

PRIMARY VALVE STANDARDS

MAJOR VALVE STANDARDS PETROCHEMICAL AND REFINING INDUSTRY

API 594 Check Valves - Tilt, Swing & Dual Flap, Flanged, Lug, Wafer & Butt-weld Ends

This standard covers the design, materials, face-to-face dimensions, pressure-temperature ratings, inspections, examination, and testing requirements for two types of swing, dual plate & tilt check valves.

API 600 Cast Steel Gate Valves - Flanged & Butt-welding Ends

API 600 is the main steel gate valve specification. Valve design and construction criteria are specified, as well as materials and trim designations. An appendix covers information pertaining to pressure seal valves. ISO Standard 10434 is essentially the same as API 600, re-produced in the ISO format.

API 602 Compact Steel Gate Valves - Flanged, Threaded, Welding and Extended-Body Ends

API 602 is for 100 NB (4") & smaller forged steel gate valve specification. Valve design and construction criteria are specified, as well as materials and trim designations. This standard includes requirements for bellows seal gate valves. In 150, 300 and 600 class API 602 requires a heavier wall than ANSI B16.34

API 603 Cast Gate Valves Corrosion - Resistant, Flanged-End

API 603 covers light walled gate valves in sizes NPS 15mm to 600mm (1/2" through 24"), in classes 150, 300 & 600. These valves are used in applications where a thicker API 600 casting is not needed. However, the wall thickness normally conforms to ANSI B16.34 wall.

API 623 Cast Globe Valves - Flanged & Butt-weld Ends

This standard covers the requirements for globe valve used in the downstream refinery industry for oil and gas. Specifically, the standard specifies a thicker walled construction and mandates low emission performance unless otherwise specified when compared against ASME B16.34 valves.

API 608 Steel Ball Valves - Flanged and Butt-welding Ends

Typically used for floating ball valves, API 608 is the purchase specification for class 150, 300, 600 and 800 class steel ball valves. Valves design and construction criteria are detailed. Trunnion mounted pipeline ball valves are manufactured to API 6D but API 608 is also allowable in refineries up to 500 NB (20").

API 609 Butterfly Valves - Lug-Type and Wafer-Type

API 609 is a specification for butterfly valves with lug-type and wafer-type configurations designed for installation between ANSI B16 flanges, 150 to 1500 class.

API 598 Valve Inspection & Testing

API 598 covers the testing and inspection requirements for check, gate, globe, ball, plug & butterfly valves. Steel valve pressure ratings in ASME/ANSI B16.34 are required to determine API 598 test pressure for steel valves.

API 6D Specification for Pipeline Valves - Gate, Plug, Ball and Check Valves

Specification for pipeline valves (gate, ball, plug, and check valves) API 6D is the primary standard for valves used in main line pipeline service, including gate, ball, plug and check valves. Occasionally refinery and petrochemical purchasers will reference the more stringent testing requirements of API 6D. Similarly ball valves manufactured to API 608 may be specified as tested to API 6D.

ASME/ANSI B16.34 Steel Valves - Flanged & Butt-welding Ends

ASME B16.34 is the standard in which steel valve pressure/temperature ratings are specified. It also offers additional valve specification data including non-destructive examination procedures for upgrading valves for special class service. Gate valves manufactured under B16.34 wall thickness minimums may not meet the minimum wall thickness required of API 600 (cast valves) & API 602 (forged valves) for class 150, 300 and 600.

ASME/ANSI B16.10 Face-to-Face Dimensions of Ferrous Valves

B16.10 specifies the face-to-face dimensions of all flanged and butt-weld end valves. Screwed and socket-weld end valve face-to-face dimensions are not included in this standard.

MSS SP-55 Quality Standard for Steel Castings for Valves, Flanges and Fittings and other Piping Components

MSS SP-55 outlines the visual inspection criteria for castings (& forgings). This specification is listed as part of the procedure under API 598.

NACE MR-0175 Standard for Sour Service

Standard material requirements for sulfide stress cracking resistant metallic materials for oilfield equipment MR-0175 is the 'standard' for materials used in 'sour' environments such as found in piping systems in many refineries. It lists materials, mechanical properties and heat treatments for metals used in hydrogen sulfide bearing hydrocarbon service.

BS 1873 Specification for Steel Globe Valves

Now redundant only used for light industrial valves (not updated since 1975) for oil & gas and refinery use. Refer to API 623. BS 1873 outlines specifications for flanged and buttweld end globe and stop check valves for petroleum petrochemical and allied industries. Valves made to BS 1873 usually dual conform to ANSI B16.34 wall thickness and other design criteria. There is no API standard for globe valves, however API 600, API 603 or ANSI B16.34 are often specified for wall thickness requirements. In addition API 600 stuffing box dimensions are often specified.

BS 1868 Specification for Steel Check Valves

Now redundant (last updated 1975). BS 1868 outlines specifications for flanged and buttweld end check valves for the petroleum petrochemical and allied industries. Valves made to BS 1868 usually dual conform to ANSI B16.34 wall thickness and other design criteria. There is no API standard for upstream & refinery check valves only API 6D 'pipeline' check valves, however API 600, API 603 or ANSI B16.34 are often specified for wall thickness requirements.

ANSI/ASME STEEL GATE, GLOBE & CHECK VALVES

Cast Gate Valves - API 600

For oil & gas and refinery use refer to API 594 only used for light industrial valves. For users of cast gate valves, API 600 is the key document. It details all design material criteria. API 600 also lists important dimensions such as stem diameter minimums, wall thickness and stuffing box size. Cast, globe and check valves can also reference this standard for wall thickness and other design criteria. Another important gate valve standard is ASME B16.34. This standard outlines requirements on valves constructed to ASME boiler code pressure temperature ratings. One important area in which API 600 differs from ANSI B16.34 is minimum wall thickness. API 600 requires a heavier wall for a given pressure rating than does ASME B16.34. API 603 is optionally used for 150# and 300# stainless steel valves and allows a lighter wall thickness than API 600.

Cast Check Valves - API 594 & API 6D

Check valves are manufactured to API 6D (full opening pipeline swing check valves) and API 594 swing, tilt & dual plate check. Valves manufactured API 594 & API 6D stocked by Global Supply Line also conform to ANSI B16.34 wall thickness and other design criteria. API 594 meets & surpasses the requirements of BS 1868. API 594 also ensures a heavier wall thickness than API 594. BS 1868 is redundant (not updated since 1975) but is still used for light industrial swing check valves. API 594 meets & surpasses the requirements of BS 1868 and is there for dual conforming. Piston check valves can be manufactured to API 6D or ASME B16.34 dual conforming to BS 1873. Wall thickness in accordance with API 594.

Cast Globe Valves - API 623

Globe Valves are manufactured to API 623. They are also made in accordance with ASME B16.34 (API 623 requires a heavier wall thickness than B16.34). BS1868 is redundant (not updated since 1975) but may still be used for light industrial valves. API 623 meets and surpasses the requirements of BS 1873 and is there for dual conforming.

Forged Gate, Globe & Check Valves - API 602

Small forged carbon steel gate, globe & check valves in 150#, 300#, 600#, 800# & 1500# class valves are covered by API 602. ANSI 150 to 2500 forged, check and globe valves can also be manufactured to ISO 15761. BS 5352 is now obsolete and covered by ISO 15761 which also incorporates API 602 and covers up to 2500 class. Forged check, gate & globe valves in 2500# are also manufactured to ANSI B16.34. API 602 specification covers the same details for small forged valves that API 600 does for larger valves. API 602 also required a heavier wall for 150#, 300# & 600# classes than does B16.34.

ISO/API/ASME MANUFACTURING STANDARDS

ISO has been part of an international effort to standardise the products for petroleum and natural gas industries. The following table shows API and ASME equivalents which ISO has so for mirrored and aligned with. Australian Pipeline Valve manufactures valves to the following standards.

| DESIGN AND MANUFACTURING STANDARDS | | |
|------------------------------------|-------------|--|
| ISO | API/ASME | Description |
| ISO 5208 | | Pressure testing of valves - Industrial |
| ISO 5209 | | Marking - General purpose industrial valves |
| ISO 5752 | | Metal valves for use in flanged pipe systems - Face-to-face and centre-to-face dimensions |
| ISO 5996 | | Cast iron gate valves |
| ISO 6002 | | Bolted bonnet steel gate valves |
| ISO 7121 | | Flanged steel ball valves |
| ISO 7259 | | Key-operated cast iron gate valves for underground use |
| ISO 10423 | API 6A | Wellhead and Christmas Tree Equipment Specification |
| ISO 10434 | API 600 | Bolted bonnet steel gate valves for the petroleum, petrochemical and allied industries |
| ISO 10497 | API 607 | Testing of valves - Fire type-test requirements (Fire Test for Soft-Seated Quarter-Turn valves) |
| ISO 10631 | | Metallic butterfly valves for general purposes |
| ISO 12149 | | Bolted bonnet steel globe valves for general-purpose applications |
| ISO 14313 | API 6D | Specifications for Pipeline Valves |
| ISO 15156 | NACE MR0175 | Petroleum and natural gas industries - Materials for use in H2S-Containing environments in oil and gas production |
| ISO 15761 | API 602 | Steel gate, globe and check valves for sizes DN 100 and smaller, for the petroleum and natural gas industries. BS 5352 is obsolete and replaced by ISO 15761 |
| ISO 15848-1 | | Industrial valves - Measurement, test and qualification procedures for fugitive emission Part 1: Classification system and qualification procedures for type testing of valves |
| ISO 17292 | | Metal ball valves for petroleum, petrochemical and allied industries |
| | API 591 | User Acceptance of Refinery Valves |
| | API 594 | Swing check & dual flap check valves |
| | API 598 | Valve Inspection and Testing |
| | API 600 | Steel Gate Valves |
| | API 602 | Compact Carbon Steel Gate Valves |
| | API 603 | Cast, Corrosion Resistance Gate Valves |
| | API 608 | Metal Ball Valves - Flanged, Threaded and Butt-Welding Ends (150&300) |
| | API 623 | Cast Globe Valves |
| | API 17D | Specifications for Subsea Wellhead and Christmas Tree Equipment |
| | API 6FA | Specification for Fire Test for Valves |
| | API 622 | Type Testing of Process Valve Packing for Fugitive Emissions |
| | ASME B16.34 | Valves 2 Flanged, Threaded and Buttwelded End |
| | ASME B16.10 | Face-to-Face and End-to-End Dimensions of Valves |
| | ASME B16.5 | Pipe Flanges and Flanged Fittings |
| | ASME B16.25 | Buttwelded Ends |
| | ASME B16.11 | Forged Fittings, Socket Welding and Threaded |

COMMON VALVE ABBREVIATIONS

| Organisations/Societies | | | |
|-------------------------|--|---------------|--|
| ANSI | American National Standards Institute | API | American Petroleum Institute |
| ASME | American Society of Mechanical Engineers | ASTM | American Society for Testing Materials |
| BS | British Standards | DIN | Deutsche Industrie - Normen |
| BVQI | Bureau Veritas Quality International | ISO | International Standards Organisation |
| Valve Materials | | | |
| Br | Bronze | A.I. | All Iron |
| C.I. | Cast Iron | M.I. | Malleable Iron |
| N.I. | Nickel Iron | D.I. | Ductile Iron |
| C.S. | Cast Steel/Carbon Steel | F.S. | Forged Steel |
| S.S. | Stainless Steel | PVC | Polyvinyl Chloride |
| N | Nickel | M | Monel |
| Mo | Molybdenum | Al | Aluminium |
| Cr | Chromium | Tef | Teflon |
| 13% Cr | Type 410 Stainless Steel | HF | Hard Face (Stellite Face) |
| Operating Mechanisms | | | |
| O.S. & Y | Outside Screw & Yoke | N.R.S. | Non Rising Stem |
| R.S. | Rising Stem | | |
| End Connections | | | |
| F.E. | Flanged Ends | S.E. | Screwed Ends |
| F.F.D. | Flanged, Faced & Drilled | B.W. | Butt Welding Ends |
| S.W. | Socket Welding Ends | Scr. | Screwed Ends |
| Flg. | Flanged Ends | S.J. | Solder Ends |

COMMON VALVE TYPES & RELATED TEST STANDARDS

| Valve type | Common test standard |
|--|------------------------|
| Steel ball, gate, globe and check valves | API 598 |
| Steel ball, gate, globe and check valves | ISO 5208* (EN 12266-1) |
| Cast Iron gate valves | API 598, MSS SP-70 |
| Bronze gate, globe and check valves | MSS SP-80 |
| Steel gate, globe and check valves larger than NPS 24" | ASME B16.34 |
| Pressure seal gate, globe and check valves | ASME B16.34 |
| Pipeline valves | API 6D, ISO 5208 |
| Cast Iron check valves | API 598, MSS SP-71 |
| Cast Iron globe valves | API 598, MSS SP-85 |
| Cast Iron plug valves | API 598, MSS SP-78 |
| Steel ball valves | API 598, API 6D |
| Steel butterfly valves | API 598 |
| Cryogenic valves | API 598, BS 6364 |
| Control valves | FCI 70-2, ISA-S75 |
| Pressure relief valves | API 527, ASME PTC 25 |

*ISO 5208 (EN 12266-1) supercedes BS 6755.

VALVE TEST STANDARDS

Main Valve Test Standards

API 598 Valve Inspection and Test

The most widely used test specification in the world. The standard covers all types of valves (soft & metal seated) in sizes up to 600NB (NPS 24). It also includes leakage rates and testing criteria for metal-seated and resilient-seated valves.

API6D Pipeline Valves Test Standard

Used for API6D ball valves, plug valves and API6D design pipeline check/gate valves (also now adopted as part of ISO 5208).

ISO 5208 Valve Test Standard

Incorporates an adoption of API6D test standard. Leakage rate A is specified for soft seated valves and plug valves (zero leakage*). Also includes standards for gate, globe and check valves (EN 12266-1).

BS 6755 Valve Test Standard

Previously used by some European Manufacturers, now superseded by ISO 5208 (EN 12266-1) standard. It includes leakage rates and testing criteria for metal and resilient seated valves.

ASME B16.34 Valves - Flanged, Threaded and Welding End

The primary valve design standard, it also contains pressure/temperature charts for determining the working pressures of valves to be used in conjunction with other test standards, such as API 598.

ASME PTC 25 Pressure Relief Devices

The main reference document for the testing of pressure relief valves, PTC 25 contains detailed procedures for testing relief valves with air or steam.

API 527 Seat Tightness of Pressure Relief Valves

This covers the seat tightness of pressure relief valves. It also includes allowable leakage rates for testing with steam, water and air.

FCI 70-2* Control Valve Seat Leakage

This document contains detailed test procedures and leakage rate classes for control valves. The leakage classes are also occasionally referenced by other documents and used as acceptance criteria. Supersedes ANSI B16.104. Class VI is the highest shut off class*.

ISA S75 Hydrostatic Testing of Control Valves

This standard provides a procedure for the hydrostatic shell testing of control valves. Seat testing and acceptance criteria are out of the scope of this document and usually are covered by referencing FCI 70-2.

ISO 5208 Industrial Valves, Pressure Testing of Valves

ISO's primary testing standard, this document covers all types of valves and has four levels of allowable closure test leakage rates.

MSS SP70 Cast Iron Gate Valves, Flanged and Threaded Ends

The primary design standard for cast iron gate valves, it also contains testing procedures and acceptance criteria.

MSS SP71 Iron Swing Check Valves, Flanged and Threaded Ends

The primary design standard for cast iron check valves also contains testing procedures and acceptance criteria.

MSS SP61* Hydrostatic Testing of Steel Valves

Similar to API 598 (in the case of soft seated valves) this document has some minor variations in test holding times and leakage rates. Metal seated valves the leakage can be a little higher than API598.

MSS SP78 Cast Iron Plug Valves, Flanged and Threaded Ends

The primary design standard for cast iron plug valves also contains testing procedures and acceptance criteria.

MSS SP80, Bronze Gate, Globe, Angle and Check Valves

The primary design standard for commodity bronze valves also contains testing procedures and acceptance criteria.

MSS SP85, Cast Iron Globe & Angle Valves

The primary design standard for cast iron globe valves also contains testing procedures and acceptance criteria.

* See next page "Explanation of Zero and Low Leakage Test Standards".

EXPLANATION OF ZERO AND LOW LEAKAGE TEST STANDARDS

In general, specification such as API598 or MSS SP-61 that govern leakage for soft seated valves call for '0' bubbles of air or '0' drops of water under the specified test conditions over the minimum test time period. These valves are therefore sometimes referred to as 'zero leakage' valves. In reality, there really is no such thing as 'zero leakage', since microscopic amounts of material may indeed cross the seat or packing boundaries, especially if helium or hydrogen or other small molecule gases are used. Another common term for soft seated valves is 'bubble tight'.

Less frequently, the leakage performance for soft seated valves is referred to as Class VI, which is the tightest leakage under FCI 70-2, and generally applies to resilient seated control valves (as opposed to metal seated control valves or soft seated shut off valves). In fact, FCI 70-2 Class VI (formerly ANSI B16.104) allows a small number of bubbles per minute, increasing with valve size, during the test, whereas API598 and MSS SP-61 do not (for soft seat, but does for metal seat). FCI 70-2 Class VI is for soft seated control valves but is frequently used as a leakage acceptance test criteria for metal seated isolation valves such as ball and butterfly valves. FCI 70-2 only requires a low pressure test, consequently closure and seat tests should also be done per API 598 or MSS SP-61.

In actual fact even for metal seat valves the API 598 leak acceptance criteria for metal seated valves (excluding check valves) allows less leakage than FCI 70-2 Class VI above 150NB (6") and 50NB (2") and under. For zero leakage metal seated valves API 6D or API 598 soft seated zero leakage criteria can be specified (such as triple offset metal seated butterfly valves and some metal seated ball valves). Special provisions for zero leakage gate valves can also be specified to BS 6755 and ISO 5208 under special zero leakage classes. However, metal seated valves usually have some level of acceptable leakage when tested, defined first as some acceptable amount of liquid, under test conditions and over the time period of the test.

ISO 5208 (EN 12266-1) supersedes BS6755-1 and specifies acceptable leakage rates such as 'Rate A' and 'Rate B'. Rate A allows 'no visible leakage', similar to API 598 for resilient seated valves. Rate B is used for gate valves.

Links

- Leakage Acceptance Rates Comparisons API598/API6D/MSSP61/FCI70-2 - www.australianpipelinevalves.com.au/lib/Pdf/ValveTestStdsLeakageRates.pdf
- American Petroleum Institute - www.api.org
- American Standards Association - <http://www.ansi.org>
- American Society of Mechanical Engineers - www.asme.org
- British Standards Institution - www.bsi-global.com
- Fluid Controls Institute - <http://www.fluidcontrolsintstitute.org>
- International Organisation for Standardisation - <http://www.iso.org>
- ISA (Instrumentation, Systems and Automatation Society of America - www.isa.org
- Manufacturers Standardization Society of the Valve and Fittings Industry - www.mss.hq.com

We can manufacture exotic grades like Nickel, Super Duplex F55 and Monel (ASTM A494-M35-1), Cd4M-Cu, Hastelloy C (ASTM A-494 CW12MW), 317 (C8G8M) in short lead time.

For other ANSI, ASME, ISO, API, BS, API valve related technical cross reference charts and tables relating to standards, codes, pressure, temperature, application, suitability, equivalents, body & trim materials, valve manufacturing & test standards, etc., go to the technical section of our website: <http://www.australianpipelinevalve.com.au>

We manufacture valves in API600, API602, API6D, BS1868, API603, API6A and numerous other standards including Ball, Butterfly, Check, Gate, Globe, Needle and Plug valves.

Go to our website for more valve and piping technical references.

At Australian Pipeline Valve (APV) the same knowledge and effort we put into the web site goes into every product we sell. If this site helps you, please reward APV with your business, tell your engineers, plant managers, purchasing officers and project managers about us!

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