

MSS SP-78-1998

Cast Iron Plug Valves Flanged and Threaded Ends

Standard Practice
Developed and Approved by the
Manufacturers Standardization Society of the
Valve and Fittings Industry, Inc.
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Substantive changes in this 1998 edition are "flagged" by parallel bars as shown on the margins of this paragraph. The specific detail of the change may be determined by comparing the material flagged with that in the previous edition.

U.S. customary units in this SP are the standard; the metric units are for reference only.

Unless otherwise specifically noted in this MSS SP, any standard referred to herein is identified by the date of issue that was applicable to the referenced standard(s) at the date of issue of this MSS SP. See Annex C.

Non-toleranced dimensions in this Standard Practice are nominal, and, unless otherwise specified, shall be considered "for reference only".

In this Standard Practice, all notes, annexes, and figures are construed to be essential to the understanding of the message of the standard, and are considered part of the text unless noted as 'supplemental'. All footnotes appearing in this document are construed as 'supplemental' where their information does not modify the text to which they refer.

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FOREWORD

The 1998 edition of MSS SP-78, in addition to various editorial changes, includes changes to: provide a more complete metric version for reference use, delete the Class 800 Pressure-Temperature rating, and expand Annex C to include ISO references.

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CAST IRON PLUG VALVES, FLANGED AND THREADED ENDS

1. SCOPE

1.1 This Standard Practice covers cast iron plug valves with flanged or threaded ends.

1.2 This standard practice also includes, directly or by reference, stipulations on chemical and mechanical properties of materials and on dimensions of end connections in common use.

2. VALVE DESIGNATION, CLASSES AND SIZES

2.1 Valve Types. Valve types covered by this standard practice are as follows.

Type I — Single Gland (2-Bolt Bonnet) See Figure A1.

Type II — Regular Gland (Bolted Gland) See Figure A2.

Type III — Threaded Gland — See Figure A3.

Type IV — Cylindrical — See Figure A4.

Note: The figures shown in Annex A are for the purpose of illustration and parts nomenclature only. They do not represent any manufacturer's product. The valves may be either of the lubricated or non-lubricated type. Only one of many types of non-lubricated valves is shown in Figure A3.

2.2. Patterns. Valve patterns covered herein are classified in three general design groups as follows: regular pattern, short pattern, and venturi pattern.

2.3 Pressure Classes. Valves covered by this standard are identified by Class numbers for mating ASME B16.1 flanged designated:

Class 125

Class 250

Threaded end valves covered by this standard are identified by Class numbers as for corresponding flanged valves.

2.4 Sizes

(a) NPS 2-24 (DN 50-600), flanged end

(b) NPS 2-6 (DN 50-150), threaded end

3. MATERIALS

3.1 General. The requirements prescribed in this standard are based upon the use of materials of high quality produced under regular control of chemical and physical properties by a recognized process. The manufacturer shall be prepared to certify, at the time of shipment from his works, that his product has been so produced and that the chemical and physical properties thereof, as proven by test specimens, are at least equal to the requirements shown in the specifications referenced in this document.

Users are cautioned against applications which may react chemically with any materials used in these valves. Consultation with the manufacturer is advised to determine suitability in cases of doubt.

3.2 Bodies and Plugs. Bodies and plugs shall be selected from the following materials:

Gray Iron Castings — ASTM A126,
Class B or Class C or ASTM A48, Grade 40.

In addition, plugs only may be:

Composition Bronze — ASTM B62, or
B584, C83600.

3.3 Seating Material. Bearing surfaces and seating materials shall be selected and/or processed so as to minimize the possibility of galling in sliding contact, and to resist wear, corrosion, and erosion within the rated temperature ranges. Hardfacing applied by welding or brazing shall not be used.

3.4 Covers and Bonnets. Covers or bonnets, where used, shall be selected from the following materials:

Gray Iron Castings — ASTM A126, Class B
Malleable Iron Casting — ASTM A47,
Grade 32510 or A197

Ductile Iron Castings — ASTM A536,
Grade 60-40-18 or A395

Carbon Steel Plate — ASTM A283, Grade D

3.5 Operating Mechanisms

3.5.1 Wrenches, handwheels and chain wrenches, when specified by the purchase order, shall be of ductile iron, malleable iron, or steel. Handwheels may also be of cast iron. Chains shall be of steel.

3.6 Bolting. Bolts and studs connecting pressure containing parts shall develop physical strength not less than requirements of ASTM A307, Grade B.

4.1 General

4.1.1 Valves shall be of design adequate to prevent harmful permanent deformation under the test pressure loadings specified in Section 5. Consideration should be given to the need for adequate metal thickness for assembly, closing stresses, shapes other than circular, and stress concentrations, in addition to pressure containment requirements. The minimum thickness of the cover or bonnet shall be at least equal to the minimum thickness of the body.

4.1.2 Valve bodies shall be designed to provide a maximum streamline flow condition through the valve.

4.1.3 Valves of the venturi pattern shall be designed for minimum pressure loss consistent with the reduced port area used in this type of valve and shall have a conjunction of body and plug ports approximating a venturi throat.

4.1.4 The plug ports in a regular pattern valve are larger than a short pattern, and the body, although designed as nearly as possible for streamline flow, does not approach the shape of a venturi throat. The plug-port area is substantially greater than for the venturi valve.

4.2 End Flanges

4.2.1 End flanges shall be integral with the valve body. Flange facings and drilling shall conform to ASME B16.1 for each respective pressure class (see Section 5, Pressure-Temperature Ratings).

4.2.2 The flanges shall be finished on the joint side in accordance with MSS SP-6.

4.2.3 Face-to-face dimensions of flanged end valves shall be as follows:

4. DESIGN

- (a) Class 125 (PN 20)
Conform to ASME B16.10

- (b) Class 250 (PN 50)
Conform to ASME B16.10, except NPS 4-12 (DN 100-300) valves with manufacturer's ratings of 400 CWP may have reduced face-to-face dimensions.

4.3 Threaded Ends. Valve ends shall be threaded with taper pipe threads that conform to ASME B1.20.1.

4.4 Bolting

4.4.1 Dimensions of bolts and cap screws shall conform to ASME B18.2.1. Nut dimensions shall conform to ASME B18.2.2.

4.4.2 Threading shall conform to ASME B1.1. Nominal diameters 1 inch and smaller shall be of the Course-Thread Series; nominal diameters 1-1/8 inch and larger shall be of the 8-Thread Series or of the Coarse-Thread Series. Bolts, studs, and stud bolts shall have Class 2A dimensions, and nuts shall have Class 2B dimensions.

4.5 Stem and Plug. The stem may be integral with the plug or separate from it. In either case, the stem or connection between the stem and plug, shall be of a design adequate to fully resist harmful permanent distortion under any reasonable maximum turning load.

4.6 Gland

4.6.1 Stem glands, where used, may be of either screwed, bolted solid, or bolted two-piece self-aligning type.

4.6.2 Gland bolts shall pass through holes in the gland; the use of open slots is not permissible in either body or gland.

4.7 Stem Retention. Valves having stems not integral with plugs shall be designed so that the stem retaining fasteners, e.g., gland fasteners, alone do not retain in the stem. Specifically, in valves having separate stems the design shall be such that the stem shall not be capable of removal from the valve by the removal of the stem seal retainer alone.

4.8 Operation

4.8.1 Plug valves shall be designed for operation by a wrench or handwheel, which shall turn counter-clockwise to open. Suitable means shall be provided to indicate the direction of opening the valve and the position of the plug. Provision shall be made for stops to limit the movement of the plug at the open and closed positions.

4.8.2 A wrench may be of integral design or consist of a head fitted onto the operating shaft and provided with a socket or other suitable means to take an extended handle. The wrench head shall be capable of being secured to the shaft with a set screw or other suitable means. When not integral, a wrench shall be furnished only when specified in the purchase order.

4.8.3 When specified in the purchase order, a handwheel shall be furnished with each gear operated valve. Handwheels shall be of spoked design. Webbed or disked handwheels shall not be used. Spokes extending beyond the wheel ring (tiller type) are permissible.

4.8.4 Valves shall be designed to accommodate a device for locking the plug assembly in either the open or closed position. Such a device shall be furnished when specified by the purchase order.

TABLE 1
PRESSURE TEMPERATURE RATINGS, NON-SHOCK psi

Degrees F	Class 125		Class 250	
	NPS 1 - 12	NPS 14 - 24	NPS 1 - 12	NPS 14 - 24
-20 to 150	200	150	500	300
200	190	135	460	280
225	180	130	440	270
250	175	125	415	260
275	170	120	395	250
300	165	110	375	240
325	155	105	355	230
350	150	100	335	220
375	145	—	315	210
400	140	—	290	200
425	130	—	270	—
450	125	—	250	—

Note: See Table B1 for Metric Units.

4.9 Bypass and Drain Connections. When specified, by-pass and drain connections shall be in accordance with MSS SP-45.

4.10 Lubrication-Seal. Lubricated plug valves shall be furnished with a lubricating-sealing system to provide a means for delivering plug valve lubricant-sealant to the body-plug interface.

4.10.1 Grooves. Grooves shall be provided in the plug and/or body of the body-plug interface surfaces to effectively seal the ports and facilitate operation. These grooves shall be so arranged that lubricant pressure may be transmitted to all parts of the system when the valve is fully open or closed.

4.10.2 Lubricant-Sealant Fittings. A lubricant-sealant fitting shall be provided in each valve for injection of the lubricant-sealant by means of a lubricant gun. This fitting may

include a compression screw so that stick lubricant-sealant can be inserted manually. The lubricant-sealant fitting, including the screw, shall be made of steel.

4.10.3 Check Valves. Check valves are required on all lubricated plug valves to prevent escape of lubricant-sealant. Material for check valves, including valve element and housing, shall be steel.

5. PRESSURE TEMPERATURE RATINGS

5.1 Pressure-temperature ratings are determined by consideration of valve structural design, temperature limitations of lubricant-sealant compounds of nonmetallic seat sealing materials in the various types of valves, and the basic pressure temperature ratings of ASME B16.1 flanges. Rating pressures in Table 1 are maximum values as limited by the associated end flanges.

5.2 Temperatures shown are temperatures of the contained fluid. Services involving sudden substantial changes in temperature or extreme differences between the fluid temperature in an uninsulated valve and the ambient air temperature should be avoided.

6. WORKMANSHIP

Valve parts shall be designed and manufacturing tolerances set so as to provide interchangeability in the product of any one manufacturer between units of the same size, class and type, except the individual fit of the plug in the body. All castings shall be clean and sound without defects which impair their serviceability.

7. TESTS

7.1 General. A shell test and a seat test shall be performed on all completed valves prior to painting and shipment.

TABLE 2
TEST DURATION, MINIMUM

Size		Shell Test	Seat Test
NPS	DN	Seconds	Seconds
2-8	50-200	30	30
10-18	250-450	60	60
20-Larger	500-Larger	180	120

7.2 Shell Test. Each valve in the fully open position, with both ends closed, shall be subjected to hydrostatic or gas test pressure equal to at least 2 times the CWP rating with no visible leakage allowed, for the test duration specified in Table 2.

Caution: Safety precautions must be taken when gas is used.

7.3 Seat Test. After being subjected to the shell test, each valve shall be subjected to a hydrostatic or gas seat test equal to 1.1 times the maximum service pressure (CWP) for which the valve is rated. The test duration is specified in Table 2.

7.3.1 For valves having closure symmetry giving identical closure geometry in two directions, test pressure shall be applied successively on each side of the closed plug, with the opposite side open for inspection. No visible leakage is permitted.

7.3.2 For non-symmetrical valves whose design is such that closure conditions are more severe in one direction than the other, a seat test in the more severe direction is sufficient. For example, valves providing mechanical wedging of the plug against one port shall be tested with pressure in the direction tending to unseat the plug at the port.

8. MARKING

Marking shall conform to MSS SP-25.

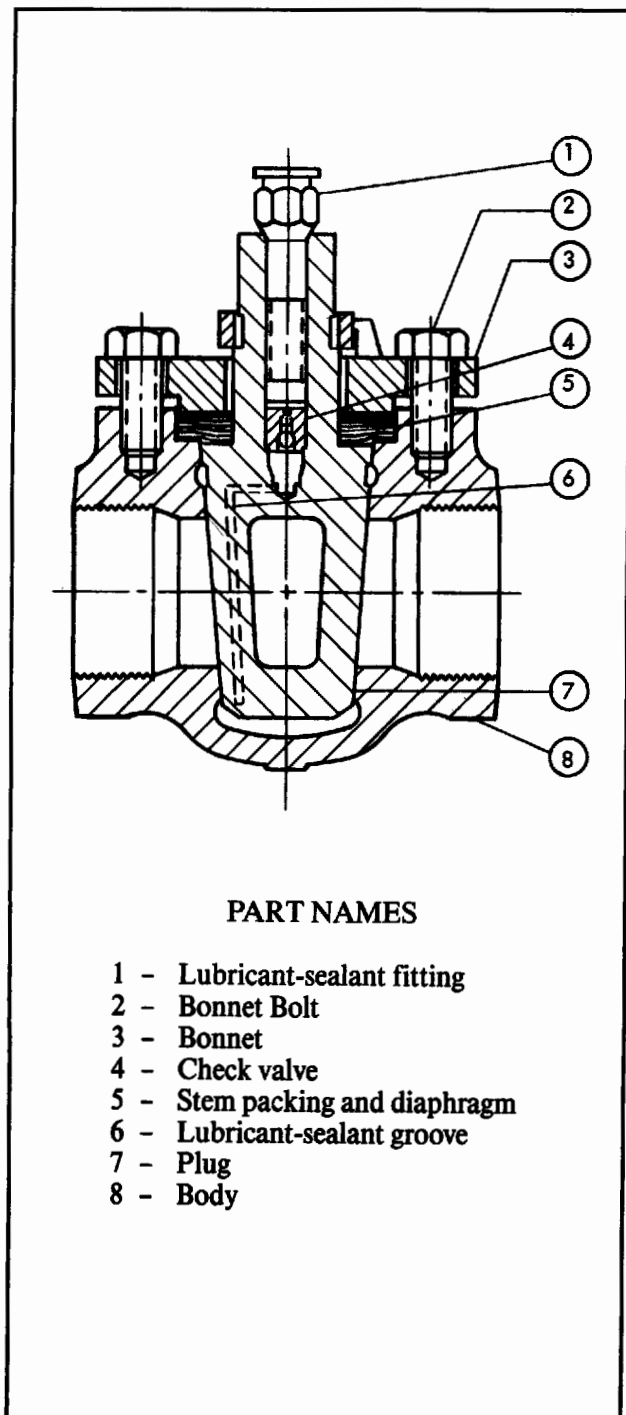
9. PREPARATION FOR SHIPMENT

9.1 Valves shall be painted with a coat of shop primer unless otherwise specified.

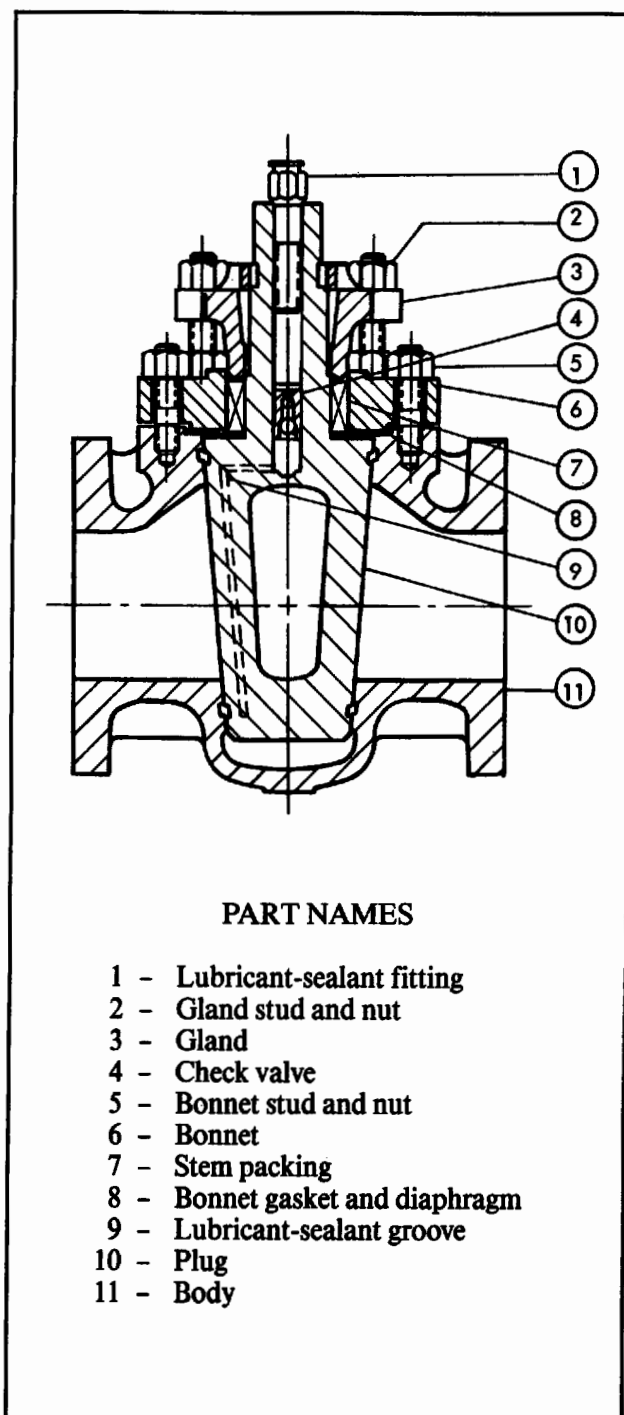
9.2 Gasket contact surfaces of finished end flanges shall be suitably protected to prevent handling damage.

9.3 Valves shall be shipped in the open position.

ANNEX A
VALVE TYPES

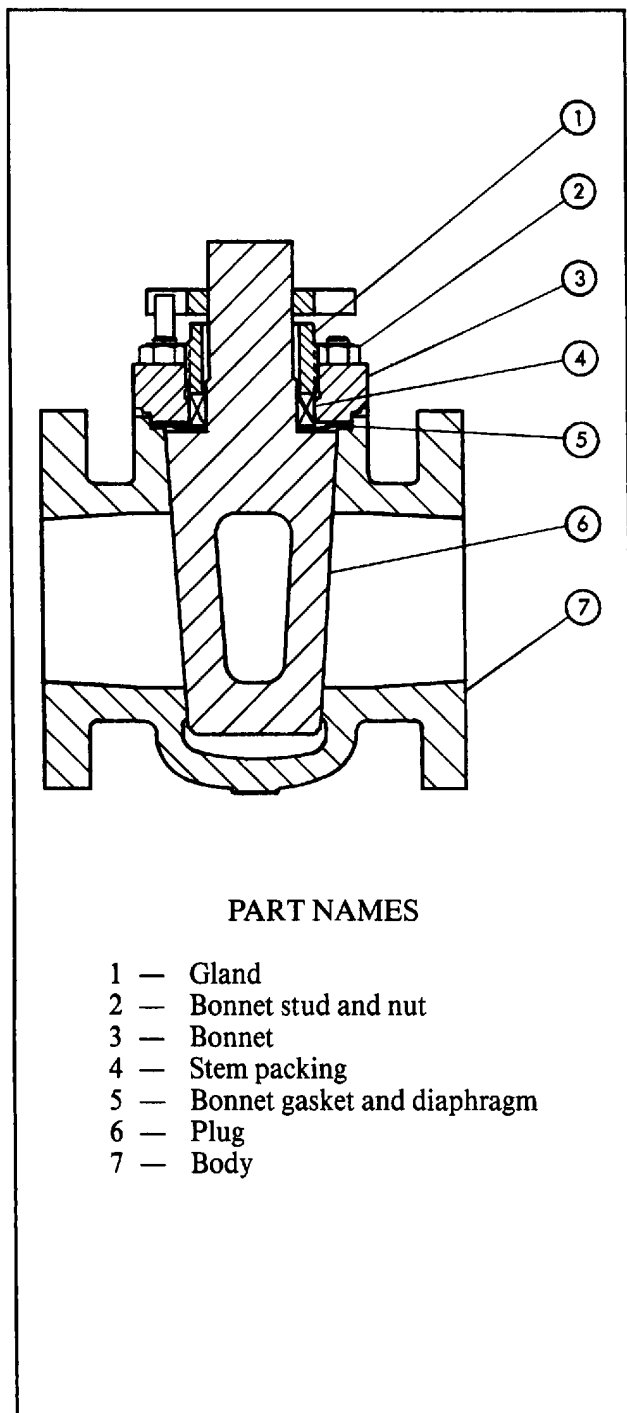


SINGLE GLAND PLUG VALVE
FIGURE A1

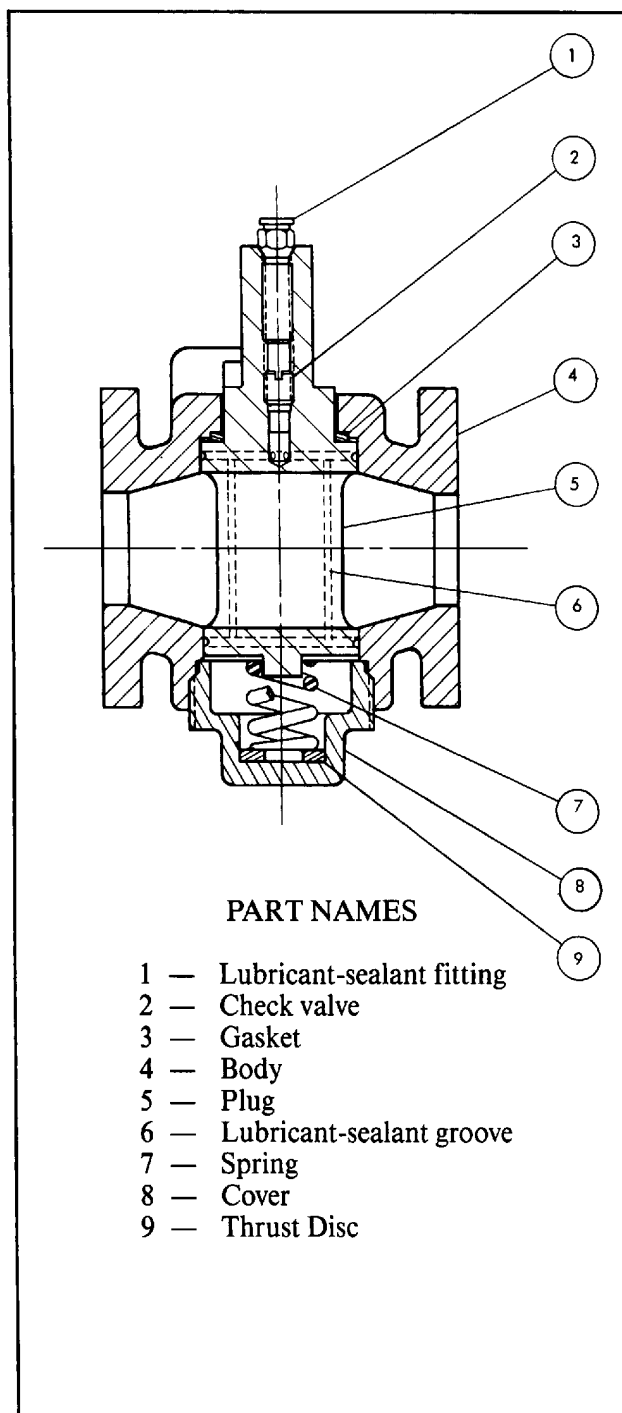


REGULAR GLAND PLUG VALVE
FIGURE A2

ANNEX A
VALVE TYPES



THREADED GLAND PLUG VALVE
FIGURE A3



CYLINDRICAL PLUG VALVE
FIGURE A4

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ANNEX B

TABLE B1
PRESSURE TEMPERATURE RATINGS, NON-SHOCK, bar

Degrees C	PN 20		PN 50	
	DN 25-300	DN 350-600	DN 25-300	DN 350-600
-30 to 65	13.8	10.3	34.5	20.7
70	13.7	10.1	34.0	20.5
80	13.4	9.8	33.0	20.0
90	13.1	9.4	32.0	19.5
100	12.8	9.2	30.9	19.0
110	12.5	8.9	29.7	18.4
120	12.2	8.6	28.7	17.9
130	11.8	8.4	27.7	17.4
140	11.5	8.1	26.8	17.0
150	11.2	7.7	25.7	16.5
160	10.8	7.3	24.8	16.0
170	10.5	7.0	23.8	15.6
180	10.2	6.8	22.8	15.1
190	9.9	—	21.8	14.6
200	9.6	—	20.5	14.0
210	9.3	—	19.4	—
220	8.8	—	18.4	—
230	8.6	—	17.4	—

NOTE: For definitions of DN and PN see International Standard ISO 6708 and ISO 7268, respectively, or MSS SP-86.

ANNEX C REFERENCED STANDARDS

This annex is an integral part of this Standard Practice which is placed after the main text for convenience.

Standard Name and Designation

ASME, ANSI/ASME, ANSI, ASME/ANSI

B1.1-1989	Unified Inch Screw Threads (UN and UNR Thread Form)
B1.20.1-1983 (R 1992)	Pipe Threads, General Purpose (Inch)
B16.1-1989	Cast Iron Pipe Flanges and Flanged Fittings (Class 25, 125, 250, and 800)
B16.10-1992	Face-to-Face and End-to-End Dimensions of Valves
B18.2.1-1996	Square and Hex Bolts and Screws, Including Askew Head Bolts, Hex Cap Screws, and Lag Screws
B18.2.2-1987 (R 1993)	Square and Hex Nuts

ASTM

Specifications for:

A 47-90	Specification for Malleable Iron Castings
A 48-94a	Specification for Gray Iron Castings
A 126-95	Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
A 197-87 (1992)	Specification for Cupola Malleable Iron
A 283/A 283M-93a	Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
A 307-94	Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
A 395-88 (1993)	Specification for Ferritic Ductile Iron Pressure-Retaining Castings for use at Elevated Temperatures
A 449-93	Specification for Quenched and Tempered Steel Bolts and Studs
A 536-84 (1993)	Specification for Ductile Iron Castings
B 62-93	Specification for Composition Bronze or Once Metal Castings
B 584-93b	Specification for Copper Alloy Sand Castings for General Applications

MSS Publications

SP-6-1996	Standard Finishes for Contact Faces of Pipe Flanges and Connecting-End Flanges of Valves and Fittings
SP-25-1998	Standard Marking System for Valves, Fittings, Flanges, and Unions
SP-45-1992	Bypass and Drain Connection Standard
SP-86-1997	Guidelines for Metric Data in Standards for Valves, Flanges, Fittings, and Actuators

ISO Publications

6708-1995	Pipe components - Definition of nominal size
7268-1983 (Amend 1, 1984)	Pipe components - Definition of nominal pressure

Publications of the following organizations appear on the above list:

ANSI	American National Standards Institute, Inc. 11 West 42nd Street, New York, New York 10036
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ASME	The American Society of Mechanical Engineers Three Park Avenue, New York, New York 10016-5990
ASTM	American Society for Testing and Materials 100 Bar Harbor Drive, West Conshohocken, PA 19428-2959
MSS	Manufacturers Society of the Valve and Fittings Industry, Inc. 127 Park Street, N.E., Vienna, VA 22180
ISO	International Organization for Standardization 1, rue de Varembe, Case postale 56, CH-1211 Geneve 20, Switzerland