**Prepared by:** JZB1

# MATERIAL SPECIFICATION FOR CARBON STEEL BALL VALVES F-21.1

**Asset Type:** Gas Transmission and Distribution **Function:** Design

**Issued by:** [redacted] Original Signed By **Date:** 09-16-10

**Rev. #**04: This document replaces Revision #03. For a description of the changes, see Page 26.

## Purpose and Scope

This numbered document provides material specifications and ordering instructions for carbon steel ball valves. It includes the design and furnishing of carbon steel ball valves, 2" and larger for either buried or non-buried service, for use in natural gas pipelines.

## Acronyms

ANSI: American National Standards Institute
API: American Petroleum Institute
FPT: female pipe thread
IPS: iron pipe size
psig: pounds per square inch gauge
SAP: Systems Applications and Products in Data Processing
WT: wall thickness

| References | Document |
|---|---|
| Pipe Thread Sealants | B-17 |
| Selecting and Applying Coatings for Buried Transmission Pipe | E-35 |
| Buried Valve Supports 16" to 42" | F-12 |
| Standard Ball Valve List: 1/4" Through 2" | F-20 |
| Standard Ball Valve List: Carbon Steel 2" Through 24" | F-21 |
| Specification for Pipeline Valves | API 6D |

## General Information

1. General Requirements
   A. All valves shall be furnished with a full port, and complete as specified in the PG&E purchase order.
   B. Flanged-end valves shall be furnished with raised-face flanges, unless specified otherwise in the PG&E purchase order.
   C. Any body relief shall be removed and plugged.
   D. Valves having the capability for seat lubrication shall be provided with large Sealweld Flow Wolf (Part Number F-FW-1/2) buttonhead grease fittings.
   E. All valves are to be furnished with a body blowdown valve no smaller than 1/2" (larger sizes are acceptable). Small valves with taps less than 1/2" may be bushed up to 1/2". In no case shall the body blowdown valve be furnished in a size smaller than the body drain tap. The body blowdown valve shall be a ball valve meeting the requirements of Numbered Document F-20. The body blowdown valve shall have screwed ends and a maximum working pressure of 2,500 to 3,000 psig.
   F. Valves with a gear operator shall be supplied with a position indicator showing from closed to full-open positions. Valves without a gear operator shall have a visible indicator near the top of the 2" square operating nut to indicate full-open or full-closed positions. Buried wrench-operated valves with a 2" square operating nut shall have an indicator to show the full-open or full-closed positions and the number of turns required to fully open and fully close the valve, if they have a gear box.
   G. For weld-end valves, the pipe WT shall be stamped on the valve.

H. Valves for aboveground application shall be coated with the manufacturer's standard primer (minimum 2 mils dry film thickness) to prevent corrosion.

I. Torque Requirements

(1) Quarter-turn wrench-operated valves shall not exceed a maximum breakaway torque of 200 foot-pounds at the maximum differential pressure. The gear operators on valves shall not exceed a running torque of 80 foot-pounds, and a maximum running handwheel rim pull force of 40 pounds, unless pre-approved by PG&E. See Table A-1 on Page 15 through Table D-4 on Page 23.

(2) The gear operators on valves shall not exceed 125 turns from open to closed position, unless pre-approved by PG&E. See Table A-1 on Page 15 through Table D-4 on Page 23.

J. The use of **Teflon tape** on threaded valve connections **is prohibited.** The following pipe thread sealants are the **only** thread sealants that are **approved** for use (see Numbered Document B-17):

(1) Rectorseal No. 5 pipe thread compound

(2) Key Tite waterproof pipe joint compound

2. Special Requirements for Buried Valves

A. Valves specified on the purchase orders as being for buried service shall meet all of the special requirements of this section, and all other applicable requirements of this numbered document.

B. The body blowdown, lube, and sealant fittings on each valve shall be extended to the locations shown in Figure 1 on Page 11, Figure 2 on Page 12, Figure 3 on Page 13, and Figure 4 on Page 14, and as specified in the purchase order, using seamless, Grade B, Schedule 80 pipe. Except for the last connection to the valve body, and the Sealweld Flow Wolf fitting and body blowdown valve, all joints are to be socket-welded. These lines shall contain no unions. The body blowdown extension shall be no smaller than 1/2" IPS. The extended body blowdown, lube, and sealant lines shall be mounted parallel to the shaft extension and located 1" to 2" from the outside of the shaft extension, unless approved by PG&E in writing. Stem sealant and stem seal vent fittings shall be plugged.

C. The extended lube lines shall be filled with lubricant.

D. The Sealweld Flow Wolf buttonhead sealant fittings and body blowdown ball valve shall point radially outward from and be made perpendicular to the extension shaft (by using 90° elbows) when the fitting and valve are located under a gear box as shown in Exhibit 1 (Figure 1 on Page 11). They shall be pointed in an upward direction for pinion extensions and for Exhibit 4 extensions (Figure 4 on Page 14). In no case shall they be located so that access to the fitting and valve is restricted from the top of a buried valve by the pinion or the Exhibit 4 extension. If access is restricted, locate the fitting and valve at a distance greater than 2" from the pinion or shaft to clear the restriction.

E. Coating for Buried Valves

(1) All valves and appurtenances for buried service shall have their complete exterior, including all extension lines, buried gear boxes, etc., shop-coated with one of the following three epoxy coatings (see Numbered Document E-35) after the shell test (see Item 3B) is performed:

- DevGrip 238
- DevTar 247 (no longer acceptable for application in California)
- Bar Rust 235 (no longer acceptable for application in California)

(2) The coating shall be applied in accordance with the requirements of Numbered Document E-35 (latest revision) and this numbered document.

(3) A minimum of two coats of the epoxy coating, with an appropriate drying time between each coat per Numbered Document E-35, are required.

(4) The minimum coating thickness shall apply to all coated areas; e.g., bolt heads, corners, clips, the outside surface of extension lines, behind extension lines, etc. For a valve with a high-head extension and a vertically mounted handwheel, the coating shall be applied to the high-head extension and all extension lines to a height of 18" below the bottom of the gear box or the square operating nut. Body blowdown valves and grease fittings shall be covered to prevent being coated by the epoxy coating.

(5) The finished coating shall be “holiday free” (i.e., contain no holes or defects). The finished coating on the valve body shall pass an electrical “holiday” test using a wet sponge with a test voltage between 60 and 75 volts.

F. Exhibit 1 valves shall have a Bettis breather (Bettis Part Number 029198) installed on the extension tube.

G. Exhibit 1 valves shall have the body blowdown valve located on the opposite side of the extension from the handwheel.

H. The valve supports shown in Numbered Document F-12 must be used for buried ball valve installation 16” and larger.

3. Test Requirements

A. The test requirements in this section are in addition to the test requirements of API 6D. The cost for the additional tests described in this section shall be included in all valve price quotes.

B. Shell and Seat Hydrostatic Tests.

(1) All weld-end valves shall be shell tested to a minimum of 1.8 times their 100°F rated working pressure unless they are supplied from manufacturer’s stock. The valves shall be shell tested before any coating is applied.

495 psi for ANSI Class 150

1,296 psi for ANSI Class 300

1,728 psi for ANSI Class 400

2,592 psi for ANSI Class 600

3,888 psi for ANSI Class 900

(2) All flange-end valves shall be tested to the minimum pressures required by API 6D.

(3) When weld-end valves are supplied from stock, the manufacturer shall either furnish a letter of certification stating that the valves may be shell tested to a maximum of 1.8 times the valve rating without damaging the valve or affecting the manufacturer’s warranty, or test the valve to 1.8 times the rating of the valve and provide documentation as such.

(4) Valves shall be complete, including (if applicable) the body blowdown lines, the body blowdown ball valves, and all associated fittings except grease fittings, before performing the shell and seat hydrostatic tests.

C. Air Seat Test

(1) All the valves (including valves supplied from the manufacturer’s stock) shall successfully complete an air seat test as described in Appendix C of API 6D, “Specification for Pipeline Valves” (latest edition). The test pressure shall be between 70 and 90 psig, and the minimum test duration shall be 5 minutes.

(2) Valves shall be cycled from the full-open to full-closed position a minimum of 5 times before the air seat test is performed.

(3) A test certificate shall be provided for each valve documenting the successful completion of the shell test, the hydrostatic seat test, and the air seat test.

D. Torque Tests

The designated PG&E inspector can require torque tests for any valve to verify that the maximum torque design values have been met. All torque tests must be performed with the actual valve operator installed. The use of an “identical” or “representative” operator in place of the actual operator is not allowed.

4. Inspection Requirements

A. All valves furnished under this specification may be inspected at the discretion of PG&E.

B. The designated PG&E inspector shall witness all tests required by this specification.

C. Valves larger than 12” shall be inspected by a designated PG&E inspector before shipment from the manufacturer.

D. Valves 12” and smaller shall be inspected by the designated PG&E inspector before shipment from the manufacturer if the valve is to be coated and/or furnished with extended gearing.

E. PG&E's Supplier Quality shall be notified a minimum of 3 working days before the valve(s) are completed and ready for final testing by contacting the supervising inspection engineer at the following numbers.

Phone: (415) 973-6323 Fax: (415) 973-7632

F. PG&E's designated inspector(s) shall be allowed free entry into the facilities where the valves are tested and stored and be given all reasonable assistance required for the inspection of the valves.

5. Shipping Requirements

A. Valves shall be shipped in the open position with the ends tightly covered to prevent dirt and moisture from entering the valves.

B. Weld ends shall be protected to prevent bevel damage.

C. Valves and all parts shall be protected to prevent damage. The valve coating shall also be protected, if present.

D. Single-bolt lifting eyes shall be removed before shipping, unless they are welded to the valve closure. PG&E employees are never to weld lifting eyes to valves. For 14" and larger buried valves, two-bolt lifting eyes are required and can remain on the valve. Two-bolt lifting eyes are acceptable on valves smaller than 14".

E. Valves with feet that are single-bolted to the closure shall have them removed or welded to the closure before shipment. PG&E employees are never to weld feet to valves.

F. Shipping tabs shall be removed, unless they are two-bolt and on buried valves.

G. Valves shall be shipped with a minimum of two copies of the operating and maintenance instructions for the valve. Additional copies shall be provided as requested on the purchase order.

H. Valves shall be placed on one continuous pallet or crated for shipping.

I. Valves shall be shipped in flatbed trucks.

6. Ordering Instructions

A. Aboveground valves

The valves shall be ordered per PG&E code numbers shown in Numbered Document F-21.

B. Buried valves

(1) When ordering buried ball valves, use the information on Form F-21.1-F01, "Buried Ball Valve Description" (Attachment A) in the SAP long text description. The intended installation for each buried ball valve needs to be clearly described. There are four basic installations:

- Figure 1, "Ball Valve, High-Head Extension"
- Figure 2, "Ball Valve, Buried Upright"
- Figure 3, "Ball Valve, Buried On-Side"
- Figure 4, "Ball Valve, Buried Installation - 2", 3", and 4""

(2) Only the responsible PG&E engineer can approve changes to the SAP technical description of the valve(s). PG&E's Supplier Quality must be notified of any changes from the original description shown in the purchase order.

(3) Code numbers for buried valves are listed in the following tables:

**Table 1 Ball Valves for Buried Service – Exhibit 1, (Figure 1)**

| Code | Valve Size (Inches) | ANSI Rating | Pipe Wall Thickness (Inches) | Pipe Grade | A Dimension (Feet) |
|---|---|---|---|---|---|
| 030458 | 6 | 300 | 0.280 | X42 | 6 |
| 030615 | 6 | 300 | 0.280 | X42 | 7 |
| 030720 | 6 | 300 | 0.280 | X42 | 8 |
| 030788 | 6 | 300 | 0.280 | X42 | 9 |
| 030826 | 8 | 300 | 0.322 | X42 | 6 |
| 030853 | 8 | 300 | 0.322 | X42 | 7 |

## Material Specification for Carbon Steel Ball Valves

**Table 1 Ball Valves for Buried Service – Exhibit 1, (Figure 1)**, continued

| Code | Valve Size (Inches) | ANSI Rating | Pipe Wall Thickness (Inches) | Pipe Grade | A Dimension (Feet) |
|---|---|---|---|---|---|
| 031007 | 8 | 300 | 0.322 | X42 | 8 |
| 031008 | 8 | 300 | 0.322 | X42 | 9 |
| 031009 | 10 | 300 | 0.365 | X42 | 6 |
| 031010 | 10 | 300 | 0.365 | X42 | 7 |
| 031011 | 10 | 300 | 0.365 | X42 | 8 |
| 031018 | 10 | 300 | 0.365 | X42 | 9 |
| 031019 | 12 | 300 | 0.375 | X42 | 6 |
| 031020 | 12 | 300 | 0.375 | X42 | 7 |
| 031021 | 12 | 300 | 0.375 | X42 | 8 |
| 031022 | 12 | 300 | 0.375 | X42 | 9 |
| 031023 | 16 | 300 | 0.375 | X52 | 6 |
| 031024 | 16 | 300 | 0.375 | X52 | 7 |
| 031025 | 16 | 300 | 0.375 | X52 | 8 |
| 031026 | 16 | 300 | 0.375 | X52 | 9 |
| 031027 | 20 | 300 | 0.375 | X60 | 6 |
| 031028 | 20 | 300 | 0.375 | X60 | 7 |
| 031029 | 20 | 300 | 0.375 | X60 | 8 |
| 031030 | 20 | 300 | 0.375 | X60 | 9 |
| 031031 | 22 | 300 | 0.375 | X60 | 6 |
| 031033 | 22 | 300 | 0.375 | X60 | 7 |
| 031034 | 22 | 300 | 0.375 | X60 | 8 |
| 031035 | 22 | 300 | 0.375 | X60 | 9 |
| 031036 | 24 | 300 | 0.375 | X60 | 6 |
| 031037 | 24 | 300 | 0.375 | X60 | 7 |
| 031038 | 24 | 300 | 0.375 | X60 | 8 |
| 031039 | 24 | 300 | 0.375 | X60 | 9 |
| 031040 | 6 | 600 | 0.280 | X42 | 6 |
| 031041 | 6 | 600 | 0.280 | X42 | 7 |
| 031042 | 6 | 600 | 0.280 | X42 | 8 |
| 031043 | 6 | 600 | 0.280 | X42 | 9 |
| 031044 | 8 | 600 | 0.322 | X42 | 6 |
| 031045 | 8 | 600 | 0.322 | X42 | 7 |
| 031046 | 8 | 600 | 0.322 | X42 | 8 |
| 031048 | 8 | 600 | 0.322 | X42 | 9 |
| 031049 | 10 | 600 | 0.380 | X42 | 6 |
| 031050 | 10 | 600 | 0.380 | X42 | 7 |
| 031051 | 10 | 600 | 0.380 | X42 | 8 |
| 031052 | 10 | 600 | 0.380 | X42 | 9 |

## Material Specification for Carbon Steel Ball Valves

**Table 1 Ball Valves for Buried Service – Exhibit 1, (Figure 1)**, continued

| Code | Valve Size (Inches) | ANSI Rating | Pipe Wall Thickness (Inches) | Pipe Grade | A Dimension (Feet) |
|---|---|---|---|---|---|
| 031053 | 12 | 600 | 0.450 | X42 | 6 |
| 031054 | 12 | 600 | 0.450 | X42 | 7 |
| 031055 | 12 | 600 | 0.450 | X42 | 8 |
| 031056 | 12 | 600 | 0.450 | X42 | 9 |
| 031057 | 16 | 600 | 0.456 | X60 | 6 |
| 031058 | 16 | 600 | 0.456 | X60 | 7 |
| 031059 | 16 | 600 | 0.456 | X60 | 8 |
| 031061 | 16 | 600 | 0.456 | X60 | 9 |
| 031062 | 20 | 600 | 0.494 | X60 | 6 |
| 031063 | 20 | 600 | 0.494 | X60 | 7 |
| 031064 | 20 | 600 | 0.494 | X60 | 8 |
| 031065 | 20 | 600 | 0.494 | X60 | 9 |
| 031066 | 24 | 600 | 0.592 | X60 | 6 |
| 031067 | 24 | 600 | 0.592 | X60 | 7 |
| 031068 | 24 | 600 | 0.592 | X60 | 8 |
| 031069 | 24 | 600 | 0.592 | X60 | 9 |

**Table 2 Ball Valves for Buried Service – Exhibit 2, (Figure 2)**

| Code | Valve Size (Inches) | ANSI Rating | Pipe Wall Thickness (Inches) | Pipe Grade | A Dimension (Feet) |
|---|---|---|---|---|---|
| 031070 | 12 | 300 | 0.375 | X42 | 2.5 |
| 031071 | 12 | 300 | 0.375 | X42 | 3 |
| 031072 | 12 | 300 | 0.375 | X42 | 3.5 |
| 031073 | 12 | 300 | 0.375 | X42 | 4 |
| 031074 | 16 | 300 | 0.375 | X52 | 2.5 |
| 031075 | 16 | 300 | 0.375 | X52 | 3 |
| 031076 | 16 | 300 | 0.375 | X52 | 3.5 |
| 031077 | 16 | 300 | 0.375 | X52 | 4 |
| 031084 | 20 | 300 | 0.375 | X60 | 2.5 |
| 031085 | 20 | 300 | 0.375 | X60 | 3 |
| 031086 | 20 | 300 | 0.375 | X60 | 3.5 |
| 031088 | 20 | 300 | 0.375 | X60 | 4 |
| 031090 | 22 | 300 | 0.375 | X60 | 2.5 |
| 031093 | 22 | 300 | 0.375 | X60 | 3 |
| 031094 | 22 | 300 | 0.375 | X60 | 3.5 |
| 031095 | 22 | 300 | 0.375 | X60 | 4 |
| 031096 | 24 | 300 | 0.375 | X60 | 2.5 |

## Material Specification for Carbon Steel Ball Valves

**Table 2 Ball Valves for Buried Service – Exhibit 2, (Figure 2)**, continued

| Code | Valve Size (Inches) | ANSI Rating | Pipe Wall Thickness (Inches) | Pipe Grade | A Dimension (Feet) |
|---|---|---|---|---|---|
| 031097 | 24 | 300 | 0.375 | X60 | 3 |
| 031098 | 24 | 300 | 0.375 | X60 | 3.5 |
| 031099 | 24 | 300 | 0.375 | X60 | 4 |
| 031100 | 12 | 600 | 0.450 | X42 | 2.5 |
| 031101 | 12 | 600 | 0.450 | X42 | 3 |
| 031102 | 12 | 600 | 0.450 | X42 | 3.5 |
| 031103 | 12 | 600 | 0.450 | X42 | 4 |
| 031104 | 16 | 600 | 0.456 | X60 | 2.5 |
| 031105 | 16 | 600 | 0.456 | X60 | 3 |
| 031106 | 16 | 600 | 0.456 | X60 | 3.5 |
| 031107 | 16 | 600 | 0.456 | X60 | 4 |
| 031108 | 20 | 600 | 0.494 | X60 | 2.5 |
| 031109 | 20 | 600 | 0.494 | X60 | 3 |
| 031110 | 20 | 600 | 0.494 | X60 | 3.5 |
| 031111 | 20 | 600 | 0.494 | X60 | 4 |
| 031112 | 24 | 600 | 0.592 | X60 | 2.5 |
| 031113 | 24 | 600 | 0.592 | X60 | 3 |
| 031114 | 24 | 600 | 0.592 | X60 | 3.5 |
| 031115 | 24 | 600 | 0.592 | X60 | 4 |

**Table 3 Ball Valves for Buried Service – Exhibit 3, (Figure 3)**

| Code | Valve Size (Inches) | ANSI Rating | Pipe Wall Thickness (Inches) | Pipe Grade | A Dimension (Feet) |
|---|---|---|---|---|---|
| 031116 | 6 | 300 | 0.280 | X42 | 2.5 |
| 031117 | 6 | 300 | 0.280 | X42 | 3 |
| 031118 | 6 | 300 | 0.280 | X42 | 3.5 |
| 031119 | 6 | 300 | 0.280 | X42 | 4 |
| 031120 | 8 | 300 | 0.322 | X42 | 2.5 |
| 031121 | 8 | 300 | 0.322 | X42 | 3 |
| 031124 | 8 | 300 | 0.322 | X42 | 3.5 |
| 031125 | 8 | 300 | 0.322 | X42 | 4 |
| 031126 | 10 | 300 | 0.365 | X42 | 2.5 |
| 031127 | 10 | 300 | 0.365 | X42 | 3 |
| 031128 | 10 | 300 | 0.365 | X42 | 3.5 |
| 031129 | 10 | 300 | 0.365 | X42 | 4 |
| 031130 | 12 | 300 | 0.375 | X42 | 2.5 |
| 031131 | 12 | 300 | 0.375 | X42 | 3 |

**Table 3 Ball Valves for Buried Service – Exhibit 3, (Figure 3)**, continued

| Code | Valve Size (Inches) | ANSI Rating | Pipe Wall Thickness (Inches) | Pipe Grade | A Dimension (Feet) |
|---|---|---|---|---|---|
| 031140 | 12 | 300 | 0.375 | X42 | 3.5 |
| 031142 | 12 | 300 | 0.375 | X42 | 4 |
| 031145 | 16 | 300 | 0.375 | X52 | 2.5 |
| 031146 | 16 | 300 | 0.375 | X52 | 3 |
| 031148 | 16 | 300 | 0.375 | X52 | 3.5 |
| 031150 | 16 | 300 | 0.375 | X52 | 4 |
| 031151 | 20 | 300 | 0.375 | X60 | 2.5 |
| 031152 | 20 | 300 | 0.375 | X60 | 3 |
| 031153 | 20 | 300 | 0.375 | X60 | 3.5 |
| 031154 | 20 | 300 | 0.375 | X60 | 4 |
| 031158 | 22 | 300 | 0.375 | X60 | 2.5 |
| 031163 | 22 | 300 | 0.375 | X60 | 3 |
| 031164 | 22 | 300 | 0.375 | X60 | 3.5 |
| 031165 | 22 | 300 | 0.375 | X60 | 4 |
| 031173 | 24 | 300 | 0.375 | X60 | 2.5 |
| 031192 | 24 | 300 | 0.375 | X60 | 3 |
| 031203 | 24 | 300 | 0.375 | X60 | 3.5 |
| 031205 | 24 | 300 | 0.375 | X60 | 4 |
| 031209 | 6 | 600 | 0.280 | X42 | 2.5 |
| 031215 | 6 | 600 | 0.280 | X42 | 3 |
| 031220 | 6 | 600 | 0.280 | X42 | 3.5 |
| 031221 | 6 | 600 | 0.280 | X42 | 4 |
| 031227 | 8 | 600 | 0.322 | X42 | 2.5 |
| 031229 | 8 | 600 | 0.322 | X42 | 3 |
| 031230 | 8 | 600 | 0.322 | X42 | 3.5 |
| 031272 | 8 | 600 | 0.322 | X42 | 4 |
| 031276 | 10 | 600 | 0.380 | X42 | 2.5 |
| 031321 | 10 | 600 | 0.380 | X42 | 3 |
| 031325 | 10 | 600 | 0.380 | X42 | 3.5 |
| 031335 | 10 | 600 | 0.380 | X42 | 4 |
| 031360 | 12 | 600 | 0.450 | X42 | 2.5 |
| 031367 | 12 | 600 | 0.450 | X42 | 3 |
| 031374 | 12 | 600 | 0.450 | X42 | 3.5 |
| 031389 | 12 | 600 | 0.450 | X42 | 4 |
| 031390 | 16 | 600 | 0.456 | X60 | 2.5 |
| 031391 | 16 | 600 | 0.456 | X60 | 3 |
| 031392 | 16 | 600 | 0.456 | X60 | 3.5 |
| 031393 | 16 | 600 | 0.456 | X60 | 4 |

## Material Specification for Carbon Steel Ball Valves

**Table 3 Ball Valves for Buried Service – Exhibit 3, (Figure 3)**, continued

| Code | Valve Size (Inches) | ANSI Rating | Pipe Wall Thickness (Inches) | Pipe Grade | A Dimension (Feet) |
|---|---|---|---|---|---|
| 031396 | 20 | 600 | 0.494 | X60 | 2.5 |
| 031413 | 20 | 600 | 0.494 | X60 | 3 |
| 031414 | 20 | 600 | 0.494 | X60 | 3.5 |
| 031416 | 20 | 600 | 0.494 | X60 | 4 |
| 031417 | 24 | 600 | 0.592 | X60 | 2.5 |
| 031418 | 24 | 600 | 0.592 | X60 | 3 |
| 031421 | 24 | 600 | 0.592 | X60 | 3.5 |
| 031422 | 24 | 600 | 0.592 | X60 | 4 |

**Table 4 Ball Valves for Buried Service – Exhibit 4, (Figure 4)**

| Code | Valve Size (Inches) | ANSI Rating | Pipe Wall Thickness (Inches) | Pipe Grade | A Dimension (Feet) |
|---|---|---|---|---|---|
| 032001 | 2 | 300 | 0.154 | B | 3 |
| 032002 | 2 | 300 | 0.154 | B | 3-1/2 |
| 032003 | 2 | 300 | 0.154 | B | 4 |
| 032004 | 2 | 300 | 0.154 | B | 4-1/2 |
| 032005 | 2 | 300 | 0.154 | B | 5 |
| 032019 | 3 | 300 | 0.216 | B | 3 |
| 032020 | 3 | 300 | 0.216 | B | 3-1/2 |
| 032021 | 3 | 300 | 0.216 | B | 4 |
| 032022 | 3 | 300 | 0.216 | B | 4-1/2 |
| 032023 | 3 | 300 | 0.216 | B | 5 |
| 032033 | 4 | 300 | 0.237 | B | 3 |
| 032035 | 4 | 300 | 0.237 | B | 3-1/2 |
| 032036 | 4 | 300 | 0.237 | B | 4 |
| 032037 | 4 | 300 | 0.237 | B | 4-1/2 |
| 032038 | 4 | 300 | 0.237 | B | 5 |
| 032006 | 2 | 600 | 0.154 | B | 3 |
| 032012 | 2 | 600 | 0.154 | B | 3-1/2 |
| 032015 | 2 | 600 | 0.154 | B | 4 |
| 032016 | 2 | 600 | 0.154 | B | 4-1/2 |
| 032018 | 2 | 600 | 0.154 | B | 5 |
| 032024 | 3 | 600 | 0.216 | B | 3 |
| 032026 | 3 | 600 | 0.216 | B | 3-1/2 |
| 032027 | 3 | 600 | 0.216 | B | 4 |
| 032028 | 3 | 600 | 0.216 | B | 4-1/2 |
| 032029 | 3 | 600 | 0.216 | B | 5 |

**Table 4 Ball Valves for Buried Service – Exhibit 4, (Figure 4)**, continued

| Code | Valve Size (Inches) | ANSI Rating | Pipe Wall Thickness (Inches) | Pipe Grade | A Dimension (Feet) |
|---|---|---|---|---|---|
| 032039 | 4 | 600 | 0.237 | B | 3 |
| 032040 | 4 | 600 | 0.237 | B | 3-1/2 |
| 032041 | 4 | 600 | 0.237 | B | 4 |
| 032042 | 4 | 600 | 0.237 | B | 4-1/2 |
| 032043 | 4 | 600 | 0.237 | B | 5 |



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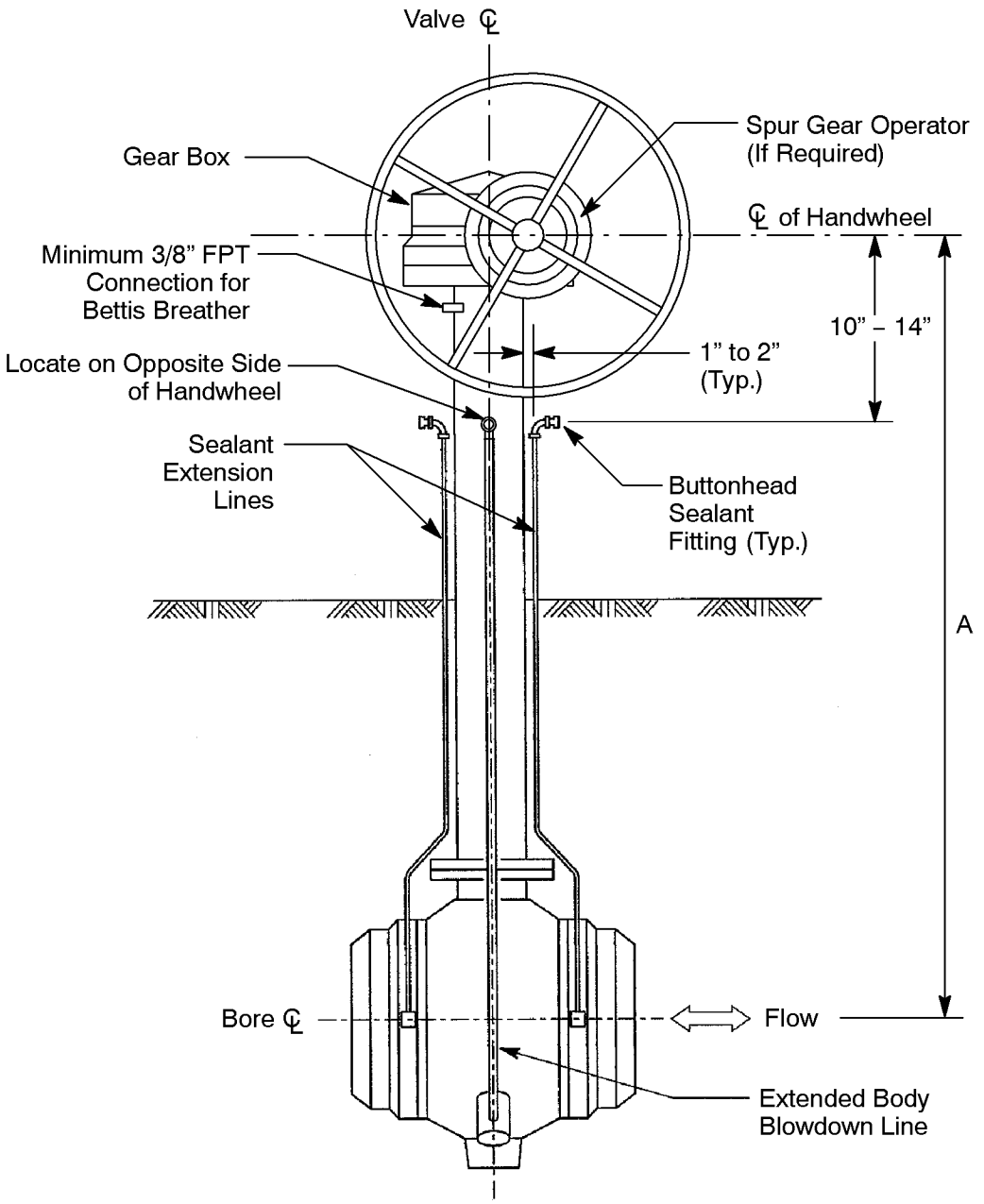
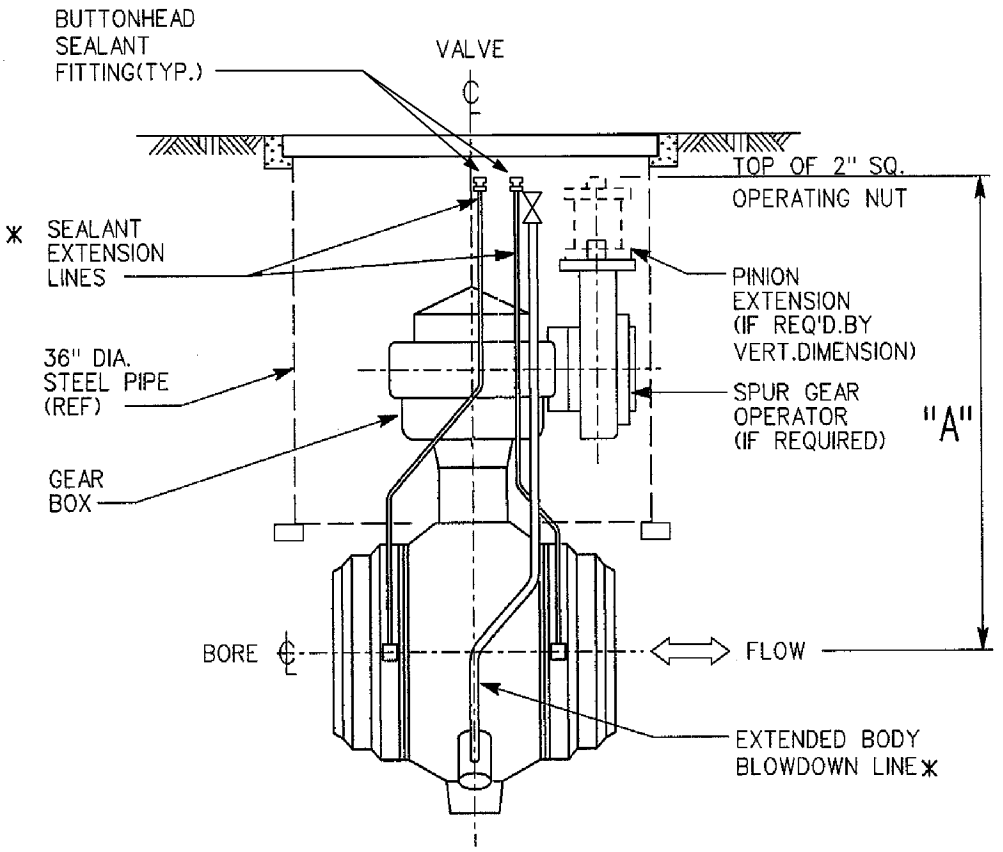



**Figure 1 – (Exhibit 1)**
**Ball Valve, Buried With High-Head Installation**




* INSTALL BODY BLOWDOWN AND SEALANT EXTENSION LINES AS CLOSE AS PRACTICAL TO GEAR BOX AND TO 2" OPERATING NUT TO ALLOW CLEARANCE FOR THE FIELD-INSTALLED VALVE FRAME (36" PIPE) & COVER.

**Figure 2 – (Exhibit 2)**
**Ball Valve, Buried Upright Installation**

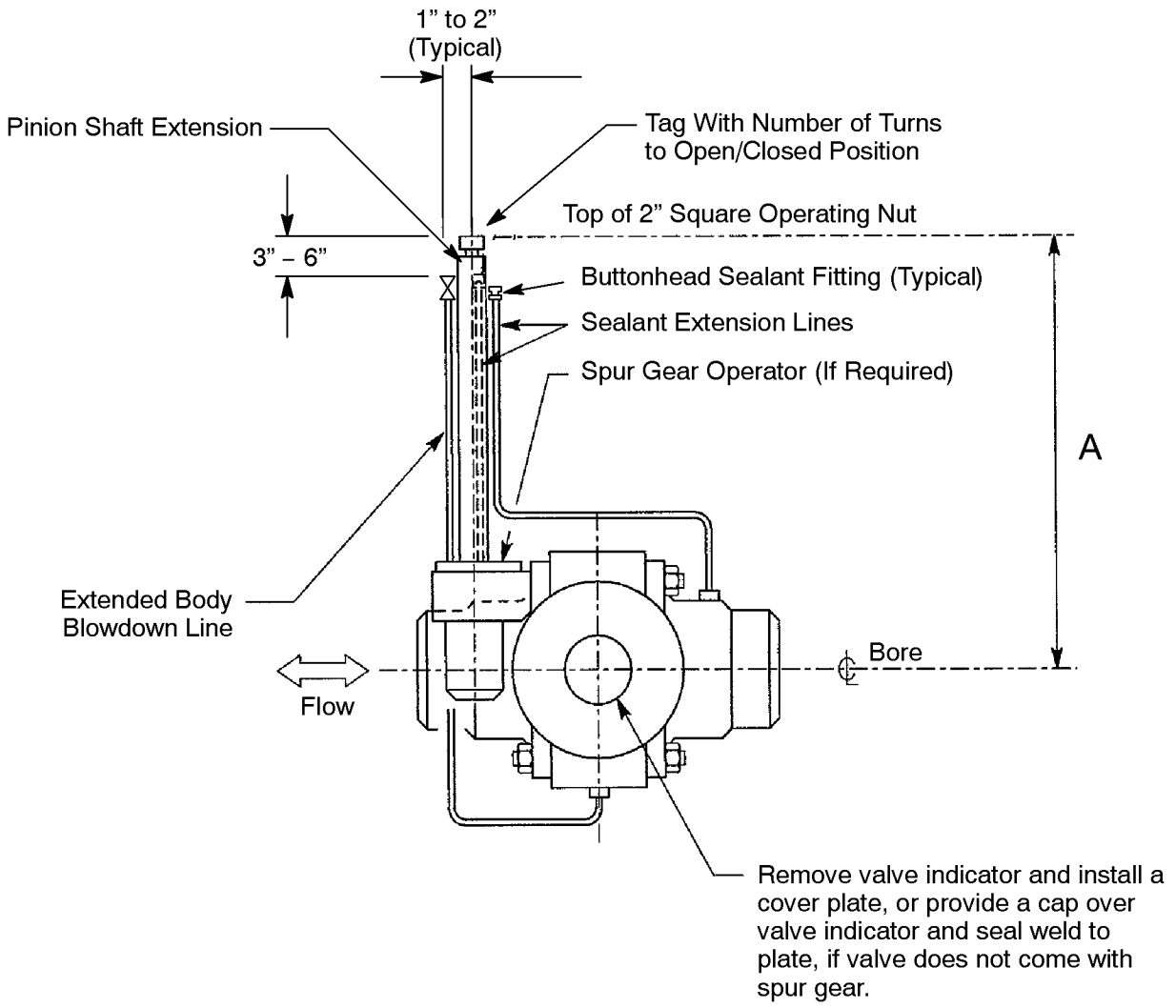



**Figure 3 – (Exhibit 3)**
**Ball Valve, Buried On-Side Installation**

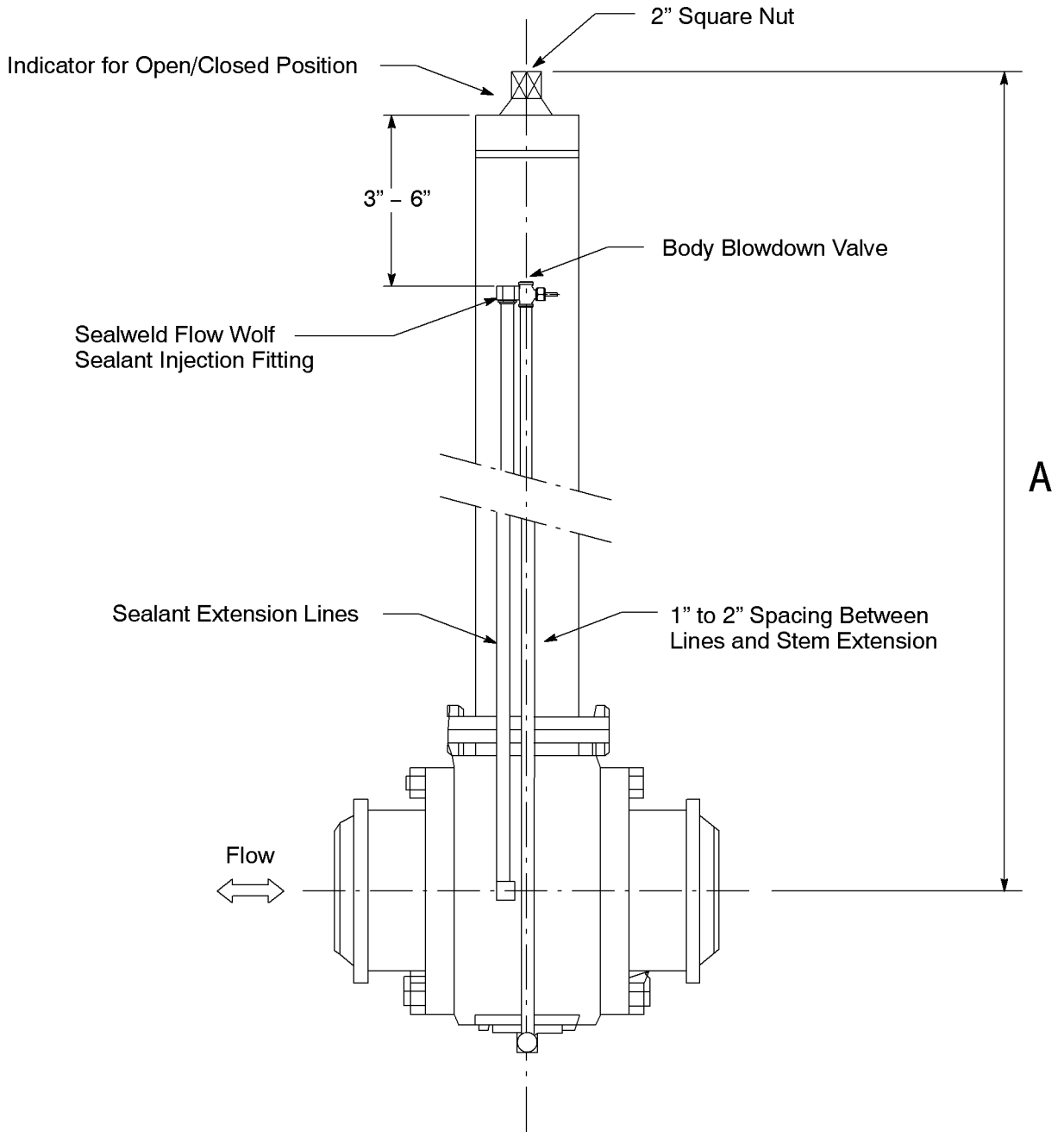



**Figure 4 – (Exhibit 4)**
**Ball Valve, Buried Installation - 2”, 3”, and 4”**

# Material Specification for Carbon Steel Ball Valves

## *Cooper Cameron*

**Table A-1 Gear Requirements for Cooper Cameron Valves – Ball Valve Operator Information, ANSI 150**

| Valve Size (Inches) | Gear Model | | Handwheel Diameter (Inches) | Mechanical Advantage | Turns to Close | Break Torque (Inch-Pounds) | Break Rim Pull (Pounds) | Run Rim Pull (Pounds) |
|---|---|---|---|---|---|---|---|---|
| 6 | Rotork | Model 880N | 18 | 13.2 | 9.5 | 5,423 | 46 | 46 |
| 8 | | Model 1950G | 18 | 19.0 | 13 | 7,965 | 47 | 43 |
| 10 | | | 24 | 19.0 | 13 | 11,440 | 67 | 67 |
| 12 | | Model IW5/IR1 | 18 | 64.6 | 40 | 16,806 | 29 | 23 |
| 14 | | | 24 | 64.6 | 40 | 20,688 | 36 | 27 |
| 16 | | | 24 | 64.6 | 40 | 24,897 | 33 | 24 |
| 18 | Cameron | WG1/B6 | 24 | 110 | 112.5 | 31,890 | 25 | 17 |
| 20 | | | 18 | 110 | 112.5 | 38,680 | 39 | 26 |
| 22 | | | 18 | 110 | 112.5 | 46,100 | 47 | 30 |
| 24 | | | 18 | 110 | 112.5 | 56,090 | 57 | 36 |
| 26 | | WG1/S12 | 24 | 153 | 190 | 66,650 | 37 | 23 |
| 30 | | | 24 | 153 | 190 | 81,775 | 45 | 27 |
| 36 | | | 36 | 153 | 190 | 121,914 | 45 | 27 |

**Table A-2 Gear Requirements for Cooper Cameron Valves – Ball Valve Operator Information, ANSI 300**

| Valve Size (Inches) | Gear Model | | Handwheel Diameter (Inches) | Mechanical Advantage | Turns to Close | Break Torque (Inch-Pounds) | Break Rim Pull (Pounds) | Run Rim Pull (Pounds) |
|---|---|---|---|---|---|---|---|---|
| 6 | Rotork | Model 880N | 18 | 13.2 | 9.5 | 5,911 | 50 | 46 |
| 8 | | Model 1950G | 18 | 19.0 | 13 | 11,086 | 65 | 43 |
| 10 | | | 24 | 19.0 | 13 | 15,070 | 66 | 51 |
| 12 | | Model IW5/IR1 | 18 | 64.6 | 40 | 22,402 | 39 | 23 |
| 14 | | | 24 | 64.6 | 40 | 28,650 | 37 | 21 |
| 16 | | | 24 | 64.6 | 40 | 35,908 | 47 | 24 |
| 18 | Cameron | WG1/B6 | 24 | 110 | 112.5 | 47,678 | 37 | 17 |
| 20 | | | 18 | 110 | 112.5 | 60,520 | 62 | 26 |
| 22 | | | 24 | 110 | 112.5 | 73,400 | 56 | 22 |
| 24 | | | 24 | 110 | 112.5 | 89,760 | 68 | 27 |
| 26 | | WG1/S12 | 24 | 153 | 190 | 107,600 | 59 | 23 |
| 30 | | | 30 | 153 | 190 | 134,100 | 59 | 22 |
| 36 | | | 24 | 297 | 297 | 236,520 | 67 | 26 |



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# Material Specification for Carbon Steel Ball Valves

**Table A-3 Gear Requirements for Cooper Cameron Valves – Ball Valve Operator Information, ANSI 400**

| Valve Size (Inches) | Gear Model | | Handwheel Diameter (Inches) | Mechanical Advantage | Turns to Close | Break Torque (Inch-Pounds) | Break Rim Pull (Pounds) | Run Rim Pull (Pounds) |
|---|---|---|---|---|---|---|---|---|
| 6 | Rotork | Model 880N | 18 | 13.2 | 9.5 | 6,278 | 53 | 46 |
| 8 | | Model 1950G | 18 | 19.0 | 13 | 12,801 | 75 | 43 |
| 10 | | | 24 | 19.0 | 13 | 17,600 | 78 | 51 |
| 12 | | Model IW5/IR1 | 18 | 64.6 | 40 | 25,477 | 44 | 23 |
| 14 | | | 24 | 64.6 | 40 | 33,025 | 43 | 21 |
| 16 | Cameron | WG1/B6 | 18 | 110 | 112.5 | 41,958 | 43 | 19 |
| 18 | | | 24 | 110 | 112.5 | 56,353 | 43 | 17 |
| 20 | | WG1/S12 | 24 | 153 | 190 | 72,520 | 40 | 14 |
| 22 | | | 24 | 153 | 190 | 88,400 | 49 | 16 |
| 24 | | | 24 | 153 | 190 | 108,260 | 59 | 19 |
| 26 | | | 24 | 153 | 190 | 130,100 | 71 | 23 |
| 30 | | | 36 | 153 | 190 | 162,850 | 60 | 18 |
| 36 | | | 30 | 297 | 297 | 286,020 | 65 | 21 |

**Table A-4 Gear Requirements for Cooper Cameron Valves – Ball Valve Operator Information, ANSI 600**

| Valve Size (Inches) | Gear Model | | Handwheel Diameter (Inches) | Mechanical Advantage | Turns to Close | Break Torque (Inch-Pounds) | Break Rim Pull (Pounds) | Run Rim Pull (Pounds) |
|---|---|---|---|---|---|---|---|---|
| 6 | Rotork | Model 880N | 24 | 13.2 | 9.5 | 6,999 | 45 | 35 |
| 8 | | Model 1950G | 24 | 19.0 | 13 | 16,163 | 71 | 32 |
| 10 | | | 30 | 19.0 | 13 | 22,559 | 80 | 41 |
| 12 | | Model IW5/IR1 | 24 | 64.6 | 40 | 31,504 | 41 | 18 |
| 14 | | | 30 | 64.6 | 40 | 41,600 | 43 | 17 |
| 16 | Cameron | WG1/B6 | 18 | 110 | 112.5 | 53,816 | 55 | 19 |
| 18 | | | 24 | 110 | 112.5 | 73,356 | 56 | 17 |
| 20 | | WG1/S12 | 24 | 153 | 190 | 96,040 | 53 | 14 |
| 22 | | | 24 | 153 | 190 | 117,800 | 65 | 16 |
| 24 | | | 30 | 153 | 190 | 144,520 | 63 | 16 |
| 26 | | | 36 | 153 | 190 | 174,200 | 64 | 15 |
| 30 | | | 30 | 297 | 297 | 261,740 | 59 | 13 |
| 36 | | | 42 | 297 | 297 | 383,040 | 62 | 15 |

# Material Specification for Carbon Steel Ball Valves

## *Grove*

**Table B-1 Gear Requirements for Grove B5 Valves – Ball Valve Operator Information, ANSI 150**

| Valve Size (Inches) | Gear Model | Handwheel Diameter (Inches) | Mechanical Advantage | Turns to Close | Break Torque (Inch-Pounds) | Break Rim Pull (Pounds) | Run Rim Pull (Pounds) |
|---|---|---|---|---|---|---|---|
| 6 | MA-46<br>M-14 | 14<br>18 | 11.6<br>16.2 | 11.5<br>15 | 3,864<br>3,937 | 48<br>27 | 28<br>15 |
| 8 | MC-72<br>M15 | 18<br>24 | 19.4<br>20.5 | 18<br>17 | 6,408<br>6,396 | 37<br>26 | 22<br>16 |
| 10 | MC-72<br>M15 | 18<br>24 | 19.4<br>20.5 | 18<br>17 | 10,320<br>10,332 | 59<br>42 | 36<br>26 |
| 12 | MC-72<br>M16 | 24<br>24 | 19.4<br>26.5 | 18<br>22 | 12,804<br>12,720 | 55<br>40 | 37<br>27 |
| 14 | MFF57/S3 | 24 | 44.5 | 42.75 | 18,120 | 34 | 23 |
| 16 | MFF57/S3 | 30 | 44.5 | 42.75 | 22,452 | 34 | 23 |
| 18 | MFF36/S5 | 30 | 52 | 45 | 35,136 | 45 | 25 |
| 20 | MFF36/S5 | 30 | 52 | 45 | 41,004 | 53 | 27 |
| 22 | MJF50/S5 | 30 | 73 | 62.5 | 51,504 | 47 | 26 |
| 24 | MLF60/D12 | 24 | 156.5 | 180 | 67,956 | 36 | 21 |
| 26 | MLF60/D12 | 24 | 156.5 | 180 | 83,532 | 44 | 30 |
| 28 | MLF60/D12 | 30 | 156.5 | 180 | 99,276 | 42 | 29 |
| 30 | MLF60/D12 | 30 | 156.5 | 180 | 106,212 | 45 | 32 |
| 32 | MLF60/D12 | 30 | 156.5 | 180 | 119,604 | 51 | 35 |
| 34 | MLF60/D12 | 30 | 156.5 | 180 | 134,988 | 58 | 38 |
| 36 | MLF60/D12 | 30 | 156.5 | 180 | 152,232 | 65 | 46 |

**Table B-2 Gear Requirements for Grove B5 Valves – Ball Valve Operator Information, ANSI 300**

| Valve Size (Inches) | Gear Model | Handwheel Diameter (Inches) | Mechanical Advantage | Turns to Close | Break Torque (Inch-Pounds) | Break Rim Pull (Pounds) | Run Rim Pull (Pounds) |
|---|---|---|---|---|---|---|---|
| 6 | MA-46<br>M14 | 14<br>18 | 11.6<br>16.2 | 11.5<br>15 | 5,388<br>5,395 | 66<br>37 | 31<br>17 |
| 8 | MC-72<br>M15 | 18<br>24 | 19.4<br>20.5 | 18<br>17 | 10,824<br>10,824 | 62<br>44 | 22<br>16 |
| 10 | MFF57/S3<br>M15 | 18<br>24 | 44.5<br>20.5 | 42.75<br>17 | 14,964<br>15,006 | 37<br>61 | 16<br>26 |
| 12 | MFF57/S3<br>M16 | 24<br>24 | 44.5<br>26.5 | 42.75<br>22 | 19,716<br>19,716 | 37<br>62 | 16<br>27 |
| 14 | MFF57/S3 | 24 | 44.5 | 42.75 | 26,832 | 50 | 23 |
| 16 | MFF36/S5 | 30 | 52 | 45 | 34,188 | 44 | 19 |
| 18 | MFF36/S5 | 30 | 52 | 45 | 49,392 | 63 | 25 |
| 20 | MJF50/S5 | 30 | 73 | 62.5 | 66,564 | 61 | 19 |
| 22 | MLF60/D12 | 24 | 156.5 | 180 | 87,408 | 47 | 15 |
| 24 | MLF60/D12 | 24 | 156.5 | 180 | 100,404 | 53 | 21 |

## Material Specification for Carbon Steel Ball Valves

**Table B-2 Gear Requirements for Grove B5 Valves – Ball Valve Operator Information, ANSI 300,** Continued

| Valve Size (Inches) | Gear Model | Handwheel Diameter (Inches) | Mechanical Advantage | Turns to Close | Break Torque (Inch-Pounds) | Break Rim Pull (Pounds) | Run Rim Pull (Pounds) |
|---|---|---|---|---|---|---|---|
| 26 | MLF60/D12 | 24 | 156.5 | 180 | 127,596 | 68 | 30 |
| 28 | MLF60/D12 | 30 | 156.5 | 180 | 145,368 | 62 | 29 |
| 30 | MLF60/D12 | 30 | 156.5 | 180 | 161,292 | 69 | 32 |
| 32 | MLF60/D12 | 36 | 156.5 | 180 | 178,680 | 63 | 29 |
| 34 | MPF50/D15 | 36 | 188.5 | 187.3 | 188,604 | 56 | 27 |
| 36 | MPF50/D15 | 36 | 188.5 | 187.5 | 239,580 | 71 | 31 |

**Table B-3 Gear Requirements for Grove B5 Valves – Ball Valve Operator Information, ANSI 600**

| Valve Size (Inches) | Gear Model | Handwheel Diameter (Inches) | Mechanical Advantage | Turns to Close | Break Torque (Inch-Pounds) | Break Rim Pull (Pounds) | Run Rim Pull (Pounds) |
|---|---|---|---|---|---|---|---|
| 6 | MA-46<br>M14 | 18<br>18 | 11.6<br>16.2 | 11.5<br>15 | 7,956<br>8,019 | 76<br>55 | 24<br>17 |
| 8 | MC-72<br>M15 | 24<br>24 | 19.4<br>20.5 | 18<br>17 | 16,056<br>15,990 | 69<br>65 | 17<br>16 |
| 10 | MFF57/S3<br>M15 | 24<br>30 | 44.5<br>20.5 | 42.75<br>17 | 21,972<br>21,833 | 41<br>71 | 12<br>20 |
| 12 | MFF57/S3<br>M16 | 24<br>30 | 44.5<br>26.5 | 42.75<br>22 | 28,440<br>28,620 | 53<br>72 | 16<br>22 |
| 14 | MFF36/S5 | 30 | 52 | 45 | 42,240 | 54 | 15 |
| 16 | MFF36/S5 | 36 | 52 | 45 | 50,364 | 54 | 16 |
| 18 | MLF60/D12 | 36 | 156.5 | 180 | 87,930 | 31 | 7 |
| 20 | MLF60/D12 | 36 | 156.5 | 180 | 104,184 | 37 | 7 |
| 22 | MLF60/D12 | 24 | 156.5 | 180 | 122,388 | 65 | 17 |
| 24 | MLF60/D12 | 30 | 156.5 | 180 | 148,244 | 63 | 16 |
| 26 | MPF50/D15 | 36 | 188.5 | 187.3 | 172,248 | 51 | 15 |
| 28 | MPF50/D15 | 36 | 188.5 | 187.3 | 190,896 | 53 | 16 |
| 30 | MPF50/D15 | 36 | 188.5 | 187.3 | 230,052 | 68 | 21 |
| 32 | M0F50/D15 | 36 | 188.5 | 187.3 | 246,012 | 73 | 22 |
| 34 | MTF50/DB6/D9 | 36 | 520.3 | 674.75 | 272,604 | 29 | 9 |
| 36 | MTF50/DB6/D9 | 36 | 520.3 | 674.75 | 322,704 | 34 | 11 |

## Material Specification for Carbon Steel Ball Valves

**Table B-4 Gear Requirements for Grove B5 Valves – Ball Valve Operator Information, ANSI 900**

| Valve Size (Inches) | Gear Model | Handwheel Diameter (Inches) | Mechanical Advantage | Turns to Close | Break Torque (Inch-Pounds) | Break Rim Pull (Pounds) | Run Rim Pull (Pounds) |
|---|---|---|---|---|---|---|---|
| 6 | MC-72<br>M15 | 24<br>24 | 19.4<br>20.5 | 18<br>17 | 11,076<br>11,070 | 48<br>45 | 11<br>10 |
| 8 | MFF57/S3<br>M15 | 24<br>24 | 44.5<br>20.5 | 42.75<br>17 | 20,784<br>20,664 | 39<br>84 | 7<br>16 |
| 10 | MFF57/S3<br>M16 | 24<br>30 | 44.5<br>26.5 | 42.75<br>22 | 32,076<br>32,198 | 60<br>81 | 12<br>16 |
| 12 | MFF57/S3<br>M16 | 24<br>30 | 44.5<br>26.5 | 42.75<br>22 | 38,844<br>38,955 | 73<br>98 | 16<br>22 |
| 14 | MJF50/S5 | 30 | 73 | 62.5 | 54,564 | 50 | 11 |
| 16 | MJF50/S5 | 30 | 73 | 62.5 | 62,412 | 57 | 14 |
| 18 | MLF60/D12 | 24 | 156.5 | 180 | 115,272 | 61 | 10 |
| 20 | MLF60/D12 | 36 | 156.5 | 180 | 148,212 | 53 | 7 |
| 22 | MPF50/D15 | 36 | 188.5 | 187.3 | 193,812 | 57 | 9 |
| 24 | MPF50/D15 | 36 | 188.5 | 187.3 | 217,056 | 64 | 12 |



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# Material Specification for Carbon Steel Ball Valves

## *PBV-USA, Inc.*

**Table C-1 Gear Requirements for PBV-USA, Inc. – 6700 [1] Series Ball Valve Operator Information, ANSI 150**

| Valve Size (Inches) | Zy-Gear Model | Handwheel Diameter (Inches) | Mechanical Advantage | Turns to Close | Break Torque (Inch-Pounds) | Break Rim Pull (Pounds) | Run Rim Pull (Pounds) |
|---|---|---|---|---|---|---|---|
| 6 | W108 | 24 | 14.9 | 18.5 | 4,032 | 23 | 11 |
| 8 | W208 | 24 | 18.4 | 17 | 7,440 | 34 | 17 |
| 10 | W208 | 24 | 18.4 | 17 | 11,280 | 51 | 26 |
| 12 | W208 | 24 | 18.4 | 17 | 14,940 | 68 | 34 |
| 14 | W308 | 24 | 56.7 | 69 | 20,160 | 30 | 15 |
| 16 | W308 | 24 | 56.7 | 69 | 24,660 | 36 | 18 |
| 18 | W308 | 30 | 56.7 | 69 | 28,560 | 34 | 17 |
| 20 | W308 | 30 | 56.7 | 69 | 44,940 | 53 | 26 |
| 24 | W408 | 30 | 142.4 | 175 | 69,540 | 33 | 16 |

[1] PBV-USA Series 6900 (welded body design) will be considered for purchase on a case-by-case basis.

**Table C-2 Gear Requirements for PBV-USA, Inc. – 6700 [1] Series Ball Valve Operator Information, ANSI 300**

| Valve Size (Inches) | Zy-Gear Model | Handwheel Diameter (Inches) | Mechanical Advantage | Turns to Close | Break Torque (Inch-Pounds) | Break Rim Pull (Pounds) | Run Rim Pull (Pounds) |
|---|---|---|---|---|---|---|---|
| 6 | W108 | 24 | 11 | 12.5 | 6,240 | 47 | 24 |
| 8 | W208 | 24 | 18.4 | 17 | 10,800 | 49 | 24 |
| 10 | W208 | 24 | 18.4 | 17 | 17,820 | 81 | 40 |
| 12 | W208 | 30 | 18.4 | 17 | 22,320 | 81 | 40 |
| 14 | W308 | 24 | 56.7 | 69 | 30,336 | 45 | 22 |
| 16 | W308 | 24 | 56.7 | 69 | 37,680 | 55 | 28 |
| 18 | W308 | 30 | 56.7 | 69 | 42,240 | 50 | 25 |
| 20 | W408 | 30 | 142.4 | 175 | 83,040 | 39 | 19 |
| 24 | W408 | 30 | 142.4 | 175 | 127,440 | 60 | 30 |

[1] PBV-USA Series 6900 (welded body design) will be considered for purchase on a case-by-case basis.

## Material Specification for Carbon Steel Ball Valves

**Table C-3 Gear Requirements for PBV-USA, Inc. – 6700 [1] Series Ball Valve Operator Information, ANSI 600**

| Valve Size (Inches) | Zy-Gear Model | Handwheel Diameter (Inches) | Mechanical Advantage | Turns to Close | Break Torque (Inch-Pounds) | Break Rim Pull (Pounds) | Run Rim Pull (Pounds) |
|---|---|---|---|---|---|---|---|
| 6 | W108 | 24 | 14.9 | 18.5 | 9,480 | 53 | 27 |
| 8 | W208 | 24 | 18.4 | 17 | 16,140 | 73 | 37 |
| 10 | W308 | 24 | 56.7 | 69 | 28,380 | 42 | 21 |
| 12 | W308 | 24 | 56.7 | 69 | 34,320 | 50 | 25 |
| 14 | W308 | 24 | 56.7 | 69 | 46,800 | 69 | 34 |
| 16 | W308 | 30 | 56.7 | 69 | 58,740 | 69 | 35 |
| 18 | W408 | 30 | 142.4 | 175 | 100,200 | 47 | 23 |
| 20 | W408 | 30 | 142.4 | 175 | 144,600 | 68 | 34 |
| 24 | W408 | 30 | 142.4 | 175 | 229,440 | 107 | 54 |

[1] PBV-USA Series 6900 (welded body design) will be considered for purchase on a case-by-case basis.

**Table C-4 Gear Requirements for PBV-USA, Inc. – 6700 [1] Series Ball Valve Operator Information, ANSI 900**

| Valve Size (Inches) | Zy-Gear Model | Handwheel Diameter (Inches) | Mechanical Advantage | Turns to Close | Break Torque (Inch-Pounds) | Break Rim Pull (Pounds) | Run Rim Pull (Pounds) |
|---|---|---|---|---|---|---|---|
| 6 | W208 | 24 | 18.4 | 17 | 12,300 | 56 | 28 |
| 8 | W208 | 30 | 18.4 | 17 | 21,180 | 77 | 38 |
| 10 | W308 | 30 | 56.7 | 69 | 41,040 | 48 | 24 |
| 12 | W308 | 30 | 56.7 | 69 | 47,820 | 56 | 28 |
| 14 | W308 | 30 | 56.7 | 69 | 60,480 | 71 | 36 |
| 16 | W408 | 30 | 142.4 | 175 | 76,080 | 36 | 18 |
| 20 | W408 | 30 | 142.4 | 175 | 184,080 | 86 | 43 |

[1] PBV-USA Series 6900 (welded body design) will be considered for purchase on a case-by-case basis.

## *KF Trunnion*

**Table D-1 Gear Requirements for KF Trunnion – P3 Series Ball Valve Operator Information, ANSI 150**

| Valve Size (Inches) | Gear Model WG | Handwheel Diameter (Inches) | Mechanical Advantage | Turns to Close | Break Torque (Inch-Pounds) | Break Rim Pull (Pounds) | Run Rim Pull (Pounds) |
|---|---|---|---|---|---|---|---|
| 6 | 20 | 11.8 | 18.7 | 15.5 | 5,611 | 50.8 | 17.8 |
| 8 | 20 | 11.8 | 18.7 | 15.5 | 8,726 | 78.7 | 27.5 |
| 10 | 20 | 19.7 | 18.7 | 15.5 | 11,683 | 63.4 | 22.2 |
| 12 | 20 | 19.7 | 18.7 | 15.5 | 14,648 | 79.5 | 27.8 |
| 14 | M36 | 31.5 | 19 | 15.5 | 24,737 | 82.7 | 28.9 |
| 16 | MR70 | 27.6 | 48.3 | 42.5 | 33,234 | 49.9 | 17.5 |
| 18 | MR70 | 27.6 | 48.3 | 42.5 | 45,050 | 67.6 | 23.7 |
| 20 | MR70 | 31.5 | 48.3 | 42.5 | 56,688 | 74.5 | 26.1 |
| 24 | MR120 | 39.4 | 62.5 | 54 | 108,811 | 88.4 | 30.9 |
| 30 | MRE260 | 27.6 | 133.3 | 138.7 | 164,447 | 89.4 | 31.3 |
| 36 | MRE260 | 39.4 | 133.3 | 138.7 | 203,478 | 77.5 | 27.1 |

**Table D-2 Gear Requirements for KF Trunnion – P3 Series Ball Valve Operator Information, ANSI 300**

| Valve Size (Inches) | Gear Model WG | Handwheel Diameter (Inches) | Mechanical Advantage | Turns to Close | Break Torque (Inch-Pounds) | Break Rim Pull (Pounds) | Run Rim Pull (Pounds) |
|---|---|---|---|---|---|---|---|
| 6 | 20 | 11.8 | 18.7 | 15.5 | 8,921.5 | 80.7 | 28.3 |
| 8 | 20 | 19.7 | 18.7 | 15.5 | 13,860.2 | 75.2 | 26.3 |
| 10 | M25 | 27.6 | 16.7 | 12.5 | 18,099.7 | 78.5 | 27.5 |
| 12 | M25 | 27.6 | 16.7 | 12.5 | 22,020.6 | 95.6 | 33.4 |
| 14 | MR70 | 27.6 | 48.3 | 42.5 | 37,314.7 | 56.0 | 19.6 |
| 16 | MR70 | 27.6 | 48.3 | 42.5 | 49,900.4 | 74.9 | 26.2 |
| 18 | MR95 | 39.4 | 53.4 | 46.3 | 72,947.7 | 69.3 | 24.3 |
| 20 | MR120 | 31.5 | 62.5 | 54 | 97,552.8 | 99.1 | 34.7 |
| 24 | MRE260 | 27.6 | 133.3 | 138.7 | 171,651.0 | 93.3 | 32.7 |
| 30 | MR340 | 39.4 | 144.7 | 127.5 | 234,015.0 | 85.3 | 29.8 |
| 36 | MRE600 | 27.6 | 250.0 | 225.0 | 302,403.0 | 87.7 | 30.7 |

## Material Specification for Carbon Steel Ball Valves

**Table D-3 Gear Requirements for KF Trunnion – P3 Series Ball Valve Operator Information, ANSI 600**

| Valve Size (Inches) | Gear Model WG | Handwheel Diameter (Inches) | Mechanical Advantage | Turns to Close | Break Torque (Inch-Pounds) | Break Rim Pull (Pounds) | Run Rim Pull (Pounds) |
|---|---|---|---|---|---|---|---|
| 6 | 20 | 19.7 | 18.7 | 15.5 | 14,276.2 | 77.5 | 27.1 |
| 8 | M25 | 27.6 | 16.7 | 12.5 | 22,162.2 | 96.2 | 33.7 |
| 10 | M36 | 31.5 | 19.0 | 15.5 | 28,464.0 | 95.1 | 33.3 |
| 12 | MR70 | 27.6 | 48.3 | 42.5 | 33,969.1 | 51.0 | 17.9 |
| 14 | MR70 | 27.6 | 48.3 | 42.5 | 57,697.9 | 86.6 | 30.3 |
| 16 | MR95 | 39.4 | 53.4 | 46.3 | 76,877.5 | 73.1 | 25.6 |
| 18 | MRE140 | 31.5 | 87.5 | 86.7 | 118,113.0 | 85.7 | 30.0 |
| 20 | MRE260 | 27.6 | 133.3 | 138.7 | 163,677.0 | 89.0 | 31.1 |
| 24 | MR340 | 39.4 | 144.7 | 127.5 | 273,311.0 | 95.9 | 33.6 |
| 30 | MRE600 | 39.4 | 250.0 | 225.0 | 370,208.0 | 75.2 | 26.3 |
| 36 | MRE600 | 39.4 | 250.0 | 225.0 | 462,504.0 | 93.9 | 32.9 |

**Table D-4 Gear Requirements for KF Trunnion – P3 Series Ball Valve Operator Information, ANSI 900**

| Valve Size (Inches) | Gear Model WG | Handwheel Diameter (Inches) | Mechanical Advantage | Turns to Close | Break Torque (Inch-Pounds) | Break Rim Pull (Pounds) | Run Rim Pull (Pounds) |
|---|---|---|---|---|---|---|---|
| 6 | M25 | 11.81 | 16.7 | 12.5 | 19,639.8 | 199.2 | 69.7 |
| 8 | M36 | 31.5 | 19.0 | 15.5 | 30,464.2 | 101.8 | 35.6 |
| 10 | MR70 | 19.7 | 48.3 | 42.5 | 38,819.3 | 81.6 | 28.6 |
| 12 | MR70 | 27.6 | 48.3 | 42.5 | 45,908.7 | 68.9 | 24.1 |
| 14 | MR95 | 39.4 | 53.4 | 46.3 | 78,090.0 | 74.2 | 26.0 |
| 16 | MR120 | 31.5 | 62.5 | 54.0 | 103,846.0 | 105.5 | 36.9 |
| 18 | MRE260 | 27.6 | 133.3 | 138.7 | 163,278.0 | 88.8 | 31.1 |
| 20 | MRE260 | 39.4 | 133.3 | 138.7 | 229,800.0 | 87.5 | 30.6 |
| 24 | MRE600 | 39.4 | 250.0 | 225.0 | 374,979.0 | 76.1 | 26.6 |
| 30 | MRE600 | 47.2 | 250.0 | 225.0 | 497,393.0 | 84.3 | 29.5 |
| 36 | MR800 | 39.4 | 380.9 | 360.0 | 622,605.0 | 83.0 | 29.0 |



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## Material Specification for Carbon Steel Ball Valves

**Table E–1 Gear Requirements for Delta 55 Ball Valves – Ball Valve Operator Information, ANSI 150**

| Valve Size (Inches) | Gear Model | Handwheel Diameter (Inches) | Mechanical Advantage | Turns to Close | Break Torque (Inch-Pounds) | Break Rim Pull (Pounds) | Run Rim Pull (Pounds) |
|---|---|---|---|---|---|---|---|
| 6 | 10KE20 | 16 | 16.7 | 20 | 4134 | 21 | 14 |
| 8 | 10KE30 | 16 | 13.3 | 16 | 6,722 | 42 | 26 |
| 10 | 10KE30 | 16 | 13.3 | 16 | 10,829 | 68 | 42 |
| 12 | 10KE40 | 24 | 15 | 12 | 14,143 | 79 | 51 |
| 14 | 10KE40 | 24 | 15 | 12 | 19,579 | 109 | 70 |
| 16 | 10KE40 | 24 | 15 | 12 | 24,572 | 137 | 88 |
| 18 | 10KE80 | 24 | 59 | 59 | 36,891 | 52 | 29 |
| 20 | MLF60/D9 | 36 | 118 | 135 | 43,044 | 20 | 11 |
| 24 | MLF60/D9 | 36 | 118 | 135 | 71,343 | 34 | 20 |
| 26 | MLF60/D9 | 36 | 118 | 135 | 90,999 | 43 | 28 |
| 30 | MLF60/D9 | 36 | 118 | 135 | 123,114 | 58 | 38 |

**Table E–2 Gear Requirements for Delta 55 Ball Valves – Ball Valve Operator Information, ANSI 300**

| Valve Size (Inches) | Gear Model | Handwheel Diameter (Inches) | Mechanical Advantage | Turns to Close | Break Torque (Inch-Pounds) | Break Rim Pull (Pounds) | Run Rim Pull (Pounds) |
|---|---|---|---|---|---|---|---|
| 6 | 10KE20 | 16 | 16.7 | 20 | 5,652 | 29 | 14 |
| 8 | 10KE30 | 16 | 13.3 | 16 | 11,358 | 71 | 26 |
| 10 | 10KE30 | 16 | 13.3 | 16 | 15,710 | 98 | 42 |
| 12 | 10KE40 | 24 | 15 | 12 | 20,697 | 115 | 51 |
| 14 | 10KE40 | 24 | 15 | 12 | 28,156 | 156 | 71 |
| 16 | 10KE80 | 24 | 59 | 59 | 35,889 | 51 | 23 |
| 18 | 10KE80 | 24 | 59 | 59 | 51,837 | 73 | 29 |
| 20 | MLF60D9 | 36 | 118 | 135 | 69,855 | 33 | 20 |
| 24 | MLF60D9 | 36 | 118 | 135 | 105,378 | 50 | 28 |
| 26 | MLF60D9 | 36 | 118 | 135 | 133,925 | 63 | 38 |
| 30 | MPF50/D12/S3 | 30 | 384.2 | 450 | 169,288 | 30 | 14 |
| 32 | MPF50/D12/S3 | 30 | 384.2 | 450 | 187,544 | 33 | 15 |
| 34 | MPF50/D12/S3 | 30 | 384.2 | 450 | 197,954 | 35 | 17 |
| 36 | MPF50/D12/S3 | 30 | 384.2 | 450 | 251,466 | 44 | 20 |
| 40 | MPF50/D12/S3 | 30 | 384.2 | 450 | 280,620 | 49 | 22 |
| 42 | MPF50/D12/S3 | 30 | 384.2 | 450 | 315,150 | 55 | 25 |

## Material Specification for Carbon Steel Ball Valves

**Table E–3 Gear Requirements for Delta 55 Ball Valves – Ball Valve Operator Information, ANSI 600**

| Valve Size (Inches) | Gear Model | Handwheel Diameter (Inches) | Mechanical Advantage | Turns to Close | Break Torque (Inch-Pounds) | Break Rim Pull (Pounds) | Run Rim Pull (Pounds) |
|---|---|---|---|---|---|---|---|
| 6 | 10KE20 | 16 | 16.7 | 20 | 8,359 | 42 | 14 |
| 8 | 10KE30 | 16 | 13.3 | 16 | 16,858 | 105 | 26 |
| 10 | 10KE30 | 16 | 13.3 | 16 | 23,072 | 144 | 42 |
| 12 | 10KE40 | 24 | 15 | 12 | 29,873 | 166 | 51 |
| 14 | 10KE80 | 24 | 59 | 59 | 44,366 | 63 | 18 |
| 16 | 10KE80 | 24 | 59 | 59 | 52,891 | 75 | 23 |
| 18 | MLF60/D9 | 36 | 118 | 135 | 92,354 | 44 | 10 |
| 20 | MLF60/D9 | 36 | 118 | 135 | 109,418 | 52 | 11 |
| 24 | MLF60/D9 | 36 | 118 | 135 | 155,675 | 74 | 19 |
| 26 | MLF60/D9 | 36 | 118 | 135 | 180,906 | 85 | 25 |
| 30 | MPF50/D12/S3 | 30 | 384 | 450 | 241,611 | 42 | 13 |
| 36 | MPF50/D12/S3 | 30 | 384 | 450 | 338,914 | 59 | 18 |
| 42 | MTF50/DB6/D9 | 36 | 520 | 675 | 429,094 | 46 | 14 |

**Table E–4 Gear Requirements for Delta 55 Ball Valves – Ball Valve Operator Information, ANSI 900**

| Valve Size (Inches) | Gear Model | Handwheel Diameter (Inches) | Mechanical Advantage | Turns to Close | Break Torque (Inch-Pounds) | Break Rim Pull (Pounds) | Run Rim Pull (Pounds) |
|---|---|---|---|---|---|---|---|
| 6 | 10KE30 | 16 | 13.3 | 16 | 11,629 | 73 | 17 |
| 8 | 10KE30 | 16 | 13.3 | 16 | 21,819 | 136 | 26 |
| 10 | 10KE40 | 24 | 15 | 12 | 33,674 | 187 | 37 |
| 12 | 10KE80 | 24 | 59 | 59 | 40,792 | 58 | 13 |
| 14 | 10KE80 | 24 | 59 | 59 | 57,287 | 81 | 18 |
| 16 | 10KE80 | 24 | 59 | 59 | 65,531 | 93 | 23 |
| 18 | MLF60/D9 | 36 | 118 | 135 | 121,034 | 57 | 10 |
| 20 | MLF60/D9 | 36 | 118 | 135 | 155,622 | 73 | 11 |
| 24 | MPF50/D12/S3 | 30 | 384 | 450 | 227,915 | 40 | 8 |
| 26 | MPF50/D12/S3 | 30 | 384 | 450 | 262,228 | 46 | 11 |
| 28 | MPF50/D12/S3 | 30 | 384 | 450 | 302,773 | 53 | 13 |
| 30 | MPF50/D12/S3 | 30 | 384 | 450 | 341,302 | 60 | 14 |

**Attachments**

Attachment A . . . . Form F-21.1-F01, "Buried Ball Valve Description (for SAP ordering)"
Attachment B . . . Form F-21.1-F02, "Valve Inspection Checklist"



material redacted

GTR0004974

# Material Specification for Carbon Steel Ball Valves

**Revision Notes**

Revision 04 has the following changes:

1. Added Numbered Documents B-17 and F-12 to the “References” section.
2. Updated Items 1J and 2E on Page 2.
3. Added Item 2H on Page 3.
4. Revised form numbers to comply with GOV-2001P-02, “Guidance Document Numbering Procedure.”
5. This document is part of Change 63.