
	<b>DESIGN DIVISION</b> Engineering Services  ISO-9001:2000	<b>FUNCTIONAL SPECIFICATION FOR PIPING FABRICATION AND INSTALLATION</b>																		
			<b>Spec No. 2004B</b>																	
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<div>1. INTRODUCTION</div> <div>1.1 GENERAL</div> <p>This specification gives the general requirements for the fabrication, installation, inspection and testing of piping materials, fittings and valves for this project.</p> <p>This specification covers all pipe work pertaining to this project except the following:</p> <p>Heating, ventilating, air and water pipe work serving non-process areas.</p> <p>Instrument piping downstream of the last piping block valve, as normally defined on the approved P&amp;ID's.</p> <div>1.2 APPLICATION OF THIS DOCUMENT</div> <p>The scope of this document is limited to piping, piping components &amp; vessels fabrication of this project. This document shall not be used for any other purpose.</p> <div>1.3 CONTRACTOR'S RESPONSIBILITIES</div> <p>The Contractor shall be responsible for the complete design, manufacture, supply, inspection and testing, including full compliance with all applicable design codes and standards, including those listed in Section 2.0 of this specification.</p> <div>1.4 SUB-CONTRACTORS</div> <p>Approval shall be obtained from the Company before any work is subcontracted.</p>				
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<div>2. CODES AND STANDARDS</div> <div>2.1 CODES, STANDARDS AND REGULATIONS</div> <p>The production piping shall be designed, manufactured and tested in accordance with the requirements of this specification, and the latest edition of the following Codes, Standards and Statutory Regulations (where applicable):</p> <table><tr><td>1</td><td>API RP 14E</td><td>Recommended Practice for Design &amp; Installation of Offshore Production Platform Piping.</td></tr><tr><td>2</td><td>ASME VIII Division 1</td><td>Pressure Vessels and Boiler Code.</td></tr><tr><td>3</td><td>ASME II Part A</td><td>Materials – Ferrous Materials Specifications.</td></tr><tr><td>4</td><td>ASME V</td><td>Non-Destructive Examination.</td></tr><tr><td>5</td><td>ASME IX</td><td>Welding and Brazing Qualifications.</td></tr><tr><td>6</td><td>ASME B1.20.1</td><td>Pipe Threads, General Purpose (Inch).</td></tr><tr><td>7</td><td>ASME B16.20</td><td>Metallic Gaskets for Pipe Flanges.</td></tr><tr><td>8</td><td>ASME B31.3</td><td>Chemical Plant and Petroleum Refinery Piping Code.</td></tr><tr><td>9</td><td>ASME B31.4</td><td>Oil Transportation Piping.</td></tr><tr><td>10</td><td>ASME B31.8</td><td>Gas Transmission and Distribution Piping.</td></tr><tr><td>11</td><td>ASME B16.25</td><td>Butt Weld Ends for Pipes, Valves, Flanges &amp; Fittings.</td></tr><tr><td>12</td><td>ASTM A283</td><td>Carbon steel Plates.</td></tr><tr><td>13</td><td>ASTM A370</td><td>Standard Test Methods &amp; Definitions for Mechanical Testing.</td></tr><tr><td>14</td><td>ASTM A435</td><td>Ultrasonic Examination of Steel Plates.</td></tr></table>				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.	14	ASTM A435	Ultrasonic Examination of Steel Plates.
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15	AWS	Welding Handbook.
16	NACE MR 01 75	Sulphide Stress Cracking Resistant Metallic Materials for Oil field Equipment.

In addition to above refer the codes and standards specified in Cl.2 of Piping Design Criteria.

### 2.2 PROJECT SPECIFICATIONS


The piping specifications covered by this specification shall be designed, manufactured and tested in accordance with the requirements of these Project Specifications:

Spec. 2004-A	Piping Design
Spec. 2004-C	Pressure Vessels
Spec. 2004-D	Piping specialties
Spec. 2005	Protective Coatings
Spec. 2006	Piping insulations
Spec.2009F	Welding & NDT


### 2.3 MANDATORY INDIAN STATUTORY REQUIREMENTS


This documents has been prepared to the International Standards detailed within. The EPC Contractor shall ensure that the Scope of Work is executed in accordance with all mandatory Indian Statutory requirements.


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<div>3. SCOPE OF WORK</div> <div>3.1 GENERAL</div> <p>The Contractor shall be responsible for supply of materials, fabrication, coating, installation testing and insulation of the pipe work, all sub-contractor coordination and guarantees as required and provision of certificates, quality control records and as-built drawings, not withstanding any omissions from this specification.</p> <p>This specification covers all pipe work on this project except Heating &amp; ventilating areas and Instrument piping downstream of the last piping block valve, as defined on the approved P&amp;IDs.</p> <div>3.2 SCOPE OF SUPPLY</div> <p>The Contractor shall provide and install the entire pipe work shown on the Project approved P&amp;IDs outside package boundaries, including the necessary supports, connections, valves, a packaging and nozzle protection required.</p> <p>The Contractor shall furnish all labour, materials and equipment necessary to perform the piping fabrication and installation.</p> <p>The Contractor shall also supply the documentation required by this specification.</p> <div>4. ENVIRONMENTAL DESIGN CRITERIA AND UTILITIES</div> <div>4.1 BASIC CLIMATIC CONDITIONS</div> <p>Refer clause no. 2 of piping design (Spec. no. 2004A)</p> <div>4.2 SEISMIC AND TRANSPORTATION LOADS</div> <p>Refer clause no. 2 of piping design (Spec. no. 2004A)</p>			
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<div>5. GENERAL REQUIREMENTS</div> <div>5.1 GENERAL REQUIREMENT</div> <p>Fabrication, installation and testing of pipe work shall conform to this Specification and ASME B31.3 and API RP 14E.</p> <p>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.</p> <div>5.2 WELDING REQUIREMENT</div> <p>Welding shall be as per spec. 2009F.</p> <div>5.3 DIMENSIONS</div> <p>Dimensions shall be in mm and be related to the Platform datums or reference lines.</p> <p>SI units shall be used, with the sole exception of pressure, for which kg/cm<sup>2</sup> shall be used.</p> <div>5.4 DOCUMENTATION</div> <p>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 &amp; approved by the Company. Weld procedures shall be accompanied by a weld procedure index and weld map for each line.</p> <p>After construction, the Contractor shall supply project isometric drawings and P&amp;ID’s annotated to show as built information i.e. any change made to the pipe work design during fabrication and installation.</p> <p>The Contractor shall be responsible for compiling and handing over all material certificates, welder qualification certificates, weld records, signed inspection &amp; test plans, mechanical clearance report, installation check lists, charts of weld heat treatments, test and inspection records applicable to the competed work.</p>				
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The contractor shall furnish these certificates/reports & relevant documents for company’s review & approval.				
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6.1 GENERAL SPECIFICATION				
Material shall comply with the Piping design criteria (Vol. II sec 3.3) and Project Specification for Piping Design, Spec. 2004 A.				
6.2 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.				
6.3 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 &				
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<p>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 beyond this point may be structural quality A283 Gr. C. or equal/superior (contractor to substantiate with sufficient information &amp; documentary evidence).</p>				
6.4	BOLTING	<p>Please refer to the Project Specification for Piping design criteria &amp; project specification of piping Design (Spec. 2004- A).</p>		
6.5	GASKETS	<p>Please refer to the Project Specification for Piping design criteria &amp; project specification of piping Design (Spec. 2004- A).</p>		
7.	FABRICATION			
7.1	GENERAL	<p>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.</p> <p>Piping design drawings and isometrics shall govern dimensions and materials.</p> <p>The requirements of this specification shall apply to shop and field fabrication and to piping within packaged units.</p> <p>Piping shall be prefabricated to the most practical extent to minimize offshore fabrication or installation.</p> <p>Galvanized pipe shall not be bent or welded. Any such piping requiring bending, welding or threading shall be galvanized after fabrication.</p>		
7.2	FLANGING & BOLTING	<p>Flange boltholes 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.</p>		
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<p>Company approved lubricants such as colloidal molybdenum disulphide shall be applied to all flange bolts before the joints are assembled.</p> <p>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).</p> <p>Bolts in gaseous hydrocarbon service and liquid service over ANSI 150# rating shall be torque-checked.</p> <p>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.</p> <p>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 tightened to full bolt torque using sequence tightening as per the gasket manufacturer’s recommendation.</p> <p><b>7.3      THREADED &amp; SOCKET WELD PIPING</b></p> <p>Threads shall be concentric with outside of pipe, per ASME B 31.3, tapped and cleaned out.</p> <p>The inside of each pipe spool shall be deburred by Reaming.</p> <p>Threaded connections shall be gauge checked or chased after welding or galvanizing.</p> <p>When socket weld fittings are used, pipe shall be spaced approximately 1.5 mm away from the “bottom” of the socket.</p> <p>Threaded joints, which are not to be seal welded shall be thoroughly cleaned, and the male threads coated with sealant.</p> <p>Sealant shall be Company approved.</p> <p>Seal welding is required as follows:</p>				
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<div>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.</div> <div>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.</div> <div>3. Thermo wells shall not be seal welded.</div> <div>4. Seal welded and threaded piping shall not be substituted for socket weld piping connections without prior written approval by the Company.</div> <div>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.</div> <div>6. Threaded connections shall be protected form oxidation during heat treatment and be gauge checked after welding or heat treatment.</div> <div>7.4BRAZED PIPING</div> <div>Brazing temperatures shall be achieved as quickly as possible using a suitably sized torch.</div> <div>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.</div> <div>7.5PIPE SUPPORT</div> <div>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.</div> <div>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.</div> <div>In locations where potentially severe vibration can occur, such as near control valves, pressure relief valves, pumps, compressors, and in high velocity streams,</div>				
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<p>all small branch connections shall be braced by means of welded gussets or brackets in two (2) planes.</p>				
7.6	VALVES			
<p>Consideration shall be made for removal or withdrawal of valves or part of valves for maintenance.</p>				
7.7	GRE PIPING SYSTEMS			
<p>Refer Cl. 7.17 of Piping design (Spec. no. 2004A)</p>				
7.8	PENETRATIONS			
<p>Final location and dimensional checks of the pipe penetrations are the responsibility of the Contractor.</p>				
<p>Deck or skid penetrations shall provide a minimum of 25 mm radial clearances around the piping.</p>				
<p>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.</p>				
7.9	PIPING AT EQUIPMENT			
<p>Piping at equipment shall be arranged so the equipment can be removed without the need to dismantle the equipment, adjacent equipment or piping.</p>				
<p>Equipment will not be used to anchor piping. Forces transmitted to equipment at tie-in points will be within the recommended limits.</p>				
<p>Piping connected to rotating equipment shall be supported to minimize the transmission of vibrations from the machines.</p>				
<p>Piping connections to exchangers shall be properly aligned to allow for hot &amp; cold service and to limit the stress on exchanger nozzles to be within allowable levels.</p>				
<p>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.</p>				
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<p>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.</p> <p>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.</p> <p>Pump suction lines in which vapors may be present shall be inclined with sufficient slopes.</p> <p>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.</p> <p>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.</p>				
<p><b>7.10 PIPING AT INSTRUMENTS</b></p> <p>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.</p>				
<p><b>8. TOLERANCES</b></p> <p>Dimensional tolerances at Annex. -1 shall apply to in-line items and connections or branches for other lines.</p> <p>Flange alignment for piping connected to rotating machinery must not cause machine-to-driver misalignment to exceed the equipment manufacturer’s tolerances.</p> <p>Tolerances may be exceeded to a maximum of 15 mm for items such as vents, drains, dummy support lengths, field supports and temperature and pressure connections where the deviation does not affect another line.</p>				
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<p>Material, which has been locally stress-relieved, shall be rechecked for tolerances in accordance with the drawings. Small residual deviations remaining after heat treatment may only be corrected by cold straightening. Hot straightening after heat treatment, except for non-pressure attachments, will not be approved.</p>				
<p>9. TESTING REQUIREMENTS</p>				
<p>9.1 PNEUMATIC TESTING</p> <p>Pneumatic checks of branch reinforcing pads shall be made on completion of the pipe spool and before hydrostatic testing. The air pressure used for this check shall not be greater than 1.75 kg/cm<sup>2</sup> nor less than 0.70 kg/cm<sup>2</sup>. Pressure shall be increased gradually and soap leak tests carried out on the outside welds of the pads, the inside welds between pads and pipes, as well as inside the branch pipes. Testing shall be witnessed by a Company representative.</p>				
<p>9.2 HYDROSTATIC TESTING</p> <p>Piping shall be hydrostatically pressure tested in accordance with ASME B 31.3 and this Specification where called for on the piping design isometric drawings. Workshop hydrostatic testing is not required the pipe is to be field-tested. Pressure test shall be performed to ASME B31.3.</p>				
<p>9.3 PREPARATION FOR TESTING</p> <p>The Contractor shall be responsible for properly preparing facilities for pressure testing.</p> <p>The Contractor shall review the drawings and piping to ensure that adequate temporary supports, vents, drains, and blinds (as necessary to allow testing) are provided to test the facility in accordance with this specification. The Contractor shall report to the Company the findings from this review.</p> <p>The Contractor shall provide all high points in the piping with vents and all low points with drains, regardless of whether or not they are specifically shown on the drawings.</p> <p>The Contractor shall prepare, for the purpose of the pressure tests, a procedure and schedule for testing all process and utility piping within the limits of their responsibilities. The procedure and schedule shall be presented to the Company</p>				
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<p>for approval at least sixty (60) days prior to the scheduled start of pressure tests. Such procedures shall include, but are not limited to, details of the following:</p> <ol style="list-style-type: none"><li>1. Mark-ups of piping and instrument diagrams (P&amp;IDs) showing the limits of piping and equipment to be included in each test.</li><li>2. Test media to be used.</li><li>3. Location of all isolation blinds, high point vents, low point drawings, and temporary piping supports.</li><li>4. Procedures for flushing lines including fill points and equipment to be removed for flushing.</li><li>5. Procedures for filling lines including addition of oxygen scavenger and bactericide in proper quantities.</li><li>6. Procedures for pressurization of the system, including the location of the injection points and specified test pressures.</li><li>7. The forms, which shall be used to record hydrostatic test data. In this form calibration details of gauges, chart, etc., shall be indicated.</li></ol> <p>The testing operations shall be conducted diligently, thoroughly, and in a safe workman-like manner in accordance with accepted piping testing practices &amp; codes.</p> <p>The Contractor shall correct any work by the Contractor, or existing conditions, which in the opinion of the Company are deemed to be unacceptable. The testing operations may not continue until the unsafe conditions have been corrected to the satisfaction of the Company. The Contractor shall not receive additional compensation for time lost due to unacceptable conditions.</p> <p>If testing is subcontracted, the Contractor shall provide an experienced supervisor who will be responsible for supervising testing operations.</p> <p>The Company, or the Company’s Representative, will witness and approve all tests.</p>				
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**9.3.1 MATERIALS AND EQUIPMENT**

The Contractor shall furnish all materials and equipment necessary to pressure test all piping. This includes, but is not limited to, pumps, compressors, valves, calibrated pressure gauges, thermometers and chart recorders, filters, plugs, blinds, caps, strainers, flanges, bolts, gasket, all piping incidental to the filling, flushing, transferring and disposing of the test medium, bactericides, oxygen scavengers, dyes (if required), and the test medium.

Prior to hydrotest, calibration certificates for pressure gauges, thermometer, chart recorder, etc., shall be submitted to the company for review. Further, these instruments shall be recalibrated in the presence of company during which calibration certificates for recalibration instruments like dead weight indicator, master gauges shall be submitted to the company for review.

The Contractor shall provide a suitable pressure-relieving device between the pressuring pump discharge nozzle and the fill point, calibrated to prevent excess pressure in any of the piping and equipment being tested.

**9.3.2 PRE-TEST FLUSHING**

Prior to commencing any flushing, the Contractor shall verify that all required non-destructive testing (NDT) such as radiography, ultrasonic, etc, has been completed.

The Contractor shall also verify that all required post-weld heat-treating has been completed.

Upon verification of the above requirements, Company’s Representative shall authorize in writing the Contractor to proceed with flushing.


All completed piping systems shall be flushed prior to testing.


All lines DN50 (2”) and larger, other than instrument and utility air, shall be flushed with potable water so as to completely clean them of any loose mill scale, rust, or various extraneous materials.


All lines smaller than DN50, and air lines of any size, shall be cleaned out in like manner using compressed air.


The flushing shall be done at a high a velocity as practical (minimum of 1.5 m/sec.) in order to flush out any loose material in the line.


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<p>Flanges shall be opened and spool pieces shall be removed as necessary to flush the piping thoroughly.</p> <p>Flushing shall be performed until a clear stream of flushing medium exits the piping, with minimum flush volume being equal to five (5) times the volume of the piping being flushed.</p> <p>All flushing shall be done in the presence of the Company’s Representative.</p> <p>Orifice plates, thermo wells, flow straightening vanes, positive displacement (PD) and turbine meters and other vulnerable equipment, if already installed, shall be removed prior to flushing.</p> <p>All instrument leads shall be disconnected prior to flushing and shall remain disconnected during pressure test.</p> <p>All control valves shall be removed.</p> <p>Spring type supports shall have stops installed to prevent overloading of the support.</p> <p>All vessels included within a piping system being flushed are to be filled and drained through the vessel drain system.</p> <p>All check valve clappers shall be removed in the presence of the Company’s Representative and attached to the outer body of the valve for the test duration.</p> <p><b>9.3.3 PIPING ACCESSORIES &amp; EQUIPMENT EXCLUDED FROM HYDROSTATIC TESTING</b></p> <p>The following piping accessories and equipment shall be excluded or isolated from hydrostatic testing of piping:</p> <ol style="list-style-type: none"><li>1. Rotating machinery, pumps, compressors, etc.</li><li>2. Strainers and filters.</li><li>3. Pressure-relieving devices such as pressure relief valves and rupture disc.</li><li>5. All instruments, including level controllers and gauge glasses.</li><li>6. Pressure gauges.</li></ol>				
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<div>7. Expansion joints.</div> <div>8. Flow nozzles.</div> <div>9. Control valves.</div> <div>10. Corrosion probes.</div> <div>11. Orifice plates, thermo wells, flow straightening vanes and instrumentation such as positive displacement (PD) and turbine meters, corrosion probes, displacement-type level instruments, carioles flow meters.</div> <div>12. Any other piping such as open drain lines, atmospheric vents, etc., or equipment designated by the Company.</div> <div>9.4 TEST FLUID</div> <div>Except as otherwise specified, all piping shall be hydrostatically tested with water. The hydro test water shall be clean and free from suspended matter. The hydro test water may be analyzed by the Company to determine its suitability for use in the testing operations.</div> <div>The hydro test water temperature shall be within 7°C - 25°C.</div> <div>Suspended matter in the hydro test water shall be removed before injection into the piping by a filter capable of removing 99% of all particles 92 microns in diameter and larger, or equivalent to using a 100 x 100 wire-mesh screen.</div> <div>If foreign material is pumped into the piping, the Contractor shall again flush the line with clean water.</div> <div>Only potable water shall be used in piping systems containing stainless steel components. No seawater can be used in these line tests. The lines shall be drained immediately after tests.</div> <div>When air is specified as the testing medium, the air shall have a maximum dew point of -7°C.</div> <div>Water used for hydrostatic testing shall be clean and contain corrosion inhibitors in the concentrations recommended by the Manufacturers. The Contractor is required to verify with the chemical contractor, current requirements regarding proper disposal procedures for the chemically inhibited test water.</div>				
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<p>Potable water used to hydrostatically test piping or vessels fabricated from, or containing parts of austenitic stainless steel, ferritic stainless or high nickel alloy, shall be free from undissolved solids and have less than 200-ppm chlorides. The system shall be flushed after testing.</p> <p>Instrument airlines and utility airlines shall be tested with compressed air of instrument quality.</p> <p>Testing of vessels or other equipment with air shall not be allowed except by written Company approval.</p> <p><b>9.5 HYDROSTATIC PRESSURE TEST</b></p> <p>The Contractor shall hydrostatically test piping, vessels and equipment for which he has fabrication or installation responsibility. Hydrostatic pressure testing of piping and piping systems shall be in accordance with ASME B31.3.</p> <p>Piping and vessel test pressures and the Hydro test schedules shall be provided by the Contractor in accordance with this Specification.</p> <p>Upon verification of the pre-flushing requirements, the Company's Representative shall authorize the Contractor to proceed with pressure testing.</p> <p>Hydrostatic testing may be performed for completed systems or for individual components of the system, as approved by the Company.</p> <p>The lines shall be drained immediately after tests.</p> <p>Vents shall be open during test water filling so that air is vented prior to applying pressure to the system. Vents shall then be closed to permit pressurization.</p> <p>Hydrostatic testing shall not be done against closed valves. Where it is impractical to hydrostatically test through a valve, that the valve shall be isolated by blinds or disconnected from the piping system.</p> <p>The hydrostatic test pressure for each section tested shall be contained by suitably placed spectacle blinds, spades, skillets, blank insert chokes, blind flanges or other means of positive closure. The Contractor's test procedures shall indicate the thickness of blinds to be used for isolation during hydrostatic tests.</p>				
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<p>Hydrostatic test pressure connections shall be on the upstream side of check valves.</p> <p>Thermo wells shall be included in hydrostatic tests.</p> <p>All hydrostatic pressure tests will be recorded on a two-pen recorder (24-hour chart type) with a range suitable for recording the test pressure. The second pen shall be used to record the ambient temperature.</p> <p>Hydrostatic test pressure shall be achieved and relieved gradually so as to allow sufficient time for pressure equalization throughout system under test.</p> <p>Hydrostatic test pressure shall be maintained for a minimum of two hours duration.</p> <p>Hydrostatic test pressure readings shall be taken from the test gauge at fifteen (15) minute intervals during the test, and recorded on form provided by the Contractor.</p> <p>During hydrostatic pressure test, the test medium may be subject to thermal expansion.</p> <p>The Contractor shall take proper precautions to avoid excessive pressure caused by thermal expansion.</p> <p>The Company’s inspectors will begin a visual examination of each joint after the hydrostatic test pressure has been maintained for thirty (30) minutes.</p> <p>After completion of hydrostatic test, the pressure shall be reduced to the design pressure and all valves including check valves in the section of the line shall be tested by being closed for ten (10) minutes with pressure contained by specific valve at one end to determine whether each valve is in turn positively shutting off and holding pressure.</p> <p>Hydrostatic test [pressure shall be removed only with the permission of the Company’s representative.</p> <p>All joints, including welds, are to be left un-insulated and exposed during the hydrostatic test.</p> <p>Only hydrostatic tests with ending pressures equal to or above starting pressure will be accepted.</p>				
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<p>The Contractor shall schedule hydrostatic tests for that portion of the day when thermal contraction will not result in ending pressures lower than starting pressure.</p> <p>Hydrostatic pressure tests on each major section of piping shall be carried out with all pressure relief valves removed and their respective nozzles or connections blinded off or plugged.</p> <p>Upon completion of piping or vessel hydrostatic tests, pressure relief valves shall be reinstalled in each system.</p> <p>Drain, instrument, relief, and blow-down lines are to be air and soap bubble tested at 1.76 kg/cm<sup>2</sup> unless otherwise noted.</p> <p><b>9.3.6 AFTER-TEST FLUSHING, DRAINING, DRYING &amp; REINSTATEMENT</b></p> <p>Piping and equipment fabricated from or containing parts of austenitic or ferritic stainless steels, or high nickel alloy shall, immediately after hydrostatic test completion, be drained and then flushed with distilled or demineralised water.</p> <p>Piping and equipment that are not fabricated from or do not contain parts of austenitic steel, ferritic stainless steel, or high nickel alloy may be hydrostatically tested with inhibited sea water, per this specification, provided the system is, immediately after testing, drained of all seawater and then flushed with potable water.</p> <p>Potable water so used for flushing shall be subject to analysis and approval by the Company and shall be treated per this specification.</p> <p>All after-test flushing shall be performed so that all pipe surfaces previously wetted during the pressure test are flushed.</p> <p>All piping shall be thoroughly dried.</p> <p>The piping, equipment and instrumentation shall be reinstated.</p> <p><b>9.3.7 HYDROSTATIC TEST RECORDS</b></p> <p>The Contractor shall provide all hydrostatic test recording instruments with all necessary supplies, and shall maintain accurate and permanent records. The</p>				
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<p>hydrostatic testing and pressure recording equipment shall be subject to the written approval of the Company.</p> <p>All hydrostatic pressure test records, data, and charts shall be clearly marked with the following information and furnished to the Company:</p> <ol style="list-style-type: none"><li>1. The Company name and authorized representative.</li><li>2. The hydrostatic testing Contractor’s name and authorized representative.</li><li>3. Line identification of piping and/or equipment tested.</li><li>4. Date, start time, and stop time of hydrostatic test.</li><li>5. Hydrostatic test pressure and duration.</li><li>6. Hydrostatic test medium used.</li><li>7. Post-test flushing medium used and its source.</li><li>8. Ambient air temperature.</li><li>9. The recorder element range.</li><li>10. Explanation of any hydrostatic pressure discontinuities that may appear on the chart.</li><li>11. Listing of items excluded from the hydrostatics test.</li><li>12. Marked up P&amp;IDs depicting valves, which passed and failed their respective service test.</li><li>13. Signature of the Company’s and the testing Contractor’s authorized representative.</li></ol> <p><b>9.3.8 RE-TESTING</b></p> <p>Should piping failure occur during hydrostatic testing, the Contractor shall locate the failure, for repair purposes.</p> <p>The Contractor shall, at their expense, repair all defects resulting from inferior workmanship or defective materials furnished by the Contractor.</p> <p>After repairs have been made and after the items have been removed, the Contractor shall perform a new hydrostatic test until a successful test result is obtained to the satisfaction of the Company’s Representative.</p>				
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<p>The Contractor shall then clean and dry the piping including the reinstatement of the items and produce the records.</p>				
9.3.9	COMPLETION OF HYDROSTATIC PRESSURE TESTS			
<p>Upon completion of all hydrostatic tests, the Contractor or Sub-Contractor shall:</p>				
<p>Dispose of all hydrostatic test medium to a location designated by the Company, exercising proper caution to avoid accidental creation of a vacuum during draining of water from equipment and piping.</p>				
<p>Restore any equipment excluded from hydrostatic tests to a fully operational condition.</p>				
<p>Remove all temporary facilities installed by the Contractor, including temporary supports and bracing.</p>				
<p>Remove and temporary plugs or blinds.</p>				
<p>Replace any used gaskets or damaged nuts and bolts.</p>				
<p>Air purges all piping and equipment, unless specifically deleted by the Company in writing, to remove low-point pockets of water. This air purging shall be preformed in the presence of the Company’s Representative and last a minimum of thirty (30) minutes.</p>				
<p>Re-torque all flange bolts on flanges in hydrocarbon service with bolts 25 mm (1”) or larger and all flanges in gas services over ANSI-150# which were remade after hydrostatic testing. These must be re-torque to their stated torque valves in the presence of a Company Inspector.</p>				
9.3.10	FINAL PIPING SYSTEM LEAK TEST			
<p>The Piping System Leak Test is the final pressure test, used to prove the integrity of the installed flanged and threaded joints and connections of piping and equipment systems. It shall be designed to demonstrate that the process and utility piping systems are properly prepared to operate at their specified design pressure.</p>				
<p>The leak test shall be performed after the final accepted hydrostatic tests, upon completion of final assembly and prior to startup.</p>				
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<p>The Contractor shall submit a detailed written procedure describing the complete piping system leak test for Company approval. The piping systems shall each be pressurized to 1 kg/cm<sup>2</sup>. The test may be carried out using either the bubble or acoustic emission methods, or a combination of both. Piping system leak testing shall be done only to the approved procedure and with the Company monitoring personnel present.</p> <p>The piping system leak test shall be performed on all completed systems, including equipment that may have been previously tested by the Contractor or Contractors.</p> <p>All valves, control valves, filters, strainers, turbine meters, PD meters, flow nozzles, level gauges, level switches, level controls, rupture disks, pressure relief valves, and pressure gauges shall be included in the piping system leak test. Some instruments or equipment may be excluded from the piping system leak test at the Company's discretion.</p> <p>The inert atmosphere remaining following the piping system leak testing is intended to eliminate the need for further pre-startup inerting of piping equipment.</p> <p><b>10. IDENTIFICATION &amp; RELEASE FOR DELIVERY</b></p> <p>Piece marking of prefabricated piping for identification during installation shall be the responsibility of the Contractor.</p> <p>Piece marks shall bear the line number with a suffix painted or tagged on each piece.</p> <p>After inspection, testing of piping and application of protective coating, identification numbers shall be stenciled in several places along with length of the spool.</p> <p>Marking paint or ink containing harmful metal salts such as zinc, lead or copper shall NOT be used to mark alloy, stress relieved or Charpy test materials.</p> <p>Stamping of identification on pipe or flanges is not permitted.</p>				
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11.

INSTALLATION

Piping shall be installed in accordance with the piping drawings.

Piping installation includes the supply and installation of supports shown in the drawings and piping schedules together with those supports necessary to adequately and properly secure the piping.

All lines shall be installed true and plumb except where specifically noted on the drawings.

Installation of piping shall be scheduled so that no undue strain will be inflicted on equipment due to lack of support, dead weight or misalignment.

Piping shall be made, broken, and re-made at all rotating equipment connecting points, with alignment checks made with and without pipe in order to prove piping does not affect alignment.

Flange bolts shall be tightened evenly and sequentially to avoid distortion or overstressing of equipment.

If any piping does not meet alignment checks, the Contractor shall cut and refit that pipe.

In special cases, when approved by the Company, heating and stress relieving of the pipe may be allowed to make final fit-up.

No heating or bending may be done except by the using Company approved procedures.


Pipe shall be installed beginning at the equipment connection then moving away as the piping is assembled.


Where required, field welds shall be used when installing pipe to equipment.


Field modification of prefabricated piping shall be performed in strict accordance with this specification and the applicable codes, standard or recommended practice.

All weld burrs and all foreign matter shall be removed from the piping prior to closure.

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<p>Field fabricated carbon steel seal oil and lube oil piping shall be “pickled” in accordance with this specification.</p> <p>Construction supports required during installation shall be provided by the Contractor and shall be clearly marked by the Contractor for removal before commissioning.</p> <p>At all times when piping fabrication or installation is not in progress and at other times when openings in pipe work are not required to be left exposed, they shall be protected against entry of foreign matter by reinstalling shipping protector caps and covers or other suitable means.</p> <p>Tack welded fit-ups lacking a completed root pass at the cessation of a work period shall be covered at the seam with polyethylene tape.</p> <p>Before installing pre-fabricated piping, the inside of the pipe shall be inspected by the Contractor to ensure that all foreign matter has been removed.</p> <p>Austenitic stainless steel pipe and fittings and all valves and special items shall be stored out of contact with the ground. Valves and special items shall also be covered to prevent entry of moisture or foreign matter.</p> <p>The Contractor shall take all possible care to avoid contamination of stainless steel materials. Stainless steel materials shall be lifted with nylon or other approved slings, which are free from dirt or ferritic particles. Under no circumstances shall chains or wire ropes be used.</p> <p>Shoes and cradles shall preferably be located and attached to the pipe work after the line has been installed. They may be attached to pipes prior to installation provided that when the pipe is installed the shoes and cradles are central over the pipe supports.</p> <p>To prevent damage to valve seal and seat surfaces, valves, when installed, shall be, and shall be left in, the following open/close positions:</p> <p>Ball and plug valves        -        fully open</p> <p>Globe and gate valves        -        fully closed.</p> <p>Piping shall not be connected to a valve of any description unless the joints can be made without inducing stress in either the valve or the pipe work.</p>				
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<p>Temporary strainers, slip-plates, blind flanges and the like shall be properly installed in the location manner and orientation shown in the drawings.</p>				
12.	<p><b>CLEANING</b></p> <p>After installation, each pipeline shall be thoroughly cleaned to remove all moisture and loose scale, sand, paint and any other foreign matter.</p> <p>Special cleaning procedures may be required for specific services. Particular care shall be taken to ensure that lines downstream of the dehydration system are thoroughly internally dried.</p> <p>After fabrication and cleaning, assembly ends shall be protected for handling and shipment.</p> <p>If the pipe is not immediately installed and is to be stored or barged to the platforms, all ends and opening shall be sealed in a suitable and approved method so as to prevent the entrance of moisture, dirt or other foreign matter.</p> <p>The Contractor shall furnish all materials for field flushing, cleaning or protection during shipment and handling.</p>			
13.	<p><b>PROTECTIVE COATING</b></p> <p>Painting, protective coatings and the procedures used for the preparation of surfaces shall be specified in the Project Specification for Protective Coatings (Spec. 2005).</p> <p>Piping shall be insulated where indicated on drawings. The piping to be insulated shall be grit blasted and given one coat of primer only then insulation applied per the Project Specification (Spec. 2006), Insulation of Piping &amp; Equipment.</p> <p>During fabrication, sandblasting, painting and installation, care shall be exercised to keep blast grit, dirt and other debris out of piping systems, instruments, and equipment. The interior of piping systems shall be thoroughly cleaned by the Contractor prior to assembly and after blasting/coating is completed.</p> <p>Flanges shall be painted on the flange edges, inside boltholes, and up to the gasket surface.</p>			
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<p>The Contractor shall be responsible for painting and/or insulation will also be responsible for cleanup after their respective work is completed. The Company will inspect/examine all such work and then provide a written acceptance prior to release of Contractor.</p>				
<p>14. SHIPPING &amp; HANDLING</p> <p>Protection for pipe, fitting and valve openings shall be applied after inspection as follows:</p> <p>Flange faces (gasket contact surfaces) shall be adequately protected by coating with a removable rust preventive and attaching a bolted or steel strapped 20 mm thick wooden or metal blank. Unpainted steel blanks shall not be used where rust would discolors the coated surface of skid-assembled components. Gasket contact surfaces shall not be painted. If the surface is painted, it shall be restored to its original specification condition before application of protection.</p> <p>Threaded connections shall be closed with a steel pipe plug.</p> <p>Beveled ends shall be closed with metal or a plastic covers.</p> <p>Each spool piece shall be clearly marked on both ends with the line number. Marking shall withstand exposure during shipping.</p> <p>Extra protection from impact shall be provided for Cu-Ni / GRE pipe.</p>				
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ANNEXURE - 1

1. +/- 3mm MAX. FROM INDICATED DIMENSIONS FOR FACE TO FACE, CENTER TO FACE LOCATION OF ATTACHMENTS ETC.

2. 10% MAX. FOR INTERNAL PRESSUER 3% MAX FOR EXTERNAL PRESSURE FLATTENING MEASURED AS DIFFERENCE BETWEEN THE MAXIMUM AND MINIMUM O.D. AT ANY CROSS SECTION.

3. +/- 3mm MAX. LATERAL TRANSLATION OF BRANCHES OR CONNECTIONS.

4. +/- 1.5 mm MAX. ROTATION OF FLANGES FROM THE INDICATED POSITION, MEASURED AS SHOWN.

5. 0.5mm MAX. OUT OF ALIGNMENT OF FLANGES FROM THE INDICATED POSITION MEASURED ACROSS ANY DIAMETER.

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