

GENERAL SPECIFICATION

INSTRUMENTATION

GS EP INS 101

**Instrumentation engineering, supply and
construction general requirements**

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1. Scope

This Specification defines the minimum requirements for instrumentation engineering, supply and construction for onshore and offshore installations.

2. Reference documents

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 551	Process Measurement Instrumentation
ASME PTC 19.3	Part 3: Temperature Measurement Instruments and Apparatus
ASME Section VIII Div. 1	Design and Fabrication of pressure vessels
ASME B16.36	Orifice flanges
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
European Directive 2004/108/EC	European Directive on the approximation of the Laws of Member States relating to electro-magnetic compatibility (EMC)
IEC 60079-14	Explosive atmospheres - Part 14: Electrical installations design, selection and erection
IEC 60331	Parts related to the Tests for electrical cables under fire conditions - Circuit integrity
IEC 60332	Parts related to the Tests on electric cables under fire conditions
IEC 60529	Degrees of protection provided by enclosures (IP code)
IEC 61000-5	Sections related to the Electromagnetic compatibility (EMC) - Part 5: Installation and mitigation guidelines
IEC 62591	Industrial communication networks- Wireless communication network and communication profiles - WirelessHart
IECEX	IEC System for Certification to Standards relating to Equipment for use in Explosive Atmospheres (IECEX System)
ISA 100	Wireless Systems for Automation
ISA-5.1	Instrumentation Symbols and Identification
ISO 4406	Hydraulic fluid power - Fluids - Method for coding the level of contamination by solid particles

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Reference	Title
ISO 5167	Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full - Part 1: General principles and requirements - Part 2: Orifice plates - Part 3: Nozzles and Venturi nozzles - Part 4: Venturi tubes
ISO 5168	Measurement of fluid flow - Evaluation of uncertainties
ISO/TR 3313	Measurement of fluid flow in close conduits - Guidelines on the effects of flow pulsations on flow-measurements instruments

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 ECP 103	Process sizing criteria
GS EP ELE 051	Design and installation of lightning protection
GS EP ELE 079	Electrical apparatus for potentially explosive gas atmospheres
GS EP ELE 311	Cable trays/ladders
GS EP INS 000	Minimum Contractor Document Requirements
GS EP INS 102	Instrumentation identification
GS EP INS 103	Instrument Database Management
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 108	Instrumentation for the design of plant rooms and control rooms
GS EP INS 120	Control and Choke Valves
GS EP INS 125	Safety Relief Valves and Rupture Discs
GS EP INS 135	Cyber Security requirements for design and supply of ICSS and Package Systems
GS EP INS 137	On/off valve control panels and actuators functional and construction requirements
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 PVV 211	Design and fabrication of pressure vessels according to ASMEVIII
GS EP PVV 771	Thermal insulation (hot service)

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Reference	Title
GS EP SAF 261	Emergency Shutdown and Emergency De-Pressurisation (ESD & EDP)
GS EP TEC 007	Obsolescence and Lifetime Cycle Management

3. Glossary

BDV	Blow Down Valve
CCR	Central Control Room
HIPS	High Integrity Protection System
IP	Ingress Protection
ITR	Instrument Technical Room
I/O	Input / Output
ICSS	Integrated Control and Safety System
PCS	Process Control System
PLC	Programmable Logic Controllers
SIL	Safety Integrity Level
SIF	Safety Instrumented Function
SSV	Surface Safety Valve
UCP	Unit Control Panel
WV	Wing valve

4. General requirements

4.1 List of Deviations

All deviations, as listed in the mandatory "List of Deviations", attached the technical proposal, shall be reviewed, clarified, approved or rejected one by one before Purchase Order by Company only.

4.2 Order of Precedence

In case a GS specification has been complemented with a project specification, then the project specification will have a higher order of priority than this specification. However, the individual instrument data sheets are considered a derivation of all other documents and any missing or erroneous data on a data sheet, resulting in wrongly sized or wrongly designed valves, shall be corrected under Contractor's responsibility.

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The equipment covered by each GS specification shall satisfy, in descending order of priority, the requirements of:

- The local regulations, when applicable
- The project specification, when existing
- The applicable Company General Specifications and other general specifications referred there-in
- The individual instrument data sheets
- Other standards, codes and professional documents to which the GS specification refers to.

In the event of conflicting requirements between GS and project specifications, rules, codes and standards, then the most restrictive requirement will apply.

The review and approval of instrument data sheets and other related documents by Company does not relieve the Contractor or Vendor to comply with referenced rules, legislation and specifications, and any necessary correction remains therefore the responsibility of the Contractor and/or Vendor.

5. Life cycle and obsolescence management

Facilities are typically designed with an expected design life in the order of 25 years. It is not practical to achieve such a design life for electronic based equipment without the requirement for upgrading.

The design shall therefore take into account the requirement that the electronic based systems and associated software will have to be upgraded during the design life of the facilities. These requirements shall be incorporated in the Basic Engineering requirements.

Level of compliance to those requirements ought to be verified during the CFT stages and cost of obsolescence and resolution costs for obsolete system or main sub system are recommended to be included in the Vendor bid evaluation and selection process.

Strategy for managing obsolescence needs to be regularly updated as an integral part of the core functions

- Design and development
- Sourcing and production
- In-service sustainability
- Vendors support.

The control and instrumentation equipment scope shall be given specific attention to ensure all production and control systems, components, software and individual elements and the respective running tools, test equipment, software and human skills can be maintained or replaced such that the original function and integrity of the whole production system can continue in an uninterrupted manner for the field life.

A project specific dossier shall be developed in accordance with **GS EP TEC 007** requirements during basic engineering and continuously updated during the life cycle time.

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The obsolescence dossier will consider the complete life cycle including:

- Bid stage
- Design phase
- Project delivery phase
- Operation & maintenance phase.

The contents of the dossier shall include as a minimum:

- Equipment Inventory
 - Bill Of Material (BOM)
 - . Comprehensive list with identification of all components up to the card level
 - Software releases
 - Obsolescence status of all main equipment, components and software.
- Dates
 - End of spare parts availability,
 - End of support (i.e. design engineering support, technical after sale support)
 - Product Change Notice (PCN)
 - Product Discontinuance Notice (PDN)
 - End of Life (EOL).
- Vendor support
 - Availability
 - Location.
- Replacement strategy of all components and associated softwares
- Replacement schedule.

All above data shall be tabled in a database or spreadsheet application.

The obsolescence dossier shall be further complemented during the detailed engineering stage and shall detail all aspects of equipment life cycle.

Obsolescence database ought to be required from Contractor/Vendor at CFT stage.

The design will include provisions to allow for an upgrade of all electronic systems to be performed with minimal disturbance to the process and utilities, fixed cabling infrastructure and general facilities infrastructure. Such provisions shall typically include:

- Tie-in points for the future equipment, while the original electronics are still functioning
- Avoidance of common components within the electronic systems for management of duty/stand-by equipment
- Allocation of sufficient space for future equipment/facilities within the ITR's and CCR.

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6. General instrumentation principles

6.1 Architecture and interconnecting principles

6.1.1 Standard architecture

The standard instrument loop architecture consists of field instruments connected to junction boxes which in turn are connected to marshalling cabinets by means of multi-cores cables. Signals are then cross-wired onto control system card-image termination boards inside “system cabinets”.

Marshalling cabinets and system cabinets are normally installed in technical rooms when junction boxes are field located.

6.1.2 Remote I/O's

In order to reduce the number and weight of multicore cables and associated cables-trays as well as the surface of technical rooms by reduction of the number of cabinets to be installed in these rooms, use of field mounted remote I/O's shall be considered.

Remote I/O's installed in hazardous area shall be certified for use in Zone 1 and when used for safety functions shall meet the SIL requirements.

Remote I/O's are considered as “smart junction boxes”. They consist of I/O modules, power supplies, communication bus interface and field terminals enclosed in boxes or cubicles according to the number of sensors or actuators they have to cope with.

RIOs installed in outdoor area shall be suitable for the environmental conditions including vibrations, temperature, humid, salt laden and corrosive atmosphere and all components shall be tropicalized and qualified to withstand the offshore tropical marine environment.

Maintenance facilities shall include:

- Replacement of I/O or power supply modules under power
- Diagnostic data available at the ICSS or UCP maintenance/operator stations in the same way as for standard I/O's
- Parameters of smart transmitters available in technical rooms for commissioning purpose.

Use of such systems shall be submitted to Company approval.

6.1.3 Field buses

Use of field buses is not recommended, but it may be studied on a case by case basis.

However use of fieldbus shall be subject to Company's approval.

Protocol will be as per recognized international standards (i.e. Foundation Fieldbus, Profibus PA).

6.1.4 Wireless Instruments

Use of wireless instruments is prohibited for all control and safety functions (PCS, PSS, ESD, F&G), time critical applications and any other critical safety applications.

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Wireless instruments may only be envisaged for:

- Non essential and non critical monitoring applications
- Non real time services
- Applications which do not require fast response time
- Applications which may withstand unavailability.

The use of wireless instruments shall be subject to a case by case study performed at pre project and basic engineering stages. These studies shall encompass interoperability, interchangeability, cyber security, reliability, availability and sustainability issues and include a risk analysis.

Coexistence between all concurrent wireless networks and radio networks shall be ensured.

Implementation shall comply with [GS EP INS 135](#) requirements.

The wireless instrument dossier shall be subject to Company approval.

Performances and availability of wireless instrumentation networks shall not be compromised by any other concurrent wireless networks or EM interferences.

Performance and installation study shall address the following topics:

- EMC
- Radio transmission obstructions
- Latency
- Instrument update rate
- Battery lifetime
- Lifecycle duration
- OPEX.

Protocol will be as per recognized international standards.

Equipment compatible with the standards [ISA 100](#) or [IEC 62591](#) are recommended as they offer greater interoperability with the equipment of up and coming generations.

All wireless network components located outdoor shall be certified for zone 1.

All components shall be of an industrial type and suitable for the environmental conditions including vibrations, temperature, humidity, salt laden and corrosive atmosphere. All components shall be tropicalised and qualified to withstand the plants specific environmental conditions.

6.1.5 Building interconnections

Copper links shall not be used to interconnect control, monitoring and safety systems when located in different buildings, whatever their nature: part of ICSS or UCP's for controlling and monitoring packages.

These interconnections will be either fibre optic or radio link according the telecommunications network availability.