			F	F		A	F		
Nickel Acetate Seal		A-316								
Nickel Chloride		F	C	C	F	X	F	X	A	A
Nickel Copper Strike (Cyanide Free)		A								
Nickel Plating, Bright							A		A	A
Nickel Plating, Dull									A	A
Nickel Plating, Watts Solution							A		A	A
Nickel Sulphate	X	A	C	C	C	X		X	A	A
Nitric Acid, Crude	X	C	X	X	X	X		X	A	A
Concentrated	X	F	X	X	X	X		X	A	A
Diluted	X	A	X	X	X	X		X	A	A
Nitric Hydrochloric Acid	X	X	X	X	X	X	X	X	A	A
Nitric 6% Phosphoric Acid		C-316							A	A
Nitric Sodium Chromate		A-316							A	A
Nitrobenzene	A	A	A	A	A	F	A	A	A	
Oakite No. 20	A									
Oakite No. 23	A									
Oakite No. 24	A									

SOLUTION	IRON AND STEEL	300 SERIES STAINLESS	MONEL	INCOLOY	INCONEL	COPPER	TITANIUM	ALUMINUM	QUARTZ	TEFLON
Oakite No. 30	A									
Oakite No. 51	A									
Oakite No. 67		A-304								
Oakite No. 90 @ 180°F	A									
Oleic Acid	C	A	A	F	A	X	F	C	A	A
Oxalic Acid	C	C	A	X	F	C	X	F	A	A
Paint Stripper (High Alkaline Type)	A									
Paint Stripper (Solvent Type)		A-316								
Paraffin	A	A				A		A		
Parkerizing										
Perchlorethylene		A		F	A		A	C	A	
Petroleum Oils, Crude <500°F	A	A	C	A		C		A	A	
>500°F	A	A	X			X		A		
>1000°F	X	C A-347	X			X		X		
Phenol										
Phenol 85%, 120°F	C	A		F	F		A	A		
Phosphate		A-316								X
Phosphate Cleaner		A-304								X
Phosphatizing		A-316								X
Phosphoric Acid, Crude	C	C	X			X		X		
Pure <45%	X	A	F	A	A	F	X	C		
>45% Cold	X	A	F	A		F	X	X		
Hot	X	X-304 C-316	C	A	F	C	X	X		
Photo Fixing Bath		A	C							
Potassium Bichromate (Potassium Dichromate)	C	A-316	F	F			F	F	A	A
Potassium Chloride	A	A	A	C	F	A	A	X	A	
Potassium Cyanide	A	A	A	F	F	X	X	X	A	A
Potassium Hydrochloride									A	A
Potassium Hydroxide	C	F	A	C	F	X	X	X	X	A
Potassium Nitrate (Salt Peter)	F	F	F	F	F	F	A	A	A	
Potassium Sulphate	A	F	A	F	F	A	A	A	A	A
Prestone 350°F	A		A							
Sea Water	X	C	A	F	F	X	A	X	A	
Silver Bromide	X	X	C			X	A	X	A	A
Silver Cyanide	C	A	F	A		X		X	A	
Silver Nitrate	X	C	X	C	C	X	A	X	A	
Soap Solutions	A	A	A			C		X		
Sodium - Liquid Metal	C	A-304	C	A	A	X		X	X	
Sodium Bisulphate	X	X	C		F	F		C		
Sodium Bromide	F	C	F	F	F	F		X	A	A
Sodium Carbonate <20%	A			F	F		A	X	C	A
Sodium Chlorate	X	F	A	F	A	A	A	F	A	A
Sodium Chloride	A	F-304 A-316	A	F	A	F	C	X	A	
Sodium Citrate	X	F				X		X	A	A
Sodium Cyanide	A	A-316	F	A	A	X	C	X	A	
Sodium Dichromate (Sodium Bichromate)	F	F				X	C	C	A	
Sodium Disulphate	X	X	C		C		C	C	A	
Sodium Hydroxide	A	F	A	A	A	X	A			
Sodium Hypochlorite	X	X	C	X	X	C	A	X	A	A
Sodium Nitrate	A	F-304 A-316	A	A	A	F	A	C	A	
Sodium Peroxide	C	A	A		F			C		
Sodium Phosphate	C	A-316	A	F	A	F	A	X	A	A
Sodium Salicylate	F	F	F	F	F	F			A	A
Sodium Silicate	A	A-316	A	F	F	C		X	A	A

SOLUTION	IRON AND STEEL	300 SERIES STAINLESS	MONEL	INCOLOY	INCONEL	COPPER	TITANIUM	ALUMINUM	QUARTZ	TEFLON
Sodium Stannate	C	F	F	F	F				A	A
Sodium Sulphate	A	A	A	F	F	A	C	F	A	A
Sodium Sulphide	A	A	F	C	C	X	C	C	C	A
Solder Bath	X	X	X	X	X	X	X	X	X	X
Soybean Oil		A								
Steam <500°F	A	A	A	A	A	A				
500-1000°F	C	A	C	A	A	C				
>1000°F	X	A	X	A	A	X				
Stearic Acid	C	A	A			C		C	A	
Sugar Solution	A	A	A	A	A	A	A	A	A	A
Sulphur	A	F	X	A	A	X	A	A	A	
Sulphur Chloride	X	C-304 X-316	X	C	F	X		X	A	A
Sulphur Dioxide	C	C	X	C	C	C	A	C	A	
Sulphuric Acid <10% Cold	X	F	C		X	C		C		
Hot	X	F-316 X-304	C		F	X		C		
10-75% Cold	X	X-304 F-316	C		X	X	X	X		
Hot	X	X	C		X	X	X	X		
75-95% Cold	C	A	C		X	X	X	X		
Hot	F	X	C			X	X	X		
Fuming	C	C-304 F-316	X	C	C	X		X		
Sulphurous Acid	A	C-316 X-304	X		C	C	A	C		
Tannic Acid		F	A		A	A	A	C	A	
Tar	A	A		A	A			A		
Tartaric Acid		C-304 A-316	C		F		F	C		
Tetrachlorethylene	A			F	A		A	C	A	
Thermoil Granodine	F									
Tin (Molten)	F	F	X		X	X	A	X		X
Tin-Nickel Plating									A	A
Tin Plating - Acid										A
Tin Plating - Alkaline	A	A-304								
Toluene	A	A	A	A	A	C	A	A		
Triad Solvent	C									
Trichloroethane	A	A-304	F	F	F	F	A	F	A	
Trichloroethylene	C	C	A	A	A	C	A	F	A	
Triethylene Glycol	A	A	A	A	A	A	A	A	A	
Trioxide (Pickle)									A	A
Trisodium Phosphate	A	C	C			C		X	X	X
Turpentine	C	A	A			C		A		
Urea Ammonia Liquor 48°F	A									
Vegetable Oil	C	A	A	A		X		F		
Vinegar	C	F-304 A-316	A					C		
Water, Fresh	C	A	A	A	A	A	A		A	
Distilled, Lab Grade	X	A	C	A	A	X				
Return Condensate	A	A	A	A	A	A				
Whiskey and Wines	X	F-304 A-316	A	A	A	A				
Yellow Dichromate		A-316							A	
X-Ray Solution		A								
Zinc (Molten)		X	X	X	X	X	X	X		X
Zinc Chloride	C	X	A	F	F	X	F	X	A	A
Zinc Plating Acid									A	
Zinc Plating Cyanide	A	A-304								
Zinc Sulphate	C	A	A	A	A	X	A	C		

Typical Watt Densities

1. Watt density is determined by dividing the heater wattage by the total surface area of all heated surfaces on the element. Remember that electric heating elements will continue to increase their surface temperature until all heat produced by the element is transferred to the work.
2. Typical watt densities shown in the table below are based on non-circulated liquids unless noted otherwise.
3. Use of watt density lower than listed will prolong heater service life.
4. This data is for use as a general guideline only. System conditions may exist that may mandate densities lower or higher than listed. Certain substances of high viscosity and low heat transfer may be subject to coking if density is too high.

MATERIAL BEING HEATED	MAXIMUM WATTS PER SQUARE INCH	OPERATING TEMP. (°F)
Acetaldehyde	14	180
Acetone	14	130
Acid Solutions (Mild) — Acetic	40	180
Acid Solutions (Mild) — Boric	40	257
Acid Solutions (Mild) — Carbonic	40	180
Acid Solutions (Mild) — Chromic	40	180
Acid Solutions (Mild) — Citric	25	180
Acid Solutions (Mild) — Fatty Acids	25	150
Acid Solutions (Mild) — Lactic	10	122
Acid Solutions (Mild) — Malic	14	120
Acid Solutions (Mild) — Nitric	25	167
Acid Solutions (Mild) — Phenol - 2-4 Disulfonic	40	180
Acid Solutions (Mild) — Phosphoric	28	180
Acid Solutions (Mild) — Phosphoric (Aerated)	26	180
Acid Solutions (Mild) — Proponic	40	180
Acid Solutions (Mild) — Tannic	30 / 40	160 / 180
Alkaline Solutions	44	212
Aluminum Acetate	14	122
Aluminum Potassium Sulfate	40	212
Ammonium Acetate	28	167
Amyl Acetate	28	240
Amyl Alcohol	24	212
Aniline	26	350
Asphalt	4 - 10	200 - 500
Barium Hydroxide	40	212
Benzene, liquid	14	150
Butyl Acetate	14	225
Calcium Bisulfate	20	400
Calcium Chloride	5 - 8	200
Carbon Monoxide	25	—
Carbon Tetrachloride	25	160
Caustic Soda — 2%	50	210
Caustic Soda — 10%	28	210
Caustic Soda — 75%	26	180
Citrus Juices	26	185
Degreasing Solution	25	275
Dextrose	25	212
Dowtherm A — 1 ft. sec. or more	23	750
Dowtherm A — non-flowing	10	750
Dowtherm E	12 - 18	400
Dyes & Pigments	23	212
Electroplating Baths — Cadmium	40	180
Electroplating Baths — Copper	40	180
Electroplating Baths — Dilute Cyanide	40	180
Electroplating Baths — Sodium Cyanide	40	180
Electroplating Baths — Potassium Cyanide	40	180
Ethylene Glycol	30	300
Formaldehyde	12	180
Freon gas	2 - 5	300
Fuel Oils — Grades 1 & 2 (distilate)	23	200
Fuel Oils — Grades 4 & 5 (residual)	14	200
Fuel Oils — Grades 6 & bunker C (residual)	8	160
Gasoline	25	300
Gelatin — Liquid	25	150
Gelatin — Solid	6	150
Glycerine	10	500
Glycerol	26	212
Grease — Liquid	26	—
Grease — Solid	5	—
Heat Transfer Oils — Static	18	500
Heat Transfer Oils — Static	14	600
Heat Transfer Oils — Circulating	24	500
Heat Transfer Oils — Circulating	22	600
Hydrazine	18	212
Linseed Oil	50	150
Lubrication Oil — SAE 10	26	250
Lubrication Oil — SAE 20	24	250
Lubrication Oil — SAE 30	23	250
Lubrication Oil — SAE 40	16	250
Lubrication Oil — SAE 50	14	250
Magnesium Chloride	40	212
Magnesium Sulfate	40	212
Manganese Sulfate	40	212
Methylamine	22	180
Methylchloride	20	180
Mineral Oil	25	200
Mineral Oil	18	400
Molasses	5	100
Molten Salt Bath	25 - 30	800 - 900
Naptha	12	212
Oil Draw Bath	25	600
Paraffin or Wax (liquid state)	20	150
Perchloroethylene	25	200
Potassium Chlorate	40	212
Potassium Chloride	40	212
Potassium Hydroxide	23	160
Soap, liquid	24	212
Sodium Acetate	45	212
Sodium Cyanide	45	140
Sodium Hydride	30	720
Sodium Hydroxide		
Sodium Phosphate	40	212
Sulfur, Molten	10	600
Therminols	26	500
Therminols	23	600
Therminols	15	650
Toluene	25	212
Trichlorethylene	25	150
Turpentine	22	300
Vegetable Oil & Shortening	40	400
Water (Process)	60 - 90	212

PRACTICAL FLOW VELOCITIES IN PIPE

FLOW/SERVICE	PSIG	VELOCITY
Saturated Steam	0-25	4000-6000 ft./min.
	25 and up	6000-10000 ft./min.
Superheated Steam	200 and up	7000-20000 ft./min.
Water/Boiler Feed	-	8 - 15 ft./sec.
Water/Pump Suction	-	4 - 7 ft./sec.
Water/Drain	-	4 - 7 ft./sec.
Water/General Service	-	4 - 10 ft./sec.

ALLOWABLE PRESSURE RATINGS FOR PIPES AND FLANGES

The information included on this page is to be used as a guide only in the pre-selection of pipe and flange sizes for various temperatures and pressures.

When calculating thickness requirements in accordance with the ASME code for safe pressure vessel design, stress values may often be less than shown in Table 1.

TABLE 1 - APPROXIMATE ALLOWABLE STRESS FOR PIPE IN PSIG

	PIPE MATERIAL AND TYPE			
TEMP. °F	A53B WELDED STEEL	A106B SEAMLESS STEEL	A312 304 S.S. WELDED	A312 316 S.S. WELDED
100	14,600	17,100	17,000	17,000
300	14,600	17,100	16,100	17,000
500	14,600	17,100	14,800	15,300
650	14,600	17,100	13,800	14,100
700	13,300	15,600	13,500	13,900
900	5,000	5,900	12,400	13,200
1100	-	-	8,300	10,500
1300	-	-	3,100	3,500

DETERMINATION OF APPROXIMATE PIPE WALL THICKNESS (t_N) FOR VARIOUS PRESSURES AND TEMPERATURES

$$t_N = \frac{.5PD}{SE - .6P} \quad (1.143)$$

t_N = Nominal pipe wall thickness (page D48) not including corrosion allowance

P = Max. pressure (PSIG)

D = Inside pipe diameter (in.)

S = Allowable stress from Table 1

E = Joint efficiency (assume a value of 1.0 for seamless pipe or welded pipe where full radiography is done).

FLANGE PRESSURE - TEMPERATURE RATINGS

		MAX. ALLOWABLE PRESSURE (PSIG)					
METAL	TEMP. °F	150 LB.	300 LB.	400 LB.	600 LB.	900 LB.	1500 LB.
CARBON STEEL	100	285	740	990	1480	2220	3705
	200	260	675	900	1350	2025	3375
	300	230	655	875	1315	1970	3280
	400	200	635	845	1270	1900	3170
	500	170	600	800	1200	1795	2995
	600	140	550	730	1095	1640	2735
	650	125	535	715	1075	1610	2685
	700	110	535	710	1065	1600	2665
	750	95	505	670	1010	1510	2520
	800	80	410	550	825	1235	2060
	850	65	270	355	535	805	1340
	900	50	170	230	345	515	860
	950	35	105	140	205	310	515
	1000	20	50	70	105	155	260
304 S.S.	100	275	720	960	1440	2160	3600
	200	235	600	800	1200	1800	3000
	300	205	540	720	1080	1620	2700
	400	190	495	660	995	1490	2485
	500	170	465	620	930	1395	2330
	600	140	435	580	875	1310	2185
	700	110	425	565	850	1275	2125
	800	80	405	540	805	1210	2015
	900	50	390	520	780	1165	1945
	1000	20	320	430	640	965	1605
	1100	-	255	345	515	770	1285
	1200	-	155	205	310	465	770
	1300	-	85	115	170	255	430
	1400	-	50	65	90	145	240
	1500	-	25	35	55	80	135
316 S.S.	100	275	720	960	1440	2160	3600
	200	235	620	825	1240	1860	3095
	300	215	560	745	1120	1680	2795
	400	195	515	685	1030	1540	2570
	500	170	480	635	955	1435	2390
	600	140	450	600	900	1355	2255
	700	110	430	580	870	1305	2170
	800	80	420	565	845	1265	2110
	900	50	415	555	830	1245	2075
	1000	20	350	465	700	1050	1750
	1100	-	305	405	610	915	1525
	1200	-	185	245	370	555	925
	1300	-	115	155	235	350	585
	1400	-	75	100	150	225	380
	1500	-	40	55	85	125	205
304L 316L S.S.	100	230	600	800	1200	1800	3000
	200	195	505	675	1015	1520	2530
	300	175	455	605	910	1360	2270
	400	160	415	550	825	1240	2065
	500	145	380	510	765	1145	1910
	600	140	360	480	720	1080	1800
	700	110	345	460	685	1030	1715
	800	80	330	440	660	985	1645

REFERENCE ASME/ANSI B16.5 - 1998

TABLE 1 - Sheet metal gauges in approximate decimals of an inch

No. of Sheet Metal Gauge	Manufacturers' Standard Gauge for Steel Thk.	lbs./ft²	300 Series Stainless Steel Thk.	lbs./ft²	Galvanized Sheet Steel Thk.
9	0.1495	6.2500	—	—	0.1532
10	0.1345	5.6250	0.134	5.628	0.1382
11	0.1196	5.0000	0.119	4.998	0.1233
12	0.1046	4.3750	0.103	4.326	0.1084
13	0.0897	3.7500	—	—	0.0934
14	0.0747	3.1250	0.074	3.108	0.0785
15	0.0673	2.8125	—	—	0.0710
16	0.0598	2.5000	0.059	2.478	0.0635
17	0.0538	2.2500	—	—	0.0575
18	0.0478	2.0000	0.047	1.974	0.0516
19	0.0418	1.7500	—	—	0.0456
20	0.0359	1.5000	0.035	1.470	0.0396
21	0.0329	1.3750	—	—	0.0366
22	0.0299	1.2500	0.030	1.260	0.0336
23	0.0269	1.1250	—	—	0.0306
24	0.0239	1.0000	0.024	1.008	0.0276
25	0.0209	0.87500	—	—	0.0247
26	0.0179	0.75000	0.019	0.798	0.0217
27	0.0164	0.68750	—	—	0.0202
28	0.0149	0.62500	—	—	0.0187
29	0.0135	0.56250	—	—	0.0172
30	0.0120	0.50000	—	—	0.0157
31	0.0105	0.43750	—	—	0.0142
32	0.0097	0.40625	—	—	0.0134
33	0.0090	0.37500	—	—	—
34	0.0082	0.34375	—	—	—
35	0.0075	0.31250	—	—	—
36	0.0067	0.28125	—	—	—

TABLE 2 - 80-20 NiCr wire properties (650 ohms circ. mil/ft)

B & S	DIAM. (INS.)	OHMS/FT (77°F)	B & S	DIAM. (INS.)	OHMS/FT (77°F)
13	.072	0.125	25	.0179	2.029
14	.064	0.158	26	.0159	2.571
15	.057	0.200	27	.0142	3.224
16	.051	0.250	28	.0126	4.094
17	.045	0.321	29	.0113	5.090
18	.040	0.406	30	.0100	6.500
19	.036	0.501	31	.0089	8.206
20	.032	0.635	32	.0080	10.160
21	.0285	0.800	33	.0071	12.890
22	.0253	1.015	34	.0063	16.330
23	.0226	1.273	35	.0056	20.730
24	.0201	1.609	36	.0050	26.000

TABLE 3 - DIMENSIONS OF STEEL PIPE

DIAMETER IN INCHES NOMINAL (O.D.)	SCHEDULE NO.	WALL THICKNESS INCHES	DIAMETER IN INCHES NOMINAL (O.D.)	SCHEDULE NO.	WALL THICKNESS INCHES
1/8 (0.405)	10S	0.049	6 (6.625)	5S	.109
	40ST, 40S	.068		10S	.134
	80XS, 80S	.095		40ST, 40S	.280
1/4 (0.54)	10S	.065		80XS, 80S	.432
	40ST, 40S	.088		120	.562
	80XS, 80S	.119		160	.719
3/8 (0.675)	10S	.065		XX	.864
	40ST, 40S	.091	8 (8.625)	5S	.109
	80XS, 80S	.126		10S	.148
1/2 (0.84)	5S	.065		20	.250
	10S	.083		30	.277
	40ST, 40S	.109		40ST, 40S	.322
	80XS, 80S	.147		60	.406
	160	.188		80XS, 80S	.500
	XX	.294		100	.594
3/4 (1.05)	5S	.065		120	.719
	10S	.083		140	.812
	40ST, 40S	.113		XX	.875
	80XS, 80S	.154		160	.906
	160	.219	10 (10.75)	5S	.134
	XX	.308		10S	.165
1 (1.315)	5S	.065		20	.250
	10S	.109		30	.307
	40ST, 40S	.133		40ST, 40S	.365
	80XS, 80S	.179		80S, 60XS	.500
	160	.250		80	.594
	XX	.358		100	.719
1 1/4 (1.66)	5S	.065		120	.844
	10S	.109		140, XX	1.000
	40ST, 40S	.140		160	1.125
	80XS, 80S	.191	12 (12.75)	5S	0.156
	160	.250		10S	0.180
	XX	.382		20	0.250
1 1/2 (1.9)	5S	.065		30	0.330
	10S	.109		ST, 40S	0.375
	40ST, 40S	.145		40	0.406
	80XS, 80S	.200		XS, 80S	0.500
	160	.281		60	0.562
	XX	.400		80	0.688
2 (2.375)	5S	.065		100	0.844
	10S	.109		120, XX	1.000
	40ST, 40S	.154		140	1.125
	80ST, 80S	.218		160	1.312
	160	.344	14 (14)	5S	0.156
	XX	.436		10S	0.188
2 1/2 (2.875)	5S	.083		10	0.250
	10S	.120		20	0.312
	40ST, 40S	.203		30, ST	0.375
	80XS, 80S	.276		40	0.438
	160	.375		XS	0.500
	XX	.552		60	0.594
3 (3.5)	5S	.083		80	0.750
	10S	.120		100	0.938
	40ST, 40S	.216		120	1.094
	80SX, 80S	.300		140	1.250
	160	.438		160	1.406
	XX	.600	16 (16)	5S	0.165
3 1/2 (4.0)	5S	.083		10S	0.188
	10S	.120		10	0.250
	40ST, 40S	.226		20	0.312
	80XS, 80S	.318		30, ST	0.375
4 (4.5)	5S	.083		40, XS	0.500
	10S	.120		60	0.656
	40ST, 40S	.237		80	0.844
	80SX, 80S	.337		100	1.031
	120	.438		120	1.219
	160	.531		140	1.438
	XX	.674		160	1.594
5 (5.563)	5S	.109	18 (18)	5S	0.165
	10S	.134		10S	0.188
	40ST, 40S	.258		10	0.250
	80XS, 80S	.375		20	0.312
	120	.500		ST	0.375
	160	.625		30	0.438
	XX	.750		XS	0.500
				40	0.562
				60	0.750
				80	0.938
				100	1.156
				120	1.375
				140	1.562
				160	1.781

Atmospheric Conditions and Temperature Codes

The information listed on this page is to be used only as a general guide. Consult the latest edition of the Code to check the suitability of the explosion-proof heater to your needs.

For detailed information concerning the installation of electrical equipment in hazardous locations, refer to either the Canadian Electrical Code Part 1 Section 18, available from the Canadian Standards Association, or the National Electrical Code Chapter 5 Articles 500 through 503, available from the National Fire Protection Association.

Where electrical equipment is required by Section 18 or Chapter 5 to be approved for the class of location, it shall also be approved for the specific gas, vapour, or dust that will be present. Such approval may be indicated by one or more atmospheric group designations which have been established for the purpose of testing and approval.

Note that the maximum external temperature of the equipment shall not exceed the minimum ignition temperature of the atmosphere as listed in Table 2.

For example:

Assume the maximum heater temperature is listed as T2C or 230°C (446°F). This heater would not be suitable for use in atmospheres containing octanes but would be suitable for use in atmospheres containing gasoline.

For octanes, select a heater having a temperature code that does not exceed 206°C (403°F).

TABLE 1 - Equipment Maximum Temperature

Temperature Code	Maximum External Temperature
T1	450°C / 842°F
T2	300°C / 572°F
T2A	280°C / 536°F
T2B	260°C / 500°F
T2C	230°C / 446°F
T2D	215°C / 419°F
T3	200°C / 392°F
T3A	180°C / 356°F
T3B	165°C / 329°F
T3C	160°C / 320°F
T4	135°C / 275°F
T4A	120°C / 248°F
T5	100°C / 212°F
T6	85°C / 185°F

TABLE 2 - Atmospheric Conditions

ATMOSPHERE	MIN. IGNITION TEMP. LIMIT
GROUP A CONTAINING	
acetylene	305°C / 581°F
GROUP B CONTAINING	
butadiene	420°C / 788°F
ethylene oxide	429°C / 804°F
hydrogen	500°C / 932°F
manufactured gases containing more than 30% hydrogen (by volume)	500°C / 932°F
propylene oxide	499°C / 930°F
GROUP C CONTAINING	
acetaldehyde	175°C / 347°F
cyclopropane	498°C / 928°F
diethyl ether	160°C / 320°F
ethylene	450°C / 842°F
unsymmetrical dimethyl hydrazine (UDMH 1, 1-dimethyl hydrazine)	249°C / 480°F
GROUP D CONTAINING	
acetone	465°C / 869°F
acrylonitrile	481°C / 898°F
alcohol (see ethyl alcohol)	
ammonia	651°C / 1204°F
benzene	498°C / 928°F
benzine (see petroleum naphtha)	
benzol (see benzene)	
butane	287°C / 549°F
1-butanol (butyl alcohol)	343°C / 649°F
2-butanol (secondary butyl alcohol)	405°C / 761°F
butyl acetate	425°C / 797°F
isobutyl acetate	421°C / 790°F
ethane	472°C / 882°F
ethanol (ethyl alcohol)	363°C / 685°F
ethyl acetate	426°C / 799°F
ethylene dichloride	413°C / 775°F
gasoline	280°C / 536°F
heptanes	204°C / 399°F
hexanes	223°C / 433°F
isoprene	395°C / 743°F
methane	537°C / 999°F
methanol (methyl alcohol)	385°C / 725°F
3-methyl-1-butanol (isoamyl alcohol)	350°C / 662°F
methyl ethyl ketone	404°C / 759°F
methyl isobutyl ketone	448°C / 838°F
2-methyl-1-propanol (isobutyl alcohol)	415°C / 779°F
2-methyl-2-propanol (tertiary butyl alcohol)	478°C / 892°F
naphtha (see petroleum naphtha)	
natural gas	482°C / 900°F
octanes	206°C / 403°F
pentanes	260°C / 500°F
1-pentanol (amyl alcohol)	300°C / 572°F
petroleum naphtha	288°C / 550°F
propane	432°C / 810°F
1-propanol (propyl alcohol)	412°C / 774°F
2-propanol (isopropyl alcohol)	399°C / 750°F
propylene	455°C / 851°F
styrene	490°C / 914°F
toluene	480°C / 896°F
vinyl acetate	402°C / 756°F
vinyl chloride	472°C / 882°F
xylenes	463°C / 865°F
GROUP E COMPRISING atmospheres containing metal dust, including aluminum, magnesium, and their commercial alloys, and other metals of similarly hazardous characteristics	
GROUP F COMPRISING atmospheres containing carbon black, coal, or coke dust	
GROUP G COMPRISING atmospheres containing flour, starch, or grain dust, and other dusts of similarly hazardous characteristics	

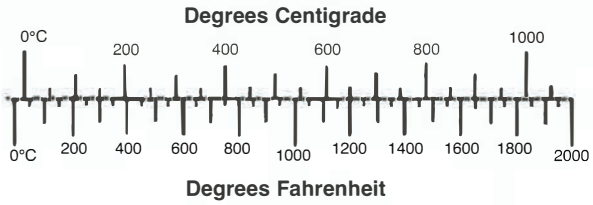
Temperature Conversion

°F = 9/5°C + 32

°C = 5/9 (°F - 32)

°R = °F + 460

°K = °C + 273



COMMON CONVERSION FACTORS

To Convert From	To	Multiply By
Atmospheres	mm Mercury (32°F)	760.
Atmospheres	Newtons / sq. meter	101,325.
Atmospheres	Ft. water (39.1°F)	33.90
Atmospheres	Ins. mercury (32°F)	29.921
Atmospheres	Pounds / sq. in.	14.696
Bars	Pounds / sq. in.	14.504
Boiler H.P.	Kilowatts	9.803
B.t.u.	Calories (gram)	252.
B.t.u. / hour	Watts	0.29307
B.t.u. / sec.	Watts	1,054.4
B.t.u. / sq. ft. / min.	Kilowatts / sq. ft.	0.1758
Circular mills	Square inches	7.854×10^{-7}
Cubic feet water	Pounds	62.37
Cubic feet / minute	Cubic cm / sec.	472.0
Cubic feet / minute	U.S. gallons / sec.	0.1247
Cubic feet / second	U.S. gallons / min.	448.8
Feet / min.	Miles / hour	0.011364
Gallons (U.S.)	Gallons (Imperial)	0.8327
H.P. (British)	Watts	745.7
Pounds	Grains	7,000.

SPECIAL CONVERSION FACTORS

To Convert From	To	Multiply By
Heat transfer		
p.c.u. / (hr.)(ft.^{2})(°C)	B.t.u. / (hr.)(ft.^{2})(°F)	1.
kg-cal. / (hr.)(m^2)(°C)	B.t.u. / (hr.)(ft.^{2})(°F)	0.2048
g-cal. / (sec.)(cm^2)(°C)	B.t.u. / (hr.)(ft.^{2})(°F)	7,380.
watts / (cm^2)(°C)	B.t.u. / (hr.)(ft.^{2})(°F)	1,760.
watts / (in^2)(°F)	B.t.u. / (hr.)(ft.^{2})(°F)	490.
B.t.u. / (hr.)(ft.^{2})(°F)	p.c.u. / (hr.)(ft.^{2})(°C)	1.
B.t.u. / (hr.)(ft.^{2})(°F)	kg-cal. / (hr.)(m^2)(°C)	4.88
B.t.u. / (hr.)(ft.^{2})(°F)	g-cal. / (sec.)(cm^2)(°C)	0.0001355
B.t.u. / (hr.)(ft.^{2})(°F)	watts / (cm^2)(°C)	0.000568
B.t.u. / (hr.)(ft.^{2})(°F)	watts / (in^2)(°F)	0.00204
B.t.u. / (hr.)(ft.^{2})(°F)	hp / (ft.^{2})(°F)	0.000394
B.t.u. / (hr.)(ft.^{2})(°F)	joules / (sec.)(m^2)(°C)	5.678
kg-cal. / (hr.)(m^2)(°C)	joules / (sec.)(m^2)(°C)	1.163
watts / (m^2)(°C)	joules / (sec.)(m^2)(°C)	1.0
Viscosity		
centipoises	g / (sec.)(cm) or poise	0.01
centipoises	lb. / (sec.)(ft.)	0.000672
centipoises	lb. / (hr.)(ft.)	2.42
centipoises	kg / (hr.)(m)	3.60
centipoises	(newton)(sec.) / m^2	0.001
lb. / (sec.)(ft.)	(newton)(sec.) / m^2	1.488
Thermal Conductivity		
g-cal. / (sec.)(cm^2)(°C / cm)	B.t.u. / (hr.)(ft.^{2})(°F / in.)	2903.0
watts / (cm^2)(°C / cm)	B.t.u. / (hr.)(ft.^{2})(°F / in.)	694.0
g-cal. / (hr.)(cm^2)(°C / cm)	B.t.u. / (hr.)(ft.^{2})(°F / in.)	0.8064
B.t.u. / (hr.)(ft.^{2})(°F / ft.)	joules / (sec.)(m^2)(°C)	1.731
B.t.u. / (hr.)(ft.^{2})(°F / in.)	joules / (sec.)(m^2)(°C)	0.1442

S. I. Conversions

BASIC CONVERSION FACTORS

Velocity			**Power**		
1 fps	=	0.3048 m/s	1 Btu/h(int.)	=	0.29307 W
1 fpm	=	0.00508 m/s	1 Btu/s(int.)	=	1.05506 kW
1 mph	=	0.44704 m/s	1 HP mech. (UK)	=	0.74570 kW
1 mph	=	1.60934 km/h	1 HP boiler	=	9.8095 kW
Length			**Density**		
1 inch	=	25.4 mm	1 lb./ft^3	=	16.01846 kg/m^3
1 foot	=	0.3048 m	1 lb./gal (imp.)	=	99.77633 kg/m^3
1 mile	=	1.60934 km	1 lb./gal (US)	=	119.82640 kg/m^3
Area			**Thermal Conductivity**		
1 sq. inch	=	6.4516 cm^2	1 Btu.ft/ft^{2}h.°F	=	1.73073 W/m°C
1 sq. foot	=	0.09290 m^2	1 Btu.in/ft^{2}h.°F	=	0.14423 W/m°C
Volume			**Volumetric Flow**		
1 inch^3	=	16.38706 cm^3	1 ft^3/s	=	0.028317 m^3/s
1 foot^3	=	0.02832 m^3	1 ft^3/s	=	101.9406 m^3/h
Capacity Imp. Measure			**Kinematic Viscosity**		
1 fluid oz.	=	28.41306 ml	1 ft^2/s	=	0.092903 m^2/s
1 gallon	=	4.54609 l	1 centistoke (cSt)	=	1.0 x 10^{-6} m^2/s
Weight or Mass			**Dynamic Viscosity**		
1 oz.	=	28.34952 g	1 centipoise (cP)	=	0.001 Pa-s
1 lb.	=	0.45359 kg	1 lb./ft.s	=	1.488164 Pa-s
Pressure			**Heat Transfer**		
1 psi	=	6.89476 kPa	1 Btu/ft^{2}h.°F	=	5.67826 W/m^2°C
1 bar	=	10^5 Pa	1 kcal/m^{2}h.°F	=	1.163 W/m^2°C
Energy			**Specific Energy**		
1 kWh	=	3.6 MJ	1 Btu/lb.	=	2.326 kJ/kg
1 watt-hour	=	3.6 kJ	1 cal/g	=	4.1868 kJ/kg
Frequency			**Specific Heat**		
1 cps	=	1 Hz	1 Btu/lb.°F	=	4.1868 kJ/kg°C

DERIVED UNITS WITH SPECIAL NAMES

Measurement	Unit	Symbol	Derivation
Frequency	hertz	Hz	s-1
Force	newton	N	kg•m/s^2
Pressure	pascal	Pa	N/m^2
Energy	joule	J	N•m
Power	watt	W	J/s
Electric potential	volt	V	W/A
Electric resistance	ohm	Ω	V/A
Electric conductance	siemens	S	1/Ω
Electric charge	coulomb	C	A•s
Capacitance	farad	F	C/V
Magnetic flux	weber	Wb	V•s
Magnetic flux density	tesla	T	Wb/m^2
Inductance	henry	H	Wb/A
Luminous flux	lumen	lm	cd•sr
Illumination	lux	lx	lm/m^2
Temperature	Celsius degree	°C	K - 273.15
Pressure	bar	bar	10^5 Pa
Volume	liter	l	dm^3

THE PREFERRED PREFIXES

Prefix	Symbol	Meaning	Prefix	Symbol	Meaning
tera-	T	10^{12}	milli-	m	10^{-3}
giga-	G	10^9	micro-	μ	10^{-6}
mega-	M	10^6	nano-	n	10^{-9}
kilo-	k	10^3	pico-	p	10^{-12}
deci-	d	10^{-1}	femto-	f	10^{-15}
centi-	c	10^{-2}	atto-	a	10^{-18}

Mission Statement

To be recognized as a world-wide industry leader in heating technology. We will provide our customers with the broadest industry knowledge, expertise and products in space and process heating.

To create an internal environment promoting participation, teamwork, training and development for our employees.

To deliver the highest possible quality standards and continue to build a loyal customer base through dedicated customer service.

To promote continuous improvement in all existing product lines and develop and market a wide range of quality heating products through a commitment to research and development.

is known as a leader in advanced heating solutions. As a provider of industrial heating equipment we offer customers the broadest based industry knowledge, expertise and products in industrial heating. In addition to our focus on product quality we are setting a new industry standard for customer service.

At our facilities across North America we manufacture some of the top brands in industrial heating: Cata-Dyne™ Gas Catalytic Explosion-Proof Heaters; Norseman™ and Ruffneck™ Electric Explosion-Proof Heaters; DriQuik™ Oven Systems; and the Caloritech™ line of Electrical Heating Equipment and Tubular Elements.

This catalog presents the products manufactured by under the Caloritech™ brand name.

Caloritech™ products are built to any one of five nationally recognized quality control standards at our modern manufacturing facilities in Oakville and Orillia, Ontario, Canada. Both of these facilities are certified ISO 9001:2000, evidence of commitment to quality. The majority of Caloritech™ equipment (where applicable) is U.L. recognized/ listed or C.S.A. approved. At we manufacture most of our own pressure vessels, we have ASME U, S, and H stamps, and we can provide National Board registration. In addition to the standard product models listed in this catalog our team of experienced engineers and designers is well equipped to handle custom projects for specific and unique applications. We have accredited design expertise to complement the custom engineered aspect of our business and we hold a corporate Certificate of Authorization from P.E.O. to practice professional engineering in the design and application of our equipment.

We invite you to visit our website at to view the broad range of innovative industrial heating products manufactured by

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Section F

Controls

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Section F

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Section B - Immersion Heaters:
screwplug heaters, domestic immersion heaters, urn heaters, flange heaters, over-the-side heaters, pipe insert heaters, gate and gain heaters.

Section C - Air and Space Heaters:
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Section D - Engineered Products:
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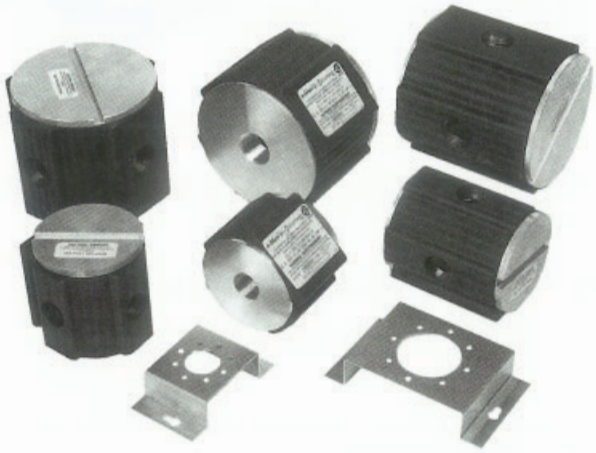
Section F - Controls:
controls, housings.

Explosion-Proof Housings Type XH

Application

Caloritech™ type XH explosion proof terminal housings (patented) feature the unique *x-Max*® **"Track and Trolley"** system. Five standard diameters, offered in lengths up to 48" (1220 mm), can cover most of your explosion proof housing requirements.



No longer is it necessary to remove dozens of bolts to gain access to housing components for installation, adjustment or servicing.

With longer Type XH housings, components are mounted to the trolley. To service, simply unscrew the end cover and slide the trolley out of the housing.

Features:

- patented under U.S. Pat. No. 5,798,910 and Canadian patent 2,212,500
- light weight, copper-free aluminum construction throughout
- four conduit openings provided as standard
- suitable for Class I Groups A,B,C,D, Class II Groups E,F,G and Class III hazardous locations, Divisions 1 & 2 Class I, Zone 1 & 2, Groups IIA, IIB & IIC
- equipped with neoprene gaskets for Type 4 moisture resistance
- horizontal or vertical mounting

The Track and Trolley System

Caloritech's "**Track and Trolley**" wiring system allows the user to mount all electrical components to an aluminum "**Trolley**", make all wiring connections outside of the enclosure, and simply slide the "**Trolley**" along the extruded "**Track**". Two "Trolley" styles are available as options.

Construction

The *x-Max*® terminal housing features copper-free (less than 0.4 of 1% by weight) aluminum construction throughout. Four conduit openings are provided on standard models, allowing the single Model XH to act not only as a standard X-, T-, C-, or B-style junction box, but as virtually any combination of standard styles.

XH1 - FRONT SIDE

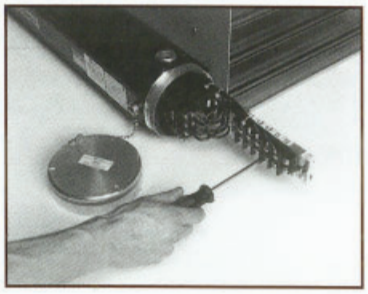
The standard *x-Max*® housing is available in five cross sectional sizes with approximate inside diameters from 2 3/4" (70mm) to 5" (127mm)

The *x-Max*® system is offered in a variety of lengths from 2 1/2" (64mm) to 48" (1220mm). Various *x-Max*® products are available that make combining multiple housings an extremely simple process.

XH1 - CLEAR ANODIZED FINISH

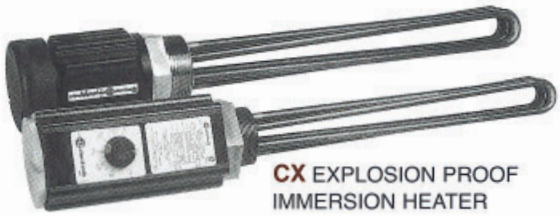
Compliances

- NEC/CEC
- Class I Division 1 & 2 Groups A, B, C, D
- Class II Division 1 & 2 Groups E, F, G
- Class III Division 1 & 2
- Class I, Zone 1 & 2, Groups IIA, IIB & IIC
- CSA Standard C22.2 No. 30
- CSA Standard C22.2 No. 25



Typical Uses

x-Max® AS A TERMINAL ENCLOSURE ...

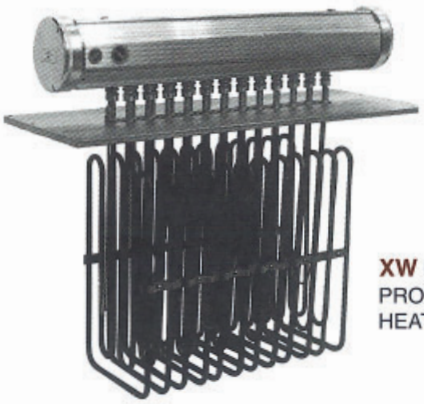


CX EXPLOSION PROOF IMMERSION HEATER

x-Max® AS A CONTROL STATION ...

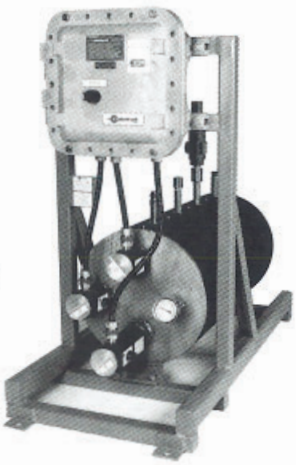
XS EXPLOSION PROOF CONTROL STATION

x-Max® AS A JUNCTION BOX ...



XW EXPLOSION PROOF DUCT HEATER

x-Max® FOR CUSTOM ENGINEERED PRODUCTS ...



XHWB EXPLOSION PROOF DOMESTIC WATER HEATER

Installation

A mounting bracket suitable for vertical or horizontal mounting is available. Figure 1 illustrates the universal mounting bracket.

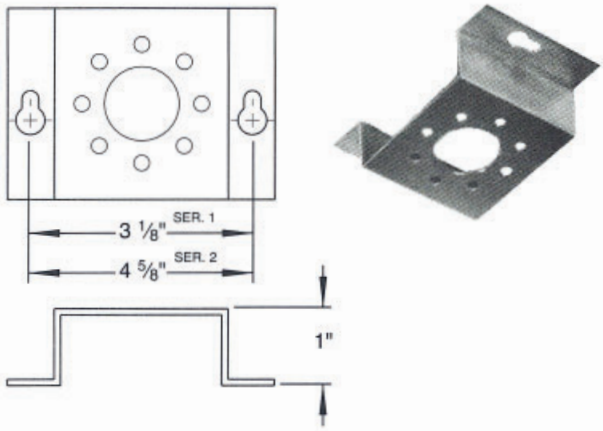


FIG. 1 - The *x-Max*® universal mounting bracket

A grounding screw threaded into the inside of the bottom cover is provided.

Options

The construction of type XH housings is such that it can be tailored to suit almost any hazardous area or moisture resistant requirement. Consult factory for special orders.

SOME OPTIONS INCLUDE:

- **Choice of cover styles:**
  - "Inside" (standard, with external threads)
  - "Outside" (with internal threads)
  - "Bolt-On hazardous"
  - "Bolt-On non-hazardous"
  - "Inside" with glass window

All cover styles can be provided with a neoprene O-ring gasket to effect a watertight seal. "Outside" and "Inside" covers are knurled for ease of hand-tightening.

Standard housings (Table 1) have "Inside" covers with a conduit entry provided through the bottom cover. Combinations of different cover styles on a single box are available.

- **Choice of finish options:**
  - black enamel finish
  - non-anodized natural finish
  - clear anodized finish (standard)
  - black anodized finish

Covers are provided with a non-anodized natural aluminum finish as standard.

Table 1 lists the most popular *x-Max*® housings normally held in stock. can manufacture box lengths up to 48" (1220mm).

Optional mounting bracket is shown on page F4. For special orders, consult factory.

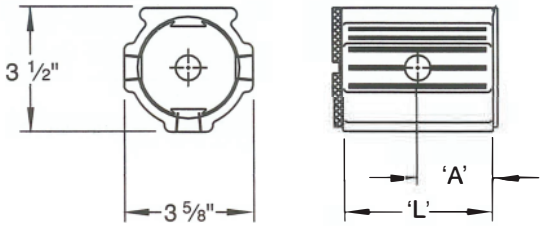


Figure 2: XH Series 1 enclosures

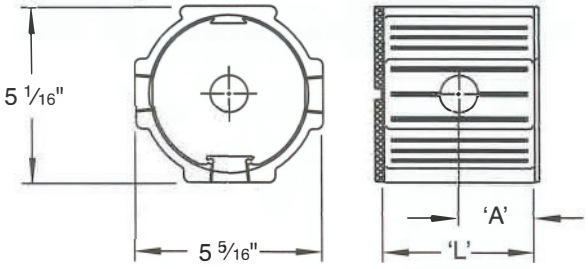


Figure 3: XH Series 2 enclosures

TABLE 1 - STANDARD TYPE XH TERMINAL ENCLOSURES

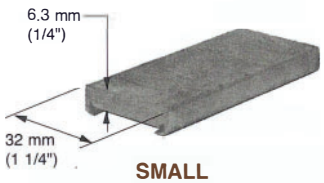
Box Length 'L' mm	Box Length 'L' in	Figure No.	Hole Sizes (NPT)	Hole Location 'A' mm	Hole Location 'A' in	Internal Volume cm^3	Internal Volume in^3	Catalog Number	Weight kg	Weight (lbs)
64	2.50	2	½"	32	1.250	87	5.3	XH1B1	0.8	(1.7)
83	3.25	2	¾"	41	1.625	155	9.5	XH1B2	0.9	(2.0)
102	4.00	2	¾"	51	2.000	222	13.5	XH1B3	1.1	(2.3)
89	3.50	3	1"	44	1.750	455	27.8	XH2B1	1.4	(3.0)
108	4.25	3	1"	54	2.125	630	38.4	XH2B2	1.6	(3.5)
127	5.00	3	1"	64	2.500	805	49.1	XH2B3	1.8	(4.0)

Special Accessories

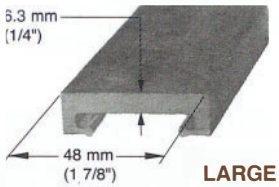
Special *x-Max*® accessories are available if required for a specific application. These items include:

- mounting bracket (see page F4)
- dry-seal plugs
- lengths of "Trolley" used for installing components
- housing to housing couplings (consult factory)
- sight glasses

Consult Table 2 and Table 3 for catalog numbers.



SMALL TROLLEY



LARGE TROLLEY

DRY SEAL PLUGS

SIGHT GLASS

TABLE 2 - *x-Max*® TROLLEY SECTIONS

Description	Length mm	Length in	Catalog Number
Small trolley (for Ser. 1 or Ser. 2)	152	6	XHT1152
	305	12	XHT1305
	457	18	XHT1457
	610	24	XHT1610
	762	30	XHT1762
	914	36	XHT1914
Large trolley (Ser. 2 only)	152	6	XHT2152
	305	12	XHT2305
	457	18	XHT2457
	610	24	XHT2610
	762	30	XHT2762
	914	36	XHT2914

TABLE 3 - *x-Max*® DRY-SEAL PLUGS

Thread Size	Catalog Number
3/8" NPT	XHP037
1/2" NPT	XHP050
3/4" NPT	XHP075
1" NPT	XHP100
1 ¼" NPT	XHP125
1 ½" NPT	XHP150

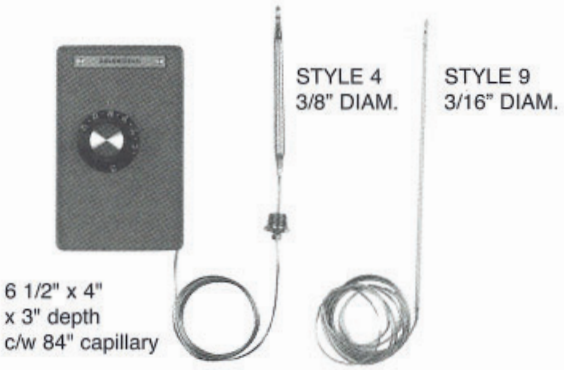
To Order

Specify quantity, catalog number and special accessories.

Industrial Thermostats - Type AR

APPLICATION

Type AR thermostats are used in industrial applications where close control of process temperatures is not a requirement.



FEATURES

All bulb and capillaries of AR thermostats are copper with nickel plating with the exception of the high temperature AR3769 and AR376893. These units have stainless bulb and capillaries. For corrosive applications a protective well or sleeving must be used.

DPST controls with 3/8" diam. bulbs include a 3/8" NPT compression fitting, non-removable. For other controls without the built-in fitting, the CA1001 is available for field mounting if required (See Fig. 2, pg. F7).

TABLE 1 - TYPE AR THERMOSTATS

Temp. Range °F	°C	Bulb Size(ins.)	Superceded Cat. No.	Catalog Number
277 VAC 25 Amp D.P.S.T. - Open On Rise				
0-100	-18 - 40	3/8 x 5 5/8	TCR220-22	AR0464
50-250	10 - 120	3/8 x 3 3/8	TCR220-25	AR1264
50-250	10 - 120	3/16 x 10 1/4	-	AR1269
150-550	70 - 280	3/8 x 3 3/8	TCR220-28	AR2864
150-550	70 - 280	3/16 x 11 1/4	-	AR2869
300-700	160 - 370	3/16 x 8 3/4	TCR220-29	AR3769
600 VAC 15 Amp T.P.S.T. - Open On Rise				
0-100	-18 - 40	3/8 x 5 1/4	TCR630-22	AR046843
50-250	10 - 120	3/16 x 10 1/4	TCR630-25	AR126893
150-550	70 - 280	3/16 x 11 1/4	TCR630-28	AR286893
300-700	160 - 370	3/16 x 8 3/4	TCR630-29	AR376893
277 VAC 25 Amp D.P.S.T. - Close On Rise				
0-100	-18 - 40	3/8 x 6	-	ARR0464
50-250	10 - 120	3/8 x 3 1/4	TCR221-25	ARR1264

NOTE: (1) T.P.S.T. switches have two poles that open thermostatically and one pole that is mechanically opened in the off position only.
(2) Inverse acting D.P.S.T. switches have only one thermostatic pole but both poles are mechanically opened in the off position.

High Limits - Type ARC

APPLICATION

Type ARC high limit temperature controls are recommended for use in industrial processes where control malfunction, loss of liquid level or air flow may cause a safety hazard or could result in damage to the heater.

The ARC must be used in conjunction with a control thermostat.

CONSTRUCTION

Controls have a screwdriver adjustment to prevent tampering. If the limit temperature is reached, the contacts will open and remain open until the temperature has dropped below the control setting and the control reset button has been depressed.

WIRING

These devices are single pole, single throw, normally closed, opening on temperature rise.

A 240V neon pilot light (suitable for 120 to 240 VAC circuits) is included. It can be wired as shown below to illuminate if the high limit trips.

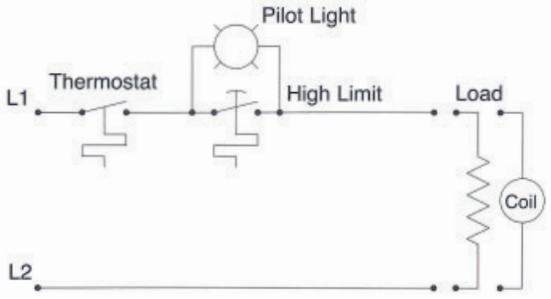


TABLE 2 - TYPE ARC HIGH LIMITS

Temp. Range °F	°C	Bulb Size(ins.)	Superceded Cat. No.	Catalog Number
120 VAC 25 Amp / 240V 22AMP S.P.S.T. - Open On Rise				
110-500	40-260	5/16 x 3	HL426	ARC260
250-650	120-340	5/16 x 3	HL1234	ARC340

TO ORDER SPECIFY: quantity, catalog number, and any special features

Thermostat Accessories

• NEON PILOT LIGHT - TYPE TCR-PL (FIG. 1)

Pilot lights are shipped separately for field mounting and wiring. Standard lights are suitable for 120 to 240 VAC. For pilot lights on higher voltages, check factory.

• STUFFING BOX - TYPE CA (FIG. 2)

Type CA1001 stuffing box is used to make a leak-proof joint where the capillary tubing goes through the wall of the tank or to secure the sensing bulb in a thermostat well.

FIG. 1 - TCR-PL

FIG. 2 - CA1001

• PROTECTIVE WELLS

Protective wells are available as standard as a welded incoloy tube style with stainless bushing. These wells are suitable for normal processes. For corrosive applications, special bar stock wells may be required. Check factory.

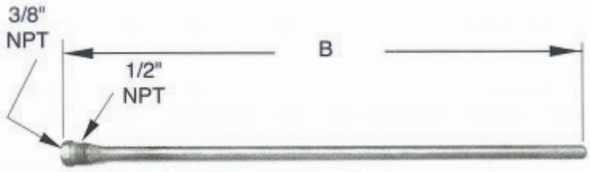


TABLE 3 - PROTECTIVE WELLS

LENGTH 'B' DIM.	INSIDE THREAD	MOUNTING THREAD	CATALOG NUMBER
12"	3/8" NPT	1/2" NPT	CWI12
24"			CWI24
36"			CWI36

• SLEEVING

Sleeving can be supplied to cover the bulb and capillary of an AR thermostat as protection against corrosion. All sleevings shown below are 84 inches long.

TABLE 4 - SLEEVING

BULB STYLE	SUPPLIED	MAT'L	MAX. TEMP.	CATALOG NO.
4 (3/8" DIA.)	LOOSE	PVC	95°C (203°F)	15902 001
4 (3/8" DIA.)	INSTALLED	"	"	15902 002
9 (3/16" DIA.)	LOOSE	"	"	15902 003
9 (3/16" DIA.)	INSTALLED	"	"	15902 004
4 (3/8" DIA.)	LOOSE	TEFLON	200°C (392°F)	15902 005
4 (3/8" DIA.)	LOOSE	"	"	15902 006

Series 30000 - SURFACE MOUNTING THERMOSWITCH® TEMPERATURE CONTROLLERS

Fenwal Series 30000 Surface Mounting Thermoswitch® Controllers operate on the principle of the differential expansion of metals. Because the case is one of the expanding metals and it is in direct contact with the heated surface, a temperature change is sensed almost instantaneously. Contacts open on temperature rise.

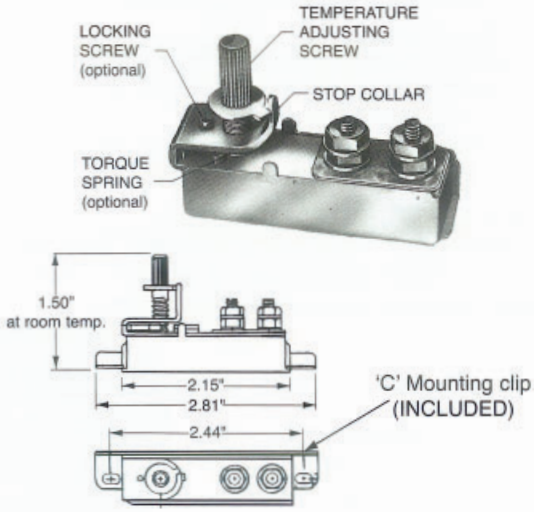


TABLE 5 - SERIES 30000

APPROX. TEMP. RANGE AND FACTORY SETTING TOLERANCE	CURRENT RATING*	CATALOG NUMBER
50 to 300°F ± 5°F or 3% of setting value	10 Amps 120 VAC 5Amps 240 VAC Resistive	11 030000 000
85 to 250°F ± 5°F or 3% of setting value		11 030000 048
50 to 600°F ± 10°F or 3% of setting value		11 030002 000

* Normally closed contact opens on temperature rise

MODIFICATIONS:

MOD 51 - Adjusting screw lengths
- Available: 1 3/64, 1 1/4, 1 3/4, 1 7/8, 2 3/8, 2 11/16.

MOD 52 - Temperature setting
- Factory setting of temperature. Locking screw included.

MOD 55A - Locking screw and torque spring
- For field calibration.

TO ORDER SPECIFY: quantity, catalog number, and any optional features

Application

The Model XT explosion proof thermostat utilizes the unique *x-Max*® system (U.S. Pat. No. 5,798,910, CDN Pat. No. 2,212,500) to provide maximum durability, safety and ease of use. Three basic units are available to suit most hazardous location temperature control applications.

XT thermostats are suitable for air, duct, pipe or tank temperature control.

Features

- approvals for all area classifications
- value engineered
- remote or local temperature sensing
- ratings to 600V, S.P.S.T. and D.P.S.T.
- multiple conduit entries
- externally adjustable with tamper-proof feature
- 'O'-rings for moisture protection

TYPE XTB

The model XTB unit is normally used for remote sensing. A CSA certified packing gland is provided to allow the 57" capillary to exit the *x-Max*® housing.

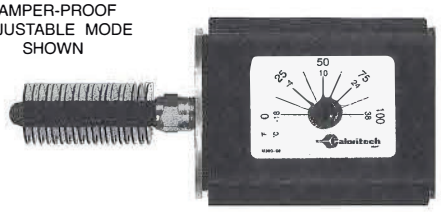
MODEL XTB
EXTERNALLY ADJUSTABLE MODE SHOWN

All XTB models are certified for Class I Groups C & D, Class II Groups E, F & G, and Class III hazardous locations, Divisions 1 and 2.

TYPE XTW

The model XTW unit is suitable for air or liquid temperature sensing and control in all hazardous locations. For air sensing applications, a finned stainless steel thermostat well assembly is provided to enclose the thermostat bulb. For liquid sensing applications, the model XTWL has an external 1/2" NPT thread on the well assembly to permit easy installation into the tank wall.

MODEL XTW
TAMPER-PROOF ADJUSTABLE MODE SHOWN



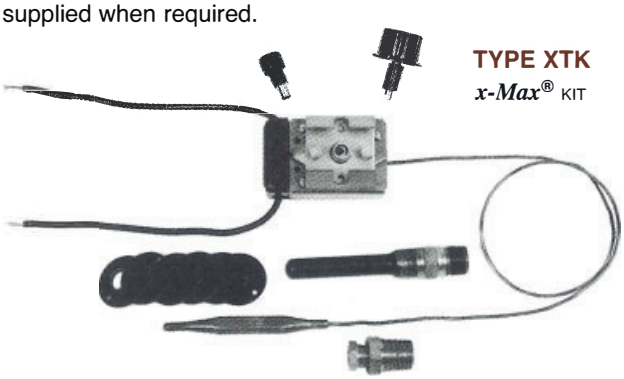
All XTW models are certified for Class I Groups A, B, C & D, Class II Groups E, F & G and Class III hazardous locations, Divisions 1 and 2.

To set the temperature in tamper-proof adjustable mode, disconnect the power to the unit, remove the socket-head cap screw and use a slot-type screwdriver to adjust.

TYPE XTK

The type XTK is a thermostat kit suitable for field installation into other Caloritech™ products, such as the CX explosion proof screwplug heater. This allows these products to be stocked without thermostat and have a kit supplied when required.

TYPE XTK
x-Max® KIT



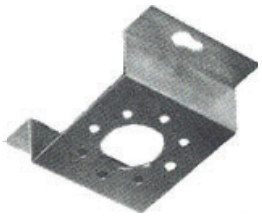
The model XTK is available either with a thermostat well assembly or with a packing gland and 60" capillary for remote bulb sensing.

Construction

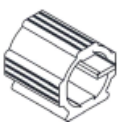
Housings and covers are made from copper-free extruded aluminum. Consult page F9 for unit dimensions.

Standard models XTW and XTB have an attractive black finish. Enclosures are provided with 3/4" NPT conduit entries on two sides.

All units are shipped with a **universal bracket** suitable for horizontal or vertical mounting.



UNIVERSAL MOUNTING BRACKET
(SEE PAGE F4 FOR DIMENSIONS)

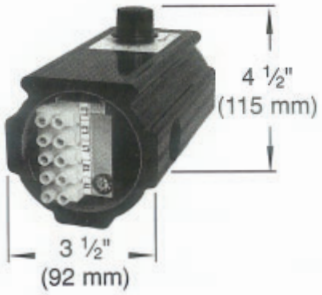


All XT explosion proof thermostats use the unique '**Track and Trolley**' wiring system for ease of connection. Models XTW and XTB are provided with a #14 GA wire lead for grounding purposes.

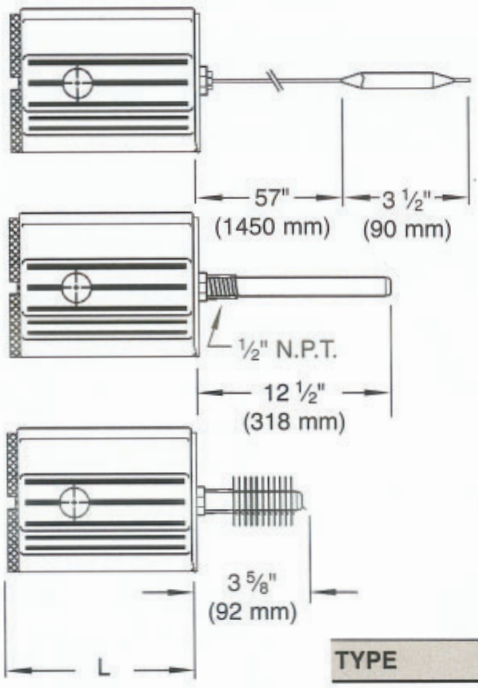
Selection

Refer to Table 1 to select the XT model best suited to your application. Note that all XT's are field convertible in minutes from externally adjustable to internally adjustable 'tamper-proof'. Just turn off the power and then simply open the cover, press down on the spring-loaded thermostat and unscrew the knob and shaft assembly. Replace this assembly with the socket-head cap screw provided as standard. When the cap screw is removed, the temperature can be adjusted using a slot-type screwdriver without having to remove the cover.

All thermostats feature a convenient terminal block mounted to a slide-out trolley.



This unique feature simplifies wiring.



TYPE	L
SPST	6 ½" (165 mm)
DPST	7 ¼" (185 mm)

TABLE 1 - MODEL XT EXPLOSION RESISTANT THERMOSTATS

DESCRIPTION	TEMPERATURE RANGE	HAZARDOUS AREA RATING		CATALOG NO.		APPROX. WT.
		Cl. 1 Gp. A,B,C,D Cl.2 Gp. E,F,G Cl.3	Cl.1. Gp C, D Cl.2 Gp E,F,G Cl.3	SPST - 15A/600V 1Ø 25A/277V	DPST - 15A/600V 3Ø	kg (lbs)
Remote Sensing Bulb, with 57" capillary length	-18 to 40°C (0-100°F)	–	✔	• XTB04481	• XTB04483	1.7 (3.8)
	10-120°C (50-250°F)	–	✔	• XTB12481	• XTB12483	1.7 (3.8)
Bulb in Well with ½" NPT Fitting for Liquid Sensing	-18 to 40°C (0-100°F)	✔	✔	• XTWL04481	• XTWL04483	1.8 (4.0)
	10-120°C (50-250°F)	✔	✔	• XTWL12481	• XTWL12483	1.8 (4.0)
Bulb in Finned Well for Air Sensing	-18 to 40°C (0-100°F)	✔	✔	• XTWA04481	• XTWA04483	1.8 (4.0)
	10-120°C (50-250°F)	✔	✔	XTWA12481	XTWA12483	1.8 (4.0)
For XB heaters, use as an add-on Kit, Well Assembly provided	-18 to 40°C (0-100°F)	✔	✔	• XTKW04481	• XTKW04483	0.3 (0.7)
	10-120°C (50-250°F)	✔	✔	XTKW12481	XTKW12483	0.3 (0.7)
For CX and XGB heaters, use as an add-on Kit, with 8" capillary	-18 to 40°C (0-100°F)	–	✔	• XTKB04481	XTKB04483	0.2 (0.5)
	10-120°C (50-250°F)	–	✔	XTKB12481	XTKB12483	0.2 (0.5)

• Normally stocked

Options

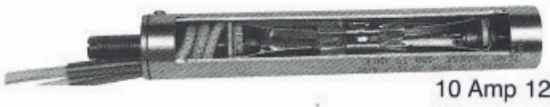
- 70°C to 280°C (150°F to 550°F) and 160°C to 370°C (300°F to 700°F) temperature ranges
- other cover styles
- series 2 housing construction (4 3/8" I.D.)
- various housing lengths up to 1220mm (48") with contactor and transformer
- multiple thermostats in one housing
- custom conduit entry size and location
- other finish options
- capillary protected with flexible armoured cable
- nickel plated or S.S. bulb and capillary

To Order

Specify quantity, catalog number, area classification and special features (consult factory).

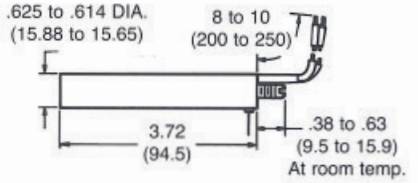
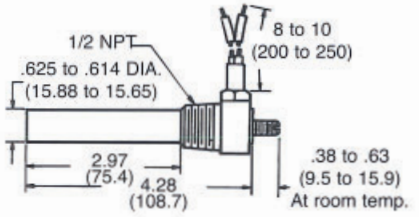
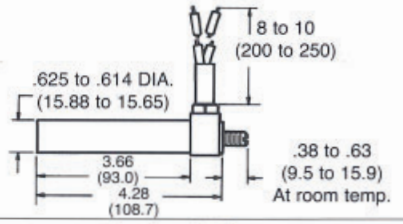
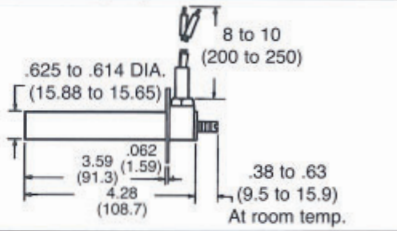
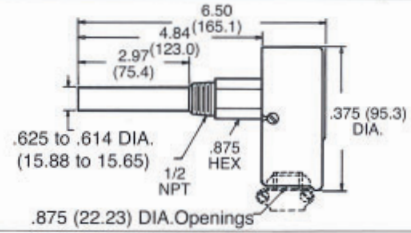
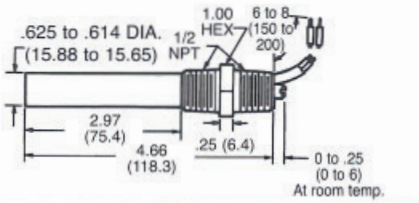
Fenwal Thermoswitch® Temperature Controls

The outer shell is an active sensing member, not merely a housing, resulting in a very fast response time. The shell and strut arrangement has anticipation characteristics substantially reducing overshoot. It is a slow make and break device with a resolution sensitivity of 0.05°C.



10 Amp 120 V
5 Amp 240 V

TABLE 1 - THERMOSWITCH® TEMPERATURE CONTROLS

THERMOSWITCH TYPE	DIMENSIONS IN INCHES (MILLIMETRES)	TEMP. RANGE	CONTACT ACTION ON TEMP. RISE	SHELL AND HEAD MAT'L	CATALOG NUMBER
 CARTRIDGE (Series 17000)		-100 to 400°F / -73 to 204°C	OPENS	Brass	01 017000 000
			CLOSES		01 017021 000
		-100 to 600°F / -73 to 316°C	OPENS	Type 300 Series S.S. Shell	01 017002 000
			CLOSES		01 017023 000
 HEX HEAD (Series 17100)		-100 to 400°F / -73 to 204°C	OPENS	Brass	01 017100 000
			CLOSES		01 017121 000
		-100 to 600°F / -73 to 316°C	OPENS	Type 300 Series S.S. Shell Brass Head	01 017102 000
			CLOSES		01 017123 000
 BLOCK HEAD (Series 17200)		-100 to 400°F / -73 to 204°C	OPENS	Brass	01 017200 000
			CLOSES		01 017221 000
		-100 to 600°F / -73 to 316°C	OPENS	Type 300 Series S.S. Shell Brass Head	01 017202 000
			CLOSES		01 017223 000
 FLANGE HEAD (Series 17300)		-100 to 400°F / -73 to 204°C	OPENS	Brass	01 017300 000
			CLOSES		01 017321 000
		-100 to 600°F / -73 to 316°C	OPENS	Type 300 Series S.S. Shell Brass Head	01 017302 000
			CLOSES		01 017323 000
 JUNCTION BOX IMMERSION (Series 17800)		-100 to 400°F / -73 to 204°C	OPENS	Brass	01 017800 000
			CLOSES		01 017821 000
		-100 to 600°F / -73 to 316°C	OPENS	Type 300 Series S.S. Shell Brass Head	01 017802 000
			CLOSES		01 017823 000
 COUPLING HEAD (Series 18000)		-100 to 400°F / -73 to 204°C	OPENS	Brass	01 018000 000
			CLOSES		01 018021 000
		-100 to 600°F / -73 to 316°C	OPENS	Type 300 Series S.S. Shell Brass Head	01 018002 000
			CLOSES		01 018023 000

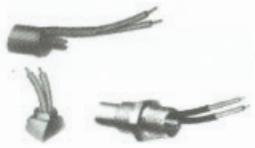
TO ORDER SPECIFY: quantity, catalog number, and any special features (see pg. F11).

Thermoswitch Modifications

Most modifications can be made to stock units on a short delivery basis. Modifications may be required to match replacement OEM equipment or to provide extra functionality for a new application. For complete information, check factory or request Fenwal brochure 1.10.

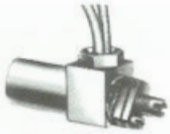
MOD 1
Special Marking

MOD 2
Extended Lead Wires

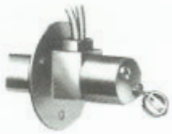


MOD 3
Factory Temperature Setting

MOD 4
Temperature Locking Device



MOD 5
Tamper-Proof Cap Over Adjusting Sleeve



MOD 6A
Large Dial & Knob (Specify Mid-Point Temperature)

MOD 6B
Small Dial & Knob (Specify Mid-Point Temperature)

MOD 8A
Moisture Resistant Seal On Adjusting Sleeve

MOD 8B
4 Hole Moisture Resistant Seal On Adjusting Sleeve used with Mod 6

MOD 10
Moisture Resistant Tamper-Proof Cap

MOD 11
Armoured Cable Over Lead Wires

MOD 13
Packing Gland On Lead Wires

MOD 14
Extended Adjusting Sleeve

NOTE: For volume OEM applications, special features including longer length shells and plating of brass parts are available. Check factory.

Thermostat Wells

In certain applications, draining the system to replace a thermoswitch is impractical. A permanently mounted well overcomes this obstacle. Wells may also be required in high pressure or corrosive applications. Although the Fenwal wells are accurately machined to reduce thermal lag, best control is still achieved by direct insertion.

FIG. 1

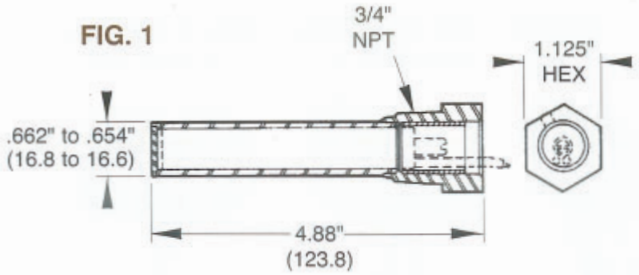


FIG. 2

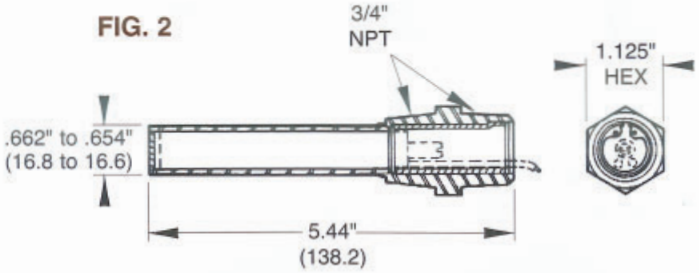


FIG. 3

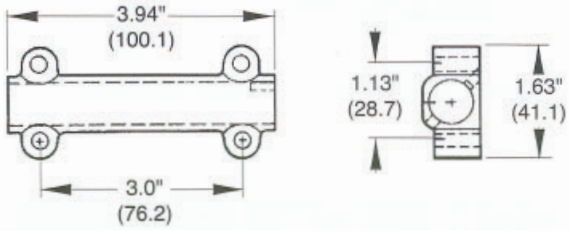


TABLE 2 - THERMOSTAT WELLS

DESCRIPTION	MATERIAL	CATALOG NO.
Fig. 1 Hex Head Well	321S.S. Well & Head 100 PSI @ 250°F 60 PSI @ 600°F	34 011201 000
Fig. 2 Coupling Head Well	"	34 011204 000
Fig. 3 Surface Mounting Well	Aluminum	34 011100 002

TO ORDER SPECIFY: quantity, catalog number, and any special features.

Series 20000 - SNAP ACTING THERMOSWITCH

Control action is provided by an expandable liquid acting in a bellows assembly. Bellows motion created by volume changes of the liquid activates a snap acting switch through a push rod. Snap switches have both normally open and normally closed contacts with a 15 amp resistive 120 / 240 VAC rating. Control differential is approximately 3.5% of span.

FIG. 1 - MODEL 23-0201XX-000

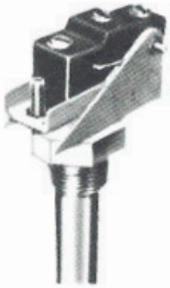


FIG. 2 - MODEL 23-0203XX-000

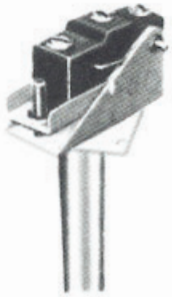


FIG. 3 - MODEL 23-0208XX-000

FIG. 4 - MODEL 23-0210XX-000*

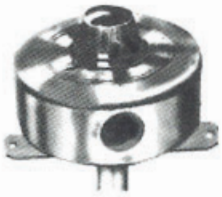


FIG. 5 - MODEL 23-0211XX-000*

*shown with optional dial and knob (MOD30)

TABLE 1 - SNAP ACTING THERMOSWITCH

TEMP. RANGE	FIG.	RATING	CATALOG NO.
100 to 300°F	1	15 Amp,120-250 VAC	23 020100 000
	2	"	23 020300 000
	3	"	23 020800 000
25 to 225°F	1	"	23 020110 000
	2	"	23 020310 000
	3	"	23 020810 000
50 to 300°F	4	"	23 021000 000
	5	"	23 021100 000
0 to 250°F	4	"	23 021010 000
	5	"	23 021110 000

TO ORDER: Specify quantity, catalog number and any special features.

Series 400 - INDICATING TEMPERATURE CONTROLLER

The 400 line is an on-off bulb and capillary control. The die cast aluminum housing is designed to NEMA 4 weather resistant standards. The stainless steel bulb and capillaries are available in many sizes and lengths. The snap acting switches are rated for 15 Amp, 125 - 250 VAC and are single pole, double throw. Control differential is typically 1.5% of span.

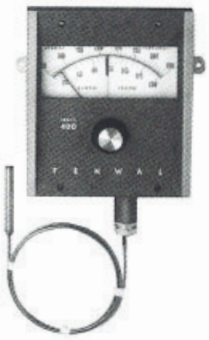


TABLE 2 - 400 LINE CONTROL

TEMP. RANGE	BULB SIZE	DESCRIPTION	CATALOG NO.
-150 to 200°F (-100 to 95°C)	.375" x 2.81"	1 KNOB 1 SWITCH 15A 250V	40 702010 401
50 to 200°F (10° to 95°C)	.375" x 5.87"		40 702010 403
50 to 700°F (10 to 370°C)	.375" x 1.87"		40 702010 416
-30 to 170°F (-35 to 75°C)	.375" x 4.92"	1 KNOB 2 SWITCHES	40 703010 408
50 to 300°F (10 to 150°C)	.375" x 4.40"		40 703010 424
50 to 400°F (10 to 200°C)	.375" x 3.20"	2 KNOBS 2 SWITCHES	40 704010 425
50 to 500°F (10 to 260°C)	.375" x 2.55"		40 704010 429

NOTES:

- Listed units above have 6 ft. capillaries. Other lengths available.
- Bulbs shown are style A, .375" Dia. Other styles available.
- All temperature ranges are available in all combinations of one or two switches and one or two knobs.

TABLE 3 - MOD 25 PACKING GLAND

GLAND SIZE	MOD. NO.	CATALOG NUMBER
NICKEL PLATED BRASS		
3/8 - 18 NPT	25A	40 990250 001
1/2 - 14 NPT	25B	40 990250 002
3/4 - 14 NPT	25C	40 990250 003
316 STAINLESS STEEL		
3/8 - 18 NPT	25D	40 990250 004
1/2 - 14 NPT	25E	40 990250 005
3/4 - 14 NPT	25F	40 990250 006

TO ORDER: Specify quantity, catalog number and any special features.

Precision Snap-Disc Thermostats

High quality snap-disc thermostats are custom made in quantities of 50 pieces and up, primarily for original equipment manufacturers. Typically, snap-discs are used as high limits. Contact factory for design assistance.

TABLE 1- SNAP-DISC THERMOSTATS

DIMENSIONS DIA.	HEIGHT	RATING	SET-POINT RANGE	CATALOG NUMBER
08-0X SURFACE MOUNT SNAP DISC				
0.640"	0.250"	7A 240VAC	-12 - 177°C; 10 - 350°F	08-01
0.640"	0.350"	12A 240V		08-02
0.667"	0.350"	5A 240V	-12 - 288°C; 10 - 550°F	08-03
08-8X PROBE STYLE SNAP DISC				
0.545"	9/16" or 1" Probe Length Standard	3A 240V	-12 - 288°C; 10 - 550°F	08-80
0.545"	9/16" or 1" Probe Length Standard	5A 240V	-12 - 177°C; 10 - 350°F	08-81

08-8X also available in coupling head styles

Control Panel Thermostat

These Fenwal snap-discs have been designed to control low wattage SS or SD type Caloritech™ strip heaters which are commonly used to heat control panels to prevent buildup of damaging internal moisture in low temperatures.

FIG. 1

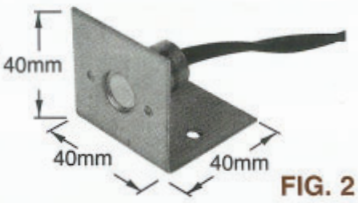


FIG. 2

TABLE 2 - PANEL THERMOSTAT

DESCRIPTION	FIG.	CONTACT RATING	OPERATING TEMP.	CATALOG NUMBER
Less BRACKET	1	12 AMP	Open 13°C	15897 001
c/w BRACKET	2	120/240 VAC	Close 2°C (fixed)	15897 002

Detect-a-Fire® Units

These highly reliable detection and release devices have been a standard of the industry for over 45 years; controlling the release of fire suppression agents such as CO_2, water, or dry chemicals. In some systems the device is used as an alarm to sense overheat or fire and alert personnel. In other systems, it is used to sense fire and actuate fire attack systems.

Detect-a-Fire units are designed with rate compensation. Only the Detect-a-Fire unit accurately senses the surrounding air temperature as well as fire growth rate. At precisely the predetermined danger point, the system is activated.

FIG. 3

FIG. 4

FIG. 5

FIG. 6

TABLE 3 - FENWAL DETECT-A-FIRE®

Contact Action On Rise	Fig. No.	Description	Catalog Number
OPEN	4	Horizontal Flush	12 027020 000
OPEN	3	Horizontal Surface	12 027020 001
CLOSE	4	Horizontal Flush	12 027021 000
CLOSE	3	Horizontal Surface	12 027021 001
OPEN	5	Vertical Hex	12 027120 000
CLOSE	5	Vertical Hex	12 027121 000
OPEN	6	Vertical Coupling	12 028020 003
CLOSE	6	Vertical Coupling	12 028021 000

5.0 Amps, 125 VAC
0.5 Amps, 125 VDC

Horizontal detectors (FIGS. 3 & 4) are designed for locations where appearance is a factor. Horizontal detectors are suitable for non-hazardous locations. Flush mounted units (FIG. 3) are designed to mount onto standard 4" octagonal electrical boxes.

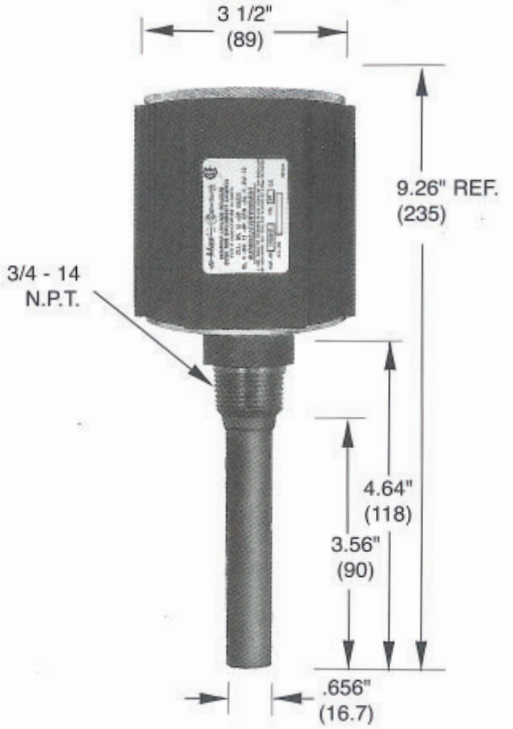
Vertical detectors (FIGS. 5 & 6) can be operated in hazardous locations provided they are terminated in an approved fitting. Models are available for all hazardous locations.

TO ORDER: Specify quantity, catalog number and temperature setting.

Series XTF - THERMOSWITCH® CONTROLLERS FOR HAZARDOUS LOCATIONS

The XTF Thermoswitch® is an assembly consisting of a Thermoswitch Unit, well assembly, and explosion-proof junction box designed to meet the UL & CSA requirements of Class I, Groups A, B, C & D, and Class II, Group E, F & G, Division 1 & 2 locations.

The sensing element, which is a cartridge-type Thermoswitch Unit, is seated in the well assembly and held in place by a snap ring. The well assembly, in turn, is threaded in to the explosion-proof junction box, giving protection to the controller.



FENWAL SERIES 17000

Electrical Rating: 10 Amps @ 120 VAC
5 Amps @ 240 VAC
Resistive

Pressure Rating: 100 PSIG @ 250°F
60 PSIG @ 500°F

TABLE 1 - SERIES XTF

TEMP. RANGE	CONTACT ACTION ON TEMP. RISE	CATALOG NUMBER
-100 to 400°F	OPENS	XTF17000
-100 to 400°F	CLOSES	XTF17021

NOTE: Above units can be factory preset and/or locked to any temperature within the range. Check factory for details.

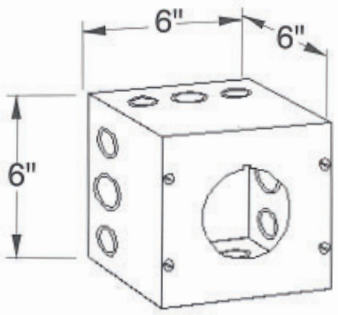
Percentage Timers

APPLICATION

Type OKT percentage timers (input controllers) are used mainly for pulsing power to metal tubular element radiant heaters. Where load voltage and current ratings exceed the timer contact rating, the timer can be used to switch contactors (see page F25). Percentage timers can not be effectively used on quartz lamp radiant heaters.

FIG. 1 Percentage timer

FIG. 2 Surface mounting enclosure



4 mounting holes
1/4" diameter
on 4" centers

OPERATION

The OKT features a synchronous motor driven cam which closes a snap action switch for a percentage of 30 second "on" time. The adjustment knob sets the pointer to an "on" time of 0 to 100%. A timer set to 50% (mid scale) would allow full voltage to the heater(s) for 15 seconds and no voltage for 15 seconds thus reducing the average heat output. Standard features include a plug-in style mounting, an electrically isolated pilot light and a cycle progress pointer.

TABLE 2 - PERCENTAGE TIMER

FIG.	DESCRIPTION	CATALOG NUMBER
1	30 second cycle percentage timer 10 Amps 120/240 VAC S.P.S.T.	OKT3010M
2	type 1 surface mounting enclosure 6" x 6" x 6"	OKE666

TO ORDER: Specify quantity, catalog number and temperature setting.

Specific Purpose Thermostats

Some of the more popular thermostats available from are shown below.

Room thermostats are normally wall mounted to sense room ambient temperature. Various models are available: some can switch line voltage resistive loads up 600 VAC, some are designed for 24 VAC low voltage systems and others have 0-135 Ω proportional outputs for step controls and SCR's.

Remote bulb controls normally mount on ducts, tanks, boilers, ovens, etc. and are also available in models for line voltage or pilot duty switching and with proportional outputs.

FIG. 1

FIG. 2

FIG. 3

FIG. 4

FIG. 5

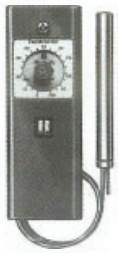


FIG. 6

TABLE 1 - ROOM THERMOSTATS

Fig. No.	Temp. Range	Contact Rating	Features	Catalog No.
1	5 - 25°C (40 - 80°F)	21A 240VAC S.P.S.T.	- Standard leads - Snap action switch - Heat anticipator	T498A1786
1	5 - 25°C (40 - 80°F)	21A 240VAC D.P.S.T.	- Standard leads - Snap action switch - Heat anticipator	T498B1652
2	13 - 30°C (55 - 85°F)	21A 240VAC S.P.S.T.	- Locking screw - Thermometer - Heavy duty	196-12
3	13 - 32°C (55 - 90°F)	25A 277VAC 15A 600VAC D.P.S.T.	- Breaks 1 pole thermostatically - Breaks 1 pole mechanically - Heavy duty	TC620
3	13 - 32°C (55 - 90°F)	15A 600VAC T.P.S.T.	- Breaks 2 poles thermostatically - Breaks 1 pole mechanically - Heavy duty	TC630
4	10 - 30°C	0 - 135 Ohms	- Proportional for step control or SCR	T921A1522

TABLE 2 - ELECTRONIC REMOTE BULB THERMOSTAT

Fig. No.	Temp. Range	Contact Rating	Features	Catalog No.
5	-29 to 116°C (-20 to 240°F)	10A 120V 5A 240V	Electronic 4 stage c/w sensor	T775A1035

TABLE 3 - TWO STAGE THERMOSTAT

Fig. No.	Temp. Range	Contact Rating	Capillary Length	Catalog No.
COPPER CAPILLARY AND BULB (1/2" DIA. x 4 13/16")				
6	-15 to 35°C (5 - 95°F)	2000 VA 240 VAC PILOT DUTY	6000 mm (236 in.)	T678A1163
6	15 - 75°C (59 - 167°F)		6000 mm (236 in.)	T678A1403
6	75 - 125°C		1500 mm (59 in.)	T678A1239

TABLE 4 - PROPORTIONAL THERMOSTAT

Fig. No.	Set Point	Throttling Range	Capillary Length	Catalog No.
COPPER CAPILLARY AND BULB (1/2" DIA. x 4 13/16")				
6	-18 to 38°C (0 - 100°F)	1.7 - 16.7°C (3 - 30°F)	6000 mm (236 in.)	T991A1012
6	-34 to 21°C (-29 to 70°F)	1.7 - 16.7°C (3 - 30°F)	1500 mm (59 in.)	T991A2044
6	13 - 79°C (55 - 174°F)	1.9 - 20°C (3.5 - 36°F)	6000 mm (236 in.)	T991A1194
6	71 - 127°C (160 - 261°F)	1.7 - 16.7°C (3 - 30°F)	1500 mm (59 in.)	T991A1061
6	71 - 127°C (160 - 261°F)	1.7 - 16.7°C (3 - 30°F)	6000 mm (236 in.)	T991A1079
6	13 - 79°C (55 - 174°F)	1.9 - 20°C (3 - 30°F)	1500 mm (59 in.)	T991A1186

TO ORDER SPECIFY: quantity, catalog number, and any special features.

Series 195 - THERMISTOR SENSING TEMPERATURE CONTROL

The 195 is a reduced feature, cost effective electronic control designed primarily for the OEM. The unit is available on-off in an open snap track mounting with relay output and field selectable 120, 208, or 240 VAC input power.

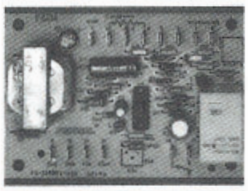


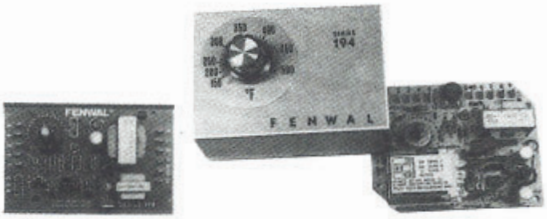
TABLE 1 - SERIES 195

CONTROL	OUTPUT	CATALOG NO.
On-Off	SPST Relay 7.5A 120V, 5A 240V	19 524007 200

TO ORDER SPECIFY: Quantity, and catalog no. - also select thermistor catalog no. from Table 3.
The temperature range is determined by the sensor.

Series 194 - THERMISTOR SENSING TEMPERATURE CONTROL

The 194 electronic control is a versatile and economical solution to temperature control requirements in the -15°C to 270°C range. Thermistor sensing controls combine accuracy and speed of response for applications needing better control than provided by mechanical controls. Control differentials are typically 0.2°C.



Series 194 is available with on-off or time proportioning control; relay, triac, or SSR outputs; local or remote set points and field selectable 120, 208 or 240 VAC input power.

TABLE 2 - SERIES 194

CONTROL	OUTPUT	CATALOG NO.
On-Off	SPDT Relay 10A 120V, 5A 240V	19 424005 200
Proportioning	"	19 404005 200
Proportioning	Remote Set Point SSR Driver	19 404077 200

TO ORDER SPECIFY: Quantity, and catalog no. - also select thermistor catalog no. from Table 3.
The temperature range is determined by the sensor.

Thermistor Probes

The probes shown are custom to Fenwal controls. The thermistor probe, along with the appropriate dial, determines the temperature range of the 194/195 temperature control.

STYLE B CARTRIDGE

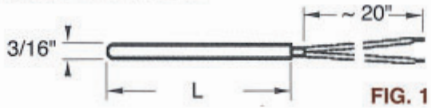


FIG. 1

STYLE E COUPLING HEAD

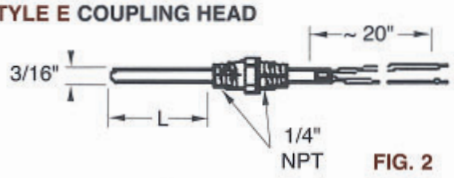


FIG. 2

TABLE 3 - THERMISTOR PROBES

'L.' DIM. (IN.)	TEMPERATURE RANGE SERIES 194 °F	SERIES 194 °C	SERIES 195 °F	SERIES 195 °C	CATALOG NUMBER
STYLE B CARTRIDGE (FIG. 1)					
1.5	-90 - 125	-70 - 50	-	-	28 230103 308
3.0					28 230106 308
1.5	0 - 200	-10 - 100	25 - 250	-10 - 130	28 230103 304
3.0					28 230106 304
1.5	-	-	75 - 270	30 - 130	28 430103 313
3.0					28 430106 313
1.5	100 - 375	40 - 190	125 - 350	50 - 175	28 230103 302
3.0					28 230106 302
1.5	150 - 525	70 - 270	200 - 450	100 - 250	28 230103 305
3.0					28 230106 305
STYLE E COUPLING HEAD (FIG. 2)					
1.5	-90 - 125	-70 - 50	-	-	28 230803 308
3.0					28 230806 308
1.5	0 - 200	-10 - 100	25 - 250	-10 - 130	28 230803 304
3.0					28 230806 304
1.5	-	-	75 - 270	30 - 130	28 430803 313
3.0					28 430806 313
1.5	100 - 375	40 - 190	125 - 350	50 - 175	28 230803 302
3.0					28 230806 302
1.5	150 - 525	70 - 270	200 - 450	100 - 250	28 230803 305
3.0					28 230806 305

Other sizes and configurations available on special order. Check factory.

TABLE 4 - DIAL SELECTION CHART

PROBE SUFFIX	SERIES 194 DIAL RANGE	SERIES 194 CATALOG NO.	SERIES 195 DIAL RANGE	SERIES 195 CATALOG NO.
-308	-90 - 125°F -70 - 50°C	06 231013 001 06 231013 011	—	—
-304	0 - 200°F -10 - 100°C	06 231013 002 06 231013 012	25 - 175°F	06 231013 074
-313	75 - 270°F	—	75 - 270°F	06 231013 075
-302	100 - 375°F 40 - 190°C	06 231013 068 06 231013 013	125 - 350°F	06 231013 076
-305	150 - 525°F 70 - 270°C	06 231013 004 06 231013 014	200 - 450°F	06 231013 077

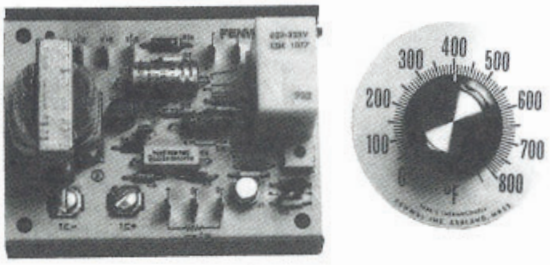
TO ORDER SPECIFY: Quantity and catalog number.

Series 544 - THERMOCOUPLE SENSING CONTROL

The 544 is an economical solution to temperature control requirements in the -20 to 430°C (0 to 800°F) range. Snap track mounting and remote potentiometer make it ideal for OEM and panel mount applications.

The 544 has a field selectable supply voltage of 120, 208 and 240 VAC.

Control differential is typically ±1°C.



544 SERIES TEMPERATURE CONTROL

SPECIFICATIONS

CONTROL MODE: On-Off or Time Proportioning

TEMPERATURE RANGES: 0 - 400°F or
0 - 800°F

SENSOR: "J" type thermocouple
sold separately (see page F21)

OUTPUT: 7.5 amp 120 VAC
5A 240 VAC SPST relay
(SSR output optional)

CYCLE TIME (prop. model): Nominal 25 seconds

BANDWIDTH (prop. model): 15°F

DIFFERENTIAL (on-off model): 3°F

TABLE 1 - 544 SERIES TEMPERATURE CONTROL

CONTROL	TEMP. RANGE	CATALOG NO.
On-Off	0 - 400°F	54 401653 102
On-Off	0 - 800°F	54 401653 103
Time Proportioning	0 - 400°F	54 403653 102
Time Proportioning	0 - 800°F	54 403653 103

TO ORDER SPECIFY: Quantity and catalog number.

Series 543 - THERMOCOUPLE SENSING CONTROL

The 543 is a premium quality non-indicating thermocouple, sensing manual reset (FM approved) limit control. Units are enclosed in surface mount metal enclosures for stand alone or panel installation. Controls accept 'J' or 'K' thermocouples as shown. Voltage inputs 120, 208, 240V are field selectable. Control differential is typically 0.25% of span.

543 SERIES TEMPERATURE LIMIT CONTROL

SPECIFICATIONS

OUTPUT: 10A 120 VAC, 5A 240 VAC
SPDT relay

NOTE: Thermocouple probes are sold separately. See page F21 for selection.

TABLE 2 - SERIES 543 THERMOCOUPLE CONTROL

T/C	TEMP. RANGE	CATALOG NUMBER
HIGH LIMIT PROTECTORS		
J	0 - 800°F	54 302121 103
J	-20 to 430°C	54 302121 203
K	0 - 2000°F	54 302121 106
K	-20 to 1100°C	54 302121 206

SERIES 550 - ELECTRONIC INDICATING (ANALOG) CONTROLS

The 550 series 1/4 DIN thermocouple sensing electronic control is a panel mount, plug in style device, in use by plastics, packaging and machinery manufacturers for many years. Several popular models are shown below. Check factory for others.

MODE	T/C	RANGE	CATALOG NUMBER
on-off	J	0 - 800°F -20 to 430°C	55 001840 303
prop.	J	0 - 800°F -20 to 430°C	55 003840 303
on-off	K	0 - 2000°F -20 to 1100°C	55 001840 306

Other models available, check factory.

TO ORDER SPECIFY: Quantity and catalog number.

Series UT - ELECTRONIC INDICATING CONTROLS

Series UT Yokogawa electronic controls are available in 1/4 and 1/8 DIN sizes. Red LED displays show both process and set point.

The UT can accept inputs from all thermocouples, RTDs, mV and mA. Outputs can be relay, pulse DC for solid state relays and 4 - 20 mA for step controls and SCRs. Most controls are field configurable to any input and output.

UT320 SERIES ELECTRONIC INDICATING CONTROL

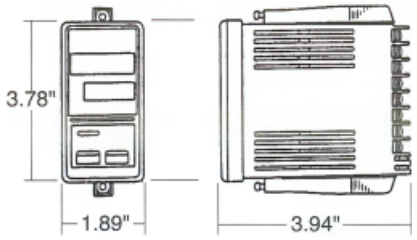


TABLE 1 - UT320 SPECIFICATION TABLE

PV/SP Data Display	4 digits / 4 digits
PV Input	1 universal input (TCs, RTDs, mV, V)
Indication Accuracy	0.1%±1 digit
Auxiliary Analog Input	Not Available
Control Scan Period	250ms
Control Loops	1
Control Modes	MAN/AUTO
Number of Setpoint(SP)	4
Control Algorithm	ON/OFF, PID (continuous, time-proportional), heating & cooling
SUPER, Auto Tuning	SUPER, SUPER2, AT
Control Outputs(MV)	Select from Relay, Voltage Pulse or 4-20 mA
Auxiliary Analog Output(*) (4-20mA)	1 point except for Heating/Cooling control (cannot use with LPS15V)
Loop Power Supply (LPS)	2 points, 15V and 24V(optional)
Digital Inputs	2
Digital Outputs	3
RS485 Communication Protocols	Four-wire, MODBUS, PC-link, Ladder or Coordinated Operation
Approvals	UL, CE, CSA. Front Protection IP55
Other Specifications	48(W) x 96(H) x 100(D) mm 90 to 264VAC power supply max. 20VA power consumption
Ambient T, Limits RH	0-50°C, 20-90%RH

TABLE 2 - UT320 MODEL AND SUFFIX CODES

MODEL	SUFFIX CODE		DESCRIPTION
UT320			Digital indicating controller
Type	-0		Standard type
	-2		Heating/cooling type
	-3		Standard type with 24V DC loop power supply
Options		0	None
		1	Communication functions, heater burnout alarm (2 points)*
		2	Heater burnout alarm (2 points)

*Sensor for heater burnout alarm sold separately.

UT350/UT450 SERIES ELECTRONIC INDICATING CONTROL

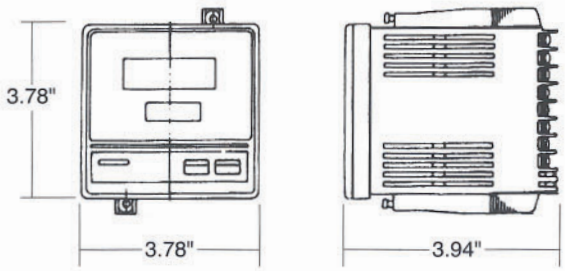


TABLE 1 - UT350/UT450 SPECIFICATION TABLE

	UT350	UT450
PV/SP Data Display	4 digits / 4 digits	5 digits / 5 digits
PV Input	1 universal input (TCs, RTDs, mV, V)	
Indication Accuracy	0.1%+1 digit	
Auxiliary Analog Input	Not Available	1 for remote SP
Control Scan Period	250ms	200ms
Control Loops	1	1
Control Modes	MAN/AUTO	MAN/AUTO/CAS, RUN/STOP
Number of Setpoint(SP)	4	8
Control Algorithm	ON/OFF, time-proportional PID, continuous PID, heating & cooling	ON/OFF, 3 position, time-proportional PID, continuous PID, heating & cooling
SUPER, Auto Tuning	SUPER, SUPER2, AT	
Control Outputs(MV)	Select from Relay, Voltage Pulse or 4-20 mA	
Auxiliary Analog Output(*) (4-20mA)	1 point except for Heating/Cooling control (cannot use with LPS15V)	1 point (cannot use with LPS15V) 2 points when MV is relay output
Loop Power Supply (LPS)	2 points, 15V and 24V(optional)	
Digital Inputs	2	2, 3, 6 or 7
Digital Outputs	3	3 or 4
RS485 Communication Protocols	Four-wire, MODBUS, PC-link, Ladder or Coordinated Operation	
Approvals	UL, CE, CSA. Front Protection IP55	
Other Specifications	96(W) x 96(H) x 100(D) mm, 90 to 264VAC power supply max. 20VA power consumption	
Ambient T, Limits RH	0-50°C, 20-90%RH	

TABLE 2 - UT350 MODEL AND SUFFIX CODES

MODEL	SUFFIX CODE	DESCRIPTION
UT350		Digital indicating controller
Type	-0	Standard type
	-2	Heating/cooling type
	-3	Std type with 24V DC loop
Options	0	None
	1	Communication functions, heater burnout alarm (2 pts)*
	2	Heater burnout alarm (2 pts)

*Sensor for heater burnout alarm sold separately.

TO ORDER SPECIFY: Quantity and catalog number.

TABLE 3 - UT450 MODEL AND SUFFIX CODES

MODEL	SUFFIX CODE	DESCRIPTION
UT450		Digital indicating controller
Type	-0	Standard type
	-1	Position-proportional type
	-2	Heating/cooling type
	-3	Std type with 24V DC loop
	-4	Position-proportional type with 24V DC loop power supply
Options	0	None
	1	Comm. functions, remote input, 5 add. DIs, 1 add. alarm
	2	Comm. functions, remote input, 1 add. DI
	3	4 add. DIs, 1 add. alarm
	4	Remote input, 1 add. DI

SERIES 100 - ELECTRONIC INDICATING CONTROLS

The 100 series of 1/16 DIN sized controls are available in a number of models having a variety of features to suit the particular application.

FIG. 1

FIG. 2

FIG. 3

FIG. 4

The S100 is the lowest cost single digital display model.

The C100 is a general purpose control with dual digital displays for both process and set point.

The D100 offers high end process features for applications where a 1/8 or 1/4 DIN control is not appropriate.

The CB100L is an indicating, manual reset, high limit, FM approved control used in conjunction with another process control. Table 1 shows the features for each model.

TABLE 1 - 100 SERIES

MODEL	DESCRIPTION	CATALOG NO.
S100 (Fig. 1)	T/C Input/Relay Output	S100F**X**A8-M*NN
	T/C Input/SSR Output	S100F**X**A8-V*NN
	RTD Input/Relay Output	S100FDB6-M*NN
	RTD Input/SSR Output	S100FDB6-V*NN
C100 (Fig. 2)	T/C Input/Relay Output	C100F**X**A3-M*NN
	T/C Input/4-20 mA Output	C100F**X**A3-8*NN
	RTD Input/Relay Output	C100FDA1-M*NN
	RTD Input/4-20 mA Output	C100FDA1-8*NN
D100 (Fig. 3)	All Inputs/Relay Output	D100F-MN*NN-NN-NN
	All Inputs/SSR Output	D100F-VN*NN-NN-NN
	All Inputs/4-20 mA Output	D100F-8N*NN-NN-NN
CB100L (Fig. 4)	T/C Input/Relay Output	CB100L**X**A3-M*NN-N-NN/A

NOTE: For thermocouple input controllers, replace '**X**' with the thermocouple type (i.e. J or K). Other models available, check factory.

STANDARD FEATURES

	S100	C100	D100	CB100L
Accuracy				
+/- 0.5% of span	✔	✔	-	-
+/- 0.3% of span	-	-	✔	-
Auto tune	✔	✔	✔	-
Fuzzy logic	-	-	✔	-
Configurable control modes	✔	✔	✔	-
Display				
dual	-	✔	✔	✔
single	✔	-	-	-
Inputs				
T/C, RTD, current voltage	-	✔	✔	✔
T/C, RTD (only)	✔	-	-	-
Outputs				
relay	✔	✔	✔	✔
SSR pulse	✔	✔	✔	-
4-20 ma	-	✔	✔	-
triac driver	-	✔	-	-
Loop break alarm	✔	OPT.	✔	-
Ramp to set point	-	-	✔	-
OPTIONAL FEATURES				
2 Alarms (temperature)	✔	✔	✔	✔
Heater break alarm	✔	✔	✔	-
Loop break alarm	STD.	✔	STD.	-
Communications	-	-	✔	✔
Retransmitted output	-	-	✔	✔
Remote reset	-	-	-	✔
Auxiliary set point	-	-	✔	-

TO ORDER: Specify quantity and catalog number.

Standard Thermocouples

Thermocouples are sensing devices used with electronic controls (such as Fenwal models 921, 550, & 543). Some normally stocked types are shown below. Many other configurations can be made to order. See Section D of the Caloritech™ catalog for general information.

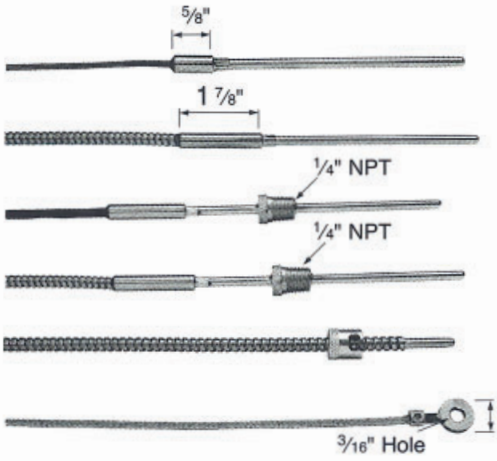


FIG. 1
FIG. 2
FIG. 3
FIG. 4
FIG. 5
FIG. 6

TABLE 1 - STANDARD THERMOCOUPLES

ANSI TYPE	PROBE LENGTH	LEAD LENGTH	LEAD TYPE	FIG.	CATALOG NO.
J	3"	72"	FIBERGLASS	1	J316G31603721ASP
J	6"	72"	"	1	J316G31606721ASP
J	12"	72"	"	1	J316G316012721ASP
J	18"	72"	"	1	J316G316018721ASP
J	24"	72"	"	1	J316G316024721ASP
J	3"	72"	PVC/ARM'R	2	J316G31603728A
J	6"	72"	"	2	J316G31606728A
K	12"	72"	FIBERGLASS	1	K316G316012721ASP
K	18"	72"	"	1	K316G316018721ASP
K	24"	72"	"	1	K316G316024721ASP
J	3"	72"	PVC	3	J316G316FX1/403724A
J	3"	72"	ARMOUR	4	J316G316FX1/403728A
J	ADJ	72"	"	5	TC11468-01
J	-	48"	-	6	J15406A48
J	1 1/8"	-	TERM. ENCL.	7	TC11467-01
J	1 5/8"	-	"	7	TC11467-02
J	2 7/8"	-	"	7	TC11467-03

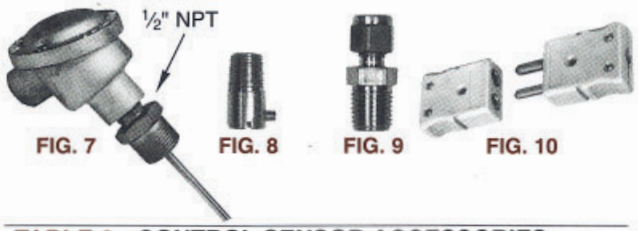


FIG. 7 FIG. 8 FIG. 9 FIG. 10

TABLE 2 - CONTROL SENSOR ACCESSORIES

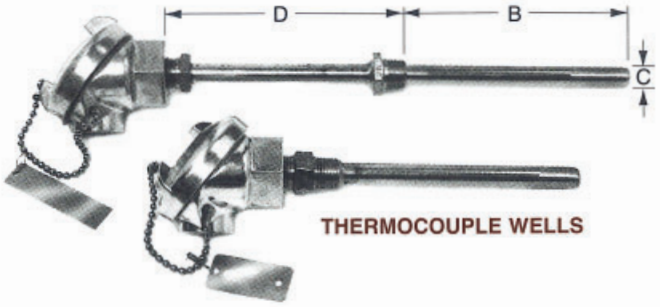
DESCRIPTION	FIG.	CATALOG NO.
1/8" NPT BAYONET ADAPTOR	8	BA4011-1
1/4" NPT COMPRESSION FITTING	9	A10687-36
PIPE CLAMP ADAPTOR	-	10949-2A
J PLUG (BLACK)	10	CO 45101
J JACK (BLACK)	10	CO 45201
K PLUG (YELLOW)	10	CO 45102
K JACK (YELLOW)	10	CO 45202

TO ORDER SPECIFY: Quantity and catalog number.

Thermocouple Well Assemblies

These assemblies are used mostly in tank applications to provide a strong one piece device to sense liquid temperatures. The terminal enclosure can be used outdoors or in dusty, oily or damp environments. Optional enclosures are available for hazardous applications.

Wells are constructed of steel or stainless for most applications. For highly corrosive liquids, check with the factory for custom bar stock well assemblies.



THERMOCOUPLE WELLS

TABLE 3 - THERMOCOUPLE WELLS

ANSI TYPE	PROCESS FITTING	WELL MAT'L	DIMENSIONS B	C	D	CATALOG NO.
J	3/4" NPT	STEEL	18"	.840	5 3/4"	B10013-01
J	3/4" NPT	304 SS	18"	.840	5 3/4"	B10013-02
J	1/2" NPT	304 SS	6"	.540	6 1/4"	B10013-03
J	3/4" NPT	304 SS	4 1/2"	.540	2 1/2"	B10013-06
J	1/2" NPT	316 SS	6"	.540	1 1/2"	B10013-09

Thermocouple Wire

FIG. 11

FIG. 12

FIG. 13

TABLE 4 - THERMOCOUPLE / INSTRUMENTATION EXTENSION WIRE

Gauge	ANSI Type	Fig.	Insulation Temperature	Catalog Number
UNTWISTED, NO SHIELD				
16	JX	11	PVC 105°C	P/P 16 JX
20	JX	11	"	P/P 20 JX
16	KX	11	"	P/P 16 KX
20	KX	11	"	P/P 20 KX
16	KX	12	G-Glass, 510°C	G/G 16 KX
20	KX	12	Fiberglass	G/G 20 KX
TWISTED, SHIELDED WITH DRAIN WIRE				
20	JX	13	PVC 105°C	UP/ALPTW20JX
20	KX	13	PVC 105°C	UP/ALPTW20KX
RTD 3WIRE COPPER, SHIELDED				
16	Copper	13	PVC 105°C	UP/ALPTW16FTRIAD
INSTRUMENT 2WIRE COPPER, SHIELDED				
16	Copper	13	PVC 105°C	UP/ALPTW16FBX

TO ORDER SPECIFY: Quantity and catalog number.

Electronic Step Controls

A step control will bring on stages a few seconds apart. As the process reaches set point, stages will drop out until the heat required balances the losses. Under steady state operation some stages remain on and one or two stages may cycle to maintain straight line control.

Series R851B Step Control

The R851B is frequently used in boiler and duct heater systems.

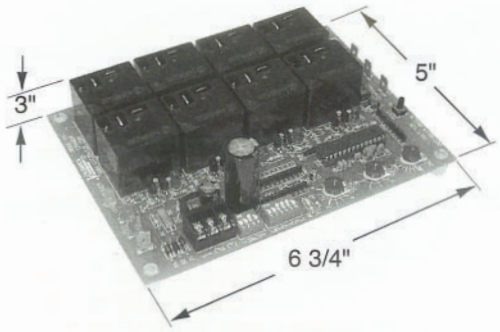


TABLE 1 - R851B SERIES STEP CONTROL

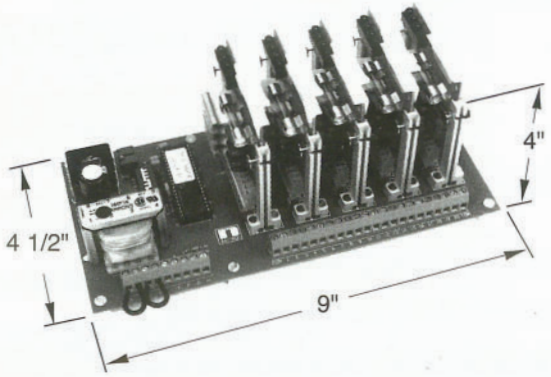
No. of Stages	Input Signal	Relay Rating	Power	Catalog Number
4	0-135 Ω 2-10 VDC 4-20 mA	10Amp 240 VAC MAX	24 VAC	R851B-4
8				R851B-8

SEQUENCE: Selectable: First stage in, last stage out; or first stage in, first stage out

Base Load Step Controls

A base load step control is used with a number of contactors and an SCR. Contactors step on approximately 80% of the load while the last 20% is controlled by an SCR for very fine trimming.

A temperature control feeds a signal to the SCR. A signal from the SCR indicating the SCR is at 100% output will cause the step control to bring on stages. If the SCR is at zero output, stages will drop out. As long as the SCR is modulating, base loads are neither added nor dropped out.



566 Series Step Control

The 566 base load step control is made up of a mother board and 1 to 5 output boards, each with 4 outputs, for a maximum of 20 stages (as shown above).

Time delay between stages is independently adjustable for up and down sequencing from 1 to 200 seconds per stage.

This step control can operate in base load control mode by receiving a signal from an SCR. It can also operate in standard step control mode receiving process signals directly from a control.

TABLE 4 - 566 SERIES STEP CONTROL
MOTHER BOARD WITH RELAY BOARDS (4 PER CARD)

No. of Stages	Input Signal	SSR Output	Power	Catalog Number
4	0/10V (SCR) 4-20 mA, 0-135 Ω	24-120 VAC, 2 Amp Max. per stage	120 VAC	566-4
8				566-8
12				566-12
16				566-16
20				566-20

TO ORDER: Specify quantity, part number, input and number of stages.

Thyristor Power Controls (SCR's)

SCR's are solid state switches which can open and close silently and as frequently as the control device dictates (even many times per second). This fast switching does not affect the life of the device as there are no moving parts. Also see discussion in Section D of the Caloritech™ catalog.

Besides improving process control, the fast switching will extend heater life. Heaters will normally stabilize at actual requirements rather than continuously cycling between off and maximum output.

For most process applications, zero voltage switched SCR's are preferred. This type produces minimal voltage spikes that may cause radio frequency interference (RFI). Phase angle fired units are available as an option for low mass heating sources that can change temperature rapidly - such as infrared lamps.

TABLE 1 - DIMENSIONS

SERIES	AMPS	DIMENSIONS - IN (mm) W	H	D
ZF2	15-40	9.6 (244)	6 (152)	3.1 (79)
ZF2	70	17.25 (438)	10 (254)	5 (127)
ZF3	15-40	14 (356)	6 (152)	3.1 (79)
ZF3	70	26 (660)	10 (254)	5 (127)

SCR's are manufactured in all standard voltages, single or three phase. Units are available with current ratings from 15 to in excess of 1000 amps. All control inputs can be accomodated including the most common process signals: 0-5k ohm and 4-20 mA.

Single phase units are single leg break. Three phase units are available in 2 or 3 leg break with the most common and cost effective version the 2 leg break.

SCR's are available as separate components or for more reliable performance, can be ordered as part of a factory designed and built control panel. See pages Section D for control panel information.

Open Style SCR's

This small, cost effective series is available in sizes from 15 through 70 amps and in single or three phase. Note that, for control inputs other than 4-20mA, a separate 24VAC control circuit transformer is required.

FIG. 1 - SCR
1 PHASE

TABLE 2 - SSR TYPE 15-70 AMP 1200V PIV
4-20 mA only - SELF POWERED

Amps 40°C	Voltage XXX	Phase	Control Signal	Catalog Number
15	120, 240,	1ph	4-20 mA	ZF1-XXX-15-C
25	480, 600	"	"	ZF1-XXX-25-C
40		"	"	ZF1-XXX-40-C
70		"	"	ZF1-XXX-70-C
0-10 VDC, 0-135 Ω, MANUAL POT				
15	120, 240,	1ph	0-10VDC	ZF1-XXX-15-V-02‡
25	480, 600	"		ZF1-XXX-25-V-02‡
40		"		ZF1-XXX-40-V-02‡
70		"		ZF1-XXX-70-V-02‡

‡These models require a separate 24VAC control circuit transformer. Replace XXX with applied line voltage.
Units also available with 5kΩ potentiometer. Change suffix 02 to 05.

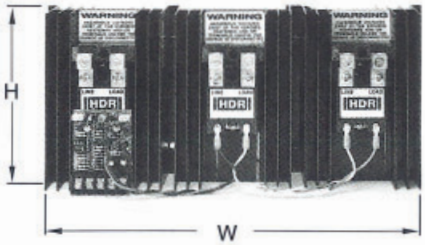


FIG. 2- SCR
3 PHASE

TABLE 3 - SSR TYPE 15-70 AMP 1200V PIV
4-20 mA only - SELF POWERED

Amps 40°C	Voltage XXX	Phase	Control Signal	Catalog Number
15	120, 240	3ph,	4-20 mA	ZF2-XXX-15-C
25	480, 600	2 leg	"	ZF2-XXX-25-C
40		break	"	ZF2-XXX-40-C
70			"	ZF2-XXX-70-C
4-20 mA, 0-10 VDC, 0-135 Ω, MANUAL POT				
15	120, 240	3ph,		ZF3-XXX-15-V-02‡
25	480, 600	3 leg	0-10VDC	ZF3-XXX-25-V-02‡
40		break		ZF3-XXX-40-V-02‡
70				ZF3-XXX-70-V-02‡

‡These models require a separate 24VAC control circuit transformer. Replace XXX with applied line voltage.
Units also available with 5kΩ potentiometer. Change suffix 02 to 05.

TO ORDER: Specify quantity, catalog number, voltage, phase, & control signal.

SCR Controls 60-1200 Amps

Listed SCR's are zero crossover fired. Units from 60 to 225 amps are semi-enclosed with electrically isolated heatsinks. Units over 225 amp are open, with live heatsinks that require mounting in a control panel enclosure with suitable venting. All units over 60 Amp are fan cooled. All units include a heat sink over temperature thermostat. The SCR's are protected with fast blow (I^2t) semi-conductor fusing.

FIG. 1- ZF3 SERIES SHOWN
60-225 AMPS

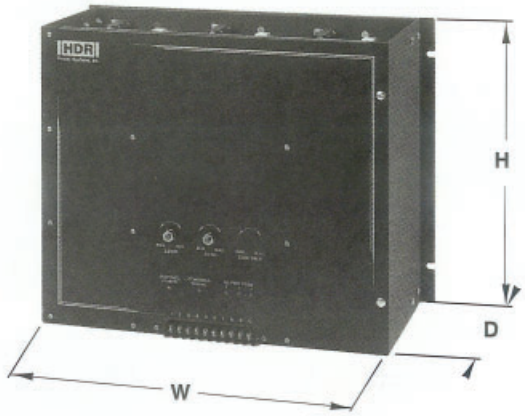


TABLE 1 - DIMENSIONS FIG. 1 CONTROLS

SERIES	DIMENSIONS - in. (mm) W	H	D
ZF1	9.5 (241)	16.25 (413)	9.25 (235)
ZF2	12.5 (318)	16.25 (413)	9.25 (235)
ZF3	17.5 (452)	16.25 (413)	9.25 (235)

TABLE 2 - SCR's 60-225AMPS 1400V PIV (FIG. 1)

Amps 40°C	Voltage XXX	Phase	Control Signal	Catalog Number
60	240,480,	1ph		ZF1-XXX-60-01‡
90	600	"		ZF1-XXX-90-01
120		"	4-20mA	ZF1-XXX-120-01
180		"		ZF1-XXX-180-01
225		"		ZF1-XXX-225-01
60	240,480,	3ph,		ZF2-XXX-60-01‡
90	600	2 leg		ZF2-XXX-90-01
120		break	4-20mA	ZF2-XXX-120-01
180				ZF2-XXX-180-01
225				ZF2-XXX-225-01
60	240,480,	3ph,		ZF3-XXX-60-01‡
90	600	3 leg		ZF3-XXX-90-01
120		break	4-20mA	ZF3-XXX-120-01
180				ZF3-XXX-180-01
225				ZF3-XXX-225-01

‡60 Amp models do not have fans or over temp. thermostats.
All others are fan cooled with a N.O. over temp. thermostat.
Replace XXX with applied line voltage.
Catalog number shown is for 4-20mA control signal. Change suffix 01 to 02 for 0-10VDC; 05 for 5kΩ potentiometer.
All models include high speed semi-conductor fusing.

TO ORDER: Specify quantity and catalog number.

FIG. 2- ZF3 SERIES SHOWN
800-1200 AMPS

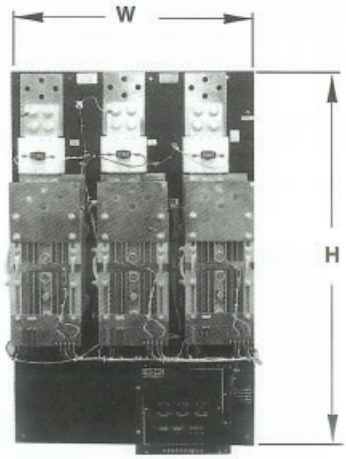


TABLE 3 - DIMENSIONS FIG. 2 CONTROLS

SERIES	AMPS	DIMENSIONS - in. (mm) W	H	D
ZF1	350-500	14 3/4 (375)	20 1/8 (511)	8 1/2 (216)
ZF1	650	16 3/4 (425)	23 (584)	11 1/2 (292)
ZF1	800-1200	16 3/4 (425)	29 (737)	12 (305)
ZF2	350-500	19 (483)	20 1/8(511)	8 1/2 (216)
ZF2	650	24 (588)	23 (584)	11 1/4 (286)
ZF2	800-1200	27 (686)	29 (737)	11 3/4 (298)

TABLE 4 - SCR's 350-800 A 1400V PIV (FIG. 2)

Amps 40°C	Voltage XXX	Phase	Control Signal	Catalog Number
350	480,600	1ph		ZF1-XXX-350-01
500	"		4-20mA	ZF1-XXX-500-01
650	"			ZF1-XXX-650-01
800	"			ZF1-XXX-800-01
350	480,600	3ph,		ZF2-XXX-350-01
500	"	2 leg	4-20mA	ZF2-XXX-500-01
650	"	break		ZF2-XXX-650-01
800	"			ZF2-XXX-800-01

Replace XXX with applied line voltage.
Catalog number shown is fo 4-20mA control signal. Change suffix 01 to 02 for 0-10VDC; 05 for 5kΩ potentiometer.
For larger units check factory
All models include fans, I^2t fusing and N.O. over temp. thermostat
All models have live heatsinks and require enclosures
3 leg break available - check factory

SCR Controls (Phase angle)

Phase angle fired SCR's are also available.
(Check Factory)

TO ORDER: Specify quantity, catalog number, voltage, phase, & control signal.

Solid State Relays

Solid state relays (SSR's) can be used in place of mechanical contactors and relays. SSR's are optically coupled, isolating control components from the high voltage of the load. SSR's turn on at zero volts and turn off at zero current, eliminating spikes that cause electrical noise (RFI). Since there are no moving mechanical parts, solid state relays are noiseless, can switch as fast as several times per second and still have a life and reliability many times that of mechanical devices.

FIG. 1- SSR

TABLE 1 - SOLID STATE RELAYS - ZERO SWITCHING

Current* Rating	Load Voltage	Control Signal	Catalog Number
10 Amp	120-240 VAC	3-32 VDC	RA2410-D06T
25 Amp	"	"	RA2425-D06T
10 Amp	120-480 VAC	"	RA4810-D12
25 Amp	"	"	RA4825-D12
50 Amp	120-600 VAC	4.5-32 VDC	RA6050-D16
90 Amp	"	"	RA6090-D16
10 Amp	120-480 VAC MAX	120-240 VAC	RA4810-HA12
25 Amp	"	"	RA4825-HA12
50 Amp	"	"	RA4850-HA12

*For 77°F (25°C) Ambient

TABLE 2 - SOLID STATE RELAYS - PHASE ANGLE

Current* Rating	Load Voltage	Control Signal	Catalog Number
50 Amp	240 VAC	4-20 mA	RE2450-AA06
50 Amp	480 VAC	4-20 mA	RE4850-AA12
50 Amp	600 VAC	4-20 mA	RE6050-AA16

*For 77°F (25°C) Ambient

An SSR has a small voltage drop when conducting. The resulting heat generated must be dissipated by means of a heat sink. Many styles and ratings are available.

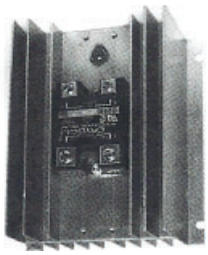


FIG. 2 - HE-54 HEAT SINK

Current rating for SSR's must be derated depending on ambient temperature and type of heat sink. The HE-54 can handle a single relay up to 50 Amps.

Check with factory for design assistance.

Definite Purpose Contactors

Contactors are required when the current or voltage conditions of the load to be switched exceed the ratings of the controller.

Compact definite purpose contactors are ideal for controlling heating and air conditioning equipment.

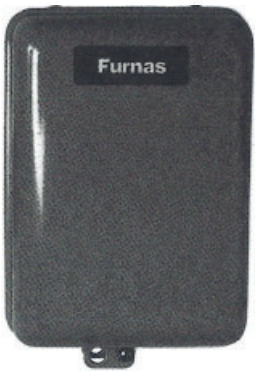


FIG. 3 - CONTACTOR WITH ENCLOSURE

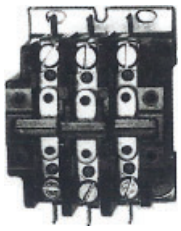


FIG. 4 - OPEN STYLE CONTACTOR

TABLE 3 - DIMENSIONS - FIG. 3

CONTACTOR SIZE (amps)	WIDTH mm (in.)	DEPTH mm (in.)	HEIGHT mm (in.)
30	125 (4 15/16)	97 (3 13/16)	158 (6 7/32)
40 - 75	144 (5 11/16)	104 (4 1/8)	219 (8 5/8)
93 - 112	144 (5 11/16)	158 (6 1/4)	265 (10 7/16)

TABLE 4 - NON-INDUCTIVE AMPS. - COIL DATA

No. of Poles	Nominal	On Off Thermostat	Proportional Control or Input Control	VA inrush	VA holding	Catalog Number
2	30	24	20	35	8	41NB20BF
3	30	24	20			41NB30BF
2	40	32	24	52	6.2	42BF15BF
3	40	32	24			42BF35BF
2	50	40	30			42CF15BF
3	50	40	30			42CF35BF
2	63	50	40	91	15.6	42DF15BF
3	63	50	40			42DF35BF
2	75	60	48			42EF15BF
3	75	60	48			42EF35BF
2	93	75	60	200	31	42FF15BF
3	93	75	60			42FF35BF
2	112	90	72			42GF15BF
3	112	90	72			42GF35BF

The contactors listed above are FIG. 3 enclosed models with 120V coils.
For FIG. 4 open contactors change 'B' to 'A': eg. 42CF35AF
For 208 / 240V coils change 'F' to 'G': eg. 42CF35BG

TO ORDER: Specify quantity, catalog number, and control circuit voltage.

On Delay Timer

This electronic module can be added in the field to any 42 series definite purpose contactor. The purpose of the relay is to delay the closing of the contactor after the coil is energized. Various models with different adjustable time bands are shown below.

A typical application would involve sequencing 2 or more contactors, all energized by one control.

TABLE 1 - ON DELAY TIMERS

Time Delay	Coil Voltage	Catalog No.
.7 - 5 sec.	"	49MD06FB
5 - 33 sec.	"	49MD06FC
33 - 240 sec.	"	49MD06FD
4 - 30 min.	"	49MD06FE

Time Delay Relays

The 12S series is a field proven relay for controlling fans, heating elements and like devices where time delay is required. Several standard on and off time delays are available with a variety of normally open and normally closed contacts.

A common application is to keep a fan running after heaters are shut off to reduce latent heat.

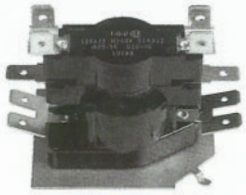


TABLE 2 - TIME DELAY RELAY

ON time (sec)	OFF time (sec)	CONTACTS Form	Control Voltage	Rating	CATALOG NUMBER
15-40	60-160	DPST	120V	25A 120/240	B11043-04
15-40	30-70	DPST	120V	10A 480/600	B11043-03
20-50	20-70	DPST	240V	"	B11043-02
20-50	20-70	SPST	240V	"	B11043-01

TO ORDER: Specify quantity, catalog number.

Silent Contactors and Thermal Relays

Silent contactors and thermal relays are typically used in comfort heating applications when noise is a factor.

Contactors respond instantly to a control signal. Thermal relays have a 60 second delay when energizing and a 15 second delay when opening. Thermal relays are not suitable for use in limit applications.

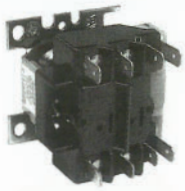


FIG. 1 - SILENT CONTACTOR

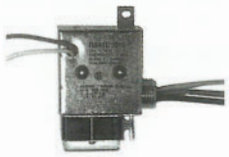


FIG. 2 - THERMAL RELAY

TABLE 3 - SILENT CONTACTORS

Electrical Rating	Fig. No.	No. of Poles	Catalog Number
600V 10 A or 240V 25A	1	DOUBLE POLE	R8229A1005B

TABLE 4 - THERMAL RELAYS

System Voltage	Max. Load	Fig. No.	Transformer Rating	Catalog Number
240V	25A	2	240V / 24V	R841C1029
600V	10A	2	600V / 24V	R841C1151
600V Max.	As Above	-	Less Transformer	R841D1028

TO ORDER: Specify quantity, catalog number.

High Temperature Wire

For specific information on allowable current capacity and temperatures for wire refer to your regional Electrical Code. Wire ampacity decreases as the ambient temperature increases.

TABLE 5 - HIGH TEMPERATURE WIRE

600V MAX. - 3 WIRES MAX. IN RACEWAY

Gauge	Maximum Allowable Wire Temp. °C	°F	Recommended Max. Amps at Ambient of 30°C	140°C	Catalog Number
8	200	392	55	32	SEW-8
10	200	392	45	26	SEW-10
12	200	392	30	17	SEW-12
10	250	482	40	23	TCGT-10
12	250	482	25	14	TCGT-12

OTHER GAUGES - Heavier gauges are available. Consult factory.

TO ORDER: Specify quantity, catalog number.

Control Circuit Transformers

Transformers are used whenever the desired control circuit voltage differs from the supply voltage.

Select a transformer with a VA rating greater than 40% of the sum of the VA inrush ratings of all contactors used in the circuit.

EXAMPLE: To determine transformer required with three only 42GF15BF contactors.

TOTAL INRUSH (Table 4, pg. F25):
200 + 200 + 200 = 600 VA
40% of 600 = 240

Select 250 VA transformer.

FIG. 1 - ENCLOSED TRANSFORMER

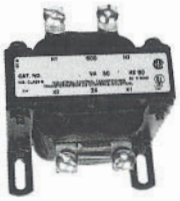


FIG. 2 - OPEN TRANSFORMER

TABLE 1 - CONTROL CIRCUIT TRANSFORMERS

VA SIZE	DEPTH mm	DEPTH (in.)	WIDTH mm	WIDTH (in.)	HEIGHT mm	HEIGHT (in.)	CATALOG NUMBER*
50	64	(2 1/2)	143	(5 5/8)	89	(3 1/2)	EE9M
150	79	(3 1/8)	143	(5 5/8)	105	(4 1/8)	EH9M
250	95	(3 3/4)	146	(5 3/4)	124	(4 7/8)	EJ9M
500	95	(3 3/4)	178	(7)	124	(4 7/8)	EL9M
750	27	(5)	225	(6 7/8)	162	(6 3/8)	EM9M
1000	127	(5)	194	(7 5/8)	162	(6 3/8)	EN9M

*Catalog numbers shown are for Fig. 1 enclosed design with 600V primary and 120V secondary.

TO ORDER: Specify quantity, VA rating, primary & secondary voltage.

Flow Switches

Flow Switches are typically used as proving switches to energize heaters only when sufficient flow is present. They are inserted into pipelines carrying non-corrosive and non-hazardous liquids. Flow rates from 3 to 700 G.P.M. can be accommodated in 1" to 8" pipe sizes.

TABLE 2 - FLOW SWITCHES

Process Connection	Switch Rating Resistive	Switch Rating Inductive	Exposure	Catalog Number
1" NPT	16A 277VAC MAX	125VA 24-277VAC	150PSIG (1034kPa)	F61KB-11

TO ORDER: Specify quantity, catalog number.

Air Flow Switches

PRESSURE DIFFERENTIAL SWITCH

This device is used as an interlock to ensure sufficient air movement before a duct heater can be energized.

The pressure differential switch must be installed to a vertical surface.

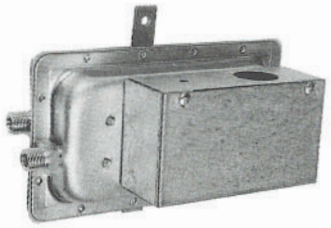


TABLE 3 - PRESSURE DIFFERENTIAL SWITCHES

PRESSURE RANGE	ELECTRICAL RATING	CATALOG NUMBER
.05" TO 12.0" WC (field adjustable)	15 AMP RESISTIVE 120 / 277 VAC 300VA INDUCTIVE	AFS-222

SAIL SWITCH

Sail switches are used to activate electrical equipment in response to airflow in a duct. Both normally open and normally closed contacts (SPDT) are provided with a 2.5 Amp 240 VAC maximum resistive rating. The normally open contact makes at 250 fpm (1.3 m/s) and breaks below 75 fpm (0.4 m/s). The sail switch can be adapted to horizontal or vertical air flow.

TABLE 4- SAIL SWITCH

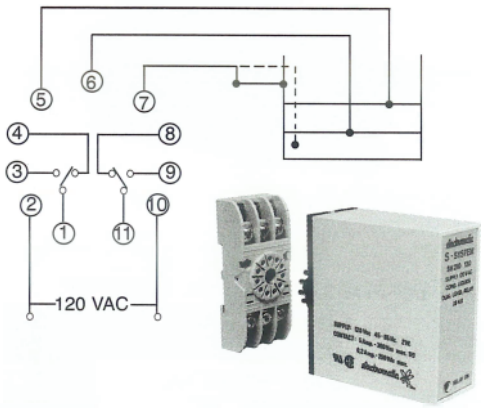
Electrical Rating	Air Flow MIN.	Air Flow MAX.	Max. Air Temp.	Catalog Number
2.5A 240VAC	75 fpm	250 fpm	170°F (77°C)	S688A1007

TO ORDER: Specify quantity, catalog number.

Level Control (FOR CONDUCTIVE LIQUIDS)

The SV series electronic liquid level control senses the resistance between remote mounted level probe electrodes (see type EH below). By altering the lengths of the electrodes, various combinations of high and low limit, heater ON-OFF and pump ON-OFF can occur as liquid levels change in the vessel.

When liquid is present, the SV220 de-energizes and the SV210 energizes. Otherwise both controls are the same.



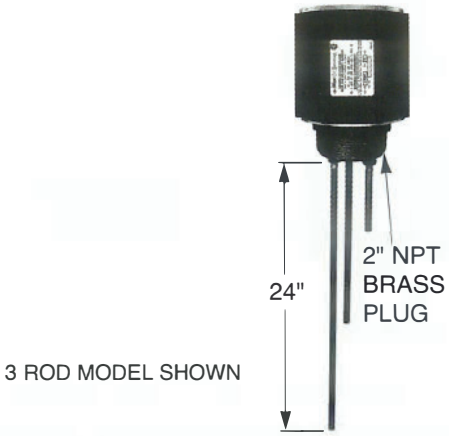
NOTE: If the container is non conductive a third (lowest position) electrode must be installed as shown.

TABLE 2 - LEVEL CONTROL

Sensor Current	< 25 kΩs Relay	Relay Rating	Catalog Number
2.5 mA	De-energizes	8 Amp 120 VAC DPDT	SV220-115
2.5 mA	Energizes		SV210-115

Level Probe

The EH probe assembly can be used with the SV series electronic level controls. The assembly consists of a 2" NPT brass screw plug, weather resistant terminal enclosure and 1,2 or 3 brass rods mechanically held and electrically isolated in porcelain holders. The rods can be field cut from the 24" supplied lengths to corresponding liquid levels required for control.



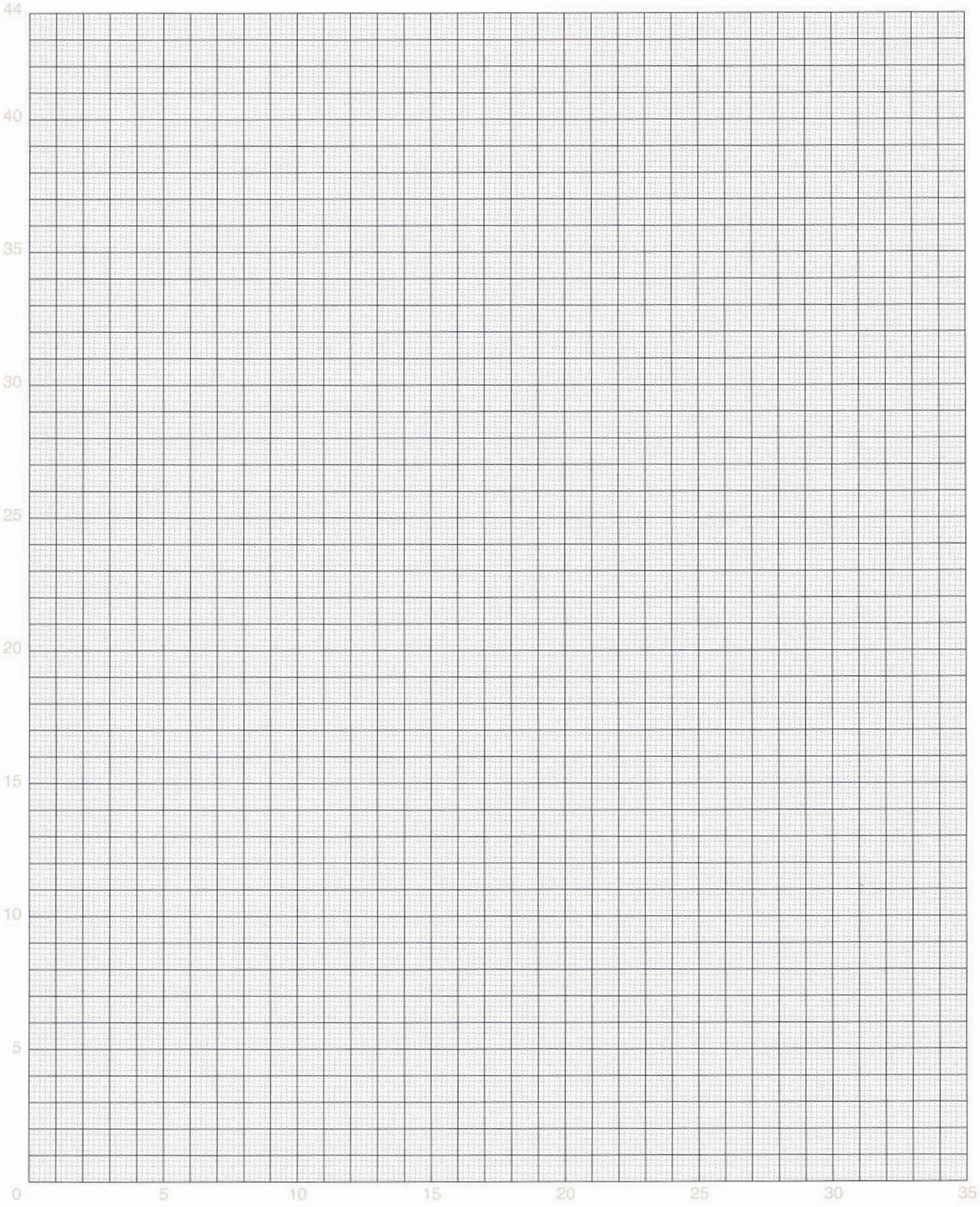
3 ROD MODEL SHOWN

TABLE 3 - LEVEL CONTROL

Number of Sensing Rods	Rod Length(s)	Mounting	Catalog Number
1	24" (Field cut to desired length)	2" NPT Brass Screwplug	EH10863-13
2			EH10863-14
3			EH10863-15

TO ORDER: Specify quantity, catalog number.

Notes:



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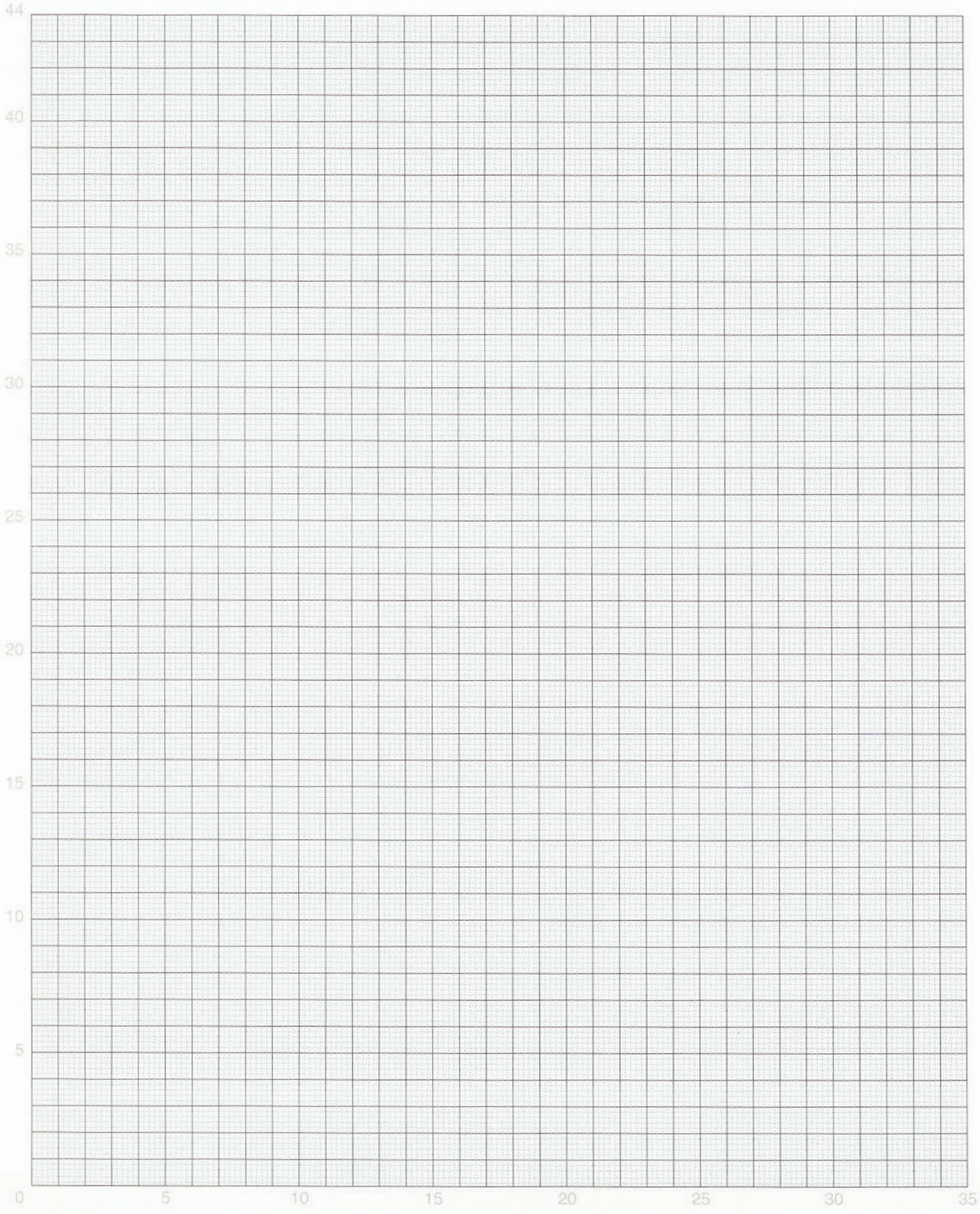

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To be recognized as a world-wide industry leader in heating technology. We will provide our customers with the broadest industry knowledge, expertise and products in space and process heating.

To create an internal environment promoting participation, teamwork, training and development for our employees.

To deliver the highest possible quality standards and continue to build a loyal customer base through dedicated customer service.

To promote continuous improvement in all existing product lines and develop and market a wide range of quality heating products through a commitment to research and development.

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