

2	31.10.2009	Tfr	Tpe	Rm	Updated	FUS
1	12.11.2007	ADy	ADe	FGr	Final document	FUS
0	09.11.2007	ADy	ADe	FGr	First issue for approval	PRE
Rev.	Revision Date	Created by	Checked by	Approved by	Description	Status

Project (Проект)

## Maritza East I Power Station

Company (Възложителя):



Space for stamp of Municipality of Galabovo  
Място за печат на Община Гълъбово

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Resp. dept. Отговорен отдел	Created by / Изготвил	Checked by / Проверил	Approved by / Одобрил	Format / Формат
Scale / Мащаб		Class. no. (e.g. KKS) / Класифик. №	for Company Review & Approval: За одобрение от Възложителя: yes	
Derived from / Произтича от	Replaces / Заменя	Doc. Type Тип на документа	Document Status Статус на окумента <b>released</b>	Sub Site No. / Подобект №
Logo of Legal Owner / Официален собственик  	Sub Contractors Doc Number / № на документа на подизпълнителя		Consortium Partner Document Code Код на документа на партньора от консорциума	
	Title, Subtitle / Заглавие, подзаглавие  <b>ERECTION PROCEDURE FOR INSULATION</b>		Project Doc. Number / № на проектния документ <b>MTZ/12/M/-----K25/EI/001</b>	
	Rev. Рев	Date Дата	Lang. Език	Sheet Страница
	2	31.10.2009	En	1/32



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# **ERECTION PROCEDURE FOR INSULATION**



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- 1 - Assembly guide sketches**



## 1. SCOPE

The present document sets out the different principles of installation of the insulating materials, sheeting and accessories for thermal insulation of equipment and pipe works in thermal power plants.

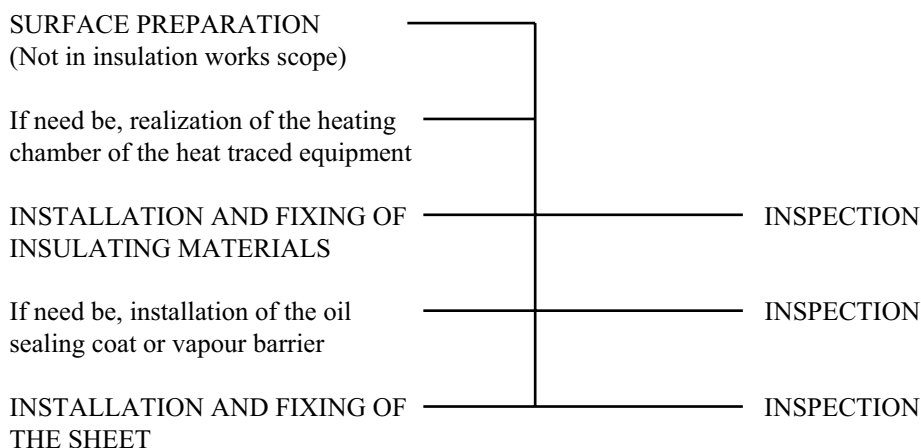
## 2. GENERAL REQUIREMENTS

### *2.1 Logic flow chart of operations*

The thermal insulation can be broken down into two major operations :

- Prefabrication : cutting-out of sheet, rolling, moulding and manufacturing of special pieces for elbows, valves, flange pairs, tees, branch connections, reductions, etc.
- Erection : insulating materials, sheets for protection against oil penetration, vapour barrier, assembly by screws, steel bands, etc.

The sequencing of the works and inspections to be performed for the installation of the thermal insulation is shown on the following flow chart :





## ***2.2 Référence documents***

The following documents are placed at the Construction Subcontractor's disposal :

- \* EFU
- \* Erection quality control
- \* Storage instructions

## ***2.3 General conditions of implantation of these works***

The jobsite is organized in four main sectors :

- A buffer storage for insulating materials, sheets (all the sheets necessary on the jobsite, as the case may be) and accessories.
- An open prefabrication room of sufficient dimensions, which vary with the size of the jobsite and the lead time of installation of the thermal insulation ; this room houses the working stations with the following major items of equipment :
  - \* handling appliances for sheet rolls (0.5 to 2t)
  - \* reel of sheet rolls
  - \* shears
  - \* bending machines
  - \* moulding machine
  - \* punching machine
  - \* rolling machine
- A storage yard for items under prefabrication (elbow sections, parts of removable boxes, etc.)
- A storage yard for prefabricated pieces.



### **3. INSTALLATION OF INSULATING MATERIALS**

#### **3.1 *Presentation of insulating materials***

##### **3.1.1 Single and double layer insulation**

- Rock wool preformed pipe section or mattress 100 kg/m<sup>3</sup> for pipes depending on the Ø (see MTZ12M---K25CA001).
- Rock wool mattress 100 kg/m<sup>3</sup> with galvanized steel wire netting for equipments.

##### **3.1.2 Two-layer insulation**

- 1<sup>st</sup> and 2<sup>nd</sup> layer : Rock wool mattress 100 kg/m<sup>3</sup> or preformed pipe section depending on the Ø (see MTZ12M---K25CA001).

#### **3.2 *Surface preparation prior to installation of insulating***

The thermal insulation works shall be started only after piping or equipment has been subjected to all the hydraulic tests & final conformity.

Before the insulating material is put in place, the surfaces shall be dried, cleaned and de-oxidized. The oxidized surfaces have to be brushed down to surface preparation SIS 055 900-1967, and the primed surfaces have to be cleaned.

#### **3.3 *General recommendations***

- The insulating material should be cut to the exact dimensions of the surface to be insulated.
- The insulating materials should always be perfectly butted.
- In case of multi-layer insulation, each layer is laid on the previous one with joints staggered in both directions to eliminate heat losses.
- The insulation is fixed by bands :
  - Aluminium 12 x 0.5 for O.D. pipe < 304 mm.
  - Aluminium 16 x 0.5 for O.D. pipe > 304 mm and equipments



The aluminium band is cut to the overall dimensions of the insulating material plus 20 to 40 mm, slightly tightened and then, fixed by clamps of the same material. The over length of the band is cut off. Straight pipe runs require : every 0.30 m.

The protruding parts of clamps and bands shall be folded not to damage the sheeting.

- The wire netting of the mattresses shall be laced with galvanized steel wire, whose ends shall be tucked into the insulating material.

### ***3.4 Installation on piping***

As regards horizontal piping, the joints shall not be realized following the upper generatrix, but within a 120° angle cantered on the lower generatrix.

See sketches 01 and 02.

### ***3.5 Installation on equipment***

- The mattresses shall be fixed by aluminium band and laced with galvanized wire.
- See sketch 04.

## **4. INSTALLATION OF SHEETING**

### ***4.1 Types of sheeting***

The thermal insulation sheeting consist of aluminium sheets whose thickness depends on the outside diameter of the insulation :

- Th. 0.8 mm for O.D. pipe  $\leq 330$  mm and flanges and valves ND  $\leq 150$
- Th. 1.0 mm for O.D. pipe  $> 330$  mm and flanges and valves ND  $> 150$
- Th. 1.2 mm for equipment.

In the case of acoustic insulating, the inner part of the sheeting has to be covered with a self adhesive « Idikell » sheet (heavy coating).



## **4.2 General recommendations**

The sheets are cut to the overall dimensions of the insulation increased by the overlaps.

<b>Outside diameter of insulation</b>	<b>Overlaps at sheet edges</b>
Ø < 200 mm	30 mm
Ø ≥ 200 mm	50 mm
Equipment	50 mm

The overlaps are so arranged as to prevent water penetration, and opposite to the direction of the prevailing winds.

The sheets are rolled to the outside diameter of the insulation and then moulded at each edge.

The sheets are fixed every approximately 250 mm to one another by stainless steel Parker screws, and stainless steel self drilling screw with "vulcain" washer into the metal supports of the sheeting.

Outdoor tightness is ensured by preformed mastic cord at the sheet overlaps.

In some particular cases, a sheet deflector can ensure tightness.

See sketch N° 07.

## **4.3 Sheeting of pipes**

### **4.3.1 Supports of the sheeting (for insul. thick > 120 mm)**

In order to prevent insulating material setting, the sheet supports are placed every 2.00 m, on the horizontal and vertical piping lines. These supports will be made up of flat bar rings (30 x 3) cut to the dimensions of the pipes and the sheets. These supports are also placed on both sides of the valves above 3' in diameter with thermal insulation 120mm thick at least, and everywhere setting is to be feared.

Spacers (flat bar 30 x 3) shall be fixed onto the rings by galv. rivets (4.8 x 16) with the insertion of a 3mm ceramic plate. Spacer pitch : 0.4 to 0.5 m. A plasticized PVC tape will be placed on the support-ring to avoid electro-chemical corrosion.

If acoustic insulation, the spacers shall be formed in " Z "

See sketch N° 05.

For vertical piping lines, place two rings supports with welded spacers.

See sketch N° 06.



#### **4.3.2 Installation on piping**

On horizontal pipe works, the longitudinal joints are placed as far possible about 45° from the high or low generatrix of the pipe.

The circumferential overlap of vertical pipes must be downwards-faced to prevent water penetration.

So as not to damage sheet attachments on piping expansion, the circumferential joints of the sheets are not assembled every 5 m of straight pipe section nor at the sheet supporting joints.  
Overlap at expansion joints must be 100 mm.

The gaps between sheeting sheets over outdoor piping in non-tight gutters are made tight by preformed mastic cord applied onto the overlaps of the sheets. In some particular cases, a sheet deflector can ensure tightness.

See sketches N° 07 and 08.

#### **4.3.3 Installation on equipment**

Supports made in the same principle as for pipes will be installed prior sheeting.

See sketches N° 9.

Vessels shall have dished ends consisting of sheets traced and cut into melon slices to suit the overall dimensions of the insulating material. The number of sections shall be sufficient to cover those dished ends fully.

The thermal insulating material is cut out around the identification plates, and finishing plates shall be secured on edges.

See sketches N° 11 - 12.



## **5. MANUFACTURING OF SPECIAL PIECES**

The following arrangements complete or amend the rules of the preceding chapters.

### **5.1 *Elbows***

The thermal insulation and the sheeting are of the same material and the same thickness as the ones of adjacent pipes.

Sheeting diameter above 250 mm

Preformed pipe sections or mattresses are cut into segments to suit the effective circumference length of the bend.

The mattress segments must be fixed carefully by bands.

The sheeting is composed of sheet sections in a sufficient quantity to cover the elbow completely.

The sheeting is assembled by stainless steel screws. Axial and circumferential overlaps are 30 mm.

They are so arranged as to avoid water penetration.

See sketch N° 13.

Sheeting diameter not more than 250 mm

The sheet sections are assembled moulding in moulding.

See sketch N° 13.

Socket welded elbows

The sheets are traced and cut to the effective circumference length of the elbow plus 30 mm overlap.

The sheeting is composed of two halves which fit into each other following a 45° angle. One part has a male moulding on half the edge and the other a female moulding on the other half.

The whole is assembled and held in place by parker screws.

See sketch N° 14.



### **5.2 Tees - Branch connections**

Tees and branch connections are insulated to the same specification as the adjacent pipes.

Overlaps are so arranged as to prevent water penetration.  
See sketch N° 15.

### **5.3 Y-pieces**

They are insulated to the same specification as the adjacent pipes.

### **5.4 Reductions**

They are insulated on the same principle and with the same thickness as the large piping.

See sketch N° 16.

### **5.5 Pipe support**

The sheet is cut out on the site around the support. The opening in the sheeting must be reduced to the minimum.

A collar cut out in sheet is tightened by a band around the circular supports to ensure tightness around outdoor supports. As the case may be, a mastic joint may be added along the cutout for better tightness.

### **5.6 Thermal insulation breaks**

There are placed at the limits of the thermal insulation for personnel protection and for flanges, valves, wall-cladding penetration, etc.

Insulation must be stopped at a sufficient distance to allow removal of flange bolts.

See sketch N° 17.



## **6. REMOVABLE THERMAL INSULATION**

### **6.1 *Flanges***

The flanges shall be insulated by means of a removable box whose thermal insulating layer is as thick as the one of the adjacent pipe.

A thermal insulation break shall be arranged on both sides with sufficient room reserved for bolt removal.

The thickness of sheeting shall be the same as the adjacent pipe

The mattress is made integral with the sheeting by lugs which are cut from a sheet, cupped round the wire netting, tucked into the insulation and secured by stainless steel rivets (3.2 x 12) to the box sheeting.

Joints between sheets are of double-folded type.

The constituent parts of the removable boxes are assembled by aluminium lever fastener PM type for  $DN \leq 100$  and GM type for  $DN > 100$ . Fixing the lever fasteners by stainless steel rivets 3.2 x 12 for PM type and 4.8 x 12 for GM type.

Joints and overlaps are made in such a way as to prevent water penetration.

See sketch N° 19.

### **6.2 *Valves***

The valves are insulated by means of removable boxes just as the flanges.

Supports for horizontal piping (see sketch N° 05) are placed on both sides of the box at the thermal insulation breaks. ( $DN > 80$  and thick of insul.  $> 120$  mm).

Welded valves of diameter not more than 2" and with thermal insulation thickness not greater than 60 mm are insulated without box and to the specification of the adjacent pipes.

See sketches 20 and 21.

### **6.3 *Manholes***

The manholes shall be insulated with removable boxes according to the same construction principle as for flanges.

See sketch 22.



## **7. SPECIAL PROTECTIONS**

### **7.1 *Vent and drain pipes***

Vent and drain pipes, except for personnel protection, shall be insulated with thermal insulation up to the flange upstream of the vent or drain valve.

### **7.2 *Thermal insulation for personnel protection***

Thermal insulation for personnel protection is installed on all hot lines without heat-loss thermal insulation and accessible by the personnel. The parts to be insulated are not more than 2m vertically and 0.8m horizontally within personnel's reach.

## **8. INSPECTIONS**

### **8.1 *Codes and standards***

- SIS 055 900/1967 : Swedish standard of degree of preparation of surfaces.

### **8.2 *Inspection steps***

The inspections of the thermal insulation include the following steps :

- Surface preparatory prior to the application of the thermal insulation :

Checking :

- preparation degree SIS 055 900/1967 standard for unprimed parts.
- cleanliness of the primed surfaces, which must be free from grease, rust or other impurities.
- Fixing of insulating materials : placing, lacing of wire netting, tightening of the insulation.
- Application of special coatings (mastic + glass cloth) : absence of porosity, appearance.
- Fixing of sheeting : appearance, outside circumference.

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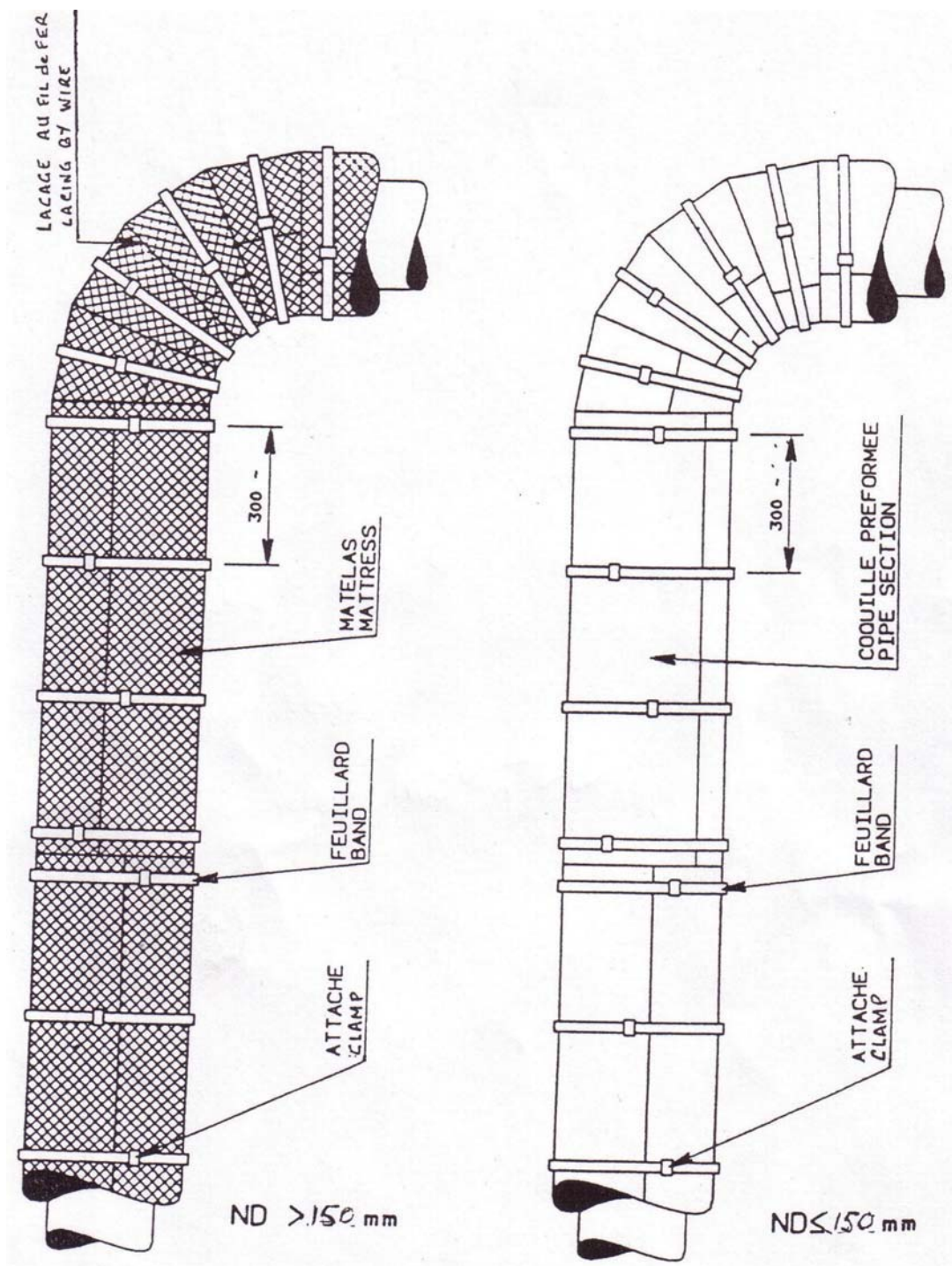
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## THERMAL INSULATION :

### 01 / SINGLE LAYER INSULATING MATERIAL SECUREMENT





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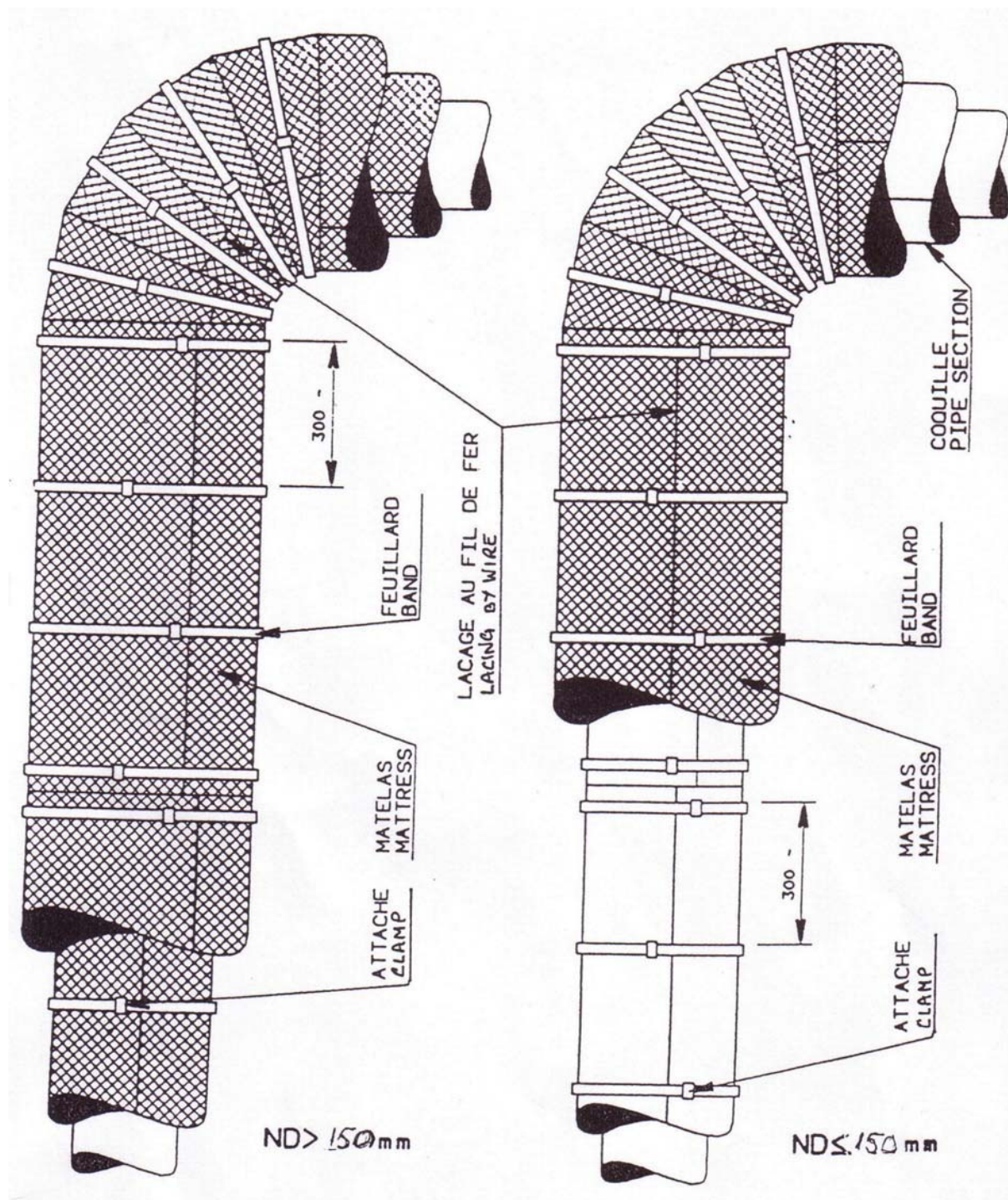
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## 02 / MULTI-LAYER INSULATING MATERIAL SECUREMENT





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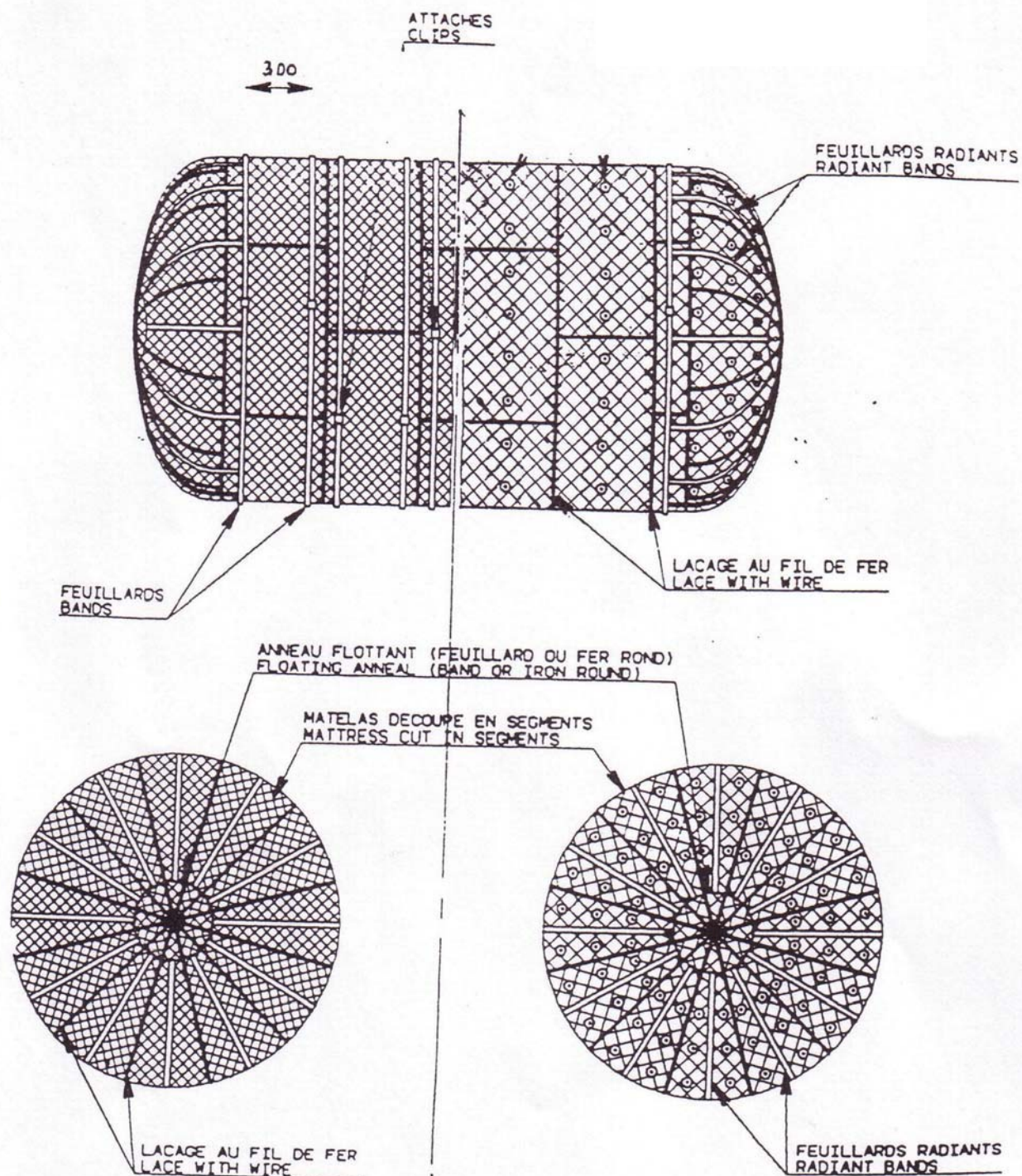
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#### 04 / VESSELS - INSULATING MATERIAL SECUREMENT





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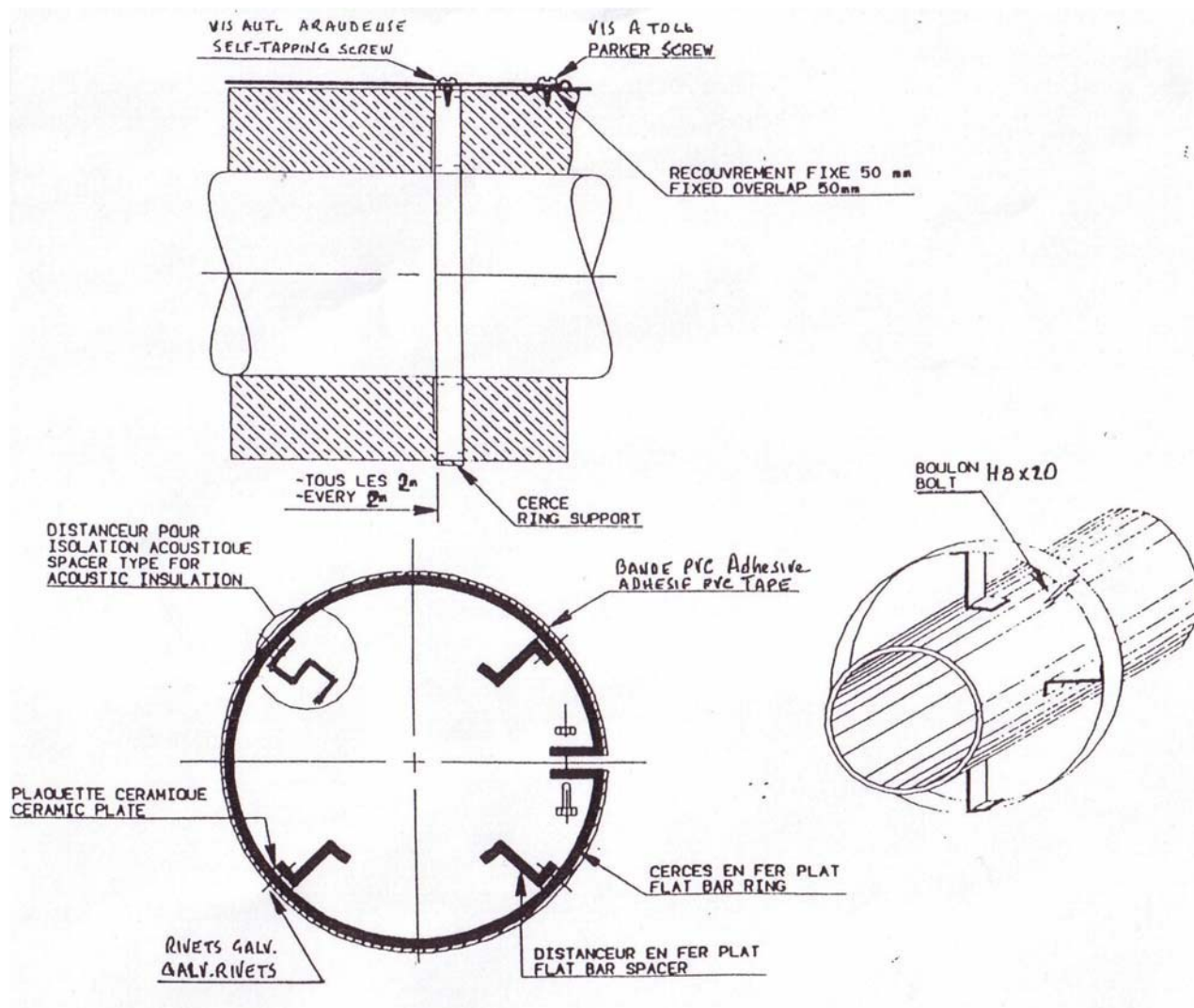
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## SHEATHING :

### 05 / SUPPORT ON HORIZONTAL PIPES





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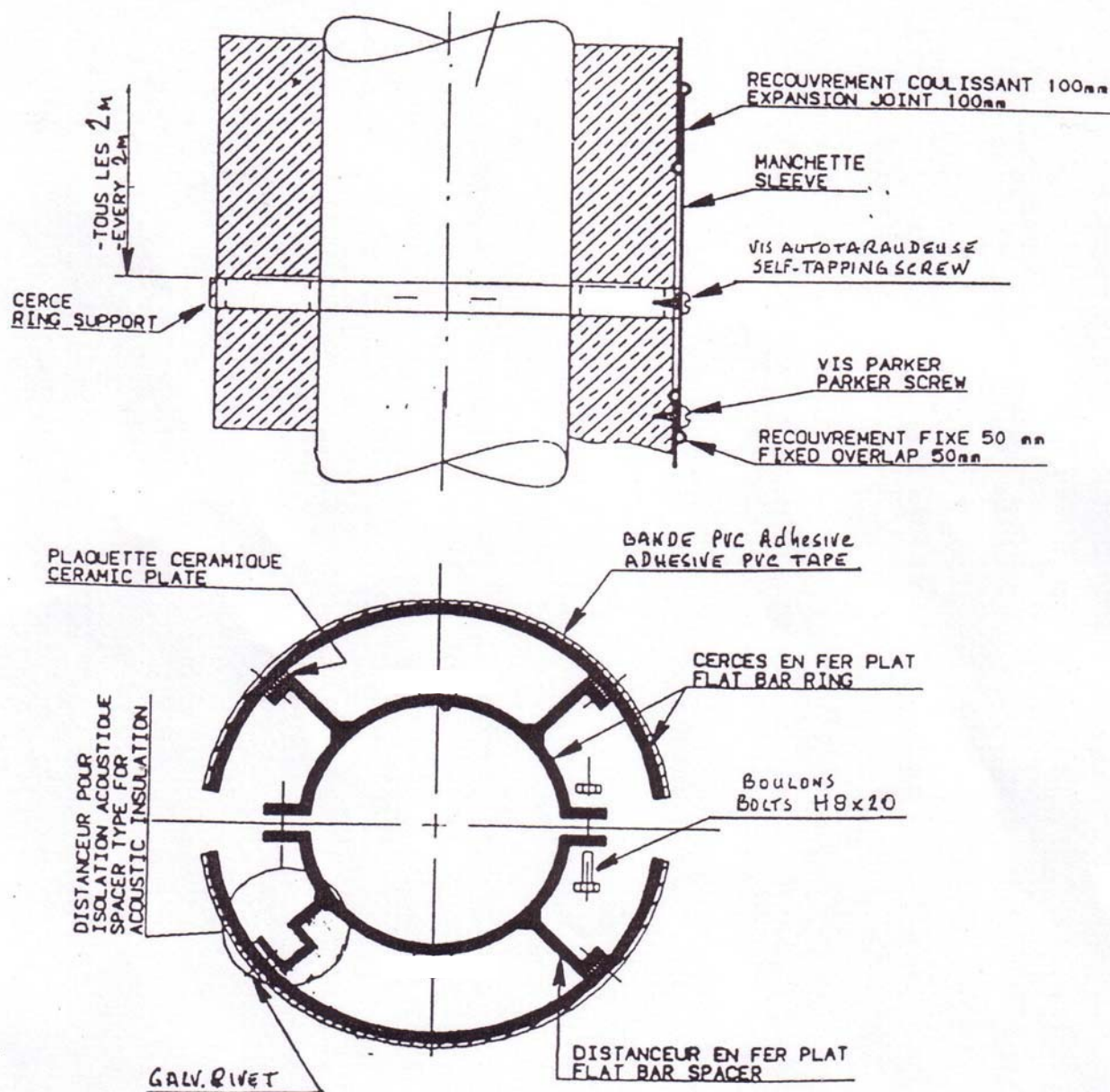
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## 06 / SUPPORT FOR VERTICAL PIPES





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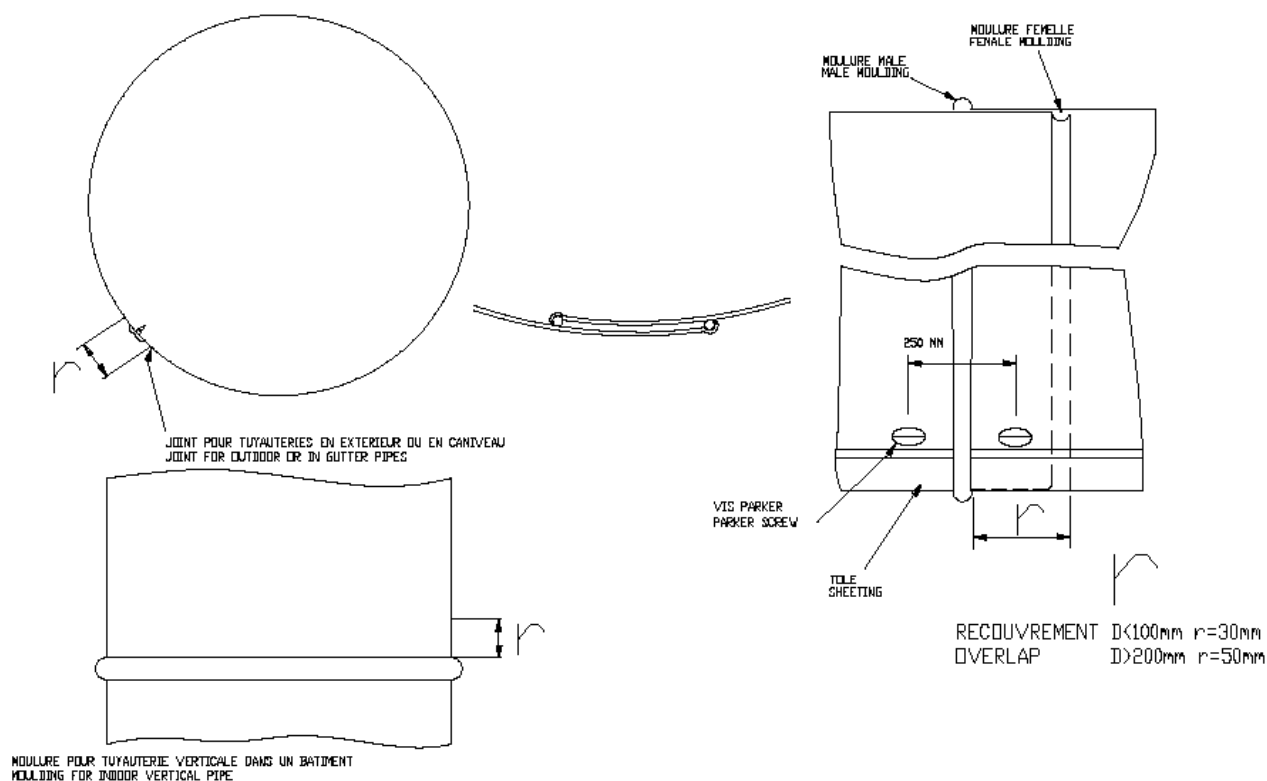
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## 07 / SHEETING ON PIPES





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**08 / NOT APPLICABLE**



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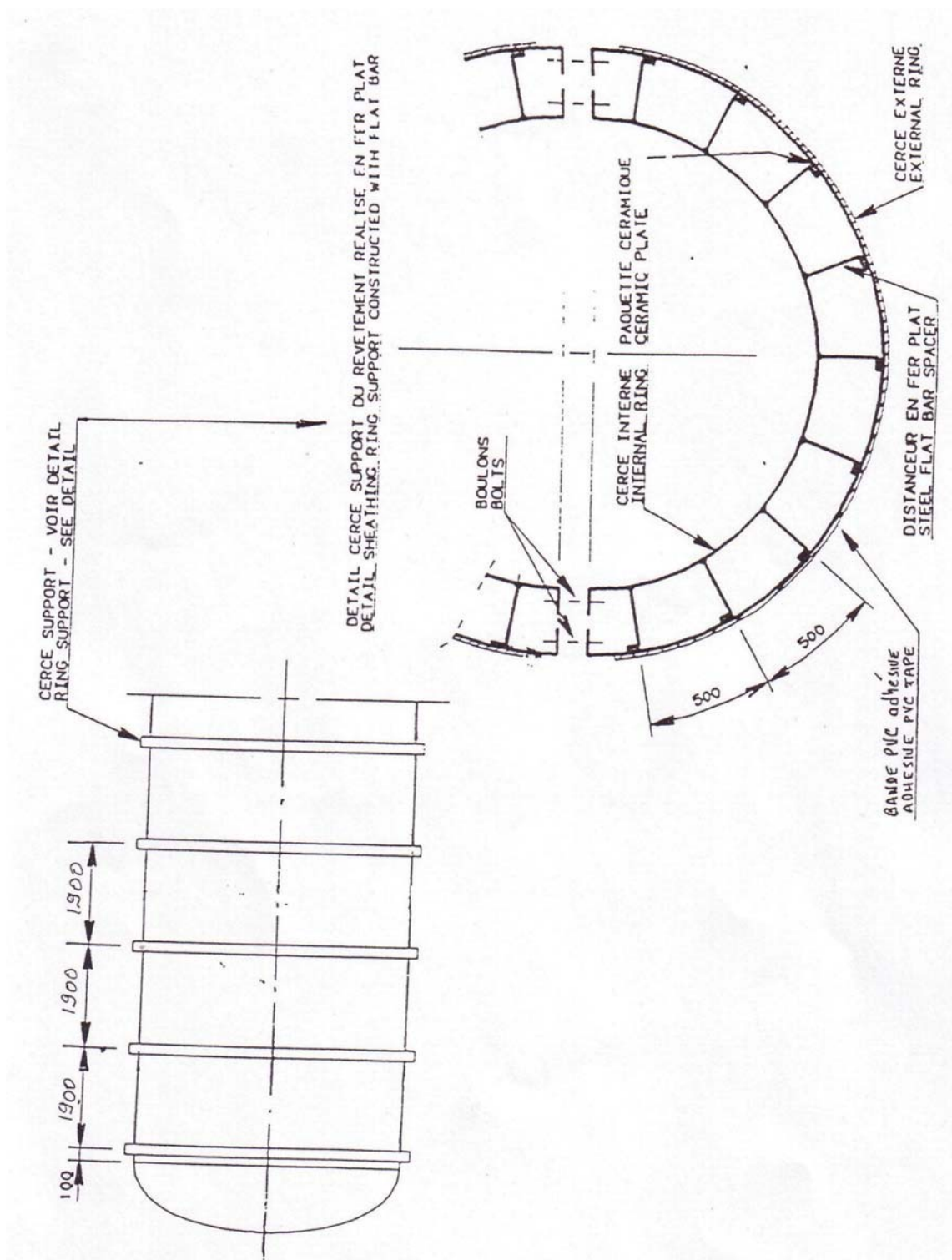
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## 09 / DRUMS – FRAME FOR SHEETING SECUREMENT





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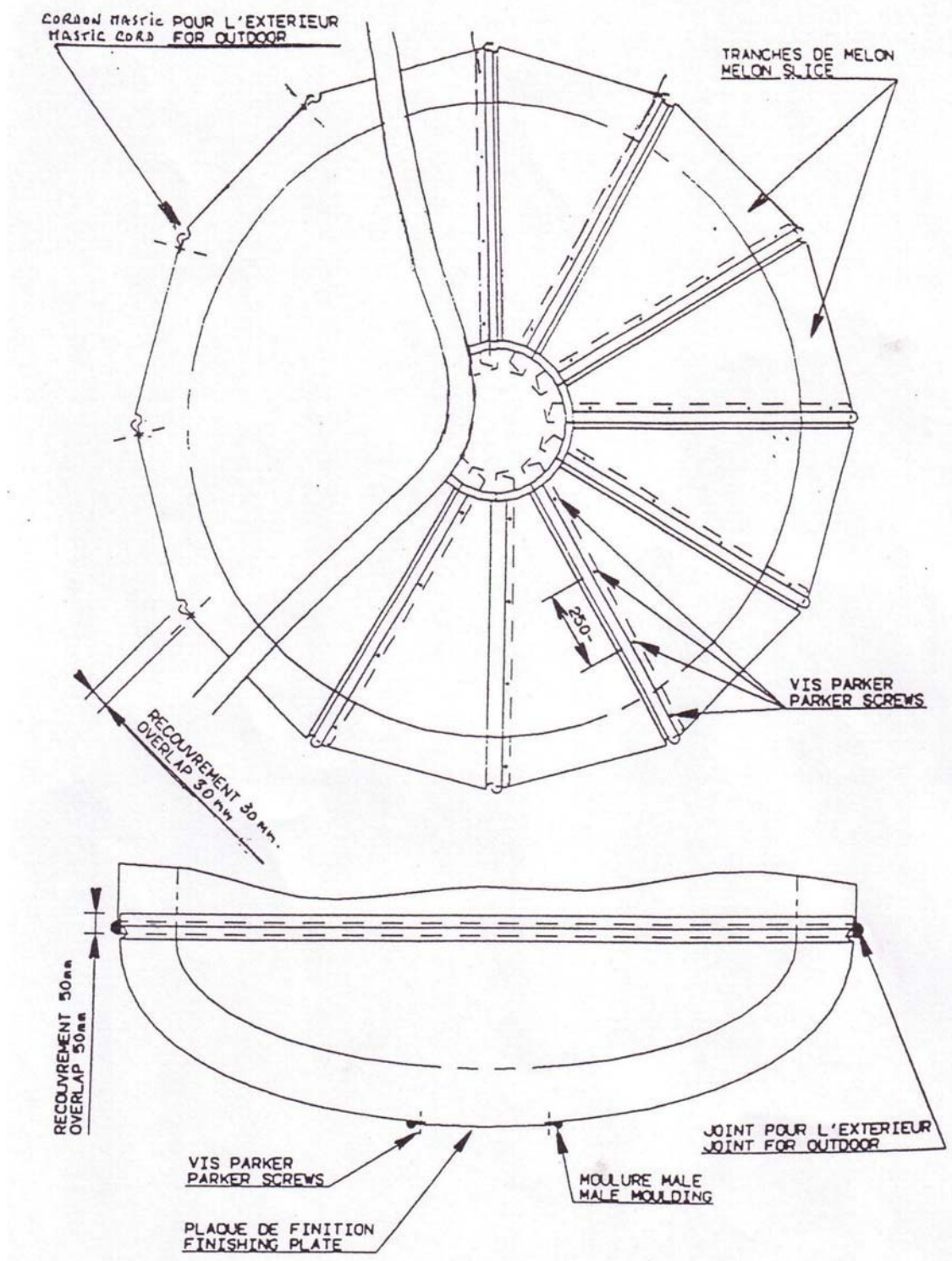
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## 11 / VESSELS - DISHED BOTTOM





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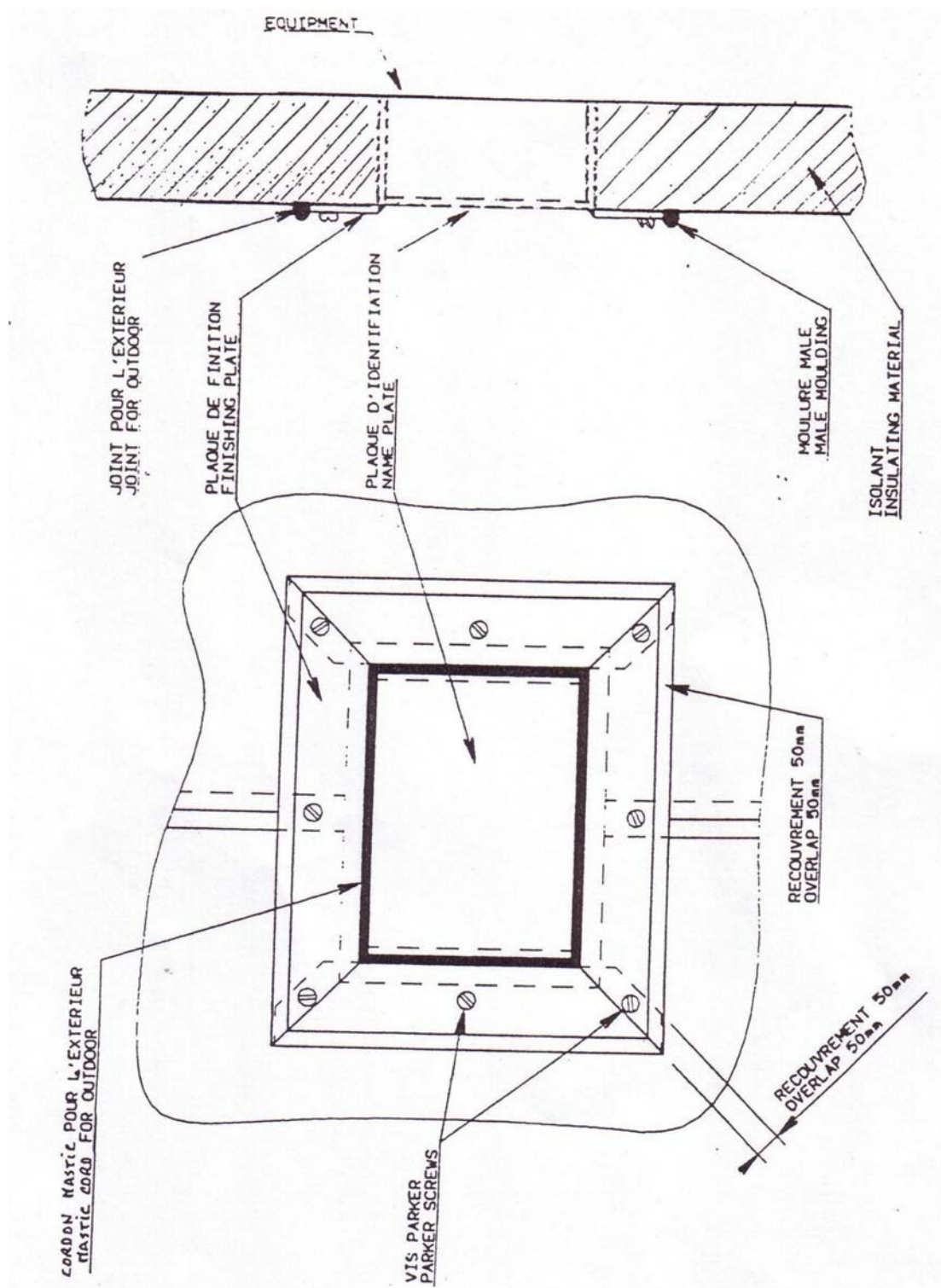
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## 12 / NAME PLATE





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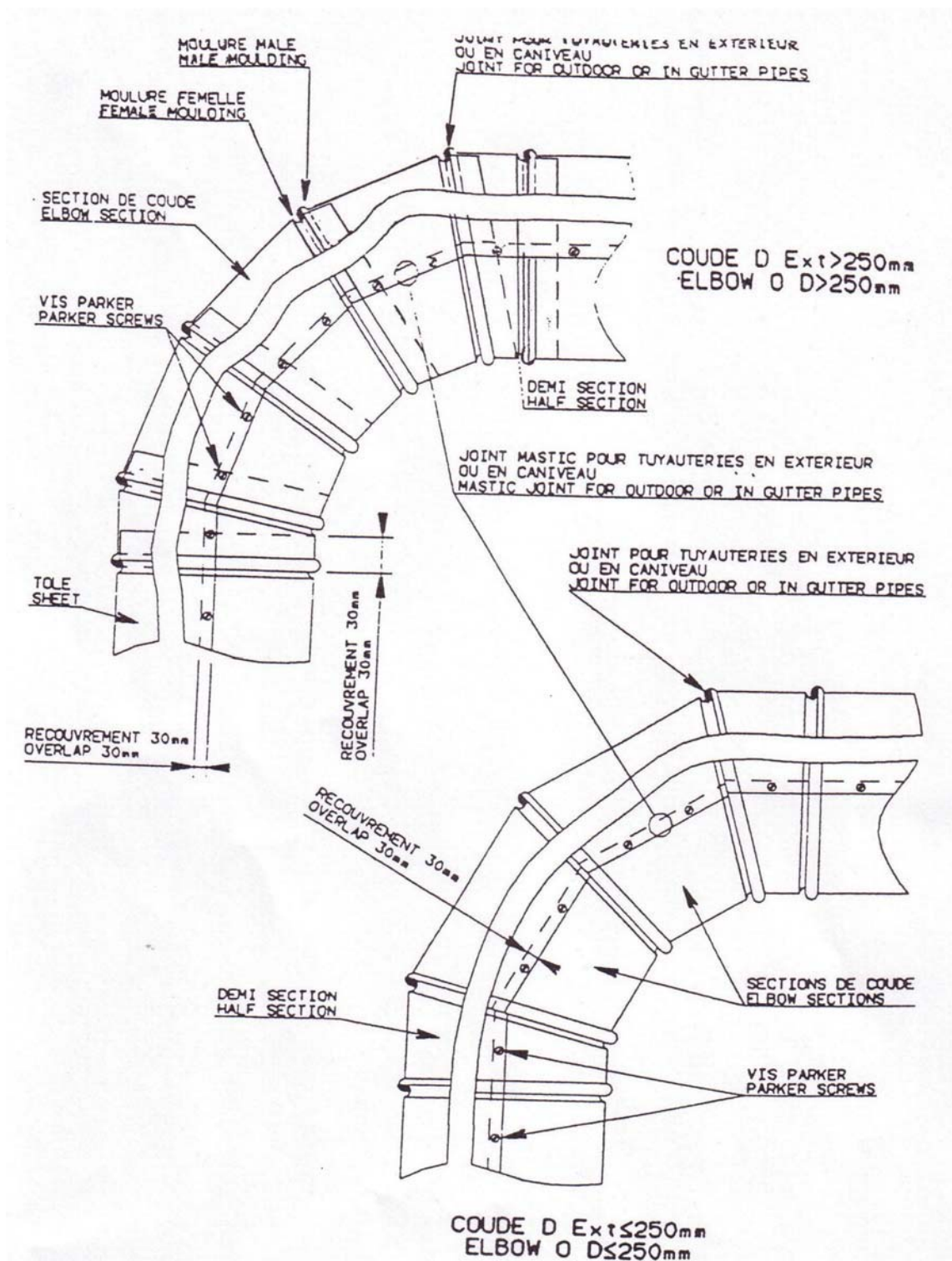
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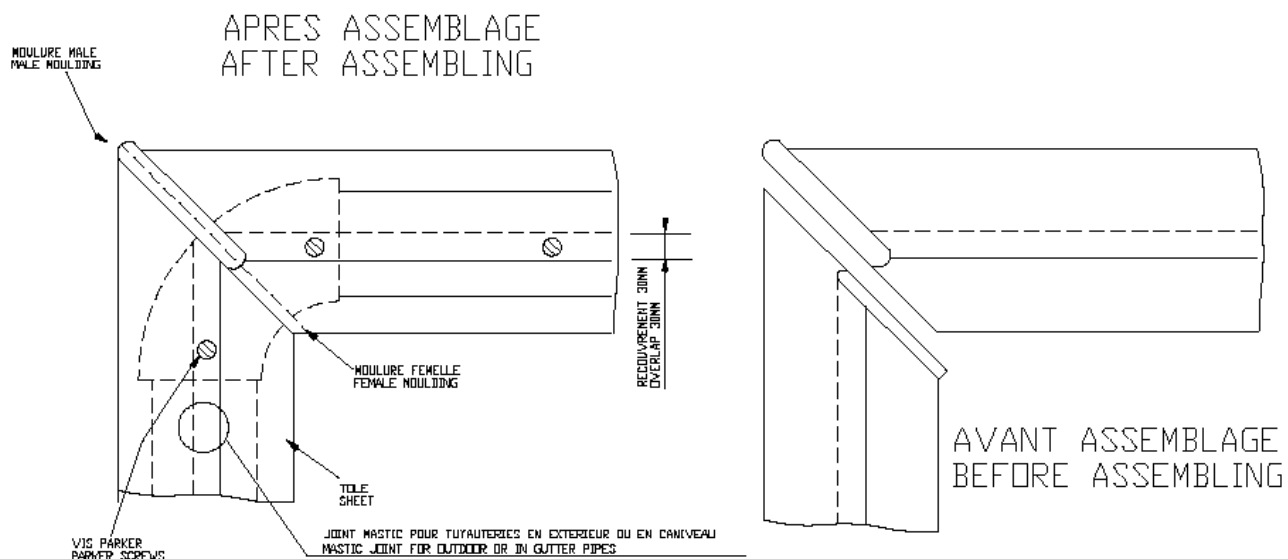
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## MANUFACTURING OF SPECIAL PIECES :

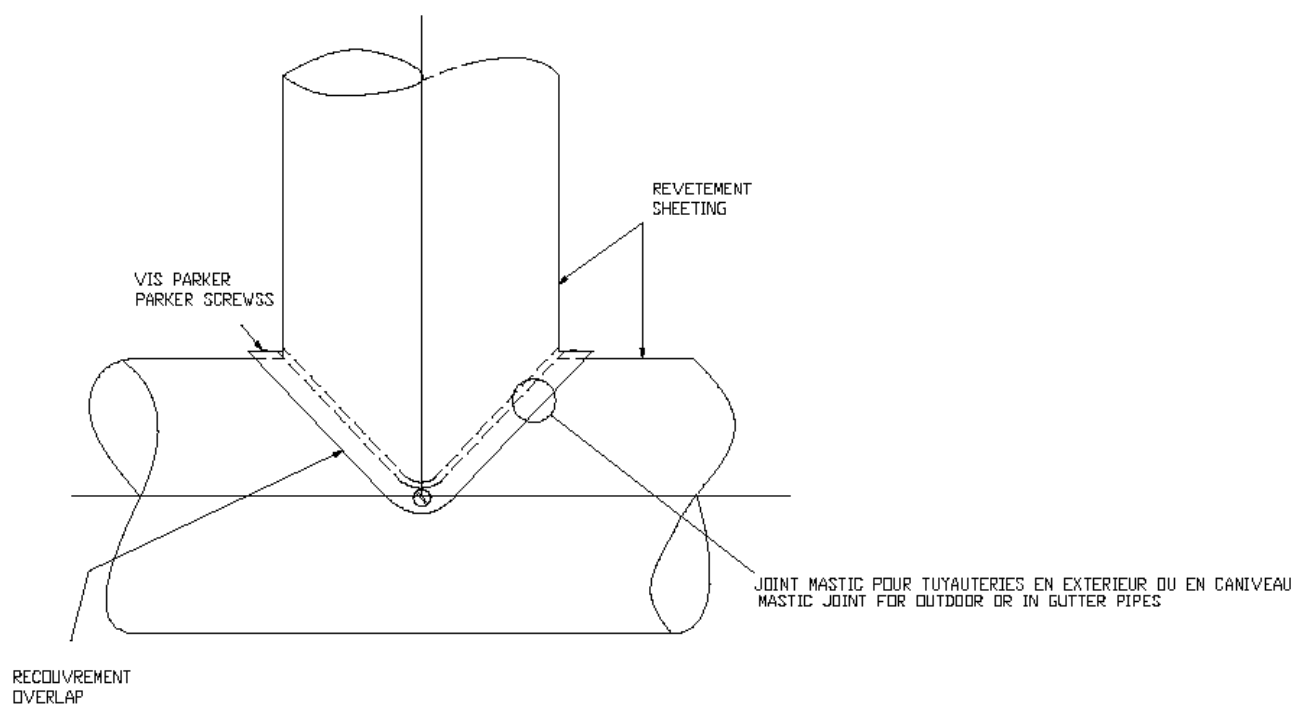
### 13 / ELBOW



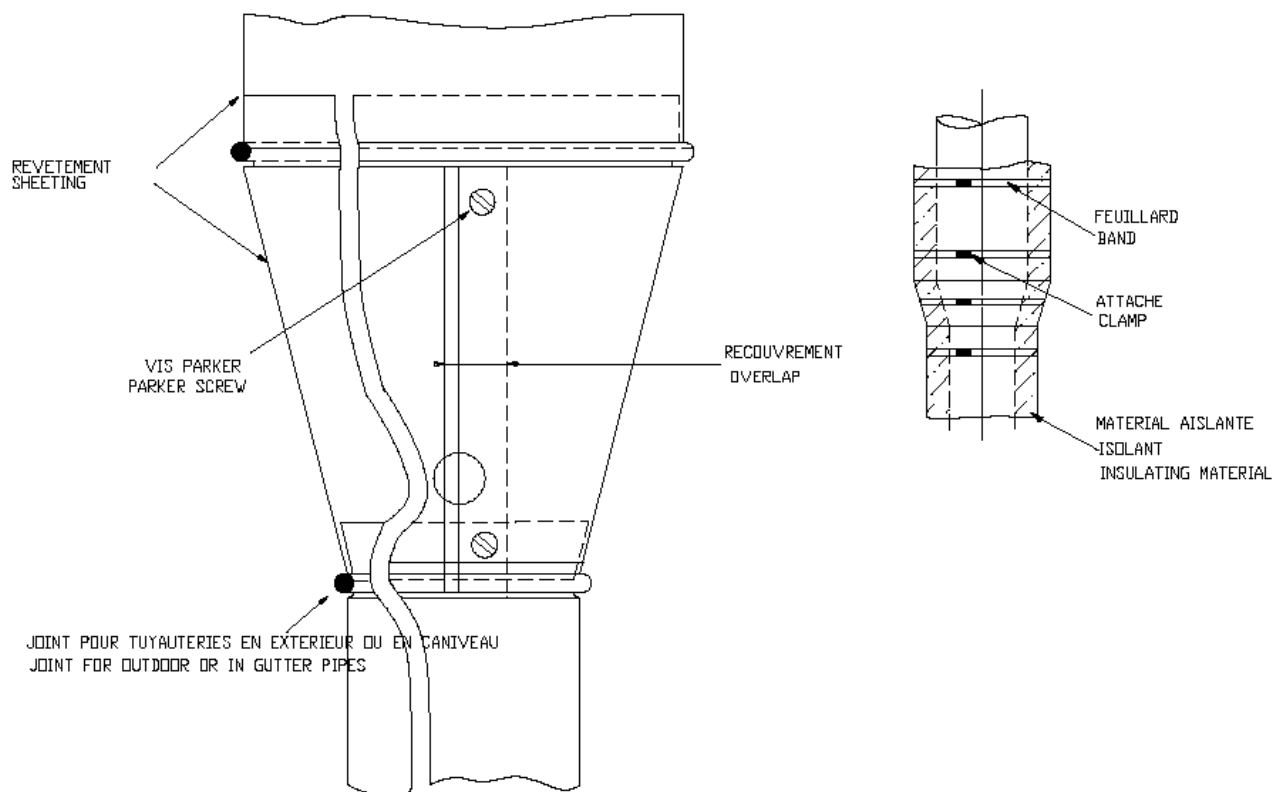
## 14 / SOCKET WELDED ELBOW



## 15 / TEES - NOZZLES



## 16 / REDUCERS





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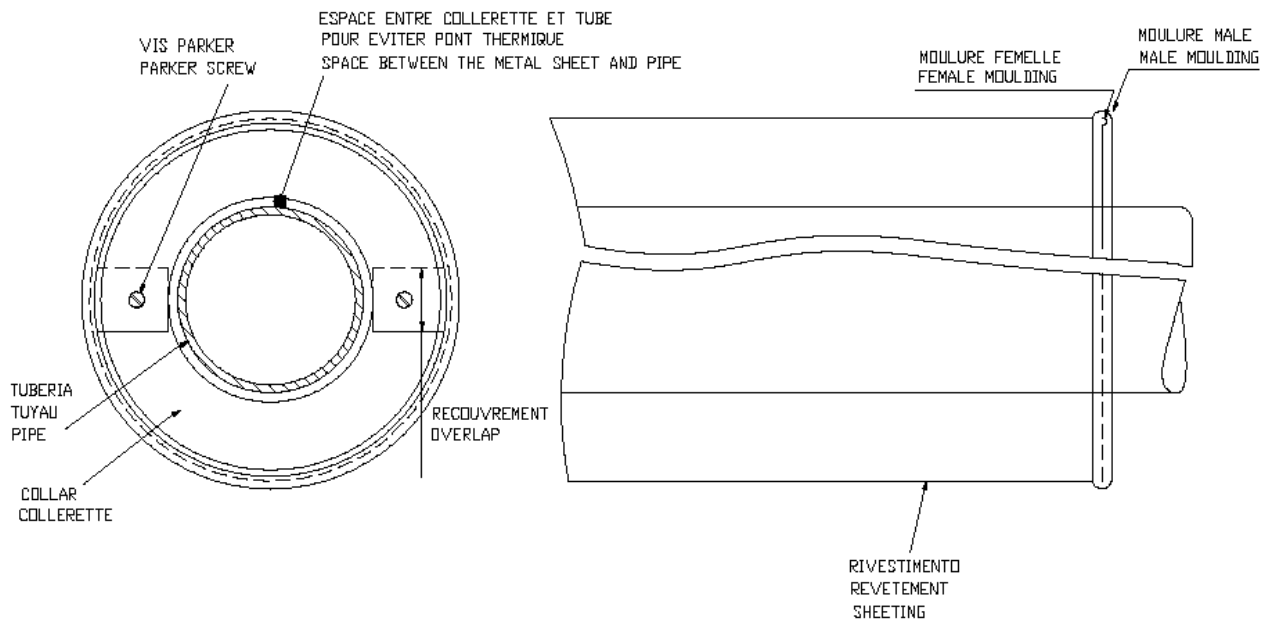
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## 17 / INSULATION BREAKS





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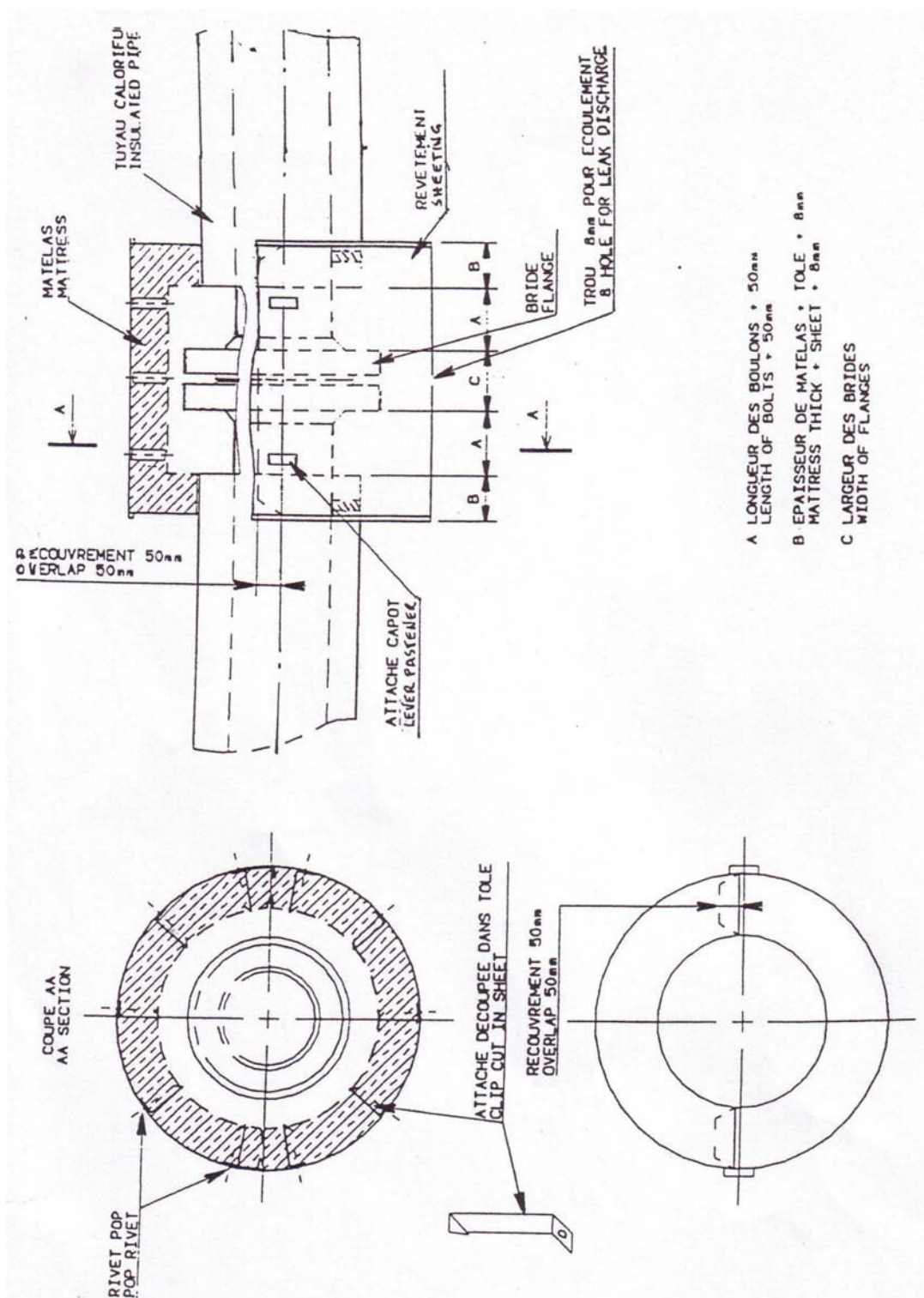
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## REMOVABLE PARTS :

### 19 / FLANGES





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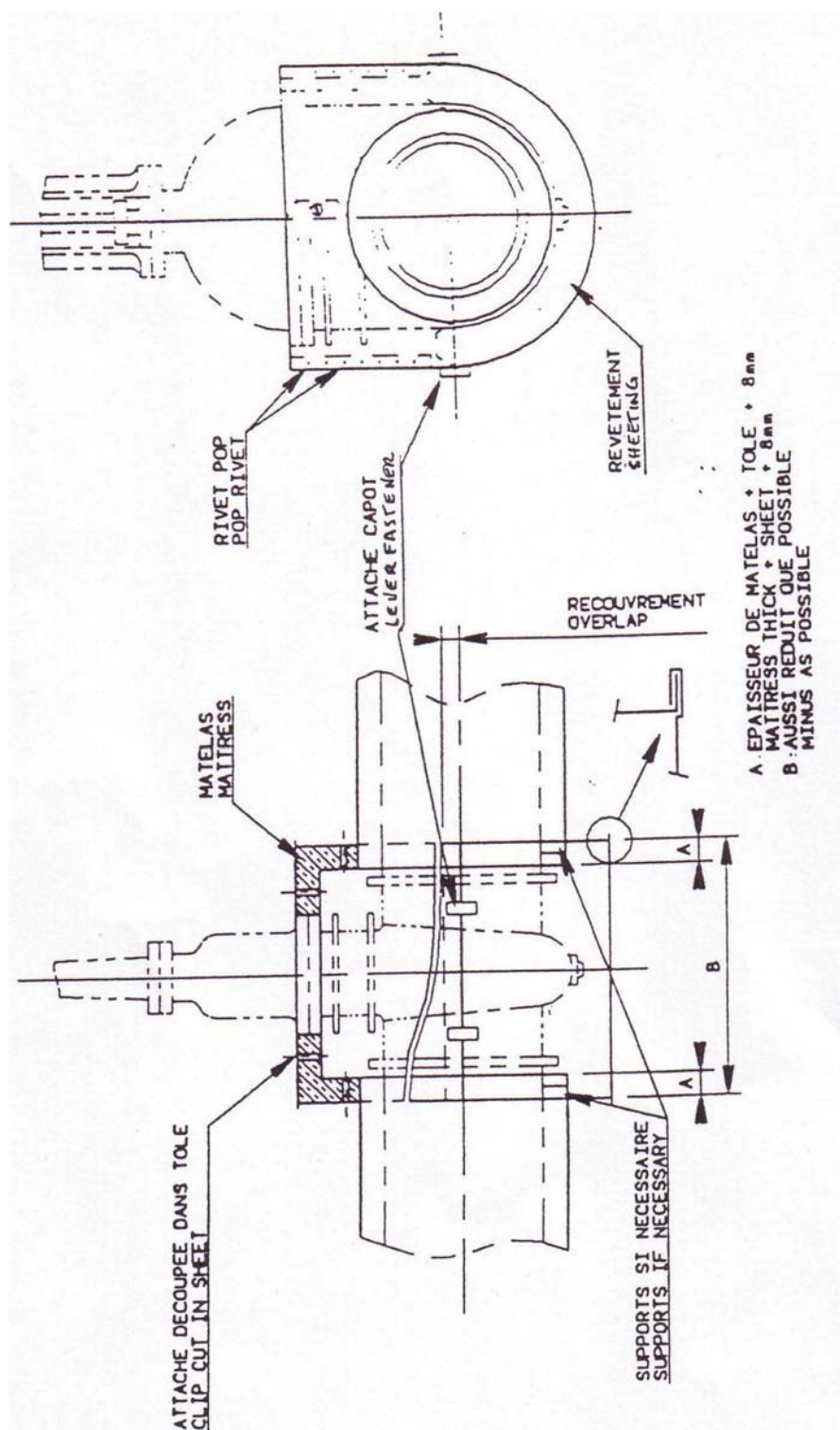
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## 20 / WELDED VALVES





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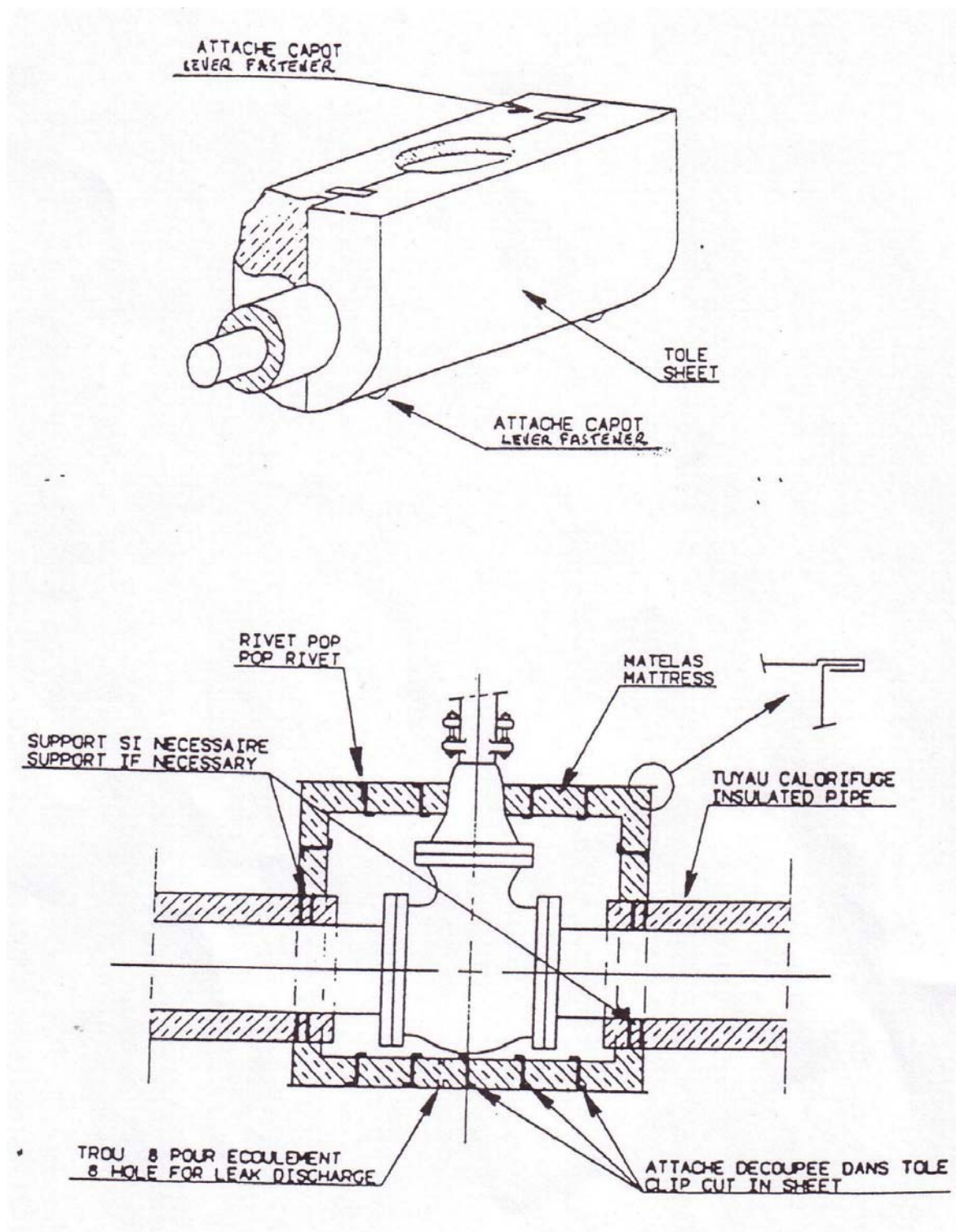
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## 21 / FLANGED VALVES





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## 22 / MANHOLES

