



Exploration & Production

GENERAL SPECIFICATION

SUBSEA SYSTEMS

GS SPS 013

Wellhead and Guidance Systems

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1. Scope

The presented technical requirements shall be applicable for subsea wellhead systems to be used for subsea production and/or injection wells.

This specification covers the minimum requirements, which shall apply for the design of the Subsea Wellhead System.

Specific concept design may require special consideration. This applies in particular to the wellhead to Tree interface and to the wellhead to well slot structural interface where due consideration is required depending upon the field concept, i.e. template, cluster or single satellite well, or other variations, also soil conditions, field environmental conditions, etc.

2. Reference documents

The reference documents listed below form an integral part of this General Specification. Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the EFFECTIVE DATE of the CONTRACT.

This general specification and all other equipment specifications referenced herein are based on a set of Industry standards and COMPANY internal rules identified below.

This general specification is supplementary to document **GS SPS 001** and shall be therefore used 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 SPS 001**.

It is complementary to **GS SPS 014** and shall therefore be used in conjunction with said documents. The following specifications are to be referred to for complementary requirements.

The Subsea Wellhead System shall comply with all documents referenced herein or otherwise agreed by the specific Project Group.

Standards

Reference	Title
NACE MR 01-75	Material Requirements. Sulphide Stress Cracking. Resistant Metallic Material for Oil Field Equipment
ISO 898	Part I Bolts, screws and nuts
ASTM D 471	Standard Test Methods for Rubber Property – Effect of Liquid E
ASTM D 2240	Standard Test Methods for Rubber Property – Durometer Hardness
ASTM D 412	Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
ASTM D 1414	Standard Test Methods for Rubber O-Rings R
ASTM D 395/B	Standard Test Methods for Rubber Property – Compression Set

Reference	Title
ISO 13628-4 ISO 10423	Subsea wellhead and tree equipment Petroleum and Natural Gas Industries – Drilling and Production Equipment – Wellhead and Christmas Tree Equipment Second Edition

Professional Documents

Reference	Title
API Spec 17 D (ISO 13628-4)	Subsea Wellhead and Tree Equipment
API 6A (ISO/DIS 10423)	Specification for Wellhead and Christmas Tree Equipment
API Spec 5 CT	Casing and Tubing
API RP 17H	ROV Interfaces with Subsea Equipment
API RP 16Q	Design and Operation of Marine Drilling Riser System
API Spec 8A	Drilling and Production Hoisting Equipment
API Spec 16A	Specification for Drill Through Equipment

Regulations

Reference	Title
Not applicable	

Codes

Reference	Title
ASME	Boiler and Pressure Vessel Code

Other documents

Reference	Title
Not applicable	

Total General Specifications

Reference	Title
GS COR 100	Design of cathodic protection of offshore structures
GS COR 201	Supply of sacrificial anodes
GS COR 350	External protection of offshore and related structures and equipment by painting



Reference	Title
GS SPS 001	Design Philosophy and Requirements for Subsea Stations
GS SPS 002	Specification for Design of Subsea Structures
GS SPS 003	Foundation design considerations for Subsea Stations
GS SPS 014	Specification for Drill Through Horizontal Tree Systems
GS SPS 017	Specification for Workover/Completion Systems

3. Introduction

3.1 Responsibility

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

The specific Project Group is responsible for the specification requirements. Any conflict between referenced standard and rules shall be indicated to the Project Group. The more stringent approach shall be followed unless otherwise specified by the Project Group.

3.2 Abbreviations

API	American Petroleum Institute
BOP	Blow out preventer
FAT	Factory Acceptance Test
NACE MR	National Association of Corrosion Engineers Material Requirements
TH	Tubing Hanger
DTHT	Drill Through Horizontal Trees
WH	Wellhead

4. System description

The specification is required to cater for several types of development scenarios. This is clearly stated within the **GS SPS 001**. Primarily this is based on four types of configuration: multi well template with production manifold (integrated or modular), individual wells connected to subsea manifold center, two wells structure, individual wells in daisy chain configuration.

Two well architectures are to be considered, light and heavy. The light architecture is to be used in conjunction with Drill Through Horizontal Trees (DTHT) which will be installed on the wellhead prior to the first BOP installation. The heavy architecture wells will be drilled in a conventional way. The same horizontal tree will be installed on the wellhead prior to drill the reservoir.

The heavy architecture drilling program will be: 36" CP, 20", 13"3/8 or 14", 10"3/4. The Horizontal Christmas tree will be installed once the 10"3/4 casing set.

The light architecture drilling program will be: 36" CP, 13"3/8 or 14", 10"3/4. The drill through horizontal tree will be installed once the Low and High pressure housings are installed

For a standardization purposes, only two types of wellhead will be supplied, one for light architecture, the other for heavy architecture. The solution consisting in adding a sleeve in a standard wellhead for the light architecture is not considered because a potential leak path is induced by this equipment.

The subsea wellhead system shall be a 18-3/4" (heavy architecture) and 13"5/8 or equivalent (light architecture), 690 bar minimal working pressure design and comprise of the following subcomponents:

- Production Guide Base (specific to each type of well)
- Low Pressure Conductor housing (standard for all wells)
- High pressure housing with extension (two different types, one for light and one for heavy architecture)
- 13-3/8" or 14" Centralized casing hanger with seal assembly (heavy architecture only)
- 10-3/4" Centralized casing hanger with seal assembly (two different types, one for light and one for heavy architecture)
- Corrosion cap with inhibitor injection capabilities (Standard for all wells)
- Associated tooling.

5. System requirements

5.1 Functional requirements

The subsea wellhead system shall:

- Provide orientation of the wellhead and tree system with respect to tree to manifold connection.
- Interface with and support the X-Mas tree system and BOP.
- Accept all loads imposed on the subsea wellhead system from drilling, completion and production operations, inclusive thermal expansion. Particular attention shall be given to the horizontal tree concept were the BOP is latched on top of the X-Mas tree.
- Ensure alignment, concentricity and verticality of the Low Pressure conductor housing and High Pressure wellhead housing.
- Be of field proven design, as far as possible, and designed to be installed with a minimum sensitivity to water depth and sea conditions.

5.2 Operational requirements

The subsea wellhead system shall:

- Provide the ability to install in the same trip the Production guide base, the 36" conductor and the Low Pressure conductor housing. The complete assembly shall be designed to be pre-installed in the moonpool prior to being run.
- Allow for jetting operations for the CP and for drill and cement as a contingency case.

- Include provision for efficient discharge of drill cuttings/cement returns associated with the drilling operations.
- Provide bore protector and wear bushings to protect the internal bores of the wellhead system components during drilling, completion and retrieval operations.
- Ensure that all seals and locking arrangements can be tested in-situ.
- Ensure that the complete packoff/seal assembly can be retrieved and replaced in case of a failed test.
- Ensure that all permanent seals are protected during running phase and remotely energized after landing.
- Be designed such that the running string with wellhead tools and components will not snag or be restricted during running in or pulling out of hole.
- Provide tooling allowing seal surfaces to be cleaned after cement operation and prior to setting seal assemblies without pulling the running string i.e. the tool shall allow cleaning of seal surfaces by circulation prior to pack off setting.
- Be designed to allow for landing of casing hanger, installation of seal assembly and pull same (in case of failure) in a single trip. Multipurpose tools shall as far as possible be used to avoid pulling of running string for tool change out.
- Allow for large enough flow by areas, and particle size, at the casing hanger and casing hanger running tool level (to be compared with the clearance between ID of the previous casing and the OD of the collars of the attached casing).
- Be designed to allow for testing of the BOP without having to pull the wear bushing.
- Provide guidance for equipment entering the well during drilling, completion and subsequent operations.
- Allow for safe and efficient retrieval of all installed equipment during permanent abandonment of the well.
- Be designed to allow access for both work class and inspection ROVs. ROV grab bars shall be included wherever an ROV operation is defined to provide stabilized working conditions for the ROV.

5.3 Design requirements

The subsea wellhead system shall:

- Be designed for 690 bar minimum operating pressure. This applies for the complete wellhead system including High Pressure housings, casing hangers, seal assemblies and associated tools.
- Include 13-3/8" (or 14") and/or 10-3/4" casing hangers with seal assemblies.
- The pack off shall, when in set and locked position, provide a primary metal to metal seal. Emergency pack off seal assembly will provide a non-metallic seal. Non-metallic seals shall be classified according to [ASTM D-471/D-2240/D-412/D-1414](#) and [D-395/B](#).
- Be designed such that there is no movement jeopardizing the sealing ability of the permanent sealing system when the subsea wellhead is exposed for operational thermal effects as specified for the field.

- The Low Pressure conductor housing, High Pressure wellhead housing and casing hangers shall be supplied with extension joint fitted with connectors specified by the project.
- Length of extensions and specific requirement to type of end connectors will be defined prior to order.

6. Guidance system

6.1 Guide base options

Guidance onto the wellhead system shall be by means of the following guide base options, dependent on the actual type of development concept (template or satellite well). The SUPPLIER may propose a design where no PGB is required if the flowline is connected directly to the tree. Further reference should be made to the Functional and Operational Requirements noted in **GS SPS 001** and **GS SPS 002**:

- **Concept 1:** Multi-Well Template with Production Manifold (integral or modular)
 - Template Mounted Production Guide Base (TMGB)
- **Concept 2:** Individual Wells Connected to subsea Manifold Center
- **Concept 3:** Two slots structures
- **Concept 4:** Individual wells in daisy chain configuration.

Three different types of guide base will be proposed for these four concepts:

- Twin Production Guide Base (Twin - PGB)
- Template Mounted Guide Base (TMGB)
- Single Well or Cluster Production Guide Base (SWPGB).

6.2 General requirements

The production guide base is an element attached to and installed with the Low Pressure housing of the wellhead. All guide bases shall comply with the following general requirements:

- All guide bases shall orient and lock to the 30" conductor housing incorporating an anti rotation device.
- In all type of wells, it shall provide orientation to the tree to be in the right position for connecting the flowlines, hydraulic and electric lines.
- The ability to re-use some of the existing exploration and appraisal wells is to be included within the design either as part of the overall design or as part of a specific modification.
- The guide base and receptacle shall be designed to withstand all vertical and horizontal loads associated with deployment, installation and retrieval of all modules including BOP's, without any permanent deformation. The base shall tolerate landing and retrieval of modules with angular misalignment relative to the centerline of the wellhead. Limitations in orientation and elevation shall be documented by the SUPPLIER. The Conductor Pipe will be installed within a vertical tolerance of 1.5.
- The guide base shall be designed to prevent snagging of ROV and associated umbilical.

- All guide bases shall be designed for a 36" Conductor Pipe to be run through the guide base at surface.
- The production guide base shall be installed with the Conductor Pipe and latched and locked to the 30" housing. It shall provide an anti-rotation device. The locking and anti rotation mechanism shall not be affected by any cutting or cement, during drilling and cementing on the associated two first phases of the well. The PGB and the template, if to be considered, shall facilitate the evacuation of cuttings and cement from the next drilling phase, in order to preserve the previously installed equipment.
- The orientation device will allow the guide base to be installed in multiple orientation positions. The orientation tolerances shall be documented by the SUPPLIER.
- The configuration shall allow to retrieve the tree with the jumper connector remaining in place.
- The guide base shall be designed to accommodate rigs which have a funnel down guidance arrangement. However, a funnel up configuration will be proposed as an option.
- The guide base and Low Pressure housing shall be designed to provide a support to suspend the Conductor Pipe in the moon-pool prior to be run.
- The Conductor Pipe will be jetted and the guide base arrangement shall allow for installing and retrieving all the tools planned to be used for this purpose.
- To drill and cement the Conductor Pipe is part of the contingency plan. The guide base design shall cope with such operations.
- The structure and the conductor locking mechanism with the anti rotation device shall accommodate all combined loads resulting from the drilling and production operations such as bending and fatigue loads, thermal and pressure effects.
- A device (bull eye for example) shall be installed on the guide base to check the Conductor Pipe verticality at the installation.
- The guide base shall include all equipment needed for ROV intervention or connection tools as defined by the SUPPLIER in the proposed solution.
- The guide base will be equipped with a cathodic system which shall be dimensioned to cater for both the guide base and the well (well drain) for the entire life of the well.
- The guide base shall be designed to avoid any clash with the different BOP planned to be used in the project in any orientation.
- A clump weight shall be added to the guide base in order to handle it in an horizontal position.
- A dedicated tool, drill pipe conveyed shall be provided for retrieving/re-orienting/re-installing the guide base. This system will be equipped with a secondary back up release ROV operated.
- If relevant, the PGB shall include retrievable protection caps for vertical mandrels. These shall be installable and retrievable by ROV. These caps provide temporary protection of bores, seal areas and hydraulic couplers against dropped objects and environmental impact, as per [ISO 13628-4](#). The protection caps shall be used during transportation and storage on land and offshore.

6.2.1 Twin Production Guide Base (Twin-PGB)

The Twin Production Guide Base (Twin-PGB) shall provide a second well slot adjacent to an existing wellhead, by means of a base structure which can be landed and locked to the existing well conductor housing by use of the guide base locking profile. It shall satisfy the same functional and design requirements as the PGB defined above, with the following additions/modifications:

- The Twin-PGB shall include a second well slot with the same functionality as a TMGB.
- The Twin-PGB shall include a two well manifold with piping arrangement, ROV operable isolation valves, hubs for vertical tree connection and horizontal inboard tie in facilities for production lines and service umbilical, as well as an electrical connection system between the inboard hub and the trees.
- The Twin PGB will not be installed with the Conductor Pipe.

6.2.2 Template Mounted Guide Base (TMGB)

In a template configuration, the function of the guide base will be limited to the orientation and the elevation of the Christmas tree. Providing all the functions listed before are included in the design, the PGB, in that special case could be installed with the template.

The Template Mounted Guide Base (TMGB) shall include the equipment necessary to facilitate the interface between the Christmas Tree and the template/manifold, such as:

- Equipment for guidance
- Alignment and suspension of the wellhead
- Flowline/service umbilical inboard connection (if relevant).

6.2.3 Single Well or cluster Production Guide Base (SWPGB)

In addition to the above General Requirements and the PGB requirements the SWPGB will satisfy the following:

- In a cluster or single well configuration, the production guide base shall orient the tree and support the tree to jumper connection. In that case, the PGB shall be designed in order to be either retrieved to surface or reoriented.
- The PGB shall provide a support for deepwater subsea telemetry to perform the measurements needed for the jumper installation.

7. Specific equipment requirements

7.1 Low pressure conductor housing

The Low Pressure conductor housing shall:

- Suspend the 36" conductor string.
- Be designed with a device, which allows for internal landing and lockdown of the HP wellhead housing.
- Be designed to support the complete weight of all casing strings.
- Pass through a 60-1/2" rotary.

- Provide side outlet ports compatible with template or PGB located outlet port for disposal of drill cuttings and 20" casing return cement. Minimum hole diameter shall be 3", quantity 4 off.
- Be designed with an internal profile to suit locking and sealing of the 36" suspension joint/conductor housing running tool, drill ahead tool.
- Control the installed elevation, concentricity and verticality of the High Pressure housing. Tolerance out of vertical alignment is 1.5 degree.
- Allow passage of a 26" drilling bit.
- Provide a positive mechanical lockdown mechanism to the PGB or template. The mechanical lockdown shall be designed to withstand imposed loads due to weight, movements and temperature effects. Capacity shall be set by analysis performed for the specific project. The lockdown mechanism shall be designed to allow for release in case the 36" conductor string needs to be pulled. The release forces required shall not exceed 300 T, unless otherwise agreed with COMPANY.
- Provide electrical continuity to the High Pressure wellhead housing.
- Be supplied with an extension joint with casing connector. Extension shall be factory welded to the conductor housing. Minimum length to be advised. Weld between housing and extension to be ground flush.
- Be supplied with an internal profile allowing the High Pressure Housing to be positively latched and locked. Requirement for pre-loading shall be documented.
- The conductor housing shall be equipped with an orientation device allowing final orientation of the production guide base.
- Be designed to allow for running the Low Pressure housing with Production Guide Base latched to conductor housing outer profile.
- A visual position indicator shall be implemented for verification of correct landing of the Low Pressure conductor housing.

7.2 High Pressure Wellhead Housing (Heavy Architecture)

The 18-3/4" Wellhead Housing shall:

- Allow passage of a 17-1/2" drill bit.
- Provide an external locking profile and internal sealing surface compatible with BOP stack (Super Heavy Duty H4 connector with 27" insert, to be confirmed by the specific project) and X-mas tree connector. Type of external housing profile shall be Vetco H4 and be suitable for the installation of a 10,000 PSI BOP stack. The wellhead housing shall withstand the clamping force from a heavy duty BOP connector without reducing the ID of the housing.
- Include a contingency sealing area to the X-mas tree or BOP connector inlaid with corrosion resistant nickel based alloy. The VX seal preparation shall be the primary sealing surface.
- Both gaskets (nominal and back up) shall resist backside to the water hydrostatic pressure with atmospheric pressure in the cavity.
- Provide pressure containment during drilling, completion and production.

- The wellhead shall withstand the fatigue loads induced by the additional height of the drill through horizontal tree.
- Be externally profiled to allow for landing and positive lock down inside the 30" conductor housing. Requirement for preloading of the high pressure housing in the conductor housing with regard to bending moments shall be addressed and documented.
- Provide adequate by pass area to fit with the ports in the CP housing.
- Include a positive landing shoulder for the first run casing hanger.
- The wellhead housing shall allow for installation of two casing hangers, 13-3/8" (or 14") and 10-3/4".
- Provide surfaces for sealing off the seal assemblies. The seal surface for the 10-3/4" upper casing hanger pack off shall as a minimum be inlaid with corrosion resistant nickel based alloy.
- The wellhead housing shall provide for interfaces with the Drill Through Horizontal Christmas Tree (DTHT).
- A dedicated hard faced area shall be provided as a back up sealing area for the Drill Through Horizontal Christmas Tree (DTHT) isolation sleeve (if seated in the housing).
- Have an inner drift diameter of 446.20 mm (17.567") minimum as per [API 6A](#).
- Be supplied with an extension, factory welded and plant tested to the high pressure housing (type and length to be advised by the project).
- Provide seal surfaces appropriate for sealing systems associated with test and running tools.
- Be designed to take full load from the specified casing program imposed via the casing hanger landing shoulder.
- Include an Housing Extension end connector with an anti-rotation feature.
- Include a visual landout indicator which clearly indicates that the High Pressure wellhead housing is fully landed inside the Low Pressure Housing.
- Allow pre-assembly of WH housing, bore protector and WH housing running tool onshore.
- In addition, if the BOP installation/retrieval presents an interference risk with the rest of the equipment in a heavy architecture configuration, a spacer spool connected between the 18"3/4 housing and the BOP shall be proposed and quoted with its running/retrieving tool (optional).

7.3 High pressure wellhead housing (Light architecture with drill through capabilities)

The same requirements have to be applied for the light architecture drill through wellheads.

The exceptions are:

- ID shall allow passage for a 12-1/4" bit.
- The wellhead shall withstand the additional fatigue loads induced by the additional height of the drill through horizontal tree during the whole drilling phase.



- The wellhead housing shall allow for installation of only one 10-3/4" casing hanger.
- Tools and wear bushings shall be designed to be installed without removing the tree protection sleeve.

7.4 Casing hangers

The following requirements shall apply for the casing hangers (13-3/8" or 14" and 10-3/4"):

- The 10-3/4" casing hanger packoff associated seal surfaces and the 10-3/4" casing hanger internal seal preparation (Tree Isolation Sleeve if relevant) shall be inlaid with corrosion resistant nickel based alloy.
- The different casing hangers shall be individually locked in the high pressure wellhead housing.
- The hang-off point for the seat protectors shall be the same for the different casing hangers.
- The casing hanger shall be designed to allow for returns during cementing operations through flow-by area. These shall be designed to be as close as possible of the value of the clearance between the casing collars and the ID of the previous casing installed.
- The casing hanger seal areas shall be protected during drilling and down hole completion activities.
- The casing hangers shall be supplied with a 18" tonging neck to allow for casing thread make-up (a pre-installed pup may be a part of the tonging neck, to be advised prior to order).
- Have a minimal internal diameter equivalent to the attached casing.
- Allow for pre-assembly of casing hanger, seal assembly, cement plug and casing hanger running tool onshore.
- Bottom end connections on casing hangers shall be specified.
- It shall be possible to install a dummy 13-3/8" casing hanger and seal assembly (i.e. no casing string below the hanger) without requirement for modification of the casing hanger or running tool (Specific to heavy architecture).

7.5 Casing hanger space out sleeve (Heavy architecture only)

The WH system shall include a casing hanger space out sleeve that can be fitted to the 10-3/4" casing hanger to allow for correct landing in the wellhead if the 13-3/8" casing hanger is not installed.

The following requirements shall apply for the casing hanger space out sleeve:

- Land and shoulder in the 18-3/4" Housing
- Include a mechanical locking feature to the 10-3/4" Casing Hanger
- Control the installed elevation of the 10-3/4" Casing Hanger
- Provide adequate flow by ports
- The space-out sleeve shall be mounted on the casing hanger prior to run in hole.

7.6 Casing hanger pack-off/Seal assemblies

The casing hanger packoff/seal assemblies shall comply with the following requirements:

- For heavy architecture, the same seal element shall be used for both casing hangers. The seal element shall be manufactured from an alloy steel compatible with its sealing area within the Wellhead.
- It shall be possible to retrieve the complete seal assembly in case of initial failure.
- Casing hanger primary seal assemblies shall be designed with a full metal to metal seal to allow for seal integrity between the individual casing hanger and High Pressure wellhead housing.
- An emergency packoff seal assembly designed with non metallic seals shall be run if it is not possible to achieve seal integrity using the primary packoff.
- Pack off and emergency packoff seal assemblies shall verify ability to seal using primary seals under gas test, without back up elastomers fitted.
- There shall also be a possibility to shim one of the components if an elevation is found to be wrong.

7.7 Wellhead corrosion cap

For temporary abandonment, a corrosion cap will be installed on wellhead to prevent debris and corrosion. This cap will be identical to the temporary abandonment cap listed in the tree equipment.

7.8 Running tools/Test tools

A list covering all required running tools/test tools to install, retrieve, maintain and operate the subsea wellhead system shall be specified by CONTRACTOR. The following requirements shall apply for the subsea wellhead running tools:

- The running tools shall be designed to allow for safe and efficient offshore installation.
- The casing hanger running tool shall allow for casing hanger and pack off installation in one trip.
- All tool joints shall be designed to allow for minimum one thread cut-off.
- All tools joint shall be designed with a minimum 18" tong neck to ease offshore tool/string make-up or break out. The tong neck shall accept an iron roughneck.
- All running tools shall be rated to accept full string hang-off load.
- The running tools shall interface to the running string with a project specified connection. Open water tools shall have a project specified connection (minimum API 6"5/8 Regular). All connections are to be determined based on the expected loads which are be clearly documented.
- All resetting of wellhead running tools shall be possible to perform offshore. All required tools shall be supplied by CONTRACTOR and be part of the wellhead running tool inventory offshore

7.9 Bore protector and wear bushings

The bore protector and wear bushings shall satisfy the following requirements:

- Protect the inner bore of the wellhead housing and all components of the installed casing hanger and packoff assemblies installed within the wellhead system during drilling and completion operations.
- Wear bushings shall be designed to withstand all hydraulically imposed end-forces due to BOP testing.
- Permit the BOP isolation test tool to be run and the BOP to be tested without the need to retrieve the bore protector or wear bushing.
- Include a retention system to lock into the wellhead housing to prevent damage and premature release during drilling operations.
- Include a positive mechanical anti-rotation device to prevent any rotation of the wear bushing during installation, retrieval or any phase on the drilling and completion operation.
- Include an adequate sealing system to prevent any debris or trash to enter the seal face area during drilling or completion operations.
- Wear bushings shall include hard facing over a limited section (inside diameter only) to resist the effects of key seating.
- It shall be possible to pull the wear bushing at the end of the down hole operations without a separate run.

7.10 Emergency hang-off tool (optional)

The emergency hang-off tool shall satisfy the following requirements:

- Suspend the complete drill string in the wellhead or on the BOP rams when operating conditions demand.
- Be spaced out to enable all pipe rams to close on the string providing isolation between the annulus and the drill pipe bore and allowing closure of blind rams above the tool box connection. This may require a rig/BOP specific slick joint. Drill string connections to be specified by the specific project.
- Tapered section on the slick joint below tool joint connection to have extended taper section (i.e. shallow angle) to allow smooth transition to regular outside diameter for stripping purposes.
- Maximum tool joint outside diameter to be 7" to allow stripping through variable rams.
- Allow for string circulation.

7.10.1 Upper donut

Include a lower drill string connection to be specified by the project (maximum outside diameter 7" to allow stripping through variable rams). Include an upper box connection to the handling string running tool. A quick stab/release thread shall be included in design.

Allow for string hang-off on closed BOP pipe rams (i.e. include flat face on lower shoulder).



7.10.2 Lower donut

Provide a landing shoulder allowing for landing on any component in the wellhead (WH housing, bore protector, wear bushing, casing hanger and pack-off).

The hang-off tool shall have a 4-1/2" x IF connection with left hand threads and guide for re-entry.

Provide guidance/alignment during re-entry of the drill pipe handling tool.

7.11 Auxiliary equipment

A list covering all required auxiliary equipment for the subsea wellhead system shall be specified by CONTRACTOR.

8. Testing requirements

8.1 Introduction

As the wellhead for heavy architecture is a standard product, units and systems shall be tested in accordance with the relevant industry standards: Factory Acceptance Test (FAT), in accordance with [ISO 10423 standard](#).

For light architecture, as the product is not field proven, qualification program and testing are required as defined in section 8.2.

Subsea Wellhead System Verification Tests shall be conducted to prove that all the different types of Subsea Wellhead System satisfy all the loads, pressure integrity, installation, retrieval and functional performances listed in the specification.

Finally the equipment delivered shall be used to perform integration and shallow water testing.

All documents and procedures shall be submitted to the Project Group for approval 30 days in advance prior the testing commencement.

8.2 Qualification

Most of the light architecture wellhead system such as high pressure housing, casing hanger, pack off, wear bushings and tooling associated are not field proven in deepwater.

As such, the equipment shall be qualified in accordance with industry recognized standards and COMPANY specifications as defined in [GS SPS 001](#). Qualification and testing of all the components shall be associated with special procedures. Design, qualification programs, qualification results, testing programs and testing results shall be submitted to client approval.

A complete stack up test shall be performed to interface with the Low Pressure housing (standard) and to prove the correct functionality of the wellhead system.

8.3 Factory Acceptance Tests (FAT)

Factory Acceptance Tests (FAT) of all Units shall prove that the components of a Unit and the Unit itself satisfy all specified requirements to strength and functional performance.

8.4 Wellhead System Verification Test

The purpose of the Wellhead System Verification Test is to prove that all the different types of Subsea Wellhead System satisfy all the loads, pressure integrity, installation, retrieval and functional performances listed in the specification.

As a minimum, the standard wellhead system will be interfaced with all types of PGB proposed by the SUPPLIER. Test of wellhead systems for template located wells requiring special guide base arrangements shall include all template located components which are part of the wellhead system. All ROV functionality's shall be tested.

As the LP housing is standard for all type of wellheads, this test will be valid for light architecture wellheads.

The same type of wellhead as the ones installed earlier delineation wells shall be interfaced with the PGB planned to be installed on the dedicated wells.

A full wellhead system Verification Test shall be performed on a specified number of light architecture wellhead systems covered by this specification. The wellhead system Verification Test shall be performed with use of facilities with capability of verifying correct assembly, pressure integrity and correct functionality of the wellhead system. All associated tools shall be used to verify all internal interfaces. Running tools assembled with housings or casing hanger shall be pressure tested.

The Wellhead System Verification test shall include stack-up and pressure test of the complete wellhead system using the appropriate running tools using the installation sequence and procedure, which will be used in the field.

8.5 Integration test and shallow water test

These tests are defined in the **GS SPS 001**.

The Subsea Wellhead System shall be used for these tests.

9. Test, handling and transportation equipment

The transportation skids and baskets shall meet the following requirements:

- The transportation skid shall include sufficient lifting points for safe handling and up righting of a fully loaded skid or basket.
- They shall be suitable for short-term storage of the respective wellhead tools.
- They shall provide a means to prevent the respective wellhead tools from sliding and rolling.
- They shall provide sea fastenings for the rig and transportation vessel.
- All components including transportation basket shall not exceed a weight of 10 Tons.
- Shall accommodate a vessel heel of 35 degrees.
- All lids and protection covers shall be possible to lock in both closed and open positions.
- If multiple tool skids are delivered for transport purposes, general single transport skids should be supplied as back up for transporting one off tool.



- Transportation skids for pre-assembled units (tools + components) should also be a part of the WH delivery.
- Tools and skids shall be designed and marked so that each tool can be easily identified without taking it out of the transport box.