# Metal Ball Valves—Flanged, Threaded, and Welding Ends

API STANDARD 608
THIRD EDITION, AUGUST 2002


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**Downstream Segment**

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## NOTES TO PURCHASER

1. If the purchaser needs a metal ball valve that deviates from this standard, the deviating requirements shall be specifically 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 608 and specify the items listed in 2.1 below. Optional items listed in 2.2 below may also be specified.

2.1 Items required on purchaser oder:

a. Valve size (see 1.1).
b. Class (see 1.3).
c. Type of end connection (see 1.1).
d. Materials of construction, including seat and seal material (see 3.3 and Section 5).
e. Valve port size. (Select full, regular, or reduced. See 4.3. Note that regular and reduced port valves have less than full port bores.)
f. Operator type (see 4.5).
g. On NPS 6 and larger flanged and buttwelding end valves, specify long or short pattern per ASME B16.10 (see 4.2.2).

2.2 Optional items:

a. Electrical continuity (see 4.4 and Note 6 below).
b. Lockable device (see 4.5.10).
c. Bolting (see 5.4).
d. Inspection by the purchaser, if required (see 6.1.2 and Note 3 below).
e. Special external coating (See 8.1).
f. Export packaging, if required (see 8.5.2).
g. Recommended spare parts information (see 9).
h. Arrangement to prevent overpressure of the body cavity (see SME B16.34, 2.3.3).
i. Drain or bypass connections (see 4.2.9).

3. Refer to API Standard 598 for additional items that may need to be specified, including supplementary examination, the extent of inspection by the purchaser, the inspector's address, and the optional high-pressure closure test.
4. The purchaser may specify conformance to API Standard 607, current edition, for applications that require a fire-tested valve.
5. This standard establishes minimum pressure-temperature ratings for seats. The ratings are applicable to valves that are used in on-off service. The manufacturer should be consulted if valves are to be used in throttling service. The user should also be cautious when using the pressure-temperature ratings in services where the fluids handled may adversely affect the properties of the seat material.
6. The purchaser may specify the need for electrical continuity between the stem and the body or stem, body, and ball. If this option is specified, see 4.4 for resistance requirements.
7. The purchaser should be cautious about using the plated balls and stems in applications where the fluid handled is corrosive to the base material.
8. This standard covers valves with solid balls only. Hollow balls are not covered by the standard (see 4.7).
9. It is the user's responsibility to install unidirectional ball valves in the correct orientation for the process.

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# Metal Ball Valves—Flanged, Threaded, and Welding Ends

## 1 Scope

**1.1** This standard covers metal ball valves used in on-off service that have butt-welding or flanged ends for nominal pipe size 1/2 through NPS 12 and threaded or socket-welding ends for sizes NPS 1/2 through NPS 2, corresponding to the nominal pipe sizes in ASME B36.10M.

**1.2** This standard covers additional requirements for ball valves that are otherwise in full conformance to the requirements of ASME B16.34, Standard Class.

**1.3** This standard covers flanged and butt-welding end valves in Standard Classes 150 and 300 and threaded and socket-welding end valves in Standard Classes 150, 300, and 600.

**1.4** Figure 1 illustrates a floating ball valve and Figure 2 illustrates a trunnion-mounted ball valve. Both figures are to be used only for the purpose of establishing standard nomenclature for valve parts.

## 2 References

The most recent edition or revision of the following standards and codes shall, to the extent specified herein, form a part of this standard:

| | |
|---|---|
| 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) |
| B1.20.1 | *Pipe Threads, General Purpose (Inch)* |
| B16.5 | *Pipe Flanges and Flanged Fittings* |
| B16.10 | *Face-to-Face and End-to-End Dimensions* |
| B16.11 | *Forged Fittings, Socket Welding and Threaded* |
| B16.20 | *Metallic Gaskets for Pipe Flanges—Ring-Joint, Spiral-wound and Jacketed* |
| B16.25 | *Butt-welding Ends* |
| B16.34 | *Valves-Flanged, Threaded, and Welding End* |
| B18.2.2 | *Square and Hex Nuts* |
| B31.3 | *Process Piping* |
| B36.10M | *Welded and Seamless Wrought Steel Pipe* |
| MSS[2] | |
| SP-45 | *Bypass and Drain Connections* |

[1]American Society of Mechanical Engineers, 345 East 47th Street, New York, New York 10017.

## 3 Pressure-temperature Ratings

### 3.1 VALVE RATING

The valve pressure-temperature rating shall be the lesser of the shell rating or the seat rating.

### 3.2 SHELL RATING

The valve shell pressure-temperature rating shall be the rating for the shell material as listed for Standard Class in ASME B16.34. (See 5.1 for definition of shell and description of shell materials.)

### 3.3 SEAL

#### 3.3.1 Seat Ratings for PTFE

The design shall be such that, when either polytetrafluoroethylene (PTFE) or reinforced PTFE is used for seats, the valve service pressure-temperature ratings shall equal or exceed those specified in Table 1.

#### 3.3.2 Seat Ratings—Other Materials

Seat ratings for other seat materials shall be the manufacturer's standard; however, the assigned value service pressure-temperature rating shall not exceed that of the valve shell.

## 4 Design

### 4.1 GENERAL

Valves manufactured in accordance with this standard shall meet the requirements of Standard Class valves per ASME B16.34 and additional requirements as specified in this standard.

### 4.2 BODY

**4.2.1** The thickness of the valve body shall be in accordance with the requirements of ASME B16.34.

**4.2.2** Face-to-face dimensions of flanged valves and end-to-end dimensions of butt-welding end valves shall conform to ASME B.16.10 long or short pattern.

**4.2.3** End-to-end dimensions of threaded and socket weld end valves shall be per the manufacturer's standard.

**4.2.4** The dimensions and facing finish of end flanges shall conform to ASME B16.5.

**4.2.5** Butt-welding ends shall conform to the requirements of ASME B16.25.

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

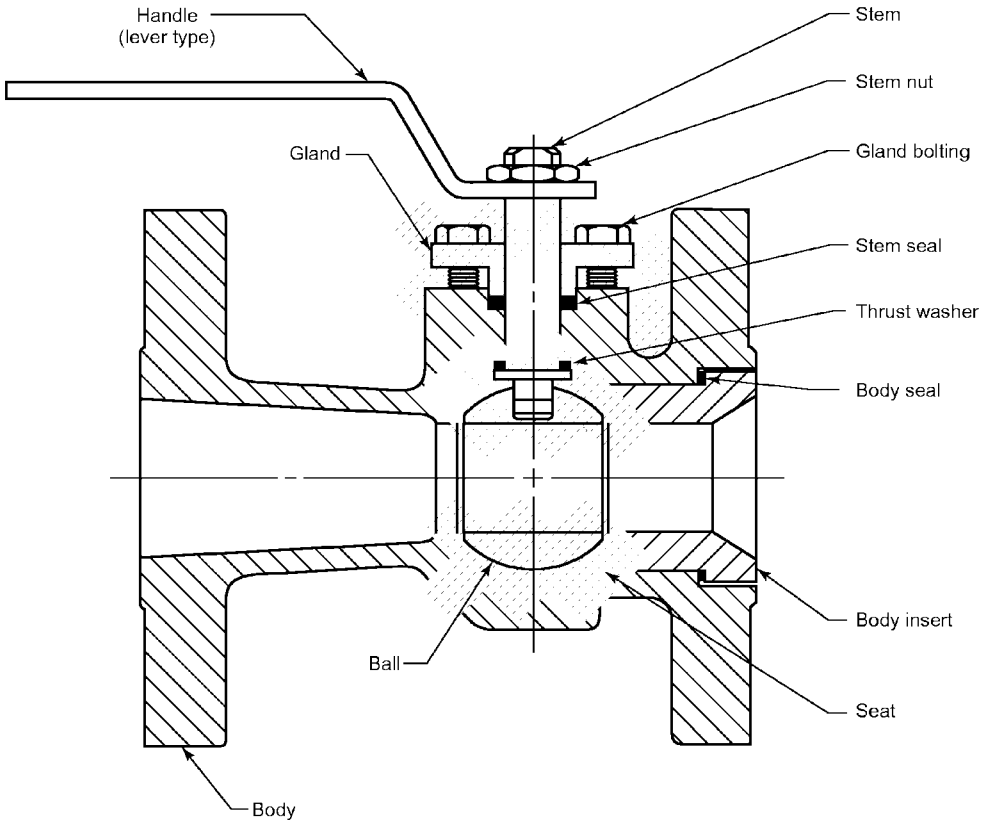


Figure 1—Typical Floating Ball Valve Components
(One-piece Body Illustrated)

**4.2.6** Dimensions of socket weld ends shall be in accordance with ASME B16.11 except that the minimum end wall thickness shall be in accordance with Table 4 of ASME B16.34.

**4.2.7** Threaded end connections shall have taper threads in accordance with ASME B1.20.1 and the minimum end wall thickness shall be in accordance with Table 4 of ASME B16.34.

**4.2.8** Upstream sealing trunnion mounted valves shall have a test plug to test seats as specified in API Std 598. Additional tapped test openings are permitted only if specified in the purchase order. Tapped openings shall be tapered pipe thread per ASME B1.20.1.

**4.2.9** If drain or bypass connections are specified by the purchaser, they shall conform to ASME B16.34 or MSS SP-45, as applicable.

### 4.3 VALVE PORT SIZES

Full-port, regular-port, and reduced-port valves shall have a flow passage through which a cylinder with the diameter shown in Table 2 can be passed when valve handle is moved to the full open limit stop.

### 4.4 ELECTRICAL CONTINUITY

When specified in the purchase order, valves shall incorporate an antistatic feature that ensures electrical continuity between the stem and the body, or stem, body, and ball. The valve shall have electrical continuity across the discharge path with a resistance of not more than 10 ohms. To test for continuity, a new, dry valve shall be cycled at least five times, and the resistance shall then be measured using a DC power source not exceeding 12 volts.

### 4.5 OPERATION

**4.5.1** Unless otherwise specified in the purchase order, manually operated valves shall be equipped with lever-type handles.

**4.5.2** Gear operators are recommended for NPS 6 and larger valves. Gear-operated valves shall be provided with handwheels.

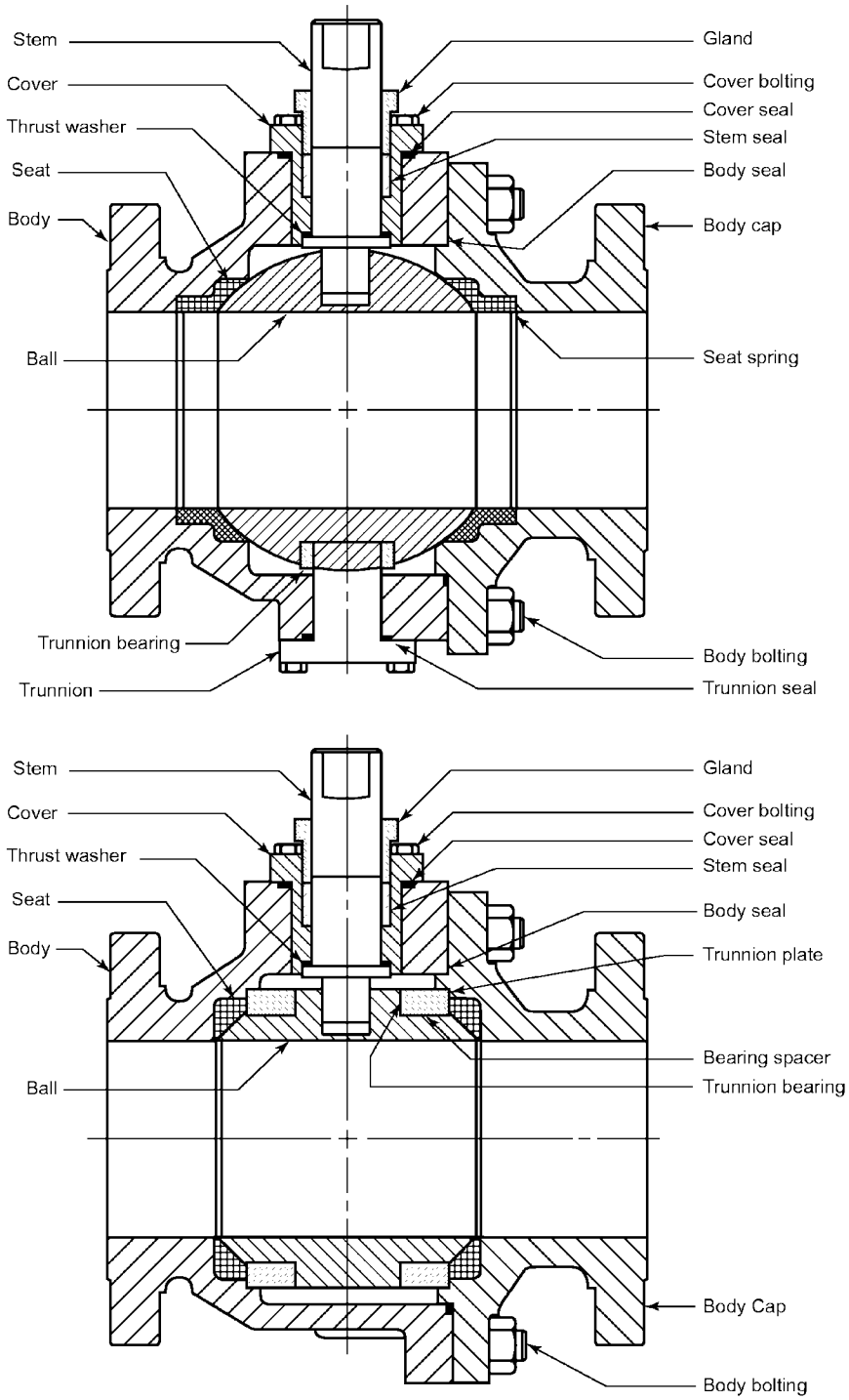


Figure 2—Two Examples of Typical Trunnion-mounted Ball Valve Components
(Split Body Valve Illustrated)

Table 1—Minimum Seat Pressure-temperature Ratings (Pounds per Square Inch Gauge)

| Temperature (degrees Fahrenheit) | PTFE[a] Seats | | | | Reinforced PTFE[a] Seats | | | |
|---|---|---|---|---|---|---|---|---|
| | Floating Ball | | | Trunnion | Floating Ball | | | Trunnion |
| | NPS ≤ 2 | 2< NPS ≤ 6 | NPS > 6 | NPS > 2 | NPS ≤ 2 | 2 ≤ NPS ≤ 6 | NPS > 6 | NPS > 2 |
| – 20 to 100[b] | 1000 | 740 | 285 | 740 | 1100 | 740 | 285 | 740 |
| 150 | 825 | 610 | 235 | 610 | 925 | 625 | 240 | 625 |
| 200 | 660 | 485 | 190 | 485 | 760 | 515 | 200 | 515 |
| 250 | 500 | 355 | 140 | 355 | 575 | 400 | 155 | 400 |
| 300 | 325 | 230 | 90 | 230 | 420 | 275 | 110 | 275 |
| 350 | 170 | 100 | 40 | 100 | 250 | 125 | 50 | 125 |
| 400 | – | – | – | – | 80 | 50 | 20 | 50 |

Note: For a given pressure class, the seat pressure-temperature ratings should not exceed the shell ratings given in ASME B16.34.
[a]Polytetrafluoroethylene.
[b]Consult manufacturer for minimum design temperature rating of the seat.

**4.5.3** Unless otherwise specified by the purchaser, the length of wrench or the gear ratio of the gear operator mechanism shall be designed such that the input force required to open or close the valve at manufacturer's published torque requirements for clean dry air service does not exceed 80 lbs (360 N). This shall be based on a differentials pressure equal to the maximum differential pressure rating of the valve at 100°F (38°C).

**4.5.4** Valves shall be closed by turning the closure device in the clockwise direction.

**4.5.5** Stops shall be provided for both the fully open and fully closed positions of the valve.

**4.5.6** Multiturn handwheels shall be marked to indicate the direction of opening or closing.

**4.5.7** If a valve is supplied with a lever-type handle, the handle shall be mounted parallel to the flow passage through the ball. If the purchaser specifies round or oval handles, a permanent means of indicating the open and closed positions shall be provided. The handle design shall not permit incorrect assembly.

Table 2—Minimum Cylinder Diameters for Determination of Port Size (Inches)

| NPS | Full Port | Regular Port | Reduced Port |
|---|---|---|---|
| 1/2 | 0.44 | 0.31 | NA |
| 3/4 | 0.69 | 0.47 | NA |
| 1 | 0.94 | 0.69 | 0.56 |
| 1 1/4 | 1.19 | 0.88 | 0.71 |
| 1 1/2 | 1.44 | 1.06 | 0.91 |
| 2 | 1.94 | 1.44 | 1.19 |
| 3 | 2.94 | 2.19 | 1.94 |
| 4 | 3.94 | 2.94 | 2.44 |
| 6 | 5.94 | 3.94 | 2.94 |
| 8 | 7.94 | 5.94 | 3.94 |
| 10 | 9.88 | 7.31 | 5.94 |
| 12 | 11.88 | 8.94 | 7.94 |

Note: NA = not applicable.

**4.5.8** The indication of the position of the port opening of the valve shall be integral with the valve stem. The indication may be accomplished by a mark on the stem or by a stem shape.

**4.5.9** Handwheels, handles, and other operators shall be fitted so that they may be removed and replaced without affecting the integrity of the stem and body seals.

**4.5.10** When specified in the purchase order, valves shall be furnished with a lockable device that accepts a purchaser-supplied lock (for example, a padlock) 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-millimeter) diameter shank, not more than 4 inches (102 millimeters) long, can be inserted directly through appropriate hole(s) and locked. Provision of a lockable device is permitted, even when it is not specified in the purchase order.

## 4.6 GLANDS

**4.6.1** Vertically split glands shall not be used.

**4.6.2** Adjustable glands shall be accessible for tightening stem seals without the disassembly of the valve or operator parts.

## 4.7 BALLS

Hollow balls are not covered by this standard and shall be furnished only if agreed to by the purchaser.

## 4.8 BALL STEM

**4.8.1** The stem shall be designed so that if failure of stem-to-ball or stem-to-internal stem occurs, no portion of the stem can be ejected from the valve as a result of internal pressure. The design shall not rely on external components (e.g., gear operators, actuators, etc.) to prevent ejection.

**4.8.2** Stem-to-ball connection and all parts of the stem within the pressure boundary shall, under torsional load, exceed the strength of the stem that lies above the packing by more than 20%. The determination of the stem strength may be done by calculation or testing.

**4.8.3** The stem and the connection between the stem and the ball shall be designed to resist permanent deformation or failure of any part when a force applied to the handle or gear operator (if the valve is equipped with one) produces a torque equal to the greater of 15 foot-pounds (20 Newton-meters) or two times the manufacturer's published torque requirement. The manufacturer's published torque requirement shall be based on clean, nonlubricated dry air service at a differential pressure equal to the maximum differential pressure rating of the valve at 100°F (38°C).

### 4.9 FLANGE FACE INTERRUPTIONS

Ring-shaped radial gaps in the faces of end flanges of flanged ball valves, located in the seating are of a centered, ASME B16.20 spiral-wound gasket, shall not exceed 0.030 inch (1 millimeter); see dimension "b" on Figure 3. An example in this category is the radial gap that exists between the outer periphery of a body insert and the inner bore of the body end flange of a valve as generally shown on Figure 1.

For ball valves designed with a body insert, as generally shown on Figure 1, with a gasket seating face outer diameter located within the seating area of a centered, ASME B16.20 spiral-wound gasket, the body insert flange face shall not protrude beyond the valve body end flange face. The body insert flange face shall not be recessed below the body end flange face by more than 0.010 inch (0.25 millimeters). See dimension "a" on Figure 3.

### 4.10 VALVE SHELL JOINTS AND BOLTING

**4.10.1** Nut and bolt head-bearing surfaces of shell parts assembled by bolting shall be within 1 degree of perpendicular to the centerline of the tapped or clearance hole for the fastener.

**4.10.2** Where bolting is used for shell part assembly, the bolting shall be studs with nuts or cap screws. Nuts shall be semifinished hexagons conforming to the ASME B18.2.2 Bolting shall be threaded in accordance with ASME B1.1. Bolting 1 inch (2.54 centimeters) or smaller shall have coarse (UNC) threads; bolting larger than 1 inch (2.54 centimeters) shall be of the eight-thread series (8 UN). Bolt threads shall be Class 2A, and nut threads shall be Class 2B.

### 4.11 PACKING GLAND BOLTING

**4.11.1** When used, 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.

**4.11.2** Packing gland bolts shall be designed so that the bolt stress shall not exceed one-third ($^1/_3$) of the minimum ultimate tensile strength of the bolt, with a compressive packing stress of 5,500 psi and a gland bolt temperature of 100°F.

## 5 Materials

### 5.1 SHELL

The shell, which is made up of the body, cover, body insert, and body cap, shall be of the materials specified in ASME B16.34.

### 5.2 TRIM

The internal metal parts of the valve, such as the ball, stem, and metal seats or seat retainers, shall be of the same nominal chemical composition as the shell and have mechanical and corrosion-resistance properties similar to those of the shell. The purchaser may specify a higher quality trim material.

### 5.3 IDENTIFICATION PLATE

The material of the identification plate shall be austenitic stainless steel or nickel alloy. When the identification plate is attached by pins, the pins shall be of materials similar to the identification plate.

### 5.4 BOLTING

Unless another bolt material is specified by the purchaser, body, cover, and gland bolting shall be at least intermediate-strength steel, as specified in ASME B16.5.

### 5.5 STEM SEALS, BODY SEALS, AND GASKETS

Material for stem seals, body seals, and gaskets shall be suitable for use at the maximum temperature rating applying to the valve. The minimum corrosion resistance or any metallic part of the gasket shall be equal to the corrosion resistance of the shell.

### 5.6 THREADED PLUGS

When plugs for tapped openings are provided (see 4.2.8 and 8.2), the corrosion resistance of the plug material shall be at least equal to that of the shell. Cast iron or malleable iron plugs shall not be used.

## 6 Inspection, Examination, Testing and Repair

### 6.1 INSPECTION AND EXAMINATION

**6.1.1** Each valve shall be visually examined by the manufacturer in accordance with API Std 598.

**6.1.2** When inspection by the purchaser is specified in the purchase order, it shall be in accordance with API Std 598.

### 6.2 PRESSURE TESTS

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

### 6.3 REPAIR OF DEFECTS

Defects, as revealed by inspection or testing, in the body of a cast or forged valve, shall be repaired as permitted by the most nearly applicable ASTM cast or forged material specification listed in ASME B16.34.

### 6.4 ASSEMBLY

Prior to valve testing the following apply:

**6.4.1** Light oil may be used to facilitate assembly of mating metal components.

**6.4.2** Light oil, with a viscosity no greater than kerosene, may be used to assemble o-rings or other seals required to move during valve assembly.

**6.4.3** No sealant or grease may be applied to the ball-seat interface.

## 7 Marking

**7.1** For ball valves that effect closure in one direction only, the valve body or body cap shall be furnished with a clearly visible cast, forged, machined-in, or die-stamped arrow to indicate the direction of shutoff.

**7.2** The identification plate shall be attached to the valve shell by pins or by welding.

**7.3** In addition to marking required by ASME B16.34, the identification plate shall be marked API Std 608.

## 8 Packaging and Shipping Requirements

### 8.1 COATINGS

**8.1.1** Unless otherwise specified in the purchase order, the unmachined exterior surfaces of a valve shall be coated in accordance with the manufacturer's standard. Coatings shall not contain lead. Nonferrous and austenitic stainless steel valves need not be coated.

**8.1.2** Machined or threaded surfaces that are not otherwise protected from atmospheric corrosion shall be coated with an easily removable rust preventive.

### 8.2 OPENINGS

**8.2.1** Except on small, individually packaged valves, valve ends shall be fully covered to protect the gasket surfaces, threaded ends, welding ends, and the valve internals during shipment and storage. The protective covers may be wood, wood fiber, plastic, or metal and shall be securely attached to the valve ends by bolting, steel straps, steel clips, or suitable friction-locking devices. The covers shall be of such design that the valve cannot be installed without complete removal of the protective covers.

A rust preventive shall be used on flange faces subject to rusting. When metal covers are used, nonasbestos, nonmetallic sheet gaskets shall be used to protect the flange facing.

**8.2.2** Taped openings shall be fitted with fully tightened, threaded, solid metal plugs (see 5.6).

### 8.3 BALL POSITION

Unless the valve is fitted with a spring-to-close actuator, it shall be shipped with the ball in the open position.

### 8.4 STEM SEALS

The valve shall be shipped with the stem seal installed.

### 8.5 PACKAGING

**8.5.1** When export packaging is not specified in the purchase order, valves may be shipped loose, palletized, or packed in a box or crate. Valves shall be packaged to prevent damage during shipment.

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

## 9 Recommended Spare Parts

When specified in 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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