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KLM Technology Group #03-12 Block Aronia, Jalan Sri Perkasa 2 Taman Tampoi Utama 81200 Johor Bahru Malaysia	OFF SHORE FUNCTIONAL SPECIFICATION FOR PIPING FABRICATION AND INSTALLATION (PROJECT STANDARDS AND SPECIFICATIONS)	

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SCOPE

This Project Standard and Specification gives the general requirements for the fabrication, installation, inspection and testing of piping materials, fittings and valves for an Oil and Gas project.

This specification covers all pipe work pertaining to this project except: heating, ventilating, air and water pipe work serving non-process areas.

Instrument piping downstream of the last piping block valve, as normally defined on the approved P&ID's.

REFERENCES

Throughout this Standard the following dated and undated standards/codes are referred to. These referenced documents shall, to the extent specified herein, form a part of this standard. For dated references, the edition cited applies. The applicability of changes in dated references that occur after the cited date shall be mutually agreed upon by the Company and the Vendor. For undated references, the latest edition of the referenced documents (including any supplements and amendments) applies.

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|-------------------------|--|
| 1. API RP 14E | Recommended Practice for Design & Installation of Offshore Production Platform Piping. |
| 2. ASME VIII Division 1 | Pressure Vessels and Boiler Code. |
| 3. ASME II Part A | Materials – Ferrous Materials Specifications. |
| 4. ASME V | Non-Destructive Examination. |
| 5. ASME IX | Welding and Brazing Qualifications. |
| 6. ASME B1.20.1 | Pipe Threads, General Purpose (Inch). |
| 7. ASME B16.20 | Metallic Gaskets for Pipe Flanges. |
| 8. ASME B31.3 | Chemical Plant and Petroleum Refinery Piping Code. |
| 9. ASME B31.4 | Oil Transportation Piping. |
| 10. ASME B31.8 | Gas Transmission and Distribution Piping. |
| 11. ASME B16.25 | Butt Weld Ends for Pipes, Valves, Flanges & Fittings. |
| 12. ASTM A283 | Carbon steel Plates. |
| 13. ASTM A370 | Standard Test Methods & Definitions for Mechanical Testing. |

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| 14. ASTM A435 | Ultrasonic Examination of Steel Plates. |
| 15. AWS | Welding Handbook. |
| 16. NACE MR 01 75 | Sulphide Stress Cracking Resistant Metallic Materials for Oil field Equipment. |

UNITS

Dimensions shall be in mm and be related to the Platform datums or reference lines.

SI units shall be used, with the sole exception of pressure, for which kg/cm² shall be used.

GENERAL REQUIREMENTS

General Requirement

Fabrication, installation and testing of pipe work shall conform to this Specification and ASME B31.3 and API RP 14E.

All equipment used, and materials used, are subject to inspection by the Company. The Company reserves the right to approve all material, tools and fabrication procedures, prior to Contractor's proceeding with the work.

Documentation

The contractor shall comply all the bid specifications. The Contractor shall provide the Company with all fabrication drawings; weld procedures and fabrication procedures for approval. Shop work shall not start until the relevant drawings and weld procedures are received & approved by the Company. Weld procedures shall be accompanied by a weld procedure index and weld map for each line.

After construction, the Contractor shall supply project isometric drawings and P&ID's annotated to show as built information i.e. any change made to the pipe work design during fabrication and installation.

The Contractor shall be responsible for compiling and handing over all material certificates, welder qualification certificates, weld records, signed inspection & test plans, mechanical clearance report, installation check lists, charts of weld heat treatments, test and inspection records applicable to the completed work.

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The contractor shall furnish these certificates/reports & relevant documents for company's review & approval.

MATERIALS

Material Identification

For all pressure parts material certification shall be traceable to heat numbers. Certificates, including all material certificates, fully catalogued and NDT test records, mechanical test certificates, welding qualification certificates, heat treatment certificates and hydrostatic test certificates shall be available at final inspection and for counter signature by the certification authority and stored by the Contractor for a minimum of 5 years after acceptance of the pipe work by the Company. Pressure retaining parts shall be clearly marked to allow verification of traciability. Double blue stripes shall be marked for NACE material for clear identification & traciability.

The contractor shall provide one set the hard copies for approved drawings/documents & materials for all pipes, fittings, valves, flanges, piping specialties & vessels documents to the piping engineer designated for the project in additions to the company's project requirement. The contractor shall submit the "ORIGINALS" on demand by company to verify the duplicate (Xerox) copies for test certificates review. On placement of order, the manufacturer/mill shall carry out all the production tests as indicated in relevant clauses of piping design criteria & project specification of piping design and submit reports to Company for review and approval. All test certificates & relevant documents shall be properly bound & submitted to company for review. Loose certificates & relevant documents submission is not considered acceptable. The test reports shall be submitted to Company before dispatch of material from the mill. The approved certificates from company shall be submitted to the piping engineer of company at fabrication site.

Support and Miscellaneous

Any material shall not be welded directly on process piping. If situation arises then prior approval of Company shall be sought during detail Engineering & shall note that the material welded directly to pressure retaining pipe work shall be of similar quality as the pipe work, including impact requirements, if any, for a length measured from the vessel wall of at least 150 mm. The material of such items

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beyond this point may be structural quality A283 Gr. C. or equal/superior (contractor to substantiate with sufficient information & documentary evidence).

FABRICATION

General

Piping shall be fabricated in accordance with the requirements of this Specification, with the piping codes and standards specified herein and under the individual material specification classes.

Piping design drawings and isometrics shall govern dimensions and materials.

The requirements of this specification shall apply to shop and field fabrication and to piping within packaged units.

Piping shall be prefabricated to the most practical extent to minimize offshore fabrication or installation.

Galvanized pipe shall not be bent or welded. Any such piping requiring bending, welding or threading shall be galvanized after fabrication.

Flanging & Bolting

Flange bolt holes shall straddle the established horizontal and vertical centerlines of the pipe except where connecting to equipment dictates otherwise and any deviation shall be shown on the piping design drawings and/or isometrics.

Company approved lubricants such as colloidal molybdenum disulphide shall be applied to all flange bolts before the joints are assembled.

Flange bolts shall be tightened evenly and sequentially to impose equal pressure on the gasket and to avoid distortion or overstressing of equipment (As per Contractor's recommendations).

Bolts in gaseous hydrocarbon service and liquid service over ANSI 150# rating shall be torque-checked.

Flange make up shall be made with clean new gaskets. The used gasket sealing compounds or sealing agents is prohibited except for anti-stick release agent.

Prior to installation, stud bolts shall be smeared with API thread compound containing molybdenum disulphide, on that portion of the stud bolt, which will be in the holes of the flanges and under the nut. Bolts shall be progressively

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tightened to full bolt torque using sequence tightening as per the gasket manufacturer's recommendation.

Threaded & Socket Weld Piping

Threads shall be concentric with outside of pipe, per ASME B 31.3, tapped and cleaned out.

The inside of each pipe spool shall be deburred by Reaming.

Threaded connections shall be gauge checked or chased after welding or galvanizing.

When socket weld fittings are used, pipe shall be spaced approximately 1.5 mm away from the "bottom" of the socket.

Threaded joints, which are not to be seal welded shall be thoroughly cleaned, and the male threads coated with sealant.

Sealant shall be Company approved.

Seal welding is required as follows:

1. All services where subject to vibrations (such as lines to/from reciprocating compressors, pumps, etc.), Hydrocarbons or other flammables, all pyrophoric, toxic, lethal and glycol services.
2. Seal welding of threaded connections, when specified, shall include the first block valve, cover all threads and be done with electrodes not to exceed 3 mm in diameter.
3. Thermo wells shall not be seal welded.
4. Seal welded and threaded piping shall not be substituted for socket weld piping connections without prior written approval by the Company.
5. Immediately before erection of piping, all threads of the pipe and fittings shall be thoroughly cleaned of cuttings, dirt, oil and any other foreign matter. The male threads shall be coated with thread sealant and the piping made up sufficiently for the threads to full thread engagement.
6. Threaded connections shall be protected from oxidation during heat treatment and be gauge checked after welding or heat treatment.

Brazed Piping

Brazing temperatures shall be achieved as quickly as possible using a suitably sized torch.

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The inside of brazed fittings and the outside of the associated tube shall be cleaned with sand paper. Flux paste is to be evenly spread over the joint.

Pipe Support

Piping shall be suitably supported to prevent sagging, mechanical stresses and vibrations, while allowing for thermal and structural movement. Piping shall generally be fastened to pipe racks with hot dip galvanized or cadmium plated U bolts and double nuts.

All pipes in hazardous service shall have 10 mm thick wear pads between the pipe and the support when the pipe would otherwise be resting directly on the support steel.

In locations where potentially severe vibration can occur, such as near control valves, pressure relief valves, pumps, compressors, and in high velocity streams all small branch connections shall be braced by means of welded gussets or brackets in two (2) planes.

Valves

Consideration shall be made for removal or withdrawal of valves or part of valves for maintenance.

Penetrations

Final location and dimensional checks of the pipe penetrations are the responsibility of the Contractor.

Deck or skid penetrations shall provide a minimum of 25 mm radial clearances around the piping.

All open deck drain cups shall be properly covered with suitable hinged caps in order to restrict the blockage due debris and unwanted mud / dirt.

Piping at Equipment

Piping at equipment shall be arranged so the equipment can be removed without the need to dismantle the equipment, adjacent equipment or piping.

Equipment will not be used to anchor piping. Forces transmitted to equipment at tie-in points will be within the recommended limits.

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Piping connected to rotating equipment shall be supported to minimize the transmission of vibrations from the machines.

Piping connections to exchangers shall be properly aligned to allow for hot & cold service and to limit the stress on exchanger nozzles to be within allowable levels.

Piping at pumps shall be supported so that equipment can be dismantled or removed with a minimum number of temporary supports and without dismantling valves and piping other than the spool that connects to the pump.

Clearances shall permit installation of blind flanges against block valves when the service is hazardous and the removal of the pump impeller without removing the pump. Where reducers are required on suction lines, they shall be eccentric and installed flat side up.

Valves shall be located as close as possible to the pump nozzles as practical. Isolation valves on pump suction lines shall be full-bore ball type. Isolation valves on discharge lines shall be located downstream of check valves.

Pump suction lines in which vapors may be present shall be inclined with sufficient slopes.

Fuel gas piping within the turbine enclosure shall be subject to strict control with respect to the number and type of flanged joints, fully welded being preferred.

All piping connected to diesel engines shall be arranged in such a manner that adequate flexibility is maintained so as to effectively isolate the piping from any engine vibration. Piping shall not be routed directly over diesel engines. Fuel lines shall not be run over exhaust piping or any location where leaks would cause fuel to impinge on to hot surfaces.

Piping at Instruments

Thermometer and thermocouple well connections, as well as vents and drains, shall be tapped after welding or stress relieving operations, using a plug tap. Verification gauges shall be used to prove the suitability of the threads and adequacy of instrument fitting-clearance.

TOLERANCES

Flange alignment for piping connected to rotating machinery must not cause machine-to-driver misalignment to exceed the equipment manufacturer's tolerances.