Metal Plug Valves—Flanged, Threaded and Welding Ends

API STANDARD 599
FIFTH EDITION, AUGUST 2002

American Petroleum Institute

Helping You Get The Job Done Right.SM

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Donwstream 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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Asbestos is specified or referenced for certain components of the equipment described in some API standards. It has been of extreme usefulness in minimizing fire hazards associated with petroleum processing. It has also been a universal sealing material, compatible with most refining fluid services.

Certain serious adverse health effects are associated with asbestos, among them the serious and often fatal diseases of lung cancer, asbestosis, and mesothelioma (a cancer of the chest and abdominal linings). The degree of exposure to asbestos varies with the product and the work practices involved.

Consult the most recent edition of the Occupational Safety and Health Administration (OSHA), U.S. Department of Labor, Occupational Safety and Health Standard for Asbestos, Tremolite, Anthophyllite, and Actinolite, 29 *Code of Federal Regulations* Section 1910.1001; the U.S. Environmental Protection Agency, National Emission Standard for Asbestos, 40 *Code of Federal Regulations* Sections 61.140 through 61.156; and the U.S. Environmental Protection Agency (EPA) rule on labeling requirements and phased banning of asbestos products (Sections 763.160-179).

There are currently in use and under development a number of substitute materials to replace asbestos in certain applications. Manufacturers and users are encouraged to develop and use effective substitute materials that can meet the specifications for, and operating requirements of, the equipment to which they would apply.

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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 Standard 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 1.1.1).
b. Class (see 1.1.2).
c. Type (lubricated or nonlubricated, see 1.1.3) and pattern (short, regular, venturi, or full bore [see 1.1.4]).
d. End connections, (1) flanged, including facing type (raised, ring joint, or flat); (2) welding end, including bore dimensions; and (3) threaded (see 1.1.1, 2.2.3 through 2.2.5, 2.2.8 and 2.2.9).
e. Standard or heavy-wall thickness, for stainless steel valves only (see 2.2.1).
f. Type of operator required (lever, handwheel, or gear) and whether supply of operator is included in the purchase order (see 2.7 and 3.5).
g. Shell (body and cover) material (see 3.1 and 3.2).
h. Fire test requirements (see 1.1.6).
i. Plug material (see 3.4).

2.2 Optional Items

a. Flanged ends attached by welding (see 2.2.3 and the following Note 3).
b. Drain and bypass connection (see 2.2.9).
c. Locking device (see 2.7.5).
d. Anti-static feature and testing (see 2.8).
e. Materials for operating mechanisms (see 3.5.1 and 3.5.2).
f. Stem seal or packing material and/or operating temperature if temperature is outside the range from – 20°F through 225°F (– 29°C through 107°C) (see 3.7).
g. Bolting material for temperatures beyond the limits specified in ASME B31.3 or for increased resistance to corrosive environments (see 3.8).
h. Lubricating sealant (see 4.1). (Specify sealant and/or operating temperature if temperature is outside the range from – 20°F through 225°F [– 29°C through 107°C].)
i. Sleeve, seat, lining, or coating material (see 4.2).
j. Inspection (see 5.1 and the following Note 5).
k. Coating for ductile iron valves (see 7.1.2).
l. Export packaging (see 7.5.1 and 7.5.2).

3. If flanges attached by welding are specified, the purchaser shall ensure that adequate quality control of the welds will be provided by the manufacturer. The purchaser may have to specify supplementary requirements for the welds, particularly for severe services, such as special heat treatment or supplementary nondestructive examination of the welds.

4. 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. If this venting affects the sealing direction of the valve, the body shall be marked with preferred shut-off direction.

5. Refer to API Standard 598 for additional items that may have to be specified, such as the extent of inspection, the inspector's address, and the optional high-pressure closure test.

Metal Plug Valves—Flanged, Threaded and Welding Ends

SECTION 1—GENERAL

1.1 SCOPE

1.1.1 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.

1.1.2 This standard covers additional requirements for plug valves that are otherwise in full conformance to the requirements of ASME B16.34 for Standard Class 150 through 2500 or ASME B16.42 for Class 150 and 300.

1.1.3 This standard covers both lubricated and nonlubricated valves that have two-way coaxial ports; three-way and four-way plug valves are not discussed in 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.

1.1.4 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 1.1.4.1 through 1.1.4.4.

1.1.4.1 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 1½ through NPS 12.

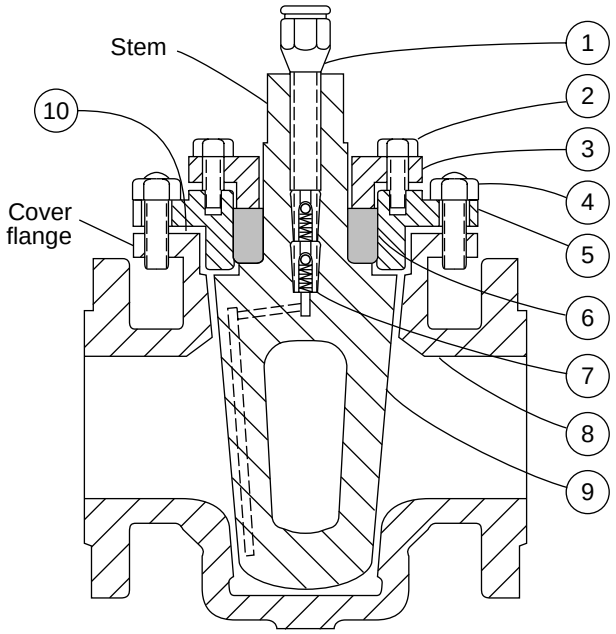
1.1.4.2 The regular pattern design has a plug port area that is greater than the venturi pattern.

1.1.4.3 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 approximates a venturi throat.

1.1.4.4 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 Annex A of ASME B16.34 for the applicable valve size and pressure class.

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

1.1.6 When fire-tested valves are specified by the purchaser, the requirements of API Standard 607 also apply.

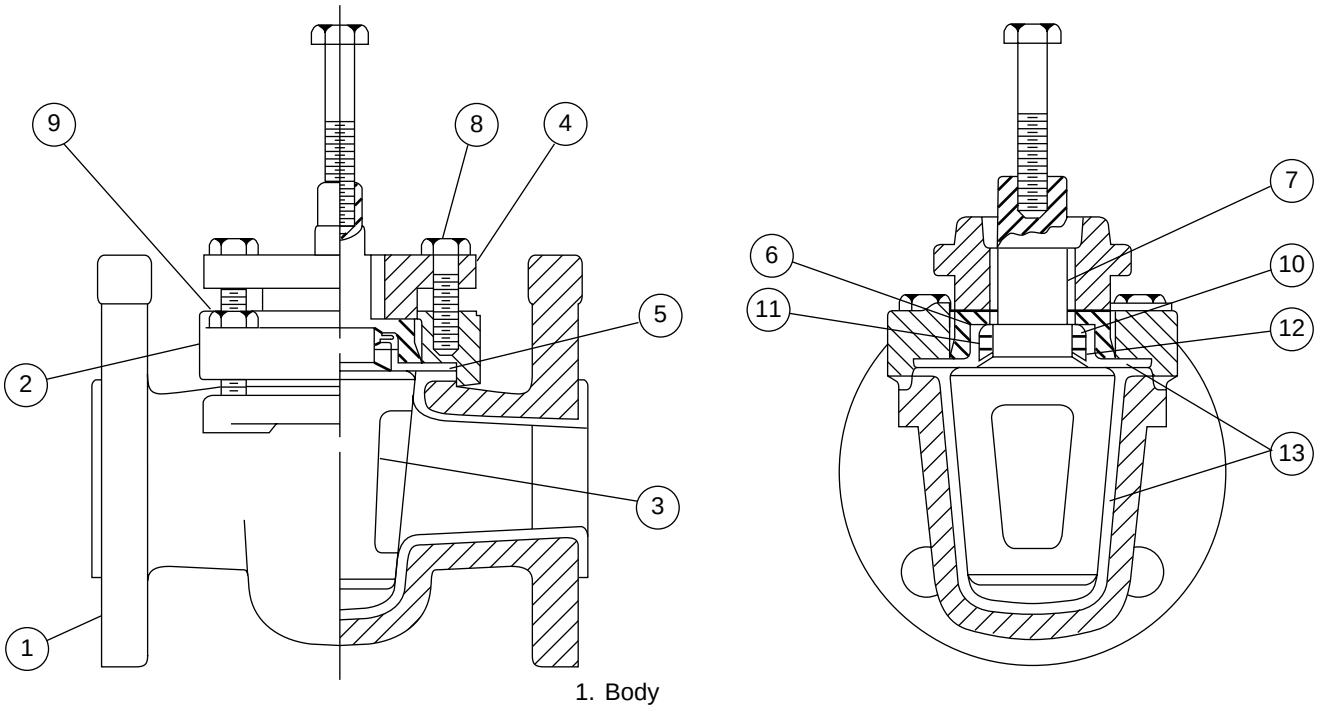


1. Lubricant fitting
2. Gland bolting
3. Gland
4. Cover bolting
5. Cover
6. Stem packing
7. Lubricant check valves
8. Body
9. Plug
10. Cover gasket

Figure 1—Typical Lubricated Plug Valve

1.2 REFERENCED PUBLICATIONS

Unless otherwise noted, the latest edition or revision of the following standards shall, to the extent specified herein, form a part of this standard. When specific parts (for example, numbered paragraphs or tables) of other documents are referenced in this text, the edition current when this standard was issued shall apply.



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—Typical Fully-lined Plug Valve

API

Std 598	*Valve Inspection and Testing*
Std 607	*Fire Test for Soft-Seated Quarter-Turn Valves*

ASME[1]

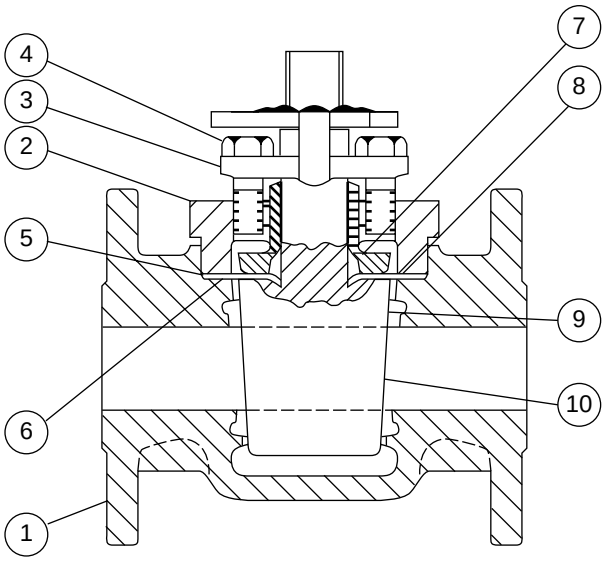
B1.1	*Unified Inch Screw Threads (UN and UNR Thread Form)*
B1.12	*Class 5 Interference-Fit Thread*
B1.20.1	*Pipe Threads, General Purpose (Inch)*
B16.5	*Pipe Flanges and Flanged Fittings*
B16.10	*Face-to-Face and End-to-End Dimensions of Ferrous Valves*
B16.11	*Forged Fittings, Socket Welding and Threaded*
B16.25	*Buttwelding Ends*
B16.34	*Valves–Flanged, Threaded and Welding End*
B16.42	*Ductile Iron Pipe Flanges and Flanged Fittings, Class 150 and 300*
B18.2.2	*Square and Hex Nuts*
B31.3	*Process Piping*
B36.10M	*Welded and Seamless Wrought Steel Pipe*
B46.1	*Surface Texture (Surface Roughness, Waviness and Lay)*

ASTM[2]

A 126	*Gray Iron Castings for Valves, Flanges, and Pipe Fittings*
A 395	*Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures*

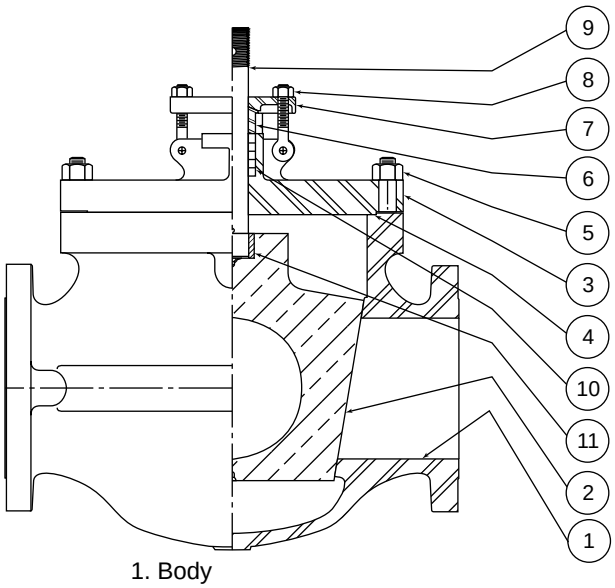
[1]ASME International, Three Park Avenue, New York, New York 10016-5990.

[2]American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, Pennsylvania 19428.



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—Typical 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—Typical Nonlubricated Plug Valve

MSS[3]

SP-25	*Standard Marking System for Valves, Fittings, Flanges, and Unions*
SP-45	*By-pass and Drain Connection Standard*
SP-91	*Guidelines for Manual Operation of Valves*

[3]Manufacturers Standardization Society of the Valves and Fittings Industry, 127 Park Street, N.E., Vienna, Virginia 22180.

1.3 PRESSURE-TEMPERATURE RATINGS

This standard covers valves that have pressure-temperature ratings 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 3.7 and 6.4).

SECTION 2—DESIGN

2.1 GENERAL

Valves manufactured in accordance with this standard shall meet the requirements of ASME B16.34 for Standard Class, ASME B16.42 where appropriate, the requirements of API Std 607 when fire testing is specified, and any additional requirements as specified in this standard.

2.2 BODY

2.2.1 The minimum thickness of the body wall is dependent upon the body material specified and shall be in accordance with the following:

a. ASME B16.42 for 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.

Valve bodies of ASME B16.34 materials that are provided with minimum wall thickness in accordance with Table 1A or 1B may be designated as heavy wall plug valves.

Table 1A—Minimum Body Thickness (Inches): Carbon Steel, Alloy Steel, and Heavy-Wall Stainless Steel[a]

Valve Size (NPS)	Class						
	150	300	400	600	900	1500	2500
1/2	0.18	0.18		0.21		0.31	0.31
3/4	0.18	0.18		0.25		0.40	0.40
1	0.25	0.25	Use Class 600 valves in these sizes	0.31	Use Class 1500 valves in these sizes	0.50	0.59
1 1/4	0.25	0.25		0.34		0.56	0.69
1 1/2	0.25	0.31		0.37		0.59	0.75
2	0.34	0.38		0.44		0.75	0.88
2 1/2	0.38	0.44		0.47		0.88	1.00
3	0.41	0.47		0.50	0.75	0.94	1.19
4	0.44	0.50	0.50	0.63	0.84	1.13	1.41
6	0.47	0.63	0.66	0.75	1.03	1.50	1.91
8	0.50	0.69	0.75	1.00	1.25	1.88	2.44
10	0.56	0.75	0.84	1.13	1.44	2.25	2.66
12	0.63	0.81	0.94	1.25	1.66	2.63	3.41
14	0.66	0.88	1.06	1.38	1.81	2.75	—
16	0.69	0.94	1.13	1.50	2.06	3.13	—
18	0.72	1.00	1.19	1.63	2.25	3.50	—
20	0.75	1.06	1.31	1.75	2.50	3.88	—
24	0.81	1.19	1.44	2.00	2.88	4.50	—

[a]See 2.2.1.

Table 1B—Minimum Body Thickness (Millimeters): Carbon Steel, Alloy Steel, and Heavy-Wall Stainless Steel[a]

Valve Size (NPS)	Class						
	150	300	400	600	900	1500	2500
1/2	4.6	4.6		5.3		5.3	5.3
3/4	4.6	4.6		6.4		10.2	10.2
1	6.4	6.4	Use Class 600 valves in these sizes	7.9	Use Class 1500 valves in these sizes	12.7	15.1
1 1/4	6.4	6.4		8.6		14.2	17.5
1 1/2	6.4	7.9		9.3		15.0	19.1
2	8.7	9.5		11.1		19.1	22.2
2 1/2	9.5	11.1		11.9		22.2	25.4
3	10.3	11.9		12.7	19.1	23.8	30.2
4	11.1	12.7	12.7	15.9	21.4	28.6	35.7
6	11.9	15.9	16.7	19.1	26.2	38.1	48.4
8	12.7	17.5	19.1	25.4	31.8	47.6	61.9
10	14.3	19.1	21.4	28.6	36.5	57.2	67.5
12	15.9	20.6	23.8	31.8	42.1	66.7	86.5
14	16.7	22.2	27.0	34.9	46.0	69.9	—
16	17.5	23.8	28.6	38.1	52.4	79.4	—
18	18.2	25.4	30.2	41.3	57.2	88.9	—
20	19.1	27.0	33.3	44.5	63.5	98.4	—
24	20.6	30.1	36.5	50.8	73.0	114.3	—

[a]See 2.2.1.

2.2.2 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 or Table 3 as applicable.

2.2.3 End flanges of steel valves shall be integrally cast or forged with the body; however, flanges may be attached by full-penetration butt welding if this method is specified in the purchase order. End flanges attached by welding shall be cast or forged butt-welding ends. Welds shall conform to ASME B31.3, as shall qualifications for the welding procedure and the welder or welding operator. The finished weld thickness shall not be less than the minimum body-wall thickness (see 2.2.1). No welding or brazing shall be permitted on ductile iron.

2.2.4 The dimensions and finish of steel end flanges shall be as specified in ASME B16.5 for the type of facing specified in the purchase order. Flat-face flanges not covered by a lining material shall be finished as specified in ASME B16.5 for raised-face flanges.

2.2.5 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.

2.2.6 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.

2.2.7 Steel butt-welding ends shall conform to ASME B16.25 for the bore specified, for use without backing rings.

2.2.8 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.

2.2.9 When specified, drain and bypass connections shall conform to ASME B16.34 and MSS SP-45, as applicable.

2.3 COVER

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

2.4 PLUG STEM

2.4.1 The stem shall be designed so that, if failure of the stem to plug or that part of the stem within the pressure boundary occurs, no portion of the stem can be ejected from the valve as a result of internal pressure. The design shall not rely on actuation components (e.g., gear operators, actuators, levers, etc.) to prevent ejection.

2.4.2 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 determination may be done by calculation.

2.4.3 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 15 ft-lbs or two times the manufacturer's maximum published torque at maximum differential pressure on dry air service.

2.5 GLANDS

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

2.6 BOLTING

2.6.1 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.

Bolting shall be threaded in accordance with ASME B1.1. Bolting 1 inch or smaller shall have coarse (UNC) threads; bolting larger than 1 inch 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.

2.6.2 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.

2.6.3 Packing gland bolts to be designed to not exceed the tensile stress values listed in Table A-2 of ASME B31.3 with a packing compressive stress of 5,500 psi and gland bolt temperature of 100°F.

2.7 OPERATION

2.7.1 Plug valves shall be designed for operation by applying a wrench (sometimes called a lever) 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. Tables 2A and 2B show the standard method of operation for each valve class, pattern, and size. The length of the wrench 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 2.4.3.

Table 2A—Lubricated and Nonlubricated Valve Stem Operation

Class	Pattern	Size (NPS) Direct Operation[a]	Size (NPS) Gear Operation[a]
150	Short and venturi	1/2 ≤ NPS ≤ 6	8 ≤ NPS ≤ 24
	Regular	1/2 ≤ NPS ≤ 4	6 ≤ NPS ≤ 24
	Round port	1/2 ≤ NPS ≤ 3	4 ≤ NPS ≤ 24
300	Short and venturi	1/2 ≤ NPS ≤ 6	8 ≤ NPS ≤ 24
	Regular	1/2 ≤ NPS ≤ 4	6 ≤ NPS ≤ 24
	Round port	1/2 ≤ NPS ≤ 3	4 ≤ NPS ≤ 24
400	Venturi	3 ≤ NPS ≤ 4	6 ≤ NPS ≤ 24
	Regular	3	4 ≤ NPS ≤ 24
	Round port	3	4 ≤ NPS ≤ 24
600	Venturi and regular	1/2 ≤ NPS ≤ 3	4 ≤ NPS ≤ 12
	Round port	1/2 ≤ NPS ≤ 2 1/2	3 ≤ NPS ≤ 12
900	Venturi and regular		3 ≤ NPS ≤ 12
	Round port	—	3 ≤ NPS ≤ 12
1500	Venturi and regular	1/2 ≤ NPS ≤ 2 1/2	3 ≤ NPS ≤ 12
	Round port	1/2 ≤ NPS ≤ 1 1/2	2 ≤ NPS ≤ 12
2500	Venturi and regular	1/2 ≤ NPS ≤ 2 1/2	3 ≤ NPS ≤ 12

Note: [a]If specified in the purchase order, wrench operation may be furnished on larger valves, and gear mechanisms may be furnished on smaller valves.

Table 2B—Sleeve Lined and Fully Lined Plug Valve Stem Operation

Class	Pattern	Size (NPS) Direct Operation[a]	Size (NPS) Gear Operation[a]
150	Short and venturi	1/2 ≤ NPS ≤ 3	4 ≤ NPS ≤ 12
300	Short and venturi	1/2 ≤ NPS ≤ 3	4 ≤ NPS ≤ 12

Note: [a]If specified in the purchase order, wrench operation may be furnished on larger valves, and gear mechanisms may be furnished on smaller valves.

2.7.2 A wrench 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.

2.7.3 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.

2.7.4 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.

2.7.5 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 a 5/16 inch (8 mm) diameter shank, not more than 4 inches (100 mm) 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.

2.7.6 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.

2.7.7 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.).

2.8 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.

SECTION 3—MATERIALS

3.1 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.

3.2 SHELL

3.2.1 The shell, which comprises the body and the cover, shall be of a material listed in ASME B16.34 or ductile iron to 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.

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

3.3 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 E, Figure E1, of ASME B16.5, or the seal or gasket may be made of a hydrocarbon-resistant plastic or elastomer.

3.4 PLUGS

3.4.1 Plugs shall be made of one of the materials specified in ASME B16.34 or ductile iron to ASME B16.42. 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. On ductile iron plugs, hard surfacing shall not be applied by welding or brazing. The corrosion resistance of the plug shall be at least equal to that of the body. 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) per ASME B46.1.

3.4.2 Stem material, when not integral with plug, shall be at least equal to plug material in torsional strength and corrosion resistance. Surface finish no rougher than Ra of 32 microinches (0.80 micrometers) per ASME B46.1 at the packing area.

3.5 OPERATING MECHANISMS

3.5.1 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 shall be made of steel, ductile iron, malleable iron, bronze, or other ductile metals. Chains shall be made of steel.

3.5.2 Unless otherwise specified by the purchaser, gears for stem operation may be made of steel, bronze, ductile iron, malleable iron, or cast iron that conforms to ASTM A 126,

Grade B, or is of a higher tensile strength. Worm gears shall be made of steel, ductile iron, or malleable iron.

3.6 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 650˚F (343˚C).

3.7 STEM SEAL OR PACKING

Unless otherwise specified in the purchase order, a hydrocarbon-resistant stem seal or packing that has a minimum temperature range from – 20˚F through 225˚F (– 29˚C through 107˚C) shall be furnished.

3.8 BOLTING

3.8.1 Cover bolting material shall conform to ASME B16.34 except that ASTM A307 Grade B carbon steel bolting shall not be used.

3.8.2 Gland and adjuster bolting material shall conform to ASME B16.34

3.8.3 All valve bolting material is subject to the temperature limitations specified in ASME B31.3.

3.9 NAMEPLATES

The nameplate shall be made of 18Cr-8Ni steel or nickel alloy. The nameplate shall be attached to the valve shell by welding, or by pins made of a material similar to that of the nameplate.

SECTION 4—SEALING SYSTEM

4.1 LUBRICATED PLUG VALVES

4.1.1 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.

4.1.2 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.

4.1.3 The lubricant fitting, including the screw, shall be made of steel.

4.1.4 Steel check valves with a minimum of two independent check elements are required on all lubricated plug valves to prevent escape of sealant. 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.

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

4.2 NONLUBRICATED PLUG VALVES

Nonlubricated 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. The material for sealing elements may be specified by the purchaser.

SECTION 5—INSPECTION AND TESTING

5.1 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 Standard 598. If inspection is not specified in the purchase order, the valves shall be capable of meeting the inspection requirements described in API Std 598. Examination by the manufacturer shall be as specified in API Std 598.

5.2 PRESSURE TESTS

Each valve shall be pressure tested in accordance with API Std 598.

5.3 REPAIR OF DEFECTS

Defects in the shell of steel valves that are revealed by inspection or testing may be repaired as permitted by the most applicable ASTM material specification.

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

SECTION 6—MARKING

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

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

6.3 Valve nameplate marking shall include the pressure rating at 100˚F (38˚C) and manufacturer's figure number.

6.4 Valve nameplate marking shall include the maximum temperature limit and its corresponding limiting pressure for any seal, sleeve, liner, diaphragm, seat, or sealant 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.

SECTION 7—SHIPMENT

7.1 COATINGS

7.1.1 Unmachined exterior surfaces of finished steel valves, except austenitic stainless steel valves, shall be painted or treated by another equally effective method, such as phospating, to protect surfaces from corrosion caused by atmospheric exposure.

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

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

7.2 OPENINGS

7.2.1 Except on small, individually packaged valves, end flanges or welding ends shall be blanked to protect the gasket surfaces or welding ends and the valve internals during shipment and storage. 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.

7.2.2 Tapped connections shall be fitted with fully tightened threaded solid metal plugs that have corrosion resistance at least equal to that of the shell.

7.3 PLUG POSITION

Valves shall be shipped with the plugs in the open position.

7.4 PACKING

If stem packing is used, valves shall be shipped with the stem packing installed. After a valve has been successfully pressure tested and accepted, at least 75 percent of the gland adjustment travel shall remain for use in service.

7.5 PACKAGING

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

7.5.2 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.

SECTION 8—RECOMMENDED SPARE PARTS

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

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