Ribco®

Since 1964

An ISO 9001:2000 Certified Company

heating elements & thermocouples

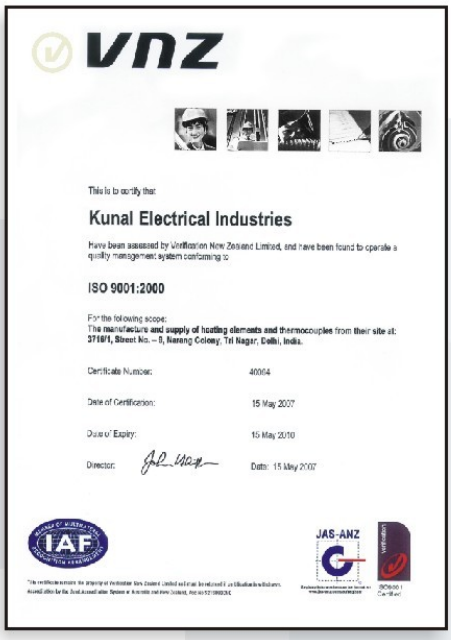
- water
- air
- chemical
- plastic
- dyes
- infra red
- defrost

HOT

HOTTEST AMONGST ALL

Company Profile

From the outset Kunal Electrical Industries has established itself in the market by proposing innovative solutions which has helped us to put the company where it is today, as market leader. Over the years Kunal Electrical Industries under the brand Name "Ribco" have been able to constantly improve on the quality of its products spurred on by growing demand for high-tech applications. This is the reason why **Kunal Electrical Industries** was one of the first companies in this sector with a Quality System Approved in accordance to **ISO 9001:2000** vision.


VNZ

This is to certify that

Kunal Electrical Industries

Have been assessed by Verification New Zealand Limited, and have been found to operate a quality management system conforming to

ISO 9001:2000

For the following scope:
The manufacture and supply of heating elements and thermocouples from their site at: 371071, Sheet No. – 0, Narang Colony, Tri Nagar, Delhi, India.

Certificate Number: 40004

Date of Certification: 15 May 2007

Date of Expiry: 15 May 2010

Director: Date: 15 May 2007

IAF

JAS-ANZ

..... and a look into the Future

we aim to be an attractive employer in a company with an ethos of a strong team spirit and an open management style. Our instrument in people involves demanding training schemes. In this way, we encourage a high level of creativity, close involvement and a customer oriented approach.

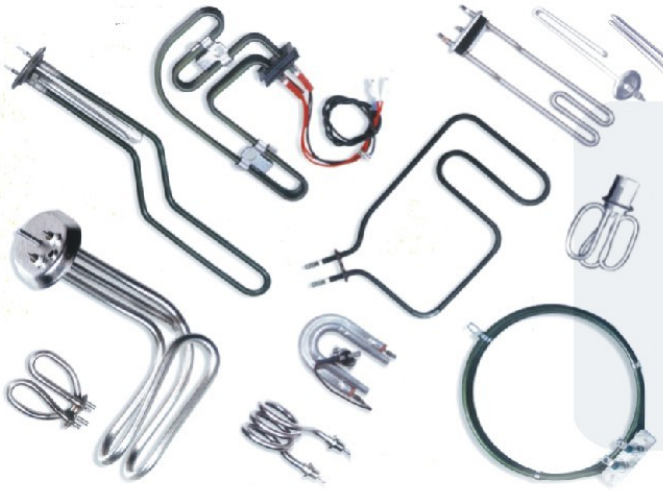
The high level of motivation and enthusiasm for innovation within our company result in an on-going process of development of new applications in the field of Heating Elements and Thermocouples with ever increasing efficiency of the product we offer for each individual application. We consider it fundamental to work closely with our customers, to make sure that we understand their needs and to meet these on time.

To combine Science and practice is part of our tradition and in the future, it is our intention to continue to pursue this course of combining a steady growth with the flexibility that will give out Customers " the right heat in the right place".

Ribco SINCE 1964

Domestic and Industrial Tubular Heating Elements

Tubular heating elements sheathed in Copper, Stainless Steel, Bundy, Incoloy or Titanium tubing of any shape and size for all makes of water, oil & air heaters for appliances.



Ribco Long Life tubular heater : in Copper, Stainless Steel, Bundy, Incoloy, Brass, Tubular sheathed heating element compacted with high grade insulation powder for better transmission of heat for different commercial applications.

Use : Instant and storage water heaters, Iron, Sandwich Toaster, Ovens (OTG), Roti Maker, Jug Kettles, Sterlizers, Waffle Bakers, Tandoors, Washing Machines, Dish Washer, Salamander, Defroster etc.

■ Commercial Water Heater

Ribco Commercial Water Heater : In Copper/Stainless Steel tubular sheathed, brazed with Brass flange nickel chrome plated provided with earthing terminal and a bacolite/plastic/matalic cap for protection of terminals.

Use : Light duty (intermittent) Boilers, Washing Machines, Geysers, Coffee Urns, Sterilizers and for other Commercial purposes.

Ribco Industrial Water Heater : In Copper/Stainless Steel tubular sheathed heating element, brazed with Brass flange nickel chrome plated provided with earthing terminal and a bacolite/plastic/matalic cap for protection of terminals.

Uses : Heavy duty industrial hot Water Baths, Water Jacketted apparatus, Side arm circulating process Tanks, Steam Generator etc.

■ Industrial Water Heater

■ Coil Heater

Ribco Coil Heater : In Stainless Steel /encoloy/enconel tubular sheathed, coiled with automatic machine and fitted mild steel/ Stainless Steel with easy plug in brass terminals.

Uses : Used in Hot Plates and Cooking Range, Ovens, Conveyers etc.

NOTE : Special Heaters can also be designed and supplied in accordance to the requirement of the customer, for which customers are requested to provide detail of dimensions with sketch or sample of the heating element along with input voltage and required wattage. The description of the sheath of the tube with the preferences and the application of the heating element.

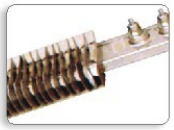
Ribco SINCE 1964

Air Heater for Domestic and Industrial Applications

Heating elements sheathed in Mild Steel, Stainless Steel, Bundy, Incoloy or Titanium Sheet and tubing of any shape and size for all makes of air heaters for appliances and industrial ovens.

■ Strip Heater

Ribco Strip Heater : Made of Kanthal wire, supported in Fluted Refractory, sheathed in rust resisting zinc plated MS or SS Sheet with end tab/circular holes for mounting.
Uses : Provides Black Heat in Ovens, Industrial and Commercial Heating Chambers and Panel Boards, Forced Air Ducts, Blower Units, Ovens, Dryers etc. Preferably Horizontal Mounting



Ribco Finned Strip Heater: Basically a Heavy Duty Strip Heater with locked on Fins for fast transfer of heat to air.
Uses : In Forced Air Ducts, Blowers units, Ovens, Dryers etc. Preferably Horizontal Mounting

■ U Shaped Heater

Ribco Long Life 'U' shape air heater : Chrom-Nickel steel tubular sheathed heating Element compacted with high grade insulation powder for better transmission of heat, provided with adjustable brackets and heavy duty brass terminals.

Uses : For efficient Heating, Baking, Curing of Paints, Enamels, Lacquers, Varnish, Adhesives. In Dehumidifying Equipments, for Dryers of Metals, Powder, Sand Paper, Plastics, Textiles, Printing Industries, in Hot Air Ducts, Oven etc.

■ Tubulor Air Heater in Different Shape

Ribco Long life 'U' finned air heater : Chrome Nickel, sheathed heating Element fitted with MS / SS Finns on top with adjustable brackets and heavy duty brass terminals.

Uses : In Recirculating Ovens, Comfort Heaters, Air Ducts, Industrial Processes, Load Resistors, Humidity Control Units and Sauna Bath Heater.

■ U Shaped Finned Heater

Air Duct Heaters

Ribco Tubular Duct Heater consists of assemble of sheathed tubular or finned tubular elements or Medium Wave Infrared Heater. Available in box or slid type commonly used for warming, drying, preheating and treating.

Uses : Specially Designed Air Duct Heater Fitted with medium wave infra red Heater. Preferably Horizontal Mounting

Uses : Specially Designed Forced-draught Dud Fitted with S.S. tubular finned heater for heating upto 300° C.

Uses : Specially Designed Forced-draught air heating upto 300° C.

NOTE : Special Heaters can also be designed and supplied in accordance to the requirement of the customer, for which customers are requested to provide detail of dimensions with sketch or sample of the heating element along with input voltage and required wattage. The description of the sheath of the tube with the preferences and the application of the heating element.

Alkaline, Chemical & Oil Heaters

Heating elements sheathed in Stainless Steel, Incoloy or Titanium tubing, Glass, Silica and Quarts Tube of any shape and size for all types of alkaline solutions and chemicals

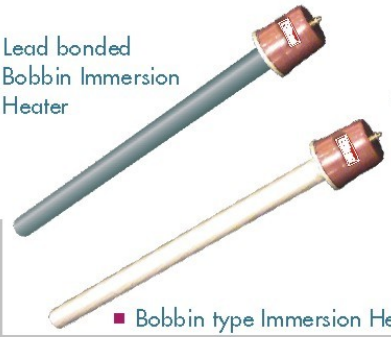
Ribco Alkaline immersion heaters : Chrome Nickel sheathed heating elements barazed to C.I./Mild Steel junction box for mounting on side of the vessel, easy to remove & clean.

Uses : Used for Heating Alkaline Cleaning Solutions, Detergents and other Alkaline Solutions normally corrosive to Mild Steel.

■ Alkaline Immersion Heater

■ Lead bonded Bobbin Immersion Heater

Ribco Re-wireable Bobbin type Immersion Heaters are available in M.S. /S.S., Titanium and Lead Bonded Tube. Replaceable refractory insulated heating element inside the tube is compacted with high grade insulation powder for better transmission of heat which enables horizontal as well as vertical application. (Rectangular/Square Top can be provided on order)

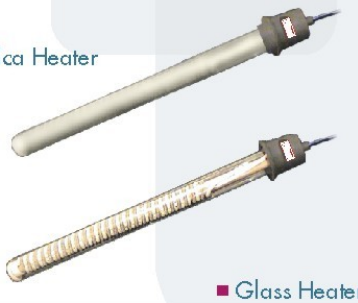


■ Bobbin type Immersion Heater

■ Silica Heater

Ribco Glass/Silica Incased Immersion Heater Made of fine glass or imported fused silica tubing with remountable heating element inside, provided with heat resistent rubber cap and connecting cable.

Uses : Highest temperatures in all Acids, Ferric Chloride, Etching Bathes, Anodising, Bright Dip Baths, Excepts Hydrofluoric and Phosphoric.



■ Glass Heater

Ribco Oil heater : Steel tubular sheathed heating element compacted with high grade insulation powder with thermal conductivity for rapid and better transmission of heat, brazed to a cast iron flange provided with thermostat pocket, earthing terminals & cap.

Uses : For Fuel Oil Heating, Oil Circulating for Systems which supply Hot Oil to Plastic & Chemicals processes, Oil Jacketted Kettle and similar equipments.

■ Oil Heater

NOTE : Special Heaters can also be designed and supplied in accordance to the requirement of the customer, for which customers are requested to provide detail of dimensions with sketch or sample of the heating element along with input voltage and required wattage. The description of the sheath of the tube with the preferences and the application of the heating element.

Ribco SINCE 1964

Coils Heaters & Hot Runners

Available with integral thermocouple (J or K)

The Construction of Ribco Micro Tubular heater are in round, square or rectangular section manufactured out of Incoloy/SS tube depending upon the working temperature to guarantee the greatest thermal exchange, planned to work in the most difficult conditions, keeping an excellent efficiency and a good reliability.
A very wide contact surface results in exceptionally high level of thermal conductivity towards the body that needs to be heated. Wide range of possible shapes & heavy duty construction results in very high resistance to mechanical shocks. Heater can be incorporated into brass aluminum casting.

Max. Watt density 95 W/Sq. inch
Max. surface temperature upto 700 Deg. C. (1300 Deg. F.)

■ Mini Coil Heater

■ Micro Tubular Coiled Heater

Cast-in-Heaters

Heating elements casted in Aluminum, Bronze, Brass and Iron

■ Aluminum cast-in heaters

Ribco Heating Elements cast in a block of Aluminum, Brass or Iron can be supplied with cooling pipes and flame-proof design, in plate or bents shape as per requirement. Cast in Heater Consist of tubular type heating element with adequate watt density & gives better surface contact to provide quicker heat transfer.
Max. Watt density 50 W/Sq. inch.
Max. Surface temp. 300 Deg. C.

Uses : Exterior Heating of Pipes of Machine parts when maximum ruggedness and reliability are required. Used in Commercial Food Equipments, Medical Equipments, Circulation Equipment (paint, water, oil etc.) Extruders & Presses of Thermoplastic Machinery. Plates for Rubber Presses, Packing Machinery.

■ Mini Coil Heater Cast-in-Brass

■ Cast-in-Micro Tubular Heater

Ribco High power density Micro Tubular heaters are casted in special high-conductivity alloy for a better heat exchange and are available also with inbuilt thermocouple.

Uses : Heating of Plastic Injection Nozzle. Aerospace, Railway, Chemical Metalworking, Food Industry, Glass & Paper Industry, Automotive, Packing & Medical Industry.

NOTE : Special Heaters can also be designed and supplied in accordance to the requirement of the customer, for which customers are requested to provide detail of dimensions with sketch or sample of the heating element along with input voltage and required wattage. The description of the sheath of the tube with the preferences and the application of the heating element.

Ribco SINCE 1964

Cartridge Heater

Can be fabricated as per requirement in different diameters lengths & supply voltage (from 12 to 460 volts), with or without thermocouple Having variety of terminal types (leads, screw type or pin type) Heater sheath materials depends upon temperature requirement (may be of incoloy, inconel stainless steel or brass)

Ribco Low watt density cartridge heater in Brass or Stainless Steel tube sheathed refractory and high grade powder insulated heater provided with 8" Long wire or terminals.

Uses : In Dies Moulds, Platens, Revolving Rolls, Plastic Injection and Extrusion Barrels, Carton Making Machines & Shoe Making Machines etc.

■ Low watt density Cartridge Heater

■ High Medium Watt Density Cartridge Heater

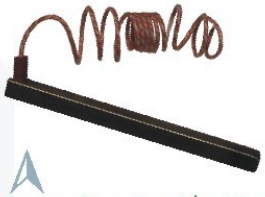
Ribco High and medium watt density cartridge heater are manufactured using high-quality material which guarantees its good operating performance in extreme conditions.

Major areas of use are Tools Heating in Plastics-Plants, Packaging Machines, Foundry-Technology, as well as Medical Devices.

We offer you standard sizes with more than 20 different diameters ranging from 6.0 mm to 30 mm and lengths from 25 mm to 600 mm. The heating power of these cartridge heaters ranges between 50 and 4000 watts.

Note :
It is advisable to use high Watt density heater through thyristor Controller

■ L Shape Cartridge Heater



■ Square Pipe Cartridge Heater

Ribco Unique D-section design ensure better surface contact in the groove when the heater is energised in Incoloy/Stainless Steel Tubing

Uses : Shell Core moulding machines, Plastic Injection Moulding Machines, Turbine Bolt Heaters etc.

■ D-Split Cartridge Heater

NOTE : Special Heaters can also be designed and supplied in accordance to the requirement of the customer, for which customers are requested to provide detail of dimensions with sketch or sample of the heating element along with input voltage and required wattage. The description of the sheath of the tube with the preferences and the application of the heating element.

Ribco SINCE 1964

MICA INSULATED NOZZLE, BAND, STRIP, PLATE, SQUARE & RING HEATERS

Mica insulated heaters consist of electric resistant ribbon/ round wire element covered with zinc plated MS, brass or SS sheet with damps. Size & terminal connections as per requirement.

Ribco Sealed Mica Nozzle heaters are hermetically sealed for liquid plastic during the manufacturing process The connection between the heating element and the leads is protected by a special fitting made of brass/ stainless steel 1 mm thick, without welding which allows a high mechanical strength, in the most delicate of the heater.

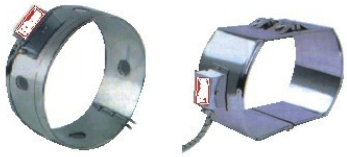
■ Sealed Mica Nozzle Heater

■ Nozzle Band Heater

Ribco Band heater are usually employed when there is a limited space around the nozzle. An excellent coupling between the heating element and the nozzle provides maximum thermal efficiency.

Mica Strip & Band Heater

Ribco Mica Band is proven heater design for good life efficiency and dependability. It assures maintaining the lowest winding temperatures possible, keeping low-mass heating element assembly for fast heat-up and quick thermal response to controls



NOTE : Special Heaters can also be designed and supplied in accordance to the requirement of the customer, for which customers are requested to provide detail of dimensions with sketch or sample of the heating element along with input voltage and required wattage. The description of the sheath of the tube with the preferences and the application of the heating element.

Ceramic Band Heaters and Power Saving Heaters

Ceramic Band Heater are made of helically wounded Nickle Chrome resistance wire precisely stetched and strung through steatite ceramic cores forming a flexible heating mat. It is then placed in flexible stainless steel housing with ceramic fibre insulation. These heaters are very flexible and can be fitted easily.

Ribco Heater Cooler Assembly is the most efficient and economical air-cooled ceramic and heater specifically designed for the blower air-cooling process/applications on extrusion machineries. Heater band is 60% open by perforated metal sheet, which ensures maximum surface exposure for better cooling. The heater band is covered with blower cover for mounting the blower. An advantage of air cooled over liquid cooled operation includes low cost, easy replacement, low maintenance, no leakage problem, uniform temperature control and maximum cooling efficiency.

■ Heater Cooler Assembly for Extrusion Machines

Ribco Ceramic Band Heaters are specifically designed and engineered to meet the ever increasing demand for energy conservation and to improve operation efficiency.
The continually increasing of the technological developments in plastic processing requires machines components ever more reliable.
Ceramic band heaters are new generation of electric heaters which tops among those accessories of primary importance for a machine to work efficiently.

Uses : Plastic Processing Machineries, Injection And Blow Moulding, Extrudes.

■ Ceramic Band Heater

Ribco Power Save Heaters are specially designed and engineered to meet the ever increasing demand for energy conservation and to improve operational efficiency, capable of generating higher temperature essential to precess today's high temperature resins.

Energy conservation is achieved by using thick ceramic fiber insulating blanket on surface increasing the overall outer diameter by 2" power consumption up to 30% because of low thermal conductivity of the ceramic fib. insulation, the external surface temperature of power save band heater is approximately 80°C while running the inside surface temperature at 300°C.

■ Power save Ceramic Band Heater

■ Spare Power save Jacket

■ Power save Mica Band Heater

■ Thermocouple

Ribco Thermocouples are specially made under stringent quality conditions. Available for all possible applications and can be made to custom specifications and also can be supplied with calibration certificates and accessories in plain, bayonet, washer, leaf and ring type etc.

Types-J,K,T,E,R and register sensor (PT-100).

NOTE : Special Heaters can also be designed and supplied in accordance to the requirement of the customer, for which customers are requested to provide detail of dimensions with sketch or sample of the heating element along with input voltage and required wattage.
The description of the sheath of the tube with the preferences and the application of the heating element.

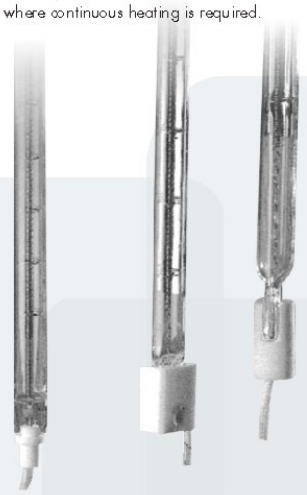
Ribco SINCE 1964

Infrared Heater

Infrared heater are the most prefered source of heat when rapid response is needed.

Thermoforming & thermo welding maching, Industrial drying, curing processes of various types where continuous heating is required.

Ribco Short Wave Infrared Lamp emitts Infrared heat which is transmitted directly in the form of electromagnetic rays, at a velocity of approx. 300,000 km / sec.i.e at the speed of light. IR is therefore not only the "faster from of heat", but is also suitable for particularly demanding applications such as vacuum technology and clean room conditions. Infrared heat is particularly economical on energy compared to to other heat sources because it acts quickly, directly on products. Short Wave IR emitters are suitable for all applications in which the attainment of high temperatures in the shortest possible time is what counts.



■ Short Wave Infrared Heater

■ Medium Wave Quartz Infrared Heaters

Ribco Medium Wave Quartz Infrared Heater consists of a helically wound resistance coil housed in a pure vitreous silica fused quartz tube. The quartz tubing is terminated with specially designed insulating caps which are securely fastened to the quartz tube with high temperature cement providing excellent support to the power connecting termination. Quartz Heaters are designed to be used in a horizontal position only. Quartz Heaters are available in various diameters like 8,10,12,15,19 mm & length upto 2000 mm. Produces medium wavelength radiation of approx. 2.55 microns with maximum watt density 30 watt per Sq. inch & Max. surface temperature 870°C.

Ribco **Single/Twin Tube Quartz in Emmitters with Gold Coating :** Gold plating is done on quartz tube over 1800. These heaters reflect the radiant energy through the operating area ony, improving element efficiency by as much as 20% compare to without gold plating heater. Energy cost saving are realized. Reflectors are often not needed. Surrounding works area tempratures are cooler, These heaters are also available with or without gold plating.

Ribco **MW Quartz IR Heating Module :** A resistance wire is enclosed in a small diameter quartz tube running parallel to each other and mounted in a special housing. The two sizes are designed to be installed in the same dimensional spacing as the ceramic infrared elements. IR heating moudules half (62 mm x 125 mm) are available in different wattage from 125 to 650 watt and IR heating full moudule (62 mm x 248 mm) are available from 250 to 1000 watt.

■ Ceramic Sealed Infrared Heater

Ribco Ceramic Sealed Infrared heater emitts radiant energy is transported throughout space by electro magnetic waves without the need of a conductive media. Consequently heat can be delivered in concentrated areas at very fast rates. IR heaters provide solutions where conventional heat sources are not practical.

Max. Watt density : 44 W/Sq. inch., Max. temp. up to 800 Geg. C.

Wave length : 3 to 4 microns. Special ceramic body, medium wavelength radiation, emitting external surface. Can be made in curved or flat shape as per following size :

(in mm) 245 x 60 -250 W to 1 KW
122 x 60 -125 W to 500 W
122 x 122-250 W to 1 KW
70 x 60 - 150 Watts.

Available with built-in thermocouple with fixing chips for easy installations.

Ribco SINCE 1964

Ceramic/Bobbin Heaters

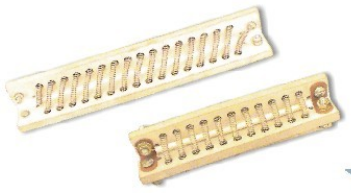
Porcelain Heater are made of helically wounded Nickle Chrome resistance wire precisely stretched and strung through circular ceramic having 6/8/12 No. of holes and forming a rode like structure fixed with the Stainless Steel rod

Ribco Porcelain heaters are available in various diameters and lengths as per customers' specification. However the standard diameters are from 8mm OD to 75mm OD. They can be designed for vertical as well as horizontal installation with required heating and non-heating zones.

Heaters are widely used as immersion heaters or as air heater selecting appropriate sheath materials for heating various types of chemicals, oils & water or air & gases.

Max. Watt density : 30 W/Sq. inch.
Max. Surface temp. 400 Deg. C.

■ Porcelain Heater



■ Ceramic Cross Heater

Ribco Unique ceramic cross heaters are available in two standard sizes & can work on voltage from 110 V to 440 V and wattage from 250 W to 4800 W.

Best for hot air gun where temperature go upto 500°C

Embedded Ring Heater and Strip Heater

Ribco Embedded Ring Heaters are available in eight convenient sizes. Consist of MgO insulated coil with terminal studs. Being sheathed in both side, it has very little residual heat. Used where chances of falling liquid on it is more and where atmosphere contains more humidity.
Max. Watt density 58 W/Sq. inch
Max. surface temp. 650°C

■ Embedded Ring Heater

■ Embedded Strips Heater

Ribco Embedded Strip Heater is rectangular section heater, insulated with compacted MgO for quicker heating & 7 better life span.

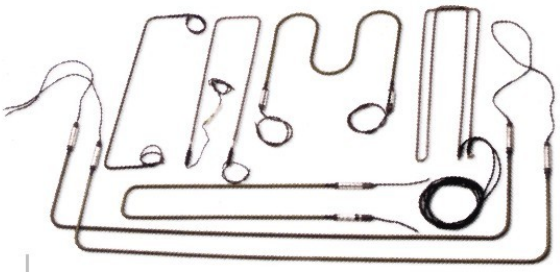
Max. Watt density 40 W/Sq. Inch and Max. surface temp. 650 Deg. c.

Uses : Air Heating, Dryers, External Heating for Tanks & Vessels.

NOTE : Special Heaters can also be designed and supplied in accordance to the requirement of the customer, for which customers are requested to provide detail of dimensions with sketch or sample of the heating element along with input voltage and required wattage. The description of the sheath of the tube with the preferences and the application of the heating element.

Ribco SINCE 1964

Defrost Heaters



■ Stainless Steel Electric Tube Defrosting Heater

Ribco Tubular Defrosting Heater in Chrom-Nickel Steel Tube Sheathed Heating Element compacted with high grade insulation powder for better transmission. Moulded silicon seal head on its two terminal ends and lead out wire ensures high level of safety which guarantees electrical insulation.

Ribco offers different heating section diameters from 6 mm to 10.8 mm to insure high thermal conductivity and easy installation.

Apply to rated voltage bellow 380V, 50-60 Hz, related humidity < 90%, defuse heat after conduct electricity in an environment temperature of -30°C ~ + 50°C. It is generally used in refrigerator, defrosting and other electric appliance.

Ribco Aluminum Tube Heater are made in pipe dia. 6.3mm. Apply to rated voltage bellow 250V, 50-60 Hz, related humidity < 90%, defuse heat after conduct electricity in an environment temperature of -30°C ~ + 50°C. It is generally used in refrigerator, defrosting and other electric appliance.

■ Aluminum Tube Heater

■ Aluminum Foil Electric Heater

Ribco Aluminum Foil Electric Heater in aluminum foil as carrier heat conductor, glue heat wine to aluminum foil using subsidiary glue. Aluminum foil electric heater has two types : one is two layer aluminum glue type, the other is single layer aluminum foil melt type. It has advantages as cheap price, long life, safe use, equal heat conduction, moisture & water proof.

Apply to rated voltage bellow 380V, 50-60 Hz, related humidity < 90%, defuse heat after conduct electricity in an environment temperature of -30°C ~ + 50°C. It is generally used in refrigerator, defrosting and other electric appliance.

Ribco PTC ceramic piece or heating wire to be used as heating body, column ceramic or stainless steel to be used as its shall, Mgo to be filled between the heating body and the shell.

Usually designed between 27W -47 W. Power deviation +5% to 10 % at rated voltage.

■ Insertion Heater for Crankcase and other Heat Appliances

NOTE : Special Heaters can also be designed and supplied in accordance to the requirement of the customer, for which customers are requested to provide detail of dimensions with sketch or sample of the heating element along with input voltage and required wattage. The description of the sheath of the tube with the preferences and the application of the heating element.

Ribco SINCE 1964

Silicon Carbide and Coil Heating Elements

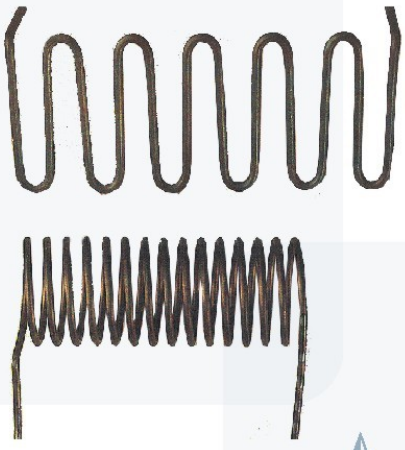
Ribco Hot Rods are made from quality SiC, which was also added to some additives according to the materials proportion, Silicon Carbide Electric Heating elements are sintered non-metallic products fo round section rod or tubular form. Compared with metallic heating elements, they have a series characteristics, such as high temperature tolerance, resistance of oxidation and corrosion, maintaining and setting-up conveniently guarantee for a long life and so on. therefore, they are widely used in electronic and magnetic material, ceramics, metallurgy, machine industry and so on.

■ Standard Silicon Carbide Heating Element

■ Dumbell Type Silicon Carbide Heating Element

■ U - Type Silicon Carbide Heating Element

■ W - Type Silicon Carbide Heating Element



■ Resistence Wire Coil Heating Element

Ribco Residence Wire Coil Heating Element can be made out of different Grades of Wire depending upon the working temperatures where the temperature does not exceed 1150°C.

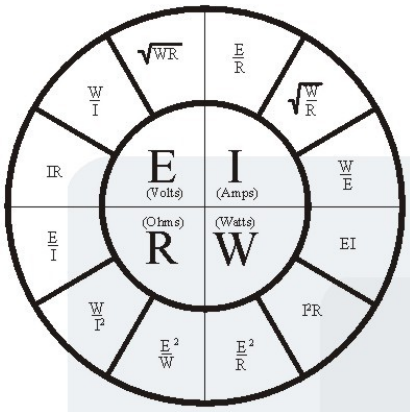
REFERENCE DATA

OHMS LAW

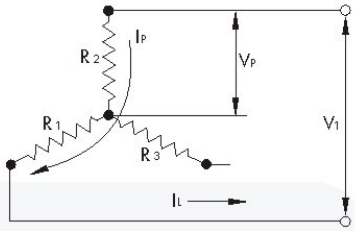
Wattage varies directly as ratio of voltages squared

$$W_2 = W_1 X \left(\frac{E_2}{E_1}\right)^2$$

$$\text{3 Phase Amperes} = \frac{\text{Total Watts}}{\text{Volts} \times 1.732}$$

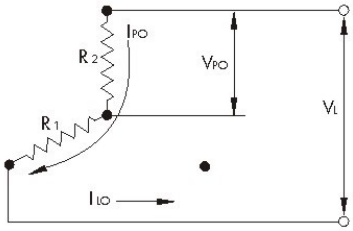


3 Phase Wye (Balanced Load)



$I_P = I_L$
$V_P = V_L / 1.73$
$W_{WYE} = V_L^2/R = 3V_P^2/R$
$W_{WYE} = 1.73 V_L I_L$

3 Phase Open Wye (No Neutral)

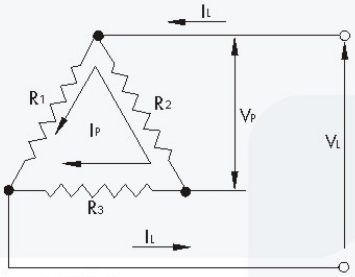


$I_{PO} = I_{LO}$
$V_{PO} = V_L / 2$
$W_{OWYE} = 1/2 = (V_L^2/R)$
$W_{OWYE} = 2(V_{PO}^2/R)$

DEFINATIONS

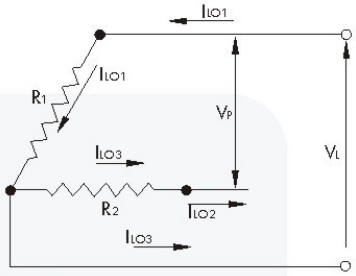
For Both Wye and Delta (Balanced Loads)
V_P = Phase Voltage
V_L = Line Voltage
I_P = Phase Current
R = R1 = 42 = 43 = Resistance of each branch
W = Wattage

3 Phase Delta (Balanced Load)



$I_P = I_L / 1.73$
$V_P = V_L$
$W_{DELTA} = 3(V_L^2/R)$
$W_{DELTA} = 1.73 V_L I_L$

3 Phase Open Delta



$V_P = V_L$
$I_{PO1} = I_{PO3} = I_{LO2}$ I
$I_{LO3} = 1.73 I_{PO1}$
$W_{ODELTA} = 2(V_L^2/R)$

Wye and Delta Equivalents

$W_{DELTA} = 3 W_{WYE}$
$W_{ODELTA} = 2/3 W_{DELTA}$
$W_{OWYE} = 1/2 W_{WYE}$