



**Resalat Oil Field Development Project  
Phase 1 (EPC-EPD)**



	Contract No.	Specification For Insulation					Class	1
	5365	Pr. Code	Area	Disc.	Type	Seq.	Rev.	Page 1 of 7
	LRSL	000	PI	SP	690	03		

## Specification For Insulation

					<i>A. Gh</i>	<i>S.M</i>	<i>M.A.</i>	
03	22-May-22	Approved for Construction	IOEC	-	A.Ghomi	S.Movahedi	M. Aghaei	-
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REVISION RECORD SHEET

REV. NO.	PURPOSE	LIST OF UPDATED MODIFIED SECTIONS IF ANY
01	Issued for Approval	-
02	Approved for Construction	-
03	Approved for Construction	-



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**1. INTRODUCTION**

**1.1. Development Overview**

The Resalat Field previously known as Rakhsh Field, is located in the Persian Gulf, some 80 km to the South of Lavan Island, in water depth of 65-75 meters. The facilities which were originally developed in 1968 have sustained some damage due to the Iran/Iraq war and adverse climate conditions thereafter.

To increase oil production capacity from this field (adding 12,000 stock barrels per day to current production), Iranian Offshore Oil Company (IOOC) has defined new project which includes Engineering, Drilling, Procurement, Construction for following items:

- New satellite Wellhead Platform (WHP1) with totally nine (9) conductor slots.
- Development and renovation of Existing offshore complex consist of new power generation, control system, HVAC, Electrical /control room, electrical panels(LV &MV),process & utility piping, and all necessary activities which shall be done for connection to existing facilities(Tie in requirements)
- Drilling of **two** new production wells in R1 and **three** wells in WHP1 platform and Re-entry and work-over of **one** existing well in R1 platform.
- One 10” productions submarine pipeline from WHP1 to PP and a single submarine cable (power and data) from SP to WHP1
- Inspection, Strengthening, Modification and Repair of existing R1 complex Jackets and topsides and replacement of boatlanding and Barge Bumpers.

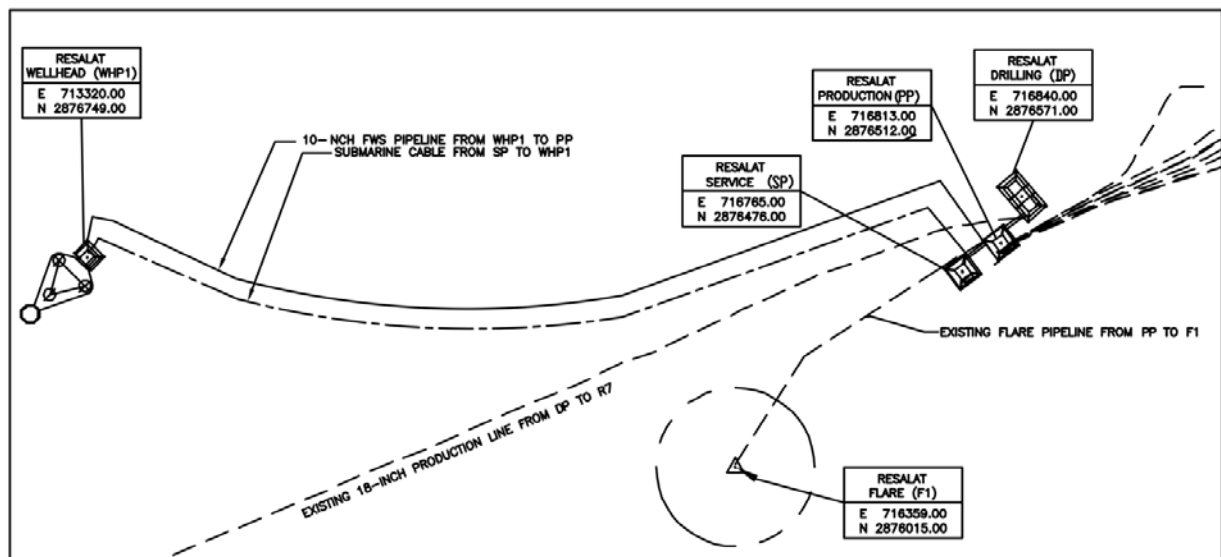


Figure 1: Resalat Development Field Layout (Datum ED 77, Zone 39, Cent. Meridian 51° East)



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**1.2. Purpose of Scope**

This specification covers the minimum requirements for hot insulation used in “Resalat Oil Field Development – Phase 1”.

The purpose of this specification is to define the thermal insulation for hot equipment, piping and instruments including the different types of insulation, materials and thickness to be applied, the extent of insulation, attachments, insulation jacketing and the technical application methods to be carried out.

**1.3. Definitions**

<b>PROJECT</b>	Resalat Oil Field Development – Phase 1
<b>COMPANY</b>	Iranian Offshore Oil Company (IOOC)
<b>CONTRACTOR</b>	Consortium of Iranian Offshore Engineering and Construction Company (IOEC) and Intelligent Solutions Inc. (ISI)
<b>SUB - CONTRACTOR</b>	Tehran Raymand Consulting Engineers (TRCE)
<b>PURCHASER</b>	Any firm who buy services, material and/or equipment for execution of the project within a dedicated contract.
<b>SUPPLIER</b>	Any vendor, manufacturer who supply any Service, Material or Equipment for the project
<b>SHALL</b>	Refer to a mandatory requirement
<b>SHOULD</b>	Refer to a recommendation
<b>MAY</b>	Refer to one acceptable course of action

**2. CODES AND STANDARDS**

Refer to “Specification for Piping and Equipment Insulation Doc. No. : -----”.

**3. REFERENCE DOCUMENTS**

Piping Design Criteria

LRS�-000-PI-DB-676



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Piping Material Specification (PMS)                      LRS�-000-PI-SP-697

**4. ABBREVIATIONS**

Not Applicable

**5. GENERAL STATEMENT**

The attached Specification, “Specification for Piping and Equipment Insulation”, Doc. No. : ----- is confirmed, except as added/modified/deleted herein, and renumbered/reissued as “Specification For Insulation Doc No. LRS�-000-PI-SP-690” for “Resalat Oil Field Development – Phase 1” Project.

**6. ADDITION/MODIFICATION/DELETION**

The following items refer to the attached “Specification for Piping and Equipment Insulation”, Doc. No. : ----- the clauses set out below modify or replace the clauses in the original specification as noted.

<b><u>6.1. 7 Personnel Protection</u></b>	
<b><u>Modification</u></b>	<del>Personnel protection is required where the non-insulated wall temperature is higher than 55°-C or lower than minus 10°-C and within reach of plant personnel</del>



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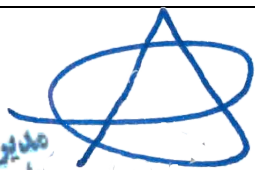
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# SPECIFICATION FOR PIPING AND EQUIPMENT INSULATION



REV	DATE	PREPARED	CHECKED	APPROVED	APPROVED	DESCRIPTION
		IOOC			IOOC	

  
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تأسیسات دریایی ایران



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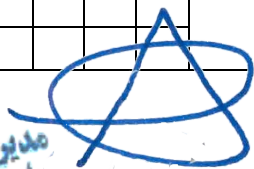


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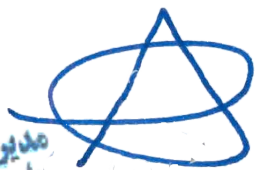


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## 1 Introduction

### 1.1 Scope of Work

### 1.2 Unit of Measurements

In principle, Units of measurement shall be in accordance with the S.I. system except for the following:

- I. Piping nominal diameter: inches
- II. Pressure: bar/g

### 1.3

This specification covers the minimum requirements for thermal hot insulation and personnel protection of pipe work and equipment for offshore installations.

This standard does not cover insulation of HVAC related items.

### 1.4 Reference Drawings And Documents

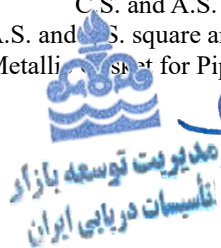
Drawings / Documents Numbers	Drawing / Document Titles
	Piping Design Basis
	Piping Material Specification

All reference documents which are referred to, means the approved latest revision of documents or AFC ones. Any changes on reference documents which impact on this document shall be considered.



### 1.5 Regulations, Standards And Specification

The following codes and standards shall be used:

- ASME American Society of Mechanical Engineers
- ASME B 31.3 Process Piping
- ASME Section V Non-destructive Examination
- ASME B1.1 Unified Inch Screw threads (UN and UNR thread form)
- ASME B1.2 Gages and Gaging for Unified Screw Threads
- ASME B1.20.1 Pipe Threads (except dry seal)
- ASME B 16.5 Steel Pipe Flanges and Flanged Fittings.
- ASME B 16.9 Wrought Steel Butt Welding Fittings
- ASME B 16.11 Forged Steel Fittings, Socket-Welding and Threaded.
- ASME B 18. 2.1 C.S. and A.S. square and hex bolts and screws
- ASME B 18.2.2 A.S. and S. square and hex nuts
- ASME B 16.20 Metallurgical Specification for Pipe Flanges- Ring Joint, Spiral wound and Jacketed



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ASME A16.21 Non-metallic flat Gasket for Pipe Flanges  
 BS British Standards Institute  
 BS 1133 Protection of Metal Surfaces against Corrosion during Transit and Storage.  
 BS 476 Part 4 Non-combustibility Test for Materials  
 ASTM American Society for Testing and Materials  
 ASTM A193 Alloy-Steel and Stainless Steel Bolting Materials for high- temperature Service  
 ASTM A194 Carbon and Alloy-Steel Nuts for Bolts for high pressure and high-temperature Service  
 ASTM B209 M Aluminium – Alloy sheet and plate / Check  
 ASTM C195 Mineral Fibre Thermal Insulating Cement  
 ASTM C533 Calcium Silicate Block and Pipe Thermal Insulation  
 ASTM C547 Mineral Fibre Performed  
 ASTM C585 Inner and Outer diameters of Rigid Thermal Insulation for Nominal Sizes of Pipes and Tubing (NPS System)  
 ASTM C612 Specification for Fibre Block 2 and board for Thermal Insulation  
 ASTM C795 Thermal Insulation for Use in Contact with Austenitic Stainless Steel  
 ASTM C892 High-Temperature Fibre Blanket Thermal Insulation  
 IPS Iranian Petroleum Standard  
 IPS-E-TP-700 Engineering Standard for Thermal Insulations.

## 2 Design

### 2.1 General

Piping, vessels and equipment shall be insulated according to type of insulation stated in the equipment datasheets, P&IDs and the line lists.

Application of base insulation materials shall be as specified in Table 2, Schedule of Insulation Materials Application.

Insulation materials shall not be applied if the moisture content is more than the stated amount given in the SUPPLIERS application data.

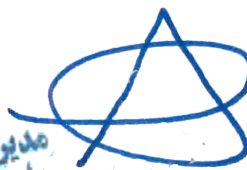
Surfaces to be insulated shall be clean, free of oil, grease, dirt and moisture. All specified coatings shall be applied and allowed to cure before proceeding with the application of insulation materials.

Insulation vendors to be ensure correct selection of insulation material.



### 2.2 Uninsulated Surfaces

The following items shall not be insulated unless otherwise noted on the drawings or herein:

- Drains
- Dummy supports
- Name plates
- Stamping



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- Vents
- Strainers
- Gauges

### 2.3 Pressure Testing Considerations

Vertical surfaces shall be insulated only after pressure testing.

Horizontal surfaces should be insulated after pressure testing. However, they may be insulated before pressure testing upon Company approval provided the insulation is temporarily held back a minimum distance of 150 mm on either side of welds, threaded, or bolted connections. After completion of pressure testing, all missing insulation shall be installed and appropriately weatherproofed.

### 2.4 Valves and Flanges

In order to protect the flange mating faces, a removable flange protection made of AISI 316 stainless steel shall be installed around the outer diameter of flanges. Tightness shall be reinforced with a double Teflon band applied on the inner face of removable flange protection. Drainage outlets shall be an integral part of the removable cover design so that leaks may be visually detected.

### 2.5 Insulation Supports

Insulation supports for vertical piping shall be of a bolted or clamp-on type. The width of the support shall be one-half of the thickness of the insulation for single layer insulation.

All equipment insulation supports shall be installed by the equipment Manufacturer.

## 3 Insulation and Accessories Materials

### 3.1 Insulation Material

Insulation materials, weatherproofing, and accessories shall be as specified in Table 1, Schedule of Insulation and Accessories Materials.

Insulation materials shall be non-corrosive, whether wet or dry, and suitably inhibited for application to steel surfaces. Insulation materials for austenitic stainless steel surfaces shall be in accordance with ASTM C795, and transported, handled, stored, and applied in accordance with ASTM C929.

All insulation materials shall be stored in moisture-proof containers. If the insulation becomes damp, moist, or wet it shall not be applied until inspected and approved.



### 3.2 Removable Insulation Covers

Removable insulation covers shall be installed on flanges, flanged valves, pumps, instrumentation or similar equipment and when so stated on pertinent drawings.

Removable covers shall be manufactured using a quilted construction of a 50mm thickness of insulation positioned between two layers of Teflon coated fiberglass cloth. The materials of construction starting from the hot face surface shall be:



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- 0.33mm thick Teflon coated fiberglass cloth
- thermal insulation 50mm thick
- 0.33 mm thick Teflon coated fiberglass cloth

A removable cover insulation system shall be made of a minimum number of pieces. Joints shall be arranged to eliminate any water penetration into the insulation. The weight of any single piece of the cover shall not exceed 23 kilograms.

Insulation covers shall be constructed so that their natural seam is positioned on the gravitational bottom of the fittings.

The various parts of covers shall be assembled using teflon-coated yarn.

Insulation covers shall fit tightly over fittings and protrusions and shall be held in place with velcro, glassfabric straps and stainless steel buckles. The insulation covers shall be of a sufficient width to overlap the adjacent weatherproofing by a minimum of 125 mm on each side of the fitting.

Each pipe of a removable cover shall have an embossed metal tag permanently attached with applicable information such as equipment or pipe line number, size, rating and fitting type.

Removable covers for valves shall cover the body, bonnet, and flanges as applicable.

#### 4 Insulation of Piping

##### 4.1 Insulation Application

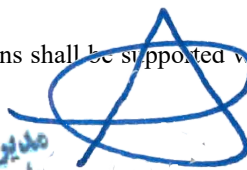
Single layer pipe insulation shall be applied in a staggered circumferential joint arrangement. Multiple layer pipe insulation shall be applied with all joints staggered. The following chart details when single or multiple layer insulation shall be used.

NPS	Number of insulation layers	Position of longitudinal joints (clock positions)
≤8"	1	3 and 9
≥10"	2	Inside layer : 4 and 10 Outside layer : 3 and 9



The circumferential joints of multiple layer insulation systems shall be staggered 150 mm from the circumferential joints of any adjacent preceding or succeeding layer.

Insulation shall be secured with wire or bands (15 mm wide) up to 8" NPS, and with bands (20 mm wide) for sizes 10" NPS and above. Wire and bands shall be spaced on 300 mm maximum centers. Securement of fittings shall be as required to hold the insulation segments together tightly, but a minimum each extreme shall be secured.

Insulation on long vertical up runs shall be supported with rings spaced on 3600 mm maximum, installed on the



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pipng. Width of rings shall be half the thickness of the insulation material. On cold piping, insulation covering on rings shall be minimum 30 mm.

#### 4.2 Weather Proofing Application

Jacket section shall be overlapped a minimum of 50 mm width, arranged to shed water, and located over the pipe side. Overlaps shall be staggered.

Pipe jacketing on calcium silicate insulation shall be secured with bands spaced on 300 mm maximum centers, each overlap shall be banded.

- Pipe jacketing on mineral wool insulation shall be secured with screws spaced on 150 mm maximum centers.

Metal jacketing over vertical pipe shall be supported on 100 mm long S-clips. The minimum number of S-clips shall be two for pipe sizes up and including 6" NPS, and four for pipe sizes over 6" NPS.

The pipe fitting covers shall be tightly fastened with screws spaced on 75 mm maximum centers. Overlaps shall be 50 mm wide and arranged to shed water. Where it is impractical to maintain the 50 mm overlap, the overlapped jackets shall be secured together with screws spaced on 75 mm centers.

All pipe fitting covers shall be banded on each extreme.

A watertight metal termination cover shall be installed where pipe insulation terminates. Insulation at each termination shall be "square cut". Band clips shall be equally spaced with one clip at the overlap. Termination covers shall be with a band at each circumferential overlap and sheet metal screws spaced on 75 mm centers.

Flashing compound shall be applied at all possible sources of moisture penetration.

Irregularly shaped surfaces, which cannot be suitably weather proofed with metal jacketing, shall be finished with a 15 mm thick layer of finishing cement. A 4 mm thick coat of weatherproofing mastic with reinforcing fabric shall be applied over the cured cement. This finish shall extend at least 50 mm under the adjacent metal jacketing. No porosity shall exist in the weatherproofing mastic when dry.

Sheet metal screws for fastening the metal weather proofing shall have a neoprene washer under its head.

### 5 Insulation of Vessels and Equipment

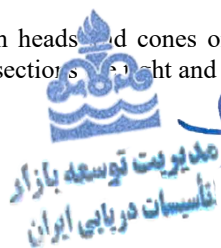
#### 5.1 Insulation Application

Insulation on vessels and tubular equipment shall be applied in a staggered joint arrangement to fit the contour so that no gaps are evident. The insulation shall be secured in place with bands spaced on 450 mm centers



Banding of insulation over the head of horizontal equipment and top heads of vertical equipment shall be as follows:

A floating ring, large enough to clear the center nozzle flange, if one exists, shall be made from 6 mm diameter stainless steel rod. The ring shall be placed in the center of the head. A girth ring, made from two bands shall be installed on the shell at approximately 150 mm below the tangent line of the head. Bands shall be run radially from the floating ring to the girth ring. The radial bands shall be spaced at 300 mm maximum centers on the girth ring.

Unexposed bottom heads and cones on vertical vessels and tubular equipment shall have the blanket insulation shaped so that all sections are tight and secured with wire to slotted weld pins or blank nuts.



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Vessel and tubular equipment transitions shall have the insulation applied with all edges securely laced together with wire.

Vessels and tubular equipment stiffener rings shall be insulated. The insulation shall be applied with all edges securely laced together with wire. The insulation shall also be secured in place with a band in the center of each stiffener ring.

Insulation shall be applied behind the name plate mounting bracket, when possible.

### 5.2 Weatherproofing Application

Vessel and tubular equipment shells shall be weatherproofed with aluminum jacketing, (1.0 mm thick by 35 mm corrugated).

Vertical overlaps of corrugated metal jacket sections shall be a minimum of one and one half corrugations but not less than 75 mm. Vertical overlaps of non-corrugated metal jacket sections shall be a minimum of 75 mm.

Circumferential overlaps at the top tangent lines, transitions and stiffeners shall be a minimum of 150 mm. All other circumferential overlaps shall be a minimum of 75 mm.

Metal jacketing overlaps and seams shall be arranged to shed water. Seams shall be water and weather tight.

Insulation on the heads and transitions shall be weatherproofed with metal jacketing fabricated from gores shaped to fit and lapped a minimum of 75 mm to ensure a weather tight construction. The gores shall be secured with screw spaced on 75 mm maximum centers. All overlaps on the top head shall have sealant.

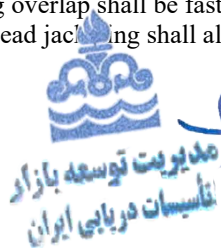
On vertical vessels and equipment, S-clips shall be used to keep the jacket sheets from sliding down. S-clips shall be fabricated from 20 mm wide bands. The length of the S-clip shall equal the overlap. They shall be spaced on 300 mm maximum centers but not less than three per each metal sheet.

Metal jacketing over shells less than 4.60 meters in diameter shall be secured with bands spaced on 300 mm maximum centers. Band spacing shall be calculated on an individual basis for shells greater than 4.60 meters in diameter. Each circumferential overlap shall have a band installed. J- Clips, fastened to the jacket with screws, shall be used to prevent bands from sliding down. Each band shall have J-clips on 1.80 meters maximum centers but not less than four J-clips per band. The band at the overlap shall be installed over the S-clips.

Band shall be secured or fastened with closed seals. Wing type seals are not allowed on tank, pressure vessel and equipment shells.



Insulated surfaces such as equipment bottom heads, which are not exposed to weather, may be weatherproofed with mastic and scrim cloth in lieu of metal.

Heads of vessels and tubular equipment shall be weatherproofed with metal jacket. A minimum of 150 mm shall be turned down and overlap the shell jacketing. The jacketing shall be formed to fit the contour of insulation. All seams shall be made up by lock-seam construction and secured with screws spaced on 125 mm maximum centers. The head jacketing overlap shall be fastened to the jacketing on the shell with sheet metal screws spaced on 125 mm centres. The head jacketing shall also be secured in place at the circumferential overlap with a band.



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## 6 Moisture Protection

The cut surfaces of insulation segments at terminations and cut-outs shall be covered with two layers of 0.15 mm thick aluminum foil extending 300 mm on the underside and top of the insulation. The foil shall be considered as a protective measure against rain water and not as a substitution for weatherproofing.

China hats shall be installed as rain shields at all protrusions and nozzles projecting upwards. The hat may be formed by cutting 0.5 mm thick aluminum sheet in the shape of a washer. It shall be slit radially, formed as a cone around the projection with its base on the insulation weatherproofing and overlap held together with a self-tapping screw.

A semicircular rain shield fabricated from 0.5 mm thick aluminum shall be installed immediately above each uninsulated horizontal protrusion. The shield shall be at least 25 mm under the adjacent vertical weatherproofing and project 25 mm to the side from the vertical surface.

## 7 Personnel Protection

Personnel protection is required where the non-insulated wall temperature is higher than 70 ° C or lower than minus 10 ° C and within reach of plant personnel.

Personnel protection by means of insulation is not preferred on piping and equipment operating at temperatures below 250 ° C or used only intermittently as they are vulnerable to severe corrosion.

If personnel protection is required, consideration should first be given to the use of expanded metal shields, wire cages, hand railings or other physical barriers or hazard markings instead of insulation. However if insulation is to be used for personnel protection, mineral fiber shall be used as per table 4.

Minimum distance between hot surface and guarding shall be 30 mm. The protection shall be confined to a distance of not more than 2.1 m vertically and 0.8 m horizontally from access walkways, ladders, platforms and work areas at ground level or elevation used by operating and maintenance personnel.

## 8 Inspection

The insulation system shall be inspected during the following stages:



- At the time of material receipt
- Before applying the insulation
- During insulation application
- Before and during application of weatherproofing

Quality control activities shall include at least the following activities at the time of receipt of the materials:

- Appropriate checks shall be made to verify materials received at the site are the same as the specified or approved materials. Such checks shall include verification of labels, material safety data sheets, delivery receipts and thickness. Damaged, unspecified, or unapproved, insulation and related materials shall be removed from the site.
- Ensure that storage of materials will protect them from being damaged by moisture, temperature, wind or



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any other atmospheric factors.

Quality control activities shall include at least the following prior to insulation application:

- If the pipe or equipment to be insulated is heat treated, inform the SUPPLIER that welding of insulation supports is prohibited without prior written approval from the CONTRACTOR.
- Verify that pressure tests have been completed.
- Verify that surfaces to be insulated are clean, dry, and coated as required.
- Verify that painting at protrusions through insulation has been done.
- Ensure that protective coatings, over stainless steel surfaces to prevent external stress corrosion cracking, have been applied.

Quality control activities shall include at least the following during insulation application:

- Make sufficient checks to verify that the materials applied are the same as specified or approved materials.
- Verify the insulated item, and insulation code is the same as given on the P&IDs and related drawings.
- Inspect the insulation supports for correct location, type, width and length.
- Verify that the insulation surface is uniform without gaps and voids.
- Inspect for thickness of joints and fasteners
- Verify the location, width, and installation of expansion joints.

Quality control activities shall include at least the following prior and during weatherproofing:

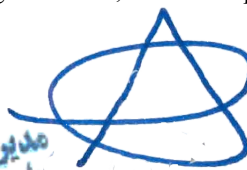
- Ensure that the insulation is clean, dry, and fit for its intended purpose before weatherproofing is applied.
- Inspect for proper overlaps of metal and flashing.
- Verify that the location of bands, screws, S-clips, J-clips, and breather springs is as specified.
- Ensure that moisture protection and weatherproofing at cut outs, protrusions and locations where moisture could enter the insulation has been appropriately installed.

## 9 Safety and Health Considerations



The SUPPLIER shall take appropriate preventive measures and precautions to reduce personnel exposure to mineral fiber and crystalline silica dust.

Care shall be taken, when applying insulation, to avoid tripping-off switches.

## 10 Handling



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### 10.1 Packaging and Shipping

Preparation for shipment shall be in accordance with the SUPPLIER'S standards, project specification and as noted herein. SUPPLIER shall be solely responsible for the adequacy of the preparation for shipment provisions with respect to materials and application, and to provide equipment at the destination in ex-works condition when handled by commercial carriers.

Adequate protection shall be provided to prevent physical damage and atmospheric damage to insulation or weatherproofing materials in transit and at the jobsite.

Preparation for shipment and packing will be subject to inspection and rejection by the COMPANY'S/CONTRACTORS inspectors. All costs occasioned by such rejection shall be to the account of the SUPPLIER.

### 10.2 Preservation and Storage

Insulation materials shall be protected to withstand ocean transit and extended periods of storage at the jobsite for a minimum period of 18 months. Materials shall be protected to safeguard against all adverse environments, such as: humidity, moisture, rain, dust, dirt, sand, mud, salt air, salt spray and seawater.

All materials shall be preserved and export packed in accordance with the Project Specification for Packing, Marking and Shipping contained within the Enquiry/Purchase Order documentation.

## 11 Insulation Tables



### 11.1 Schedule of Insulation and Accessory Materials

Table 1

Material	Maximum Operating Temp. °C	DESCRIPTION	COMMENTS
Mineral fiber- Blanket	650	ASTM C 592 Class 2 with metal mesh both sides	
Mineral fiber – Pipe & fitting covers	650	ASTM C 547 Class 3	
Ceramic fiber - Blanket	1260	ASTM C892M, Type 3, Grade 8, 128 kg/m <sup>3</sup> Unfaced – for Fire protection	
Aluminium jacketing	-	Type 3003-H14 or 5005-H14 aluminium alloy with factory applied moisture barrier. 0.5 mm thick for $\varnothing \leq 200$ mm size 0.8 mm thick for $200 \text{ mm} < \varnothing \leq 500$ mm size 1.0 mm thick for $\varnothing > 500$ mm size	
Stainless steel jacketing	-	Type 316 stainless steel with 2B mill finish 0.5 mm thick smooth Fire Protection Pipe and Equipment	
Removable insulation	500	See Section 3.2	



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Bands	-	Type 316 SS annealed & tempered, 15 mm by 0.4 mm for piping up to 8" NPS, 20 mm by 0.5 mm for equipment and piping over 8" NPS	Accessory Materials
Seals	-	Type 316 SS, hardened & tempered, wing and closes types, 0.8 mm thick to match the band	Accessory Materials
"S" Clips and band loops	-	Type 316 SS, 20 mm wide by 0.5 mm thick banding	Accessory Materials
Breather springs	-	Type 316 SS, 120 mm long	Accessory Materials
Screws	-	Type 316SS, # 8 by 13 mm, Self tapping slotted pan head with integral neoprene washer	Accessory Materials
Wire	-	316SS annealed & tempered, 1.29 mm Dia.	Accessory Materials
Fibrous adhesive	454	Sodium silicate based fibrous adhesive	Accessory Materials
Flashing	93	Flexible non-shrinking type	Accessory Materials
Insulation cement	650	ASTM C 195, mineral fibre insulating cement	Accessory Materials
Floating Ring	-	6mm diameter stainless steel rod	

Note: Requirements of mineral wool Pipe Insulation (Mineral Fiber) is mentioned in Table 1 "ASTM C 547 Class 3" additional information is:  
 Max. Chloride Content: 20 p.p.m Density : 100 Kg/m<sup>3</sup> ±10%

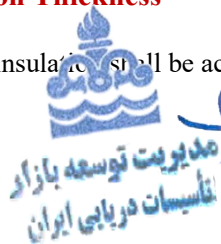
## 11.2 Schedule of Insulation Materials Application

Table 2



Items To Be Insulated	Material Type
Pipe	Mineral fiber preformed pipe cover
Elbows & Tees	Mineral fiber preformed elbows
Flanges	Removable covers as required
Valves flanged	Removable covers as required
Vessels	
Top heads	Mineral fiber blanket
Heads-other	Mineral fiber blanket
Shells	
≤24" diameter	Mineral fiber blanket
> 24" diameter	Mineral fiber blanket
Manhole covers	Removable covers

## 11.3 Insulation Thickness

The thickness of insulation shall be according to the thickness is shown in Table 3 and Table 4.

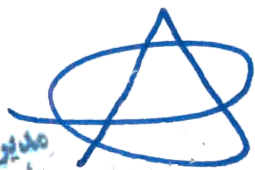


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For process temperatures from 70°C to 250°C barrier protections should be applied, without insulation (e.g. 60 % rigid perforated sheets or wire mesh, as indicated in Detail 15), except where there isn't enough space for installation of barrier on the piping, hot insulation with thickness of 25 mm can be used instead of barrier.

Recommended distances between perforated metal sheet/guards and bare surface along with insulation thickness for personnel protection for process temperatures above 250°C shall be as per Table 4.



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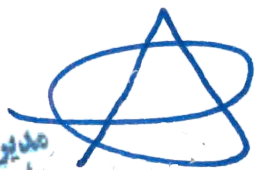
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**Table 3 – Hot Insulation Thickness for Heat Conservation Calcium Silicate (Centimetres)**



NOMINAL PIPE SIZE	TEMPERATURE °C								
	66 to 149	150 to 204	205 to 260	261 to 315	316 to 371	372 to 427	428 to 482	483 to 538	539 to 593
4 cm & under	3.0	3.0	4.3	4.4	4.7	6.4	6.7	6.8	8.7
5 cm	3.0	3.0	4.3	4.4	4.7	6.4	6.7	6.8	8.7
8 cm	3.0	3.0	4.3	4.4	6.0	6.4	7.9	8.1	10.3
10 cm	3.0	3.0	4.3	5.6	6.0	7.6	7.9	8.1	10.3
15 cm	3.8	4.0	5.5	6.7	7.1	10.0	10.4	10.7	13
20 cm	3.8	4.0	5.5	6.7	7.1	10.0	10.4	12.2	13
25 cm	3.8	4.0	6.5	7.9	9.3	11.4	11.9	13.6	14.5
30 cm	3.8	6.0	7.7	8.8	9.3	11.4	13.2	13.6	16
36 cm & over	5.8	6.0	7.7	8.8	10.6	12.7	14.7	15	17.3
Equipment	3.8	4.0	6.5	7.9	8.4	10.0	10.4	12.2	13

**Table 4 – Hot Insulation Thickness for Heat Conservation Mineral Wool Slab (Centimetres)**

NOMINAL PIPE SIZE	TEMPERATURE °C								
	66 to 149	150 to 204	205 to 260	261 to 315	316 to 371	372 to 427	428 to 482	483 to 538	539 to 593
4 cm & under	3.0	3.0	4.3	4.4	4.7	6.4	6.7	6.8	8.7
5 cm	3.0	3.0	4.3	4.4	4.7	6.4	6.7	6.8	8.7
8 cm	3.0	3.0	4.3	4.4	6.0	6.4	7.9	8.1	10.3
10 cm	3.0	3.0	4.3	5.6	6.0	7.6	7.9	8.1	10.3
15 cm	3.8	4.0	5.5	6.7	7.1	10.0	10.4	10.7	13
20 cm	3.8	4.0	5.5	6.7	7.1	10.0	10.4	12.2	13
25 cm	3.8	4.0	6.5	7.9	9.3	11.4	11.9	13.6	14.5
30 cm	3.8	6.0	7.7	8.8	9.3	11.4	13.2	13.6	16
36 cm & over	5.8	6.0	7.7	8.8	10.6	12.7	14.7	15	17.3
Equipment	3.8	4.0	6.5	7.9	8.4	10.0	10.4	12.2	13



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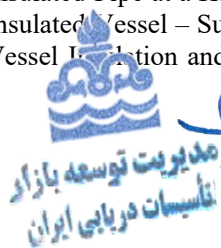
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**Table 5 – Personnel Protection - Guard Distances and Insulation Thickness**



Nominal pipe diameter (DN)	Normal operating temperature (Deg.C)						
	70 to 250	> 250	350	400	450	500	600
	Distance from sheet/guard to bare surface (mm)	Insulation thickness (mm)					
< 25	50	25	30	40	40	50	60
25	50	25	30	40	40	50	60
40	50	25	30	40	50	60	70
50	50	25	40	40	50	60	70
80	50	30	40	40	50	60	80
100	50	30	40	50	50	70	80
150	50	30	40	50	60	70	80
200	50	30	40	50	60	80	80
250	50	30	40	50	60	80	100
300	100	30	40	50	60	80	100
350	100	30	40	50	70	80	100
400	100	30	40	50	70	80	100
450	100	30	40	50	70	80	100
500 & Above	100	40	40	50	70	80	100
Equipment Channels/ Flat Surfaces	100	40	40	50	70	80	100

## 12 Insulation Details

- Detail 1** Pipe Insulation (Fibrous – 1 piece), Single Layer
- Detail 2** Pipe Insulation (Fibrous – 2 piece), Single Layer
- Detail 3** Weatherproofing of Elbows
- Detail 4** Weatherproofing of Tees and Stub-ins
- Detail 5** China Hat (Weatherproofing)
- Detail 6** Insulation Termination at Flanges
- Detail 7** Insulated Piping at a Support Point (without Shoes)
- Detail 8** Insulated Piping at a Support Point (Single Web Shoe)
- Detail 9** Insulated piping at as Support Point (Double web Shoe)
- Detail 10** Insulated Pipe at a Hanger Rod
- Detail 11** Insulated Vessel – Support Ring and Bottom Head Detail (without a hot box)
- Detail 12** Vessel Insulation and Weatherproofing



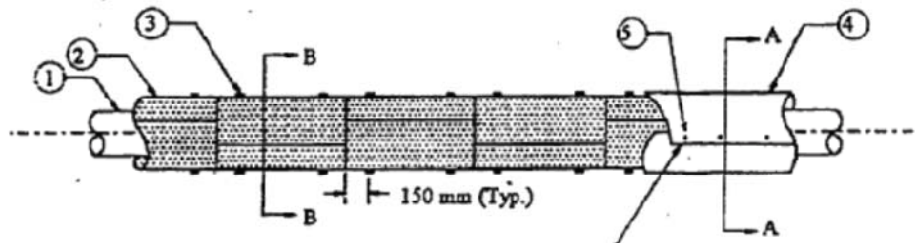
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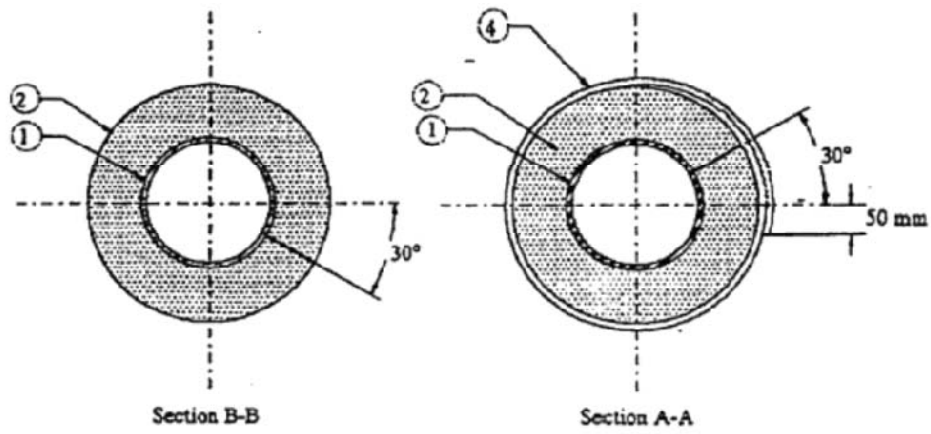
- Detail 13**      Insulation at a Nozzle or Protrusion
- Detail 14**      Insulation at a Manway
- Detail 15**      Personnel Protection – Physical Barriers

**Detail 1**

**Pipe Insulation (Fibrous – 1 Piece), Single Layer**



All joints in weatherproofing jacket shall be overlapped 50 mm and arranged to shed water.





- 1 Pipe
- 2 Pipe insulation (Fibrous, wraparound or premolded 1 piece)
- 3 Band/wire (see specification)
- 4 Weatherproofing jacket
- 5 Screws spaced 150 mm. centers



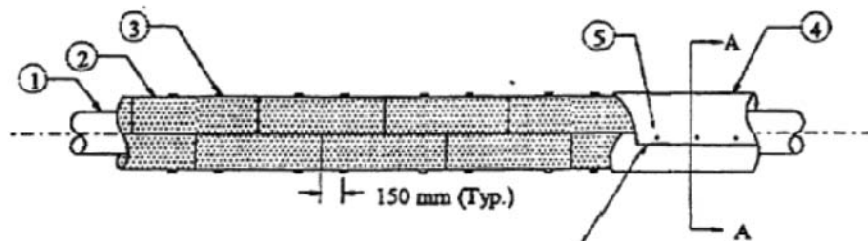
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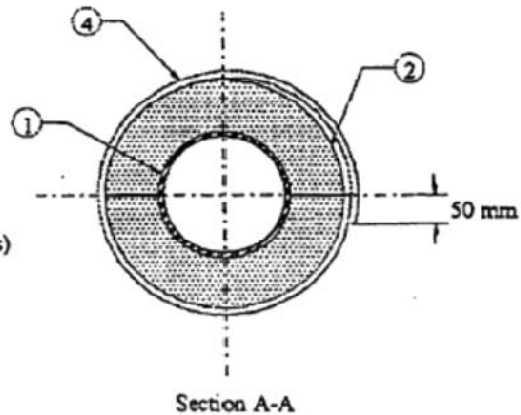
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**Detail 2**

**Pipe Insulation (Fibrous – 2 Piece), Single Layer**





All joints in weatherproofing jacket shall be overlapped 50 mm and arranged to shed water.



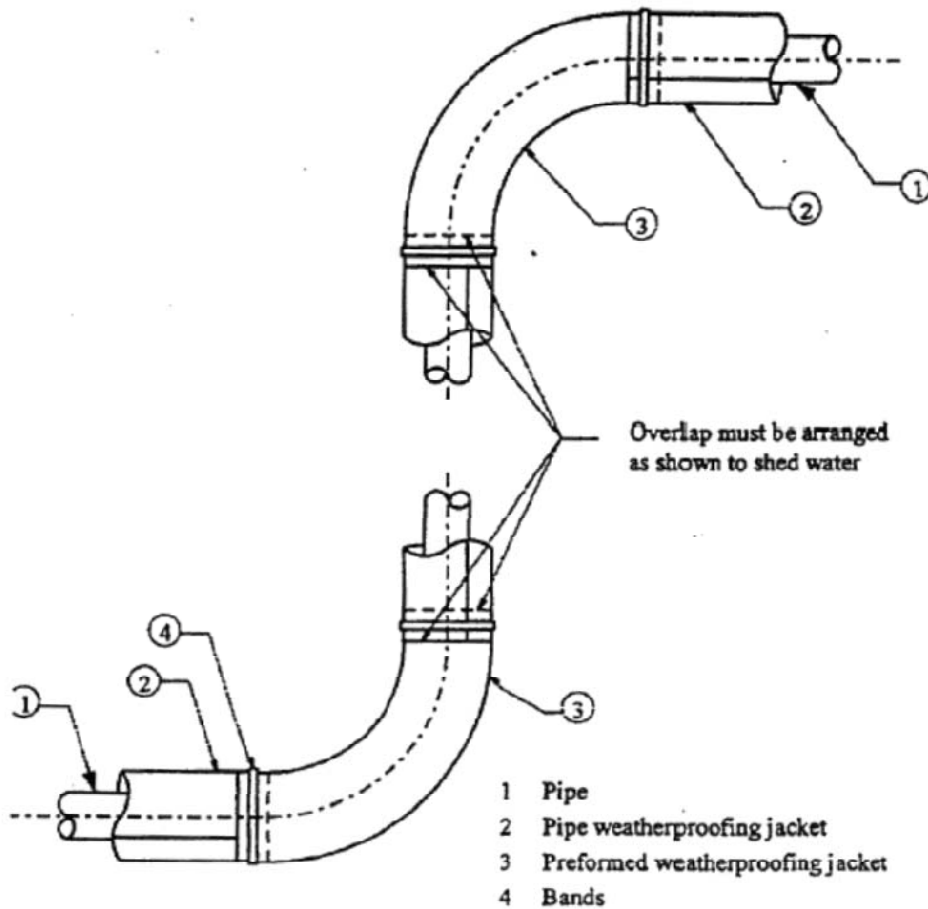
- 1 Pipe
- 2 Pipe insulation (Fibrous - 2 pieces)
- 3 Band/wire (see specification)
- 4 Weatherproofing jacket
- 5 Screws spaced 150 mm. centers



  
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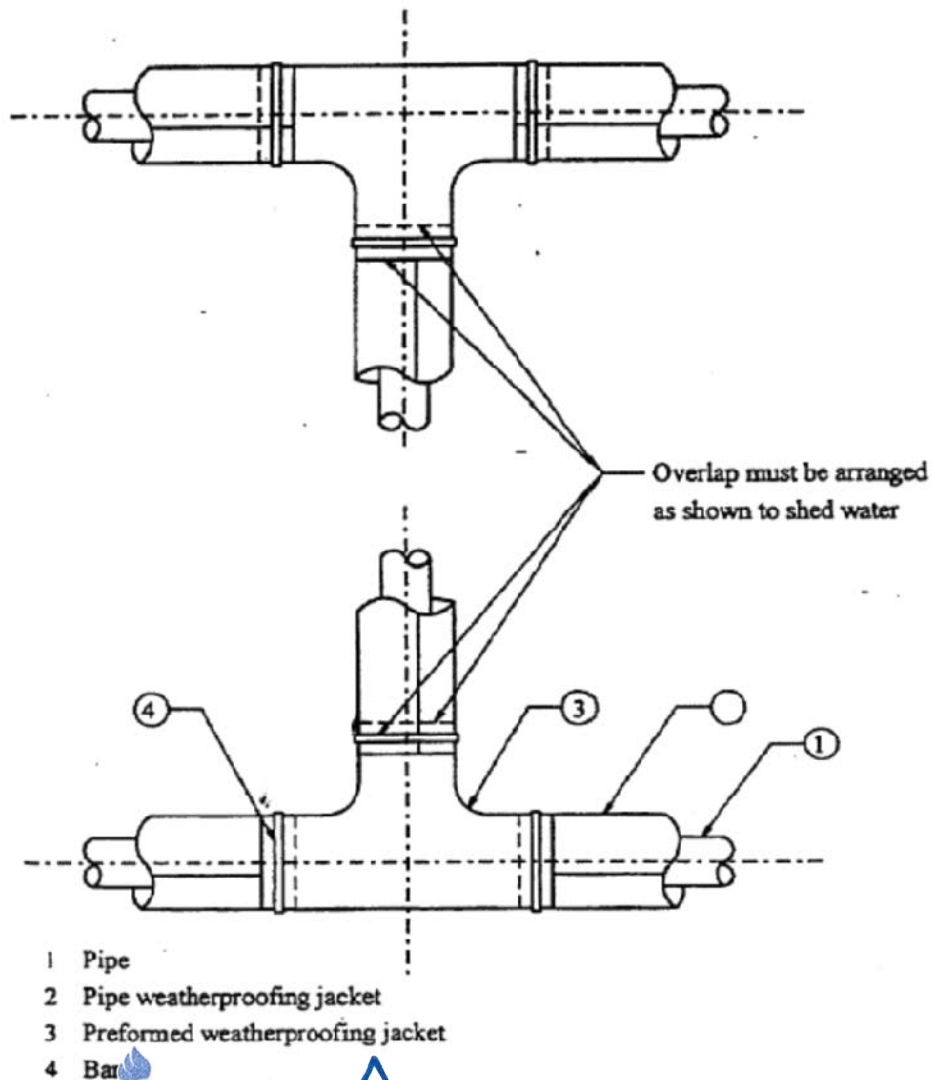
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**Detail 3**  
**Weatherproofing Of Ells**





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**Detail 4**  
**Weatherproofing Of Tees and Stub-Ins**

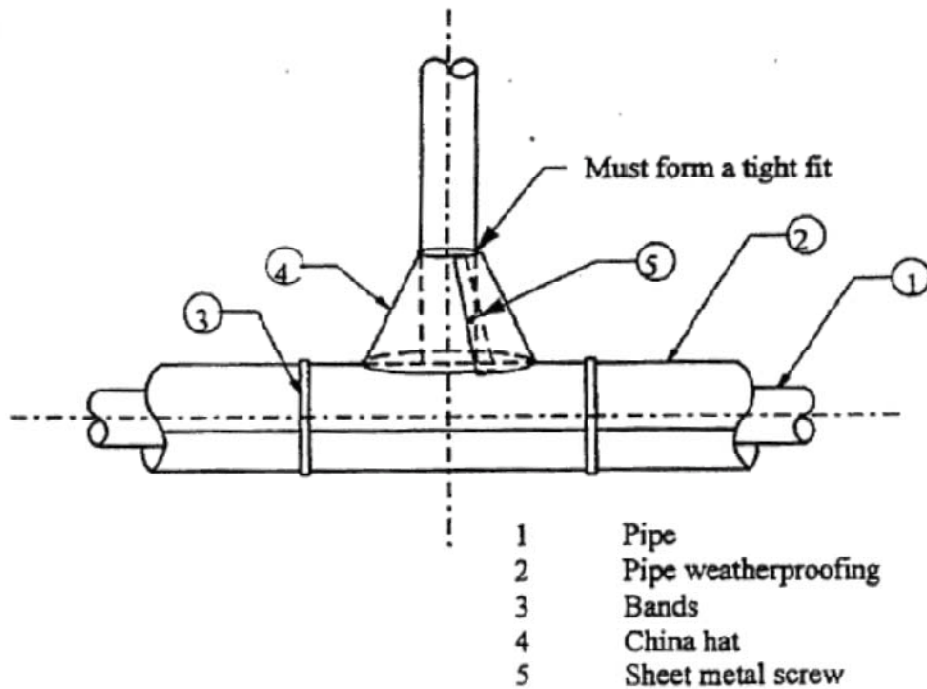


  
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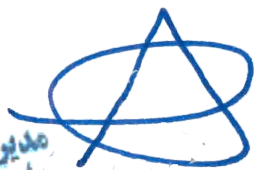
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**Detail 5**  
**China Hat (Weatherproofing)**



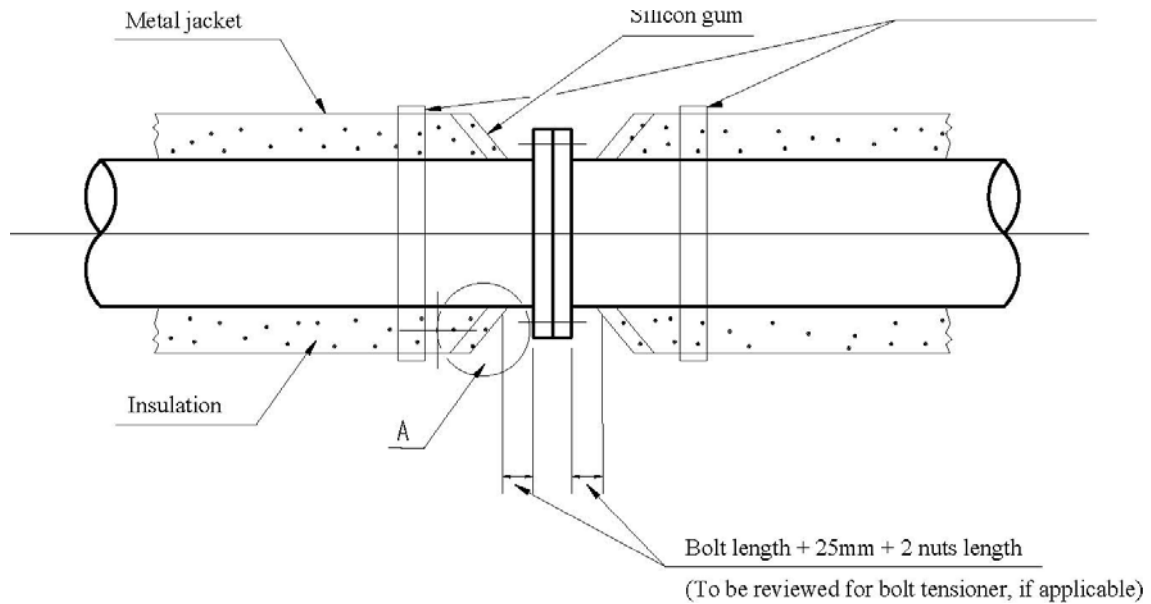
  
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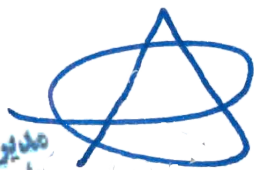
**Detail 6**  
**Insulation Termination at Flanges**





Stainless Steel band

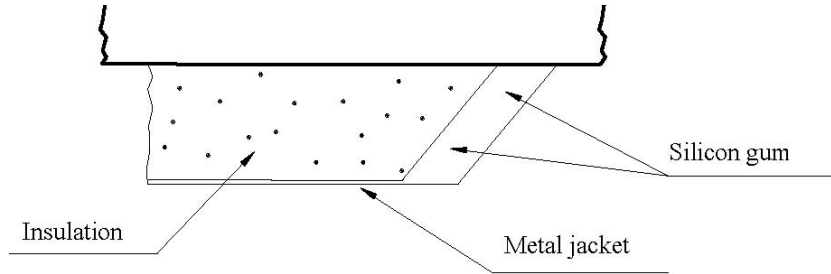
Silicon gum

  
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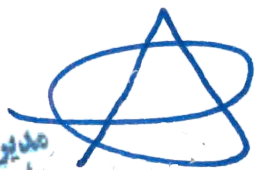
 <b>I.O.O.C</b> Iranian Offshore Oil Co	<b>GENERAL SPECIFICATION OF          IRANIAN OFFSHORE OIL COMPANY          ENGINEERING DEPARTMENT</b>	 <b>I.O.O.C</b> Iranian Offshore Oil Co				
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Detail A

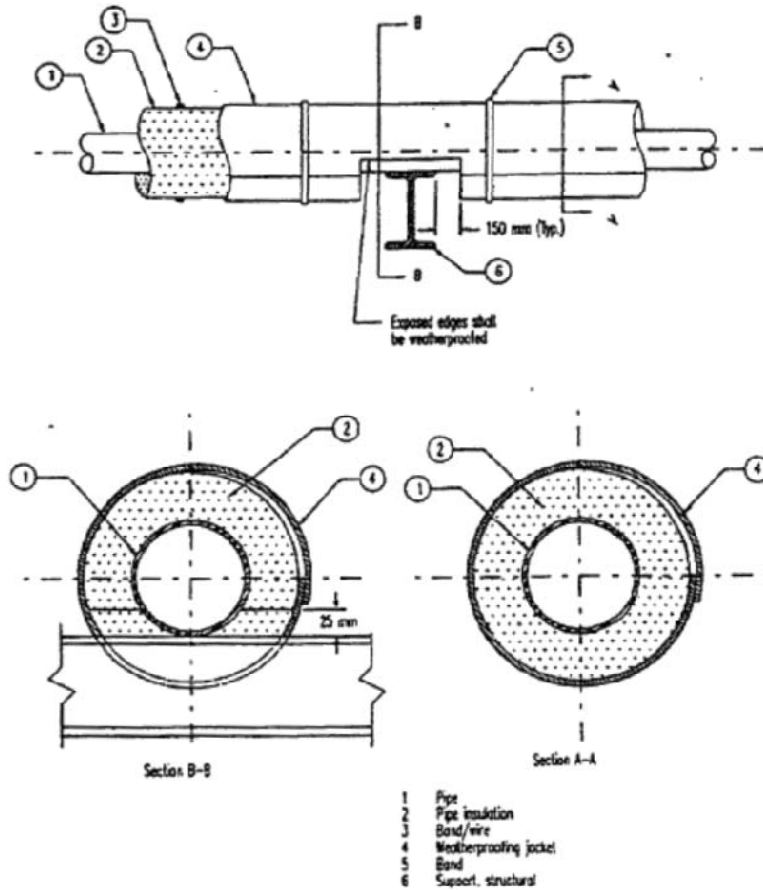
**Detail 7**

**Insulated Piping at a Support Point (Without Shoes)**



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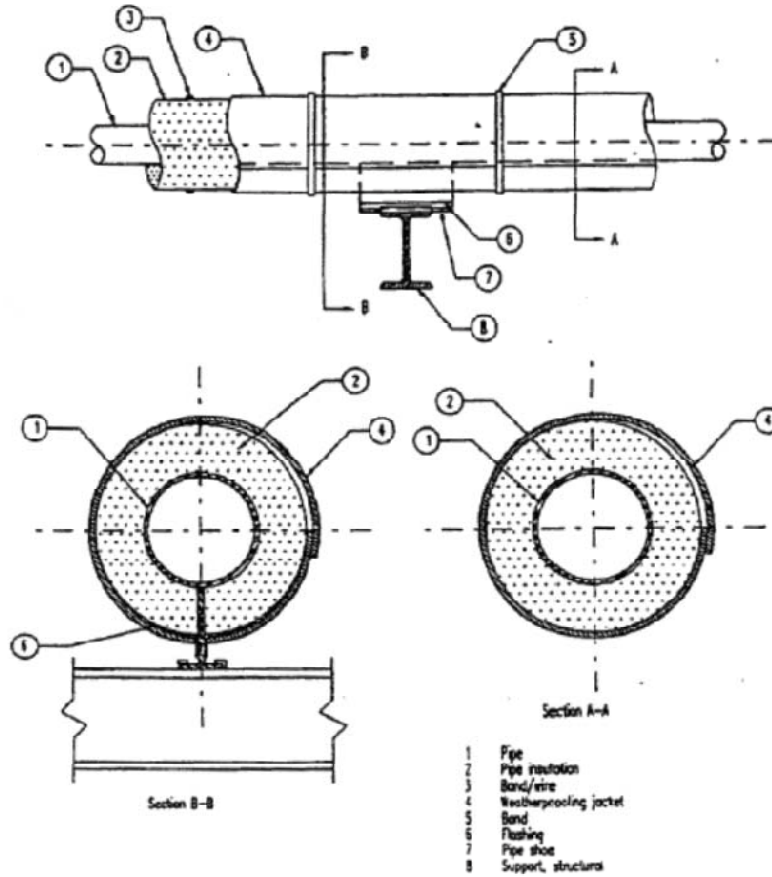
**Detail 8**

**Insulated Piping at a Support Point (Single Web Shoe)**

  
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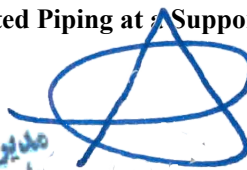
 <b>I.O.O.C</b> Iranian Offshore Oil Co	<b>GENERAL SPECIFICATION OF          IRANIAN OFFSHORE OIL COMPANY          ENGINEERING DEPARTMENT</b>	 <b>I.O.O.C</b> Iranian Offshore Oil Co				
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**Detail 9**

Insulated Piping at Support Point (Double Web Shoe)

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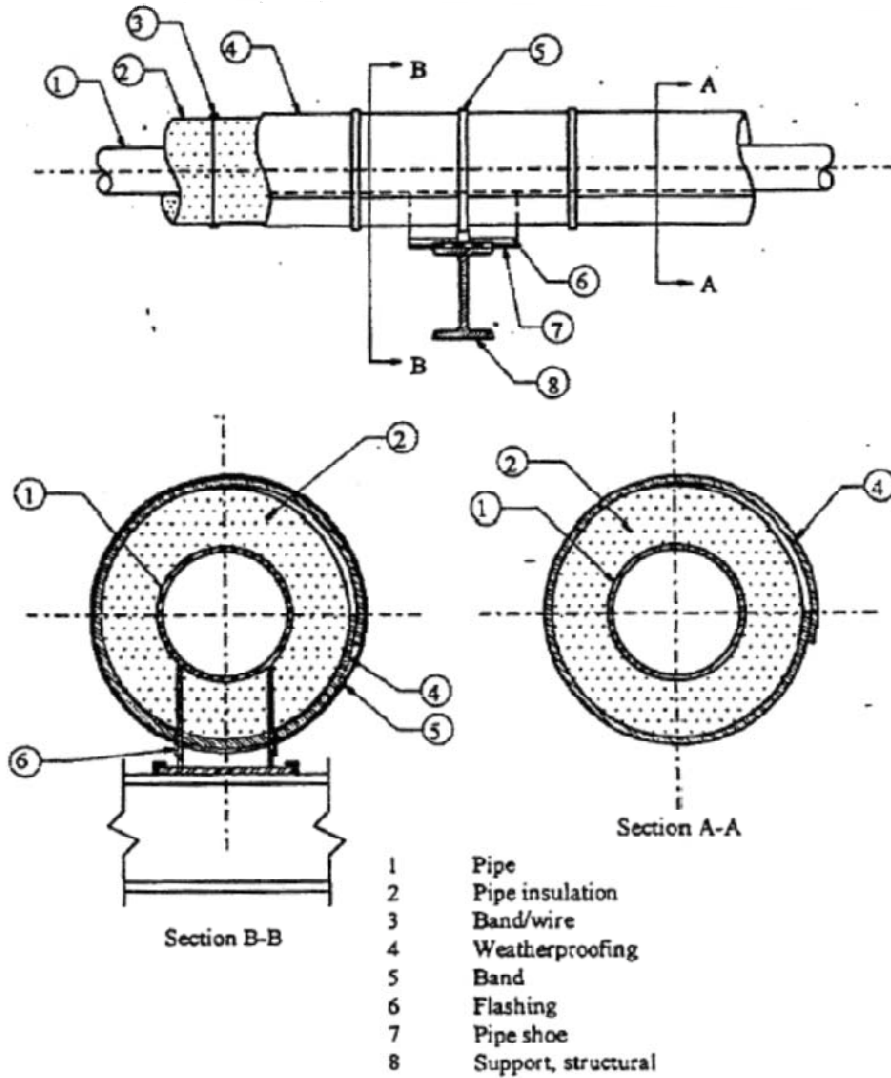
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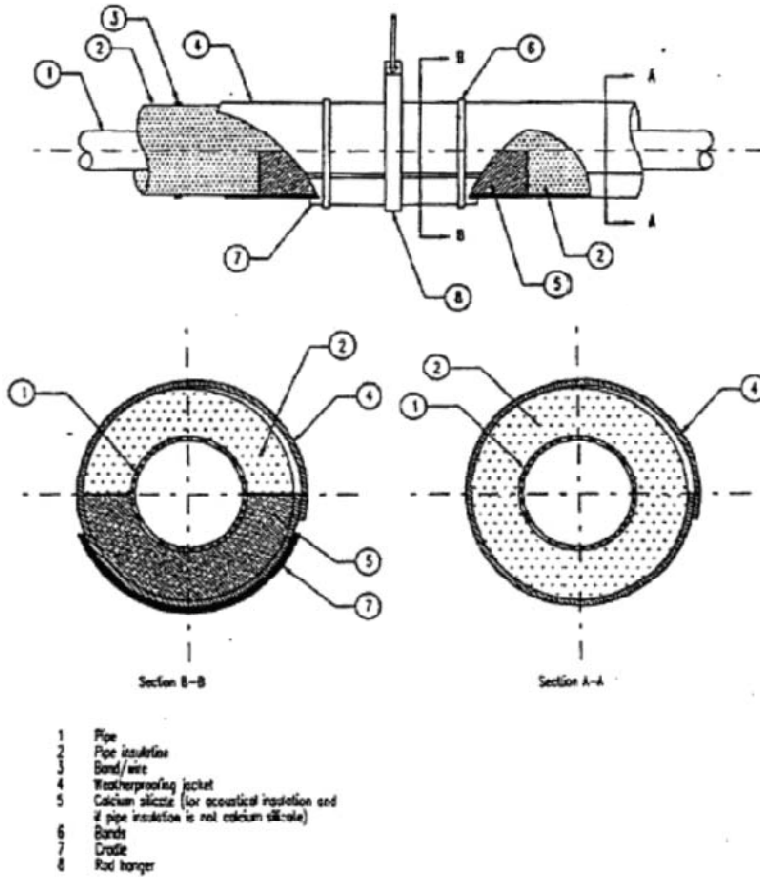
Detail 10

Insulate Pipe at a Hanger Rod

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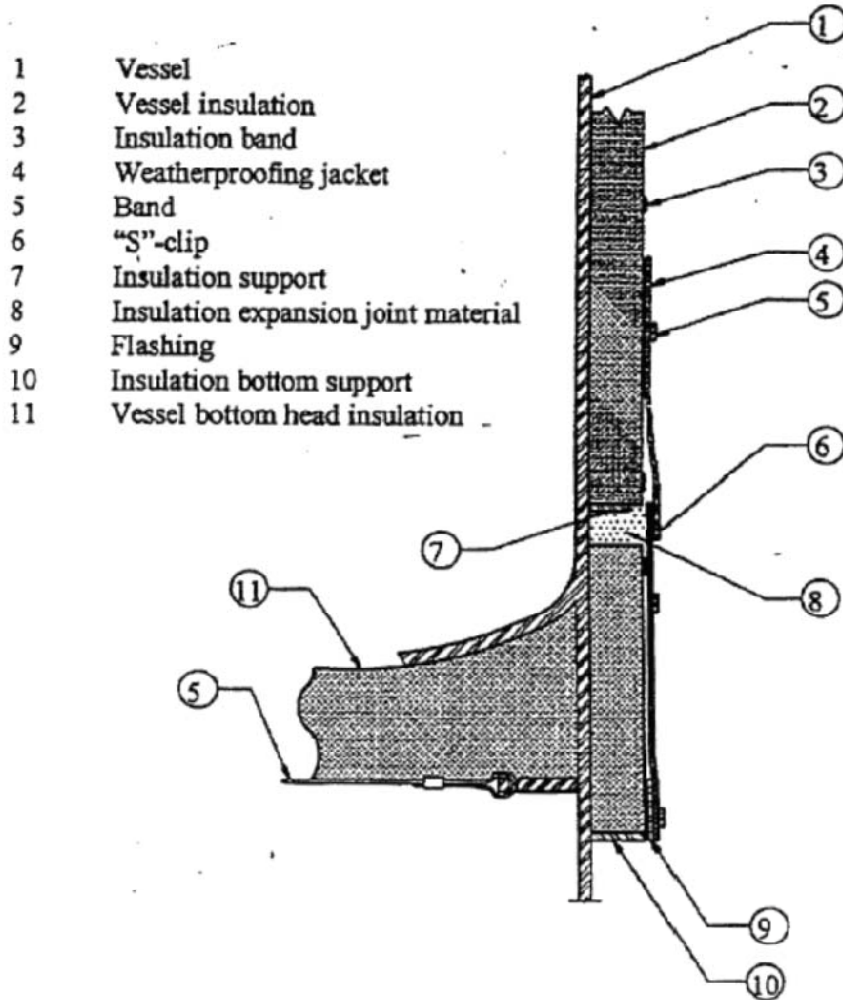
Detail 11

Insulated Vessel – Support Ring and Bottom Head Detail

  
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- 1 Vessel
- 2 Vessel insulation
- 3 Insulation band
- 4 Weatherproofing jacket
- 5 Band
- 6 "S"-clip
- 7 Insulation support
- 8 Insulation expansion joint material
- 9 Flashing
- 10 Insulation bottom support
- 11 Vessel bottom head insulation

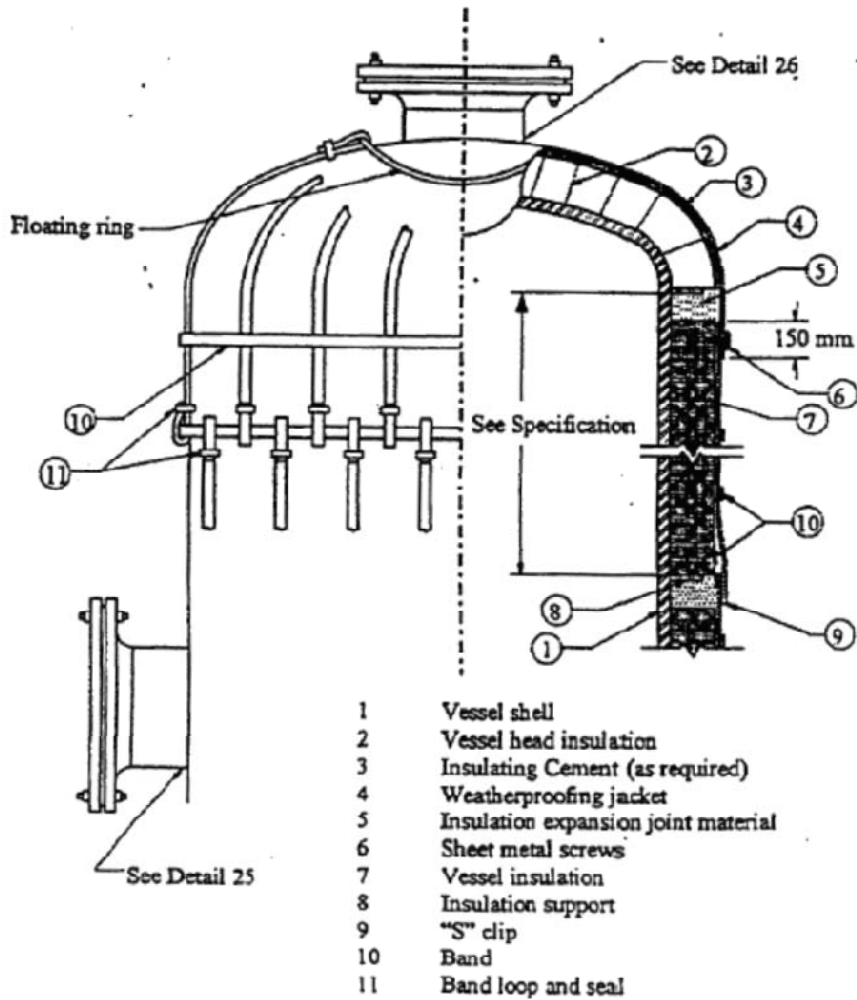
Detail 12

Vessel Insulation and Weatherproofing

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**Detail 13**

**Insulation at a Nozzle or Protrusion**

  
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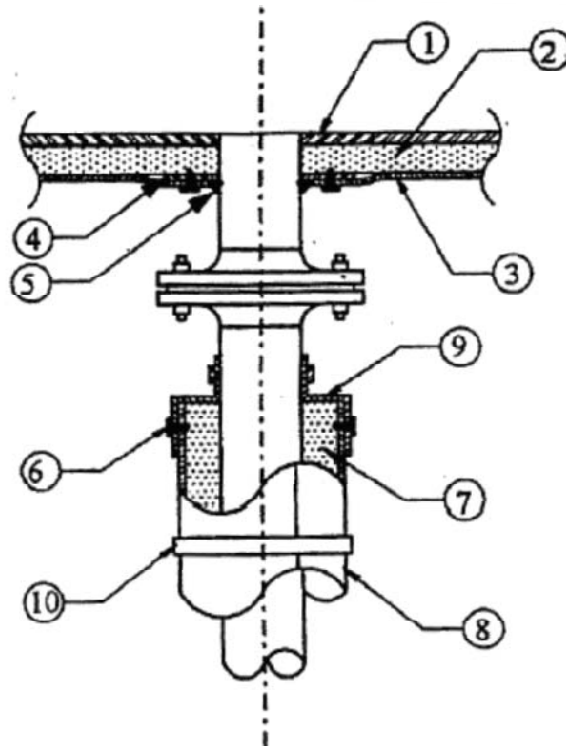
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- 1 Tank/vessel
- 2 Tank/vessel insulation
- 3 Tank/vessel weatherproofing jacket
- 4 Flashing
- 5 Flashing compound
- 6 Sheet metal screw
- 7 Pipe insulation
- 8 Pipe weatherproofing jacket
- 9 Metal end cover with extensions
- 10 Bands

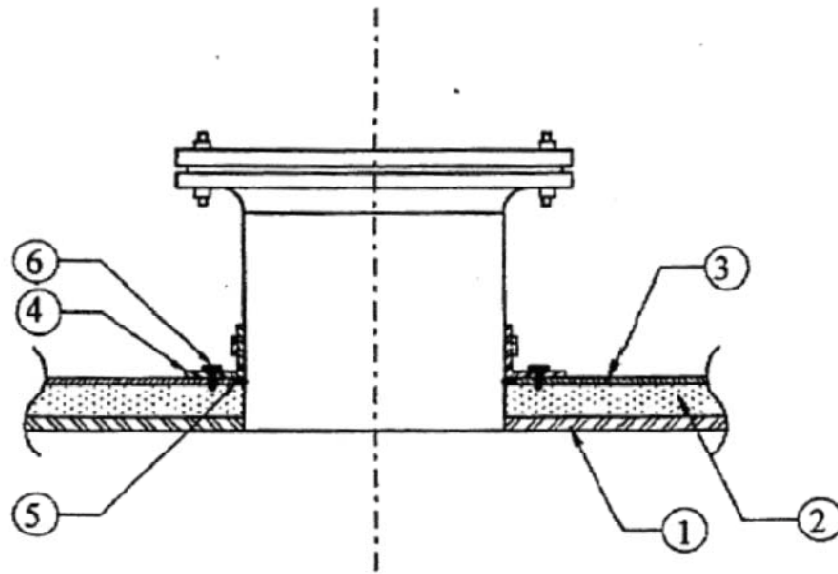
Detail 14

Insulation at a Manway



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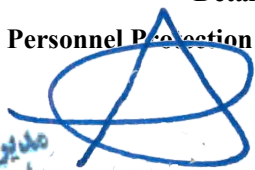


- 1 Tank/vessel
- 2 Tank/vessel insulation
- 3 Tank/vessel weatherproofing jacket
- 4 Flashing
- 5 Flashing compound
- 6 Sheet metal screw



Detail 15

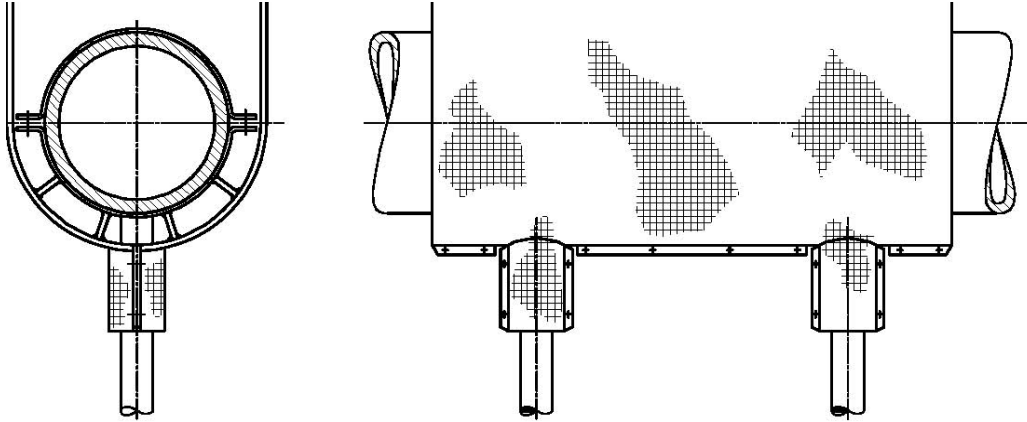
Personnel Protection – Physical Barriers

  
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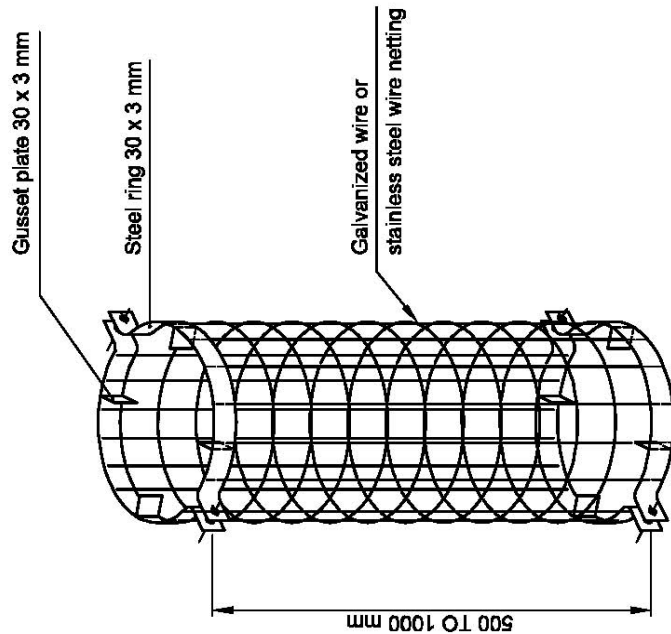


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**PERFORATED METAL SHEET**



Number of gusset plates:  
One per 100 mm circumference,  
but minimum 4 numbers

**MESH GUARD**