

GENERAL SPECIFICATION

INSTRUMENTATION

GS EP INS 106

Instrument Installation

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1. Scope

This Specification defines the minimum requirements for the installation of instruments and associated equipment for onshore and offshore Oil and Gas installations.

2. Reference documents

All instruments and instrument equipment installations shall satisfy the requirements and regulations of the country of installation and specific standards referred to in this specification.

Where national regulations exist, their provisions and those of the standards and codes to which they refer shall apply, supplementing or amending the provisions of this General Specification.

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

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 552	Transmission System
ISO 4406	Hydraulic Fluid Power - Fluids - Method for Coding the Level of Contamination by Solid Particles
ISO 5167	Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full
NFPA 72	National Fire Alarm and Signaling Code

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 COR 350	External protection of offshore and coastal structures and equipment by painting
GS EP COR 351	External protection of structures and equipment by painting. Floating structures
GS EP COR 354	External protection of onshore structures and equipment by painting
GS EP ELE 051	Design and installation of lightning protection (cancelled document)
GS EP ELE 364	Electrical installations

Reference	Title
GS EP EXP 105	Pre-commissioning Execution
GS EP INS 101	Instrumentation Design
GS EP INS 102	Instrumentation identification
GS EP INS 108	Instrumentation for the design of plant rooms and control rooms
GS EP INS 114	Instrument Tubing and Fittings
GS EP INS 115	Instrument Earthing
GS EP INS 120	Control and Choke Valves
GS EP INS 125	Safety Relief Valves and Rupture Discs
GS EP INS 146	Design of generation and distribution of hydraulic energy
GS EP INS 900	Instrument Hook-up Diagram
GS EP PVV 102	Piping Hook-up Standards
GS EP SAF 261	Emergency Shutdown and Emergency De-Pressurisation (ESD & EDP)
GS EP SAF 337	Passive fire protection: Basis of design

3. Terminology and Definitions

There are five types of statements in this specification, the “shall”, “should”, “may”, “can” and “must” statements. They are to be understood as follows:

Shall	Is to be understood as mandatory. Deviating from a “shall” statement requires derogation approved by Company.
Should	Is to be understood as strongly recommended to comply with the requirements of the specification. Alternatives shall provide a similar level of protection and this shall be documented.
May	Is to be understood as permission.
Can	Is to be understood as a physical possibility.
Must	Expresses a regulatory obligation.
Company	TOTAL E&P or any TOTAL E&P subsidiary.
Contractor	Any Party that has signed a Contract with Company for the Engineering, Procurement, Construction, and Installation in part(s) or in full of a project.
Vendor	The package Vendor sub-contracted by the Contractor or by Company.
Supplier	The Party that manufactures or supplies equipment, either individually or as a Packaged unit for the project.

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3.1 Abbreviations

The following terms and abbreviations will be used in this document.

CCR	Central Control Room
ESD	Emergency ShutDown (System)
ESDV	Emergency ShutDown Valve
FAT	Factory Acceptance Test
FGS	Fire & Gas System
FO	Fibre Optic
GS	Company's General Specification
GRP	Glass Reinforced Plastic
HIPS	High Integrity Protection System
ICSS	Integrated Control and Safety System
IE	Instrument Earth
IPE	Instrument Protective Earth
IS	Intrinsically Safe
ISE	Intrinsically Safe Earth
ITR	Instrument Technical Room
JB	Junction Box
LCP	Local Control Panel
MAC	Manual Call Point
MC	Marshalling cabinet
MCT	Multi cable Transit
PCS	Process Control System
PSS	Process safety System
TSO	Tight Shut Off
UCP	Unit Control panel
UPS	Uninterruptible Power Supply

4. General Requirements

4.1 Installation guidelines

The installation of instruments and associated equipment shall be carried out in a safe manner to ensure the safe and robust operations of the facilities

Dedicated Hook-ups, installation details and detailed drawings shall be issued for all instruments, their process connections and impulse lines in accordance with this document,

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GS EP INS 101, GS EP INS 114, GS EP INS 900 and GS EP PVV 102, prior to commencement of installation work.

All instruments, instrument equipment, tubing, cables, cable trays etc shall be robustly supported and protected from vibration, stress and risk of physical damage.

4.1.1 Indoor Installation Rules

Instrument cabinets shall generally be installed in Instrument Technical Rooms (ITRs). The cabinets shall be installed with their plinths on channel base supports fixed at the four corners.

The operator control desk, emergency panels and associated control units shall be generally located in Central Control Rooms (CCR).

The ITRs shall normally be equipped with HVAC, false floor for cables, as defined in GS EP INS 108.

Field cables entry to buildings shall be through MCT (multi cable transit) suitable for zone 1 hazardous area and rated to the same as the wall.

Within buildings, cable entries between technical rooms shall be generally by sleeves through partition walls. These cable entries shall be sealed by foam and/or sealing compound rated to the same as the partition.

Inside the technical rooms, all cables including field cables shall be routed under the false floor on cable trays/ladders.

The cable routing under the false floor shall follow segregation rules defined in GS EP INS 101.

4.1.2 Outdoor Installation Rules

The following general rules shall be applied for instrument installation outdoors:

- Instruments shall be suitably installed and provide with protection against abnormal environmental conditions such as low or high ambient temperature operating limits.
- If a diaphragm with capillary connection is to be installed, supports and mechanical and thermal protection shall be provided for the capillary. Refer to GS EP INS 900.
- Cable glands on instruments shall be mounted at the side or facing downwards, but never upwards. Cable glands for instrument equipment (JBs, LCPs etc) shall always be downwards.
- All in-line instruments shall be installed only after line cleaning and flushing.
- All instruments shall be mounted as close as possible to the process unless otherwise specified by project particular specification.
- Mounting principles and details shall take into consideration, easy access to instrument and also Supplier's recommendations.
- Instruments heat tracing shall be used when necessary as defined in GS EP INS 101.
- For Instrument equipment (Valve, JB, Panel, Transmitter, etc.) mechanically protected by a roof, the support of the roof/shelter will be designed to take into account build up of ice/snow and the effect of wind during storm, when installed in cold and/or windy regions. Slope of the roof/shelter will be designed to avoid build up of ice/snow.

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- All instruments or instrument equipment installed outdoor, in open air or exposed to sun or flare radiation shall be provided with radiation shield.

4.1.3 Environmental Conditions

All instruments and instrument equipment shall be suitably installed, supported and protected for permanent operation and to withstand the prevailing environmental conditions of the installation location or as specified by project particular Design Conditions.

4.1.4 Instrument Mounting Arrangements

Instrument and equipment supports shall in general be independent from the process lines. Process line shall not be used as supports where lines are:

- Smaller than 2"
- Insulated process piping
- Vibrating pipes
- Piping of material other than carbon steel.

Accessories and remote mounting equipment shall be provided to facilitate maintenance for inaccessible instruments (e.g. remote indicators for smoke detectors installed within false floor or HVAC duct, remote transmitters and calibration tubing for gas detectors).

Isolating facility shall be accessed from the instrument location.

Close coupled pressure gauges can be supported by the process connection and the gauge root valve.

All other instruments, except line mounted temperature devices, shall be properly supported.

Tubing lengths longer than 1m shall be supported using tube clamps. Those clamps shall be design to reduce corrosion issues (Crevice, pitting and galvanic). Tubing clamps shall be made with stainless steel AISI 316 as a minimum.

Special attention must be taken into account for mounting clearance; e.g. penetrations in floor for tubing and cables shall be behind valve and clear of flange bolts.

Accessories, such as instrument valve manifolds, shall be supported to avoid any stress on compression fittings.

Two different mounting arrangements may be used depending on the installation requirement:

- On a support
- Inside a protective housing.

On a 2 inch support, the instrument shall be fixed on its support, via its valve manifold (and not instrument itself), by means of the instrument/manifold manufacturer's dedicated AISI 316 brackets.

Inside a protective housing, the instrument shall be bolted to the manifold block, itself bolted to a mounting plate provided by the instrument housing Manufacturer. It is recommended to order the manifold block from the housing Manufacturer or to provide the manifold block to the

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housing Manufacturer as free issue equipment to be fitted by them inside the instrument housing.

The housing material shall be AISI 316 or fibreglass reinforced polyester.

4.1.5 Tapping Points and Orientations

Process tapping points and orientation shall follow [GS EP PVV 102](#) and [GS EP INS 900](#).

However, taps on liquid service in buried piping may be situated in the upper section of the pipe. However, care shall be taken to minimise risk of gas being trapped in the tapping and impacting the measure.

4.1.6 Tubing and Accessories

Instrument tubing used for impulse lines, valves and fittings shall be designed in accordance with [GS EP INS 114](#).

All tubing shall be neatly laid out and adequately supported to prevent tube kink and facilitate trouble-shooting. Tubing shall not be left with any stress imposed.

Each section of tubing shall be blown clean prior to assembly, to ensure that no foreign matter can enter control components.

The number of joints shall be kept to the minimum. Elbow fittings shall be avoided and replaced by bends of the tubing, taking into account the minimum radius given by the tubing Supplier.

Multiple tubing runs shall be grouped vertically, rather than horizontally. Fittings on grouped tubing runs shall be staggered and off-set for easier accessibility.

All tubing shall be routed to provide maximum accessibility to all equipment. No tubing shall pass a control component in such a way that would prevent convenient calibration or adjustment or easy removal of the control component.

Tubing and electrical cables shall be run separately.

All piping connections to instruments shall avoid imposing stresses on the instrument.

Tubing entering the valve panels shall be through the bottom/side of the panel via bulk head fittings suitable for field tubing.

Tubing clamps shall be made from non-conducting material in order to isolate the tube from the supports. All tube fitting construction materials shall be compatible with the tubing material selected.

Cutting shall be carried out using tube cutter (mechanical means) to achieve accurate 90° angle cuts. Flame cutters shall not be used. Wherever practical, bends shall be used instead of fittings. Bending shall be done with a tube bending machine.

The minimum-bending radius for installation shall be advised by tubing Supplier.

All personnel used for make-off of tube fittings shall have undergone training by the tube fitting supplier in the specific requirements of installing a fitting; Evidence of this training shall be provided to Company.

The individual runs shall be above ground on trays.

All pneumatic tubing shall be tagged as per [GS EP INS 102](#).

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The tubing shall be tagged at both ends: each side of penetrations, and every 25 meters.

4.1.6.1 Impulse Line

Instrument impulse lines shall be installed in line with instrument hook up guidelines defined in [GS EP INS 900](#).

All impulse line tubing shall be adequately supported throughout.

Layout of fittings shall be such that the individual piping components or sections can be easily dismantled with minimum additional disassembly work.

Connections shall be provided with sufficient flexibility to allow displacement in relation to piping or equipment (due to thermal stresses) without causing any damage.

Connections between instruments and process shall be as short as possible, taking into account required slopes of impulse line, and accessibility.

4.1.6.2 Tubing and Fittings Installation Tools

Installation of tubing and associated fittings shall be made using the appropriate tools and equipment as shall be recommended by tubing and fittings Manufacturer.

4.1.7 Passive Protection of Safety ON/OFF Valves

Passive protection of safety ON/OFF valves, actuators and control panels shall comply with [GS EP SAF 337](#) and [GS EP SAF 261](#).

4.1.8 LNG/LPG Service and Cryogenic Specific Requirements

When using differential pressure type instruments, the principle of self-purging shall be applied.

Hook-up shall be in accordance with [GS EP INS 900](#).

Special pre-caution to be taken for all material that will be in contact with cryogenic fluid:

- 100 mm distance for cable
- 200 mm minimum distance for junction box
- 100 mm extension minimum for each bracket support.

Installation of instruments and control valves shall be such that heat influx through the instruments and connecting piping is minimised (except for self-purging applications).

All connections between the cryogenic piping or equipment and instruments must be installed with provisions for thermal expansion/contraction that occurs due to process temperatures at operating conditions versus ambient temperatures at installation time.

The process isolating valve shall be so positioned that the packing box is above the valve body. The spindle shall preferably be vertical, but not more than 45 degrees away from the vertical.

Instrument impulse piping shall continuously slope upwards from the taps to the instrument. Slope shall be between 1:10 and 1:20.

A sign must be displayed at the isolation valve to warn personnel that closing the isolation valves without venting the impulse lines may cause damage to the instrument and/or impulse piping.