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ADDENDUM 2

Addendum 2 includes requirements related to flow instruments. The following table shows the location of the modifications.

Section	Update
Clause 7	New rows added to Table 9
Clause 7	New rows added to Table 10
Clause 7	New rows added to Table 11
Clause 7	Table 11 deleted and Table 11 requirements moved to new subclauses in Clause 7
Subclause 7.1	Subclause 7.1.5 deleted
Subclause 7.2	Title added to subclause 7.2 heading
Subclause 7.2	Title added to subclause 7.2.1 heading
Subclause 7.2	Original subclauses 7.2.1 to 7.2.4 renumbered 7.2.1.1 to 7.2.2.4
Subclause 7.2	New subclause 7.2.2 added
Subclause 7.3	Subclause 7.3.1 modified
Subclause 7.3	Subclause 7.3.2 modified
Subclause 7.3	Original subclause 7.3.2 renumbered 7.3.2.1
Subclause 7.3	New subclause 7.3.2.2 added
Subclause 7.3	Subclause 7.3.3 modified
Subclause 7.3	Original subclause 7.3.3 renumbered 7.3.3.1
Subclause 7.3	New subclause 7.3.3.2 added
Subclause 7.3	New subclause 7.3.4 added
Clause 7	New subclause 7.4 added

International Association of Oil & Gas Producers

SPECIFICATION

IOGP S-718J

May 2023

Version 1.002

ADDENDUM 2 TO FIRST EDITION (SEPTEMBER 2022)

Specification for Basic Process Measurement Instruments

NOTE This version (S-718J) of the specification document provides the justification statements for each technical requirement, but is otherwise identical in content to S-718.

JIP33 JOINT INDUSTRY PROGRAMME

Revision history

VERSION	DATE	PURPOSE
1.002	May 2023	Addendum 2 for Public Review
1.001	April 2023	Addendum 1 for Public Review
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).

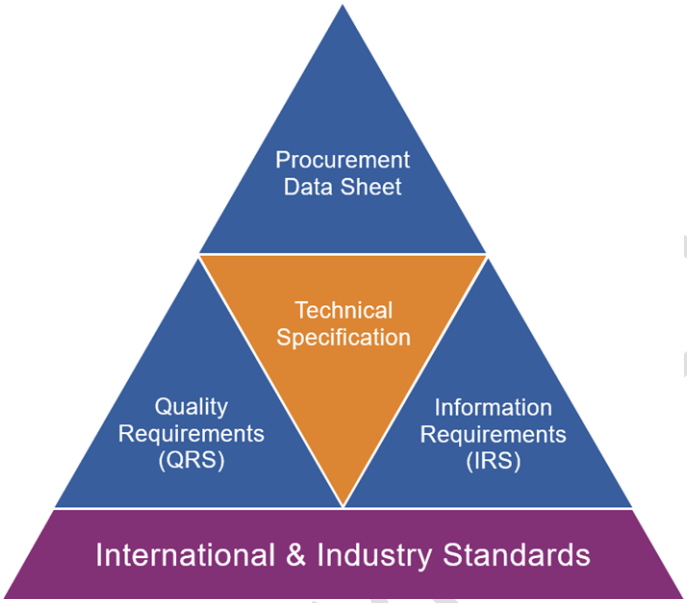
Table of Contents

List of Tables

Introduction

The purpose of 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;

e) selected instrument-specific normative standards.

1 Scope

MODIFIED 1.1 Technologies

This specification defines the minimum 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.

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, flange and bubbler hydrostatic level transmitters;
- displacer level;
- ultrasonic level;
- RF capacitance/admittance;
- guided wave radar level transmitters;
- non-contact radar level transmitters;
- tuning fork;
- nucleonic level.

e) General type:

— corrosion erosion and sand monitor.

Justification

The scope of supply has been decided based on the agreed framing proposal from the operating companies.

MODIFIED 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.

Justification

The operating companies have agreed the scope for the boundary conditions mostly commonly encountered for the instrumentation.

MODIFIED 1.3 Exclusions

The following general requirements are excluded from this specification:

— IoT;

— signal conditioners.

The following technologies are excluded from this specification:

— thermowells in reactors;

— skin-type thermocouples;

— magnetic temperature sensors;

— orifice flange;

— density profiler.

Justification

There is a vast range of instrumentation that could have been covered within the specification and the above are included, for the avoidance of doubt, where there could be some element of misunderstanding.

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.

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*

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

BS 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 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 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 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*

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 9300, *Measurement of gas flow by means of critical flow nozzles*

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 15609, *Specification and qualification of welding procedures for metallic materials — Welding procedure specification*

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

3.1.1
calibrated range
region within which an instrument/device has been bench calibrated to check the actual device output reading against known standards

3.1.2
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

3.1.3
diaphragm seal
chemical seal
remote seal
flexible material used for pressure measurements when the process material is required to be kept away from the pressurised 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.

3.1.4
impulse line
instrument tubing connection provided between the process isolation valve and the measuring element

3.1.5
instrument range
region in which the instrument/device can reliably measure within the supplier stated performance limits

3.1.6
name plate
plate, permanently affixed to the instrument, stating identification information

3.1.7
pressure retaining bolting
bolting whose failure to function as intended results in a release of contained fluid into the environment

3.1.8
tag plate
identifier plate, normally attached by wire to the instrument, stating the tag number

3.2 Abbreviated terms

IoT internet of things

MDS material data sheet

NDE non-destructive examination

PMI positive material identification

PTFE polytetrafluoroethylene

RTD resistance temperature device

UV ultraviolet

4 Common requirements

4.1 System design

4.1.1 General design codes

Basic process measurement instrumentation shall comply with the following general design codes listed in Table 1.

Table 1 — General design codes

Standard number	Scope covered
IEC 62828 (all parts)	Performance
ISO 21457	Materials

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 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 between the process fluid and electrical components, 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

Device type manager 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

Device type manager 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.

4.2 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.

4.3.1.2 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 comply with NACE MR0175/ISO 15156 or NACE MR0103/ISO 17945.

4.3.1.2.3

Cadmium-plated bolting shall not be used.

4.3.1.3 Housing materials

4.3.1.3.1

Housing material for marine/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 to mitigate against rapid gas decompression shall be in accordance with ISO 23936-1, ISO 23936-2 or NORSOK M-710.

4.3.1.4.2

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

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

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.

4.4 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

The design of 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

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 2.

Table 2 — General standards applicable to pressure instrumentation

Standard number	Scope covered
ASME PTC 19.2	Performance test codes
IEC 60381-1	Transmitter signal
IEC 61326-1	EMC
IEC 61326-3-1	EMC
IEC 61508 (all parts)	SIL
IEC 61518	Mating dimensions
IEC 62305 (all parts)	Lightning protection
IEC 62402	Obsolescence management
ISA 50.00.01	Analog signals
MSS SP-99	Instrument valves
NAMUR NE 43	Transmitter failure signal level
NAMUR NE 107	Field device diagnostics

5.1.2

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

Table 3 — US standards applicable to pressure instrumentation

Standard number	Scope covered
ASME *BPVC,* Section IX	Welding
ASME B1.20.1	Threads
ISA 50.00.01	Analog signals
NEMA 250	Electrical equipment enclosures
NFPA 70	National electrical code
UL 94	Plastic flammability tests

5.1.3

Pressure instrumentation supplied in accordance with non-US standards shall comply with the standards in Table 4.

Table 4 — Non-US standards applicable to pressure instrumentation

Standard number	Scope covered
IEC 60695-11-10	Fire tests
IEC 60695-11-20	Fire tests
IEC 60079 (all parts)	Explosive atmospheres
IEC 60381-1	Transmitter signal
IEC 60529	Ingress protection
ISO 261	Threads
ISO 15614 (all parts)	Welding

5.1.4

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

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

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 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

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

5.3.8

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

6 Temperature instrumentation

6.1 General

6.1.1

Temperature instrumentation shall comply with the standards in Table 5.

6.1.2

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

6.1.3

Temperature instrumentation supplied in accordance with non-US standards shall comply with the standards in Table 7.

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.

Table 5 — General standards applicable to temperature instrumentation

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

Table 6 — US standards applicable to temperature instrumentation

Standard number	Scope covered
ASME B1.20.1	Threads
ISA 50.00.01	Analog signals
NEMA 250	Electrical equipment enclosures
NFPA 70	National electrical code

Table 7 — Non-US standards applicable to temperature instrumentation

Standard number	Scope covered
IEC 60079 (all parts)	Explosive atmospheres
IEC 60381-1	Transmitter signals
IEC 60529	Ingress protection
ISO 261	Threads

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 duplex type.

6.1.10

The thermowell body shall not have welds i.e. single piece.

6.2 Resistance temperature devices (RTD)

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.

7 Flow instrumentation

7.1 General

7.1.1

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

7.1.2

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

7.1.3

Flow instrumentation supplied in accordance with non-US standards shall comply with the design standards in Table 10.

7.1.4

Flow elements shall be marked with the flow direction.

~~DELETED 7.1.5~~

~~For cones manufactured from sheet metal, the thickness of the sheet shall be adjusted to avoid the natural frequency.~~

Justification This requirement is now redundant as the details from Table 11 requirements are moved to new subclauses in Clause 7.

7.1.6

Flow meters shall be wet-calibrated.

Justification

This ensures the standardisation and the accuracy of calibration.

Table 8 — General standards applicable to flow instrumentation

Standard number	Scope 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	A	A	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
IOGP S-705	Welding	N/A	A	A	A	A	A	A	A	A	A	A	A	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

Justification *This table is a list of general flow codes to be complied with.*

Table 9 — US standards applicable to flow instrumentation

Standard number	Scope 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	Cone meter	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
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 nozzles	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/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

Justification *This table is a list of general flow codes to be complied with.*

Table 10 — Non-US standards applicable to flow instrumentation

Standard number	Scope 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 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	Orifice	A	A	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 and Venturi	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 9300	Flow nozzles	N/A	N/A	A	N/A	N/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 and Venturi	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 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	A	N/A	A	A	A	A	A	A

Key
A Applicable
N/A Not applicable

Justification *This table is a list of general flow codes to be complied with.*

DELETED Table 11 — General standards applicable to temperature instrumentation

~~Technology~~	~~Accuracy~~
~~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~~

Justification *This table has been deleted. The details from Table 11 requirements are moved to new subclauses in Clause 7.*

MODIFIED 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.

NEW 7.2.2 Cone meter

NEW 7.2.2.1

Cones greater than or equal to 80 mm (3 in) shall have additional supports.

Justification

This ensures the minimization of the flow induced vibrations and oscillation of the cone. This eliminates the vibrations transmission to the meter from the operating equipment.

NEW 7.2.2.2

The structural integrity of the cone and supports shall not be reduced during operational conditions.

Justification

This ensures that the offered instrument can meet the service conditions without failure.

NEW 7.2.2.3

For cones manufactured from sheet metal, the thickness of the sheet shall be adjusted to avoid the natural frequency.

Justification

This prevents premature damage if the sheet is allowed to vibrate at its natural frequency.

NEW 7.2.2.4

The shape of sheet metal cones shall allow for additional supports.

Justification

This ensures options to increase rigidity or shift the natural frequency if needed.

NEW 7.2.2.5

Cone meters shall be tested in accordance with API MPMS 22.2.

Justification

This ensures standardisation on testing.

NEW 7.2.2.6

The qualification testing and performance assessment of cone meters shall be performed for all applications.

Justification

This ensures that qualification and performance testing is performed despite the lack of dedicated design code.

NEW 7.2.2.7

Qualification testing and performance assessment of cone meters shall be performed by a nationally certified flow lab.

Justification

This ensures the high quality of testing.

NEW 7.2.2.8

Qualification testing and performance assessment of cone meters shall be performed under specified flow conditions.

Justification

This ensures that all expected parameters are tested.

NEW 7.2.2.9

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

Justification

This ensures concentricity of the cone in relation to the internal walls of the instrument.

NEW 7.2.2.10

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.

Justification

This allows for performing the identical measurement to verify baseline clearances or determine whether clearances are unchanged when measured later.

NEW 7.2.2.11

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

Justification

This ensures the adequate validation of the cone alignment.

NEW 7.2.2.12

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

Justification

This ensures the quality of welds exposed to the process fluid.

NEW 7.2.2.13

The wall surface roughness of pipe sections of cone meters shall be measured at eight locations.

Justification

This provides a baseline for when the item is first purchased and allows assessment of wear.

NEW 7.2.2.14

The measured clearances of cone meters shall be within 1 % of the baseline.

Justification

This provides a maximum level of wear on the instrument.

NEW 7.2.3 Wedge flow meters

NEW 7.2.3.1

Wedge meters shall be flow calibrated.

Justification

This ensures calibration is provided for the flow as there are no specific codes for the design.

NEW 7.2.3.2

The wedge meters material shall be minimum 316 stainless steel.

Justification

316 stainless steel is considered to be the minimum austenitic stainless steel grade for this application by most operators. 316 SS offers better corrosion resistance than 304 SS. The use of 304 SS is also discouraged by API Recommended Practice 551.

NEW 7.2.4 Average pitot tube

NEW 7.2.4.1

Average pitot tubes shall be retractable in operation.

Justification

This allows maintenance on the device without interrupting its operation.

NEW 7.2.4.2

The process stream shall be isolated on retraction of the average pitot tube assembly.

Justification

This supports the maintenance activity by not requiring the line to be isolated.

NEW 7.2.4.3

The blowout prevention (i.e. retention chain) of average pitot tubes shall be provided for removable elements.

Justification

This ensures that the design is inherently safe and does not just rely on operator diligence.

NEW 7.2.4.4

Transmitters shall be mounted directly to the average pitot tube.

Justification

This minimises the number of connections and potential leak points. It also allows for faster response time to any changes in pressure.

NEW 7.2.4.5

Transmitters shall be mounted with a close coupled manifold arrangement.

Justification

This minimises the number of connections and potential leak points. It also allows for faster response time to any changes in pressure.

NEW 7.2.4.6

The average pitot tube instruments shall allow for zeroing and removal of the transmitter without interrupting the process.

Justification

This ensures minimal impact to the process and reduces maintenance work.

NEW 7.2.5 Variable area (VA) meters

NEW 7.2.5.1

Direct reading glass type variable area meters shall be used with air and uncontaminated water at pressures lesser than or equal to 689 kPa (100 psig).

Justification

This prevents basic safety and environment issues related to the use of glass types.

NEW 7.2.5.2

Metal tube variable area meters shall be used in hydrocarbon service.

Justification

This prevents the direct reading glass type meters from being used in hydrocarbon service.

NEW 7.2.5.3

Glass tube variable area meters shall be rated for twice the maximum working pressure in the process.

Justification

This ensures a minimum factor of safety for the glass type.

NEW 7.2.5.4

Variable area meters shall have self-cleaning floats.

Justification

This ensures minimal maintenance and accuracy of reading.

NEW 7.2.5.5

Variable area meters shall have inlet and outlet float stops.

Justification

This ensures that the float remains within the body of the instrument.

NEW 7.2.5.6

Variable area meters accuracy shall be within ± 10 % of full scale flow.

Justification

This ensures the accuracy of the equipment.

NEW 7.2.5.7

The repeatability of variable area meters shall be within ± 0,5 % tolerance.

Justification

This ensures a baseline tolerance level.

NEW 7.2.5.8

The normal flow rate of the variable area flow meter shall be within the middle third of the scale range.

Justification

This ensures good resolution when reading the measurement.

NEW 7.2.5.9

Variable area meters shall not have straight length piping limitations upstream or downstream.

Justification

This ensures the use of the instrument type with minimum impact on the piping design.

NEW 7.2.5.10

Variable area flow meters scales shall be in percentage.

Justification

This ensures alignment with other codes and standards.

NEW 7.2.5.11

The meter factor for maximum flow at 100 % shall be engraved on the variable area flow meter scale.

Justification

This ensures standardisation of the approach. The capacity data is typically supplied in table format with full scale flow Cr defined. Qv = Cr (%scale/100). A volume correction for fluid and float densities that differ from the calculation can be made. From an operations perspective it is preferred to have a procedure that states to set the flow rate to XX % on the VA meter rather than states a flow in units where the actual flow does not match the scale reading. This can potentially lead to confusion later about what the rate should be (e.g. someone not realizing the flow rate has already been compensated may apply another adjustment for the fluid).

7.3 Volumetric meters

MODIFIED 7.3.1 Ultrasonic flow instrument

Ultrasonic flow meters accuracy shall not exceed ± 1 % of full scale flow.

Justification

This provides the minimum accuracy level.

MODIFIED 7.3.2 Electromagnetic flow meter

7.3.2.1

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

NEW 7.3.2.2

Electromagnetic flow meters accuracy shall not exceed ± 1 % of full scale flow.

Justification

This ensures the minimum accuracy level.

MODIFIED 7.3.3 Vortex flow meter

7.3.3.1

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

NEW 7.3.3.2

Vortex flow meters accuracy for liquid flow shall not exceed ± 1 % of full scale flow.

Justification

This ensures the minimum accuracy level for the liquid flow.

NEW 7.3.3.3

Vortex flow meters accuracy for gas flow shall not exceed ± 2 % of full scale.

Justification

This ensures the minimum accuracy level for gas flow.

NEW 7.3.4 Turbine flow meters

NEW 7.3.4.1

Insertion-type turbine flow meters shall not be used.

Justification

This ensures standardisation as there is no code supporting the design.

NEW 7.3.4.2

The turbine flow meters material for body housing, rotor hubs, blades and rims shall be minimum 316L stainless steel.

Justification

This provides the minimum material specification to ensure quality design.

NEW 7.3.4.3

The bearing and sleeve material for turbine flow meters shall be tungsten carbide.

Justification

This provides the base minimum material specification to ensure the longevity of the instrument.

NEW 7.3.4.4

Turbine flow meters shall be marked with the direction of flow.

Justification

This ensures that the meter is installed in the correct direction given that the meter could be rotated and installed in the incorrect orientation.

NEW 7.3.4.5

The accuracy of the turbine flow meters shall be within ± 0,5 % of the full scale flow.

Justification

This ensures the minimum accuracy level.

NEW 7.3.4.6

The repeatability of the turbine flow meters shall be within ± 0,05 % tolerance.

Justification

This ensures the minimum accuracy level.

NEW 7.4 Mass flow meters

NEW 7.4.1

Thermal mass flow meter sensors shall be removable without interrupting the process.

Justification

This ensures the availability of the system by allowing maintenance to be performed without production interruption.

NEW 7.4.2

For thermal mass flow meter sensors, the stress analysis shall be performed for each probe under the flow conditions.

Justification

This ensures that the mechanical integrity is maintained.

MODIFIED 7.4.3

The accuracy of the Coriolis flow meters shall not exceed ± 1 % of full scale flow.

Justification

This ensures the minimum accuracy level.

8 Level instrumentation

8.1 General

8.1.1

Level instrumentation shall comply with the design standards in Table 12.

8.1.2

Level instrumentation supplied in accordance with US standards shall comply with the design standards in Table 13.

8.1.3

Level instrumentation supplied in accordance with non-US standards shall comply with the design codes in Table 14.

8.1.4

The accuracy of level instrumentation shall not exceed the values in Table 15.

8.1.5

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

Table 12 — General standards applicable to level instrumentation

Standard number	Scope covered	Magnetic level indicator	Hydrostatic	Guided wave radar	Non-contact radar
ASME B31.3	Process piping	A	N/A	N/A	N/A
ASME PTC 19.2	Performance test codes	N/A	A	N/A	N/A
IEC 61326-1	EMC	A [a]	A	A	A
IEC 61326-3-1	EMC	A [a]	A	A	A
IEC 61508 (all parts)	SIL	N/A	A	A	A
IEC 61518	Mating dimensions	N/A	A [b]	N/A	N/A
IEC 62305 (all parts)	Lightning protection	A [a]	A	A	A
IEC 62402	Obsolescence management	A	A	A	A
IOGP S-705	Welding	A	N/A	A	A
NAMUR NE 43	Transmitter failure signal level	A [a]	A	A	A
NAMUR NE 107	Field device diagnostics	A [a]	A	A	A

Key
A Applicable
N/A Not applicable

[a] Only active if transmitter option is selected.

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

Table 13 — US standards applicable to level instrumentation

Standard number	Scope covered	Magnetic level indicator	Hydrostatic	Guided wave radar	Non-contact radar
ASME *BPVC*, Section IX	Welding	A	A	A	A
ASME B1.20.1	Threads	A	A	A	A
ISA 50.00.01	Analog signals	A [a]	A	A	A
NEMA 250	National electrical code	A [a]	A	A	A
NFPA 70	Electrical equipment enclosures	A [a]	A	A	A
UL 94	Plastic flammability tests	N/A	A	N/A	N/A

Key
A Applicable
N/A Not applicable

[a] Only active if transmitter option is selected.

Table 14 — Non-US standards applicable to level instrumentation

Standard number	Scope covered	Magnetic level indicator	Hydrostatic	Guided wave radar	Non-contact radar
IEC 60695-11-1	Fire tests	N/A	A	N/A	N/A
IEC 60695-11-20	Fire tests	N/A	A	N/A	N/A
IEC 60079 (all parts)	Explosive atmospheres	A [a]	A	A	A
IEC 60381-1	Transmitter signal	A [a]	A	A	A
IEC 60529	Ingress protection	A [a]	A	A	A
ISO 261	Threads	A	A	A	A
ISO 15614 (all applicable parts)	Welding	A	A	A	A
Key A Applicable N/A Not applicable					
[a] Only active if transmitter option is selected.					

Table 15 — 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)
Magnetic level indicator	± 5 mm (± 0,2 in)

8.2 Magnetic level indicators

8.2.1

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

8.2.2

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

8.2.3

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

8.2.4

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

8.2.5

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

8.2.6

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

8.2.7

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

8.3 Non-contact radar transmitter

8.3.1

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

8.3.2

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

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