OIL & GAS DEVELOPMENT COMPANY LIMITED

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JHAL MAGSI GAS FIELD
DEVELOPMENT PROJECT

SPECIFICATION FOR INSULATION

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ENAR Petrotech Services (Pvt.) Limited

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1 INTRODUCTION

Oil & Gas Development Company Limited (OGDCL) is developing its Jhal Magsi Gas Field near Quetta, Balochistan Province of Pakistan. OGDCL has engaged ENAR Petrotech Services (Pvt.) Limited (ENAR) for the preparation of Basic Engineering Package and ITB development for engagement of EPCC contractor.

2 SCOPE

This specification covers the minimum requirements for the materials and application for external thermal insulation on vessels, heat exchangers, furnaces & pipes for hot service inside and outside the process area.

2.1 Definitions and abbreviations

Project	Jhal Magsi Gas Field Development Project
Plant	Jhal Magsi Gas Treatment Plant
Company	Oil & Gas Development Company Limited (OGDCL)
Engineering Consultant	ENAR Petrotech Services (Pvt.) Ltd.
Company Representative	A party or parties duly authorized by the Company to act on behalf of the Company with whom the Contractor shall consult at all reasonable times, and whose instructions, requests and decisions shall be binding on the Contractor.
Contractor	Entity engaged by Company to perform the EPCC scope of work for the Project
EPCC	Engineering, Procurement, Construction and Commissioning
Project	Jhal Magsi Gas Field Development Project

Purchaser	Contractor and/or Company
Services	Basic Engineering, Detailed Engineering, Procurment, Fabrication, Installation, Testing, Pre-commissioning, Commissioning etc.
Vendor/Subcontractor	Entity to be engaged by Contractor to supply equipment and/or Services.

2.2 Contractor's Responsibility

It shall be the responsibility of the Contractor to check and complete this Specification (as per Contractor's detail engineering) for the Project, and develop additional specifications where necessary. All deviations to this Specification, other related specifications or attachments shall be with written Approval of the Company. This specification is also applicable to Contractor's Vendors/Subcontractors. It is the responsibility of the Contractor to modify this specification for his Vendors/Subcontractors and obtain Company's Approval.

3 CODES AND STANDARDS

3.1 General

Contractor shall meet or exceed the requirements of the latest edition of the following codes, regulations and standards, except as superseded herein. In cases where more than one code, regulations and standard apply to the same condition, most stringent shall be followed. All specifications and publications shall be the current issue on the date.

3.2 Codes and Standards

- General Industry Standard
- Materials, Relevant ASTM Specification (insulation, covering material etc.)
- BS 874 Methods for determining insulating properties with definitions of thermal insulating terms

- BS 5422 Specification for the use of thermal insulating materials
- BS 5970 Thermal insulation of Pipe work and Equipment

3.3 Referenced Documents

Specification for Painting and Protective Coating (0102-PU-9013)

Site & Environmental Design Data (0102-A-1017)

4 GENERAL REQUIREMENTS/RESTRICTION

4.1 No insulation shall be applied to any component (piping vessel or other equipment) unless it has been inspected, tested and approved for the service.

4.2 The surfaces to be insulated shall be coated with suitable primer in accordance with the painting specification (0102-PU-9013) except stainless steel surface.

4.3 All surfaces to be insulated shall be hand cleaned to remove any loose rust, paint, dirt, grease or any other foreign matter prior to the application of insulation.

4.4 Materials shall follow ASTM standards, latest edition, substitute material will be considered only if the manufacturer guarantees that they are equal or superior to these specified and will need Company's Approval.

4.5 All insulation materials, mastics etc. to be used on equipment or piping subject to stress, corrosion, cracking such as austenitic stainless steel, shall be guaranteed as these which do not contribute to stress corrosion cracking. For each one (1) ppm of bleachable chlorine in the materials the material shall contain a minimum of 20 ppm sodium silicate.

4.6 Insulation containing more than 800 ppm of chloride is not acceptable for use on Austenitic steel.

4.7 For austenitic stainless steels containing molybdenum (316 type etc.) and operating at or about 815°C (1500°F) insulation containing sodium silicate is not acceptable.

4.8 Materials composed of asbestos fibres shall not be used.

4.9 Aluminum jacketing shall not be used on any equipment or piping whose maximum normal or short term operating temperature exceeds 1100°F (500°C).

4.10 Galvanized or zinc coated materials shall not be used on any equipment or piping whose maximum, normal or short term operating temperatures exceeds 700°F (370°C).

5 APPLICATION OF INSULATION ON PIPING & EQUIPMENTS

5.1 Fillings flange and valve insulation covers shall be fabricated from the same material and insulation thickness as specified for the adjacent piping.

> ***Note:*** *The cover shall be of two pieces removable type and shall be secured with the required specified band and seals. Except surface of screwed or socket welded valves in preference to cladding.*

5.2 Valves and flanges shall not be insulated until permission is obtained from Company/Company Representative.

5.3 The insulation of bends and fittings shall be continuous from the adjacent pipe erection of metal elbows etc. and fitting the void between cladding and pipe with loose insulation is permitted.

5.4 On vertical insulated pipe, the Contractor shall supply and install insulation supports at 3700mm pitch. Welding is not permitted on any lines or equipment. Tee branches and pipe support brackets may be utilized as insulation supports.

5.5 Supports on tanks and vessels should be spaced to suit the insulation but in no case should exceed 3700mm vertical pitch and should be an integral part of the equipment as delivered.

5.6 The insulation on vertical tanks shall terminate at 100 to 150 mm above the bottom of the tank shell and 75 to 100 mm above the wind girder. Adequate means of support for the insulation materials shall be provided.

5.7 Electrical tracing will be installed and tested by others before it is released to the Contractor for insulation. The extent of Electrical tracing will be as indicated on the isometrics and other procurement documentation developed by Contractor.

5.8 Suitably oversized insulation material shall be used on traced services to ensure that no burying of the tracer occurs in the insulation. A layer of 0.06mm aluminum foil shall be applied to the line prior to the application of the insulation.

5.9 Unless otherwise noted, insulation shall not normally be applied to fans compressors, pumps and other rotating equipment, valves and flanges, vessel man-way covers, nozzle and flanges on equipment. The exception to this shall be:

- Heat traced lines and equipment
- Where operating temperature exceeds 95ºC

5.10 Bonnet and channel flanges on heat exchangers shall be insulated by means of a removable double skin box. On large exchangers boxes insulation shall be in two or more parts and no part shall weigh more than 25 kg.

5.11 For heat exchangers the tube sheet and channel flanges shall not be insulated, but a simple removable galvanized sheet metal protecting shroud shall be placed over the bolts to protect them from the effect of thermal shock from rainstorms. A suitable gap should be left between the bolts and the shroud to allow adequate ventilation.

5.12 The insulation surrounding equipment nameplates, which indicate design and/or operating data shall be neatly trimmed and seated so that the nameplates are clearly visible.

5.13 For the purpose of taking shell or pipe thickness measurements a removable section of insulation shall be provided as and where required. The Contractor shall supply design details for Approval.

5.14 Single layer insulation shall be applied to pipe and vessels with lateral joints in a staggered arrangement. All joints shall be tightly butted and fitted together so as to eliminate voids. Large voids shall be eliminated by refitting or replacing insulation. Additional layers of pipe insulation, where required,

shall be applied in the same manner as the first layer, with lateral and end joints staggered over the preceding layer so that no joints coincide, except where they cross at right angles. The outer layer of insulation shall be secured with specified bands and seals on approximately 600mm centers. Inside layers shall be secured with wire on approximately 600mm centers. With double layer insulation, the thickness or any single layer shall not exceed 50mm.

5.15 Where flanges or flanged fittings are not being insulated, the insulation shall be cut to a 45º bevel and sealed to the pipe adjacent to each side of the flange or flanged fittings to allow bolt removal without damaging the insulation.

5.16 Expansion joints shall be installed in insulation for horizontal and vertical straight run piping and vessels in increments of not more than 12 meters. When flanged fittings or valves are installed within this limit, the joint shall be provided for in flange or valve cover only.

Expansion joints shall have a 12mm space between adjoining pipe insulation sections. Insulation cover the joint shall be of a specified thickness of insulation and shall extend one and one-half times the insulation thickness on each side of the 12mm space.

5.17 Specified sheet cladding shall be applied over all pipe and vessel insulation. The cladding shall be installed with seams and laps arranged to shed water. The cladding on vessels shall be secured with specified bands on 1000mm centers and hardened steel screws on 150mm centers. All joints in the cladding shall have an overlap of 50mm minimum and shall be sealed with non-setting mastic.

On vertical piping and vessels the cladding shall be supported with 50mm ‘S’ clips secured to the next lower section. The ‘S’ clips shall be made from the specified banding. Cladding shall not be installed over any insulation that is not thoroughly dry. Spring buckles or bands, which will allow for expansion, shall be used on vessels where necessary.

5.18 Polyvinyl acetate weather-barrier coating may be applied to insulated surfaces of screwed or socket welded valves in preference to cladding.

The surface of insulation shall receive an adhesive coat of polyvinyl acetate mastic. While still tacky, glass-reinforcing cloth shall be stretched taut and thoroughly embedded in the coating, care being exercised that the weave is not stretched and that the cloth is overlapping approximately 40 mm. Before the Surface becomes dry to touch, a second coating shall be applied and allowed to dry. Total dry thickness of coating shall be 3.5 mm minimum.

Cloth shall not be visible on the finished surface. Weather coating shall extend 75mm under cladding adjacent to fittings prior to application of the galvanized sheet cladding.

All sharp corners of insulation shall be rounded and the weather coating provided with a double layer of reinforcing cloth.

Coating shall not be applied when the atmospheric temperature is such that condensation of moisture and ultimate freezing may occur on the finished surface within 24 hours from time of application. Polyvinyl acetate weather-coating shall not be thinned with water.

6 PROTECTION

6.1 The insulation shall be protected from moisture and weather effects before and during application.

6.2 All insulation shall be dry and free from moisture prior to application of insulation finish.

6.3 If bare insulation cannot be finished before the end of the working day, it shall be protected to prevent the insulation from becoming wet.

6.4 The finish covering shall be applied as soon as possible after the insulation has been secured.

6.5 Sharp edges of insulation shall be well removed for protection.

7 THICKNESS OF INSULATION

7.1 The required nominal thickness of thermal insulation will be indicated on equipment insulation schedule or line insulation schedule which will be developed by Contractor.

7.2 The thicknesses of insulation given in the schedules are those required for the size of the line shown on equipment.

7.3 To determine the required insulation thicknesses for minor components of the line or equipment, such as branch connections, drain and vent lines, nozzles etc. the contractor shall refer to standard details/ drawings.

7.4 Thicknesses shown on the schedules are only nominal thicknesses and do not include finish thicknesses.

7.5 If insulation is not available in thickness specified, the next larger commercially available thickness shall be used.

7.6 Exact extent of insulation is indicated on relevant P&ID and equipment drawing.

7.7 For "Hot Service" multilayered insulation shall only be used when required thickness is not available in single layer or exceeds 3" (75mm).

8 MATERIALS

8.1 Insulation Materials for Hot Services

a) Insulation – Class H

Material	Temp Range	Application
Mineral Wool preformed Section (100 kg/m^3)	Up to 350ºC	Piping and Equipment below 36" OD
Mineral Wool Stabs (65-80 kg/m^3)	Up to 350º	Equipment above 36" OD
Mineral Wool Section Slabs, (144 kg/m^3)	Up to 650ºC	Equipment and Piping
Mineral Wool Wired Blanket (90 kg/m^3)	Up to 450ºC	Removable boxes for Equipment and irregular surfaces
Mineral Wool Wired Blanket (48 kg/m^3)	Up to 50ºC	Irregular Surfaces

Mineral Wool Stabs (48 kg/m^3)	Up to 250ºC	Rectangular Equipment

b) Insulation Securement – Class H

Material	Spacing	Application
1.6mm soft. Annealed Stainless Steel Wire	300mm	Equipment and Piping Up to 1500mm OD Inner Layer
12mm wide by 0.5m Stainless Steel Type 316 Banding	300mm	Equipment and Piping 250mm OD to 600 mm OD
18mm wide by 0.5mm Stainless Steel type 316 Banding	300mm	Equipment and Piping above 600mm OD upto 1500mm OD
25mm wide by 0.5 mm Stainless Steel type 316 Banding	300mm	Equipment and Piping above 600mm OD upto 1500mm OD
9mm Dia. Weld pins and self adhesive double prong clips	As necessary	Irregular Surfaces or as required

c) Insulation Cladding - Class H

Material	Application
Stainless Steel Type 304 Sheet 0.5mm thick	Piping and Equipment upto 300mm OD
Stainless Steel Type 304 Sheet 0.5mm thick	Piping & Equipment 350mm to 1500mm OD
Corrugated Stainless Steel type 304 Sheet	Equipment above 1500mm OD

d) Cladding Securement – Class H

Material	Spacing	Application
12mm × No. 10 Stainless Steel self-tapping screws.	150mm	Equipment and Piping
Stainless Steel type 316 Banding 12mm wide × 0.5mm thick	700mm	Equipment and Piping above 300mm OD to 1500mm OD
Stainless Steel Type 316 Banding 25mm wide × 0.5mm thick	1000mm	Equipment and Piping above 1500mm OD

e) Coating and Mastics – Class H

Material	Application
Fire Resistive Mastic and Glass cloth. Natural or impregnated with material compatible with the mastic.	Piping insulation terminations at flanges and valves etc. Insulation finish on horizontal equipment heads, screwed and socket weld fittings.
Non Setting Mastic	Sealing against water ingress on removable items
Sealing Mastics	Sealing against water ingress at sheeting joints/laps/cut-outs etc.

8.2 Materials for Fireproofing Services

8.2.1 Insulation Class - F

The fireproofing insulation shall be calcium silicate to ASTM C-533, Type II and shall have thermal conductivity of 0.11 W/m per ºC based on 540ºC mean temperature.

The insulation shall be supplied in blocks which must retain their shape and function effectively for a minimum period of twenty minutes when exposed to a surface temperature of 900ºC.

It is to be capable of being easily cut and shaped using conventional hand tools and shall be applied as follow:

Performed sections	Piping and equipment below 36" OD
Slabs	Equipment above 36" OD

a) **Insulation Securement – Class F**

Material	Spacing	Application
1.6mm Soft Annealed Stainless Steel Wire	600mm	Equipment and Piping up to 1500mm OD Inner layer
12mm wide by 0.5m Stainless Steel Type 316 Banding	600mm	Equipment & Piping 250mm OD to 600mm OD
1.8mm wide by 0.5mm Stainless Steel	600mm	Equipment and Piping above

Type 316 Banding		600 mm OD to 1500mm OD
25mm wide by 0.5mm Stainless Steel Type 316 Banding	600mm	Equipment above 1500mm OD

b) **Insulation Cladding – Class F**

Material	Equipment
Stainless Steel type 316 Sheet 0.5mm thick	Piping and Equipment up to 300mm OD
Stainless Steel Type 316 Sheet 0.5mm thick	Piping & Equipment 350mm to 1500mm OD
Corrugated Stainless Steel type 316 Sheet	Equipment above 1500mm OD

c) **Cladding Securement – Class F**

Material	Spacing	Application
12mm × No.10 Stainless Steel Self tapping screws	150mm	Equipment and Piping
Stainless Steel Type 316 Banding 12mm wide × 0.5mm thick	1000mm	Equipment and Piping above 1500mm OD
Stainless Steel Type 316 Banding 25mm wide × 0.5mm thick	1500mm	Equipment and Piping above 1500mm OD

d) **Cladding and Mastics – Class F**

Material	Application
Fire Resistive Mastic and Glass cloth. Natural or impregnated with material compatible with the mastic	Piping insulation terminations at flanges & valves etc. Insulation finish on horizontal equipment heads, screwed and socket weld fittings.
Non Setting Mastic	Sealing against water and vapor ingress on removable items.
Sealing Mastics	Sealing against water and vapor ingress at sheeting joints. Laps/ Cutouts, etc.,

8.3 Insulation Materials or Methods for Personnel Protection

8.3.1 Where personnel protection is specified on the Piping Line List (to be developed by the Contractor), all piping, valves, flanges, nozzles and equipment within 2 meters height and one meter reach of walkways, working platforms, ladders etc., Shall be insulated, or otherwise guarded or screened.

8.3.2 Where design temperature is at 55ºC and above, the protection shall be by means of either:

- A suitable guard or screen (e.g. extended hand railing or weld mesh shied)

  Or

- Application of hot insulation

8.3.3 Where the design temperature is –25ºC and below, the protection shall be by means of a suitable guard or screen. (e.g. Extended hand railing or weld mesh shield).

9 CAUSES OF REJECTION OF INSULATION

Insulation will be gauged defective and liable for rejection for any of the following reasons:

9.1 If there are any cracks extending through the insulation.

9.2 If there are any cracks which would cause insulation to break upon sawing or gentle flexing (bending).

9.3 If the ends are broken or damaged.

9.4 If more than 10% of the surface area of the insulation is composed of large voids.

9.5 If any large void has a depth greater than 10% of the insulation thickness.

10 INSPECTIONS

10.1 Company / Company Representative shall have the right to inspect all work and materials on site or at the Contractor's work.

10.2 Of during Inspection any work related to insulation find out below or material standards and specifications as defined than under must be responsible for the further correctness of the materials or work in immediate fashion or work in immediate fashion.