



Exploration & Production

GENERAL SPECIFICATION

PIPELINES - RISERS

GS EP PLR 242

**Fabrication of Duplex & Superduplex stainless steel
in seamless pipes for pipelines in Sweet service**

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1. Scope

This specification defines the Company's requirements for the manufacture and supply of bare Duplex and Superduplex stainless steel line pipes to be used in the construction of onshore or underwater pipelines for crude oil, gas, multiphase or condensate effluents, operating in "Sweet Service" (i.e. corresponding respectively to area "0" in design specification **GS EP COR 170**).

It applies to seamless pipes in Grade 22Cr or 25Cr duplex of **DNV-OS-F101** or **API 5LC**.

This Specification shall **always** be used in conjunction with a Project Particular Specification (P.P.S.) detailing the additional tests and requirements or the possible modifications to the present specification, based on the particular design conditions of the Pipeline Project (see § 4 in this specification).

Applicable Standards are:

- **API 5LC** for onshore pipeline
- **API 5LC** and **DNV-OS-F101** for offshore pipeline.

Additional requirements are specifically stated in this specification for pipes to be used in pipelines to be laid underwater using the reeling technique. The related pipes shall thus be suitable for cold forming operations involving spooling, un-spooling, straightening and bending.

Requirements are also provided in this specification for pipes to be used in platform topsides, risers or expansion loops.

Mother pipes fabrication is addressed in the General Specification for hot induction bends.

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 Particular Specification
- The present General Specification
- The codes and standards in reference.

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

Unless otherwise specifically indicated in writing by the COMPANY, the SUPPLIER shall work in accordance with the requirements specified herein and the applicable requirements of the latest editions at date of CONTRACT award of the referenced Codes and Standards, whenever asked in the present specification.

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

Standards equivalent to those referred to herein shall not be substituted without written approval from the COMPANY. Approval of equivalent standards will not, in any way, remove



responsibility from SUPPLIER to meet the requirements of the Standards referred to and amended herein, in the event of conflict.

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

Note: The specification **GS EP COR 170** is mentioned herein only as a background to the definition of the types of sour service (i.e. Sweet or Mild Sour Service) and corresponding “areas” on graph of the said specification (i.e. area 0 or 1).

Standards

Reference	Title
API 5LC	Specification for CRA Line Pipe
ASTM A 370	Mechanical Testing of Steel products
ASTM A 380	Cleaning/De-scaling and passivation of stainless steel parts, equipments and systems
ASTM A 578	Straight-beam ultrasonic examination of plain and clad steel plates of special application
ASTM E 23	Notched Bar Impact Testing of Metallic Materials
ASTM E 165	Standard Practice for Liquid Penetrant Examination for General Industry
ASTM E 384	Guide for Test Method for Micro hardness of Materials
ASTM E 562	Standard Test Method for Determining Volume Fraction by Systematic Manual Point Count
ASTM E 1417	Standard Practice for Liquid Penetrant Testing
ASTM G 48	Standard Test Methods for Pitting and Crevice Corrosion Resistance of Stainless Steels and Related Alloys by Use of Ferric Chloride Solution
DNV-OS-F101	Submarine Pipeline System (Oct' 2007)
EN 473	Non destructive testing - Qualification and certification of NDT personnel - General principles
EN 10204	Types of inspection documents
ISO/TS 29001	Petroleum, petrochemical and natural gas industries - Sector-specific quality management systems - Requirements for product and service supply organisations

Professional Documents

Reference	Title
API RP 5L1	Railroad Transportation of Line pipe
API RP 5LW	Transportation of Line pipe on Barges and Marine Vessels
COFREND	Comité français des essais non destructifs (French Committee of Non-Destructive Testing)
DNV-RP-F112	Design of duplex stainless steel subsea equipment exposed to cathodic protection

Regulations

Reference	Title
Not applicable	

Codes

Reference	Title
ASME V	Pressure Vessel Code, Section V: Non-Destructive Examination

Other documents

Reference	Title
Not applicable	

Total General Specifications

Reference	Title
GS EP COR 170	Materials for Sour Service (Upstream Applications). Specification for design
GS EP PVV 175	Cleaning of piping and vessels

3. General

3.1 Definitions

COMPANY

TOTAL E&P or agents acting on its behalf, shall be referred to herein as the "COMPANY".

SUPPLIER

The Companies, or their agents including steel and pipe MANUFACTURERS, designated on the Purchase Order form or Contract as being the selected supplier of the said materials and pipes shall be referred to herein as the "SUPPLIER".

Inspection Agency	An independent inspection body (other than any inspection department of the SUPPLIER or any Inspection Agency subcontract by him), or its members, who shall be appointed by COMPANY and thus notified to SUPPLIER.
Inspector	The COMPANY's representatives or members from the COMPANY's elected Inspection Agency for the time being or from time to time duly appointed in writing by the COMPANY to act as its representatives for the purpose of the contract shall be referred to herein as the "Inspector".
Mill	The plants, mills, workshops, laboratories or other locations where the fabrication, inspection and testing of steel and pipes are to be performed complete or in part, including storage areas shall be referred to herein as the "Mill".
Contract Documents	The material requisitions, material specifications, etc. issued by the COMPANY and attached to the contract or the purchase order shall be referred to herein as the "Contract Documents".
Approval	Authorisation in writing given by COMPANY to SUPPLIER to proceed with the performance of a specific part of the work without releasing in any way SUPPLIER from any of its obligations or liabilities under the contract or at law; Approve, Approved and Approval shall be construed accordingly.
PPS	Used to designate the Project Particular Specification.
May	Used to indicate that a provision is optional.
Shall	Used to indicate that a provision is mandatory.
Should	Used to indicate that a provision is not mandatory but is recommended as good practice.

3.2 Quality Assurance/Quality Control

1. The SUPPLIER shall operate a Quality Assurance system in accordance with [ISO/TS 29001](#), or equivalent, approved by a COMPANY recognised authority. The Quality Assurance Manual shall be submitted prior to the start of work.
2. Four weeks prior to the commencement of the pipe manufacture, the SUPPLIER shall prepare and submit a Quality Control Plan which describes the inspections to be performed during the supply of pipes. The Quality Control Plan shall set forth "witness", "hold", "review", and "monitor" points.
3. Just before production starting, mill QA Representative accompanied by Inspector shall check at every production and inspection station, that the relevant working instructions and procedures are available, complete, conform to the procedures agreed by COMPANY or to COMPANY specification requirements. A report shall be issued by supplier, signed by Inspector and enclosed with the final dossier.

4. Project Particular Specification

The Project Particular Specification (PPS) shall define:

- Applicable Standard
- Grade
- Nominal dimensions (OD x W.T.) of pipes to be supplied
- Routine impact test temperature
- Any other information or particular tests to be carried out with related requirements (e.g. weldability tests, bending tests, bevels protectors, etc.).

The PPS shall include the pipeline Data Sheet (see Appendix 5), if it is not included elsewhere in any other Project Specifications.

5. Inspection by the COMPANY

1. All procedures shall have prior approval of the COMPANY. All qualification tests shall take place under the supervision of the Inspector.
2. The SUPPLIER shall notify the Inspector sufficiently in advance to enable him to be present at qualification tests and at all other tests or stages of manufacture subject to acceptance in accordance with this specification.
3. The SUPPLIER shall ensure that the Inspector has full and free access to all parts of the Mill during all fabrication stages.
4. The Inspector shall ensure that materials and pipes are fabricated in accordance with all the specified requirements and COMPANY's approved procedures.
5. At steel making mills, billet casting mills and pipe mills: offices, workshops, storage yards etc., information on paper and/or in computers (procedures, working instructions, data, records, tracking system, etc.) concerning the order manufacturing and inspection, shall be made fully available and comprehensible to Inspector reading. Where the mill country language is not English, all these information shall be written in double language, i.e. mill country language and English language.
6. It shall be made available in the inspector office, a free access to the mill computerised:
 - Tracking system of production and inspection
 - All data and results of mechanical tests, NDE results
 - Billet input/pipe output, rejections status with causes, repairs
 - Any other information considered pertinent by the inspector for his monitoring
 - Computer, software environment compatible with the mill software, software interface where necessary for data exploitation with EXCEL and ACCESS shall be made available by the SUPPLIER
 - The COMPANY's Inspector shall be provided with facilities/equipments for sending and receiving faxes, communicating by @mails and fast Internet access.
7. Inspection by the Inspector shall be carried out during pipe production in order to avoid any special or additional handling. Inspection will be made in such a manner to avoid delay in

pipe production insofar as the pipes which are presented to him meet the specified requirements.

8. The Inspector shall finalise (when required) its inspection by the application of a special stamp (or indelible paint marking, when so previously agreed). Die stamping is permitted only on the bevel surface.
9. The Inspector shall notify the COMPANY without delay of any difficulty, irregularity, problem or delay likely to occur during pipe production.
10. The COMPANY reserves the right to check tests carried out by the SUPPLIER. For this purpose, the COMPANY may request the delivery of the corresponding samples or specimens to be analysed in an independent laboratory chosen by the COMPANY.
11. The clause H.4 of Appendix H of [API 5LC](#) shall fully apply.

6. Pipe manufacture

6.1 General requirements

1. Pipes shall be manufactured in accordance with all the requirements of applicable Standard (see § 2) unless otherwise indicated in the present specification (i.e. applicable Standard remains applicable for all matters not specifically mentioned or modified herein the present specification).
2. Except as otherwise agreed between the SUPPLIER and the COMPANY, all inspections and tests required for qualification and pipes acceptance shall be performed at the manufacturing Mill.
3. Pipe production shall not start without the approval of the Company and until a pre-production meeting has been held between the Company, the Supplier and the Inspector.

6.2 Particular precaution

Contact between stainless steel and carbon steel is prohibited.

All the tools, except machining tools, shall not have been used on carbon steel. The following precautions shall be implemented:

- Grinding disks shall be free from iron and carbon
- Brush shall be stainless steel
- Cutting shall be carried out only by plasma or by mechanical sawing*.

Contamination of surface with low melting point metals such as Copper, Zinc, etc., is not acceptable.

Paint and markers containing zinc or chloride are prohibited.

Correction of deflexion by flame straightening is prohibited.

* Chloride content in machining oil shall be limited to 1.0 ppm.

6.3 Process of manufacture

Pipes shall be **seamless**. They shall be manufactured from billets by the hot rolling process / hot finished process using exclusively the Plug Rolling Mill Process or the Mandrel Mill Process. All other processes are not acceptable (i.e.: Pilger Mill, etc.).

6.4 Billet manufacture

1. Steel making shall be the Electric Arc Furnace or Basic Oxygen Furnace. COMPANY shall be provided with all ladle analyses (see § 8.2.1.4 of this specification).
2. Billet shall be produced from continuously strand cast.
3. All billets shall be visually examined to ensure freedom from injurious surface defects. Billets shall be correctly marked and stored to avoid any confusion between heats of steel (e.g. heat n°, casting strand n° and sequential n°).

The SUPPLIER shall provide the COMPANY at the bid stage with a technical specification giving full details of all the characteristics of the proposed steel, the steel-making process, the billet manufacturing process and the inspection procedures.

The SUPPLIER's specification shall include the following minimum information concerning the steel-making process:

- Steel-making process (Electric Furnace or Basic Oxygen Furnace)
- Special treatments for controlling residual elements and segregations
- Nominal weight of each heat
- Aimed chemical analysis, minimum and maximum working limits (ladle and product) selected by SUPPLIER for the order.

6.5 Pipe manufacture

Pipes shall be manufactured by the hot rolling seamless process as stated in § 6.3 above.

Pipes shall be delivered in solution-annealed and water-quenched condition.

Pipe shall be sized, straightened and hydrostatically tested.

The SUPPLIER must also refer to the provisions of § 6.11 of this specification for pipe surface condition.

6.6 Pipe Manufacturing Procedure Specification (MPS)

The SUPPLIER shall establish a detailed specification for the manufacture and inspection of pipes, describing all proposed operations in their correct sequence together with their parameters of execution. The proposed specification shall include, but not be limited to, all information concerning:

- Billet heating
- Equipment for pipe rolling, sizing, straightening
- Heat treatment for pipes
- Aimed chemical analysis, minimum and maximum working limits (ladle and product) selected by SUPPLIER for the order

- Typical metallographic structure of base metal with supporting documentation such as microphotographs, grain size, ferrite content, etc.
- Visual inspection
- NDT procedures
- Dimensional inspections with frequencies.

This document shall also mention the characteristics of equipment and procedures used to carry out these operations.

This detailed specification together with the SUPPLIER's Quality Control Plan shall be submitted to the COMPANY **at the bid stage**.

The SUPPLIER shall provide adequate supervision to ensure strict adherence to the described procedures during pipe production.

6.7 Qualification of pipe manufacturing procedure

One finished pipe among the first pipes produced in each size, grade and steel source (first shift production) shall be subject to the inspections and tests as described below in order to qualify the pipe manufacturing procedure. The Inspector shall select this pipe.

6.7.1 Destructive and non-destructive tests

The selected pipe shall be visually inspected for compliance with dimensional tolerances for wall thickness, diameters, out-of-roundness, straightness, surface defects, etc. (see § 6.10).

After visual inspection and dimensional inspection as above, the said pipe shall be tested as follows.

Note: That testing according to paragraph m) through n) hereafter is required only for pipeline to be laid by the reeling technique.

When the line pipes of the pipeline to be laid by the reeling technique are directly purchased by the installation Contractor, then the impact tests and tensile tests under paragraph j) hereafter shall be made on full scale bending test simulating the successive bending of pipeline from first spooling to final laying. The bending scheme and equipment shall be mutually agreed with the Company.

- The entire pipe shall be **ultrasonically** examined and, also, either electromagnetic or magnetic particle examined for longitudinal and transverse defects, and laminations.
- A **chemical analysis** shall be carried out on the pipe. At this stage, one cast shall be analysed for residual elements. Results shall be in accordance with Table 1 of Appendix 1. However, the ruling composition shall be that proposed by SUPPLIER and approved by COMPANY at the bid stage (see § 6.4 above).
- Two **tensile** specimens (one longitudinal and one transverse to pipe axis) shall be removed from each pipe end. Strip specimens shall be used unless round bar specimens have been agreed at the bid stage (see § 8.2.1.1).

The Yield and Ultimate Tensile Strength plus percentage Elongation shall be measured according to Standard. The Yield Strength (YS) to Ultimate Tensile Strength (UTS) ratio shall be calculated. The results shall conform to Table 2 of Appendix 2 of this specification.