

GENERAL SPECIFICATION

SUBSEA SYSTEMS

GS EP SPS 004

Subsea Valves

10	10/2015	General revision
09	09/2013	General revision, title change
08	01/2012	General revision
07	01/2011	General revision
00	10/2002	First issue
Rev.	Date	Purpose of the revision

Owning entity: DSO/TEC

Managing entity: DSO/TEC/SBS

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1. Scope

This document provides general Company requirements and overall recommendations for function, design and testing of large bore subsea valves (> 2" ND). This Specification is intended to establish the technical and functional requirements while allowing flexibility to benefit from Contractor/manufacturer experience and expertise.

This Specification covers gate, ball and check valves and both manual/ROV operated and hydraulically/electrically actuated valves with ROV override.

Valves may be individual units installed into piping or integrated into another unit (such as XT blocks).

Other valves such as Chemical Injection Throttling Valves (CITV), service valves in subsea stations (small bore ≤ 2" ND) and choke valves are not covered by this Specification.

2. Reference Documents

This technical specification is to be read in conjunction with **GS EP SPS 001** and the other Company specifications and standards identified herein.

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 RP 17H	Remotely Operated Vehicle Interfaces on Subsea Production Systems
API SPEC 17D	Design and Operation of Subsea Production Systems - Subsea Wellhead and Tree Equipment
API SPEC 6A / ISO 10423	Specification for Wellhead and Christmas Tree Equipment
API SPEC 6AV1	Specification for Validation of Wellhead Surface Safety Valves and Underwater Safety Valves for Offshore Service
API SPEC 6DSS / ISO 14723	Specification for Subsea Pipeline Valves
API STD 17F	Standard for Subsea Production Control Systems
ASME B16.34	Valves - Flanged, Threaded, and Welding End
ASME BPVC Section VIII Div 2	Rules for Construction of Pressure Vessels - Alternative Rules
DNV-RP-F112	Design of Duplex Stainless Steel Subsea Equipment Exposed to Cathodic Protection
ISO 10474	Metallic products - Inspection documents

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Reference	Title
ISO 5208	Industrial valves - Pressure testing of metallic valves
NORSOK M-710	Qualification of non-metallic sealing materials and manufactures

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 001	Subsea Production Systems General Design Requirements
GS EP SPS 009	Corrosion protection of subsea stations
GS EP SPS 010	Preservation requirements for subsea package
GS EP SPS 011	Mechanical Completion of Subsea Package
GS EP SPS 024	Subsea Valve Manual Actuators
GS EP SPS 025	Subsea Valve Actuators
GS EP SPS 029	Metallic Materials for Subsea Production Facilities
GS EP SPS 035	Material specification for Duplex 22Cr and Superduplex 25Cr stainless steel subsea equipments
GS EP SPS 036	Welding of pressure and non pressure containing equipment for subsea applications
GS EP SPS 037	Welding of Duplex 22Cr and Super Duplex 25Cr Stainless Steels for subsea equipment

3. Terms and Definitions

Technical terms and definitions are listed in [API SPEC 6A / ISO 10423](#) and API 17 series.

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

Service Valve	Small bore valve ≤ 2" ND
Actuator	Either mechanical actuator (gearbox) or hydraulic/electric actuator
Company	TOTAL E&P
Contractor	Contractor appointed by the Company for the supply of the equipment.
Manufacturer	The party(s) which manufactures and/or supplies materials, equipment, technical documents/drawings and services to perform the duties specified by Company.
'Shall'	'Shall' is used to indicate requirements which are to be strictly followed in order to conform to the specification and acceptance by all parties.

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‘Should’	‘Should’ is used to indicate that among several possibilities one is the recommended as particularly suitable without mentioning or excluding others, or that a certain course of action is preferred but not necessarily required.
‘May’	‘May’ is used to indicate a course of action permissible within the limits of the specification. An optional course of action.
‘Can’	‘Can’ is used for statements of possibility and capability, whether material, physical or capable.

3.1 Abbreviated Terms

API	American Petroleum Institute
COG	Center of Gravity
CP	Cathodic Protection
CRA	Corrosion Resistant Alloy as defined by API SPEC 6A / ISO 10423
DNV	Det Norske Veritas
DPE	Double Piston Effect
FAT	Factory Acceptance Test
FEA	Finite Element Analysis
FLET	Flowline End Termination
GS	General Specification
HISC	Hydrogen Induced Stress Cracking
HP	High Pressure
HVOF	High Velocity Oxygen Fuel
ID	Internal Diameter
ISO	International Standardisation Organisation
LAF	Load Amplification Factor
LP	Low Pressure
ND	Nominal Diameter
NDT	Non Destructive Testing
NPT	National Pipe Taper
PSL	Product Specification Level
RGD	Rapid Gas Decompression
ROV	Remotely Operated Vehicle
RP	Recommended Practice
SPE	Simple Piston Effect

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SWL	Safe Working Load
TRL	Technical Readiness Level
XT	Christmas Tree

4. Requisition and Valve Data Sheet

Valve data sheets shall be issued by the Contractor or Company for each type of valve, or each itemized valve, detailing the main features as derived from the relevant material and pressure classes, the Project requirements and the present Specification.

Manufacturer shall integrate the valve data sheets with suitable information and drawings to satisfy the requirements of Appendix 1.

Each valve data sheet shall clearly identify the service fluids and line design conditions. The valve design, manufacturing and testing requirements are dependant on these criteria regardless of the valve type.

For all valves, the data sheets shall also specify the internal bore dimension to match the adjacent pipe requirements.

Valves installed in piggable lines shall be clearly identified in the datasheets.

In case qualification status of the package is not thoroughly reviewed by Company before order placement, then valve manufacturer shall quote for full validation testing programme. Extent of such programme can then be relaxed after TRL is fully assessed. The requirements are specified in detail in **GS EP SPS 001**.

Manufacturer shall provide assemblies which comply entirely with this Specification and the Project requirements. Any exceptions shall be clearly identified and submitted to Company for review, prior to approval.

5. Definition of Service Classes for Valves

Valves covered by this GS are of the two following categories:

1. Subsea valves designed in accordance with [API SPEC 17D](#) and [API SPEC 6A / ISO 10423](#) PSL 3 and this Specification. Valve assemblies to be installed in production and export systems or in lines where they may be temporarily in contact with production fluids, shall be tested to PSL 3G and this Specification.
2. Valves designed in accordance with pressure/temperature ratings as per [API SPEC 6DSS / ISO 14723](#) and [ASME B16.34](#) may be used subsea if a pre-qualified design exists, subject to prior approval from Company. PSL 3/PSL 3G level requirements (manufacturing and testing) shall apply to these valves as well.

The requirements of the following sections apply to both categories without distinction.

The temperature classification shall be as per Project requirements. A minimum temperature class 'U' relating to an operating range of -18°C to +121°C shall be set for development programmes or qualification testing not finalized to a specific Project.

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6. Materials and Manufacturing

6.1 General Requirements

The requirements as per [GS EP SPS 029](#), [GS EP SPS 035](#), [GS EP SPS 036](#) and [GS EP SPS 037](#) apply for selection, manufacturing and fabrication of metallic materials. For corrosion protection requirements refer to [GS EP SPS 009](#).

Valve designs and materials shall be selected to maximize the use of proven manufacturing and fabrication experience of the manufacturer for the range of valve sizes. Substantial changes to consolidated manufacturing processes shall be brought to the attention of Company and shall be qualified before use. Materials shall be suitable for the service conditions defined in the data sheets.

All valve assemblies are deemed to be fabricated and tested at the manufacturer's premises. Any deviation to this requires approval from Company which shall be obtained prior to the Purchase Order issue.

All sub-manufacturers for pressure containing parts and pressure controlling parts shall be approved by Company. The requirement also applies to sub-manufacturers for special processes, e.g. weld-overlay, tungsten carbide coating, etc.

Use of cast material (including centrifugally cast) is not acceptable for subsea valve components. All components shall be a single piece forged to shape. Use of bars for internal components requires Company acceptance and shall be subject to additional mechanical testing as per [GS EP SPS 029](#) and [GS EP SPS 035](#).

Materials used in valve manufacture shall be in accordance with the relevant valve data sheets issued by the purchaser. Any material substitution is subject to approval by Company.

Valve wetted part materials shall be compatible with all relevant fluids. Special consideration shall be given to the compatibility of non-metallic materials with all contained fluids during manufacture, testing, pre-commissioning, commissioning and operation.

6.2 Valve Seal Material

All seal materials shall be suitable for exposure to all intended fluids. The effects of low temperature caused by depressurization during valve closure or possible leakage shall be considered during seal material selection.

Where metallic seals are used, the seal area (seal ring groove) shall be of a harder material than the seal element, with a minimum difference in hardness that shall be demonstrated by the manufacturer. Thermoplastic (or other non-metallic) coatings shall not be used on seal rings for connections that are made-up in-house/onshore.

Non-metallic seals shall satisfy the qualification testing requirements for ageing and resistance to Rapid Gas Decompression (RGD) as per [API SPEC 17D](#) and [NORSOK M-710](#).

When elastomeric materials are used, fluoro-elastomeric products (FPM/FKM) are not acceptable for subsea service where contact with methanol is expected.

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7. Valve Assemblies

7.1 General Requirements

The requirements provided in this section are applicable to all valve types.

The design shall be identified by design life, external and internal design pressures and temperatures, material compatibility with produced media, injected chemicals such as methanol, inhibitors and other relevant chemical substances.

Based on the Project requirements, corrosion and erosion allowances shall be implemented in the valve design. In case of heavy sand content the seats, seals and the trunnion and stem bearings (as applicable) shall incorporate means to prevent the ingress of foreign particles.

The valve pressure rating shall be identified by the maximum internal absolute pressure at installation water depth without offsetting of the external pressure given by the static head.

General requirements for the valve are:

1. All the valves mounted in-line with the pipe shall have butt welding ends to fit the adjoining pipe system. Flanged ends are acceptable for use only with valves mounted/integrated directly onto XT blocks.
2. The valve ends shall be supplied with pup pieces and where necessary transition pieces to allow for transition between the valve body (material grade and thickness) and the adjacent pipe (material grade and thickness) to which the valve is intended to be connected. The total length of pup piece and transition piece (or pup piece alone if no transition piece is required) shall be sufficient:
 - To allow for at least 1 (one) cut and re-weld in case of welding defects leading to failure
 - To provide minimum distance in between integration welding bevel and seat pockets, enough to preserve soft seals from heat
 - To avoid variation of thickness across welded joints to minimise stress concentration
 - To include for a slope angle not bigger than 14 degrees (1-to-4) for thickness transitions
 - To provide suitable geometry for the expected NDT techniques.
3. The resulting geometry of transition piece and welded joints shall be included in the FEA model for local stress evaluation under the various loading conditions. Typical configuration and applicable codes are shown in Figure 1a.