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SPECIFICATION

FOR

SUBSEA FLOW TEES


(SOUR SERVICE)


OIL AND NATURAL GAS CORPORATION LTD.

INDIA

RP	AKS	VKK	Reproduced from Rev. 0	10+3	13.03.06	0
KPV		VKK	ISSUED FOR BID	10 + 3	09.05.03	0
Prepared by	Reviewed by	Approved by	REMARKS	NO. OF PAGES	DATE	REV.

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1.0

SCOPE

1.1

This Specification covers the minimum requirements for Design, Manufacture and supply of carbon steel flow tees to be installed in submarine pipeline systems transporting sour hydrocarbons in liquid or gaseous phase.

2.0

REFERENCE DOCUMENTS

Reference has been made in this specification to the latest edition of the following Codes, Standards & Specifications:

a.

ASME B-31.8

:

Gas Transmission and Distribution piping Systems.

b.

ASME B-31.4

:

Liquid Petroleum Transportation Piping Systems.

c.

ANSI-B-16.9

:

Factory Made Wrought Steel Butt Welding Fittings.

d.

API-1104

:

Specification for Welding of Pipelines and Related Facilities.

e.

ASME-Sec. VIII

:

Boilers & Pressure Vessel Code Rules for the construction of Pressure Vessels.

f.

ASME-Sec. IX

:

Boilers & Pressure Vessel Code Welding and Brazing Qualifications

g.

ASTM-A370

:

Test Method and Definitions for Mechanical Testing of Steel Products.

h.

MSS-SP-75

:

Specification for High Test Wrought Welding Fittings.

i.

DNV-1981


:

Det Norske Veritas Rules for submarine pipeline.

j.

NACE Standard MR-01-75

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3.0

MATERIALS

3.1

All materials exposed to sour environment shall comply to the requirements of NACE Standard MR-01-75. All sour service material shall meet special testing viz. HIC (as per NACE MR 0177) and inclusion count check (as per ASTM E 45) Materials for the pressure containing parts of the flow tees shall be as indicated in the Data Sheet. Other components shall be as per Manufacturer's standard suitable for the service, which shall be subject to approval by Purchaser.

3.2

Each heat of steel used for the manufacture of pressure containing parts of the flow tees shall have carbon equivalent not exceeding 0.40, based on check analysis calculated as per the following formula:

CE = C +

Mn

6

+

Cr+Mo+V

5

+

Ni+Cu

15


3.3

Charpy V-notch test shall be conducted at 0°C for each heat of steel used in manufacture of pressure containing parts of the flow tees. Test procedure shall conform to MSS-SP-75.

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.

In addition, the average shear area shall comply the requirements of MSS-SP-75.

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3.4

Transverse guided weld bend test shall be performed 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.

3.5

One transverse weld tensile test shall be conducted on each heat / lot of welded fittings in accordance with the requirements of MSS-SP-75.

4.0

DESIGN AND CONSTRUCTION

4.1

Flow tees shall be designed and manufactured in accordance with the provisions of Codes and Standards referred in clause 2.0 of this specification. Design shall take into account the allowable stress level limits, design factor and corrosion allowance indicated in the Data Sheet.

4.2

Flow tees shall generally conform to the figure shown in the Data Sheet and shall meet the following requirements:

a.

An internal pipe having the same internal diameter of the connecting pipeline allowing the passage of scraper / instrumented pigs shall be provided with holes / slots located in the centre line of the branch. The holes shall be sized to prevent the pig getting stuck or damaged without affecting the flow through the branch line.


b.

A seamless / submerged arc welded extruded "tee" enclosing the internal pipe, fixed to it by suitably shaped forged steel rings. Machined steel rings shall not be used.

4.3

Stub-in or pipe to pipe connection shall not be used in the manufacture of flow tees. Flow tees shall be manufactured by forging or extrusion methods only.

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In case flow tees are manufactured using welded tees, the longitudinal weld seam shall be atleast 90⁰ to the extrusion.

4.4 Tees used for fabrication of flow tees shall be seamless type for run sizes ≤ 16" NB and shall be either welded or seamless type for run sizes ≥ 18" NB. Fittings shall conform to MSS-SP-75.

4.5 The flow tees run/branch diameter and wall thickness shall be as indicated in the Data Sheet, matching with the connecting pipeline.

4.6 Butt weld ends of flow tees shall have ends prepared as per MSS-SP-75.

4.7. All flow tees shall be completely stress relieved as per the provisions of MSS-SP-75.


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, and guided bend test complying the requirements of clause 3.3 and 3.4 of this specification respectively. Previously qualified procedures meeting the above requirements are acceptable.


4.9 Repair by welding on parent metal of the flow tee 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.

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 his Works. Such inspections and tests shall be, but not limited to, the followings:

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<p>5.1.1 All flow tees shall be visually inspected.</p> <p>5.1.2 Dimensional check shall be carried out as per the approved drawings.</p> <p>5.1.3 Chemical composition and mechanical properties shall be checked as per relevant material standards and this specification, for each heat of steel used.</p> <p>5.1.4 Non-destructive inspection shall be carried out on flow tees as given below:</p> <p>a. 100% inspection by radiography shall be carried out on all butt welds of pressure containing parts. Acceptance limits shall be as per API 1104.</p> <p>b. All finished wrought weld ends shall be 100% ultrasonically inspected for lamination type defects for a distance of 50mm from the end. Laminations shall not be acceptable.</p> <p>c. 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% shall be carried out as per the Supplementary Requirement SR 3 of MSS-SP-75.</p> <p>d. 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 U and Appendix VI respectively.</p> <p>5.1.5 Hydrostatic test shall be conducted for all flow tees complete in all respects, at a pressure equal to 1.5 times the design pressure indicated in the Data Sheet. Test pressure shall be held for a minimum period of 15 minutes.</p> <p>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</p>				
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Works 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 and mechanical properties of the materials used for manufacture of flow tees as per relevant standards and this specification.
- b. Test reports of radiography, ultrasonic inspection and magnetic particle examination.
- c. Test reports of heat treatment carried out as per the specification.
- d. Welding procedures and welders qualification reports.
- e. Certificates for each tee used in the manufacture of flow tees 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 flow tee is to be attached, without impairment of serviceability.

7.0 PAINTING, MARKING AND SHIPMENT

7.1 Painting shall be done in accordance to the “General Specification for Protective Coating Spec. No. 2005”.

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<p>7.2 Ends of flow tees shall be suitably protected to avoid any damage during transit. Metallic or high impact plastic bevel protectors shall be provided for flow tees.</p> <p>7.3 Flow tees shall be marked with indelible paint with the following:</p> <ul style="list-style-type: none">a. Manufacturer's Nameb. Nominal diameter of run and branchc. Nominal thickness of run and branchd. Material <p>8.0 DOCUMENTATION</p> <p>8.1 Manufacturer shall furnish at the time of bidding, the following documents:</p> <ul style="list-style-type: none">a. General arrangement drawing of flow tees with Overall dimensions.b. Reference list of similar supplies including all relevant details viz. Project, Year, Client, Location, Size and Service.c. Record of successful proof test of tees in compliance with the requirement of cl. 9.0 of this specification.d. Brief description of the manufacturing, heat treatment and quality control facilities of the Manufacturer's Works.e. Clausewise list of deviations from this specification, if any.				
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8.2 Within three weeks of placement of order, the Manufacturer shall submit four copies, of, but not limited to, the following drawings, documents and specifications for approval :

 a. Fabrication drawing and relevant calculations for end rings according to the relevant codes.

 b. Calculation for the hole/slot size and flow area.

 d. Welding procedures and method of manufacture.

 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 flow tees are manufactured.

8.3 Within four weeks from the approval data, Manufacturer shall submit six copies of all approved drawings, documents/specifications and one reproducible of all approved drawings as listed tin clause 8.2 of this specification.

8.4 Prior to shipment, the Manufacturer shall submit six copies of the test certificates as listed in clause 6.0 of this specification.

8.5 All documents shall be in English Language only.

9.0 **MANUFACTURER'S QUALIFICATION**

 Manufacturer who intend bidding for flow tees must possess the records of a successful proof test for tees used in the fabrication of flow tees, in accordance with the provisions of ANSI B-16.9/MSS-SP-75 as applicable.

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