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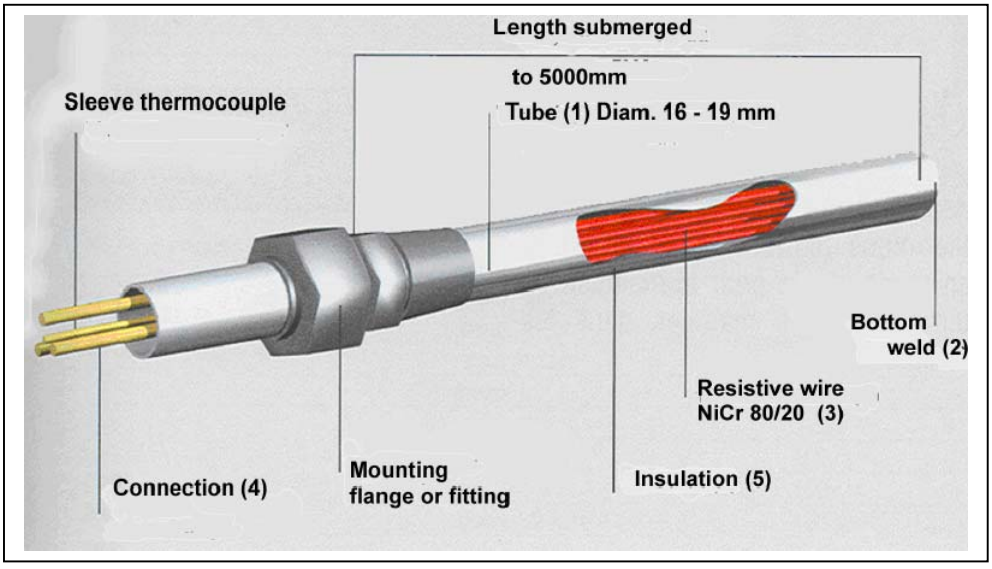
CETAL

**CT- 080.20E**

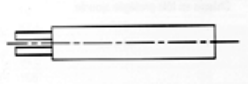
# VERY HIGH PERFORMANCE ELEMENTS THP

Manufacturing of very high performance elements is the result of the research and development carried out by CETAL during the period 1986 -1987. This allowed the widening of the application perimeters of heating by the Joule effect which until then was by traditional armoured heating elements (insulation by electrical grade magnesium oxide).
The very high performances of these elements are directly connected to the control of the manufacturing process :
- Positioning of the heating wire as close as possible to the sheath whilst guaranteeing dielectric rigidity.
- Compactness of the insulation (boron nitride) allowing heat transfer and providing electrical insulation when hot.
Boron nitride is used as an electrical insulator to produce stainless steel or incolloy tubular heating elements (diameter 10, 16 or 19 mm). These one- or three-phased elements can be equipped with a core-integrated thermocouple. The watt density, which depends on the operating conditions (convection, conduction and radiation) and on the elements sheath temperature, can exceed 100 W/cm²

(1) the outer sheath element ensures protection of THP Their nature depends on the medium and temperature. (See metallurgical characteristics). The tube is 2 mm thick, to ensure the mechanical strength the element of handling when hot.
(2) The sealing element at the bottom of THP is assured. Like the cover, the bottom is welded by argon qualified procedures.
(3) High quality resistive wire. Its melting temperature is about 1200 ° C, their number depends on the ohmic value of food and the wire diameter.
(4) The connections usually in copper-nickel, ensure a good connection. The section determines the intensity of the line.
(5) The boron nitride insulation ensures thermal conduction and electrical insulation




## Table of dimensional characteristics

| The characteristics of the table below correspond to a temperature of 70 ° C in the connections. | Nominal Diameter mm | Power supply | | |
|---|---|---|---|---|
| | | Connections | Maximum Intensity A | |
| | | | Cu | Ni |
|  | 8,2 | Single-phase | 105 | / |
| | 8,5 | | 240 | 110 |
|  | 16 | Single-phase | 85 | 27,5 |
| | | Thtree-fase | 60 | 27,5 |
| | | Single-phase | 135 | 60 |
| | | Single-phase +TC | 60 | 27,5 |
| | | Thtree-fase +TC | 50 | 22,5 |
| | 19 | Return to earth | 240 | 110 |
| | | Single-phase | 85 | 27,5 |
| | | Thtree-fase | 60 | 27,5 |
| | | Single-phase | 135 | 60 |
| | | Single-phase+TC | 60 | 27,5 |
| | | Thtree-fase +TC | 50 | 22,5 |

## Metallurgical characteristics

| **Materials** | | | | |
|---|---|---|---|---|
| Designation AFNOR | Z3 CND 18-12-02 | Z8 CN 25-20 | Z8 NC 75-15 | Z8 NCDU 42-22 |
| Designation AISI | 316L | 310 | Inconel 600 | Incoloy 825 |
| Designation EN | 1.4404 | 1.4845 | 2.4816 | 2.4858 |
| **Diameters usual** | | | | |
| 8,2 | • | | | |
| 8,5 | • | | | |
| 16 | • | • | • | • |
| 19 | • | • | • | • |
| **Working temperature limit** | | | | |
| | 750 °C | 1050 °C | 1050 °C | 1000 °C |

## Mechanical characteristics

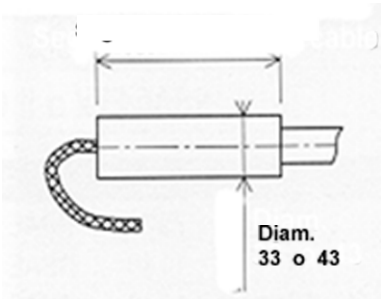
Diameter tolerance : According to application
Length tolerance :According to specifications
Options THP :Rectifie according to specifications
: Spiral Machining
: Leaning, maximum 90 ° on cold zone
: Thermocouple integrated non dismantled, in the layered elements

## Electrical characteristics

Power supply : <1000V
Power tolerance : -10%+5% for P> de 5000W
± 10% for P< de 5000W
Outputs Copper-nickel rod length 50mm
Cables :H07RNF (standard, mechanical protection
Cables of silicon or other, on request)

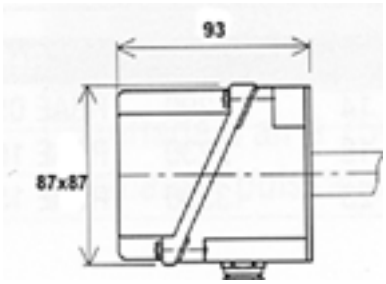
## Junction Boxes

**Stainless Steel Sheet**

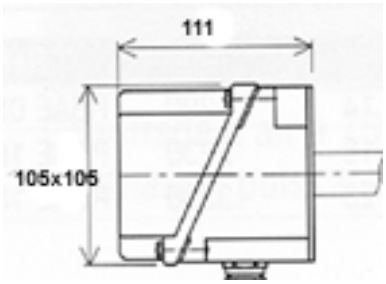



It bicomponent landing with a resin that ensures the tightness of connections

**Aluminum Casting**
Equipped with cable glands for the cable outlet

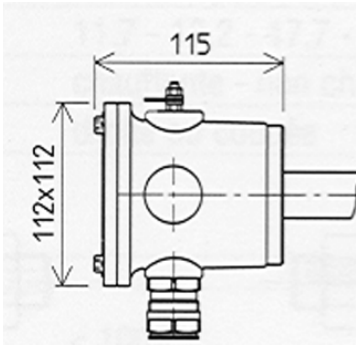



**TIPE ORPM IP55 or IP66**

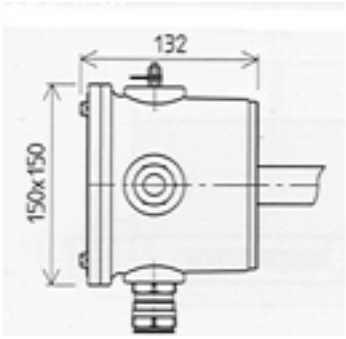



**TIPE ORGM IP55 or IP66**

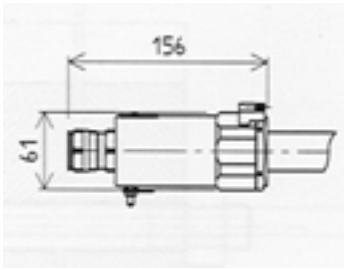
**Flameproof**




**TIPE BROAE IP67**
According LCIE 04 ATEX 008U

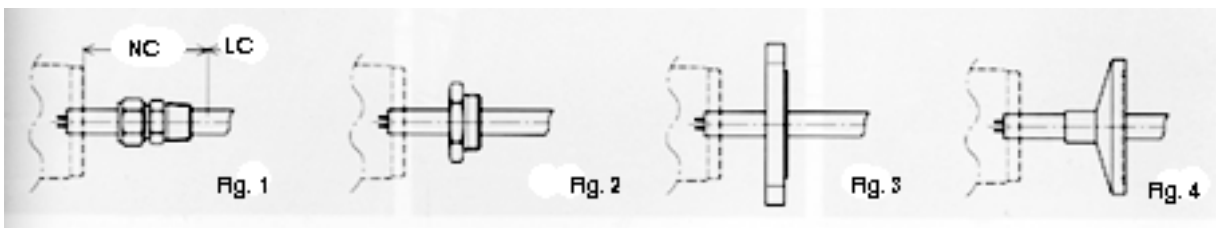



**TIPE BROAE130 IP67**
According LCIE 04 ATEX 008U




**TIPE BRAE55 IP66**
According LCIE 04 ATEX 001U

## Installation of heaters THP

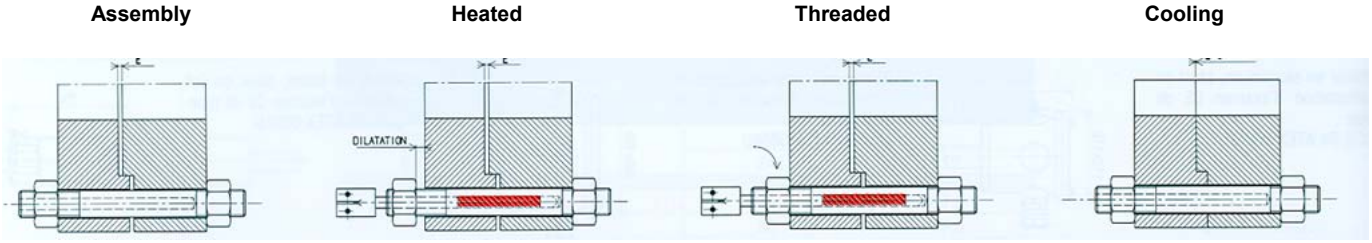



THP elements support multiple mounting procedures.
Fig. 1 By fitting sliding. Fig. 2 Fitting Taps. Fig. 3 Welded flange. Fig. 4 Part machined according to specifications

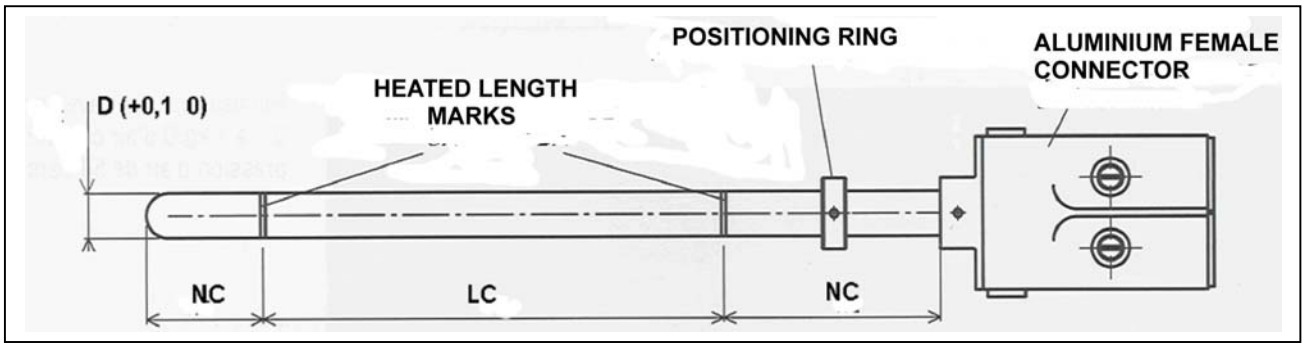
# HOT BOLTS / HEATERS MATRICES

The use of non THP much energy can be concentrated in a minimum volume. The total installed power is transferred by radiation.
With this technology, installation times are greatly reduced for bolt tightening applications thermal expansion (turbine assembly).
The same applies to cases of temperature maintenance of the parent in the workshops of forging.

## Application of heated bolts: squeezed by expansion




## Schematic of a hot bolt

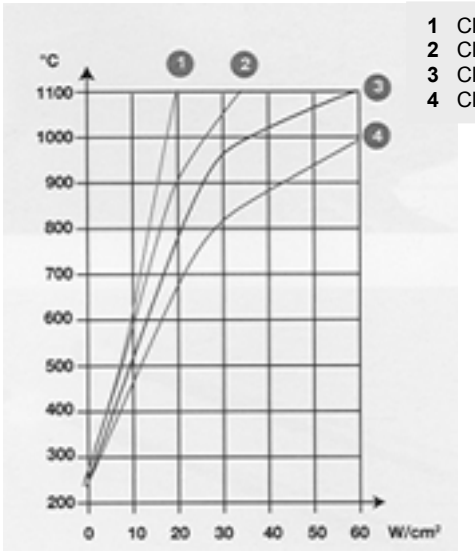



## Calculation of the power W / cm$^2$

| Ø Hot bolt | Ø recommended for the hole (H11) |
|---|---|
| 10,7 | 11 |
| 11,7 | 12 |
| 12,2 | 12,5 |
| 15,7 | 16 |
| 17,7 | 18 |
| 19,7 | 20 |
| 21,65 | 22 |
| 24,6 | 25 |
| 29,6 | 30 |

The heater power W is given by the specific load (W/cm$^2$ ) and limited by the clearance (see table)

Example: for a clearance of 0.5 mm, a load of 20 W/cm$^2$ gives us a temperature of 800 ° C in the exterior wall




**1** Clearance 0,8 mm
**2** Clearance 0,6 mm
**3** Clearance 0,5 mm
**4** Clearance 0,4 mm

## Mechanical characteristics

AISI 316L stainless steel tube (On request other materials)
Option: layered element (maximum 90 degrees in the cold zone

## Dimensional characteristics

| Nominal Diameter mm | Power supply | |
|---|---|---|
| | Conections | Maximum Intensity A |
| 10,7 | Return to earth | 100 |
| | Single-phase | 20 |
| 11,7 | Return to earth | 100 |
| | Single-phase | 20 |
| 12,2 | Return to earth | 100 |
| | Single-phase | 20 |
| 15,7 – 17,7 | Return to earth | 275 |
| 19,7 | Single-phase | 100 |
| 21,65 | Three-phase | 100 |
| 24,6 | Single-phase | 100 |
| 29,6 | | |

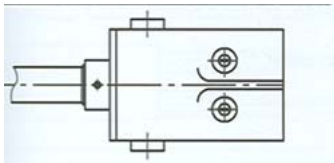
## Technical characteristics

| | |
|---|---|
| Specific load | Up to 40 W/cm$^2$ |
| Power supply single or three-phase | 24V – 48V – 110V – 230V – 400V u otra |
| Tube | Stainless steel 321 – 310 – 316L – Incoloy - Inconel |
| Ø standardr mm | 11,7 – 12,2 – 17,7 – 19,7 – 21,65 – 24,6 –29,6 |
| Length | Heated - cold, according to specifications |
| Shape | Straigth or layered |

## Electrical characteristics

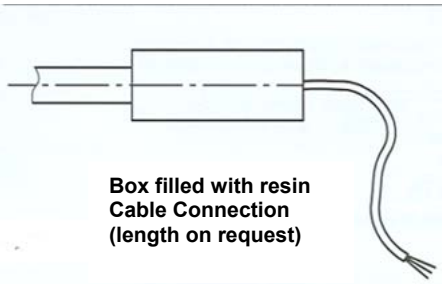
| | |
|---|---|
| Power supply | < 1000V |
| Power tolerance | -10% +5% for P> 5000W |
| | ± 10% for P< 5000W |
| Connection | Aluminum Connector (24 - 48V) |
| Cable | H07RNF |
| | Silicone cable or other |
| | Connector, on-demand |
| | Terminal box with handle |

**Power supply 24 / 48V**



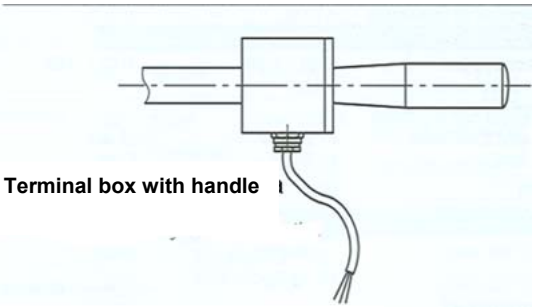
**connector**
**male / female**

**Power supply 230V – 400V**



**Box filled with resin**
**Cable Connection**
**(length on request)**

**Power supply 230V – 400V**

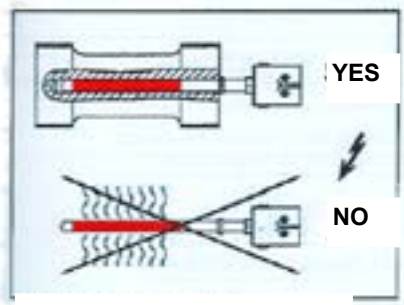


**Terminal box with handle**

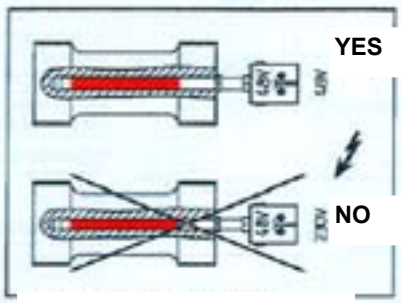
## Mounting and accessories

Positioning rings Ø30, Ø40 or Ø50 depending on the diameter of the heated bolts.
Other accessories on request

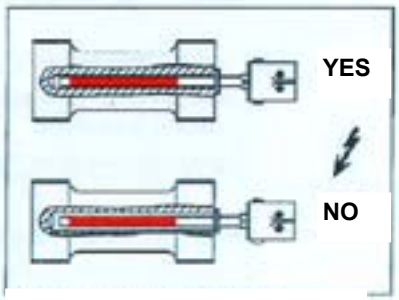
## Precautions in the use



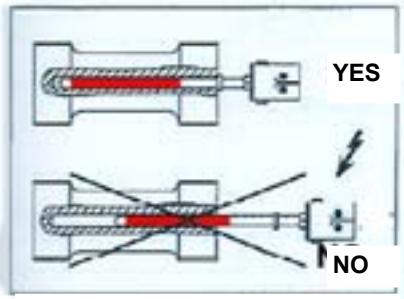

Do not connect the air



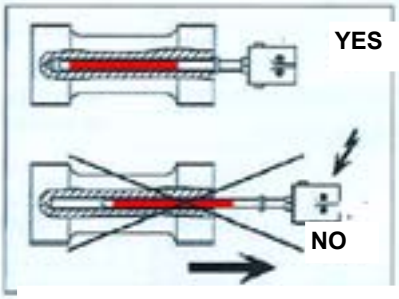

Check the supply voltage



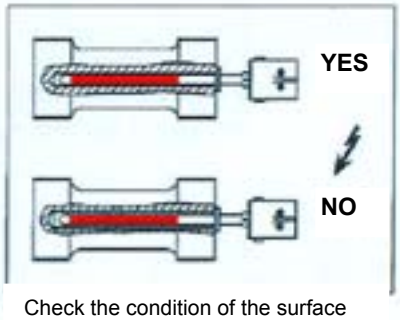

Check the clearance




Before connecting to verify the depth of the hole




disconnected before removing




Check the condition of the surface of the hole