

GENERAL SPECIFICATION

SUBSEA SYSTEMS

GS EP SPS 036

Welding of pressure and non pressure containing equipment for subsea applications

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1. Scope

This Specification covers the requirements for welding, heat treatment, and non-destructive examination of pressure and non pressure containing subsea equipments made of but not limited to:

- Carbon steels
- Low alloy steels subject to post weld heat treatment or not
- Austenitic stainless steels
- Nickel alloy stainless steels
- Overlay
- Heterogeneous welding.

For Duplex SS dissimilar welding, the present GS shall apply in conjunction with **GS EP SPS 037**.

This specification is to be considered as a supplement to either:

- [API SPEC 6A](#) Specification for Wellhead and Xmas Tree Equipment
- [API SPEC 17D](#) Design and Operation of Subsea Production Systems-Subsea Wellhead and Tree Equipment
- [API RP 5C6](#) Welding connections to Pipe

and their respective associated standards.

It is intended to apply to works on fabrication sites such as construction sites or fabrication yards, as well as in manufacturer's workshops.

Welds for use in hydrogen sulfide service shall also conform to the requirements of [ISO 15156-2](#) and [ISO 15156-3](#).

This document is intended to be used together with the applicable codes and standards as listed in the following section "Reference documents".

2. Reference documents

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

Any code or Government regulations which may be listed in the Project Specifications, in the requisition, or in the Purchase Order shall have precedence except where this Specification is more stringent.

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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
AISI 4130	Alloy Steel (UNS G41300)
AISI 8630	Alloy Steel (UNS G86300)
API RP 5C6	Welding connections to Pipe
API SPEC 17D	Design and Operation of Subsea Production Systems - Subsea Wellhead and Tree Equipment
API SPEC 6A	Specification for Wellhead and Christmas Tree Equipment
ASME BPVC Section II-C	Materials - Specifications for Welding Rods, Electrodes, and Filler Metals
ASME BPVC Section IX	Welding and Brazing Qualifications - Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators
ASME BPVC Section VIII Div 1	Rules for Construction of Pressure Vessels - Pressure Vessels
ASTM A182	Standard Specification for forged or rolled alloy and stainless steel pipe flanges, forged fittings, and valves and parts for high-temperature service
ASTM A380	Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems
ASTM E1254	Standard Guide for Storage of Radiographs and Unexposed Industrial Radiographic Films
ASTM E1815	Standard Test Method for Classification of Film Systems for Industrial Radiography
ASTM G28	Standard Test Methods for Detecting Susceptibility to Intergranular Corrosion in Wrought, Nickel-Rich, Chromium-Bearing Alloys
EN 12668	Non Destructive Testing - Characterization and verification of ultrasonic examination equipment
EN ISO 9606-1	Qualification testing of welders - Fusion welding - Part 1: Steels
ISO 10474	Metallic Products - Type of inspection documents
ISO 11666	Non Destructive Testing of welds - Ultrasonic testing - Acceptance levels
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 14175	Welding consumables - Gases and gas mixtures for fusion welding and allied processes
ISO 14732	Welding personnel - Qualification testing of welding operators and weld setters for mechanized and automatic welding of metallic materials
ISO 15156 / NACE MR 0175	Petroleum and natural gas industries - Materials for use in H ₂ S-containing environments in oil and gas production
ISO 15607	Specification and qualification of welding procedures for metallic materials - General rules
ISO 15609 (Parts 1; 3)	Specification and qualification of welding procedures for metallic materials - Welding procedure specification - Parts 1; 3
ISO 15614 (Parts 1; 11)	Specification and qualification of welding procedures for metallic materials - Welding procedure test - Parts 1; 11
ISO 17636-1	Non-destructive testing of welds - Radiographic testing - Part 1: X- and gamma-ray techniques with film
ISO 17638	Non Destructive Testing of welds - Magnetic Particle Testing
ISO 17640	Non Destructive Testing of welds- Ultrasonic Testing - Techniques, testing, levels and assessment
ISO 19232	Non-destructive testing - Image quality of radiographs
ISO 22825	Non Destructive Testing of welds - Ultrasonic testing - Testing of welds in austenitic steels and Nickel based alloys
ISO 23278	Non Destructive testing of welds - Magnetic Particle Testing of welds - Acceptance levels
ISO 23279	Non Destructive Testing of welds - Ultrasonic testing - Characterization of indications in welds
ISO 2400	Non-destructive testing - Ultrasonic testing - Specification for calibration block No. 1
ISO 3452 (All parts)	Non-destructive testing - Penetrant inspection - General principles - All parts
ISO 3834-2	Quality requirements for fusion welding of metallic materials - Part 2: Comprehensive quality requirements
ISO 5579	Non-destructive testing - Radiographic examination of metallic materials by X-rays and gamma rays - Basic rules
ISO 7963	Non-destructive testing - Ultrasonic testing Specification for calibration block No. 2

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Reference	Title
ISO 9712	Non destructive testing - Qualification and certification of NDT personnel
ISO/IEC 17025	General requirements for the competence of testing and calibration laboratories

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 SPS 029	Metallic Materials for Subsea Production Facilities
GS EP SPS 037	Welding of Duplex 22Cr and Super Duplex 25Cr Stainless Steels for subsea equipment

Acronyms

WPS	Welding Procedure Specification
WPQR	Welding Procedure Qualification Record
PWHT	Post Welding Heat Treatment
HAZ	Heat Affected Zone
WM	Weld Metal
VT	Visual Testing
PT	Penetrant Testing
MT	Magnetic Particle examination/Testing
RT	Radiography Testing
UT	Ultrasonic Testing

3. Quality requirements

All welding and related activities shall comply with the requirements of [ISO 3834-2](#) and the additional requirements in this specification.

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4. General welding requirements

Only butt welds shall be used. Socket welding shall not be authorized.

Manufacture shall not commence until the Company has reviewed and approved:

- Inspection Testing Plan (ITP)
- Welding Procedure Specification (WPS) and associated Welding Procedure Qualification Report (WPQR).

The Welding Procedure Specification shall include all factors which influence the quality and reliability of the components.

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

Correlation between marking on materials and materials certificates shall be checked by the Contractor, prior fabrication.

Contact between stainless steel and carbon steel shall be prohibited.

The workshop shall be clean and free from oil and grease.

The workshop shall be sufficiently draught free to ensure adequate gas shielding.

Correction of deflection by flame straightening is prohibited for CRA.

Grinding of all start/stop is required.

The bevels shall be prepared by machining, but a preparation by automatic plasma cutting is acceptable. The heat affected zone shall then be removed by grinding.

Company shall be notified for welding procedure qualification and mechanical testing performances and also for starting of welding production.

These Welding Procedure Qualifications shall be performed in the workshop facilities (and sub-vendor facilities) used for production welding.

5. Welding Documents

5.1 General

Welding procedures without filler metal are prohibited.

All welds including weld repairs shall be supported by a relevant WPS.

5.2 Welding book

Prior fabrication, a welding book shall be submitted to the Company for review.

The welding book including repair procedures shall be submitted as soon as possible after the award of work, prior to any fabrication or any parts and sufficiently ahead of the actual welding for the review of the Company.

The welding book shall be fully transmitted each time a new revision is issued.

5.3 Welding Procedures Specifications (WPS)

Welding procedure specifications shall be established for all welding and shall follow [ISO 15607](#), [ISO 15609-1](#) and [ISO 15609-3](#) requirements with the following additional requirements.

Applicable welding procedure specifications shall indicate the diameter and thickness range as appropriate.

A welding procedure is defined as the method and sequences to be adopted to achieve a satisfactory welded joint when carried out by a competent workman under the expected conditions of manufacture.

All welding procedures submitted to the Company shall include the actual welding details including all of the essential and non-essential variables and in particular the weld preparation and the bead sequence.

The actual job welding parameters shall be within the range used for the procedure qualification.

Weld procedures shall state the actual consumable or flux trade name and type as well as the code designation.

The welding procedure shall be issued on [ASME BPVC Section IX](#) form QW 482 or equivalent such as [ISO 15609-1](#) Annex A and [ISO 15609-3](#) Annex A.

All WPS shall be in writing and shall be qualified and certified in accordance with the applicable code. All supporting PQR shall be witnessed, or at least certified, by a recognised inspection authority.

All WPS, including their qualification test records (PQR) shall be submitted to the Company for approval prior to starting fabrication.

All test results shall be from specimen representative of the final condition of the equipment, including heat treatment(s) where applicable.

5.4 Welding Procedures Qualification Record (WPQR)

All welding procedures shall be qualified in accordance with the requirements of [ISO 15614-1](#), [ISO 15614-11](#), [ASME BPVC Section IX](#) or equivalent and the additional requirements given in this specification.

Procedure tests for all welding processes shall be qualified using the same welding consumables and flux as will be used on the actual item.

The qualification shall be performed as practicable on actual bulk material.

The qualification records shall include when applicable the composition and flow rate of shielding and backing gas, power sources, inductance setting, electrode diameter and stick out, current and voltage, wire feed rate and travel speed.

For Submerged Arc Welding, the qualification record shall include the current arc intensity and voltage and the travel speed for each weld run.