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1.0

SCOPE

1.1

This specification covers the minimum requirements for manufacture and supply of carbon steel flanges and fittings to be installed in submarine pipeline systems transporting sour hydrocarbons in liquid or gaseous phase, in compliance to the requirements of NACE Standard MR-01-75 and Spec.2004 A of Piping Material of relevant class.

2.0

REFERENCE DOCUMENTS

Reference has been made in this specification to the latest edition of the following codes, standards and specifications:

a.

ANSI B 31.8

:

Gas Transmission and Distribution Piping Systems

b.

ANSI B 31.4

:

Liquid Petroleum Transportation Piping System.

c.

ANSI B 16.5

:

Steel Pipe Flanges and Flanged Fittings

d.

ANSI B 16.9

:

Factory-Made Wrought Steel Butt Welding Fittings.

e.

API 1104

:

Specification for Welding Pipeline and Related Facilities

f.

ASME Sec. VIII

:

Boiler and Pressure Vessel Code Rules for the Construction of Pressure Vessels.

g.

ASME Sec. IX

:

Boiler and Pressure Vessel Code Welding and Brazing qualifications.

h.

ASTM A 370

:

Mechanical Testing of Steel Products.

i.

MSS-SP-44

:

Steel Pipeline Flanges


j.


MSS-SP-75


:

Specification for High Test Wrought Welding Fittings.

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<p>k. DNV-1981 : Det Norske Veritas Rules for Submarine Pipelines.</p> <p>l. API 6H : End closures, connectors and swivels</p> <p>m. NACE TM-02-84 : Test Method Evaluation of Pipeline Steels for Resistance to Stepwise Cracking.</p> <p>n. NACE MR-01-75 : Material Requirements : Sulphide Stress Cracking Resistant Metallic Materials for Oil Field Equipments.</p> <p>o. MSS-SP-25 : Standard Marking System for valves, fittings, flanges and unions.</p> <p>In case of conflict between the requirements of this specification and the requirement of above referred documents, the requirement of this specification shall govern.</p> <p>3.0 MATERIALS</p> <p>3.1 Materials used in manufacture of flanges and fittings shall be as indicated in the Purchase Requisition or as per the Piping Spec. and Annex-I of Spec.2004.</p> <p>3.2 Fully killed carbon steel shall be used in the manufacturer of flanges and fittings.</p> <p>3.3(a) Chemical composition of each heat of carbon steel used, on check analysis shall be in accordance with the following requirements :</p> <table><tr><th>Element</th><th>Product Analysis (%)</th></tr><tr><td>Carbon</td><td>0.25 Max.</td></tr><tr><td>Manganese</td><td>As per relevant material code, subject to max. 1.40</td></tr><tr><td>Sulphur</td><td>0.01 Max.</td></tr><tr><td>Phosphorous</td><td>0.02 Max.</td></tr><tr><td>Nickel</td><td>0.20 Max.</td></tr></table>					Element	Product Analysis (%)	Carbon	0.25 Max.	Manganese	As per relevant material code, subject to max. 1.40	Sulphur	0.01 Max.	Phosphorous	0.02 Max.	Nickel	0.20 Max.
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<p>3.3(b) Each heat of steel used for the manufacturer of flanges and fittings shall have carbon equivalent not exceeding 0.40, based on check analysis, calculated as per the following formula:</p> $CE = C + \frac{Mn}{6} + \frac{Cr+Mo+V}{5} + \frac{Ni+Cu}{15}$ <p>3.4 Charpy V-notch test shall be conducted at 10°C for each heat of steel used in manufacture of flanges and fittings. Test procedure shall conform to ASTM A370 for flanges and MSS-SP-75 for all fittings.</p> <p>The average absorbed impact energy value of three specimens of base metal, weld metal and HAZ shall be 29 joules. Minimum impact value of any one specimen of the three specimens analysed as above shall not be less than 22 joules.</p> <p>In addition, the average shear area shall comply the requirements of MSS-SP-75.</p> <p>3.5 Transverse guided weld bend test shall be performed for each lot of welded fittings produced from same heat in accordance with the provisions of MSS-SP-75. The dimension “A” in guided bend test shall not exceed 4.0 times the nominal wall thickness and dimension “B” shall be equal to A + 2t + 3.2 mm. Where t is nominal thickness.</p> <p>3.6 One transverse weld tensile test shall be conducted on each heat/lot of welded fittings in accordance with the requirements of MSS-SP-75.</p> <p>3.7 The maximum hardness of the base material, weld metal and heat affected zone (HAZ) shall be 248 HV5. Hardness test shall be carried out for each heat of steel used.</p> <p>3.8 Heat treatment shall be carried out on all materials exposed to sour environment as per the requirements of NACE Standard MR-01-75.</p> <p>3.9 Hydrogen Induced Cracking (HIC) test shall be carried out on each heat of carbon steel used. HIC test shall be performed as per NACE Standard TM-02-84. The acceptance criteria for Crack Sensitivity Ratio (CSR) shall be 0.00%.</p>				
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4.0

DESIGN AND CONSTRUCTION

4.1

Flanges such as welding neck flanges and blind flanges shall conform to the requirements of ANSI B 16.5 for sizes ≤ 24” NB (excluding 22” NB) and MSS-SP-44 for 22” NB and 26” NB and above.

4.2

Fittings such as tees, elbows and reducers shall be seamless type for sizes ≤ 16” NB and shall be either welded or seamless type for sizes ≥ 18” NB. Fittings shall conform to MSS-SP-75.

4.3

Fittings not covered in MSS-SP-75, like weldolets, sockolets, nippolets, etc. shall be manufactured in accordance with manufacturer’s standard.

4.4

Type, face and face finish of flanges shall be as specified in Purchase Requisition.

4.5

Stub-in or pipe to pipe connection shall not be used in the manufacture of tees. Tees shall be manufactured by forging or extrusion methods. The longitudinal weld seam shall be kept at 90° from the extrusion. Fittings shall not have any circumferential joints.

4.6

All butt weld ends shall be beveled as per ANSI B 16.5/MSS-SP-44 as applicable for flanges and MSS-SP-75 for fittings.

4.7

The reinforcement of inside weld seam shall be removed for a distance of 100 mm from each end of the welded fittings.


4.8

All welds shall be made by welders and welding procedures qualified in accordance with the provisions of ASME Sec. IX. The procedure qualification shall include impact test for weld/heat affected zone, guided bend test, hardness test and HIC test and shall meet the requirements of clause 3.4, 3.5,3.7 and 3.9 of this specification, respectively.

4.9

Repair by welding on flanges and parent metal of the fittings is not allowed. Repair of weld seam by welding shall be carried out by the welders and welding procedures duly qualified as per ASME Section IX and records for each repair shall be maintained. Repair welding procedure qualification shall include all tests which are applicable for regular production welding procedure qualification.

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5.0

INSPECTION AND TESTS

5.1

The manufacturer shall perform all inspection and tests as per the requirements of this specification and the relevant codes, prior to shipment at is works. Such inspection and tests shall be, but not limited to, the following.

5.1.1

All flanges and fittings shall be visually inspected.

5.1.2

Dimensional check shall be carried out on finished products as per ANSI B 16.5/MSS-SP-44 as applicable for flanges and ANSI B 16.9/ MSS-SP-75 as applicable for fittings and as per this specification. Fittings not covered in MSS-SP-75 shall be checked as per Manufacturer’s Standard.

5.1.3

Chemical composition, mechanical properties shall be checked as per relevant material standards and this specification, for each heat of steel used.

5.1.4

The non-destructive inspection shall be carried out as given below:

a.

All butt and repair welds for welded fittings shall be examined 100% by radiography. Acceptance limits shall be as per API 1104.

b.

When elbows of size $\geq 18''$ NB are manufactured, the first elbow of each radius, diameter and wall thickness shall be ultrasonically checked for sufficient wall thickness in areas where a minimum wall thickness is to be expected. This shall be followed by random inspection of one out of every three elbows of the same radius, diameter and wall thickness.

c.

All finished wrought weld ends shall be 100% ultrasonically inspected for lamination type defects for a distance of 50 mm from the end. Laminations shall not be acceptable.


d.

Magnetic particle or liquid penetrant examination shall be performed on cold formed butt welding tees with extruded outlets, that are subjected to an extreme fiber elongation of greater than 5%. This test shall be carried out as per the Supplementary Requirement SR 3 of MSS-SP-75.

e.

Welds which cannot be inspected by radiographic methods shall be checked by ultrasonic or magnetic particle methods. Acceptance criteria shall be as per ASME Section VIII Appendix 12 and Appendix 6 respectively.

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5.2

Company’s Inspector reserves the right to perform stagewise inspection and witness tests, as indicated in Clause 5.1 of this specification at Manufacturer’s Work prior to shipment. Manufacturer shall give reasonable notice of time and shall provide without charge reasonable access and facilities required for inspection, to the Company’s Inspector.

Inspection and tests performed/witnessed by Company’s Inspector shall in no way relieve the Manufacturer’s obligation to perform the required inspection and tests.

6.0

TEST CERTIFICATES

Manufacturer shall furnish the following certificates:

a.

Test certificates relevant to the chemical composition and mechanical properties including hardness and HIC test of the materials used for manufacture of flanges and fittings and per relevant standards and this specification.

b.

Test Reports on radiography, ultrasonic inspection and magnetic particle examination.

c.

Test reports of heat treatment carried out as per this specification.

d.

Welding procedures and welders qualification reports.

e.

Test certificates for each fitting stating that it is capable of withstanding without leakage a test pressure which results in a hoop stress equivalent to 100% of the specified minimum yield strength for the pipe with which the fittings is to be attached without impairment of serviceability.


7.0


PAINTING, MARKING AND SHIPMENT

7.1

After all inspection and tests required have been carried out, all external surfaces shall be thoroughly cleaned to remove grease, dust and rust and shall be applied with standard mill coating for protection against corrosion during transit and storage. The coating shall be easily removable in the field. Manufacturer shall furnish the details of paint to be used at the time of bidding.

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<p>7.2 Ends of all fittings and weld neck flanges shall be suitably protected to avoid any damage during transit. Metallic or high impact plastic bevel protectors shall be provided for fittings and flanges. Flange face shall be suitably protected to avoid any damage during transit.</p> <p>7.3 All fittings and flanges shall be marked as per MSS-SP-25.</p> <p>7.4 Package shall be marked legibly with suitable marking ink to indicate the following:</p> <div><div>a.</div>Manufacturer’s Name</div> <div><div>b.</div>Type of flange(s) and fitting(s)</div> <div><div>c.</div>Nominal diameter and thickness</div> <div><div>d.</div>Material</div> <p>8.0 DOCUMENTATION</p> <p>8.1 Manufacturer shall furnish at the time of bidding, the following documents :</p> <div><div>a.</div>Reference list of similar supplies including, all relevant details viz. Project, Year, Client, Location, Size and Service in the last five years.</div> <div><div>b.</div>Record of successful proof test of fittings in compliance with the requirement of Clause 9.2 of this specification.</div> <div><div>c.</div>Brief description of the manufacturing, heat treatment and quality control facilities of the Manufacturer’s Works.</div> <div><div>d.</div>Clausewise list of deviations from this specification, if any.</div> <p>8.2 Within three weeks of placement of order, Manufacturer shall submit four copies of method of manufacture, testing and quality control procedure for raw material and finished product for Company’s approval.</p> <p>Once the approval has been given by Purchaser, any changes in design, material and method of manufacture shall be notified to the Purchaser, whose approval in writing of all changes shall be obtained before the flanges and fittings are manufactured.</p>				
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<p>8.3 Within four weeks from the approval date, Manufacturer shall submit six copies of all documents as listed in clause 8.2 of this specification.</p> <p>8.4 Prior to shipment, the Manufacturer shall submit six copies of the test certificates as listed in Clause 6.0 of this specification.</p> <p>8.5 All documents shall be in English Language only.</p> <p>9.0 MANUFACTURERS’ QUALIFICATIONS</p> <p>9.1 Manufacturer who intend bidding for flanges and fittings must submit the previous supply record including all relevant details as mentioned in clause 8.1 (a) of this specification, to establish that the flanges and fittings suitable for Sour Service requirements have been successfully supplied in the last five years. Manufacturer who has not supplied the flanges and fittings suitable for Sour Service in the last five years are not acceptable.</p> <p>9.2 Manufacturer who intend bidding for fittings must possess the records of a successful proof test, in accordance with the provisions of ANSI B 16.9/MSS-SP-75 as applicable. These records shall be submitted at the time of bidding, qualifying the entire range of fittings offered. Failure to submit such records shall cause rejection of the offer.</p>				
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