

## GENERAL SPECIFICATION

### SUBSEA SYSTEMS

#### GS EP SPS 002

#### Design of Subsea Stations

| Rev. | Date    | Purpose of the revision               |
|------|---------|---------------------------------------|
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## 1. Scope

This specification provides for the design of subsea stations additional requirements to those specified in [API RP 17P](#) using the same section numbering and headings.

When it refers to [API RP 17P](#), the word '*should*' shall be replaced by the word '*shall*'.

The equipments covered by the scope of this document are listed below:

- Production and injection manifolds
- Pipeline end manifolds (PLEM)
- Pipeline/flow line end terminations (PLET/FLET)
- Tee (ILT) and Wye (Y-) connections
- Subsea isolation valve modules (SSIV)
- Subsea Process (SSP) stations (e.g. compression, separation, pumping, chemical injection/storage, water treatment, electrical power distribution)
- HIPPS.

This document shall also serve as a reference for other subsea stations as listed here after:

- Subsea controls and distribution structures (SDU, UTA)
- PGB
- FCM
- XT structure
- Subsea Pig Launcher/Receiver (SPLR).

The flow line riser bases and export riser bases (FRB, ERB) components and their applications as well as driven piles are outside of the scope of this document.

## 2. Reference documents

This document shall be read in conjunction with the [GS EP SPS 001](#) for general design requirements and the [GS EP SPS 038](#) for design and fabrication of subsea stations.

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

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## 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 STD 170   | Standard for Subsea High Integrity Pressure Protection Systems (HIPPS)                 |
| API RP 17P    | Design and Operation of Subsea Production Systems - Subsea Structures and Manifolds    |
| API RP 2A-WSD | Planning, Designing and Constructing Fixed Offshore Platforms - Working Stress Design. |
| ASME B31.3    | Process Piping                                                                         |
| ASME B31.4    | Pipeline Transportation Systems for Liquids and Slurries                               |
| ASME B31.8    | Gas Transmission and Distribution Piping Systems                                       |
| DNV-OS-F101   | Submarine Pipeline Systems                                                             |
| DNV-RP-F112   | Design of Duplex Stainless Steel Subsea Equipment exposed to Cathodic Protection       |
| ISO 19902     | Petroleum and natural gas industries. Fixed steel offshore structures                  |

## 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 GEO 702 | Requirements for design and installation of skirted foundations and suction anchors |
| GS EP SAF 380 | Safety engineering requirements for an F(P)SO                                       |
| GS EP SPS 001 | Subsea Production Systems General Design Requirements                               |
| GS EP SPS 004 | Subsea Valves                                                                       |
| GS EP SPS 006 | Service valves in subsea stations                                                   |
| GS EP SPS 007 | Subsea Connection Systems                                                           |
| GS EP SPS 008 | Thermal insulation of subsea stations                                               |
| GS EP SPS 009 | Corrosion Protection of Subsea Stations                                             |
| GS EP SPS 010 | Preservation requirements for subsea package                                        |
| GS EP SPS 012 | Documentation requirements for subsea stations                                      |

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| Reference     | Title                                                                                         |
|---------------|-----------------------------------------------------------------------------------------------|
| GS EP SPS 016 | Subsea Choke Valves                                                                           |
| GS EP SPS 019 | Subsea production control system                                                              |
| 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 031 | Chemical Injection Throttling Valves                                                          |
| GS EP SPS 033 | Subsea Intervention Tooling                                                                   |
| GS EP SPS 034 | Well Jumper Design                                                                            |
| 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            |
| GS EP SPS 038 | Subsea Structures design and fabrication                                                      |
| GS EP STR 433 | Structural design of skirted foundations and suction anchors                                  |
| GS EP TEC 260 | HIPS Design, Implementation and Life Cycle                                                    |

### 3. Terms, abbreviated terms, and definitions

#### 3.1 Terms and definitions

The section 3.1 of [API RP 17P](#) fully applies.

In addition, for the purpose of this document, the following terms and definitions shall apply:

|                   |                                                                                                                                                                                                              |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Company</b>    | Total E&P                                                                                                                                                                                                    |
| <b>Contractor</b> | The party appointed by Company for the supply of the equipment.                                                                                                                                              |
| <b>‘Shall’</b>    | Indicates requirements which are to be strictly followed in order to conform to this Specification and acceptance by all parties.                                                                            |
| <b>‘Should’</b>   | Indicates that among several possibilities one is recommended as particularly suitable without mentioning or excluding others, or that a certain course of action is preferred but not necessarily required. |
| <b>‘May’</b>      | Used to indicate a course of action permissible within the limits of the Specification.                                                                                                                      |
| <b>‘Can’</b>      | Used for statements of possibility and capability, whether material, physical or capable.                                                                                                                    |

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### 3.2 Abbreviated terms

The section 3.2 of [API RP 17P](#) fully applies.

In addition, the following abbreviations are used in the Specification:

|                      |                                           |
|----------------------|-------------------------------------------|
| <b>BOP</b>           | Blow-Out Preventer                        |
| <b>CITV</b>          | Chemical Injection Throttling Valve       |
| <b>CP</b>            | Cathodic Protection                       |
| <b>CS</b>            | Carbon Steel                              |
| <b>DAF</b>           | Dynamic Amplification Factor              |
| <b>EFL</b>           | Electrical Flying Lead                    |
| <b>ERB</b>           | Export Riser Base                         |
| <b>ESDV</b>          | Emergency Shut Down Valve                 |
| <b>FCM</b>           | Flow Control Module                       |
| <b>FEA</b>           | Finite Element Analysis                   |
| <b>FL</b>            | Flying Lead                               |
| <b>FLET</b>          | Flowline End Termination                  |
| <b>FRB</b>           | Flowline Riser Base                       |
| <b>GS</b>            | General Specification                     |
| <b>HFL</b>           | Hydraulic Flying Lead                     |
| <b>HIPPS</b>         | High Integrity Pressure Protection System |
| <b>HISC</b>          | Hydrogen Induced Stress Cracking          |
| <b>H<sub>s</sub></b> | Significant Wave Height                   |
| <b>ID</b>            | Internal Diameter                         |
| <b>ILT</b>           | In-Line Tee                               |
| <b>MPFM</b>          | Multi-Phase Flow Meter                    |
| <b>MQC</b>           | Multi-Quick Connection                    |
| <b>MSS</b>           | Manifold Support Structure                |
| <b>ND</b>            | Nominal Diameter                          |
| <b>OD</b>            | Outside Diameter                          |
| <b>PFD</b>           | Process Flow Diagram                      |
| <b>PGB</b>           | Permanent Guide Base                      |
| <b>PID</b>           | Piping and Instrumentation Diagram        |
| <b>PLEM</b>          | Pipeline End Manifold/Module              |
| <b>PLET</b>          | Pipeline End Termination                  |

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|                      |                                      |
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| <b>ROV</b>           | Remotely Operated Vehicle            |
| <b>ROT</b>           | Remotely Operated Tool               |
| <b>SCM</b>           | Subsea Control Module                |
| <b>SDU</b>           | Subsea Distribution Unit             |
| <b>SPLR</b>          | Subsea Pig Launcher/Receiver         |
| <b>SRM</b>           | Subsea Retrievable Module            |
| <b>SSIV</b>          | Subsea Safety Isolation Valve        |
| <b>SSP</b>           | Subsea Process                       |
| <b>SURF</b>          | Subsea Umbilical Riser Flowlines     |
| <b>TRL</b>           | Technical Readiness Level            |
| <b>T<sub>p</sub></b> | Wave Period                          |
| <b>UTA</b>           | Umbilical Termination Assembly       |
| <b>WOROV</b>         | Work Class Remotely Operated Vehicle |
| <b>XT</b>            | Christmas Tree                       |

## 4. Subsea stations functional considerations

### 4.1 General

The section 4.1 of [API RP 17P](#) shall be applied with the following additional requirements.

### 4.2 System requirements

The section 4.2 of [API RP 17P](#) shall be applied with the following additional considerations:

- a) When relevant and unless otherwise stated, the subsea stations shall be designed so that:
  - Spools, jumpers and UTAs can be installed on receptacle without the need of having the main structure/module in-place.
  - The main structures/modules are detachable from their foundation for retrieval/replacement without requirement for recovery of spools, jumpers and UTAs.
  - Spool Jumper metrology at tie-in locations can be carried out without the need of having the main structure/module in place.
- b) Subsea stations and foundations shall be as far as possible standardised across the same field to allow for the maximum possible flexibility during installation campaign.
- c) All subsea stations and their foundation (suction piles, not-driven piles) shall be designed in a way that they can be removed after the life of field has expired.
- d) Equipment pressure rating shall be such that it will never be exceeded during any activity performed subsea including pre-commissioning and commissioning testing.

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- e) All sensitive equipment with high potential for maintenance or replacement (e.g. MPFM modules, SCM, SRM, Choke valves modules, CITVs, etc.) shall be easily accessible for retrieval and re-installation from light intervention vessels.
- f) Subsea stations shall be designed for required access with both working and inspection ROV's as specified by the **GS EP SPS 033**.
- g) In particular for module connections and tooling interventions, subsea stations shall operate within maximum  $\pm 3^\circ$  angle of verticality. Contractor shall assess the type of leveling system required to be approved by Company.
- h) Snagging avoidance:
  - Subsea station design shall minimize the risk of local guide wire and WOROVB umbilical snagging.
- i) Installation:
  - The subsea station shall be designed for the metocean conditions during installation and in place at seabed, given by Project through a Project Particular Specification.
- j) Cable trays:
  - The subsea station shall include cable trays for electrical cables where applicable.
  - The cable trays shall be routed for maximum protection of the cables and shall provide protection against mechanical damage.

### 4.3 System Interfaces

The section 4.3 of **API RP 17P** shall be applied with the following additional considerations:

- a) Subsea stations shall provide connection interfaces for jumpers, spools, umbilical terminations and Flying Leads (FL). Consideration shall be made for the inclusion of the appropriate number of FL parking places and for their protection.
- b) Subsea stations may include hold back points for installation, initiation and lay-down of sea lines.

### 4.4 Cluster manifold requirements

**API RP 17P** shall be applied with the following additional requirements.

#### 4.4.1 General

The cluster manifold shall not exceed a capacity of 6 wells.

The cluster manifold shall include a foundation as a suction pile with an intermediate Manifold Support Structure (MSS) for levelling and to interface with the Manifold Module.

#### 4.4.2 Alignment

- a) Visual level indication shall be included on the structures.
- b) Fixed/retrievable bull eye shall be incorporated on the Manifold Support Structure.

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- c) If hydraulic jacking system is used, the design shall include a method to mechanically lock the structure in its relative position to the foundation after levelling.
- d) On the Manifold Support Structure, the levelling system shall be able to adjust the inclination within the tolerances associated to the ability of connection and disconnection of the different equipments as required in chapter 4.2 g).
- e) The leveling system capacity shall be based on the combination of both seabed slope and installation tolerances as specified by the project documentation.
- f) The Manifold Support Structure may be integrated with the foundation.
- g) The connector receptacles shall be located on the Manifold Support Structure (for Manifold Module retrievability without spool, jumper or umbilical termination recovery).
- h) Metrology receptacle shall be provided close to each tie-in connection point on the Manifold Support Structure.
- i) Feasibility of all relevant operations shall be documented by the Contractor with the subsea station affected by the worst case scenario for residual misalignment.
- j) For Manifold Module, the final residual inclination (from production location towards the riser base in case of double header development) shall be less than 1.0° unless otherwise stated by Project.
- k) Interface between inboard hubs and connector receptacles including tolerances shall be fully documented and in line with the connector functional requirements.

#### 4.4.3 Guidance system

- a) The guidance system shall cope with the worst possible installation tolerances as specified by the project documentation.
- b) A soft landing system shall be integrated into the structure and modules to reduce the impact loads during final landing.

### 4.5 Template system requirements

[API RP 17P](#) shall be applied with the following additional requirements.

#### 4.5.1 General

Ref is made to [API RP 17P](#) chapter 4.5 with the following additional requirements:

- a) Templates may allow for further connection to a future in-line template, i.e. daisy chaining of templates following Project Requirements.
- b) Where locking mechanisms are required between manifold and the template, the lockdown system shall include a positive action lockdown indicator for visual confirmation by ROV.
- c) The template shall provide landing and locking capability for the wellhead conductor housing. The locking mechanism shall be able to carry part of the loads from the template/manifold to counteract settlement of the template. Assessment of these loads and of the resulting locking mechanism capability shall be established and documented by Contractor.

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- d) The template shall allow for installation of a well jumper for connection of cluster/satellite wells to any of the template well slots.

#### 4.5.2 Drilling and completion interface

- a) The design should allow for any Blow Out Preventer (BOP) orientation in steps of 90°. Recommendation is that rig shall be able to work at any well slot on the same template without having to change its heading.
- b) The template system shall include washout prevention sleeves and cement return outlets.

#### 4.5.3 Alignment

Same requirements as identified in section 4.4.2 shall be applied with the following additions:

- a) Any requirement for levelling of the subsea structures after the first conductor hang-off should be considered and accounted for if required.
- b) The template shall allow for a 1.5° inclination of the conductor housing in any direction.

#### 4.5.4 Guidance system

Same requirements as identified in section 4.4.3 shall be applied.

### 4.6 Other subsea stations requirements

This section is in addition to [API RP 17P](#).

#### 4.6.1 PLEM/PLET/FLET/ILT

PLEM/PLET, FLET, ILT and associated equipments can be either installed integrally with the pipeline or separately for the following systems:

- a) Production flowlines
- b) Service lines
- c) Water injection flowlines
- d) Gas injection line
- e) Gas export pipelines.

##### 4.6.1.1 Functional requirements

The general functionalities shall be as follows:

- a) To allow initiation or abandonment of the flowline or pipeline.
- b) To enable transfer of its transported fluid between the spool pipe and the main header (Flowline).
- c) To allow connection of the spool to the line.
- d) To support, protect valves and all accessories/components (if any).
- e) To provide connection for a temporary recoverable pig launcher/receiver, where applicable.
- f) To provide anchoring of the line, if required.