

# Metal Plug Valves—Flanged, Threaded and Welding Ends

API STANDARD 599  
SIXTH EDITION, OCTOBER 2007





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**Downstream Segment**

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## Foreword

This standard is a purchase specification that covers requirements for metal plug valves, including flanged, threaded and butt-weld valves in steel and alloy materials, and flanged valves in ductile iron.

This standard requires the purchaser to specify certain details and features. Although it is recognized that the purchaser may desire to modify, delete, or amplify sections of this standard, it is strongly recommended that such modifications, deletions, and amplifications be made by supplementing this standard, rather than by rewriting or incorporating sections thereof into another complete standard.

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## Notes to Purchaser

1) If the purchaser needs a plug valve that deviates from this standard, the deviating requirements shall be stated in the purchase order.

2) If no exceptions are to be taken to this standard, the purchase order need only refer to API 599 and specify the items included in 2.1. Optional items included in 2.2 may also be specified.

### 2.1 Items Required on the Purchase Order

a) Valve size (see 1.1).

b) Class (see 1.2).

c) Type (lubricated or non-lubricated, see 1.3) and pattern [short, regular, venturi, or full bore (see 1.5)] or tandem plug (see 1.4).

d) End connections, (1) flanged, including facing type (raised, ring joint, or flat); (2) welding end, including bore dimensions; and (3) threaded (see 1.1, 4.2.3 through 4.2.8).

e) Standard or heavy-wall thickness, for stainless steel and nickel base valves only (see 4.2.1).

f) Type of operator required (wrench, handle, handwheel, or gear) and whether supply of operator is included in the purchase order (see 4.7 and 5.5).

g) Shell (body and cover) material (see 5.1 and 5.2).

h) Fire test requirements (see 7.2.2).

i) Plug material (see 5.4).

### 2.2 Optional Items

a) Flanged ends attached by welding (see 4.2.3).

b) Drain and bypass connection (see 4.2.9).

c) Locking device (see 4.7.5).

d) Anti-static feature and testing (see 4.8).

e) Materials for operating mechanisms (see 5.5).

f) Stem seal or packing material and/or operating temperature if temperature is outside the range from  $-29^{\circ}\text{C}$  through  $107^{\circ}\text{C}$  ( $-20^{\circ}\text{F}$  through  $225^{\circ}\text{F}$ ) (see 5.7).

g) Bolting material for temperatures beyond the limits specified in ASME B31.3 or for increased resistance to corrosive environments (see 5.8).

h) Lubricating sealant (see 6.1.5). [Specify sealant and/or operating temperature if temperature is outside the range from  $-29^{\circ}\text{C}$  through  $107^{\circ}\text{C}$  ( $-20^{\circ}\text{F}$  through  $225^{\circ}\text{F}$ ).]

i) Inspection (see 7.1).

j) Coating for ductile iron valves (see 9.1.2).

k) Export packaging (see 9.5.1 and 9.5.2).

l) Vented body cavity (see 4.2.10).

# Metal Plug Valves—Flanged, Threaded and Welding Ends

## 1 Scope

**1.1** This standard covers steel, nickel base and other alloy plug valves with flanged or butt-welding ends and ductile iron plug valves with flanged ends in sizes NPS 1/2 through NPS 24 and threaded or socket-welding ends for sizes NPS 1/2 through NPS 2. Valve bodies conforming to ASME B16.34 may have one flange and one butt-welding end, or one threaded and one socket-welding end.

**1.2** This standard covers additional requirements for plug valves that are in full conformance to the requirements of ASME B16.34 for Standard Class 150 through 2500 except that in the case of ductile iron valves, Class 150 and 300, the requirements of ASME B16.42 for pressure-temperature ratings, wall thickness, flange dimensions and ductile iron material shall be substituted.

**1.3** This standard covers both lubricated and non-lubricated valves that have two-way coaxial ports; three-way and four-way plug valves do not fall under the scope of this standard. This standard includes requirements for valves fitted with internal body, plug, or port linings or applied hard facings on the body, body ports, plug, or plug port. The extent of linings and the materials of which they are made are not covered in this standard.

**1.4** This standard covers tandem plug valves which have two independent operating plugs in a single body.

**1.5** Plug valves covered in this standard belong to one of four general design groups that in many cases have different face-to-face and end-to-end dimensions. Some types of plug valves are not made to all patterns. The four groups are described in 1.5.1 through 1.5.4.

**1.5.1** The short pattern design is found only in Class 150 and 300 where flanged plug valves match the face-to-face dimensions of steel-flanged gate valves in NPS 1 1/2 through NPS 12.

**1.5.2** The regular pattern design has a plug port area that is greater than the venturi pattern.

**1.5.3** Valves of the venturi pattern are designed for minimum pressure loss consistent with the reduced port area used in this type of valve. Venturi valves have a configuration of body and plug ports that approximate a venturi throat.

**1.5.4** The round-port full-bore pattern has a circular port through both the plug and the body that is not smaller than that specified in Appendix A of ASME B16.34 for the applicable valve size and pressure class.

**1.6** The standard nomenclature for valve parts is shown in Figures 1, 2, 3, and 4.

## 2 Referenced Publications

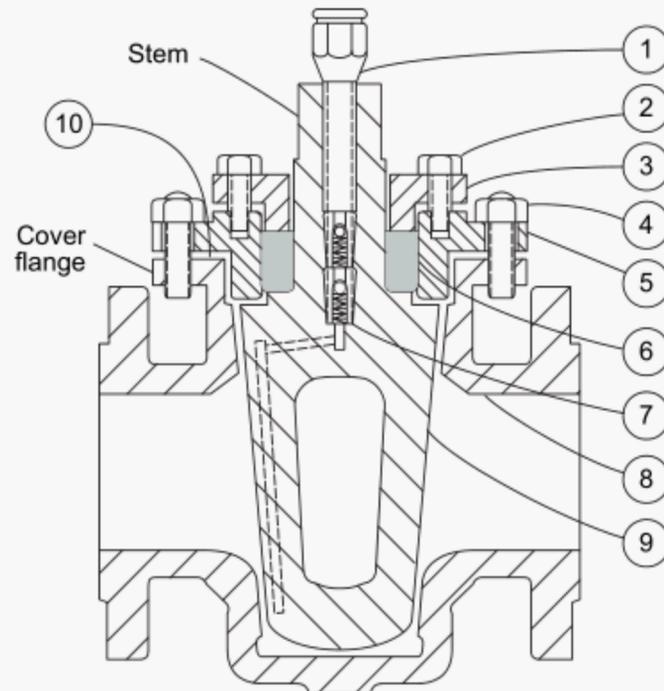
The following documents contain provisions which, through reference in this text, constitute provisions of this standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. For undated references, the latest edition of the document referred to applies. However, parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the documents listed below.

API Std 598, *Valve Inspection and Testing*

API Std 607, *Testing of Valves—Fire Type-testing Requirements*

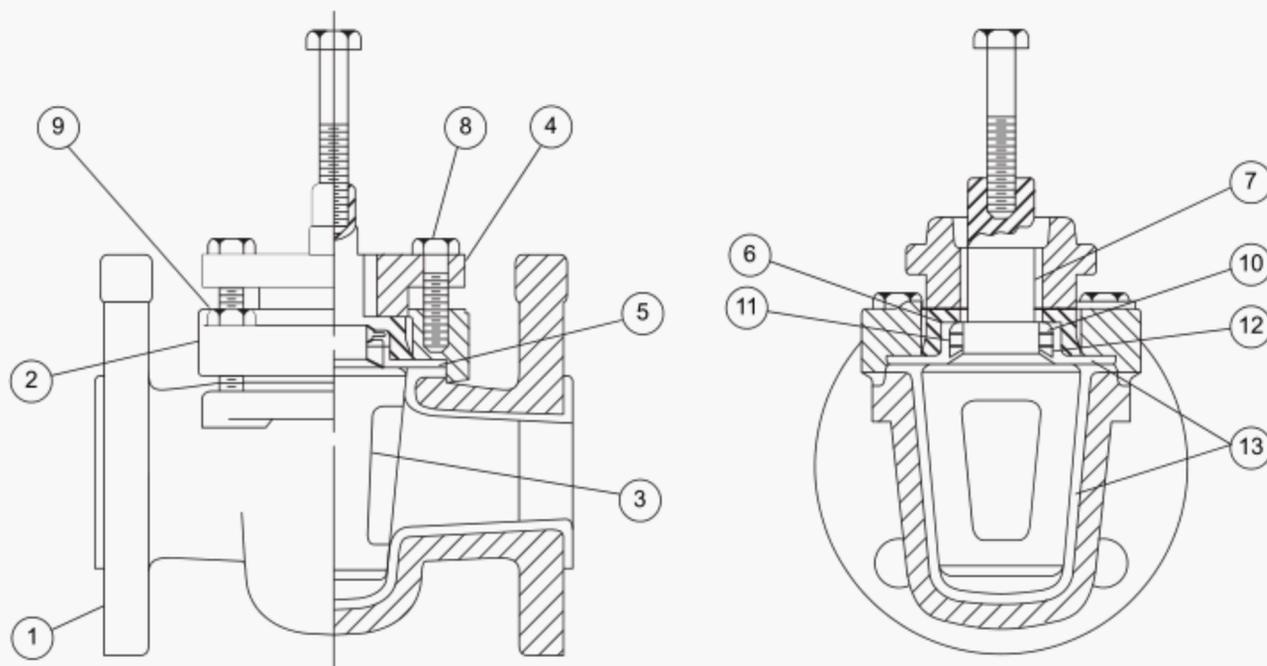
ASME B1.1<sup>1</sup>, *Unified Inch Screw Threads (UN and UNR Thread Form)*

<sup>1</sup>ASME International, 3 Park Avenue, New York, New York 10016, [www.asme.org](http://www.asme.org).



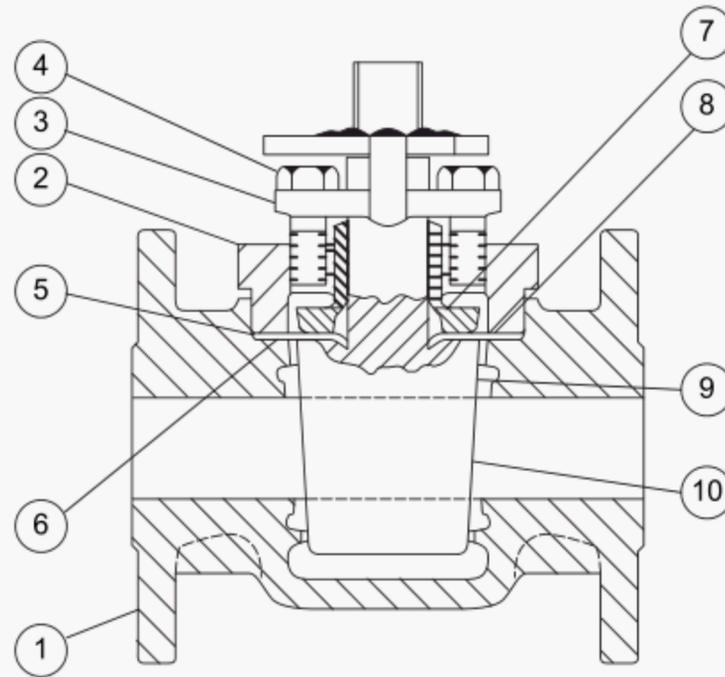
1. Lubricant fitting
2. Gland bolting
3. Gland
4. Cover bolting
5. Cover
6. Stem packing
7. Lubricant check valves
8. Body
9. Plug
10. Cover gasket

**Figure 1—Parts Identification for Lubricated Plug Valve**



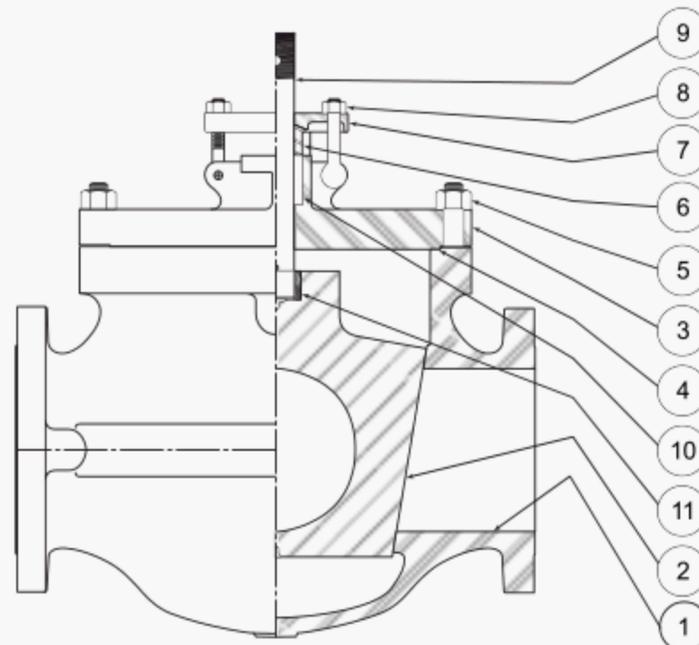
1. Body
2. Cover
3. Plug
4. Gland
5. Stem seal
6. Thrust washer
7. Antistatic device
8. Gland bolting
9. Cover bolting
10. Spring washers
11. Support ring
12. Cup seal
13. Lining

**Figure 2—Parts Identification for Fully-lined Plug Valve**



1. Body
2. Cover
3. Adjuster
4. Adjuster bolting
5. Cover gasket or seal
6. Nonmetallic diaphragm
7. Stem seal or packing
8. Metallic diaphragm
9. Sleeve
10. Plug

**Figure 3—Parts Identification for Sleeve-lined Plug Valve**



1. Body
2. Plug
3. Bonnet
4. Gasket, bonnet
5. Bonnet bolting
6. Packing gland
7. Packing gland flange
8. Packing gland bolting
9. Stem
10. Packing
11. Stem connection

**Figure 4—Parts Identification for Non-lubricated Plug Valve**

ASME B1.12, *Class 5 Interference-Fit Thread*

ASME B1.20.1, *Pipe Threads, General Purpose (Inch)*

ASME B16.5, *Pipe Flanges and Flanged Fittings*

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

ASME B16.11, *Forged Steel Fittings, Socket Welding and Threaded*

ASME B16.25, *Buttwelding Ends*

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

ASME B16.42, *Ductile Iron Pipe Flanges and Flanged Fittings, Class 150 and 300*

ASME B18.2.2, *Square and Hex Nuts*

ASME B31.3, *Process Piping*

ASME B36.10M, *Welded and Seamless Wrought Steel Pipe*

ASME B46.1, *Surface Texture (Surface Roughness, Waviness and Lay)*

ASTM A 126<sup>2</sup>, *Gray Iron Castings for Valves, Flanges, and Pipe Fittings*

ASTM A 395, *Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures*

MSS SP-25<sup>3</sup>, *Standard Marking System for Valves, Fittings, Flanges, and Unions*

MSS SP-45, *By-pass and Drain Connections*

MSS SP-91, *Guidelines for Manual Operation of Valves*

### **3 Pressure-temperature Ratings**

The pressure-temperature ratings shall be in accordance with ASME B16.34 Standard Class, and ASME B16.42 as appropriate for the shell material. This standard also recognizes that seals, sleeves, liners, diaphragms, seats, and sealants may limit the applications of valves to more restricted pressures and temperatures (see 5.7 and 8.4).

## **4 Design**

### **4.1 General**

Valves manufactured in accordance with this standard shall also meet the requirements of ASME B16.34 for Standard Class, except that in the case of ductile iron valves, Class 150 and 300, the requirements of ASME B16.42 for pressure-temperature ratings, wall thickness, flange dimensions and ductile iron material shall be substituted.

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<sup>2</sup>ASTM International, 100 Bar Harbor Drive, West Conshohocken, Pennsylvania 19428, [www.astm.org](http://www.astm.org).

<sup>3</sup>Manufacturers Standard Society of the Valve and Fittings Industry, Inc., 127 Park Street, N.E., Vienna, Virginia 22180-4602, [www.mss-hq.com](http://www.mss-hq.com).

## 4.2 Body

4.2.1 The minimum thickness of the body wall shall be in accordance with the following:

- a) ASME B16.42 minimum wall for fittings shall apply for equivalent size valve bodies of ductile iron.
- b) Table 1A or 1B for lubricated plug valves with valve bodies of ASME B16.34, Group 1 material.
- c) ASME B16.34 for lubricated plug valves with valve bodies of ASME B16.34, Group 2 and 3 materials.
- d) ASME B16.34 for non-lubricated plug valves with bodies of ASME B16.34, Group 1, 2, or 3 materials.

Plug valves having a body material listed in ASME B16.34 Table 1 and provided with minimum wall thickness in accordance with Table 1A or 1B, may be designated as heavy-wall (API 600 wall) plug valves.

**Table 1A—Minimum Body Thickness (Millimeters): Materials Except Ductile Iron and Heavy-wall (API 600 Wall) Stainless Steel<sup>a</sup>**

Nominal Valve Size (NPS)	Class Designation					
	150	300	600	900	1500	2500
1/2	4.6	4.6	5.3	5.3	5.3	5.3
3/4	4.6	4.6	6.4	10.2	10.2	10.2
1	6.4	6.4	7.9	12.7	12.7	15.0
1 1/4	6.4	6.4	8.6	14.2	14.2	17.5
1 1/2	6.4	7.9	9.4	15.0	15.0	19.1
2	8.6	9.7	11.2	19.1	19.1	22.4
2 1/2	9.7	11.2	11.9	22.4	22.4	25.4
3	10.4	11.9	12.7	19.1	23.9	30.2
4	11.2	12.7	16.0	21.3	28.7	35.8
6	11.9	16.0	19.1	26.2	38.1	48.5
8	12.7	17.5	25.4	31.8	47.8	62.0
10	14.2	19.1	28.7	36.6	57.2	67.6
12	16.0	20.6	31.8	42.2	66.8	86.6
14	16.8	22.4	35.1	46.0	69.9	—
16	17.5	23.9	38.1	52.3	79.5	—
18	18.3	25.4	41.4	57.2	88.9	—
20	19.1	26.9	44.5	63.5	98.6	—
24	20.6	30.2	50.8	73.2	114.3	—

<sup>a</sup> See 4.2.1.

4.2.2 Face-to-face dimensions for raised-face and ring-joint flanged end valves and end-to-end dimensions for butt-welding end valves shall conform to ASME B16.10 unless otherwise agreed to between the manufacturer and the end user.

4.2.3 Steel, nickel base and other alloy plug valve end flanges and bonnet flanges shall be cast or forged integral with the body; except that cast or forged flanges attached by full penetration butt-welding or inertia welding may be used if agreed by the purchaser. When a flange is attached by welding, the welding procedure and the welder or welding operator shall be qualified in accordance with ASME *BPVC*, Section IX. Alignment rings, integral or loose, employed as a welding aid or upset weld curls created by inertia welding shall be completely removed following

**Table 1B—Minimum Body Thickness (Inches): Materials Except Ductile Iron and Heavy-wall (API 600 Wall) Stainless Steel<sup>a</sup>**

Nominal Valve Size (NPS)	Class Designation					
	150	300	600	900	1500	2500
1/2	0.18	0.18	0.21	0.31	0.31	0.31
3/4	0.18	0.18	0.25	0.40	0.40	0.40
1	0.25	0.25	0.31	0.50	0.50	0.59
1 1/4	0.25	0.25	0.34	0.56	0.56	0.69
1 1/2	0.25	0.31	0.37	0.59	0.59	0.75
2	0.34	0.38	0.44	0.75	0.75	0.88
2 1/2	0.38	0.44	0.47	0.88	0.88	1.00
3	0.41	0.47	0.50	0.75	0.94	1.19
4	0.44	0.50	0.63	0.84	1.13	1.41
6	0.47	0.63	0.75	1.03	1.50	1.91
8	0.50	0.69	1.00	1.25	1.88	2.44
10	0.56	0.75	1.13	1.44	2.25	2.66
12	0.63	0.81	1.25	1.66	2.63	3.41
14	0.66	0.88	1.38	1.81	2.75	—
16	0.69	0.94	1.50	2.06	3.13	—
18	0.72	1.00	1.63	2.25	3.50	—
20	0.75	1.06	1.75	2.50	3.88	—
24	0.81	1.19	2.00	2.88	4.50	—

<sup>a</sup> See 4.2.1.

welding, while care shall be taken that the minimum wall thickness is maintained. Valves having flanges attached by welding shall meet the requirements of Paragraph 2.1.6 of ASME B16.34. Flanges for ductile iron valves shall only be the integral type.

**4.2.4** The dimensions and finish of steel and nickel base end flanges shall be as specified in ASME B16.5 for the type of facing specified in the purchase order.

**4.2.5** The dimensions and finish of ductile iron end flanges shall be as specified in ASME B16.42 for the type of facing specified in the purchase order.

**4.2.6** Socket-welding end preparation shall conform to ASME B16.11. The bottom of the socket shall be square and flat with the thickness in accordance with Table 4 of ASME B16.34.

**4.2.7** Steel and nickel base butt-welding ends shall conform to ASME B16.25 for the bore specified, for use without backing rings.

**4.2.8** Threaded end valves shall be threaded as specified in ASME B1.20.1. All internal threads shall be countersunk a distance of approximately one half the pitch of the thread at an angle of approximately 45 degrees with the axis of the thread.

**4.2.9** When specified, drain and bypass connections shall conform to ASME B16.34.

**4.2.10** If a vented body cavity is specified, not only the area within a closed plug, but also the area above and below the plug shall be vented by drilling or by other positive means. For lubricated tapered plug valves, the area below the

small end of the plug need not be vented if it prevents the sealant injection system from performing its intended function. If this venting affects the sealing direction of the valve, the body shall be marked with preferred shut-off direction.

### 4.3 Cover

Covers shall have nut bearing surfaces for bolting that are parallel to the cover face within 1 degree. When spot-facing or back-facing of flange covers is required, it shall be in accordance with the requirements of ASME B16.5 for end flanges.

### 4.4 Stem and Plug

**4.4.1** Stem retention and stem strength shall meet the requirements of Paragraph 6.5.1.1 and 6.5.1.2 of ASME B16.34. The design shall not rely on actuation components (e.g. gear operators, actuators, levers, etc.) to prevent ejection.

**4.4.2** Stem-to-plug connection and all parts of the stem within the pressure boundary shall under torsional load exceed the strength of the stem that lies outside the pressure boundary by more than 10 %. This shall be verified by destructive testing or calculation methods that have been verified by destructive testing on items of the same geometric configuration.

**4.4.3** The stem and connection between stem and plug shall be designed to resist permanent deformation or failure of any part when a force applied to handle or gear operator produces a torque equal to the greater of 20 N-m (15 ft-lb) or two times the manufacturer's maximum published torque at maximum differential pressure at 21°C (70°F) on dry air service. This shall be verified by destructive testing or calculation methods that have been verified by destructive testing on items of the same geometric configuration.

**4.4.4** If the surfaces of plugs that rotate against elastomeric or plastic sleeves, liners, seals, gaskets, or seats are not coated with an elastomer or plastic, these surfaces of plugs shall have a surface finish no rougher than Ra of 16 microinches (0.40 micrometers) in accordance with ASME B46.1. Lubricated plug valves shall have a surface finish between the seat and plug that will insure maximum retention of lubricant as determined by the manufacturer.

**4.4.5** Stem surface area in contact with the stem seal or packing shall be no rougher than Ra of 32 microinches (0.80 micrometers) in accordance with ASME B46.1.

### 4.5 Glands

Adjustable glands may be a threaded type, a bolted one-piece type, or a bolted two-piece, self-aligning type.

### 4.6 Bolting

**4.6.1** Covers shall be bolted with studs, stud bolts, or cap screws. Studs and stud bolts shall be equipped with heavy, semifinished hexagon nuts that conform to ASME B18.2.2.

**4.6.2** Bolting shall be threaded in accordance with ASME B1.1. Bolting 1 in. or smaller shall have coarse (UNC) threads; bolting larger than 1 in. shall be of the 8-thread series (8 UN). Bolt threads shall be Class 2A, and nut threads shall be Class 2B. When wrench-fit studs are furnished, the wrench-fit end of these studs and the threaded hole shall have threads in accordance with a Class 5 interference fit, as specified in ASME B1.12.

**4.6.3** Gland bolting shall pass through holes in the gland. The use of open slots is not permitted in the cover flange, cover, adjuster, or gland.

**4.6.4** Packing gland bolts shall be designed so that the bolt stress shall not exceed one third ( $1/3$ ) of the minimum tensile stress of the bolt due to average packing compressive stress required to retain the maximum cold working pressure of the valve (CWP rating).

## 4.7 Operation

**4.7.1** Plug valves shall be designed for operation by applying a wrench (sometimes called a lever), handle, or a handwheel to the stem either directly, or indirectly through the use of a gear mechanism or another mechanical device. The purchaser shall specify the type of operation required. The length of the wrench (or lever), handle, or the gear ratio of the gear mechanism shall be designed such that the input force required to operate the valve does not exceed the operator input force capability values given in MSS SP-91 using short-term force, a combined multiplier of 0.4 at the manufacturer's maximum operating torque as defined in 4.4.3. In no case shall the input force exceed 360 N (80 lbf).

**4.7.2** A wrench (or lever) shall be furnished as a separate item and shall be supplied only when specified in the purchase order. A wrench may be of an integral design or may consist of a head that fits onto the stem and is provided with a socket or another suitable means of accommodating an extended handle. The head shall be designed so that the handle can be permanently attached. The head shall be secured to the stem or operating mechanism with a set screw of ample size, or by another positive means.

**4.7.3** A spoked handwheel shall be furnished with each gear-operated valve; webbed or disked handwheels shall not be used. Spokes that extend beyond the wheel rim (tiller type) are permissible.

**4.7.4** Gear mechanisms may be operated manually or by means of an electric motor or another similar power device. Keys or pins shall be used to secure gears or pinions to shafts. On power-operated valves, the gear assembly shall be suitably guarded.

**4.7.5** When specified in the purchase order, valves shall be furnished with a lockable device that accepts a purchaser-supplied lock that enables the valve to be locked in the open and closed positions. The lockable device shall be designed such that a lock with an 8 mm ( $5/16$  in.) diameter shank, not more than 100 mm (4 in.) long, can be inserted directly through appropriate holes and locked. Provisions for a lockable device are permitted even when it is not specified in the purchase order provided they are not the type that latch automatically.

**4.7.6** Valves shall be provided with a suitable stop for the plug assembly in both the open and the closed position. The open or closed position of the plug in the body shall be shown by an indicator. Cast or integrally forged indicators shall be raised rather than recessed. If the position indicators are not integral with the plug, they shall be designed to prevent the plug and indicators from being assembled in any way other than with the indicator in its proper position with respect to the plug port. Stem wrench flats in line with the plug port are also a suitable integral position indicator.

**4.7.7** The handle shall be mounted parallel to the flow passage through the plug, if the valve is supplied with a lever-type handle. The handle design shall not permit incorrect assembly.

**4.7.8** Valves shall be supplied with the capability of mounting actuators or gear mechanisms without removing any pressure-containing components (e.g. body bolts, bonnet bolts, flange bolts, packing gland bolts, packing retaining stem nut, etc.).

## 4.8 Electrical Continuity

When specified in the purchase order, valves shall incorporate an antistatic feature that ensures electrical continuity between the plug and the body. The valve shall have electrical continuity across the discharge path, with a resistance of not more than 10 ohms from a power source of not more than 12 volts DC. This continuity shall be verified by testing a new, dry valve that has been (a) pressure tested and (b) cycled at least five times.

## 5 Materials

### 5.1 General

When service or environmental conditions, such as low temperatures or a corrosive environment, make special considerations necessary in choosing valve materials, the purchaser shall indicate this on the purchase order, and the materials shall be as agreed upon by the purchaser and the manufacturer.

### 5.2 Shell

**5.2.1** The shell, which comprises the body and the cover, shall be of a material listed in ASME B16.34 or ductile iron listed in ASME B16.42. For ASME B16.34 listed materials, the body and the cover do not have to be to identical material specifications; however, the body and the cover shall be of materials of the same materials group.

**5.2.2** A metallographic examination may not be substituted for the tensile test required by ASTM A 395.

### 5.3 Body-to-Cover Seals, Diaphragms, or Gaskets

When body-to-cover seals or metallic or nonmetallic diaphragms or gaskets are used, they shall be suitable for the service conditions and the valve's pressure-temperature ratings. Where necessary, compression of the seals, diaphragms, or gaskets shall be controlled by a compression ring or by the body-to-cover design. The corrosion resistance of any metal in contact with the service fluid shall at least equal that of the body. The seal or gasket may be made of a material listed in Annex C, Table C1, of ASME B16.5, or the seal or gasket may be made of a hydrocarbon-resistant plastic or elastomer.

### 5.4 Stem and Plug

**5.4.1** Plugs shall be made of one of the materials specified in ASME B16.34 or ductile iron specified in ASME B16.42. Other materials may be used if they are specified in the purchase order. The corrosion resistance of the plug shall be at least equal to that of the body. The plug surfaces shall have bearing properties that will resist galling. Steel plugs may be hard surfaced to provide the desired resistance to abrasion and galling. Other materials may be used if they are specified in the purchase order. When ductile iron plugs are hard surfaced, hard surfacing shall not be applied by welding or brazing.

**5.4.2** Stem material, when not integral with plug, shall have a corrosion resistance at least equal to the body and meet the strength requirements of 4.4.2.

### 5.5 Operating Mechanisms

Handwheels and chainwheels shall be made of carbon steel, ductile iron, or malleable iron. Unless otherwise specified in the purchase order, handwheels and chainwheels shall be cast or forged, or they may be fabricated from other carbon steel product forms, provided that the fabricated wheels are as strong and as tough as those made by casting or forging. All handwheels shall be free from burrs and sharp edges. Wrenches and handles shall be made of steel, ductile iron, malleable iron, bronze, or other ductile metals. Chains shall be made of steel.

### 5.6 Glands

Glands shall be made of cast, forged, or rolled steel or of ductile iron. Ductile iron shall not be used for fluid services with operating temperatures above 343°C (650°F).

## 5.7 Stem Seal or Packing

A hydrocarbon-resistant stem seal or packing that has a minimum temperature range from  $-29^{\circ}\text{C}$  through  $107^{\circ}\text{C}$  ( $-20^{\circ}\text{F}$  through  $225^{\circ}\text{F}$ ) shall be furnished unless otherwise specified on the purchase order.

## 5.8 Bolting

**5.8.1** Cover bolting material shall conform to ASME B16.34, Group 4 materials except that ASTM A307 Grade B carbon steel bolting shall not be used.

**5.8.2** Gland and adjuster bolting material shall conform to ASME B16.34, Group 4 materials.

**5.8.3** Valve bolting material is subject to the temperature limitations specified in ASME B31.3.

## 5.9 Identification plate

**5.9.1** The identification plate material shall be 18Cr-8Ni steel or nickel alloy.

**5.9.2** The identification plate shall be attached to the valve shell by welding, except for ductile iron, or by pins made of a material similar to that of the nameplate.

## 5.10 Repair of Defects

**5.10.1** Defects in the shell of valves that are revealed during manufacturing operations or testing may be repaired as permitted by the most nearly applicable ASTM material specification.

**5.10.2** No repair, including plugging or impregnation, of defects found in ductile iron castings is permitted. Welding or brazing of ductile iron is not permitted.

# 6 Sealing System

## 6.1 Lubricated Plug Valves

**6.1.1** Lubricated plug valves shall be furnished with an internal lubricating system that is capable of delivering lubricant to the body/plug contact surfaces in the seating and seal areas.

**6.1.2** Grooves shall be provided in the body/plug surfaces. The grooves shall be arranged so that lubricant under pressure will be transmitted to all parts of the system when the valve is fully open or closed, thereby sealing the ports and facilitating operation.

**6.1.3** The design of the sealant (lubricant) fitting shall be a lubricant screw, a sealant (lubricant) fitting or a combination (lubricant) fitting and screw. The sealant fitting, including the screw, shall be made of steel.

**6.1.4** For valves that are supplied with a lubricant screw or a combination sealant fitting and lubricant screw, steel check valves with a minimum of two independent check elements are required. For valves supplied with a sealant fitting, steel check valves with a one check element can be used, provided the lubricant fitting has a separate checking element. The material for the check valves, including the check elements and the housing, shall be at least as corrosion resistant as the metal of the valve body.

**6.1.5** Unless otherwise specified in the purchase order, lubricated plug valves shall be furnished with hydrocarbon-resistant lubricating sealant that has a temperature range from  $-29^{\circ}\text{C}$  through  $107^{\circ}\text{C}$  ( $-20^{\circ}\text{F}$  through  $225^{\circ}\text{F}$ ). This sealant shall have both proper plasticity for tight sealing and lubricity for ease of operation.

## 6.2 Non-lubricated Plug Valves

Non-lubricated plug valves may use as sealing elements metal seats or hydrocarbon-resistant plastic or elastomer sleeves, seats, or complete or partial linings or coatings. Sleeves shall be mechanically restrained to prevent displacement or dislodging while valves are in service. Linings or coatings of the plug shall be bonded or mechanically locked. Linings or coatings of the shell shall also be bonded or mechanically locked unless the strength and rigidity of the lining or coating are sufficient to prevent displacement or dislodging while valves are in service. In sleeved, lined, and soft-seated plug valves, a means shall be provided to adjust, either manually or automatically, the position of the plug as wear occurs.

## 7 Inspection and Testing

### 7.1 Inspection

If inspection by the purchaser is specified in the purchase order and a detailed procedure is not included, inspection shall be in accordance with API 598. If inspection is not specified in the purchase order, the valves shall be capable of meeting the inspection requirements described in API 598. Examination by the manufacturer shall be as specified in API 598. Additional inspection requirements should be specified in the purchase order, if required by the purchaser.

### 7.2 Testing

**7.2.1** Each valve shall be pressure tested in accordance with API 598. Valves shall be tested at the factory in the fully assembled condition, including auxiliary components, fitting and gland packing, and before coating or painting. During the pressure test, the valve body shall be free of external constraints applied in the direction of the pipe axis. Valves having surface conversion treatment may be tested with the treatment applied.

**7.2.2** When fire-tested valves are specified by the purchaser, the requirements of API 607 shall apply.

## 8 Marking

**8.1** Valves other than ductile iron valves shall be marked in accordance with ASME B16.34.

**8.2** Ductile iron valves shall be marked in accordance with MSS SP-25.

**8.3** Valve identification plate marking shall include the pressure rating at 38°C (100°F) and manufacturer's figure number.

**8.4** Valve identification plate marking shall include the maximum temperature limit and its corresponding limiting pressure for any seal, sleeve, liner, diaphragm, or seat, that causes the valve to be limited to a pressure-temperature rating that is lower than that listed in applicable ASME B16.34 or ASME B16.42.

**8.5** API 599 may also be added to identification plate for valves complying with this standard.

## 9 Shipment

### 9.1 Coatings

**9.1.1** Except for austenitic stainless steel valves, unmachined exterior valve body and bonnet surfaces shall have a rust-preventative coating.

**9.1.2** Unless otherwise specified in the purchase order, unmachined surfaces of ductile iron bodies and covers shall be coated with green paint.

**9.1.3** Machined surfaces of flange faces and welding ends shall be coated with an easily removable rust preventive.

## **9.2 Openings**

**9.2.1** End flanges or welding ends shall be covered to protect the gasket surfaces or welding ends and the valve internals during shipment and storage, except on small, individually packaged valves where the packaging provides such protection. The protective covers shall be made of wood, wood fiber, plastic, or metal and shall be securely attached to the valve ends by bolts, steel straps, steel clips, or suitable friction-locking devices. The cover shall be designed so that the valve cannot be installed without complete removal of the cover.

**9.2.2** Tapped connections shall be fitted with fully tightened threaded solid metal plugs that have corrosion resistance at least equal to that of the shell. Cast iron plugs shall not be used. However, ductile iron plugs may be used in ductile iron valves.

## **9.3 Plug Position**

Valves shall be shipped with the valve plug or plugs in the open position.

## **9.4 Packing**

If stem packing is used, valves shall be shipped with the stem packing installed. The remaining packing adjustment, with the gland tight, shall be greater than one packing width.

## **9.5 Packaging**

**9.5.1** Unless export packaging is specified in the purchase order, valves may be shipped loose, palletized, or packed in cartons, boxes, or crates.

**9.5.2** If export packaging is specified in the purchase order, valves shall be shipped individually or collectively in wooden boxes or crates in a manner that will prevent their shifting within the package.

## **10 Recommended Spare Parts**

When specified on the purchase order, the vendor shall submit a recommended list of spare parts. The list shall include cross-sectional or assembly type drawings for identification with part numbers.



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