International Association of Oil & Gas Producers

SPECIFICATION

IOGP S-562

December 2024

Version 3.1

Supplementary Specification to API Specification 6D for Ball Valves

JIP33 JOINT INDUSTRY PROGRAMME

Revision history

VERSION	DATE	PURPOSE
3.1	December 2024	Issued for Public Review
3.0	January 2019	Third Edition
2.0	December 2016	Second Edition
1.0	September 2016	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

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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

List of Figures

Introduction

The purpose of the IOGP S-562 specification documents is to define a minimum common set of requirements for the procurement of ball valves in accordance with API Specification 6D, 25th Edition published November 2021 and Addendum 2, published September 2024, for application in the petroleum and natural gas industries.

The IOGP S-562 specification documents follow a common structure (as shown below) comprising a specification, also known as a technical requirements specification (TRS), a procurement data sheet (PDS), an information requirements specification (IRS) and a quality requirements specification (QRS). These four specification documents, together with the purchase order, define the overall technical specification for procurement.

JIP33 Specification for Procurement Documents
Supplementary Technical Requirements Specification (TRS)

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

IOGP S-562: Supplementary Specification to API Specification 6D for Ball Valves

This specification defines technical requirements for the supply of the equipment and is written as an overlay to API 6D, following the API 6D clause structure. Clauses from API 6D not amended by this specification apply as written. Modifications to API 6D defined in this specification are introduced by a description that includes the type of modification (i.e. *Add*, *Replace* or *Delete*) and the position of the modification within the clause.

NOTE Lists, notes, tables, figures, equations, examples and warnings are not counted as paragraphs.

IOGP S-562D: Procurement Data Sheet for Ball Valves (API)

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

IOGP S-562L: Information Requirements for Ball Valves (API)

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

IOGP S-562Q: Quality Requirements for Ball Valves (API)

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

The specification documents follow the editorial format of API 6D and, where appropriate, the drafting principles and rules of ISO/IEC Directives Part 2.

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

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

a) regulatory requirements;

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

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

d) this specification;

e) API 6D.

1 Scope

In first paragraph, replace "axial, ball, check, gate, and plug valves" with

trunnion mounted ball valves

Add after NOTE

This specification applies to manually operated ball valves, i.e., lever, gearbox and, bare shaft (for actuation).

This specification applies to ball valves operating within an allowable temperature range of –50 °F (–46 °C) to 302 °F (150 °C).

Add to section

Requirements related specifically to the following have not been addressed in this specification. Additional requirements or amendments to existing requirements may be needed to purchase valves of these designs/applications:

— any other end connector that does not conform to 5.2.3;

— actuated valves;

— valves with a minimum allowable temperature below –50 °F (–46 °C);

— high-temperature valves with a maximum allowable temperature above 302 °F (150 °C);

— buried valves with stem extensions;

— lined (plastic or rubber) valves;

— internally painted or internally coated valves;

— integral block and bleed valve manifold with two obturators;

— valves in hydrogen (H_2) gas service.

2 Normative References

Add to first paragraph

The following publications are referred to in this specification, the PDS (IOGP S-562D) or the IRS (IOGP S-562L) in such a way that some or all of their content constitutes requirements of these specification documents.

API

Add to section

API Specification 6A, *Specification for Wellhead and Christmas Tree Equipment*

API Standard 607:1993, *Fire Test for Quarter-turn Valves and Valves Equipped with Nonmetallic Seats*

ASME

Add to section

ASME B1.20.1:2013, *Pipe Threads, General Purpose, Inch*

ASME B16.34:2020, *Valves — Flanged, Threaded, and Welding End*

ASME B31.3:2022, *Process Piping*

ASTM

Add to section

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

ASTM A106/A106M, *Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service*

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 A240/240M, *Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications*

ASTM A262, *Standard Practices for Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels*

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

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

ASTM A494/494M, *Standard Specification for Castings, Nickel and Nickel Alloy*

ASTM A516/A516M, *Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service*

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

ASTM A694/A694M, *Standard Specification for Carbon and Alloy Steel Forgings for Pipe Flanges, Fittings, Valves, and Parts for High-Pressure Transmission Service*

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

ASTM A961/A961M, *Standard Specification for Common Requirements for Steel Flanges, Forged Fittings, Valves, and Parts for Piping Applications*

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

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

ASTM B443, *Standard Specification for Nickel-Chromium-Molybdenum-Columbium Alloy and Nickel-Chromium-Molybdenum-Silicon Alloy Plate, Sheet, and Strip*

ASTM B446, *Standard Specification for Nickel-Chromium-Molybdenum-Columbium Alloy, Nickel-Chromium-Molybdenum-Silicon Alloy, and Nickel-Chromium-Molybdenum-Tungsten Alloy 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 D4894, *Standard Specification for Polytetrafluoroethylene (PTFE) Granular Molding and Ram Extrusion Materials*

ASTM D4895, *Standard Specification for Polytetrafluoroethylene (PTFE) Resin Produced From Dispersion*

ASTM F2168:2013, *Standard Specification for Packing Material, Graphitic, Corrugated Ribbon or Textured Tape, and Die-Formed Ring*

ASTM F2191/F2191M:2013, *Standard Specification for Packing Material, Graphitic or Carbon Braided Yarn*

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*

Add new AWS section

AWS

AWS A4.2M/A4.2, *Standard Procedures for Calibrating Magnetic Instruments to Measure Delta Ferrite Content of Austenitic and Duplex Ferritic-Austenitic Stainless Steel Weld Metal*

Add new EN section

EN

EN 14772:2005, *Flanges and their joints – Quality assurance inspection and testing of gaskets in accordance with the series of standards EN 1514 and EN 12560*

Add new FSA section

FSA

FSA-G-604-07, *Oxidation Test Standard for Flexible Graphite Gasket Materials*

Add new IEC section

IEC

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

Add new IOGP section

IOGP

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 Surface Preparation and Protective Coatings*

ISO

Add to section

ISO 5211, *Industrial Valves – Part-turn actuator attachments*

ISO 8249, *Welding – Determination of Ferrite Number (FN) in austenitic and duplex ferritic-austenitic Cr-Ni stainless steel weld metals*

ISO 17781, *Petroleum, petrochemical and natural gas industries - Test methods for quality control of microstructure of ferritic/austenitic (duplex) stainless steels*

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

MSS

Add to section

MSS SP-9, *Spot Facing for Bronze, Iron, and Steel Flanges*

MSS SP-101, *Part-Turn Valve Actuator Attachment - FA Flange and Driving Component Dimensions and Performance Characteristics*

3 Terms, Definitions, Acronyms, Abbreviations, Symbols, and Units

3.1 Terms and Definitions

3.1.17
drive train

Replace definition with

All parts of the valve drive from the operator to and including the closure member connection, couplings, connectors and bolted flanges that transmit or react to loads.

Add new term 3.1.55

3.1.55
bolted valve joint
Valve joint with bolted bonnet, cover or body as defined in ASME B16.34:2020, 6.4.

Add new term 3.1.56

3.1.56
component batch
Quantity of components of the same design, material, size and rating, from a single production lot, manufactured in one location.

Add new term 3.1.57

3.1.57
corrosion allowance
Additional thickness to be added to the minimum required thickness determined in accordance with the selected standard to account for loss of material due to corrosion.

Add new term 3.1.58

3.1.58
injection point
A device that enables injection of cleaning agent, lubricant or sealant to the ball and seat sealing surface or to the stem sealing area.

Add new term 3.1.59

3.1.59
lagging
Material used for heat insulation.

Add new term 3.1.60

3.1.60
maximum required operating torque
The maximum torque required to operate the valve in all cases including (but not limited to) when differential pressure equals MAWP and breakaway torque at the full temperature range for valve design.

Add new term 3.1.61

3.1.61
pressure-containing weld
Welding of pressure-containing parts rated to valve MAWP.

Add new term 3.1.62

3.1.62
soft-seat insert
Nonmetallic ring insert that is the primary seat sealing element.

Add new term 3.1.63

3.1.63
special tools
Non-standard tools designed by the manufacturer to perform a specific activity.

Add new term 3.1.64

3.1.64
valve batch
Quantity of valves of the same design, material, size and rating, from a single purchase order, manufactured in one location.

3.2 Acronyms and Abbreviations

Add to section

CA	corrosion allowance
CS	carbon steel
DIB-1	double isolation and bleed (both seats bidirectional - DPE) valves
DIB-2	double isolation and bleed (one seat unidirectional and one seat bidirectional) valves
DSS	duplex stainless steel
EDS	element datasheet
ENP	electroless nickel plating
FEA	finite element analysis
FKM	fluorocarbon terpolymer
HNBR	hydrogenated nitrile butadiene rubber
LT	low temperature
LTCS	low temperature carbon steel
MDS	material datasheet
NTCS	normal temperature carbon steel
PC	pressure-containing parts (as defined by 3.1.35)
PCTFE	polychlorotrifluoroethylene
PEEK	polyetheretherketone
PR	pressure-controlling parts (as defined by 3.1.36)
PTFE	polytetrafluoroethylene
PW	process-wetted parts (as defined by 3.1.35 excluding PC and PR)
RF	raised face
RPTFE	reinforced polytetrafluoroethylene
RTJ	ring type joint

SDSS super duplex stainless steel

SS stainless steel

SWG spiral wound gasket

TCC tungsten carbide coating

UNS unified numbering system (alloys)

US United States (of America)

3.3 Symbols and Units

Add to section

Ra roughness average

4 Application, Configuration, and Performance

4.1 Valve Types

4.1.3 Ball Valves

Add to section

The valve closure member shall have a cylindrical port.

4.2 Conformance and General Performance Requirements

Add after first paragraph

The quality management system shall comply with IOGP S-562Q.

4.4 Valve Bore

4.4.3 Reduced-opening Valves with a Circular Opening

Add new list item e)

e) valve sizes less than NPS 4 (DN 100): one size below nominal size of valve with bore in accordance with Table 1, except for NPS 3 (DN 80) where two sizes below nominal size of valve are permitted;

Add new list item f)

f) valve sizes greater than NPS 24 (DN 600): maximum of three sizes below nominal size of valve with bore in accordance with Table 1.

Add new section

4.6 General

When applicable, lagging extension lengths required for insulation shall be specified.

NOTE 1 For suggested lagging extension lengths, see L.30.

Valves shall be bidirectional (see 3.1.3).

Seats shall be of unidirectional self-relieving type (SPE), unless DIB-1 or DIB-2 is specified.

The valve shall withstand the pressure applied on both ends of the valve simultaneously (i.e., with no pressure into the body cavity) without damage.

Valves sizes below NPS 2 (DN 50) shall function in any orientation.

Valve sizes NPS 2 (DN 50) and above shall function when installed in any of the following orientations (see Figure 6):

— horizontal position (horizontal flow bore, with vertical upright valve stem);

— horizontal position (horizontal flow bore, with horizontal valve stem);

— vertical position (vertical flow bore, with horizontal stem);

— any inclined position with stem orientation between horizontal and vertical upright.

NOTE 3 See K.18 for specific valve orientations.

Add new Figure 6

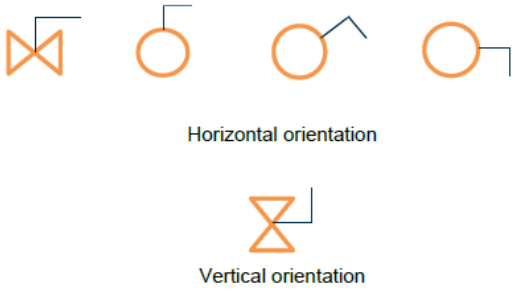

Figure 6—Valve Orientation

Valve bolted connections (e.g., end connectors, bonnets) shall not require special tools for disassembly.

The manufacturer shall inform the purchaser when special tools are required for disassembly or maintenance, in accordance with L.22.

For spring-loaded seat design, the gap between the seat ring and the body shall be protected against debris accumulation (e.g., with an anti-debris lip) to ensure that seat dynamics and seal performance are not impaired.

5 Design

5.1 General

5.1.1 Design Standards and Calculations

Replace first paragraph with

Design and calculations for pressure-containing parts and pressure-boundary bolting sizing shall be in accordance with ASME B16.34, ASME BPVC, Section VIII, Division 1 or ASME BPVC, Section VIII, Division 2.

Add new section

5.1.1.1 Valves Designed to ASME B16.34

Valves designed to ASME B16.34 shall meet the requirements of this section.

Except for inner ligaments and body transition parts, if a corrosion allowance of 0.12 in. (3 mm) or less is specified, wall thicknesses shall be in accordance with ASME B16.34.

Except for inner ligaments and body transition parts, if a corrosion allowance greater than 0.12 in. (3 mm) is specified, wall thicknesses shall be in accordance with ASME B16.34, plus the difference between the specified corrosion allowance and 0.12 in. (3 mm).

Minimum wall thickness of ligament section about axial holes in the central core section of a two or three-piece split body shall be calculated in accordance with ASME B16.34:2020, 6.1.2 and 6.1.3.

Wall thickness of inner ligaments shall be in accordance with ASME B16.34 plus the specified corrosion allowance.

Wall thickness of the transition from the flow passage to the central core section (e.g. for cast top entry body designs or some two-piece cast body designs) shall be in accordance with ASME B16.34 plus the specified corrosion allowance.

If a corrosion allowance is greater than 0.12 in. (3 mm), the wall thickness calculation shall be based on the inside diameter (ID) plus twice the difference between the specified corrosion allowance (CA) and 0.12 in. (3 mm) (i.e., ID + 2(CA - 0.12 in. (3 mm))).

Add new section

5.1.1.2 Valves Designed to ASME BPVC, Section VIII, Division 1 or ASME BPVC, Section VIII, Division 2

Valves designed to ASME BPVC, Section VIII, Division1 or ASME BPVC, Section VIII, Division 2 shall meet the requirements of this section.

Wall thickness calculations of the valve body shall be in accordance with ASME BPVC, Section VIII, Division 1 or by finite element analysis in accordance with ASME BPVC, Section VIII, Division 2.

The inner ligaments wall thickness shall prevent permanent deformation or loss of pressure containment due to body dilation in the corroded condition.

If a corrosion allowance is not specified for a valve made of non-corrosion-resistant material, the wall thickness calculation shall be based on a 0.12 in. (3 mm) corrosion allowance.

The thickness of the inner ligaments shall be the calculated thickness of the inner ligaments, plus the corrosion allowance.

The wall thickness calculation shall be based on the inside diameter plus twice the specified corrosion allowance.

Bolting shall comply with either of the following:

— ASME BPVC, Section VIII, Division 1 rules and stresses excluding bending and axial pipe loads;

— ASME BPVC, Section VIII, Division 2 rules including bending and axial pipe loads.

If ASME BPVC, Section VIII, Division 1 rules and stresses are used for bolting design, the allowable stress value shall not exceed 20 KSI (138 MPa).

If ASME BPVC, Section VIII, Division 1 rules and stresses are used for bolting design, gasket factors shall be used for primary, secondary and fire-safe seals.

The valve design shall incorporate external load cases in accordance with Annex O.

The valve design shall be verified by finite element analysis for consideration of allowable design stresses, deformations and integrity of sealing areas as a result of the piping loads specified.

The external load analysis of valves shall include the MAWP at ambient and maximum design temperatures.

5.1.3 Pressure-controlling Parts

Add after second paragraph

Valve shall be supplied with a pressure balance hole only if specified.

Add to section

When a balance hole is specified, the minimum diameter of the hole shall be 0.25 in. (6 mm) for valve sizes NPS 8 (DN 200) and smaller.

When a balance hole is specified, the minimum diameter of the hole shall be 0.31 in. (8 mm) for valve sizes above NPS 8 (DN 200).

NOTE See L.23 for additional requirements on the pressure balance hole.

When a balance hole is specified, the balance hole shall be positioned adjacent to the stem and top trunnion of the ball.

The operator shall be sized without considering the balance hole.

5.1.4 Bolted Joint Design

Add after first paragraph

Bolting lubricant for bolting preload torque calculations shall have the same coefficient of friction on the threads and nut face as the one used in production.

Add to section

Pressure-containing bolted valve joints shall be secured by stud and nut bolting, except that the bonnet cover or gland plate may be secured by cap screws.

NOTE 2 See K.25 for cases where cap screws may be permitted.

Pressure-containing bolted valve joints shall have at least four bolts in any flange.

Pressure-containing bolted valve joints shall not use bolt sizes less than ⅜ in. (10 mm).

The bolting preload shall not be less than the calculated bolt load required to seal under hydrostatic test conditions.

Body joints bolting preload shall be verified after successful completion of body pressure testing.

5.2 Dimensions

5.2.1 Standard Face-to-face and End-to-end Dimensions

Add to section

Short pattern dimensions shall only be used when specified.

5.2.3 End Connectors

5.2.3.1 Flanged Connectors

5.2.3.1.1 General

Add to section

Bolting bearing surfaces shall be spot faced or back faced in accordance with MSS SP-9.

At least two threads shall protrude above the nut without contacting valve body parts or bolting.

The valve flanged ends shall be integral with the valve body or end closure forging or casting.

Welding on flanges shall not be permitted.

5.2.3.2 Weld End Connectors

Replace first paragraph with

Weld-end dimensions shall conform to ASME B16.25 if no other dimensions or design code are specified.

Add to section

Valves shall be suitable for welding to pipes based on the details specified for the mating pipe.

The maximum allowable valve body temperature during welding and post-weld heat treatment shall be provided.

Valves with weld end connectors shall be provided with pipe pup/transition piece when specified.

NOTE 4 See L.32 for requirements for pipe pup/transition pieces.

5.3 Drive Train

5.3.2 Torque/Thrust

Add to section

The drive train shall not experience permanent deformation and stress beyond the yield point at the maximum specified operator output torque for the full range of design temperatures.

5.3.3 Allowable Stress

Add to section

The load transmission calculation shall state how the load is shared (if applicable) between friction and other means (e.g., dowels).

Add new section

5.3.6 Drive Train Design and Verification

5.3.6.1 Valve Stem, Actuator Drive Adapter, and Other Cylindrical Parts Under Torsional Loads, Driven by Keys or Splines

For keyed couplings in the drive train, the torsional design of stem shall be based on the stem cross-sectional area excluding the area of the keyed slot.

For keyed couplings in the drive train, the stem design shall withstand the bearing stress at the interface with the key.

For keyed couplings in the drive train, the key design shall account for the shear stress due to the design torque (see 5.3.2) applied at the interface between the key and the stem.

For keyed couplings in the drive train, the key design shall account for bearing stress at the interface with the stem and with the total transmitted force applied to half of the longitudinal section of the key.

Splined shaft design shall be based on calculated torsional stress of the minimum cross-sectional area.

5.3.6.2 Valve Bonnet/Top Plate to Body Design

If bolting is intended to resist the torque reaction of the actuator in addition to providing a pressure containment function, bolt stress shall produce a clamping load required to hold (without movement) the top plate/bonnet in position without relative movement.

NOTE This is to ensure that the drive train bolts are working with axial load and not shear.

The torque transmission design shall be based on a coefficient of friction no greater than 0.2 between the flanges, with the torque reaction acting on the bolt circle.

The torque transmission design shall account for the friction forces between flanges due to the bolt preload, reduced by ejection force due to internal pressure.

If dowels are present, the torque transmission design shall account for the dowels contribution to the torque transmission in addition to the friction between flanges.

If dowels are present, the dowel design shall account for shear and bearing stress resulting from the design torque, in accordance with 5.3.2.

If dowels are present, the dowels housing design shall account for bearing stress.

5.4 Operations

5.4.1 Method of Operation

Add after first paragraph

The valve wrench (lever) or gearbox shall be designed and sized to operate against the MAWP.

5.4.2 Wrenches (Levers) and Hand-wheels

5.4.2.1 Torque or Thrust

Add to section

The maximum force for seating, unseating and operating shall be evaluated for the complete range of operating temperatures.

5.4.2.2 Size

Replace second paragraph with

The wrench (lever) length shall not exceed 24 in. (610 mm) or twice the face-to-face or end-to-end dimension of the valve, whichever is less.

Replace first sentence of fourth paragraph with

The handwheel diameter shall not exceed 32 in. (800 mm) or the face-to-face/end-to-end dimension of the valve, whichever is less.

Add new section

5.4.2.3 General

The nut for the wrench (lever) or handwheel shall have a secondary locking feature (e.g., additional nut or retention pin).

Wrenches (levers) and handwheels shall be manufactured from the material as specified in the PDS.

Wrenches (levers) and handwheels shall be free from burrs and sharp edges.

5.4.3 Position Indicators

5.4.3.1 General

Add to section

The gearbox position indicator shall be directly connected to the actual stem or port position.

The gearbox position indicator shall be legible after coating and not visually obstructed by other valve components.

The gearbox attachment to the valve shall be provided with means (e.g., guide pin) to assure re-assembly to the exact same position indicated by the position indicator.

5.4.4 Travel Stops

Add to section

Valves operated with a gearbox shall have a travel stop on the gearbox (i.e. not on the valve).

Replace section 5.4.5 title with

5.4.5 Operators, Gearboxes, and Stem Extensions

5.4.5.1 General

Add to section

Mechanical means (e.g. dowel pin) shall be used to assure the proper assembly of operators and stem extension assemblies in the required location.

5.4.5.3 Overpressure Protection

Add to section

The relief device for overpressure of gearbox shall be made from a corrosion-resistant material.

Add new section

5.4.5.5 Gearbox Requirements

Gearboxes shall have a protection class of IEC 60529 IP65.

NOTE See L.31 for alternative protection classes for the gearbox.

Gearboxes shall be equipped with injection fittings and a weatherproof vent connection, to enable lubrication of rotating parts.

External shafts shall be manufactured from a corrosion-resistant material.

Gearbox components shall be lubricated such that all moving parts are covered by lubricant.

The operating temperature for the gearbox, if not specified, shall be between -4 °F and 176 °F (-20 °C and 80 °C).

The assembly of gearboxes shall only have two orientations, 180° apart.

Gearboxes shall be a self-locking design that holds position (e.g., worm and wheel design).

The output of the gearbox, at an input torque given by a force equal to 1.5 times 80 lbf (360 N) and applied at the rim of the handwheel, shall not produce stresses that exceed the stress limits of the drive train specified in 5.3.3.

The dimensions of the gearbox flange shall be in accordance with ISO 5211 or MSS SP-101.

Body/bonnet closure bolting shall not be used to directly mount a gearbox to the valve.

Valves with ball bore sizes equal to or greater than those specified in Table 14 shall have gearboxes fitted.

If the force or dimensional limitations are exceeded on directly installed levers or handwheels, the valve shall be provided with a gearbox.

The dimensions of the gearbox shall not exceed the limitations specified for handwheels (see 5.4.2.2).

If the number of handwheel turns exceeds 100 from the fully open position to the fully closed position, the number of handwheel turns shall be specified on the quotation.

Add new Table 14

Table 14—Minimum Bore Sizes at which a Gearbox is Required

Class	Ball Bore Size	
	NPS	DN
150	≥ 6	≥ 150
300	≥ 6	≥ 150
600	≥ 6	≥ 150
900	≥ 4	≥ 100
1500	≥ 3	≥ 80
2500	≥ 2	≥ 50

5.5 Cavity Relief

Add to section

With the exception of DIB-1 valves, valve cavity pressure relief shall be achieved by self-relieving seat rings that internally relieve excess pressure from the valve cavity.

When cavity relief is specified for valves with DIB-1 functionality, the cavity relief feature shall be approved.

5.6 Body Penetrations

5.6.1 Vents and Drains

Add after first paragraph

Valves with bore sizes NPS 4 (DN 100) and larger shall have a vent and a drain except when specified in conformance with M.3.2.

Add new section

5.6.1.1 Drain and Vent Standard Connections

When orientation is not specified, the vent and drain connections shall be positioned for the body in the horizontal and stem in the vertical.

When installation orientation is specified, the drain connection shall be at the lowest possible position on the valve body cavity of the specified orientation.

When installation orientation is specified, the vent connection shall be at the highest possible position on the valve body cavity of the specified orientation.

Plugs and fittings shall have a MAWP that is not less than the valve rated pressure.

Plugs and fittings shall withstand the valve hydrostatic shell test pressure.

Plugs, fittings and blinds shall have dimensions in accordance with a recognized industry standard.

Wall thickness of connection areas shall be in accordance with ASME B16.34.

On a corrosion-resistant alloy (CRA) clad valve where drain ports breach the CRA layer, the drain and vent ports shall be fitted with a welded nickel-based alloy insert that has an integral shoulder on the valve cavity side to prevent blowout in case of attachment weld failure.

NOTE See K.20 for alternate vent and drain port designs of CRA clad valves.

Welds of the nickel-based alloy insert for vent and drain ports of CRA clad valve shall be pressure-containing welds in accordance with ASME BPVC, Section VIII, Division 1 or ASME BPVC, Section VIII, Division 2.

If PWHT is required on the seal weld, seal welding of threaded connections shall not be permitted.

Parallel threaded plugs shall have an external cylindrical surface to accept a seal weld.

Add new section

5.6.1.2 NPT Tolerance and Torque Control

PTFE tape shall not be used on threaded connections.

NPT connections hand-tight engagement shall be as per ASME B1.20.1:2013, Table 2.

Final torques shall meet the approved documented torques using a calibrated torque wrench.

Thread sealant shall be free of ingredients that cause corrosion for the plug and housing materials.

Add new section

5.6.1.3 Seal Welds

Sealant shall be removed prior to seal welding.

Seal welding of threaded plugs shall be considered a pressure-containing weld.

Seal welding of threaded plugs shall consist of not less than two passes with rotating starts and stops.

Seal welding shall have a welding dimension not less than Cx in accordance with ASME B31.3:2022, Figure 328.5.2C.

Seal welding qualification shall be in accordance with ASME B31.3 for an equally sized socket weld.

NDE for seal welds shall comply with the QSL2 requirements.

Add new section

5.6.1.4 Locking Ring

The locking ring shall lock the plug to prevent loosening.

Locking ring shall be secured to the valve body.

Locking ring removal shall be possible without loosening the plug.

5.6.2 Injection Points

Replace first sentence with

When specified, injection fittings shall be provided.

In first list section, replace "Seat injection points" with

Seat and stem/shaft injection points

Add new NOTE after first list section

NOTE 1 See K.21 for alternative stem/shaft injection point arrangements (e.g., when gland thickness is not enough for housing of independent non-return valve).

In second list section, replace "protective cap/plug" with

protective threaded cap/plug

Replace third list section with

— Stem/shaft injection point shall be located above the primary sealing barrier.

Add new list sections after third list section

— Graphite fire safe seal shall not be considered as a primary sealing barrier.

— Valves supplied with stem sealing lip seal, the seal shall be of anti-collapse design so that the injection of sealant does not compromise the integrity of the lip seal.

Add new list sections after fifth list section

— Injection fitting internals shall be fully contained in the fitting body with anti blow-out design.

— Injection fitting spring shall not exceed yield stress at its fully compressed state.

Add new list sections

— Non-return valves shall be metal-seated and contain a tungsten carbide ball with a UNS N06625 spring.

NOTE 2 The purchaser may specify other materials in conformance with K.21.

— Minimum wall thickness of connection areas shall be in accordance with ASME B16.34

— Injection points shall be capable of withstanding the valve hydrostatic shell test pressure.

— The MAWP of injection fittings shall be provided.

— Injection points shall be designed and tested in compliance with ASME BPVC, Section VIII or API 6A.

— A minimum of two injection fittings per seat, equally spaced around the perimeter starting from the horizontal axis, shall be provided for valve sizes NPS 16 (DN 400) and larger.

5.7 Stem Retention

Add to section

Stem retention shall be achieved by an integral stem shoulder.

5.8 Antistatic

Add to section

Graphite seals shall not be considered to offer electrical continuity.

5.9 Lifting

Add after second paragraph

The mandatory safe lifting points and SWL of individual lifting lugs shall be marked on the valve.

The total weight of the valve shall include the manual operator (e.g., a gearbox with a handwheel or lever) and accompanying valve accessories.

Add to section

Permanent lifting points shall be provided for valves of NPS 8 (DN 200) and above.

Permanent lifting points shall be provided for valves weighing more than 550 lbs (250 kg).

Acceptable designs of lifting points shall be as follows:

— forged lifting lug welded to valve body/bonnet;

— integral forged/cast lifting lug;

— single piece plate lifting lug connected to at least two pressure retaining bolts;

— lifting eye bolt threaded into valve body/bonnet.

Lifting instructions for the valve shall not utilize lifting points on the gearbox.

When the valve orientation is not specified, lifting point position design shall be based on the valve being lifted in the stem upright position.

When the valve orientation is specified, lifting point position design shall be based on the valve being lifted in the stem upright position and the valve being lifted in the specified valve orientation.

Lifting points shall not be manufactured from cast iron or ductile iron material.

Selection of lifting point material shall prevent galvanic corrosion.

Coating of lifting points shall not be a means to prevent galvanic corrosion.

Add new section

5.11 Pigging

When piggability is specified, the specified bore shall continue throughout the entire valve (i.e., the valve, the transition piece and the pipe pup).

NOTE See K.22 for other bore options with smooth transition, to avoid purchasing a bespoke valve where a standard valve can be used.

Snagging areas between the seat and ball shall be prevented.

Debris collection between the seats and the ball shall be prevented.

Vertical ball movement shall be prevented to avoid damage to the seat inserts.

Seats shall withstand a dragging force that does not displace the seat and associated parts by spring compression.

Add new section

5.12 Stem Design

Stem design shall prevent galling by the use of a stem bearing.

The stem shall be constructed from one piece of wrought material.

Stem sections shall be cylindrical, within a tolerance of 0.002 in. (0.05 mm).

The stem shall be straight over its end-to-end length, within a tolerance of 0.012 in./ft (1 mm/m).

The stem sealing area shall have a surface finish, Ra, less than or equal to 32 µin. (0.8 µm).

The stem sealing area shall be free from any defects.

The stem sealing area with polymer (other than lip-seal or V-packing) or elastomer materials shall have a surface finish, Ra, less than or equal to 16 µin. (0.40 µm).

The stem surface area in contact with graphite packing shall have a surface finish, Ra, less than or equal to 32 µin. (0.80 µm).

The stem shall be supported and have a clearance gap to avoid rubbing contact with the adjacent static metallic components (e.g. bonnet, gland ring).

The clearance gap between the stem and the adjacent static metallic components shall be sized for the side loads.

Add new section

5.13 Securing of Internal Valve Parts

Internal valve parts that are removable and at risk of being lost through the valve bore shall be secured against loosening.

Press fit assemblies and spring tension pins shall not be used for locking of internal valve components.

Add new section

5.14 Soft-Seat Insert Design

If not specified, the soft-seat materials used shall be in accordance with Table 15.

Add new Table 15

Table 15—Soft-Seats

Class	Type
150	RPTFE / PCTFE
300	RPTFE / PCTFE
600	RPTFE / PEEK / PCTFE
900	PEEK / PCTFE
1500	PEEK / PCTFE
2500	PEEK

Soft-seat material and design shall be compatible with the MAWP for the specified temperature range.

If the temperature is not specified, soft-seat materials shall be fully operable for the MAWP at a temperature up to 302 °F (150 °C).

Alternative soft-seat materials shall be proposed if the materials in Table 15 are inadequate for the MAWP or not chemically compatible with the process fluids at the specified temperature range.

Add new section

5.15 Sealing Rings

5.15.1 Elastomers

Elastomer O-rings shall be fully operable at the valve design rated pressure for specified temperature range of the valve and their use limited to temperatures including and above of –20 °F (–29 °C).

NOTE See K.23 for acceptable use of elastomeric O-rings at temperatures below –20 °F (–29 °C).

The elastomer O-ring material grade shall be specified.

For valves Class 600 and above, the size of the O-ring section for elastomers shall be qualified for resistance to rapid gas decompression (RGD) at the MAWP or above.

Elastomeric seal rings shall be fully contained.

5.15.2 Lip seals and V-packing seals

Lip seals or V-packing (chevron) seals shall be used if no elastomeric materials are compatible for the specified valve temperature range and service.

Lip seals and V-packing (chevron) seals shall only be used on metallic surfaces of corrosion-resistant material or with a corrosion-resistant overlay.

Polymers in lip seals shall be reinforced PTFE (RPTFE).

Lip seals shall have an anti-collapse design incorporating a support ring made from RPTFE, PEEK or metal designed for a backpressure equal to the MAWP.

Lip seals with an anti collapse ring made from RPTFE shall not be permitted for valves Class 600 and above.

Springs and metal support rings used in lip seals shall be constructed from UNS N06625, R30003 or R30035.

Metallic surface areas in contact with lip seals shall have a surface finish in accordance with the seal manufacturer's recommendation and not to exceed 8 µin. (0.20 µm).

Lip seals arrangement shall not have two face-to-face lip seals with the open ends facing each other.

Design using lip seals with open ends oriented in opposite directions (see example in Figure 7) shall only be proposed if previously validated by successfully performing tests in accordance with L.11.

Add new Figure 7

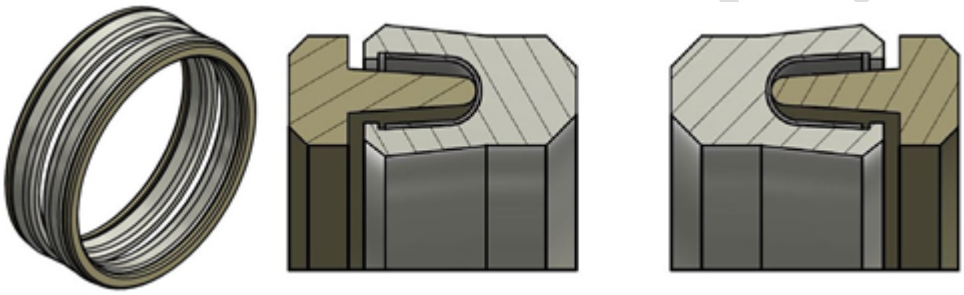

Figure 7—Lip Seals, Back-to-back Configuration

5.15.3 Seals in Vacuum Conditions

Valves with nonmetallic (soft) seals shall withstand vacuum drying at pressures of 0.07 psia (500 Pa).

Valves with nonmetallic (soft) seals shall withstand vacuum drying during maintenance at pressures down to 0.001 psia (10 Pa).

Add new section

5.16 Stem Seals, Stuffing Box, and Gland

Seals surfaces shall have a surface finish in accordance with the seal OEM recommendations.

Stem primary seals shall be self-energizing.

Stem seal arrangements consisting of only a single O-ring or lip seal shall not be permitted for valves Class 600 and above.

Graphite fire-safe seals shall not be considered as a secondary seal in the stem seal arrangement.

Add new section

5.17 O-ring Housing Design

For seals with toroidal sealing rings (O-rings), the groove design dimensions shall be based on achieving a groove filling ranging from 75 % to 85 % unless supported by approved RGD testing.

NOTE ISO 23936-2 recommends a groove filling range of 80 % to 85 % to allow for an effective resistance to rapid gas decompression.

The radial sealing housing design of elastomeric O-rings shall use thermoplastic back-up rings on the two sides for valves at pressure of Class 900 and above.

Thermoplastics in elastomeric O-ring back-up rings shall be PEEK or reinforced PTFE.

Add new section

5.18 Fire Testing

Valves shall be qualified by fire testing in accordance with L.27, unless otherwise specified.

Add new section

5.19 Finite Element Analysis (FEA)

For metal-seated valves, FEA of the ball to seat interface and seat to body interface with full differential pressure applied shall be performed for valves in Table 16.

FEA shall be performed using an elastic-plastic analysis to satisfy the service criteria described in ASME BPVC, Section VIII, Division 2.

NOTE ASME BPVC, Section VIII, Division 2 service criteria require verification for operability, functionality, and integrity of the valve at the operating pressure and temperature range.

Add new Table 16

Table 16—Metal-Seated Valves That Require FEA

Class	Valve Size	
	NPS	DN
150	≥ 20	≥ 500
300	≥ 20	≥ 500
600	≥ 20	≥ 500
900	≥ 20	≥ 500
1500	≥ 16	≥ 400
2500	≥ 12	≥ 300

Add new section

5.20 Locking Provision

Manually operated isolation valves shall have brackets or locking plates to lock the valve in the open or closed position using padlocks.

NOTE Padlocks provided by others.

6 Materials

6.1 Metallic Requirements

6.1.1 General

Add to section

Materials for valves and valve parts shall comply with IOGP S-563.

Where there is no MDS or EDS in IOGP S-563, the material shall comply to the material standard specification.

Stem, sliding elements and threaded components shall have hardness differences between contacting surfaces or surface treatment to prevent galling.

NOTE 3 Required differential hardness to prevent galling varies depending on materials. 50 HBW hardness differential is considered as a general recommended practice.

6.2 Nonmetallic Requirements

Replace second paragraph with

Elastomeric materials for valves at pressures of Class 600 and above shall be resistant to rapid gas decompression (RGD) in accordance with L.6.

6.5 Impact Test

Replace seventh paragraph with

Impact test results for full-size specimens shall meet the most stringent requirements (i.e., highest energy and lowest test temperature) of the following:

— MDS and Table 4;

— MDS and Table 5.

6.6 Sour Service

Add new NOTE 2

NOTE 2 See L.33 for the requirement when ANSI/NACE MR0103/ISO 17945 is specified.

6.7 Body Penetrations

Replace section with

Material requirements for drain, vent, injection and auxiliary connections shall meet the requirements of this section.

Welded plugs material, fittings material and the valve body material shall have the same P-No, in accordance with ASME BPVC, Section II, Part D.

The material of non-welded removable plugs and fittings shall be equal to that of the valve trim material.

If the trim material has an inferior corrosion-resistance grade to 316 stainless steel, non-welded removable plugs and fittings shall be 316 stainless steel.

NOTE To prevent galling between austenitic or duplex/super duplex plug and body materials, the threaded portion of the plug may be silver plated in accordance with SAE AMS 2410.

The drain/vent auxiliary blind flange shall be made of a forging material equivalent (the same B16.34 material group) to the body material.

Austenitic stainless-steel gaskets (spiral wound or ring joint) shall pass an intergranular corrosion test in accordance with ASTM A262, Practice E.

Spiral wound gaskets with filler materials shall be in accordance with 6.12 for expanded graphite.

Spiral wound gaskets with filler materials shall be in accordance with ASTM D4894 or ASTM D4895 for PTFE.

Gasket materials shall be in accordance with Table 17.

Add new Table 17

Table 17—Gasket Materials for Drain, Vent, Injection, and Auxiliary Connections

Body Material	**NTCS**		**LTCS**			**SS 316**	**DSS**	**SDSS**		**Alloy 625**
Trim Material	**ENP Trim**	**SS Trim**	**ENP Trim**	**SS Trim**	**Cladded**					
Service	**Sweet**	**Sour**	**Sour**	**Sour**	**Sour**	**Sour**	**Sour**	**Sour**	**Seawater [a]**	**Sour**
RF	SWG 316 + graphite	SWG 316 + graphite	SWG 316 + graphite	SWG 316 + graphite	SWG 625 + graphite	SWG 316 + graphite	SWG DSS + graphite	SWG SDSS + graphite	SWG SDSS + PTFE	SWG 625 + graphite
RTJ	Octagonal Soft Iron	Octagonal Soft Iron	Octagonal Soft Iron	Octagonal Soft Iron	Octagonal Alloy 625	Octagonal SS 316	Octagonal DSS	Octagonal SDSS	Octagonal SDSS	Octagonal Alloy 625

[a] When fire safe gaskets are required in sea water service, RTJ gaskets shall be used.

Parallel threaded plugs shall have a primary seal (i.e., an elastomeric O-ring or a thermoplastic lip seal inboard of the thread) to protect the thread against crevice corrosion.

The primary inboard seal and the main valve static primary seal material on parallel threaded plugs shall have the same service compatibility.

The axial seal connection between the parallel threaded plug and the body shall provide a fire-safe graphite seal outboard of the thread.

When a metallic seal ring is used on a parallel threaded plug, the seal material shall be grade 316 stainless steel.

The parallel threaded plug locking ring material and body securing parts materials shall be grade 316 stainless steel.

Add new section

6.9 Valves Manufactured from Bar Material

Valve parts manufactured from bar material shall be in accordance with ASTM A961.

Hollow cylindrically shaped pressure-containing parts shall only be manufactured from hot rolled, hot rolled and cold finished or forged round bar if permitted by the material standards of the final form.

The body to integral flange transition radius shall be at least 0.4 in. (10 mm) when bar material is used.

Add new section

6.10 Graphite Materials

Flexible graphite and die-formed rings shall be in accordance with ASTM F2168 with supplementary requirements S3, S6.1, S6.2 and S10.

Braided yarn shall be in accordance with ASTM F2191/F2191M with supplementary requirements S6.1 and S10.

Active (sacrificial) corrosion inhibition using zinc shall not be permitted.

The chlorine content shall not exceed 50 ppm.

The fluorine content shall not exceed 10 ppm.

The halogen content shall not exceed 310 ppm.

Graphite oxidation testing shall be performed in accordance with EN 14772:2005, 6.7 or FSA-G-604-07.

The accumulated weight loss during graphite oxidation testing shall be less than 4 % per hour.

Add new section

6.11 IOGP S-562 Material Class

Material of valve components shall be in accordance with IOGP S-562 material class, as specified in Annex N.

NOTE See K.26 for acceptable materials combinations not listed in Annex N.

7 Welding

7.5 Weld Overlay

7.5.1 General

Add new NOTE

NOTE See L.33 for the requirements when ANSI/NACE MR0103/ISO 17945 is specified.

7.5.3 Corrosion-resistant Alloy (CRA) Weld Overlays

7.5.3.1 General

Add to section

CRA weld overlay shall extend beyond both sides of sealing areas by a distance of at least 0.12 in. (3 mm) or the specified corrosion allowance, whichever is greater.

Add new section

7.5.3.3 Stainless Steel Weld Overlay

7.5.3.3.1 Applicability of IOGP S-563, Table B.6

Stainless steel weld overlay shall be in accordance with IOGP S-563, Table B.6 with the exceptions and additions detailed in 7.5.3.3.2 through 7.5.3.3.4.

7.5.3.3.2 Exception to IOGP S-563, Table B.6—Welding, Welding Consumables

Welding consumable shall be of type 309LMo for the first layer and type 316L for the remaining (top) layer(s).

7.5.3.3.3 Exception to IOGP S-563, Table B.6—Procedure Qualification Testing, Chemical Composition

The specified chemical composition of the 316L filler metal shall be met at a depth of at least $^{1}/_{16}$ in. (1.5 mm) from the minimum qualified overlay thickness.

7.5.3.3.4 Addition to IOGP S-563, Table B.6—Procedure Qualification Testing

When PWHT is required, corrosion testing in accordance with ASTM A262 practice E shall be part of the weld procedure qualification test.

Replace section 7.10 title with

7.10 NDE—Pipe Pressure-containing Welds

In first paragraph, replace "pressure-containing pipe pup-to-valve welds" with

pressure-containing butt welds

In second paragraph, replace "pressure-containing pipe pup-to-valve welds" with

pressure-containing butt welds

7.11 Manufacturing Repair

7.11.2 Casting Repair at the Manufacturer

Add after third paragraph

RT or UT shall be performed on major repair welds (see API 20A for definition) on pressure-containing cast parts.

Replace fourth paragraph with

Weld repair of castings shall be in accordance with the applicable MDS in IOGP S-563.

Weld repairs shall not be permitted for castings that leak during pressure testing.

Casting weld repair examination shall use the same examination method that was used for the original casting inspection.

7.11.4 Repair of Welds

Add to section

Repairs to welds shall be performed in accordance with a documented procedure specifying requirements for defect removal, welding, heat treatment and NDE.

Add new section

7.12 Ferrite Content

A ferrite content check shall be performed on duplex and super duplex stainless steel welds, supplied in the as-welded condition (e.g. welds between duplex/super duplex pup-pieces and valve bodies).

The percentage ferrite range shall be checked using a ferrite content meter of type approved by the purchaser.

The ferrite content meter shall be calibrated in accordance with AWS A4.2 or ISO 8249.

Calibration blocks shall cover ferrite content within the range of 25 % to 70 %.

Ferrite content checks shall be undertaken on the OD for at least three locations equally spaced around the circumference.

Coatings and surface oxide shall be removed.

The test location shall be ground to a 120 grit finish prior to the test.

The acceptance criteria for the ferrite content shall be within the range of 30 % to 70 % in accordance with ISO 17781 for welds in the as-welded condition.

8 Bolting

8.1 Pressure-boundary Bolting

Replace second paragraph with

Bolting materials shall conform to IOGP S-563.

Add to section

Carbon and low-alloy steel bolting shall be coated, as specified in the PDS.

9 Quality Control

9.1 Measuring and Test Equipment Control

9.1.1 Control

Add to section

NDE personnel shall be qualified in accordance with ISO 9712 or ASNT SNT-TC-1A.

Personnel performing NDE evaluation shall be certified in accordance with Level 2.

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

9.3 Welding Inspectors

Replace section with

Personnel performing inspections of welding operations and completed welds shall be qualified and recorded in accordance with IOGP S-705.

9.4 Visual Inspection

9.4.2 Visual Inspection of Castings

Add before first paragraph

Visual inspection of castings shall conform to the applicable MDS in IOGP S-563.

9.4.4 Visual Inspection of Finished Machined Parts

Add after first paragraph

Surfaces of finished CRA components shall be free of surface contamination such as debris, dirt and weld spatter.

Add new section

9.7 NDE Requirements

NDE shall conform to the requirements of Table 18, or Annex I for the specified QSL.

Add new Table 18

Table 18—NDE Requirements

Part	Cast	Wrought [e]
Body or closures and end connections or bonnet or cover or gland housing [g] or integral lifting lugs	VT1 and VT5	VT2 and VT5
Weld ends [a]	VT1 and VT5	VT2 and VT5
	MT1 or PT1	MT1 or PT1
	RT3 or UT4	UT2
Stem or shaft [b]	N/A	VT5
Trunnion [c] Trunnion/bearing plates	VT1 and VT5	VT2 and VT5
Pressure-boundary bolting	N/A	VT4 [g]
Ball [b] and seat rings [b]	VT1 and VT5	VT2 and VT5
Corrosion-resistant overlay in final supplied condition	VT3	
	PT1	
Welds [d] to pressure-containing parts	VT3	
	MT1 or PT1	
Hard facing	VT4	
Sealing surfaces	VT5	
Seals, gaskets and seat springs	VT4	
Pressure-containing welds	VT3	
	MT1 or PT1	
	RT2[f]	
Plating	VT4	

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

[a] A band around each weld end extending back from the body end a distance equal to the greater of 3 times wall thickness (tm) or 2.75 in. (70 mm). See ASME B16.34 for definition of wall thickness “tm”.

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

[c] Trunnion may be pressure-containing or pressure-controlling, depending on design type. If the trunnion is a pressure-containing part, the requirements for body shall apply.

[d] These include fillet, attachment, reinforcing, stiffening welds, etc.

[e] Wrought material applies to bar, forgings and plate.

[f] Where RT2 is not possible, UT3 shall be performed.

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

10 Factory Acceptance Testing

10.1 Pressure Testing—General

10.1.1 Procedure

Add after second paragraph

When orientation is specified, valves size NPS 10 (DN 250) and larger shall be tested in specified orientation.

NOTE Valves size NPS 8 (DN 200) and below can be tested in any orientation regardless of the specified orientation.

When orientation is not specified, valves NPS 10 (DN 250) and larger shall be tested with horizontal flow bore and stem vertical upward.

Replace last paragraph (including list items) with

Testing shall conform to the requirements and the sequence order of Table 19 or Annex I for the specified QSL.

Add new Table 19

Table 19—Pressure Testing Requirements

Sequence	Type	Minimum Testing Frequency
1[a]	Antistatic testing as per L.5	One valve per valve batch
2	Hydrostatic shell test as per 10.3 as follows: — standard as per 10.3.1; — higher as per 10.3.2; — with external relief as per 10.3.3; — with pipe pups as per 10.3.4; — with drain, vent, and sealant injection lines as per 10.3.5.	All valves when applicable
3	Torque or thrust test as per I.6	One valve per valve batch (only for valves supplied bare stem)
4	Functional test per I.6 with operator at 1.0 times the rated pressure as per I.6.1	One valve per valve batch (when torque test is not performed)
5[b]	High-pressure hydrostatic seat test at 1.1 times the rated pressure as per 10.4	All valves
6	DBB/ DIB testing as per 10.4.4	All valves when applicable
7	Low-pressure gas seat test Type II at 80 psi (6 bar) to 100 psi (7 bar) as per I.9	All valves

NOTE Refer to 10.6 for end thrust effect test requirements.

[a] For valves that are already in stock and that do not have any anti-static test documentation, the anti-static test may be done later.

[b] Hydrostatic seat testing may be replaced by high-pressure gas seat testing as per I.8.3, when specified by the purchaser.

10.1.2 Test Conditions

Add to first paragraph

The pH of the water shall be between 6 and 8.5.

10.3 Hydrostatic Shell Test

10.3.1 Hydrostatic Shell Test Preparation, Method, and Acceptance Criteria

Add to section

Drains, vents, sealant injection internal non-return valves, additional connections and blind flanges that form part of the final assembly shall be subjected to the hydrostatic test with the valve.

On completion of the test, sealant injection internal non-return valves shall not be removed.

Injection fittings shall be installed after the pressure testing requirements have been completed.

The valve shall be isolated from the supply pressure source.

10.4 Hydrostatic Seat Test

10.4.1 Hydrostatic Seat Test Preparation, Method, and Acceptance Criteria

Replace sixth paragraph (including list items) with

The acceptance criteria for seat leakage rates for hydrostatic seat tests, low-pressure gas seat test and high-pressure gas seat test shall conform to Table 20.

Add new Table 20

Table 20—Seat Test Acceptance Criteria

Ball Valve Type	Test Pressure Applied from	Hydrostatic Seat Test Maximum Leak Rate [c]	Low-pressure Gas Seat Test Maximum Leak Rate [c]
Soft-seated	One valve end [a]	A	A
	Both valve ends [b]	A	A
Metal-seated	One valve end [a]	B	B
	Both valve ends [b]	2 X B	2 X B

[a] The acceptance criteria are applicable to seat testing when the pressure is applied from one valve end only and also to DIB-2 testing when pressure is applied from one valve end and the cavity.

[b] The acceptance criteria are applicable to DBB testing when the pressure is applied from both ends simultaneously.

[c] Leakage rates as per ISO 5208.

NOTE 2 See K.17 for alternate acceptance criteria to those specified in Table 20 for metal-seated valves.

10.4.3 Hydrostatic Seat Test—Axial On-Off, Ball, Gate, and Plug Valves

10.4.3.1 Unidirectional Valve

Add after second sentence

The valve shall be isolated from the supply pressure source with the volume beyond the pressurized seat being at atmospheric pressure.

Decrease in the water level from the leakage detection device shall not be allowed.

If the volume at the opposite side of the tested seat is not measuring leakage, the volume shall be isolated.

Add to section

Draining shall not be allowed from the valve body cavity or from the downstream side of the valve during the hydrostatic seat test.

10.4.3.2 Bidirectional Valve

Add after second sentence

The valve shall be isolated from the supply pressure source with the volume beyond the pressurized seat being at atmospheric pressure.

Decrease in the water level from the leakage detection device shall not be allowed.

If the volume at the opposite side of the tested seat is not measuring leakage, the volume shall be isolated.

Add to section

Draining shall not be allowed from the valve body cavity or from the downstream side of the valve during the hydrostatic seat test.

Add new section

10.6 Testing Valves with End Load

The valve tests listed in Table 19 and Table I.4 shall be subjected to the end load test requirements in accordance with Table 21.

In order to perform the end load test, the valve shall be fitted with end connections that allows the full pressure thrust load to act on the valve body joints (e.g., blind flanges, welded on caps and blind caps).

If a selected sample valve fails a test, two additional sample valves from the same batch shall be tested.

If any of the additional sample valves fail the test, a structured root cause analysis, corrective action and preventative action report shall be submitted for approval.

Valves in the failed valve batch shall be subsequently tested.

Add new Table 21

Table 21—Number of Valves per Batch for End Load Testing

Valve Size		Valve Rating					
NPS	DN	150	300	600	900	1500	2500
2	50						
3	8						
4	100						1
6	150					1	1
8	200				1	1	1
10	250			1	1	1	1
12	300			1	1	1	1
14	350		1	1	1	1	All
16	400	1	1	1	1	1	All
18	450	1	1	1	1	1	All
20	500	1	1	1	1	1	All
22	550	1	1	1	1	1	All
24	600	1	1	1	1	1	All
≥26	≥650	All	All	All	All	All	All

KEY

1 = 1 valve per batch.

All - All valves per batch.

NOTE 1 Valve selection is made at random by the purchaser.

NOTE 2 End load testing may be performed as part of the basic pressure testing listed in Table 19 or Table I.4.

11 Coating/Painting

Add to first paragraph

Valves and valve parts shall be painted using the coating systems and coating products as specified.

Add new NOTE 3 after NOTE 2

NOTE 3 Valves for offshore and marine coastal environment should be coated in accordance with IOGP S-715.

12 Marking

12.1 General

Table 12—Additional Marking

Add row Item No. 5

Item No.	Marking	Format	Location
5	Schedule on weld end valves	Sch. 160	On body weld ends

Add to section

Marking on the valve bodies, end connector and bonnet/cover shall not be located on weld bevels, flange faces or surfaces that can be hidden following fabrication, assembly or installation.

12.3 Nameplate

In second paragraph, replace "an austenitic stainless-steel" with

a 316 austenitic stainless-steel

Table 13—Valve Marking on Nameplate

Add rows Item no. 15 and Item no. 16

Item No.	Marking	Section	Format Example
15	Schedule on weld end valves [h]	—[e]	Sch. 160
16	Valve datasheet identification code when provided by the purchaser	—[e]	As per purchaser requirements

Add footnote h

[h] Shall be on either the body weld ends or the nameplate, at a minimum; may be on both.

Add to section

Nameplate marking shall be die-stamped, or laser engraved with readable indications.

Multiple nameplates shall be used if needed to guarantee legibility of the information.

The nameplate shall contain metric and US customary units.

The nameplate rivet holes shall be pre-drilled prior to the body hydrotest.

The nameplate shall be attached to the valve after coating is completed.

13 Draining, Protection, and Preparation for Transport

Replace section 13.1 title with

13.1 Draining and Cleaning

Add to section

Valves shall be cleaned internally and be free of particles and organic substances.

13.2 Protection

In list item e), add after "cover/plug"

made from wood with moisture barrier or rigid plastic

Add to section

Wooden protective covers shall be attached to the valve ends using bolting and nuts.

Plastic protective covers with integral moulded securing plugs shall be secured in bolt holes.

Unpainted surfaces shall be protected from atmospheric corrosion during shipping and storage.

Preservation shall be by corrosion preventative fluids.

Corrosion preventative fluids used for valve preservation shall not be detrimental to nonmetallic parts.

Machined and threaded surfaces made of non-corrosion-resistant materials shall be coated with a rust-preventative compound.

The rust-preventative compound shall be removable without mechanical means.

When the rust-preventive compound is not compatible with the specified service, the rust prevention method shall comply with the specified cleanliness requirements.

Valves shall be packed in an enclosed vapor-proof barrier material.

Vapor phase corrosion inhibitors (VPCIs) shall be applied to the valve packaging in accordance with the VPCI manufacturer’s instructions.

Auxiliary connections shall be protected from mechanical damage during transportation.

Auxiliary connections shall be protected from the ingress of water and foreign material.

13.3 Preparation for Transport

Add to section

Plug and protective cover design shall the prevent ingress of water and foreign material into the valve during shipping and outdoor storage.

Valves with a calculated weight of more than 2205 lbs (1000 kg) excluding packaging shall be weighed.

For identical valves with a weight of more than 2205 lbs (1000 kg), only a single valve shall require weighing.

14 Documentation

Add new section 14.0 before section 14.1

14.0 General

Documentation shall be in accordance with IOGP S-562L.

14.1 Minimum Documentation and Retention

In first paragraph, replace "minimum of 10 years following the date of manufacture" with

minimum of 15 years following the date of manufacture

Add new list items

— cross-section drawings with parts and materials list;

— manufacturing, testing and inspection procedures;

— nonconformance records;

— authorized concessions, waivers and/or material substitutions;

— applicable manuals (e.g. assembly or maintenance manuals);

— weld maps of major repairs;

— heat treatment records, including heat treatment charts.

14.2 Documentation Provided with the Valve

14.2.1 General

Add new list items

— procedure for receipt and installation;

— manufacturer's release note;

— agreed deviations (where applicable for receipt control).

Add to section

The documentation provided with the valve shall be attached to the valve or the shipping container in a sealed waterproof envelope.

Annex H
(normative)

Heat-treat Equipment Qualification

Add new section H.0 before H.1

H.0 General

Heat-treatment facilities shall comply with the applicable MDSs in IOGP S-563.

Annex I
(normative)

Quality Specification Level (QSL) and Supplemental Testing

I.1 General

In first paragraph, replace "QSL2, QSL3, QSL3G, QSL4, or QSL4G" with

QSL2, QSL2G, QSL3, QSL3G, QSL4, or QSL4G

In NOTE, replace "QSL numbers 2, 3, 3G, 4, and 4G" with

QSL numbers 2, 2G, 3, 3G, 4, and 4G

I.2 NDE Requirements for Quality Specification Levels

In first paragraph, replace "QSL2, QSL3/3G, and QSL4/4G" with

QSL2/2G, QSL3/3G, and QSL4/4G

Add after NOTE 3

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.

Table I.1—NDE Requirements

Update Table I.1 as per amendments inside the table

Part	*Add new column* NDE Type	*Replace column heading with* QSL2/2G		QSL3/3G		QSL4/4G	
		Cast	Wrought[9]	Cast	Wrought[9]	Cast	Wrought[9]
Replace API 6D data with Body, end connectors, bonnet, cover, gland housing [f] and integral lifting lugs	Visual NDE *Replace row with*	VT1 and VT5	VT2 and VT5	VT1 and VT5	VT2 and VT5	VT1 and VT5	VT2 and VT5
	Surface NDE	[API 6D data]	[API 6D data]	[API 6D data]	[API 6D data]	[API 6D data]	[API 6D data]
	Volumetric NDE	*Replace API 6D data with* RT1 [a i]	[API 6D data]	[API 6D data]	[API 6D data]	[API 6D data]	*Replace API 6D data with* RT3 [a]
Weld ends [b f]	*Add new row* Visual NDE	VT1 and VT5	VT2 and VT5	VT1 and VT5	VT2 and VT5	VT1 and VT5	VT2 and VT5
	Surface NDE	[API 6D data]	[API 6D data]	[API 6D data]	[API 6D data]	[API 6D data]	[API 6D data]
	Volumetric NDE	[API 6D data]	[API 6D data]	[API 6D data]	[API 6D data]	[API 6D data]	[API 6D data]
Stem or shaft [c]	Visual NDE	*Replace API 6D data with* N/A	[API 6D data]	*Replace API 6D data with* N/A	[API 6D data]	*Replace API 6D data with* N/A	[API 6D data]
	Volumetric NDE	*Replace API 6D data with* N/A	[API 6D data]	*Replace API 6D data with* N/A	[API 6D data]	*Replace API 6D data with* N/A	[API 6D data]
Replace API 6D data with Trunnion [d] and trunnion/bearing plates	Visual NDE	[API 6D data]	[API 6D data]	*Replace API 6D data with* VT1 and VT5	*Replace API 6D data with* VT2 and VT5	*Replace API 6D data with* VT1 and VT5	*Replace API 6D data with* VT2 and VT5
	Surface NDE	[API 6D data]	[API 6D data]	[API 6D data]	[API 6D data]	[API 6D data]	[API 6D data]
	Volumetric NDE	[API 6D data]	[API 6D data]	[API 6D data]	[API 6D data]	[API 6D data]	[API 6D data]
Pressure-boundary bolting	Visual, surface and volumetric NDE	*Replace API 6D data with* N/A	*Replace API 6D data with* VT4 [k]	*Replace API 6D data with* N/A	*Replace API 6D data with* VT4 [k] Table I.3	*Replace API 6D data with* N/A	*Replace API 6D data with* VT4 [k] Table I.3

Table I.1 *(continued)*

Part	*Add new column* NDE Type	*Replace column heading with* QSL2/2G		QSL3/3G		QSL4/4G	
		Cast	Wrought[9]	Cast	Wrought[9]	Cast	Wrought[9]
Replace API 6D data with Ball [c] and seat rings [c]	Visual NDE	VT1 and VT5	VT2 and VT5	VT1 and VT5	VT2 and VT5	VT1 and VT5	VT2 and VT5
	Surface NDE	-	-	MT2 or PT2	MT1 or PT1	MT2 or PT2	MT1 or PT1
Corrosion-resistant overlay in final supplied condition	Visual NDE	[API 6D data]	[API 6D data]	[API 6D data]	[API 6D data]	[API 6D data]	[API 6D data]
	Surface NDE	[API 6D data]	[API 6D data]	[API 6D data]	[API 6D data]	[API 6D data]	[API 6D data]
	Volumetric NDE	[API 6D data]	[API 6D data]	*Replace API 6D data with* UT3 [h]	*Replace API 6D data with* UT3 [h]	[API 6D data]	[API 6D data]
Welds [e] to pressure-containing parts	Visual NDE	[API 6D data]	[API 6D data]	[API 6D data]	[API 6D data]	[API 6D data]	[API 6D data]
	Surface NDE	*Replace API 6D data with* MT1 or PT1	*Replace API 6D data with* MT1 or PT1	[API 6D data]	[API 6D data]	[API 6D data]	[API 6D data]
Hard facing	Visual NDE	[API 6D data]	API 6D data]	VT4	VT4	VT4	VT4
	Surface NDE	PT1	PT1	[API 6D data]	[API 6D data]	[API 6D data]	[API 6D data]
Sealing surfaces	*Add new row* Visual NDE	VT5	VT5	VT5	VT5	VT5	VT5
	Surface NDE	MT3 or PT3	MT3 or PT3	[API 6D data]	[API 6D data]	[API 6D data]	[API 6D data]
Seals gaskets and seat springs	Visual NDE	[API 6D data]					
Pressure-containing welds	Visual NDE	[API 6D data]					
	Surface NDE	[API 6D data]					
	Volumetric NDE	*Replace API 6D data with* RT2 [j]					
Plating	Visual NDE	[API 6D data]					

Table I.1 *(continued)*

Part	*Add new column* NDE Type	*Replace column heading with* QSL2/2G		QSL3/3G		QSL4/4G	
		Cast	Wrought[9]	Cast	Wrought[9]	Cast	Wrought[9]

Add key

Key

N/A The manufacturer is not allowed to use this material form for this specific part.

Add new NOTE

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

In footnote a, add after "TR1"

and TR3

In footnote b, replace "3TM" with

3 times the wall thickness (tm)

Add new footnotes h to k

[h] Machined surfaces only.

[i] 5 % or minimum QSL2, 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 items represented shall be examined.

[j] Where RT2 is not possible, UT3 shall be performed.

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

Table I.2—Extent, Method, and Acceptance Criteria of NDE/Item Examination Code

In row "Exam RT1", replace data in column "Extent" with

Exam	Extent	Method	Acceptance
RT1	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.	[API 6D data]	[API 6D data]

In row "Exam MT3", replace data in column "Acceptance" with

Exam	Extent	Method	Acceptance
MT3	[API 6D data]	[API 6D data]	No rounded or linear indications in pressure-contact sealing surfaces shall be permitted. Re-examination of questionable indications per ASME BPVC, Section VIII, Division 1 Appendix 6-3 (c) is acceptable.

In row "Exam PT3", replace data in columns "Method" and "Acceptance" with

Exam	Extent	Method	Acceptance
PT3	[API 6D data]	[API 6D data]	No rounded or linear indications in pressure-contact sealing surfaces shall be permitted. Re-examination of questionable indications per ASME BPVC, Section VIII, Division 1 Appendix 8-3 (c) is acceptable.

Replace row "Exam VT3" with

Exam	Extent	Method	Acceptance
VT3	Weldments: 100 % accessible as welded surfaces	7.8 or 7.9	7.8 or 7.9
	Overlay: 100 % accessible as welded surfaces	Per applicable EDS. If no EDS refer to 7.5.3.2	Per applicable EDS. If no EDS refer to 7.5.3.2

In row "Exam VT4", add footnote b to "VT4" and replace data in columns "Method" and "Acceptance" with

Exam	Extent	Method	Acceptance
VT4 [b]	[API 6D data]	Per manufacturer requirements and per applicable EDS	Per manufacturer requirements and per applicable EDS

Add new footnote b

[b] Visual inspection of gaskets shall ensure the item is free from sharp edges, burrs, organic substances or foreign particulate matter.

I.4 Testing Requirements

In first paragraph, replace "QSL2, QSL3, QSL3G, QSL4, or QSL4G" with

QSL2, QSL2G, QSL3, QSL3G, QSL4, or QSL4G

Replace Table I.4 title with

Table I.4—Pressure Testing Requirements for Quality Specification Levels (QSLs)

Update Table I.4 as per amendments inside the table

Sequence	Test Activity	QSL2	*Add new column QSL2G* QSL2G	QSL3 [a, b]	QSL3G [a, b]	QSL4 [a, b, c]	QSL4G [a, b, c]
Replace row Sequence 1 with 1	Antistatic testing per L.5	One valve of each unique design/size/ rating/material	One valve of each unique design/size/ rating/material	All	All	All	All
2	[API 6D data]	[API 6D data]	One test	[API 6D data]	[API 6D data]	[API 6D data]	[API 6D data]
3	[API 6D data]	Only for bare stem valves and bare stem valves to be fitted with actuators	Only for bare stem valves and bare stem valves to be fitted with actuators	[API 6D data]	[API 6D data]	[API 6D data]	[API 6D data]
Add row Sequence 4 4	Functional test per I.6.1 with lever/ gearbox fitted excluding bare stem valves at 1.0 times the rated pressure	All	All	All	All	All	All
Update row 4 Sequence number to 5 5	[API 6D data]	[API 6D data]	N/R [d]	[API 6D data]	[API 6D data]	[API 6D data]	[API 6D data]
Update row 5 Sequence number to 6 6	*Add "using water" after "test"* [API 6D data]	[API 6D data]	N/R	[API 6D data]	N/R	[API 6D data]	N/R
Update row 6 Sequence number to 7 7	[API 6D data]	[API 6D data]	One test	[API 6D data]	[API 6D data]	[API 6D data]	[API 6D data]
Add row Sequence 8 8	Low-pressure gas seat test per I.9.1	N/R	N/R	N/R	All	All	All

Table I.4 *(continued)*

Sequence	Test Activity	QSL2	*Add new column QSL2G* **QSL2G**	QSL3 [a, b]	QSL3G [a, b]	QSL4 [a, b, c]	QSL4G [a, b, c]
Update row 7 Sequence number to 9 9	[API 6D data]	[API 6D data]	One test	[API 6D data]	[API 6D data]	[API 6D data]	[API 6D data]
Add row Sequence 10 10	Seat cavity relief test using inert gas per I.7	N/R	1 valve per lot [e]	N/R	All	N/R	All
Add row Sequence 11 11	Testing per 10.4.4 when DBB/DIB functionality is specified	All	All	All	All	All	All
Update row 8 Sequence number to 12 12	[API 6D data]	[API 6D data]	One test	[API 6D data]	[API 6D data]	[API 6D data]	[API 6D data]
Add row Sequence 13 13	Low-pressure gas shell test at 80 psi (6 bar) to 100 psi (7 bar)	For threaded plug or flange connections	N/R	For threaded plug or flange connections	N/R	For threaded plug or flange connections	N/R
Add row Sequence 14 14	High-pressure gas shell test per I.8.2	None except for seal welded plug. 1 test as per I.8.2	None except for seal welded plug. 1 test as per I.8.2	None except for seal welded plug. 1 test as per I.8.2	None except for seal welded plug. 1 test as per I.8.2	None except for seal welded plug. 1 test as per I.8.2	None except for seal welded plug. 1 test as per I.8.2
Add row Sequence 15 15 [f]	Sample fugitive emission testing per L.24.2	When specified Test per L.24.2	Test per L.24.2	When specified Test per L.24.2	Test per L.24.2	When specified Test per L.24.2	Test per L.24.2

Add new footnote f

[f] Sequence 15 related to sample fugitive emission testing may be combined with sequence 14. In this case, the fugitive emission test pressure is increased to 1.1 rated pressure.

Add to section

The QSL2 valve tests listed in Table I.4 shall be subjected to end load tests in accordance with Table 21.

If QSL2G, QSL3 or QSL3G is specified, where Table 21 specifies one valve per batch, 10 % of valves shall be tested with end load.

If QSL4 or QSL4G is specified, where Table 21 specifies one valve per batch, all valves shall be tested with end load.

I.6 Torque/Thrust Functional Testing

I.6.1 Method

Replace section with

Functional testing and/or torque testing shall be performed for the following valve operations:

a) closed-to-open and open-to-closed without pressure;

b) closed-to-open with one side of the ball pressurized, and the cavity and opposite side at atmospheric pressure;

c) repeat step b) but with the other side of the ball pressurized, and the cavity and opposite side at atmospheric pressure;

d) open-to-closed with the bore pressurized and the cavity at atmospheric pressure, if applicable to the valve design;

e) closed-to-open with both sides of the ball pressurized and the cavity at atmospheric pressure.

During the opening and closing operations, respectively the valve shall be fully opened and fully closed.

Functional testing shall be performed at the pressure rating in accordance with 4.3 for the material at 100 °F (38 °C).

When one side of the ball is pressurized, the body cavity and opposite side of the ball shall be kept at atmospheric pressure.

When opening the valve, one side of the ball is pressurized while the body cavity and opposite side of the ball shall be opened to atmospheric pressure.

When both sides of the ball are pressurized, the body cavity shall be kept at atmospheric pressure.

When opening the valve, both sides of the ball are pressurized while the body cavity shall be opened to atmospheric pressure.

Where applicable to the valve design, when the valve bore is pressurized, the body cavity shall be kept at atmospheric pressure.

Where applicable to the valve design, when opening the valve, the valve bore is pressurized while the body cavity shall be opened to atmospheric pressure.

NOTE 1 When the valve bore is pressurized, keeping the body cavity at atmospheric pressure is not required for valves with a pressure balancing hole.

For the functional testing, the operating torque shall be measured at each step detailed in I.6.1, a) through e) with the operator installed.

When performing torque measurements (during torque testing and functional testing steps), the highest value shall be recorded for each of the steps detailed in I.6.1, a) through e).

When performing I.6.1 b), c), d) and e) operations, the valve shall be operated after a minimum of 1 minute of maintaining the test pressure.

When performing I.6.1 b), c), d) and e) operations, torque measurement shall be performed up to decompression of the pressurized volume.

Torque testing and functional testing shall be performed with the seats free of sealant.

NOTE 2 If necessary for assembly, a lubricant with a viscosity not exceeding that of SAE 10W motor oil may be used.

I.6.3 Acceptance Criteria

Replace section with

I.6.3.1 Acceptance Criteria for Torque Testing

The measured torque results shall be less than or equal to the manufacturer's documented valve torques.

The measured operating torque shall not exceed the design torque (see 5.3.2).

I.6.3.2 Acceptance Criteria for Functional Testing

Manual valves shall demonstrate smooth operability.

The measured operating torque shall not exceed the design torque (see 5.3.2).

The measured operating torque results for valves with a manual gearbox shall be less than or equal to the manufacturer's documented valve torques.

The measured/calculated force required at the perimeter of the hand-wheel or wrench (lever) for manual valves shall not exceed 80 lbf (360 N) (see 5.4.2.1) or the manufacturer's documented operating forces, whichever is lower.

The gearbox output torques for valves with a manual gearbox shall be calculated using the gearbox mechanical advantage ratio.

The calculated gearbox output torques shall be compared and correlated to the valve torques.

I.6.3.3 Acceptance Criteria Results

The measured/calculated torques and forces shall be recorded.

I.7 Cavity Relief Testing

I.7.1 General

Add to section

When specified, cavity relief testing described in I.7.2. shall be performed with a test fluid of inert gas.

I.7.2 Trunnion-mounted Ball Valves

I.7.2.1 Procedure 1—Self-relieving Seats

Add after second paragraph

The valve cavity relief pressure shall not exceed 33 % of the valve pressure rating or 435 psig (30 bar), whichever is lower.

I.8 High-pressure Gas Testing

I.8.1 Valve Preparation for Testing

Add to section

The valve shall be isolated from the supply pressure source with the volume beyond the pressurized seat being at atmospheric pressure.

Following pressurization and prior to measurement of seat leakage commencing, the valve shall be fully stabilized.

The valve stabilization period shall begin once the test pressure in the valve has remained constant for at least 2 minutes.

I.8.2 High-pressure Gas Shell Test

I.8.2.1 Method

Add to section

Connections shall be installed prior to the start of the high-pressure gas shell test.

Dismantling of body connections (e.g., vent and drain plugs) after the initial gas shell test shall require that an additional gas shell test is performed, when body connections have been re-installed.

I.8.3 High-pressure Gas Seat Test

I.8.3.1 Method

Add after first paragraph

The stabilization period duration shall not be less than duration specified in Table L.1.

During the stabilization period, the outlet port where leakage is to be measured from shall remain connected to the leakage detection source (e.g., flow meter or water-filled bubble counter vessel).

During the stabilization period, the outlet port shall be monitored.

Add to section

The valve shall be isolated from the supply pressure source with the volume beyond the pressurized seat being at atmospheric pressure.

Seat leakage shall be monitored from the downstream side of the seat when under high-pressure gas seat test.

Body connections not used for leakage detection shall be isolated during the high-pressure gas test.

I.9 Low-pressure Gas Seat Testing

I.9.1 Low-pressure Gas Seat Testing—Type II

Replace second requirement ("the inner parts shall be…") of second sentence with

and there shall be no visible fluids on the seat to ball contacts and leakage connection port prior to the start of the low-pressure gas seat test

Add after second sentence

Following pressurization and prior to commencing seat leakage measurement, the valve shall be fully stabilized.

Replace third sentence with

Pressure shall be identified as stabilized when the valve pressure remains constant for at least 2 minutes.

Add to section

During the stabilization period, the outlet port where leakage is to be measured from shall remain connected to the leakage detection source, e.g. flow meter or water-filled bubble counter vessel.

During the stabilization period, the outlet port shall be monitored for the duration.

The stabilization period duration shall not be less than as specified in Table L.1.

NOTE See K.16 for optional stabilization period duration.

The stabilization duration shall be extended if stabilization is not achieved.

Following stabilization, the seat leakage test shall begin.

The test duration shall be in accordance with Table 10.

I.9.2 Acceptance Criteria

Replace section with

The acceptable leakage rate for the low-pressure gas seat test shall be in accordance with Table 20.

I.10 Documentation

Replace "QSL2" with

QSL2/2G

Table I.6—Documentation Requirements for Each QSL

Replace third column heading "QSL2" with "QSL2/2G"

In rows "Item 3" and "Item 4", column "QSL2/2G", replace "N/R" with "X"

Add rows "Item 11" to "Item 20"

Item	Documentation	QSL2/2G	QSL3/3G	QSL4/4G
11	Design documentation	x	x	x
12	Weld procedure specification (WPS)	x	x	x
13	Weld procedure qualification record (PQR)	x	x	x
14	Visual inspection records	x	x	x
15	Chloride content in the hydrostatic test water (see 10.1.3)	x	x	x
16	Valve assembly serial number traceable to the following information:	x	x	x
17	Manufacturing, testing and inspection procedures	x	x	x
18	Nonconformance records	x	x	x
19	Authorized concessions, waivers and/or material substitutions	x	x	x
20	Weld maps of major repairs	x	x	x

Annex K
(normative)

Purchaser-specified Customization—Permissible Deviations to Specified Design and Manufacturing Requirements

Add new section

K.16 Stabilization Period for Type II Low-Pressure Gas Testing

When specified, the stabilization period duration for Type II low-pressure gas testing that does not conform to Table L.1 shall be permitted.

Add new section

K.17 Alternate Seat Test Acceptance Criteria

When specified for metal-seated valves, acceptance criteria for seat leakage rates for hydrostatic seat tests and low-pressure gas seat test shall conform to Table K.1.

Add new Table K.1

Table K.1—Alternative Metal-seated Valve Seat Test Acceptance Criteria For Leakage

Test Pressure Applied from	Hydrostatic Seat Test Maximum Leak Rate [c]	Low-pressure Gas Seat Test Maximum Leak Rate [c]
One valve end [a]	C	2 X C
Both valve ends [b]	2 X C	4 X C

[a] The acceptance criteria is applicable to seat testing when pressure is applied from one valve end only and also to DIB-2 testing when pressure is applied from one valve end and the cavity.

[b] Acceptance criteria applicable to DBB testing when pressure is applied from both ends simultaneously.

[c] Leakage rates as per ISO 5208.

Add new section

K.18 Specific Valve Orientation

When valve orientation is specified, valve shall only be required to function in the specified orientation and at the stem-upright position.

Add new section

K.19 Other Bolted Joint Designs

When specified, bolted joint designs not specified in 5.1.4 shall be permitted.

Add new section

K.20 Vent and Drain Ports of Corrosion-resistant Alloy (CRA) Clad Valves

When specified, vent and drain ports of CRA clad valve designs not specified in 5.6.1.1 shall be permitted.

Add new section

K.21 Alternative Stem/Shaft Injection Point Arrangements

When specified, alternative stem/shaft injection point arrangements not specified in 5.6.2 shall be permitted.

Add new section

K.22 Standard Bore with Smooth Transition for Piggable Valves

Any bore that is different to the specified internal pipeline diameter bore shall require prior approval.

When an alternative bore is approved, it shall have a smooth transition at the valve end.

Add new section

K.23 Use of Elastomeric O-rings at temperatures below –20 °F (–29 °C).

When specified, elastomeric O-rings shall be acceptable for use at temperatures below –20 °F (–29 °C) when qualified in accordance with purchaser requirements.

Add new section

K.24 Fire Testing Option

When specified, valves shall not be qualified by fire testing.

Add new section

K.25 Permitted use of Cap Screws

When specified, cap screws shall be allowed for pressure-containing bolting.

Add new section

K.26 Acceptable Material Combinations Other Than IOGP S-562 Material Classes

When specified, materials for valve components from material combinations not listed in Annex N shall be allowed.

Annex L
(informative)

Specified Customization—Supplemental Options to Specified Design and Manufacturing Requirements

L.9 Double Block and Bleed (DBB) Valves

Add new list item after fourth list item

— The seat test duration shall conform to Table 10.

Replace fifth list item with

— Acceptance criteria for seat leakage rates shall be in accordance with Table 20.

Add to section

The valve shall be isolated from the supply pressure source with the volume beyond the pressurized seat being at atmospheric pressure.

When QSL2G, QSL3G or QSL4G is specified, the test fluid shall be inert gas.

When testing with gas, the valve shall be drained of the hydrostatic test fluid prior to the start of the testing.

The inner parts of the valve shall be purged with air prior to the start of the high-pressure gas testing.

When testing with gas, the pressure shall be stabilized in accordance with Table L.1 prior to the start of pressure testing.

When testing with gas, acceptance criteria for soft-seated valves shall be in accordance with the requirements of I.8.3.2.

When testing with gas, the leakage rate for metal-seated valves shall not be more than four times ISO 5208, Rate C.

L.10 Double Isolation and Bleed DIB-1 (Both Seats Bidirectional)

Add new list sections after fourth list section

— The valve shall be isolated from the supply pressure source with the volume beyond the pressurized seat being at atmospheric pressure.

— If the volume at the opposite side of the tested seat is not measuring leakage, the volume shall be isolated.

— The seat test duration shall be in accordance with Table 10.

— Draining shall not be allowed from the valve body cavity or from the downstream side of the valve during the hydrostatic seat test.

Add new list section after fifth list section

— The cavity and the valve shall be filled with the test fluid, with the valve unseated and partially open, until the test fluid overflows through each valve end connector.

Replace last list section with

— Acceptance criteria for the hydrostatic seat test shall be in accordance with the requirements of 10.4.1.

Add to section

When QSL2G, QSL3G or QSL4G is specified, the test fluid shall be inert gas.

When testing with gas, the valve shall be drained of the hydrostatic test fluid prior to the start of the testing.

The inner parts of the valve shall be purged with air prior to the start of the high-pressure gas testing.

When testing with gas, prior to the start of pressure testing, the pressure shall be stabilized in accordance with Table L.1.

Pressure shall be identified as stabilized when the valve pressure remains constant for at least 2 minutes.

When testing with gas, acceptance criteria shall be in accordance with the requirements of I.8.3.2.

L.11 Double Isolation and Bleed DIB-2 (One Unidirectional and One Bidirectional Seat)

Add new list sections after fourth list section

— The valve shall be isolated from the supply pressure source with the volume beyond the pressurized seat being at atmospheric pressure.

— If the volume at the opposite side of the tested seat is not measuring leakage, the volume shall be isolated.

— Seat test duration shall be in accordance with Table 10.

— Draining shall not be allowed from the valve body cavity or from the downstream side of the valve during the hydrostatic seat test.

Replace last list item with

— Acceptance criteria for the hydrostatic seat test shall be in accordance with Table 20.

Add to section

When QSL2G, QSL3G or QSL4G is specified, the test fluid shall be inert gas.

When testing with gas, the valve shall be drained of the hydrostatic test fluid prior to the start of the testing.

The inner parts of the valve shall be purged with air prior to the start of the high-pressure gas testing.

When testing with gas, prior to the start of pressure testing, the pressure shall be stabilized in accordance with Table L.1.

Pressure shall be identified as stabilized when the valve pressure remains constant for at least 2 minutes.

When testing with gas, acceptance criteria shall be in accordance with the requirements of I.8.3.2.

L.12 Operations Testing—Valves Required for Double Isolation and Bleed (DIB-1 or DIB-2)

Add new list sections a-i) to a-x) after list section a)

a-i) When QSL2G, QSL3G or QSL4G is specified, the test fluid shall be inert gas.

a-ii) When testing with gas, the valve shall be drained of the hydrostatic test fluid prior to the start of testing.

a-iii) The inner parts of the valve shall be purged with air prior to the start of the high-pressure gas testing.

a-iv) The seat test duration shall be in accordance with Table 10 for hydrostatic testing.

a-v) When testing with gas, prior to the start of pressure testing, the pressure shall be stabilized in accordance with Table L.1.

a-vi) Pressure shall be identified as stabilized when the valve pressure remains constant for at least 2 minutes.

a-vii) The seat test duration shall be in accordance with Table I.5 for gas testing.

a-viii) Hold periods shall start when pressure stabilization has been achieved.

a-ix) Draining shall not be allowed from the valve body cavity or from the downstream side of the valve during the hydrostatic seat test.

a-x) The cavity shall be isolated (closed) from the atmospheric pressure or pressure source prior to monitor leakage.

In step 3) of list section b), add after "Reduce pressure"

, in 25 % increments,

Add new steps 3-i) to 3-iii) after step 3) of list section b)

3-i) Stabilize pressure at every reduction increment.

3-ii) Pressure shall be restored if pressure drops below MAWP on the upstream side and the cavity.

3-iii) Isolate the valve from the supply pressure source with the volume beyond the pressurized seat being at atmospheric pressure.

Add new step 5-i) after step 5) of list section b)

5-i) Stabilize pressure.

Replace step 6) of list section b) with

6) Reintroduce pressure into the cavity, in 14.5 psig (1 barg) increments, up to 145 psi (10 bar) and monitor leakage, after stabilization, to the downstream side.

Add new steps 6-i) and 6-ii) after step 6) of list section b)

6-i) While upstream and cavity pressures are maintained, increase pressure into the cavity, in 145 psig (10 barg) increments, up to MAWP.

6-ii) Monitor leakage to the downstream side and the upstream pressure, after stabilization.

In step 7) of list section b), add after "Reduce pressure"

, in 25 % increments,

Replace list section d) with

d) Acceptance criteria for hydrostatic seat test and low-pressure gas seat test shall be per the requirements of 10.4.1.

Add new list section e)

e) Acceptance criteria for high-pressure gas testing shall be per the requirements of I.8.3.2.

L.14 Drive Train Strength Test

Add new list items after first list item

— the maximum operator torque; or

— 1.1 times the maximum actuator torque, when an actuator is specified; or

Add after NOTE

The drive train strength test shall be performed by blocking movement of the valve from its fully open position (e.g., by inserting a test mandrel into the valve).

A single valve shall qualify identical valves in the order.

The test mandrel shall be manufactured from a softer material than the valve components in contact with the test mandrel.

The test plug shall be cylindrical and within $^{1}/_{16}$ in. (1.5 mm) of the bore diameter, to prevent damage of internal valve parts.

Prior to start the drive train strength test, interfaces between body, body cover, bonnet, bonnet cover, adapting flanges, mounting kit, extension casing and operator shall be marked with a paint pen.

On completion of the test, misalignment between marked parts shall not be allowed.

L.19 Low-pressure Gas Seat Testing

L.19.1 Low-pressure Gas Seat Testing—Type I

L.19.1.2 Acceptance Criteria

In second list item, replace "two times Rate C" with

Rate B

L.19.2 Low Pressure Gas Seat Testing—Type II

Replace section with

When specified, low-pressure gas seat testing Type II shall be performed as per I.9.

L.20 High-pressure Gas Testing

Replace section with

When specified, high pressure gas testing shall be performed as per I.8.

L.22 Disassembly/Maintenance Tools

In first paragraph, add after "inform the purchaser"

, prior to order,

L.24 Fugitive Emissions

L.24.1 Valve Qualification Testing

Add to section

When qualification testing is in accordance with ISO 15848-1, the fugitive emission tightness class and the endurance class shall be specified.

The test temperature shall qualify valve designs for the specified minimum and maximum design temperatures.

When performing a new qualification, test equipment shall have a valid calibration certificate and a valid calibration date not exceeding 6 months.

When performing a new qualification, personnel performing fugitive emission testing shall be qualified in accordance with the manufacturer's documented training program.

NOTE 2 As fugitive emission tightness is adversely affected when the stem is in the horizontal position, it is considered conservative and advantageous to test the valve in such orientation, as such qualification will cover any other installation orientation. API 624 requires testing with the stem in the vertical position, and this is a limitation when choosing API 624 for new qualifications.

Fugitive emission testing shall be in accordance with Level 1 requirements specified in ISO 9712 or ASNT SNT-TC-1A for the tracer gas method.

When performing a new qualification in accordance with ISO 15848-1, if the valve installation orientation is not specified, the valve shall be tested with the stem or shaft in horizontal position.

Previous ISO 15848-1 qualification testing with the stem or shaft in vertical position shall require purchaser acceptance.

Leakage from the stem/shaft seal and from the body seals shall cover all potential leak paths (e.g., drain, vent, body joint and bolting connections).

L.24.2 Valve Production Testing

Add to section

The fugitive emission tightness class shall be specified.

The valve shall be tested in the specified installation orientation.

If the valve installation orientation is not specified, the valve shall be tested with the stem or shaft in horizontal position.

The measurement shall commence after the test pressure has been applied for 10 minutes.

Personnel performing emission testing shall be qualified in accordance with the manufacturer's documented training program.

Fugitive emission testing shall be in accordance with Level 1 requirements specified in ISO 9712 or ASNT SNT-TC-1A for the tracer gas method.

Leakage from the stem (or shaft) seal and from the body seals shall cover all potential leak paths, (e.g., drain, vent, body joint and bolting connections).

NOTE 2 When selecting the sampling percentage consideration to be given to sealing design, material and valve manufacturing location.

If the sample size is not specified, it shall be determined in accordance with Table L.3.

Add new Table L.3

Table L.3—Sample Strategy for Production Testing

Purchase order quantity per fugitive emission class (X)	Sample size (n) [a]	
	Class AH	Class BH
X ≤ 10	Minimum 1 or as specified by purchaser	Minimum 1 or as specified by purchaser
11 ≤ X ≤ 100	5 %	3 %
101 ≤ X ≤ 1000	4 %	3 %
X > 1000	3 %	2 %

[a] Actual sample size shall be rounded-up to the next whole number with a maximum total sample size of 10 % of the whole purchase order (rounded-up to the next whole number).

The samples shall be selected at random from each lot.

The lot shall be accepted when tested valves meet the acceptance criteria.

All valves that are part of the sample shall be tested.

If any valve fails the test, the valve shall be repaired and retested.

If any valve fails the test, a new sample, the same quantity per the original sample, shall be drawn from the failed lot.

If additional valves fail, the manufacturer shall provide a structured root cause analysis, corrective action and preventative action report.

All valves in that valve batch shall be subsequently tested as defined in the approved corrective action and preventative action report.

The fluid used for testing shall be 97 % Helium or 10 % Helium + 90 % Nitrogen.

When testing with a 10 % He + 90 % N2 mixture, the measured detector reading shall be multiplied with a factor 10.

The test pressure shall be the rated pressure at ambient temperature.

The stem leakage shall be measured during the final cycle, when the closure member moves from the fully closed to the fully open position.

L.27 Fire Testing

Add after first paragraph and list items

Qualification of sizes smaller than the test valve permitted in API 607:1993 shall not be permitted.

NOTE 2 Substitution of a soft-seat for a metal-seat of the same soft sealing configuration may not require requalification.

NOTE 3 Change of nonmetallic materials affects qualification even when the graphitic gasket design is unchanged.

NOTE 4 Qualification scaling criteria have to be consistent with the standard used for fire testing.

For valves fire safe tested fitted with a gearbox, only the same brand and design of gearbox shall be considered as qualified.

Fire type-tests shall be witnessed by an independent agency.

A graphitic or metallic sealing barrier shall be installed on each external leakage path.

Graphite seals shall only be acceptable as back-up seals for fire resistance properties.

Graphite back-up seals shall be constructed from a single piece (i.e., not be cut or bonded multi-part).

Any modification to the design or material specification of the graphite back-up seals shall require a new qualification.

Add new section

L.30 Lagging Extension Lengths Clearance Required for Insulation

When specified, lagging extension length shall be in accordance with Table L.4.

Lagging extension length shall be measured from the upper bonnet flange to the larger of the flange rim or body diameter.

NOTE The gland has to be clear of the lagging so that any stem leakage does not enter the lagging. Lagging extensions do not have a vapor space requirement.

Add new Table L.4

Table L.4—Lagging Extension Length Required for Insulation

Valve Size		Lagging Extension Length in. (mm)
NPS	DN	
½ to 2	15 to 50	2 (50)
3 to 16	80 to 400	3 (75)
18 to 48	450 to 1200	4 (100)

Lagging extended bonnets shall be provided with an insulation collar plate.

The collar plate shall be clamped on the extended bonnet with the bolting on the upper side for adjustment accessibility.

The gap between the bonnet and the collar plate shall be sealed.

The insulation collar shall clear the bonnet lower flange/connection and the valve end flange by a distance in accordance with Table L.5.

Add new Table L.5

Table L.5—Insulation Collar Clearance Required for Insulation

Valve Size		Insulation Collar Clearance in. (mm) tolerance + 0 to + 1.0 in. (+ 0 to + 25 mm)
NPS	DN	
½ to 2	15 to 50	2 (50)
3 to 16	80 to 400	3 (75)
18 to 48	450 to 1200	4 (100)

NOTE The connective heat loss can be reduced by minimizing the diametrical clearance between the stem and the extended bonnet housing.

A stem guide bushing shall be installed at the lower end of the lagging extension bonnet.

The extended bonnet shall meet the wall thickness requirements of the applicable pressure class of the valve body in accordance with ASME B16.34.

The extended body wall thickness shall account for the pressure stresses, operating torque, stem thrust and bending stresses induced by handwheels, gears and power actuators.

Add new section

L.31 Gearbox Protection Class

When specified, gearboxes shall be provided with a higher degree of protection class than specified in 5.4.5.5.

Add new section

L.32 Pipe Pup/Transition Pieces

When specified, valves shall be provided with pipe pup/transition pieces.

Pipe pup/transition piece lengths shall be in accordance with Table L.6, unless specified.

Add new Table L.6

Table L.6—Pup Lengths

Valve Size	Pup Length
NPS 2 to NPS 8 (DN 50 to DN 200)	8 in. (200 mm)
NPS 10 to NPS 20 (DN 250 to DN 500)	Minimum 1D or Maximum 20 in. (500 mm)
NPS 22 (DN 550) and above	32 in. (800 mm)
Key D NPS (DN)	

If a pipe pup/transition piece is to be welded to a valve by the manufacturer's sub-contractor, the manufacturer shall submit the qualified welding procedure and procedure qualification record for approval.

The pipe pup/transition piece shall be welded (and the weld heat-treated, if applicable) prior to the installation of valve internals.

Transition tapers shall not be steeper than 1:4.

The ratio of the valve body thickness to the pipe wall thickness shall not exceed 1.5:1.

The ratio of the specified minimum yield strength of the transition piece/pipe pup material to the valve body material or transition piece to the pipe pup shall be less than or equal 1.5 to 1.

Add new section

L.33 ANSI/NACE MR0103/ISO 17945

When specified, metallic materials for use in sour service shall conform to ANSI/NACE MR0103/ ISO 17945.

Add new section

L.34 Other Vent and Drain Connectors

When specified, drain and vent connections shall be one of the following types:

— NPT standard threaded fitting compatible for seal welding;

— seal welded NPT standard threaded fitting;

— seal welded NPT threaded plug (IOGP design - see Figure L.3);

— double seal (axial outboard and radial inboard) parallel threads with locking ring;

— Studded flange connection (see example in Figure L.4).

When the seal welded NPT threaded plug (IOGP design) is specified, welding on to threaded areas of welded plugs shall not be permitted.

After tightening, the welded plug thread form of the NPT threaded plug (IOGP design) shall protrude above the first internal thread (see Figure L.3) to enable additional tolerance requirements in accordance with 5.6.1.2.

Add new Figure L.3

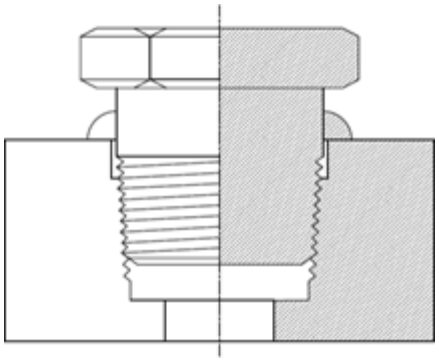

Figure L.3— Seal Welded IOGP Welded NPT Threaded Plug Additional Tolerance Requirements

The shoulder of the NPT threaded plug (IOGP design) shall extend below the surface of the valve body so that the seal weld does not come into contact with the threads of the NPT fitting.

During loosening of double seal parallel threads, the pressure shall be relieved from the inboard seal without thread disengagement.

Add new Figure L.4

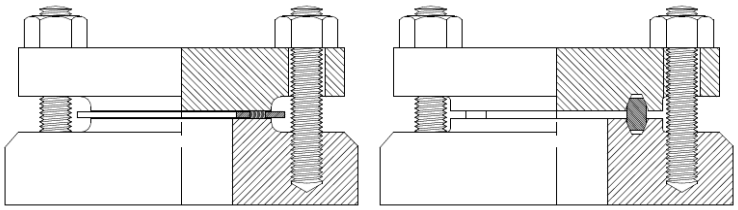

Figure L.4—Studded Flange Connection

Annex M
(informative)

Valves in Hydrogen (H2) Gas Service

M.10 Minimum Documentation and Retention

In first sentence, replace "minimum of 10 years" with

minimum of 15 years

Add new Annex N

Annex N
(normative)

Material Tables for Valves

This annex provides acceptable and optional component materials for “IOGP S-562 material class”.

When an “IOGP S-562 material class” from Table N.1 is specified, the components shall be manufactured from one of the acceptable alternative materials listed in that table.

NOTE 1 The material selection from Table N.1 may be further restricted when specified.

When an “IOGP S-562 material class” is specified from Table N.2, the components shall be manufactured from the materials listed.

NOTE 2 Equivalent material specification may be used when approved.

When a corrosion allowance of 0.12 in. (3 mm) or greater is specified, CRA weld overlay shall be applied to all sealing areas in accordance with 7.5.3 and the applicable IOGP S-563 EDS.

When specified, full CRA weld overlay shall be applied on all wetted body surfaces and all sealing areas in accordance with 7.5.3 and the applicable IOGP S-563 EDS.

Add new Table N.1

Table N.1—Basic Material Combinations Table

Basic Material			**NTCS**										
			[-20 °F (-29 °C) to 302 °F (150 °C)]										
IOGP S-562 material class			**N1a**										
Valve options to be specified by purchaser:													
— Service			Sweet										
— Nominal trim material			NTCS + ENP[a]										
— Corrosion Allowance			As specified										
— Seat Sealing			Soft (RPTFE / PCTFE / PEEK)										
— Seal			O-rings [≥ -20 °F (-29 °C)]										
— CRA weld overlay seal pockets			N/A										
Valve parts: Grouped as follows: PC = Pressure-containing parts as defined by API 6D 3.1 PR = Pressure-controlling parts as defined by API 6D 3.1 PW = Process-wetted parts excluding PC and PR		Component Type	**PC**			**PR**		**PW**					
			Body / Bonnet / Auxiliary Flange	**Stem**	**Bolting**	**Ball, Seat, Trunnion**	**Trunnion plates**	**Springs**	**Bearings**	**Seat sealing ≤ 300#**	**Seat sealing ≥ 600#**	**Seals ≤ 600#**	**Seals ≥ 900#**
Material selection (specification and/or grade)	**MDS / EDS**		A=Acceptable alternative / O=Option to be specified by Purchaser										
A105N/ A105NT/ A105QT	IC004	Pressure-containing parts	A			A[a]							
A216 WCB	IC006		A			O[a]							
A216 WCC	IC006		A			O[a]							
A516 Gr.60/ Gr.65/ Gr.70	IC005						A[a]						
A350 LF2 Class 1	IC104		A			A[a]							
A350 LF6 Class 1 or 2	IC104		A										
A352 LCC	IC106		A			O[a]							
A516 Gr.60/ Gr.65/ Gr.70	IC105						A[a]						
A694 F52	IX124		A			A[a]							
A694 F60	IX124		A			A[a]							
A694 F65	IX124		A			A[a]							
A182 F6A	-			A									
A182 FXM-19	-			A[b]									
A479 UNS S20910 XM-19	-			A[b]									
A479 UNS S41000	-			A									
A276 T410/A276 T420	-			A									
A564 Gr. 630 UNS S17400 (H1150M / H1150D)	-			A									
A705 Gr. 630 UNS S17400 (H1150M / H1150D)	-			A									
A182 F316/316L	IS104			A[b]		A[b]							
A276 316/316L	IS107			A[b]		A[b]							
A479 316/316L	IS107			A[b]		A[b]							
A351 CF3M/CF8M	IS106					A[b]							
A240 316/316L	IS105						A[b]						
A182 F51	ID144			A		A							
A182 F53/F55	ID254			A		A							
A276 UNS S31803	ID147			A		A							
A276 UNS S32750 / UNS32760	ID257			A		A							
A479 UNS S31803	ID147			A		A							
A479 UNS S32750 / UNS32760	ID257			A		A							
A995 Gr. 4A	ID146					A							
A995 Gr. 6A	ID256					A							
A240 UNS S31803 / UNS S32205	ID145						A						
A240 UNS S32550 / UNS S32750 / UNS S32760	ID255						A						
A494 CW-6MC	IN106S					A							
B446 UNS N06625	IN107S			A		A							
B564 UNS N06625	IN104S			A		A							
B443 UNS N06625	IN105S						A						
B637 UNS N07718 [c]	-			A		A							
UNS N06625	-	Spring material						A					
UNS N07718	-							A					
UNS N07750	-							A					
UNS N10276	-							A					
UNS R30003	-							A					
316 + PTFE	-	Bearing Material							A				
625 + PTFE	-								A				
A193 B7 / A194 2H	IX120	Bolting materials			A								
A320 L43 / A194 7	IX100				A								
A320 L7 / A194 7	IX100				A								
A320 L7M / A194 7M	IX100				A								
RPTFE	-	Seat sealin								A			
PCTFE	-									O[d]	O[d]		
PEEK	-										A		
FKM LT RGD	-	Sealing										O	
FKM LT RGD + Back-up rings both sides (RPTFE or PEEK)	-												O
HNBR RGD	-											O	
HNBR RGD + Back-up rings both sides (RPTFE or PEEK)	-												O

Table N.1 *(continued)*

Basic Material			NTCS										
IOGP S-562 material class			[-20 °F (-29 °C) to 302 °F (150 °C)]										
			N1b										
Valve options to be specified by purchaser:													
— Service			Sour NACE										
— Valve trim			316 Stainless Steel										
— Corrosion Allowance			As specified										
— Seat Sealing			Soft (RPTFE / PCTFE / PEEK) or Metal (TCC)										
— Seal			O-rings [≥ -20 °F (-29 °C)]										
— CRA weld overlay seal pockets			316SS (see Annex N para 2)										
Valve parts: Grouped as follows: PC = Pressure-containing parts as defined by API 6D 3.1 PR = Pressure-controlling parts as defined by API 6D 3.1 PW = Process-wetted parts excluding PC and PR		Component Type	PC			PR		PW					
			Body/Bonnet/ Auxiliary Flange	Stem	Bolting	Ball, Seat, Trunnion	Trunnion plates	Springs	Bearings	Seat sealing ≤ 300#	Seat sealing ≥ 600#	Seals ≤ 600#	Seals ≥ 900#
Material selection (specification and/or grade)	**MDS / EDS**		A=Acceptable alternative / O=Option to be specified by Purchaser										
A105N/ A105NT/ A105QT	IC004S	Pressure-containing parts	A			A[e]							
A216 WCB	IC006S		A										
A216 WCC	IC006S		A										
A350 LF2 Class 1	IC004S		A			A[e]							
A350 LF6 Class 1 or 2	IC004S		A			A[e]							
A352 LCC	IC006S		A										
A694 F52	IX124S		A			A[e]							
A694 F60	IX124S		A			A[e]							
A694 F65	IX124S		A			A[e]							
A182 FXM-19	-			A									
A479 UNS S20910 XM-19	-			A									
A564 Gr. 630 UNS S17400 (H1150M / H1150D)	-			A[f]		A[f]							
A705 Gr. 630 UNS S17400 (H1150M / H1150D)	-			A[f]		A[f]							
A182 F316/316L	IS104S			A		A							
A276 316/316L	IS107S			A		A							
A479 316/316L	IS107S			A		A							
A351 CF3M/CF8M	IS106S					A							
A240 316/316L	IS105						A						
A182 F51	ID144S			A		A							
A182 F53/F55	ID254S			A		A							
A276 UNS S31803	ID147S			A		A							
A276 UNS S32750 / UNS32760	ID257S			A		A							
A479 UNS S31803	ID147S			A		A							
A479 UNS S32750 / UNS32760	ID257S			A		A							
A995 Gr. 4A	ID146S					A							
A995 Gr. 6A	ID256S					A							
A240 UNS S31803 / UNS S32205	ID145S						A						
A240 UNS S32550 / UNS S32750 / UNS S32760	ID255S						A						
A494 CW-6MC	IN106S					A							
B446 UNS N06625	IN107S			A		A							
B564 UNS N06625	IN104S			A		A							
B443 UNS N06625	IN105S						A						
B637 UNS N07718 [c]	-			A		A							
UNS N06625	-	Spring material						A					
UNS N10276	-							A					
UNS R30003	-							A					
316 + PTFE	-	Bearing Material							A				
625 + PTFE	-								A				
A193 B7M / A194 2HM	IX120S	Bolting materials			A								
A320 L7M / A194 7M	IX100S				A								
RPTFE	-	Seat sealing								A			
PCTFE	-									O[d]	O[d]		
PEEK	-									O[g]	A[g]		
Tungsten Carbide Coating HVOF hardfacing	IH002					A[h]				A[h]	A[h]		
FKM LT RGD	-	Sealing										O	
FKM LT RGD + Back-up rings both sides (RPTFE or PEEK)	-												O
HNBR RGD	-											O	
HNBR RGD + Back-up rings both sides (RPTFE or PEEK)	-												O

Table N.1 *(continued)*

Basic Material			**NTCS**										
IOGP S-562 material class			**[-20 °F (-29 °C) to 302 °F (150 °C)]**										
Valve options to be specified by purchaser:			**N1c**										
— Service			Sour NACE										
-— Nominal trim material			Duplex Stainless Steel										
— Corrosion Allowance			As specified										
— Seat Sealing			Soft (RPTFE / PCTFE / PEEK) or Metal (TCC)										
— Seal			O-rings [≥ -20 °F (-29 °C)]										
— CRA weld overlay seal pockets			Alloy 625 (see Annex N para 2)										
Valve parts: Grouped as follows: PC = Pressure-containing parts as defined by API 6D 3.1 PR = Pressure-controlling parts as defined by API 6D 3.1 PW = Process-wetted parts excluding PC and PR		**Component Type**	**PC**			**PR**		**PW**					
			Body/Bonnet/ Auxiliary Flange	**Stem**	**Bolting**	**Ball, Seat, Trunnion**	**Trunnion plates**	**Springs**	**Bearings**	**Seat sealing ≤ 300#**	**Seat sealing ≥ 600#**	**Seals ≤ 600#**	**Seals ≥ 900#**
Material selection (specification and/or grade)	**MDS / EDS**		A=Acceptable alternative / O=Option to be specified by Purchaser										
A105N/ A105NT/ A105QT	IC004S	Pressure-containing parts	A			A[e]							
A216 WCB	IC006S		A										
A216 WCC	IC006S		A										
A350 LF2 Class 1	IC004S		A			A[e]							
A350 LF6 Class 1 or 2	IC004S		A			A[e]							
A352 LCC	IC006S		A										
A694 F52	IX124S		A			A[e]							
A694 F60	IX124S		A			A[e]							
A694 F65	IX124S		A			A[e]							
A182 F51	ID144S			A		A							
A182 F53/F55	ID254S			A		A							
A276 UNS S31803	ID147S			A		A							
A276 UNS S32750 / UNS32760	ID257S			A		A							
A479 UNS S31803	ID147S			A		A							
A479 UNS S32750 / UNS32760	ID257S			A		A							
A995 Gr. 4A	ID146S					A							
A995 Gr. 6A	ID256S					A							
A240 UNS S31803 / UNS S32205	ID145S						A						
A240 UNS S32550 / UNS S32750 / UNS S32760	ID255S						A						
A494 CW-6MC	IN106S					A							
B446 UNS N06625	IN107S			A		A							
B564 UNS N06625	IN104S			A		A							
B443 UNS N06625	IN105S						A						
B637 UNS N07718 [c]	-			A		A							
UNS N06625	-	Spring material						A					
UNS N10276	-							A					
UNS R30003	-							A					
625 + PTFE	-	Bearing Material							A				
A193 B7M / A194 2HM	IX120S	Bolting materials			A								
A320 L7M / A194 7M	IX100S				A								
RPTFE	-	Seat sealing								A			
PCTFE	-									O[d]	O[d]		
PEEK	-									O[g]	A[g]		
Tungsten Carbide Coating HVOF hardfacing	IH002					A[h]				A[h]	A[h]		
FKM LT RGD	-	Sealing										O	
FKM LT RGD + Back-up rings both sides (RPTFE or PEEK)	-												O
HNBR RGD	-											O	
HNBR RGD + Back-up rings both sides (RPTFE or PEEK)	-												O

Table N.1 *(continued)*

Basic Material			**LTCS**										
IOGP S-562 material class			**[-50 °F (-46 °C) to 302 °F (150 °C)]**										
			N1d										
Valve options to be specified by purchaser:													
— Service			Sweet										
— Nominal trim material			LT Carbon Steel + ENP[a]										
— Corrosion Allowance			As specified										
— Seat Sealing			Soft (RPTFE / PCTFE / PEEK)										
— Seal			O-rings [≥ -20 °F (-29 °C)] or Lip Seals [≥ -50 °F (-46 °C)]										
— CRA weld overlay seal pockets			N/A										
Valve parts: Grouped as follows: PC = Pressure-containing parts as defined by API 6D 3.1 PR = Pressure-controlling parts as defined by API 6D 3.1 PW = Process-wetted parts excluding PC and PR		Component Type	**PC**			**PR**		**PW**					
			Body / Bonnet / Auxiliary Flange	**Stem**	**Bolting**	**Ball, Seat, Trunnion**	**Trunnion plates**	**Springs**	**Bearings**	**Seat sealing ≤ 300#**	**Seat sealing ≥ 600#**	**Seals ≤ 600#**	**Seals ≥ 900#**
Material selection (specification and/or grade)	**MDS / EDS**		A=Acceptable alternative / O=Option to be specified by Purchaser										
A350 LF2 Class 1	IC104	Pressure-containing parts	A			A[a]							
A350 LF6 Class 1 or 2	IC104		A			A[a]							
A352 LCC	IC106		A			O[a]							
A516 Gr.60/ Gr.65/ Gr.70	IC105						A[a]						
A694 F52	IX124		A			A[a]							
A694 F60	IX124		A			A[a]							
A694 F65	IX124		A			A[a]							
A182 FXM-19	-			A[b]									
A479 UNS S20910 XM-19	-			A[b]									
A182 F316/316L	IS104			A[b]		A[b]							
A276 316/316L	IS107			A[b]		A[b]							
A479 316/316L	IS107			A[b]		A[b]							
A351 CF3M/CF8M	IS106					A[b]							
A240 316/316L	IS105						A[b]						
A182 F51	ID144			A		A							
A182 F53/F55	ID254			A		A							
A276 UNS S31803	ID147			A		A							
A276 UNS S32750 / UNS32760	ID257			A		A							
A479 UNS S31803	ID147			A		A							
A479 UNS S32750 / UNS32760	ID257			A		A							
A995 Gr. 4A	ID146					A							
A995 Gr. 6A	ID256					A							
A240 UNS S31803 / UNS S32205	ID145						A						
A240 UNS S32550 / UNS S32750 / UNS S32760	ID255						A						
A494 CW-6MC	IN106S					A							
B446 UNS N06625	IN107S			A		A							
B564 UNS N06625	IN104S			A		A							
B443 UNS N06625	IN105S						A						
B637 UNS N07718 [c]	-			A		A							
UNS N06625	-	Spring material						A					
UNS N07718	-							A					
UNS N07750	-							A					
UNS N10276	-							A					
UNS R30003	-							A					
316 + PTFE	-	Bearing Material							A				
625 + PTFE	-								A				
A320 L43 / A194 7	IX100	Bolting materials			A								
A320 L7 / A194 7	IX100				A								
A320 L7M / A194 7M	IX100				A								
RPTFE	-	Seat sealing								A			
PCTFE	-									O[d]	O[d]		
PEEK	-									O	A		
FKM LT RGD	-	Sealing										O	
FKM LT RGD + Back-up rings both sides (RPTFE or PEEK)	-												O
HNBR RGD	-											O	
HNBR RGD + Back-up rings both sides (RPTFE or PEEK)	-												O
PTFE Lip Seal + Elgiloy Spring + Anti Collapse	-											O	O
V-packing (chevron) seals	-											O	O

Table N.1 *(continued)*

Basic Material			LTCS											
IOGP S-562 material class			[-50 °F (-46 °C) to 302 °F (150 °C)]											
			N1e											
Valve options to be specified by purchaser:														
— Service			Sour NACE											
— Nominal trim material			316 Stainless Steel											
— Corrosion Allowance			As specified											
— Seat Sealing			Soft (RPTFE / PCTFE / PEEK) or Metal (TCC)											
— Seal			O-rings [≥ -20 °F (-29 °C)] or Lip Seals [≥ -50 °F (-46 °C)]											
— CRA weld overlay seal pockets			316SS (see Annex N para 2)											
Valve parts: Grouped as follows: PC = Pressure-containing parts as defined by API 6D 3.1 PR = Pressure-controlling parts as defined by API 6D 3.1 PW = Process-wetted parts excluding PC and PR		Component Type	PC			PR		PW						
			Body/Bonnet/ Auxiliary Flange	Stem	Bolting	Ball, Seat, Trunnion	Trunnion plates	Springs	Bearings	Seat sealing ≤ 300#	Seat sealing ≥ 600#	Seals ≤ 600#	Seals ≥ 900#
Material selection (specification and/or grade)	**MDS / EDS**		A=Acceptable alternative / O=Option to be specified by Purchaser											
A350 LF2 Class 1	IC004S	Pressure-containing parts	A			A[e]								
A350 LF6 Class 1 or 2	IC004S		A			A[e]								
A352 LCC	IC006S		A											
A694 F52	IX124S		A			A[e]								
A694 F60	IX124S		A			A[e]								
A694 F65	IX124S		A			A[e]								
A182 FXM-19	-			A										
A479 UNS S20910 XM-19	-			A										
A182 F316/316L	IS104S			A		A								
A276 316/316L	IS107S			A		A								
A479 316/316L	IS107S			A		A								
A351 CF3M/CF8M	IS106S					A								
A240 316/316L	IS105						A							
A182 F51	ID144S			A		A								
A182 F53/F55	ID254S			A		A								
A276 UNS S31803	ID147S			A		A								
A276 UNS S32750 / UNS32760	ID257S			A		A								
A479 UNS S31803	ID147S			A		A								
A479 UNS S32750 / UNS32760	ID257S			A		A								
A995 Gr. 4A	ID146S					A								
A995 Gr. 6A	ID256S					A								
A240 UNS S31803 / UNS S32205	ID145S						A							
A240 UNS S32550 / UNS S32750 / UNS S32760	ID255S						A							
A494 CW-6MC	IN106S					A								
B446 UNS N06625	IN107S			A		A								
B564 UNS N06625	IN104S			A		A								
B443 UNS N06625	IN105S						A							
B637 UNS N07718 [c]	-			A		A								
UNS N06625	-	Spring material						A						
UNS N10276	-							A						
UNS R30003	-							A						
316 + PTFE	-	Bearing Material							A					
625 + PTFE	-								A					
A320 L7M / A194 7M	IX100S	Bolting materials			A									
RPTFE	-	Seat sealing								A				
PCTFE	-									O[d]	O[d]			
PEEK	-									O[g]	A[g]			
Tungsten Carbide Coating HVOF hardfacing	IH002					A[h]				A[h]	A[h]			
FKM LT RGD	-	Sealing										O		
FKM LT RGD + Back-up rings both sides (RPTFE or PEEK)	-												O	
HNBR RGD	-											O		
HNBR RGD + Back-up rings both sides (RPTFE or PEEK)	-												O	
PTFE Lip Seal + Elgiloy Spring + Anti Collapse	-											O	O	
V-packing (chevron) seals	-											O	O	

Table N.1 *(continued)*

Basic Material			LTCS										
IOGP S-562 material class			[-50 °F (-46 °C) to 302 °F (150 °C)]										
			N1f										
Valve options to be specified by purchaser:													
— Service			Sour NACE										
— Nominal trim material			Duplex Stainless Steel										
— Corrosion Allowance			As specified										
— Seat Sealing			Soft (RPTFE / PCTFE / PEEK) or Metal (TCC)										
— Seal			O-rings [≥ -20 °F (-29 °C)] or Lip Seals [≥ -50 °F (-46 °C)]										
— CRA weld overlay seal pockets			Alloy 625 (see Annex N para 2)										
Valve parts: Grouped as follows: PC = Pressure-containing parts as defined by API 6D 3.1 PR = Pressure-controlling parts as defined by API 6D 3.1 PW = Process-wetted parts excluding PC and PR			PC			PR		PW					
			Body/Bonnet/ Auxiliary Flange	Stem	Bolting	Ball, Seat, Trunnion	Trunnion plates	Springs	Bearings	Seat sealing ≤ 300#	Seat sealing ≥ 600#	Seals ≤ 600#	Seals ≥ 900#
Material selection (specification and/or grade)	**MDS / EDS**	**Component Type**	A=Acceptable alternative / O=Option to be specified by Purchaser										
A350 LF2 Class 1	IC004S	Pressure-containing parts	A			A[e]							
A350 LF6 Class 1 or 2	IC004S		A			A[e]							
A352 LCC	IC006S		A										
A694 F52	IX124S		A			A[e]							
A694 F60	IX124S		A			A[e]							
A694 F65	IX124S		A			A[e]							
A182 F51	ID144S			A		A							
A182 F53/F55	ID254S			A		A							
A276 UNS S31803	ID147S			A		A							
A276 UNS S32750 / UNS32760	ID257S			A		A							
A479 UNS S31803	ID147S			A		A							
A479 UNS S32750 / UNS32760	ID257S			A		A							
A995 Gr. 4A	ID146S					A							
A995 Gr. 6A	ID256S					A							
A240 UNS S31803 / UNS S32205	ID145S						A						
A240 UNS S32550 / UNS S32750 / UNS S32760	ID255S						A						
A494 CW-6MC	IN106S					A							
B446 UNS N06625	IN107S			A		A							
B564 UNS N06625	IN104S			A		A							
B443 UNS N06625	IN105S						A						
B637 UNS N07718 [c]	-			A		A							
UNS N06625	-	Spring material						A					
UNS N07718	-							A					
UNS N07750	-							A					
UNS N10276	-							A					
UNS R30003	-							A					
625 + PTFE	-	Bearing Material							A				
A320 L7M / A194 7M	IX100S	Bolting materials			A								
RPTFE	-	Seat sealing								A			
PCTFE	-									O[d]	O[d]		
PEEK	-									O[g]	A[g]		
Tungsten Carbide Coating HVOF hardfacing	IH002					A[h]				A[h]	A[h]		
FKM LT RGD	-	Sealing										O	
FKM LT RGD + Back-up rings both sides (RPTFE or PEEK)	-												O
HNBR RGD	-											O	
HNBR RGD + Back-up rings both sides (RPTFE or PEEK)	-												O
PTFE Lip Seal + Elgiloy Spring + Anti Collapse	-											O	O
V-packing (chevron) seals	-											O	O

Table N.1 *(continued)*

Basic Material			**LTCS + Alloy 625 Clad [≥ NPS 4 (DN 100)]**										
			[-50 °F (-46 °C) to 302 °F (150 °C)]										
IOGP S-562 material class			**N1g**										
Valve options to be specified by purchaser:													
— Service			Sour NACE										
— Nominal trim material			Alloy 625										
— Corrosion Allowance			N/A										
— Seat Sealing			Soft (RPTFE / PEEK) or Metal (TCC)										
— Seal			O-rings [≥ -20 °F (-29 °C)] or Lip Seals [≥ -50 °F (-46 °C)]										
— CRA weld overlay seal pockets			Alloy 625 weld overlay shall be applied on all wetted body surfaces										
Valve parts: Grouped as follows: PC = Pressure-containing parts as defined by API 6D 3.1 PR = Pressure-controlling parts as defined by API 6D 3.1 PW = Process-wetted parts excluding PC and PR			**PC**			**PR**		**PW**					
			Body / Bonnet / Auxiliary Flange	**Stem**	**Bolting**	**Ball, Seat, Trunnion**	**Trunnion plates**	**Springs**	**Bearings**	**Seat sealing ≤ 300#**	**Seat sealing ≥ 600#**	**Seals ≤ 600#**	**Seals ≥ 900#**
Material selection (specification and/or grade)	**MDS / EDS**	**Component Type**	A=Acceptable alternative / O=Option to be specified by Purchaser										
A350 LF2 Class 1	IC004S	Pressure-containing parts	A[e]			A[e]						A[e]	
A350 LF6 Class 1 or 2	IC004S		A[e]			A[e]							
A352 LCC	IC006S		A[e]			O[e]							
A516 Gr.60/ Gr.65/ Gr.70	IC105						A[e]						
A694 F52	IX124S		A[e]			A[e]							
A694 F60	IX124S		A[e]			A[e]							
A694 F65	IX124S		A[e]			A[e]							
A494 CW-6MC	IN106S					A	A						
B446 UNS N06625	IN107S			A		A							
B564 UNS N06625	IN104S			A		A							
B443 UNS N06625	IN105S						A						
B637 UNS N07718 [c]	-			O		O							
UNS N06625	-	Spring material						A					
UNS N10276	-							A					
UNS R30003	-							A					
625 + PTFE	-	Bearing Material							A				
A320 L7M / A194 7M	IX100S	Bolting materials			A								
RPTFE	-	Seat sealing								A			
PCTFE	-									O[d]	O[d]		
PEEK	-									O[g]	A[g]		
Tungsten Carbide Coating HVOF hardfacing	IH002					A[h]				A[h]	A[h]		
FKM LT RGD	-	Sealing										O	
FKM LT RGD + Back-up rings both sides (RPTFE or PEEK)	-												O
HNBR RGD	-											O	
HNBR RGD + Back-up rings both sides (RPTFE or PEEK)	-												O
PTFE Lip Seal + Elgiloy Spring + Anti Collapse	-											O	O
V-packing (chevron) seals	-											O	O

Table N.1 *(continued)*

Basic Material			**SS316**										
IOGP S-562 material class			**[-50 °F (-46 °C) to 302 °F (150 °C)]**										
			N1h										
Valve options to be specified by purchaser:													
— Service			Sour NACE										
— Nominal trim material			316 Stainless Steel										
— Corrosion Allowance			N/A										
— Seat Sealing			Soft (RPTFE / PEEK) or Metal (TCC)										
— Seal			O-rings [≥ -20 °F (-29 °C)] or Lip Seals [≥ -50 °F (-46 °C)]										
— CRA weld overlay seal pockets			N/A										
Valve parts: Grouped as follows: PC = Pressure-containing parts as defined by API 6D 3.1 PR = Pressure-controlling parts as defined by API 6D 3.1 PW = Process-wetted parts excluding PC and PR			**PC**			**PR**		**PW**					
			Body / bonnet / Auxiliary Flange	**Stem**	**Bolting**	**Ball, Seat, Trunnion**	**Trunnion plates**	**Springs**	**Bearings**	**Seat sealing ≤ 300#**	**Seat sealing ≥ 600#**	**Seals ≤ 600#**	**Seals ≥ 900#**
Material selection (specification and/or grade)	**MDS / EDS**	**Component Type**	A=Acceptable alternative / O=Option to be specified by Purchaser										
A350 LF2 Class 1	IC104	Pressure-containing parts				A[e]							
A350 LF6 Class 1 or 2	IC104					A[e]							
A352 LCC	IC106					O[e]							
A516 Gr.60/ Gr.65/ Gr.70	IC105						A[e]						
A694 F52	IX124					A[e]							
A694 F60	IX124					A[e]							
A694 F65	IX124					A[e]							
A182 FXM-19	-			A		A							
A479 UNS S20910 XM-19	-			A		A							
A182 F316/316L	IS104S		A	A		A							
A276 316/316L	IS107S			A		A							
A479 316/316L	IS107S			A		A							
A351 CF3M/CF8M	IS106S		A			A							
A240 316/316L	IS105						A						
A182 F51	ID144S			A		A							
A182 F53/F55	ID254S			A		A							
A276 UNS S31803	ID147S			A		A							
A276 UNS S32750 / UNS32760	ID257S			A		A							
A479 UNS S31803	ID147S			A		A							
A479 UNS S32750 / UNS32760	ID257S			A		A							
A995 Gr. 4A	ID146S					A							
A995 Gr. 6A	ID256S					A							
A240 UNS S31803 / UNS S32205	ID145S						A						
A240 UNS S32550 / UNS S32750 / UNS S32760	ID255S						A						
A494 CW-6MC	IN106S					A							
B446 UNS N06625	IN107S			A		A							
B564 UNS N06625	IN104S			A		A							
B443 UNS N06625	IN105S						A						
B637 UNS N07718 [c]	-			A		A							
UNS N06625	-	Spring material						A					
UNS N10276	-							A					
UNS R30003	-							A					
316 + PTFE	-	Bearing Material							A				
625 + PTFE	-								A				
A193 B8M Class 1 / A194 8M / A194 8MA	-	Bolting materials			A								
A193 B8M Class 2 / A194 8M / A194 8MA	-				A								
A193 B8M2 Class 2B / A194 8M / A194 8MA	-				A								
A193 B8M3 Class 2C / A194 8M / A194 8MA	-				A								
A193 B8MLCuNA / A194 Gr. 8MLCuNA	-				A								
A193 B8MLCuN-CLASS 1B / A194 Gr. 9CA	-				A								
UNS N07718 to API 6ACRA (120K)	IN120S				A								
RPTFE	-	Seat sealing								A			
PCTFE	-									O[d]	O[d]		
PEEK	-									O[g]	A[g]		
Tungsten Carbide Coating HVOF hardfacing	IH002					A[h]				A[h]	A[h]		
FKM LT RGD	-	Sealing										O	
FKM LT RGD + Back-up rings both sides (RPTFE or PEEK)	-												O
HNBR RGD	-											O	
HNBR RGD + Back-up rings both sides (RPTFE or PEEK)	-												O
PTFE Lip Seal + Elgiloy Spring + Anti Collapse	-											O	O
V-packing (chevron) seals	-											O	O

Table N.1 *(continued)*

Basic Material			DSS										
			[-50 °F (-46 °C) to 302 °F (150 °C)]										
IOGP S-562 material class			**N1i**										
Valve options to be specified by purchaser:													
— Service			Sour NACE										
— Nominal trim material			Duplex Stainless Steel										
— Corrosion Allowance			N/A										
— Seat Sealing			Soft (RPTFE / PEEK) or Metal (TCC)										
— Seal			O-rings [≥ -20 °F (-29 °C)] or Lip Seals [≥ -50 °F (-46 °C)]										
— CRA weld overlay seal pockets			N/A										
Valve parts: Grouped as follows: PC = Pressure-containing parts as defined by API 6D 3.1 PR = Pressure-controlling parts as defined by API 6D 3.1 PW = Process-wetted parts excluding PC and PR		Component Type	PC			PR		PW					
			Body / Bonnet / Auxiliary Flange	Stem	Bolting	Ball, Seat, Trunnion	Trunnion plates	Springs	Bearings	Seat sealing ≤ 300#	Seat sealing ≥ 600#	Seals ≤ 600#	Seals ≥ 900#
Material selection (specification and/or grade)	**MDS / EDS**		A=Acceptable alternative / O=Option to be specified by Purchaser										
A350 LF2 Class 1	IC104	Pressure-containing parts				A[e]							
A350 LF6 Class 1 or 2	IC104					A[e]							
A352 LCC	IC106					O[e]							
A516 Gr.60/ Gr.65/ Gr.70	IC105						A[e]						
A694 F52	IX124					A[e]							
A694 F60	IX124					A[e]							
A694 F65	IX124					A[e]							
A182 F51	ID144S		A	A		A							
A182 F53/F55	ID254S			A		A							
A276 UNS S31803	ID147S			A		A							
A276 UNS S32750 / UNS32760	ID257S			A		A							
A479 UNS S31803	ID147S			A		A							
A479 UNS S32750 / UNS32760	ID257S			A		A							
A995 Gr. 4A	ID146S		A			A							
A995 Gr. 6A	ID256S					A							
A240 UNS S31803 / UNS S32205	ID145S						A						
A240 UNS S32550 / UNS S32750 / UNS S32760	ID255S						A						
A494 CW-6MC	IN106S					A							
B446 UNS N06625	IN107S			A		A							
B564 UNS N06625	IN104S			A		A							
B443 UNS N06625	IN105S						A						
B637 UNS N07718 [c]	-			A		A							
UNS N06625	-	Spring material						A					
UNS N10276	-							A					
UNS R30003	-							A					
625 + PTFE	-	Bearing Material							A				
A193 B8MLCuNA / A194 Gr. 8MLCuNA	-	Bolting materials			~~A~~								
A193 B8MLCuN-CLASS 1B / A194 Gr. 9CA	-				A								
UNS N07718 to API 6ACRA (120K)	IN120S				A								
A1082 UNS S32750, S32760	ID260S				A								
RPTFE	-	Seat sealing								A			
PCTFE	-									O[d]	O[d]		
PEEK	-									O[g]	A[g]		
Tungsten Carbide Coating HVOF hardfacing	IH002					A[h]				A[h]	A[h]		
FKM LT RGD	-	Sealing										O	
FKM LT RGD + Back-up rings both sides (RPTFE or PEEK)	-												O
HNBR RGD	-											O	
HNBR RGD + Back-up rings both sides (RPTFE or PEEK)	-												O
PTFE Lip Seal + Elgiloy Spring + Anti Collapse	-											O	O
V-packing (chevron) seals	-											O	O

Table N.1 *(continued)*

Basic Material			SDSS										
IOGP S-562 material class			[-50 °F (-46 °C) to 302 °F (150 °C)]										
			N1j										
Valve options to be specified by purchaser:													
— Service			Seawater[i] / Sour NACE										
— Nominal trim material			Super Duplex Stainless Steel										
— Corrosion Allowance			N/A										
— Seat Sealing			Soft (RPTFE / PEEK) or Metal (TCC)										
— Seal			O-rings [≥ -20 °F (-29 °C)] or Lip Seals [≥ -50 °F (-46 °C)]										
— CRA weld overlay seal pockets			N/A										
Valve parts: Grouped as follows: PC = Pressure-containing parts as defined by API 6D 3.1 PR = Pressure-controlling parts as defined by API 6D 3.1 PW = Process-wetted parts excluding PC and PR		Component Type	PC			PR		PW					
			Body / Bonnet / Auxiliary Flange	Stem	Bolting	Ball, Seat, Trunnion	Trunnion plates	Springs	Bearings	Seat sealing ≤ 300#	Seat sealing ≥ 600#	Seals ≤ 600#	Seals ≥ 900#
Material selection (specification and/or grade)	**MDS / EDS**		A=Acceptable alternative / O=Option to be specified by Purchaser										
A350 LF2 Class 1	IC104	Pressure-containing parts				A[e]							
A350 LF6 Class 1 or 2	IC104					A[e]							
A352 LCC	IC106					O[e]							
A516 Gr.60/ Gr.65/ Gr.70	IC105						A[e]						
A694 F52	IX124					A[e]							
A694 F60	IX124					A[e]							
A694 F65	IX124					A[e]							
A182 F53/F55	ID254S		A	A		A							
A276 UNS S32750 / UNS32760	ID257S			A		A							
A479 UNS S32750 / UNS32760	ID257S			A		A							
A995 Gr. 6A	ID256S		A			A							
A240 UNS S32550 / UNS S32750 / UNS S32760	ID255S						A						
A494 CW-6MC	IN106S					A							
B446 UNS N06625	IN107S			A		A							
B564 UNS N06625	IN104S			A		A							
B443 UNS N06625	IN105S						A						
B637 UNS N07718 [c]	-			A[j]		A[j]							
UNS N06625	-	Spring material						A					
UNS N07718	-							A[j]					
UNS N10276	-							A					
UNS R30003	-							A					
625 + PTFE	-	Bearing Material							A				
A193 B8MLCuNA / A194 Gr. 8MLCuNA	-	Bolting materials			~~A~~								
A193 B8MLCuN-CLASS 1B / A194 Gr. 9CA	-				A								
UNS N07718 to API 6ACRA (120K)	IN120S				A								
A1082 UNS S32750, S32760	ID260S				A								
RPTFE	-	Seat sealing								A			
PCTFE	-									O[d]	O[d]		
PEEK	-									O[g]	A[g]		
Tungsten Carbide Coating HVOF hardfacing	IH002					A[h]				A[h]	A[h]		
FKM LT RGD	-	Sealing										O	
FKM LT RGD + Back-up rings both sides (RPTFE or PEEK)	-												O
HNBR RGD	-											O	
HNBR RGD + Back-up rings both sides (RPTFE or PEEK)	-												O
PTFE Lip Seal + Elgiloy Spring + Anti Collapse	-											O	O
V-packing (chevron) seals	-											O	O

Table N.1 *(continued)*

Basic Material			Alloy 625										
IOGP S-562 material class			[-50 °F (-46 °C) to 302 °F (150 °C)]										
			N1k										
Valve options to be specified by purchaser:													
— Service			Sour NACE										
— Nominal trim material			Alloy 625										
— Corrosion Allowance			N/A										
— Seat Sealing			Soft (RPTFE / PEEK) or Metal (TCC)										
— Seal			O-rings [≥ -20 °F (-29 °C)] or Lip Seals [≥ -50 °F (-46 °C)]										
— CRA weld overlay seal pockets			N/A										
Valve parts: Grouped as follows: PC = Pressure-containing parts as defined by API 6D 3.1 PR = Pressure-controlling parts as defined by API 6D 3.1 PW = Process-wetted parts excluding PC and PR		Component Type	PC			PR		PW					
			Body / Bonnet / Auxiliary Flange	Stem	Bolting	Ball, Seat, Trunnion	Trunnion plates	Springs	Bearings	Seat sealing ≤ 300#	Seat sealing ≥ 600#	Seals ≤ 600#	Seals ≥ 900#
Material selection (specification and/or grade)	**MDS / EDS**		A=Acceptable alternative / O=Option to be specified by Purchaser										
A350 LF2 Class 1	IC004S	Pressure-containing parts				A[e]							
A350 LF6 Class 1 or 2	IC004S					A[e]							
A352 LCC	IC006S					O[e]							
A516 Gr.60/ Gr.65/ Gr.70	IC105						A[e]						
A694 F52	IX124S					A[e]							
A694 F60	IX124S					A[e]							
A694 F65	IX124S					A[e]							
A494 CW-6MC	IN106S		A			A	A						
B446 UNS N06625	IN107S		A	A		A							
B564 UNS N06625	IN104S		A	A		A							
B443 UNS N06625	IN105S						A						
B637 UNS N07718 [c]	-			O		O							
UNS N06625	-	Spring material						A					
UNS N10276	-							A					
UNS R30003	-							A					
316 + PTFE	-	Bearing Material											
625 + PTFE	-								A				
A193 B8M Class 1 / A194 8M / A194 8MA	-	Bolting materials			A								
A193 B8M Class 2 / A194 8M / A194 8MA	-				A								
A193 B8M2 Class 2B / A194 8M / A194 8MA	-				A								
A193 B8M3 Class 2C / A194 8M / A194 8MA	-				A								
A193 B8MLCuNA / A194 Gr. 8MLCuNA	-				A								
A193 B8MLCuN-CLASS 1B / A194 Gr. 9CA	-				A								
A320 L43 / A194 7	IX100												
A320 L7 / A194 7	IX100												
A320 L7M / A194 7M	IX100S												
UNS N07718 to API 6ACRA (120K)	IN120S				A								
A1082 UNS S32750, S32760	ID260				A								
ASTM F468 UNS N06625 / ASTM F467 UNS N06625 Grade 2	IN100S				A								
RPTFE	-	Seat sealing								A	O		
PCTFE	-									O[d]	O[d]		
PEEK	-									O[g]	A[g]		
Tungsten Carbide Coating HVOF hardfacing	IH002					A[h]				A[h]	A[h]		
FKM LT RGD	-	Sealing										O	
FKM LT RGD + Back-up rings both sides (RPTFE or PEEK)	-												O
HNBR RGD	-											O	
HNBR RGD + Back-up rings both sides (RPTFE or PEEK)	-												O
PTFE Lip Seal + Elgiloy Spring + Anti Collapse	-											O	O
V-packing (chevron) seals	-											O	O

Table N.1 *(continued)*

Basic Material			**6Mo**										
			[-50 °F (-46 °C) to 302 °F (150 °C)]										
IOGP S-562 material class			**N1I**										
Valve options to be specified by purchaser:													
— Service			Sour NACE										
— Nominal trim material			6Mo										
— Corrosion Allowance			N/A										
— Seat Sealing			Soft (RPTFE / PEEK) or Metal (TCC)										
— Seal			O-rings [≥ -20 °F (-29 °C)] or Lip Seals [≥ -50 °F (-46 °C)]										
— CRA weld overlay seal pockets			N/A										
Valve parts: Grouped as follows: PC = Pressure-containing parts as defined by API 6D 3.1 PR = Pressure-controlling parts as defined by API 6D 3.1 PW = Process-wetted parts excluding PC and PR		**Component Type**	**PC**			**PR**		**PW**					
			Body / Bonnet / Auxiliary Flange	**Stem**	**Bolting**	**Ball, Seat, Trunnion**	**Trunnion plates**	**Springs**	**Bearings**	**Seat sealing ≤ 300#**	**Seat sealing ≥ 600#**	**Seals ≤ 600#**	**Seals ≥ 900#**
Material selection (specification and/or grade)	**MDS / EDS**		A=Acceptable alternative / O=Option to be specified by Purchaser										
A350 LF2 Class 1	IC004S	Pressure-containing parts				A[e]							
A350 LF6 Class 1 or 2	IC004S					A[e]							
A516 Gr.60/ Gr.65/ Gr.70	IC105						A[e]						
A694 F52	IX124S					A[e]							
A694 F60	IX124S					A[e]							
A694 F65	IX124S					A[e]							
A494 CW-6MC	IN106S					A	A						
B446 UNS N06625	IN107S			A		A							
B564 UNS N06625	IN104S			A		A							
B443 UNS N06625	IN105S						A						
B637 UNS N07718 [c]	-			O		O							
ASTM A276 / ASTM A479 UNS S31254	IR117		A	A		A							
ASTM A182 Grade F44	IR114		A	A		A	A						
ASTM A351 Grade CK3MCuN, CN3MN	IR116		A				A						
UNS N06625	-	Spring material						A					
UNS N10276	-							A					
UNS R30003	-							A					
625 + PTFE	-	Bearing Material							A				
A193 B8M Class 1 / A194 8M / A194 8MA	-	Bolting materials			A								
A193 B8M Class 2 / A194 8M / A194 8MA	-				A								
A193 B8M2 Class 2B / A194 8M / A194 8MA	-				A								
A193 B8M3 Class 2C / A194 8M / A194 8MA	-				A								
A193 B8MLCuNA / A194 Gr. 8MLCuNA	-				A								
A193 B8MLCuN-CLASS 1B / A194 Gr. 9CA	-				A								
UNS N07718 to API 6ACRA (120K)	IN120S				A								
A1082 UNS S32750, S32760	ID260				A								
ASTM F468 UNS N06625 / ASTM F467 UNS N06625 Grade 2	IN100S				A								
RPTFE	-	Seat sealing								A	O		
PCTFE	-									O[d]	O[d]		
PEEK	-									O[g]	A[g]		
Tungsten Carbide Coating HVOF hardfacing	IH002					A[h]				A[h]	A[h]		
FKM LT RGD	-	Sealing										O	
FKM LT RGD + Back-up rings both sides (RPTFE or PEEK)	-												O
HNBR RGD	-											O	
HNBR RGD + Back-up rings both sides (RPTFE or PEEK)	-												O
PTFE Lip Seal + Elgiloy Spring + Anti Collapse	-											O	O
V-packing (chevron) seals	-											O	O

Table N.1 *(continued)*

[a] ENP shall be applied and meet the requirements of IOGP S-563, EDS IH04.
[b] Shall not be used for chloride service.
[c] Wrought precipitation-hardened nickel base alloy to UNS N07718 shall comply with the requirements in API 6ACRA.
[d] Manufacturer to recommend max. operating temperature limitation for PCTFE for each allowable pressure rating (150#, 300#, 600#, 900# and 1500#).
[e] Alloy 625 weld overlay shall be applied to NTCS or LTCS.
[f] Depending on the level of sourness this material may not be suitable.
[g] TCC or ENP shall be applied to the ball when PEEK seats used. This is only applicable when ball made of austenitic stainless steel, duplex or 6Mo material).
[h] Metal-seated valves shall have TCC HVOF hard facing on ball and seats.
[i] For valves in seawater service, materials should be supplied in accordance with referenced MDSs without the "S" suffix.
[j] Shall not be used for seawater service.

Add new Table N.2

Table N.2—Standard Trim Materials Table

General					Materials[a, o, r]							
IOGP S-562 Material Class	Nominal Body & Trim Material	Temperature Range °F (°C)	ASME Pressure Rating	Service	Pressure-containing Parts Except Stem	Stem [h]	Ball	Seat Ring, and Other Wetted parts	Bolting[q]	Springs [s]	Seat Insert [c]	Primary Seals [d,e,f]
10N	NTCS / NTCS+ENP	-20 to 300 (-29 to 150)	CL 150 - CL 600	Sweet	ASTM A105N / ASTM A216-WCB / ASTM A216-WCC	ASTM A479 UNS S41000/ ASTM A276 T410 / ASTM A276 T420	NTCS[n] + ENP [i]	NTCS[n] + ENP [i]	ASTM A193-B7 & A194-2H ASTM A320-L7 & A194-7	UNS N06625 / UNS R30003 / UNS N07718 / UNS N07750	RPTFE	FKM / HNBR
11N	NTCS / NTCS+ENP	-20 to 300 (-29 to 150)	≥ CL 600	Sweet	ASTM A105N / ASTM A216-WCB / ASTM A216-WCC	ASTM A479 UNS S41000/ ASTM A276 T410 / ASTM A276 T420	NTCS[n] + ENP [i]	NTCS[n] + ENP [i]	ASTM A193-B7 & A194-2H ASTM A320-L7 & A194-7	UNS N06625 / UNS R30003 / UNS N07718 / UNS N07750	PEEK	FKM / HNBR [k]
10L	LTCS / LTCS+ENP	-50 to 300 (-46 to 150)	CL 150 - CL 600	Sweet	ASTM A350-LF2-1 / ASTM A352-LCC	ASTM A479 UNS S20910 (XM-19)/ ASTM A182 FXM-19 / A479 316/ A182 F316	LTCS[m] + ENP [i]	LTCS[m] + ENP [i]	ASTM A320-L7 & A194-7	UNS N06625 / UNS R30003 / UNS N07718 / UNS N07750	RPTFE	FKM LT/ HNBR
11L	LTCS / LTCS+ENP	-50 to 300 (-46 to 150)	≥ CL 600	Sweet	ASTM A350-LF2-1 / ASTM A352-LCC	ASTM A479 UNS S20910 (XM-19)/ ASTM A182 FXM-19 / A479 316/ A182 F316	LTCS[m] + ENP [i]	LTCS[m] + ENP [i]	ASTM A320-L7 & A194-7	UNS N06625 / UNS R30003 / UNS N07718 / UNS N07750	PEEK	FKM LT/ HNBR [k]
20N	NTCS / 316 SS	-20 to 300 (-29 to 150)	CL 150 - CL 600	Sweet	ASTM A105N / ASTM A216-WCB / ASTM A216-WCC	ASTM A479 UNS S20910 (XM-19)/ ASTM A182 FXM-19	ASTM A182-F316/316L / ASTM A351-CF3M/CF8M	ASTM A182-F316/316L / ASTM A351-CF3M/CF8M	ASTM A193-B7 & A194-2H ASTM A320-L7 & A194-7	UNS N06625 / UNS R30003 / UNS N07718 / UNS N07750	RPTFE	FKM / HNBR
21N	NTCS / 316 SS	-20 to 300 (-29 to 150)	≥ CL 600	Sweet	ASTM A105N / ASTM A216-WCB / ASTM A216-WCC	ASTM A479 UNS S20910 (XM-19)/ ASTM A182 FXM-19	[ASTM A182-F316/316L / ASTM A351-CF3M/CF8M] + ENP [i]	ASTM A182-F316/316L / ASTM A351-CF3M/CF8M	ASTM A193-B7 & A194-2H ASTM A320-L7 & A194-7	UNS N06625 / UNS R30003 / UNS N07718 / UNS N07750	PEEK	FKM / HNBR [k]
20S	NTCS /316 SS Sour	-20 to 300 (-29 to 150)	CL 150 - CL 600	Sour [j]	ASTM A105N / ASTM A216-WCB / ASTM A216-WCC	ASTM A479 UNS S20910 (XM-19)/ ASTM A182 FXM-19	ASTM A182-F316/316L / ASTM A351-CF3M/CF8M	ASTM A182-F316/316L / ASTM A351-CF3M/CF8M	ASTM A193-B7M & A194-2HM / ASTM A320-L7M & A194-7M	UNS N06625 / UNS R30003 / UNS N10276	RPTFE	FKM / HNBR
21S	NTCS /316 SS Sour	-20 to 300 (-29 to 150)	≥ CL 600	Sour [j]	ASTM A105N / ASTM A216-WCB / ASTM A216-WCC	ASTM A479 UNS S20910 (XM-19)/ ASTM A182 FXM-19	[ASTM A182-F316/316L / ASTM A351-CF3M/CF8M] + ENP [i]	ASTM A182-F316/316L / ASTM A351-CF3M/CF8M	ASTM A193-B7M & A194-2HM / ASTM A320-L7M & A194-7M	UNS N06625 / UNS R30003 / UNS N10276	PEEK	FKM / HNBR [k]
20L	LTCS / 316 SS LT	-50 to 300 (-46 to 150)	CL 150 - CL 600	Sweet	ASTM A350-LF2-1 / ASTM A352-LCC	ASTM A479 UNS S20910 (XM-19)/ ASTM A182 FXM-19	ASTM A182-F316/316L / ASTM A351-CF3M/CF8M	ASTM A182-F316/316L / ASTM A351-CF3M/CF8M	ASTM A320-L7 & A194-7	UNS N06625 / UNS R30003 / UNS N07718 / UNS N07750	RPTFE	FKM LT / HNBR
21L	LTCS / 316 SS LT	-50 to 300 (-46 to 150)	≥ CL 600	Sweet	ASTM A350-LF2-1 / ASTM A352-LCC	ASTM A479 UNS S20910 (XM-19)/ ASTM A182 FXM-19	[ASTM A182-F316/316L / ASTM A351-CF3M/CF8M] + ENP [i]	ASTM A182-F316/316L / ASTM A351-CF3M/CF8M	ASTM A320-L7 & A194-7	UNS N06625 / UNS R30003 / UNS N07718 / UNS N07750	PEEK	FKM LT/ HNBR [k]
20X	LTCS / 316 SS Sour LT	-50 to 300 (-46 to 150)	CL 150 - CL 600	Sour [j]	ASTM A350-LF2-1 / ASTM A352-LCC	ASTM A479 UNS S20910 (XM-19)/ ASTM A182 FXM-19	ASTM A182-F316/316L / ASTM A351-CF3M/CF8M	ASTM A182-F316/316L / ASTM A351-CF3M/CF8M	ASTM A320-L7M & A194-7M	UNS N06625 / UNS R30003 / UNS N10276	RPTFE	FKM LT / HNBR

Table N.2 *(continued)*

General					Materials[a, o, r]							
IOGP S-562 Material Class	**Nominal Body & Trim Material**	**Temperature Range** °F (°C)	**ASME Pressure Rating**	**Service**	**Pressure-containing Parts Except Stem**	**Stem [h]**	**Ball**	**Seat Ring, and Other Wetted parts**	**Bolting[q]**	**Springs [s]**	**Seat Insert [c]**	**Primary Seals [d,e,f]**
21X	LTCS / 316 SS Sour LT	-50 to 300 (-46 to 150)	≥ CL 600	Sour [j]	ASTM A350-LF2-1 / ASTM A352-LCC	ASTM A479 UNS S20910 (XM-19)/ ASTM A182 FXM-19	[ASTM A182-F316/316L / ASTM A351-CF3M/CF8M] + ENP [i]	ASTM A182-F316/316L / ASTM A351-CF3M/CF8M	ASTM A320-L7M & A194-7M	UNS N06625 / UNS R30003 / UNS N10276	PEEK	FKM LT/ HNBR [k]
20P	LTCS / 316 SS Sour LT	-50 to 300 (-46 to 150)	CL 150 - CL 600	Sour [j]	ASTM A350-LF2-1 / ASTM A352-LCC	ASTM A479 UNS S20910 (XM-19)/ ASTM A182 FXM-19	ASTM A182-F316/316L / ASTM A351-CF3M/CF8M	ASTM A182-F316/316L / ASTM A351-CF3M/CF8M	ASTM A320-L7M & A194-7M	UNS N06625 / UNS R30003 / UNS N10276	RPTFE	PTFE Lip Seal + Elgiloy Spring + Anti Collapse / V-Packing (Chevron)
21P	LTCS / 316 SS Sour LT	-50 to 300 (-46 to 150)	≥ CL 600	Sour [j]	ASTM A350-LF2-1 / ASTM A352-LCC	ASTM A479 UNS S20910 (XM-19)/ ASTM A182 FXM-19	[ASTM A182-F316/316L / ASTM A351-CF3M/CF8M] + ENP [i]	ASTM A182-F316/316L / ASTM A351-CF3M/CF8M	ASTM A320-L7M & A194-7M	UNS N06625 / UNS R30003 / UNS N10276	PEEK	PTFE Lip Seal + Elgiloy Spring + Anti Collapse / V-Packing (Chevron)
30S	NTCS / DSS	-20 to 300 (-29 to 150)	CL 150 - CL 600	Sour [j]	ASTM A105N / ASTM A216-WCB / ASTM A216-WCC	ASTM A182-F51 / ASTM A276 UNS S31803	ASTM A182-F51 / ASTM A276 UNS S31803 / ASTM A995-4A	ASTM A182-F51 / ASTM A276 UNS S31803 / ASTM A995-4A	ASTM A193-B7M & A194-2HM / ASTM A320-L7M & A194-7M	UNS N06625 / UNS R30003 / UNS N10276	RPTFE	FKM / HNBR
31S	NTCS / DSS	-20 to 300 (-29 to 150)	≥ CL 600	Sour [j]	ASTM A105N / ASTM A216-WCB / ASTM A216-WCC	ASTM A182-F51 / ASTM A276 UNS S31803	[ASTM A182-F51 / ASTM A276 UNS S31803 / ASTM A995-4A] + ENP [i]	ASTM A182-F51 / ASTM A276 UNS S31803 / ASTM A995-4A	ASTM A193-B7M & A194-2HM / ASTM A320-L7M & A194-7M	UNS N06625 / UNS R30003 / UNS N10276	PEEK	FKM / HNBR [k]
30X	LTCS / DSS LT	-50 to 300 (-46 to 150)	CL 150 - CL 600	Sour [j]	ASTM A350-LF2-1 / ASTM A352-LCC	ASTM A182-F51 / ASTM A276 UNS S31803	ASTM A182-F51 / ASTM A276 UNS S31803 / ASTM A995-4A	ASTM A182-F51 / ASTM A276 UNS S31803 / ASTM A995-4A	ASTM A320-L7M & A194-7M	UNS N06625 / UNS R30003 / UNS N10276	RPTFE	FKM LT/ HNBR
31X	LTCS / DSS LT	-50 to 300 (-46 to 150)	≥ CL 600	Sour [j]	ASTM A350-LF2-1 / ASTM A352-LCC	ASTM A182-F51 / ASTM A276 UNS S31803	[ASTM A182-F51 / ASTM A276 UNS S31803 / ASTM A995-4A] + ENP [i]	ASTM A182-F51 / A276 UNS S31803 / A995 Gr. 4A	ASTM A320-L7M & A194-7M	UNS N06625 / UNS R30003 / UNS N10276	PEEK	FKM LT/ HNBR [k]
40S	316 SS Sour	-20 to 300 (-29 to 150)	CL 150 - CL 600	Sour [j]	ASTM A182-F316/F316L / ASTM A351-CF3M/CF8M	ASTM A479 UNS S20910 (XM-19)/ ASTM A182 FXM-19 / A479 316/ A182 F316	ASTM A182-F316/316L / ASTM A351-CF3M/CF8M	ASTM A182-F316/316L / ASTM A351-CF3M/CF8M	A193 B8M Class 1 / A194 8M / A194 8MA[p]	UNS N06625 / UNS R30003 / UNS N10276	RPTFE	FKM / HNBR
41S	316 SS Sour	-20 to 300 (-29 to 150)	≥ CL 600	Sour [j]	ASTM A182-F316/F316L / ASTM A351-CF3M/CF8M	ASTM A479 UNS S20910 (XM-19)/ ASTM A182 FXM-19 / A479 316/ A182 F316	[ASTM A182-F316/316L / ASTM A351-CF3M/CF8M] + ENP [i]	ASTM A182-F316/316L / ASTM A351-CF3M/CF8M	A193 B8M Class 1 / A194 8M / A194 8MA[p]	UNS N06625 / UNS R30003 / UNS N10276	PEEK	FKM / HNBR [k]
40X	316 SS Sour LT	-50 to 300 (-46 to 150)	CL 150 - CL 600	Sour [j]	ASTM A182-F316/F316L / ASTM A351-CF3M/CF8M	ASTM A479 UNS S20910 (XM-19)/ ASTM A182 FXM-19 / A479 316/ A182 F316	ASTM A182-F316/316L / ASTM A351-CF3M/CF8M	ASTM A182-F316/316L / ASTM A351-CF3M/CF8M	A193 B8M Class 1 / A194 8M / A194 8MA[p]	UNS N06625 / UNS R30003 / UNS N10276	RPTFE	FKM LT / HNBR
41X	316 SS Sour LT	-50 to 300 (-46 to 150)	≥ CL 600	Sour [j]	ASTM A182-F316/F316L / ASTM A351-CF3M/CF8M	ASTM A479 UNS S20910 (XM-19)/ ASTM A182 FXM-19 / A479 316/ A182 F316	[ASTM A182-F316/316L / ASTM A351-CF3M/CF8M] + ENP [i]	ASTM A182-F316/316L / ASTM A351-CF3M/CF8M	A193 B8M Class 1 / A194 8M / A194 8MA[p]	UNS N06625 / UNS R30003 / UNS N10276	PEEK	FKM LT/ HNBR [k]

Table N.2 *(continued)*

General					Materials[a, o, r]							
IOGP S-562 Material Class	**Nominal Body & Trim Material**	**Temperature Range** °F (°C)	**ASME Pressure Rating**	**Service**	**Pressure-containing Parts Except Stem**	**Stem [h]**	**Ball**	**Seat Ring, and Other Wetted parts**	**Bolting[q]**	**Springs [s]**	**Seat Insert [c]**	**Primary Seals [d,e,f]**
50S	22 Cr Duplex Sour	-20 to 300 (-29 to 150)	CL 150 - CL 600	Sour [j]	ASTM A182-F51 / ASTM A995-4A	ASTM A182-F51 / ASTM A276 UNS S31803	ASTM A182-F51 / A276 UNS S31803 / A995 Gr. 4A	ASTM A182-F51 / A276 UNS S31803 / A995 Gr. 4A	A193 B8M Class 1 / A194 8M / A194 8MA[p]	UNS N06625 / UNS R30003 / UNS N10276	RPTFE	FKM / HNBR
51S	22 Cr Duplex Sour	-20 to 300 (-29 to 150)	≥ CL 600	Sour [j]	ASTM A182-F51 / ASTM A995-4A	ASTM A182-F51 / ASTM A276 UNS S31803	[ASTM A182-F51 / A276 UNS S31803 / A995 Gr. 4A] + ENP [i]	ASTM A182-F51 / A276 UNS S31803 / A995 Gr. 4A	A193 B8M Class 1 / A194 8M / A194 8MA[p]	UNS N06625 / UNS R30003 / UNS N10276	PEEK	FKM / HNBR [k]
50X	22 Cr Duplex Sour LT	-50 to 300 (-46 to 150)	CL 150 - CL 600	Sour [j]	ASTM A182-F51 / ASTM A995-4A	ASTM A182-F51 / ASTM A276 UNS S31803	ASTM A182-F51 / A276 UNS S31803 / A995 Gr. 4A	ASTM A182-F51 / A276 UNS S31803 / A995 Gr. 4A	A193 B8M Class 1 / A194 8M / A194 8MA[p]	UNS N06625 / UNS R30003 / UNS N10276	RPTFE	FKM LT / HNBR
51X	22 Cr Duplex Sour LT	-50 to 300 (-46 to 150)	≥ CL 600	Sour [j]	ASTM A182-F51 / ASTM A995-4A	ASTM A182-F51 / ASTM A276 UNS S31803	[ASTM A182-F51 / A276 UNS S31803 / A995 Gr. 4A] + ENP [i]	ASTM A182-F51 / A276 UNS S31803 / A995 Gr. 4A	A193 B8M Class 1 / A194 8M / A194 8MA[p]	UNS N06625 / UNS R30003 / UNS N10276	PEEK	FKM LT/ HNBR [k]
60S	25 Cr Duplex Sour	-20 to 300 (-29 to 150)	CL 150 - CL 600	Sour [j]	ASTM A182-F53/F55 / ASTM A995-6A	ASTM A182-F53/F55 / ASTM A276 UNS S32750/S32760	ASTM A182-F53/F55 / ASTM A276 UNS S32750/S32760/ ASTM A995-6A	ASTM A182-F53/F55 / ASTM A276 UNS S32750/S32760/ ASTM A995-6A	A193 B8M Class 1 / A194 8M / A194 8MA[p]	UNS N06625 / UNS R30003 / UNS N10276	RPTFE	FKM / HNBR
61S	25 Cr Duplex Sour	-20 to 300 (-29 to 150)	≥ CL 600	Sour [j]	ASTM A182-F53/F55 / ASTM A995-6A	ASTM A182-F53/F55 / ASTM A276 UNS S32750/S32760	[ASTM A182-F53/F55 / ASTM A276 UNS S32750/S32760/ ASTM A995-6A] + ENP [i]	ASTM A182-F53/F55 / ASTM A276 UNS S32750/S32760/ ASTM A995-6A	A193 B8M Class 1 / A194 8M / A194 8MA[p]	UNS N06625 / UNS R30003 / UNS N10276	PEEK	FKM / HNBR [k]
60X	25 Cr Duplex Sour LT	-50 to 300 (-46 to 150)	CL 150 - CL 600	Sour [j]	ASTM A182-F53/F55 / ASTM A995-6A	ASTM A182-F53/F55 / ASTM A276 UNS S32750/S32760	ASTM A182-F53/F55 / ASTM A276 UNS S32750/S32760/ ASTM A995-6A	ASTM A182-F53/F55 / ASTM A276 UNS S32750/S32760/ ASTM A995-6A	A193 B8M Class 1 / A194 8M / A194 8MA[p]	UNS N06625 / UNS R30003 / UNS N10276	RPTFE	FKM LT / HNBR
61X	25 Cr Duplex Sour LT	-50 to 300 (-46 to 150)	≥ CL 600	Sour [j]	ASTM A182-F53/F55 / ASTM A995-6A	ASTM A182-F53/F55 / ASTM A276 UNS S32750/S32760	[ASTM A182-F53/F55 / ASTM A276 UNS S32750/S32760/ ASTM A995-6A] + ENP [i]	ASTM A182-F53/F55 / ASTM A276 UNS S32750/S32760/ ASTM A995-6A	A193 B8M Class 1 / A194 8M / A194 8MA[p]	UNS N06625 / UNS R30003 / UNS N10276	PEEK	FKM LT/ HNBR [k]
70S	Alloy 625 Clad NTCS / Alloy 625 SOUR [l] [≥ NPS 4 (DN 100)]	-20 to 300 (-29 to 150)	CL 150 - CL 600	Sour [j]	Alloy 625 Weld Overlay ASTM A105N / ASTM A216-WCB / ASTM A216-WCC	ASTM B446 UNS N06625 / ASTM B564 UNS N06625 / ASTM B637 UNS N07718	Alloy 625 Weld Overlay ASTM A105N / ASTM A216-WCB / ASTM A216-WCC	ASTM B564 UNS N06625 / ASTM B637 UNS N07718	ASTM A320-L7M & A194-7M	UNS N06625 / UNS R30003 / UNS N10276	RPTFE	FKM / HNBR
71S	Alloy 625 Clad NTCS / Alloy 625 SOUR [l] [≥ NPS 4 (DN 100)]	-20 to 300 (-29 to 150)	≥ CL 600	Sour [j]	Alloy 625 Weld Overlay ASTM A105N / ASTM A216-WCB / ASTM A216-WCC	ASTM B446 UNS N06625 / ASTM B564 UNS N06625 / ASTM B637 UNS N07718	Alloy 625 Weld Overlay ASTM A105N / ASTM A216-WCB / ASTM A216-WCC	ASTM B564 UNS N06625 / ASTM B637 UNS N07718	ASTM A320-L7M & A194-7M	UNS N06625 / UNS R30003 / UNS N10276	PEEK	FKM / HNBR [k]

Table N.2 *(continued)*

General					Materials[a, o, r]							
IOGP S-562 Material Class	**Nominal Body & Trim Material**	**Temperature Range** °F (°C)	**ASME Pressure Rating**	**Service**	**Pressure-containing Parts Except Stem**	**Stem [h]**	**Ball**	**Seat Ring, and Other Wetted parts**	**Bolting[q]**	**Springs [s]**	**Seat Insert [c]**	**Primary Seals [d,e,f]**
70P	Alloy 625 Clad LTCS / Alloy 625 SOUR LT [l] [≥ NPS 4 (DN 100)]	-50 to 300 (-46 to 150)	CL 150 - CL 600	Sour [j]	Alloy 625 Weld Overlay ASTM A350-LF2-1/ ASTM A352-LCC	ASTM B446 UNS N06625 / ASTM B564 UNS N06625 / ASTM B637 UNS N07718	Alloy 625 Weld Overlay ASTM A350-LF2-1/ ASTM A352-LCC	ASTM B564 UNS N06625 / ASTM B637 UNS N07718	ASTM A320-L7M & A194-7M	UNS N06625 / UNS R30003 / UNS N10276	RPTFE	PTFE Lip Seal + Elgiloy Spring + Anti Collapse / V-Packing (Chevron)
71P	Alloy 625 Clad LTCS / Alloy 625 SOUR LT [l] [≥ NPS 4 (DN 100)]	-50 to 300 (-46 to 150)	≥ CL 600	Sour [j]	Alloy 625 Weld Overlay ASTM A350-LF2-1/ ASTM A352-LCC	ASTM B446 UNS N06625 / ASTM B564 UNS N06625 / ASTM B637 UNS N07718	Alloy 625 Weld Overlay ASTM A350-LF2-1/ ASTM A352-LCC	ASTM B564 UNS N06625 / ASTM B637 UNS N07718	ASTM A320-L7M & A194-7M	UNS N06625 / UNS R30003 / UNS N10276	PEEK	PTFE Lip Seal + Elgiloy Spring + Anti Collapse / V-Packing (Chevron)
72P	Alloy 625	-50 to 300 (-46 to 150)	CL 150 - CL 600	Sour [j]	ASTM B564 UNS N06625 / A494 CW-6MC	ASTM B446 UNS N06625 / ASTM B564 UNS N06625 / ASTM B637 UNS N07718	ASTM B446 UNS N06625 / ASTM B564 UNS N06625 / ASTM B637 UNS N07718[t]	ASTM B446 UNS N06625 / ASTM B564 UNS N06625 / ASTM B637 UNS N07718	A193 B8M Class 1 / A194 8M / A194 8MA[p] / UNS N07718 to API 6ACRA (120K)	UNS N06625 / UNS R30003 / UNS N10276	RPTFE	PTFE Lip Seal + Elgiloy Spring + Anti Collapse / V-Packing (Chevron)
73P	Alloy 625	-50 to 300 (-46 to 150)	≥ CL 600	Sour [j]	ASTM B564 UNS N06625 / A494 CW-6MC	ASTM B446 UNS N06625 / ASTM B564 UNS N06625 / ASTM B637 UNS N07718	ASTM B446 UNS N06625 / ASTM B564 UNS N06625 / ASTM B637 UNS N07718[t]	ASTM B446 UNS N06625 / ASTM B564 UNS N06625 / ASTM B637 UNS N07718	A193 B8M Class 1 / A194 8M / A194 8MA[p]/ UNS N07718 to API 6ACRA (120K)	UNS N06625 / UNS R30003 / UNS N10276	PEEK	PTFE Lip Seal + Elgiloy Spring + Anti Collapse / V-Packing (Chevron)
80P	6Mo	-50 to 300 (-46 to 150)	CL 150 - CL 600	Sour [j]	ASTM A182 Grade F44 / ASTM A351 Grade CK3MCuN, CN3MN	ASTM A276-A479 UNS S31254 / ASTM A182 Grade F44	[ASTM A276-A479 UNS S31254 / ASTM A182 Grade F44] + ENP[t]	ASTM A276-A479 UNS S31254 / ASTM A182 Grade F44	A193 B8M Class 1 / A194 8M / A194 8MA[p] / UNS N07718 to API 6ACRA (120K)	UNS N06625 / UNS R30003 / UNS N10276	RPTFE	PTFE Lip Seal + Elgiloy Spring + Anti Collapse / V-Packing (Chevron)
81P	6Mo	-50 to 300 (-46 to 150)	≥ CL 600	Sour [j]	ASTM A182 Grade F44 / ASTM A351 Grade CK3MCuN, CN3MN	ASTM A276-A479 UNS S31254 / ASTM A182 Grade F44	[ASTM A276-A479 UNS S31254 / ASTM A182 Grade F44] + ENP[t]	ASTM A276-A479 UNS S31254 / ASTM A182 Grade F44	A193 B8M Class 1 / A194 8M / A194 8MA[p] / UNS N07718 to API 6ACRA (120K)	UNS N06625 / UNS R30003 / UNS N10276	PEEK	PTFE Lip Seal + Elgiloy Spring + Anti Collapse / V-Packing (Chevron)

Key for IOGP Material Class

Basic Numbering

10 CS/ENP
20 CS/316
30 CS/DSS
40 316SS
50 Duplex SS
60 Super Duplex SS
70 Alloy 625/ Alloy 625 Cladded
80 6Mo

Suffix

N Sweet -20F - 300F
L Sweet -50F - 300F
S Sour -20F - 300F
P Sour -50F - 300F Lip Seals
X Sour -50F - 300F

Table N.2 *(continued)*

General					Materials[a, o, r]							
IOGP S-562 Material Class	**Nominal Body & Trim Material**	**Temperature Range** °F (°C)	**ASME Pressure Rating**	**Service**	**Pressure-containing Parts Except Stem**	**Stem [h]**	**Ball**	**Seat Ring, and Other Wetted parts**	**Bolting[q]**	**Springs [s]**	**Seat Insert [c]**	**Primary Seals [d,e,f]**

[a] The following alternative materials are acceptable per table N.2. Other alternative materials shall be approved by the purchaser if listed materials are not available or will not be suitable to meet design requirements.
1. LTCS material is acceptable alternative to NTCS.
2. DSS and SDSS materials are acceptable alternatives to 316 SS and 6Mo SS.
3. SDSS materials are acceptable alternative to DSS.
4. When trim 10N or trim 11N is specified and ENP is not practical, 410, 420 and DSS are acceptable alternatives.
5. Alloy 625 or 718 materials are acceptable alternatives to 6Mo for stem, ball and seat ring.

[b] When lip seal is offered as an alternative, sealing surfaces shall have weld overlay applied with corrosion-resistant material specified by the purchaser (See 5.15.2).

[c] Soft-seat material and design shall be compatible with the MAWP at the specified temperature range. Alternative soft-seat materials shall be proposed if materials are inadequate for MAWP or not chemically compatible with the process fluids at the specified temperature range (See 5.14).

[d] Chemical compatibility might vary depending on seal grade. Manufacturer shall confirm compatibility of seals material for specified service and shall specify seal grade.

[e] Additional fire safe seal shall be provided when needed to conform with fire testing certificates.

[f] Lip seals are acceptable alternative when approved by purchaser if no elastomeric seals are suitable for service.

[h] Cast material is not acceptable for stem.

[i] Ball shall be electroless nickel coated (ENP) in accordance with IOGP S-563, EDS IH004.

[j] For materials in sour service, see 6.6.

[k] Elastomers shall be RGD resistant (AED).

[l] Alloy 625 solid material is acceptable alternative to alloy 625 weld overlaid NTCS /LTCS.

[m] LTCS material shall be ASTM A350 LF2-1, A352 LCC, A350 LF6-1 or A350 LF6-2.

[n] NTCS material shall be ASTM A105, ASTM A216-WCB, ASTM A216-WCC, ASTM A694-F52, ASTM A694-F60 or ASTM A694-F65.

[o] Bearing shall be PTFE lined 316 SS unless ball material is of a higher corrosion-resistance in which case the bearing material shall be equivalent to the ball as a minimum.

[p] A193 B8M class 2 may be used when approved by purchaser. B8M Class 2 is strain hardened with concern of chloride stress corrosion cracking at temperature higher than 122 °F (50 °C).

[q] When bolting is used in an offshore or marine environment, alternative bolting materials may be specified.

[r] Other alternative materials shall be approved by the purchaser if listed materials are not available or will not be suitable to meet design requirements.

[s] For sour service, when H2S partial pressure is specified as less than 14.5 psi (1 bar) UNS N07750 may be used when approved by purchaser.

[t] Ball material ASTM A350-LF2-1 with Alloy 625 weld overlay may be used when approved by purchaser.

Add new Annex O

Annex O
(normative)

Load on Valves Designed to ASME BPVC, Section VIII

O.1 General

This annex provides bending moments and axial forces to be used for the design of valve bodies in accordance with 5.1.1.2 and where the manufacturer has selected ASME BPVC, Section VIII as the design basis.

NOTE 1 Alternative loads and forces for specific applications may be specified.

ASME BPVC, Section VIII valves shall be designed using the three load cases listed in O.2.

Design of reduced bore valves shall be based on the larger size.

EXAMPLE An NPS 6 (DN 150) × NPS 4 (DN 100) reduced bore valve is based on the bending moments and forces of an NPS 6 (DN 150) valve.

NOTE 2 The pipe outside diameter used for these calculations is in accordance with ASME B36.10M.

NOTE 3 Pipe material used for these calculations is ASTM A106 Gr. B.

NOTE 4 The pipe bore used for these calculations is based on the full bore sizes in API 6D.

NOTE 5 The pipe outside diameter for NPS 54 (DN 1350) is not covered by ASME B36.10M, therefore the pipe outside diameter for NPS 54 (DN 1350) is 54 in. (1371.6 mm) for these calculations.

Bending moment for pipe shall be calculated in accordance with Equation (3):

(3)

$$M = \frac{0.25 \times I \times SMYS}{OD \div 2}$$

where

M is bending moment;

I is moment of inertia = $\frac{\pi}{64} \times (OD^4 - ID^4)$;

OD is pipe outside diameter;

SMYS is the ASTM A106 Gr. B specified minimum yield strength.

Axial force for pipe shall be calculated in accordance with Equation (4):

(4)

$$F = 0.25 \times SMYS \times A$$

where

F is axial force;

A is area = $\frac{\pi}{4} \times (OD^2 - ID^2)$.

O.2 Calculations for Load Cases

Calculations for the three load cases shall be performed at the rated pressures of the valves.

The first calculation shall be performed for the bending moment.

The second calculation shall be performed for the axial force.

The third calculation shall be performed for 50 % of the bending moment, and 50 % of the axial force.

O.3 Acceptance Criteria

Stresses shall be within the limits of the design code.

Seal performance integrity shall be maintained, ensuring that valve functionality is not affected.

O.4 Bending Moment Values

Bending moment values shall be in accordance with Table O.1.

Add new Table O.1

Table O.1—Bending Moment

NPS	DN	OD in. (mm)	Class 150 to 600		Class 900		Class 1500		Class 2500	
			Bore ID in. (mm)	Moment ft. lbf (Nm)	Bore ID in. (mm)	Moment ft. lbf (Nm)	Bore ID in. (mm)	Moment ft. lbf (Nm)	Bore ID in. (mm)	Moment ft. lbf (Nm)
2	50	2.375 (60.3)	1.94 (49)	532 (728)	1.94 (49)	532 (728)	1.94 (49)	532 (728)	1.69 (42)	713 (988)
2 ½	65	2.875 (73)	2.44 (62)	819 (1099)	2.44 (62)	819 (1099)	2.44 (62)	819 (1099)	2.06 (52)	1253 (1702)
3	80	3.5 (88.9)	2.94 (74)	1541 (2152)	2.94 (74)	1541 (2152)	2.94 (74)	1541 (2152)	2.44 (62)	2344 (3160)
4	100	4.5 (114.3)	3.94 (100)	2690 (3643)	3.94 (100)	2690 (3643)	3.94 (100)	2690 (3643)	3.44 (87)	4296 (5844)
6	150	6.625 (168.3)	5.94 (150)	7363 (10362)	5.94 (150)	7363 (10362)	5.69 (144)	9489 (13031)	5.19 (131)	12975 (17773)
8	200	8.625 (219.1)	7.94 (201)	12943 (18073)	7.94 (201)	12943 (18073)	7.56 (192)	18819 (25420)	7.06 (179)	25311 (34355)
10	250	10.75 (273)	9.94 (252)	23923 (32836)	9.94 (252)	23923 (32836)	9.44 (239)	36049 (49449)	8.81 (223)	48814 (66491)
12	300	12.75 (323.8)	11.94 (303)	34261 (46642)	11.94 (303)	34261 (46642)	11.31 (287)	56505 (76553)	10.44 (265)	81675 (110264)
14	350	14 (355.6)	13.19 (334)	41665 (58726)	12.69 (322)	63831 (86793)	12.44 (315)	73975 (101781)	11.5 (292)	107000 (144446)
16	400	16 (406.4)	15.19 (385)	55017 (76928)	14.69 (373)	84865 (114813)	14.19 (360)	111816 (151929)	13.13 (333)	160242 (217150)
18	450	18 (457)	17.19 (436)	70226 (96431)	16.69 (423)	108900 (149548)	16 (406)	156852 (211993)	14.75 (374)	229244 (310025)
20	500	20 (508)	19.19 (487)	87290 (119988)	18.56 (471)	147960 (201571)	17.88 (454)	206867 (279604)	16.5 (419)	307389 (414831)
22	550	22 (559)	21.19 (538)	106209 (146119)	20.56 (522)	180817 (246545)	19.69 (500)	273157 (370335)	-	-
24	600	24 (610)	23.19 (589)	126984 (174824)	22.44 (570)	233279 (317685)	21.5 (546)	352264 (478822)	-	-
26	650	26 (660)	24.94 (633)	192972 (260571)	24.31 (617)	296594 (400047)	23.38 (594)	435511 (582392)	-	-
28	700	28 (711)	26.94 (684)	224787 (303739)	26.19 (665)	368603 (496992)	25.25 (641)	532215 (718526)	-	-
30	750	30 (762)	28.94 (735)	259031 (350216)	28.06 (712)	453516 (619624)	27 (686)	664695 (894294)	-	-
32	800	32 (813)	30.69 (779)	361162 (497206)	29.94 (760)	548160 (748144)	28.75 (730)	817354 (1107800)	-	-

Table O.1 *(continued)*

NPS	DN	OD in. (mm)	Class 150 to 600		Class 900		Class 1500		Class 2500	
			Bore ID in. (mm)	Moment ft. lbf (Nm)	Bore ID in. (mm)	Moment ft. lbf (Nm)	Bore ID in. (mm)	Moment ft. lbf (Nm)	Bore ID in. (mm)	Moment ft. lbf (Nm)
34	850	34 (864)	32.69 (830)	409203 (563640)	31.81 (808)	657837 (893287)	30.5 (775)	991612 (1339717)	-	-
36	900	36 (914)	34.44 (874)	542363 (737148)	33.69 (855)	778206 (1053643)	32.25 (819)	1188892 (1598076)	-	-
38	950	38 (965)	36.44 (925)	606384 (824582)	35.63 (904)	892022 (1216785)	-	-	-	-
40	1000	40 (1016)	38.44 (976)	673978 (916918)	37.63 (956)	993067 (1335062)	-	-	-	-
42	1050	42 (1067)	40.19 (1020)	856828 (1179892)	39.63 (1006)	1099540 (1501275)	-	-	-	-
48	1200	48 (1219)	45.94 (1166)	1274040 (1738092)	45.25 (1149)	1664226 (2247708)	-	-	-	-
54	1350	54 (1371.6)	51.69 (1312)	1808523 (2474614)	-	-	-	-	-	-
56	1400	56 (1422)	53.56 (1360)	2051965 (2766306)	-	-	-	-	-	-
60	1500	60 (1524)	57.44 (1458)	2474799 (3383886)	-	-	-	-	-	-

NOTE 1 The bending moment to be applied to the valve for these calculations is considered the moment that produces a stress value equal to 25 % SMYS in the outer fibers of the attached pipe.

NOTE 2 The torsion in the pipe is not considered in these calculations.

O.5 Axial Force Values

Axial force values shall be in accordance with Table O.2.

Add new Table O.2

Table O.2—Axial Force

NPS	DN	OD in. (mm)	Class 150 to 600		Class 900		Class 1500		Class 2500	
			Bore ID in. (mm)	Force lbf (N)	Bore ID in. (mm)	Force lbf (N)	Bore ID in. (mm)	Force lbf (N)	Bore ID in. (mm)	Force lbf (N)
2	50	2.375 (60.3)	1.94 (49)	12899 (58202)	1.94 (49)	12899 (58202)	1.94 (49)	12899 (58202)	1.69 (42)	19136 (88220)
2 ½	65	2.875 (73)	2.44 (62)	15889 (69979)	2.44 (62)	15889 (69979)	2.44 (62)	15889 (69979)	2.06 (52)	27640 (123700)
3	80	3.5 (88.9)	2.94 (74)	24784 (114380)	2.94 (74)	24784 (114380)	2.94 (74)	24784 (114380)	2.44 (62)	43270 (191286)
4	100	4.5 (114.3)	3.94 (100)	32481 (144411)	3.94 (100)	32481 (144411)	3.94 (100)	32481 (144411)	3.44 (87)	57839 (258969)
6	150	6.625 (168.3)	5.94 (150)	59149 (274491)	5.94 (150)	59149 (274491)	5.69 (144)	79131 (357618)	5.19 (131)	116515 (526086)
8	200	8.625 (219.1)	7.94 (201)	77979 (358321)	7.94 (201)	77979 (358321)	7.56 (192)	118457 (524998)	7.06 (179)	168693 (752277)
10	250	10.75 (273)	9.94 (252)	115171 (519541)	9.94 (252)	115171 (519541)	9.44 (239)	181763 (820333)	8.81 (223)	260777 (1168672)
12	300	12.75 (323.8)	11.94 (303)	137437 (614375)	11.94 (303)	137437 (614375)	11.31 (287)	238098 (1059224)	10.44 (265)	368138 (1631497)
14	350	14 (355.6)	13.19 (334)	151353 (701927)	12.69 (322)	240280 (1072887)	12.44 (315)	283455 (1283012)	11.5 (292)	438105 (1940909)
16	400	16 (406.4)	15.19 (385)	173619 (798088)	14.69 (373)	276291 (1226727)	14.19 (360)	375526 (1675771)	13.13 (333)	574540 (2557506)
18	450	18 (457)	17.19 (436)	195885 (883714)	16.69 (423)	312301 (1409947)	16 (406)	467312 (2074064)	14.75 (374)	731463 (3250276)
20	500	20 (508)	19.19 (487)	218152 (984654)	18.56 (471)	381590 (1706969)	17.88 (454)	551879 (2447992)	16.5 (419)	877928 (3887862)
22	550	22 (559)	21.19 (538)	240418 (1085593)	20.56 (522)	421174 (1884814)	19.69 (500)	661823 (2944348)	-	-
24	600	24 (610)	23.19 (589)	262684 (1186532)	22.44 (570)	497869 (2224248)	21.5 (546)	781717 (3486414)	-	-
26	650	26 (660)	24.94 (633)	371076 (1645142)	24.31 (617)	584304 (2587620)	23.38 (594)	889099 (3900162)	-	-
28	700	28 (711)	26.94 (684)	400214 (1774921)	26.19 (665)	674056 (2982754)	25.25 (641)	1006353 (4459805)	-	-
30	750	30 (762)	28.94 (735)	429352 (1904701)	28.06 (712)	774064 (3473031)	27 (686)	1175152 (5185890)	-	-
32	800	32 (813)	30.69 (779)	564375 (2550722)	29.94 (760)	876872 (3928672)	28.75 (730)	1356837 (6035109)	-	-

Table O.2 *(continued)*

NPS	DN	OD in. (mm)	Class 150 to 600		Class 900		Class 1500		Class 2500	
			Bore ID in. (mm)	Force lbf (N)	Bore ID in. (mm)	Force lbf (N)	Bore ID in. (mm)	Force lbf (N)	Bore ID in. (mm)	Force lbf (N)
34	850	34 (864)	32.69 (830)	600385 (2714148)	31.81 (808)	990453 (4412304)	30.5 (775)	1551407 (6874009)	-	-
36	900	36 (914)	34.44 (874)	755165 (3370301)	33.69 (855)	1106319 (4918368)	32.25 (819)	1758862 (7758242)	-	-
38	950	38 (965)	36.44 (925)	798048 (3562566)	35.63 (904)	1199226 (5372548)	-	-	-	-
40	1000	40 (1016)	38.44 (976)	840931 (3754832)	37.63 (956)	1264375 (5575699)	-	-	-	-
42	1050	42 (1067)	40.19 (1020)	1022340 (4622335)	39.63 (1006)	1329524 (5958957)	-	-	-	-
48	1200	48 (1219)	45.94 (1166)	1329890 (5956695)	45.25 (1149)	1762298 (7811256)	-	-	-	-
54	1350	54 (1371.6)	51.69 (1312)	1677814 (7537116)	-	-	-	-	-	-
56	1400	56 (1422)	53.56 (1360)	1837130 (8128117)	-	-	-	-	-	-
60	1500	60 (1524)	57.44 (1458)	2066112 (9274547)	-	-	-	-	-	-

NOTE The force to be applied to the valve is considered the axial force that produces a membrane stress value equal to 25 % SMYS in the pipe section.

Bibliography

Add to start of Bibliography

The following documents are informatively cited in the text of this specification, API 6D, the PDS (IOGP S-562D) or the IRS (IOGP S-562L).

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