
	<p>نگهداشت و افزایش تولید میدان نفتی بینک</p> <p>سطح الارض و ابنیه تحت الارض</p> <p>عمومی و مشترک</p>							
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## طرح نگهداشت و افزایش تولید 27 مخزن

## SPECIFICATION FOR INSULATION

### نگهداشت و افزایش تولید میدان نفتی بینک



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 IFC: Issued For Comment  
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 AFD: Approved For Design  
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 AFP: Approved For Purchase  
 AFQ: Approved For Quotation  
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 AB-R: As-Built for COMPANY Review  
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## 1.0 INTRODUCTION

Binak oilfield in Bushehr province is a part of the southern oilfields of Iran, is located 20 km northwest of Genaveh city.

With the aim of increasing production of oil from Binak oilfield, an EPC/EPD Project has been defined by NIOC/NISOC and awarded to Petro Iran Development Company (PEDCO). Also PEDCO (as General Contractor) has assigned the EPC-packages of the Project to "Hirgan Energy - Design and Inspection" JV.



### GENERAL DEFINITION

The following terms shall be used in this document.

CLIENT:	National Iranian South Oilfields Company (NISOC)
PROJECT:	Binak Oilfield Development – General Facilities
EPD/EPC CONTRACTOR (GC):	Petro Iran Development Company (PEDCO)
EPC CONTRACTOR:	Joint Venture of: Hirgan Energy – Design & Inspection(D&I) Companies
VENDOR:	The firm or person who will fabricate the equipment or material.
EXECUTOR:	Executor is the party which carries out all or part of construction and/or commissioning for the project.
THIRD PARTY INSPECTOR (TPI):	The firm appointed by EPD/EPC CONTRACTOR(GC) and approved by CLIENT (in writing) for the inspection of goods.
SHALL:	Is used where a provision is mandatory.
SHOULD:	Is used where a provision is advisory only.
WILL:	Is normally used in connection with the action by CLIENT rather than by an EPC/EPD CONTRACTOR, supplier or VENDOR.
MAY:	Is used where a provision is completely discretionary.

## 2.0 DOCUMENT SCOPE

This specification covers the material requirements and application procedures for above-ground external insulation of piping and equipment operating between ambient temperature and 300°C for the purpose of heat conservation and personnel protection of this PROJECT.

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### 3.0 NORMATIVE REFERENCES

The last revision of following Codes and Standards shall be considered.



#### 3.1 LOCAL CODES AND STANDARDS

- IPS-E-TP-700 Engineering Standard for Thermal Insulations.
- IPS-C-TP-701 Application of Thermal Insulations.
- IPS-M-TP-710 Material and Equipment Standard for Thermal Insulation.
- IPS-C-TP-101 Construction Standard for Surface Preparation



#### 3.2 INTERNATIONAL CODES AND STANDARDS

- ASTM A167 Specification for Seamless and Heat-Resisting Cr-Nickel Steel Plate Sheet and Strip.
- ASTM B209 Specification for Aluminium & Aluminium Sheet & Plate.
- ASTM C168 Terminology Relating to Thermal Insulating Materials
- ASTM C449 Mineral Fiber Insulating and Finishing Cement (Hydraulic Setting)
- ASTM C547 Pipe Insulation Mineral Fiber Preformed
- ASTM C591 Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
- ASTM C592 Class II Mineral Fiber Blanket Insulation & Blanket Type Pipe Insulation
- ASTM C612 Specification for Mineral Fiber Block and Board Thermal Insulation.
- ASTM C692 Test Method for Evaluating the Influence to Thermal Insulations on the External Stress Corrosion Cracking Tendency of Austenitic Stainless Steel.
- ASTM C795 Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
- ASTM C871 Test Method for Chemical Analysis of Thermal Insulation Materials for Leachable Chloride, Fluoride Silicate and Sodium Ions.
- BS 476 Fire Tests on Building Materials and Structures
- BS 2972 Methods of Test for Inorganic Thermal Insulating Materials
- BS 3958 Thermal Insulating Materials

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- BS 5970 Code of Practice for Thermal Insulation of Pipework and Equipment (In The Temperature Range -100 Degree C to +870 Degree C)
- BS 5422 Method For Specifying Thermal Insulating Materials For Pipes, Tanks, Vessels, Ductwork And Equipment Operating Within The Temperature Range -40 Degrees C To +700 Degrees C
- BS 2654 Specification for Manufacture of Vertical Steel Welded Non-Refrigerated Storage Tanks With Butt- Welded Shells For The Petroleum Industry

### 3.3 THE PROJECT DOCUMENTS



- BK-GNRAL-PEDCO-000-PI-DC-0001 Piping Design Criteria
- BK-GNRAL-PEDCO-000-PI-SP-0006 Specification for Painting

### 3.4 ENVIRONMENTAL DATA

Refer to "Process Basis of Design; Doc. No. BK-GNRAL-PEDCO-000-PR-DB-0001".

### 3.5 ORDER OF PRECEDENCE



In case of conflict between requirements specified herein & the requirements of any other referenced document, the most approved stringent requirements of below listed items shall be considered based on the approval given by the owner's representative:

- Purchase order
- Material Requisition
- MTO & Data Sheet
- This Specification
- Drawing & Other Specification
- Reference Project Specification
- Iranian Petroleum Standard (IPS)
- Reference international Code & Standards



When the term "Authorized", Authorization", "Approval", or "Approved" are used in this specification, it shall mean authorization or Approval from OWNER.

In case of any conflict between the project documents, the most stringent one shall be considered.

## 4.0 TECHNICAL SPECIFICATION

4.1 Piping systems requiring hot insulation are indicated on the following project documents.

- a) Line list

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- b) Piping and Instrument Diagrams (P&IDs).
- c) Piping plans and Isometrics.
- d) Instrument process piping hook-up's and schedules.

**4.2** Insulation thicknesses for heat conservation and/or, process control shall be as specified in Table 1, attached to this specification.

**4.3** Where operating temperature of piping, vessels and equipment is above 55°C and insulation is not required for heat conservation, those portions of equipment or piping which present a hazard to operating personnel and guard rails or screen not provided shall be insulated for personnel protection. Insulation thicknesses for personnel protection shall be as specified in Table 2, attached to this specification.

**4.4** Instruments and associated piping subject to operating flow and/or temperature conditions prevailing in the connected piping shall be insulated to the same requirements as that of piping.

**4.5** Hydrostatic tests on piping systems shall, if possible be completed before insulation installed. If insulation is applied before testing, all welds, bolted joints and threads shall be left exposed until completion of testing.

**4.6** Care shall be taken to avoid contact between dissimilar materials which might cause galvanic corrosion.



**4.7** For surface preparation and painting of insulated surfaces shall be performed in accordance with BK-GNRAL-PEDCO-000-PI-SP-0006 and IPS-C-TP-101.

**4.8**

## 5.0 EXTENT OF INSULATION



**5.1** Insulated piping system shall have straight pipes, bends, tees and pipe fittings completely covered by insulation.

**5.2** All valves and flanged joints on insulated lines shall be left un-insulated.

**5.3** Lines shall be generally insulated independently and may only be insulated collectively in specific cases where prior approval is given to the Insulation Contractor.

**5.4** Insulation shall not be applied to the following, unless otherwise specified:

- Piping which becomes hot intermittently, such as relief valves, vents, flare and blow down systems.
- Supports for piping, excluding pipe hangers to the extent covered by insulation.

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- Valves and flanges in process piping system. However, personnel protection insulation for these items shall be applied, as required.
- Expansion joints, hinged joints and hose assemblies.

- 5.5** Inspection openings shall be provided in the insulation at locations to be selected at site by the Owner. The removable window shall be of the same basic material and thickness as the rest of the insulation and of sufficient rigidity to withstand handling.
- 5.6** Insulation which needs to be removed for maintenance purposes shall be fabricated in such a manner, that it is easily removable and can be remounted with a minimum of work. Quick opening boxes and similar construction shall be used in that case.
- 5.7** Single thickness sectional pipe insulation shall be applied with longitudinal joints staggered and shall be secured with wire ties on 230 mm centers. Double thickness sectional pipe insulation shall be applied with all joints staggered and shall have inner layer secured by at least two wires per section with the outer layer secured by wire ties on 230 mm centers.
- 5.8** External stiffening rings on the piping shall be insulated with the same thickness as required for the piping.
- 5.9** Special care shall be taken to coat the outside surface of insulation with hard material like reinforced self-setting cement for the portions of piping where foot traffic is expected.

## 6.0 MATERIALS

### 6.1 GENERAL



**6.1.1** The basic insulation materials to be used in this project on piping are as follows:

- Mineral Fiber (Rock Wool), as insulation material
- Aluminum sheets, for jacketing
- Loose fill (compatible with insulation), for filling interstices and box items.

**6.1.2** All materials shall be of high quality, good appearance and shall not have any deleterious action on the surface to be insulated. All insulation and non-metallic accessory materials shall be formulated without the addition of any form of asbestos, including the tremolite, anthrophyllite and actinolite species of asbestos minerals.

**6.1.3** Insulation materials shall be of low chloride content, chemically inert, not decaying, and inodorous. non-flammable, producing no toxic gases when exposed to flame, non-sulfurous, rot proof, vermin proof, impervious to hot water non- injurious to health and non-corrosive to steel and aluminum (even if soaked in water at ambient temperatures for extended periods).



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**6.1.4** Generic references to the thermal insulation material such as rock wool, mineral wool, mineral fiber, etc., shall be interpreted in accordance with the definition given in ASTM C 547, ASTM C612, BS 3958 Part 6, as man made mineral fiber made from rock, slag or glass, processed from a molten state into a fibrous form with a suitable binder. For the purposes of this standard, materials of a rock composition (diabase, Silica Ore, basalt or similar types) shall be acceptable. Materials made from slag (in part or in whole) shall not be acceptable. Materials made of glass shall only be permitted where specified as an expansion joint filler.

**6.1.5** Original manufacturer's product data sheets and product safety data sheets for various insulating and accessory materials together with samples of insulating materials shall be provided for approval of Owner. Product safety data sheets shall include information concerning general composition, physical data, hazards and precautions during and after application, toxicity/first aid, storage, spillage and waste disposal.

## 6.2 MINERAL FIBER

**6.2.1** Preformed mineral fiber insulation shall be of a rock composition as per clause complying with physical characteristics listed in BS 3958. Parts 4 and 5 and where these do not conflict, physical characteristics listed in ASTM C612 and C547. The material shall comply with the following overriding requirements:

- a) Combustibility; Non-combustible when tested in accordance with BS 476, Part 4.
- b) Chemical requirements; Less than 10 ppm chloride, when tested in accordance with Section 22 of BS 2972, and less than 10 ppm fluoride, with a combined halide content no greater than 15 ppm. The material shall be qualified for use on austenitic stainless steel in accordance with ASTM C795 by conforming to the production test requirements of ASTM C692 and the confirming quality control requirements for chemical analysis of ASTM C871. The material shall have a maximum nitrate content of 5 ppm.
- c) Shot content; Less than 6% by weight of shot exceeding 250 microns when tested in accordance with section 14 of BS 2972, and less than 31% by weight of shot/coarse fibers between 63 microns and 250 microns.
- d) Content of sulphur compounds; Less than one half percent by weight.
- e) Alkalinity; PH of between 7 and 8 when tested in accordance with Appendix C of BS 3958, Parts 4 and 5.
- f) Optimum service temperature range; 21°C to 300°C.
- g) Binder; Resin impregnation during manufacture prior to compressing and curing.
- h) Facings for flexible mattresses; Facings shall comprise 1 mm x 25 mm mesh wire netting sewn with wire ties at close regular intervals in such a way as to ensure that these can not be pulled through during storage, handling and fabrication. The wire mesh shall be galvanized steel. The facing shall be on one side only.
- i) Proportion of fine fibers; 28% or less of fibers less than 3 microns diameter in the bulk fibrous material.

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- j) Thermal conductivity; Not greater than the following, when tested in accordance with Section 4 of BS 2972.

#### MEAN K VALUE (KCal/m.h°C)

TEMP (°C)	Slab/Sections	Mattresses
50	0.032	0.031
100	0.037	0.037
150	0.043	0.044
200	0.051	0.051
250	0.061	0.061
300	0.072	0.071
350	0.084	0.084

- k) Water retention; when tested in accordance with an authoritative modification to section 11 of BS 2972 approved by Owner, to cover test specimens of performed pipe section, size NPS 10 x 25 mm thick x 25 mm deep. The following maximum acceptance values shall be achieved:

Partial immersion:

0.2 Kg/m<sup>2</sup> @ 20°C

0.2 Kg/m<sup>2</sup> @ 250°C

Total immersion:



20 Kg/m<sup>3</sup> @ 20°C

20Kg/m<sup>3</sup> @ 250°C

#### 6.2.2 The following density and form of mineral fiber shall be used:

- Preformed pipe sections, 125 to 155 kg/m<sup>3</sup> density, either in two halves or in one piece hinged (snap-on) for pipes up to 12" N.B.
- Flexible mattresses or blankets, 90 to 100 kg/m<sup>3</sup> density, comprising 1 mm x 25 mm mesh galvanized wire netting on one side up to 300°C operating temperature for large diameter pipes (12" N.B. and larger pipes and all equipment).

#### 6.2.3 For hot face temperatures up to 300°C, the concentration of organic bonding material for all specified insulation densities shall not constitute a fire risk through the incidence of welding sparks or through an internal self-heating phenomenon (punching) over the range of insulation thicknesses and individual layers

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proposed by Owner. Manufacturer of the material shall demonstrate to the requirements of Section 18 of BS 2972 that the degree of self-heating does not exceed safe limits.

### 6.3 SELF-SETTING CEMENT

- 6.3.1** Self-setting finishing cement shall comprise an intimate mixture of non- asbestos inorganic mineral fibers combined with hydraulic cement and chemically pure inert fillers which when mixed with clean water, forms a general purpose protective coating suitable for trowel or hand application and with fast setting properties without the application of heat. The material shall produce a robust surface layer having breather type weather resistant properties and resistant to impact and abrasion damage, with a temperature limit not less than 175°C for continuous service conditions. When dried out, the cement shall be free from cracking other than fine hairline cracks.
- 6.3.2** Mineral fiber insulating and finishing cement (hydraulic setting) shall be in accordance with ASTM C449.

### 6.4 ALUMINUM SHEETING

- 6.4.1** Aluminum sheeting shall be 3003/3005 alloy to ASTM B209, and H16 hardness with a factory attached lamination of polyethylene 0.025 mm thick, and kraft paper 0.10 mm thick, heat sealed onto the side which is in contact with the insulation.
- 6.4.2** Thickness of sheets shall be as follows:
- 0.60 mm thick flat sheets for piping up to 6" nominal diameter.
  - 0.80 mm thick flat sheets for piping over 6" nominal diameter, valve boxes and all equipment.

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## 6.5 BANDS & CLIPS

- 6.5.1** Bands used for securing insulation and metal sheeting on pipes and equipment shall be of stainless steel type 304 to ASTM A167 in the hot rolled annealed and descaled condition.
- 6.5.2** The width and thickness of bands shall be 13x0.5 mm.
- 6.5.3** Stainless steel banding 19 mm wide x 0.5 mm thick shall be used for the fabrication of “Z” clips on vertical pipe and equipment cladding.

## 6.6 WIRE & WIRE NETTING



- 6.6.1** Wire for the securement of pipework and equipment insulation shall be 304 stainless steel (18% Cr-8% Ni) of the following diameters:
- a) Pipe up to 12” nominal diameter, wire gage 16 (1.5 mm).
  - b) Pipe larger than 12” nominal diameter, and all equipment, wire gage 14 (2.0 mm).
- 6.6.2** Wire netting for the reinforcement of self-setting cement shall be 25 mm hexagonal mesh, manufactured from 1 mm stainless steel or monel wire.

## 6.7 Screws, Rivets and Fasteners

- 6.7.1** Sheet metal screws for fastening the metal weatherproofing to insulation supports shall be stainless steel self-tapping type with hexagonal head No. 7x15 mm and 7x25 mm long (style B) and shall be complete with tight fitting neoprene washers.
- 6.7.2** Sheet metal screws for metal weatherproofing lap joint shall be No. 7 x 10 mm long (style A). type 304 stainless steel pan head self-tapping and shall be complete with tight fitting neoprene washers.
- 6.7.3** Pop-rivets for the securement of metal jacketing in locations where screws are impracticable, shall be monel or stainless steel (18% Cr – 80% Ni). Rivets shall be of the self-sealing type unless otherwise approved by Owner and shall be 3.0 mm diameter, except where required for the securement of toggle fasteners where 4.0 mm diameter shall be supplied.

## 6.8 WEATHERPROOFING MASTIC

The coating used as a mastic weatherproofing over self-setting cement shall be a filled polyvinyl acetate copolymer emulsion suitable for temperatures at coated surface up to 80°C with good

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tolerance to cold weather before drying and having characteristics meeting the following minimum requirements:

- a) Flammability wet: Non-flammable
- b) Dry flame spread: Class 1, BS 476, Part 7
- c) Service temperature range: -18 to +80°C
- d) Water vapour permeance: 0.5 perms at 1.6 mm dry film thickness per ASTM E96
- e) Colour: Aluminum grey
- f) Volume solids: 55%
- g) Dry film thickness: 1.35 mm

## 6.9 SEALANT

**6.9.1** The metal sealant for insertion at metal sheeting overlaps shall be a butyl based sealant strip factory performed into a malleable extrusion on a silicone release paper. The material shall not harden or significantly deteriorate with age and with permanent tack; shall provide a watertight gasket seal deforming under slight pressure to fill irregularities and voids. The material shall have the following properties:

- a) Colour : Light grey
- b) Solids content : 99% minimum by weight
- c) Service temperature : -18°C to 70°C limits
- d) Application temperature : 5°C to 40°C limits
- e) Minimum size : 1) For insertion into 5 mm radius swage: 8 mm round bead  
2) For insertion between flat sheets: 12 mm x 3 mm flat tape

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**6.9.2** The metal sealant suitable for gun extrusion where a sealant strip is impracticable shall be a tough flexible elastomer based material, comprising polymeric vapour sealant of butyl rubber and hydrocarbon resin dissolved in white spirit/xylol blend and pigmented with neutral fillers and aluminum paste. The material shall have the following properties:

- a) Coverage : 35.4 m per litre at 6 mm bead
- b) Solids content : Average 55% by volume
- c) Drying time : Touch-1/2 hour: through-3 days
- d) Service temperature : -40°C to 120°C limits
- e) Solvent : White spirit
- f) Flammability (dry) : Low flame spread

**6.9.3** The sealant for use in flashing protrusions through metal cladding over hot insulation and for sealing the edges at insulation terminals, shall be a one part-silicone rubber paste curing to a tough elastomeric solid gasket with good adherence to steel surfaces, having the following properties:

- a) Tensile strength : 2.4 MPa.
- b) Elongation : 500%.
- c) Tack-free time : 15 minutes at 25°C/ 50% R.H.
- d) Cure time : 24 hr for 3.2 mm thickness.
- e) Colour : Red/brown.
- f) Service temperature : -65°C to 316°C. limits

## 6.10 MEMBRANES



The membrane for embedding between coats of the weatherproofing mastic shall be an open weave glass cloth having 4 x 4 strand/cm.

## 6.11 METALLIC FOILS

Aluminum foil for protection of stainless steel surfaces shall be a soft temper foil, 0.19 mm thick. per ASTM B209 alloy 3003/3005, H16.

## 6.12 TAPES

The tape for insertion at bi-metallic contact points between aluminum sheeting over insulated piping/nozzles, shall be a 2.0 mm thick solid neoprene tape 40 mm wide having a self-adhesive backing. The tape shall be capable of withstanding a service temperature of 100°C, without deformation.

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## 6.13 PACKING FOR SHIPMENT AND STORAGE

**6.13.1** All insulating materials shall be new and unused.

**6.13.2** Insulation materials shall be packed in a manner that ensures no moisture can enter during transport, in transit, and storage at site. Preferably, the materials shall be fixed to nonreturnable pallets.

## 7.0 APPLICATION



### 7.1 CORROSION PREVENTION

**7.1.1** Carbon steel and low alloy steel piping with normal operating temperatures of 120° and below shall be protected against corrosion by 70 micron primer coat of epoxy polyamide. The coat of primer shall be provided by Insulation Contractor.

**7.1.2** All austenitic stainless steel piping insulated with rock wool shall be protected against chloride attack as follows:

For operating temperatures up to 300°C the surfaces shall not be primed but shall be wrapped with 0.19 mm thick aluminum foil with 50 mm overlap at longitudinal and circumferential joints before application of insulation. All joints of aluminum foil shall have barium chromate primer interposed. Aluminum foil shall be firmly secured on the stainless steel surfaces by aluminum bands at a pitch of 500 mm. Care shall be taken while applying aluminum foil to ensure that the foil is not punctured at any place during wrapping and clamping with aluminum bands.





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## 7.2 INSULATION APPLICATION

- 7.2.1** The application methods, given in this standard are general in nature. The Insulation Contractor is responsible for applying an insulating system that will give a satisfactory operational performance and the requirements given herein shall be regarded as the acceptable minimum. The Insulation Contractor shall carryout the work in accordance with the best practices of insulation application with the minimum of waste and debris and the final job shall have a neat, efficient and workmanlike appearance.
- 7.2.2** All insulation application shall be performed during dry weather, uncompleted and exposed surfaces should be protected at all time against dampness, condensation or rain. All insulation applied in one day shall have the mastic weatherproofing or metal weatherproofing applied the same day and any exposed ends shall be temporarily protected with weatherproofing. Insulation showing any evidence of moisture shall be removed and replaced.
- 7.2.3** Prior to the release of any equipment and piping to the insulation applicator, all valves, gauges. etc. shall be inspected, tested and repaired before application of insulation.
- 7.2.4** Prior to insulation work commencing on any particular section, Owner should be satisfied that all insulation supports on vessels, vertical pipelines and equipment, and also shoes on horizontal pipelines have been correctly installed. Additionally all metal surfaces are clean and free of foreign or spattered materials.
- 7.2.5** In general, all lines shall be insulated separately. Where lines are to be insulated collectively in specific cases, prior approval is given to the Insulation Contractor.
- 7.2.6** Insulation supports shall be provided at least at 3.7 meter intervals on vertical lines or lines inclined more than 45° from horizontal. Supports shall be installed above all flanges in vertical lines and located to allow removal of flange bolts.
- 7.2.7** Insulation of fittings shall consist of the same material and thickness specified for pipe insulation. Insulation shall be applied in the same manner as pipe insulation and shall include metal weatherproofing.
- 7.2.8** Insulation at flanges, valves, etc. shall be terminated from a certain distance from the flange, to permit removal of flange bolts or studs without causing damage to insulation. Void area is to be packed with loose mineral fiber insulation.
- 7.2.9** Before applying weatherproofing, insulation shall be inspected for open joints, voids, cracks and defacing. Open joints, voids and cracks shall be adequately filled with insulation and defacing made good to the satisfaction of the inspector.



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- 7.2.10** Special consideration shall be given to application of insulation near pipe supports. The insulation and weatherproofing shall be applied in a manner, which does not restrict thermal expansion or contraction of the piping at its support points.
- 7.2.11** Where the insulation thickness exceeds the limit set forth in tables 1 and 2 (75mm), the insulation shall be applied in two layers.
- 7.2.12** Inner layers in multiple layer pipe insulation and insulation on irregular equipment surfaces (where use of bands and seals is impractical) shall be secured, using stainless steel wire. The wire shall be drawn taut to imbed it into the insulation. The ends shall be firmly twisted and the excess cut off. The twisted ends shall be bent over and imbedded into the insulation.
- 7.2.13** Butt and expansion joints shall be staggered for single layer insulation and in both directions on all multiple layers of insulation.
- 7.2.14** Expansion joints for single layer application shall be provided on straight run piping and spaced in accordance with the table below. Expansion joints shall consist of a 25 mm gap between the sections of insulation. This gap shall be filled with loose mineral wool compressed in place. The weatherproofing shall be lapped at this point in such a manner to allow movements.

#### **EXPANSION JOINTS SPACING**

<b>Operating Temp. of Line (°C)</b>	<b>Approx. Spacing (m)</b>
Below 150	Not required
150 to 300	15
Over 300	10

**7.2.15** Blanket Insulation Application for Piping and Equipment:

- Install blanket insulation with lath side outward and all joints butted together. Fasten blankets with metal bands.
- Tightly lace all metal lath edges together with wire or hog rings. Ends of wires shall be bent over and into exposed metal lath leaving no projections.
- Equipment and piping shall be provided with expansion joints filled with loose mineral fiber insulation.
- Instrument connections shall be insulated. The insulation shall be shaped at the instrument connections by tapering it to and around the connections with loose material.
- Support lugs for ladders, platforms, piping, etc. shall be flashed and pointed.

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- f) Insulation on heads shall be cut in segments for a tight fit. Cut and bend wire and loop through nuts on head. Impale insulation over wire, lace and bend protruding stubs into exposed metal lath leaving no projections.
- g) Manways under 610mm and nozzle necks on vessels less than 305mm shall not be insulated. Flash all manways and nozzle necks and seal to prevent entry of water.
- h) Insulation on exchangers shall be stopped at a sufficient distance from each flange to permit the removal of the flange bolts and shall be finished with a bevel of sealer.
- i) Exchanger body flanges shall not be insulated, unless otherwise indicated in the insulation list.

**7.2.16** All preformed pipe insulation shall be installed in same manner as the blanket insulation except as follows:

- a) Insulation shall be applied with all joints tightly butted together and shall be secured with tie wires or bands.
- b) Tie wires shall be drawn taut and firmly twisted. The excess ends shall be cut off and twisted ends bent over and embedded into the insulation.

**7.2.17** Weatherproofing:



- a) Metal weatherproofing (for pipes, fittings and equipment)
  - 1) Metal weatherproofing shall be applied over insulation, banded with all laps secured with sheet metal screws.
  - 2) Vessel head shall be provided with 2 beads of caulking.
- b) Mastic weatherproofing (for irregular surfaces)
  - 1) Apply insulating and finishing cement over entire surface of blanket insulation with metal lath insulation, and trowel to smooth finish. Thickness when dry over metal lath insulation shall be 3.0 mm.
  - 2) When insulating and finishing cement is dry, apply mastic weatherproofing and embed a layer of fabric (glass) into mastic. Smooth out all wrinkles and lap fabric 75 mm at all joints.
  - 3) After fabric is installed and dry. Apply a sprayed or trowled finish coat of mastic weatherproofing, thickness when dry, over fabric shall be 1.5 to 2.0 mm minimum.

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## 8.0 INSPECTION



- 8.1 All materials furnished and/or used in connection with the insulation work shall be subject to inspection and approval by Owner, in order to assure the use of material of the type and quality, which meet the requirements of this standard. It is the responsibility of Insulation Contractor to ensure adequate precautions against damage and deterioration are taken during the storage of insulation, jacketing and ancillary materials.
- 8.2 Storage of insulation material shall be indoors, in an area where relative humidity does not exceed 85%.
- 8.3 Installation procedure shall be subject to inspection by Owner or by his representative and any material which has been improperly installed or excessively damaged shall be removed and replaced properly with undamaged material.
- 8.4 All work shall be executed in a neat and workman like manner, in strict accordance with this standard and as called for, on drawings and documents.
- 8.5 Inspection and approval of materials and workmanship by owner shall not relieve Insulation Contractor of any of his responsibilities whatsoever.

## 9.0 ATTACHMENTS

	<p>نگهداشت و افزایش تولید میدان نفتی بینک سطح الارض و ابنیه تحت الارض</p> <p>عمومی و مشترک</p>								
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### Attachment No.1




**Table -1: Insulation Thickness for Heat Treatment**

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Pipe Size Inch	Operating Temperature (°C)/ Insulation Thickness (mm)				
	60-110	111-160	161-210	211-260	260-300
3/4	30	30	30	40	40
1	30	40	40	60	60
1 1/2	40	40	50	60	60
2	40	40	50	60	60
3	40	50	60	80	80
4	40	50	60	80	90
6	40	60	80	80	90
8	40	60	80	90	100
10	40	60	80	90	100
12	50	80	90	90	100
14	50	80	90	90	100
16	50	80	90	90	100
18	50	80	90	90	100
20	50	80	90	90	100
24	50	80	90	90	100
26	50	80	90	90	100
28	50	80	90	100	100
30	50	80	90	100	100
36	50	80	90	100	100
48	50	80	90	100	100
Flat	50	80	90	100	100
Single Layer		Double Layer			

## Attachment No.2

Table -2: Insulation Thickness for Personnel Protection

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Pipe Size Inch	Operating Temperature (°C)/Insulation Thickness (mm)				
	60-110	111-160	161-210	211-260	260-300
3/4	30	30	40	40	40
1	30	40	40	40	40
1 1/2	40	40	40	40	40
2	40	40	40	40	40
3	40	40	40	40	40
4	40	40	40	40	40
6	40	40	40	40	50
8	40	40	40	40	50
10	40	40	40	40	50
12	40	40	40	40	50
14	40	40	40	40	50
16	40	40	40	40	50
18	40	40	40	50	50
20	40	40	40	50	70
24	40	40	40	50	70
26	40	40	40	50	70
28	40	40	40	50	70
30	40	40	40	50	70
36	40	40	40	50	70
48	40	40	40	50	70
Flat	40	40	40	70	80
Single Layer					Double Layer

Attachment No.3

DETAILS FOR HOT THERMAL INSULATION



نگهداشت و افزایش تولید میدان نفتی بینک  
سطح الارض و ابنیه تحت الارض

عمومی و مشترک



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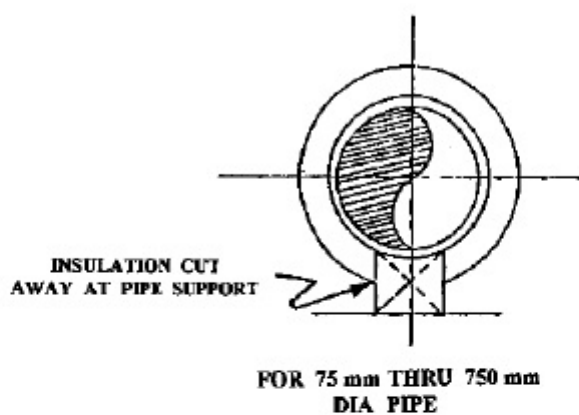
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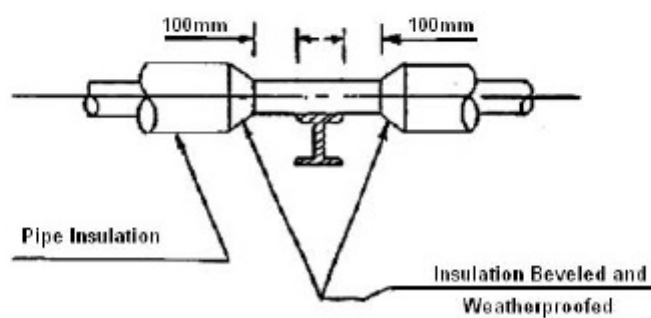
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D02	0019	SP	PI	000	PEDCO	GNRAL	BK

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PIPE SHOE FOR LINES 75 mm AND LARGER



INSULATION CUT AWAY AT SUPPORTS FOR LINES UNDER 75mm



INSULATION AT THE PIPE SUPPORT-HOT SERVICES



نگهداشت و افزایش تولید میدان نفتی بینک  
سطح الارض و ابنیه تحت الارض

عمومی و مشترک



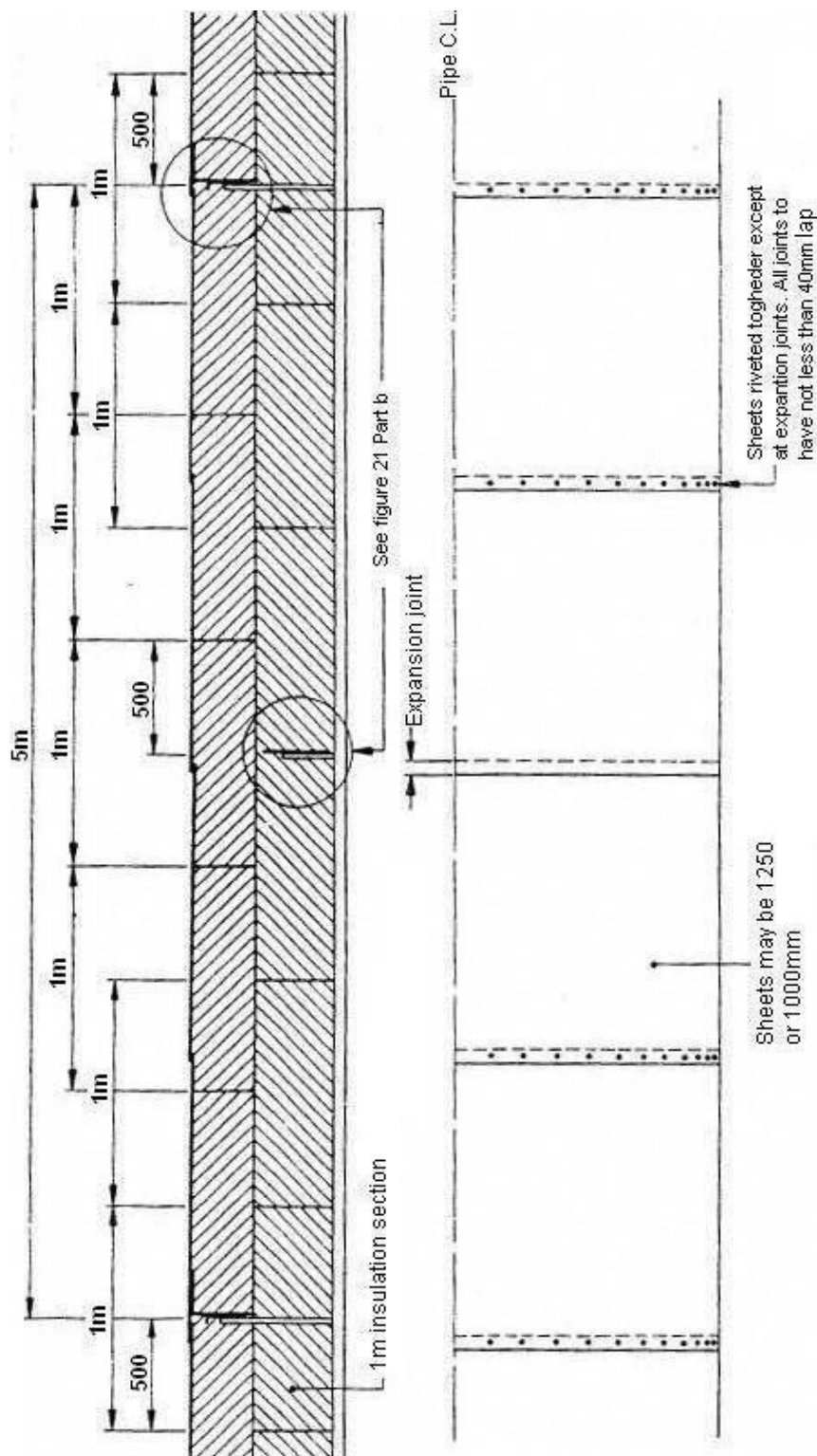
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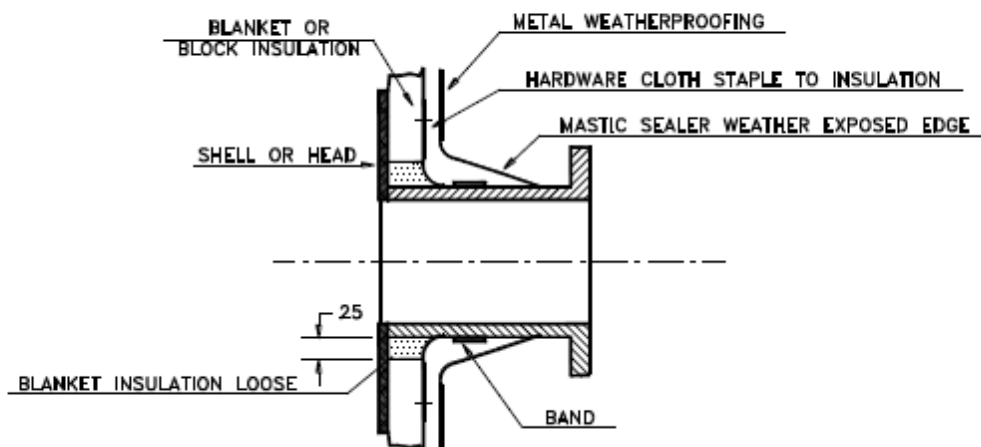
شماره صفحه : 24 از 46



TYPICAL CLEADING AND/OR INSULATION SUPPORT FOR VERTICAL PIPEWORK



	<p>نگهداشت و افزایش تولید میدان نفتی بینک</p> <p>سطح الارض و ابنیه تحت الارض</p> <p>عمومی و مشترک</p>								
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HOT INSULATION DETAILS  
FLASHING AT NOZZLES OR OTHER PROJECTIONS  
WITH METAL WEATHERPROOFING



نگهداشت و افزایش تولید میدان نفتی بینک  
سطح الارض و ابنیه تحت الارض

عمومی و مشترک



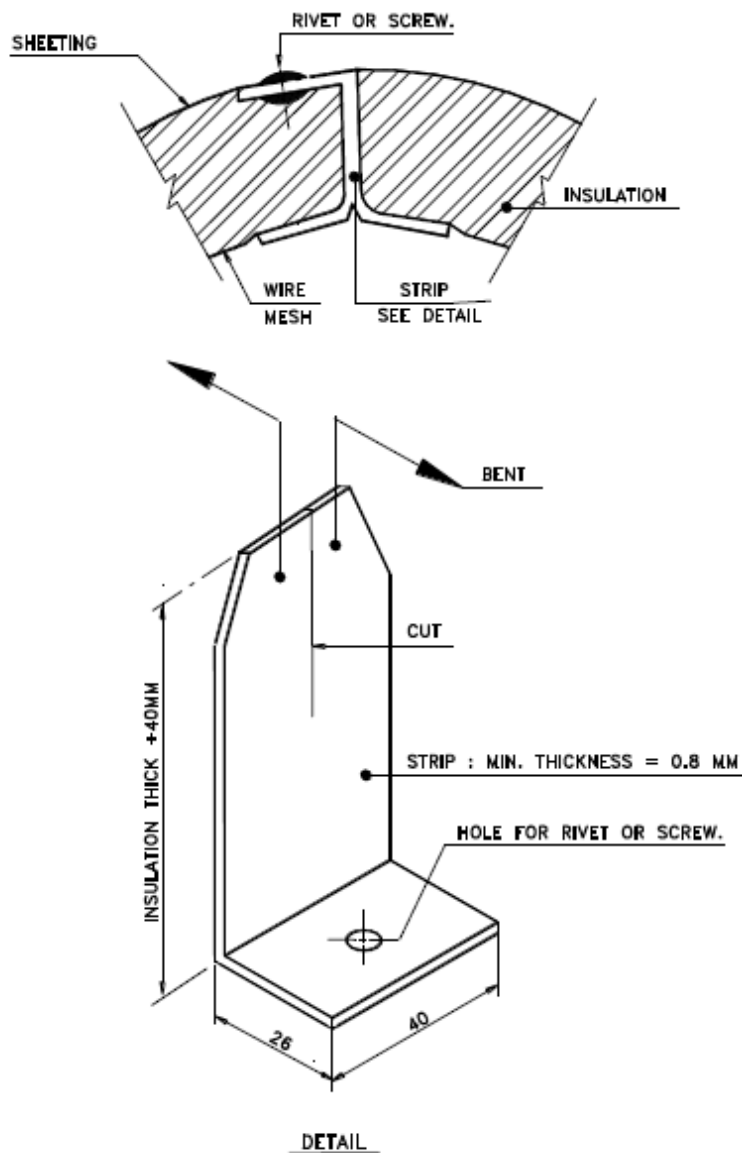
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HOT INSULATION DETAILS  
INSULATION SUPPORT PINS FOR ENCLOSURES



نگهداشت و افزایش تولید میدان نفتی بینک  
سطح الارض و ابنیه تحت الارض

عمومی و مشترک



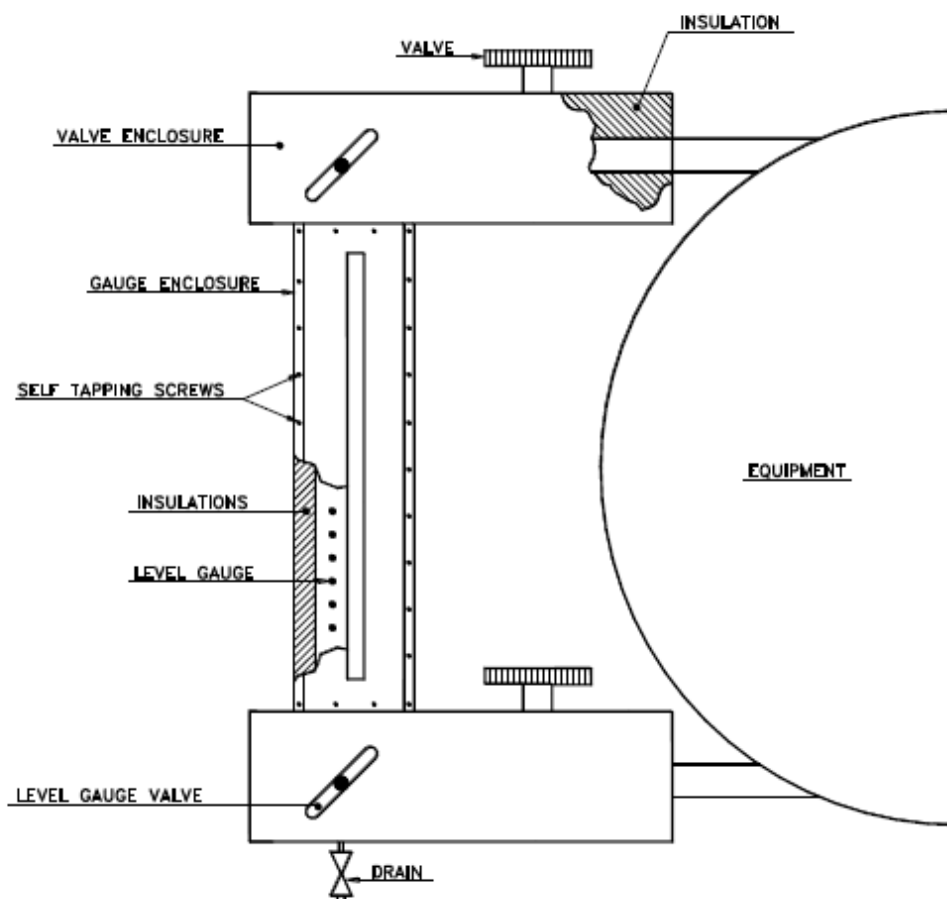
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HOT INSULATION DETAILS  
INSULATION DETAILS LEVEL GAUGES



نگهداشت و افزایش تولید میدان نفتی بینک  
سطح الارض و ابنیه تحت الارض

عمومی و مشترک



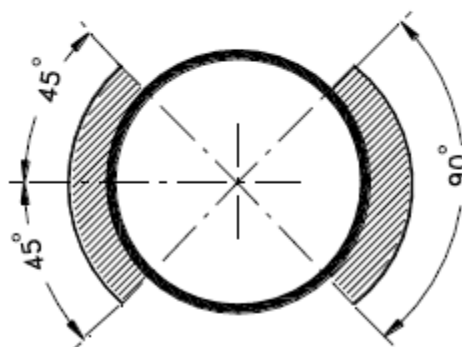
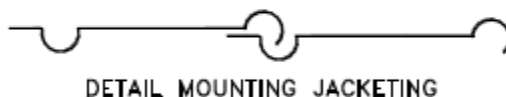
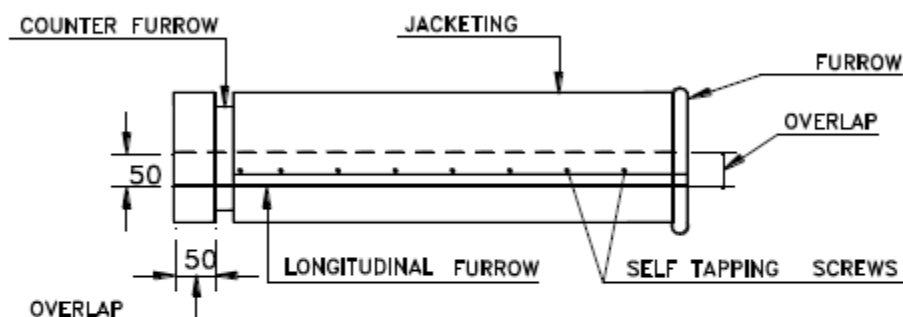
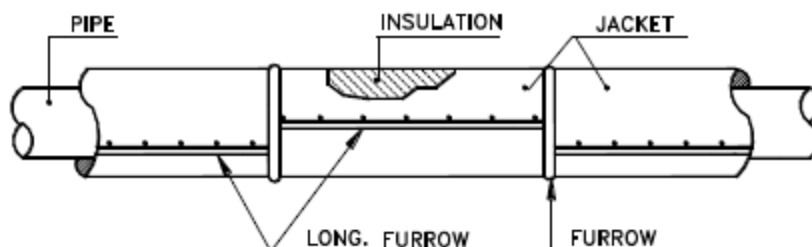
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POSITIONING LONGITUDINAL FURROWS  
HOT INSULATION DETAILS  
SHEETING DETAILS PIPE INSULATION



نگهداشت و افزایش تولید میدان نفتی بینک  
سطح الارض و ابنیه تحت الارض

عمومی و مشترک



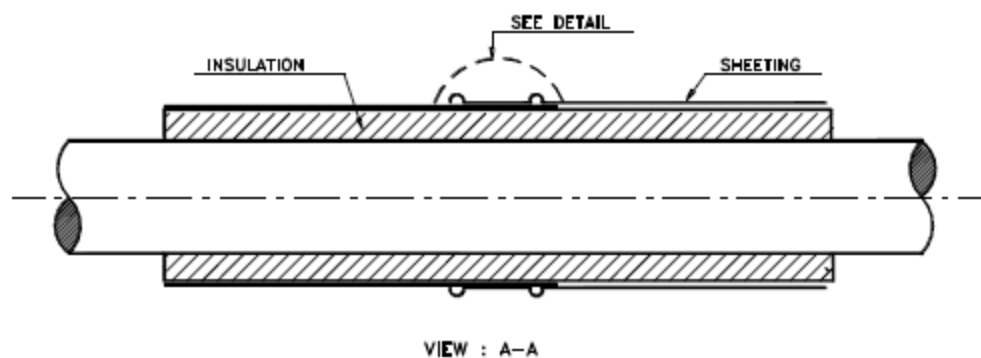
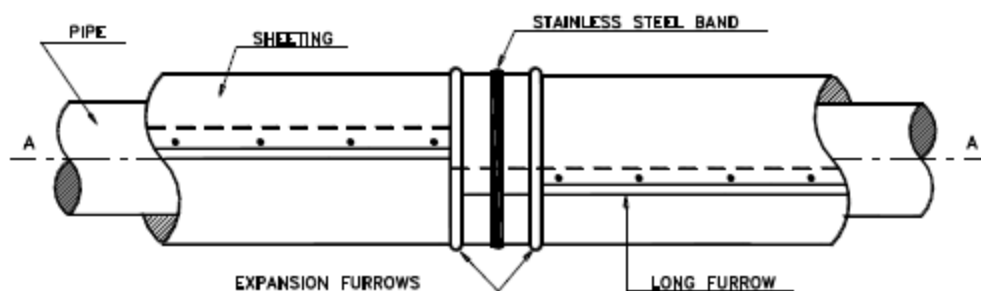
شماره پیمان:

053 - 073 - 9184

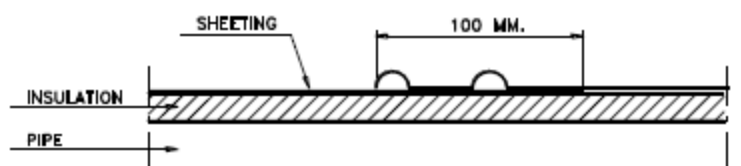
SPECIFICATION FOR INSULATION

پروژه	بسته کاری	صادر کننده	تسهیلات	رشته	نوع مدرک	سریال	نسخه
BK	GNRAL	PEDCO	000	PI	SP	0019	D02

شماره صفحه : 29 از 46



VIEW : A-A



DETAIL : EXPANSION FURROWS

HOT INSULATION DETAILS  
EXPANSION JOINT FOR PIPE SHEETING



نگهداشت و افزایش تولید میدان نفتی بینک  
سطح الارض و ابنیه تحت الارض

عمومی و مشترک



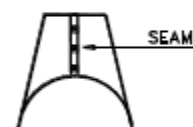
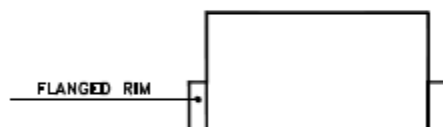
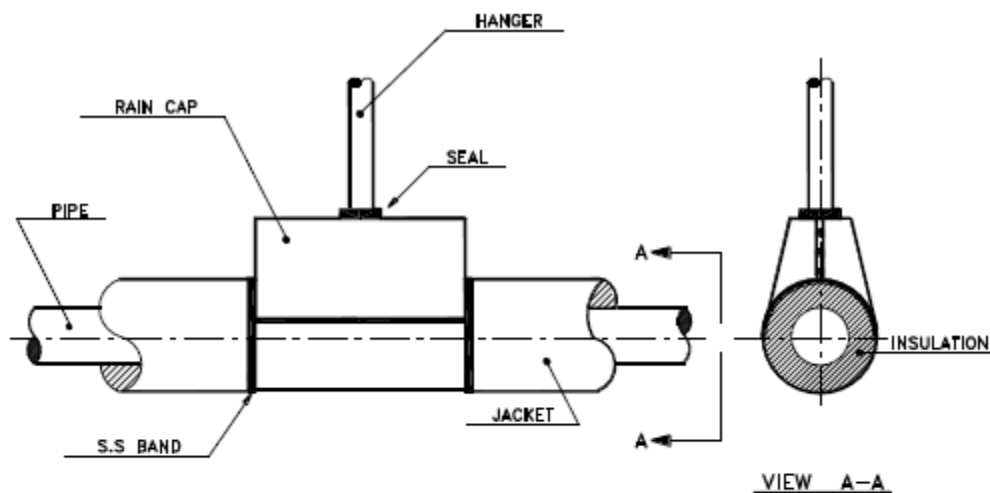
شماره پیمان:

053 - 073 - 9184

SPECIFICATION FOR INSULATION

پروژه	بسته کاری	صادر کننده	تسهیلات	رشته	نوع مدرک	سریال	نسخه
BK	GNRAL	PEDCO	000	PI	SP	0019	D02

شماره صفحه : 30 از 46



HOT INSULATION DETAILS  
DETAILS RAIN CAP AT SUPPORTS



نگهداشت و افزایش تولید میدان نفتی بینک  
سطح الارض و ابنیه تحت الارض

عمومی و مشترک



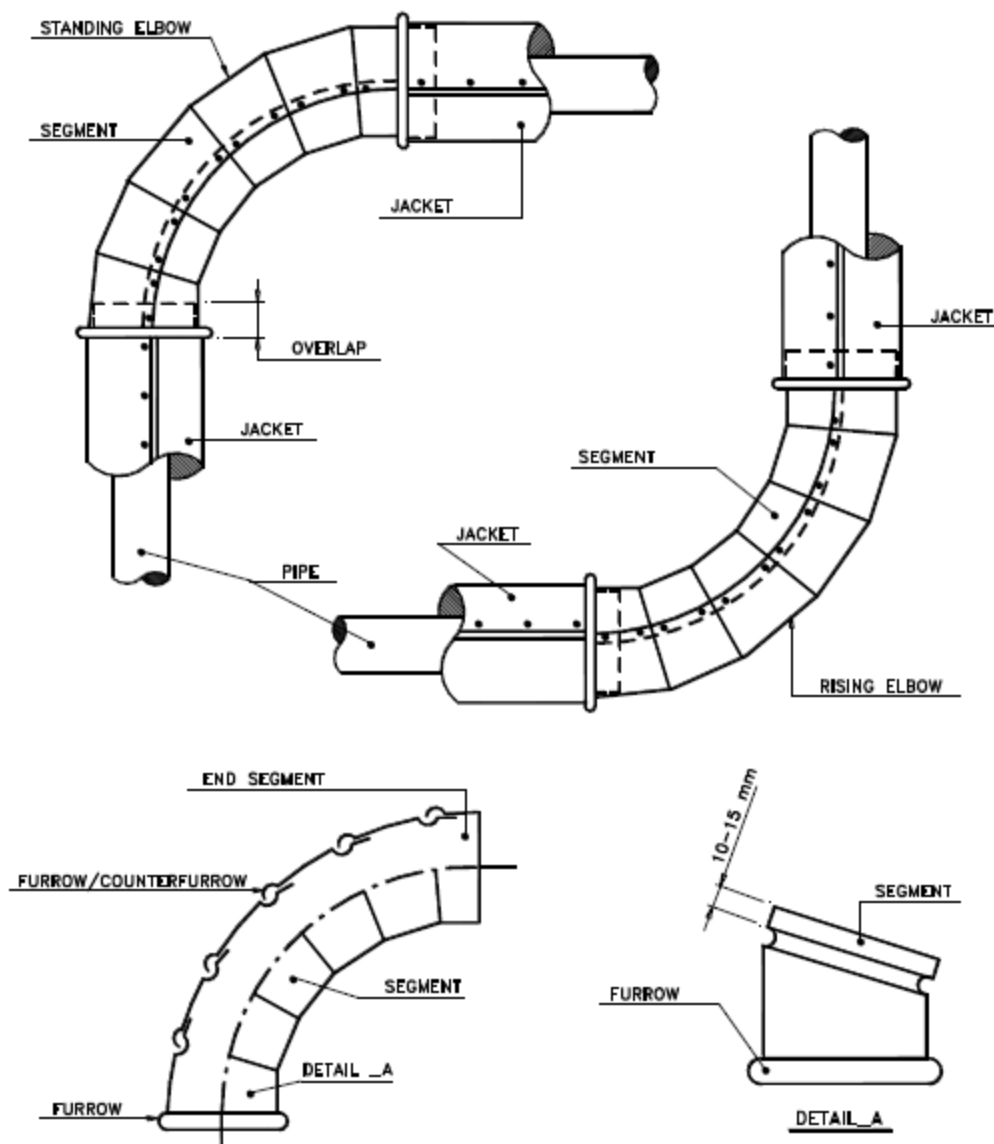
شماره پیمان:

053 - 073 - 9184

SPECIFICATION FOR INSULATION

پروژه	بسته کاری	صادر کننده	تسهیلات	رشته	نوع مدرک	سریال	نسخه
BK	GNRAL	PEDCO	000	PI	SP	0019	D02

شماره صفحه : 31 از 46





نگهداشت و افزایش تولید میدان نفتی بینک  
سطح الارض و ابنیه تحت الارض

عمومی و مشترک



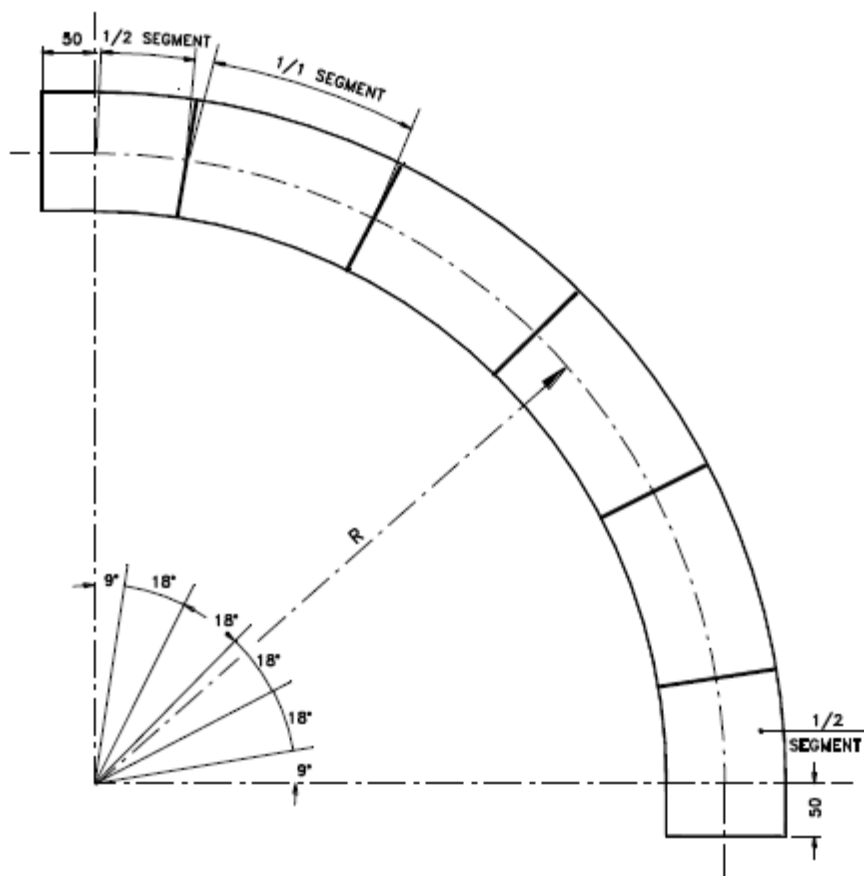
شماره پیمان:

053 - 073 - 9184

SPECIFICATION FOR INSULATION

نسخه	سریال	نوع مدرک	رشته	تسهیلات	صادر کننده	بسته کاری	پروژه
D02	0019	SP	PI	000	PEDCO	GNRAL	BK

شماره صفحه : 32 از 46



HOT INSULATION DETAILS

BENDS  $R > 1.5D$





نگهداشت و افزایش تولید میدان نفتی بینک  
سطح الارض و ابنیه تحت الارض

عمومی و مشترک



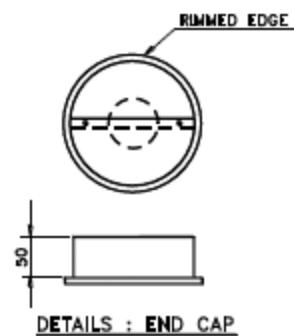
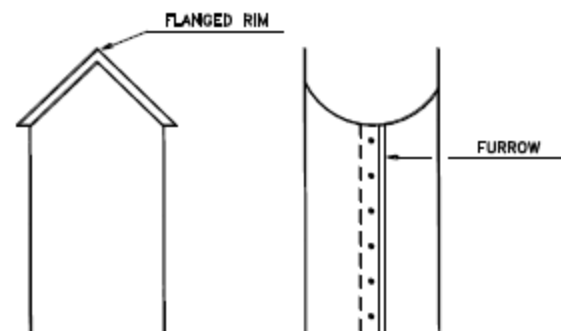
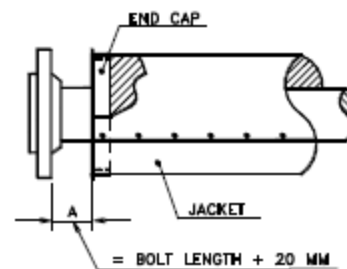
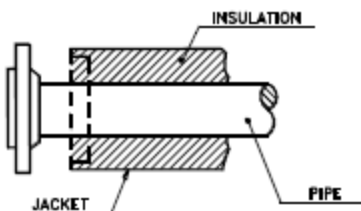
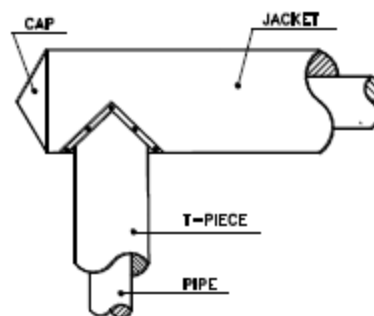
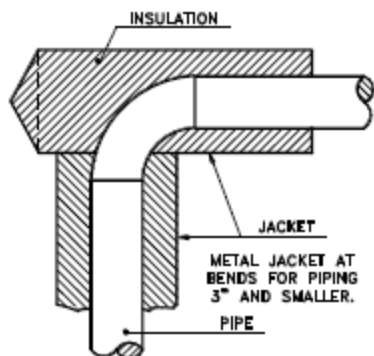
شماره پیمان:

053 - 073 - 9184

SPECIFICATION FOR INSULATION

نسخه	سریال	نوع مدرک	رشته	تسهیلات	صادر کننده	بسته کاری	پروژه
D02	0019	SP	PI	000	PEDCO	GNRAL	BK

شماره صفحه : 33 از 46



HOT INSULATION DETAILS  
SHEETING DETAILS FOR FITTINGS



نگهداشت و افزایش تولید میدان نفتی بینک  
سطح الارض و ابنیه تحت الارض

عمومی و مشترک



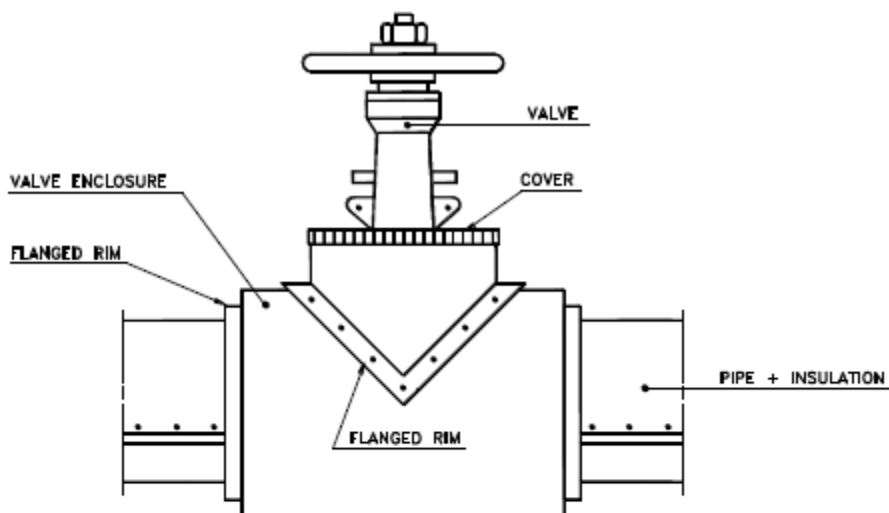
شماره پیمان:

053 - 073 - 9184

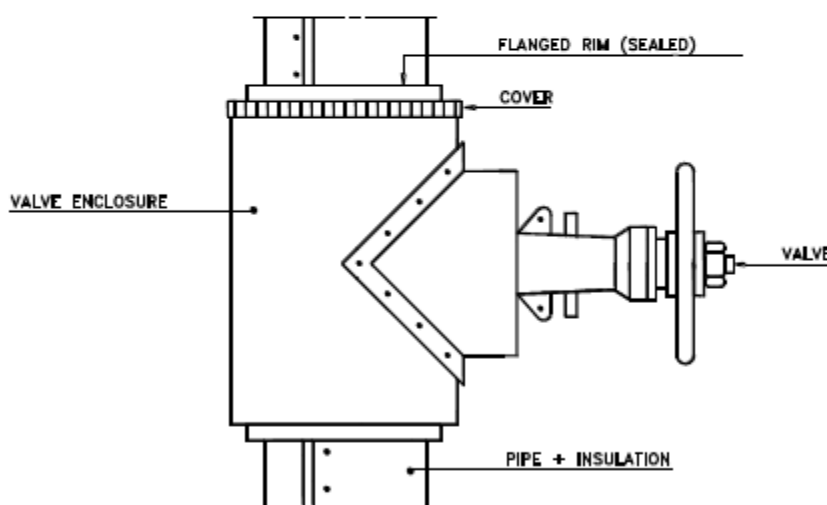
SPECIFICATION FOR INSULATION

پروژه	بسته کاری	صادر کننده	تسهیلات	رشته	نوع مدرک	سریال	نسخه
BK	GNRAL	PEDCO	000	PI	SP	0019	D02

شماره صفحه : 34 از 46



HORIZONTAL MOUNTED VALVES



VERTICAL MOUNTED VALVES

HOT INSULATION DETAILS

ENCLOSURES VALVES 1 1/2" & SMALLER



نگهداشت و افزایش تولید میدان نفتی بینک  
سطح الارض و ابنیه تحت الارض

عمومی و مشترک



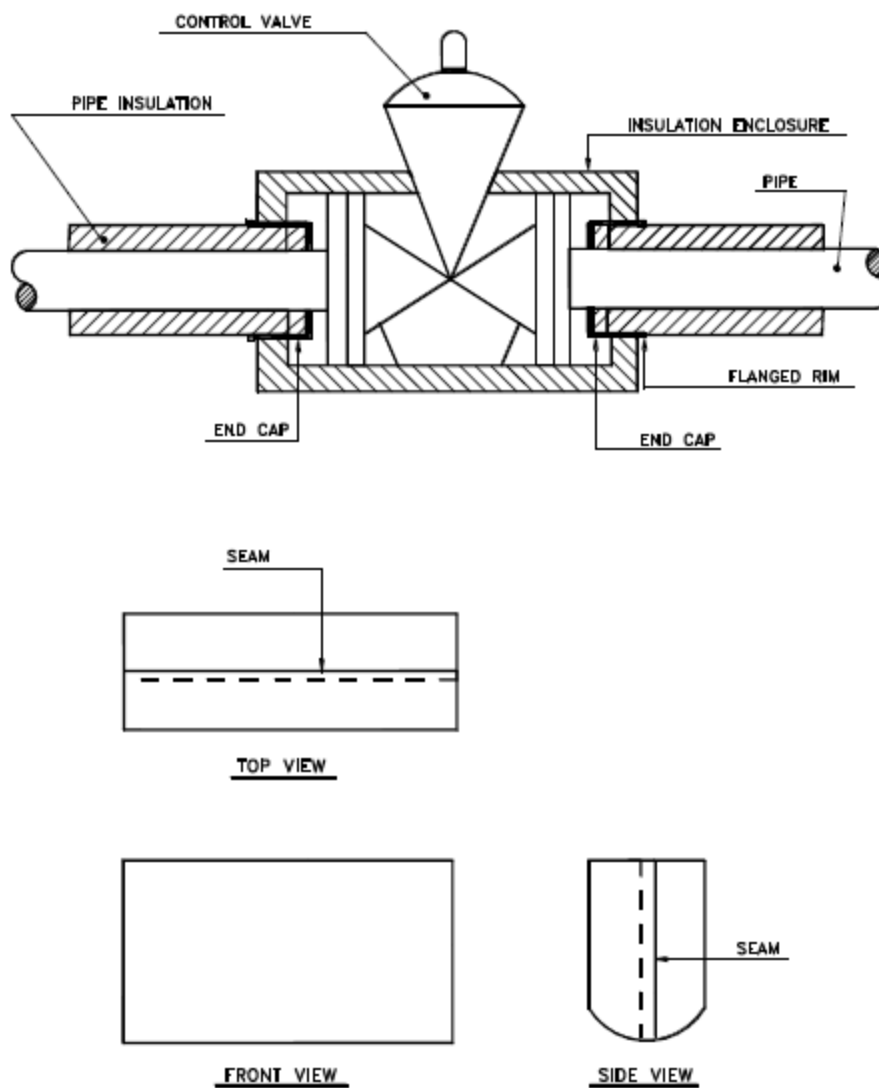
شماره پیمان:

053 - 073 - 9184

SPECIFICATION FOR INSULATION

پروژه	بسته کاری	صادر کننده	تسهيلات	رشته	نوع مدرک	سریال	نسخه
BK	GNRAL	PEDCO	000	PI	SP	0019	D02

شماره صفحه : 35 از 46



HOT INSULATION DETAILS  
FLANGED VALVES & CONTROL VALVES ENCLOSURES



نگهداشت و افزایش تولید میدان نفتی بینک  
سطح الارض و ابنیه تحت الارض

عمومی و مشترک



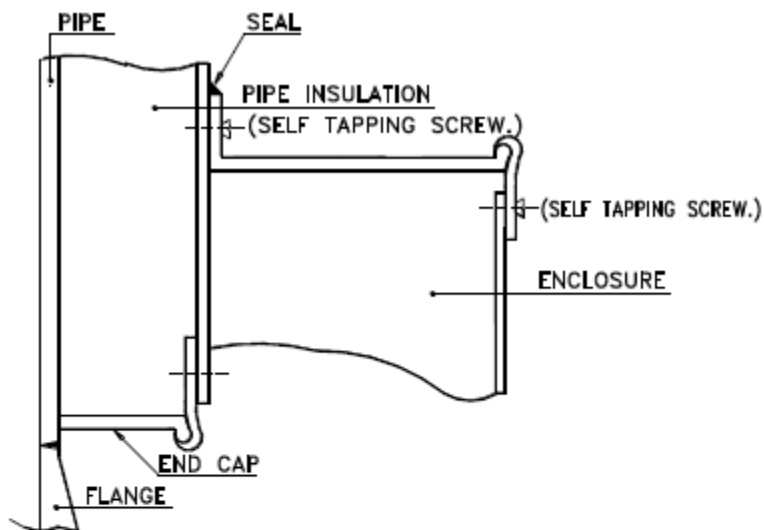
شماره پیمان:

053 - 073 - 9184

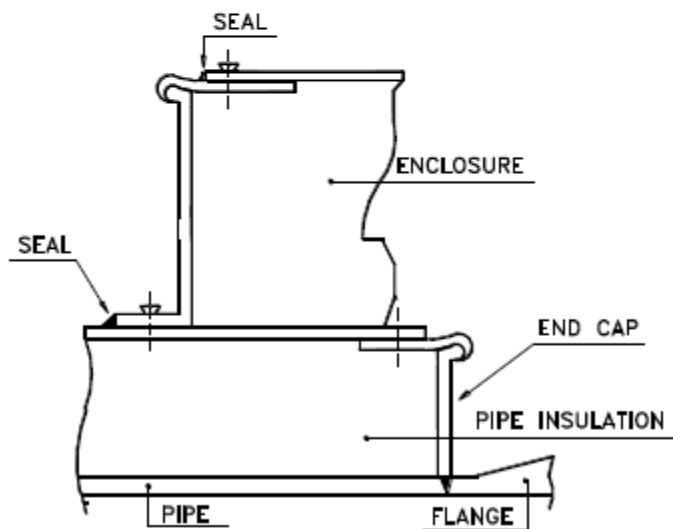
#### SPECIFICATION FOR INSULATION

نسخه	سریال	نوع مدرک	رشته	تسهیلات	صادر کننده	بسته کاری	پروژه
D02	0019	SP	PI	000	PEDCO	GNRAL	BK

شماره صفحه : 36 از 46



VERTICAL INSULATION



HORIZONTAL INSULATION

#### HOT INSULATION DETAILS

END CAPS FOR FLANGE AND VALVE ENCLOSURES



نگهداشت و افزایش تولید میدان نفتی بینک  
سطح الارض و ابنیه تحت الارض

عمومی و مشترک



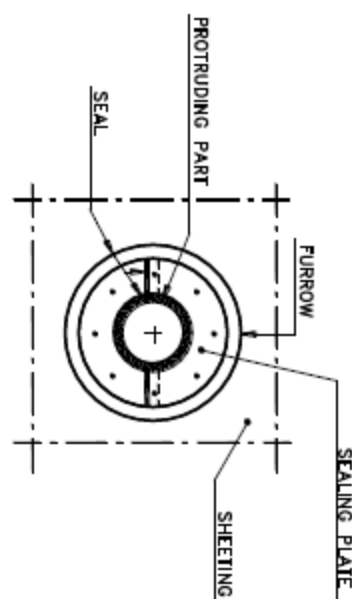
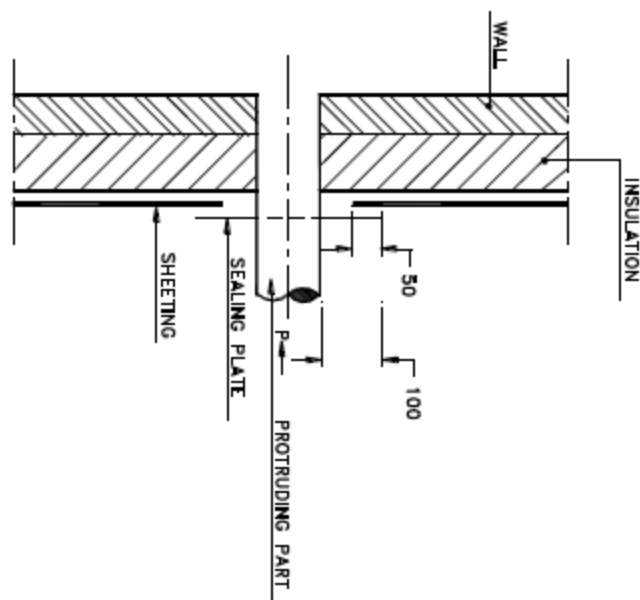
شماره پیمان:

053 - 073 - 9184

SPECIFICATION FOR INSULATION

نسخه	سریال	نوع مدرک	رشته	تسهیلات	صادر کننده	بسته کاری	پروژه
D02	0019	SP	PI	000	PEDCO	GNRAL	BK

شماره صفحه : 37 از 46



HOT INSULATION DETAILS  
SEALING PLATES METAL WEATHERPROOFING



# نگهداشت و افزایش تولید میدان نفتی بینک سطح الارض و ابنیه تحت الارض

## عمومی و مشترک



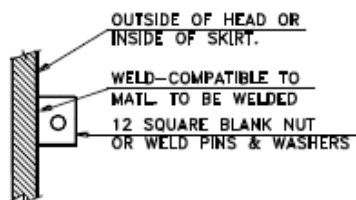
شماره پیمان:

053 - 073 - 9184

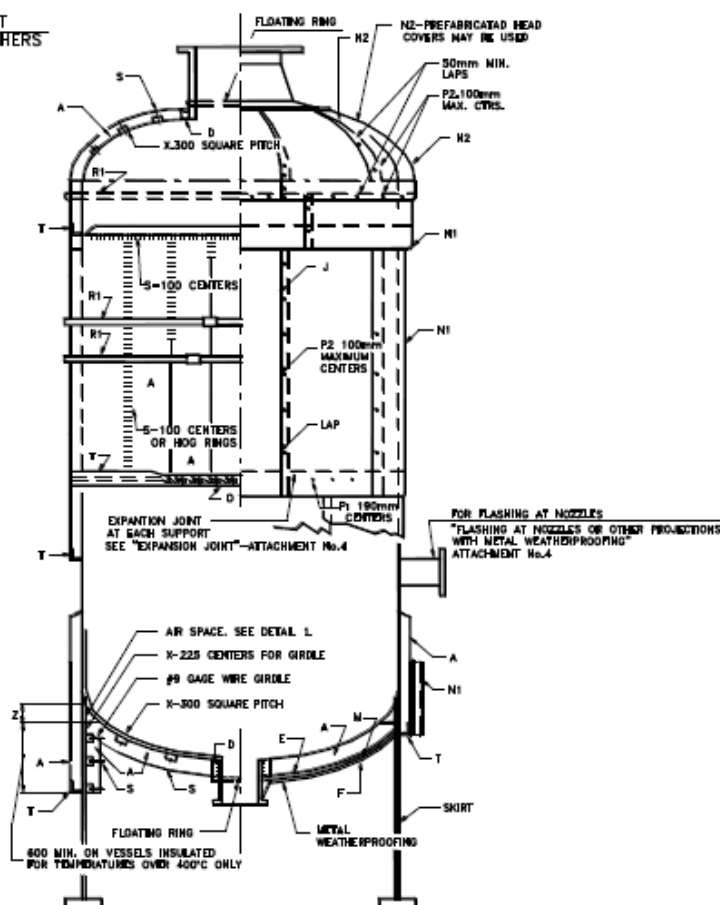
### SPECIFICATION FOR INSULATION

پروژه	بسته کاری	صادر کننده	تسهیلات	رشته	نوع مدرک	سریال	نسخه
BK	GNRAL	PEDCO	000	PI	SP	0019	D02

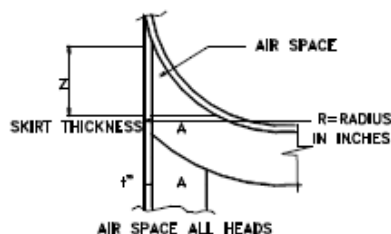
شماره صفحه : 38 از 46



DETAIL-A



- A -BLANKET INSULATION WITH METAL MESH
- D -BLANKET INSULATION-LOOSE
- E -INSULATING OR FINISHING CEMENT
- F -MASTIC WEATHERPROOFING
- J -LAP SEALER
- M -FABRIC
- N1-METAL WEATHERPROOFING
- N2-METAL WEATHERPROOFING
- P1-SELF TAPPING SCREWS
- P2-SHEET METAL SCREWS
- R1-BANDS 250 CENTERS
- S -#16 GAGE WIRE TIES
- T-ANGLE RING SUPPORT & LUGS.
- SEE DETAIL-A, "SUPPORT FOR INSULATION"-ATTACHMENT No.4
- X-NUTS. SEE DETAIL-A.



VESSEL DIAMETER	Z
UP TO 1800	150
1801 UP TO 3000	200
3001 UP TO 4200	250
4201 & ABOVE	300

DETAIL-1

VESSEL TEMP. OVER 400°C ONLY

NOTE:

FOR VESSELS WITH SKIRTS A MINIMUM AIR SPACE Z SHALL NOT BE LESS THAN SPECIFIED. IN ADDITION Z SHALL IN NO CASE BE LESS THAN  $Z = \frac{R}{4}$

### HOT INSULATION DETAILS VERTICAL VESSEL-BLANKET INSULATION WITH METAL WEATHERPROOFING



# نگهداشت و افزایش تولید میدان نفتی بینک سطح الارض و ابنیه تحت الارض

## عمومی و مشترک



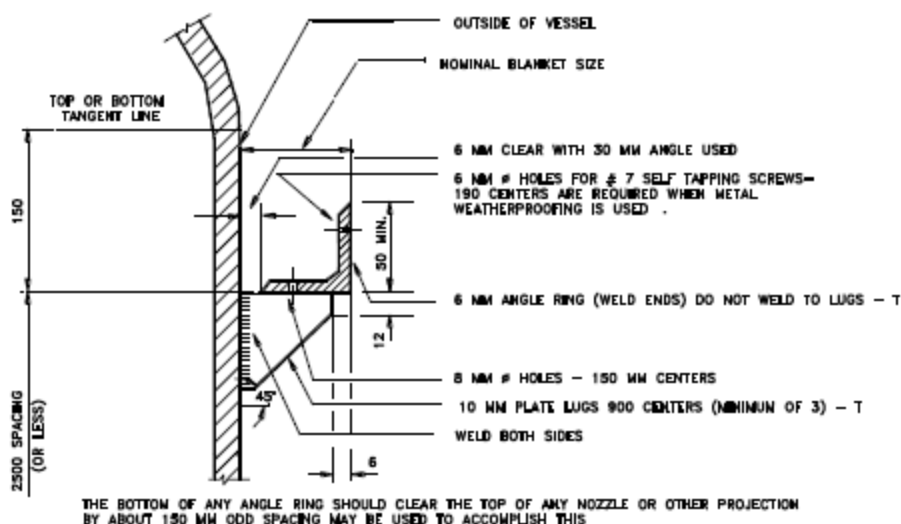
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053 - 073 - 9184

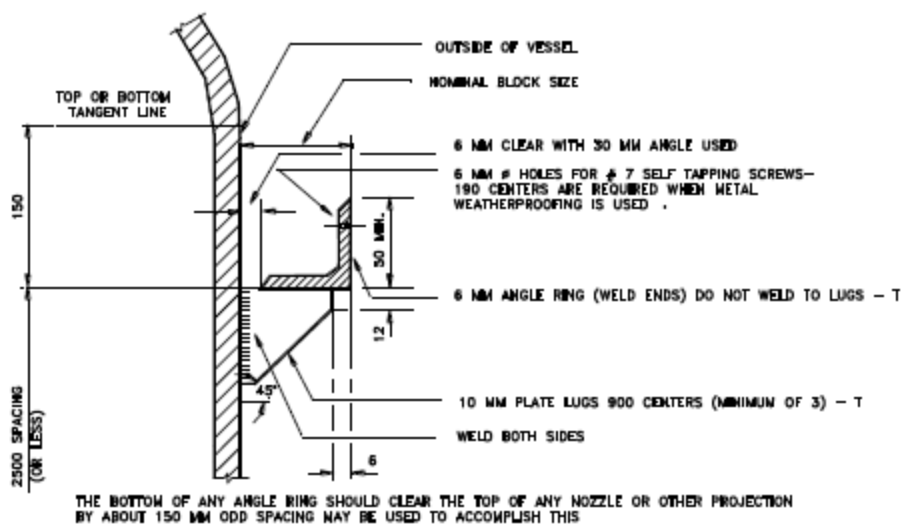
### SPECIFICATION FOR INSULATION

نسخه	سریال	نوع مدرک	رشته	تسهیلات	صادر کننده	بسته کاری	پروژه
D02	0019	SP	PI	000	PEDCO	GNRAL	BK

شماره صفحه : 39 از 46



DETAIL - A  
BLANKET INSULATION



DETAIL - B  
BLOCK OR BOARD INSULATION

### HOT INSULATION DETAILS SUPPORT FOR INSULATION



نگهداشت و افزایش تولید میدان نفتی بینک  
سطح الارض و ابنیه تحت الارض

عمومی و مشترک



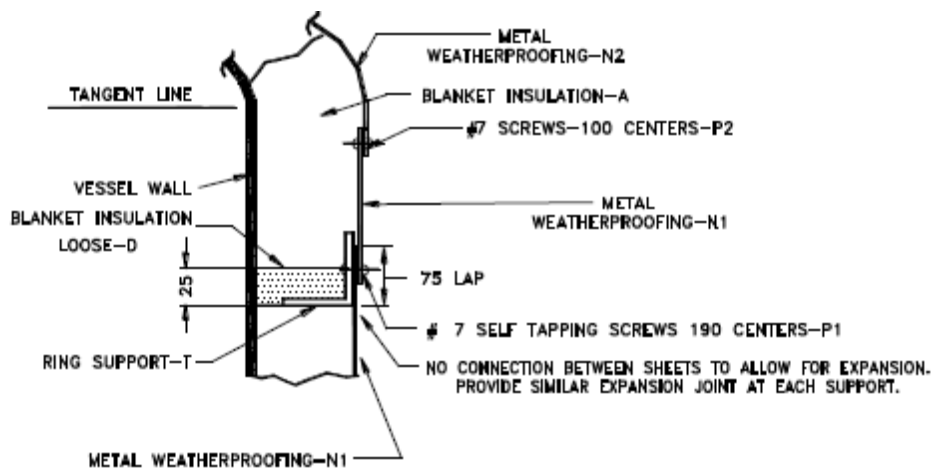
شماره پیمان:

053 - 073 - 9184

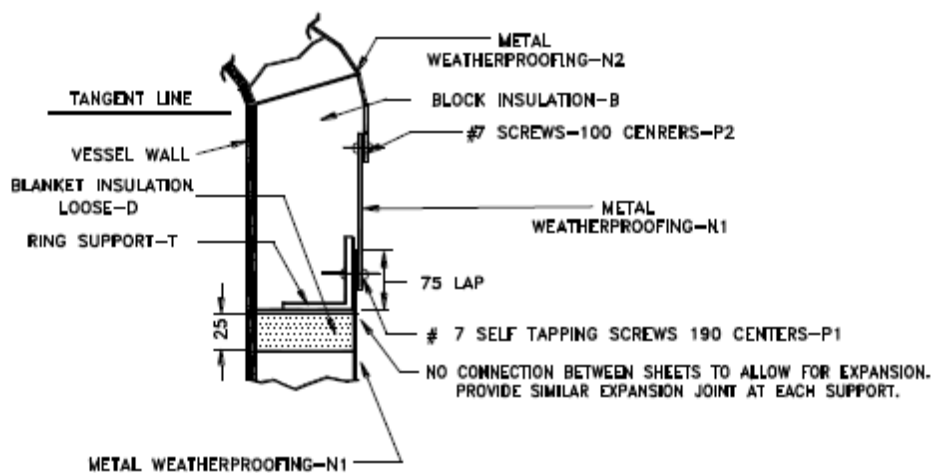
SPECIFICATION FOR INSULATION

پروژه	بسته کاری	صادر کننده	تسهیلات	رشته	نوع مدرک	سریال	نسخه
BK	GNRAL	PEDCO	000	PI	SP	0019	D02

شماره صفحه : 40 از 46



BLANKET INSULATION  
WITH METAL WEATHERPROOFING



BLOCK OR BOARD INSULATION  
WITH METAL WEATHERPROOFING

HOT INSULATION DETAILS  
EXPANSION JOINT





نگهداشت و افزایش تولید میدان نفتی بینک  
سطح الارض و ابنیه تحت الارض

عمومی و مشترک



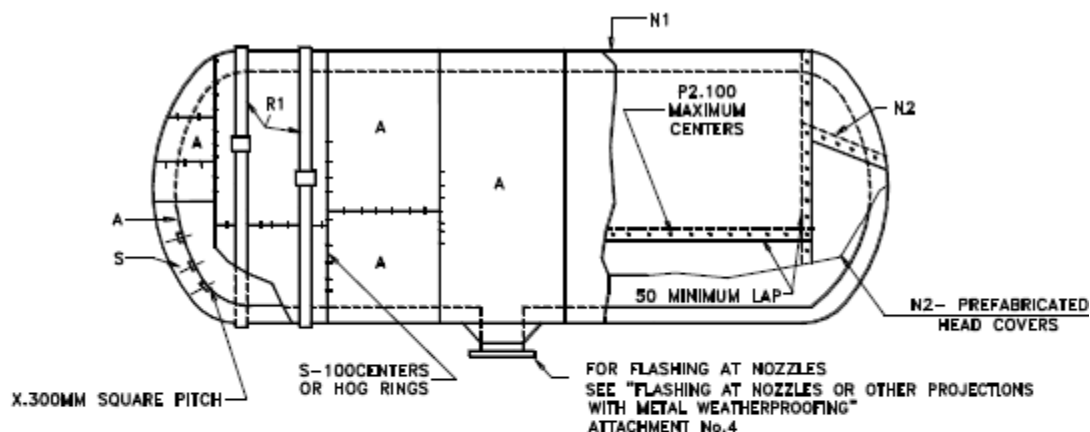
شماره پیمان:

053 - 073 - 9184

SPECIFICATION FOR INSULATION

نسخه	سریال	نوع مدرک	رشته	تسهیلات	صادرکننده	بسته کاری	پروژه
D02	0019	SP	PI	000	PEDCO	GNRAL	BK

شماره صفحه : 41 از 46



A-BLANKET INSULATION

N1-METAL WEATHERPROOFING

N2-METAL WEATHERPROOFING

P2-SHEET METAL SCREWS

R1-BANDS 250 CENTERS

S- #16 GAGE WIRE TIES

X-NUTS. FOR DETAIL SEE "VERTICAL VESSEL-BLANKET INSULATION WITH METAL WEATHERPROOFING" ATTACHMENT No.4

HOT INSULATION DETAILS

HORIZONTAL VESSELS AND EXCHANGERS WITH  
BLANKET INSULATION AND METAL WEATHERPROOFING



نگهداشت و افزایش تولید میدان نفتی بینک  
سطح الارض و ابنیه تحت الارض

عمومی و مشترک



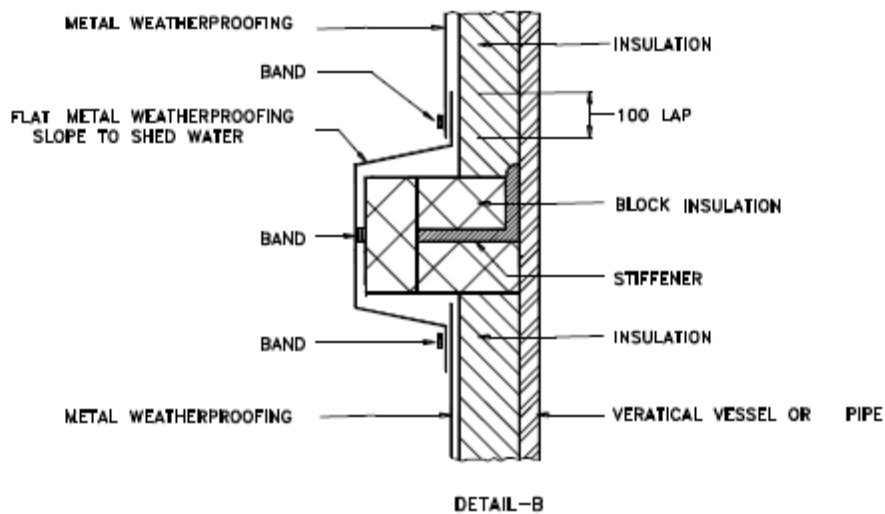
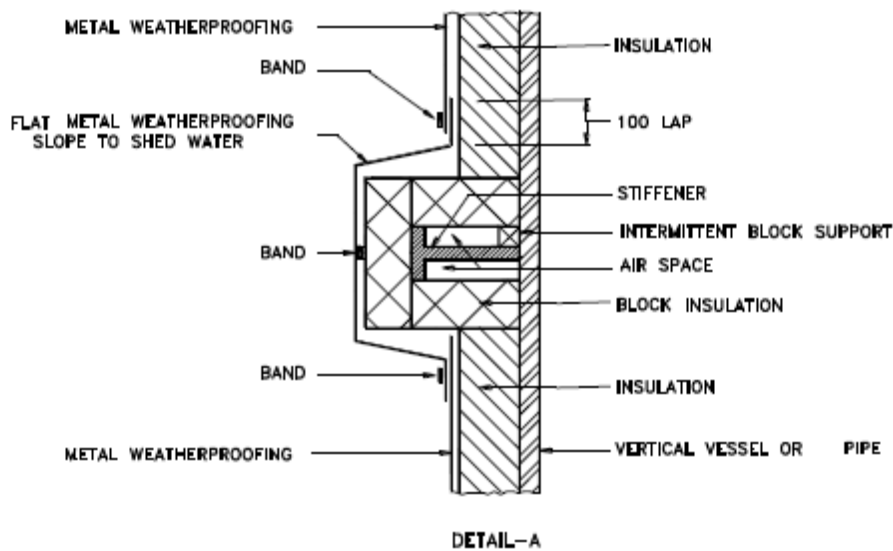
شماره پیمان:

053 - 073 - 9184

SPECIFICATION FOR INSULATION

پروژه	بسته کاری	صادر کننده	تسهیلات	رشته	نوع مدرک	سریال	نسخه
BK	GNRAL	PEDCO	000	PI	SP	0019	D02

شماره صفحه : 42 از 46



NOTE : (HORIZONTAL VESSEL OR PIPE SIMILAR)

HOT INSULATION DETAILS  
VESSEL STIFFENER INSULATION



نگهداشت و افزایش تولید میدان نفتی بینک  
سطح الارض و ابنیه تحت الارض

عمومی و مشترک



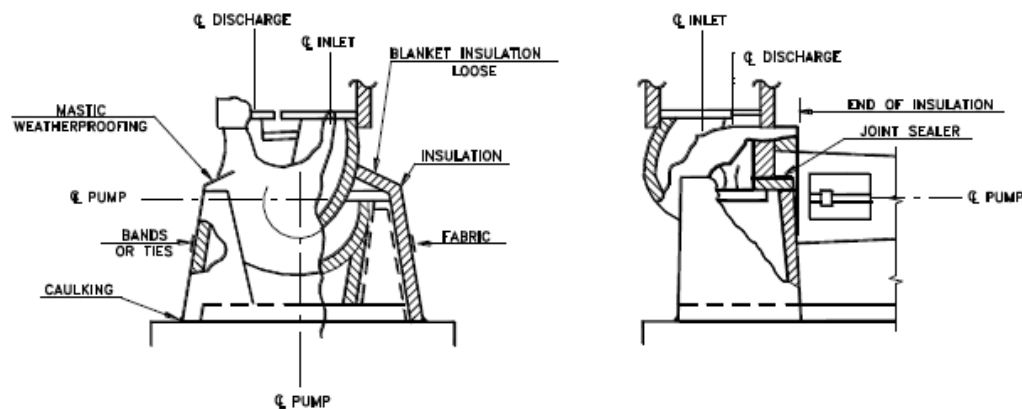
شماره پیمان:

053 - 073 - 9184

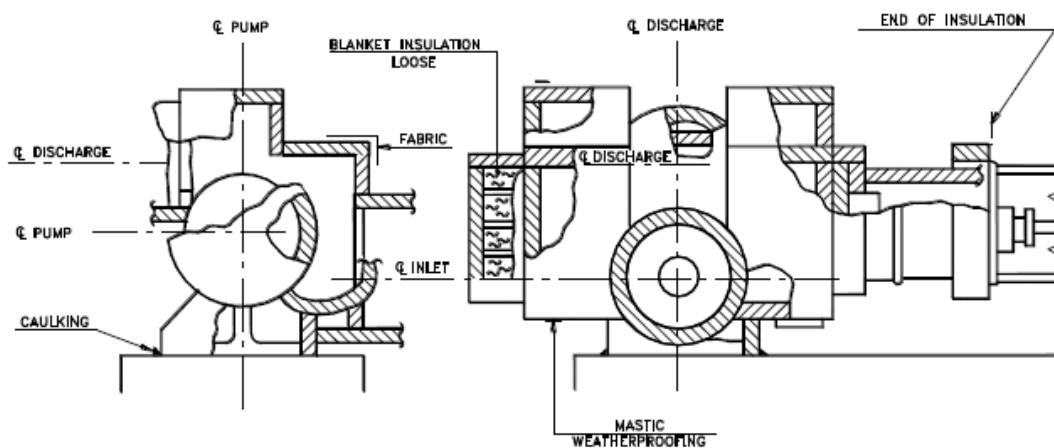
SPECIFICATION FOR INSULATION

پروژه	بسته کاری	صادر کننده	تسهیلات	رشته	نوع مدرک	سریال	نسخه
BK	GNRAL	PEDCO	000	PI	SP	0019	D02

شماره صفحه : 43 از 46



CENTRIFUGAL



RECIPROCATING

NOTES :

COMPRESSOR INSULATION DETAILS SIMILAR.  
LEAVE BEARINGS AND SEAL AREA FREE AT ALL TIMES  
CONSIDER MAINTENANCE REQUIREMENTS FOR EACH ITEM.

HOT INSULATION DETAILS  
PUMP INSULATION DETAIL



نگهداشت و افزایش تولید میدان نفتی بینک  
سطح الارض و ابنیه تحت الارض

عمومی و مشترک



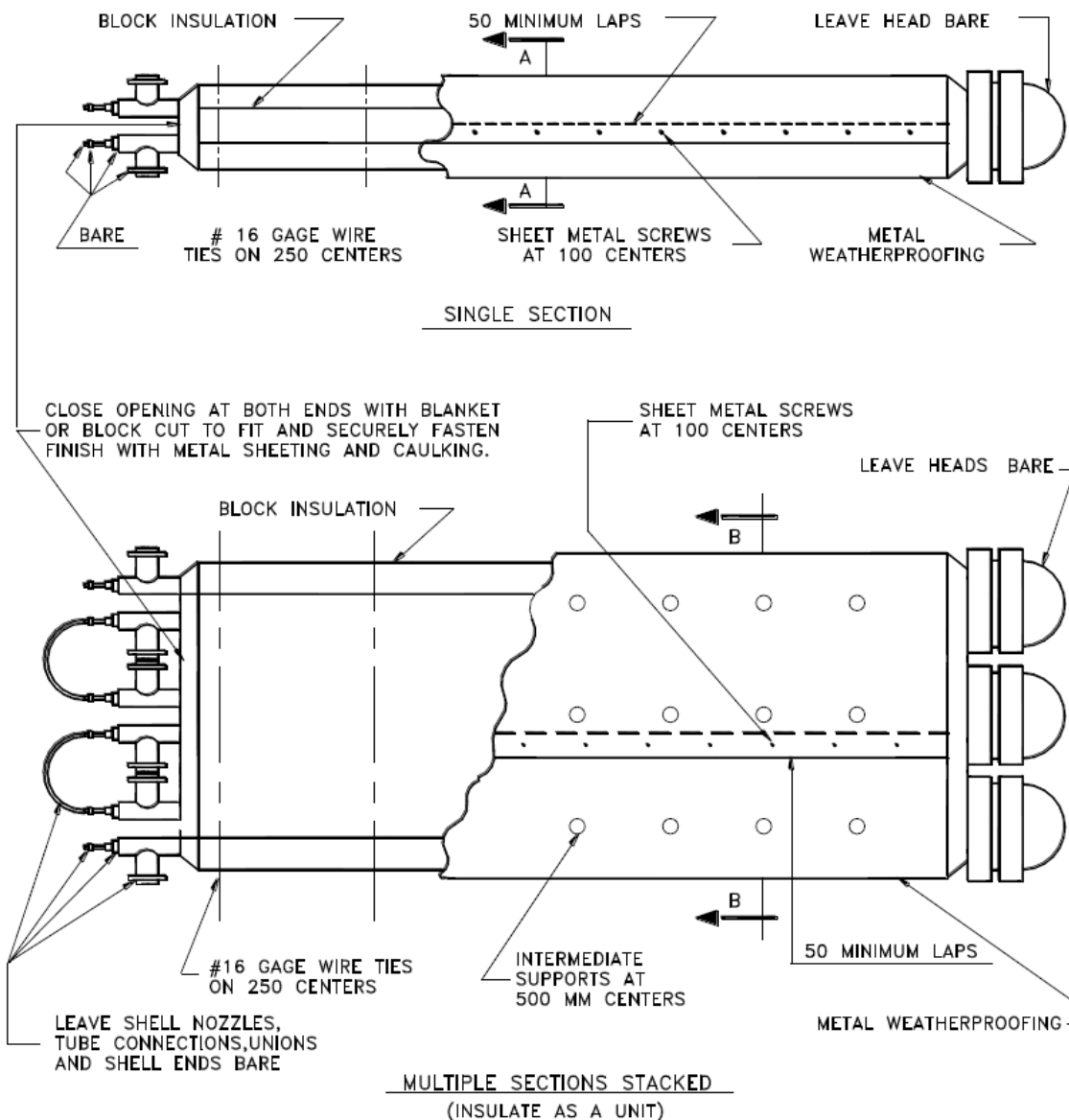
شماره پیمان:

053 - 073 - 9184

SPECIFICATION FOR INSULATION

پروژه	بسته کاری	صادر کننده	تسهیلات	رشته	نوع مدرک	سریال	نسخه
BK	GNRAL	PEDCO	000	PI	SP	0019	D02

شماره صفحه : 44 از 46



NOTE : FOR SECTIONS SEE "HAIR PIN EXCHANGER INSULATION DETAIL"—ATTACHMENT No.4

HOT INSULATION DETAILS  
HAIR PIN EXCHANGERS WITH BLOCK  
INSULATION AND METAL WEATHERPROOFING



نگهداشت و افزایش تولید میدان نفتی بینک  
سطح الارض و ابنیه تحت الارض

عمومی و مشترک



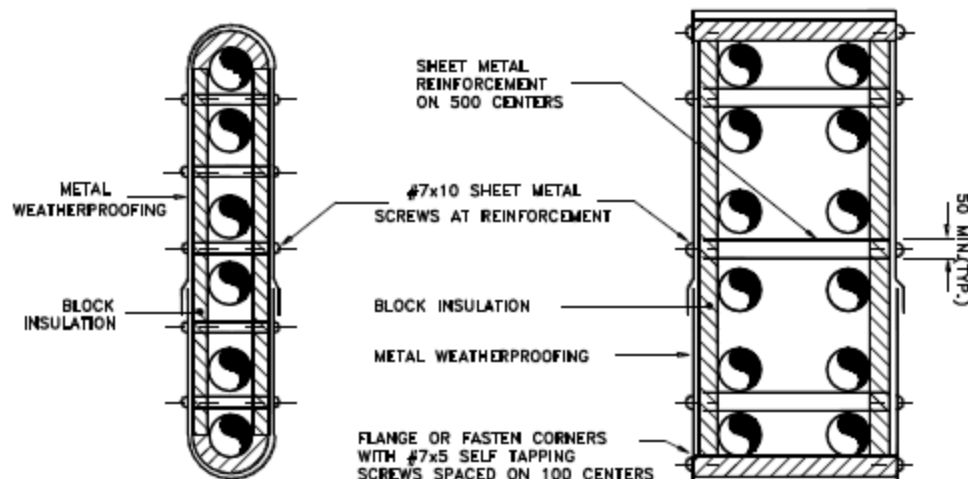
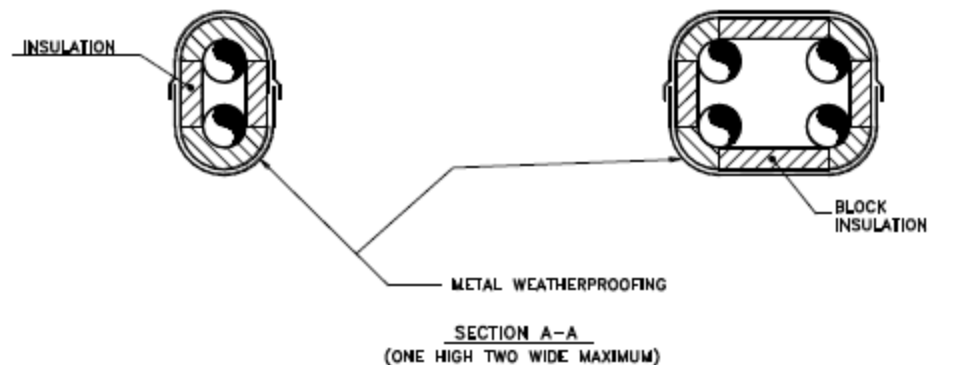
شماره پیمان:

053 - 073 - 9184

SPECIFICATION FOR INSULATION

پروژه	بسته کاری	صادر کننده	تسهیلات	رشته	نوع مدرک	سریال	نسخه
BK	GNRAL	PEDCO	000	PI	SP	0019	D02

شماره صفحه : 45 از 46



HOT INSULATION DETAILS  
HAIR PIN EXCHANGER INSULATION DETAIL



نگهداشت و افزایش تولید میدان نفتی بینک  
سطح الارض و ابنیه تحت الارض

عمومی و مشترک



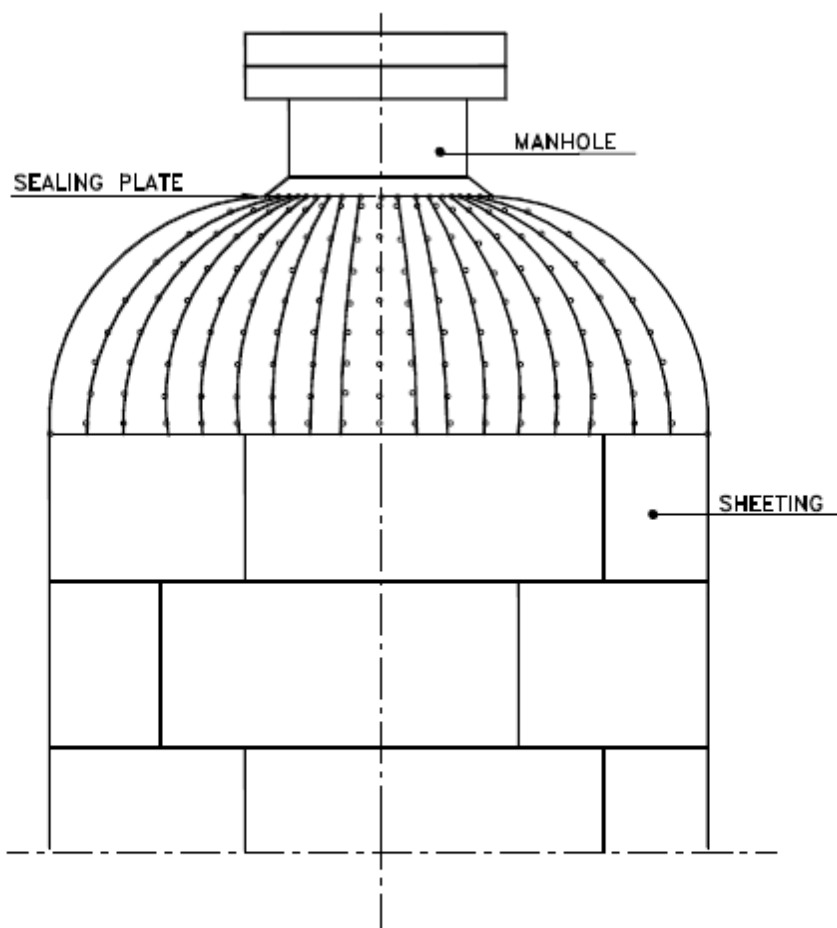
شماره پیمان:

053 - 073 - 9184

SPECIFICATION FOR INSULATION

نسخه	سریال	نوع مدرک	رشته	تسهیلات	صادر کننده	بسته کاری	پروژه
D02	0019	SP	PI	000	PEDCO	GNRAL	BK

شماره صفحه : 46 از 46



HOT INSULATION DETAILS  
SEALING PLATE AROUND MANHOLES  
ON VERTICAL EQUIPMENT.