

GENERAL SPECIFICATION

PIPELINES - RISERS

GS EP PLR 206

**Specification for coiled line pipe
manufacturing
according to API SPEC 5LCP**

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1. Scope

This specification defines Company requirements for the manufacture and supply of carbon steel coiled line pipes to be used for the construction of onshore or offshore pipelines, operating in sweet Service for Utility and Service Lines.

This specification does not cover pipeline installed by Reel Lay, fatigue sensitive or pipeline within seismic area.

This specification shall only apply to High Frequency Welded pipes ranging from 2in (60.3 mm) OD to 6^{5/8} in. (168.3 mm) pipes with thickness limitation to 10 mm in Grade X52C to X70C.

This specification is written as an overlay to [API SPEC 5LCP](#) 2nd edition, starting from section 5 is follows the clause structure of the parent standard, to assist in cross-referencing the requirements.

Where clauses from the parent standard are not covered in this specification, there are no supplementary requirements or modifications to the respective clause.

This specification shall be used in conjunction with a project particular Specification (PPS) to be made for the purpose of detailing the additional tests and requirements or the possible modifications to the present specification, based on the special design conditions of the pipeline project.

This specification may also be applied for line pipe manufacturing for pipelines designed according to other design codes.

In such case, Manufacturer shall make a gap analysis to identify the different requirements and ensure the requirements within the design code and this specification are fulfilled.

2. Normative references

2.1 External Documents

If conflicts arise between this specification and [API SPEC 5LCP](#) (or its referenced documents) then the more stringent requirements shall be applied.

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

Reference	Title
API SPEC 5LCP	Specification for Coiled Line Pipe, second edition, October 18, 2006

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Reference	Title
API STD 1104	Welding of Pipelines and Related Facilities
ASTM A370	Standard Test Methods and Definitions for Mechanical Testing of Steel Products
ASTM E45	Standard Test Methods for Determining the Inclusion Content of Steel
DNVGL-ST-F101	Submarine pipeline systems
EN 10204	Metallic products - Types of inspection documents
ISO 1027	Radiographic image quality indicators for non-destructive testing - Principles and identification
ISO 10893-7	Non-destructive testing of steel tubes - Part 7: Digital radiographic testing of the weld seam of welded steel tubes for the detection of imperfections
ISO 10893-9	Non-destructive testing of steel tubes - Part 9: Automated ultrasonic testing for the detection of laminar imperfections in strip/plate used for the manufacture of welded steel tubes
ISO 148-1	Metallic materials - Charpy pendulum impact test - Part 1: Test method
ISO 17025	General requirements for the competence of testing and calibration laboratories
ISO 17639	Destructive tests on welds in metallic materials - Macroscopic and microscopic examination of welds
ISO 5173	Destructive tests on welds in metallic materials - Bend tests
ISO 8492	Metallic materials - Tube - Flattening test
ISO 8493	Metallic materials. Tube. Drift-expanding test
ISO 9001	Quality managements systems - Requirements
ISO 9712	Non-destructive testing - Qualification and certification of NDT personnel

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Reference	Title
ISO/TS 29001	Petroleum, petrochemical and natural gas industries - Sector-specific quality management systems - Requirements for product and service supply organizations
NAS 1638	National Aerospace Standard - particulate contamination coding system

2.2 Total General Specifications

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and addendums, is the latest revision published.

Reference	Title
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 DNVGL-ST-F101

3. Definitions and Abbreviations

3.1 Definitions

For the purpose of this document, the following terms and definitions apply.

Inspector	The Company's representatives or members from an Inspection Agency duly appointed by the Company and thus notified to the Manufacturer, shall be referred to herein as the "Inspector". The inspector is not to be amalgamate to a third party.
Company	TOTAL S.A.; Company Referential Authority is the entity responsible for the technical aspects within this specification (HQ Pipelines & Risers Entity).
Contract	The Purchase Order together with all material requisitions, specifications, etc., issued by the Company and/or Company and attached to the contract or the purchase order shall be referred to herein as the "Contract".

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Approval Authorization in writing given by the Company to the Manufacturer on a procedure or to proceed with the performance of a specific part of the work without releasing in any way the Manufacturer from any of its obligations to conform to the technical specifications, requisitions, etc., "approve", "approved" and "approval" shall be construed accordingly.

PPS Project Particular Specification

3.2 Abbreviations

AUT	Automatic Ultrasonic Testing
CR	Computed Radiography
DBTT	Ductile brittle transition temperature
DDA	Digital Detector Array
DR	Digital Radiography
HAZ	Heat Affected Zone
pWPS	preliminary Welding Procedure Specification
t_{min}	Minimum permissible wall thickness of pipe
WPS	Welding Procedure Specification
WPQR	Welding procedure Qualification Records

4. Compliance to this Standard

4.1 Quality

Manufacturer(s) shall be previously audited and approved by Company.

Company can suspend the approval of a manufacturer due to a negative feedback concerning quality, delivery time, missing documentation or HSE issues.

All sub-suppliers (e.g. raw material supply, NDT, etc.) shall be clearly identified at the bid stage and be approved by Company.

The Manufacturer and its sub-suppliers shall operate a Quality Assurance system in accordance with [ISO 9001](#) or [ISO/TS 29001](#), approved by a Company recognized authority. Laboratory used for testing shall be certified according to [ISO 17025](#).

The Quality Manual shall be submitted prior the start of work. It shall be demonstrated that a continuous improvement program is in place.

Responsibility for quality control shall rest with the Manufacturer aided by such staff as may be required. Company may perform or delegate second party inspection during the entire manufacturing.

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The Manufacturer shall maintain quality records as documentary evidence of compliance with quality requirements.

Quality records shall be available to the Inspector for analysis and review.

4.2 Production

Pipe production including MPQT shall not start without the approval of the Company and until a pre-production meeting has been held between the Company and its representatives and the Manufacturer.

Just before production, mill QA Representative accompanied by Inspector shall check that the relevant working instructions and procedures are available, complete, conform to the procedures agreed by Company or to Company specification requirements at every production and inspection station.

Pre-production meeting report and mill readiness inspection report shall be issued by Manufacturer, signed by Inspector and enclosed with the final dossier.

An appropriate system shall be put in place to alert the operator if there is any deviation to the approved process parameters.

The incidence shall be recorded in the logbook and be available upon request at the QA/QC department.

The Manufacturer shall submit daily production and inspection reports to Inspector within 48 hours after completion of the inspection.

4.3 Minimum inspection requirements

All qualification tests shall be witnessed by the Inspector.

The Manufacturer shall notify the Company and 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.

The Manufacturer shall ensure that the Company and Inspector have free access to all parts of the Mill during all manufacturing and inspection stages (from steel to pipe making)

Manufacturer shall provide details as a minimum on:

- Production tracking system and inspection status (e.g.: tests results)
- Rejection rate and rejection status with associated causes and repairs
- Any other information considered pertinent by the Inspector for his monitoring

The Manufacturer shall make available computer and software compatible with the mill computer system where production data can be exported into spreadsheets to the inspector.

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The Inspector shall be provided with facilities/equipment for printing, communicating by emails and fast Internet access.

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.

If specified in the PPS, the Inspector shall finalize its inspection by the application of a special stamp (or indelible paint marking, when so previously agreed).

Die stamping is permitted only on the pipe end surface.

The Manufacturer shall notify the Company and Inspector without delay of any difficulty, irregularity, problem or delay likely to occur during production.

The Company reserves the right to cross check tests carried out by the Manufacturer.

For this purpose, the Company may request the delivery of the corresponding samples or specimens to be analyzed in an independent laboratory chosen by the Company.

If during the main production, more than 10% of the pipes are rejected in any day's production or re-routed for repairs or re-processing, then the Company and/or Inspector are entitled to require Manufacturer to increase his Quality Control Program to an appropriate level and to maintain it until the causes of the defective quality are identified and eliminated.

A Corrective Action request will be send by Inspector to Manufacturer.

Production is not acceptable until a response with positive results is accepted by Inspector.

Where above rate reaches 15%, the Company and/or Inspector may require the main production to be stopped. In such a case Company requires a program of investigation to determine the root cause(s) of the defective quality. This program will be established in mutual agreement between Company and Manufacturer.

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The rest of production shall be put on hold until result of investigations and Company acceptance.

Note: The percentage of defective welds shall be understood as weld length for seam weld or by weld for end and pipe-to-pipe weld.

The sum of all ground areas shall not exceed 10% of the total surface area of the coil.

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4.4 Non-Conformance Reports

Any work performance or test result which is found, after contract award, not in conformance with Company specifications or agreed procedure shall be subject to a Non-Conformance Report (NCR) to be issued by the Manufacturer for submission to Company.

NCR report shall indicate corrective action intended by the Manufacturer

NCR shall be submitted to the Inspector within 48 hours after the finding.

Manufacturer shall be fully responsible for complying with all of the applicable requirements of [API SPEC 5LCP](#) and design code.

5. Process of Manufacture and Material

5.1 Process of Manufacture

5.2 Type of Pipe

5.3 Types of welds

5.3.1 Electric-Weld (Seam)

5.3.2 Skelp end weld

Skelp end welds shall be performed according to a project specific qualified welding procedure.

The weld shall start and stop on run-on and run-off tabs.

After execution of the seam, the run-on and run-off tabs shall be removed by flame cutting or sawing only.

Mechanical breaking of tabs is be forbidden.

Unless otherwise agreed, the weld shall be angled at 45° to the axis of the skelp.

5.3.3 Pipe to pipe weld

With prior Company approval, lengths of pipe may be welded together by the manufacturer.

Welding, destructive testing and non-destructive testing shall be carried out as per [GS EP PLR 425](#) and [API SPEC 5LCP](#) Appendix A and B or [GS EP PLR 426](#) and [DNVGL-ST-F101](#) Appendix C, as applicable and as specified in the PPS.

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5.4 Welding Processes

5.5 Heat treatment

Skelp end welds shall be subject to a stress relieve heat treatment.

Alternative heat treatment for the longitudinal seam and pipe body as described in [API SPEC 5LCP](#) is not acceptable.

The full thickness of the weld seam and HAZ shall be normalized above the upper critical transformation temperature of the steel.

This temperature shall be listed in the MPS.

The heat treatment area shall be extended to the base metal at minimum distance of two times the pipe wall thickness.

Cooling by water is permitted when this area temperature is 250°C or below.

Weld seam tracking device coupled to the seam heat-treating equipment shall be used.

The system shall be reviewed and accepted by Company.

The Heat treatment temperature shall be continuously monitored and recorded.

The records shall be available for review by the inspector during production and until the order is released.

Alternate ways of ensuring adequate heat treatment and seam inspection may be proposed, but shall be reviewed and accepted by Company.

5.6 Traceability

5.7 Starting material

Steelmaking shall be by the basic oxygen furnace (BOF) or electric arc furnace (EAF).

Double de-slagging. Argon-stirring, Vacuum Degassing, Secondary/Ladle Refining, other clean steel making practices and specific treatment to control inclusions size, shape and distribution shall be used to produce quality steel required to produce the pipes according to this specification.

For HFW pipes, inclusion control with respect to content, distribution, and shape shall be performed by desulfurizing, degassing, and either calcium injection or rare earth metal treatment.

External scraps deliveries shall be checked for radioactivity.

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If steel scrap is used, a procedure for scrap management shall be issued.

Hydrogen control practice for billets and slabs shall be applied if the hydrogen content more than 0.0002% on the ladle analysis.

Procedure describing hydrogen control practice shall be submitted for Company review and approval.

Slabs shall be:

- Produced by continuous casting process
- Visually examined to ensure freedom from injurious surface defects and
- Correctly marked and stored to avoid any confusion between heats of steel.

Slitting of slabs is not permitted.

The coils shall be produced through thermomechanical control process.

Coil shall be provided pickled and free of scale.

Slitting location shall:

- Be proposed and agreed with Company
- Not be in the mid-coil width.

6. Material Requirements

6.1 Chemical Properties

The mill shall propose the aimed chemical composition at the bid stage.

The chemical composition of MPQT and the entire ladle and product analysis shall be within the aimed one.

Pipes Shall have chemical composition and tolerances given in Table 1.

The mill shall control the listed chemical elements even if the elements are considered as not intentionally added.

The intentionally added elements not specified in the table shall not be permitted without prior approval of the Company.

Testing frequency shall be as per [API SPEC 5LCP](#) section 8.2.1.

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Table 1 - Chemical composition for PSL 2 pipe

Element	Max. Chemical Composition (% WT)	Tolerance
C	0.08	+ 0.010 / - 0.020
Mn	1.40 and minimum 0.700	± 0.150
P	0.010 (100 ppm)	/
S	0.0020 (20 ppm)	/
Ca	0.0040 (40 ppm)	/
Si	0.30	± 0.050; min. 0.150
Ni	0.30	± 0.050
Cr	0.20	± 0.050
Mo	0.20	± 0.005
Cu	0.20	± 0.150
Ti	0.020	± 0.005
V	0.080	± 0.008
Nb	0.040	± 0.005
Al	0.025	± 0.005; min. 0.015(4)
N	0.015	± 0.0025
O	0.0020 (20 ppm)	/
B	0.00040 (4 ppm)	/
H	0.00040 (4 ppm)	/
CEIIW	0.350	± 0.010
Pcm	0.20	± 0.010

Notes:

- Maximum percentages of residual elements:
 $\text{Sn} \leq 0.0050\%$; $\text{Sb} \leq 0.0050\%$; $\text{Bi} \leq 0.0015\%$; $\text{Pb} \leq 0.0005\%$; $\text{As} \leq 0.0005\%$; $\text{Ce} \leq 0.0050\%$.

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2. If $S < 0.0012\%$, then $0.0010\% \leq Ca \leq 0.0040\%$
If $S \geq 0.0012\%$, then $2 \leq Ca/S \leq 4$, with $Ca \leq 0.0040\%$ In all cases, the ratio of Ca/Al shall be higher than 0.15.
3. $Ti + V + Nb \leq 0.1200\%$.
4. $|Altot - Alsol| \leq 0.0040\%$: Soluble Aluminium (Alsol) and Aluminium total (Altot)
5. $CEIIW = C + \frac{Mn}{6} + \frac{Cr+Mo+V}{5} + \frac{Cu+Ni}{15}$
6. $Pcm = C + \frac{Si}{30} + \frac{Mn+Cu+Cr}{20} + \frac{Ni}{60} + \frac{Mo}{15} + \frac{V}{10} + 5B$

6.2 Mechanical properties

6.2.1 Tensile properties

For the body tensile tests, the maximum yield strength shall be capped to: minimum yield strength as per [API SPEC 5LCP](#) + 120 MPa.

Yield to Tensile ratio shall be limited to 0.90 for grade up to X56C and 0.92 for grade X60C and above.

For cross seam weld tensile tests, acceptance criteria shall be:

- Tensile strength > Tensile strength base material
- Specimen failure: outside weld metal.

The yield strength and elongation shall be reported for information.

Elongation shall be measured and reported.

The uniform elongation (U_{EL}) in longitudinal direction shall be minimum 6%.

6.2.2 Flattening Test

Acceptable criteria for flattening tests shall be as follows:

- For all pipe diameter to thickness ratios (D/t), flatten to 50% of the original OD without weld opening and cracks or breaks in the parent metal.
- For pipe with a D/t > 10, continue flattening to 33% of the original OD without cracks or breaks other than in the weld.
- For all pipe D/t, continue flattening until opposite walls of the pipe meet with no evidence of lamination developing during the entire test.

Note: See [DNVGL-ST-F101](#) section 7.2.4.12 and 7.2.4.13 for reference.

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6.2.3 Weld Ductility Test

6.2.4 Flaring Tests - All Grades

6.2.5 Fracture toughness test

Largest size test piece shall be used.

For sub-size test pieces, the measured impact energy and the test piece cross-section measured under the notch shall be reported.

For comparison with full-size test piece, the measured average impact energy (set of three test pieces) shall be converted to the impact energy (KV) using the below formula.

$$KV = 80 * \frac{KV_m}{A}$$

KV = the average impact energy of full-size specimens
KV_m = the measure average impact energy of sub-size specimens
A = the sub-size test piece cross-section under the notch (mm²)

Required absorbed energy based on transverse full-size specimen shall be:

- 40 / 54J (minimum / minimum average) for grade X60C and below
- 45 / 60J (minimum / minimum average) for grade X65C and above.

Only one test piece is allowed to have single value less than the minimum average value.

If, due to size limitation, specimen in transverse direction cannot be used, longitudinal direction specimen shall be used however.

The required longitudinal direction specimens (KVL) values shall be 50% higher than the required KVT values.

Lateral expansion shall be recorded and reported for information only.

The minimum average fracture area for each test shall be:

- At least 85%
- For weld metal: recorded for information only.

Test shall be performed at the minimum design temperature or -20°C whichever is lower.

If Charpy testing cannot be performed, with prior Company approval, a check of microstructure and grain size shall be made instead with acceptance criteria proposed and justified by manufacturer.