



Exploration & Production

GENERAL SPECIFICATION

Drilling & Wells

GS EP FP 413

Subsea vertical Dual Bore Christmas Tree

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1. Scope

This General Specification is written to cover the specifications required by both EP/OPS/FP and EP/DEV/TEC/SBS, and is thus managed and administered by both departments. OPS/FP/FP states the minimum functional requirements and the DEV/TEC/SBS states the specific component technical detail requirements.

This general specification is applicable to the Subsea Conventional Christmas Tree systems (VXT) for subsea production and/or injection wells. It defines the requirements for the individual components and/or equipment Units of the VXT System. These comprise of the permanently installed subsea production equipment and associated main running tools.

This specification does not identify all components of a complete VXT System. It is the Contractors responsibility to identify all Units which are part of their complete System, and as per their system's requirements to install and operate.

2. Reference documents

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

This technical specification is supplementary to document **GS EP SPS 001**, and shall be therefore read in conjunction with said document and other Company specifications and standards identified therein. The relationship between the main Company documents defining the requirements to the Subsea Stations is illustrated in **GS EP SPS 001**.

The subsea VXT system shall comply with all relevant industry standards such as ISO, API and other referenced standards unless otherwise stated by Company.

Standards

Reference	Title
ISO 13628	Petroleum and Natural Gas Industries - Design and operation of subsea production systems • Part 1, General requirements and recommendations • Part 4, Subsea Wellhead and Tree Equipment • Part 8, ROV Interfaces on Subsea Production Systems
ISO 10423	Petroleum and Natural Gas Industries – Drilling and Production Equipment – Wellhead and Christmas Tree Equipment
ISO 898-1	Mechanical Properties of fasteners made of carbon steel and alloy steel - Part I Bolts, screws and studs with specified property classes – coarse thread and fine pitch thread
SAE AS 4059 E	Cleanliness classification of hydraulic fluids



Reference	Title
NACE MR 0175/ISO 15156	Material Requirements. Sulphide Stress Cracking. Resistant Metallic Material for Oil Field Equipment
ASME VIII – DIV 1	Boiler and Pressure Vessel Code
ISO TS 29001/Q1	Petroleum petrochemical and natural gas industries—Sector-specific quality management systems—Requirements for product and service supply organizations
ISO 14001	Environmental management systems - Requirements with guidance for use
ISO 10005	Quality management systems - Guidelines for quality plans

Professional Documents

Reference	Title
API SPEC A	Specification for Wellhead and Christmas Tree Equipment
API SPEC 17D	Specification for Subsea Wellhead and Christmas Tree Equipment
API RP 17H	ROV Interfaces with Subsea Equipment

Regulations

Reference	Title
Not applicable	

Codes

Reference	Title
Not applicable	

Other documents

Reference	Title
Not applicable	



Total General Specifications

Reference	Title
GS EP COR 356	Corrosion Protection of Fasteners for Subsea & Topside Applications
GS EP PJC 703	Contractor Final Documentation Requirements
GS EP SPS 001	Design Philosophy and Requirements for Subsea Stations
GS EP SPS 002	Design of subsea structures
GS EP SPS 003	Foundation design considerations for subsea stations
GS EP SPS 006	Service valves in subsea stations
GS EP SPS 007	Tie-In 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 011	Mechanical Completion for Subsea stations
GS EP SPS 012	Documentation Requirements for Subsea Stations
GS EP SPS 015	Subsea Gate Valves and Actuators in Subsea Christmas Tree Systems
GS EP SPS 016	Subsea Insert Chokes and Associated Running and Retrieval Tools
GS EP SPS 018	Multiphase flow meter
GS EP SPS 019	Subsea Production Control System
GS EP SPS 021	Subsea mateable electrical/optical connectors
GS EP SPS 022	Environmental testing of Subsea Electronics
GS EP SPS 023	Cleaning and Flushing of Hydraulic Systems
GS EP SPS 029	Metallic Materials for Subsea Production Facilities
GS EP FP 410	Subsea Wellhead and Guidance Systems

3. Introduction

The following abbreviations are used in this specification:

AMV	Annulus Master Valve
AWV	Annulus Wing Valve
BOP	Blowout Preventer
CIV	Chemical Injection Valve
CMV	Chemical Metering Valve



CRA	Corrosion Resistant Alloy
EQD	Emergency Quick Disconnect
EDP	Emergency Disconnect Package
IWOCS	Installation & Work Over Control System
LRP	Lower Riser Package
LWI	Light Well Intervention
MIV	Methanol Injection Valve
MODU	Mobile Offshore Drilling Unit
MQC	Multi Quick Connect
PCS	Production Control System
PCV	Production Choke Valve
PFD	Production Flow Diagram
PGB	Permanent Guide Base
PMV	Production Master Valve
PWV	Production Wing Valve
ROT	ROV Operated Tool
ROV	Remote Operated Vehicle
SCM	Subsea Control Module
SCSSSV	Surface Controlled Sub Surface Safety Valve
SLV	Service Line Valve
SSTT	Sub Sea Test Tree
STT	Surface Test Tree
TCTV	Tree Cap Test Valve
TGB	Temporary Guide Base
TH	Tubing Hanger
THAIV	Tubing Hanger Annulus Isolation Valve
THRT	Tubing Hanger Running Tool
THERT	Tubing Hanger Emergency Recovery (Release) Tool
TRT	Tree Running Tool
VXT	Vertical Christmas Tree
WH	Wellhead
WROV	Work Class Remote Operated Vehicle
WST	Wellhead connector Seal Test
XOV	Cross Over Valve



XT Christmas Tree

3.1 Definitions

See [GS EP SPS 001](#).

3.2 Responsibility

It is the responsibility of anyone who supplies equipment to this specification to ensure and document compliance with the requirements defined by this specification, other relevant standards and statutory requirements. Any deviation from any of the requirements defined herein shall be clearly indicated and treated as a non-conformance.

In case of discrepancy between standards and/or specifications, the more stringent applies unless otherwise specified by Company.

3.3 Documents

Documents: [GS EP SPS 002](#), [GS EP SPS 003](#), [GS EP SPS 006](#), [GS EP SPS 010](#), [GS EP SPS 011](#), [GS EP SPS 018](#), [GS EP SPS 021](#), [GS EP SPS 022](#), [GS EP SPS 023](#), [ISO 13628](#), [ISO 10423](#), [ISO 898-1](#), [NACE MR-0175/ISO 15156](#), [ASME VIII-DIV1](#), [SAE AS 4059 E](#), [API RP 17H](#), are an integral part of this document.

4. System description

4.1 System overview

The Subsea Christmas Tree System comprises of a set of equipment which can be divided into two groups:

- Permanently Installed Equipment.
- Workover/Completion Equipment.

This specification covers the following permanently installed main sub systems with running tools and auxiliary equipment:

- Tubing Hanger System, including the Tubing Hanger Running Tool.
- Subsea Vertical Christmas Tree system, including the Tree Running Tool.

The Wellhead System is covered by specification [GS EP FP 410](#) and specifications for the Workover/Completion equipment shall be covered in Project Particular Specifications during the Tender phase.

For the VXT, the specification does not cover the connector at the end of the flowspool which interfaces with either the template connector, or the jumper connector or the flow line connector. For this connection, reference is made to document [GS EP SPS 007](#).

The Specification does not cover the Control pod. For this equipment, reference is made to the document [GS EP SPS 019](#), Specification for Production control System.

4.2 Subsea Conventional Christmas Tree (VXT) system options

The VXT systems shall be used on development projects which may vary in form and function, dependent on a number of factors determined by field conditions and development strategy.



This specification is valid for all VXT options required to form any configuration, with or without choke, PGB, etc. The various development concepts, pressure regimes and water depths may be covered by the same Units where this is feasible without compromising any of the requirements specified in this document and where a positive cost benefit can be demonstrated.

The conventional vertical Christmas tree is considered to be dual bore. However, this specification should be followed for variations of the vertical XT design, such as slim bore wellhead Christmas Trees, as far as possible, with up front gap analysis completed prior to/with system proposal to minimize discussions as far as possible. Sub notes are included in this GS to give indication of known deviations allowable.

5. Equipment functional requirements

5.1 General requirements

The Christmas Tree system shall be remotely controlled from the Production Control System once the umbilical is hooked up and the control system commissioned. During installation and workover operations, an LRP/EDP will be used as the primary well barrier. The PCS shall be partly or totally disabled and the necessary functions either controlled from the IWOCs, or by ROV.

The TH and XT orientation shall be controlled such as all components remain interchangeable. It shall be possible to perform a full work over (completion change out) and still reconnect the same well jumper.

Valve configuration and operation modes for the Vertical Christmas Trees System are illustrated in Appendix 1.

5.2 Barrier and valve configuration

The subsea XT System shall be configured in accordance with the dual barrier element philosophy, which implies there shall be two independent barriers between the produced fluids and the environment.

The Total Generic P&ID (Flow Diagram) is provided in Appendix 1 for Oil Producer, Water Injector and Gas Injector wells. These are Total's Standardized Christmas Tree designs. Company Project group may modify the P&ID specifically for the Project needs (additional or less chemical injection points etc.), but in keeping with the general design and this shall be documented in the Project Specific Specifications, and shall be submitted to DEV/TEC/SPS & OPS/FP for prior approval.

Well flow and annulus pressure shall be controlled by gate valves in the vertical bores and the wing outlets. There shall be one automatically operated master valve in the production bore and one in the annulus bore, integral with the XT block. Vertical flow isolation shall be achieved by use of a swab valve in the production bore above the lateral production outlet, and pressure tight stingers in the Christmas Tree Cap (XTC) plugging the bores above the swab valve. The annulus bore shall have an identical configuration. The wing valves may be integral or as bolt on side wing outlets

For slim bore wellhead systems – typical to shallow water subsea systems, where it may not be possible to integrate a vertical annulus and production bore to the main block (size restrictions), wing mounted Annulus Master valve can be considered acceptable in conjunction with appropriate protection to the wing block (refer to section 6.2.7 – Christmas Tree Roof).



Primary seals on barrier elements shall be metal to metal, with elastomeric back-up. It shall be possible to test all barrier elements bi-directionally (with the exception of the XTC which can only be tested from below). Additionally, a facility to pressure test between the XTC and the swab valves from the work over control system or via ROV hot stab shall be provided. The same test lines shall provide the facility to vent any trapped pressure above the swab valves prior to retrieving the XTC. The design shall allow for communication from production to annulus. This communication shall be established between the production master valve and upstream of the production wing valve.

5.3 Tubing Hanger system

5.3.1 Tubing Hanger

- The dual bore tubing hanger shall suspend the production tubing string and provide a pressure tight fluid conduit to the tree block with the following requirements:
- The TH shall be designed to land, lock and seal inside the High Pressure wellhead housing and the production casing hanger, and thereby provide a pressure tight seal between the tubing, to the production casing and the wellhead housing.
- The TH system shall be designed to be run and retrieved inside the marine riser and Subsea BOP by means of a running tool string consisting of the following minimum elements, from bottom to top, but not limited to, elements:
 - THRT
 - TH Orientation Joint
 - Shear sub
 - Slick joint for interfacing with an annular or ram within the BOP
 - Mono Bore Workover Riser.

(Exemption for shallow water subsea system ran from Jack Up rig, where THRT / TH Orientation Joint / WOR only apply.)

- It shall be run, oriented, landed, locked and tested in a single trip by means of a simplified hydraulic controlled landing string.
- The various TH tools / Landing String shall be capable of passing through the BOP flex joint with the joint deflected to an angle of 1.0 degrees, with the TH attached.
- The TH system shall incorporate a facility providing full orientation prior to entry of the seal assemblies into the seal bores to minimize the risk of wear or damage to the seal elements.
- A soft landing system shall be considered for safe and gentle landing of the tubing hanger with seal assemblies.
- The integrity of energized seal assemblies shall be verified by pressure testing from below.
- Through bore access for the production bore, designed to allow passage of wire line tool strings for downhole work and wire line plugs, shall be provided. The minimum bore diameter and the production bore plug profile shall be detailed in the Project Particular Specifications.