

GENERAL SPECIFICATION

PIPELINES - RISERS

GS EP PLR 228

Carbon steel tees for pipelines
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1. Scope

- This specification defines the Company's general technical requirements for the design, materials, manufacture, testing and inspection of hot extruded carbon steel tees (including barred tees and sphere tees) of the welding neck type, for use in onshore and offshore pipeline systems.
- Tees specified in this specification are to be used in Sweet (*Region 0*) and Sour Service (*Region 1, 2, or 3*) as defined in **GS EP COR 170**.
- This specification applies to tees with minimum specified yield strengths ranging from 290 N/mm² (42,000 psi) to 485 N/mm² (70,000 psi) for sweet and mild sour service application and up to 450 N/mm² (65,000 psi) or intermediate and severe sour service application.
- Tees shall comply with the requirements of **MSS SP-75**, except where otherwise noted in this specification. Pressure-temperature ratings shall be defined in Appendix 1.
- Requirements are also specially stated in this specification for tees where the properties of base material are to be ascertained after a Post Weld Heat Treatment.
- Tees may be supplied welded onto piece(s) of pipe at least 1.5 pipe OD or 750 mm in length whichever greater, when so required in the PPS. This welded pipe piece is designated as "pup piece" in this specification.
- This specification shall be used in conjunction with a Project Particular Specification (PPS) detailing the additional tests requirements or the possible modifications to the present specification, based on the particular design conditions of the pipeline Project.

2. Reference documents

The reference documents listed below form an integral part of this General Specification. Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the EFFECTIVE DATE of the CONTRACT.

The order of precedence of the applicable documents shall be:

- The Purchase Order/Requisition
- The Project Particular Specification (PPS)
- The General Specification
- The Codes and Standards in reference.

Applicable Codes and Standards, which are to be used in conjunction with this specification, shall be as stated hereafter.

Unless otherwise specifically indicated in writing, the Supplier shall work in accordance with the requirements specified herein and the applicable requirements of the latest editions at time of contract award of the referenced Codes and Standards, whenever requested in the present specification.

Where this specification states no overriding requirements, the referenced Codes and Standards shall apply in full.

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Standards equivalent to those referred to herein shall not be substituted without the written approval of the Company.

The Supplier shall equip himself with copies of all the specifications referred to in this specification and shall make them readily available to all fabrication, testing and inspection personnel involved on the work.

External Documents

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the effective date of this document.

Reference	Title
API SPEC 5L	Specification for Line pipe
ASME B16.9	Factory-Made Wrought Buttwelding Fittings
ASME B31.4	Pipeline Transportation System for Liquid and Slurries
ASME B31.8	Gas Transmission and Distribution Piping Systems
ASME BPVC Section V	Nondestructive Examination
ASME BPVC Section VIII Div 1	Rules for Construction of Pressure Vessels
ASTM A283	Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
ASTM A370	Mechanical Testing of Steel Products
ASTM A578	Standard Specification for Straight-Beam Ultrasonic Examination of Rolled Steel Plates for Special Applications
ASTM E23	Standard Test Methods for Notched Bar Impact Testing of Metallic Materials
ASTM E384	Standard Test Method for Knoop and Vickers Hardness of Materials
ASTM E709	Standard Guide for Magnetic Particle Testing
DNV-OS-F101	Submarine Pipeline Systems
EN 10160	Ultrasonic testing of steel flat product of thickness equal or greater than 6 mm (reflexion method)
EN 10204	Metallic products - Types of inspection documents
ISO 10893-6	Non-destructive testing of steel tubes - Part 6 Radiographic testing of the weld seam of welded steel tubes for the detection of imperfections
ISO 11699-1	Non-destructive testing - Industrial radiographic film - Part 1 Classification of film systems for industrial radiography

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Reference	Title
ISO 148-1	Metallic materials - Charpy pendulum impact test - Part 1 Test method
ISO 15156 (Parts 1; 2) / NACE MR0175	Petroleum and natural gas industries - Materials for use in H ₂ S-containing environments in oil and gas production - Parts 1; 2
ISO 6507 (All parts)	Metallic materials - Vickers hardness test - All parts
ISO 9712	Non-destructive testing - Qualification and certification of NDT personnel
ISO/TS 29001	Petroleum, petrochemical and natural gas industries - Sector-specific quality management systems - Requirements for product and service supply organizations
MSS SP-75	High-Strength, Wrought, Butt-Welding Fittings

Total General Specifications

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published in the applicable yearly collection.

Reference	Title
GS EP COR 170	Materials for upstream sour service application - Specification for selection and design
GS EP PLR 205	Carbon steel, clad and lined pipe manufacturing for linepipe applications according to API SPEC 5L and DNV-OS-F101 (sweet and sour service, onshore and offshore)
GS EP PLR 227	Carbon Steel Flanges, Branch Outlet Fittings and Forged Components for Pipelines
GS EP PLR 425	Site welding of carbon steel pipelines (sweet and sour service, onshore and offshore) according to API STD 1104
GS EP PLR 426	Site welding of carbon steel and CRA pipelines (sweet and sour service, onshore and offshore) according to DNV-OS-F101

3. General

3.1 Definitions

Throughout this specification, the following definitions shall apply:

Purchaser Means the Company or the Supplier (as applicable), which have placed the purchase order to the Manufacturer.

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- Inspector** Means the Company's inspector(s) or inspector(s) from an independent Inspection Agency duly appointed by the Company or the Supplier (as applicable) to act on its behalf for the purpose of the contract.
- Approval** Means the authorisation in writing given by the Company to the Supplier on a procedure or to proceed with the performance of a specific part of the work without releasing in any way the Supplier from any of his obligations or liabilities under the contract or at law. The words Approve, Approved and Approval shall be construed accordingly.
- PPS** Designates the Project Particular Specification.

3.2 Approval of Supplier's procedures

The Supplier shall submit the following documentation for review and approval one month prior to commencement of fabrication.

- Design calculations and fabrication drawings of tees
- Manufacturing Procedure Specification, describing all proposed forming and forging operations, heat treatment, inspection and non-destructive testing in their correct sequence. This document will also include the characteristics of equipment used to carry out above mentioned operations
- Sketch showing location and orientation of test specimens in test tee
- Heat treatment and recording procedures, including number and location of thermocouples
- Dimensional inspection procedures
- Non-destructive inspection procedures
- Quality Control Plan
- Welding Procedures Specifications (where applicable)
- Welder qualifications (when applicable)
- Handling, storage and packing procedures
- Proposed measures for temporary corrosion prevention (non-coated tees).

Once approved these procedures shall not be altered without the Approval of the Company.

The Supplier shall submit, at bid stage, to Company's prior approval any deviations to requirements specified in applicable technical documents.

3.3 Quality assurance/quality control

1. The Supplier shall operate a Quality Assurance system in accordance with [ISO/TS 29001](#), approved by a Company recognised authority. The Quality Assurance Manual shall be submitted one month prior to commencement of work.
2. Four weeks prior to commencement of tee manufacture, the Supplier shall prepare and submit a Quality Control Plan which describes the inspections to be performed during the

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supply of tees. The Quality Control Plan shall set forth “witness”, “hold”, “review” and “monitor” points.

3.4 Project Particular Specification (PPS)

The PPS shall clarify, where needed, the following:

1. The necessity or not to have pup piece(s) (refer to section 1).
2. The requirement to have the ID of tee same as that of matching pipes (i.e. constant internal diameter pipeline) (refer to § 4.2).
3. The minimum tee thickness above which the simulated PWHT is required, if this thickness is below or equal to 25 mm (refer to § 5.3.5).
4. The sour service severity and type of pipeline effluent to clarify the H₂S test conditions and hardness requirements in welds (if any) (refer to § 5.5 of this specification and 4.3 of Appendix 2).
5. The number of originals and copies required for the documentation (refer to § 15.1).
6. The tees characteristics, including impact test temperatures (refer to § 5.3.3, § 6.1 and Appendix 1 and Appendix 2).

4. Design

4.1 Design data

Details of pipe diameter, wall thickness and material steel grades of the matching pipelines shall be given in Appendix 1 of this specification, together with the relevant design conditions.

4.2 Tee design

1. All tees shall be designed to [MSS SP-75](#), unless otherwise stated in this specification. Moreover, the tees shall also conform to the applicable pipeline code or standard ([ASME B31.4](#); [ASME B31.8](#); [DNV-OS-F101](#)... Calculation shall be provided to Company for approval.
2. All tees shall be designed in material with tensile properties at least equal to those of the matching pipes (refer to § 5.3 of this specification).
3. The nominal internal diameter (bore) of the main header shall be that of the matching pipeline, unless otherwise stated in the PPS and in Appendix 2, with a tolerance of ± 1.6 mm.
4. The minimum wall thickness at welding ends shall not be less than those of the matching pipelines. Excess material shall be machined back as stated in § 10.2 of this specification. There should be no excess material on the internal diameter of tees when pipeline is designed as a constant internal diameter pipeline.
5. Internal bars (if any) shall be welded into the outlet neck of tees running longitudinally with the run and conform to the ID of the run, when nominal diameter of outlet neck is NPS 12” and above, unless otherwise stated in the PPS. Welds shall be full penetration welds, unless otherwise stated in PPS or on Company approved drawings.

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6. The bars and bars fixing shall be designed in such way that welds are out of the crotch radius area. Welds for bar fixing shall be carried out before final Heat Treatment (Q+T).
7. The Supplier shall consider and meet the requirements stated about Design Proof Test in [MSS SP-75](#).
8. Supplier shall submit the Design Proof Test for Company review and approval. When records of successful Design Proof Test corresponding to the tee of the order is not available or not approved by Company, then Finite Element Analysis is required for the said tee together with hydrostatic testing as stated in section 11 of this specification.
9. The design for the connection in between Header and Branch shall be governed by the OD ratio (OD Header v/s OD Branch). The required connection type is summarized in the table (Appendix 3).

5. Materials

5.1 Manufacturing process

1. Steel shall be made by the Electric Furnace or Basic Oxygen Converter, and shall be fully killed and made to fine grain practice.
2. Inclusion control with respect to content, distribution and shape shall be carried out by desulphurization, degassing, calcium injection in order to provide resistance of steel to sour environments.
3. Pipe or hollow cylindrical forging shall be used as mother pipe for tee. The outlet branch shall be made through hot extrusion process and shall be formed diametrically opposite to any longitudinal weld.
4. All tees shall be quenched and tempered after hot extrusion process.
5. Bars or internal sleeves (if any) shall be manufactured from low grade weld-able steel (e.g. steel with SMYS of 240 MPa) or to a Company approved higher grade, having a maximum hardness of 250 HV5.
6. The welded pup pieces, if any (refer to section 1 of this specification), shall be selected among the pipes procured for the pipeline Project, and complying with the requirements of relevant Project specifications.

5.2 Chemical composition

The chemical analysis shall comply with the provisions of table hereafter for ladle and product. Alternate chemical composition may be proposed by the Supplier, but it must be reviewed and approved by the Company at bid stage.