

TECHNICAL INFORMATION RECOMMENDATIONS FOR INSTALLATION



Distribute the required load over the highest possible number of heaters in order to reduce the density in W/cm² of each heater.

Insert the cartridges in bored holes. Clearance as possible. Clearance between heater and hole reduces heat transmission, increases cartridge temperature, intensifies the oxidation process, increases energy consumption and considerably decreases heater life.

If the heaters are mounted on moving parts of the machine, make sure the cables are well anchored a few centimeters upstream from the heater outlet to prevent movement that could result in break-downs. Even though small movements are generally acceptable, there is always a high risk of breakage. It is advisable to make a few extra turns of the cable upstream of the outlet to prolong its life. If the application requires continuous movements, it is indispensable to communicate the width and type of motion. In many cases an intermediate box is very useful for transferring motion to an additional cable that can easily be replaced.

If there is a significant number of vibrations, it is advisable to use an intermediate connection box as described above.

Protect cables and cartridge head, especially if not sealed, against contamination from oils, liquids, sprays, corrosive gases, splashes of water. With repeated hot/cold cycles, the cartridge absorbs any substance that comes into contact with the insulating material. Most substances char and produce short circuits. The only sealant that ensures total protection is SC400.

If the cables remain in areas with a constant temperature above 250°C, it is indispensable to use one of the following solutions:

- Flexible nickel cables insulated with ceramic fiber or ceramic beads.
- Rigid nickel conductors, not insulated alternatively insulated with a sheath of ceramic fiber or ceramic beads.
- Extend cold zone of heater enough to bring the cables out of the high temperature area.

Prevent the cartridge head, and, consequently the cables, from entering the hole. The heat of the metal ground could damage the insulating material and the sealant.

Avoid using self-sticking tape near cartridge head. The adhesive of certain types of tape could enter the head, char and produce short circuits. If taping is unavoidable, use silicone-base adhesives.

At high temperatures, it is always advisable to thermally insulate the heated parts.

The following positive effects are obtained by insulation:

- Energy consumption is lowered with up to 40%.
- Less powerful and consequently longer lasting elements can be used.
- Higher temperatures are reached in a shorter time.

To improve heat conductivity and ease the extraction of the element, use the compound LUBRIHOT. Avoid polluting the head with the paste as this can cause electricity leakage or short circuits.

Standard tolerances

Diameter: The tolerance is indicated in correspondance to the various diameters listed in the catalogue.

Length: $\leq 100\text{mm} \pm 2\text{mm}$
 $> 100\text{mm} \pm 2\%$

Power: +5% -10%

Resistance: +10% -5%

Resistance changes as the temperature varies. At ambient temperature, resistance is approximately 5% lower than that of working temperature.

Straightness: For lengths up to 300mm:
0.1mm/150mm.
For lengths >300mm:
 $L^2 \times 4$
1.000.000
L=length of heater in mm.
In any case, given the flexibility of the heater, the straightness can hardly represent a problem upon being inserted into the heater, even if the hole is very precise.

Tolerances stricter than standard can be accepted after agreement.

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Place the external thermocouples no further than 10mm from the cartridge and, if possible, in the center area. This warning is extremely important when the heater has a high watt density.

To achieve increased life time of the element, the use of proportional microprocessor thermo regulators is essential.

Oxidation of the heaters and the hole in which they are inserted, produced by many hours of work at high temperatures, can make it difficult to extract the burnt element. Try first to loosen the element with the spray EXTRACTOR. Then drill a hole with a bit 2 to 3 tenths smaller than the nominal diameter of the heater. Remove the element, then use a boring machine to rebore the hole, if necessary, use an iron rod and a hammer as well.

If used correctly, the heaters have a very long life. To obtain maximum performance it is important to supply an accurate specification of the element demand and the operation conditions.

Working temperature								
W/cm ²	100°C	200°C	300°C	400°C	500°C	600°C	700°C	800°C
2								1.30
3		Clearance (in mm)						0.35
4							1.00	0.15
5						2.00	0.60	0.080
6					2.00	1.50	0.50	0.065
7		2.00	1.75	1.30	1.50	0.70	0.30	0.040
8	2.00	1.75	1.50	1.20	1.30	0.55	0.20	0.035
9	1.75	1.50	1.30	1.00	1.00	0.45	0.15	0.030
10	1.50	1.25	1.00	0.70	0.60	0.35	0.10	0.025
12	1.00	0.75	0.70	0.60	0.50	0.25	0.085	0.020
15	0.65	0.60	0.55	0.50	0.35	0.20	0.065	0.015
18	0.55	0.50	0.50	0.40	0.30	0.15	0.050	0.010
20	0.50	0.45	0.40	0.35	0.20	0.10	0.040	
25	0.40	0.35	0.35	0.30	0.15	0.075	0.030	
30	0.30	0.25	0.25	0.20	0.10	0.050	0.025	
35	0.25	0.20	0.18	0.10	0.085	0.045	0.020	
40	0.22	0.17	0.15	0.080	0.075	0.040	0.015	
50	0.20	0.15	0.10	0.070	0.050	0.035		
60	0.15	0.12	0.085	0.065	0.045	0.030		
70	0.13	0.10	0.075	0.060	0.040	0.025		
80	0.10	0.080	0.060	0.050	0.035	0.020		

For aluminium and brass, choose the clearance in the column corresponding to the temperature immediately superior that of the working temperature (+100°C)

The clearance is obtained by difference between the hole diameter and the real diameter of the cartridge.

Example: Hole diameter 12.6mm, nominal diameter of the cartridge 12.5mm

12.6mm - 12.42mm (12.5 - 0.08 max catalog tolerance) = 0.18 (max admissible clearance)

For optimum working conditions, energy saving and longer life time of the heater, it is advisable to bore holes with tolerance of H7.

Heating of liquids

The compactness and high surface load of the cartridge heaters offer excellent solutions for heating liquids.

General recommendations

Place the element as far away as possible from the walls of the container, allowing best possible circulation of the liquid by convection.

Make sure that the liquid level always is at least 20mm above the element.

Avoid too frequent ON/OFF cycles, (use a proportional thermo regulator).

Make sure there are no deposits of incrustation, lime deposits, substances etc. on the heater surface.

To avoid emptying the container when a worn-out element shall be replaced, it is recommended to use our supplementary sheaths.

If there is a risk of the liquid overflowing, steam, high ambient humidity, contamination etc., sealed elements should be used.

As far as possible, never exceed recommended surface loads, according to table beside.

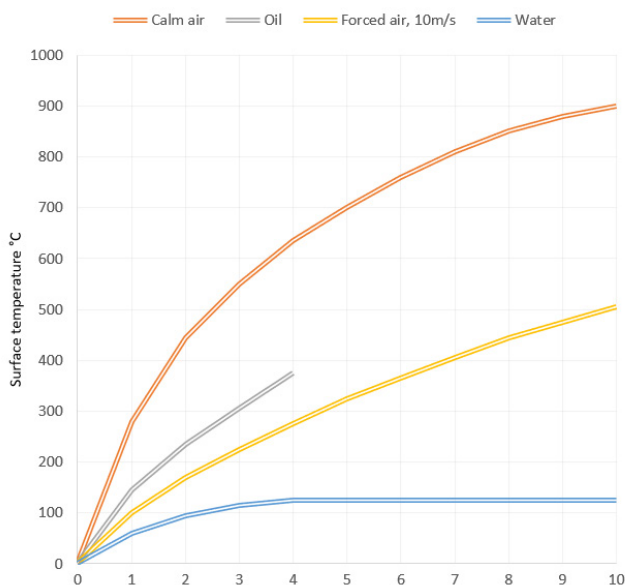
Material	Max temp. °C	Max W/cm ²
Water	100	30
Asphalt, tar and other thick substances	95	1.5
	150	1.5
	200	1.0
	250	0.8
Petrol - photogen	150	3.5
Freon	150	0.5
Ethylene glycol	150	4.5
Molasses	40	0.7
Melt metal	260-500	4.0
Heavy oil	90	1.5
Heat conducting oil	400	3.5
SAE 30 motor oil	120	3.0
Vegetable oil	200	4.5
Salt bath	500	4.5
Caustic soda, NaOH 10%	90	4.0
Caustic soda, NaOH 75%	70	2.3
Acid solutions	70	6.0
Alcalic solutions	100	6.0
Degreasing solutions	130	3.5

Recommended surface loads for different material

At forced circulation the density can be slightly increased.

A lower density than indicated will increase the heater life time.

Temperature taken on by sheath at various wattages densities



Maximum density on the heaters, used in high temperature environments

