

Flange Heaters

Construction Features

- Removable NEMA 1 outlet boxes provide free access to line terminals.
- Element spacers prevent hot spots.
- Permanent bus bars prevent loose connections.
- CSA approval available on most items.
- Raised face flanges insure leak-tight union with mating flange.
- Lifting rings afford ease of handling.
- Large diameter elements provide extra electrical insulation for better dielectric strength.

Field Wire and Knockout Sizing

Table II

Number of Three-Phase Circuits					Field Wire Gauge	Number Of Circuits (Three-Phase)	Maximum Outlet Box Temperature (°F)			
5	4	3	2	1			158	320	392	
Trade Size Conduit Required (Inches)							Wire Insulation Rating (°C)			
							90	200	250	
					Maximum Amps Per Three-Phase Circuit					
1-1/4	1	1	3/4	1/2	14*	1	12	18	19.1	
						2		14.4	15.2	
						3		12.6	13.3	
						4-5		9	9.5	
1-1/4	1	1	3/4	1/2	12*	1	16	22.5	26.4	
						2		18	21.1	
						3		15.7	18.5	
						4-5		—	11.2	13.2
1-1/2	1-1/2	1-1/4	1	3/4	10*	1	23.2	30	35.7	
						2		18.5	24	28.6
						3		16.2	21	25
						4-5		—	15	17.8
2	2	2	1-1/2	1	8	1	31.9	41.5	45.5	
						2		25.5	33.2	36.4
						3		22.3	29	31.9
						4-5		15.9	20.7	22.7
2-1/2	2	2	1-1/2	1-1/4	6	1	43.5	55	57.3	
						2		34.8	44	45.8
						3		30.4	38.5	40.1
						4-5		21.7	27.5	28.6
3	2-1/2	2-1/2	2	1-1/4	4	1	55.1	62.5	72.5	
						2		44	50	58
						3		38.5	43.7	50.7
						4-5		27.5	31.2	36.2
3	3	2-1/2	2	1-1/2	3	1	63.8	76	81.3	
						2		51	60.8	65
						3		44.6	53.2	56.9
						4-5		31.9	38	40.6
Consult Factory	3	2-1/2	2	1-1/2	2	1	75.4	85.5	93.5	
						2		60.3	68.4	74.8
						3		52.7	59.8	65.5
						4-5		37.7	42.7	46.7
Consult Factory	Consult Factory	3	2-1/2	2	1	1	87	98.5	105.3	
						2		69.6	78.8	84.2
						3		60.9	68.9	73.7
						4-5		43.5	—	—

Values per NEC 2005 Article 310.

Conduit sizing is based on largest wire insulation thickness for temperature ratings shown.

Consult factory for wire sizes above 1 gauge or if required amps per circuit is above listed values.

*Wire gauges 14, 12 and 10 are sized based on maximum fuse size per NEC Article 240-3.

Flange Heaters

Construction Features (continued)

Outlet Boxes - Removable NEMA 1 outlet boxes are furnished on heaters with 3" through 8" flanges, drawing up to 150 amps. A permanently mounted plate contains electrical knockouts.

On heaters with 10" and 12" flanges, or heaters drawing more than 150 amps, permanently attached NEMA 1 outlet boxes with threaded hubs are provided.

Element Spacers - Element spacers are fabricated from material similar to the element sheath and are normally perforated to allow for maximum fluid flow parallel to the elements. They prevent hot spots caused by elements touching while maintaining the size and rigidity of the heater bundle.

Spacers are provided on 24" maximum centers and are secured in such a manner as to allow elements to expand and contract freely.



Flanges - Raised face flanges carry a nominal Class 150 rating and are made from forged steel or mill certified steel plate to ANSI standards. Raised face insures a leak-tight gasketed union with mating flange.

Electrical Connections - Pipe flange heaters are furnished with properly sized terminals and conduit openings to match the heater load, number of circuits and operating temperature. Table II shows the maximum amperage per circuit for various gauges of field wiring brought to heaters having one through five circuits. Note: The maximum conduit size is 3".

Unless otherwise specified, heaters are furnished with conduit openings and terminals suitable for a maximum outlet box temperature of 250° F and the number of circuits shown in the table. Heaters ordered with additional circuits, or for higher fluid temperatures, will be furnished with conduit openings and terminals to accommodate the wire gauges shown in Table II.

For three-phase conduits, amperage per circuit is calculated as follows:

$$\frac{\text{Total Heater KW} \times 1000}{\text{Line Voltage} \times \text{No. of Circuits} \times 1.73}$$

Occasionally low KW heaters operate from single-phase power. In this case, omit the 1.73 factor in the above formula.

When a heater has more than five circuits, or requires field wiring that will not fit into a single 3" conduit, multiple conduit openings will be furnished. For example, a heater with outlet box temperatures of 350° F with six circuits drawing 70 amps each would be furnished with two openings, each sized for 3" conduit. At 70 amps, 250° C insulated 1 gauge field wiring is required for three circuits per conduit.

Gasketing - A 1/16" thick gasket is furnished as standard with each heater. The gasket is sized to match the seating surface on the flange. Spirotallic gaskets are also available.

Flange Temperature/Pressure Ratings - Although pipe flanges have nominal ratings, the actual pressure that they will safely withstand is a function of temperature. Table III below shows pressure ratings per ANSI Standard B16.5.

Flange Pressure Ratings (PSI)

Table III

Maximum Fluid Temperature °F	Class 150 Steel Flange (Standard)	Class 300 Steel Flange	Class 150 Type 304 SS Flange
-20 to 100	285	740	275
200	260	675	235
300	260	655	205
400	200	635	180
500	170	600	170
600	140	550	140
650	125	535	125
700	110	535	110
750	95	505	95
800	80	410	80
850	65*	270*	65
900	50*	170*	50
950	35*	105*	35
1000	20*	50*	20

*These ratings are permissible, but not recommended. Type 304 stainless is preferred above 800° F.

Flange Heaters

Construction Features (continued)

Bus Bars - Stainless steel bus bars are permanently welded in place to eliminate field failures due to loose bus connections. Copper bus bars are used with lower temperature heaters and where amperage is high.



Large Diameter Elements - Elements measure .475" O.D., providing extra electrical insulation for superior dielectric strength. As a result, elements are suitable for line voltages up to 600 volts. At the same time, uniform heat transfer from coil to sheath is assured by compacting the insulation in high pressure rollers, then repressing all bends to insure insulation integrity in this critical area. Copper sheathed elements are silver soldered to the flange; all other materials are welded.

Unheated Lengths - It is imperative that the entire heated length of an element be submerged in liquid to prevent the sheath from overheating. Normally, copper, steel and stainless steel sheathed heaters have a 2" minimum cold end (unheated length). Incoloy sheathed heaters have a 5" minimum cold end.

Vertically mounted heaters require a longer cold end in applications where the liquid may not otherwise cover the elements.

Terminal Seals - Moisture-resistant epoxy seals are furnished as standard on all copper sheathed heaters operating in maximum fluid temperatures of 250° F.

Since steel, stainless steel and Incoloy sheathed heaters may operate at higher temperatures, standard units in these materials are furnished with mica terminal insulators and without epoxy seals.

When specified, and within temperature limits, epoxy seals are available with steel, stainless steel and Incoloy sheaths.

For applications requiring an absolute seal against moisture, ceramic-to-metal hermetic seals are available for temperatures up to 1000° F.

Lifting Rings - Lifting rings are provided on all heaters with flanges 4" and larger to facilitate handling.

Circuiting - All standard heaters are designed with electrical connections for a maximum outlet box temperature of 250° F with one electrical circuit for single stage operation unless two or more circuits are specified in the listing tables.

Additional circuits are available upon request.

Three-phase circuits are always balanced using a multiple of three elements per circuit.

Flange Heaters

Construction Features (continued)

Dimensions of Class 150 ANSI Flange Heaters

Nominal flange size (inches)	Flange diameter (inches)	Flange thickness (inches)	Bolt circle (inches)	Bolt hole diameter (inches)	Bolt diameter (inches)	Number of bolts
2	6	3/4	4-3/4	3/4	5/8	4
3	7-1/2	15/16	6	3/4	5/8	4
4	9	15/16	7-1/2	3/4	5/8	8
5	10	15/16	8-1/2	7/8	3/4	8
6	11	1	9-1/2	7/8	3/4	8
8	13-1/2	1-1/8	11-3/4	7/8	3/4	8
10	16	1-3/16	14-1/4	1	7/8	12
12	19	1-1/4	17	1	7/8	12
14	21	1-3/8	18-3/4	1-1/8	1	12
16	23-1/2	1-4/9	21-1/4	1-1/8	1	16
18	25	1-9/16	22-3/4	1-1/8	1-1/8	16

Dimensions of Class 300 ANSI Flange Heaters

Nominal flange size (inches)	Flange diameter (inches)	Flange thickness (inches)	Bolt circle (inches)	Bolt hole diameter (inches)	Bolt diameter (inches)	Number of bolts
2	6-1/2	7/8	5	3/4	5/8	8
3	8-1/4	1-1/8	6-5/8	7/8	3/4	8
4	10	1-1/4	7-7/8	7/8	3/4	8
5	11	1-3/8	9-1/4	7/8	3/4	8
6	12-1/2	1-7/16	10-5/8	7/8	3/4	12
8	15	1-5/8	13	1	7/8	12
10	17-1/2	1-7/8	15-1/4	1-1/8	1	16
12	20-1/2	2	17-3/4	1-1/4	1-1/8	16
14	23	2-1/8	20-1/4	1-1/4	1-1/8	20
16	25-1/2	2-1/4	22-1/5	1-3/8	1-1/4	20
18	28	2-3/8	24-3/4	1-3/8	1-1/4	24

Height of Terminal Boxes

Nominal flange size (inches)	Flange diameter (inches)	Flange thickness (inches)	Bolt circle (inches)	Bolt hole diameter (inches)	Bolt diameter (inches)	Number of bolts
2	4-3/8	8-1/2	4-3/8	8-1/2	6	9-1/2
3	4-3/8	9-3/4	5-1/4	9-1/2	6	10-1/2
4	4-3/8	9	5-1/4	8-1/4	6	9
5	5	9	5-1/4	8-1/4	6	9
6	5	9	5-1/4	8-1/4	6	9
8	6	10	5-1/4	8-1/4	10	10
10	8-1/4	8-1/4	8-1/4	8-1/4	10	10
12	8-1/4	8-1/4	8-1/4	8-1/4	Consult Factory	Consult Factory