

## PRIMARY VALVE STANDARDS

### MAJOR VALVE STANDARDS PETROCHEMICAL AND REFINING INDUSTRY

#### **API 600 Steel 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 gates 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, Corrosion - Resistant, Flanged-End Gate Valves**

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 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 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, 602, 609 or BS 1868, 1873 is specified upstream. 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**

BS 1873 outlines specifications for flanged and butt-weld 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**

BS 1868 outlines specifications for flanged and butt-weld 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 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**

Check valves can be manufactured to API 6D (full opening pipeline check valves), BS 1868 or ANSI B16.34/API 600. Valves manufactured to BS 1868 stocked by Global Supply Line also conform to ANSI B16.34 wall thickness and other design criteria.

### **Cast Globe Valves**

Globe Valves can be manufactured to BS 1873 or ANSI B16.34/API 600. Valves manufactured to BS 1873 stocked by Global Supply Line also dual conform to ANSI B16.34 wall thickness and other design criteria.

### **Forged Gate, Globe & Check Valves**

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 BS 5352. 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 15761 has been recently published as 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 far mirrored. Global Supply Line supplies and stocks valves to the following standards:

DESIGN AND MANUFACTURING STANDARDS		
ISO	API/ASME	Description
ISO 5208:1993		Pressure testing of valves - Industrial
ISO 5209:1977		Marking - General purpose industrial valves
ISO 5752:1982		Metal valves for use in flanged pipe systems - Face-to-face and centre-to-face dimensions
ISO 5996:1984		Cast iron gate valves
ISO 6002:1992		Bolted bonnet steel gate valves
ISO 7121:1986		Flanged steel ball valves
ISO 7259:1988		Key-operated cast iron gate valves for underground use
ISO 10423:2003	API 6A	Wellhead and Christmas Tree Equipment Specification
ISO 10434:2004	API 600	Bolted bonnet steel gate valves for the petroleum, petrochemical and allied industries
ISO 10497:2004	API 607	Testing of valves - Fire type-test requirements (Fire Test for Soft-Seated Quarter-Turn Valves)
ISO 10631:1994		Metallic butterfly valves for general purposes
ISO 12149:1999		Bolted bonnet steel globe valves for general-purpose applications
ISO 14313	API 6D	Specification for Pipeline Valves
ISO 15156	NACE MR0175	NACE MR0175, Petroleum and natural gas industries - Materials for use in H <sub>2</sub> S-containing environments in oil and gas production
ISO 15761:2002	API 602 - (Incorporates BS5352)	Steel gate, globe and check valves for sizes DN 100 and smaller, for the petroleum and natural gas industries
ISO 15848-1:2006		Industrial valves - Measurement, test and qualification procedures for fugitive emission Part 1: Classification system and qualification procedures for type testing of valves
ISO 17292:2004		Metal ball valves for petroleum, petrochemical and allied industries
	API 591	User Acceptance of Refinery Valves
	API 598	Valve Inspection and Testing
	API 600	Steel Gate Valves
	API 602	Compact Carbon Steel Gate Valves
	API 603	Cast, Corrosion Resistant Gate Valves
	API 608	Metal Ball Valves-Flanged, Threaded and Butt-Welding Ends (150&300)
	API 17D	Specification 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			
<b>ANSI</b>	American National Standards Institute	<b>API</b>	American Petroleum Institute
<b>ASME</b>	American Society of Mechanical Engineers	<b>ASTM</b>	American Society for Testing Materials
<b>BS</b>	British Standards	<b>DIN</b>	Deutsche Industrie - Normen
<b>BVQI</b>	Bureau Veritas Quality International	<b>ISO</b>	International Standards Organisation
Valve Materials			
<b>Br</b>	Bronze	<b>A.I.</b>	All Iron
<b>C.I.</b>	Cast Iron	<b>M.I.</b>	Malleable Iron
<b>N.I.</b>	Nickel Iron	<b>D.I.</b>	Ductile Iron
<b>C.S.</b>	Cast Steel/Carbon Steel	<b>F.S.</b>	Forged Steel
<b>S.S.</b>	Stainless Steel	<b>PVC</b>	Polyvinyl Chloride
<b>N</b>	Nickel	<b>M</b>	Monel
<b>Mo</b>	Molybdenum	<b>Al</b>	Aluminium
<b>Cr</b>	Chromium	<b>Tef</b>	Teflon
<b>13% Cr</b>	Type 410 Stainless Steel	<b>HF</b>	Hard Face (Stellite Face)
Operating Mechanisms			
<b>O.S. &amp; Y</b>	Outside Screw & Yoke	<b>N.R.S.</b>	Non Rising Stem
<b>R.S.</b>	Rising Stem		
End Connections			
<b>F.E.</b>	Flanged Ends	<b>S.E.</b>	Screwed Ends
<b>F.F.D.</b>	Flanged, Faced & Drilled	<b>B.W.</b>	Butt Welding Ends
<b>S.W.</b>	Socket Welding Ends	<b>Scr.</b>	Screwed Ends
<b>Flg.</b>	Flanged Ends	<b>S.J.</b>	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	BS 6755*, 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 checks	API 598, MSS SP-71
Cast iron globes	API 598, MSS SP-85
Cast iron plugs	API 598, MSS SP-78
Steel ball valves	API 598
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) supersedes 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 122661-).

### 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 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. Metal seated valves, on the other hand, usually (not always, triple offset butterfly and ball valves for instance are available bubble tight) 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 BS 6755-1 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/MSSSP61/FCI70-2 - [www.globalsupplyline.com.au/wp-content/uploads/2014/10/Valve\\_Leakage\\_Rates\\_Test\\_Std.pdf](http://www.globalsupplyline.com.au/wp-content/uploads/2014/10/Valve_Leakage_Rates_Test_Std.pdf)
- American Petroleum Institute - [www.api.org](http://www.api.org)
- American Standards Association - <http://www.ansi.org>
- American Society of Mechanical Engineers - [www.asme.org](http://www.asme.org)
- British Standards Institution - [www.bsi-global.com](http://www.bsi-global.com)
- Fluid Controls Institute - <http://www.fluidcontrolsinstitute.org>
- International Organisation for Standardisation - <http://www.iso.org>
- ISA (Instrumentation, Systems and Automation Society of America) - [www.isa.org](http://www.isa.org)
- Manufacturers Standardization Society of the Valve and Fittings Industry - [www.mss.hq.com](http://www.mss.hq.com)

For cross reference tables and charts of ASTM/ANSI specifications covering equivalent materials used for valves, flanges & fittings got to: <http://www.globalsupplyline.com.au/catalogue-gsl-stainless-valve-grade/>

For other ANSI, ASME, ISO, API, valve related technical cross references relating to pressure, temperature, application, suitability, equivalents, valve body & trim materials, valve manufacturing & test standards, etc., go to the technical section of our website.

If we don't have the valve in stock we can source it from our overseas network of stockists and very short lead-time specialty manufacturers. We can even supply exotic grades like Nickel, Super Duplex F55 and Monel (ASTM A494-M35-1) Cd4M-Cu, Hastelloy C (ASTM A494 CW12MW), 317 (C8G8M) in short lead-time.

For technical references and cross reference information on stainless, duplex, chrome-moly and Alloy steel used in valves and piping systems in the petrochemical and refining industry go to: [www.globalsupplyline.com.au/catalogue-gsl-valve-API603/](http://www.globalsupplyline.com.au/catalogue-gsl-valve-API603/)

We stock valves in A105, LF2, 304, 304L, 316, 316L, F51, CF8, CF3, F82, WC5, WC6, WC9, F11, F5, Bronze, Iron, etc. Ball, Butterfly, Check, Control, Gate, Globe, Needle, Parallel slide, Plug, etc. Valves are manufactured to API 600, API 602, API 603, API 6D, BS1868 and numerous other standards.

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~ MAJOR VALVE STOCKIST & SHORT LEAD-TIME PROJECT SUPPLIER ~

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