International Association of Oil & Gas Producers

SPECIFICATION
S-718

November
2021

Specification for Basic Process Measurement Instruments

JIP33
JOINT INDUSTRY PROGRAMME

Revision history

VERSION	DATE	PURPOSE
0.3	November 2021	Issued for Public Review

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 this 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.

This specification follows a common document structure comprising the four documents as shown below, which together with the purchase order define the overall technical specification for procurement.

JIP33 Specification for Procurement Documents
Technical Specification

This specification is to be applied in conjunction with the supporting procurement data sheet, information requirements specification (IRS) and quality requirements specification (QRS) as follows.

IOGP S-718: Specification for Basic Process Measurement Instruments

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

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

The procurement data sheet defines application specific requirements, attributes and options specified by the purchaser for the supply of equipment to the technical specification. The procurement data sheet may also include fields for supplier provided information attributes subject to purchaser's technical evaluation. Additional purchaser supplied documents may also be incorporated or referenced in the procurement data sheet 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 the information requirements, including contents, format, timing and purpose to be provided by the supplier. It may also define specific conditions which invoke 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 data sheet or in the purchase order.

The terminology used within this specification and the supporting procurement data sheet, IRS and QRS is in accordance with ISO/IEC Directives, Part 2.

The procurement data sheet and IRS are published as editable documents for the purchaser to specify application specific requirements. The specification and QRS are fixed documents.

The order of precedence (highest authority listed first) of the documents shall be:

a) regulatory requirements;

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

c) purchaser defined requirements (procurement data sheet, IRS, QRS);

d) this specification.

1 Scope

1.1 Technologies

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

— electronic pressure and differential pressure transmitters (both with manifold and diaphragm seal options);

— electronic temperature transmitters;

— RTD, thermocouple and thermowell temperature elements;

— concentric sharp edge, conic, quadrant edge and eccentric orifice head flow meter elements and quick change assembly;

— venturi flow elements;

— ultrasonic flow, magnetic flow and vortex volumetric flow meter elements;

— coriolis mass flow meter elements;

— magnetic level transmitters;

— wet leg and diaphragm hydrostatic level transmitters;

— guided wave radar level transmitters;

— non-contact radar level transmitters.

1.2 Boundaries

This specification covers instrumentation for the following applications:

— upstream production facilities excluding wellhead, drilling and subsea instrumentation;

— midstream transportation and storage (excluding pipelines to ASME B31.8);

— downstream refining and distribution.

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:

— wireless technology;

— internet of things (IoT);

— signal conditioners.

The following technologies are excluded from this specification:

— electronic remote pressure seals (for level measurement);

— multi-variable pressure transmitters;

— thermowells in vessels;

— skin-type thermocouples;

— magnetic temperature sensors;

— orifice flange, integral orifice run, flow nozzle, v-cone and multi-hole orifice head flow meter elements;

— turbine volumetric flow meter elements;

— gauge glass level indicators;

— hydrostatic bubbler level transmitters;

— displacer, nucleonic level, density profiler and ultrasonic level transmitters.

2 Normative references

The following publications are referred to in this document, the procurement data sheet (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.

API Recommended Practice 551, *Process Measurement*

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 B40.200, *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-16, *Measurement of Liquid Flow in Closed Conduits With Electromagnetic Flowmeters*

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

ASME PTC 19.3 TW, *Thermowells*

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*

BS 476-7, *Fire tests on building materials and structures Part 7.Method of test to determine the classification of the surface spread of flame of products*

IEC 60079 (all parts), *Explosive atmospheres*

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

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 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 61508, *Functional safety of electrical/electronic/programmable electronic safety-related systems*

IEC 61515, *Mineral insulated metal-sheathed thermocouple cables and thermocouples*

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 – Part 1: General principles*

IEC 62402 , *Obsolescence management*

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

IOGP S-715, *Supplementary Specification to NORSOK M-501 Coating and Painting for Offshore, Marine, Coastal and Subsea Environments*

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

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

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

ISO 10790, *ASTM E235/E235M — Standard Specification for Type K and Type N Mineral-Insulated, Metal-Sheathed Thermocouples for Nuclear or for Other High-Reliability Applications*

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 12944-5, *Paints and varnishes — Corrosion protection of steel structures by protective paint systems — Part 5: Protective paint systems*

ISO 12944-6, *Paints and varnishes — Corrosion protection of steel structures by protective paint systems — Part 6: Laboratory performance test methods*

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*

ISO 15614, *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 21457, *Petroleum, petrochemical and natural gas industries — Materials selection and corrosion control for oil and gas production systems*

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*

MSS SP-99, *Instrument Valves*

NACE MR0175/ISO 15156 (all parts), *Petroleum and natural gas industries — Materials for use in H2S-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*

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

NFPA 70, *National Electrical Code*

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

3 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
capillary
tube used to provide high integrity connection between the diaphragm seal (process connection) and the sensing element (transmitter)

3.2
diaphragm seal
chemical seal
remote seal
flexible material located at the process connection 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

3.3
impulse line
instrument tubing connection provided between the process isolation valve and the measuring element

4 Common requirements

4.1 System design

4.1.1 Design codes

Basic process measurement instrumentation shall comply with the following standards:

— IEC 62828 (all parts);

— IOGP S-563;

— ISO 21457;

— ISO 23936-1;

— ISO 23936-2.

4.1.2 Configuration

4.1.2.1

Transmitters shall permit re-ranging without requiring re-calibration.

4.1.2.2

Instrumentation shall be preconfigured with the following data:

— tag number;

— failure mode;

— operating range;

— units of measure.

4.1.2.3

Instrumentation configuration shall be via the specified communication protocol.

4.1.2.4

The communication protocol shall be backward compatible.

4.1.2.5

Instrumentation shall be supplied as single assemblies.

4.1.3 Electronics

4.1.3.1

Transmitters shall have an integral local display.

4.1.3.2

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

4.1.3.3

Transmitter housings shall rotate and have the facility to be locked in position at any point about that rotation.

4.1.3.4

Transmitter displays shall have manual rotation adjustment.

4.1.3.5

Transmitter displays shall be provided with independent adjustments for span and zero.

4.1.3.6

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

4.1.3.7

Instrumentation shall maintain configuration settings on loss of power.

4.1.3.8

Instrumentation with external power supplies shall have the facility to be electrically isolated.

4.1.3.9

Transmitters shall have an ungrounded shield terminal.

4.1.3.10

Screw terminals shall be provided for wire connections.

4.1.3.11

Electrical connections shall be reverse polarity protected.

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

Device type manager and device description files shall be obtained directly from the original equipment manufacturer.

4.1.5.2

Device type manager and device description files shall be digitally signed by the original equipment manufacturer.

4.1.5.3

Device type manager and device description files shall be verified with the original equipment manufacturer.

4.1.5.4

Instrumentation shall be protected against inadvertent changes to the configuration and parameters.

4.1.6 Ingress protection

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

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 stainless steel.

4.3.1.1.2

316 stainless steel shall not be used in chloride-containing process fluids.

4.3.1.1.3

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

4.3.1.1.4

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

4.3.1.1.5

For hydrogen services, the diaphragm shall be designed to resist hydrogen embrittlement.

4.3.1.1.6

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

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

Exposed and non-exposed bolting shall comply with NACE MR0175/ISO 15156 or NACE MR0103/ISO 17945 when the instrument is designated in sour service.

4.3.1.2.3

Cadmium-plated bolting shall not be used.

4.3.1.3 Housing materials

4.3.1.3.1

Housing material for use in offshore applications 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 for explosive decompression shall be in accordance with ISO 23936.

4.3.1.4.2

Nitrile rubber o-rings shall not be used in hydrocarbon applications.

4.3.2 Painting and coating

4.3.2.1

Instrumentation installed in coastal, marine or offshore environments shall have a coating system applied in accordance with IOGP S-715.

4.3.2.2

The coating system applied to instrumentation installed in onshore or non-marine environments shall be selected in accordance with ISO 12944-5.

4.3.2.3

Onshore and non-marine environment coating systems shall be qualified in accordance with ISO 12944-6.

4.3.3 Tag and name plates

4.3.3.1

Tag and name plate information shall be stamped or engraved.

4.3.3.2

Tag and name plate font size shall be at least 3 mm ($^{1}/_{8}$ in).

4.3.3.3

Tag and name plates shall be 316 stainless steel.

4.3.3.4

Name plates shall include the following information:

— manufacturer's name;

— model, type and serial number;

— operating voltage;

— hazardous area certification details;

— date of manufacture;

— beta ratio – venturi flow meter only;

— internal diameter of pipe – venturi flow meter only;

— material of construction – venturi flow meter only;

— flow direction – venturi flow meter only.

4.3.3.5

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

4.3.3.6

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

4.3.4 Cable entry

4.3.4.1

Unused electrical ports shall be fitted with plugs certified to the specified hazardous area classification.

4.3.4.2

Terminals within the head shall be clearly marked "+", "−", "earth" or "ground", as appropriate.

4.4 Inspection and shop tests

4.4.1 Pressure testing

4.4.1.1

Pressure-containing parts shall be hydrostatically tested in accordance with the material specification.

4.4.1.2

The complete instrument assembly shall be hydrostatically pressure tested at a pressure of 1.5 times the 38 °C (100 °F) rating rounded off to the next higher 1 bar (25 psi) increment.

4.4.1.3

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

4.4.2 Nondestructive examination

4.4.2.1

Nondestructive examination of pressure-containing parts or of parts in contact with the process fluid shall be in accordance with IOGP S-563.

4.4.2.2

Nondestructive examination of non-pressure-containing parts or of parts not in contact with the process fluid shall be in accordance with the material standard specification.

4.5 Preparation for shipment

4.5.1

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

4.5.2

Threaded openings shall have temporary plugs.

4.5.3

Temporary plugs shall be distinguishable from permanent plugs.

4.5.4

Flange faces shall be protected.

4.5.5

Flange openings shall be sealed.

4.5.6

The design of the 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 following standards:

— ASME B16.5;

— ASME PTC 19.2;

— IEC 60381-1;

— IEC 61326-1;

— IEC 61326-3-1;

— IEC 61508;

— IEC 61518;

— IEC 62305 (all parts);

— IEC 62402;

— IOGP S-715;

— ISA 50.00.01;

— ISO 12944-5;

— ISO 12944-6;

— MSS SP-99;

— NAMUR NE 43;

— NAMUR NE 107.

5.1.2

Pressure instrumentation supplied in accordance with US standards shall comply with the following standards:

— ASME *BPVC*, Section IX;

— ASME B1.20.1;

— NEMA 250;

— NFPA 70;

— UL 94.

5.1.3

Pressure instrumentation supplied in accordance with non-US standards shall comply with the following standards:

— BS 476-7;

— IEC 60079 (all parts);

— IEC 60529;

— ISO 15614 (all parts);

— ISO 261.

5.1.4

Pressure and differential pressure transmitter response time shall be less than 1 s.

5.1.5

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

5.2 Instrument protection

5.2.1

Diaphragm seal assembly capillary material shall be 316 stainless steel.

5.2.2

Diaphragm seal assembly capillaries shall have flexible armoured tubing.

5.2.3

Diaphragm seal assembly capillaries shall be coated with PVC or polyethylene.

5.2.4

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

5.2.5

Diaphragm seal material shall be minimum 316 stainless steel.

5.2.6

Diaphragm seal capillary fill fluid shall not be pyrophoric.

5.2.7

Diaphragm seals shall be permanently marked with the seal fluid used and the specific gravity of the seal fluid.

5.3 Instrument process manifolds

5.3.1

Manifold valve bonnets shall have a locking pin.

5.3.2

Manifold valve process connections shall be flanged type for direct mounted installation.

5.3.3

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

5.3.4

Manifold valves shall be fabricated from bar stock material.

5.3.5

Manifold valves shall be directly mounted on the transmitter.

5.3.6

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

5.3.7

The needle valve packing in manifold valves shall be PTFE for design temperatures less than or equal to 232 °C (450 °F).

5.3.8

The needle valve packing in manifold valves shall be graphite-based packing for temperatures greater than 232 °C (450°F).

6 Temperature instrumentation

6.1 General

6.1.1

Temperature instrumentation shall comply with the following standards:

— ASME B16.5;

— ASME B40.200;

— ASME PTC 19.3TW;

— ASTM B912;

— ASTM E230/E230M;

— ASTM E235/E235M;

— ASTM E608/E608M;

— ASTM E1137/E1137M;

— IEC 60381-1;

— IEC 60584-1;

— IEC 60584-3;

— IEC 60751;

— IEC 61326-1;

— IEC 61326-3-1;

— IEC 61508;

— IEC 61515;

— IEC 62305 (all parts);

— IEC 62402;

— IOGP S-715;

— ISA 50.00.01;

— ISO 10790;

— ISO 12944-5;

— ISO 12944-6;

— NAMUR NE 43;

— NAMUR NE 107.

6.1.2

Temperature instrumentation supplied in accordance with US standards shall comply with the following standards:

— ASME B1.20.1;

— NEMA 250;

— NFPA 70.

6.1.3

Temperature instrumentation supplied in accordance with non-US standards shall comply with the following standards:

— IEC 60079 (all parts);

— IEC 60529;

— ISO 261.

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 ±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 transmitter and the head shall be permanently connected by a stainless steel chain.

6.1.9

Temperature transmitter assemblies shall have duplex elements.

6.2 Thermocouples

Thermocouples shall be supplied ungrounded.

6.3 Resistance temperature devices

6.3.1

RTD transition pieces shall be hermetically sealed.

6.3.2

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

7 Flow instrumentation

7.1 General

7.1.1

Flow instrumentation shall comply with the design standards in Table 1.

Table 1 — General standards applicable to flow instrumentation

Standard number	Venturi	Coriolis	Magnetic	Ultrasonic	Vortex	Orifice
ASME B16.5	X	X	X	X	X	
ASME B31.3	X					
ASME MFC-3M	X					X
ASME MFC-5.1				X		
ASME MFC-5.3				X		
ASME MFC-6M					X	
ASME MFC-11		X				
ASME MFC-16			X			
IEC 60381-1	X	X	X	X	X	
IEC 61326-1	X	X	X	X	X	
IEC 61326-3-1	X	X	X	X	X	
IEC 61508	X	X	X	X	X	
IEC 62305 (all parts)	X	X	X	X	X	
IEC 62402	X	X	X	X	X	
IOGP S-705	X	X	X	X	X	
IOGP S-715	X	X	X	X	X	
ISA 50.00.01	X	X	X	X	X	
ISO 5167-1	X					X
ISO 5167-2						X
ISO 5167-4	X					
ISO 12764					X	
ISO 12944-5	X	X	X	X	X	
ISO 12944-6	X	X	X	X	X	
ISO/TR 15377						X
ISO 17089-2				X		
ISO 20456			X			
NAMUR NE 43	X	X	X	X	X	
NAMUR NE 107	X	X	X	X	X	

7.1.2

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

Table 2 — US standards applicable to flow instrumentation

Topic	Standard number	Venturi	Coriolis	Magnetic	Ultrasonic	Vortex
Welding (offline)	ASME *BPVC,* Section IX	X				
Threads	ASME B1.20.1	X	X	X	X	X
Integrity	NEMA 250	X	X	X	X	X
Hazardous area	NFPA 70	X	X	X	X	X
NOTE Standards and topics not relevant to orifice plates.						

7.1.3

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

Table 3 — Non-US standards applicable to flow instrumentation

Topic	Standard number	Venturi	Coriolis	Magnetic	Ultrasonic	Vortex
Hazardous area	IEC 60079 (all parts)	X	X	X	X	X
Integrity	IEC 60529	X	X	X	X	X
Threads	ISO 261	X	X	X	X	X
Welding (offline)	ISO 15614 (all applicable parts)	X				
NOTE Standards and topics not relevant to orifice plates.						

7.1.4

Flow elements shall be marked with the flow direction.

7.1.5

The accuracy of flow instrumentation shall comply with Table 4.

Table 4 — Flow instrumentation accuracy

Technology	Accuracy
DP flow	3 % of span
Ultrasonic	± 1 % of full scale flow
Coriolis	± 1 % of full scale flow
Electromagnetic	± 1 % of full scale flow
Vortex	± 1 % of full scale for liquid flow ± 2 % of full scale for gas flow

7.2 Head meters, orifice

7.2.1

Orifice plate metering shall be minimum 50 mm (2 in) in size.

7.2.2

Orifice plate material shall be minimum 316 stainless steel.

7.2.3

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;

— manufacturer's name.

7.2.4

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

7.2.5

The orifice plate differential pressure range for sizing shall be between 0 to 250 mbar (100 in H_2O).

7.2.6

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

7.3 Volumetric meters

7.3.1 Ultrasonic flow meters

7.3.1.1

Ultrasonic flow meters with insertion probes shall have a probe retraction mechanism.

7.3.1.2

A clamp-on ultrasonic instrument couplant pad or couplant lubricant shall be selected dependent on process pipe temperature.

7.3.2 Magnetic flow meters

7.3.2.1

Magnetic flow meter liners shall not deteriorate or be eroded by process flow conditions.

7.3.2.2

When the pipe is empty of liquid, the magnetic flow meter shall signal an alarm.

7.3.2.3

Magnetic flow meter tubes, electrodes and grounding rings shall be minimum 316 stainless steel.

7.3.3 Vortex flow meters

The vortex flow meter minimum design flow shall be greater than 10 % of the meter's inherent low flow cut-off.

7.4 Coriolis mass flow meters

Coriolis flow meters shall have fully rated secondary containment.

8 Level instrumentation

8.1 General

8.1.1

Level instrumentation shall comply with the design standards in Table 5.

Table 5 — General standards applicable to level instrumentation

Standard number	Gauge	Hydrostatic	Guided wave radar	Non-contact radar
ASME B16.5	X	X	X	X
ASME B31.3	X			
ASME PTC 19.2		X		
IEC 60381-1	X	X	X	X
IEC 61326-1	X	X	X	X
IEC 61326-3-1	X	X	X	X
IEC 61508		X	X	X
IEC 61518		X		
IEC 62305 (all parts)	X	X	X	X
IEC 62402	X	X	X	X
IOGP S-705	X		X	X
IOGP S-715	X	X	X	X
ISA 50.00.01	X	X	X	X
ISO 12944-5	X	X	X	X
ISO 12944-6	X	X	X	X
NAMUR NE 43	X	X	X	X
NAMUR NE 107	X	X	X	X

8.1.2

Level instrumentation supplied in accordance with US standards shall comply with the design standards in Table 6.

Table 6 — US standards applicable to level instrumentation

Topic	Standard number	Gauge	Hydrostatic	Guided wave radar	Non-contact radar
Welding (offline)	ASME *BPVC,* Section IX	X	X	X	X
Threads	ASME B1.20.1	X	X	X	X
Hazardous area	NFPA 70	X	X	X	X
Integrity	NEMA 250	X	X	X	X
Fire retardant	UL 94		X		

8.1.3

Level instrumentation supplied in accordance with non-US standards shall comply with the design codes in Table 7.

Table 7 — Non-US standards applicable to level instrumentation

Topic	Standard number	Gauge	Hydrostatic	Guided wave radar	Non-contact radar
Fire retardant	BS 476-7		X		
Hazardous area	IEC 60079 (all parts)	X	X	X	X
Integrity	IEC 60529	X	X	X	X
Threads	ISO 261	X	X	X	X
Welding (offline)	ISO 15614 (all applicable parts)	X	X	X	X

8.1.4

The accuracy of level instrumentation shall comply with Table 4.

Table 8 — Level instrumentation accuracy

Technology	Accuracy
DP	± 0,1 % of specified span
Radar non-contact	± 3 mm (0,12 in) with an overall operating accuracy within ± 5 mm (0,2 in)
Radar GWR	± 5 mm (± 0,2 in)

8.1.5

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

8.2 Magnetic level gauges

8.2.1

Magnetic level gauges shall use flag-type indicators.

8.2.2

Magnetic level gauges shall have a hermetically-sealed 316 stainless steel indicator housing the flags.

8.2.3

Magnetic level gauge flags shall be replaceable without the need to isolate the gauge.

8.2.4

Individual magnetic level gauge indicator segments shall be interlocked to prevent colour change due to external forces.

8.2.5

Magnetic level gauge internals shall be removable through the bottom flange.

8.2.6

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

8.2.7

The magnetic level gauge float and chamber design shall ensure that the float movement is not affected by process conditions.

8.2.8

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

8.2.9

The magnetic level gauge scale element shall be integrally illuminated.

8.3 Guided wave radar transmitter

Guided wave radar flexible cable for the sensor probe shall be used for applications exceeding 1 830 mm (6 ft) in length.

8.4 Non-contact radar transmitter

8.4.1

Non-contact radar echo curves shall be provided.

8.4.2

Software used to display or interpret the non-contact radar echo curves shall be provided.

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