

GENERAL SPECIFICATION

PIPELINES - RISERS

GS EP PLR 423

Welding of Super-Duplex Stainless Steel Small Bore Tube for Umbilical
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1. Scope

This specification defines the Company's requirements for welding and non destructive examination of Super Duplex Stainless steel small bore tubes to be used in the construction of umbilical, for sweet or sour crude oil, natural gas service or service line.

This specification is also covering ISU & IPB Structures application as well as tubes to be used on platform topsides, risers or expansion loops in straight or coiled lengths.

It applies to seamless or long seam welded pipes up to 2" (60.3 mm) ID in UNS number S 32750 / 32760 / 39274 in conformance of requirements come from [GS EP PLR 241](#) & [GS EP PLR 245](#).

It applies to butt-welding (Pipe mill and ties-in) of small bore pipes, bends, flanges and other fittings.

Branches made of tubes directly welded to main small bore tubes are forbidden.

This specification is to be considered as a supplement to Subsea Umbilical Standard [ISO 13628-5](#) and respective associated Standards.

This Specification shall **always** be used in conjunction with a Project Particular Specification (P.P.S.) detailing any additional requirements (see section 4 in this specification).

2. Reference documents

The reference documents listed below form an integral part of this General Specification.

The work shall satisfy the requirements of [ISO 13628-5](#), where applicable. Should omissions or ambiguity or incorrect information exist, they shall be notified as soon as possible by Contractor to Company.

All codes, specifications, standards and other documents which are referenced in this specification are listed hereafter.

The order of precedence of the applicable documents shall be:

- The Contract
- This Specification
- The codes and standards in reference.

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

Unless otherwise specifically indicated in writing by the Company, Contractor and 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 requested in the present specification.

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

External Documents

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 document.

Reference	Title
API RP 578	Material Verification Program for New and Existing Alloy Piping Systems
ASME B31.3	Process Piping - Includes Interpretation 23
ASME BVPC Section II, Part C	Materials Part C-Specifications for Welding Rods Electrodes and Filler Metals
ASME BVPC Section IX	Welding, Brazing, and Fusing Qualifications
ASME BVPC Section V	ASME Boiler and Pressure Vessel Code, Section V: Nondestructive Examination
ASTM A370	Standard test methods and definitions for mechanical testing of steel products
ASTM A923	Standard Test Methods for Detecting Detrimental Intermetallic Phase in Duplex Austenitic/Ferritic Stainless Steels
ASTM E1647	Standard Practice for Determining Contrast Sensitivity in Radioscopy
ASTM E2002	Standard Practice for Determining Total Image Unsharpness and Basic Spatial Resolution in Radiography and Radioscopy
ASTM E2597	Standard Practice for Manufacturing characterization of digital detector Arrays
ASTM E384	Standard Test Method for Microindentation Hardness of Materials
ASTM E562	Standard test method for determining volume fraction by systematic manual point count.
AWS A5.01	Procurement Guidelines for Consumables - 2008
COFREND	Comité français des essais non destructifs (French Committee of non destructive testing)
CSWIP	Certification Scheme for Personnel
DNV-OS-F101	Submarine pipelines systems
DNV-OS-F201	Dynamic Risers
DNV-RP-F112	Design of duplex stainless steel subsea equipment exposed to cathodic protection
EN 10204	Metallic products - Types of inspection documents

Reference	Title
EN 13068-3	Non-destructive testing - Radioscopic testing - Part 3: General principles of radioscopic testing of metallic materials by X- and gamma rays
EN 462-5	Non-destructive testing - Image quality of radiographs - Part 5: Image quality indicators (duplex wire type), determination of image unsharpness value
ISO 10005	Quality management systems - Guidelines for quality plans
ISO 11699-1	Non-destructive testing - Industrial radiographic film - Part 1: Classification of film for industrial radiography
ISO 13628-5	Petroleum and natural gas industries - Design and operation of subsea production systems - Part 5: Subsea umbilicals
ISO 17636 (All parts)	Non-destructive testing of welds - Radiographic testing - All parts
ISO 19232-1	Non-destructive testing - Image quality of radiographs - Part 1: Determination of the image quality value using wire-type image quality indicators
ISO 9001	Quality Management Systems - Requirements
ISO 9712	Non-destructive testing - Qualification and certification of NDT personnel

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 160	Design, fabrication and testing of Subsea Umbilicals
GS EP PLR 241	Fabrication of Super-Duplex Stainless Steel Small Bore Seamless Tube for Umbilical
GS EP PLR 245	Fabrication of Super Duplex stainless steel Small bore seam welded tubes for umbilical
GS EP PVV 175	Cleaning of piping and vessels

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3. General

3.1 Definitions

Company	TOTAL E&P or agents acting on its behalf, shall be referred to herein as the "Company".
Contractor	Shall be the Company appointed by Company to carry out the work but shall also include his Sub-Contractors and vendors.
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".
Supplier	The Companies, or their agents including steel and pipe Manufacturer, 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".
Work	Means all and any part of the obligations to be performed by Contractor under the Contract Documents or purchase order and contract amendments.
Site	This term designates the sites, workshops, worksites, barges, ship or other locations where the prefabrication, welding and installation of the pipeline is performed complete or in part.
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".
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 Company Project Particular Specification.
Approval	shall be construed accordingly.
May	Used to indicate that a provision is optional.

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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.
Duplex	Is the generic name of stainless steel containing 22% of Chromium.
Super Duplex	Is the generic name of stainless steel containing 25% of Chromium.

3.2 Abbreviations

WPS	Welding Procedure Specification
p-WPS	Welding Procedure Specification - Preliminary
WPQ	Welding Procedure Qualification
WPQR	Welding Procedure Qualification Record
NDE	Non Destructive Examination
RE	Radiographic Examination
LPE	Liquid Penetrant Examination
SMLS	Seamless
SRb	Basic Spatial Resolution
LSW	Long seam welded
WM	Weld Metal
HAZ	Heat Affected Zone
DWP	Design Working Pressure (as per ISO 13628-5)
PMI	Positive Material Identification
GTAW	Gas Tungsten Arc Welding (manual - With A means Automatic or Mechanized)
QCP/ITP	Quality Control Plan / Inspection Test Plan
KOM/PIM	Kick Of Meeting / Pre Inspection Meeting
WT	Wall Thickness

4. Quality Assurance/Quality Control

The Contractor shall maintain an effective Quality System that complies with the requirements of [ISO 9001](#) and associated guides.

The Contractor shall work to a Company approved quality plan according [ISO 10005](#) for the systematic control of the construction, inspection and testing, as dictated by the overall contract quality programme.

Three weeks prior to start welding activities, the Supplier shall prepare and submit to the Company a QCP/ITP describing the inspections to be performed during welding. The QCP/ITP shall set for “witness”, “hold”, “review” and “monitor” points.

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The QCP/ITP shall include:

- Flow chart or numbering table illustrating each inspection point and its relative location in the procedure cycle, where conformance of characteristics is verified
- Parameters to be inspected at each inspection point, the procedures and acceptance criteria to be used
- Copies of specific forms used by Contractor to record the results of each inspection.

The QCP/ITP shall be sent to Company for review and approval before starting welding operation.

The Contractor shall maintain records/reports as documentary evidence of compliance with quality requirements.

Quality records/reports shall be available upon Company's request for review.

Contractor's inspection system shall be subject to evaluation and checked by the Company to ensure that the system is effectively applied and meets the requirements of this specification and relevant Contract Documents.

5. Project Particular Specification

The Company Project Particular Specification (PPS) shall define (see Appendix 4):

- Grade
- Manufacturing process, SMLS or LSW depending of project constrain
- Minimum Internal Diameter of tubes to be supplied
- Any other information or particular tests to be carried out with relevant requirements (e.g. weldability tests, bending tests, fatigue tests, etc.).

6. Proposal submission file

Upon submission of his proposal, Contractor shall provide Company with the following information and documents as a minimum requirement:

- The specification data for the equipment used:
 - Layout and make-up of the production welding line or site
 - Maximum and minimum pipe lengths which can be welded on this welding installation (welding line only)
 - Technical data about welding device
 - Technical characteristics of preheating and post-weld heat treatment equipment (where applicable)
 - Alignment clamp type and technical data
 - Beveling machine for main line, double joints, etc.
- The proposed Welding Procedure Specifications for welds, with execution sequence of the various passes in association with the dedicated welding stations.

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- The welder qualification scheme.
- The procedures for non-destructive inspections together with data sheets of the equipment used.
- Any other technical information concerning the work to be carried out, such as previous references from similar work performed successfully, welding procedure test certificates previously used in production, etc.

7. Inspection by the Company

The main procedures shall be issued for approval to Company. All qualification tests shall take place under the supervision of the Company Inspector.

Company's Inspector shall be notified at least 2 weeks prior any qualification tests.

The Supplier shall ensure that the Inspector has full and free access to all parts of the Mill or site during all fabrication stages.

The Company reserves the right to re-check tests carried out by the Supplier. For this purpose, the Company may request the delivery of samples or specimens for analyse in an independent laboratory chosen by the Company.

8. Production and welding requirements

8.1 General

Welding shall not start without approval of the Contractor's QCP/ITP and Inspection Procedures by Company.

Materials shall be inspected after delivery on site. All damage shall be reported to the Company representative.

Correlation between identification marking on materials and relevant materials certificates shall be checked by the Contractor and Supplier, prior to start fabrication.

8.2 Overall Requirement

8.2.1 General

Contact between stainless steel and carbon steel is prohibited.

Contractor procedure for management of Stainless Steel material shall be sent to Company for approval prior starting with fabrication.

All the tools, except machining tools, shall not have been used for either carbon steel or any others high alloyed steel. The following precautions shall be implemented:

- Dedicated grinding disk for stainless or duplex steel shall be used
- Brush wires shall be stainless steel
- Small bore pipes, tees, fittings shall be cleaned internally and all foreign material shall be removed by means of special tools

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- Earth connection for welding and cutting equipment shall be made of stainless steel
- Cutting shall be carried out only by plasma or by mechanical sawing.

In case of condensation on materials, humidity shall be eliminated by using hot air blowers and/or by controlled induction heating. Use of any flame heating device is prohibited.

Oil, moisture, rust, scale, paint or other foreign matter shall be removed from bevel surface and internally and externally on at least 50 mm on base metal prior welding.

Contamination of surface, weld bevel and surrounding areas with low melting point metals such as Copper, Zinc, etc., are not acceptable.

Inner and outer surface of weld preparation shall be thoroughly:

- Cleaned by wire brushing using a stainless steel wire brush
- Followed by de-greasing with solvent free from chloride and in accordance with local health and safety regulations.

Paint and markers containing zinc or chloride are prohibited.

Stringer beads shall be used. Minor arc oscillation to ensure side wall fusion is permitted (see paragraph 9.1).

Correction of deflexion by **flame straightening is prohibited**.

Grinding of all start/stop is not recommended.

In case a start/stop grinding is applied, this operation shall be as well applied during WPQ as an essential variable.

The bevels shall be prepared by machining (Chloride content in machining oil shall be limited to 1.0ppm) or by automatic plasma cutting. The heat affected zone shall then be removed by machining.

Any other welding configuration other than butt welding is **strictly forbidden** (i.e. socket welding...).

8.2.2 Special requirements for welding performed in workshop, pipe mill and/or site

The **workshop and/or site** shall be clean and free from oil and grease and shall be dedicated to welding of stainless steel only. The workshop and/or site shall be sufficiently draught free to ensure adequate gas shielding. Temperature and humidity control shall be part of welding procedure qualification.

A reception workshop and/or site certificate shall be filled-in before starting with fabrication and shall be reviewed to follow the fabrication quality. This certificate will be approved by all parties. A form of document is proposed in Appendix 2.

Welding environments shall be always clean with a controlled atmosphere. Therefore a welding habitat is strongly recommended in case of site welding.

8.2.3 Special requirement for welding performed offshore

Contractor offshore method statement, i.e. welding procedure and qualification program shall be established.

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The procedure shall take into account backing protection effect, floating support vessel impact, impact of cathodic protection, etc.

This documentation shall be issued to Company for review and approval.

9. Welding

9.1 General

Three (3) weeks prior fabrication the welding book, QCP/ITP and p-WPS shall be sent to Company for review. These documents shall cover all actions to be carried out before welding to secure the welding operation.

Company shall be notified for welding procedure qualification, for mechanical testing performance and for starting the welding production. Those welding procedures qualifications shall be performed in the identical facilities & conditions where production will take place (i.e. Contractor's workshop, sub-Vendor's facilities and pipe mill etc.).

Before welding, bevels adjacent inner and outer surfaces on at least 50 mm and GTAW wires shall be cleaned with acetone or equivalent as ethanol and fluffiness fabric.

The oxidised end of filler wire shall be cut out prior to be re-used.

Weaving bead is not authorized in single pass technique. In case of multi passes technique and provided the waiving is limited to 6 times the electrode diameter, waiving could be acceptable.

In case of coated tubes, dedicated WPQ shall be performed, i.e. butt weld after coating application, to ensure the efficiency of cleaning method. This WPQ will be part of the procedure and method statement.

Temporary fittings, such as hydrostatic test adaptors may be manually welded by GTAW.

9.2 Base material

Small bore pipe and fittings shall be supplied by Company, Contractor or Sub-Contractor as defined in Company General Specification listed in section 2 and associated Particular Project Specification (see section 5).

The bevel of the small bore tube shall be defined by Contractor.

In case of supply of straight length to Company, tubes shall be delivered with square finish.

Traceability of base material shall be provided before any welding operation.

9.3 Welding process

Only Gas Tungsten Arc Welding (GTAW - A-GTAW) process, manual and automatic, is authorised.

Any other process that Supplier would intent to use shall be subject to prior approval by Company. This approval would be based on the submission of complete file detailing past experience and quality achieved with the proposed process.

Welding without filler metal addition is strictly forbidden except for tack welding.

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All manual and automatic GTAW equipment shall be equipped with high frequency start/stop and pre/post purge gas flow for the torch. Whenever the welder stops welding, the welding arc power shall gradually decrease by using the remote current control. The torch shall be held in position close to the weld pool until the gas shielding post-purge flow is completed to prevent oxidation.

Permanent backing material is not allowed.

For automatic welding process, the following additional parameters shall be:

- Amplitude of weave (specified and measured)
- Frequency of wave (specified)
- Dwell time (specified and measured).

9.4 Welding consumables

9.4.1 General

Welding consumable (wires, gas...) shall be purchased from recognised well-known Manufacturer.

All welding consumables shall conform to [ASME BPVC Section IX](#), [AWS A5.01](#), [ASME BPVC Section II, Part C](#) or approved equivalent standard.

9.4.2 Filler metal

1. Each heat, lot (or so called batch herein) of consumables shall be supplied with a 3.1 (3.1 certificate will be part of Manufacturing Record Data Book for inspection) certificate according to [EN 10204](#). Mill test certificates from consumables Manufacturer shall exhibit actual test results obtained from the intended lot and shall be submitted to the Inspector for approval. Mill certificates shall include the following minimum information:
 - Chemical composition
 - Mechanical properties.
 - The lot and the level of testing shall be in conformance with the following requirement as specified in [AWS A5.01](#) class S3 for wires
 - The level of testing shall be as per [AWS A5.01](#) - paragraph 6.5 - Schedule-I as a minimum.
2. All welding consumables shall be supplied in sealed, dirt and moisture proof containers.
3. All welding consumables shall be, as a minimum, stored and handled in accordance with the written Manufacturer's recommendations.
4. Contractor's procedure relative to storing, handling, drying, recycling and traceability of consumables shall be approved by the Inspector before starting of welding.
5. Each tin or packet of wire or reel of filler wire shall be clearly marked with the respective batch number. Consumables being unmarked or showing signs of deterioration or exhibiting other damage shall be discarded.