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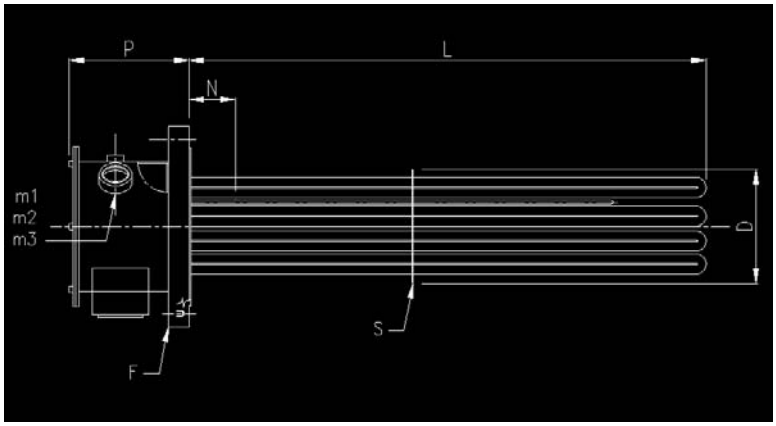
Технические характеристики на фланцевые нагреватели компании MASTERWATT

FLANGED HEATERS

Flanged heaters | Fuel heaters | Lube oil heaters
The flange-mounted electric heaters have been conceived to satisfy the most different needs in the heating of liquid substances, both in the industrial and in the civil applications. They are designed to be inserted into tubes, basins or pressurised tanks and they are sunk in direct contact with the fluid. Thanks to the presence of armoured electrical heaters in direct contact with the fluid, the heat exchange is very effective and it is possible to design very compact heaters.

These products are designed by our technical department on the basis of customer provided functional requirements. The design takes into account the physical, chemical and thermodynamic characteristics of the fluid to be heated, as well as the operating temperature, the features of the site and the allowable clearance in the area where the heater will be installed.

Figure 1: Typical sketch of a flange-mounted electric heater



GENERAL CHARACTERISTICS

The flange-mounted electric heaters have been conceived to satisfy the most different needs in the heating of liquid substances, both in the industrial and in the civil applications.
They are designed to be inserted into tubes, basins or pressurised tanks and they are sunk in direct contact with the fluid.
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These products are designed by our technical department on the basis of customer provided functional requirements. The design takes into account the physical, chemical and thermodynamic characteristics of the fluid to be heated, as well as the operating temperature, the features of the site and the allowable clearance in the area where the heater will be installed. The iteration between design and analysis leads to define:

1. the specific power and the required number of heating elements
2. the diameter, thickness and material of the flange
3. the maximum sheath temperature and, consequently, the safety devices to be used
4. the materials to be used in the construction
5. the dimensional characteristics of the heater

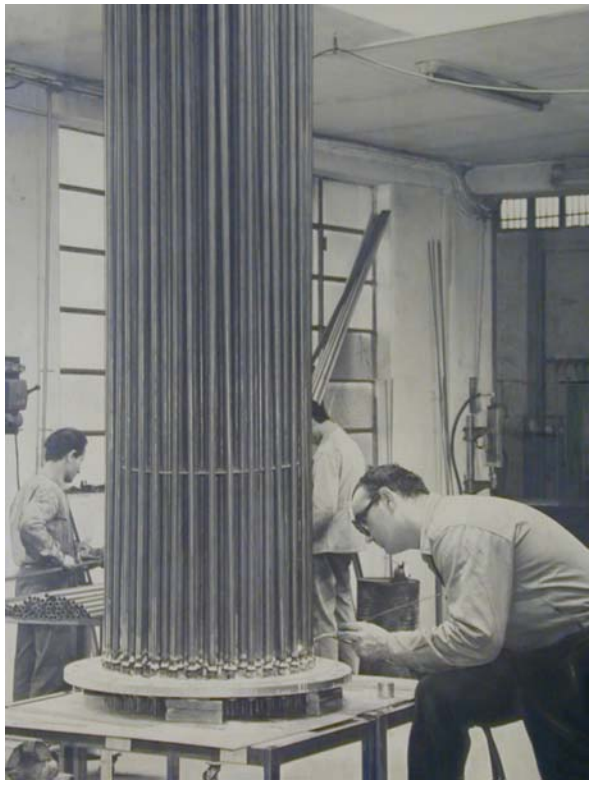
The manufacturing experience built up in several years of operation in the market, coping with the most different applications, enables us to suggest to our customers materials and technical solutions which are best suited to the application of interest.

The results of the preliminary design is provided, in form of a data sheet, already as part of the offer. This enables the customer to verify the main electric data and the mechanical interfaces to the plant.

TECHNICAL DATA

(see also Figure 1)

F	Tank Coupling Flange
L	Maximum Length Below Ledge
N	Neutral (non heating) section
P	Electrical contact box height
D	Diameter/tube bundle maximum envelope
S	Full-section distancing baffle
M1	Female sleeve for power cable glands
M2	Female sleeve for signal cable glands

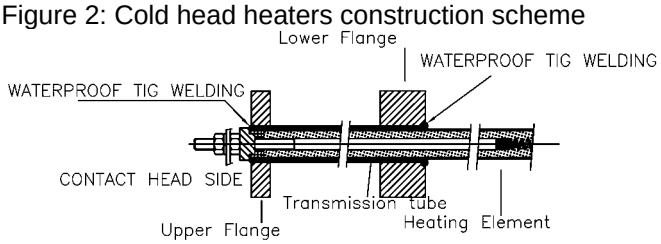


Braze Welding of the first flange-mounted heater
Year 1967

THE WELDING OF THE HEATING ELEMENTS

The elements are welded to the flange by waterproof TIG welding.
In some cases, the high operating temperature impose a construction which foresees a "distancing" of the electric contact box ("cold head" construction). In these cases the welding of the elements is made on the upper flange and the elements are left free to slide within the lower flange. To prevent fluid spillage, each element is covered by a distancing tube, TIG-welded to both flanges, that guarantees a waterproof construction (see Figure 2). This solution adequately supports the thermal expansion needs of the heating elements.

Figure 2: Cold head heaters construction scheme



The TIG welding of the heating elements is a key step in the manufacturing of the heater. It is, therefore, performed by highly skilled personnel.

TIG WELDING

Masterwatt welders and welding procedures have been certified by the Istituto Italiano di Saldatura. This enables us to comply with the requirements of UNI EN 287-1 and UNI EN 288-1 specifications, to BPV code of ASME specification Section VIII, Division 2, Article F-3 (welding of tubes onto plates) and Section IX (welding of plates). Therefore, the welds relevant to the following material couplings are executed in a controlled way:

- ☑ stainless steel / carbon steel
- ☑ stainless steel / stainless steel
- ☑ Incoloy 800 / carbon steel
- ☑ Incoloy 800 / stainless steel

At the end of the welding phase, each heater undergoes a hydraulic pressure test that lasts several minutes and that is performed at a pressure 1.5 times higher than the operating pressure. Whenever the applicable specifications impose high values, they are considered.

HYDRAULIC PRESSURE TEST

This test allows to verify that the welds are waterproof and to identify micro-cracks potentially hidden into the heating elements tube sheaths.
The test results are reported in the Acceptance Test Report that is delivered to the Customer at delivery.

THERMAL SAFETY DEVICE

Each heater is provided with a safety device that limits the sheath temperature in case of unforeseen events. This device protects at the same time the heater and the plant the heater belongs to.
The type of safety device to be used is defined by our Technical Department depending on the process needs.

TYPICAL INDUSTRIAL APPLICATIONS

- Oil pre-heating in lubrication gear cases
- Pre-heating of combustible oils in tanks
- anti-frost protection in storage tanks
- Technical and process gases heating
- Hot/Warm water supply on-board the ships
- Oil separation and filtration
- Food industry machinery
- Reverse osmosis systems
- Boilers
- Back-up heating unit

DATA REQUIRED FOR A CORRECT DEFINITION OF A FLANGE-MOUNTED HEATER

To design a flange-mounted heater a set of data is required. The availability of all the data is a pre-requisite for an optimum sizing and for a precise definition of the heating power. The Table 1 presented hereunder summarises the required data.

Table 1: data required to design a flange-mounted heater

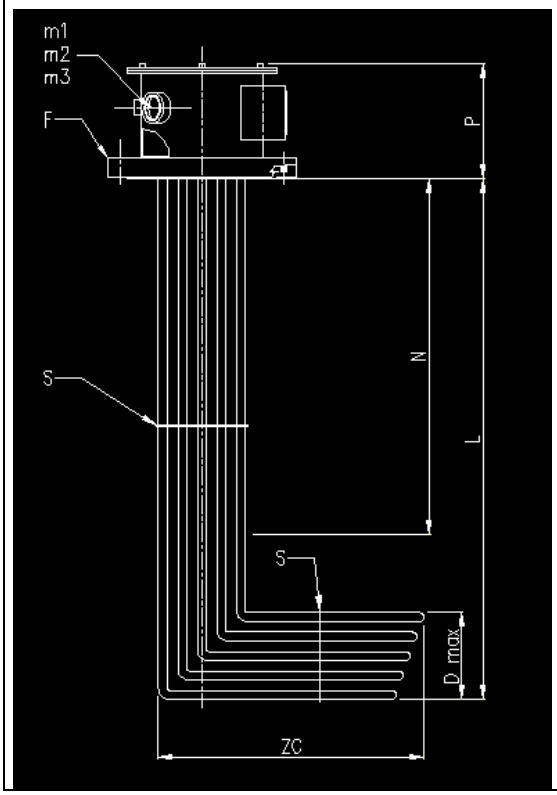
<table>
<tr><th>Design Data</th><th>Notes</th><th></th></tr>
<tr><td colspan="3">Thermodynamic Data</td></tr>
<tr><td>Fluid

Note:
More information on fluids characteristics are contained in the “Useful Technical Information” Volume</td><td>⇨ For non common fluids please specify the thermodynamic characteristics at, at least, three different temperatures
<table>
<tr><td>thermodynamic properties</td><td>M.U.</td><td>Temp °C</td><td>Temp. °C</td><td>Temp. °C</td></tr>
<tr><td>Density</td><td>Kg/m3</td><td></td><td></td><td></td></tr>
<tr><td>Thermal conductivity</td><td>W/(m°K)</td><td></td><td></td><td></td></tr>
<tr><td>Viscosity</td><td>cP</td><td></td><td></td><td></td></tr>
<tr><td>Specific Heat</td><td>J/(kg°K)</td><td></td><td></td><td></td></tr>
</table></td><td></td></tr>
<tr><td>Fluid Quantity</td><td>⇨ in litres. If variable, please specify min. and max</td><td></td></tr>
<tr><td>Tank Volume and dimensions</td><td>⇨ in m^3 (volume) and mm (dimensions)</td><td></td></tr>
<tr><td>Thermal Insulation</td><td>⇨ Please specify if the tank is thermally insulated</td><td></td></tr>
<tr><td>Design pressure</td><td>⇨ in bar absolute</td><td></td></tr>
<tr><td>Maximum operating pressure</td><td>⇨ in bar absolute</td><td></td></tr>
<tr><td>Design Temperature</td><td>⇨ in degrees centigrade</td><td></td></tr>
<tr><td>Temperature at start up</td><td>⇨ in degrees centigrade</td><td></td></tr>
<tr><td>Required Temperature</td><td>⇨ in degrees centigrade</td><td></td></tr>
<tr><td>Plant start up time</td><td>⇨ Please specify the maximum time available for the heater to bring the fluid to the required temperature. (Attention! This datum shall be carefully evaluated to avoid an over sizing of the heater electric power)</td><td></td></tr>
<tr><td>Installation</td><td>⇨ Horizontal / Vertical (in this case, please make sure that the liquid level is always above the neutral section threshold)
⇨ Outdoor / Indoor</td><td></td></tr>
<tr><td>Type of connection to the plant</td><td>⇨ please specify if a UNI or an ANSI coupling flange is required</td><td></td></tr>
<tr><td>Envelope</td><td>⇨ Please specify max. envelope, all included</td><td></td></tr>
<tr><td colspan="3">Electrical Data</td></tr>
<tr><td>Installed Power</td><td>⇨ in kW</td><td></td></tr>
<tr><td>Power Supply Voltage</td><td>⇨ in Volt</td><td></td></tr>
<tr><td>Type of Electrical connection</td><td>⇨ Star / Delta / Monophase</td><td></td></tr>
<tr><td>Number of stages</td><td>⇨</td><td></td></tr>
<tr><td>Contact Head Protection</td><td>⇨ IP 00/55/65</td><td></td></tr>
<tr><td>Cable glands (if required)</td><td>Please specify: material and Φ external of the power supply cable</td><td></td></tr>
<tr><td colspan="3">Control</td></tr>
<tr><td>Power</td><td>⇨ On/Off / SCR (Solid Control Relais) / On/Off + SCR</td><td></td></tr>
<tr><td>Fluid thermal sensor</td><td>⇨ please specify number and type</td><td></td></tr>
<tr><td>Sheath thermal sensor</td><td>⇨ please specify number and type</td><td></td></tr>
<tr><td colspan="3">Certifications and Calculations</td></tr>
<tr><td>FLANGE calculation codes</td><td>⇨ VSR; AD2000; ASME VIII</td><td></td></tr>
<tr><td>ATEX Certification</td><td>⇨ see Explosion Proof Heaters catalogue</td><td></td></tr>
</table>

NOTE: Data in bold character must be provided to insure a correct sizing of the heater. For the remaining data, missing specific customer information, Masterwatt standards will be applied

NON STANDARD CONSTRUCTIONS

"L-bent" Vertical Heater



Designed to heat large liquid quantities or liquids which experience, during the process, significant level changes, this type of heater is best suited whenever it is requested to perform maintenance operations without removing the fluid itself.

The heater has a neutral section which corresponds to its straight vertical length or, in any case, defined coherently with the minimum fluid level that can be expected in the different operational phases.

The horizontal section is the heating one. Should the liquid level be reduced, the heater can continue to operate safely as long as the height of the liquid column does not fall below the D max area. In this way, even small fluid quantities can be heated.
In case of heater replacement, the heater shall be extracted from the top. The L-shape envelope shall be taken carefully into account when defining the plant installation architecture.

F	Basin coupling Flange	D	tube bundle maximum envelope
L	Maximum vertical length	S	Distancing Baffles
N	Non heating section	M1-2	Female sleeve for power supply cable glands
P	Electric contact box height	ZC	Horizontal heating section

Interchangeable Elements Flange-Mounted Heater

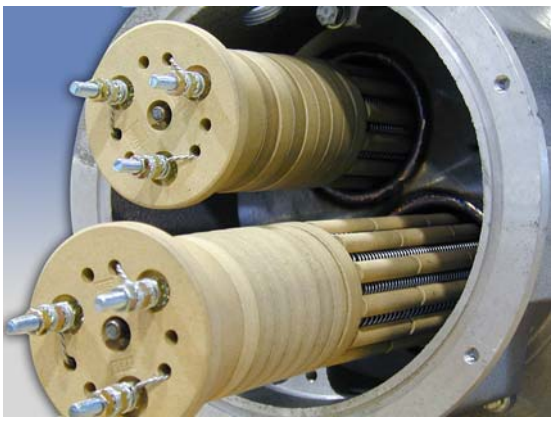
Manufactured using stainless steel AISI 316L tubes, this type heater is best suited in the applications presenting corrosion problems or whenever it must be insured that the heating elements can be replaced.
Thanks to its peculiar features, this type of heater can be employed successfully in the chemical and in the food industry.

The heater contains one or more heating elements. Each element consists of wire-wound resistances, hosted by a ceramic body provided with appropriate grooves. The ceramic body insures a high electrical insulation and a good mechanical resistance. The coils are manufactured using high temperature resistant wires and are designed to transfer in the best way the heat to the metallic sheath and, finally, to the fluid. The heat is transferred to the sheath without requiring any conductive material.

The architecture of this heater allows, in case of maintenance, to replace the internal heating elements without being forced to remove the process fluid.

This type of heater shall be installed horizontally, at the bottom of the tank or of the basin.

The maximum operating temperature is 90 °C.



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