International Association of Oil & Gas Producers

SPECIFICATION

IOGP S-562J

December 2024

Version 3.1

Supplementary Specification to API Specification 6D for Ball Valves

NOTE This version (S-562J) of the specification document provides the justification statements for each technical requirement, but is otherwise identical in content to S-562.

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).

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).

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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

Justification

API 6D covers several types of valves, S-562 only covers trunnion mounted ball valves.

Add after NOTE

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

Justification

Requirements for on-off valve actuators are covered in IOGP S-707.

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.

Justification

This paragraph clarifies the scope by listing the items that are not excluded but may require some additional requirements for their purchase.

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.

Justification

A cylindrical port ensures that the bore has parallel sides, which minimizes the impact on flow.

4.2 Conformance and General Performance Requirements

Add after first paragraph

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

Justification

IOGP S-562Q provides a standardized quality management system for ball valves.

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;

Justification

This requirement has been added to drive standardization. For NPS 3 (DN 80), one size reduction (NPS 3 (DN 80) x NPS 2 ½ (DN 65)) is not deemed sufficient, the standard size being NPS 3 (DN 80) x NPS 2 (DN 50).

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.

Justification

This requirement covers a gap identified in item d) of this list and provides a maximum reduction value for valve sizes greater than NPS 24 (DN 600).

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.

Justification

This requirement provides an effective insulation length that ensures that the gland is clear of lagging. The note points to suggested lengths that provide standardization. Lengths cannot be completely standardized as there are too many variables such as service, geographical location, etc. The note has been added to direct the user to the new requirements in L.30, which is in line with API 6D current philosophy.

Valves shall be bidirectional (see 3.1.3).

Justification

This requirement ensures that all valves are designed to block flow from the upstream and downstream direction.

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

Justification

Self-relieving seats in standard valves are critical for maintaining safety, preventing overpressure and ensuring efficient operation.

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.

Justification

This requirement ensures that plastic deformation of the ball, seats, stem, trunnion, bearings or sealing components does not occur as this negatively impacts sealing performance.

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

Justification

This requirement has been added as it is common to have vertical downward stem for small valves.

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.

Justification

Orientation of standard valves is not known until installation. Therefore, valves that can function properly in multiple orientations are advantageous due to installation interchangeability and overall standardization.

<u>*Add new Figure 6*</u>

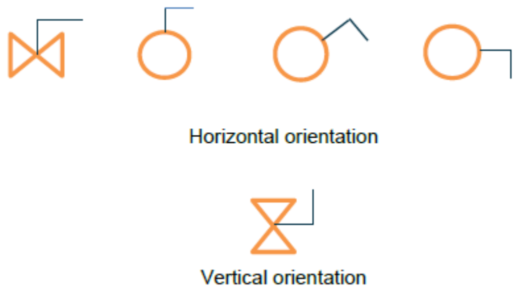

Figure 6—Valve Orientation

Justification

This figure adds clarity to acceptable valve orientations.

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

Justification

This requirement ensures that valve end connectors and bonnets can be removed for maintenance requirements without delays due to tool unavailability.

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

Justification

L.22 covers the requirements for special tools but it is part of an informative annex. Reference to L.22 is made in the main body of the specification to mandate that manufacturers identify any special tools required for disassembly or maintenance. This ensures that the correct special tools are purchased and readily available for maintenance activities.

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.

Justification

Protecting the gap ensures 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.

Justification

This requirement limits the design codes to only ASME B16.34, ASME BPVC, Section VIII, Division 1 and ASME BPVC, Section VIII, Division 2 to promote valve design standardization.

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.

Justification

This requirement ensures valve integrity by covering gaps in ASME B16.34.

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.

Justification

It is considered that ASME B16.34 minimum wall thicknesses already include an allowance equal to 0.12 in. (3 mm) for all valve parts except inner ligaments and body transition parts. This requirement allows the manufacturer to take advantage of this built-in corrosion allowance. Without this requirement, the integrity of the valve can be compromised in the corroded condition.

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).

Justification

It is considered that ASME B16.34 minimum wall thicknesses already include an allowance equal to 0.12 in. (3 mm) for all valve parts except inner ligaments and body transition parts. This requirement allows the manufacturer to take advantage of this built-in corrosion allowance. Without this requirement, the integrity of the valve can be compromised in the corroded condition.

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.

Justification

This requirement has been added to provide clarity. While this requirement simply points to sections within ASME B16.34, it is commonly incorrectly interpreted by valve manufacturers leading, to ligament sections thinner than the minimum wall thicknesses.

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

Justification

ASME B16.34 minimum wall thicknesses of inner ligaments does not include a corrosion allowance, therefore the specified corrosion allowance must be added to ensure valve integrity in the corroded condition.

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.

Justification

ASME B16.34 minimum thicknesses of the transition from the flow passage to the central core section is based on a calculation using the bore size of the valve. If any of the valve sections are larger than the bore size, the wall thicknesses may not be thick enough, in the corroded condition, if a corrosion allowance is specified.

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))).

Justification

The corroded diameter is the worst-case scenario, so the minimum wall thickness calculation needs to be based on this to ensure valve integrity in the corroded condition. This requirement is only applicable when the corrosion allowance is greater than 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.

Justification

This section has been added to clarify requirements within ASME BPVC, Section VIII, Division 1 or ASME BPVC, Section VIII, Division 2 that have a history of being misinterpreted leading to potential valve integrity issues.

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.

Justification

This requirement aligns with ASME B31.3 requirement for design of unlisted components. If this is not followed, any valve not designed to ASME B16.34 is not permitted in ASME B31.3 systems.

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

Justification

The design needs to be based on the worst-case scenario which is in the corroded condition to ensure valve integrity.

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.

Justification

This requirement provides a minimum value when a corrosion allowance is not specified, thereby ensuring robustness of the valve body.

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

Justification

The design needs to be based on the worst-case scenario which is in the corroded condition to ensure valve integrity, the corrosion allowance will need to be added to the minimum calculated thickness.

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

Justification

The corroded diameter is the worst-case scenario, so the minimum wall thickness calculation needs to be based on this to ensure valve integrity in the corroded condition.

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.

Justification

ASME BPVC, Section VIII, Division 1 allowable stress levels are implemented to prevent excessive deflection and body-closure-bonnet leakage. For ASME BPVC, Section VIII, Division 2, it is mandatory to include external loads in the calculations.

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).

Justification

This requirement aligns allowable stress values with ASME B16.34:2020, 6.4.

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.

Justification

ASME BPVC, Section VIII, Division 1 does specify that gasket factors should be used, but the requirement is unclear. This additional requirement removes any ambiguities.

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

Justification

Deflection resulting from external loads can impact the valve performance and operability. ASME BPVC, Section VIII, Division 1 and ASME BPVC, Section VIII, Division 2 do not provide external load values to be used in the design, so without these values in Annex O the valve integrity can be compromised.

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.

Justification

Finite element analysis in valve design verification ensures that the valve can handle allowable stresses, deformations and external loads, maintaining the integrity of the sealing areas and ensuring the reliability, safety, and compliance of the valve.

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

Justification

This requirement ensures that the whole range of pressures and temperatures is considered in the external load analysis.

5.1.3 Pressure-controlling Parts

Add after second paragraph

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

Justification

This requirement makes it clear that the valve will have a pressure balance hole only if specified. Many operating companies prefer not to use a pressure balance hole.

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.

Justification

Minimum size restriction is added to prevent blockage.

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).

Justification

Minimum size restriction is added to prevent blockage.

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

Justification

Note added to link to other requirements for pressure balance hole in Annex L.

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

Justification

It is common to have different pressure balance hole positions with different valve manufacturers. Defining the pressure balance hole position prevents safety issues.

The operator shall be sized without considering the balance hole.

Justification

This requirement ensures that the operator can provide sufficient output torque if the balance hole is blocked.

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.

Justification

Different types of lubricants can have significantly different friction factors and impact bolting tightening torque, therefore it is important to ensure that the lubricant used has the same friction factor as used in these calculations.
Examples of lubricants that influence the friction factor value differently include light oil, mechanical grease, graphite base grease and PTFE base grease.

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.

Justification

The head of a cap screw is not able to accept a deflection of its bearing surface. Typically, by design, flange of closure (connection to body) is subject to deflection (under pressure). Deflection can drastically be increased by external piping loads and run the risk of rupturing the head of cap screw. It remains acceptable only for bonnet cover of rigid construction.

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

Justification

A design with four bolts ensures correct tightening distribution and safety operations in case of degraded mode (rupture of one bolt). Loss of 50 % or 33 % of the tightening (respectively, assembly with a flange design of two or three bolts) is not acceptable. Four bolts ensure that the assembly functions in degraded mode.

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

Justification

Small size of bolting (less than ⅜ in. (10 mm)) is not acceptable due to high risk of snatching of the threaded area (e.g., over torque, corrosion, machining issue).

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

Justification

This bolting preload condition (at test pressure) is often overlooked. Failure to correctly preload the bolting can result in external leakage during testing at the manufacturer's premises or after installation on site.

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

Justification

Bolting may stretch which can lead to a loss of pressure containment during test, or a relaxation in preload, with subsequent loss of pressure containment in service.

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.

Justification

This requirement standardizes on long patterned valves.

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.

Justification

Machining the back faces of flanges flat over the entire back flange area or incorporating spot facings is essential for ensuring proper load distribution, gasket sealing integrity, bolt load transfer and overall reliability of flange joints.

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

Justification

Most externally threaded fastener blanks are manufactured with a header point prior to thread rolling, which leaves the first two threads undersized for ease of assembly. To ensure full load carrying capability there should therefore be at least two protruding threads.

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

Justification

Valves with integral flanged ends provide greater safety, reliability and longevity.

Welding on flanges shall not be permitted.

Justification

Welding on flanges is not permitted due to the aggressive corrosive conditions in welding locations, increased testing requirements (e.g. PWHT) and welding size calculations often incorrectly do not include the piping external loads.

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.

Justification

Currently API 6D gives three options for weld-end dimensions (ASME B31.4, ASME B31.8, or ASME B16.25). This requirement standardizes on ASME B16.25.

Add to section

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

Justification

This requirement ensures that butt welded valves and pipe pups/transition pieces are compatible.

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

Justification

This information is required to prevent damaging valve internals during welding or heat treatment due to exceeding maximum temperature limits the valve can be exposed to.

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.

Justification

Heat from welding the valves into position at site can affect the performance of soft-seated valves and metal-seated valves. When this is deemed to be an issue, pup pieces are specified to keep the welding further away from the seats to ensure that this does not happen.

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.

Justification

API 6D specifies a safety factor in relation to the breakaway thrust or torque and does not consider torque from an operator/actuator/gearbox which can be much greater than 2 times the valve breakaway thrust or torque. This requirement prevents the drive train from being designed for only the breakaway torque which is often, and incorrectly, considered the maximum torque (e.g., the breakaway torque at minimum allowable operating temperature can be higher than at ambient conditions). This requirement mandates that all design temperatures be considered.

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).

Justification

Drive train calculation is one aspect of the calculation where there is too much variability in the interpretation of the analytical models, hypothesis, etc, resulting in errors. This requirement provides greater transparency in the calculations.

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.

Justification

Stem integrity may be at risk if the correct cross-sectional area is not used in this calculation.

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

Justification

To ensure load distribution, mechanical strength, reliability, durability and safety of the valve assembly. By considering these factors during the design process, manufacturers can produce valves that perform optimally.

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.

Justification

It is essential to ensure proper load transmission, mechanical stability, prevention of premature failure, safety and performance optimization of the valve assembly. By considering these factors, manufacturers can design keys that can withstand the applied torque, contributing to the reliable and efficient operation of the valve system.

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.

Justification

This requirement ensures even load distribution, stress reduction, strength, durability, load-carrying capacity and safety of the valve assembly. By considering these factors in the key design, manufacturers can optimize the performance and reliability of the valve system.

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

Justification

Calculations need to be based on the minimum cross-sectional area to ensure that the shaft can withstand stress concentrations at the spline teeth and effectively transfer torque. It ensures strength, durability, load-carrying capacity, safety and optimization in the system.

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.

Justification

This requirement ensures 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.

Justification

The coefficient of friction of 0.2 is consistent with ISO 5211, and used in API 6DX. This requirement ensures load distribution, determines the required tightening force, prevents loosening, ensures safety, and provides a conservative design which maintains the integrity of the system.

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.

Justification

This requirement is crucial for accurate torque calculation, load distribution, safety, reliability and design optimization of the flange connection.

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.

Justification

The effect of dowels to torque transmission should be accounted for to prevent overdesigning of the valve.

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.

Justification

Considering these stresses ensures that the dowels are properly sized and can withstand the applied torque, optimizing load distribution, maintaining joint integrity, and ensuring the safety and reliability of the connection.

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

Justification

To ensure proper design, if bearing stress is not accounted for the housing design may not be fit for purpose, potentially leading to valve integrity issues.

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.

Justification

Lever (wrench) or gearbox has to be designed for the worst-case scenario which is 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.

Justification

Valves has to be operable at the minimum operating temperature and this historically has been missed (considering ASME B16.34 does not mandate specific "negative" operating temperatures). Use of "operating temperature" in accordance with API 6D terminology.

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.

Justification

Lever length limitation has been defined to limit clash and obstruction on pedestrian way and valve accesses, facilitate 3D pre-studies/studies. Large valves are usually provided with gearboxes.

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.

Justification

Handwheel diameter has been limited to 32 in. (800 mm) to limit overall dimensions and offshore footprint (access, congested area, pedestrian path...). Handwheel diameter of 32 in. (800 mm) has been widely adopted and standardized without any concerns.

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).

Justification

This requirement secures lever connection to the valve and prevents loosening of fitted parts with lever or handwheel after several valve operations (historical concern and safety issue).

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

Justification

Due to the range of environmental conditions, it is not economically viable to specify one material for all wrenches (levers) and handwheels, therefore this is specified in the PDS.

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

Justification

Burrs and sharp edges on wrenches (levers) and handwheels may cause injury.

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.

Justification

This ensures the position indicator reflects port position.

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

Justification

The position indicator is of no use if it is positioned in a way that is not visible to the operator.

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.

Justification

During valve installation or maintenance on the line, the operator can be removed for numerous reasons (e.g., weight, overall dimension, packing intervention). When the operator is reassembled, it has to recover the exact position to find the ball setting position. Assembly by bolting does not offer this possibility and requires an additional device.

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).

Justification

This requirement prevents excess force from the gearbox to the end stops of the valve which can cause failure to 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.

Justification

Preventing misalignment or improper assembly is essential for maintaining the functional integrity, reliability and safety of valves.

5.4.5.3 Overpressure Protection

Add to section

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

Justification

The relief valve is a safety function and as such, it must be as reliable as possible, and this includes being made by a corrosion-resistant material. Historic incidents of gearbox blowouts because relief passage which is typically narrow was clogged by debris and scales due to corrosion.

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.

Justification

This requirement aligns with API 6DX for IEC 60529 IP65 protection class which requires having full protection against dust and other similar particles and low-pressure water jets. In some cases (offshore applications, primarily), a minimum of IP67 is required so an option for other protection classes has been added to L.31 and guidance in the form of the note has been added.

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

Justification

There is extensive historic data showing that gearboxes seize up without injection fittings and a weatherproof vent connection.

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

Justification

A corroded shaft can make the gearbox inoperable, and the shaft is always exposed to the environment. The shaft is not as easy to replace as a handwheel, so a minimum level of corrosion protection is needed.

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

Justification

Local greasing of gears is not suitable for exposure to valve lifetime. Grease comes off from critical parts, after a period of static position (accentuated by the temperature effect) which can lead to mechanical failure.

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

Justification

Lubricants or grease are only effective for a specific temperature range, the range specified is for standard temperature range for lubricants or grease so will help to provide standardization.

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

Justification

Allows flexibility which is important if gearbox needs to be rotated due to space/ access issues.

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

Justification

Without this requirement, the valve shaft can rotate by itself without external influence. Self-locking design is required for any positions to prevent handwheel rotation during valve operation and therefore prevent involuntary manual operator injuries.

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.

Justification

Although the gearbox has to be selected to allow valve operation with a relatively low effort for ergonomic reasons, it is not easy for an operator to have a feeling of what effort corresponds to 360 N, hence a safety factor is added to ensure that the operator does not damage the valve train if the input force is exceeded.

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

Justification

This requirement promotes standardization. ISO 5211 and MSS SP-101 are the two most widely used specifications.

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

Justification

It is important to use a separate mounting system specifically designed for gearboxes, ensuring proper alignment, load distribution, and system integrity.

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

Justification

This requirement provides standardization.

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

Justification

Defines what happens when force or dimensional limitations are exceeded.

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

Justification

Gearbox dimension limitation has been defined to limit clash and obstruction on pedestrian way and valve accesses, facilitate 3D pre-studies/studies.

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.

Justification

Required so that review of these valves can be undertaken to see if any require actuators/ "easidrives". Alternative means of operation such as square nut for use with hand-held power drive or hand-crank type handwheel might be needed for operation of valves that need high number of turns to switch positions.

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

Justification

Table leads to standardization.

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.

Justification

This requirement ensures the valve cavity cannot be over-pressurized which can potentially lead to damage or failure.

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

Justification

DIB-1 valve cannot relieve through the seats so a cavity relief feature is required so that the cavity cannot be over pressurized. Approval is a critical step in ensuring that the valve meets specific operational and safety requirements.

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.

Justification

5.6.1 states that valves shall be equipped with a drain or a vent. This requirement ensures that all valve NPS 4 and larger will have both. These are necessary to ensure safe pressure management, facilitate maintenance and maintain operational integrity.

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.

Justification

Majority of valves, when installed, will have 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.

Justification

If the drain is not at the lowest point when the valve is in specified orientation, then it is impossible to drain all fluid from the valve body cavity.

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

Justification

If the vent is not at the highest point when the valve is in specified orientation to ensure that all air can be expelled, and to ensure that the valve can be completely filled with test medium during hydrotesting.

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

Justification

While API 6D does cover pressure-containing parts (see 5.1.2), there is a gap with regards to plugs and fittings. This requirement covers this gap.

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

Justification

While API 6D does cover pressure-containing parts (see 5.1.2), there is a gap with regards to plugs and fittings. This requirement, and the previous requirement, cover this gap.

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

Justification

Without this requirement valve OEM could design their own fitting and flanges. Adhering to recognized industry standards is crucial for ensuring compatibility (should components need to be replaced), safety and quality.

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

Justification

This requirement has been defined to be applied whatever the valve design standard and prevent mistakes and concerns when ASME div.1 or 2 is applied. The requirement also reinforces the design rules to be applied, because it has been found that the body penetration areas were sometimes forgotten from valve manufacturers.

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.

Justification

This requirement has been added to prevent the blowout of the insert, in case of attachment weld failure.

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.

Justification

To ensure the weld will withstand pressure and loads, this will avoid vent and drain connections failing due to weld failure.

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

Justification

The high temperatures and thermal cycles involved in PWHT can distort the threads, compromise the seal integrity, weaken the connection, and lead to cracking or leakage.

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

Justification

Helps protect the threads from welding heat, ensures proper sealing, enhances weld strength, and aligns with industry standards.

<u>Add new section</u>

5.6.1.2 NPT Tolerance and Torque Control

PTFE tape shall not be used on threaded connections.

Justification

The use of PTFE tape on NPT connections may mask a machining defect or nonconforming thread.

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

Justification

Body connections and plugs/fittings are machined separately, gaging in conformance with B1.20.1 fig 6 and 7, but assembly of 2 parts is never checked, which can lead to catastrophic failure, specifically with external threads machined to the maximum tolerances and internal threads to minimum.

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

Justification

Manufacturer has documented torque procedures and torque values which depend on many factors such as sealant and that will ensure a leak tight connection at the rated pressure. The torque values specified will keep plugs from being ejected under pressure and/or damaging the gasket.

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

Justification

This requirement has been added to ensure thread sealants do not cause corrosion.

Add new section

5.6.1.3 Seal Welds

Sealant shall be removed prior to seal welding.

Justification

Surfaces should always be cleaned and prepared prior to any welding to ensure the integrity of the weld is not compromised.

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

Justification

If there is any thread damage, then the weld will become pressure-containing. To ensure the structural integrity and safety of the valve compliance with ASME B31.3 requirements for pressure-containing welds is essential.

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

Justification

If there is any thread damage, then the weld will become pressure-containing. To ensure the structural integrity and safety of the valve compliance with ASME B31.3 requirements for pressure-containing welds is essential.

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

Justification

If there is any thread damage, then the weld will become pressure-containing. To ensure the structural integrity and safety of the valve compliance with ASME B31.3 requirements for pressure-containing welds is essential.

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

Justification

Weld to be considered as a pressure-containing weld in case of thread damage. To ensure the structural integrity and safety of the valve compliance with ASME B31.3 requirements for pressure-containing welds is essential.

NDE for seal welds shall comply with the QSL2 requirements.

Justification

As specified in this section seal welds are to be considered as pressure-containing welds. Currently there is a gap in API 6D for NDE relating to pressure-containing welds where only visual inspection is required (see 7.9). Therefore, this requirement has been added to cover the gap and have the same NDE as QSL2 as specified in Table I.1.

Add new section

5.6.1.4 Locking Ring

The locking ring shall lock the plug to prevent loosening.

Justification

A locking ring is essential for ensuring the correct functionality, safety and reliability of the plugs. Leakage can potentially cause environmental and safety issues as well as potential damage to the valve.

Locking ring shall be secured to the valve body.

Justification

The function of the locking ring is to hold the plug in place, ensuring the ring is attached to the body will allow a more robust design.

Locking ring removal shall be possible without loosening the plug.

Justification

If the plug needs to be loosened when removing the locking ring (this happens, for example, if the plug was to be seal welded), any pressure testing would need to be repeated.

5.6.2 Injection Points

Replace first sentence with

When specified, injection fittings shall be provided.

Justification

Manufacturers sometimes provide valves with injection points even when not requested, these are potential leak paths and should be avoided, if not specified.

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

Seat and stem/shaft injection points

Justification

Injection points can be exposed to pressure (seal leakage under dynamic operation) which can lead to the injection stem point being exposed directly to internal pressure in case of stem leakage. This is a safety concern and could compromise the integrity of the stem injection system. This is why the standard design for the stem injection point should include a second non-return valve. K.21 provides an option to have only one non-return valve for the stem injection points, if purchaser wishes to specify.

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).

Justification

This is simply a pointer to K.21 which allows the purchaser to specify alternative stem/shaft injection point arrangements, if required.

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

protective threaded cap/plug

Justification

Requirement for cap plug to be threaded.

Replace third list section with

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

Justification

Second part of sentence is deleted, "shall include a fitting inclusive of a non-return valve and a pressure-containing cap/plug." This is now covered in bullet 1 by replacing "seat injection points" with "seat and stem/shaft injection points". i.e. all injection points are the same.

Add new list sections after third list section

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

Justification

Fire safe graphite should not be considered as primary sealing barrier as they are likely not seal, leaving a potential leak path through the injection point.

— 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.

Justification

Anti-collapse design is required to ensure that the injection of fluid does not compromise the integrity of the lip seal. Justification has been included as part of requirement to give manufacturer a clear understanding for the rationale of the design requirement.

Add new list sections after fifth list section

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

Justification

To prevent components from the injector to be injected into the valve following a grease/sealant injection at high pressure.

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

Justification

Fully compression state is not always tested with injectors but that can happen during full pressure injection, and if the design is not suitable, the spring will not re-seat after being excessively deformed which will compromise the integrity of the injection fitting.

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.

Justification

These material choices ensure standardization for non-return valves as they are suitable for challenging conditions, such as high temperatures, abrasive fluids, corrosive environments, and frequent cycling. The combination of a metal-seated design, a tungsten carbide ball, and a UNS N06625 spring helps ensure that the non-return valve can provide reliable and long-lasting performance, maintain effective sealing, and prevent backflow in demanding operational settings. However, these materials are expensive and not always required, so options via K.21 can be selected by the purchaser.

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

Justification

This requirement has been defined to be applied whatever the valve design standard and prevent mistakes and concerns when ASME div.1 or 2 is applied. The requirement also reinforces the design rules to be applied, because it has been found that the body penetration areas were sometimes forgotten from valve manufacturers.

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

Justification

Although injection points are not in situ during hydrotest (See 10.3.1), there are many situations in which the valve could be tested with the injectors installed, especially on site, in case of failure of the primary check valve, injection fitting is exposed to the hydrotest pressure.

— The MAWP of injection fittings shall be provided.

Justification

To ensure injection fitting has a higher pressure rating than the shell test pressure and injection pressure (Manufacturer may not know the injection pressure so this allows purchaser to check).

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

Justification

Either of these standards will ensure integrity of the injection fittings and provide standardization.

— 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.

Justification

Ensures good distribution of sealant or cleansing agent to the seats.

5.7 Stem Retention

Add to section

Stem retention shall be achieved by an integral stem shoulder.

Justification

API 6D considered insufficiently complete to guarantee the safety conditions to prevent stem blowout.

5.8 Antistatic

Add to section

Graphite seals shall not be considered to offer electrical continuity.

Justification

Graphite does not offer the necessary safety guarantee on the valve lifetime as graphite can wear. Compression of the graphite can also compromise the electrical continuity and subsequently the anti-static functionality.

5.9 Lifting

Add after second paragraph

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

Justification

This is critical for ensuring safety and preventing accidents during handling, installation, and maintenance.

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

Justification

Manual operators and valve accessories can have a large impact on the overall weight (and center of gravity) so should be considered when lifting the valve.

Add to section

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

Justification

As a valve get larger, it makes the lifting more challenging due to the overall dimensions and where the centre of gravity is located. The permanent lifting points ensure both workers and the valve are protected from the dangers associated with improper lifting, ensuring that weight is distributed evenly and safely.

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

Justification

As a valve get heavier, it makes the lifting more challenging due to the overall dimensions and where the centre of gravity is located. The permanent lifting points ensure both workers and the valve are protected from the dangers associated with improper lifting, ensuring that weight is distributed evenly and safely.

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.

Justification

This list of historically proven designs ensures the valves can be handled safely protecting both workers and the valves themselves.

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

Justification

Lifting points on a gearbox are designed for the weight of the gearbox only. If gearbox lifting points are used with the valve attached there can be significant safety hazards and structural damage.

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

Justification

Majority of valves will not have a specified orientation so will need to be designed to be lifted in the horizontal, with the stem in the upright position as this is the normal orientation of a valve when it is lifted.

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.

Justification

When the valve has a specified orientation, lifting lugs position will also need to allow for the specified orientation as the valve will need to be lifted into its installed position in this orientation.

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

Justification

Using cast and ductile iron are brittle and do not have endurance for axial tension loads. These materials pose a significant safety risk, as sudden failure during lifting can cause injuries or damage to the valve.

Selection of lifting point material shall prevent galvanic corrosion.

Justification

Requirement added to avoid galvanic corrosion which negatively impacts the integrity of lifting points.

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

Justification

This requirement is added to reinforce the previous requirement that galvanic corrosion is to be prevented by material selection not a coating selection. Coatings of lifting points will wear and not provide a long term solution.

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).

Justification

This requirement ensures there is a continuous full bore for passing the pigs without obstruction.

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

Justification

To avoid purchasing a bespoke valve where a standard valve can be used.

Snagging areas between the seat and ball shall be prevented.

Justification

When the pig passes through the valve it brings with it debris. Because of this, the design needs to avoid gap between internal parts and avoid snagging areas. The pig also exerts a force on the valve as it passes through so the ball will have to be correctly supported (support by spring to be avoided, specifically for sphered pigging operations) to avoid seat insert and ball damage.

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

Justification

When the pig passes through the valve it brings with it debris. Preventing debris collection between the seats and the ball is essential for ensuring proper sealing and maintaining smooth operation.

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

Justification

The pig exerts a force on the valve as it passes through so the ball will have to be correctly supported (support by spring to be avoided, specifically for sphered pigging operations) to avoid seat insert and ball damage.

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

Justification

Prevents the seat from shifting and cavity filling with debris which negatively impacts the sealing capability of the valve.

Add new section

5.12 Stem Design

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

Justification

Stem galling in a ball valve should be avoided as it leads to increased operating torque, stem seizing, valve damage, leaking, and reduced valve lifespan.

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

Justification

If the stem is made by different parts threaded or welded together, the verification of the design and stem retention feature becomes too complex, as well as quality assurance around it.

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

Justification

Tolerance is based on recommendations of manufacturers and suppliers and qualification testing to minimize stem damages, wear, abrasion and increase valve durability and sealing performance. There is no particular qualification of 6D valve industry is required to validate the valve performances and its durability.

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

Justification

This requirement is in accordance with tolerances specified in Table A.4 in API 6D.

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

Justification

Tolerance is based on recommendations of manufacturers and suppliers and qualification testing to minimize stem damages, wear, abrasion and increase valve durability and sealing performance. There is no particular qualification from 6D valve industry is required to validate the valve performances and its durability.

The stem sealing area shall be free from any defects.

Justification

Defects on the sealing area will have a negative impact on sealing performance.

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).

Justification

Surface finish tolerance is based on recommendations from manufacturers, suppliers and qualification testing to minimize wear, abrasion and ensure valve durability and sealing performance to be suitable for gas or fugitive emissions. There is no particular qualification from 6D valve industry is required to validate the valve performances and its durability.

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).

Justification

Surface finish tolerance is based on recommendations from manufacturers, suppliers and qualification testing to minimize wear, abrasion and ensure valve durability and sealing performance to be suitable for gas or fugitive emissions. There is no particular qualification from 6D valve industry is required to validate the valve performances and its durability.

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).

Justification

Valve performance is adversely affected if the stem is rubbing or galling against adjacent parts.

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

Justification

Side loads can cause deflection in the stem, valve performance is adversely affected if the stem is rubbing against adjacent parts. Examples of side loads: operator output torques, weight of operator, stem extension and drive train parts when the valve stem is installed in horizontal position, force from the ball.

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.

Justification

Internal parts that can come loose can fall off, impacting the operability / functionality of the valve, and potentially damaging downstream equipment (e.g., pumps).

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

Justification

Press fit assemblies and spring tension pins are not reliable means to prevent internal valve components from coming loose as they can lose attachment due to multiple operations and by matting of surfaces.

Add new section

5.14 Soft-Seat Insert Design

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

Justification

If a soft-seat material is not specified in data sheet or purchase description, then Table 15 provides a list of acceptable materials. This will help with standardization.

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

Justification

This table has been added to promote standardization, if the seat material has not been specified by the purchaser.

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

Justification

If the soft-seat material is used outside of the material's coincidental pressure/temperature range, the material properties can be adversely affected which will impact the integrity of the seat's sealing function.

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).

Justification

Temperature data is mandatory for elastomeric and polymeric material selection. As management of temperature definition is different for each company (piping material class or definition of operating or design temperature in accordance with the service conditions), a default value needs to be defined, if not specified in purchase documentation, in accordance with metallic materials (definition: API 6D/ASME B16.34) to avoid safety concerns and to lead standardization. 302 °F (150 °C) is a common temperature for soft-seated valves since pressure rating for nonmetallic materials tend to drop sharply above this temperature.

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.

Justification

If soft-seat material is not compatible with MAWP or process fluid the integrity of the valve can be compromised. This requirement allows the manufacturer to use an alternative material to Table 15 to ensure the valve can function as intended.

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).

Justification

Elastomer needs to be able to seal for the full temperature range of the valve. Historically these materials do not reliably seal at pressure at temperatures below –20 °F (–29 °C). The note has been added to allow the purchaser a permissible deviation to allow for customized valves.

The elastomer O-ring material grade shall be specified.

Justification

Elastomeric material properties can vary significantly between different grades, so it is important to clarify which one is being specified to ensure the physical and mechanical properties are compatible with service and operational conditions.

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.

Justification

Rapid gas decompression becomes a significant concern in CL600 and above because of the higher pressures involved, which lead to more gas permeation into elastomers. This qualification prevents seal failure during sudden depressurization, avoids leaks and equipment damage.

Elastomeric seal rings shall be fully contained.

Justification

To minimize extrusion and prevent a dislodgement in the event of back pressure or vacuum effect.

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.

Justification

The use of lip seals or V-packing is more expensive than the use of elastomers due to the requirement of CRA metallic sealing surfaces, therefore elastomers should be used where possible. Evidence needs to be provided for elastomeric material suitability and sealing performance, especially at lower temperatures.

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

Justification

Lip seals and chevron packing require a surface finish between 4 μin to 8 μin for the seal to work correctly. Carbon steel surfaces may have this surface finish initially but as the surface corrodes the finish will no longer meet requirements and sealing is adversely affected. This is why corrosion resistant materials must be used in these sealing areas.

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

Justification

By selecting RPTFE we have standardized on the most common and universally compatible material we can possibly use.

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.

Justification

To prevent crushing against backpressure in the reverse direction.

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

Justification

RPTFE does not have the tensile strength, stiffness, or resilience to perform reliably at very high pressures, so it is limited to a maximum of CL600.

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

Justification

For standardization and to ensure compatibility with service. Materials proposed are used by most lip seals manufacturers.

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).

Justification

OEMs design their seals to work within specific surface finish limitations on metallic sealing surfaces. However, it is well known in the industry that lip-seals require a maximum surface finish of 8 µin (0.20 µm) so this has been set as the maximum.

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

Justification

Avoid overpressure in the pocket between the lip seals without ability to relieve.

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.

Justification

The requirement is simply to provide evidence that the seal has been successfully proven and not to wait until FAT test at which point the schedule can be negatively impacted.

Add new Figure 7

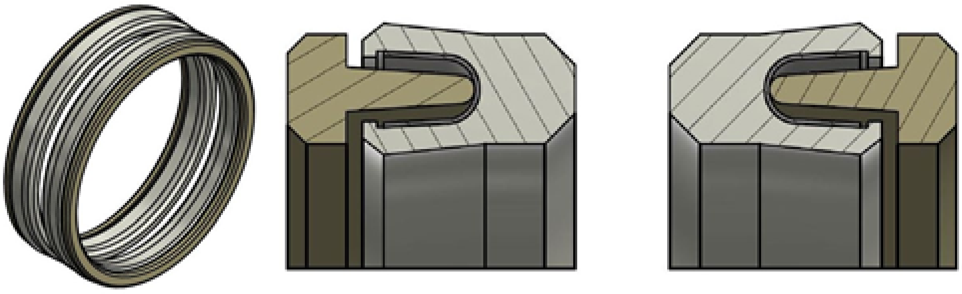

Figure 7—Lip Seals, Back-to-back Configuration

Justification

Figure helps clarify the previous requirement.

5.15.3 Seals in Vacuum Conditions

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

Justification

This requirement has been added for valves in vacuum service, this is related to all valves as they can be subject to these pressures during vacuum drying. If these soft seals cannot withstand these pressures, then the seals run the risk of being damaged which will result in the valves not being able fit for purpose.

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

Justification

Requirement has been added for valves in vacuum service, this is related to all valves as they can be subject to these pressures during vacuum drying. If these soft seals cannot withstand these pressures, then the seals run the risk of being damaged which will result in the valves not being able fit for purpose.

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.

Justification

This requirement has been added to ensure that valve manufacturers check they are adhering to the sealing manufacturers' required surface finish.

Stem primary seals shall be self-energizing.

Justification

This requirement will provide standardization and improve maintenance efficiency as stem seals require very little to no maintenance, e.g. no need to re-tighten periodically the packing gland.

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

Justification

The dynamic stem area is very sensitive and is the first valve leak path encountered as failure mode. Double barrier is considered mandatory to ensure safety sealing performance for dynamic stem area.

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

Justification

Fire-safe graphite gaskets are not a reliable seal. Graphite is there to prevent gross flow in the event of a fire, and not to be treated as a secondary gasket capable of retaining pressure with zero leakage performance with any type of application including gas service.

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.

Justification

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.

Justification

Use of back-up rings will prevent extrusion of the elastomeric O-ring. If the O-ring is extruded it will no longer be able to seal effectively which will affect the integrity of the valve.

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

Justification

To promote standardization around the two most common materials, and with materials that are the most compatible with practically all applications.

Add new section

5.18 Fire Testing

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

Justification

99 % of valves require to be qualified by fire testing, so mandating this will drive standardization. An option not to have a valve qualified by fire testing, is provided, but this is the exception to the rule.

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.

Justification

FEA is essential for assessing the structural integrity, performance, and reliability of valve components subjected to full differential pressure. It allows a detailed understanding of the mechanical behaviour, identify potential issues, and optimize the design.

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.

Justification

Linear elastic analysis and subsequent stress linearization on the complex geometries involved are not covered in the classification list from ASME BPVC, Section VIII, Division 2 which is why elastic-plastic analysis is specified.

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

Justification

To demonstrate that the required seat to ball contact is maintained with the material remaining within the elastic limit and freedom of movement is preserved.

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.

Justification

To mandate that all manual valves can be locked in the open and closed positions. API 6D currently has this as an option.

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.

Justification

This requirement ensures standardization of materials in accordance with IOGP requirements.

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

Justification

This requirement ensures standardization of materials in accordance with industry standard requirements.

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.

Justification

Galling of two surfaces is to be avoided, as it will impair the functionality of the valve. Hardness differential or surface treatment on contacting surfaces are the simplest way of achieving this. The stem is also included in this requirement, even though previous requirement in 5.12 states "Stem design shall prevent galling by the use of a stem bearing." This is because these bearings are generally PTFE lined and if the PTFE fails, galling can still be an issue.

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.

Justification

In most cases, it is not known which lines these valves are used in, it is therefore a huge advantage if all valves in lines Class 600 and above have elastomeric materials that are RGD resistant grades. These grades have been widely used in this industry from many years. This aligns with 5.15.1.

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.

Justification

This requirement ensures standardization of materials in accordance with IOGP requirements while ensuring the most stringent requirements are met.

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.

Justification

API 6D requirement did not reference auxiliary connections so this potential gap has been closed.

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.

Justification

API 6D is not specific enough, there is real definition to what "compatible" means. The new requirement gives a verifiable requirement by stipulating welded material requirements.

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

Justification

Ensures the plug can be removed when required (i.e. not corroded).

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.

Justification

Ensure plug can be removed when required (i.e. not corroded).

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.

Justification

This note provides a good example of how galling can be prevented.

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

Justification

Blind flange material type should be the same as the valve body to ensure the same compatibility to the service and conditions to ensure the integrity of the valve.

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

Justification

Gaskets are critical to pressure-containment, if the austenitic stainless-steel corrodes then the integrity of the gasket is compromised. The intergranular corrosion test will screen material batches to determine corrosion susceptibility.

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

Justification

This requirement simply sets the minimum level of requirements to have fillers in line with industry standards.

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

Justification

This requirement simply sets the minimum level of requirements to have fillers in line with industry standards.

Gasket materials shall be in accordance with Table 17.

Justification

This requirement provides a clear definition of gasket material to ensure standardization.

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.

Justification

This table provides a clear definition of gasket material to ensure standardization.

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.

Justification

This requirement ensures the thread is protected from crevice corrosion which in turn ensures the integrity of the joint is maintained.

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

Justification

To ensure compatibility of both seals. If seals are not compatible, then the seal integrity can be compromised resulting in seal failure.

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

Justification

The axial seal connection protects the thread from atmospheric corrosion which in turn ensures the integrity of the joint is maintained.

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

Justification

This ensures the seal ring will not corrode in atmospheric conditions which compromises the integrity of the design.

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

Justification

Corrosion will weaken and damage the structural integrity of these components, compromising their functionality.

Add new section

6.9 Valves Manufactured from Bar Material

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

Justification

By specifying ASTM A961, we ensure the bar material meet certain quality standards and performance criteria such as chemical composition, mechanical properties, heat treatment, etc. Without these quality checkpoints, there is a danger that substandard bar material is used which can lead to both safety and valve integrity issues.

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.

Justification

Not all individual product specifications allow bar to be used in lieu of forgings, so this requirement has been added to cover this eventuality.

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

Justification

Transitional radius is extremely important to reduce stress intensity factor.

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.

Justification

To ensure compliance with industry standards. This ensures the longevity of the valve performance.

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

Justification

To ensure compliance with industry standards. This ensures the longevity of the valve performance.

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

Justification

In case of a fire, molten zinc can cause liquid metal embrittlement when it comes into contact with austenitic stainless steels. This impacts the integrity of the austenitic stainless steel components.

The chlorine content shall not exceed 50 ppm.

Justification

These limits have been set to avoid stress corrosion cracking of austenitic stainless steels.

The fluorine content shall not exceed 10 ppm.

Justification

These limits have been set to avoid stress corrosion cracking of austenitic stainless steels.

The halogen content shall not exceed 310 ppm.

Justification

These limits have been set to avoid stress corrosion cracking of austenitic stainless steels.

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

Justification

In cases of a fire or high temperature applications, graphite can oxidize and lose mass very quickly which will result in degradation potential leading to leaks, therefore these tests have been implemented to ensure longevity of the graphite material.

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

Justification

This acceptance criterium is an industry standard and has been specified to ensure longevity of the graphite material.

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.

Justification

Annex N uses a new way to specify and standardize material combinations, this requirement introduces this concept and also points to K.26 which gives an option if other material combinations are required.

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.

Justification

This requirement compensates for any potential corrosion-related material loss. This material loss can impact the long-term sealing ability of the valve.

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.

Justification

As there is currently no EDS for stainless steel weld overlay, this requirement provides standardization.

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).

Justification

To minimize the risk of welding defects at the base material/weld interface, compensate for dilution with the base material and ensure appropriate composition of the weld overlay is obtained on the weld surface and after machining to unsure the corrosion properties match those of 316L stainless steel.

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.

Justification

To confirm that appropriate composition of the weld overlay is obtained consistently at weld surface after machining. This can be simplified to align it with IOGP S-563, EDS IO001, i.e. the weld overlay deposit shall comply with UNS S31603 composition at the minimum qualified 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.

Justification

To ensure that PWHT did not impair (sensitize) the corrosion-resistance of the 316 stainless steel weld overlay.

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

Justification

Text changed to cover all pressure containing welds, not just pressure-containing pipe pup-to-valve welds.

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

pressure-containing butt welds

Justification

Text changed to cover all pressure containing welds, not just pressure-containing pipe pup-to-valve 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.

Justification

Standardization by using IOGP S-563 is already specified, however, not all materials are covered by IOGP S-563 so clarity on volumetric NDE is required to ensure there are no defects which will help to maintain the mechanical and pressure integrity of the pressure-containing cast part.

Replace fourth paragraph with

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

Justification

Standardization of materials in accordance with IOGP S-563 requirements.

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

Justification

Leaked defects from pressure testing are a through leak and there is a high probability of cracks which can be exacerbated through service time. This is an indication for poor casting and may have other defects not detected.

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

Justification

Using the same technique which identified the defect is the best way of ensuring the defect has been removed and therefore vital to enhancing consistency, quality and safety.

7.11.4 Repair of Welds

<u>*Add to section*</u>

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

Justification

Ensures that repairs are carried out in a controlled and systematic manner, reducing risks and improving the long-term reliability.

<u>*Add new section*</u>

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).

Justification

To ensure ferrite content in welds is within acceptable limit, to optimize their mechanical and physical properties. Duplex and super duplex stainless steels achieve their desirable combination of properties from their 'duplex' austenite: ferrite microstructure.

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

Justification

Due to criticality of the correct measurement, purchaser oversight is mandated. Incorrect ferrite content will compromise the mechanical and physical properties.

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

Justification

Due to criticality of the correct measurement content meters must be calibrated correctly hence this industry standard has been specified. Incorrect ferrite content will compromise the corrosion-resistance of the duplex stainless steel.

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

Justification

This calibration block range covers the full acceptable ferrite content range, this is essential for accurate and consistent measurement of ferrite.

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

Justification

To ensure measurements are representative of the valve material.

Coatings and surface oxide shall be removed.

Justification

To ensure the material tested is the duplex material and not coating or surface oxide.

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

Justification

To ensure the material tested is the duplex material and not coating or surface oxide.

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.

Justification

Acceptance criteria is clearly specified to ensure corrosion-resistance of duplex stainless steel is as per industry standard.

8 Bolting

8.1 Pressure-boundary Bolting

Replace second paragraph with

Bolting materials shall conform to IOGP S-563.

Justification

Drives standardization of materials.

Add to section

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

Justification

Coating requirements are too varied and even having hot-dipped galvanized as a minimum requirement is incorrect, therefore this is a data sheet option.

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.

Justification

There is a gap in API 6D, visual NDE personnel qualification is covered but nothing for surface or volumetric personnel qualification. This is covered in Annex I (for QSL2 and above but not for the main specification).

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

Justification

There is a gap in API 6D, this is covered in Annex I (for QSL2 and above but not for the main specification).

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).

Justification

Added to avoid a level III within the company qualifying others within the same company, which can lead to a decrease in standards of personnel.

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.

Justification

Standardization of welding IOGP requirements.

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.

Justification

Standardization of materials in accordance with IOGP requirements.

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.

Justification

To ensure the surfaces maintain sealing integrity and ensure smooth operation.

Add new section

9.7 NDE Requirements

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

Justification

Specifies minimum NDE requirements. Previously this was achieved in Annex J but as "QSL1" no longer exists, Table 18 has been added to the main specification.

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.

Justification

Specifies NDE requirements. Previously this was achieved in Annex J but as "QSL1" no longer exists, this Table 18 has been added to the main specification.

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.

Justification

Testing in the specified orientation ensures proper sealing, accurate performance, safety, and reliability under the actual conditions in which the valve is installed.

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

Justification

While the design of the valves is to function in any orientation (as specified in 4.6) the most common installed orientation is horizontal flow bore and stem vertical upward. Therefore, testing in this orientation ensures proper sealing, accurate performance, safety, and reliability under the actual conditions in which the valve is most likely to be installed.

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.

Justification

Table added to clearly show additional testing requirements and the sequence of testing. This was previously shown in Annex I but now that there is no "QSL1", it needs to be shown in main body of the specification.

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.

Justification

The table replaces the 6th paragraph of 10.1.1 in API 6D and ensures that the correct sequence of testing.
Anti-static test to verify antistatic capability of the valve. The test is simple and does not cause any delay in schedule. Antistatic test to be performed at the start of the test sequence to avoid having to disassemble a valve after completing a full FAT if this test fails. However, note "a" has been added to allow some flexibility in when this test can be performed, if necessary.
Hydrostatic shell test as per API 6D.
Torque test added to verify torque per required for actuator sizing.
Functional test added as batch test to ensure issues with seat insert/TCC/Stem seals which only happen when the valve is stroked are captured.
High pressure hydrostatic seat test as per API 6D.
DBB/DIB testing as per API 6D, when applicable.
Low-pressure seat testing to verify valve seating without relying on pressure and internal components did not damage during HP hydrostatic seat testing.

10.1.2 Test Conditions

Add to first paragraph

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

Justification

To minimize any adverse reactions to valve materials by keeping a neutral pH level in the water.

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.

Justification

Clarification required to ensure that the components highlighted are part of the shell test to ensure the whole system is tested to ensure system integrity.

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

Justification

If these valves are removed, this can introduce a potential leak path as the new joint (once re-installed) will not have been tested.

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

Justification

Body check valve for seat sealant injection needs to be checked during testing to ensure integrity, this cannot be achieved if injection fitting is installed.

The valve shall be isolated from the supply pressure source.

Justification

During testing, pressure needs to be isolated from the source to allow for a stable test environment where any changes in pressure can be accurately attributed to the valve's performance rather than to fluctuations in the supply system.

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.

Justification

Leakage rate B, for the hydrostatic seat test on metal-seated valves provides tighter sealing, improved safety and a longer service life. Leakage rate B, for the low-pressure gas seat test on metal-seated valves is necessary to detect a damaged valve once all the testing has been complete.

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.

Justification

Leakage rate B, for the hydrostatic seat test on metal-seated valves provides tighter sealing, improved safety and a longer service life. Leakage rate B, for the low-pressure gas seat test on metal-seated valves is necessary to detect a damaged valve once all the testing has been complete.

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.

Justification

Having the pressurized volume isolated and surrounded by volumes at ambient pressure is the only way to make sure that any pressure drop is immediately identified.

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

Justification

Decrease of water level from detection device means that the test is incorrectly performed, integrity of measured leakage rates compromised.

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

Justification

Without this requirement, there is a possibility that not all the leakage is measured, leading to false readings.

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.

Justification

If draining is allowed from the valve body cavity or from the downstream side of the valve, part of the leak may not be detected. Without this requirement, the seal tests may provide incorrect results.

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.

Justification

Having the pressurized volume isolated and surrounded by volumes at ambient pressure is the only way to make sure that any pressure drop is immediately identified.

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

Justification

Decrease of water level from detection device means that the test is incorrectly performed, integrity of measured leakage rates compromised.

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

Justification

Without this requirement, there is a possibility that not all the leakage is measured, leading to false readings.

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.

Justification

If draining is allowed from the valve body cavity or from the downstream side of the valve, part of the leak may not be detected. Without this requirement, the seal tests may provide incorrect results.

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.

Justification

This requirement is to ensure the effectiveness of body joints and other seals that might be helped by the compression of hydraulic rams.

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).

Justification

By using blind flanges or temporary caps we are ensuring that no assistance is given to the body joints of the valves. This ensures there is a test of the effectiveness of body joints and tightness.

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

Justification

The requirement is needed to clarify what the procedure is if a sample valve fails a test.

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.

Justification

If 2 out of 3 valves tested fail this test it indicates that there is a design flaw and a full design review should be carried out to identify the issue, correct the issue and prevent the issue from happening again. It is important that the purchaser is part of the review, and that the purchaser is in agreement with all findings.

Valves in the failed valve batch shall be subsequently tested.

Justification

It is standard practice that if there are multiple failures in a batch, that all valves in that batch are tested. Especially if any corrective action is need for that specific batch.

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.

Justification

Hydrostatic end load testing is a critical step in the quality assurance process for ball valves, ensuring that they function correctly, safely, and reliably under operational conditions. Potential weaknesses in the valve can be identified and addressed before installation. This reduces the risk of failure during operation, which can lead to accidents, environmental harm, or costly downtime.

11 Coating/Painting

Add to first paragraph

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

Justification

API 6D specifies coating per manufacturer details, this requirement needs to be included so coating is a purchaser requirement.

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.

Justification

This has been added as a note as it can become very difficult to mandate a coating for all eventualities, however, the intention is to standardize wherever possible.

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

Justification

To ensure construction contractor is aware of schedule of weld ends. This ensures there is a proper fit up between the weld ends and the piping system when welding the valve in place.

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.

Justification

Information marked on valves provides the field operators with important information. If the marking is not visible once the valve is assembled or installed (e.g. on a hidden flange face or weld bevels) then the marking on the body is of no use.

12.3 Nameplate

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

a 316 austenitic stainless-steel

Justification

316SS is required for nameplates otherwise they become rapidly unreadable in salt laden, tropical environments due to staining; often, the only link back to the PO from an installed manual valve is from the nameplate.

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.

Justification

Items 15 and 16 are important pieces of information and, when applicable, are required for identification in the field.

Add to section

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

Justification

Marking needs to be readable for as long as possible as loss of the information can cause safety concerns.

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

Justification

This requirement is required to allow for off the shelf valves where additional information that is not on original tag will need to be added.

The nameplate shall contain metric and US customary units.

Justification

Without this requirement there is a potential risk of a wrong conversion by the user from one unit system to the other which can lead to a safety issue.

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

Justification

Drilling holes into the valve body can affect the integrity of the valve so this must be done before hydrotest so that the hydrotest can verify the integrity.

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

Justification

If nameplate attached prior to painting, then there is a high probability of corrosion.

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.

Justification

Particles and organic substances can lead to deterioration of the internal components leading to valve operability being compromised.

13.2 Protection

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

made from wood with moisture barrier or rigid plastic

Justification

To ensure robustness of the cover/plug. Also ensures that if cover/plug is made from wood it must have a moisture barrier (wood can rot if moisture barrier is not used which compromises the integrity of the cover).

Add to section

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

Justification

The use of bolting and nuts provides a secure and stable means of fastening the wooden covers and ensures the covers do not become dislodged due to vibrations or other external forces. This stability is important for maintaining the integrity of the cover's protective function.

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

Justification

This method of securing plastic covers is the most practical way to maintain the functionality, ensuring they fit securely and perform their protective function effectively.

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

Justification

Protecting unpainted surfaces from atmospheric corrosion, during transportation and storage, is essential to ensure integrity and performance.

Preservation shall be by corrosion preventative fluids.

Justification

To ensure the sealing performance of nonmetallic parts are not adversely affected by corrosion preventative fluids.

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

Justification

If these fluids damage the nonmetallic parts, the valve will not be able to seal. To avoid this scenario, guarantees to ensure the integrity of the sealing functionality.

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

Justification

Protecting unpainted surfaces from atmospheric corrosion, during transportation and storage, is essential to ensure integrity and performance. Machined and threaded surfaces have been finished to tight tolerances so it is important that the rust-preventative compound can be removed without mechanical means so that the finish and tolerances are not compromised.

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

Justification

Machined and threaded surfaces have tight tolerances, if the rust preventative compound is removed by mechanical means these tolerances can be compromised which can lead to loss of containment.

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

Justification

This requirement is crucial to prevent contamination, maintain component integrity and ensure safety.

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

Justification

Using vapor-proof barrier will help to minimize moisture which will in turn minimize corrosion.

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

Justification

Vapor phase inhibitor sachets will further inhibit corrosion.

Auxiliary connections shall be protected from mechanical damage during transportation.

Justification

Historically, there have been issues with auxiliary connections of valves being damaged. Providing a physical means of support or protection for the connection will keep this damage from occurring.

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

Justification

Foreign particles and water ingress through auxiliary connections can cause corrosion and valve malfunction. This requirement ensures the auxiliary connections are suitably protected.

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.

Justification

If water or foreign matter accesses the valve internals this can lead to corrosion, erosion or contamination of critical components. This can compromise the valve's performance and service life.

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

Justification

This requirement facilitates the planning of suitable lifting equipment for installation at site.

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

Justification

There is no value in weighing more than one of these valves, so this requirement saves time and money.

14 Documentation

Add new section 14.0 before section 14.1

14.0 General

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

Justification

Defines where to find documentation requirements.

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

Justification

This modification to the existing API requirement extends the period that the manufacturer needs to maintain the specified documentation to cater for valves that are not used directly after manufacture (typically valves purchased by stockists). Previous S-562 requirement of "10 years following the commencement of the contract guarantee period" is too complicated for the manufacturer to keep track of.

Add new list items

— cross-section drawings with parts and materials list;

Justification

Although these documents are provided in the MRB, historically the documents have been requested from the vendor during the ten-year period, so they need to be maintained.

— manufacturing, testing and inspection procedures;

Justification

Testing records are listed in API 6D but procedures have not been requested, this is perceived as a gap. The procedures are essential to understand the testing records.

— nonconformance records;

Justification

Although these documents are provided in the MRB, historically the documents have been requested from the vendor during the ten-year period, so they need to be maintained.

— authorized concessions, waivers and/or material substitutions;

Justification

Although these documents are provided in the MRB, historically the documents have been requested from the vendor during the ten-year period, so they need to be maintained.

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

Justification

These manuals include instructions and guidelines for activities required for maintenance and handling.

— weld maps of major repairs;

Justification

Although these documents are provided in the MRB, historically the documents are requested from the manufacturer during the ten-year period, so they need to be maintained.

— heat treatment records, including heat treatment charts.

Justification

Although these documents are provided in the MRB, historically the documents are requested from the manufacturer during the ten-year period, so they need to be maintained.

14.2 Documentation Provided with the Valve

14.2.1 General

Add new list items

— procedure for receipt and installation;

Justification

An installation procedure is required by the site team immediately to ensure the valve is installed correctly.

— manufacturer's release note;

Justification

Manufacturer's release note will confirm to the site team that the valve has been through all the necessary quality control checks and is fit for purpose.

— agreed deviations (where applicable for receipt control).

Justification

Any agreed deviations are required to ensure the site team do not reject a valve as it is not in accordance with other documentation (i.e. purchase description or general arrangement drawing).

Add to section

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

Justification

The documents listed are required at the time the valve is received for any maintenance, etc that may be required by the site team.

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.

Justification

Reference to IOGP S-563 is required to ensure standardization of materials in accordance with IOGP requirements.

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

Justification

S-562 has added QSL2G (to cover gap for QSL 2 valves that require gas testing). QSL2G has been added to this requirement.

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

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

Justification

"2G" has been added to S-562 so should be referenced with the other QSLs

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

Justification

S-562 has added QSL 2G (to cover gap for QSL 2 valves that require gas testing) so this needs to be referenced.

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.

Justification

Consistent with IOGP S-563. This ensures level III inspectors, within the company, from qualifying others within the same company which has historically seen levels of competency drop. This can lead to defects not being detected.

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.

Justification

Table modified to address concerns.

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.

Justification

Table modified to address concerns raised.

I.4 Testing Requirements

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

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

Justification

"QSL2G" has been added to cover QSL valves in gas service.

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.

Justification

Table modified to address concerns.

<u>*Add to section*</u>

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

Justification

Ensures the effectiveness of body joints and other seals that might be helped by the compression of hydraulic rams. The sample size is deemed sufficient for the criticality of a QSL2 valve.

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

Justification

Ensures the effectiveness of body joints and other seals that might be helped by the compression of hydraulic rams. These QSL levels are more critical than QSL2 so the percentage of valves tested has increased to mitigate any risk.

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

Justification

Ensures the effectiveness of body joints and other seals that might be helped by the compression of hydraulic rams. Due to the criticality of these valves every single valve to be tested this way to ensure that the body joints and other seals are not helped by the compression of the hydraulic rams to pass the pressure tests.

I.6 Torque/Thrust Functional Testing

I.6.1 Method

<u>*Replace section with*</u>

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

Justification

The bullet list requirements are the same as in API 6D but the sequencing has been modified. The sequencing has been changed so that the least stringent tests (and simplest to perform) are first, this is the most logical sequence, if the first test fails the more complicated tests will not be performed.

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

Justification

The initial cycles of a torque functional test without pressure for a ball valve helps assess its mechanical integrity, verify proper operation, inspect seating surfaces and establish baseline torque values.

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

Justification

This is a methodical approach that simulates real-world conditions. This test helps evaluate sealing performance, identify potential issues, and ensures that the valve can operate effectively under the anticipated pressure differentials.

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

Justification

The bidirectional test provides additional verification of the overall integrity of the valve. It ensures that the valve's design and construction can consistently meet performance expectations, regardless of the direction of fluid flow.

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

Justification

This test verifies the sealing integrity of the valve under operational conditions, ensuring that it can reliably prevent fluid from flowing through when closed, even under pressure.

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

Justification

This test is part a comprehensive approach to evaluate the sealing integrity and bidirectional performance of a ball valve under realistic operating conditions. This test step helps identify potential issues, ensures reliable valve performance, and contributes to the safety and functionality of the valve.

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

Justification

By fully opening and closing the valve, the test validates the overall integrity of the valve under different operating conditions. It ensures that the valve can perform its intended function consistently and reliably throughout its range of motion.

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

Justification

Functional testing at the specified pressure rating is crucial for ensuring the safety of the valve in real-world applications. It verifies that the valve can withstand the maximum pressure it is expected to encounter during normal operation without failure.

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

Justification

This requirement allows for a controlled evaluation of the valve's sealing integrity and overall functionality without introducing unnecessary variables that can affect the test outcomes.

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.

Justification

Testing in this manner helps minimize the potential for false readings. By pressurizing one side and leaving the other side at atmospheric pressure, any leakage detected can be more confidently attributed to the condition of the seats rather than other potential points of leakage.

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

Justification

By maintaining the body cavity at atmospheric pressure, the test is focused on potential leakage across the ball and seat, reducing the likelihood of false readings that might be caused by other sources of leakage within the valve or associated components.

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

Justification

By keeping the body cavity open to atmospheric pressure, the focus of the test is specifically on the performance of the valve seats. This configuration minimizes the potential for false readings that can be caused by other components within the valve.

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

Justification

By maintaining the body cavity at atmospheric pressure, the test aims to isolate and identify leakage points specifically related to the ball and seat interface.

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.

Justification

By maintaining the body cavity at atmospheric pressure, the test aims to isolate and identify leakage points specifically related to the ball and seat interface.

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.

Justification

Measuring torques at each step during a torque functional test is a comprehensive approach that provides crucial information for quality control, anomaly detection, troubleshooting, and validation of the valve's operational performance. These measurements contribute to the overall reliability and functionality of the ball valve in various operating conditions.

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).

Justification

Recording the highest torque values provides a record of the torque measurements performed during inspections, maintenance, or testing. This documentation is essential for compliance with industry standards, regulations, and internal quality assurance protocols.

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.

Justification

This ensures stable testing conditions leading to reliable test results.

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

Justification

Measuring torque up to decompression ensures that these components are properly loaded and compressed during the entire pressurized phase, which is critical for maintaining a leak-tight seal.

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.

Justification

Functional testing with seats free of sealant helps prevent false positives that may occur if the sealant contributes to achieving a temporary or artificial seal during testing.

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.

Justification

To ensure that the torque and associated safety factors are as expected (i.e., that there are no assembly issues).

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

Justification

If measured operating torque exceeds design torque mechanical integrity, sealing performance, reliability and safety can be compromised

I.6.3.2 Acceptance Criteria for Functional Testing

Manual valves shall demonstrate smooth operability.

Justification

To ensure valve assembly was performed correctly and no excessive torque is required.

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

Justification

If measured operating torque exceeds design torque mechanical integrity, sealing performance, reliability and safety can be compromised.

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

Justification

To ensure the valve has been assembled correctly.

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.

Justification

To ensure valve assembly was performed correctly and no excessive torque is required.

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

Justification

This is the easiest way to evaluate the output torque.

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

Justification

To ensure that the valve torque was properly assessed during design.

I.6.3.3 Acceptance Criteria Results

The measured/calculated torques and forces shall be recorded.

Justification

It is important to have traceability, so these values need to be recorded for quality. If operational issues arise with the valve in the future, having recorded torque values can aid trouble shooting and diagnostics.

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.

Justification

API 6D does not cover the cavity relief testing for QSL2G, QSL3G or QSL4G valves so this requirement covers this gap.

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.

Justification

Safety concerns of very high trapped pressure were raised and the effect of the high pressure damaging the PTFE seats when pressure is relieved which adversely impacts the durability of the valve. To counter this a cap of 435 psig (30 bar) has been applied.

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.

Justification

Having the pressurized volume isolated and surrounded by volumes at ambient pressure is the only way to make sure that any pressure drop is immediately identified.

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

Justification

The seats need to be given enough time to settle, the test results can be skewed and show as a false failure if a stabilization period is not observed.

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

Justification

Test pressure needs to be constant before the stabilization period begins to ensure the accuracy, reliability, and safety of the testing process. 2 minutes is consistent with the timeframe already used in L.19 of this specification.

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.

Justification

All connections are potential leak path sources so must be installed prior to the test to ensure they are part of the 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.

Justification

If body connections have been dismantled, the only way to ensure body connections have been re-installed correctly and that the valve shell is gas tight is to gas test the valve again. Failure to do so can lead to shell leakage.

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.

Justification

The stabilization time specified in Table L.1 is the time it takes for a typical Rate B leakage to cause a pressure increase in the cavity comparable with the sensitivity of the measuring instrument.

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).

Justification

This is the only way to monitor what is happening during stabilization period. The test results can be skewed and show as a false failure if a stabilization period is not observed.

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

Justification

This is the only way to monitor what is happening during stabilization period. The test results can be skewed and show as a false failure if a stabilization period is not observed.

Add to section

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

Justification

Having the pressurized volume isolated and surrounded by volumes at ambient pressure is the only way to make sure that any pressure drop is immediately identified.

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

Justification

Monitoring seat leakage from the downstream side allows for the most accurate measurement, API 6D has an identical requirement for hydrostatic seat test in 10.4.1.

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

Justification

If the opposite side is opened, part of the leak may not be detected. Without this requirement, it must be considered that most of seat tests are performed incorrectly.

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

Justification

API 6D 25th states "purged with air", which is not measurable, so this has been modified.

Add after second sentence

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

Justification

The seats need to be given enough time to settle, the test results can be skewed and show as a false failure if a stabilization period is not observed.

Replace third sentence with

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

Justification

Requesting more stringent variation as 5 % is seen as too large a variation which can lead to the test results being skewed and show as a false failure. 2 minutes is aligned with L.19.1.1.

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.

Justification

This is the only way to monitor what is happening during stabilization period. The test results can be skewed and show as a false failure if a stabilization period is not observed.

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

Justification

This is the only way to monitor what is happening during stabilization period. The test results can be skewed and show as a false failure if a stabilization period is not observed.

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

NOTE See K.16 for optional stabilization period duration.

Justification

This "stabilization period" is deemed as critical for the leak to have sufficient time to present itself. If this time is not allowed there is a risk that you will not get a consistent leakage measurement leading to false positive results.

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

Justification

The test results can be skewed and show as a false failure if a stabilization is not achieved.

Following stabilization, the seat leakage test shall begin.

Justification

Stabilization before seat leakage tests on ball valves is essential for obtaining accurate and reliable results, ensuring the valve is in a consistent and controlled state before evaluating its sealing performance.

The test duration shall be in accordance with Table 10.

Justification

Test duration is consistent with other seat test durations, I.9 already states that "The seat shall be tested as specified in 10.4 at a test pressure between 80 psi and 100 psi (5.5 bar and 6.9 bar) using air or nitrogen as the test medium." so this requirement is duplicated but it was agreed to retain it.

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.

Justification

Leakage rate B, for the hydrostatic seat test on metal-seated valves provides tighter sealing, improved safety and a longer service life. Leakage rate B, for the low-pressure gas seat test on metal-seated valves is necessary to detect a damaged valve once all the testing has been complete.

I.10 Documentation

Replace "QSL2" with

QSL2/2G

Justification

QSL2G has been added to S-562.

Table I.6—Documentation Requirements for Each QSL

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

Justification

QSL 2G has been added to S-562.

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

Justification

Any valve QSL2 and above has a high criticality so these valves should all have the same documents maintained by the manufacturer.

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

Justification

Table I.6 indicates the documents that are to be maintained by the manufacturer and has been updated in accordance with 14.1.

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.

Justification

Some operating companies do not require this stabilization period and feel that it adds cost and time for little or no benefit. This deviation gives the option not to implement the durations specified in Table L.1

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.

Justification

This specification has more stringent leakage rates than that of API 6D, this requirement gives an option to select the API 6D leakage rates.

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.

Justification

Valves are generally lifted in the "stem-upright" position, so the valve needs to be suitable for this process as well as the specified orientation.

Add new section

K.19 Other Bolted Joint Designs

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

Justification

This requirement has been added to ensure valve designs that are already used successfully are not invalidated by 5.1.4 (especially the min size of bolt and cap screw restrictions)

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.

Justification

5.6.1.1 has been added to avoid bad designs which have been encountered in the industry for vent and drain ports of CRA clad valve designs. However, if the purchaser wants a specific design, this requirement allows for this option.

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.

Justification

5.6.2 specifies two non-return valves as standard for stem injection points whereas API 6D only requires one. This requirement allows an option for only one, if specified by purchaser. Also, the materials of the non-return valves are high spec which may not always be required, so this can be downgraded, if specified by purchaser.

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.

Justification

Requirement added to give an option of not having to purchase a bespoke valve where a standard valve can be used.

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

Justification

Requirement added to give an option of not having to purchase a bespoke valve where a standard valve can be used. Previous requirement has been split as two requirements.

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.

Justification

This requirement is added to allow the purchaser the option to accept the use of O-rings below temperatures of –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.

Justification

While most valves are required to be fire tested, there are some applications (e.g., water) where this is not required. This option allows for this eventuality.

Add new section

K.25 Permitted use of Cap Screws

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

Justification

Cap screws have been prohibited from use as pressure-containing bolting as this is a good safe practice, however, in certain applications cap screws may be acceptable so the option has been added to Annex K.

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.

Justification

Annex N provides the most common material combinations, but it is not meant to be an exclusive list, this requirement allows selection of other material combinations.

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.

Justification

Duration for this test has not been specified in API 6D so this requirement has been added to cover the gap. Without a standard test duration, spurious test results may occur.

Replace fifth list item with

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

Justification

Leakage rate B, for the hydrostatic seat test on metal-seated valves provides tighter sealing, improved safety and a longer service life. Leakage rate B, for the low-pressure gas seat test on metal-seated valves is necessary to detect a damaged valve once all the testing has been complete.

Add to section

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

Justification

During testing, pressure needs to be isolated from the source to allow for a stable test environment where any changes in pressure can be accurately attributed to the valve's performance rather than to fluctuations in the supply system. This is consistent with testing as specified in 10.4.3.1 and 10.4.3.2

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

Justification

Covers potential gap regarding gas testing.

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

Justification

The presence of liquid or moisture can potentially impact the gas leak test results, so to ensure the integrity of these tests the valve internals need to be dried.

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

Justification

The presence of liquid or moisture can potentially impact the gas leak test results, so to ensure the integrity of these tests the valve internals need to be dried.

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

Justification

This requirement is accordance with the main specification. It is important to allow the pressure to stabilize to ensure correct testing and accurate leakage rates. This is consistent with testing as specified in 10.1.2.

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

Justification

Acceptance criteria for testing for soft-seated DBB valves with gas has not been specified, this requirement addresses the gap.

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

Justification

Acceptance criteria for testing for metal-seated DBB valves with gas has not been specified, this requirement addresses the gap.

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.

Justification

During testing, pressure needs to be isolated from the source to allow for a stable test environment where any changes in pressure can be accurately attributed to the valve's performance rather than to fluctuations in the supply system. This is consistent with testing as specified in 10.4.3.1 and 10.4.3.2.

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

Justification

Without this requirement, there is a possibility that not all the leakage is measured, leading to false readings.

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

Justification

Duration for this test has not been specified in API 6D so this requirement has been added to cover the gap. Without a standard test duration, spurious test results may occur.

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

Justification

If draining is allowed from the valve body cavity or from the downstream side of the valve, part of the leak may not be detected. Without this requirement, it must be considered that most of seat tests are performed incorrectly.

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.

Justification

To ensure there are no air pockets which can adversely affect the test results.

Replace last list section with

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

Justification

Acceptance criteria for gas seat test has been added to this L.10 so this requirement for hydrostatic seat test is also required.

Add to section

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

Justification

Covers potential gap regarding gas testing.

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

Justification

The presence of liquid or moisture can potentially impact the gas leak test results, so to ensure the integrity of these tests the valve internals need to be dried.

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

Justification

The presence of liquid or moisture can potentially impact the gas leak test results, so to ensure the integrity of these tests the valve internals need to be dried.

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

Justification

This requirement is accordance with the main specification. It is important to allow the pressure to stabilize to ensure correct testing and accurate leakage rates. This is consistent with testing as specified in 10.1.2.

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

Justification

Test pressure needs to be constant before the stabilization period begins to ensure the accuracy, reliability, and safety of the testing process. 2 minutes is consistent with the timeframe already used in L.19 of this specification.

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

Justification

Acceptance criteria for testing for DIB-1 valves with gas has not been specified, this requirement addresses the gap.

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.

Justification

During testing, pressure needs to be isolated from the source to allow for a stable test environment where any changes in pressure can be accurately attributed to the valve's performance rather than to fluctuations in the supply system. This is consistent with testing as specified in 10.4.3.1 and 10.4.3.2.

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

Justification

Without this requirement, there is a possibility that not all the leakage is measured, leading to false readings.

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

Justification

Duration for this test has not been specified in API 6D so this requirement has been added to cover the gap. Without a standard test duration, spurious test results may occur.

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

Justification

If draining is allowed from the valve body cavity or from the downstream side of the valve, part of the leak may not be detected. Without this requirement, it must be considered that most of seat tests are performed incorrectly.

Replace last list item with

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

Justification

Leakage rate B, for the hydrostatic seat test on metal-seated valves provides tighter sealing, improved safety and a longer service life. Leakage rate B, for the low-pressure gas seat test on metal-seated valves is necessary to detect a damaged valve once all the testing has been complete.

Add to section

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

Justification

Covers potential gap regarding gas testing.

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

Justification

The presence of liquid or moisture can potentially impact the gas leak test results, so to ensure the integrity of these tests the valve internals need to be dried.

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

Justification

The presence of liquid or moisture can potentially impact the gas leak test results, so to ensure the integrity of these tests the valve internals need to be dried.

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

Justification

This requirement is accordance with the main specification. It is important to allow the pressure to stabilize to ensure correct testing and accurate leakage rates. This is consistent with testing as specified in 10.1.2.

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

Justification

Test pressure needs to be constant before the stabilization period begins to ensure the accuracy, reliability, and safety of the testing process. 2 minutes is consistent with the timeframe already used in L.19 of this specification.

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

Justification

Acceptance criteria for testing for DIB-2 valves with gas has not been specified, this requirement addresses the gap.

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.

Justification

Covers potential gap regarding gas testing.

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

Justification

The presence of liquid or moisture can potentially impact the gas leak test results, so to ensure the integrity of these tests the valve internals need to be dried.

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

Justification

The presence of liquid or moisture can potentially impact the gas leak test results, so to ensure the integrity of these tests the valve internals need to be dried.

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

Justification

Duration for this test has not been specified in API 6D so this requirement has been added to cover the gap. Without a standard test duration, spurious test results may occur.

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

Justification

This requirement is accordance with the main specification. It is important to allow the pressure to stabilize to ensure correct testing and accurate leakage rates. This is consistent with testing as specified in 10.1.2.

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

Justification

Test pressure needs to be constant before the stabilization period begins to ensure the accuracy, reliability, and safety of the testing process. 2 minutes is consistent with the timeframe already used in L.19 of this specification.

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

Justification

Extended time required for additional steps, due to the criticality of this test this will improve the accuracy and reliability of this test.

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

Justification

If test begins prior to pressure stabilization test results may not be reliable.

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.

Justification

If draining is allowed from the valve body cavity or from the downstream side of the valve, part of the leak may not be detected. Without this requirement, it must be considered that most of seat tests are performed incorrectly.

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

Justification

Any connection with external atmosphere can falsify the reading, so this must be avoided.

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

, in 25 % increments,

Justification

Sudden reduction in pressure can aid the seat energization and engagement, ensuring this slower rate of depressurization will provide more accurate results.

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

3-i) Stabilize pressure at every reduction increment.

Justification

The seats need to be given enough time to settle, the test results can be skewed and show as a false failure if a stabilization period is not observed.

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

Justification

This simulates what happens on site, i.e., even if there is leakage there is a full pressure in the line. This keeps the test consistent, despite any pressure drop which can impact the test result.

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

Justification

During testing, pressure needs to be isolated from the source to allow for a stable test environment where any changes in pressure can be accurately attributed to the valve's performance rather than to fluctuations in the supply system. This is consistent with testing as specified in 10.4.3.1 and 10.4.3.2.

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

5-i) Stabilize pressure.

Justification

The seats need to be given enough time to settle, the test results can be skewed and show as a false failure if a stabilization period is not observed.

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.

Justification

Slow rate of pressurization is a more representative simulation of a situation where the upstream seat is leaking into the cavity.

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.

Justification

This requirement mimics the conditions that are present if there was a failure of the upstream seat. Increasing the pressure with 145 psig (10 barg) increments ensures the seat is sealing without the assistance of any shock loading that rapid increase in pressure may cause.

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

Justification

This requirement ensures that both the leakage rate and the upstream pressure are checked. Both are indicators as to whether the seats are leaking.

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

, in 25 % increments,

Justification

Sudden reduction in pressure can aid the seat energization and engagement, ensuring this slower rate of depressurization will provide more accurate results.

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.

Justification

API 6D only specified acceptance criteria for hydrostatic seat test and not gas seat test, low-pressure hydrostatic and low-pressure gas seat test. These all need to be specified to ensure the integrity of the sealing performance.

Add new list section e)

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

Justification

API 6D only specified acceptance criteria for hydrostatic seat test and not gas seat test, low-pressure hydrostatic and low-pressure gas seat test. These all need to be specified to ensure the integrity of the sealing performance.

L.14 Drive Train Strength Test

Add new list items after first list item

— the maximum operator torque; or

Justification

Need to take into account torque from an operator/actuator/gearbox (can be much greater than 2 times the valve breakaway thrust or torque).

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

Justification

For valves with actuators, this torque must be considered to ensure the drive train is appropriately sized to operate the valve reliably and safely. Failing to do so can result in valve failure.

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).

Justification

Ensuring that the valve can handle extreme torque loads is essential for safety. If a valve's drive train isn't strong enough, it may fail to close or open properly, leading to hazardous situations.

A single valve shall qualify identical valves in the order.

Justification

This test is to ensure the design of the drive train is strong enough, so in essence it is a type test. Testing identical valves will delay deliveries and add minimal value.

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

Justification

To ensure the inside of the valve and sealing areas are not damaged.

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.

Justification

To ensure an even distribution of force throughout the valve's components preventing deformation of the valve. Part of the justification has been left in at the insistence of the group as they felt it added to the requirement. Tolerance is in line with API 6A drift mandrel tolerance.

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.

Justification

If the interfaces are not marked prior to the test then it will not be possible to see if any permanent deformation has occurred. Permanent deformation of the drive train severely impacts the integrity and performance of the valve.

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

Justification

Any misalignment means permanent deformation has occurred, if this is the case the valve should be rejected. Permanent deformation of the drive train severely impacts the integrity and performance of the valve.

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

Justification

This aligns with the modified leakage rates in Table 19

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.

Justification

I.9 and L.19.2 are identical so this requirement simply points to I.9.

L.20 High-pressure Gas Testing

Replace section with

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

Justification

I.8 and L.20 are identical so, this requirement simply points to I.8.

L.22 Disassembly/Maintenance Tools

In first paragraph, add after "inform the purchaser"

, prior to order,

Justification

If special tools are required, then at least one set will need to be procured, this revision to the requirement makes sure this happens at the right time. This helps ensure that there are no delays in purchasing these special tools which can, otherwise, negatively impact the fabrication schedule.

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.

Justification

Tightness class is very application-based requirement, so is left as an option.

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

Justification

FE testing at specified minimum and maximum design temperatures is essential for ensuring the reliability, safety, and compliance of valve designs. It allows manufacturers to assess the performance of materials, seals, lubricants, and other components under realistic operating conditions, contributing to the overall effectiveness of fugitive emissions control measures.

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

Justification

These parameters have been imposed to ensure all readings are accurate and reliable, which, in turn, contributes to quality assurance and risk mitigation. Inaccurate readings can cause false passes and failures.

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

Justification

Having qualified personnel trained in accordance with the manufacturer's documented training program is crucial for ensuring the accuracy, reliability, and safety of fugitive emission testing. It contributes to compliance with standards, quality assurance, and the overall integrity of the testing process.

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.

Justification

Adhering to Level 1 requirements specified in ISO 9712 or ASNT SNT-TC-1A for the tracer gas method in fugitive emission testing ensures standardization, quality assurance, competence of personnel, reliable results, regulatory compliance, and safety. These factors collectively contribute to the integrity and effectiveness of fugitive emission testing processes.

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.

Justification

Testing in this orientation is considered the most onerous, a successful test in any other orientation does not necessarily guarantee the same performance if the valve were to be installed with the stem or shaft in the horizontal position.

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

Justification

Some trunnion mounted ball valve designs are less affected by the test orientation than others. In such cases, the purchaser can approve the previous qualification testing saving both time and money.

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).

Justification

To ensure the fugitive emission is correctly and effectively measured, all leak paths need to be measured, otherwise leakage readings are incorrect.

L.24.2 Valve Production Testing

Add to section

The fugitive emission tightness class shall be specified.

Justification

Tightness class is very application-based requirement, so is left as an option.

The valve shall be tested in the specified installation orientation.

Justification

Testing a valve in its specified installation orientation ensures that its performance meets the intended specifications.

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

Justification

Testing in this orientation is considered the most onerous, a successful test in any other orientation does not necessarily guarantee the same performance if the valve were to be installed with the stem or shaft in the horizontal position.

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

Justification

Commencing measurements 10 minutes after the application of test pressure in FE testing is designed to enhance the accuracy, repeatability, and reliability of the testing process. It allows the system to reach a consistent and representative state, ensuring that measurements capture the true fugitive emissions characteristics of the valve under realistic conditions.

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

Justification

Having qualified personnel trained in accordance with the manufacturer's documented training program is crucial for ensuring the accuracy, reliability, and safety of fugitive emission testing. It contributes to compliance with standards, quality assurance, and the overall integrity of the testing process.

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.

Justification

Adhering to Level 1 requirements specified in ISO 9712 or ASNT SNT-TC-1A for the tracer gas method in fugitive emission testing ensures standardization, quality assurance, competence of personnel, reliable results, regulatory compliance, and safety. These factors collectively contribute to the integrity and effectiveness of fugitive emission testing processes.

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).

Justification

To ensure the fugitive emission is correctly and effectively measured, all leak paths need to be measured, otherwise readings are incorrect.

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.

Justification

Sample size to be agreed prior to start of testing regime to ensure clarity on requirements on a project-to-project basis.

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).

Justification

This table simply helps to agree on a sample size prior to start of testing regime to ensure clarity on requirements on a project-to-project basis.

The samples shall be selected at random from each lot.

Justification

There are many reasons for this requirement, random sampling is considered a key component of statistical methods but the main concern here is not to allow the manufacturer to put forward valves that have been treated differently (i.e., given more care and attention to ensure they pass the test) to the other valves.

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

Justification

A lot is not acceptable until the complete sample set has been tested and met the acceptance criteria.

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

Justification

When sample valve fails this is an indication of potential problems for the whole batch. Therefore, all the valves in the sample should be tested.

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

Justification

Clarification required to ensure all parties know their responsibilities in a sample testing situation.

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

Justification

Taking a new sample set after a valve failure is a systematic and strategic approach to quality control. It allows for a more comprehensive evaluation of the entire population, helps identify and address root causes, supports continuous improvement, and contributes to overall product quality.

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

Justification

If multiple valves failures occur conducting a root cause analysis, implementing corrective actions, and developing a preventative action report are integral to quality management, risk mitigation, and building and maintaining customer confidence. These processes contribute to the overall reliability and performance of valves.

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

Justification

Once approved, all the actions from the report need to be implemented as specified. It was agreed to keep this in the specification even though it can be managed through the IRS. There were concerns that because a root cause analysis, corrective action and preventative action report is not always required this can easily be missed if managed through the IRS.

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

Justification

Testing with 97 % Helium is an industry standard (see ISO 15848-1and ISO 15848-2), however, using a 10 % helium + 90 % Nitrogen is a cheaper option while still providing high sensitivity to leaks.

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

Justification

As 10 % He + 90 % N2 mixture has now been allowed the acceptance criteria also needs to be set for the new mixture. This new mixture is a diluted helium mixture, to compensate for this dilution effect, acceptance criteria for the diluted mixture is updated to allow for a larger leak rate.

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

Justification

Setting the test pressure to be the rated pressure at ambient temperature is a standard practice that prioritizes safety, material behaviour and design verification. Testing at rated pressure at ambient temperature provides a conservative assessment of the material's strength under normal operating conditions.

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

Justification

This is a practical and standardized approach in fugitive emissions testing. It reflects realistic operating conditions, addresses worst-case scenarios, and provides a comprehensive assessment of sealing integrity during dynamic phases of valve operation.

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.

Justification

This requirement has been added due to scaling issues in this edition that has been rectified in subsequent issues. Using the 4th edition allows some sizes to be incorrectly deemed as qualified.

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

Justification

This information is useful guidance to the manufacturer.

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

Justification

Although the three fire test standards clearly state that a change of nonmetallic materials requires a new qualification, this note is a useful reminder to the manufacturers.

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

Justification

Scaling criteria for each of the three fire type testing specifications is different, so this note is to clarify that only the scaling related to the specific standard can be used.

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

Justification

To ensure that the entire assembly can maintain its functionality and integrity after a fire event it is important to test the valve and gearbox together. Of the three standards specified in L.27 only API 607 qualifies a valve with a specific gearbox. ISO 10497 also tests the valve with a gearbox but currently, once the valve has been tested with a gearbox the valve is deemed fire safe and can be used with any gearbox, this requirement has been added to ensure that the valve can only be used with the specific gearbox it was tested with. Currently API STD 6FA does not qualify gearboxes so cannot be used but this may change in the upcoming revision and if this does happen then this requirement may also allow the use of this standard.

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

Justification

Independent agencies play a role in risk management by ensuring that the fire type-tests are conducted with a high level of scrutiny.

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

Justification

The installation of graphite or metallic sealing barriers ensures the safety and reliability of a sealing system in a fire.

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

Justification

While graphite seals offer resistance at high temperatures, graphite seals have limitations in terms of compression set recovery which can impact long-term sealing performance.

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

Justification

Seals constructed from a single piece of solid graphite have fewer points of potential failure compared to multi-part seals. The absence of seams, joints, or bonded interfaces enhances the overall integrity of the seal, reducing the risk of leaks or structural weaknesses.

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

Justification

The fire testing standards imply but do not specifically state this requirement, so this requirement has been added. Change of design or material specification of the graphite back-up seals can impact the performance of the seals.

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.

Justification

This requirement standardizes extension lengths when lagging is required.

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.

Justification

This requirement ensures that the lagging adequately covers and extends beyond critical components, providing the intended insulation. Also, standardizing the measurement from the upper bonnet flange to the larger of the flange rim or body diameter promotes consistency in how lagging extension length is determined.

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)

Justification

The dimensions in this table ensure that the lagging adequately covers and extends beyond critical components, providing the intended insulation. Also, standardizing the measurement from the upper bonnet flange to the larger of the flange rim or body diameter promotes consistency in how lagging extension length is determined.

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

Justification

Insulation collar plates on lagging extended bonnets serve to improve thermal efficiency and enhance safety.

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

Justification

Placing the bolting on the upper side of the collar plate makes it more accessible during installation and maintenance activities.

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

Justification

To avoid condensation entering the insulated area.

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

Justification

Clearing both the bonnet lower flange/connection and the valve end flange ensures that the insulation collar provides comprehensive thermal coverage. Stipulating dimensions will help drive standardization.

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)

Justification

Clearing both the bonnet lower flange/connection and the valve end flange ensures that the insulation collar provides comprehensive thermal coverage. Stipulating dimensions will help drive standardization

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

Justification

Justification not required for note

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

Justification

Stem guide is essential with extended stem to prevent misalignment and subsequent wear/ galling. When the stem guide bushing is positioned at the lower end, it facilitates easier inspection and maintenance.

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

Justification

This requirement is crucial for maintaining structural integrity, preventing leaks, and ensuring the overall safety and reliability of the valve.

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.

Justification

This requirement is essential for creating a robust and reliable valve that ensures that the valve can operate safely and effectively.

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.

Justification

5.4.5.5 specifies a protection class of IP65, however, there are times when this will not be sufficient (offshore) when IP67 is required. This option and the accompanying data sheet element will cover this requirement.

Add new section

L.32 Pipe Pup/Transition Pieces

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

Justification

This optional requirement has been added to drive standardization when pipe pups/ transition pieces are specified.

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

Justification

To drive standardization of pipe pup. transition piece lengths.

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)

Justification

Drives standardization of pipe pup lengths.

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.

Justification

While the IRS will have a requirement that the welding procedure and procedure qualification record will need to be reviewed and approved by purchaser, the manufacturer must ensure that any such documents provided by any sub-suppliers should be reviewed and approved prior to any welding taking place. Failure to do so can result in the damaging of valve internals during welding or heat treatment due to exceeding maximum temperature limits the valve should be exposed to.

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

Justification

Requirement to prevent and avoid seat seal damages, seat housing deformation and potential loss of sealing integrity.

Transition tapers shall not be steeper than 1:4.

Justification

This requirement is to avoid stress concentration in proximity of the transition, which are even more critical in case the pressure varies cyclically.

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

Justification

This requirement is consistent with requirements in ASME B31.8 Chap. II. This helps to prevent local stress peak at the weld due to excessive change diameter and prevents weld local defects during welding into the sloping connection area.

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.

Justification

This requirement is consistent with requirements in ASME B31.8 Chap. II. This helps to prevent local stress peak at the weld due to excessive change diameter and prevents weld local defects during welding into the sloping connection area.

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.

Justification

This requirement covers a gap in the current version of API 6D specific for downstream refinery environments.

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).

Justification

Gives clearer definition of options and drives standardization.

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

Justification

This option has been added as some operating companies do not want welding on threaded areas.

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.

Justification

The aim is to standardize on a good safety practice that the current B1.20.1 and B16.11 does not provide. The safety issue exists when extreme tolerances for male and female are considered for assembly which this requirement addresses.

Add new Figure L.3

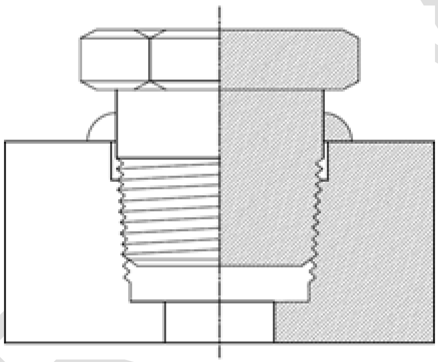

Figure L.3— Seal Welded IOGP Welded NPT Threaded Plug Additional Tolerance Requirements

Justification

This figure provides additional clarity as to what a seal welded IOGP welded NPT threaded plug looks like.

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.

Justification

This ensures that the seal weld does not come into contact with the threads.

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

Justification

Relieving pressure from the inboard seal before disengaging double seal parallel threads is a safety measure aimed at preventing blowouts, minimizing the risk of injury, avoiding component damage, ensuring controlled decompression, and promoting overall work safety.

Add new Figure L.4

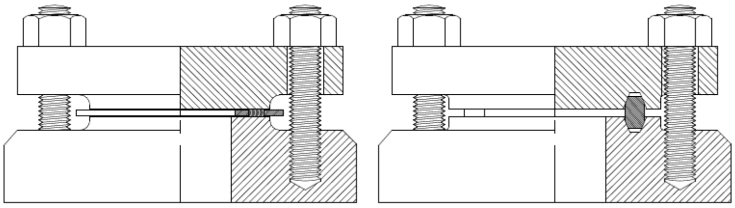

Figure L.4—Studded Flange Connection

Justification

This figure promotes the use of a "boss type" connection rather than a fillet welded long weld necks or flangeolets.

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

Justification

To be consistent with the modification made to the main spec this requirement should align with 14.1.

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".

Justification

The addition of the " IOGP S-562 material class" will help to clarify when standard trims are being specified.

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.

Justification

This requirement will drive standardization of materials.

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.

Justification

This requirement will drive standardization of materials.

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.

Justification

In sealing areas of ball valves where maintaining tight tolerances and smooth surfaces is crucial for O-ring performance, relying solely on the corrosion allowance might not be sufficient. CRA weld overlay adds an extra layer of corrosion-resistant material to these critical areas, ensuring long-term corrosion protection and maintaining the valve's integrity.

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.

Justification

By applying a full CRA weld overlay, every part of the wetted surface is protected, ensuring complete resistance to corrosion. This is critical for maintaining the integrity of the valve over its operational life.

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

A=Acceptable alternative / O=Option to be specified by Purchaser

Material selection (specification and/or grade)	**MDS / EDS**	**Component Type**	**PC: Body / Bonnet / Auxiliary Flange**	**PC: Stem**	**PC: Bolting**	**PR: Ball, Seat, Trunnion**	**PR: Trunnion plates**	**PW: Springs**	**PW: Bearings**	**PW: Seat sealing ≤ 300#**	**PW: Seat sealing ≥ 600#**	**PW: Seals ≤ 600#**	**PW: Seals ≥ 900#**
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 [-20 °F (-29 °C) to 302 °F (150 °C)]**										
IOGP S-562 material class			**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 [-20 °F (-29 °C) to 302 °F (150 °C)]										
IOGP S-562 material class			**N1c**										
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)]										
— 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 [-50 °F (-46 °C) to 302 °F (150 °C)]
IOGP S-562 material class	**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 [-50 °F (-46 °C) to 302 °F (150 °C)]										
IOGP S-562 material class			**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** **[-50 °F (-46 °C) to 302 °F (150 °C)]**
IOGP S-562 material class	**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

A=Acceptable alternative / O=Option to be specified by Purchaser

Material selection (specification and/or grade)	MDS / EDS	Component Type	PC: Body/Bonnet/ Auxiliary Flange	PC: Stem	PC: Bolting	PR: Ball, Seat, Trunnion	PR: Trunnion plates	PW: Springs	PW: Bearings	PW: Seat sealing ≤ 300#	PW: Seat sealing ≥ 600#	PW: Seals ≤ 600#	PW: Seals ≥ 900#
A350 LF2 Class 1	IC004S	Pressure-containing parts	A			A[e]							
A350 LF6 Class 1 or 2	IC004S	Pressure-containing parts	A			A[e]							
A352 LCC	IC006S	Pressure-containing parts	A										
A694 F52	IX124S	Pressure-containing parts	A			A[e]							
A694 F60	IX124S	Pressure-containing parts	A			A[e]							
A694 F65	IX124S	Pressure-containing parts	A			A[e]							
A182 F51	ID144S	Pressure-containing parts		A		A							
A182 F53/F55	ID254S	Pressure-containing parts		A		A							
A276 UNS S31803	ID147S	Pressure-containing parts		A		A							
A276 UNS S32750 / UNS32760	ID257S	Pressure-containing parts		A		A							
A479 UNS S31803	ID147S	Pressure-containing parts		A		A							
A479 UNS S32750 / UNS32760	ID257S	Pressure-containing parts		A		A							
A995 Gr. 4A	ID146S	Pressure-containing parts				A							
A995 Gr. 6A	ID256S	Pressure-containing parts				A							
A240 UNS S31803 / UNS S32205	ID145S	Pressure-containing parts					A						
A240 UNS S32550 / UNS S32750 / UNS S32760	ID255S	Pressure-containing parts					A						
A494 CW-6MC	IN106S	Pressure-containing parts				A							
B446 UNS N06625	IN107S	Pressure-containing parts		A		A							
B564 UNS N06625	IN104S	Pressure-containing parts		A		A							
B443 UNS N06625	IN105S	Pressure-containing parts					A						
B637 UNS N07718 [c]	-	Pressure-containing parts		A		A							
UNS N06625	-	Spring material						A					
UNS N07718	-	Spring material						A					
UNS N07750	-	Spring material						A					
UNS N10276	-	Spring material						A					
UNS R30003	-	Spring material						A					
625 + PTFE	-	Bearing Material							A				
A320 L7M / A194 7M	IX100S	Bolting materials			A								
RPTFE	-	Seat sealing								A			
PCTFE	-	Seat sealing								O[d]	O[d]		
PEEK	-	Seat sealing								O[g]	A[g]		
Tungsten Carbide Coating HVOF hardfacing	IH002	Seat sealing				A[h]				A[h]	A[h]		
FKM LT RGD	-	Sealing										O	
FKM LT RGD + Back-up rings both sides (RPTFE or PEEK)	-	Sealing											O
HNBR RGD	-	Sealing										O	
HNBR RGD + Back-up rings both sides (RPTFE or PEEK)	-	Sealing											O
PTFE Lip Seal + Elgiloy Spring + Anti Collapse	-	Sealing										O	O
V-packing (chevron) seals	-	Sealing										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		**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]			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** **[-50 °F (-46 °C) to 302 °F (150 °C)]**										
IOGP S-562 material class			**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		**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 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 [-50 °F (-46 °C) to 302 °F (150 °C)]**										
IOGP S-562 material class			**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 [-50 °F (-46 °C) to 302 °F (150 °C)]										
IOGP S-562 material class			**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.

Justification

1) "Nominal IOGP material class" added to allow clearer selection option.
2) "Trunnion plates" material column added as this has been split out from "Ball, seat, trunnion and trunnion plates" column. Plate material then selected.
3) "NTCS SS trim" split into "NTCS + 316SS" trim and "NTCS + DSS trim" to avoid 316SS material being used on DSS trim.
4) "LTCS SS trim" split into "LTCS + 316SS" trim and "LTCS + DSS trim" to avoid 316SS material being used on DSS trim.
5) Corrosion allowance changed to "as specified" as this not deemed a decisive factor in the choice of "Nominal IOGP material class".
6) Note added to ensure 316SS material not used for chloride services.
7) Additional metallic options provided (i.e. DSS and SDSS when 316SS already an option)
8) Alloy 625 overlay of LTCS and NTCS added as an option to stainless steel trims.
9) UNS N07718 and UNS N07750 removed as options for spring materials in sour service due to recent performance issues.
10) MDS numbers for sour service have been updated to include the suffix "S" (which indicates additional supplementary requirements for sour service).
11) Removal of 316SS ball option in "LTCS + clad with Alloy 625 trim" as this is incorrect.
12) Previous notes updated and changed to footnotes in accordance with ISO/IEC Directives Part 2 rules.

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.

Justification

Adds standard trims, leading to standardization but allowing the purchaser to have more control of materials proposed than in Table N.1

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.

Justification

Calculations in ASME BPVC, Section VIII do not consider any external forces. This requirement ensures those external forces are considered in the calculations in the design of the ball valve. Axial forces and bending moments are crucial when designing ball valves to ensure pressure containment, stem integrity, sealing performance, operability of the valve and structural integrity.

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

Justification

Using the three load cases is standard practice for accounting for external loads. This approach comprehensively evaluates the structural integrity, safety, and performance of the valves under different loading conditions that they may encounter during operation.

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

Justification

The loading considered for these calculations is based on the piping system. Therefore the flange size (i.e., the larger size of a reduced bore valve) should be used in the calculations as this is the same size as the associated piping.

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.

Justification

This provides a useful clarification.

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

Justification

This note provides clarity to the user and helps understand how the tables were generated.

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

Justification

This note provides clarity to the user and helps understand how the tables were generated.

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

Justification

This note provides clarity to the user and helps understand how the tables were generated.

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.

Justification

This note provides clarity to the user and helps understand how the tables were generated for NPS 54 (DN 1350) valves.

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

$$M = \frac{0.25 \times I \times SMYS}{OD \div 2} \quad (3)$$

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.

Justification

This is a standard bending moment calculation for bending moments in piping systems.

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

$$F = 0.25 \times SMYS \times A \quad (4)$$

where

F is axial force;

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

Justification

This is a standard axial force calculation in piping systems.

O.2 Calculations for Load Cases

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

Justification

Calculations to cover the worst case scenario when the valve is expected to experience the highest stresses during the maximum rated pressure.

The first calculation shall be performed for the bending moment.

Justification

This is to verify that the valve is suitable under the bending moments specified.

The second calculation shall be performed for the axial force.

Justification

This is to verify that the valve is suitable under the axial forces specified

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

Justification

This is to verify that the valve is suitable under the loads and forces specified.

O.3 Acceptance Criteria

Stresses shall be within the limits of the design code.

Justification

To avoid permanent damage to the valve and confirm compliance to the design code.

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

Justification

To ensure that the valve is fit for purpose.

O.4 Bending Moment Values

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

Justification

This table is simply a tabulated list of values derived from Equation (3).

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.

Justification

This table is simply a tabulated list of values derived from Equation (3).

O.5 Axial Force Values

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

Justification

This table is simply a tabulated list of values derived from Equation (4).

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.

Justification

This table is simply a tabulated list of values derived from Equation (4).

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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