


# FLANGE IMMERSION HEATERS



**CETAL**

INDUSTRIAL



# GENERAL DESCRIPTION

## USE

### HEATING OF LIQUIDS HEATING OF GASES

CETAL flange immersion heaters can be used to heat any static or circulating fluids (liquids or gases).

The service pressure and number of circuits determine the choice of flange. The nature of the fluid and the usage conditions determine the grade of jacket and the transmission rate in  $W/cm^2$ : the service life of the equipment and the installation performance depend on these 2 parameters.

An unsuitable transmission rate (surface temperature) and/or jacket grade are liable to accelerate corrosion phenomena under tension, corrosion by pitting or deposits: this can affect exchange conditions and accelerate ageing of the heating elements. An unsuitable transmission rate ( $W/cm^2$ ) can also destroy the fluids to be heated (carbonization of some oils, etc.).

If the jacket is of an unsuitable type, it can reduce the life of the immersion heater to several days. The "Technical Information" catalogue contains information to assist in selection.

Immersion heaters for pressures over 150 bars are possible with different welding techniques.

## ASSEMBLY

### TANK

These immersion heaters are frequently used in hot water tanks. They are generally mounted horizontally, and we recommend secure fixing in the tank if large sized immersion heaters are used (cradle-mount).

### BOILER

Depending on the boiler dimensions (hot water or steam), the unit rating of the immersion heaters may exceed 800 kW. Water treatment qualities are an essential factor in ensuring a satisfactory immersion heater life.

### VAT

The shape of the immersion heater can be adapted to conditions of use and is not limited to the traditional perpendicular hairpin bundle with mounting flange.

The examples at the back of the catalogue illustrate the many possible forms and uses (vertical or horizontal assembly).

### CIRCULATION HEATER

This is used to heat water, and as a steam, thermal fluid or gas superheater. The high performance is guaranteed by perfect exchange coefficient and flow characteristics control.

## CHARACTERISTICS OF HOUSING

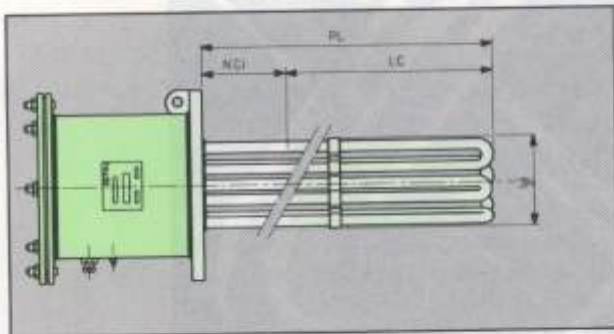
Of robust construction to protect the electrical connections and temperature control instrumentation.

The degree of protection (IP) will depend on the service conditions.

The assembly conditions must in each case ensure that there is a sufficient gap around the cover to allow air to circulate around it.

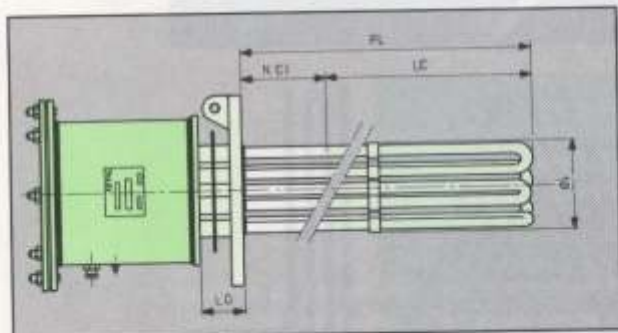
### STAND ON COVER

Recommended for use to heat fluid below  $120^{\circ}C$ .



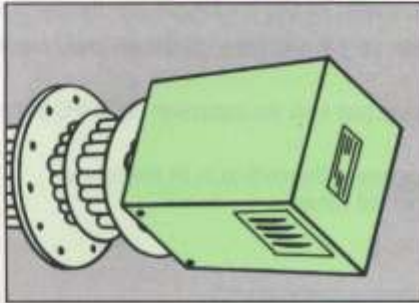
### STAND OFF COVER

To limit temperature rise at electrical connections and cable entries, stand off cover are used for any service temperature over  $120^{\circ}C$ .



# CONNECTION BOXES

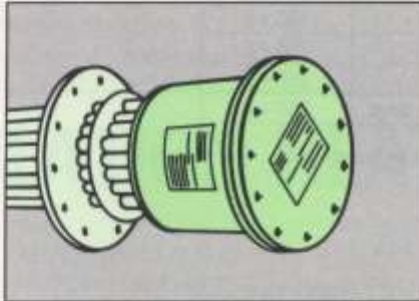
## PROTECTED BOXES



These are painted or stainless steel with ventilation system.

Nominal Ø of flange	in mm	150	200	250	300	350	400	450
	in inches	6	8	10	12	14	16	18
Box	section mm	240 x 240	245 x 290	285 x 290	340 x 350	370 x 380	420 x 430	480 x 490
	length mm	400	430	430	480	480	480	540

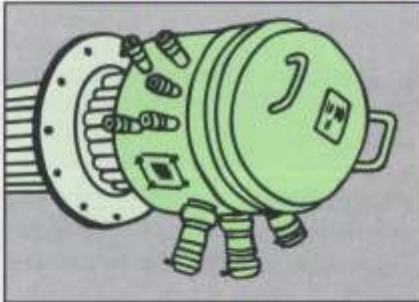
## SEALED BOXES



These are painted or stainless steel. Degree of protection IP 679 (LCIE Certificate 227616 B)

Nominal Ø of flange	in mm	80	100	125	150	200	250	300	350	400
	in inches	3	4	5	6	8	10	12	14	16
Box	section mm	155	180	210	235	285	340	390	440	490
	length mm	150	150	200	200	200	250	250	250	250

## EXPLOSION-PROOF BOXES



These are steel, brass or aluminium constructed to meet standard EN 50014 - EN 50018. See Table below.

The dimension of the box determines the maximum number of heating elements of dia. 16 (R16) and the bundle diameter (Ø). See Table below.

Explosion-proof box Ref.	Dim. mm	Class	Used in medium	Certificate No.		R16 Ø	Max. No. of ratings size	Max. packing box
				Compliance of immersion heater	Box components			
B 135 <sup>(1)</sup>	Ø = 55 L = 105	II C	G	LCIE 91 C 60 30 X		3	1	3/4"
			L			Ø 40		
B 200 <sup>(1)</sup>	Ø = 55 L = 105	II C	G	LCIE 91 C 60 30 X		3	1	3/4"
			L			Ø 40		
BRAE 55	Ø = 55 L = 105	II C	G		LCIE 86.B0015 U	3	1	3/4"
			L			Ø 40		
BRPM	Ø = 114 L = 134	II C	G		LCIE 83.0003 U	3	1	3/4"
			L			Ø 85		
BROAE 87 <sup>(2)</sup>	172 x 167 L = 188	II C	G	TPAEG LCIE 81.6056 X	LCIE 88.B.0009U	3	1	1"
			L	TPAEL LCIE 81.6055 X		Ø 75		
BRGM <sup>(3)</sup>	Ø = 200 L = 177	II C	G	TPAEG LCIE 81.6056 X	LCIE 82.0025 U	6	1	1"
			L	TPAEL LCIE 81.6055 X		Ø 110		
BRAE 200	Ø = 265 L = 216	II B	G	TPAE 200 LCIE 82.6028 X	LCIE 82.0011 U	12	2	1" 1/2
			L			Ø 170		
BRAE 2000	Ø = 198 L = 235	II C	G	TPAE 2000 LCIE 83.6208 X	LCIE 83.0022 U	9	2	1" 1/2
			L			Ø 150		
BRAE 300	Ø = 395 L = 265	II B	G	TPAE 300 LCIE 82.6029 X	LCIE 82.0012 U	30	3	2"
			L			Ø 300		
BRAE 3000	Ø = 330 L = 325	II C	G	TPAE 3000 LCIE 83.6209 X	LCIE 83.0023 U	24	3	2"
			L			Ø 280		
BRAE 3500	Ø = 360 L = 345	II C	G	TPAE 3500 LCIE 83.6210 X	LCIE 83.0024 U	33	4	2"
			L			Ø 310		
BRAE 400	Ø = 480 L = 495	II C	G	TPAE 400 LCIE 82.6273 X	LCIE 82.0024 U	48	6	2" 1/2
			L			Ø 420		
BRAE 500	Ø = 625	II C	G			84	8	3"
			L					

# TECHNICAL CHARACTERISTICS

## CHARACTERISTICS OF BUNDLE

### HEATING LENGTH

### NON-HEATING PART

### IMMERSION DEPTH

### OFFSET LENGTH

The immersion heaters consist of heating elements assembled by brazing or welding

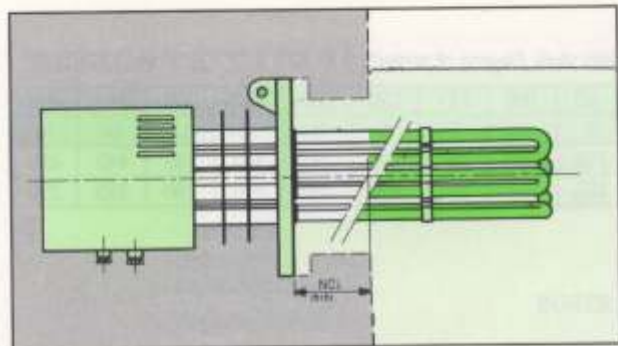
The heated length (LC) must always be fully immersed when the unit is switched on.

The size of the un-heated part (NCI) is determined by the assembly conditions and level control.

The heated length + un-heated part form the immersion depth (PL) of the immersion heater.

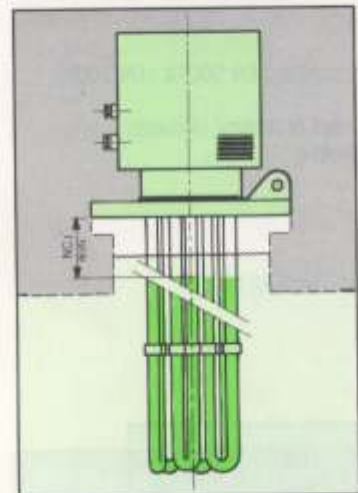
This depends on the temperature of the medium to be heated. The table below gives the normal values.

Ø	NCI	LC	PL
31	31	31	62



T °C	Max. No. of cooling discs	Offset length
< 120° C	-	0 + E
< 150° C	1	100 + E
< 250° C	2	150 + E
< 350° C	3	250 + E
> 350° C	depending on temp.	350 + E

T = temperature of medium to be heated  
E = thickness of flange



## CHOICE OF FLANGE

The operating temperature and service pressure determine the design (diameter, shape) of the flange and the metal grade.

The nominal diameter will limit the number of heating elements in the bundle, depending on the welding method. Conventional standard flanges will be used for preference to minimize manufacturing time. All of our immersion heaters equipped with standard flanges (shaded boxes) are tested for 30 minutes at 1.5 times the nominal pressure in a hydraulic chamber for pressures less than 40 bars. Please inquire for other sizes or higher pressures.

Flange		No. of circuits		
ND	Inches	Ø Max. bundle dia.	low pressure welding	high pressure welding
80	3	65	3	1
100	4	93	3	2
125	5	118	6	3
150	6	148	9	6
200	8	195	15	9
250	10	240	21	12

Flange		No. of circuits		
ND	Inches	Ø Max. bundle	low pressure welding	high pressure welding
300	12	292	30	18
350	14	340	42	21
400	16	390	57	30
450	18	438	66	36
500	20	485	87	45
600	24	585	138	63

## SEAL QUALITY

All of our immersion heaters are supplied without seals, as these must be selected to suit conditions of use.

## WELDING

The various types of weld are subject to welding method qualification certification for various combinations of materials.

- BUTT-WELDING between heating elements, pipe spacer and flange (or plug) with gap on immersion side
  - FILLET WELD between heating elements, pipe space and flange (or plug) with or without gap on immersion side.
- If there is the risk of corrosion in gaps, the latter solution will be used.

## LOCKING SPACER

Various types of spacer are available to lock the heating elements in the bundle. For circulating preheaters, the shape is adapted to meet bundle centring requirements and control flow (centring pins, 1/2 crescent, etc.).

## TEMPERATURE CONTROL INSTRUMENTATION

One or more fingers are welded onto the flange for assembling temperature control instrumentation.

- Single pole positive safety thermostat, adjustable within the following ranges :
  - 0 to 150° C
  - 50 to 300° C
  - 20 to 500° C
- Combined 3-pole thermostat/limiter adjustable within the following range :
  - 50 to 80° C and limiter at 100° C (fixed reference point)

- Single pole positive safety contact temperature limiter with manual reset with opening adjustable within the following ranges :

20 to 150° C  
50 to 300° C  
20 to 500° C

- Demountable jacketed thermocouples for regulator slotted into finger for welding to bundle element.  
thermocouple type T  
thermocouple type J  
thermocouple type K

- Demountable heat sensor fixed or otherwise to heating element - type Pt 100 to 0° C

## IMMERSION HEATER WIRING

Flange immersion heaters are supplied fully wired to one or more ratings as appropriate for optimum temperature regulation conditions.

Cables are high temperature of suitable section to avoid any temperature rise. If required, cables can be sealed and adapted for use in high humidity.

Connection is by :

- 6-terminal change-over star/delta block
- nickel-plated copper strip mounted on an insulator.

Cable entries on connection boxes are selected according to current : check that cable entry characteristics correspond with conditions of use (section).

# CIRCULATION HEATER

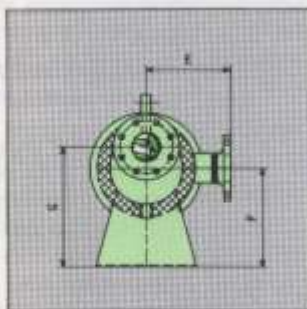
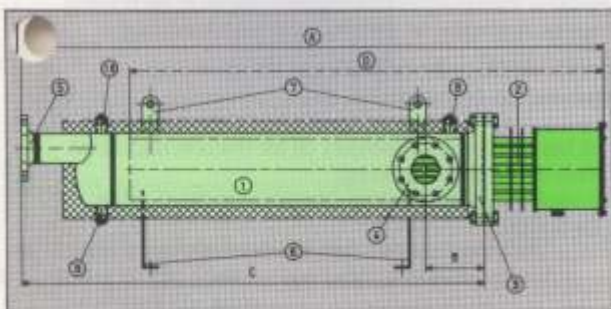
**USE** Heating of liquid or gaseous fluids.

## CHARACTERISTICS

- Mechanically welded steel body
- Inlet and outlet flanges to ISO PN or other standards
- Under-jacket heat insulation
- Flange immersion heater as per manual page 4
- Electric wiring in 1 or more groups on terminal blocks or busbars
- Cover (see page 3) in 2 versions :
  - Standon fanges for temperatures lower than 100° C
  - Standoff for temperatures over 100° C
- Drainage pipe (Bleed screw - Sump plug)
- Temperature regulation or limitation to order
- Dimensions to order

## SPECIAL VERSION

- Explosion-proof Flange Immersion Heaters
- Vertical mounting



- |  |  |
|--|--|
| ④ Total length                         | ⑤ Outlet flange                          |
| ⑩ Total flange immersion heater length | ⑥ Fixing support                         |
| ① Circulation heater body              | ⑦ Lifting rings                          |
| ② Flange immersion heater              | ⑧ Vent                                   |
| ③ Body flange                          | ⑨ Drain pipe                             |
| ④ Inlet flange                         | ⑩ Adapter plug for temperatur regulation |

## SPECIAL MODELS IMPORTANT

Entirely stainless steel

- Heating of liquids : check installation and purge before activation.
- Heating of liquid of gaseous fluids : ensure that flowrate is suitable for rating when elements are switched on and that heat inertia is checked when switched off.

# EXPLOSION-PROOF IMMERSION HEATERS

These are various types of explosion-proof or special immersion heaters with specific characteristics to meet a large number of different industrial applications. They differ in cover dimension and the characteristics of the explosion-proof seals used, and in the size of the heating element bundle.

## GENERAL CHARACTERISTICS

**PROTECTION BY EXPLOSION-PROOF ENCLOSURE (EN 50018)**

This resists pressure developing on internal explosion of an explosive mixture and prevents transmission of the explosion to the surrounding environment.

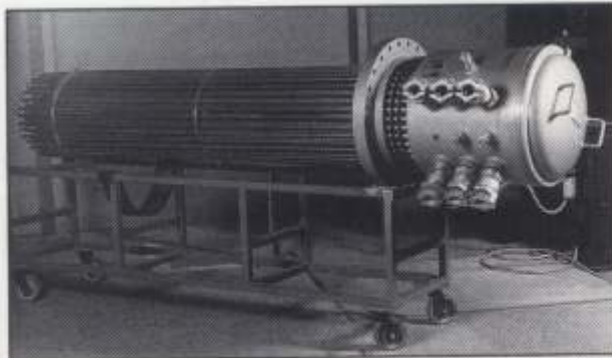
**EXPLOSION-PROOF SEALS**

These meet particular requirements (quality, length, and maximum gap) dependent on the shell volume and gas subdivision A, B, C.

**MARKED TEMPERATURE**

This marked temperature is the highest surface temperature reached in normal conditions. This temperature must always be lower than the self-ignition temperature of the explosive atmospheres concerned.

Electrical equipment is classified according to temperature classes referenced T1 (450°C) to T6 (85°C) depending on the nature of the gas.



T1	T2	T3	T4
450°C	300°C	200°C	135°C
Methane / Ethane Propane / Iso-butane Iso-octane Methyl alcohol Acetic acid Methyl acetate Ethylene / Propylene Styrene / Isobutylene Benzene Toluene Xylene Trimethyl benzene Nitro-benzene Chlorobenzene Naphthalene Phenol Acetone Ammonia Hydrogen Acrylonitrile Methyl chloride	Butane Iso-pentane Iso-hexane Ethyle alcohol Butyl alcohol Isobutyl alcohol Propylic acid Vinyl acetate Butyl acetate Ethyl benzene Butene Ethyl chloride Vinyl chloride Acetylene Butadiene Ethylene oxide	Octane Nonane Decane Butyl alcohol Amylic alcohol Pentane n-Hexane Cyclo-hexane Heptane Acetic anhydride Crude petroleum Fuel oil Gas oil Petrol	Iso-decane Ethylether Gas oil Petrol
			T5
			100°C
			Carbon sulphide
			T6
			85°C
			Ethylinitrite

## COVER

This is always constructed to standard EN 50018, of aluminium or mechanically welded steel, with bosses for fitting cable entries to meet the standard specifications (for dimensions see p. 3).

Joints comply with class IIB (plane joints) or IIC (threaded joints - plane joints). Connection inside the cover is directly on the terminals of the heating elements or on terminal blocks or busbars.

Temperature control and regulation instrumentation is mounted directly in the housing. Coupling can be at various ratings depending on the connection box dimensions.

## BUNDLE

This consists of heating elements welded to the assembly unit (flange or plug). Temperature control and regulation can be incorporated directly on this.

## GAS AND VAPOUR SUBDIVISIONS

Group II electrical equipment has subdivisions dependent on the characteristics of the characteristics of the atmosphere for which it is intended. All equipment has individual rating plates and marking complies with the "General Requirements" in standard EN 50018.

## USE

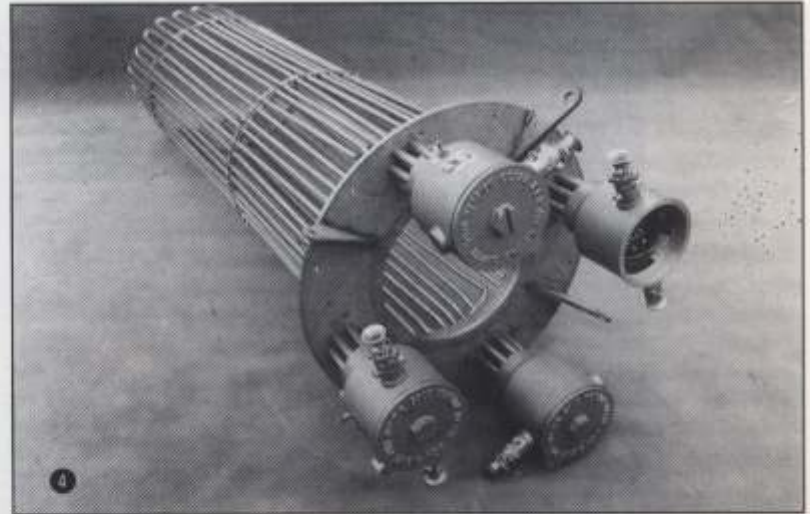
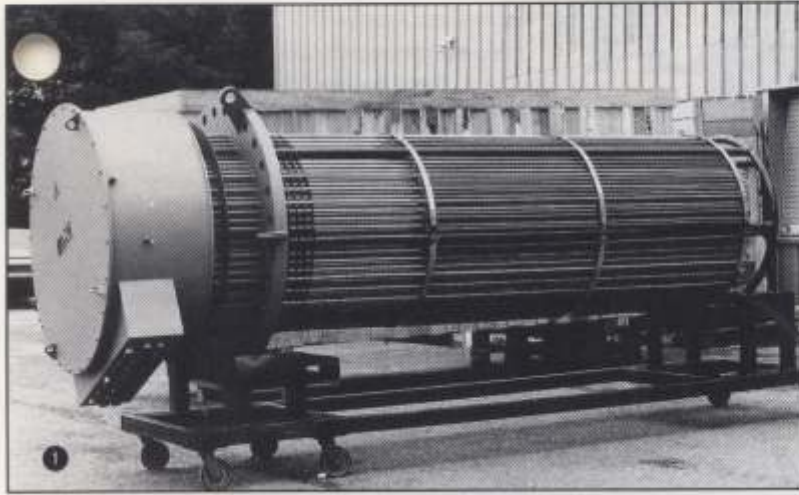
**SPECIAL IMMERSION HEATER EQUIPPED WITH EXPLOSION-PROOF COVER TPS SERIES**

The housing is designed to prevent ignition inside it from spreading to the surrounding atmosphere. It is constructed to meet the specifications of standard EN 50018 and has European EEx certification (see p. 3). It can be used for heating liquid or gaseous media.

**APPROVED IMMERSION HEATER: TP AE SERIES**

This is constructed to standard EN 50018 and EN 50014. The connection box is designed to prevent ignition inside the housing from spreading to the surrounding atmosphere. Provision is made to ensure that the temperatures reached by the walls in contact with the surrounding explosive atmosphere remain below the ignition temperature of the medium. Particular assembly and usage conditions may apply (heating of liquids with level control, heating of gases under certain conditions). It has European EEx conformity certification (see p. 3).

# EXAMPLES OF APPLICATIONS



- 1 1200 kW immersion heater, consisting of 216 heating elements, weighing 3.5 T for heating air for filter regeneration.
- 2 Copper immersion heater for hydro-accumulation tank. Rating 60 kW. Special shape to optimise water circulation and prevent lime scale.
- 3 Curved immersion heater, of a shape and rating for use in rotary machinery or a generator set for preheating oil.
- 4 Reheater with explosion-proof housing for precipitation in thermal fluid treatment (cracking).
- 5 Wiring of flange immersion heaters in the CETAL workshops.

