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Circulation Heaters
Selection Guidelines

Selecting a Circulation Heater

Selecting the proper circulation heater component requires critical engineering judgement and careful evaluation of the application. After determining the heat requirement for a specific heat application, the proper selection of the flange and vessel material, heating element sheath material, and correct watt density is critical to achieve long heater life. The ultimate selection of equipment is determined by the knowledge of the process and engineering acumen of the designer or plant engineer. Consult the Technical section of this catalog for circulation heater calculations and guidelines.

Application Factors

Heater selection is influenced by the following parameters.

1. The heated medium, viscosity, specific heat, density and corrosive properties.
2. The presence of contaminants in the medium.
3. The corrosion resistant properties of the heater sheath material.
4. The sheath watt density of the heating elements — the watts per square inch, and the flow rate of the heated medium.
5. The vessel design and material — pressure and temperature of the fluid being heated.

Corrosion Policy

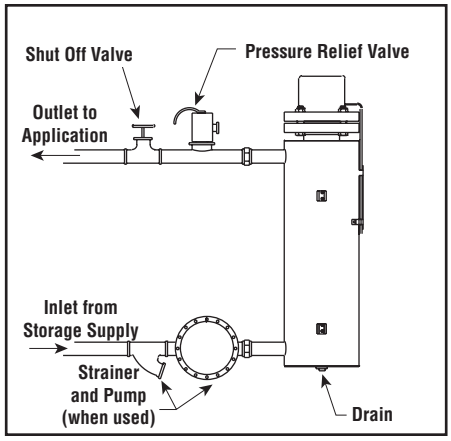
Chromalox will not warrant any electric heater against failure by sheath corrosion if such failure is the result of operating conditions beyond the control of the heater manufacturer. It is the responsibility of the purchaser to make the ultimate choice of sheath material based on his knowledge of the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

Circulation Heaters — Selection Guidelines

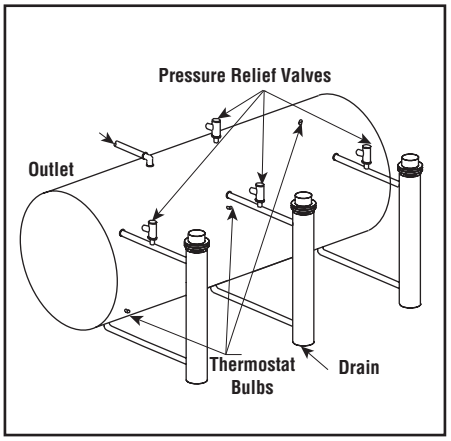
Application	① Solution or Heater Type	② Alkaline or Acid Content (Est. % by Volume)	③ Sheath Material	④ Watt Density (W/in^2)	⑤ Vessel Material
Water	Clean Water	pH6 to pH8 (Neutral)	Copper	45 - 100	Galvanized Steel
Mild Solutions	Process Water and Very Weak Solutions Weak Solutions Demineralized, De-ionized or Pure Water	pH5 to pH9 (2 - 3%) 5 - 6% —	INCOLOY® INCOLOY® INCOLOY®	45 - 86 45 - 75 45 - 75	Stainless Steel Stainless Steel Stainless Steel
Corrosive & High Viscous Solutions	Mildly Corrosive Solutions More Severe Corrosive Solutions Severely Corrosive Solutions	5 -15% 10 - 25% 30 - 60%	INCOLOY® INCOLOY® INCOLOY®	20 - 25 20 - 25 10 - 20	Stainless Steel Stainless Steel Stainless Steel
Oil	Low Viscosity Oils Medium Viscosity Oils High Viscosity Oils (Fuel Oil)	— — —	Steel Steel Steel	20 - 25 10 - 20 5 - 15	Steel Steel Steel
Air, Gases & Steam	Medium Temperatures to 750°F High Temperatures to 1400°F	— —	INCOLOY® INCOLOY®	20 - 25 10 - 20	Steel Stainless Steel

Typical Applications

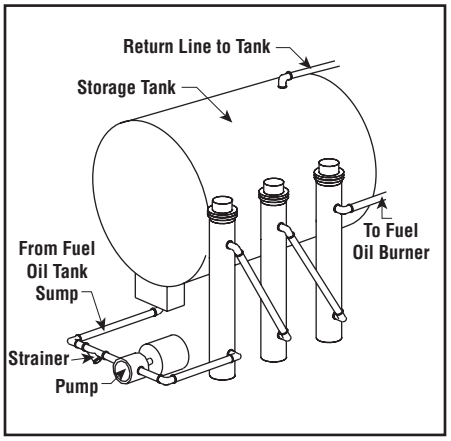
Inline Heating — Where demands for heated water or oil are nearly constant, circulation heaters may be installed directly in the fluid line, eliminating the need for storage tanks and their related heat losses.



Side Arm — Requirements of large storage tanks can be satisfied by using a number of circulation heaters, providing flexibility in temperature control and reducing power demand.



Closed-Loop Fuel Oil Heating — Requirements may be provided by a number of circulation units individually adjustable to temperature and fluid flow, reducing electrical demand on your utility bill.



Circulation Heaters
Selection Guidelines *(cont'd.)*

Circulation Heaters — Selection Guidelines

Application	Heater/Vessel Material	kW Rating	Feature	Model	Page
Clean Water	Copper/Steel or Brass	1.5 - 3	Booster	NWHJR	C-13
	Copper/Galv. Steel	3 - 18 6 - 500	Screw Plug Flanged	NWH	C-11
Clean Water or Oil	INCOLOY®/ Galvanized	0.5 - 40	Field Adjustable	NWHSRG	C-14
Corrosive & High Viscous Solutions	INCOLOY®/ Stainless INCOLOY®/ CPVC	6 - 200 2 - 30 1.5 - 3	Flanged Reduced Watt Density Non-Metallic Body	NWHIS NWHOIS CVCHS	C-29 C-30 C-16
Oil Light Medium	Steel/Steel	3 - 120 30 - 120	Flanged Baffled	NWHSR NWHO NWHOB	C-19 C-17 C-18
Heavy	Steel/Steel	3 - 120 20 - 70	Reduced Watt Density Baffled	NWHOR NWHORB	C-21 C-21
Steam, Air & Gas	INCOLOY®/ Steel INCOLOY®/ Stainless	30 - 50 0.5 - 3.0 3 - 350 2 - 200	Low Flow Flanged Flanged Baffled	GCHCIS GCHI GCHIS GCHISB	C-33 C-24 C-32 C-32
Pre-engineered Packages — Wired & Skid Mounted					C-34
ASME & Custom Engineering Specifications (SDS)					C-35

Codes & Standards

ASME Certification to Sections I, III, IV and VIII, Division 1 or PED — Chromalox is the leader in providing ASME (American Society of Mechanical Engineers or PED) certification for pressure vessel applications.

Underwriters Laboratories — UL Listing available for many circulation heaters. Consult your Local Chromalox Sales office.

ATEX Directive — Many Chromalox products are approved for use in explosive atmoshpe-here

Canadian Standards Association — CSA certification available.

National Electrical Code (NEC and IEC) — All Chromalox circulation heaters are built to allow NEC installation requirements.

Special Features Available

Kilowatt Ratings — Large kilowatt circulation heaters (500 kW and above) are available as single chambers or with multiple chambers in series. Skid mounting and integral control panels are also available.

Vessel Construction — Chamber size available in 10, 12, 14, 16, 18" and above for larger kilowatt capacities.

Pressure Ratings — 150, 300, 400, 600, 900, 1,500 and 2,500 Lb. Class.

Materials — 304, 316, 321, 347 Stainless Steel, INCONEL® and more.

Thermocouples can be provided on element sheath for overtemperature protection and/or mounted in the outlet nozzle for process control.

Inlet and Outlet Nozzles — Available with flanged or threaded connections, smaller or larger pipe sizes and different orientations.

Baffles mounted on element bundle inside chamber to increase fluid or gas velocity.

Terminal Standoffs in 4, 6 and 8" allow the terminal enclosure housing and the field wir-ing connection to operate at lower tempera-tures in high temperature heaters. Standoffs are frequently used in heat transfer and gas heating applications.

Mounting Saddles for horizontally mounted circulation heaters.

Weatherproof Insulation Jacket for outdoor unprotected installations.

More Information is Available Online.

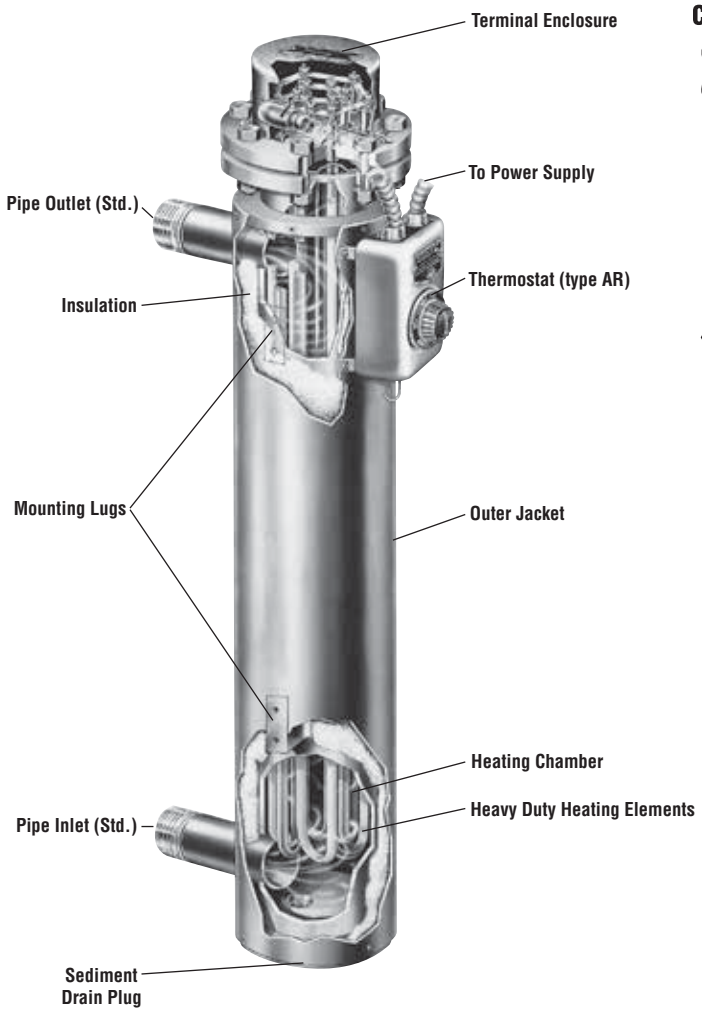
Bookmark Your Browser to ***www.chromalox.com*** *and Select* ***Manuals.***

Circulation Heaters

Features

- Kilowatt Ratings from 0.5 kW (500 W) to Over 500 kW (500,000 W)
- Voltage Ratings to 600V
- Pressure Ratings to 5000 psig (345 bar)
- Temperatures to 1500°F (815°C)
- Pipe Chambers 1 - 48" NPS
- Quality Heating Elements in Screw Plugs or Flanges for Ease of Replacement
- Sheath Materials include Copper, Steel, Stainless, INCOLOY® and INCONEL® to Suit Most Operating or Corrosive Environments
- Vessel Materials include Carbon Steel, 304 or 316 Stainless Steel, Non Ferrous Alloys and High Temperature Plastics
- Terminal Enclosures for General Purpose, Moisture Resistant and Explosion Proof Applications
- Thermocouples and RTD Sensors for Process and Overtemperature Control
- Wide Range of Mechanical and Solid State Electronic Controls including Temperature Controllers
- Contactor or SCR Power Panels for Close Temperature Control (see Controls Section)
- Vertical or Horizontal Mounting with Mounting Lugs or Saddle Supports
- Available with High Temperature Standoffs and Internal Element Baffles
- Custom Designed Skid Mounting, Multiple Chambers and Integral Control Panels
- ASME Certification Section I, III, IV or VIII, Division 1 or PED
- UL, CSA, ATEX and Other Third Party Approval, Listing or Certification Available on Many Models

Basic Construction



Basic Construction

Terminal Enclosures — E1 General Purpose, sheet metal, painted with red enamel, E2 Moisture Resistant/Explosion Proof, E4 Moisture Resistant.

Controls — Some catalog units are provided with a thermostat mounted on the heater.

Mounting — Small units supported by inlet and outlet piping; larger units provided with mounting lugs for support.

Outer Jacket — Constructed of heavy gauge painted steel sleeving which contains high temperature thermal insulation to reduce heat losses from heating chamber.

Heating Chamber — Pipe chambers (150 Lb welded construction, standard) have a flanged or threaded end to receive heater assembly and are closed at the opposite end. Larger units have drain connections to allow sludge removal. Inlet and outlet nozzles are provided for circulation of fluid or gas through heater chamber. Chamber material available in Steel, Galvanized Steel or Stainless Steel depending on the application.

Heating Elements — Flange or screw plug mounted tubular type heating elements offered in Stainless Steel, Copper, Steel or INCOLOY® sheath to suit corrosive resistance requirements.

Wiring Connections — All Etirex circulation heaters are provided with internal wiring and power connections that are sized in accordance with wiring tables in the National Electrical Code and International Electric Code. For safe operation of the heaters, all external wiring should also be in accordance with local codes.

Circulation Heaters
Terminal Enclosures

- **E1 General Purpose**
- **E2 Moisture Resistant/Explosion Resistant**
- **E4 Moisture Resistant**
- **Conduit Openings Matched to the Number of Circuits**

Applications

The versatility of electric heaters permits them to be used in almost any conceivable location indoors or outdoors, exposed to the weather. Chromalox provides a variety of electrical terminal enclosures to match the unique requirements of virtually any environment.

Features

E1 General Purpose Enclosure — Suitable for most indoor or protected commercial and industrial applications.

E2 Combination Moisture Resistant and Explosion Proof Enclosures — Type E2 explosion proof terminal enclosures are intended for use in hazardous locations. Refer to the following table for details.

Type E2 terminal enclosures are provided with gaskets and are suitable for outdoor or wet locations as well as hazardous areas.

E4 Moisture Resistant Enclosure — Suitable for outdoor or wet locations. The terminal covers are provided with water-tight gaskets to seal the electrical terminals and connections from the environment.

Special Requirements for Electric Heaters & Terminal Enclosures in Hazardous Locations:

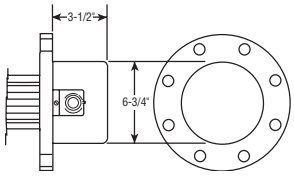
Wiring — The proper use of Type E2 terminal enclosures on electric heaters located in hazardous areas requires that all electrical wiring comply with National Electrical Code (NEC) and IEC requirements for hazardous locations.

Maximum Temperatures — Safe operation in a hazardous location requires the maximum operating temperatures of all exposed surfaces of the heater including temperatures on the outside of the vessel, piping, flanges, screw plugs, enclosures and other heat conducting parts be limited. The maximum surface temperature permitted in any hazardous location is determined by the flammable liquids, vapors or gases present. The end user or purchaser of the electric heating equipment is responsible for determining the proper classification of an area and for providing Chromalox with hazardous area specifications and requirements for proper equipment design. (NEC Articles 500 and 501 provide guidelines for evaluating and classifying hazardous locations.)

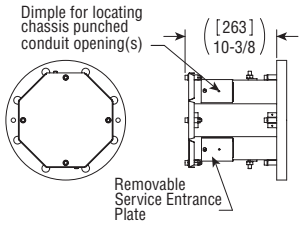
Safety Devices — Approved pressure and/or temperature limiting controls must be used on electric heaters and heating elements to ensure safe operation in the event of system malfunctions.

Note 1 — Class I Group B locations include Hydrogen gas. These areas require additional conduit seals and thread engagement. Contact your Local Chromalox Sales office for heaters and terminal enclosures suitable for Class I Group B hazardous locations.

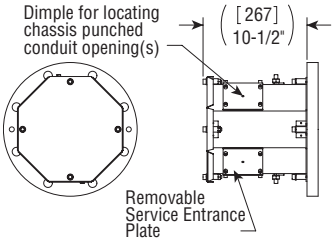
Typical Terminal Enclosures



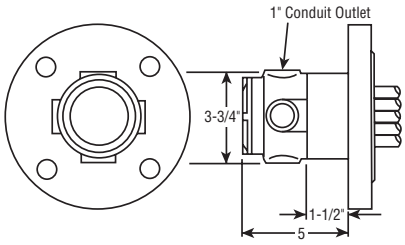
E1 — General Purpose, for up to 5" Flange



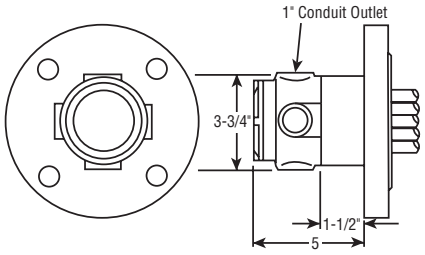
E1 — General Purpose, for 6" and Larger Flange



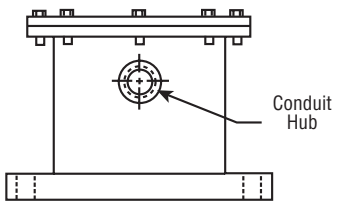
E4 — Moisture Resistant Enclosure with Gasket 6" and Larger



E4 — Moisture Resistant Enclosure with Gasket up to 5" Flange



E2 — Explosion Proof Enclosure up to 5" Flange



E2 — Explosion Proof Enclosure for 6" and Larger Flange

Circulation Heaters
Terminal Enclosures

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 stand-offs 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	**Moisture Resistant/ Explosion Proof Ex d IIB+H2 T1 to T6** **Note:** Temps over T4 (135°C) require stand-offs 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
E4 Flange Size 3"-8" 8"-12" 12"-18"	**Moisture Resistant/ Explosion Proof Ex d IIB+H2 T1 to T6 540°C, 600°C** ATEX IIC Labeling Reference CFP4, CFP8, CFP12 Refer to European Catalog	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.

Circulation Heaters

Terminal Enclosures

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	
			Minimum Standoff Dimension		Minimum Standoff Dimension	
Temperature Code	Wet Face Temperature: °F	Wet Face Temperature: °C	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	
			Minimum Standoff Dimension		Minimum Standoff Dimension	
Temperature Code	Wet Face Temperature: °F	Wet Face Temperature: °C	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	
			Minimum Standoff Dimension		Minimum Standoff Dimension	
Temperature Code	Wet Face Temperature: °F	Wet Face Temperature: °C	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

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Circulation Heaters

Mechanical & Electronic Control Options

Ordering Information

To Order — Complete the Model Number using the Matrix provided.

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.

Model — **Clean Water**

Code	
GCH	Gas Circulation Heater
NWH	Liquid Circulation Heater

Bundle Connection Style

Code		Code	
(Blank)	ANSI Flange	JRG	Special Galvanized Body w/ 1" NPT Plug, Copper Element
MT	NPT Threaded Screwplug	C	Cartridge Style heater, NPT thread
SRG	Special Galvanized Body w/ 2.5" NPT Plug, Incoloy Element		

Element Sheath Material

Code	
(Blank)	Copper
O	Carbon Steel
S	304 Stainless Steel
I	Incoloy 800
X	Other Material

Shell Material

Code	
(Blank)	Carbon Steel
S	304 Stainless Steel
X	Other Material

Baffled Flow

Code	
(Blank)	No Baffles
B	Baffled Flow

Number of Elements

Code		Code	
03	Three Heating Elements	27	Twenty Seven Heating Elements
06	Six Heating Elements	36	Thirty Six Heating Elements
12	Twelve Heating Elements	45	Forty Five Heating Elements
18	Eighteen Heating Elements		

Wattage

Code	
004P5	4.5 kW (use actual kilowatt in three digits)

Terminal Housing Style

Code	
E1	General Purpose
E4	Moisture Resistant
E2	Explosion / Moisture Resistant
E5	Explosion / Moisture Resistant - addition of Group IIC w/ Acetylene (IEC only)

Non-Standard Feature

Code	
(Blank)	Catalog PCN item
XX	Custom Feature

Voltage

Code		Code		Code	
208	208V	240	240V	380	380V
415	415V	480	480V	575	575V

Number of Circuits

Code		Code	
1	One	3	Three
2	Two	4	Four

Phase

Code	
1P	Single Phase
3P	Three Phase

Kilowatts

Code	
4.5	kW

GCH	I	-03	-004P5	-E4	480V	1	-3P	4.5kW	**Typical Model Number**

Example of Final Model Description: GCHI-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.