



Heater

■ FORMULAS

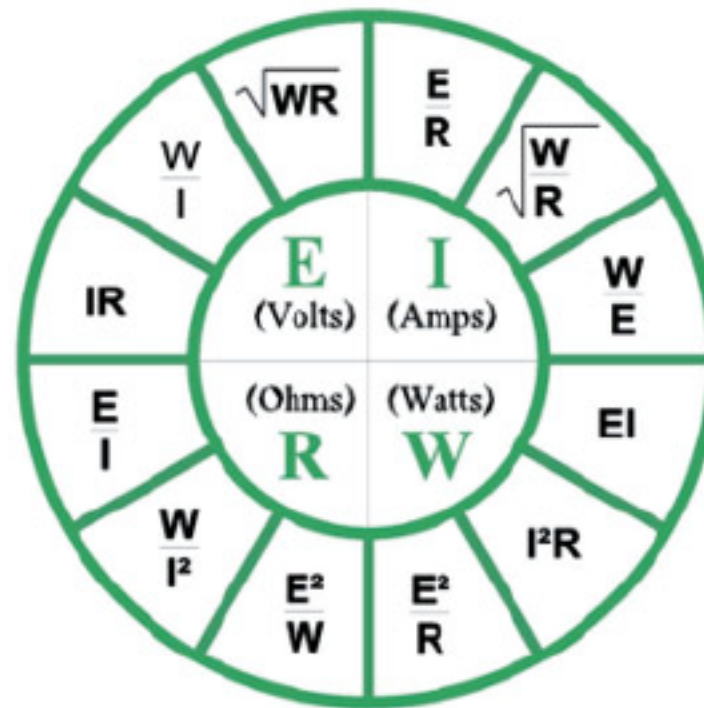
OHMS

$$\text{Ohms} = \frac{\text{VOLTS}^2}{\text{WATTS}}$$

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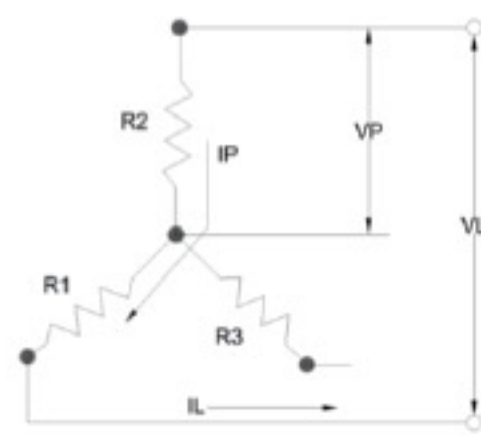
$$3 \text{ PHASE AMPERES} = \frac{\text{TOTAL WATTS}}{\text{VOLTS} \times 1.732}$$



3 PHASE WYE (BALANCED LOAD)

$$I_P = I_L$$

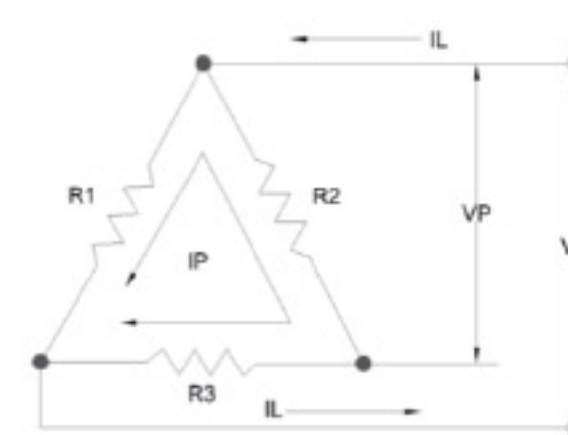
$$V_P = \frac{V_L}{1.73}$$



3-PHASE DELTA (BALANCED LOAD)

$$I_P = \frac{I_L}{1.73}$$

$$V_P = V_L$$



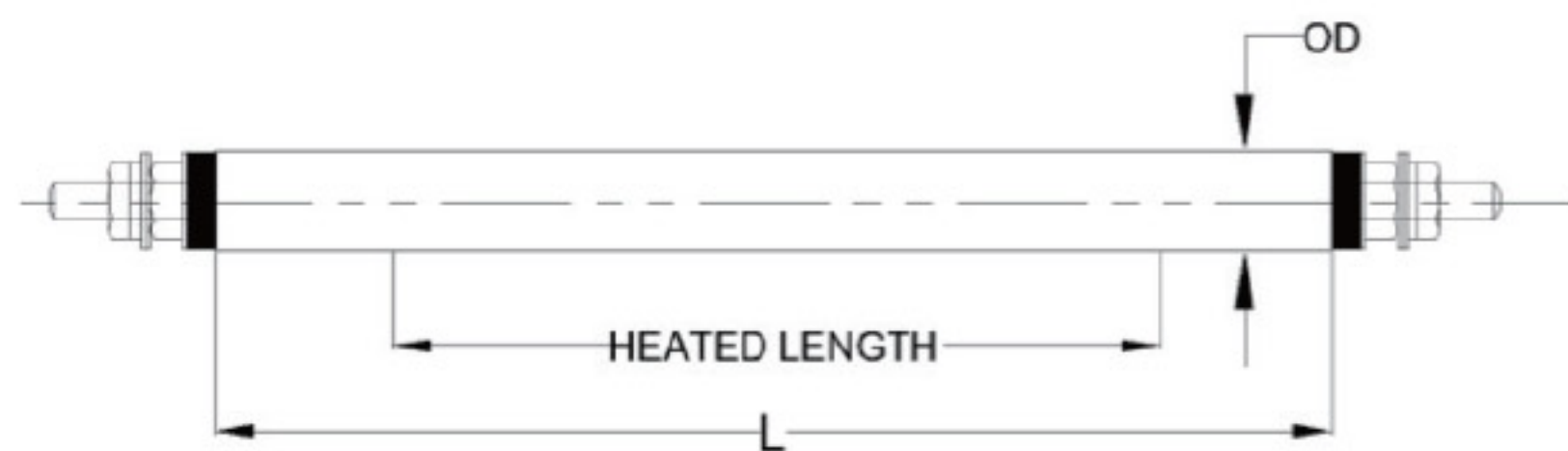
■ ESTIMATE OF WATTAGE REQUIREMENTS

$$KW = \frac{\text{WEIGHT (KG)} \times \text{SPECIFIC HEAT} \times \text{TEMPERATURE RISE (}^\circ\text{C)}}{860} \times \text{HEAT UP TIMES (HRS)} + \text{LOSS} + \alpha$$

■ SPECIFIC HEATED

SUBSTANCE	KCAL / KG
ALUMINIUM	0.23
COPPER	0.1
STAINLESS	0.11
GLASS	0.186
RUBBER	0.27 - 0.48
STEEL / IRON	0.12
BENZINE	0.45
ZINC	0.095
WATER	1
ALCHOL	0.65
HELIUM	1.25
ETHYLENE	0.4
CO2	0.203
NITROGEN	0.245
AIR	0.237

■ WATTS DENSITY



$$\text{WATT DENSITY} = \frac{\text{WATTS}}{\text{OD OF HEATERS (CM)} \times 3.14 \times \text{HEATED LENGTH (CM)}}$$



Heater

■ MAXIMUM WATT DENSITY OF EACH HEATER

HEATER	WATTS DENSITY	MAX TEMPERATURE
BAND HEATER	4 - 5 W/CM ²	-
CARTRIDGE HEATER	15 W/CM ²	-
SHEATH HEATER		
• WATER	8.0 W/CM ²	100 °C
• MACHINING OIL	2.8 W/CM ²	120 °C
• COATING BATH WITHOUT OIL	3.8 W/CM ² 3.0 W/CM ²	200 °C 300 °C

■ USAGE TEMPERATURE OF SHEATH HEATER

APPLICATION	TEMPERATURE
WATER	100 °C
AIR	120 °C
STEAM	100 - 450 °C
OIL	260 °C
ELECTRIC FURNACE	540 °C
ANNEAL	580 °C

■ SHEATH HEATER WITH CURRENT CAPACITY

SHEATH "OD"	TERMINAL	FITTING	CURRENT
Ø7, Ø8	Ø3.0	M3	10A
Ø9, Ø10	Ø4.0	M4	15A
Ø12, Ø14	Ø5.0	M5	25A
Ø16	Ø6.0	M6	35A

■ PROTECTION TUBE CHOICE

APPLICATION	PIPE MATERIAL
WATER	SUS316L
AIR	SUS321, SUS316L, INC800, INC600
OIL	SUS321, STPT
MOLD	SUS304, SUS321
CORROSION	SUS316L, INC800, INC600, TITANIUM

■ STRUCTURE OF HEATER

SHEATH HEATER

(1) SHEATH PIPE	(6) TERMINAL INSULATOR
(2) HEATING ELEMENT	(7) WASHER
(3) INSULATION POWDER	(8) NUT
(4) SPECIAL INSULATOR-1	(9) TERMINAL
(5) SPECIAL INSULATOR-2	

CARTRIDGE HEATER

(1) HEATING ELAMENT	(5) NIKEL PIN
(2) INSULATION POWDER	(6) TERMINAL
(3) SHEATH PIPE	(7) INSULATOR
(4) CERAMIC CORE	(8) HEAT WIRE



Heater

■ APPLICATION



CARTRIDGE HEATER

Continues to provide superior heat transfer, uniform temperature and resistance to oxidation and corrosion even at high temperatures.

Applications

- Molds
- Dies
- Platens
- Hot plates



IMMERSION HEATER

Tubular elements and assemblies are primarily used for direct immersion in water oils, viscous materials, solvents, process well as air and gases.

Heating assemblies, including

- Screw plug
- Flange
- Circulation

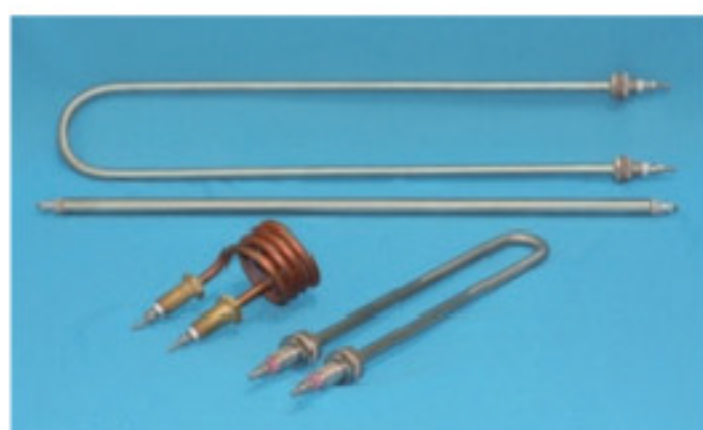


FINNED HEATER

Aluminized steel fins are attached in a way that maximizes surface and transferred into the air faster.

Applications

- Drying ovens
- Air heating
- Ink drying
- Moisture protection



TUBULAR HEATER

Tubular elements and assemblies are primarily used for direct immersion in water, oils, viscous materials, solvents, process well as air and gases.

Heating assemblies, including

- Screw plug
- Flange
- Circulation

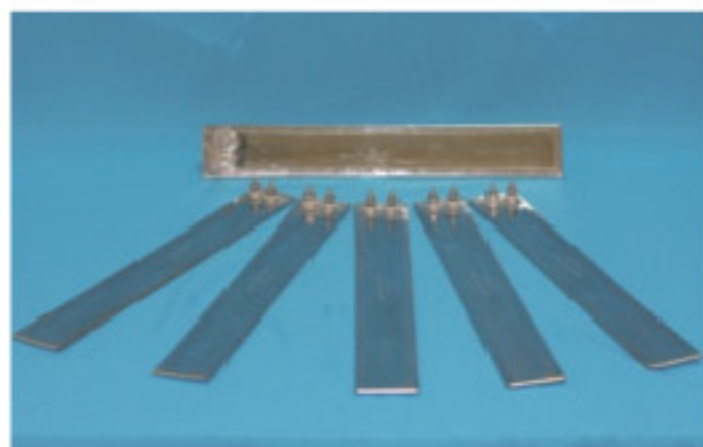


BAND HEATER

Operating temperature to 1400°F (760°C) make it possible to safely melt even the newest resins, like peek , Teflon

Applications

- Extruders
- Blown film dies
- Injection molding machines
- Other cylinder heating applications



STRIP HEATER / PLATE HEATER

The heater resheathed in rust-resistance steel or in stainless steel sheath as it provides strength and good thermal conductivity. These heater are available with various terminal

Option

Screw / Pin / Flexible lead wire



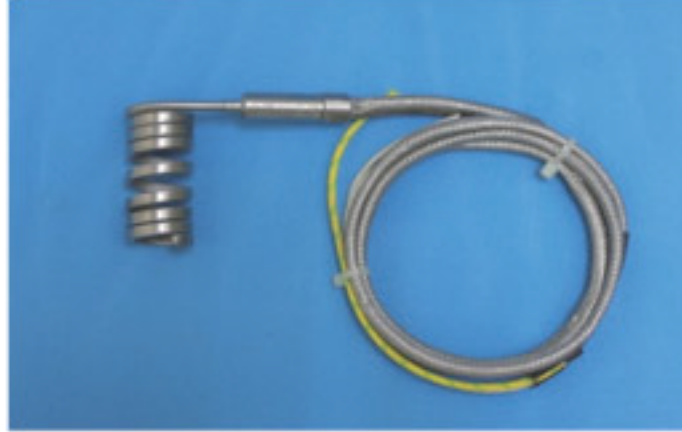
BOBBIN / PIPE HEATER

Robbin and pipe heater are inserted into a thermowell, offer a large heated area to the liquid. It is suitable for usage of oil, wax and fat. The advantage of this heater is, it can be removed for repair.



Heater

■ APPLICATION



HOT RUNNER

The heater can be formed into a compact coiled nozzle heater for use on plastic injection molding equipment supplying a full 360 degrees of heat with optional distributed wattage.

Flat spiral configurations are used in semiconductor manufacturing while a star wound cable is used for air and gas heating.



ALUMINIUM CASTING HEATER

The heater part consists of a formed cable or tubular heater cast into aluminum.

For high temperature applications, The part is then customized to meet specific application needs including machining, termination, coatings and assembly



INFRARED CERAMIC HEATER

Infrared heater provides medium wave infrared energy and fast heat up and cool down.

With element temperature around 1700°F (930°C) the heater produces infrared radiation with a peak energy wavelength of 2.5 microns.

Applications

- Shrink packaging
- Vulcanizing and curing rubber
- Lamination
- Drying processes : photos, textiles, coatings and sand core castings.

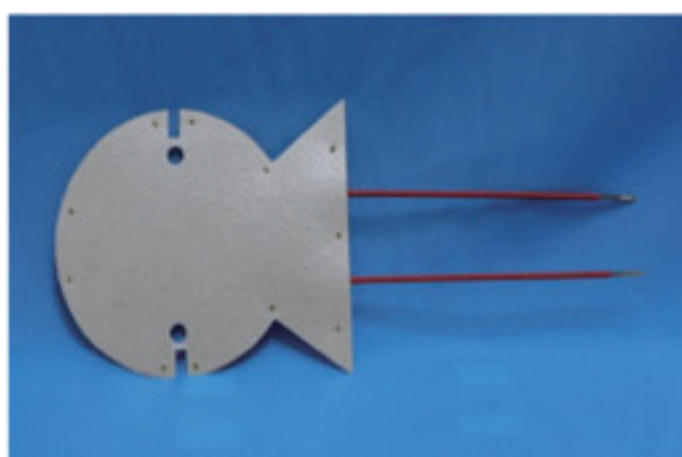


SILICON RUBBER HEATER

Silicone rubber heaters is limited only by the imagination. With these heaters, heat can be placed where it is needed and operating temperatures up to 500°F (260°C)

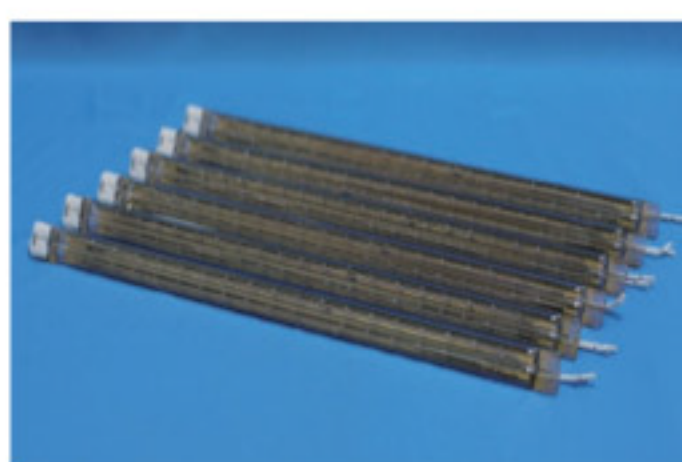
Applications

- Computer peripherals such as laser printers
- Curing of plastic laminates
- Photo processing equipment
- Semiconductor processing equipment
- Medical equipment such as blood analyzers and test tube heaters



MICA HEATER

Mica heaters are an excellent choice when cost and performance supersede substrate flexibility. Mica is a rigid substrate able to withstand very high temperatures and are suited for applications up to 500°F (260°C). Mica heaters can be configured in a wide range of sizes and watt densities. Mica heaters offer several distinct advantages over other flexible heater technologies, including extremely low leakage, lower material costs, and higher operating temperatures.



QUARTZ /INFRARED HEATER

Quartz infrared heating elements provide medium wave infrared radiation. They are favoured in industrial applications where a more rapid heater response is necessary, including systems with long heater off cycles.