Date of issue:
February 2024

Affected publication:
IOGP S-718, Specification for Basic Process Measurement Instruments, First Edition, September 2022, including Addendum 1, December 2023

ADDENDUM 2 FOR PUBLIC REVIEW

This addendum will replace Edition 1.0 published in September 2022 and Addendum 1 published in December 2023.

While this addendum primarily adds requirements and data sheet elements for additional level instruments, due to the extent of updates, it should be treated as a new document.

International Association of Oil & Gas Producers

SPECIFICATION
IOGP S-718
ADDENDUM 2 TO FIRST EDITION (SEPTEMBER 2022)

February 2024
Version 1.011

Specification for Basic Process Measurement Instruments

JIP33
JOINT INDUSTRY PROGRAMME

Revision history

VERSION	DATE	PURPOSE
1.011	February 2024	Addendum 2 for Public Review
1.01	December 2023	Addendum 1
1.0	September 2022	First Edition

Acknowledgements

This IOGP Specification was prepared by a Joint Industry Programme 33 Standardization of Equipment Specifications for Procurement organized by IOGP with support by the World Economic Forum (WEF).

Disclaimer

Copyright notice

Foreword

This specification was prepared under Joint Industry Programme 33 (JIP33) "Standardization of Equipment Specifications for Procurement" organized by the International Oil & Gas Producers Association (IOGP) with the support from the World Economic Forum (WEF). Companies from the IOGP membership participated in developing this specification to leverage and improve industry level standardization globally in the oil and gas sector. The work has developed a minimized set of supplementary requirements for procurement, with life cycle cost in mind, resulting in a common and jointly agreed specification, building on recognized industry and international standards.

Recent trends in oil and gas projects have demonstrated substantial budget and schedule overruns. The Oil and Gas Community within the World Economic Forum (WEF) has implemented a Capital Project Complexity (CPC) initiative which seeks to drive a structural reduction in upstream project costs with a focus on industry-wide, non-competitive collaboration and standardization. The CPC vision is to standardize specifications for global procurement for equipment and packages. JIP33 provides the oil and gas sector with the opportunity to move from internally to externally focused standardization initiatives and provide step change benefits in the sector's capital projects performance.

This specification has been developed in consultation with a broad user and supplier base to realize benefits from standardization and achieve significant project and schedule cost reductions.

The JIP33 work groups performed their activities in accordance with IOGP's Competition Law Guidelines (November 2020).

Table of contents

List of tables

Introduction

The purpose of the IOGP S-718 specification is to define a minimum common set of requirements for the procurement of basic process measurement instruments for application in the petroleum and natural gas industries.

The IOGP S-718 specification documents follow a common structure (as shown below) comprising a specification, also known as a technical requirements specification (TRS), a procurement data sheet (PDS), an information requirements specification (IRS) and a quality requirements specification (QRS). These four specification documents, together with the purchase order, define the overall technical specification for procurement.

JIP33 Specification for Procurement Documents
Technical Requirements Specification (TRS)

This specification is to be applied in conjunction with the supporting PDS, IRS and QRS as follows.

IOGP S-718: Specification for Basic Process Measurement Instruments

This specification defines technical requirements for the supply of the equipment.

IOGP S-718D: Procurement Data Sheets for Basic Process Measurement Instruments

The PDS defines application-specific requirements. The PDS is applied during the procurement cycle only and does not replace the equipment data sheet. The PDS may also include fields for supplier-provided information required as part of the purchaser's technical evaluation. Additional purchaser-supplied documents may also be incorporated or referenced in the PDS to define scope and technical requirements for enquiry and purchase of the equipment.

IOGP S-718L: Information Requirements for Basic Process Measurement Instruments

The IRS defines information requirements for the scope of supply. The IRS includes information content, format, timing and purpose to be provided by the supplier, and may also define specific conditions that invoke the information requirements.

IOGP S-718Q: Quality Requirements for Basic Process Measurement Instruments

The QRS defines quality management system requirements and the proposed extent of purchaser conformity assessment activities for the scope of supply. Purchaser conformity assessment activities are defined through the selection of one of four generic conformity assessment system (CAS) levels on the basis of evaluation of the associated service and supply chain risks. The applicable CAS level is specified by the purchaser in the PDS or in the purchase order.

The specification documents follow the drafting principles and rules of ISO/IEC Directives, Part 2.

The PDS and IRS are published as editable documents for the purchaser to specify application-specific requirements. The TRS and QRS are fixed documents.

The order of precedence of documents applicable to the supply of the equipment, with the highest authority listed first, shall be as follows:

a) regulatory requirements;

b) contract documentation (e.g. purchase order);

c) purchaser-defined requirements (e.g. PDS, IRS and QRS);

d) this specification;

e) selected instrument-specific normative standards.

1 Scope

1.1 Technologies

This specification defines the minimum requirements for the sizing, selection, materials, manufacture, inspection and testing, marking and preparation for shipment of basic process measurement instrumentation, for pressure ratings up to class 2500, covering the following measurement types:

a) pressure type:

- electronic pressure and differential pressure transmitters, both with manifold and diaphragm seal options;
- pressure and differential pressure gauges.

b) temperature type:

- electronic temperature transmitters;
- RTD and thermocouples;
- thermowells;
- temperature gauges.

c) flow type:

- concentric sharp edge, conic, quadrant edge, multi-hole and eccentric orifice head flow meter elements including quick change assemblies;
- integral orifice run, venturi, flow nozzle, cone, wedge, averaging pitot tube and variable area meter flow elements;
- ultrasonic, magnetic, vortex and turbine volumetric flow meter elements;
- Coriolis and thermal mass flow meter elements.

d) level type:

- magnetic level indicators and transmitters;
- level gauge glass indicator;
- wet leg, diaphragm and bubbler hydrostatic level transmitters;
- level displacer;
- ultrasonic level;
- RF capacitance/admittance;
- guided wave radar level transmitters;
- non-contact radar level transmitters;
- tuning fork;

- nucleonic level.

e) general type:

- Sand monitor;
- Erosion monitor;
- Corrosion monitor.

1.2 Boundaries

This specification covers instrumentation for the following applications:

- upstream production facilities excluding wellhead, drilling and subsea instrumentation;
- midstream transportation and storage;
- downstream refining and distribution.

In addition to general service, this specification is applicable for instrumentation in the following special services:

- NACE compliance for H_2S and alkaline service;
- hydrogen service.

1.3 Exclusions

The following general requirements are excluded from this specification:

- Industrial Internet of Things (IIoT);
- signal conditioners.

The following technologies are excluded from this specification:

- multi-point temperature devices;
- skin-type thermocouples;
- magnetic temperature sensors;
- orifice flanges;
- density profilers;
- custody transfer metering and weighing systems;
- wellhead, drilling and subsea instruments;
- multi-phase flowmeters;
- fire and gas detectors;
- all types of quality measurement instruments such as analysers and gas chromatographs;

- process switches (non-smart), pig detectors, position indicators and pushbuttons;
- machine monitoring devices such as vibration and speed/acceleration/phase sensors;
- beacons and sounders;
- naval systems such as ballast tank level measurement;
- ATG.

2 Normative references

The following publications are referred to in this document, the PDS (IOGP S-718D) or the IRS (IOGP S-718L) in such a way that some or all of their content constitutes requirements of this specification. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ANSI/HPS N43.8, *Classification of Industrial Ionizing Radiation Gauging Devices*

ANSI/ISA 12.27.01, *Requirements For Process Sealing Between Electrical Systems and Flammable or Combustible Process Fluids*

API MPMS 5.3, *Manual of Petroleum Measurement Standards Chapter 5—Metering Section 3—Measurement of Liquid Hydrocarbons by Turbine Meters*

API MPMS 22.2, *Manual of Petroleum Measurement Standards Chapter 22—Testing Protocol: Section 2—Differential Pressure Flow Measurement Devices*

API Recommended Practice 551, *Process Measurement*

ASME BPVC, Section I, *Rules for Construction of Power Boilers*

ASME BPVC, Section IX, *Welding, Brazing, and Fusing Qualifications*

ASME B1.20.1, *Pipe Threads – General Purpose – Inch*

ASME B16.5, *Pipe Flanges and Flanged Fittings – NPS ½ Through NPS 24 – Metric/Inch Standard*

ASME B31.3, *Process Piping*

ASME B40.100, *Pressure Gauges and Gauge Attachments*

ASME B40.200, *Thermometers, Direct Reading and Remote Reading*

ASME MFC-3M, *Measurement of Fluid Flow in Pipes Using Orifice, Nozzle, and Venturi*

ASME MFC-5.1, *Measurement of Liquid Flow in Closed Conduits Using Transit-Time Ultrasonic Flowmeters*

ASME MFC-5.3, *Measurement of Liquid Flow in Closed Conduits Using Doppler Ultrasonic Flowmeters*

ASME MFC-6M, *Measurement of Fluid Flow in Pipes Using Vortex Flowmeters*

ASME MFC-11, *Measurement of Fluid Flow by Means of Coriolis Mass Flowmeters*

ASME MFC-12M, *Measurement of Fluid Flow in Closed Conduits Using Multiport Averaging Pitot Primary Elements*

ASME MFC-16, *Measurement of Liquid Flow in Closed Conduits With Electromagnetic Flowmeters*

ASME MFC-18M, *Measurement of Fluid Flow Using Variable Area Meters*

ASME MFC-21.2, *Measurement of Fluid Flow by Means of Thermal Dispersion Mass Flowmeters*

ASME PTC 19.2, *Pressure Measurement – Instruments and Apparatus Supplement – Performance Test Codes*

ASME PTC 19.3 TW, *Thermowells – Performance Test Code*

ASME PTC 19.5, *Flow Measurement*

ASTM B912, *Standard Specification for Passivation of Stainless Steels Using Electropolishing*

ASTM E230/E230M, *Standard Specification for Temperature-Electromotive Force (emf) Tables for Standardized Thermocouples*

ASTM E235/E235M, *Standard Specification for Type K and Type N Mineral-Insulated, Metal-Sheathed Thermocouples for Nuclear or for Other High-Reliability Applications*

ASTM E608/E608M, *Standard Specification for Mineral-Insulated, Metal-Sheathed Base Metal Thermocouples*

ASTM E1137/E1137M, *Standard Specification for Industrial Platinum Resistance Thermometers*

EN 837-1, *Pressure Gauges - Part 1: Bourdon Tube Pressure Gauges. Dimensions, Metrology, Requirements and Testing*

EN 13190, *Dial thermometers*

IEC 60079 (all parts), *Explosive atmospheres*

IEC 60381-1, *Analogue signals for process control systems – Part 1: Direct current signals*

IEC 60462, *Nuclear instrumentation – Photomultiplier tubes for scintillation counting – Test procedures*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 60584-1, *Thermocouples – Part 1: EMF specifications and tolerances*

IEC 60584-3, *Thermocouples – Part 3: Extension and compensating cables – Tolerances and identification system*

IEC 60695-11-10, *Fire hazard testing – Part 11-10: Test flames – 50 W horizontal and vertical flame test methods*

IEC 60695-11-20, *Fire hazard testing – Part 11-20: Test flames – 500 W flame test method*

IEC 60751, *Industrial platinum resistance thermometers and platinum temperature sensors*

IEC 61326-1, *Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements*

IEC 61326-3-1, *Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 3-1: Immunity requirements for safety-related systems and for equipment intended to perform safety-related functions (functional safety) – General industrial applications*

IEC 61453, *Nuclear instrumentation – Scintillation gamma ray detector systems for the assay of radionuclides – Calibration and routine tests*

IEC 61508 (all parts), *Functional safety of electrical/electronic/programmable electronic safety-related systems*

IEC 61518, *Mating dimensions between differential pressure (type) measuring instruments and flanged-on shut-off devices up to 413 BAR (41,3 MPa)*

IEC 62305 (all parts), *Protection against lightning*

IEC 62402, *Obsolescence management*

IEC 62591, *Industrial networks – Wireless communication network and communication profiles – WirelessHART™*

IEC 62598, *Nuclear Instrumentation - Constructional requirements and classification of radiometric gauges*

IEC 62734, *Industrial networks – Wireless communication network and communication profiles – ISA 100.11a*

IEC 62828 (all parts), *Reference conditions and procedures for testing industrial and process measurement transmitters*

IEC 62828-1:2017, *Reference conditions and procedures for testing industrial and process measurement transmitters — Part 1: General procedures for all types of transmitters*

IOGP S-563, *Material Data Sheets for Piping and Valve Components*

IOGP S-705, *Supplementary Specification to API Recommended Practice 582 Welding Guidelines for Welding of Pressure Containing Equipment and Piping*

ISA 50.00.01, *Compatibility of Analog Signals for Electronic Industrial Process Instruments*

ISO 261, *ISO general purpose metric screw threads — General plan*

ISO 2715, *Liquid hydrocarbons — Volumetric measurement by turbine flowmeter*

ISO 3966, *Measurement of fluid flow in closed conduits — Velocity area method using Pitot static tubes*

ISO 5167-1, *Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full — Part 1: General principles and requirements*

ISO 5167-2, *Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full — Part 2: Orifice plates*

ISO 5167-3, *Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full — Part 3: Nozzles and Venturi nozzles*

ISO 5167-4, *Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full — Part 4: Venturi tubes*

ISO 5167-5, *Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full — Part 5: Cone meters*

ISO 5167-6, *Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full — Part 6: Wedge meters*

ISO 9951, *Measurement of gas flow in closed conduits — Turbine meters*

ISO 10790, *Measurement of fluid flow in closed conduits — Guidance to the selection, installation and use of Coriolis flowmeters (mass flow, density and volume flow measurements)*

ISO 12764, *Measurement of fluid flow in closed conduits — Flowrate measurement by means of vortex shedding flowmeters inserted in circular cross-section conduits running full*

ISO 14511, *Measurement of fluid flow in closed conduits — Thermal mass flowmeters*

ISO 15614 (all parts), *Specification and qualification of welding procedures for metallic materials — Welding procedure test*

ISO 17089-2, *Measurement of fluid flow in closed conduits — Ultrasonic meters for gas — Part 2: Meters for industrial applications*

ISO 20456, *Measurement of fluid flow in closed conduits — Guidance for the use of electromagnetic flowmeters for conductive liquids*

ISO 23936-1, *Petroleum, petrochemical and natural gas industries — Non-metallic materials in contact with media related to oil and gas production — Part 1: Thermoplastics*

ISO 23936-2, *Petroleum, petrochemical and natural gas industries — Non-metallic materials in contact with media related to oil and gas production — Part 2: Elastomers*

ISO/TR 15377, *Measurement of fluid flow by means of pressure-differential devices — Guidelines for the specification of orifice plates, nozzles and Venturi tubes beyond the scope of ISO 5167*

MSS SP-99, *Instrument Valves*

NACE MR0175/ISO 15156 (all parts), *Petroleum and natural gas industries — Materials for use in H_2S-containing environments in oil and gas production*

NACE MR0103/ISO 17945, *Petroleum, petrochemical and natural gas industries — Metallic materials resistant to sulfide stress cracking in corrosive petroleum refining environments*

NAMUR NE 43, *Standardization of the Signal Level for the Failure Information of Digital Transmitters*

NAMUR NE 107, *Self-Monitoring and Diagnosis of Field Devices*

NAMUR NE 132, *Coriolis Mass Meter (CMM)*

NEMA 250, *Enclosures for Electrical Equipment (1000 Volts Maximum)*

NFPA 70, *National Electrical Code*

NORSOK M-710, *Qualification of non-metallic materials and manufacturers - Polymers*

UL 94, *Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

– ISO Online browsing platform: available at https://www.iso.org.obp

– IEC Electropedia: available at http://www.electropedia.org/

3.1.1
bluff body
object whose significant portion of the surface area has separated flow

3.1.2
calibrated range
region within which an instrument/device has been bench calibrated to check the actual device output reading against known standards

3.1.3
capillary
flexible tube used to provide a high-integrity connection between the diaphragm seal and the sensing element (transmitter) permitting remote location of the instrument from the process connection

3.1.4
diaphragm seal
chemical seal
remote seal
flexible material used for pressure measurements when the process material is required to be kept away from the pressurized parts of the measuring instrument

Note 1 to entry: The purpose of the seal is to isolate the capillary line fill fluid from the process fluid while permitting the transmission of pressure through to the fill fluid contained within the capillary.

3.1.5
impulse line
instrument tubing connection provided between the process isolation valve and the measuring element

3.1.6
instrument range
region in which the instrument/device can reliably measure within the supplier-stated performance limits

3.1.7
marine installation
offshore installation
nearshore installation
installation sited in oceans, seas, bays, estuaries and other high salinity water bodies including land up to 1 km (0,6 miles) from shore

3.1.8
multivariable transmitter
device used to measure and simultaneously transmit multiple process variables

Note to entry 1: These process variables can include parameters such as pressure, temperature and flow rate.

3.1.9
name plate
plate, permanently affixed to the instrument, stating identification information

3.1.10
pressure retaining bolting
bolting whose failure to function as intended results in a release of contained fluid into the environment

3.1.11
retractable type instrument
instrument that can be installed and removed from service without interruption to the process

3.1.12
tag plate
identifier plate, normally attached by wire to the instrument, stating the tag number

3.2 Abbreviated terms

ATG automatic tank gauging

DTM device type manager

EDDL electronic device description language

IRS information requirements specification

MDS material data sheet

NDE non-destructive examination

PDS procurement data sheet

PMI positive material identification

PTFE polytetrafluoroethylene

QRS quality requirements specification

RF radio frequency

RTD resistance temperature device

SIL safety integrity level

TRS technical requirements specification

UV ultraviolet

4 Common requirements

4.1 System design

4.1.1 General design codes

Basic process measurement instrumentation shall comply with IEC 62828 (all parts).

NOTE The scope of IEC 62828 (all parts) covers performance.

4.1.2 Configuration

4.1.2.1

Instrumentation shall be preconfigured with the following data:

— tag number;

— fail safe direction;

— calibrated range;

— units of measure.

4.1.2.2

Instrumentation configuration shall be via the specified communication protocol.

4.1.2.3

The communication protocol shall be backward compatible.

4.1.2.4

Instrumentation shall be supplied and tested as a single assembly.

4.1.2.5

Transmitters shall detect failure of sensors with the upscale or downscale failsafe direction configured.

4.1.3 Electronics

4.1.3.1

Transmitter integral displays shall be configured to display the measured variable and unit of measure.

4.1.3.2

Transmitter housings shall have the facility to be locked in position at a minimum of 90° steps.

4.1.3.3

Transmitter displays shall have rotation adjustment.

4.1.3.4

Failure or removal of a transmitter integral local display shall have no effect on the output signal.

4.1.3.5

Instrumentation shall maintain configuration settings on loss of power.

4.1.3.6

Electrical connections shall be reverse-polarity protected.

4.1.3.7

Seals that are located between the process fluid and electrical components and that are integral to the instrument shall comply with ANSI/ISA 12.27.01.

4.1.4 Safety integrity

Safety instrumented function transmitters shall be provided with a SIL certificate from an independent, internationally-recognized organization.

4.1.5 Cyber security

4.1.5.1

DTM and device description files shall be available directly from the equipment manufacturer or from the equipment manufacturer's authorized secure website.

4.1.5.2

DTM and device description files shall be signed by the equipment manufacturer using a trusted certificate authority.

4.1.5.3

The instrument shall be protected against inadvertent changes with the use of a physical switch, jumper or password.

4.1.6 Ingress protection

The ingress protection for the instrumentation housing and termination enclosures shall be minimum IP66 or NEMA 4X.

4.1.7 Wireless

4.1.7.1

WirelessHART® and ISA 100.11a instruments shall use approved, tested and certified electronic device description language (EDDL) or DTM.

4.1.7.2

Battery life expectancy for a one-hour transmit interval at 15 °C (60 °F) shall be at least three years.

4.1.7.3

The wireless instrument battery or battery pack shall be of pluggable type.

4.1.7.4

The wireless instrument battery or battery pack shall permit replacement in the designated hazardous area.

4.1.7.5

Batteries shall be keyed to prevent reverse polarity.

4.1.7.6

Wireless devices shall have non-volatile memory.

4.1.7.7

Wireless devices shall have the capability to transmit battery diagnostic data.

4.2 Performance

4.2.1

Instrument hardware, firmware and software shall be supported for 10 years from order placement.

4.2.2

Transmitters shall have a vibration level resistance of "Field with general application or pipeline with low vibration" in accordance with IEC 62828-1:2017, Table 4.

4.3 Mechanical construction

4.3.1 Metallurgy and soft goods

4.3.1.1 Wetted materials

4.3.1.1.1

Wetted part materials shall be minimum 316/316L stainless steel.

4.3.1.1.2

Alloy C-276 (UNS N10276) or higher corrosion-resistant alloy sensor elements shall be used when in contact with chloride-, amine- or ammonium-containing process fluids.

4.3.1.1.3

Copper and copper alloys shall not be used for parts exposed to sour service process fluids.

4.3.1.1.4

Diaphragm seals in hydrogen service shall be designed to resist hydrogen permeation leading to embrittlement.

4.3.1.1.5

Silver, mercury and alloys containing silver or mercury shall not be used for wetted parts.

4.3.1.1.6

Butt welds in butt joints where the weld root is exposed to the process shall be full penetration.

4.3.1.2 Pressure-retaining parts

4.3.1.2.1

Pressure-retaining bolting and nuts shall be in accordance with IOGP S-563.

4.3.1.2.2

When the instrument is designated in sour service, exposed and non-exposed bolting shall be in accordance with NACE MR0175/ISO 15156 or NACE MR0103/ISO 17945.

4.3.1.2.3

Cadmium-plated bolting shall not be used.

4.3.1.2.4

Insertion-type instruments shall incorporate physical positive retention elements that prevent the element from being projected under pressure.

4.3.1.2.5

Belleville (spring) washers shall be the default spring type for pressure retaining service.

4.3.1.3 Housing materials

4.3.1.3.1

The housing material for marine installations shall be minimum 316 stainless steel.

4.3.1.3.2

Instrumentation shall not contain mercury, asbestos or ceramic fibres.

4.3.1.3.3

Instrumentation shall be UV resistant.

4.3.1.4 Soft goods

4.3.1.4.1

The selection and evaluation of elastomeric seals shall be in accordance with ISO 23936-1, ISO 23936-2 or NORSOK M-710.

4.3.1.4.2

Wetted parts for hydrocarbon service shall not use nitrile rubber.

4.3.2 Tag and name plates

4.3.2.1

Tag and name plate information shall be stamped or engraved.

4.3.2.2

The material of tag and name plates shall be 316 stainless steel.

4.3.2.3

Name plates shall include the following information:

— manufacturer's name;

— model, type and serial number;

— operating voltage;

— hazardous area certification details.

4.3.2.4

Tag plates shall be secured to the transmitter or remote indicator with 316 stainless steel tie wire.

4.3.2.5

Name plates shall be affixed with 316 stainless steel rivets or screws.

4.3.3 Cable entry

4.3.3.1

Electrical ports shall be fitted with plugs certified to the instrument hazardous area certification.

4.3.3.2

Terminals within the head shall be clearly marked "+" and "−" symbols for the relative voltage applied.

4.3.4 Retractable instruments

4.3.4.1

The retractable assembly shall have an isolation mechanism for removal of the retractable element.

4.3.4.2

Retractable-type instruments shall be equipped with a seal for safe removal of the element.

4.4 Inspection and shop tests

4.4.1 Pressure testing

4.4.1.1

Pressure-containing parts shall comply with the respective MDSs of IOGP S-563.

4.4.1.2

The complete instrument assembly shall be hydrostatically pressure tested in accordance with ASME B16.5:2020, 8.2.

4.4.1.3

Assemblies of pressure-containing components shall remain assembled on completion of the hydrostatic test.

4.4.1.4

Instrumentation used in hydrocarbon service shall not allow a fault in the primary process barrier to lead to a leak into the main compartment or junction box.

4.4.2 Non-destructive examination (NDE)

4.4.2.1

NDE of pressure-containing parts shall be in accordance with IOGP S-563.

4.4.2.2

NDE of non-pressure-containing parts shall be in accordance with its associated material standard specification.

4.4.2.3

PMI of pressure-containing parts shall be performed on stainless steel, nickel alloy and non-ferrous alloy instrumentation with frequency, extent and acceptance criteria defined in the PMI procedure.

4.5 Preparation for shipment

4.5.1

Instrumentation internal surfaces shall be free from test fluids, cleaning agents, particles and organic substances prior to shipping.

4.5.2

Temporary plugs shall be distinguishable from permanent plugs.

4.5.3

Flange faces shall be protected prior to shipping.

4.5.4

Flange openings shall be sealed prior to shipping.

4.5.5

The design of covers shall prevent the instrumentation from being installed without prior removal of the covers.

5 Pressure and differential pressure transmitters

5.1 General

5.1.1

Pressure instrumentation shall be designed and tested in accordance with the standards in Table 1.

5.1.2

Pressure instrumentation supplied in accordance with US standards shall comply with the standards in Table 2.

5.1.3

Pressure instrumentation supplied in accordance with non-US standards shall comply with the standards in Table 3.

Table 1 — General standards applicable to pressure instrumentation

Standard number	Scope covered	Pressure gauge	Pressure transmitter
ASME PTC 19.2	Performance test codes	N/A	A
IEC 60381-1	Transmitter signal	N/A [a]	A
IEC 61326-1	EMC	N/A [a]	A
IEC 61326-3-1	EMC	N/A [a]	A
IEC 61508 (all parts)	SIL	N/A	A
IEC 61518	Mating dimensions	N/A	A
IEC 62305 (all parts)	Lightning protection	N/A	A
IEC 62402	Obsolescence management	A	A
IEC 62591 IEC 62734	Wireless	N/A [a]	A
ISO 23936-1	Seals	N/A	A
ISO 23936-2	Seals	N/A	A
ISA 50.00.01	Analog signals	N/A	A
MSS SP-99	Instrument valves	A	A
NAMUR NE 43	Transmitter failure signal level	N/A [a]	A
NAMUR NE 107	Field device diagnostics	N/A [a]	A
NORSOK M-710	Seals	N/A	A
Key A Applicable N/A Not applicable			
[a] Applicable if there is a wireless option.			

Table 2 — US standards applicable to pressure instrumentation

Standard number	Scope covered	Pressure gauge	Pressure transmitter
ASME BPVC, Section IX	Welding	A	A
ASME B1.20.1	Threads	A	A
ASME B40.100	Gauges	A	N/A
ISA 50.00.01	Analog signals	N/A	A
NEMA 250	Electrical equipment enclosures	N/A	A
NFPA 70	National electrical code	N/A	A
UL 94	Plastic flammability tests	A [a]	A [a]
Key A Applicable N/A Not applicable			
[a] Code active if weather enclosure (external) is selected as an accessory from the PDS.			

Table 3 — Non-US standards applicable to pressure instrumentation

Standard number	Scope covered	Pressure gauge	Pressure transmitter
EN 837-1	Pressure gauge design	A	N/A
IEC 60695-11-10	Fire tests	A [a]	A [a]
IEC 60695-11-20	Fire tests	A [a]	A [a]
IEC 60079 (all parts)	Explosive atmospheres	N/A	A
IEC 60381-1	Transmitter signal	N/A	A
IEC 60529	Ingress protection	A	A
ISO 261	Threads	A	A
ISO 15614 (all parts)	Welding	A	A
Key A Applicable N/A Not applicable			
[a] Code active if weather enclosure (external) is selected as an accessory from the PDS.			

5.1.4

Pressure transmitters shall have a minimum accuracy of ±0,1 % of the calibrated span.

5.1.5

Gold plating thickness for hydrogen service shall be greater than or equal to 5 µm (196,85 µin).

5.2 Instrument protection

5.2.1

Diaphragm seal capillary material shall be minimum 316 stainless steel.

5.2.2

Diaphragm seal capillaries shall be filled and welded to the seals and the instrument.

5.2.3

The diaphragm material shall be minimum 316 stainless steel.

5.2.4

Diaphragm seal capillary fill fluid shall not be pyrophoric.

5.2.5

Diaphragm seals shall be permanently marked to identify the seal fluid.

5.3 Instrument process manifolds

5.3.1

Manifold valve bonnets shall have a locking pin.

5.3.2

Manifold valve bonnets shall be fitted with colour-coded ring labels in accordance with API Recommended Practice 551.

5.3.3

Manifold valves shall be fabricated from bar stock material.

5.3.4

Manifold valves shall be directly mounted on the transmitter.

5.3.5

Five-valve manifolds shall be single equalization valve pattern in accordance with API Recommended Practice 551.

5.3.6

Needle valve packing in manifold valves shall be graphite-based or PTFE.

5.3.7

PTFE needle valve packing shall be limited to design temperatures from -40 °C (-40 °F) to 200 °C (392 °F).

5.4 Pressure gauges

5.4.1

The nominal head diameter of pressure gauges installed on piping or process equipment shall be greater than or equal to 100 mm or 4,5 in.

5.4.2

For panel-mounted pressure gauges, the nominal head diameter shall be 63 mm (2,5 in).

5.4.3

Pressure gauges shall have a means of preventing over-range pressure from rotating the pointer past full scale (e.g. a pointer stopper) and back to within scale measurement.

5.4.4

Pressure gauges in vibrating service shall have damped movements (e.g. be liquid filled).

5.4.5

Pressure gauge pointers shall have an external-type adjustment feature for zero without the need to open the gauge.

5.4.6

The material of the pressure gauge case shall have a corrosion resistance greater than or equal to 316 stainless steel.

5.4.7

The material of pressure gauge pressure-containing and moving parts shall be minimum 316 stainless steel for non-welded parts or minimum 316L stainless steel for welded parts.

5.4.8

Pressure gauges shall be provided with a blow-out back section, a baffle wall and non-splintering glass.

5.4.9

The accuracy of pressure gauges shall be graded 1A in accordance with ASME B40.100 or class 1 in accordance with EN 837-1.

5.4.10

Bourdon tube design pressure gauges shall have the same socket and tip material as the tube.

5.4.11

Bourdon tube pressure gauge connections between the socket, tube and tip shall be welded.

5.4.12

Pressure gauge socket stems shall be provided with wrench flats.

5.4.13

Pressure gauge dials shall be white with black markings.

5.4.14

Pressure gauges shall have an anti-parallax dial.

6 Temperature instrumentation

6.1 General

6.1.1

Temperature instrumentation shall comply with the standards in Table 4.

6.1.2

Temperature instrumentation supplied in accordance with US standards shall comply with the standards in Table 5.

6.1.3

Temperature instrumentation supplied in accordance with non-US standards shall comply with the standards in Table 6.

6.1.4

Temperature transmitters shall have configurable linearization.

6.1.5

The thermal connection between the thermowell tip and tip-sensitive elements shall be maintained with mechanical loading.

6.1.6

Temperature transmitters shall have an accuracy of at least ±0,1 % of the calibrated span.

6.1.7

Temperature transmitter assemblies shall be designed with nipple-union-nipple fittings.

6.1.8

The temperature element head cover shall be attached to the head with a stainless steel chain.

6.1.9

Temperature element assemblies shall be of duplex type.

6.1.10

The thermowell body shall be constructed from a single piece without any welds.

Table 4 — General standards applicable to temperature instrumentation

Standard number	Topic covered	Temperature gauge	Temperature transmitter	Temperature clamp-on
ASME PTC 19.3 TW	Thermowell design	A	A	N/A
ASTM B912	Thermowell electropolishing	A	A	N/A
ASTM E230/E230M	Thermocouple EMF tables	N/A	A	N/A
ASTM E235/E235M	Type K and N thermocouples	N/A	A	N/A
ASTM E608/E608M	Thermocouple specification	N/A	A	N/A
ASTM E1137/E1137M	Platinum resistance RTD	A	A	A
IEC 60584-1	Thermocouple EMF specification	A	A	A
IEC 60584-3	Thermocouple tolerances	N/A	A	N/A
IEC 60751	Platinum resistance sensors	A	A	A
IEC 61326-1	EMC	N/A	A	A
IEC 61326-3-1	EMC	N/A	A	A
IEC 61508 (all parts)	SIL	N/A	A	A
IEC 62305 (all parts)	Lightning protection	N/A	A	A
IEC 62402	Obsolescence management	A	A	A
IEC 62591 IEC 62734	Wireless	N/A	A	A
NAMUR NE 43	Transmitter failure signal level	N/A	A	A
NAMUR NE 107	Field device diagnostics	N/A	A	A

Key
A Applicable
N/A Not applicable

Table 5 — US standards applicable to temperature instrumentation

Standard number	Topic covered	Temperature gauge	Temperature transmitter	Temperature clamp-on
ASME B1.20.1	Threads	A	A	A
ASME B40.200	Gauge design	A	N/A	A
ASTM B912	Thermowell electropolishing	A	A	N/A
ASTM E230/E230M	Thermocouple EMF tables	N/A	A	A
ASTM E235/E235M	Type K and N thermocouples	N/A	A	A
ASTM E608/E608M	Thermocouple specification	N/A	A	A
ASTM E1137/E1137M	Platinum resistance RTD	A	A	A
ISA 50.00.01	Analog signals	N/A	A	A
NEMA 250	Electrical equipment enclosures	N/A	A	A
NFPA 70	National electrical code	N/A	A	A

Key
A Applicable
N/A Not applicable

Table 6 — Non-US standards applicable to temperature instrumentation

Standard number	Topic covered	Temperature gauge	Temperature transmitter	Temperature clamp on
ASTM B912	Thermowell electropolishing	A	A	N/A
ASTM E230/E230M	Thermocouple EMF tables	N/A	A	A
ASTM E235/E235M	Type K and N thermocouples	N/A	A	A
ASTM E608/E608M	Thermocouple specification	N/A	A	A
ASTM E1137/E1137M	Platinum resistance RTD	A	A	A
EN 13190	Gauge design	A	N/A	N/A
IEC 60079 (all parts)	Explosive atmospheres	N/A	A	A
IEC 60381-1	Transmitter signals	N/A	A	A
IEC 60529	Ingress protection	A	A	A
ISO 261	Threads	A	A	A

Key
A Applicable
N/A Not applicable

6.2 Resistance temperature devices (RTDs)

6.2.1

RTD transition pieces shall be hermetically sealed.

6.2.2

RTD heads shall have an integral terminal block with a shield terminal.

6.3 Temperature Gauges

6.3.1

Temperature gauges shall be of bi-metallic type.

6.3.2

The nominal head diameter for temperature gauges installed on piping or process equipment shall be greater than or equal to 100 mm (non-US) or 5 in (US).

6.3.3

For panel-mounted temperature gauges, the nominal head diameter shall be 63 mm (non-US) or 3 in (US).

6.3.4

Temperature gauge heads shall be adjustable type when installed on piping or equipment.

6.3.5

The material of temperature gauge cases and bezel rings shall be 316 stainless steel.

6.3.6

Temperature gauge dials shall be white with black markings.

6.3.7

Temperature gauge dials shall have a black pointer.

6.3.8

The material of the temperature gauge stem and connection nuts shall be 316 stainless steel.

6.3.9

Temperature gauges shall have accuracy class 1 in accordance with EN 13190 or grade A in accordance with ASME B40.200.

6.3.10

Temperature gauge ranges shall be selected from the standard ranges defined in the selected code.

6.3.11

The temperature gauge bimetallic element shall be of helix type.

6.3.12

Temperature gauge stem outside diameter screwed connection shall be ½-14 NPTM.

6.3.13

Temperature gauge stems shall be provided with wrench flats.

6.3.14

Temperature gauges shall have an anti-parallax dial.

7 Flow instrumentation

7.1 General

7.1.1

Flow instrumentation shall comply with the design standards in Table 7.

7.1.2

Flow instrumentation supplied in accordance with US standards shall comply with the design standards in Table 8.

7.1.3

Flow instrumentation supplied in accordance with non-US standards shall comply with the design standards in Table 9.

Table 7 — General standards applicable to flow instrumentation

Standard number	Topic covered	Head type flow							Volumetric flow				Mass flow	
		Orifice	Venturi	Nozzle	Cone	Wedge	Pitot	Variable area	Ultrasonic	Electro-magnetic	Vortex	Turbine	Coriolis	Thermal
ASME B31.3	Process piping	N/A	A	A	A	A	A	A	A	A	A	A	A	A
IEC 61326-1	EMC	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A	A	A	A
IEC 61326-3-1	EMC	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A	A	A	A
IEC 61508 (all parts)	SIL	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A	A	A	A
IEC 62305 (all parts)	Lightning protection	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A	A	A	A
IEC 62402	Obsolescence management	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A	A	A	A
IEC 62591	Wireless	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A	A	A
IEC 62734	Wireless	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A	A	A
ISO 2715	Turbine (liquid)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A
ISO 3966	Pitot	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ISO 5167-1	Differential pressure general	A	N/A	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ISO 5167-2	Orifice	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ISO 5167-3	Nozzle	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ISO 5167-4	Venturi	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ISO 5167-5	Cone	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ISO 5167-6	Wedge	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ISO 9951	Turbine (gas)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A
ISO 10790	Coriolis	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	N/A
ISO 12764	Vortex	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A
ISO 14511	Thermal mass	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A
ISO/TR 15377	Orifice, nozzle and Venturi	A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 7 *(continued)*

Standard number	Topic covered	Head type flow							Volumetric flow				Mass flow	
		Orifice	Venturi	Nozzle	Cone	Wedge	Pitot	Variable area	Ultrasonic	Electro-magnetic	Vortex	Turbine	Coriolis	Thermal
ISO 17089-2	Ultrasonic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A
ISO 20456	Electromagnetic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A
NAMUR NE 43	Transmitter failure signal level	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A	A	A	A
NAMUR NE 107	Field device diagnostics	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A	A	A	A
NAMUR NE 132	Coriolis	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	N/A

Key

A Applicable

N/A Not applicable

Table 8 — US standards applicable to flow instrumentation

Standard number	Topic covered	Head type flow							Volumetric flow				Mass flow	
		Orifice	Venturi	Nozzle	Cone	Wedge	Pitot	Variable area	Ultrasonic	Electro-magnetic	Vortex	Turbine	Coriolis	Thermal
API MPMS 5.3	Turbine	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A
API MPMS 22.2	DP flow testing	A	A	A	A	A	A	A	N/A	N/A	N/A	N/A	N/A	N/A
ASME BPVC, Section IX	Welding	N/A	A	A	A	A	A	A	A	A	A	A	A	A
ASME B1.20.1	Threads	N/A	A	A	N/A	N/A	N/A	N/A	A	A	A	A	A	A
ASME MFC-3M	Orifice, nozzle, wedge and Venturi	A	A	A	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ASME MFC-5.1	Ultrasonic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A
ASME MFC-5.3	Ultrasonic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A
ASME MFC-6M	Vortex	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A
ASME MFC-11	Coriolis	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	N/A
ASME MFC-12M	Pitot	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ASME MFC-16	Electromagnetic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A
ASME MFC-18M	Variable area	N/A	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A
ASME PTC 19.5	Flow measurement	A	A	A	A	A	A	A	A	A	A	A	A	A
ASME MFC 21.2	Thermal mass	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A
ISA 50.00.01	Analog signals	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A	A	A
NEMA 250	Electrical equipment enclosures	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A	A	A
NFPA 70	National electrical code	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A	A	A

Key
A Applicable
N/A Not applicable

Table 9 — Non-US standards applicable to flow instrumentation

Standard number	Topic covered	Head type flow							Volumetric flow				Mass flow	
		Orifice	Venturi	Nozzle	Cone	Wedge	Pitot	Variable area	Ultrasonic	Electro-magnetic	Vortex	Turbine	Coriolis	Thermal
IEC 60079 (all parts)	Explosive atmospheres	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A	A	A
IEC 60381-1	Transmitter signal	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A	A	A
IEC 60529	Ingress protection	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A	A	A
ISO 261	Threads	N/A	A	A	N/A	N/A	N/A	N/A	A	A	A	A	A	A
ISO 15614 (all parts)	Welding	N/A	A	A	A	A	A	A	A	A	A	A	A	A

Key

A Applicable

N/A Not applicable

7.1.4

Flow elements shall be marked with the flow direction.

7.1.5

For bluff bodies, a mechanical integrity report shall be supplied.

7.2 Head meters

7.2.1 Orifice

7.2.1.1

Orifice plate material shall be minimum 316 stainless steel.

7.2.1.2

Orifice plate handles shall be engraved on the upstream side with the following information:

— "INLET";

— instrument tag;

— bore size;

— plate material;

— plate type;

— line size;

— flange rating.

7.2.1.3

Orifice plate information shall be visible without the removal of insulation.

7.2.1.4

The orifice plate tab shall be in line with the drain or vent hole.

7.2.2 Cone meter

7.2.2.1

For cones greater than or equal to 80 mm (3 in), calculations confirming the mechanical integrity shall be provided.

7.2.2.2

The shape of sheet metal cones shall permit additional supports.

7.2.2.3

The clearance of cone meters between the cone and the pipe wall shall be measured at eight equally spaced locations from the starting point.

7.2.2.4

The starting point of clearances and direction of measurement of cone meters shall be marked on the downstream flange and downstream face of the cone.

7.2.2.5

The maximum allowable misalignment between the pipe and the cone axes of cone meters in linear shift and in angular orientation shall be provided.

7.2.2.6

The cone meters welds exposed to the process shall be smooth and free of relevant indications.

7.2.3 Wedge flow meters

7.2.3.1

The material of wedge meters shall be minimum 316 stainless steel.

7.2.4 Average pitot tube

7.2.4.1

Blowout prevention of average pitot tubes shall be provided for removable elements.

7.2.4.2

Average pitot tubes shall permit zeroing and removal of the transmitter assembly without interrupting the process.

7.2.4.3

Average pitot tubes shall have end support.

7.2.5 Variable area (VA) meters

7.2.5.1

Variable area flow meters shall have self-cleaning floats.

7.2.5.2

Variable area flow meters shall have inlet and outlet float stops.

7.2.5.3

For scales in percent, the meter factor for maximum flow at 100 % shall be engraved on the variable area flow meter scale.

7.3 Volumetric meters

7.3.1 Ultrasonic flow instrument

Ultrasonic flow meter accuracy shall be within ± 1 % of full-scale flow.

7.3.2 Electromagnetic flow meter

7.3.2.1

The electromagnetic flowmeter shall identify when the pipe is not completely full.

7.3.2.2

Electromagnetic flow meter accuracy shall be within ± 1 % of full-scale flow.

7.3.3 Vortex flow meter

7.3.3.1

Vortex flow meters shall meet the performance requirements at the minimum flow case.

7.3.3.2

Vortex flow meters accuracy for liquid flow shall be within ± 1 % of full-scale flow.

7.3.3.3

Vortex flow meters accuracy for gas flow shall be within ± 2 % of full-scale flow.

7.3.4 Turbine flow meters

7.3.4.1

The material of the turbine flow meter body housing, rotor hubs, blades and rims shall be minimum 316 stainless steel for non-welded parts or minimum 316L stainless steel for welded parts.

7.3.4.2

The accuracy of turbine flow meters in liquid service shall be within ± 0,5 % of full-scale flow.

7.4 Mass flow meters

7.4.1

Thermal mass flow meter sensors shall have retractable probes.

8 Level instrumentation

8.1 General

8.1.1

Level instrumentation shall comply with the design standards in Table 10.

8.1.2

Level instrumentation supplied in accordance with US standards shall comply with the design standards in Table 11.

8.1.3

Level instrumentation supplied in accordance with non-US standards shall comply with the design standards in Table 12.

8.1.4

The accuracy of level instrumentation shall be within ± 0,1 % of the specified span.

8.1.5

Purchaser-provided level sketches shall be used to size and select the level instrumentation.

8.1.6

If a chamber is specified, the vent and drain valves shall be size ¾-14 NPTM × ¾-14 NPTF.

Table 10 — General standards applicable to level instrumentation

Standard number	Topic covered	Magnetic level indicator	Gauge glass	Hydrostatic	Displacer	Ultrasonic	RF capacitance/ admittance	Guided wave radar	Non-contact radar	Tuning fork	Nucleonic
ASME B31.3	Process piping	A	A	N/A	A	A	A	N/A	N/A	A	N/A
ASME PTC 19.2	Performance test codes	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
IEC 60462	Radiation measure	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A
IEC 61326-1	EMC	A [a]	N/A	A	A	A	A	A	A	A	A
IEC 61326-3-1	EMC	A [a]	N/A	A	A	A	A	A	A	A	A
IEC 61453	Radiation measure	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A
IEC 61508 (all parts)	SIL	N/A	N/A	A	A	A	A	A	A	A	A
IEC 61518	Mating dimensions	N/A	N/A	A [b]	N/A	N/A	N/A	N/A	N/A	N/A	N/A
IEC 62305 (all parts)	Lightning protection	A [a]	N/A	A	A	A	A	A	A	A	A
IEC 62402	Obsolescence management	A	A	A	A	A	A	A	A	A	A
IEC 62591 / IEC 62734	Wireless	A	N/A	A	A	A	A	A	A	A	A
NAMUR NE 43	Transmitter failure signal level	A [a]	N/A	A	A	A	A	A	A	A	A
NAMUR NE 107	Field device diagnostics	A [a]	N/A	A	A	A	A	A	A	A	A

Key

A Applicable

N/A Not applicable

[a] Only active if the transmitter option is selected.

[b] Only active when the transmitter is connected to a manifold block.

Table 11 — US standards applicable to level instrumentation

Standard number	Topic covered	Magnetic level indicator	Gauge glass	Hydrostatic	Displacer	Ultrasonic	RF capacitance/ admittance	Guided wave radar	Non-contact radar	Tuning fork	Nucleonic
ANSI/HPS N43.8	Containers	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A
ASME BPVC, Section IX	Welding	A	A	A	A	A	A	A	A	A	A
ASME B1.20.1	Threads	A	A	A	A	A	A	A	A	A	A
ISA 50.00.01	Analog signals	A [a]	N/A	A	A	A	A	A	A	A	A
NEMA 250	National electrical code	A [a]	A [c]	A	A	A	A	A	A	A	A
NFPA 70	Electrical equipment enclosures	A [a]	A [c]	A	A	A	A	A	A	A	A
UL 94	Plastic flammability tests	N/A	N/A	A [b]	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Key

A Applicable

N/A Not applicable

[a] Only active if the transmitter option is selected.

[b] Code active if the weather enclosure (external) is selected as an accessory from the PDS.

[c] Only active if the illuminator option is selected.

Table 12 — Non-US standards applicable to level instrumentation

Standard number	Topic covered	Magnetic level indicator	Gauge glass	Hydrostatic	Displacer	Ultrasonic	RF capacitance/admittance	Guided wave radar	Non-contact radar	Tuning fork	Nucleonic
IEC 60695-11-10	Fire tests	N/A	N/A	A [b]	N/A	N/A	N/A	N/A	N/A	N/A	N/A
IEC 60695-11-20	Fire tests	N/A	N/A	A [b]	N/A	N/A	N/A	N/A	N/A	N/A	N/A
IEC 60079 (all parts)	Explosive atmospheres	A [a]	A [c]	A	A	A	A	A	A	A	A
IEC 60381-1	Transmitter signal	A [a]	N/A	A	A	A	A	A	A	A	A
IEC 60529	Ingress protection	A [a]	A [c]	A	A	A	A	A	A	A	A
IEC 62598	Containers	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A
ISO 261	Threads	A	A	A	A	A	A	A	A	A	A
ISO 15614 (all parts)	Welding	A	A	A	A	A	A	A	A	A	A

Key

A Applicable

N/A Not applicable

[a] Only active if the transmitter option is selected.

[b] Code active if the weather enclosure (external) is selected as an accessory from the PDS.

[c] Only active if the illuminator option is selected.

8.2 Level indicators

8.2.1 Magnetic level indicators

8.2.1.1

Magnetic level indicators shall not be of follower/floating shuttle type.

8.2.1.2

Magnetic level indicator flags shall be hermetically sealed.

8.2.1.3

Magnetic level indicator flags shall be made from 316 stainless steel.

8.2.1.4

Individual magnetic level indicator segments shall not change colour when acted on by external forces.

NOTE Interlocking the magnetic level indicator segments is one method of ensuring that the colour is maintained.

8.2.1.5

Magnetic level indicator floats shall be removable through the bottom flange.

8.2.1.6

Magnetic level indicators shall have float stop springs in the bottom and top of the chamber.

8.2.1.7

Float movement in the magnetic level indicator chamber shall not be affected by process conditions.

8.2.1.8

Magnetic level indicator scale markings shall be indelibly stamped or engraved.

8.2.2 Level gauge glass

8.2.2.1

Pressure rating at maximum temperature for gauge glass shall be at least twice the maximum operating pressure.

8.2.2.2

Borosilicate glass shall be used in services up to 316 °C (600 °F).

8.2.2.3

Glass failure shall be with an inter-crystalline fracture without flying particles.

8.2.2.4

The gauge glass body shall be machined from a solid steel bar or a steel forging.

8.2.2.5

The level gauge chamber and cover shall be provided with a high integrity seal (e.g. flat mating surfaces, machined recess).

8.2.2.6

The material of gauge glass bolts, nuts and washers shall be minimum 316 stainless steel.

8.2.2.7

Gauge glasses shall have vent and drain valves.

8.2.2.8

Gauge glass vent and drain valves shall be of ball valve type.

8.2.2.9

The level gauge glass total length shall be no longer than 1090 mm (43 in).

8.2.2.10

When gauge glass excess flow check valves are selected, they shall be of offset type.

8.2.2.11

When gauge glass excess flow check valves are selected, they shall be of quick-opening type.

8.2.2.12

When gauge glass gauge cocks or excess flow ball check valves are required by the application, they shall conform to ASME BPVC, Section I, A-18.

8.2.2.13

When the gauge glass excess flow check valve is selected, the pressure shall equalize across the ball.

8.2.2.14

When gauge glass excess flow check valves are selected, bonnets shall be bolted.

8.3 Level transmitters

8.3.1 Non-contact radar transmitter

8.3.1.1

Non-contact radar instrumentation shall be supplied with the functionality to produce echo curves.

8.3.1.2

The non-contact radar shall have software to display and interpret echo curves.

8.3.2 Level displacer

8.3.2.1

The level displacer shall be of removable type.

8.3.2.2

Level displacer vented or pressure-equalized floats and displacers shall not be used.

8.3.2.3

External level displacer displays shall have rotatable heads.

8.3.3 RF capacitance/admittance probe

8.3.3.1

The RF capacitance/admittance probe shall be prevented from flexing whatever its orientation is.

8.3.3.2

RF capacitance/admittance probes used on non-metallic or lined vessels shall have a separate conductive path for signal return.

8.3.3.3

Teflon or Kynar® coated RF capacitance/admittance probes shall be used when the process fluid is conductive (> 100 micro mhos).

8.3.4 Tuning fork level instrument

8.3.4.1

The tuning fork level instrument shall have self-diagnostic capability.

8.3.5 Nucleonic level

8.3.5.1

Nucleonic level instrument sources shall have a minimum operating life of 10 years.

8.3.5.2

The nucleonic level instrument source holder shall have collimating plates to restrict radiation to the specific angle required.

8.3.5.3

The nucleonic level instrument source shall have a lockable shutter.

8.3.5.4

Hardware for insertion, removal, shipment and storage of nuclear sources shall be provided.

8.3.5.5

Radiation hazard labels for nucleonic level instruments shall be provided.

9 Other types of instrumentation

9.1 General

9.1.1

General instrumentation shall comply with the design standards in Table 13.

Table 13 — General standards applicable to level instrumentation

Standard number	Topic covered	Corrosion	Erosion	Sand
IEC 61326-1	EMC	A	A	A
IEC 61326-3-1	EMC	A	A	A
IEC 62305 (all parts)	Lightning protection	A	A	A
IEC 62402	Obsolescence management	A	A	A
IEC 62591 / IEC 62734	Wireless	A	A	A
NAMUR NE 43	Transmitter failure signal level	A	A	A
NAMUR NE 107	Field device diagnostics	A	A	A
Key A Applicable N/A Not applicable				

9.1.2

General instrumentation supplied in accordance with US standards shall comply with the design standards in Table 14.

Table 14 —US standards applicable to level instrumentation

Standard number	Topic covered	Corrosion	Erosion	Sand
ASME BPVC, Section IX	Welding	A [a]	A [a]	N/A
ASME B1.20.1	Threads	A	A	A
ISA 50.00.01	Analog signals	A	A	A
NEMA 250	National electrical code	A	A	A
NFPA 70	Electrical equipment enclosures	A	A	A
Key A Applicable N/A Not applicable				
[a] Only active if the insertion type option is selected.				

9.1.3

General instrumentation supplied in accordance with non-US standards shall comply with the design codes in Table 15.

Table 15 — Non-US standards applicable to general instrumentation

Standard number	Topic covered	Corrosion	Erosion	Sand
IEC 60079 (all parts)	Explosive atmospheres	A	A	A
IEC 60381-1	Transmitter signal	A	A	A
IEC 60529	Ingress protection	A	A	A
ISO 261	Threads	A	A	A
ISO 15614 (all parts)	Welding	A [a]	A [a]	N/A
Key A Applicable N/A Not applicable				
[a] Only active if the insertion type option is selected.				

9.2 Corrosion and erosion type

9.2.1

Insertion probe erosion sensors shall provide real-time erosion data.

9.2.2

Insertion probe erosion sensors shall be retractable.

9.2.3

Ultrasonic detectors shall be of clamp-on type.

9.2.4

Ultrasonic detectors shall have the accessories to fix to pipework.

9.2.5

Ultrasonic detectors shall be provided with a coupling medium.

9.2.6

The material of ultrasonic detectors and mounting parts shall be minimum 316 stainless steel.

9.3 Sand type

9.3.1

Acoustic detectors shall have accessories to fix to pipework.

9.3.2

The material of acoustic detectors and mounting parts shall be minimum 316 stainless steel.

9.3.3

Acoustic detectors shall be provided with a coupling medium.

Bibliography

The following documents are informatively cited in the text of this document, the PDS (IOGP S-718D) or the IRS (IOGP S-718L).

[1] ASTM E1086, *Standard Test Method for Analysis of Austenitic Stainless Steel by Spark Atomic Emission Spectrometry*

[2] EN 10204, *Metallic products - Types of inspection documents*

[3] IEC 61511, *Functional safety – Safety instrumented systems for the process industry sector*

[4] ISO 3166-1, *Codes for the representation of names of countries and their subdivisions — Part 1: Country code*

[5] ISO 9001, *Quality management systems — Requirements*

[6] ISO 10474, *Steel and steel products — Inspection documents*

[7] ISO/IEC 17000, *Conformity assessment — Vocabulary and general principles*

[8] ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*

[9] ISO/IEC 17050-1, *Conformity assessment — Supplier's declaration of conformity — Part 1: General requirements*

[10] ISO/IEC Directives, Part 2, *Principles and rules for the structure and drafting of ISO and IEC documents*

Registered Office
City Tower
Level 14
40 Basinghall Street
London EC2V 5DE
United Kingdom

T +44 (0)20 3763 9700
reception@iogp.org

Brussels Office
Avenue de Tervuren 188A
B-1150 Brussels
Belgium

T +32 (0)2 790 7762
reception-europe@iogp.org

Houston Office
15377 Memorial Drive
Suite 250
Houston, TX 77079
USA

T +1 (713) 261 0411
reception-americas@iogp.org

www.iogp.org