



Exploration & Production

GENERAL SPECIFICATION

INSTRUMENTATION

GS EP INS 147

Design and supply of wellhead control panels

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1. Scope

This document defines the minimum requirements for the design, supply and construction of wellhead valve control panels for TOTAL Exploration & Production facilities, onshore and offshore.

The WellHead Control Panel (WHCP) shall be used to operate and control the wells subsurface and surface safety valves.

This specification does not deal with small WHCP units for standalone wells. These will have to be treated by project documents.

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.

Standards

Reference	Title
IECEX	IEC System for Certification to Standards relating to Equipment for use in Explosive Atmospheres (IECEX System)
ISO 4406-1999	Hydraulic fluid power - Fluids - Method for coding the level of contamination by solid particles

Professional Documents

Reference	Title
Not applicable	

Regulations

Reference	Title
ATEX European Directive 94/9/EC	European Directive on the approximation of the laws of the Member States concerning equipment and protective systems intended for use in potentially explosive atmospheres

Codes

Reference	Title
Not applicable	

**Other documents**

Reference	Title
Not applicable	

Total General Specifications

Reference	Title
GS EP ELE 031	Design of earthing and bonding systems
GS EP ELE 079	Electrical apparatus for potentially explosive gas atmospheres
GS EP INS 101	Instrumentation engineering, supply and construction general requirements
GS EP INS 102	Instrumentation identification
GS EP INS 104	Design of generation and distribution of instrument air or gas
GS EP INS 107	Design and installation of instrumentation links
GS EP INS 146	Design of generation and distribution of hydraulic energy
GS EP INS 900	Instrument hook-up diagrams
GS EP PVV 112	Piping material classes
GS EP SAF 226	Completed wells safety systems and safety rules
GS EP SAF 261	Emergency Shutdown and Emergency De-Pressurisation (ESD & EDP)

3. Definitions**3.1 DHSV**

Down Hole Safety Valve: sub-surface safety valve, Fail to Close, controlled by the ESD System.

3.2 SSV

Surface Safety Valve: master valve, Fail to Close, and controlled by the Process Safety System (PSS).

3.3 Wing valve

Fail to Close, and controlled by the Process Safety System (PSS). For some specific applications (e.g. remote Full Control of Wells FCW), wing valves could also be controlled by the Process Control System (PCS).

4. Functional requirements

4.1 Generalities

Wellhead panels are to be connected to the Hydraulic Power Unit. Therefore, this specification shall be read in close relationship with **GS EP INS 146** for all aspects related to production and distribution of hydraulic energy. All statements and requirements included in the **GS EP INS 146** are fully applicable to this specification.

The wellhead control panel shall be linked to the platform control and safety systems for remote monitoring and control of the wells.

The wellhead control panel shall be of fail-safe design so that in case of loss of power or safety control signal, or in case of failure of any component in the control panel, all concerned safety valves shall move to their safety position.

Wellhead valves control devices shall be designed as normally energized.

The wellhead control panel shall enable the controls as described below:

	DHSV	SSV Master Valve	Wing Valve
Control signal failure action	Close	Close	Close
Power fluid failure action	Close	Close	Close
Open/Close local command	Yes	Yes	Yes
Local Reset after ESD	Yes	Yes	Yes (1)
Partial stroking facility	No	No	No
ESD signal test facility	Yes	Yes	Yes
Open/Close remote authorization	Yes	Yes	Yes
Open remote control	No	No (2)	(2)
Close remote control	Yes	Yes	Yes
Open/Close status in CCR (3)	Yes	Yes	Yes

(1) Local reset except if wing valve was voluntarily closed (e.g. FCW)

(2) As per project requirements

(3) CCR: HMI in Central Control Room.

For more details about wellhead safety valves functional requirements and accessories, see **GS EP SAF 261**.

4.2 Control functions

4.2.1 Local Control

4.2.1.1 General

A manual "OPEN/CLOSE" device shall be available for each DHSV, SSV and wing valve. It shall directly act on the hydraulic fluid circuitry and shall be lockable in the "CLOSE" position.



Demand for local closing of the valve shall always override the command from the control and safety system.

Opening the valve shall only be possible if the safety system controlled pilot is energized.

4.2.1.2 Downhole valves

Some high pressure wells may require a “soft starting” device for DHSV's. This will be specified in the project documents. In such cases, a pressure regulator, manually operated, shall be used to open the valve; it will be mounted in the front panel.

4.2.2 Remote Control

4.2.2.1 General

Wellhead valves shall be remotely controlled by means of solenoid controlled pilot valves.

Solenoid valves will be monostable; pilots will be 3-way/2-position.

Valves shall move to their safety or ‘fail to’ positions in case control signal, electrical power supply or power fluid is lost.

4.2.2.2 Wing valves

When PCS control is required, a second solenoid controlled pilot valve shall be installed in series with the one used for safety. The solenoid shall be de-energized in normal operation, energized for closing.

4.2.3 Local Reset

4.2.3.1 General

After a shutdown, X-mas tree valves must be reset locally after solenoid pilot valves have been re-energized by the SSS.

This “RESET” function can be combined with the local control by means of a 3-way valve, push to close/pull and hold till pressurized to open, spring return to safety position (i.e. valve closing) when pilot pressure is lost.

4.2.3.2 Wing valves

Local reset is required in case of safety shutdown only. Remote opening shall be possible when wing valve is closed voluntarily by the PCS.

4.2.4 Solenoid Valve Test

Wellhead valves control panel shall provide the capability for testing the signal from the safety system.

In order to specify the basic features to be implemented, is described hereafter a manual system, based on a key locked switch. This is one of the possible solutions, and other systems, in particular “smart” systems, may be proposed.

The switch shall have two (2) positions: “NORMAL” and “ESD OVERRIDE”. It shall be spring return to the “NORMAL” position and the key shall be locked in the “ESD OVERRIDE” position.



In the “ESD OVERRIDE” position the solenoid controlled pilot shall be bypassed so as to allow the solenoid to be de-energized without moving the valve to its safety position.

The signal downstream of the solenoid valve is monitored locally with a pressure gauge.

A “TEST” status shall be sent to the relevant safety system by means of a pressure switch. Electrical contact shall be Single Pole Double Throw (SPDT).

4.2.5 Interlocks

Wellhead valves shall always be operated in sequence: DHSV shall open before master and wing valves and close after them.

Time delays between actuation of the different valves are normally handled by the safety system.

In addition, local interlocking between DHSV and SSV's shall also be provided. This shall close the SSV, or prevent the SSV from opening, in case of loss of pressure in the DHSV control line. It shall be achieved by means of a hydraulic pressure pilot, operated by the hydraulic pressure to the DHSV, installed in series with the solenoid pilot valve on each SSV control line.

4.2.6 Valves position monitoring

4.2.6.1 Surface valves

Master and wing valves will normally be fitted with limit switches. If it is not the case, pressure transmitters shall be installed inside the WHCP to monitor each actuator supply pressure.

4.2.6.2 Downhole valves

Pressure transmitters shall be installed inside the WHCP to monitor each DHSV supply pressure.

4.2.7 Specific wire-line operations

Facilities shall be provided to by-pass the remote control of the DHSV and SSV and allow operations from an external wire-line control panel through bulkhead connections.

5. Construction requirements

The wellhead control panels should normally be part of the same cabinet as the hydraulic power unit. Consequently, the following requirements come in addition to those of [GS EP INS 146](#).

Beside more details about related topics can be found in Company's General Specification [GS EP ELE 031](#), [GS EP ELE 079](#), [GS EP INS 104](#), [GS EP INS 107](#), [GS EP INS 900](#), [GS EP PVV 112](#) and [GS EP SAF 226](#).

5.1 Generalities

The WHCP shall be designed as a modular system. Each well control module/drawer shall permit operation and monitoring of the X-mas tree valves for one well.

Distributors, solenoid valves and, more generally, all components and links shall be sized and selected to meet all valves opening and closing time criteria.

The number of joints shall be minimized in order to reduce the risk of oil leakage.



Solenoid valves shall be of the low energy consumption type, 10 W maximum. Operating voltage shall be 24 VDC except otherwise specified in the instrument datasheet. Solenoid valves coils shall incorporate surge suppression diodes.

All components shall be corrosion resistant and IP 65 rated. Metallic parts shall be stainless steel AISI 316 at the minimum.

All equipment must comply with the requirements of the specific hazardous area where they are installed

For any installation, [ATEX European Directive 94/9/EC](#) / [IECEx](#) standards shall be followed.

Specifically all field instruments shall be certified for zone 1.

5.2 Construction details

5.2.1 General

5.2.1.1 Hydraulic oil distribution

Generally, two levels of pressure will be used in WHCP: High Pressure ($HP \leq 207$ barg) for operation of master and wing valves and Very High Pressure (VHP > 207 barg) for DHSV operation. Actuators swept volumes and actual pressure levels for sizing the HPU shall be given in project documents.

Each well module shall be connected the HPU supply and return headers. There shall be an isolation valve, double block and bleed when required by pressure level, on each supply line to well modules and check valves on the return paths so as to allow dismantling of a module without interrupting operation of the other wells. Connections in the headers for future wells shall be plugged.

DHSV's and surface valves supply and return headers shall be independent.

Isolation valve shall not be fitted on the return path/network.

Return sub headers and header shall be protected against mechanical damage which may reduce or block the hydraulic oil return to the reservoir.

A compact design reducing the number of links and unions shall be encouraged. With this aim, machined integrated manifold blocks can be used.

Use of close-coupled stacked manifold blocks is subject to Company approval.

All internal piping connections shall be supplied and installed up to the side wall of the WHCP by means of bulkhead fittings.

The HPU and the hydraulic supply and return networks shall be designed considering:

- All valves can move simultaneously
- Future wells must be taken into account for sizing
- Connection of future wells shall be possible without shutdown of the other wells.

5.2.2 Cables

Instrument cables shall be armoured.



All instrument cables shall be supplied and installed up to the junction boxes to be located inside the WHCP.

Junction boxes and cable trays shall include spare capacity for future wells.

5.3 Front panel

All local control and monitoring devices shall be mounted in the cabinet front panel, in a section apart from the hydraulic power control.

The following instruments shall be made available, as a minimum, for each wellhead module:

- Down hole valve: reset command
open/close command
safety solenoid valve test command
pressure downstream of solenoid valve
control line pressure
- Master valve: reset command
open/close command
safety solenoid valve test command
pressure downstream of solenoid valve
control line pressure
- Wing valve: reset command
open/close command
safety solenoid valve test command
pressure downstream of solenoid valve
control line pressure.

Holes for future wells instruments shall be pre-drilled and covered by a sealed blind plate, AISI 316L.

The front panel shall be fitted with a sloped canopy to protect instruments from dripping liquids. The minimum protrusion shall be 200 mm.

5.4 Safety Integrity Level (SIL)

As part of a safety system the WHCP shall respect the SIL requirements for this system.

This applies to the panel design and to the choice of the components.

When the SIL certification is not available for the whole panel, the Vendor shall submit SIL calculation notes, approved by a certified third party, taking into account components individual data.

5.5 Labelling and marking

All panel instruments shall be tagged and identified according to the principles set out in [GS EP INS 101](#) and [GS EP INS 102](#).

The function of each isolation valve inside the panel shall be indicated on an engraved plate close to it.

Local commands devices shall be clearly labelled; command modes and operation shall be described on an engraved plate close to each device.



Operating instructions shall be available on the front panel.

6. Testing

Wellhead control panels shall be factory tested. The test shall be performed on the complete assembly "HPU + WHCP".

The FAT shall include the test of all functions and a pressure leak test.

At the end of the test, hydraulic oil shall be circulated inside the WHCP and filtered to reach cleanliness codes 17/15/12 as defined in [ISO 4406-1999](#). Then the WHCP shall be emptied and dried before shipment. All bulkhead connections shall be plugged.

The Vendor shall be responsible for supplying and implementing all necessary equipment and accessories to demonstrate the panel provides the required service.



Bibliography

IEC 60079	Parts related to the Electrical apparatus for explosive gas atmospheres
IEC 60529	Degrees of protection provided by enclosures (IP code)
API 6A - 1986	Specification for Wellhead and Christmas Tree Equipment
API RP 14B	Recommended Practice for Design, Installation, Repair and Operation of Subsurface Safety Valves Systems
API RP 14C	Recommended Practice for Analysis, Design, Installation, and Testing of Basic Surface Safety Systems for Offshore Production Platforms
API RP 552	Transmission Systems