

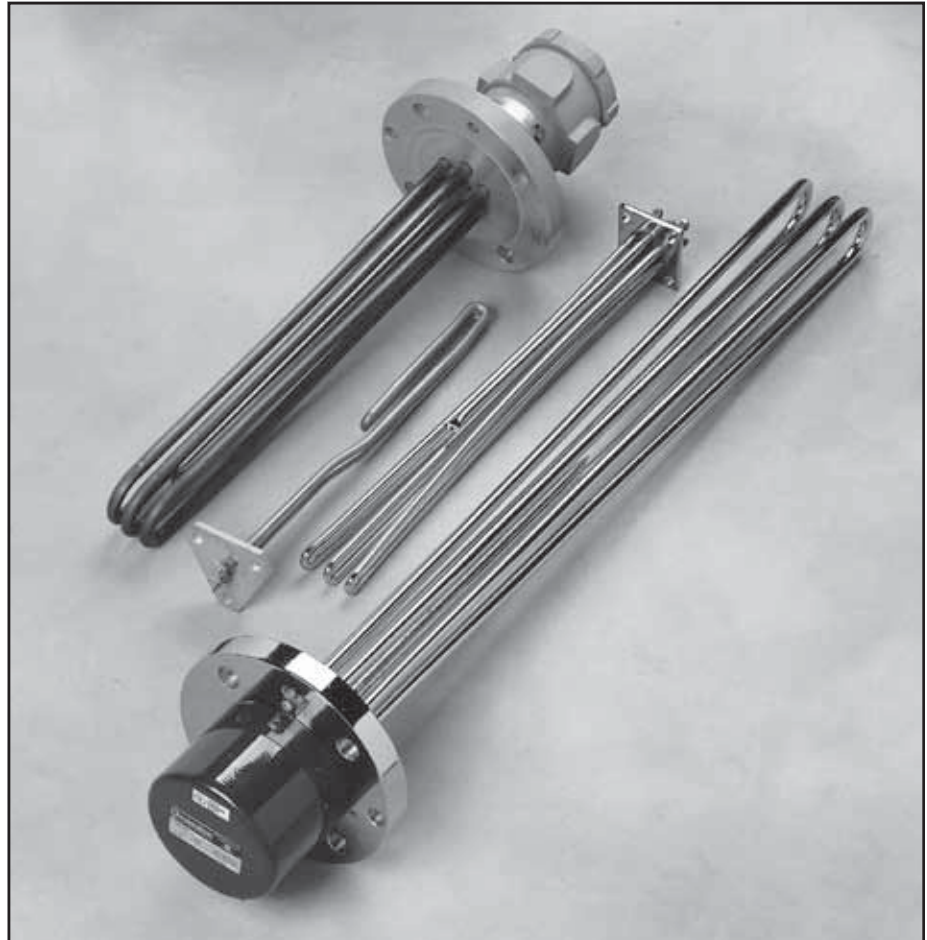
Flanged Immersion Heaters Overview

Flanged Immersion Heaters consist of hairpin bent tubular elements welded or brazed into a flange and provided with wiring boxes for electrical connections. Flange heaters are installed by bolting to a matching flange welded to the tank wall or nozzle. A wide selection of flange sizes, kilowatt ratings, voltages, terminal enclosures and sheath materials make these heaters ideal for all types of heating applications.

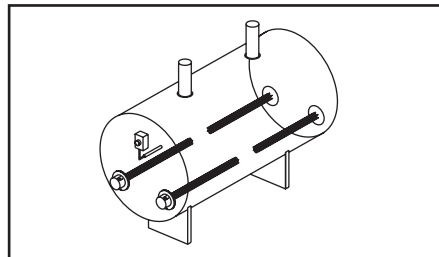
Applications

Flanged immersion heaters are one of the most widely used methods for heating gases and liquids (such as water, oil, heat transfer fluid and corrosive solutions). Designed for use in tanks and pressurized vessels, they are easy to install and maintain to provide heat for many processes. The direct immersion method is energy efficient and easily monitored and controlled.

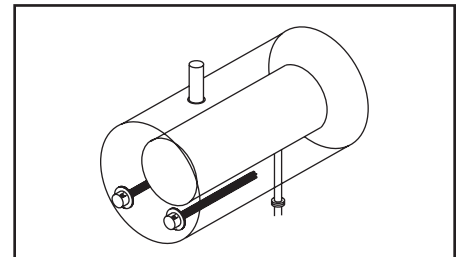
- Hot Water Storage Tanks
- Warming Equipment
- Preheating All Grades of Oil
- Food Processing Equipment
- Cleaning and Rinsing Tanks
- Heat Transfer Systems
- Process Air Equipment
- Boiler Equipment
- Freeze Protection of Any Fluid



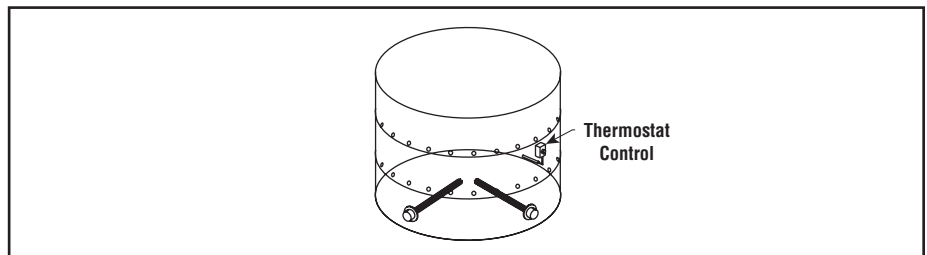
Typical Applications



Flange heaters mounted on each end of hot water storage tank or for an efficient shower system.



Flange heaters in tank of water to heat inner tank of viscous materials.



Flange heaters mounted angularly around tank bottom permitting free vertical work area.

Flanged Immersion Heaters

Application & Selection Guidelines

Selection Guidelines

The selection of the proper Flanged Immersion Heater requires critical engineering judgement. After determining the heat requirement (see the applications section of this catalog), the proper selection of the flange material, heating element sheath material and correct watt density is critical for long life of a heater. The following table may be used as a guide to this selection along with the Technical Information at the back of this catalog. Ultimate choice is determined by the knowledge of the process and engineering acumen of the plant engineer.

Heater application is influenced by the following parameters.

- ① The heated medium viscosity, specific heat density and corrosive properties.
- ② Contaminants present in the medium.
- ③ The heater sheath material corrosion resistant properties.
- ④ Watt density of the heating element — the heat output per square inch.
- ⑤ Maximum sheath temperature — this is the recommended maximum sheath temperature of the element material. It is not the operating temperature of the heated medium (sheath temperature is dependent on items 1 thru 4).

Applications

See Selection Guidelines below for your application.

- Hot Water Storage Tanks
- Warming Equipment
- Preheating All Grades of Oil
- Food Processing Equipment
- Cleaning and Rinsing Tanks
- Heat Transfer Systems
- Process Air Equipment
- Boiler Equipment
- Freeze Protection of Any Fluid

Application Selection — Guidelines

Application	①	②	③	④	⑤
	Solution or Heater Type	Alkaline or Acid Content (Est. % by Volume)	Sheath Material	Watt Density (W/in ²)	Max. Recommended Sheath Temp. (°F)
Water & Very Mild Solutions	Clean Water	pH6 to pH8 Neutral	Copper	45	350
	Process Water	pH5 to pH9	Stainless Steel ¹	45	1200
	Very Weak solutions	2 - 3%	INCOLOY®	45	1600
	Weak Solutions	5 - 6%	INCOLOY®	45	1600
Corrosive & High Viscous Solutions	Demineralized, De-ionized or pure water	—	INCOLOY® w/ Stainless Flange	45	1600
	Mild Corrosive Solution	5 - 15%	Stainless Steel ¹	23	1200
	More Severe Corrosive Solution	10 - 25%	INCOLOY®	23	1200
Specialty Water	Severe Corrosive Solution	30 - 60%	INCOLOY® w/ Stainless Flange	15	1600
	Steam Boilers	Treated	INCOLOY®, Copper	—	1600
Oil	Low Viscosity Oil	—	Steel	23	750
	Medium Viscosity Oil	—	Steel	15	750
	High Viscosity Oil	—	Steel	6.5	750
Oil Reservoir	Lubrication Oil	—	Steel	15	750
Air, Gases & Steam	Low Temperature		Stainless Steel	23	1200
	High Temperature		INCOLOY®	23	1600

1. Passivated stainless steel recommended for water.

Flanged Immersion Heaters Selection Guidelines

Flanged Immersion Heaters — Selection Guidelines

Application	Flange Size (In.)	Sheath Material	Flange Material	Heater Type	Page
Clean Water	3	Copper	Steel	TM	B-95
	5	Copper	Steel	TM	B-95
	6	Copper	Steel	TM	B-96
	8	Copper	Steel	TM	B-96
	10	Copper	Steel	TM	B-96
	12	Copper	Steel	TM	B-96
	14	Copper	Steel	TM	B-96
Process Water	3	SS	Steel	TMS	B-97
	5	SS	Steel	TMS	B-98
	6	SS	Steel	TMS	B-98
	8	SS	Steel	TMS	B-98
Solution Water	3	INCOLOY®	Steel	TMI	B-99
	5	INCOLOY®	Steel	TMI	B-100
	6	INCOLOY®	Steel	TMI	B-100
	8	INCOLOY®	Steel	TMI	B-100
Mildly Corrosive Solution	3	SS	Steel	TMS	B-101
	5	SS	Steel	TMS	B-102
	6	SS	Steel	TMS	B-102
	8	SS	Steel	TMS	B-102
Corrosive Solution & Gas	3	INCOLOY®	Steel	TMI	B-103
	5	INCOLOY®	Steel	TMI	B-104
	6	INCOLOY®	Steel	TMI	B-104
	8	INCOLOY®	Steel	TMI	B-104
	10	INCOLOY®	Steel	TMI	B-104
	12	INCOLOY®	Steel	TMI	B-104
	14	INCOLOY®	Steel	TMI	B-104
Severely Corrosive Solution	3	INCOLOY®	SS	TMIS	B-105
	5	INCOLOY®	SS	TMIS	B-105
	6	INCOLOY®	SS	TMIS	B-105
Demineralized or De-ionized Water	3	INCOLOY®	SS	TMIS	B-106
	5	INCOLOY®	SS	TMIS	B-106
Light Weight Oil	3	Steel	Steel	TMO	B-107
	5	Steel	Steel	TMO	B-107
	6	Steel	Steel	TMO	B-108
	8	Steel	Steel	TMO	B-108
	10	Steel	Steel	TMO	B-108
	12	Steel	Steel	TMO	B-108
	14	Steel	Steel	TMO	B-108
Medium Weight Oil	3	Steel	Steel	TMO	B-109
	5	Steel	Steel	TMO	B-109
	6	Steel	Steel	TMO	B-109
Heavy Weight Oil	3	Steel	Steel	TMO	B-111
	5	Steel	Steel	TMO	B-111
Boiler & Water	2-1/2 Sq.	Copper	Brass	TTSF	B-112
	2-1/2 Sq.	INCOLOY®	Steel	TTSF	B-112
	4-1/2 Sq.	Copper	Steel	WCFS	B-112
Food Equipment	3-1/4 Dia.	Copper	Brass	TTUH	B-113
		Copper	Brass	TTUH-CO	B-114

Flanged Immersion Heaters

Technical & Application Data

Description

These thru-the-side immersion heaters utilize standard pipe flanges ranging from 3 to 14" nominal pipe diameter to support high tank pressures of superheated steam, compressed gases or liquids. They are installed through a matching companion flange (obtainable from local industrial supply houses) to the tank wall. A wide selection of Watt densities, heating outputs and flange sizes and ratings make this an excellent heater for all tanks, vats or irregularly shaped vessels.

Features — Stock Units

Element

- **Materials** — Copper, steel, 304 stainless steel, INCOLOY®.
- **Number Elements in Flanges** — 3, 6, 12, 18, 27, 36 and 45.
- **Element Diameter** — 0.475".
- **Watt Density** — 6.5, 15, 23, 45 and 75 W/in².

Flange

- **Material** — Carbon steel, stainless steel.
- **Rating** — 150 lb. pressure class per ANSI B16.5
- **Sizes** — 3, 5, 6, 8, 10, 12 and 14", 150 lb.

Process Control Thermowell

- **Materials** — Copper, carbon steel, stainless steel, INCOLOY®.
- 1/2" diameter.

Special Features

Kilowatt Ratings — 500 kW and above available.

Element

- **Materials** — 316, 321, 347 stainless steel, INCONEL® and more.

Flange

- **Materials** — 316, 321, 347 stainless steel, INCONEL®, INCOLOY® and more.

- **Rating** — 300, 400, 600, 900, 1,500 and 2,500 lb. pressure class.
- **Size** — 16, 18" and larger.

Optional Features

ASME Section I, IV and VIII designed and certified

Baffles to distribute flow on elements

Passivation of stainless steel

Immersion Lengths up to 240 inches

Stand-off Terminal Enclosures to isolate terminal housing from flange in high temperature applications

Stock Status & Availability

S — Stocked in finished form

AS — Assembly Stock. Items put together using major stocked subassemblies requiring three day shipping lead time

NS — Non Stock (made to order). Contact your Local Chromalox Sales office for delivery

Terminal Enclosures


Type E1 General Purpose, sheet metal (NEMA 1) painted with red enamel

Type E2 Combination Moisture Resistant, Explosion Resistant

Type E3 Explosion Resistant

Type E4 Moisture Resistant

Type E2 Explosion Resistant enclosures involve the use of a wiring enclosures for use in hazardous location conditions:

- Class I Groups B, C & D, Division 1 & 2 T1-T6
- Class I Zone 1 Ex d IIB + H₂ T1-T6
- Class I Zone 1 AEx d IIB + H₂ T1-T6
- Class II Groups E, F 200°C (T3) & G 165°C (T3B), Division 1 & 2
- ATEX/IECEx Enclosures
-  II2G Ex d IIB + H₂ T1-T6

Safe operation of heaters equipped with these enclosures depends on employment of electrical wiring meeting the National Electrical Code for hazardous locations and limiting maximum operating temperatures (including temperatures on outside of vessel, piping, flanges, screw plugs, enclosures and other heat conducting parts) as dictated by flammable liquids, vapors or gases present. Approved pressure and/or temperature limiting controls must be used to assure safe operation in the event of a system malfunction.

Temperature Controls

- A thermostat protective well is standard on most models. This well is installed through the flange, parallel with the heating elements. An AR type on-off mechanical control can be externally mounted to the heater with the capillary bulb installed in this well (order separately — see Controls section for details).
- A contactor is needed when the line voltage and/or current exceeds the thermostat rating.
- Other types of controls and sensors are available where a high degree of accuracy or a more versatile control scheme is required. Electronic controls and complete control panels are easily installed. See the Controls section for details.

Corrosion Policy

Chromalox cannot warrant any electric immersion heater against failure by sheath corrosion if such failure is the result of operating conditions beyond the control of the heater manufacturer. It is the responsibility of the purchaser to make the ultimate choice of sheath material based on their knowledge of the chemical composition of the corrosive solution, character of materials entering the solution, and controls which he maintains on the process.

Flanged Immersion Heaters

Technical & Application Data

*ATEX/IECEX/CSA Zone Classification Selection chart for terminal enclosure
standoff dimension based on 30°C rise over 40°C ambient*

70°C Cable Supply			Vertical Heater Orientation		Horizontal Heater Orientation	
Temperature Code	Wet Face Temperature: °F	Wet Face Temperature: °C	Minimum Standoff Dimension		Minimum Standoff Dimension	
			Inches	mm	Inches	mm
T6	185	85	3	76	1	25
T5	212	100	3	76	2	50
T4A	248	120	5	127	3	76
T4	275	135	6	152	3	76
T3C	320	160	7.5	191	4	102
T3B	329	165	7.5	191	4	102
T3A	356	180	7.5	191	5	127
T3	392	200	9	229	5	127
T2D	419	215	9	229	5	127
T2C	446	230	9	229	6	152
T2B	500	260	10.5	267	6	152
T2A	536	280	10.5	267	6	152
T2	572	300	10.5	267	7.5	191
T1	842	450	13.5	343	9	229

*ATEX/IECEX/CSA Zone Classification Selection chart for terminal enclosure
standoff dimension based on 10°C rise over 60°C ambient*

70°C Cable Supply			Vertical Heater Orientation		Horizontal Heater Orientation	
Temperature Code	Wet Face Temperature: °F	Wet Face Temperature: °C	Minimum Standoff Dimension		Minimum Standoff Dimension	
			Inches	mm	Inches	mm
T6	185	85	9	229	6	152
T5	212	100	10.5	267	7.5	191
T4A	248	120	12	305	7.5	191
T4	275	135	12	305	7.5	191
T3C	320	160	12	305	7.5	191
T3B	329	165	12	305	9	229
T3A	356	180	13.5	343	9	229
T3	392	200	15	381	9	229
T2D	419	215	15	381	10.5	267
T2C	446	230	15	381	10.5	267
T2B	500	260	16.5	419	10.5	267
T2A	536	280	18	457	10.5	267
T2	572	300	18	457	10.5	267
T1	842	450	24	610	12	305

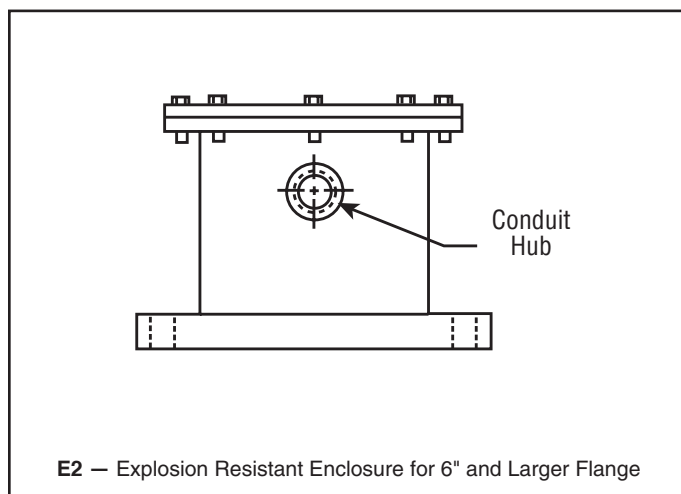
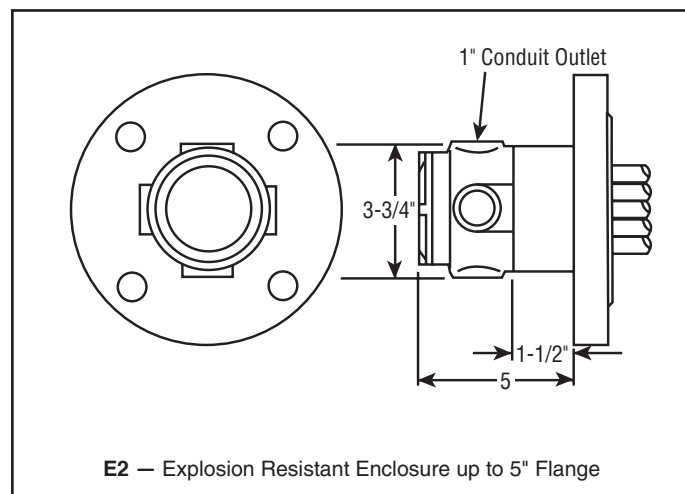
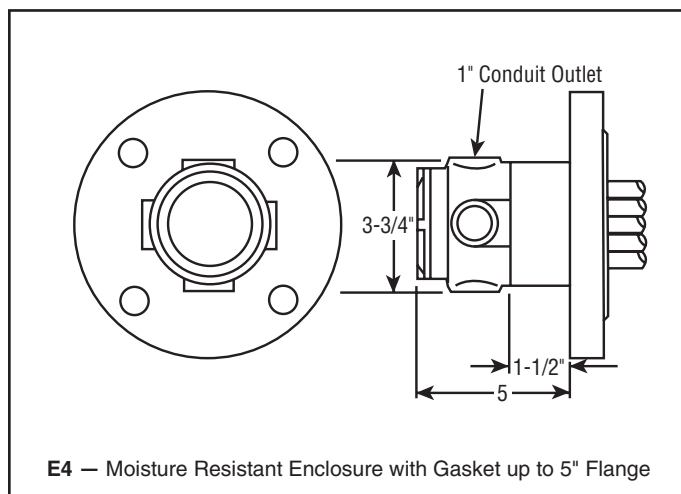
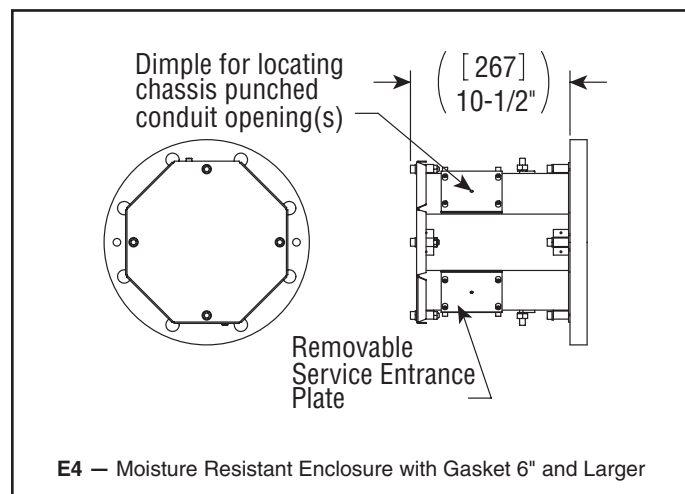
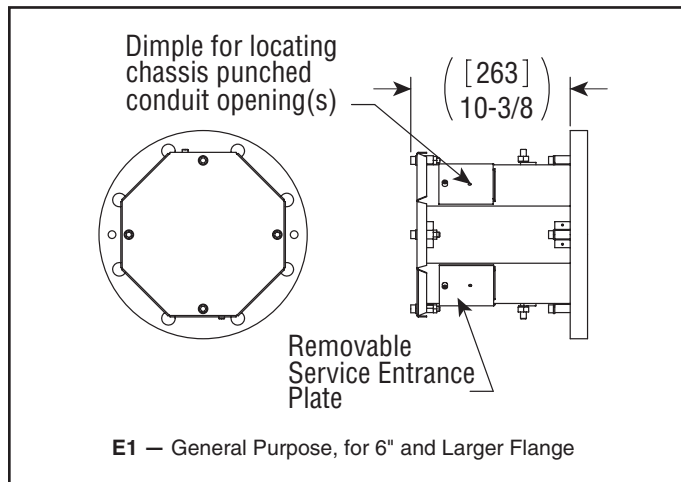
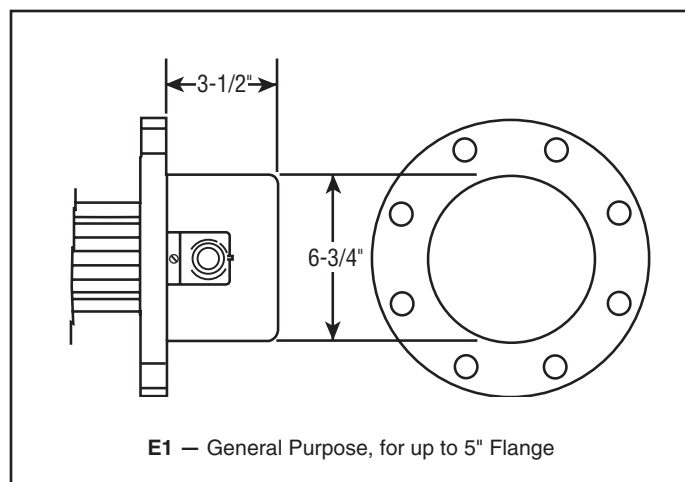
*CSA Class and Division Classification Selection chart for terminal enclosure
standoff dimension based on 85°C rise over 40°C ambient*

125°C Cable Supply			Vertical Heater Orientation		Horizontal Heater Orientation	
Temperature Code	Wet Face Temperature: °F	Wet Face Temperature: °C	Minimum Standoff Dimension		Minimum Standoff Dimension	
			Inches	mm	Inches	mm
T6	185	85	0	0	0	0
T5	212	100	0	0	0	0
T4A	248	120	0	0	0	0
T4	275	135	0	0	0	0
T3C	320	160	2	50	0	0
T3B	329	165	2	50	0	0
T3A	356	180	4	102	2	50
T3	392	200	4	102	2	50
T2D	419	215	4	102	2	50
T2C	446	230	4	102	2	50
T2B	500	260	6	152	4	102
T2A	536	280	6	152	4	102
T2	572	300	6	152	4	102
T1	842	450	7.5	191	6	152

Flanged Immersion Heaters

Terminal Enclosures

Enclosure Styles and Dimensions (Inches)



FLANGED

Flanged Immersion Heaters

Terminal Enclosures

Specifications

Nom. Pipe Size	No. Elem.	150 Lb. Rated Flange Dimensions (In.)							Terminal Enclosure ²					
		C	D	E	Dia. F	G No. Holes	H Min. Hole Dia. Req ¹	General Purpose E1		Explosion Resistant E2		Moisture Resistant E4		
								J	K	J	K	J	K	
3	3	15/16	6	7-1/2	3/4	4	2-3/4	3-1/2	4-9/16	5-3/8	4-1/4	5-3/8	4-1/4	
5	6	15/16	8-1/2	10	7/8	8	5	3-1/2	6-11/16	6-15/16	5-3/4	3-7/16	7-1/4	
6	12	1	9-1/2	11	7/8	8	6	5-3/8	7-11/16	8-5/8	8	5-11/32	8	
8	18	1-1/8	11-3/4	13-1/2	7/8	8	7-15/16	10-3/8	9-13/16	7-9/16	10	5-11/16	10	
10	27	1-3/16	14-1/4	16	1	12	9-3/4	10-3/8	11-3/16	9-1/8	10-1/2	5-11/16	12	
12	36	1-1/4	17	19	1	12	11-3/4	10-3/8	13-3/16	7-15/16	12-3/4	6-1/4	12-3/4	
14	45	1-3/8	18-3/4	21	1-1/8	12	12-3/4	10-3/8	15-3/16	9-1/8	14	6-5/16	14	

1. Bundle diameters are suitable for insertion into standard schedule 40 pipe. If higher schedule pipe is used, please specify.

Third Party Specifications by Housing Style

Model	Purpose		North American Designation(s)	Canadian Designation(s)	European Designation(s)	International Designation(s)
E1	General Purpose	Generic Agency (s)	NEMA 1, NEC UL/CSAus	NEMA 1 IP32 CSA	IP32 CE: Manufacturer's Declaration	CE: Manufacturer's Declaration
		Ratings	General Duty Only	General Duty Only	General Duty Only	General Duty Only
E4*	Moisture Resistant Note: Temps over T3 (200°C) require standoffs for third party listing. Refer to IECex & ATEX certifs. for standoff dimensions	Generic Agency (s)	NEMA 4 UL / CSAus	NEMA 4 CSA	IP66 CE: Manufacturer's Declaration	IP66 CE: Manufacturer's Declaration
		Ratings	Class I Div. 2, Groups B, C, D Groups E, F: 200°C (T3) Group G 165°C (T3B) Class I Zone 2 AEx nA II T1 to T6	Class I Div. 2, Groups B, C, D Class II Division 2, Groups E, F: 200°C (T3) Group G 165°C (T3B) Class I Zone 2 Ex nA II T1 to T6	II 3 G Ex nA II T1 to T6	Ex nA II T1 to T6
E2	Ex de IIC T1 to T6 540°C, 600°C Note: Temps over T4 (135°C) require standoffs for third party listing. Refer to IECex & ATEX certifs. for standoff dimensions	Generic Agency (s)	CSAus	CSA	ATEX	IECex
		Ratings	Class I, Div. 1 Groups B,C & D Class II, Div. 1 Groups E, F & G Class I Zone 1 AEx d IIB + H2 T1 to T6	Class I, Div. 1 Groups B,C & D Class II, Div. 1 Groups E, F & G Class I Zone 1 Ex d IIB + H2 T1 to T6	I 2 G EEx d IIB+H2 T1 to T6	Ex d IIB+H2 T1 to T6
E5 Flange Size 3"-8" 8"-12" 12"-18"	Moisture/Explosion Resistant ATEX IIC Labeling Reference CFP4 CFP8 CFP12	Generic Agency (s)			ITS ATEX	IECex
		Ratings			II 2 G EEx de IIC T1 to T6, 540°C, 600°C	Ex de IIC T1 to T6 540°C, 600°C

* **WARNING:** Addition of sparking devices such as a Thermostat to an E4 housing will annul hazardous area rating.

Flanged Immersion Heaters

Process Temperature & Overtemperature Controls

Temperature Control — Mechanical Devices

An integral on-off process temperature control thermostat can be factory installed into the housing of the heater. The sensing bulb of the thermostat is inserted into a thermowell in the center of the heating bundle. AR type mechanical controls (see Controls section for details) are utilized.

Mechanical Devices

Option Number	Thermostat Range
T1	0 - 100°F
T2	60 - 250°F
T3	200 - 550°F

Notes —

- A. The controls are for pilot duty only and must be connected to a remote mounted magnetic contactor.
- B. For explosion resistant heaters, an integral thermostat can only be specified on a 3, 5 and 6" flange immersion heater.

Temperature Control — Electronic Devices

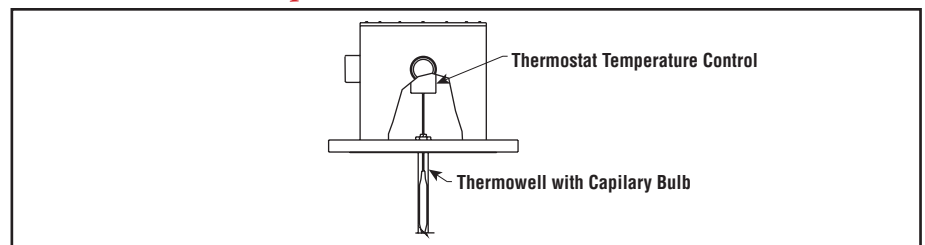
A process control thermocouple can be factory installed into a thermowell in the center of the heating bundle for process control. This thermocouple must be connected to a remote mounted electronic temperature controller.

Overtemperature Protection — Electronic Devices

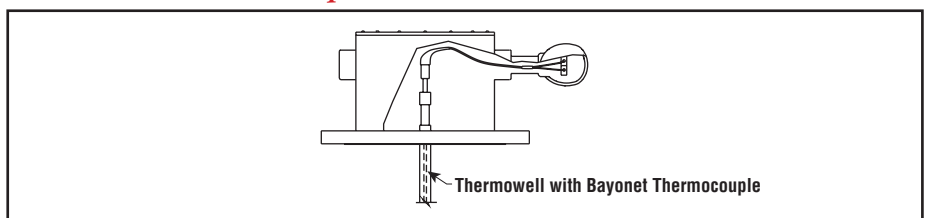
A thermocouple can be attached to the heating element sheath to switch the heater off in the event of a high temperature condition. This thermocouple must be connected to a remote mounted electronic high limit temperature controller.

FLANGED

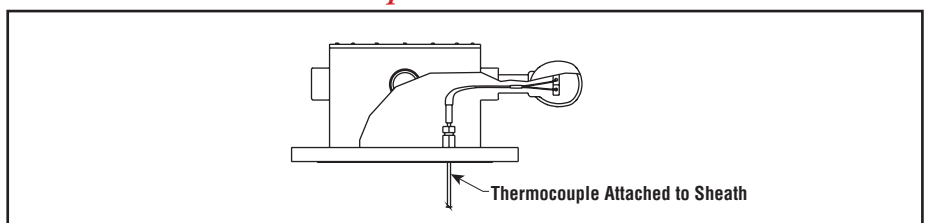
Mechanical Device Temperature Control (T1, T2 or T3)



Process Control Thermocouple



Overheat Protection Thermocouple



Flanged Immersion Heaters

Process Temperature & Overtemperature Controls

Flanged Immersion Heater Model Descriptions

Model										
TM	ANSI Flange Immersion Heater									
	Code	Element Sheath Material								
	(Blank)	Copper								
	O	Carbon Steel								
	S	304 Stainless Steel								
	I	Incoloy 800								
	X	Other Material								
	Code	Flange Material								
	(Blank)	Carbon Steel								
	S	304 Stainless Steel								
	X	Other Material								
	Code	Baffled Flow								
	(Blank)	No Baffles								
	B	Baffled Flow								
	Code	Number of Elements								
	03	Three Heating Elements								
	06	Six Heating Elements								
	12	Twelve Heating Elements								
	18	Eighteen Heating Elements								
	27	Twenty-Seven Heating Elements								
	36	Thirty-Six Heating Elements								
	45	Forty-Five Heating Elements								
	Code	Wattage								
	004P5	4.5 kW (use actual kilowatt in 3 digits)								
	Code	Terminal Housing Style								
	E1	General Purpose								
	E4	Moisture Resistant								
	E2	Explosion / Moisture Resistant								
	E5	Explosion / Moisture Resistant - addition of Group IIC w/ Acetylene (IEC only)								
	Code	Non-Standard Feature								
	(Blank)	Catalog PCN item								
	XX	Custom Feature								
	Code	Voltage								
	208	208V								
	240	240V								
	380	380V								
	415	415V								
	480	480V								
	575	575V								
	Code	Number of circuits								
	1	One								
	2	Two								
	3	Three								
	4	Four								
	Code	Phase								
	1P	Single Phase								
	3P	Three Phase								
	Code	Kilowatts								
	4.5	kW								
TM	I	- 03	- 004P5	- E4	480V	1	- 3P	4.5	kW	Typical Model Number

Example of Final Model Description: TMI-03-004P5-E4 480V 1-3P 4.5kW

Note: Shaded sections of the model build table are not a finite list. Items such as Number of Elements, Wattage, Voltage, Circuits, and Phase should be adjusted to match design.