Date of issue:
March 2026

Affected publication:
IOGP S-729, Specification for Control Valves, First Edition, May 2022

ADDENDUM 1

This addendum (Version 1.01) replaces Edition 1.0 published in May 2022.

NOTE: In addition to the updates listed below, minor editorial/typographical amendments may have been made.

List of updates

Clause/subclause	Description
2	Reference IOGP S-716 amended
5	Subclauses 5.3.1 and 5.3.2 amended
6	Subclause 6.5.2 amended New subclause 6.5.3 Subclause 6.8.1 amended Subclause 6.8.2 * deleted including NOTE Subclause 6.8.3 * renumbered to 6.8.2 and amended New subclause 6.8.3
10	New subclauses 10.1.11 and 10.1.12 New subclause 10.5.5
Table 3	Reference to footnote [e] added to column "Stem", rows ASTM A182 F6A, ASTM A479 UNS S41000, ASTM A276 T410 / ASTM A276 T420, ASTM A564 Gr. 630 UNS S17400 and ASTM A705 Gr. 630 UNS S17400 New footnote [e]
Table 4	Reference to footnote [e] added to column "Stem", rows ASTM A564 Gr. 630 UNS S17400 and ASTM A705 Gr. 630 UNS S17400 New footnote [e]
Table 12	New row "Actuator spring"
11	Subclause 11.2.1 amended Subclauses 11.3.1 and 11.3.2 amended New subclauses 11.3.4 and 11.3.5 New subclause 11.5.4
12	Subclause 12.1.1 amended New subclause 12.4.4 New subclauses 12.5.3 and 12.5.4 Subclause 12.7.2 amended Subclause 12.8 amended New subclauses 12.9 and 12.10 including subclauses 12.10.1 through 12.10.4

List of updates *(continued)*

Clause/subclause	Description
13	Subclause 13.2.1 amended and NOTE deleted New subclause 13.2.5
14	Subclause 14.1.8.2 amended New subclause 14.1.8.3 Subclause 14.1.8.3 * renumbered to 14.1.8.4 Subclauses 14.1.8.4 * renumbered to 14.1.8.5 and amended New subclause 14.1.11
16	Subclause 16.5 amended
* Clause/subclause number from Edition 1.0.	

International Association of Oil & Gas Producers

SPECIFICATION
IOGP S-729
March 2026
Version 1.01
ADDENDUM 1 TO FIRST EDITION (MAY 2022)

Specification for Control Valves

JIP33
JOINT INDUSTRY PROGRAMME

Revision history

VERSION	DATE	PURPOSE
1.01	March 2026	Addendum 1
1.0	May 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).

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).

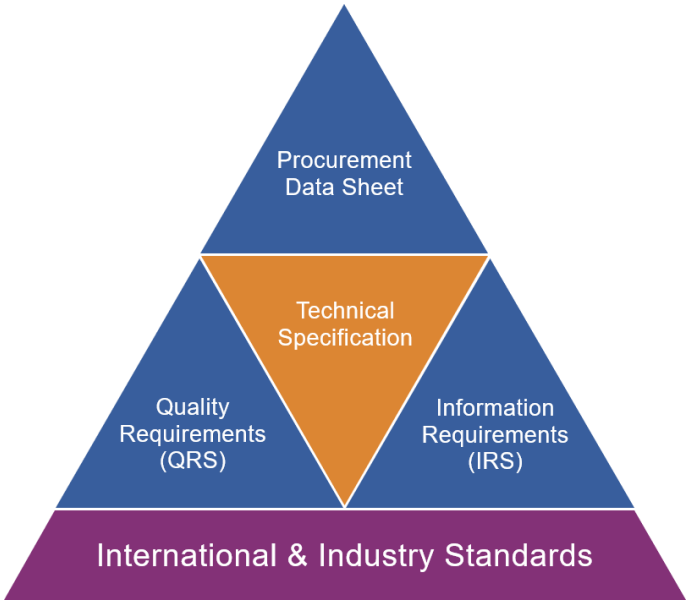
Table of Contents

List of Tables

Introduction

The purpose of this specification is to define a minimum common set of requirements for the procurement of control valves 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-729: Specification for Control Valves

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

IOGP S-729D: Procurement Data Sheet for Control Valves

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-729L: Information Requirements for Control Valves

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-729Q: Quality Requirements for Control Valves

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

This specification defines the requirements for the design, sizing and selection, materials, inspection and testing, marking, preparation for shipment and preservation of control valves in production, transportation, refining, petrochemical, distribution and storage facilities.

This specification is applicable to general, severe and special service control valves using a pneumatic, single acting diaphragm or piston type (with spring return), double acting piston type actuator, with actuator control components.

1.2

This specification can be used for control valves DN 25 (NPS 1) or greater in the following applications:

— throttling (modulating) applications;

— on-off or gap control applications;

— final element of a safety instrumented function where the function of the valve is not considered to provide primary isolation (e.g. emergency shutdown, process shutdown, blowdown function).

1.3

The following exclusions apply to this specification.

a) List of valves excluded:

— subsea control and choke valves;

— topside production choke valves.

b) List of special application valves excluded:

— control valves within the process equipment licensor scope where the specific make and model is prescribed by the licensor;

— process gas-actuated control valves;

— control valves with special requirements that are part of a proprietary OEM package (e.g. fuel control valves);

— de-superheater control valves;

— process applications such as oxygen, chlorine, molten sulfur, caustic (alkaline) and acids;

— pressure-independent chemical injection valves;

— fire safe or fire tested design valves.

NOTE The actuator requirements detailed in this specification do not cover actuators for process gas-actuated control valves.

1.4

With the addition of supplementary requirements, this specification can be used for the procurement of the excluded valves/applications listed in 1.3.

2 Normative references

The following publications are referred to in this document, the procurement data sheet (IOGP S-729D) or the IRS (IOGP S-729L) 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 references document (including any amendments) applies.

ANSI/FCI 70-2, *Control Valve Seat Leakage*

ANSI/FCI 91-1, *Standard for Qualification of Control Valve Stem Seals*

ANSI/ISA 75.01.01, *Industrial-Process Control Valves - Part 2-1: Flow capacity - Sizing equations for fluid flow under installed conditions*

ANSI/ISA 75.02.01, *Control Valve Capacity Test Procedures*

ANSI/ISA 75.05.01, *Control Valve Terminology*

ANSI/ISA 75.08.01, *Face-to-Face Dimensions for Integral Flanged Globe-style Control Valve Bodies (Classes 125, 150, 250, 300, and 600)*

ANSI/ISA 75.08.02, *Face-to-Face Dimensions for Flanged and Flangeless Rotary Control Valves (Classes 150, 300, and 600, and PN 10, PN 16, PN 25, PN 40, PN 63 and PN 100)*

ANSI/ISA 75.08.04, *Face-to-Face Dimensions for Buttweld-End Globe-Style Control Valves (Class 4500)*

ANSI/ISA 75.08.05, *Face-to-Face Dimensions for Buttweld-End Globe-Style Control Valves (Class 150, 300, 600, 900, 1500, and 2500)*

ANSI/ISA 75.08.06, *Face-to-Face Dimensions for Flanged Globe-style Control Valve Bodies (Classes 900, 1500, and 2500)*

ANSI/ISA 75.08.08, *Face-to-Centerline Dimensions for Flanged Globe-Style Angle Control Valve Bodies (Classes 150, 300, and 600)*

ANSI/ISA 75.11.01, *Inherent Flow Characteristic and Rangeability of Control Valves*

ANSI/ISA 75.17, *Control Valve Aerodynamic Noise Prediction*

ANSI/ISA 75.19.01, *Hydrostatic Testing of Control Valves*

ANSI/ISA 75.25.01, *Test Procedure for Control Valve Response Measurement from Step Inputs*

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

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

API Standard 609, *Butterfly Valves: Double-flanged, Lug- and Wafer-type, and Butt-welding Ends*

API Standard 6ACRA, *Age-hardened Nickel-based Alloys for Oil and Gas Drilling and Production Equipment*

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

ASME B16.10, *Face-to-Face and End-to-End Dimensions of Valves*

ASME B16.34, *Valves — Flanged, Threaded, and Welding End*

ASME B16.47, *Large Diameter Steel Flanges: NPS 26 Through NPS 60 Metric/Inch Standard*

ASME *BPVC*, Section V, *Nondestructive Examination*

ASME *BPVC*, Section VIII, Division 1, *Rules for Construction of Pressure Vessels*

ASNT SNT-TC-1A, *Personnel Qualification and Certification in Nondestructive Testing*

ASTM A105/A105M, *Standard Specification for Carbon Steel Forgings for Piping Applications*

ASTM A182/A182M, *Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service*

ASTM A193/A193M, *Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications*

ASTM A194/A194M, *Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both*

ASTM A216/A216M, *Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service*

ASTM A217/A217M, *Standard Specification for Steel Castings, Martensitic Stainless and Alloy, for Pressure-Containing Parts, Suitable for High-Temperature Service*

ASTM A276/A276M, *Standard Specification for Stainless Steel Bars and Shapes*

ASTM A320/A320M, *Standard Specification for Alloy-Steel and Stainless Steel Bolting for Low-Temperature Service*

ASTM A350/A350M, *Standard Specification for Carbon and Low-Alloy Steel Forgings, Requiring Notch Toughness Testing for Piping Components*

ASTM A351/A351M, *Standard Specification for Castings, Austenitic, for Pressure-Containing Parts*

ASTM A352/A352M, *Standard Specification for Steel Castings, Ferritic and Martensitic, for Pressure-Containing Parts, Suitable for Low-Temperature Service*

ASTM A453/A453M, *Standard Specification for High-Temperature Bolting, with Expansion Coefficients Comparable to Austenitic Stainless Steels*

ASTM A479/A479M, *Standard Specification for Stainless Steel Bars and Shapes for Use in Boilers and Other Pressure Vessels*

ASTM A564/A564M, *Standard Specification for Hot-Rolled and Cold-Finished Age-Hardening Stainless Steel Bars and Shapes*

ASTM A578/A578M, *Standard Specification for Straight-Beam Ultrasonic Examination of Rolled Steel Plates for Special Applications*

ASTM A609/A609M, *Standard Practice for Castings, Carbon, Low-Alloy, and Martensitic Stainless Steel, Ultrasonic Examination Thereof*

ASTM A705/705M, *Standard Specification for Age-Hardening Stainless Steel Forgings*

ASTM A739, *Standard Specification for Steel Bars, Alloy, Hot-Wrought, for Elevated Temperature or Pressure-Containing Parts, or Both*

ASTM A995/A995M, *Standard Specification for Castings, Austenitic-Ferritic (Duplex) Stainless Steel, for Pressure-Containing Parts*

ASTM A1014/A1014M, *Standard Specification for Precipitation-Hardening Bolting (UNS N07718) for High Temperature Service*

ASTM A1082/A1082M, *Standard Specification for High Strength Precipitation Hardening and Duplex Stainless Steel Bolting for Special Purpose Applications*

ASTM B446, *Standard Specification for Nickel-Chromium-Molybdenum-Columbium Alloy (UNS N06625), Nickel-Chromium-Molybdenum-Silicon Alloy (UNS N06219), and Nickel-Chromium-Molybdenum-Tungsten Alloy (UNS N06650) Rod and Bar*

ASTM B564, *Standard Specification for Nickel Alloy Forgings*

ASTM B637, *Standard Specification for Precipitation-Hardening and Cold Worked Nickel Alloy Bars, Forgings, and Forging Stock for Moderate or High Temperature Service*

ASTM F788, *Standard Specification for Surface Discontinuities of Bolts, Screws, Studs, and Rivets, Inch and Metric Series*

ASTM F812 , *Standard Specification for Surface Discontinuities of Nuts, Inch and Metric Series*

EN 10204, *Metallic products – Types of inspection documents*

EN 13445-3, *Unfired pressure vessels — Part 3: Design*

IEC 60079 (all parts), *Explosive atmospheres*

IEC 60085, *Electrical insulation – Thermal evaluation and designation*

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

IEC 60534-1, *Industrial-process control valves – Part 1: Control valve terminology and general considerations*

IEC 60534-2-1, *Industrial-process control valves – Part 2-1: Flow capacity – Sizing equations for fluid flow under installed conditions*

IEC 60534-2-3, *Industrial-process control valves – Part 2-3: Flow capacity – Test procedures*

IEC 60534-2-4, *Industrial-process control valves – Part 2-4: Flow capacity – Inherent flow characteristics and rangeability*

IEC 60534-3-1, *Industrial-process control valves – Part 3-1: Dimensions – Face-to-face dimensions for flanged, two-way, globe-type, straight pattern and centre-to-face dimensions for flanged, two-way, globe-type, angle pattern control valves*

IEC 60534-3-2, *Industrial-process control valves – Part 3-2: Dimensions – Face-to-face dimensions for rotary control valves except butterfly valves*

IEC 60534-3-3, *Industrial-process control valves – Part 3-3: Dimensions – End-to-end dimensions for buttweld, two-way, globe-type, straight pattern control valves*

IEC 60534-4, *Industrial-process control valves – Part 4: Inspection and routine testing*

IEC 60534-5:2004, *Industrial-process control valves – Part 5: Marking*

IEC 60534-6-1, *Industrial-process control valves – Part 6-1: Mounting Details for Attachment of Positioners to Control Valves – Positioner Mounting on Linear Actuators*

IEC 60534-6-2, *Industrial-process control valves – Part 6-2: Mounting Details for Attachment of Positioners to Control Valves – Positioner Mounting on Rotary Actuators*

IEC 60534-8-3, *Industrial-process control valves – Part 8-3: Noise considerations – Control valve aerodynamic noise prediction method*

IEC 60534-8-4, *Industrial-process control valves – Part 8-4: Noise considerations – Prediction of noise generated by hydrodynamic flow*

IEC 60534-9, *Industrial-process control valves – Part 9: Test procedure for response measurements from step inputs*

IEC 60721-2-1, *Classification of environmental conditions – Part 2-1: Environmental conditions appearing in nature – Temperature and humidity*

IEC 60721-3-0, *Classification of environmental conditions – Part 3-0: Classification of groups of environmental parameters and their severities – Introduction*

IEC 61000-4-3, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*

IEC 61000-4-8, *Electromagnetic compatibility (EMC) – Part 4-8: Testing and measurement techniques – Power frequency magnetic field immunity test*

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

IEEE 1, *IEEE Recommended Practice— General Principles for Temperature Limits in the Rating of Electrical Equipment and for the Evaluation of Electrical Insulation*

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*

IOGP S-716:2021/ADD1:2025, *Specification for Small Bore Tubing and Fittings — Addendum 1*

ISO 8573-1, *Compressed air — Part 1: Contaminants and purity classes*

ISO 9712, *Non-destructive testing — Qualification and certification of NDT personnel*

ISO 10474, *Steel and steel products — Inspection documents*

ISO 12944-1, *Paints and varnishes — Corrosion protection of steel structures by protective paint systems — Part 1: General introduction*

ISO 12944-2, *Paints and varnishes — Corrosion protection of steel structures by protective paint systems — Part 2: Classification of environments*

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 15848-1, *Industrial valves — Measurement, test and qualification procedures for fugitive emissions — Part 1: Classification system and qualification procedures for type testing of valves*

ISO 15848-2, *Industrial valves — Measurement, test and qualification procedures for fugitive emissions — Part 2: Production acceptance test of valves*

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 28921-1, *Industrial valves — Isolating valves for low-temperature applications — Part 1: Design, manufacturing and production testing*

NAMUR NE 004, *Mounting of Positioners / Position Transmitters to Actuators*

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*

3 Terms, definitions and acronyms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60534-1, ANSI/ISA 75.05.01 and the following 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
severe service
application where one or more of the following criteria is met for the specified operating conditions:
— cavitation potential: $(P_1-P_2)/(P_1-P_V)$ is greater than 0,5 for water and aqueous solutions
— cavitation potential: $(P_1-P_2)/(P_1-Pv)$ is greater than 0,7 for single-phase fluids other than water and aqueous solutions
— flashing in liquids: P_2 is less than P_V
— choked flow: where the pressure drop ratio $(P_1-P_2)/P_1$ is greater than 0,7
— liquids and compressible gases where pressure drop is greater than 3000 kPa for any given flow rate where
P_1 is the upstream absolute pressure
P_2 is the downstream absolute pressure
P_V is the absolute vapour pressure of the fluid at flowing temperature

3.1.2
special service
application where one or more of the following apply:
— aerodynamic compressor anti-surge control valves
— low-temperature and cryogenic conditions where the service temperature ranges from colder than -46 °C (-51 °F) to -196 °C (-321 °F)
— release of gases from pressurized liquids or outgassing
— erosive service with entrained solids or particles
— trim blockage may occur due to potential scaling or wax formation
— supercritical fluids are present

3.1.3
general service
criteria or applications not defined as severe or special

3.1.4
pressure-containing part
part whose failure to function as intended results in a release of contained fluid into the environment

Note 1 to entry: Includes as a minimum the body, bonnet, stem, gland flange, bolting and body/bonnet gasket that pass through the pressure boundary.

3.1.5
pressure-controlling part
part intended to control the flow of fluids

Note 1 to entry: Includes as a minimum the plug and seat.

3.1.6
free-machining steel
steel to which elements such as sulfur, selenium and lead have been added intentionally to improve machineability

3.2 Acronyms

For the purposes of this document, the following acronyms apply.

CAS conformity assessment system

EDS element data sheet

MDS material data sheet

MT magnetic particle testing

NDE non-destructive examination

OEM original equipment manufacturer

PMI positive material identification

ppmw parts per million weight

PT penetrant testing

QSL quality specification level

RT radiographic testing

UT ultrasonic testing

VT visual testing

4 General requirements

4.1

Valves and actuator control equipment shall be designed to operate for the specified:

— environmental conditions; or

— environmental classification in accordance with IEC 60721-3-0 and climatic classification in accordance with IEC 60721-2-1.

4.2

Valve design and pressure-temperature ratings shall be in accordance with ASME B16.34 for the specified pressure class.

5 Valve body style

5.1 General

Separable flanges shall not be used.

5.2 Sliding stem control valves

5.2.1

Sliding stem valves shall have a single-piece cast or forged body.

5.2.2

Sliding stem valves shall be a single-port design.

5.3 Rotary control valves

5.3.1

Butterfly valves shall be designed in accordance with ASME B16.34 or API Standard 609.

5.3.2

Wafer type end connections or flangeless rotary valves shall be used only in Category D service.

6 Valve body design

6.1 Connection size

6.1.1

The minimum valve size shall be a maximum of two sizes smaller than the upstream line size and larger than or equal to half the upstream line size.

NOTE Typical upstream line sizes and their corresponding minimum valve sizes are indicated in Table 1.

Table 1 — Minimum valve size

Upstream line size — DN (NPS)	25 (1)	40 (1½)	50 (2)	80 (3)	100 (4)	150 (6)	200 (8)	250 (10)	300 (12)	350 (14)	400 (16)	450 (18)	500 (20)	600 (24)	700 (28)	750 (30)	800 (32)	900 (36)
Minimum valve size — DN (NPS)	25 (1)	25 (1)	25 (1)	40 (1½)	50 (2)	80 (3)	100 (4)	150 (6)	200 (8)	250 (10)	300 (12)	350 (14)	400 (16)	450 (18)	500 (20)	600 (24)	700 (28)	750 (30)

6.1.2

Body flange dimensions of valve sizes between DN 25 (NPS 1) and DN 600 (NPS 24) shall be in accordance with ASME B16.5.

6.1.3

The body flange dimensions of valve sizes between DN 650 (NPS 26) and DN 1500 (NPS 60) shall be in accordance with ASME B16.47.

6.2 Flow direction marking

6.2.1

The normal flow direction of sliding stem valves shall be marked with an arrow in accordance with one of the following options:

— permanently cast on the valve body;

— engraved on the valve body; or

— on a stainless steel plate riveted to the valve body.

6.2.2

The normal flow direction of rotary valves shall be marked with an arrow in accordance with one of the following options:

— engraved on the valve body;

— on a stainless steel plate riveted to the valve body or bonnet; or

— stamped on the flange rim.

6.2.3

Three-way valves shall be marked to indicate the common inlet or common outlet port by a permanent stamp on the flange.

6.3 Valve dimensions

6.3.1

The valve body face-to-face, centre-to-face and end-to-end dimensions shall be in accordance with Table 2.

Table 2 — Body face-to-face, centre-to-face and end-to-end dimensions

Body style	IEC/API standards	ANSI/ISA standards
Flanged and flangeless rotary control valves	API Standard 609 (butterfly valves up to ASME class 600) IEC 60534-3-2 (except butterfly valves up to ASME class 600)	ANSI/ISA 75.08.02 (up to ASME class 600)
Globe style angle with integral flanges	IEC 60534-3-1 (up to ASME class 1500)	ANSI/ISA 75.08.08 (up to ASME class 600)
Globe style with integral flanges	IEC 60534-3-1 (up to ASME class 1500)	ANSI/ISA 75.08.01 (up to ASME class 600) ANSI/ISA 75.08.06 (for ASME class 900 to class 2500)
Globe style buttweld	IEC 60534-3-3 (for ASME class 150 to class 2500)	ANSI/ISA 75.08.04 (for ASME class 4500) ANSI/ISA 75.08.05 (for ASME class 150 to class 2500)

6.3.2

When the selected valve pressure classification and sizes are outside the limits of the standards indicated in Table 2, the dimensions specified in ASME B16.10 shall apply.

6.3.3

If the dimensional standards indicated in Table 2 cannot be met when the valve design incorporates multi-stage pressure let-down trims, the manufacturer's standard dimensions may be applied to the valve body face-to-face, centre-to-face and end-to-end dimensions.

6.4 Body/bonnet gasket and seals

Qualification and production testing of polymers shall be performed in accordance with:

— ISO 23936-1 or NORSOK M-710 for thermoplastics;

— ISO 23936-2 or NORSOK M-710 for elastomers.

6.5 Packing

6.5.1

The packing system shall be lubricant free.

6.5.2

The packing material and design shall be based on a low-friction solution using polytetrafluoroethylene-based materials unless any of the following apply:

— the design temperature of the application is below - 40 °C (- 40 °F);

— the design temperature of the application is above 200 °C (392 °F); or

— polytetrafluoroethylene is incompatible with the process fluid.

6.5.3

Packing material shall be graphite-based when graphite is inert to the process and the design temperature is above 230 °C (+446 °F).

6.6 Fugitive emission or low emission packing

6.6.1

When fugitive emission packing is specified, the packing shall be type tested and certified in accordance with ISO 15848-1 or ANSI/FCI 91-1.

NOTE Fugitive emission packing is also referred to as low-emission packing.

6.6.2

Type test qualification shall be performed in accordance with the specified endurance class.

6.6.3

Bellows seal bonnets shall not be used.

6.7 Bonnet design

6.7.1

Bonnets shall be integral or bolted type with fully retained gaskets.

6.7.2

Bonnet bolts shall not be used for mounting brackets or actuator control equipment.

6.8 Lifting

6.8.1

Lifting points (e.g. lifting lugs) or a method for lifting (e.g. using lifting slings) shall be provided for valve assemblies weighing above 25 kg (55 lb).

6.8.2

When lifting lugs are provided, they shall be certified and have a minimum design safety factor of 2.

6.8.3

When lifting lugs are provided on the valve and actuator, the lifting locations shall be provided with an AISI 316 text plate stating the purpose for use (i.e. valve only, actuator only, or both).

7 Valve trim design

7.1 General

7.1.1

The seat ring shall not be pinned or spot-welded.

7.1.2

Seat rings and cages shall be removable.

7.2 Stem

7.2.1

The sliding stem valve stem attachment to the plug shall be one of the following:

— threaded and pinned;

— threaded and welded; or

— single-piece design from bar stock.

7.2.2

The rotary valves stem shall have an anti-blowout design that prevents the stem from being ejected in the event of a stem to disc/ball attachment failure or broken stem within the pressure boundary.

7.2.3

Rotary valves shaft to actuator connection shall be splined or keyed.

7.2.4

Rotary valves shall have a scribe mark indicating the closure member position when the travel indicator and actuator are removed.

7.3 Seat leakage

Valve seat leakage shall conform to IEC 60534-4 or ANSI/FCI 70-2.

7.4 Severe service trims

7.4.1 Erosive service

Cage-guided, single or multi-stage trim used in erosive service shall have trim materials hardened in accordance with 10.5.

7.4.2 Cavitation service

7.4.2.1

For incipient cavitation service, trims shall be hardened according to 10.5.

7.4.2.2

For cavitation service, trim shall be an anti-cavitation design.

NOTE Cavitation service indicated in this requirement does not include incipient cavitation.

7.4.3 Flashing

Angle valves used in flashing services shall have replaceable outlet liners.

8 Valve sizing and selection

8.1 General

8.1.1

Control valve flow coefficient shall be calculated in accordance with IEC 60534-2-1 or ANSI/ISA 75.01.01.

8.1.2

For outgassing, supercritical fluids and multi-phase fluid applications, the sizing method, equations and correction factor used to calculate the flow coefficient shall be provided.

8.2 Operating range

8.2.1

The travel of sliding stem valves with linear trim should be between 15 % and 80 % for the specified minimum and maximum flow conditions.

8.2.2

The travel of sliding stem valves with equal percentage trim should be between 15 % and 90 % for the specified minimum and maximum flow conditions.

8.2.3

The rotation of eccentric rotary valves and butterfly valves should be between 15° and 60° for the specified minimum and maximum flow conditions.

8.2.4

The rotation of high performance butterfly valves should be between 15° and 70° for the specified minimum and maximum flow conditions.

8.2.5

The rotation of ball, segmented ball and eccentric plug valves should be between 10° and 90° for the specified minimum and maximum flow conditions.

8.3 Characteristics

8.3.1

Sliding stem valve characteristics shall only be achieved by the trim.

8.3.2

The valve travel vs flow coefficient plots shall be available.

8.4 Velocity limitation

The valve body outlet velocity shall be limited to:

— 0,2 Mach for gas, vapor, and steam services, with any particulates including black powder;

— 0,3 Mach for wet gas, wet vapor and saturated steam services;

— 0,4 Mach for dry gas, dry vapor and superheated steam services;

— 0,5 Mach for gas in infrequent services or services such as venting and depressurization;

— 10 m/s (33 ft/s) for liquid services including water;

— 6 m/s (20 ft/s) for fluids containing erosive particles.

8.5 Noise requirements

8.5.1

Aerodynamic noise calculations for gas, steam or vapour shall be performed in accordance with IEC 60534-8-3 or ANSI/ISA 75.17.

8.5.2

Hydrodynamic noise calculations for liquids shall be performed in accordance with IEC 60534-8-4.

9 Valves used in safety instrumented function

9.1

On a solenoid valve trip, valves shall switch to the fail-safe state, irrespective of the positioner control signal.

9.2

The components used to achieve the fail-safe state for a safety instrumented function shall comply with IEC 61508 (all parts).

9.3

When specified, solenoid valves shall be installed between the positioner signal output and the actuator.

10 Material selection

10.1 General

10.1.1

Material selection shall be based on the specified service, pressure-temperature envelope and piping material.

10.1.2

Pressure-containing and pressure-controlling part materials shall be selected from Table 3 through Table 11.

10.1.3

Materials shall comply with the material standards and IOGP S-563 material data sheets referenced in Table 3 through Table 11 for the listed components and any applicable additional requirements in this specification.

10.1.4

Free machining steel shall not be used.

10.1.5

Lifting lugs, supports, plugs and fittings welded directly to the valve body shall be of the same material type as the body.

10.1.6

Metallic gaskets shall be corrosion-resistant material equal or better than 316 stainless steel.

10.1.7

Asbestos and asbestos-containing materials shall not be used.

10.1.8

Cadmium plating shall not be used.

10.1.9

Mating surfaces of sliding elements and threaded components shall be designed to avoid galling (e.g. having different hardness or an anti-galling coating).

10.1.10

Galvanized bolting and components shall not be used in continuous service at temperature exceeding 200 °C (392 °F).

10.1.11

O-rings and polytetrafluoroethylene-based material seals shall not be used for temperatures above 230 °C (+446 °F).

10.1.12

For valves in seawater service, graphite based gaskets or graphite based stem seals shall not be used.

10.2 Materials

10.2.1

If Table 3 through Table 11 do not list an MDS for a particular material grade, the materials shall be supplied in accordance with the material standard without additional requirements.

10.2.2

Materials for pneumatic actuator components shall be in accordance with Table 12.

Table 3 — Normal temperature carbon steel – Sweet service, -29 °C (-20 °F) to 425 °C (800 °F)

Material selection	MDS [a, d]	Pressure-containing parts			Pressure-controlling parts	
		Body/ bonnet	Stem	Bolting	Seat ring [b, d]	Plug, ball, disk, cage [b, d]
ASTM A105	IC004	A [c]				
ASTM A216 WCB	IC006	A [c]				
ASTM A216 WCC	IC006	A [c]				
ASTM A182 F6A	IM104		A [e]		A	A
ASTM A182 FXM-19	IS404		A			
ASTM A479 UNS S20910 XM-19	IS407		A			
ASTM A479 UNS S41000	IM107		A [e]		A	A
ASTM A276 T410 / ASTM A276 T420	IM107/IM127		A [e]		A	A
ASTM A217 CA 15	IM106				A	A
ASTM A564 Gr. 630 UNS S17400	IU607		A [e]			
ASTM A705 Gr. 630 UNS S17400	IU604		A [e]			
ASTM A182 F316/316L	IS104		A		A	A
ASTM A276 316/316L	IS107		A		A	A
ASTM A479 316/316L	IS107		A		A	A
ASTM A351 CF3M/CF8M	IS106					A
ASTM A193 B7 / ASTM A194 2H	IX110/IX120			A		
ASTM A193 B7M / ASTM A194 2HM	IX110/IX120			A		
ASTM A320 L7 / ASTM A194 7	IX100/IX109			A		
ASTM A320 L7M / ASTM A194 7M	IX100/IX109			A		

Key

A Acceptable material

[a] The MDS requirements from IOGP S-563 apply.

[b] Trim material for severe service shall be hardfaced or solid hard material in accordance with 10.5.

[c] The corrosion allowance 3 mm.

[d] For pressure controlling parts, the MDS requirements shall apply for QSL-3 and QSL-4 only.

[e] These materials shall not be used for stems in offshore and marine coastal plant environmental locations.

Table 4 — Normal temperature carbon steel – Sour service, -29 °C (-20 °F) to 425 °C (800 °F)

Material selection	MDS [a, d]	Pressure-containing parts			Pressure-controlling parts	
		Body/ bonnet	Stem	Bolting	Seat ring [b, d]	Plug, ball, disk, cage [b, d]
ASTM A105	IC004S	A [c]				
ASTM A216 WCB	IC006S	A [c]				
ASTM A216 WCC	IC006S	A [c]				
ASTM A182 FXM-19	IS404S		A			
ASTM A479 UNS S20910 XM-19	IS407S		A		A	A
ASTM A564 Gr. 630 UNS S17400	IU607S		A [e]		A	A
ASTM A705 Gr. 630 UNS S17400	IU604S		A [e]		A	A
ASTM A182 F316/316L	IS104S		A		A	A
ASTM A276 316/316L	IS107S		A		A	A
ASTM A479 316/316L	IS107S		A		A	A
ASTM A351 CF3M/CF8M	IS106S					A
ASTM A193 B7M / ASTM A194 2HM	IX110S / IX120S			A		
ASTM A320 L7M / ASTM A194 7M	IX100S / IX109S			A		

Key

A Acceptable material

[a] The MDS requirements from IOGP S-563 apply.

[b] Trim material for severe service shall be hardfaced or solid hard material in accordance with 10.5.

[c] The corrosion allowance is 3 mm.

[d] For pressure controlling parts, the MDS requirements shall apply for QSL-3 and QSL-4 only.

[e] These materials shall not be used for stems in offshore and marine coastal plant environmental locations.

Table 5 — Low temperature carbon steel – Sour service, -46 °C (-50 °F) to 315 °C (600 °F)

Material selection	MDS [a, e]	Pressure-containing parts			Pressure-controlling parts	
		Body/ bonnet	Stem	Bolting	Seat ring [b, e]	Plug, ball, disk, cage [b, e]
ASTM A350 LF2 Class 1	IC104S	A [c]				
ASTM A352 LCC	IC106S	A [c]				
ASTM A182 FXM-19	IS404S		A			
ASTM A479 UNS S20910 XM-19	IS407S		A		A	A
ASTM A182 F316/316L	IS104S		A		A	A
ASTM A276 316/316L	IS107S		A		A	A
ASTM A479 316/316L	IS107S		A		A	A
ASTM A351 CF3M/CF8M	IS106S					A
ASTM A182 F51	ID144S		A		A	A
ASTM A276 UNS S31803	ID147S		A		A	A
ASTM A995 Gr. 4A	ID146S					A
ASTM B564 UNS N06625	IN104S		A		A	A
ASTM B637 UNS N07718	- [d]		A			
ASTM A320 L7M / ASTM A194 7M	IX100S / IX109S			A		

Key

A Acceptable material

[a] The MDS requirements from IOGP S-563 apply.

[b] Trim material for severe service shall be hardfaced or solid hard material in accordance with 10.5.

[c] The corrosion allowance 3 mm.

[d] UNS N07718 compliant with API Standard 6ACRA.

[e] For pressure controlling parts, the MDS requirements shall apply for QSL-3 and QSL-4 only.

Table 6 — Low temperature carbon steel – Sweet service, -46 °C (-50 °F) to 315 °C (600 °F)

Material selection	MDS [a, e]	Pressure-containing parts			Pressure-controlling parts	
		Body/ bonnet	Stem	Bolting	Seat ring [b, e]	Plug, ball, disk, cage [b, e]
ASTM A350 LF2 Class 1	IC104	A [c]				
ASTM A352 LCC	IC106	A [c]				
ASTM A182 FXM-19	IS404		A			
ASTM A479 UNS S20910 XM-19	IS407		A		A	A
ASTM A182 F316/316L	IS104		A		A	A
ASTM A276 316/316L	IS107		A		A	A
ASTM A479 316/316L	IS107		A		A	A
ASTM A351 CF3M/CF8M	IS106					A
ASTM A182 F51	ID144		A		A	A
ASTM A276 UNS S31803	ID147		A		A	A
ASTM A995 Gr. 4A	ID146					A
ASTM B564 UNS N06625	IN104		A		A	A
ASTM B637 UNS N07718	- [d]		A			
ASTM A320 L43 / ASTM A194 7	IX100 / IX109			A		
ASTM A320 L7 / ASTM A194 7	IX100 / IX109			A		
ASTM A320 L7M / ASTM A194 7M	IX100 / IX109			A		

Key

A Acceptable material

[a] The MDS requirements from IOGP S-563 apply.

[b] Trim material for severe service shall be hardfaced or solid hard material in accordance with 10.5.

[c] The corrosion allowance is 3 mm.

[d] UNS N07718 compliant with API Standard 6ACRA.

[e] For pressure controlling parts, the MDS requirements shall apply for QSL-3 and QSL-4 only.

Table 7 — Austenitic stainless steel type 316, -198 °C (-325 °F) to 540 °C (1 000 °F)

Material selection	MDS [a, c]	Pressure-containing parts			Pressure-controlling parts	
		Body/ bonnet	Stem	Bolting	Seat ring [b, c]	Plug, ball, disk, cage [b, c]
ASTM A182 FXM-19	IS404/IS404S		A			
ASTM A479 UNS S20910 XM-19	IS407/IS407S		A			
ASTM A182 F316/316L	IS104/IS104S	A	A		A	A
ASTM A276 316/316L	IS107/IS107S		A		A	A
ASTM A479 316/316L	IS107/IS107S		A		A	A
ASTM A351 CF3M/CF8M	IS106/IS106S	A				A
ASTM A193 B8M/B8MA / ASTM A194 8M/8MA	IS109/IS109S			A		

Key

A Acceptable material

[a] The MDS requirements from IOGP S-563 apply.

[b] Trim material for severe service shall be hardfaced or solid hard material in accordance with 10.5.

[c] For pressure controlling parts, the MDS requirements shall apply for QSL-3 and QSL-4 only.

Table 8 — 22Cr duplex stainless steel, -46 °C (-50 °F) to +260 °C (+500 °F)

Material selection	MDS [a, d]	Pressure-containing parts			Pressure-controlling parts	
		Body/ bonnet	Stem	Bolting	Seat ring [b, d]	Plug, ball, disk, cage [b, d]
ASTM A182 F51	ID144	A	A		A	A
ASTM A995 Gr. 4A	ID146	A			A	A
ASTM A276 UNS S32750 / UNS32760	ID257		A		A	A
ASTM A193 B8MLCuNA / ASTM A194 GRADE 8MLCuNA	-			A		
ASTM A193 B8MLCuN-CLASS 1B / ASTM A194 GR 9CA	-			A		
ASTM A453 GR 660 Class D	IU100			A		
ASTM A1014 UNS N07718 / API Std 6ACRA (120K)	IN120S			A		
ASTM B637 UNS N07718	- [c]		A			
ASTM B564 UNS N06625	IN104S		A			
ASTM A320 L7 / ASTM A194 7	IX100/IX109			A		
ASTM A320 L7M / ASTM A194 7M	IX100/IX109			A		
ASTM A1082 UNS S32750, S32760	ID260			A		

Key

A Acceptable material

[a] The MDS requirements from IOGP S-563 apply.

[b] Trim material for severe service shall be hardfaced or solid hard material in accordance with 10.5.

[c] UNS N07718 compliant with API Standard 6ACRA.

[d] For pressure controlling parts, the MDS requirements shall apply for QSL-3 and QSL-4 only.

Table 9 — 25Cr duplex stainless steel, -46 °C (-50 °F) to +300 °C (+570 °F)

Material selection	MDS [a, c]	Pressure-containing parts			Pressure-controlling parts	
		Body/ bonnet	Stem	Bolting	Seat ring [b, c]	Plug, ball, disk, cage [b, c]
ASTM A182 F53/F55	ID254	A	A		A	A
ASTM A276 UNS S32750 / UNS32760	ID257		A		A	A
ASTM A995 Gr. 6A	ID256	A			A	A
ASTM A193 B8MLCuNA / ASTM A194 GRADE 8MLCuNA	-			A		
ASTM A193 B8MLCuN-CLASS 1B / ASTM A194 GR 9CA	-			A		
ASTM A453 GR 660 Class D	IU100			A		
ASTM B564 UNS N06625	IN104S		A			
ASTM B446 UNS N06625	IN107S		A			
ASTM A1014 UNS N07718 / API Std 6ACRA (120K)	IN120S			A		
ASTM A1082 UNS S32750, S32760	ID260			A		
ASTM A1082 UNS S32750, S32760 (strain hardened)	ID259			A		

Key

A Acceptable material

[a] The MDS requirements from IOGP S-563 apply.

[b] Trim material for severe service shall be hardfaced or solid hard material in accordance with 10.5.

[c] For pressure controlling parts, the MDS requirements shall apply for QSL-3 and QSL-4 only.

Table 10 — 1¼Cr ½Mo low alloy steel, -29°C (-20 °F) to 440 °C (825 °F)

Material selection	MDS [a, d]	Pressure-containing parts			Pressure-controlling parts	
		Body/ bonnet	Stem	Bolting	Seat ring [b, d]	Plug, ball, disk, cage [b, d]
ASTM A182 F316/316L	IS104				A	A
ASTM A182 F6A	IM104		A		A	A
ASTM A479 UNS S41000	IM107		A		A	A
ASTM A276 T410/ ASTM A276 T420	IM107/IM127		A		A	A
ASTM A217 CA 15	IM106				A	A
ASTM A276 316/316L	IS107				A	A
ASTM A479 316/316L	IS107				A	A
ASTM A351 CF3M/CF8M	IS106				A	A
ASTM A182 F11 Cl. 2	IV104	A [c]				
ASTM A217 WC6	IV106	A [c]				
ASTM A739 B11	IV107	A [c]				
ASTM A193 B16 / ASTM A194 7	- /IX109			A		

Key

A Acceptable material

[a] The MDS requirements from IOGP S-563 apply.

[b] Trim material for severe service shall be hardfaced or solid hard material in accordance with 10.5.

[c] The corrosion allowance is 3 mm.

[d] For pressure controlling parts, the MDS requirements shall apply for QSL-3 and QSL-4 only.

Table 11 — 2¼Cr ½Mo low alloy steel, -29°C (-20 °F) to 540 °C (1 000 °F)

Material selection	MDS [a, d]	Pressure-containing parts			Pressure-controlling parts	
		Body/ bonnet	Stem	Bolting	Seat ring [b, d]	Plug, ball, disk, cage [b, d]
ASTM A182 F316/316L	IS104				A	A
ASTM A182 F6A	IM104		A		A	A
ASTM A479 UNS S41000	IM107		A		A	A
ASTM A276 T410/ ASTM A276 T420	IM107/IM127		A		A	A
ASTM A217 CA 15	IM106				A	A
ASTM A276 316/316L	IS107				A	A
ASTM A479 316/316L	IS107				A	A
ASTM A351 CF3M/CF8M	IS106				A	A
ASTM A182 F22 Cl. 3	IV204	A [c]				
ASTM A217 WC9	IV206	A [c]				
ASTM A739 B22	IV207	A [c]				
ASTM A193 B16 / ASTM A194 7	- /IX109			A		

Key

A Acceptable material

[a] The MDS or EDS requirements from IOGP S-563 apply.

[b] Trim material for severe service shall be hardfaced or solid hard material in accordance with 10.5.

[c] The corrosion allowance is 3 mm.

[d] For pressure controlling parts, the MDS requirements shall apply for QSL-3 and QSL-4 only.

Table 12 — Material requirements for pneumatic actuator components

Item	Material
Actuator cylinder/covers/spring housing	Onshore: carbon steel with coating [a] or aluminium Offshore and marine coastal: carbon steel with coating [a] or 316 stainless steel
Actuator diaphragm material	Nylon reinforced neoprene or nitrile rubber
Stroke adjustment components, piston rods and shafts exposed to external environment	Onshore: manufacturer to specify Offshore and marine coastal: 316 stainless steel or better
Yoke	Carbon steel with coating [a], high tensile cast or ductile iron with coating [a] or 316 stainless steel
Mounting kit (connection between valve and actuator)	Carbon steel with coating [a] or 316 stainless steel
Tie-rods/bolts/nuts/washers	316 stainless steel or low alloy steel with hot dip galvanized coating [a]
Actuator/valve connection bolts, nuts, washers, keys	316 stainless steel
Brackets for mounting accessories like limit switch box, junction box, positioner	Onshore: carbon steel with coating [a] Offshore and marine coastal: 316 stainless steel
Hand-wheel	Onshore: carbon steel with coating [a] Offshore and marine coastal: 316 stainless steel
Air receiver (volume tank or buffer vessel)	Onshore: carbon steel with coating [a] Offshore and marine coastal: 316 stainless steel
Actuator spring	Corrosion-resistant alloy, or non-corrosion-resistant alloy with corrosion-resistant treatment and corrosion-resistant coating
[a] The coating systems shall be in accordance with Clause 15.	

10.3 Welding and non-destructive examination (NDE)

10.3.1

Welding and post weld heat treatment of pressure-containing parts and attachment welding to pressure-containing parts shall be performed in accordance with IOGP S-705.

10.3.2

Weld overlay and hardfacing shall comply with IOGP S-563 EDSs IO001, IH001, IH002 and IH005.

10.4 Sour service

When sour service is specified, materials and fabrication shall comply with ANSI/NACE MR0175/ISO 15156 (all parts) or ANSI/NACE MR0103/ISO 17945 and the additional metallurgical, manufacturing, testing and certification requirements stated in the applicable MDS and EDS in IOGP S-563.

10.5 Severe and erosive services

10.5.1

Closure member and seat materials for severe service shall be hardfaced.

10.5.2

Closure member and seat materials for erosive service shall be hardfaced, solid tungsten carbide or ceramic in accordance with 10.3.2.

10.5.3

Hardfacing or solid hard material shall be compatible with the process fluid.

10.5.4

Solid tungsten carbide shall be in accordance with IOGP S-563, EDS IH005.

10.5.5

Stellite 6 hardfacing, solid tungsten carbide and tungsten carbide hardfacing shall not be used in seawater service.

11 Actuators

11.1 General

11.1.1

Sliding stem actuators shall have a valve travel indicator.

11.1.2

Rotary valve position shall be indicated using a travel indicator marked in degrees.

11.1.3

Open, close and intermediate position indications shall be marked on a 316 stainless steel scale.

11.1.4

Pneumatic actuators and actuator control equipment shall be operable for the compressed air quality specified below:

— class 6 for particle size;

— class 3 for pressure dew point or at least 10 °C (50 °F) below the specified lowest ambient temperature; and

— class 3 for oil concentration.

NOTE The definition of class specified in this requirement is in accordance with ISO 8573-1.

11.2 Actuator sizing

11.2.1

Actuators shall be sized for:

— maximum shut-off differential pressure; and

— minimum network supply pressure.

11.2.2

The sum of forces required from the actuator shall be calculated using:

— unbalanced forces arising based on the chosen control valve and trim design;

— frictional forces due to valve drive train, trim and packing; and

— seating forces to attain the required seat leakage class.

11.2.3

For applications involving bi-directional flow, actuator sizing shall take account of the reverse flow maximum shut-off differential pressure.

11.2.4

The selected actuator torque/thrust shall be greater than or equal to 110 % of the required torque/thrust by calculation using 11.2.2.

11.3 Pneumatic actuators

11.3.1

When specified for fail-open or fail-close applications, double-acting actuators without spring return shall be supplied with an air receiver and air-safe trip valves to achieve the desired air failure position.

NOTE Air receivers are also referred to as buffer vessels or volume tanks.

11.3.2

The piston actuator cylinder design pressure shall withstand:

— the specified network maximum supply pressure; or

— an alternative pressure specified by the purchaser.

11.3.3

Exhaust, vent and breathing ports of actuators and control equipment shall prevent ingress of water, bugs, debris or ice formation.

11.3.4

Where the instrument air network supply pressure exceeds the diaphragm actuator maximum allowable pressure, an independent pressure-relief valve shall not be required if a local self-relieving filter regulator is provided to control the supply pressure.

11.3.5

Piston type actuators in marine, tropical and humid environments shall be sealed and equipped with a closed-loop breathing system to prevent humid air and moisture from moving in and out of enclosed spring housings.

11.4 Travel stops

11.4.1

Travel stops shall be achieved by a mechanical device fitted to the valve or actuator.

11.4.2

Travel stop functionality shall be achieved independently from the handwheel.

11.4.3

When an adjustable travel stop is specified, the travel stop adjustments shall be made using a mechanism that prevents unauthorized changes.

11.5 Handwheel

11.5.1

The force required at the handwheel to apply the breakaway torque or thrust shall not exceed 360 N (80 lb).

11.5.2

The handwheel diameter shall not exceed 800 mm (32 in).

11.5.3

The handwheel shall have permanent markings to aid operation, i.e. open direction, neutral position and close direction.

11.5.4

The handwheel shall be designed such that excessive force on the handwheel does not cause damage to the valve stem.

12 Actuator control equipment

12.1 General

12.1.1

Actuator control equipment, air receivers and pneumatic components shall be designed for the specified maximum network supply pressure.

NOTE Actuator control equipment is also referred to as accessories.

12.1.2

Actuator control electronic equipment shall be provided with an earth boss.

12.1.3

Actuator control equipment shall be accessible for repair or replacement without removing other actuator control components.

12.1.4

Electronic equipment and termination boxes shall have a minimum ingress protection of IP66 in accordance with IEC 60529 or NEMA 4X in accordance with NEMA 250.

12.2 Air filter regulators

12.2.1

Air filter regulators shall be installed in the supply line to the control valve.

12.2.2

Air filter regulators shall have a mesh size of 5 micron.

12.2.3

Air filter regulators shall be internal relief type with an integral filter and manual drain.

NOTE Internal relief type is also referred to as self-relieving type.

12.2.4

Air filter regulators shall be provided with a mechanism that prevents inadvertent changes to setpoint.

12.3 Positioners

12.3.1 Mounting hardware

For offshore and marine coastal applications, the positioner mounting bracket, mounting bolts and nuts material shall be 316 stainless steel.

12.3.2 Diagnostics

12.3.2.1

The smart positioner shall have a diagnostic feature to detect if the valve does not move in accordance with the commanded position within the set time.

12.3.2.2

The smart positioner shall have a diagnostic feature to detect if the valve has moved away from the commanded position.

12.3.2.3

The smart positioner shall have a diagnostic feature to detect a loss of air supply.

12.3.2.4

The smart positioner shall have a feature to capture the valve signature.

NOTE The valve signature is also referred to as valve profile or footprint.

12.3.3 Cyber security

12.3.3.1

Device type manager and device description files shall be obtained directly from the equipment manufacturer or downloaded from the equipment manufacturer's authorized secure website.

12.3.3.2

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

12.3.3.3

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

12.3.4 Electromagnetic immunity

Positioners shall be certified for electromagnetic immunity in accordance with IEC 61000-4-3 or IEC 61000-4-8.

12.4 Solenoid valves

12.4.1

Solenoid valves power consumption shall be less than or equal to 10 W.

12.4.2

The solenoid coil insulation rating shall be in accordance with IEC 60085 or IEEE 1.

12.4.3

When solenoid valves and a positioner are specified for the same application, the solenoid valves shall be installed between the positioner signal output and the actuator.

12.4.4

Solenoid valves shall be made of 316 stainless steel.

12.5 Position indication

12.5.1

When limit switches are specified for position indication, they shall be magnetic or inductive proximity type.

12.5.2

Limit switches with flying leads shall be terminated in a single junction box.

12.5.3

Flying leads from the limit switch to the junction box shall be physically protected.

NOTE 316 stainless steel tubing can be used only when other options are not available.

12.5.4

The adjustable limit switch shall be set at:

— 3° from the open and closed positions for quarter turn actuators; or

— 3 % from the open and closed positions for linear actuators.

12.6 Air lock relay (lockup valve)

When a "fail-last" position is specified, an airlock relay shall be provided.

12.7 Air receiver

12.7.1

The air receiver shall be sized to operate at least three valve strokes at minimum network instrument air supply pressure in the event of air supply failure to double-acting actuators:

— fail open valve: open to close, close to open and open to close;

— fail close valve: close to open, open to close and close to open.

NOTE Air receivers are also referred to as volume tanks or buffer vessels.

12.7.2

Air receivers shall be provided with a check valve and a block valve for the supply line, a manifold block valve for the pressure instrument connection, a drain valve and a vent valve.

12.7.3

When air receivers are subjected to fire case, a pressure safety valve or rupture disc shall be supplied and installed on the equipment.

12.8 Tubing, fittings and instruments valves

Instrument air supply tubing and fittings shall be in accordance with the following clauses of IOGP S-716:2021/ADD1:2025:

— 4.1.3 for general requirements in design of tubing system;

— 4.2.1 and 4.2.3 for sizing of tubing system;

— 4.3.1.1, 4.3.1.2, 4.3.1.4, 4.3.1.5 and 4.3.1.6 for design of tubes;

— 4.4.1.1, 4.4.1.4 and 4.4.1.6 for design of tubing system components;

— 4.7.1 for vibration and thermal effects in design of tubing system;

— 6.1.1 for general requirements in installation of tubing system;

— 6.2.3.2, 6.2.3.3, 6.2.3.4, 6.2.3.8, 6.2.3.10, 6.2.3.11 and 6.2.3.14 for tubing installation;

— 6.4.2 for thread sealing in installation of tubing system.

12.9

Quick exhaust valves or volume boosters shall only be used where stroke time cannot be achieved by the specified positioners or solenoid valves.

12.10 Variable restrictors for speed control

12.10.1

When variable restrictors for speed control are installed, the restrictors shall be installed in the valve control tubing.

12.10.2

When variable restrictors for speed control are installed, it shall not be possible to fully close the restrictors.

12.10.3

When variable restrictors for speed control are installed, the restrictors shall be adjustable during operation.

12.10.4

When variable restrictors for speed control are installed, the restrictors shall include functionality to lock in any adjusted position.

13 Performance requirements

13.1 Hysteresis and dead band

The total hysteresis with dead band error for valves in severe and special services shall be less than or equal to:

— 2 % of the calibrated span for sliding stem valve sizes up to DN 400 (NPS 16) and rotary valve sizes up to DN 250 (NPS 10);

— 3 % of the calibrated span for sliding stem valve sizes greater than DN 400 (NPS 16) and rotary valve sizes greater than DN 250 (NPS 10).

13.2 Anti-surge valves

13.2.1

Upon initiation of a trip command to the solenoid valve, the anti-surge valve shall travel from fully closed to fully open in the lesser of the project-specified opening time or 2,0 s with a dead time less than 0,5 s.

13.2.2

Following a step change to the positioner, the anti-surge valve shall be fully opened from the closed position within the specified time, or in no greater than 2 s.

NOTE Travel time includes dead time.

13.2.3

The dead band for a valve with an actuator and positioner shall be less than 0,5 % of the calibrated span.

13.2.4

When a limit is not specified, the overshoot shall not exceed 3 % of the calibrated span for a control signal step change within the 10 % to 80 % range.

13.2.5

Following a step change to the positioner, each step response shall have only a single overshoot with a dead time of less than 0,5 s per step.

14 Inspection and testing

14.1 Mandatory testing

14.1.1 General

14.1.1.1

Inspection and routine testing shall be carried out in accordance with IEC 60534-4.

14.1.1.2

100 % inspection and routine testing shall be carried out for the following:

— visual inspection in accordance with 14.1.2;

— dimensional check in accordance with 14.1.3; and

— functional tests in accordance with 14.1.8.

14.1.1.3

When "Hold" or "Witness" interventions are required based upon the specified CAS level and IOGP S-729Q, Annex A, acceptance testing shall be performed in accordance with Table 13.

Table 13 — Acceptance testing

Test	Extent of acceptance testing for severe and special service for all pressure classes	Extent of acceptance testing for general service		Acceptance criteria (reference in this specification)
		≤ 600 ASME class	≥ 900 ASME class	
Visual inspection	100 %	100 %	100 %	14.1.2
Dimensional check	100 %	100 %	100 %	14.1.3
Hydrostatic test	100 %	20 %	30 %	14.1.4
Seat leakage test	100 %	20 %	30 %	14.1.5
Packing test	100 %	20 %	30 %	14.1.6
Rated valve travel test	100 %	20 %	30 %	14.1.7
Functional test	100 %	20 %	30 %	14.1.8
Positive material identification for body/bonnet/closure member	100 %	20 %	30 %	14.1.9

14.1.1.4

Butterfly valves designed in accordance with API Standard 609 shall be tested in accordance with this specification.

14.1.2 Visual inspection

A visual inspection shall be performed to verify the following:

— make/model number;

— cable/tube entry;

— tag plate, name plate and marking;

— flow direction;

— orientation of actuator;

— material grade for body/bonnet;

— coating and colour coding check;

— flange size, rating and surface finish;

— supply of accessories;

— plugs and adapters;

— heat number correlation with material certificates;

— actuator coating and painting color, if specified.

14.1.3 Dimensional check

A dimensional check shall be performed to verify the following:

— face-to-face or center-to-face dimensions;

— dimensional information for valves with an actuator;

— bolt circle diameter, number of bolts and flange thickness.

14.1.4 Hydrostatic test

14.1.4.1

A hydrostatic shell test shall be carried out for pressure-containing components in accordance with IEC 60534-4 or ANSI/ISA 75.19.01.

14.1.4.2

The hydrostatic test medium shall be filtered, potable water with a chloride content not exceeding 200 mg/l (200 ppmw), reduced to 50 mg/l (50 ppmw) for austenitic and duplex stainless steels.

14.1.4.3

On completion of hydrostatic testing, valves shall be drained of test fluids.

14.1.5 Seat leakage test

14.1.5.1

Seat leakage tests shall be performed in accordance with IEC 60534-4 or ANSI/FCI 70-2.

14.1.5.2

Seat leakage tests shall be performed on assembled valves with actuators and actuator control components.

14.1.5.3

When water is used for seat leakage testing, the testing medium shall comply with 14.1.4.2.

14.1.5.4

No adjustments shall be made to the actuator, body and bonnet assembly after completion of the seat leakage test.

14.1.6 Packing test

Packing not subjected to fugitive emission testing shall be tested in accordance with IEC 60534-4.

14.1.7 Rated valve travel test

Rated valve travel tests shall be performed with positioners in accordance with IEC 60534-4.

14.1.8 Functional test

14.1.8.1

Functional tests shall be performed on assembled valves with actuator and actuator control equipment.

14.1.8.2

Functional tests shall be performed by stroking the valve from 0 % to 100 % and 100 % to 0 % at least three times under atmospheric conditions for the verification of the following parameters and conditions:

— set pressure for the air filter regulator and air lock relay, as applicable;

— specified power supply applied to the positioner, position transmitters and solenoid valve, as applicable;

— tightening of the packing according to the manufacturer's specifications;

— limit switch setting, if applicable;

— actuator bench set, if applicable;

— position transmitter output, if applicable;

— positioner settings and firmware revisions;

— valve signature, when smart positioner is supplied;

— travel stop, if specified;

— operation of solenoid valve, if specified;

— movement is smooth without any jerking;

— stroke time, if applicable.

14.1.8.3

The following additional requirements for anti-surge valve tests shall be performed:

— fully opening with control override device (solenoid valve);

— fast controlled opening in case of a process disturbance / step response test using the following step changes:

  • [10 %, 20 %, 10 %, 30 %, 10 %, 40 %, 10 %, 50 %, 10 %, 60 %, 10 %, 70 %, 10 %, 80 %, 10 %, 90 %, 10 %] and in reverse order;

  • [10 %, 30 %, 50 %, 70 %, 90 %] and in reverse order;

  • [10 %, 60 %];

  • [0 %, 100 %].

— smooth control when operating on the surge control line / dead band and resolution by performing the small-step test and the response-time test in accordance with EN 60534-9.

14.1.8.4

The fail-safe position shall be checked for air supply and control signal failure.

14.1.8.5

Handwheel operation shall be checked from 0 % to 100 % open and 100 % open to 0 %.

14.1.9 Positive material identification (PMI)

PMI shall be performed on alloy steel, stainless steel, nickel alloy and non-ferrous alloy valves with extent according to Table 13 and acceptance criteria defined in the PMI procedure.

14.1.10 Non-destructive examination

NDE shall be performed in accordance with Annex A.

14.1.11 Leak testing of pneumatic control circuit

The pneumatic control circuit downstream of the supply filter-regulator, inclusive of tubing, fittings, and control accessories, shall pass a leak-test (i.e. no visible leakage at any joint on soap/bubble inspection) at the regulator's operational set pressure using clean, dry air or nitrogen.

14.2 Supplementary testing

14.2.1 Fugitive emission production test

When specified, fugitive emission production tests shall be carried out in accordance with ISO 15848-2 or ANSI/FCI 91-1.

14.2.2 Flow capacity test

When specified, flow capacity tests shall be performed in accordance with IEC 60534-2-3 or ANSI/ISA 75.02.01.

14.2.3 Flow characteristic test

When specified, flow characteristic tests shall be performed in accordance with IEC 60534-2-4 or ANSI/ISA 75.11.01.

14.2.4 Step response test

When specified, step response tests shall be performed using positioners in accordance with IEC 60534-9 or ANSI/ISA 75.25.01.

14.2.5 Stroking time test

When specified, stroking time tests shall be carried out in accordance with IEC 60534-4 and booster/speed control devices set at required set values, if supplied.

NOTE The stroking time is also referred to as travel time.

14.2.6 Low-temperature and cryogenic valves test

14.2.6.1 Seat leakage test

When specified, the seat leakage test for low-temperature and cryogenic valves with class IV or above shall be performed in accordance with Table 14.

Table 14 — Low-temperature/cryogenic seat leakage test

Testing prerequisite and acceptance criteria	Low-temperature/cryogenic seat leakage testing
Test pressure	IEC 60534-4 or ANSI/FCI 70-2
Test temperature	Specified minimum operating temperature or lower [a]
Test gas	Helium gas (97 % pure) for applications with a design temperature colder than -110 °C (-166 °F) [a] Nitrogen for applications with a design temperature equal to or hotter than -110 °C (-166 °F) [a]
Holding time	5 min
Acceptance criteria	IEC 60534-4 or ANSI/FCI 70-2 [a]
[a] Leakage rate has to be corrected for the test temperature and test gas.	

14.2.6.2 Hydrostatic shell and body/bonnet/stem seal leakage test

When specified, a single test for hydrostatic shell and body/bonnet/stem seal leakage shall be performed on low-temperature/cryogenic valves in accordance with Table 15.

Table 15 — Low temperature / cryogenic shell (external leakage) test

Testing prerequisite and acceptance criteria	Low-temperature/cryogenic valves hydrostatic shell and body/bonnet/stem seal leakage	
	Option 1	Option 2
Method	Low-pressure gas test	High-pressure gas test
Test pressure	0,6 MPag (87 psig)	Design pressure
Test temperature	Specified minimum design temperature or lower	Specified minimum design temperature or lower
Test gas	Helium gas (97 % by volume) or helium (3 % by volume) and in accordance with specified minimum design temperature	Helium gas (97 % by volume) or helium (3 % by volume) and in accordance with specified minimum design temperature
Holding time	As per the manufacturer's standard	ISO 28921-1
Leakage testing for stem seal, body/bonnet and body/bonnet extension gasket area	Sniffing probe with spectrometer	Sniffing probe with spectrometer
Acceptance criteria	ISO 15848-2	ISO 28921-1

14.2.6.3 Functional test

14.2.6.3.1

When low-temperature and cryogenic valve seat leakage or shell hydrostatic testing is specified, functional testing shall be performed at the specified lowest operating temperature or lower.

14.2.6.3.2

When specified, the low-temperature and cryogenic valves functional tests shall be performed by stroking the valve from 0 % to 100 % and vice versa at least three times.

15 Surface protection

15.1

Offshore and marine coastal coating systems shall be in accordance with IOGP S-715.

15.2

Onshore and non-marine coating systems shall be selected in accordance with ISO 12944-5.

15.3

Onshore and non-marine coating systems shall be qualified to ISO 12944-6.

15.4

Coating under insulation shall be in accordance with IOGP S-715.

16 Marking, tagging and nameplate

16.1

Tag plates shall be marked with the tag numbers of the valve assemblies, air receivers, positioners, solenoid valves, limit switches and position transmitters.

16.2

Tag plates shall be 316 stainless steel.

16.3

Tag plates shall be affixed with 316 stainless steel rivets, screws or wire.

16.4

Tag plate information shall be stamped or engraved.

16.5

Nameplate markings shall be in accordance with IEC 60534-5:2004, Table 1, with items 19, 23 and 28 mandatory.

17 Preparation for shipment and preservation

17.1

Inside and outside surfaces of valves and threaded surfaces of accessories shall be protected from atmospheric corrosion during shipment and storage.

17.2

Open ports and connections shall be blanked off prior to packaging using covers or plugs made of hard plastic or a metal compatible with the port/flange material.

17.3

The mating surfaces of flanges and weld ends shall be protected from damage during shipment and storage.

17.4

Packing shall prevent moisture, water or foreign matter entering the valve body and components.

17.5

Items that are not installed on the valve shall be packed separately, labelled and tied to the valve.

Annex A
(normative)
Requirements for non-destructive examination (NDE)

A.1

NDE of valves shall be in accordance with Table A.1 for quality levels QSL-1, QSL-2, QSL-3 and QSL-4.

NOTE QSL-1 is the default quality level. QSL-2 to QSL-4 are optional levels specified by the purchaser. Higher QSL levels correspond to more stringent inspection requirements. The inspection requirements vary by type of material product form and valve part being inspected.

A.2

The extent, method and acceptance criteria for the NDE inspection codes used in Table A.1 shall be as specified in Table A.2.

A.3

NDE activities shall be conducted after any specified final heat treatment or post-weld heat treatment.

A.4

NDE of pilot castings for pressure containing and pressure controlling parts shall be according to IOGP S-563.

A.5

NDE personnel shall be qualified to ASNT SNT-TC-1A or ISO 9712, Level 2 or Level 3.

A.6

NDE personnel certification shall be performed by an independent third-party certification body or authorized qualifying body in accordance with the ASNT Central Certification Program (ACCP) or ISO 9712.

A.7

Visual inspection and dimensional check after assembly shall be in accordance with Table 13.

A.8

Production weld inspection shall be in accordance with IOGP S-705 and Annex A.

A.9

Personnel shall have a training record demonstrating competence in the use of the specific PMI tester or ferrite meter used for testing.

Table A.1 — NDE requirements

Part	QSL-1		QSL-2		QSL-3		QSL-4	
	Cast	Forged	Cast	Forged	Cast	Forged	Cast	Forged
Body, bonnet, yoke, gland flange [e]	VT1	VT2	VT1 + RT1 [a, g] + MT1 [g] or VT1 + RT1 [a, g] + PT1 [i]	VT2 + MT1 [g] or VT2 + PT1 [g]	VT1 + RT1 [a] + MT1 [g] or VT1 + RT1 [a] + PT1 [g]	VT2 + UT2 + MT1 [g] or VT2 + UT2 + PT1 [g]	VT1 + RT1 [a, d] + UT1 + MT1 or VT1 + RT1 [a, d] + UT1 + PT1	VT2 + UT2 + MT1 or VT2 + UT2 + PT1
Welding ends (including pipe pup welding ends) [b]	VT1 + RT3 [g] or VT1 + UT4 [g]	VT2 + UT2 [i]	VT1 + RT3 [g] + MT1 [g] or VT1 + RT3 [g] + PT1 [g] or VT1 + UT4 [g] + MT1 [g] or VT1 + UT4 [g] + PT1 [g]	VT2 + UT2 [g] + MT1 [g] or VT2 + UT2 [g] + PT1 [g]	VT1 + RT3 + MT1 or VT1 + RT3 + PT1 or VT1 + UT4 + MT1 or VT1 + UT4 + PT1	VT2 + UT2 + MT1 or VT2 + UT2 + PT1	VT1 + RT3 + MT1 or VT1 + RT3 + PT1 or VT1 + UT4 + MT1 or VT1 + UT4 + PT1	VT2 + UT2 + MT1 or VT2 + UT2 + PT1
Stem [c, e]	N/A	VT2	N/A	VT2	N/A	VT2 + MT1 or VT2 +PT1	N/A	VT2 + UT2 + MT1 or VT2 + UT2 + PT1
Bolting – pressure containing	N/A	VT4 [h]	N/A	VT4 [h]	N/A	VT4 [h]	N/A	VT4 [h] + MT1 or VT4 [h] + PT1
Closing members (except seat rings) [c]	VT1	VT2	VT1	VT2	VT1 + MT1 [g] or VT1 + PT1 [g]	VT2 + MT1 [g] or VT2 + PT1 [g]	VT1 + MT1 or VT1 + PT1	VT2 + MT1 or VT2 + PT1
Seat rings [c, e]	VT1	VT2	VT1	VT2	VT1 + MT1 [g] or VT1 + PT1 [g]	VT2 + MT1 [g] or VT2 + PT1 [g]	VT1 + MT1 or VT1 + PT1	VT2 + MT1 or VT2 + PT1
Corrosion-resistant overlay	VT3 + PT1				VT3 + UT3 [f] + PT1		VT3 + UT3 + PT1	
Seals, gaskets	VT4							

Table A.1 *(continued)*

Part	QSL-1	QSL-2			QSL-3	QSL-4		
	Cast	Forged	Cast	Forged	Cast	Forged	Cast	Forged
Pressure-containing welds	VT3 + RT2 or VT3 + UT3				VT3 + RT2 + MT1 or VT3 + RT2 + PT1 or VT3 + UT3 + MT1 or VT3 + UT3 + PT1			
Fillet and attachment welds to pressure-containing parts	VT3				VT3 + MT1 or VT3 + PT1			
Hard facing	VT4				VT4 + PT1			
Sealing surfaces	VT4				VT4 + MT2 or VT4 + PT2			
Welded on lifting lugs	VT3 + PT1 or VT3 + MT1							
Integrally cast lifting lugs	RT3 or UT4							

NOTE 1 See Table A.2 for specification of the examinations referred to in this table.

NOTE 2 N/A means that the manufacturer is not allowed to use this material form for that specific part.

NOTE 3 All the NDE activities listed above for a specific part and product form or forms shall be conducted. All parts shall be inspected, unless a reduced inspection frequency is specified.

NOTE 4 Qualification and NDE requirements for pilot casting shall be according to IOGP S-563 and the applicable material data sheet in IOGP S-563 as referenced in the material selection Table 3 through Table 11.

Table A.1 *(continued)*

Part	QSL-1	QSL-2	QSL-3	QSL-4				
	Cast	Forged	Cast	Forged	Cast	Forged	Cast	Forged

[a] RT1 may be replaced by UT4 by agreement.

[b] ASME B16.34:2020, section 8.3.1.1 (a) (1).

[c] MT or PT to be performed prior to coating, or overlay.

[d] RT1 plus UT1 may be replaced by RT3.

[e] Requirements for examination of bar material shall be as for forgings.

[f] Machined surfaces only.

[g] 5 % or minimum (QSL-1 and QSL-2) and 10 % or minimum (QSL-3), 1 part per component batch to be examined. If defects outside acceptance criteria are detected, two or more parts shall be tested, and if any of these two fails, all item represented shall be examined.

[h] VT examination shall cover all areas of threads, shanks and heads. Discontinuities shall comply with requirements specified in ASTM F788 for bolts/studs and ASTM F812 for nuts.

Table A.2 — NDE extent, method and acceptance criteria

Examination	NDE	Extent	Method	Acceptance
RT1	RT casting [a]	Areas defined by ASME B16.34 for special class valves, at abrupt changes in sections and at the junctions of risers, gates or feeders to the casting	ASME *BPVC*, Section V, Article 2	ASME *BPVC*, Section VIII, Div. 1, Appendix 7
RT2	RT weldments	100 % where practicable	ASME *BPVC*, Section V, Article 2	ASME *BPVC*, Section VIII, Div. 1, UW-51 for linear indications ASME *BPVC*, Section VIII, Div. 1, Appendix 4 for rounded indications
RT3	RT casting [a]	100 %	ASME *BPVC*, Section V, Article 2	ASME *BPVC*, Section VIII, Div. 1, Appendix 7
UT1	UT casting [a]	Remaining areas not covered by RT1	ASME *BPVC*, Section V, Article 5	ASTM A609/A609M, Table 2, Quality Level 2
UT2	UT forging	All surfaces	ASME *BPVC*, Section V, Article 5	ASME *BPVC*, Section VIII, Div.1, UF-55 for angle beam and ASME B16.34 for straight beam
UT3	UT weldments	100 % of full penetration welds	ASME *BPVC*, Section V, Article 4	ASME *BPVC*, Section VIII, Div. 1, Appendix 12
	UT overlay weld	100 % of overlay weld surface	ASME *BPVC*, Section V, Article 4 (straight beam method)	ASTM A578/A578M, Level C
UT4	UT casting [a]	100 %	ASME *BPVC*, Section V, Article 5	ASTM A609/A609M, Table 2, Quality Level 1
MT1	MT casting [a]	All accessible external and internal surfaces	ASME *BPVC*, Section V, Article 7	ASME *BPVC*, Section VIII, Div. 1, Appendix 7
	MT forgings	All surfaces	ASME *BPVC*, Section V, Article 7	ASME *BPVC*, Section VIII, Div. 1, Appendix 6
	MT welds	100 % of weld surface	ASME *BPVC*, Section V, Article 7	ASME *BPVC*, Section VIII, Div. 1, Appendix 6
	MT bolting surface area	100 % of bolting surface	ASME *BPVC*, Section V, Article 7	ASME *BPVC*, Section VIII, Div. 1, Appendix 6
	MT machined surfaces including weld bevels	100 % of machined surface	ASME *BPVC*, Section V, Article 7	ASME *BPVC*, Section VIII, Div. 1, Appendix 6
MT2	MT sealing surfaces	100 % sealing surfaces	ASME *BPVC*, Section V, Article 7	No indications permitted

Table A.2 *(continued)*

Examination	NDE	Extent	Method	Acceptance
PT1	PT casting [a]	All accessible external and internal surfaces	ASME *BPVC*, Section V, Article 6	ASME *BPVC*, Section VIII, Div. 1, Appendix 7
	PT forgings	All surfaces	ASME *BPVC*, Section V, Article 6	ASME *BPVC*, Section VIII, Div. 1, Appendix 8
	PT welds	100 % of weld surface	ASME *BPVC*, Section V, Article 6	ASME *BPVC*, Section VIII, Div. 1, Appendix 8
	PT weld overlay	Per applicable EDS	Per applicable EDS	Per applicable EDS
	PT bolting surface area	100 % of bolting surface	ASME *BPVC*, Section V, Article 6	ASME *BPVC*, Section VIII, Div. 1, Appendix 8
	PT machined surfaces including weld bevels	100 % of machined surface	ASME *BPVC*, Section V, Article 6	ASME *BPVC*, Section VIII, Div. 1, Appendix 8
PT2	PT sealing surfaces	100 % sealing surfaces	ASME *BPVC*, Section V, Article 6	No indications permitted
VT1	VT castings [a]	Per applicable MDS	Per applicable MDS	Per applicable MDS
VT2	VT forgings	Per applicable MDS	Per applicable MDS	Per applicable MDS
VT3	VT weldments	100 % accessible surfaces	ASME *BPVC*, Section V, Article 9	Undercut not to reduce the thickness in the area (considering both sides) to below the minimum thickness
	VT weld overlay	Per applicable EDS	Per applicable EDS	Per applicable EDS
VT4	Other	100 % accessible surfaces	Per applicable MDS, EDS or material standard	Per applicable MDS, EDS or material standard

NOTE Where the table refers to MDS or EDS, NDE shall comply with the requirements in the applicable MDS or EDS in IOGP S-563 as referenced in the material selection Table 3 through Table 11. Where no MDS or EDS is referenced in the material selection tables, the material standard shall apply without additional requirements.

[a] NDE requirements for pilot casting shall be according to IOGP S-563.

Bibliography

[1] API Specification Q1, *Specification for Quality Management System Requirements for Manufacturing Organizations for the Petroleum and Natural Gas Industry*

[2] API Specification Q2, *Specification for Quality Management System Requirements for Service Supply Organizations for the Petroleum and Natural Gas Industries*

[3] API Recommended Practice 578, *Guidelines for a Material Verification Program (MVP) for New and Existing Assets*

[4] ASTM E415, *Standard Test Method for Analysis of Carbon and Low-Alloy Steel by Spark Atomic Emission Spectrometry*

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

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

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

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

[9] NORSOK M-650, *Qualification of manufacturers of special materials*

Copy for SC Approval

IOGP Headquarters

Level 6, 3 Moorgate Place, London, EC2R 6EA, United Kingdom
T: +44 20 4570 6879
E: reception@iogp.org

IOGP Europe

T: +32 2 882 16 53
E: reception-europe@iogp.org

www.iogp.org