CTBV-01

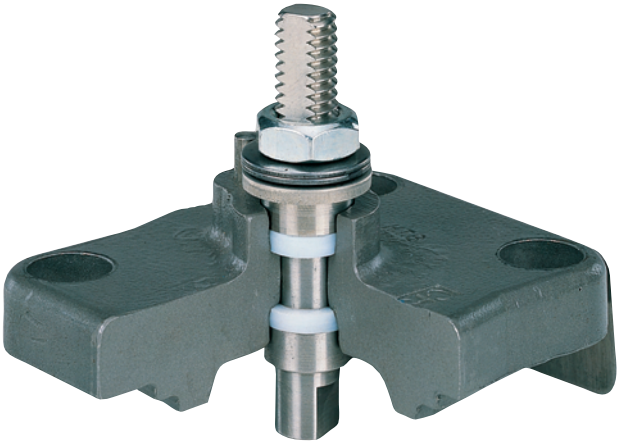
# Cam-Tite®

## Top Entry Metal Ball Valves for Severe Service Applications

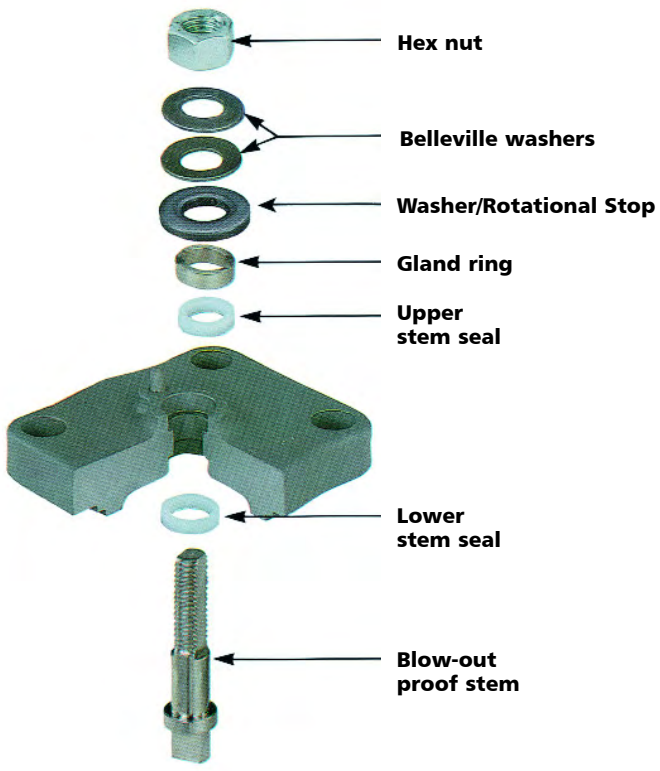

ITT Industries

*Engineered for life*

# Superior Stem Seal Design
# Low Torque Makes The Difference



Most stem seals would work well if their only job was to contain the fluid or gas in the piping system. However, stem seals must also serve as bearings and hold the stem in alignment. High operating torques resulting in high lateral loading cause premature stem seal failure in conventional ball and plug valve designs. The Cam-Tite Ball Valve is by design a low torque valve, thereby minimizing lateral loading on the stem seals. In addition, the Cam-Tite stem seals are located further apart, closer to the ends of the stem, reducing the effects of lateral loading.



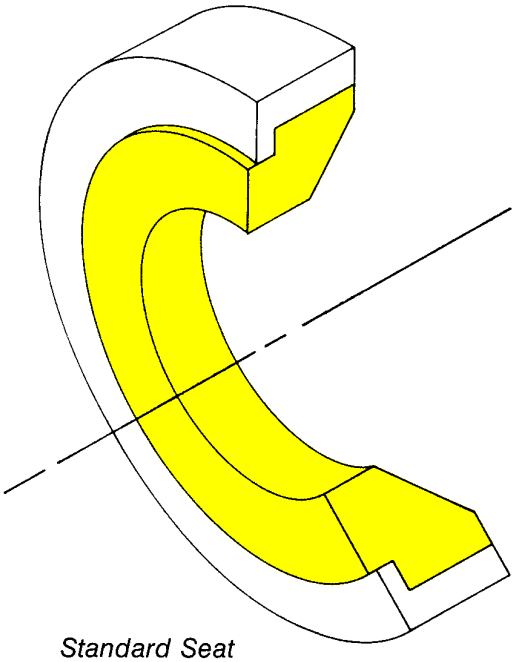

## Cam-Tite Ball Valve Seal Assembly

### Features and Benefits

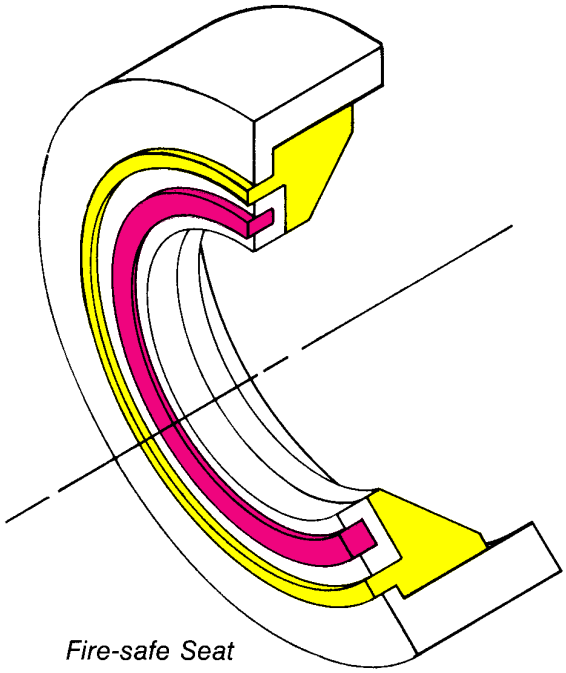
- Low operating torque reduces lateral loads on stem seals for superior performance.
- Blow-out proof stem with special attention given to surface finish.
- Upper and lower seals provide balanced loading of stem seals
- Standard belleville spring washers provide constant "live load" on stem seals, assuring a tight seal under varying service parameters.

## Cam-Tite Seat Design

Refer to pages 14-15 for pressure/temperature data.



*Standard Seat*



*Fire-safe Seat*

## PTFE Seats and Seals

All standard PTFE seats and seals are manufactured using unfilled, unpigmented PTFE. Virgin PTFE provides excellent resistance to the most aggressive chemicals and can handle media at both elevated and semi cryogenic temperatures. Having no filler material, PTFE components are commonly specified for applications where attack of an added filler could occur. Typical applications would be fluorine based chemicals which would attack glass or highly oxidizing media which would deteriorate graphite. Virgin PTFE is commonly used in Cam-Tite Ball Valves specified for hydrofluoric acid and fluorine gas service. Cam-Tite Ball Valves utilizing virgin PTFE seats and seals have a temperature range of -50°F to 450°F (-45°C to 232°C).

## Reinforced PTFE Seats and Seals

For applications that require higher tempera ture resistance and improved hardness, the Cam-Tite can be supplied with reinforced PTFE (RTFE) seats and stem seals. These components are glass reinforced and offer a temperature range of -60°F to 520°F (-51°C to 271°C), dependent upon process pressure conditions.

## Firesafe Seats and Seals

For applications involving flammable fluids, the Cam-Tite Ball Valve is available with seat and seals designated Firesafe. Most commonly supplied as reinforced PTFE, Firesafe seats incorporate secondary metal-to-metal seat rings and a special back seal for normal seat operation. Stem seals combine the fire resistance of graphite with a reinforced PTFE bearing. Cam-Tite Ball Valves equipped with these components meet the requirements of API 607 (3rd or 4th edition depending on valve configuration).

## UHMWP Seat and Seal Components

Ultrahigh molecular weight (high density) polyethylene offers abrasion resistance and wear resistance far superior to that of PTFE. Seats and seals of UHMWP provide exceptional service in high cycle applications. The material has a practical temperature limit of 200 degrees F (93°C).

# PEEK Seat and Seal Components

PEEK is a tough high temperature engineered thermoplastic offering broad chemical resistance, excellent recovery from deformation, a high degree of dimensional stability, and exceptional resistance to hydrolysis. PEEK has outstanding abrasion resistance and is not sensitive to dynamic fatigue.

## G2000 PEEK

### Chemical

Since G2000 PEEK is a virgin crystalline polymer, its resistance to chemical attack is excellent. G2000 PEEK is recommended for most environments other than strong oxidizers. It is compatible with numerous acids, bases, and aliphatic and aromatic hydrocarbons.

### Steam

Unlike most thermoplastics, G2000 PEEK will not hydrolize and is recommended for use in steam service and other high-temperature aqueous processes.

### Nuclear

G2000 PEEK offers excellent resistance to embrittlement when exposed to gamma radiation. This resistance is maintained in both acid and alkali media.

## G3000 PEEK

G3000 PEEK combines the basic properties of the G2000 PEEK with that of carbon graphite and PTFE fillers, yielding a seating material with greater stability at higher temperatures and significantly reduced seating torque. Due to its filled content, G3000 PEEK is an excellent choice for high temperature applications, having a maximum temperature capability of 550°F (288°C).

### Table 1

Comparison of typical physical properties

| Property | G3000 PEEK | G2000 PEEK | PTFE | PTFE Filled |
|---|---|---|---|---|
| Specific Gravity | 1.48 | 1.32 | 2.20 | 2.19 |
| Hardness (Shore) ▲ | D85 | D85 | D50-55 | D50-60 |
| Tensile Strength (psi) | 17,000 | 14,500 | 4000 | 2000 |
| Tensile Elongation(%) | 5 | 35 | 300 | 200 |
| Flexural Strength (psi) | 30,500 | 16,000 | No break | - |
| Flexural Modulus (psi) | 1.45M | 550,000 | 90,000-100,000 | - |
| Shear Strength (psi) | | | | |
| @ 100F | - | 12,000 | 2800 | 3400 |
| @ 200F | - | 11,000 | 1900 | 2750 |
| @ 300F | 7,750 | 9,000 | 1700 | 2500 |
| @ 400F | - | 6,500 | - | - |
| @ 500F | - | 3,800 | - | - |
| Impact Strength | | | | |
| Notched IZOD | 9 | 1.6 | - | 2.7 |
| Tensile (ft-lbs/in) | - | - | 30-200 | - |

▲ Rockwell "D" Scale

# Ceramic Ball

The Cam-Tite ceramic ball is an advanced engineering oxide ceramic, magnesia-partially stabilized zirconia (Mg-PSZ) which has extremely high strength and fracture toughness.

## Features:

- Corrosion resistant*
- Impervious to gases
- Impact resistant
- Withstands high temperature
- High thermal shock resistance
- Impervious to build-up on the ball
- Excellent choice where ferric chloride build-up is a problem

The ceramic ball can be used with any combination of the available stem and body materials for the Cam-Tite Ball Valve.

# Caged Bonnet Option

The patented "Caged Bonnet" was specifically designed to meet the needs of those hazardous applications where a quick and easy turnaround during scheduled maintenance is required. The uniquely designed caged bonnet assembly allows the repair and replacement of all internal components simply by removing the bonnet bolts and lifting off the bonnet assembly.

The caged device is available on all bonnet configurations (standard, extended, severe service and bellows) in both nuclear and commercial configurations. The device utilizes a captured (caged) metal saddle that holds the ball, seat rings, seats, grounding springs and cover gasket (nuclear model only) in place. This device allows the removal and replacement of all components utilizing one subassembly.

*Caged bonnet shown on a standard bonnet*
*U.S. Patent 5, 152,502*

*Consult factory for specific applications.

# Bonnet Options

## Extended Bonnet

Cam-Tite Ball Valves can be furnished with extended bonnets for higher temperature or semi-cryogenic services. The extended bonnet allows the valve to be wrapped with insulation without interference from the hand lever and is interchangeable with the standard bonnet. This arrangement raises the stem seal further away from the flowing fluid, thereby reducing the effects of the temperature extremes. The stem is supported to minimize the possibility of galling or stem leakage. The extended bonnet permits the packing nut to extend beyond the valve insulation, thereby permitting stem seal adjustment without disturbing the insulation.

## Severe Service Bonnet

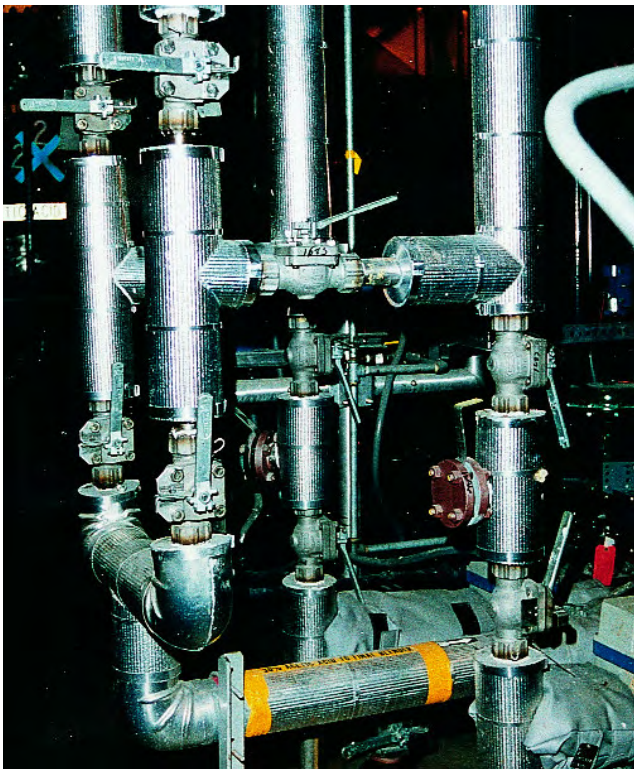
The severe service bonnet option was specifically designed to meet the needs of those difficult applications where a true stuffing box is preferred. This design utilizes the extended bonnet as the primary component maintaining the conventional bottom stem seal, augmented by stacked Chevron V-ring packing at the top. The addition of an optional lantern ring and bonnet tap provides for the insertion of compatible lubricants into the packing, inert gas padding, or leak detection. Available in ANSI Class 150 through 600, the severe service bonnet option brings a modular approach to the stem sealing system of the Cam-Tite Ball Valve.


## Bellows Stem Seal

Cam-Tite Ball Valves are also available with a bellows stem seal. This stem seal device, manufactured by Kerotest Manufacturing Corp., provides a hermetic stem seal via a unique quarter-turn bellows design.

The interface design for the bellows stem seal to the Cam-Tite Ball Valve was a joint effort between Engineered Valves and Kerotest in which the bellows assembly becomes integral to the bonnet of the valve. This allows for disassembly should replacement of internal components be required. The device can also be easily actuated. Bellows stem seals are available in ANSI Class 150 and 300 in a variety of materials.

# The Trusted Name For Severe Services



Since 1979 the Cam-Tite Ball Valve has become a performance leader in tough-to-handle services. The combination of the patented sealing arrangement and the superior stem seal design has ushered the Cam-Tite into services where its design superiority has proven itself over plug valves and conventional floating ball type valves. Among the services where Cam-Tite Ball Valves have emerged as the solution are the following:

- Dry Chlorine
- Phosgene
- Anhydrous HF
- Anhydrous Ammonia
- Anhydrous HCL
- High Vacuum
- $PCL_3$
- Steam
- $VOC_s$

## Anhydrous HF Acid Service

Numerous years of field application experience has lead to a recommended construction for Cam-Tite Ball Valves in anhydrous hydrofluoric acid. With a variety of body materials to choose from, valves prepared for HF service normally incorporate inconel 600 bonnet bolting, inconel 718 belleville washers, a stainless steel rotational stop (in applicable sizes), and virgin PTFE seats and seals. Additionally, all HF valves are specially assembled, cleaned, and tested. Specify "Prepared for HF Service" using code "HF" in the valve configuration number.

## Oxygen Service

Cam-Tite Ball Valves can be prepared for oxygen service. These valves are subjected to rigid procedures to insure that they are free from all burrs, chips, and dirt. They are specially assembled, cleaned, tested and packaged. Valves prepared for oxygen are lubricated with DuPont Krytox® GPL 206 unless otherwise specified. Order valves "Prepared for Oxygen Service" using "OX" in the configuration number.

## Vacuum Service

The Standard Cam-Tite Ball Valve is suitable for vacuum services down to 20 microns absolute. For vacuum conditions below 20 microns absolute high vacuum valves can be supplied. High vacuum service valves are manufactured with special attention to seat and seal tolerances and finishes and are specially cleaned and packaged. These valves have leakage rates less than 1 x $10^{-7}$ STD. CC/Sec as verified by a mass spectrometer test. Specify valves "Prepared for High Vacuum Service" using code "VAC" in the configuration number.

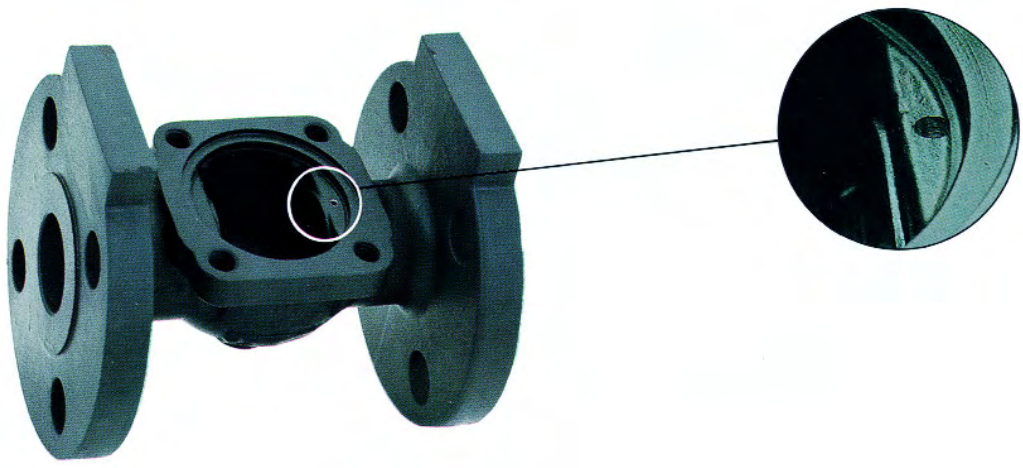
See pages 43-45 for additional ordering information for Cam-Tite Ball Valves prepared for the above special services.

## The Proven Leader in Dry Chlorine

In dry chlorine service, valves must be capable of absolute shutoff while maintaining piping system integrity (no stem seal leakage). For cost-effectiveness, they must also offer long service life. Simple enough, yet the punishing nature of chlorine handling has defeated many types of chlorine valves and forced users to accept compromises in performance and safety.

Such compromises are no longer necessary. Thousands of installed Cam-Tite valves are demonstrating their superiority, based on three important features:

- Patented Ball Design – Assures zero leakage through the valve.
- Superior Stem Seals – Prevents leakage to the atmosphere.
- Positive Valve Body Vent



*Valve Body Vent For Positive Pressure Relief*

## Positive Relief

In accordance with the Chlorine Institute Pamphlet No. 6, all dry chlorine ball valves must be equipped to relieve excess pressure in the ball cavity toward the direction of high pressure. This is an important safety feature, ensuring that excess pressure in a closed valve will bleed off harmlessly. Cam-Tite Ball Valves prepared for dry chlorine service are equipped with a positive vent in the valve body as opposed to competitive designs that rely on self-relieving seats or vents through the ball or plug. Experi-ence has proven that self-relieving seats do not provide predictable performance. Placing the vent in the body eliminates the possibility of installing a vented ball or plug backwards. A positive body vent is the only way to provide predictable, repeatable safety relief.

**Note:** Cam-Tite Ball Valves supplied with vented bodies are considered unidirectional with regards to shut-off.

## Chlorine Valve Preparation

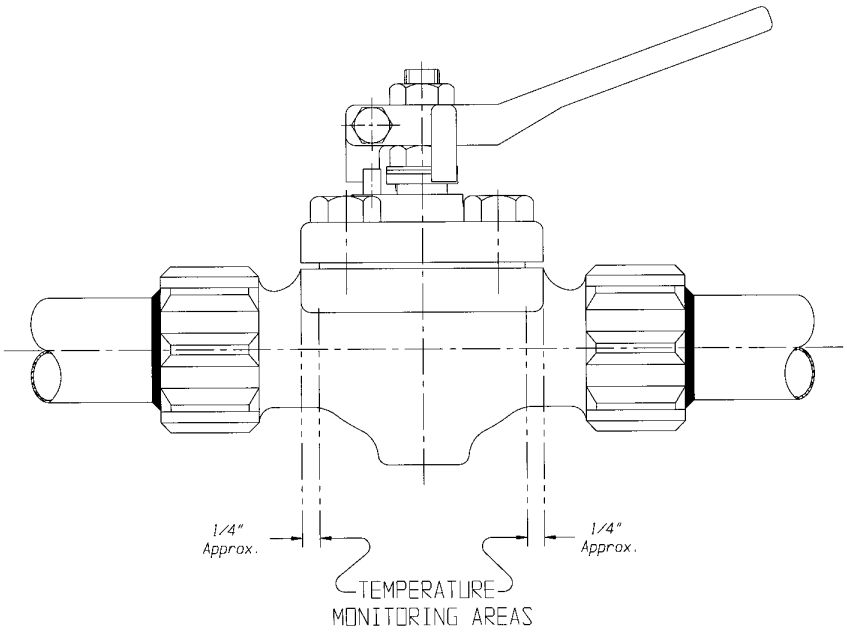
Preparation in accordance with the Chlorine Institute Pamphlet 6 includes:

- A relief vent in the body to bypass the upstream seat.
- A cast arrow on the body to indicate the direction of pressure tightness.
- Special cleaning of all valve components.
- Special testing for seat tightness and relief port venting.
- Special packaging and marking.

Cam-Tite Ball Valves for dry chlorine service are usually supplied with cast carbon steel (ASTM A216 Gr. WCB) bodies, monel ball and stem, and reinforced PTFE seats, seals and cover gasket. Other materials, including alloy 20, hastelloy, and ceramic are commonly used in chlorine services and are available as required.

When ordering valves "Prepared for Dry Chlorine Service", specify code "CLV" in the configuration number.

# Welding Without Disassembly




Cam-Tite Ball Valves can be welded into the pipeline without disassembly provided certain procedures and precautions are followed. The valve must be in the open position during welding and should remain open until it cools to ambient temperature. Welding procedures in accordance with Section IX of the ASME Boiler and Pressure Vessel Code should be utilized. In addition, a Tempilstik (350 degrees F for PTFE and RTFE seats and seals or 200 degrees F for UHMWP seats and seals) must be used to monitor the temperature at the seat/gasket area. This is the area in line with the body/cover flange as shown above. Welding should be controlled such that the maximum temperature in this area remains below that of the rated Tempilstik. A tremendous amount of time and trouble associated with the dismantling and reassembly of welded valves is avoided, but more importantly, the integrity of the factory hydrostatic and seat testing is maintained when following these procedures.

See page 42 for weld end machining standards.

# Drilled, Tapped And Plugged Drain Bosses

All Cam-Tite Ball Valves have an integrally cast drain boss on the bottom side of the body. This drain boss can be drilled, tapped, and plugged if draining of the valve cavity is required. The standard drilling is 1/4" NPT on 1/2" through 2" sizes and 1/2" NPT on 3" through 6" sizes. Carbon steel valves are furnished with ASTM A193 GR B7 plugs while stainless steel valves are furnished with ASTM A193 GR B8 plugs. (Consult the factory for specifications of drain plugs supplied on other body materials.) Specify valves "Prepared with Tapped and Plugged Drain Port" using code "D" in the configuration number when ordering.

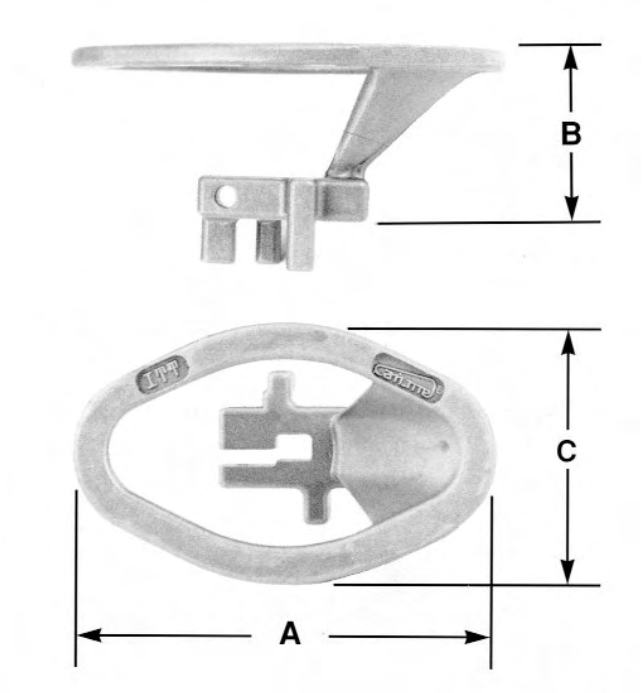
# Stem Extensions

The Cam-Tite Ball Valve can be supplied with a variety of designs to support applications which require extended stems. Stem extensions can be provided in carbon steel and stainless steel materials of construction and can be specified in a wide range of lengths for complete versatility.

See pages 43-45 for information on ordering stem extensions for Cam-Tite valves.

## Oval Safety Handwheels

Oval safety handwheels are available on Cam-Tite Ball Valves 1/2" through 2". These handwheels are used where the standard hand levers could be accidentally bumped open or closed. The oval safety handwheels are either cast carbon steel or cast stainless steel. The oval shape provides quick, easy identification of valve position. Specify "Prepared with Oval Safety Handwheel" using code "HD2" (carbon steel) or code "HD3" (stainless steel) in the configuration number.




**DIMENSIONS (INCH)**

| Valve Size | A | B | C |
|---|---|---|---|
| 1/2" - 1" | 5.0 | 2.03 | 3.0 |
| 1 1/2" | 6.5 | 2.03 | 4.0 |
| 2" | 6.5 | 2.03 | 4.0 |

**DIMENSIONS (MM)**

| | | | |
|---|---|---|---|
| 1/2" - 1" | 127 | 52 | 76 |
| 1 1/2" | 165 | 52 | 102 |
| 2" | 165 | 52 | 102 |

## Spring Return Handle Options

The Cam-Tite Ball Valve can be supplied with either a manual spring return handle (dead man's handle) or a fire-safe fusible linked spring return handle for safety shut-off of manually operated valves.

## Chain Operator Options

The Cam-Tite Ball Valve can be provided with a T-handle and chain for operation in services where access to the valve is limited. The T-handle operator can be supplied for installation in either vertical or horizontal pipelines and is available in both carbon steel and stainless steel construction.

## Lock Out Device Option

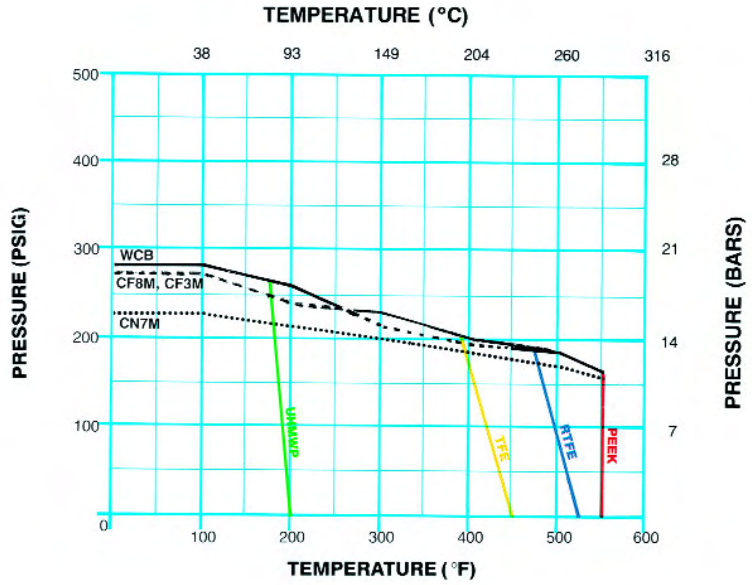
OSHA 1910.147 requires that valves in certain applications have a method of being locked out in the closed position to prevent unauthorized opening. The Cam-Tite Ball Valve can be supplied with a locking device which will lock the valve in either the open or closed position. The standard locking device is constructed of stainless steel and can be provided on any of the optional bonnet designs. Specify "Prepared with Locking Device" using code "LDS" in the configuration number for the valve.

See pages 43-45 for additional ordering instructions for Cam-Tite valves prepared with the above handle options.

# Pressure/Temperature Ratings

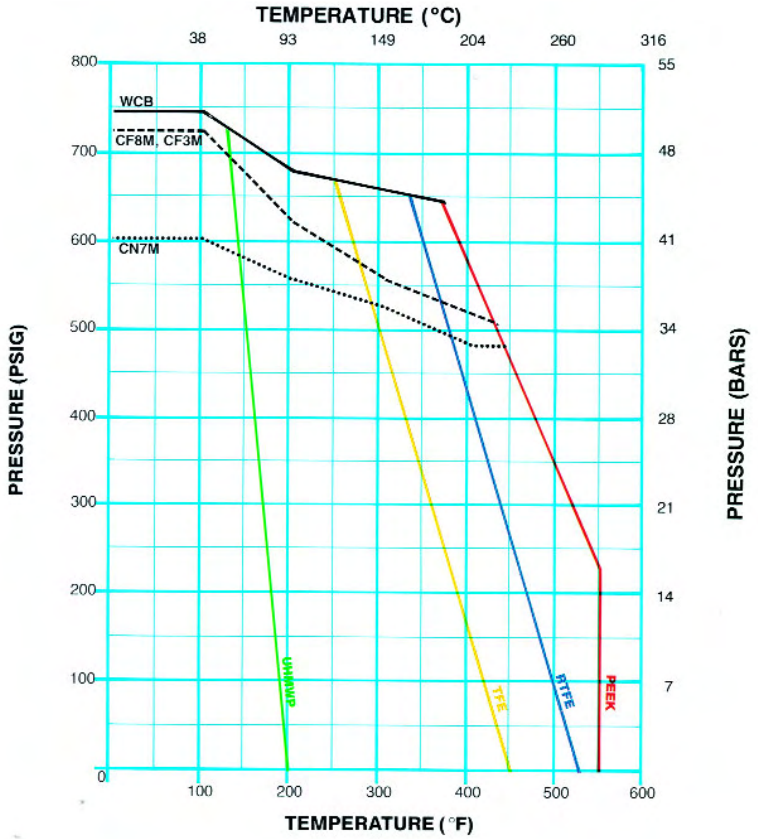
## Class 150
## Flanged, Butt Weld

| Cold Working Pressure (PSIG) | |
|---|---|
| Carbon Steel – WCB | 285 |
| Stainless Steel – CF8M, CF3M | 275 |
| Alloy 20 – CN7M | 230 |
| Monel M-35-1 | 230 |
| Hastelloy CW-6M | 290 |
| Titanium – B367 Gr C3 | 265 |




## Class 150-300
## Screwed, Socket Weld
## Class 300
## Flanged, Butt Weld

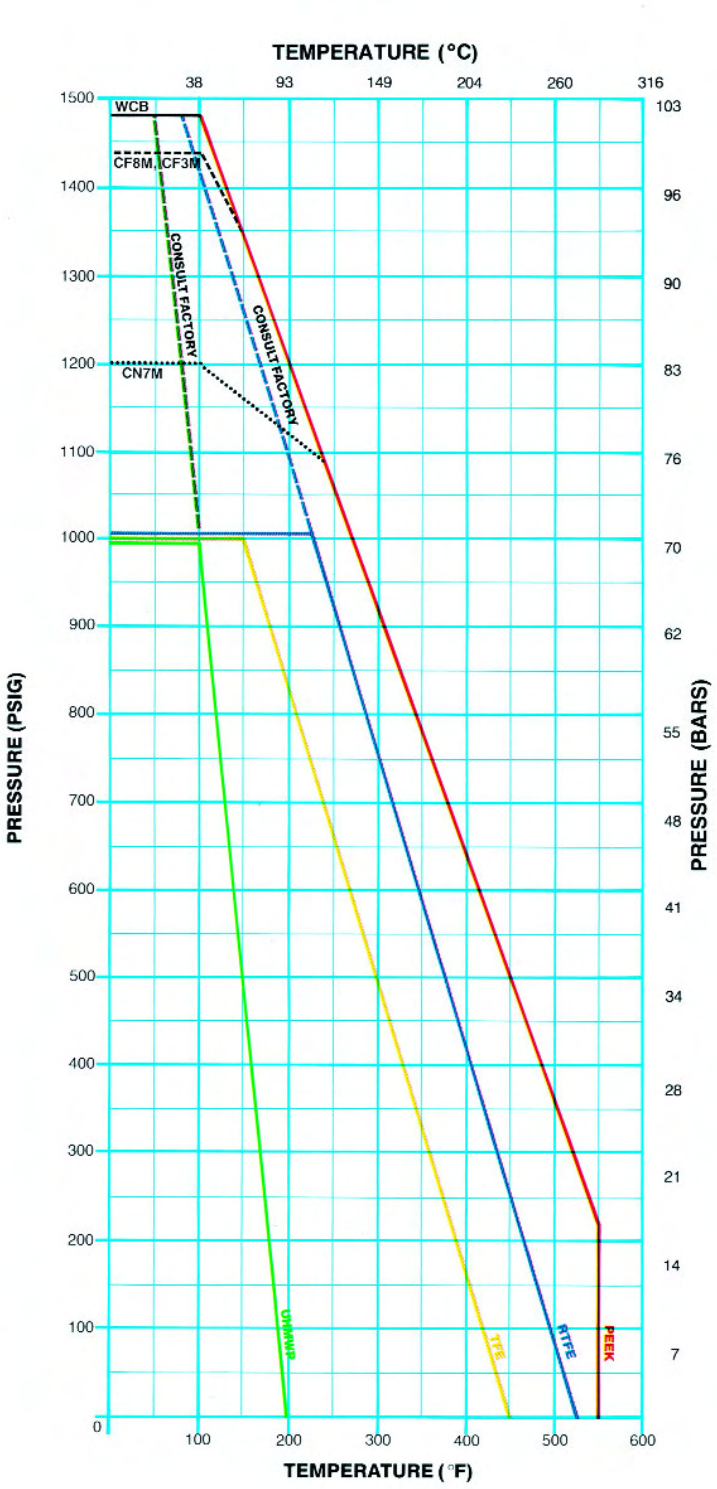
| Cold Working Pressure (PSIG) | |
|---|---|
| Carbon Steel – WCB | 740 |
| Stainless Steel – CF8M, CF3M | 720 |
| Alloy 20 – CN7M | 600 |
| Monel M-35-1 | 600 |
| Hastelloy CW-6M | 750 |
| Titanium – B367 Gr C3 | 695 |



# Pressure/Temperature Ratings

## Class 600
## Flanged, Butt Weld
## Screwed, Socket Weld

| Cold Working Pressure (PSIG) | |
|---|---|
| Carbon Steel – WCB | 1480 |
| Stainless Steel – CF8M, CF3M | 1440 |
| Alloy 20 – CN7M | 1200 |
| Monel M-35-1 | 1200 |
| Hastelloy CW-6M | 1500 |
| Titanium – B367 Gr C3 | 1390 |




**Note:** Consult factory for pressure/temperature recommendations for 3" and larger
Class 600 fire-safe seats.

# Flow Coefficients (Cv)

Cv = Flow of water in U.S. gallons per minute through the valve with a one psi pressure drop.

## Class 150 Flanged and Butt Weld

| Degrees Open From Closed | 10° | 20° | 30° | 40° | 50° | 60° | 70° | 80° | 90° |
|---|---|---|---|---|---|---|---|---|---|
| 1/2" | – | – | 0.1 | 0.3 | 0.9 | 1.4 | 2.2 | 3.5 | 8.4 |
| 3/4" | | – | 0.2 | 1.2 | 2.2 | 3.7 | 5.4 | 8.0 | 17.0 |
| 1" | – | – | 0.2 | 1.1 | 2.5 | 4.6 | 7.6 | 12.8 | 30.0 |
| 1 1/2" | – | – | 1.0 | 3.0 | 5.5 | 11.0 | 17.5 | 33.5 | 73.0 |
| 2" | – | 0.5 | 3.0 | 6.5 | 11.5 | 21.0 | 39.0 | 81.5 | 160.5 |
| 3" | – | 0.5 | 3.7 | 12.4 | 22.9 | 42.4 | 81.5 | 181.0 | 355.0 |
| 4" | | 1.1 | 7.8 | 26.1 | 48.4 | 89.7 | 172.5 | 383.4 | 751.6 |
| 6" | – | – | – | – | – | – | – | – | 1500 |

## Class 300 Flanged and Butt Weld

| Degrees Open From Closed | 10° | 20° | 30° | 40° | 50° | 60° | 70° | 80° | 90° |
|---|---|---|---|---|---|---|---|---|---|
| 1/2" | | – | 0.1 | 0.3 | 0.7 | 1.2 | 2.1 | 3.8 | 8.4 |
| 3/4" | – | – | 0.2 | 0.8 | 1.6 | 2.8 | 5.0 | 9.5 | 18.2 |
| 1" | – | – | 0.2 | 1.0 | 2.4 | 4.6 | 8.0 | 15.6 | 31.6 |
| 1 1/2" | – | 1.0 | 2.5 | 5.5 | 10.0 | 17.5 | 29.0 | 51.0 | 80.0 |
| 2" | – | 1.0 | 3.0 | 6.5 | 13.5 | 22.0 | 39.0 | 72.0 | 163.0 |
| 3" | – | 2.5 | 8.4 | 17.9 | 34.5 | 57.5 | 99.2 | 180.3 | 360.5 |
| 4" | – | 5.3 | 17.8 | 37.9 | 73.0 | 121.7 | 209.9 | 381.6 | 763.3 |
| 6" | – | – | – | – | – | – | – | – | 1500 |

## Class 600 Flanged and Butt Weld

| Degrees Open From Closed | 10° | 20° | 30° | 40° | 50° | 60° | 70° | 80° | 90° |
|---|---|---|---|---|---|---|---|---|---|
| 1/2" | – | – | 0.1 | 0.3 | 0.8 | 1.3 | 2.2 | 3.5 | 8.5 |
| 3/4" | – | – | 0.2 | 0.9 | 1.9 | 3.4 | 5.6 | 8.2 | 17.0 |
| 1" | – | – | 0.2 | 0.8 | 1.9 | 3.8 | 7.0 | 14.2 | 28.4 |
| 1 1/2" | – | – | 0.5 | 3.5 | 9.5 | 17.0 | 31.0 | 55.0 | 81.0 |
| 2" | – | 0.9 | 3.0 | 6.0 | 11.5 | 21.0 | 39.0 | 87.0 | 163.0 |
| 3" | – | 1.4 | 4.7 | 11.2 | 28.1 | 51.1 | 94.6 | 197.1 | 365.0 |
| 4" | – | 2.9 | 9.9 | 23.6 | 59.1 | 107.4 | 198.9 | 414.5 | 767.5 |

## Screwed and Socket Weld – All Classes

| Degrees Open From Closed | 10° | 20° | 30° | 40° | 50° | 60° | 70° | 80° | 90° |
|---|---|---|---|---|---|---|---|---|---|
| 1/2" | – | – | 0.1 | 0.2 | 0.7 | 1.2 | 2.1 | 3.6 | 8.4 |
| 3/4" | – | – | 0.2 | 0.7 | 1.6 | 2.9 | 5.0 | 8.5 | 17.0 |
| 1" | – | – | 0.5 | 0.7 | 2.0 | 3.8 | 6.8 | 12.5 | 30.8 |
| 1 1/2" | – | 1.0 | 2.5 | 5.0 | 9.5 | 15.5 | 24.5 | 45.0 | 78.4 |
| 2" | – | 1.0 | 3.0 | 6.0 | 11.5 | 21.0 | 38.5 | 76.5 | 158.5 |
| 3" | – | 2.9 | 8.4 | 16.8 | 32.3 | 53.9 | 96.3 | 181.7 | 349.5 |

**Note:** Consult factory for recommendations on valves intended for throttling or modulating services.

# Valve Operating Torques

The actual amount of torque required to operate a valve is dependent upon many variables, such as line pressure, temperature, type of fluid, and frequency of operation. The following tables are based on the maximum break-away/closing torque requirements of a Cam-Tite Ball Valve handling a clean, particle free liquid. For valves used in heavy liquids, high particulate fluids, gases, or sub zero temperatures, consult the factory for actual torque recommendations.

UNFILLED PTFE

| | PRESSURE DROP ACROSS VALVE | | |
|---|---|---|---|
| SIZE | 275 PSIG | 740 PSIG | 1000 PSIG |
| ½", ¾", 1" | 75 in-lb | 75 in-lb | 75 in-lb |
| 1 ½" | 85 in-lb | 85 in-lb | 85 in-lb |
| 2" | 175 in-lb | 175 in-lb | 175 in-lb |
| 3" | 435 in-lb | 435 in-lb | 450 in-lb |
| 4" | 525 in-lb | 770 in-lb | 925 in-lb |
| 6" | 1270 in-lb | 1615 in-lb | N/A |

FIRESAFE REINFORCED PTFE

| | PRESSURE DROP ACROSS VALVE | | |
|---|---|---|---|
| SIZE | 275 PSIG | 740 PSIG | 1000 PSIG |
| ½", ¾", 1" | 115 in-lb | 115 in-lb | 115 in-lb |
| 1 ½" | 150 in-lb | 150 in-lb | 160 in-lb |
| 2" | 325 in-lb | 325 in-lb | 350 in-lb |
| 3" | 735 in-lb | 750 in-lb | 1700 in-lb |
| 4" | 890 in-lb | 1545 in-lb | 2535 in-lb |
| 6" | 2300 in-lb | 2650 in-lb | N/A |

REINFORCED PTFE (RTFE)

| | PRESSURE DROP ACROSS VALVE | | |
|---|---|---|---|
| SIZE | 275 PSIG | 740 PSIG | 1000 PSIG |
| ½", ¾", 1" | 105 in-lb | 105 in-lb | 105 in-lb |
| 1 ½" | 110 in-lb | 110 in-lb | 110 in-lb |
| 2" | 220 in-lb | 220 in-lb | 235 in-lb |
| 3" | 590 in-lb | 590 in-lb | 640 in-lb |
| 4" | 695 in-lb | 895 in-lb | 1195 in-lb |
| 6" | 1355 in-lb | 1730 in-lb | N/A |

UHMW POLYETHYLENE

| | PRESSURE DROP ACROSS VALVE | | |
|---|---|---|---|
| SIZE | 275 PSIG | 740 PSIG | 1000 PSIG |
| ½", ¾", 1" | 95 in-lb | 95 in-lb | 95 in-lb |
| 1 ½" | 120 in-lb | 120 in-lb | 120 in-lb |
| 2" | 260 in-lb | 260 in-lb | 260 in-lb |
| 3" | 620 in-lb | 620 in-lb | 785 in-lb |
| 4" | 795 in-lb | 795 in-lb | 1080 in-lb |
| 6" | 1555 in-lb | 1555 in-lb | N/A |

G3000 PEEK

| | PRESSURE DROP ACROSS VALVE | | |
|---|---|---|---|
| SIZE | 275 PSIG | 740 PSIG | 1480 PSIG |
| ½", ¾", 1" | 195 in-lb | 195 in-lb | 195 in-lb |
| 1 ½" | 240 in-lb | 265 in-lb | 265 in-lb |
| 2" | 340 in-lb | 375 in-lb | 695 in-lb |
| 3" | 1285 in-lb | 1345 in-lb | 1705 in-lb |
| 4" | 1400 in-lb | 1610 in-lb | 2665 in-lb |
| 6" | N/A | N/A | N/A |

G2000 PEEK

| | PRESSURE DROP ACROSS VALVE | | |
|---|---|---|---|
| SIZE | 275 PSIG | 740 PSIG | 1480 PSIG |
| ½", ¾", 1" | 195 in-lb | 195 in-lb | 195 in-lb |
| 1 ½" | 250 in-lb | 250 in-lb | 250 in-lb |
| 2" | 375 in-lb | 555 in-lb | 960 in-lb |
| 3" | 1400 in-lb | 1595 in-lb | 2500 in-lb |
| 4" | 2055 in-lb | 2775 in-lb | 3960 in-lb |
| 6" | N/A | N/A | N/A |

# Maximum Allowable Stem Torques

The following torque values represent the maximum allowable torque which can be applied to a specific valve size and stem material before permanent damage to the stem occurs. These values should not be exceeded when sizing power actuators for application with the Cam-Tite Ball Valve.

| | STEM MATERIAL | | | | |
|---|---|---|---|---|---|
| **SIZE** | **316 ss** | **Monel** | **Alloy 20** | **Hastelloy 276** | **Inconel 625** |
| ½" - 1" | 460 in-lb | 390 in-lb | 275 in-lb | 275 in-lb | 275 in-lb |
| 1½" | 590 in-lb | 505 in-lb | 355 in-lb | 355 in-lb | 355 in-lb |
| 2" | 1040 in-lb | 1110 in-lb | 785 in-lb | 785 in-lb | 785 in-lb |
| 3" | 4660 in-lb | 4300 in-lb | 2510 in-lb | 2940 in-lb | 4300 in-lb |
| 4" | 4800 in-lb | 5760 in-lb | 3360 in-lb | 3940 in-lb | 5760 in-lb |
| 6" | 14500 in-lb | 29100 in-lb | 17000 in-lb | 19900 in-lb | 29100 in-lb |

Consult factory for stem materials not listed above.

# Actuated Service

By virtue of its low torque design, the Cam-Tite Ball Valve is an inexpensive and easy valve to actuate. The low torque feature allows the valve to be actuated with a much smaller and more cost effective actuator. This means you have the superior performance of the Cam-Tite Ball Valve at a lower package cost than with conventional ball or plug valves.

When it comes to actuated "isolation" valves, the Cam-Tite is truely unique. To begin with, since there is virtually no load on the seats when the valve rests in the open position, the seats remain in prime condition waiting to be called into service. Since there is no "breakaway" when moving from the open to closed positions, the actuator is set into motion without opposing load. Only when the valve is essentially closed does the valve operating torque reach design peak. It is nice to know that when peak load is reached, the valve is already closed.


Engineered Valves can supply actuator packages utilizing the Compact rack and pinion actuator or any other actuator suited to your needs. Actuator packages are completely assembled and tested by Engineered Valves to meet our highest standards of quality.

Typical actuator mounting is accomplished either by utilizing the flange pads on flanged end valves or by replacing the cover bolts with studs and double nuts on socket, threaded and buttweld configurations. Both methods allow the removal of the actuator without disturbing the body/cover seal.

If field mounting of actuation is necessary, the following guidelines should be followed:

1. Use flange pad mounting when available. If not, then machined studs must be used – not threaded rod.

2. It is recommended that if the bonnet is loosened, then the cover gasket should be replaced.

3. Bolting torques shown on page 40 should be followed.

4. The rotational stop pin in the cover (3", 4" and 6") should be removed. Open/closed positioning should be accomplished by proper adjustment of the actuator travel stops.

See pages 26-29 for actuator mounting details.

# Actuator Output Torques (in-lb)

## Double Acting

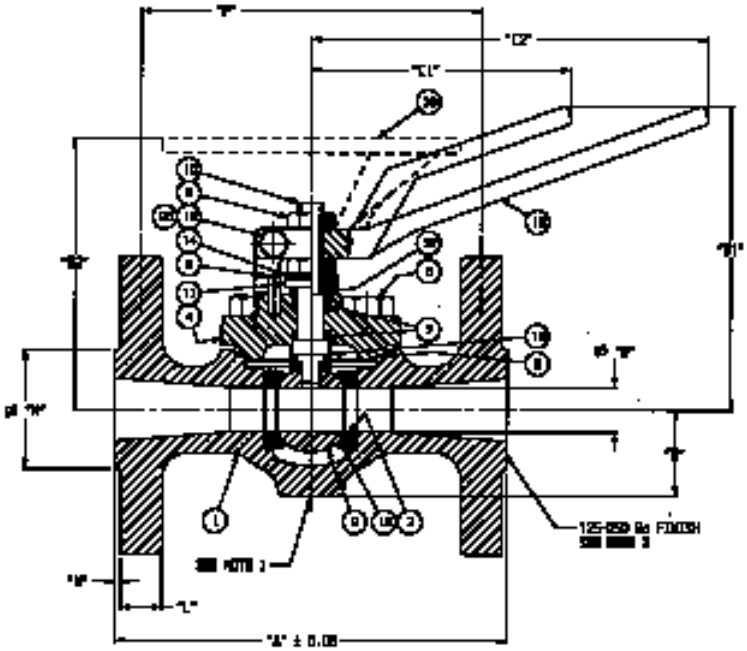
1A – Inner spring (H15 only)
1B – Outer spring (H15 only)
2 – Two springs (H15 only)
2A – Inner and middle springs
2B – Inner and outer springs
2C – Middle and outer springs
3 – All three springs

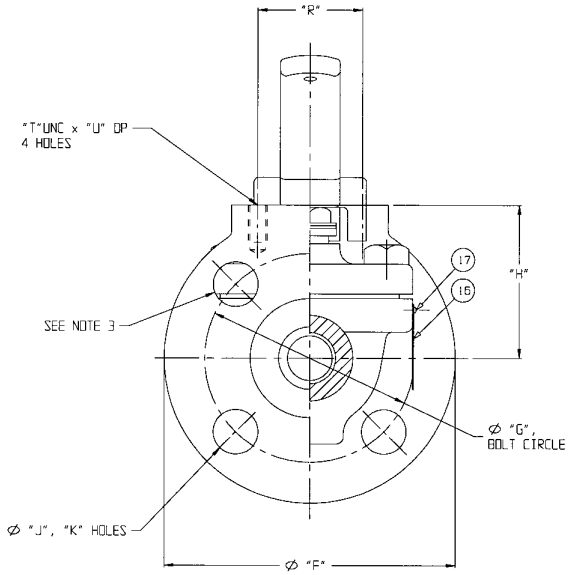
| ACTUATOR SIZE | OPERATING PRESSURE (PSI) | | | | | |
|---|---|---|---|---|---|---|
| | 20 | 40 | 60 | 80 | 100 | 120 |
| 15 | 39 | 79 | 119 | 160 | 199 | 239 |
| 20 | 79 | 158 | 238 | 318 | 398 | 478 |
| 25 | 160 | 320 | 480 | 640 | 800 | 960 |
| 30 | 267 | 537 | 806 | 1074 | 1343 | 1611 |
| 35 | 471 | 941 | 1412 | 1882 | 2353 | 2824 |
| 45 | 907 | 1813 | 2719 | 3626 | 4532 | 5438 |
| 60 | 2149 | 4298 | 6446 | 8595 | 10744 | 12893 |
| 75 | 3765 | 7530 | 11295 | 15060 | 18825 | 22590 |

| ACTUATOR SIZE | No. OF SPRINGS | OPERATING PRESSURE (PSI) | | | | | | | | | | SPRING TORQUE | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 40 | | 60 | | 80 | | 100 | | 120 | | MAXIMUM | |
| | | AIR START | AIR END | AIR START | AIR END | AIR START | AIR END | AIR START | AIR END | AIR START | AIR END | SPRG START | SPRG END |
| 15 | 1A | 53 | 26 | 92 | 64 | 133 | 103 | 171 | 140 | 210 | 178 | 49 | 24 |
| | 1B | | | 69 | 18 | 109 | 56 | 147 | 93 | 186 | 131 | 96 | 48 |
| | 2 | | | | | 85 | 8 | 123 | 45 | 162 | 83 | 144 | 72 |
| 20 | 2A | 78 | 27 | 158 | 104 | 244 | 187 | 322 | 262 | 411 | 339 | 115 | 68 |
| | 2B | | | 129 | 55 | 215 | 138 | 293 | 214 | 381 | 290 | 164 | 97 |
| | 2C | | | | | 191 | 97 | 269 | 173 | 358 | 249 | 205 | 121 |
| | 3 | | | | | 165 | 60 | 243 | 136 | 331 | 212 | 242 | 147 |
| 25 | 2A | 169 | 46 | 331 | 200 | 502 | 366 | 659 | 518 | 816 | 670 | 242 | 128 |
| | 2B | | | 278 | 98 | 449 | 264 | 606 | 416 | 763 | 568 | 344 | 178 |
| | 2C | | | | | 419 | 207 | 576 | 359 | 733 | 511 | 401 | 208 |
| | 3 | | | | | 371 | 116 | 528 | 268 | 685 | 420 | 492 | 256 |
| 30 | 2A | 284 | 92 | 556 | 351 | 847 | 629 | 1106 | 885 | 1369 | 1139 | 391 | 210 |
| | 2B | | | 486 | 221 | 773 | 499 | 1036 | 755 | 1299 | 1009 | 521 | 280 |
| | 2C | | | | | 703 | 369 | 966 | 625 | 1229 | 879 | 651 | 350 |
| | 3 | | | | | 634 | 239 | 897 | 495 | 1160 | 749 | 781 | 419 |
| 35 | 2A | 487 | 86 | 962 | 538 | 1465 | 1027 | 1927 | 1474 | 2388 | 1922 | 761 | 379 |
| | 2B | | | 836 | 284 | 1339 | 773 | 1801 | 1220 | 2262 | 1668 | 1015 | 505 |
| | 2C | | | | | 1212 | 520 | 1674 | 967 | 2135 | 1415 | 1268 | 632 |
| | 3 | | | | | 1068 | 266 | 1548 | 713 | 2009 | 1161 | 1522 | 758 |
| 45 | 2A | 913 | 115 | 1828 | 985 | 2798 | 1929 | 3686 | 2789 | 4574 | 3650 | 1516 | 755 |
| | 2B | | | 1576 | 482 | 2546 | 1425 | 3434 | 2285 | 4322 | 3146 | 2020 | 1007 |
| | 2C | | | | | 2295 | 919 | 3183 | 1779 | 4071 | 2640 | 2526 | 1258 |
| | 3 | | | | | 2043 | 414 | 2931 | 1274 | 3819 | 2135 | 3031 | 1510 |
| 60 | 2A | 2261 | 437 | 4431 | 2499 | 6730 | 4734 | 8836 | 6776 | 10942 | 8817 | 3431 | 1693 |
| | 2B | | | 3867 | 1355 | 6166 | 3590 | 8272 | 5632 | 10378 | 7673 | 4575 | 2257 |
| | 2C | | | | | 5602 | 2447 | 7708 | 4489 | 9814 | 6530 | 5718 | 2821 |
| | 3 | | | | | 5040 | 1303 | 7146 | 3345 | 9252 | 5386 | 6862 | 3383 |
| 75 | 2A | 3869 | 927 | 7332 | 4538 | 11700 | 8454 | 15390 | 12031 | 19079 | 15607 | 5853 | 3059 |
| | 2B | | | 6313 | 2585 | 10681 | 6501 | 14371 | 10078 | 18060 | 13655 | 7806 | 4078 |
| | 2C | | | | | 9661 | 4552 | 13351 | 8129 | 17040 | 11706 | 9755 | 5098 |
| | 3 | | | | | 8642 | 2600 | 12332 | 6177 | 16021 | 9754 | 11707 | 6117 |

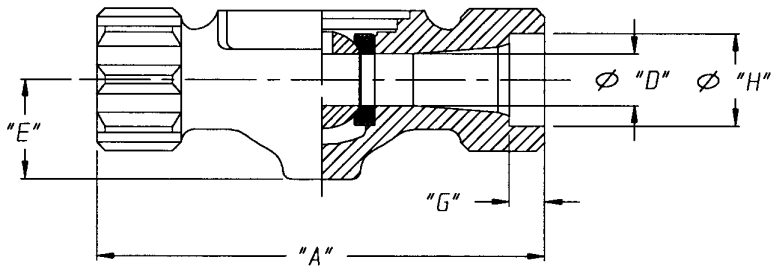
# Dimensions, Weights, & Parts Lists ½" – 2" Valves

## Flanged Body





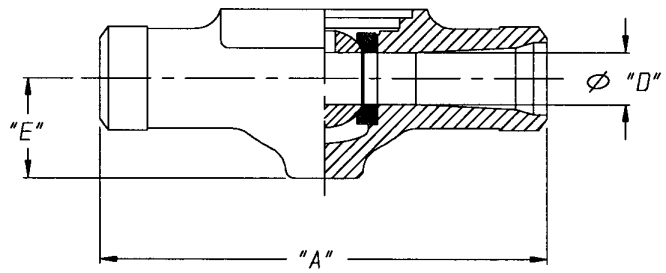

## Socket Weld & Threaded Body

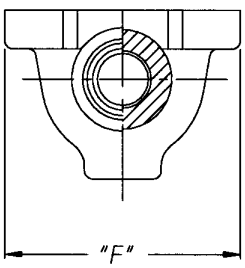



***NOTE:***

1. ***Body boss can be drilled, tapped, and plugged.***
2. ***End machining meets ANSI B16.5 for flanged ends.***
3. ***1/2" & 3/4" 150 lb. class flanged bolt holes are tapped 1/2"-13 UNC class 2B. Top two holes are blind drilled and tapped.***
4. ***The design meets ANSI B16.34, MSS-SP 72 & ANSI B16.10.***
5. ***Valve is shown in the open position. Clockwise rotation of stem closes the valve.***

## Butt Weld Body



# Dimensions, Weights, & Parts Lists ½" – 2" Valves

## Flanged Body

| VALVE SIZE | PRESSURE CLASS | "A" DIM. | "B1" DIM. | "B2" DIM. | "C1" DIM. | "C2" DIM. | "D" DIM. | "E" DIM. | "F" DIM. | "G" DIM. | "H" DIM. | "J" DIM. | "K" | "L" DIM. | "M" DIA. | "N" DIM. | "P" DIM. | "R" DIM. | "T" DIM. | "U" DIM. | WEIGHT LBS | WEIGHT KG |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/2" | 150# | 4.25 (113.0) | 5.10 (129.5) | 4.62 (117.3) | 4.35 (110.5) | - | 0.62 (15.7) | 1.44 (36.6) | 3.50 (88.9) | 2.38 (60.4) | 1.94 (49.3) | | 4 | 0.38 (9.6) | 1.38 (35.0) | 0.06 (1.5) | 3.62 (91.9) | 2.00 (50.8) | 1/4-20 UNC | 0.38 (9.6) | 6.9 | 3.1 |
| | 300# | 5.50 (139.7) | | | | | | | 3.75 (95.2) | 2.62 (66.5) | 2.06 (52.3) | 0.63 (16.0) | | 0.50 (12.7) | | | 4.88 (124.0) | | | | 7.9 | 3.6 |
| | 600# | 6.50 (165.1) | | | | | | | | | | | | 0.61 (15.5) | | 0.25 (6.4) | 5.38 (136.6) | | | | 9.0 | 4.1 |
| 3/4" | 150# | 4.62 (117.3) | | | | | 0.75 (19.0) | | 3.88 (98.6) | 2.75 (69.8) | 2.12 (53.8) | | | 0.41 (10.4) | 1.69 (42.9) | 0.06 (1.5) | 4.00 (101.6) | | | | 8.0 | 3.6 |
| | 300# | 6.00 (152.4) | | | | | | | 4.62 (117.3) | 3.25 (82.6) | 2.50 (63.5) | 0.75 (19.0) | | 0.56 (14.2) | | | 5.31 (134.9) | | | | | |
| | 600# | 7.50 (190.5) | | | | | | | | | | | | 0.67 (17.0) | | 0.25 (6.4) | 6.31 (160.3) | | | | 11.5 | 5.2 |
| 1" | 150# | 5.00 (127.0) | | | | | | | 4.25 (108.0) | 3.12 (79.2) | 2.56 (65.0) | 0.63 (16.0) | | 0.41 (10.4) | 2.00 (50.8) | 0.06 (1.5) | 4.19 (106.4) | 1.75 (44.4) | 5/16-18 UNC | 0.62 (15.7) | 9.0 | 4.1 |
| | 300# | 6.50 (165.1) | | | | | | | 4.88 (124.0) | 3.50 (88.9) | | 0.75 (19.0) | | 0.69 (17.5) | | | 5.69 (144.5) | | | | 12.0 | 5.4 |
| | 600# | 8.50 (215.9) | | | | | | | | | | | | 0.74 (18.8) | | 0.25 (6.4) | 7.25 (184.2) | | | | 13.0 | 5.8 |
| 1-1/2" | 150# | 6.50 (165.1) | 5.65 (143.5) | 5.16 (131.1) | 5.14 (130.6) | - | 1.12 (28.4) | 1.72 (43.7) | 5.00 (127.0) | 3.88 (98.6) | 3.00 (76.2) | 0.63 (16.0) | | 0.56 (14.2) | 2.88 (73.2) | 0.06 (1.5) | 5.62 (142.7) | | | | 14.5 | 6.5 |
| | 300# | 7.50 (190.5) | | | | | | | 6.12 (155.4) | 4.50 (114.3) | 3.31 (84.1) | 0.88 (22.4) | | 0.81 (20.6) | | | 6.56 (166.6) | | | | 22.0 | 9.9 |
| | 600# | 9.50 (241.3) | | | | | | | | | | | | 0.93 (23.6) | | 0.25 (6.4) | 8.00 (203.2) | | | | 24.0 | 10.8 |
| 2" | 150# | 7.00 (177.8) | 6.60 (167.6) | 5.54 (140.7) | - | 8.65 (219.7) | 1.50 (38.1) | 2.06 (52.3) | 6.00 (152.4) | 4.75 (120.6) | 3.12 (79.2) | | | 0.62 (15.7) | 3.62 (91.9) | 0.06 (1.5) | 6.19 (157.2) | 2.25 (57.2) | | | 23.5 | 10.6 |
| | 300# | 8.50 (215.9) | | | | | | | 6.50 (165.1) | 5.00 (127.0) | 3.75 (95.2) | 0.75 (19.0) | 8 | 0.88 (22.4) | | 0.25 (6.4) | 7.50 (190.5) | | | | 30.0 | 13.5 |
| | 600# | 11.50 (292.1) | | | | | | | | | | | | 1.05 (26.7) | | | 9.88 (251.0) | | | | 34.0 | 15.3 |

**Dimensions in parenthesis ( ) are millimeters.**

## Socket Weld & Threaded Body

| VALVE SIZE | PRESSURE CLASS | "A" DIM. | "B1" DIM. | "B2" DIM. | "C1" DIM. | "C2" DIM. | "D" DIM. | "E" DIM. | "F" DIM. | "G" DIM. | "H" DIM. | WEIGHT LBS | WEIGHT KG |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/2" | 150-600# | 5.50 (139.7) | 5.10 (129.5) | 4.62 (117.3) | 4.35 (110.5) | - | 0.62 (15.7) - SOCKETWELD<br>0.70 (17.8) - THREADED | 1.44 (36.6) | 3.44 (87.4) | 0.39 (9.9) | 0.86 (21.8) | 5.7 | 2.6 |
| 3/4" | | 6.00 (152.4) | | | | | 0.75 (19.0) | | | 0.51 (13.0) | 1.07 (27.2) | 5.8 | 2.6 |
| 1" | | 6.50 (165.1) | | | | | | | | 0.51 (13.0) | 1.34 (34.0) | 6.5 | 2.9 |
| 1-1/2" | | 7.50 (190.5) | 5.65 (143.5) | 5.18 (131.1) | 5.14 (130.6) | - | 1.12 (28.4) | 1.72 (43.7) | 3.81 (96.8) | 0.51 (13.0) | 1.92 (48.8) | 13.0 | 5.8 |
| 2" | | 8.50 (215.9) | 6.60 (167.6) | 5.54 (140.7) | - | 8.65 (219.7) | 1.50 (38.1) | 2.06 (52.3) | 4.81 (122.2) | 0.63 (16.0) | 2.41 (61.2) | 18.0 | 8.1 |

## Butt Weld Body

| VALVE SIZE | PRESSURE CLASS | "A" DIM. | "B1" DIM. | "B2" DIM. | "C1" DIM. | "C2" DIM. | "D" DIM. | "E" DIM. | "F" DIM. | WEIGHT LBS | WEIGHT KG |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/2" | 150-300# | 5.50 (139.7) | 5.10 (129.5) | 4.62 (117.3) | 4.35 (110.5) | - | 0.56 (14.2) | 1.44 (36.6) | 3.44 (87.4) | 5.3 | 2.4 |
| | 600# | 6.50 (165.1) | | | | | | | | 5.7 | 2.6 |
| 3/4" | 150-300# | 6.00 (152.4) | | | | | 0.69 (17.3) | | | 5.5 | 2.5 |
| | 600# | 7.50 (190.5) | | | | | 0.62 (15.7) | | | 7.0 | 3.2 |
| 1" | 150-300# | 6.50 (165.1) | | | | | 0.75 (19.0) | | | 6.0 | 2.7 |
| | 600# | 8.50 (215.9) | | | | | | | | 6.5 | 2.9 |
| 1-1/2" | 150-300# | 7.50 (190.5) | 5.65 (143.5) | 5.16 (131.1) | 5.14 (130.6) | - | 1.12 (28.4) | 1.72 (43.7) | 3.81 (96.8) | 13.0 | 5.8 |
| | 600# | 9.50 (241.3) | | | | | | | | 14.0 | 6.3 |
| 2" | 150-300# | 8.50 (215.9) | 6.60 (167.6) | 5.54 (140.7) | - | 8.65 (219.7) | 1.50 (38.1) | 2.06 (52.3) | 4.81 (122.2) | 17.0 | 7.6 |
| | 600# | 11.50 (292.1) | | | | | | | | 18.5 | 8.3 |

## Bill of Materials - Base Valve with Standard Cover

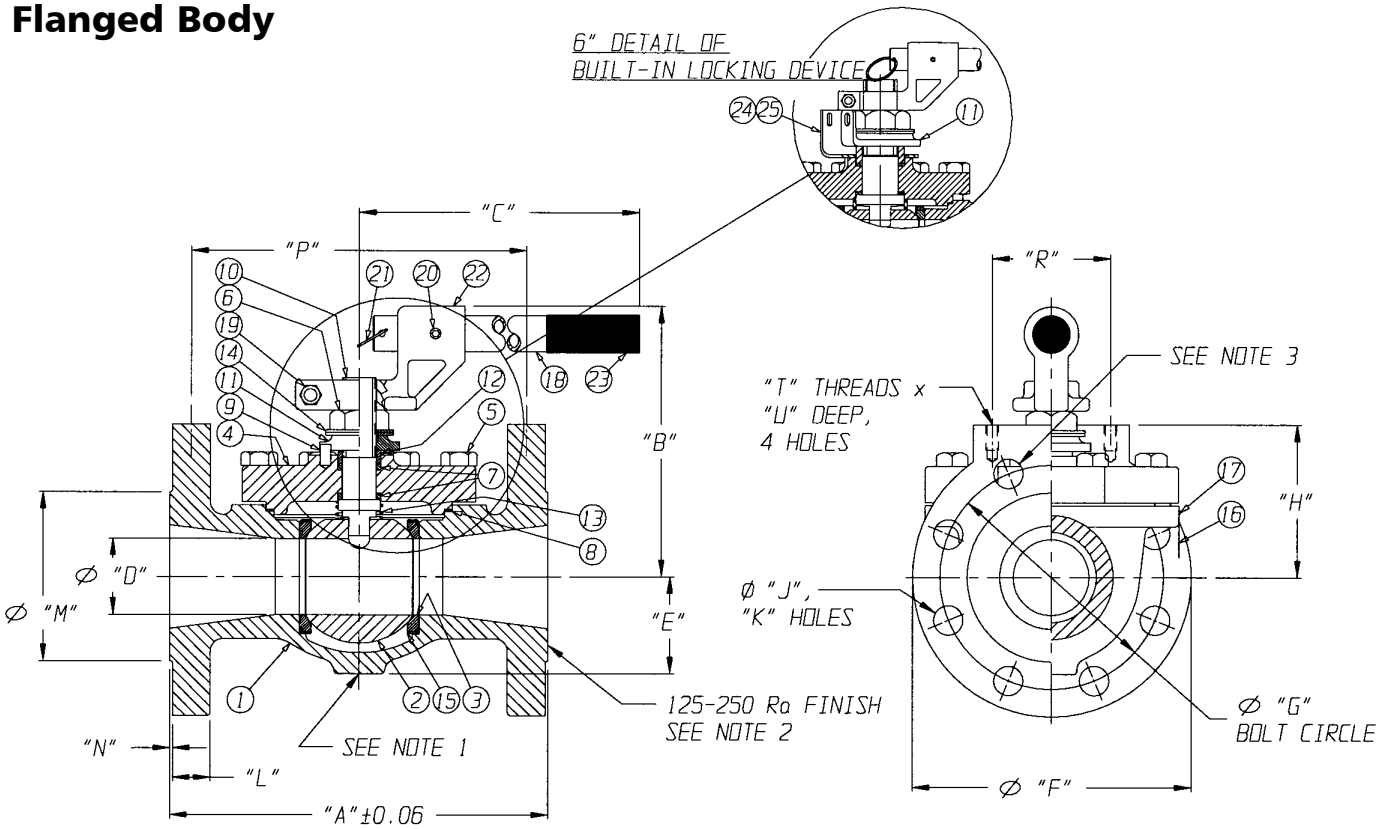
| ITEM | QTY | DESCRIPTION | CARBON STEEL | STAINLESS STEEL | ALLOY 20 | HASTELLOY |
|---|---|---|---|---|---|---|
| 1 | 1 | BODY | CS ASTM A216 GR WCB ▲ | SS ASTM A351 GR CF8M ❑ | SS ASTM A351 GR CN7M | HAST ASTM A494 CW6M ◈ |
| 2 | 1 | BALL | SS ASTM A276 TYPE 316 | SS ASTM A276 TYPE 316 | SS ASTM B473 N08020 | HAST ASTM B574 10276 |
| * 3 | 2 | SEAT ◆ | PTFE | PTFE | PTFE | PTFE |
| 4 | 1 | COVER | CS ASTM A216 GR WCB ▲ | SS ASTM A351 GR CF8M | SS ASTM A351 GR CN7M | HAST ASTM A494 CW6M |
| 5 | 4 | SCREW, HEX HD.CAP | CS ASTM A193 GR B7 | SS ASTM A193 GR B8 | SS ASTM A193 GR B8 | SS ASTM A193 GR B8 |
| 6 | 2 | NUT, HEX JAM | CS | CS | CS | CS |
| * 7 | ✖ 2 | SEAL, STEM ◆ | PTFE | PTFE | PTFE | PTFE |
| * 8 | 1 | GASKET ◆ | PTFE | PTFE | PTFE | PTFE |
| 9 | 1 | PIN, GROOVED | SS | SS | SS | SS |
| 10 | 1 | STEM | SS ASTM A276 TYPE 316 | SS ASTM A276 TYPE 316 | SS ASTM B473 N08020 | HAST ASTM B574 10276 |
| 11 | 1 | WASHER, FLAT | CS ASTM A659 GR1018 | CS ASTM A659 GR1018 | CS ASTM A659 GR1018 | CS ASTM A659 GR1018 |
| 12 | 1 | RING, GLAND | SS ASTM A276 TYPE 316 | SS ASTM A276 TYPE 316 | SS ASTM A276 TYPE 316 | SS ASTM A276 TYPE 316 |
| 13 | 1 | SPRING | SS ASTM A313 TYPE 316 | SS ASTM A313 TYPE 316 | INCONEL ASTM B637, X750 | INCONEL ASTM B637, X750 |
| 14 | 2 | WASHER, BELLEVILLE | CS ASTM A684 | CS ASTM A684 | CS ASTM A684 | CS ASTM A684 |
| * 15 | 2 | RING, SEAT | SS ASTM A240 TYPE 316 | SS ASTM A240 TYPE 316 | ALLOY 20 ASTM B463 N08020 | HAST ASTM B574 10276 |
| 16 | 1 | PLATE, IDENT. | SS ASTM A240 TYPE 304 | SS ASTM A240 TYPE 304 | SS ASTM A240 TYPE 304 | SS ASTM A240 TYPE 304 |
| 17 | 2 | SCREW, DRIVE | CS | CS | CS | CS |
| 18 | 1 | HANDLE | CS ASTM A216 GR WCB | CS ASTM A216 GR WCB | CS ASTM A216 GR WCB | CS ASTM A216 GR WCB |
| 19 | 1 | SCREW, HEX HD.CAP | STEEL | STEEL | STEEL | STEEL |
| 20 | 1 | NUT, HEX | STEEL | STEEL | STEEL | STEEL |

❑ - Buttweld, socketweld and threaded bodies are ASTM A351-CF3M.
◈ - Buttweld, socketweld and threaded bodies are ASTM A494-CW2M.
Φ - Refer to the "Ordering Information" section of this catalog for specific seat/seal combonations.
✖ - Extended covers have three stem seals.
* - Recommended spare parts. Available as seat/seal kit.
▲ - Zinc phosphate coated.

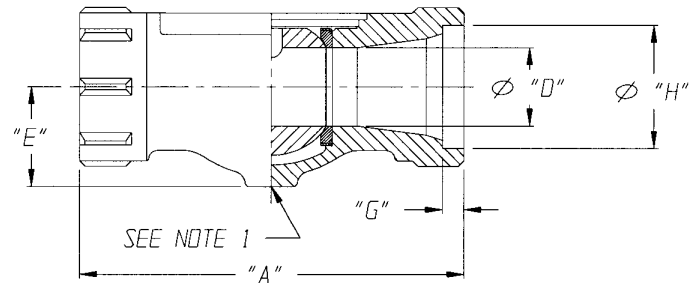
***Note: See pages 44–45 for optional materials.***

# Dimensions, Weights, & Parts Lists 3", 4" and 6" Valves

## Flanged Body



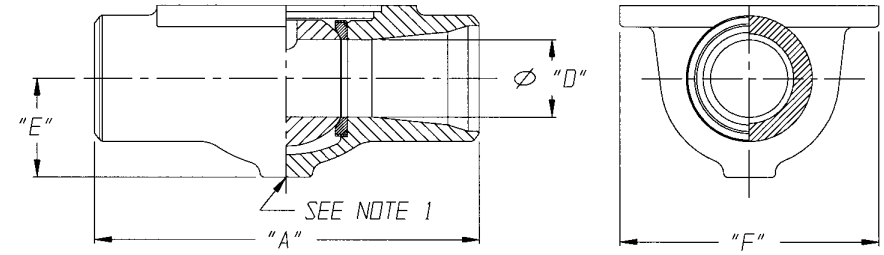

## Socket Weld & Threaded Body




***NOTE:***

1. ***Body boss can be drilled, tapped, and plugged.***
2. ***End machining meets ANSI B16.5 for flanged ends.***
3. ***Top two flanged bolt holes on 3" & 4" 150 lb. class valves are drilled and tapped 5/8"-11 UNC class 2B. Top two flanged bolt holes on 4" 300# Class valves are drilled and tapped 3/4"-10 UNC class 2B.***
4. ***The design meets ANSI B16.34, MSS-SP 72 and ANSI B16.10.***
5. ***Valve is shown in the open position. Clockwise rotation of stem closes the valve.***

## Butt Weld Body



# Dimensions, Weights, & Parts Lists 3", 4" and 6" Valves

## Flanged Body

| VALVE SIZE | PRESSURE CLASS | "A" DIM. | "B" DIM. | "C" DIM. | "D" DIA. | "E" DIM. | "F" DIA. | "G" DIA. | "H" DIM. | "J" DIM. | "K" | "L" DIM. | "M" DIA. | "N" DIM. | "P" DIM. | "R" DIM. | "T" DIM. | "U" DIM. | WEIGHT LBS | WEIGHT KG |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3" | 150# | 8.00 (203.2) | 8.00 (203.2) | 15.12 (384.0) | 2.25 (57.2) | 2.88 (73.2) | 7.50 (190.5) | 6.00 (152.4) | 4.00 (101.6) | 0.75 (19.0) | 4 | 0.75 (19.0) | 5.00 (127.0) | 0.06 (1.5) | 7.12 (180.8) | 3.50 (88.9) | 3/8-16 UNC | 0.75 (19.0) | 41.0 | 18.4 |
| | 300# | 11.12 (282.4) | | | | | 8.25 (209.6) | 6.62 (168.1) | 4.50 (114.3) | 0.88 (22.4) | 8 | 1.12 (28.4) | | | 9.88 (251.0) | | | | 64.0 | 28.8 |
| | 600# | 14.00 (355.6) | | | | | | | | | | 1.32 (33.5) | | 0.25 (6.4) | 12.12 (307.8) | | | | 77.0 | 34.6 |
| 4" | 150# | 9.00 (228.6) | 9.00 (228.6) | | 3.00 (76.2) | 3.38 (85.8) | 9.00 (228.6) | 7.50 (190.5) | 4.88 (124.0) | 0.75 (19.0) | | 0.94 (23.9) | 6.19 (157.2) | 0.06 (1.5) | 8.00 (203.2) | 4.00 (101.6) | 7/16-14 UNC | 0.88 (22.4) | 54.0 | 24.3 |
| | 300# | 12.00 (304.8) | | | | | 10.00 (254.0) | 7.88 (200.2) | 5.62 (142.7) | 0.88 (22.4) | | 1.25 (31.8) | | | 10.69 (271.5) | | | 1.00 (25.4) | 102.0 | 45.9 |
| | 600# | 17.00 (431.8) | | | | | 10.75 (273.0) | 8.50 (215.9) | | 1.00 (25.4) | | 1.56 (39.6) | | 0.25 (6.4) | 14.88 (378.0) | 4.50 (114.3) | | | 146.0 | 65.7 |
| 6" | 150# | 15.50 (393.7) | 12.51 (317.8) | 21.37 (542.8) | 4.00 (101.6) | 4.56 (115.8) | 11.00 (279.4) | 9.50 (241.3) | 6.50 (165.1) | 0.88 (22.4) | | 1.00 (25.4) | 8.50 (215.9) | 0.06 (1.5) | 14.38 (365.2) | 4.00 (101.6) | | 0.75 (19.0) | 198.4 | 89.3 |
| | 300# | 15.88 (403.4) | | | | | 12.50 (317.5) | 10.62 (269.7) | 7.12 (180.8) | | 12 | 1.44 (36.6) | | | | | | | 235.0 | 105.8 |

**Dimensions in parenthesis ( ) are millimeters.**

## Socket Weld & Threaded Body

| VALVE SIZE | PRESSURE CLASS | "A" DIM. | "B" DIM. | "C" DIM. | "D" DIA. | "E" DIM. | "F" DIM. | "G" DIM. | "H" DIM. | WEIGHT LBS | WEIGHT KG |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3" | 150-300# | 11.12 (282.4) | 8.00 (203.2) | 15.12 (384.0) | 2.25 (57.2) | 2.88 (73.2) | 7.50 (190.5) | 0.63 (16.0) | 3.54 (89.9) | 42.0 | 18.9 |

## Butt Weld Body

| VALVE SIZE | PRESSURE CLASS | "A" DIM. | "B" DIM. | "C" DIM. | "D" DIA. | "E" DIM. | "F" DIM. | WEIGHT LBS | WEIGHT KG |
|---|---|---|---|---|---|---|---|---|---|
| 3" | 150-300# | 11.12 (282.4) | 8.00 (203.2) | 15.12 (384.0) | 2.25 (57.2) | 2.88 (73.2) | 7.50 (190.5) | 39.0 | 17.5 |
| | 600# | 14.00 (355.6) | | | | | | 47.0 | 21.2 |
| 4" | 150-300# | 12.00 (304.8) | 9.00 (228.6) | | 3.00 (76.2) | 3.38 (85.8) | 8.38 (212.8) | 61.0 | 27.4 |
| | 600# | 17.00 (431.8) | | | | | 8.63 (219.2) | 80.0 | 36.0 |
| 6" | 150-300# | 15.88 (403.4) | 12.51 (317.8) | 21.37 (542.8) | 4.00 (101.6) | 4.56 (115.8) | 12.10 (307.3) | 164.6 | 74.1 |

## Bill of Materials - Base Valve with Standard Cover

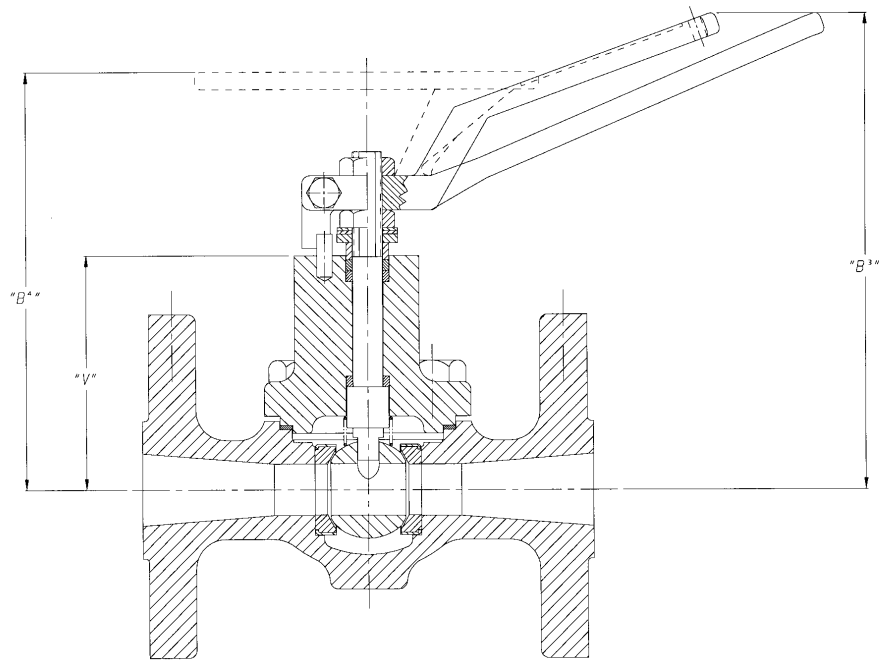
| ITEM | QTY. | DESCRIPTION | CARBON STEEL | STAINLESS STEEL | ALLOY 20 | HASTELLOY |
|---|---|---|---|---|---|---|
| 1 | 1 | BODY | CS ASTM A216 GR WCB Δ | SS ASTM A351 GR CF8M ❑ | ALLOY 20 ASTM A351 GR CN7M | HAST ASTM A494 CW6M ◇ |
| 2 | 1 | BALL | SS ASTM A351 CF8M | SS ASTM A351 CF8M | ALLOY 20 ASTM A351 CN7M | HAST ASTM B574 10276 |
| *3 | 2 | SEAT ◈ | PTFE | PTFE | PTFE | PTFE |
| 4 | 1 | COVER | CS ASTM A216 GR WCB Δ | SS ASTM A351 GR CF8M | ALLOY 20 ASTM A351 GR CN7M | HAST ASTM A494 CW6M |
| 5 | ∩8 | SCREW, HEX HD.CAP | CS ASTM A193 GR B7 | SS ASTM A193 GR B8 | SS ASTM A193 GR B8 | SS ASTM A193 GR B8 |
| 6 | 1 | NUT, HEX JAM | CS | SS | SS | SS |
| *7 | ⋉2 | SEAL, STEM ◈ | PTFE | PTFE | PTFE | PTFE |
| *8 | 1 | GASKET ◈ | PTFE | PTFE | PTFE | PTFE |
| 9 | 1 | PIN, GROOVED | SS | SS | SS | SS |
| 10 | 1 | STEM | SS ASTM A276 TYPE 316 | SS ASTM A276 TYPE 316 | ALLOY 20 ASTM B473 N08020 | HAST ASTM B574 10276 |
| 11 | 1 | ROTATIONAL STOP | CS ASTM A216 GR WCB | CS ASTM A216 GR WCB | CS ASTM A216 GR WCB | CS ASTM A216 GR WCB |
| 12 | 1 | RING, GLAND | SS ASTM A276 TYPE 316 | SS ASTM A276 TYPE 316 | SS ASTM A276 TYPE 316 | SS ASTM A276 TYPE 316 |
| 13 | 1 | SPRING | SS ASTM A313 TYPE 316 | SS ASTM A313 TYPE 316 | INCONEL ASTM B637, X750 | INCONEL ASTM B637, X750 |
| 14 | 2 | WASHER, BELLEVILLE | CS ASTM A684 | 17-7PH | 17-7PH | 17-7PH |
| *15 | 2 | RING, SEAT | SS ASTM A240 TYPE 316 | SS ASTM A240 TYPE 316 | ALLOY 20 ASTM B463 N08020 | HAST ASTM B574 10276 |
| 16 | 1 | PLATE, IDENT. | SS ASTM A240 TYPE 304 | SS ASTM A240 TYPE 304 | SS ASTM A240 TYPE 304 | SS ASTM A240 TYPE 304 |
| 17 | 2 | SCREW, DRIVE | CS | CS | CS | CS |
| 18 | 1 | HANDLE | CS ASTM A-53 | CS ASTM A-53 | CS ASTM A-53 | CS ASTM A-53 |
| 19 | 1 | SCREW, HEX HD.CAP | STEEL | SS | SS | SS |
| 20 | 1 | SCREW, SOC.HD.SET | STEEL | STEEL | STEEL | STEEL |
| 21 | 1 | CIRCLE, COTTER | STEEL | STEEL | STEEL | STEEL |
| 22 | 1 | HUB, LEVER | CS ASTM A216 GR WCB Δ | CS ASTM A216 GR WCB Δ | CS ASTM A216 GR WCB Δ | CS ASTM A216 GR WCB Δ |
| 23 | 1 | GRIP, HANDLE | PLASTIC | PLASTIC | PLASTIC | PLASTIC |
| 24 | 2 | SCREW,FLAT HD.MACH. | STEEL | STEEL | STEEL | STEEL |
| 25 | 1 | PLATE, LOCKING | CS ASTM A108-1018 | CS ASTM A108-1018 | CS ASTM A108-1018 | CS ASTM A108-1018 |

❑ - Buttweld, socketweld and threaded bodies are ASTM A351-CF3M.
◇ - Buttweld, socketweld and threaded bodies are ASTM A494-CW2M.
◈ - Refer to the "Ordering Information" section of this catalog for specific seat/seal combinations.
⋉ - Extended covers have three stem seals.
∩ - 3" and 4" Class 150 flanged valves have four cap screws.
* - Recommended spare parts. Available as seat/seal kits.
Δ - Zinc phosphate coated.

***Note: See pages 44–45 for optional materials.***

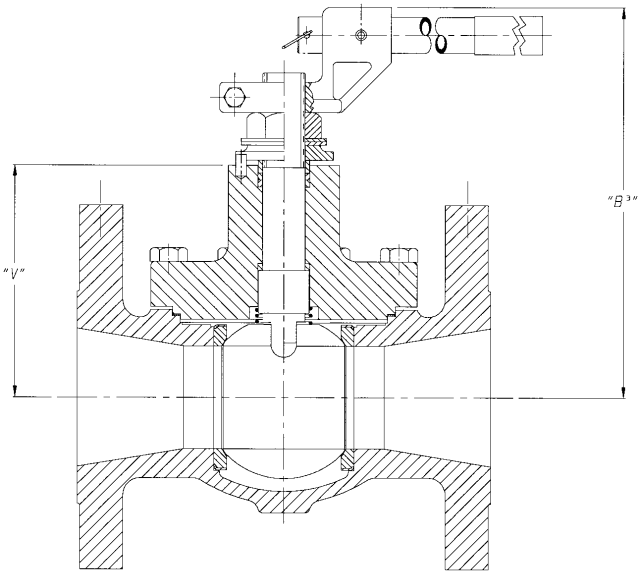
# Dimensions

## Extended Bonnet Valves




| VALVE SIZE | "B1" DIM. | "B4" DIM. | "V" DIM. |
|---|---|---|---|
| 1/2" | 6.65 (168.9) | 6.12 (155.4) | 3.41 (86.6) |
| 3/4" | | | |
| 1" | | | |
| 1-1/2" | 7.44 (189.0) | 6.91 (175.5) | 4.14 (105.2) |
| 2" | 8.80 (223.5) | 7.54 (191.5) | 4.63 (117.6) |

NUMERALS IN PARENTHESIS ( ) ARE IN MILLIMETERS.



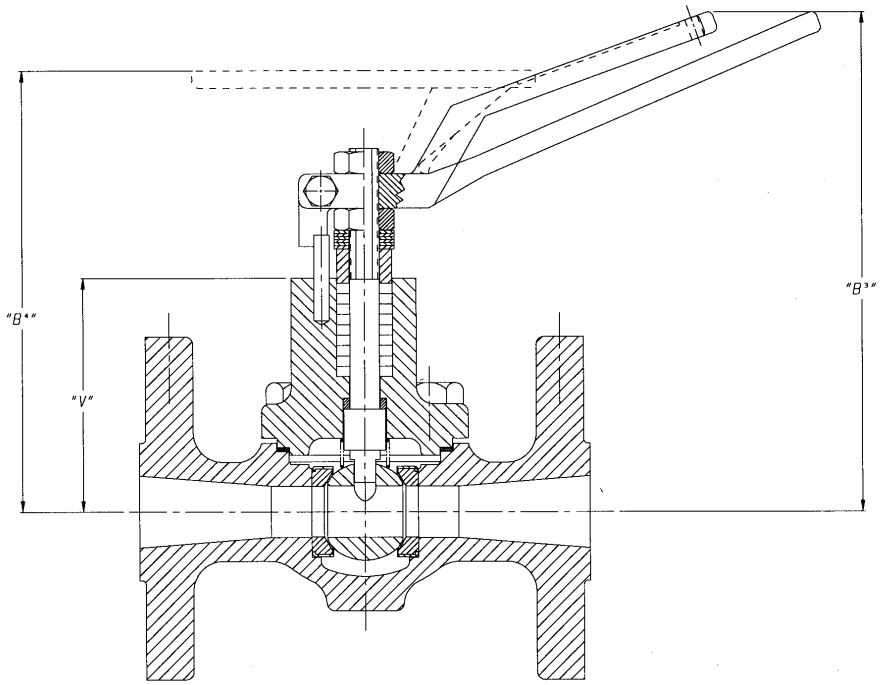

| VALVE SIZE | "B3" DIM. | "V" DIM. |
|---|---|---|
| 3" | 10.30 (261.6) | 5.84 (148.3) |
| 4" | 11.46 (291.1) | 6.79 (172.5) |
| 6" | 15.50 (393.7) | 8.62 (218.9) |

NUMERALS IN PARENTHESIS ( ) ARE IN MILLIMETERS.

The basic dimensions shown above are for Cam-Tite Ball Valves with extended bonnets as described on page 9. All components with the exception of the bonnet and stem are interchangeable on valves with standard bonnets. Parts identification and materials are also consistent with the standard bonnet and are described for the various configurations on pages 20–23. For complete dimensions and materials of construction for the extended bonnet, consult the factory.

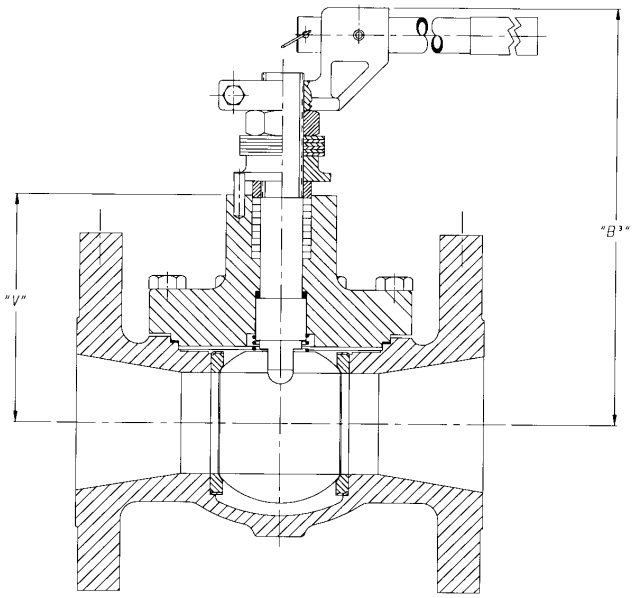
# Dimensions

## Severe Service Bonnet Valves




| VALVE SIZE | "B³" DIM. | "B⁴" DIM. | "V" DIM. |
|---|---|---|---|
| 1/2" | 6.91 (175.5) | 6.36 (161.5) | 3.41 (86.6) |
| 3/4" | | | |
| 1" | | | |
| 1-1/2" | 8.03 (204.0) | 7.19 (182.6) | 4.14 (105.2) |
| 2" | 9.05 (229.9) | 7.80 (198.1) | 4.63 (117.6) |

NUMERALS IN PARENTHESIS ( ) ARE IN MILLIMETERS.

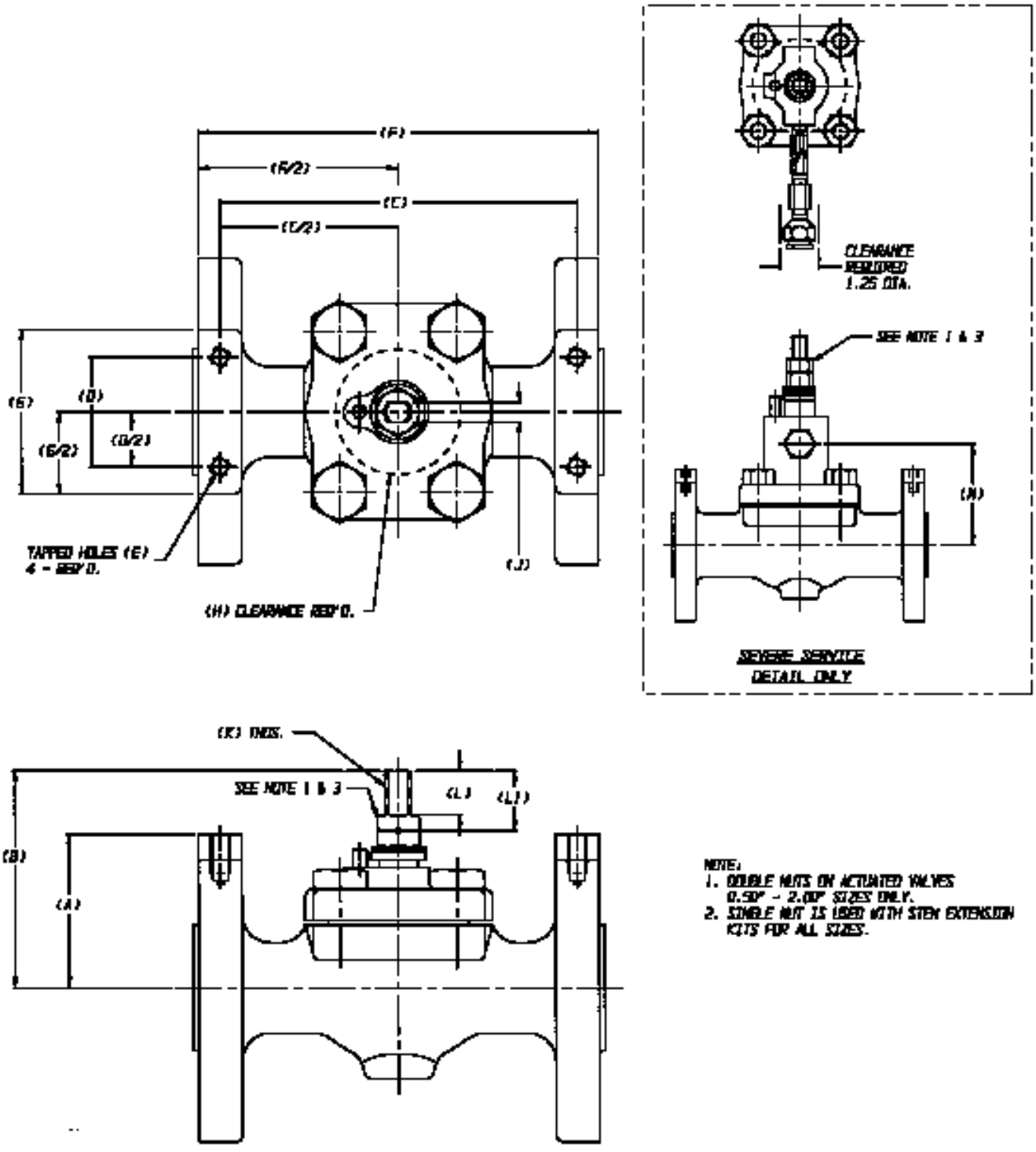



| VALVE SIZE | "B³" DIM. | "V" DIM. |
|---|---|---|
| 3" | 11.13 (282.7) | 5.84 (148.3) |
| 4" | 12.33 (313.2) | 6.79 (172.5) |
| 6" | 15.77 (400.6) | 8.62 (218.9) |

NUMERALS IN PARENTHESIS ( ) ARE IN MILLIMETERS.

The basic dimensions shown above are for Cam-Tite Ball Valves with severe service bonnets as described on page 9. All components with the exception of the bonnet, stem, and stem seals are interchangeable on valves with standard bonnets. Otherwise, parts identification and materials are consistent with the standard bonnet and are described for the various configurations on pages 20–23. For complete dimensions and materials of construction for the severe service bonnet, consult

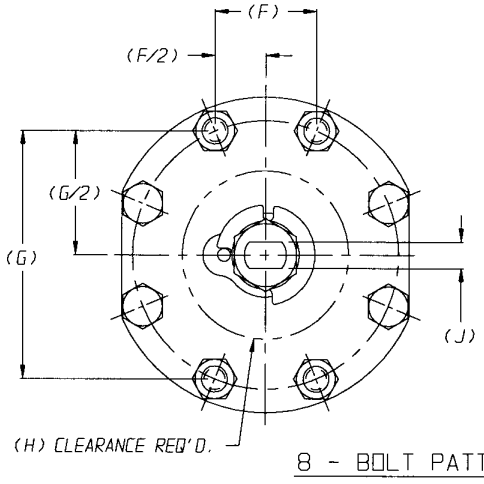
# Actuator Mounting Dimensions — Flange Pads



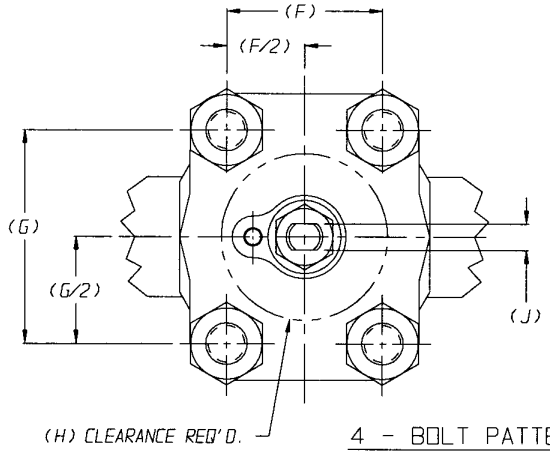

NOTE:
1. DOUBLE NUTS ON ACTUATED VALVES 0.50" - 2.00" SIZES ONLY.
2. SINGLE NUT IS USED WITH STEM EXTENSION KITS FOR ALL SIZES.

| VALVE SIZE | PRESS. CLASS | COVER TYPE | (A) | (B) | (C) | (D) | (E) | (F) | (G) | (H) | (J) | (K) | (L) | (L1) | (M) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/2" | 150# | STANDARD | 1.94 | 3.47 | 3.62 | 2.00 | 0.25-20UNC x 0.38 DP. | 4.12 | 2.62 | 2.00 | 0.309 0.305 | 0.438-14UNC | 0.58 | 0.83 | - |
| | | EXTENDED | | 4.97 | | | | | | 2.31 | | | | | |
| | | SEVERE SERV. | | 5.34 | | | | | | | | | 0.65 | 0.90 | 2.78 |
| | 300# | STANDARD | 2.06 | 3.47 | 4.88 | | | 5.38 | | 2.00 | | | 0.58 | 0.83 | - |
| | | EXTENDED | | 4.97 | | | | | | 2.31 | | | | | |
| | | SEVERE SERV. | | 5.34 | | | | | | | | | 0.65 | 0.90 | 2.78 |
| | 600# | STANDARD | | 3.47 | 5.38 | | | 6.00 | | 2.00 | | | 0.58 | 0.83 | - |
| | | EXTENDED | | 4.97 | | | | | | 2.31 | | | | | |
| | | SEVERE SERV. | | 5.34 | | | | | | | | | 0.65 | 0.90 | 2.78 |
| 3/4" | 150# | STANDARD | 2.12 | 3.47 | 4.00 | | | 4.50 | | 2.00 | | | 0.58 | 0.83 | - |
| | | EXTENDED | | 4.97 | | | | | | 2.31 | | | | | |
| | | SEVERE SERV. | | 5.34 | | | | | | | | | 0.65 | 0.90 | 2.78 |
| | 300# | STANDARD | 2.50 | 3.47 | 5.31 | | | 5.88 | | 2.00 | | | 0.58 | 0.83 | - |
| | | EXTENDED | | 4.97 | | | | | | 2.31 | | | | | |
| | | SEVERE SERV. | | 5.34 | | | | | | | | | 0.65 | 0.90 | 2.78 |
| | 600# | STANDARD | | 3.47 | 6.31 | | | 7.00 | | 2.00 | | | 0.58 | 0.83 | - |
| | | EXTENDED | | 4.97 | | | | | | 2.31 | | | | | |
| | | SEVERE SERV. | | 5.34 | | | | | | | | | 0.65 | 0.90 | 2.78 |
| 1" | 150# | STANDARD | 2.56 | 3.47 | 4.19 | 1.75 | | 4.88 | | 2.00 | | | 0.58 | 0.83 | - |
| | | EXTENDED | | 4.97 | | | | | | 2.31 | | | | | |
| | | SEVERE SERV. | | 5.34 | | | | | | | | | 0.65 | 0.90 | 2.78 |
| | 300# | STANDARD | | 3.47 | 5.69 | | | 6.38 | | 2.00 | | | 0.58 | 0.83 | - |
| | | EXTENDED | | 4.97 | | | | | | 2.31 | | | | | |
| | | SEVERE SERV. | | 5.34 | | | | | | | | | 0.65 | 0.90 | 2.78 |
| | 600# | STANDARD | | 3.47 | 7.25 | | | 8.00 | | 2.00 | | | 0.58 | 0.83 | - |
| | | EXTENDED | | 4.97 | | | | | | 2.31 | | | | | |
| | | SEVERE SERV. | | 5.34 | | | | | | | | | 0.65 | 0.90 | 2.78 |
| 1 1/2" | 150# | STANDARD | 3.00 | 4.10 | 5.62 | | 0.312-18UNC x .47/.56 DEEP | 6.38 | 3.12 | 2.00 | | 0.50-13UNC | 0.60 | 0.91 | - |
| | | EXTENDED | | 5.85 | | | | | | 3.19 | | | | | |
| | | SEVERE SERV. | | 6.35 | | | | | | | | | 0.78 | 1.09 | 3.32 |
| | 300# | STANDARD | 3.31 | 4.10 | 6.56 | | | 7.38 | | 2.00 | | | 0.60 | 0.91 | - |
| | | EXTENDED | | 5.85 | | | | | | 3.19 | | | | | |
| | | SEVERE SERV. | | 6.35 | | | | | | | | | 0.78 | 1.09 | 3.32 |
| | 600# | STANDARD | | 4.10 | 8.00 | | | 9.00 | | 2.00 | | | 0.60 | 0.91 | - |
| | | EXTENDED | | 5.85 | | | | | | 3.19 | | | | | |
| | | SEVERE SERV. | | 6.35 | | | | | | | | | 0.78 | 1.09 | 3.32 |
| 2" | 150# | STANDARD | 3.12 | 4.87 | 6.19 | 2.25 | | 6.88 | | 2.50 | 0.372 0.368 | 0.625-11UNC | 0.97 | 1.34 | - |
| | | EXTENDED | | 6.87 | | | | | | 3.38 | | | | | |
| | | SEVERE SERV. | | 7.19 | | | | | | | | | 0.93 | 1.30 | 3.81 |
| | 300# | STANDARD | 3.75 | 4.87 | 7.50 | | | 8.38 | | 2.50 | | | 0.97 | 1.34 | - |
| | | EXTENDED | | 6.87 | | | | | | 3.38 | | | | | |
| | | SEVERE SERV. | | 7.19 | | | | | | | | | 0.93 | 1.30 | 3.81 |
| | 600# | STANDARD | | 4.87 | 9.88 | | | 11.00 | | 2.50 | | | 0.97 | 1.34 | - |
| | | EXTENDED | | 6.87 | | | | | | 3.38 | | | | | |
| | | SEVERE SERV. | | 7.19 | | | | | | | | | 0.93 | 1.30 | 3.81 |
| 3" | 150# | STANDARD | 4.00 | 5.89 | 7.12 | 3.50 | 0.375-16UNC x 0.75 DP. | 7.88 | 4.62 | 3.00 | 0.622 0.618 | 1.00-8UNC | | 0.90 | - |
| | | EXTENDED | | 8.14 | | | | | | 4.50 | | | | | |
| | | SEVERE SERV. | | 9.22 | | | | | | | | | | 1.09 | 5.03 |
| | 300# | STANDARD | 4.50 | 5.89 | 9.88 | | | 11.00 | | 3.00 | | | | 0.90 | - |
| | | EXTENDED | | 8.14 | | | | | | 4.50 | | | | | |
| | | SEVERE SERV. | | 9.22 | | | | | | | | | | 1.09 | 5.03 |
| | 600# | STANDARD | | 5.89 | 12.12 | | | 13.50 | | 3.00 | | | | 0.90 | - |
| | | EXTENDED | | 8.14 | | | | | | 4.50 | | | | | |
| | | SEVERE SERV. | | 9.22 | | | | | | | | | | 1.09 | 5.03 |
| 4" | 150# | STANDARD | 4.88 | 7.11 | 8.00 | 4.00 | 0.438-14UNC x 0.88 DP. | 8.88 | 6.00 | 3.50 | 0.747 0.743 | 1.25-7UNC | | 1.10 | - |
| | | EXTENDED | | 9.48 | | | | | | 5.31 | | | | | |
| | | SEVERE SERV. | | 10.41 | | | | | | | | | | 1.08 | 5.97 |
| | 300# | STANDARD | 5.62 | 7.05 | 10.69 | | 0.438-14UNC x 1.00 DP. | 11.88 | | 3.50 | | | | 1.10 | - |
| | | EXTENDED | | 9.43 | | | | | | 5.31 | | | | | |
| | | SEVERE SERV. | | 10.41 | | | | | | | | | | 1.08 | 5.91 |
| | 600# | STANDARD | | 7.05 | 14.88 | 4.50 | | 16.50 | | 3.50 | | | | 1.10 | - |
| | | EXTENDED | | 9.43 | | | | | | 5.31 | | | | | |
| | | SEVERE SERV. | | 10.41 | | | | | | | | | | 1.08 | 5.91 |
| 6" | 150# | STANDARD | 6.50 | 10.20 | 14.38 | 4.00 | 0.438-14UNC x 0.75 DP. | 15.32 | 5.25 | 6.00 | 1.247 1.243 | 2.00-12UN | | 1.69 | - |
| | | EXTENDED | | 13.45 | | | | | | | | | | | |
| | | SEVERE SERV. | | | | | | | | | | | | 1.30 | 6.68 |
| | 300# | STANDARD | 7.12 | 10.20 | | | | 15.70 | | | | | | 1.69 | - |
| | | EXTENDED | | 13.45 | | | | | | | | | | | |
| | | SEVERE SERV. | | | | | | | | | | | | 1.30 | 6.68 |
| | - | - | | - | - | - | - | - | | | | | | - | - |
| | | - | | - | | | | | | | | | | | |
| | | - | | - | | | | | | | | | | - | - |

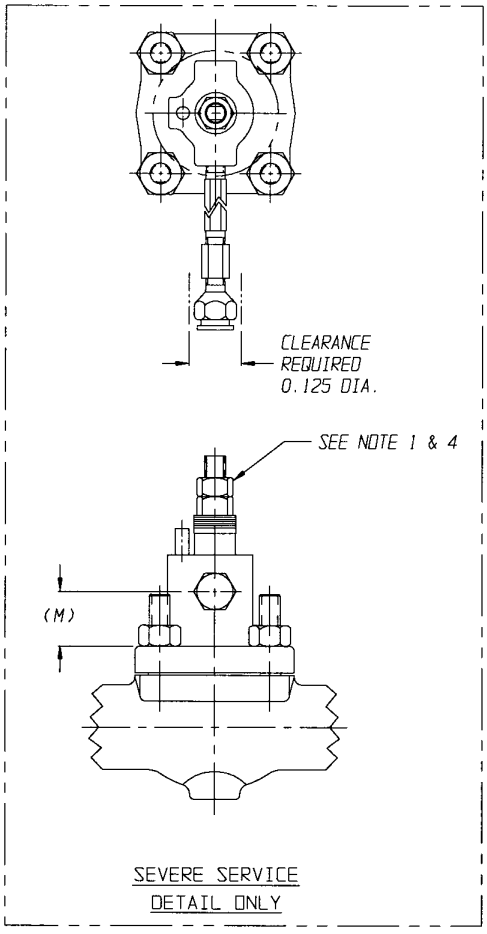
# Actuator Mounting Dimensions — Bonnet Studs and Double Nuts

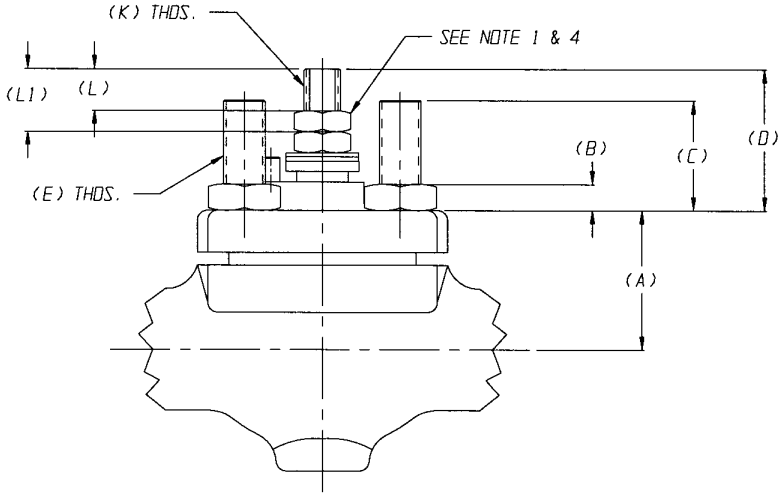



8 - BOLT PATTERN




4 - BOLT PATTERN




NOTE:
1. DOUBLE NUTS ON ACTUATED VALVES 0.50" - 2.00" SIZES ONLY.
*2. INDICATES DIMENSIONS FOR FINISHED HEX. NUTS.
3. SINGLE NUT IS USED WITH STEM EXTENSION KITS FOR ALL SIZES.

| VALVE SIZE | PRESS. CLASS | COVER TYPE | (A) | (B)-* | (C) | (D) | (E) | (F) | (G) | (H) | (J) | (K) | (L) | (L1) | (M) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/2" | 150# (4 BOLT) | STANDARD | 1.56 | 0.448 0.427 | 1.31 | 1.91 | 0.50-13UNC | 1.875 | 2.562 | 2.00 | 0.309 0.305 | 0.438-14UNC | 0.58 | 0.83 | - |
| | | EXTENDED | | | | 3.41 | | | | 2.31 | | | | | |
| | | SEVERE SERV. | | | | 3.78 | | | | | | | 0.65 | 0.90 | 1.22 |
| | 300# (4 BOLT) | STANDARD | | | | 1.91 | | | | 2.00 | | | 0.58 | 0.83 | - |
| | | EXTENDED | | | | 3.41 | | | | 2.31 | | | | | |
| | | SEVERE SERV. | | | | 3.78 | | | | | | | 0.65 | 0.90 | 1.22 |
| | 600# (4 BOLT) | STANDARD | | | | 1.91 | | | | 2.00 | | | 0.58 | 0.83 | - |
| | | EXTENDED | | | | 3.41 | | | | 2.31 | | | | | |
| | | SEVERE SERV. | | | | 3.78 | | | | | | | 0.65 | 0.90 | 1.22 |
| 3/4" | 150# (4 BOLT) | STANDARD | | | | 1.91 | | | | 2.00 | | | 0.58 | 0.83 | - |
| | | EXTENDED | | | | 3.41 | | | | 2.31 | | | | | |
| | | SEVERE SERV. | | | | 3.78 | | | | | | | 0.65 | 0.90 | 1.22 |
| | 300# (4 BOLT) | STANDARD | | | | 1.91 | | | | 2.00 | | | 0.58 | 0.83 | - |
| | | EXTENDED | | | | 3.41 | | | | 2.31 | | | | | |
| | | SEVERE SERV. | | | | 3.78 | | | | | | | 0.65 | 0.90 | 1.22 |
| | 600# (4 BOLT) | STANDARD | | | | 1.91 | | | | 2.00 | | | 0.58 | 0.83 | - |
| | | EXTENDED | | | | 3.41 | | | | 2.31 | | | | | |
| | | SEVERE SERV. | | | | 3.78 | | | | | | | 0.65 | 0.90 | 1.22 |
| 1" | 150# (4 BOLT) | STANDARD | | | | 1.91 | | | | 2.00 | | | 0.58 | 0.83 | - |
| | | EXTENDED | | | | 3.41 | | | | 2.31 | | | | | |
| | | SEVERE SERV. | | | | 3.78 | | | | | | | 0.65 | 0.90 | 1.22 |
| | 300# (4 BOLT) | STANDARD | | | | 1.91 | | | | 2.00 | | | 0.58 | 0.83 | - |
| | | EXTENDED | | | | 3.41 | | | | 2.31 | | | | | |
| | | SEVERE SERV. | | | | 3.78 | | | | | | | 0.65 | 0.90 | 1.22 |
| | 600# (4 BOLT) | STANDARD | | | | 1.91 | | | | 2.00 | | | 0.58 | 0.83 | - |
| | | EXTENDED | | | | 3.41 | | | | 2.31 | | | | | |
| | | SEVERE SERV. | | | | 3.78 | | | | | | | 0.65 | 0.90 | 1.22 |
| 1 1/2" | 150# (4 BOLT) | STANDARD | 1.94 | | 1.44 | 2.16 | | 2.625 | 2.875 | 2.00 | | 0.50-13UNC | 0.60 | 0.91 | - |
| | | EXTENDED | | | | 3.91 | | | | 3.19 | | | | | |
| | | SEVERE SERV. | | | | 4.41 | | | | | | | 0.78 | 1.09 | 1.38 |
| | 300# (4 BOLT) | STANDARD | | | | 2.16 | | | | 2.00 | | | 0.60 | 0.91 | - |
| | | EXTENDED | | | | 3.91 | | | | 3.19 | | | | | |
| | | SEVERE SERV. | | | | 4.41 | | | | | | | 0.78 | 1.09 | 1.38 |
| | 600# (4 BOLT) | STANDARD | | | | 2.16 | | | | 2.00 | | | 0.60 | 0.91 | - |
| | | EXTENDED | | | | 3.91 | | | | 3.19 | | | | | |
| | | SEVERE SERV. | | | | 4.41 | | | | | | | 0.78 | 1.09 | 1.38 |
| 2" | 150# (4 BOLT) | STANDARD | 2.31 | | 1.62 | 2.56 | | 2.875 | 3.625 | 2.50 | 0.372 0.368 | 0.625-11UNC | 0.97 | 1.34 | - |
| | | EXTENDED | | | | 4.56 | | | | 3.38 | | | | | |
| | | SEVERE SERV. | | | | 4.88 | | | | | | | 0.93 | 1.30 | 1.50 |
| | 300# (4 BOLT) | STANDARD | | | | 2.56 | | | | 2.50 | | | 0.97 | 1.34 | - |
| | | EXTENDED | | | | 4.56 | | | | 3.38 | | | | | |
| | | SEVERE SERV. | | | | 4.88 | | | | | | | 0.93 | 1.30 | 1.50 |
| | 600# (4 BOLT) | STANDARD | | | | 2.56 | | | | 2.50 | | | 0.97 | 1.34 | - |
| | | EXTENDED | | | | 4.56 | | | | 3.38 | | | | | |
| | | SEVERE SERV. | | | | 4.88 | | | | | | | 0.93 | 1.30 | 1.50 |
| 3" | 150# FLGD (4 BOLT) | STANDARD | 2.84 | 0.559 0.535 | 2.16 | 3.05 | 0.625-11UNC | 4.125 | 4.75 | 3.00 | 0.622 0.618 | 1.00-8UNC | | 0.90 | - |
| | | EXTENDED | | | | 5.30 | | | | 4.50 | | | | | |
| | | SEVERE SERV. | | | | 6.39 | | | | | | | | 1.09 | 2.19 |
| | 150/300# (8 BOLT) | STANDARD | 3.28 | | 1.72 | 2.61 | | 2.440 | 5.890 | 3.00 | | | | 0.90 | - |
| | | EXTENDED | | | | 4.86 | | | | 4.50 | | | | | |
| | | SEVERE SERV. | | | | 5.94 | | | | | | | | 1.09 | 1.75 |
| | 600# (8 BOLT) | STANDARD | | | | 2.61 | | | | 3.00 | | | | 0.90 | - |
| | | EXTENDED | | | | 4.86 | | | | 4.50 | | | | | |
| | | SEVERE SERV. | | | | 5.94 | | | | | | | | 1.09 | 1.75 |
| 4" | 150# FLGD (4 BOLT) | STANDARD | 3.35 | | 2.34 | 3.77 | | 4.75 | 5.50 | 3.50 | 0.747 0.743 | 1.25-7UNC | | 1.10 | - |
| | | EXTENDED | | | | 6.15 | | | | 5.31 | | | | | |
| | | SEVERE SERV. | | | | 7.08 | | | | | | | | 1.08 | 2.00 |
| | 150/300# (8 BOLT) | STANDARD | 3.97 | | 1.72 | 3.14 | | 2.774 | 6.698 | 3.50 | | | | 1.10 | - |
| | | EXTENDED | | | | 5.52 | | | | 5.31 | | | | | |
| | | SEVERE SERV. | | | | 6.44 | | | | | | | | 1.08 | 2.00 |
| | 600# (8 BOLT) | STANDARD | | 0.665 0.617 | 1.91 | 3.14 | 0.75-10UNC | 2.822 | 6.814 | 3.50 | | | | 1.10 | - |
| | | EXTENDED | | | | 5.52 | | | | 5.31 | | | | | |
| | | SEVERE SERV. | | | | 6.44 | | | | | | | | 1.08 | 2.00 |
| 6" | 150# (8 BOLT) | STANDARD | 4.75 | 1.012 0.956 | 3.00 | 5.45 | 1.00-8UNC | 3.895 | 9.404 | 6.00 | 1.247 1.243 | 2.00-12UN | | 1.69 | - |
| | | EXTENDED | | | | 8.66 | | | | | | | | | |
| | | SEVERE SERV. | | | | | | | | | | | | 1.30 | 2.39 |
| | 300# (8 BOLT) | STANDARD | | | | 5.45 | | | | | | | | 1.69 | - |
| | | EXTENDED | | | | 8.66 | | | | | | | | | |
| | | SEVERE SERV. | | | | | | | | | | | | 1.30 | 2.39 |
| | - | - | | | | - | | | | | | | | - | - |
| | | - | | | | - | | | | | | | | | |
| | | - | | | | - | | | | | | | | - | - |

# Service Guide

The following charts have been assembled based on experiences in actual field installations, as well as from commonly published corrosion data. Due to the many variables involved in determining the degree of compatibility between a certain material and a certain fluid, the charts must be used as a guide only, and cannot be interpreted as a guarantee. Factors such as temperature, concentration, pressure, velocity, aeration, abrasion, cavitation, flashing, etc. play an important application role in determining the suitability of any material in a particular application and must also be taken into consideration.

The selection of a suitable valve body material for a particular application is much easier than the selection of other valve components such as seats, ball, stem and packing. A certain amount of corrosion is sometimes acceptable on the valve body, but the seats, ball and stem materials must be chosen carefully since corrosion of these components will likely affect the sealing characteristics of the valve.

In addition to the compatibility of the material to the fluid, care must be taken to select materials and designs that are capable of withstanding the actual pressures and temperatures. Consult pages 14-15 of this catalog for pressure/temperature ratings of valves with various seats.

Engineered Valves cannot accept responsibility for the accuracy, currency or reliability of the information contained herein. Selection of materials is at the sole risk of the user.

CONSULT FACTORY FOR SERVICES NOT LISTED.

| Chemicals | Body/Trim | | | | | Seats/Packing | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Carbon Steel | 316 Stainless Steel | Alloy 20 | Monel | Hastelloy C | EPDM | PEEK | Graphite | PTFE | Reinforced (PTFE) | UHMWP |
| Acetaldehyde | C | A | A | A | A | B | A | A | A | A | D |
| Acetamide | B | B | | | A | | | A | A | A | |
| Acetate Solvents | A | A | | A | A | | A | A | A | A | |
| Acetic Acid, Aerated | D | A | | A | A | | | A | A | A | |
| Acetic Acid, Air Free | D | A | A | A | A | | | A | A | A | |
| Acetic Acid, Crude | C | A | A | B | A | | | A | A | A | |
| Acetic Acid, Glacial | | D | | | A | B | A | A | A | A | |
| Acetic Acid, Pure | D | A | A | C | A | | A | A | A | A | C |
| Acetic Acid, 10% | C | A | A | B | A | B | | A | A | A | A |
| Acetic Acid, 80% | C | A | A | B | A | C | | A | A | A | C |
| Acetic Acid Vapors | | D | B | C | A | | A | A | A | A | |
| Acetic Anhydride | D | B | B | B | A | C | A | A | A | A | C |
| Acetone | A | A | A | A | A | A | A | A | A | A | A |
| Acetyl Chloride | | C | | B | A | D | A | A | A | A | |
| Acetylene | A | A | A | A | A | A | A | A | A | A | |
| Acrylonite | A | A | B | A | A | D | | A | A | A | |
| Acryolontrile | A | A | A | A | | | | | A | A | |
| Adipic Acid | A | A | B | B | | | B | | A | A | |
| Acid Fumes | D | B | B | | | | | C | A | A | |
| Air | A | | A | A | A | A | A | B | A | A | A |
| Albumen | | A | | | | | | | A | | |

| Chemicals | Body/Trim | | | | | Seats/Packing | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Carbon Steel | 316 Stainless Steel | Alloy 20 | Monel | Hastelloy C | EPDM | PEEK | Graphite | PTFE | Reinforced (PTFE) | UHMWP |
| Alcohol, Allyl | A | A | A | A | | | | | A | A | |
| Alcohol, Amyl | B | A | B | B | B | A | A | A | A | A | |
| Alcohol, Benzyl | | A | | | A | | | | A | A | |
| Alcohol, Butyl | B | A | A | A | A | C | A | A | A | A | |
| Alcohol, Diacetone | A | A | A | B | A | B | | A | A | A | |
| Alcohol, Ethyl | B | B | A | B | A | A | A | A | A | A | A |
| Alcohols, Fatty | B | A | A | | A | | | A | A | A | |
| Alcohol, Furfuryl | | A | | | | | | | A | A | |
| Alcohol, Isopropyl | B | B | A | B | B | A | | A | A | A | |
| Alcohol, Methyl | B | A | A | A | A | A | A | A | A | A | |
| Alcohol, Propyl | B | A | A | A | A | A | A | A | A | A | |
| Alumina | | A | | | A | A | A | A | A | A | |
| Aluminum Acetate | | A | B | C | B | A | A | A | A | A | A |
| Aluminum Chloride Dry | C | C | D | B | B | A | A | A | A | A | |
| Aluminum Chloride Solution | | D | B | B | A | | A | A | A | A | A |
| Aluminum Fluoride | D | C | | B | A | A | | A | A | D | A |
| Aluminum Hydroxide | D | A | B | B | B | A | | A | A | A | A |
| Aluminum Nitrate | | C | B | C | B | B | | B | A | A | |
| Alum (Aluminum Potassium Sulfate) | | B | B | C | A | | | A | A | A | A |
| Aluminum Sulfate | D | B | B | C | A | A | | A | A | A | A |

A = Excellent B = Fair C = Poor D = Not Recommended

# Service Guide

| Chemicals | Body/Trim | | | | | Seats/Packing | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Carbon Steel | 316 Stainless Steel | Alloy 20 | Monel | Hastelloy C | EPDM | PEEK | Graphite | PTFE | Reinforced (PTFE) | UHMWP |
| Amines | B | A | A | B | B | C | A | A | A | A | |
| Ammonia, Alum | | A | A | | A | | | A | A | A | |
| Ammonia, Anhydrous Liquid | A | A | A | B | A | B | A | A | A | A | |
| Ammonia, Aqueous | A | A | A | B | B | | A | A | A | A | |
| Ammonia Gas, Hot | | A | A | B | B | A | A | A | A | A | A |
| Ammonia Liquor | | A | A | | B | | | A | A | A | |
| Ammonia Solutions | B | A | A | B | B | B | | A | A | A | |
| Ammonium Acetate | | B | A | B | B | A | | A | A | A | |
| Ammonium Bicarbonate | C | B | B | B | | A | | A | A | A | A |
| Ammonium Bromide 5° | | B | B | B | | | | A | A | A | A |
| Ammonium Carbonate | B | B | B | B | | A | | A | A | A | A |
| Ammonium Chloride | D | C | B | B | B | A | A | A | A | A | A |
| Ammonium Hydroxide 28% | C | B | A | D | B | B | | A | A | A | A |
| Ammonium Hydroxide, Concentrated | C | B | A | C | B | A | | A | A | A | A |
| Ammonium Monophosphate | D | B | B | B | | | | | A | A | |
| Ammonium Monosulfate | | A | B | B | B | | | | A | A | A |
| Ammonium Nitrate | D | A | B | D | B | A | | B | A | A | A |
| Ammonium Persulfate | | A | A | D | | B | | | A | A | A |
| Ammonium Phosphate | D | B | B | C | | A | | A | A | A | A |
| Ammonium Phosphate Di-basic | D | B | B | C | B | | | A | A | A | |
| Ammonium Phosphate Tri-basic | D | B | B | C | B | | A | A | A | | |
| Ammonium Sulfate | C | B | B | B | B | A | | A | A | A | A |
| Ammonium Sulfide | D | B | B | B | | A | | A | A | A | A |
| Ammonium Sulfite | C | A | B | D | | B | | A | A | A | |
| Amyl Acetate | C | B | A | B | A | B | | A | A | A | A |
| Amyl Chloride | | A | A | B | B | D | | A | A | A | D |
| Aniline | C | B | A | B | B | C | | A | A | A | A |
| Aniline Dyes | C | A | A | A | | C | | A | A | A | |
| Antimony Trichloride | D | D | C | B | | | | | A | A | |
| Aqua Regia (Strong Acid) | D | B | B | | | D | D | D | A | A | C |
| Aromatic Solvents | C | A | A | B | | D | | A | A | A | |
| Arsenic Acid | D | B | B | D | B | B | | A | A | A | A |
| Barium Carbonate | B | B | B | B | A | A | | A | A | A | A |
| Barium Chloride | C | B | C | B | | A | | A | A | A | A |
| Barium Cyanide | | B | B | D | | B | | A | A | A | |
| Barium Hydrate | | A | A | B | | | | A | A | A | |
| Barium Hydroxide | C | B | A | B | | B | | A | A | A | A |
| Barium Nitrate | | A | | A | | | | B | A | A | |

| Chemicals | Body/Trim | | | | | Seats/Packing | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Carbon Steel | 316 Stainless Steel | Alloy 20 | Monel | Hastelloy C | EPDM | PEEK | Graphite | PTFE | Reinforced (PTFE) | UHMWP |
| Barium Sulfate | C | A | A | B | | B | | A | A | A | A |
| Barium Sulfide | C | B | B | C | | A | | A | A | A | A |
| Benzaldehyde | A | A | A | B | B | A | | A | A | A | D |
| Benzene (Benzol) | B | B | A | A | B | D | D | A | A | A | D |
| Benzoid Acid | D | B | B | B | A | D | | A | A | A | A |
| Beryllium Sulfate | | B | A | B | | B | | A | A | A | |
| Benzyl Chloride | B | B | | | | | | | A | A | |
| Black Sulfate Liquor | C | B | B | B | | | | | A | A | |
| Bleaching Powders | D | B | B | D | | | | | A | A | |
| Bleaching Powder, Wet | | C | B | D | A | B | | A | A | A | A |
| Blood (Meat Juices) | | A | A | B | | B | A | A | A | A | |
| Borax (Sodium Borate) | C | A | | A | A | A | A | A | A | A | A |
| Bordeaux Mixture | | A | A | | | | | A | A | A | |
| Boric Acid | D | B | B | B | A | B | A | A | A | A | A |
| Brake Fluid | | B | | B | | B | | A | A | A | |
| Brines, saturated | D | B | B | B | A | A | | A | A | A | A |
| Bromine, Dry | D | D | B | A | A | D | D | B | A | A | D |
| Bromine, Wet | D | D | D | D | | | | | A | A | |
| Bromic Acid | | | | | | | | | A | A | |
| Bunker Oils (Fuel) | B | A | A | A | | | | A | A | A | D |
| Butadiene | B | A | A | C | B | C | A | A | C | C | D |
| Butane | B | A | A | B | A | D | A | A | A | A | A |
| Butyl Acetate | | B | A | B | B | D | | A | A | A | D |
| Butylene | A | A | A | A | | D | A | A | A | A | |
| Butyric Acid | D | B | B | B | A | C | A | A | A | A | D |
| Calcium Bisulfite | D | B | B | D | B | D | | A | A | A | |
| Calcium Carbonate | D | B | B | B | B | B | A | A | A | A | A |
| Calcium Chlorate | | B | B | B | | B | | B | A | A | A |
| Calcium Chloride | C | B | B | B | A | B | A | A | A | A | A |
| Calcium Hydroxide | C | B | B | A | A | A | A | A | A | A | A |
| Calcium Hypochlorite | D | C | B | C | | | | | A | A | |
| Calcium Nitrate | | B | B | | | B | | B | A | A | A |
| Calcium Phosphate | | B | B | | | B | | A | A | A | A |
| Calcium Silicate | | B | B | | | B | | A | A | A | |
| Calcium Sulfate | C | B | B | B | B | B | A | A | A | A | A |
| Camphor | | B | C | C | | B | | A | A | A | D |
| Cane Sugar Liquors | | A | A | B | | B | | A | A | A | |
| Carbolic Acid (Phenol) | D | B | A | B | | B | A | A | A | A | |
| Carbonated Beverages | D | B | B | C | | B | | A | A | A | |
| Carbonated Water | B | A | A | B | | A | | A | A | A | A |
| Carbon Bisulfide | B | B | B | B | | D | | A | A | A | D |

A = Excellent B = Fair C = Poor D = Not Recommended

# Service Guide

| Chemicals | Body/Trim | | | | | Seats/Packing | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Carbon Steel | 316 Stainless Steel | Alloy 20 | Monel | Hastelloy C | EPDM | PEEK | Graphite | PTFE | Reinforced (PTFE) | UHMWP |
| Carbon Dioxide, Dry | A | A | A | A | | B | | A | A | A | A |
| Carbon Monoxide | | A | A | A | A | B | A | | A | A | A |
| Carbon Tetrachloride, Dry | B | A | A | A | A | D | A | A | A | A | D |
| Carbon Tetrachloride, Wet | D | B | B | B | B | D | A | A | A | A | D |
| Castor Oil | B | A | A | A | A | B | | A | A | A | A |
| Caustic Potash (KOH) | | A | A | B | | | B | A | A | A | |
| Caustic Soda (NaOH) | B | A | A | A | | B | B | A | A | A | |
| Cellulose Acetate | | B | | B | B | B | | A | A | A | |
| Chlorinated Solvents | C | A | A | B | | D | D | A | A | A | |
| Chlorinated Water | | C | A | D | D | | D | A | A | A | C |
| Chlorine, Dry | B | D | B | A | A | | | | A | A | |
| Chlorine, Wet | D | D | C | D | A | | | | A | A | |
| Chlorine Gas, Dry | B | B | A | A | A | D | D | A | A | A | D |
| Chlorobenzene, Dry | B | A | A | B | B | D | B | A | A | A | D |
| Chloroform, Dry | B | A | A | A | B | D | | A | A | A | |
| Chlorophyll, Dry | | B | A | B | | B | | A | A | A | |
| Chlorosulfonic Acid, Dry | B | B | B | B | A | D | D | | A | D | D |
| Chlorosulfonic Acid, Wet | D | D | D | C | | | | | A | A | |
| Chrome Alum | B | A | A | B | | B | | A | A | A | A |
| Chromic Acid <50% | D | C | B | C | B | C | D | A | A | A | A |
| Chromic Acid >50% | D | C | B | D | B | C | D | A | A | A | |
| Chromium Sulfate | | B | C | B | | B | | A | A | A | |
| Citric Acid | D | B | A | B | A | B | A | A | A | A | A |
| Coke Oven Gas | B | A | A | B | | D | | A | A | A | |
| Cooking Oil | B | A | A | A | | D | | A | A | A | |
| Copper Acetate | D | A | A | C | B | B | | A | A | A | |
| Copper Carbonate | | A | A | | | | | A | A | A | |
| Copper Chloride | D | D | D | C | | | | | A | A | |
| Copper Cyanide | | A | A | C | | B | | A | A | A | A |
| Copper Nitrate | D | B | B | D | | B | | B | A | A | A |
| Copper Sulfate | D | B | B | C | A | A | | A | A | A | A |
| Corn Oil | C | B | B | B | | C | | A | A | A | A |
| Cottonseed Oil | C | B | B | B | | C | A | A | A | A | A |
| Cresol | | B | B | | | D | | A | A | A | D |
| Creosote Oil | B | B | A | B | B | D | A | A | A | A | D |
| Cresylic Acid | C | B | B | B | | D | | A | A | A | A |
| Crude Oil, Sour | B | A | A | B | | D | | A | A | A | |
| Crude Oil, Sweet | B | A | A | A | | | A | A | A | A | |
| Cumeme | B | B | B | B | | | | | A | A | |
| Cupric Nitrate | | A | A | D | | | | B | A | A | |
| Cutting Oils (Water Emulsions) | B | A | | A | | | | A | A | A | |

| Chemicals | Body/Trim | | | | | Seats/Packing | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Carbon Steel | 316 Stainless Steel | Alloy 20 | Monel | Hastelloy C | EPDM | PEEK | Graphite | PTFE | Reinforced (PTFE) | UHMWP |
| Cyanide Plating Solution | | B | B | D | | B | | | A | A | |
| Cyclohexane | A | A | A | B | B | D | A | A | A | A | C |
| Cyclohexanone | | A | A | B | B | | B | A | A | A | D |
| Denatured Alcohol | B | A | A | A | | | | | A | A | |
| Detergents, Synthetic | | B | A | B | | B | | A | A | A | A |
| Dextrin | | B | B | B | | B | | A | A | A | A |
| Diacetone Alcohol | A | A | A | A | | | | | A | A | |
| Diamylamine | | A | A | | | | | | A | A | |
| Dibutyl Phthalate | | | | | | | | | A | A | |
| Dichloroethane | | C | B | B | | D | | A | A | A | |
| Dichloroethyl Ether | | B | B | | | D | | | A | A | |
| Diesel Oil Fuels | A | A | A | A | | D | | A | A | | |
| Diethylamine | A | A | A | B | | C | | A | A | A | |
| Diethyl Benzene | | B | B | | | D | | A | A | A | |
| Diethylene Glycol | | A | A | B | | A | A | A | A | A | A |
| Diethyl Sulfate | | B | B | B | | C | | A | A | A | |
| Dimethyl Formamide | | A | A | B | | D | A | A | A | A | |
| Dimethyl Phthalate | | D | | | | | | A | A | A | |
| Dioxane | | B | B | B | | C | A | A | A | A | |
| Dipentane (Pinene) | | A | A | | | D | | A | A | A | |
| Disodium Phosphate | | B | B | C | | | | A | A | A | A |
| Dowtherm | B | A | A | A | | D | A | A | A | A | |
| Drilling Mud | B | A | A | B | | A | | A | A | A | |
| Dry Cleaning Fluids | B | A | A | B | | | | A | A | A | |
| Drying Oil | C | B | B | B | | | | A | A | A | |
| Enamel | | A | | | | D | | A | A | A | |
| Epsom Salts (MgSo4) | C | B | B | B | | | | A | A | A | |
| Ethane | C | B | B | B | | D | A | A | A | A | |
| Ether | A | A | A | B | | C | A | A | A | A | D |
| Ethyl Acetate | B | B | B | B | B | C | | A | A | A | C |
| Ethyl Acrylate | C | A | A | B | A | C | | A | A | A | |
| Ethylamine | | A | | | | | | | | A | A |
| Ethyl Benzene | | B | A | | A | D | | A | A | A | |
| Ethyl Bromide | | B | C | B | | B | | A | A | A | |
| Ethyl Chloride, Dry | B | A | A | B | B | C | | A | A | A | D |
| Ethyl Chloride, Wet | D | B | B | B | B | B | | A | A | A | A |
| Ethylene | A | A | A | A | | | | | A | A | |
| Etylenediamene | | A | | | | | | | A | A | |
| Ethylene Chloride | | | A | A | B | B | | A | A | A | |
| Ethylene Dichloride, Dry | B | A | A | A | | | | | A | A | |
| Ethylene Dichloride, Wet | D | C | A | B | | | | | A | A | |

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# Service Guide

| Chemicals | Body/Trim | | | | | Seats/Packing | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Carbon Steel | 316 Stainless Steel | Alloy 20 | Monel | Hastelloy C | EPDM | PEEK | Graphite | PTFE | Reinforced (PTFE) | UHMWP |
| Ethylene Glycol | B | B | A | B | A | A | A | A | A | A | A |
| Ethylene Oxide | B | B | B | B | A | D | A | D | A | A | C |
| Ethyl Ether | | A | A | A | B | D | A | A | A | A | |
| Ethyl Silicate | | B | B | B | | B | | A | A | A | |
| Ethyl Sulfate | | B | B | | | C | | A | A | A | |
| Fatty Acids | D | A | A | B | A | D | A | A | A | A | A |
| Ferric Chloride | D | D | D | D | | | | | A | A | |
| Ferric Hydroxide | | A | A | A | | | | A | A | A | |
| Ferric Nitrate | D | C | A | D | B | A | | B | A | A | A |
| Ferric Sulfate | D | B | A | D | | A | | A | A | A | A |
| Ferrous Ammonium Citrate | | B | B | | | | | A | A | A | A |
| Ferrous Chloride | D | D | D | D | D | A | | A | A | A | A |
| Ferrous Sulfate | D | B | B | B | B | A | | A | A | A | A |
| Ferrous Sulfate, Saturated | C | A | A | B | B | B | | A | A | A | |
| Fertilizer Solutions | B | B | B | B | | | | A | A | A | |
| Fish Oils | B | A | A | A | | D | | A | A | A | |
| Flue Gases | | A | A | B | | D | | A | A | A | |
| Fluoride Salts | | B | | | | | | | A | D | |
| Fluorine Gas, Dry | | B | A | A | A | | D | | A | D | |
| Fluoboric Acid | | B | A | | | | | | A | D | A |
| Fluorosilicic Acid | D | B | B | A | B | C | | | A | D | A |
| Formaldehyde, Cold | A | A | A | A | B | B | | A | A | A | A |
| Formaldehyde, Hot | D | C | B | B | B | | | A | A | A | A |
| Formic Acid, Cold | D | B | A | B | A | | | A | A | A | A |
| Formic Acid, Hot | D | B | B | B | B | | | A | A | A | A |
| Freon Gas, Dry | B | A | A | A | B | C | A | A | A | A | |
| Freon 11, MF, 112, BF | | A | A | B | B | C | A | A | A | A | |
| Freon 12, 13, 32, 114, 115 | | A | A | B | B | A | A | A | A | A | |
| Freon 21, 31 | | A | A | B | B | D | A | A | A | A | |
| Freon 22 | | A | A | | B | D | A | A | A | A | |
| Freon 113, TF | | A | A | B | B | C | A | A | A | A | |
| Freon, Wet | | C | B | B | B | B | D | A | A | A | |
| Fuel Oil | B | A | A | B | | | D | A | A | A | D |
| Fumaric Acid | | | A | | | | | | A | A | |
| Gallic Acid 5% | D | B | B | B | B | C | | | A | A | A |
| Gas, Manufactured | B | B | B | A | | D | | A | A | A | |
| Gas, Natural | B | A | B | A | | D | | A | A | A | |
| Gas, Odorizers | B | B | A | B | | | | A | A | A | |
| Gasoline, Aviation | A | A | A | A | A | | | A | A | A | D |
| Gasoline, Leaded | A | A | A | B | A | | A | A | A | A | D |
| Gasoline, Motor | A | A | A | A | A | D | A | A | A | A | D |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| | Carbon Steel | 316 Stainless Steel | Alloy 20 | Monel | Hastelloy C | EPDM | PEEK | Graphite | PTFE | Reinforced (PTFE) | UHMWP |
| Gasoline, Refined | B | A | A | B | A | D | | A | A | A | D |
| Gasoline, Sour | B | A | A | C | A | D | | A | A | A | D |
| Gasoline, Unleaded | A | A | A | A | A | | | A | A | A | D |
| Glue | A | B | A | B | A | B | A | A | A | A | A |
| Glutamic Acid | | B | A | | | | | | A | A | |
| Glycerine (Glycerol) | C | A | A | A | A | A | A | A | A | A | A |
| Glycol Amine | | B | | | D | D | | A | A | A | |
| Glycol | C | B | A | B | | A | A | A | A | A | |
| Helium Gas | | A | A | B | A | B | A | A | A | A | A |
| Heptane | B | A | A | B | A | D | A | A | A | A | C |
| Hexane | B | A | A | B | A | D | A | A | A | A | D |
| Hexanol, Tertiary | A | A | A | A | A | D | | A | A | A | A |
| Hydraulic Oil, Petroleum Base | A | A | A | A | | D | | A | A | A | |
| Hydrazine | | B | B | D | | B | | | A | A | |
| Hydrobromic Acid | D | D | D | D | | | | | A | A | |
| Hydrochloric Acid | D | D | D | D | | | | | A | A | |
| Hydrocyanic Acid | D | A | A | C | B | B | A | | A | A | A |
| Hydrofluoric Acid, Anhydrous | B | B | B | A | | | | | A | D | |
| Hydrofluosilicic Acid | D | C | B | B | | B | D | A | A | D | |
| Hydrogen Gas, Cold | B | A | A | A | | B | A | A | A | A | A |
| Hydrogen Gas, Hot | B | B | A | | A | B | A | A | A | A | A |
| Hydrogen Bromide Gas | | | | | | | | | A | A | |
| Hydrogen Chloride Gas, Dry | D | B | A | B | | | | | A | A | |
| Hydrogen Peroside, Concentrated | D | B | B | D | D | B | A | D | A | A | C |
| Hydrogen Peroxide, Dilute | D | B | B | D | D | B | A | C | A | A | A |
| Hydrogen Sulfide, Dry | B | A | B | B | B | A | A | A | A | A | A |
| Hydrogen Sulfide, Wet | C | B | B | C | D | B | A | A | A | A | A |
| Hypo (Sodium Thiosulfate) | D | B | B | B | | A | | A | A | A | |
| Illuminating Gas | A | A | A | A | | D | | A | A | A | |
| Ink-Newsprint | D | A | A | B | | B | | A | A | A | A |
| Iso-Butane | | B | B | | | D | | A | A | A | |
| Iso-Octane | A | A | A | A | | D | A | A | A | A | |
| Isopropyl Acetate | | B | A | | | D | A | A | A | A | |
| Isopropyl Ether | A | A | A | B | A | D | A | A | A | A | |
| J P-4 Fuel | A | A | A | A | A | | A | A | A | A | |
| J P-5 Fuel | A | A | A | A | A | | A | A | A | A | |
| J P-6 Fuel | A | A | A | A | A | | A | A | A | A | |
| Kerosene | B | A | A | A | A | D | A | A | A | A | C |
| Ketones | A | A | A | A | | D | A | A | A | A | |
| Lacquer (and Solvent) | C | A | A | A | | D | A | A | A | A | |

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# Service Guide

| Chemicals | Body/Trim | | | | | Seats/Packing | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Carbon Steel | 316 Stainless Steel | Alloy 20 | Monel | Hastelloy C | EPDM | PEEK | Graphite | PTFE | Reinforced (PTFE) | UHMWP |
| Lactic Acid Concentrated, Cold | D | A | A | D | A | B | A | A | A | A | A |
| Lactic Acid Concentrated, Hot | D | B | A | D | B | B | A | A | A | A | A |
| Lactic Acid Dilute Cold | D | A | A | C | A | B | A | A | A | A | A |
| Lactic Acid Dilute Hot | D | A | A | D | B | | A | A | A | A | A |
| Lactose | | B | B | B | | B | | A | A | A | |
| Lard Oil | C | B | A | B | | B | A | A | A | A | A |
| Lead Acetate | D | B | B | B | | B | A | A | A | A | A |
| Lead Arsenate | B | | | | | | | | A | A | |
| Lead Oxide | | | | | | | | | A | A | |
| Lead Sulfate | | B | B | B | | B | | A | A | A | |
| Lecithin | | B | B | B | | D | | | A | A | |
| Linoleic Acid | B | A | A | B | | D | | A | A | A | |
| Linseed Oil | A | A | A | B | | D | A | A | A | A | A |
| Lithium Chloride | | B | A | B | | B | A | A | A | A | |
| LPG | B | B | B | B | | D | A | A | A | A | |
| Lubricating Oil (Petroleum Based) | A | A | A | B | | D | | A | A | A | C |
| Lye — See Sodium Hydroxide & Potassium Hydroxide | | | | | | | | | | | |
| Magnesium Bisulfate | B | A | A | B | | B | A | A | A | A | |
| Magnesium Bisulfide | | B | B | B | | B | A | A | A | A | |
| Magnesium Carbonate | | A | A | B | | B | A | A | A | A | A |
| Magnesium Chloride | C | B | B | B | A | A | A | A | A | A | A |
| Magnesium Hydroxide | B | A | A | B | B | A | A | A | A | A | A |
| Magnesium Hydroxide, Hot | B | A | A | A | B | | A | A | A | A | A |
| Magnesium Oxide | | | | | | | | | A | A | |
| Magnesium Nitrate | | A | A | B | | | A | B | A | A | A |
| Magnesium Sulfate | B | A | A | B | A | A | A | A | A | A | A |
| Maleic Acid | B | B | B | B | A | D | A | A | A | A | A |
| Maleic Anhydride | | B | B | B | B | D | | A | A | A | |
| Malic Acid | D | B | B | B | | | A | A | A | A | |
| Manganese Carbonate | | B | A | | | | A | A | A | A | |
| Manganese Sulfate | | A | A | B | | B | A | A | A | A | |
| Meat Juices | | A | A | | | | | A | A | A | A |
| Melamine Resins | | C | C | | | | | A | A | A | |
| Methanol | | A | A | B | | D | | A | A | A | |
| Mercuric Chloride | D | B | B | D | B | A | A | A | A | A | A |
| Mercuric Cyanide | D | A | A | C | B | A | A | A | A | A | A |
| Mercurous Nitrate | | A | A | D | | | A | B | A | A | A |
| Mercury | A | A | A | B | B | A | A | A | A | A | A |
| Methane | B | A | A | B | A | | A | A | A | A | |
| Methyl Acetate | B | A | A | B | A | B | A | A | A | A | |

| Chemicals | Body/Trim | | | | | Seats/Packing | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Carbon Steel | 316 Stainless Steel | Alloy 20 | Monel | Hastelloy C | EPDM | PEEK | Graphite | PTFE | Reinforced (PTFE) | UHMWP |
| Methyl Acetone | A | A | A | A | | A | A | A | A | A | |
| Methylamine | B | A | A | C | B | B | A | A | A | A | |
| Methyl Bromide 100% | | B | A | B | | D | A | A | A | A | D |
| Methyl Cellosolve | B | A | A | B | B | B | | A | A | A | |
| Methyl Cellulose | | A | A | | B | | | A | A | A | |
| Methyl Chloride | B | A | A | B | | D | A | A | A | A | D |
| Methyl Ethyl Ketone | A | A | A | A | B | B | C | A | A | A | D |
| Methylene Chloride | B | A | A | B | B | D | A | A | A | A | D |
| Methyl Formate | C | B | A | B | B | B | | A | A | A | |
| Methyl Isobutyle Ketone | | A | A | | | | | A | A | A | |
| Mineral Oils | B | A | A | A | | D | A | A | A | A | D |
| Mine Water (Acid) | D | C | C | C | | | | | A | A | |
| Mineral Spirits | B | B | B | B | | | | A | A | A | D |
| Molybdic Acid | | A | A | | | | | A | A | A | |
| Monochloroacetic Acid | D | D | C | D | | | | | A | A | |
| Monocloro Benzene, Dry | | B | B | B | | | B | A | A | A | |
| Morpholine | | A | A | B | | B | | A | A | A | |
| Muriatic Acid | D | D | D | D | D | | | | A | A | |
| Naptha | B | B | B | B | A | D | A | A | A | A | D |
| Napthalene | B | B | B | B | B | D | A | A | A | A | D |
| Natural Gas, Sour | B | A | A | D | A | D | A | A | A | A | A |
| Nickel Ammonium Sulfate | D | A | A | C | | B | | A | A | A | |
| Nickel Chloride | D | B | A | B | A | B | A | A | A | A | A |
| Nickel Nitrate | D | B | A | B | | A | A | B | A | A | A |
| Nickel Sulfate | D | B | A | B | B | B | A | A | A | A | A |
| Nicotinic Acid (Niacin) | B | A | A | A | | D | | A | A | A | A |
| Nitric Acid 10% | D | A | A | D | | | B | B | A | A | A |
| Nitric Acid 30% | D | A | A | D | | B | B | D | A | A | A |
| Nitric Acid 80% | D | C | B | D | | D | D | D | A | A | D |
| Nitric Acid 100% | D | A | A | D | | D | D | D | A | A | D |
| Nitric Acid Anhydrous | D | A | A | D | | D | D | D | A | A | |
| Nitrobenzene | B | A | A | B | B | C | C | A | A | A | D |
| Nitrocellulose | B | B | B | B | | | | | A | A | |
| Nitrogen | A | A | A | A | | B | A | A | A | A | A |
| Nitrous Acid 10% | D | B | B | D | | | D | A | A | A | |
| Nitrous Gases | B | A | A | D | | | A | A | A | A | |
| Nitrous Oxide | B | B | B | D | B | | A | A | A | A | |
| Oil, Linseed | A | A | A | B | | | | | A | A | |
| Oil, Lubricating | A | A | A | B | | | | | A | A | |
| Oils Petroleum Refined | A | A | A | A | A | D | A | A | A | A | |
| Oils, Petroleum Sour | B | A | A | A | A | D | A | A | A | A | |

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| Chemicals | Body/Trim | | | | | Seats/Packing | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Carbon Steel | 316 Stainless Steel | Alloy 20 | Monel | Hastelloy C | EPDM | PEEK | Graphite | PTFE | Reinforced (PTFE) | UHMWP |
| Oils Water Mixture | B | A | A | | A | | A | A | A | A | |
| Olaic Acid | | B | B | A | | | | A | A | A | |
| Oleic Acid | C | B | A | B | B | D | D | A | A | A | C |
| Oleum | B | B | B | C | B | D | | | A | A | D |
| Oleum Spirits | | B | B | D | | D | | | A | A | |
| Olive Oil | B | A | A | A | | B | A | A | A | A | A |
| Oxalic Acid | D | B | B | B | | B | A | A | A | A | A |
| Oxygen | B | A | A | A | A | A | D | D | A | A | A |
| Ozone, Dry | A | A | A | A | A | A | D | | A | A | C |
| Ozone, Wet | C | A | A | A | A | B | D | | A | A | C |
| Paints & Solvents | A | A | A | A | | D | | A | A | A | A |
| Palmitic Acid | C | B | B | B | | B | A | A | A | A | |
| Palm Oil | C | B | A | A | | D | | A | A | A | A |
| Paraffin | B | A | A | A | A | D | A | A | A | A | C |
| Paraformaldehyde | B | B | B | B | | D | | A | A | A | |
| Paraldehyde | | B | B | | | D | | A | A | A | |
| Pentane | B | A | A | B | | D | A | A | A | A | |
| Perchlorethylene, Dry | B | A | A | B | B | D | | A | A | A | |
| Phenol | D | A | A | A | A | D | | A | A | A | D |
| Phosphate Ester | A | A | A | A | | A | | A | A | A | |
| Phosphoric Acid 10% Cold | D | C | B | C | | | | | A | A | |
| Phosphoric Acid 10% Hot | D | C | B | B | | | | | A | A | |
| Phosphoric Acid 50% Cold | D | B | B | C | | B | D | A | A | A | A |
| Phosphoric Acid 50% Hot | D | D | B | C | | B | D | A | A | A | A |
| Phosphoric Acid 85% Cold | B | A | B | A | | | D | A | A | A | A |
| Phosphoric Acid 85% Hot | C | B | B | | | | D | A | A | A | A |
| Phosphoric Anhydride | | A | A | | | | D | A | A | A | |
| Phosphorous Trichloride | B | A | A | | | B | D | A | A | A | A |
| Phthalic Acid | C | B | B | A | B | | B | A | A | A | |
| Phthalic Anhydride | C | B | B | A | A | | | A | A | A | A |
| Pine Oil | B | A | A | B | | D | | A | A | A | D |
| Pitch (Bitumen) | | A | A | | | D | | A | A | A | |
| Polysulfide Liquor | | B | A | B | | B | | A | A | A | |
| Polyvinyl Acetate | | B | B | B | | B | | A | A | A | |
| Polyvinyl Chloride | | B | B | B | B | B | | A | A | A | |
| Potassium Bicarbonate | | A | A | B | | | | A | A | A | A |
| Potassium Bichromate | | A | A | A | | | | A | A | A | |
| Potassium Bisulfate | | A | A | B | | | | A | A | A | |
| Potassium Bisulfite | D | B | B | D | B | | | A | A | A | |
| Potassium Bromide | D | A | B | B | B | | | A | A | A | A |
| Potassium Carbonate | B | B | B | B | | B | | A | A | A | A |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| | Carbon Steel | 316 Stainless Steel | Alloy 20 | Monel | Hastelloy C | EPDM | PEEK | Graphite | PTFE | Reinforced (PTFE) | UHMWP |
| Potassium Chlorate | B | B | B | C | | B | | C | A | A | A |
| Potassium Chloride | C | B | A | B | B | A | | A | A | A | A |
| Potassium Chromate | | B | B | B | | B | | | A | A | A |
| Potassium Cyanide | B | B | B | B | B | A | | A | A | A | A |
| Potassium Dichromate | C | B | A | B | | B | | | A | A | A |
| Potassium Ferricyanide | C | A | B | B | | B | | A | A | A | A |
| Potassium Ferrocyanide | C | B | B | A | | | | A | A | A | A |
| Potassium Hydroxide, Dilute Cold | A | B | B | A | | | | A | A | A | A |
| Potassium Hydroxide, To 70%, Cold | B | B | B | A | | B | | A | A | A | A |
| Potassium Hydroxide, Dilute Hot | B | B | B | A | | | | A | A | A | A |
| Potassium Hydroxide, To 70%, Hot | A | B | B | A | | A | | A | A | A | A |
| Potassium Iodide | C | B | B | B | B | B | | A | A | A | |
| Potassium Nitrate | B | B | B | B | B | B | | B | A | A | A |
| Potassium Oxalate | | A | A | | | | A | A | A | A | |
| Potassium Permanganate | B | B | B | B | B | B | D | | A | A | A |
| Potassium Phosphate | | B | B | B | B | A | D | | A | A | A |
| Potassium Phosphate, Di-basic | A | A | A | B | B | B | | A | A | A | |
| Potassium Phosphate, Tri-basic | A | B | B | B | | B | | A | A | A | |
| Potassium Sulfate | B | A | A | B | | A | | A | A | A | A |
| Potassium Sulfide | B | A | A | C | A | B | | A | A | A | A |
| Potassium Sulfite | B | A | A | C | B | A | | A | A | A | A |
| Propane Gas B | B | A | B | A | D | A | A | A | A | A | |
| Propionic Acid | D | B | B | B | | | | | A | A | |
| Propyl Alcohol | B | A | A | A | | | | | A | A | |
| Propyl Bromide | | B | A | B | | B | | A | A | A | |
| Propylene Glycol | B | B | B | B | | B | A | A | A | A | A |
| Pyridine | | B | A | | | | | A | A | A | |
| Pyrolgalic Acid | B | B | A | B | | | | | A | A | |
| Pyroligenous Acid | | A | B | | | | | | A | A | |
| Quinine, Sulfate, Dry | | A | A | B | | | | A | A | A | |
| R P-1 Fuel | A | A | A | A | | | | A | A | A | |
| Rubber Latex Emulsions | B | A | A | | | | | A | A | A | |
| Salicyclic Acid | D | A | B | B | | B | A | A | A | A | A |
| Salt (NaCl) | C | B | A | A | | | A | A | A | A | A |
| Salt Brine | | B | B | B | | B | A | A | A | A | A |
| Sea Water | D | B | B | A | | A | A | A | A | A | A |
| Sewage | C | B | B | B | | B | A | A | A | A | A |

A = Excellent B = Fair C = Poor D = Not Recommended

# Service Guide

| Chemicals | Body/Trim | | | | | Seats/Packing | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Carbon Steel | 316 Stainless Steel | Alloy 20 | Monel | Hastelloy C | EPDM | PEEK | Graphite | PTFE | Reinforced (PTFE) | UHMWP |
| Shellac | A | A | A | A | | | A | A | A | A | |
| Silicone Fluids | | B | B | | | | A | A | A | A | C |
| Silver Bromide | | A | A | B | | | | A | A | A | |
| Silver Cyanide | | A | A | B | | | | A | A | A | |
| Silver Nitrate | D | A | A | D | | A | | B | A | A | A |
| Silver Plating Sol. | | A | A | | | | | | A | A | |
| Soap Solutions (Stearates) | A | A | A | A | | A | | A | A | A | |
| Sodium Acetate | C | B | B | B | B | B | A | A | A | A | A |
| Sodium Aluminate | C | A | B | B | B | B | A | A | A | A | |
| Sodium Benzoate | | B | B | B | | | A | A | A | A | A |
| Sodium Bicarbonate | C | B | A | B | | A | A | A | A | A | A |
| Sodium Bichromate | | B | B | | | | A | | A | A | |
| Sodium Bisulfate 10% | D | A | A | B | | B | A | A | A | A | A |
| Sodium Bisulfite 10% | D | A | B | B | B | B | A | A | A | A | A |
| Sodium Borate | C | B | B | B | | B | A | A | A | A | A |
| Sodium Bromide 10% | C | B | B | B | | B | | A | A | A | A |
| Sodium Carbonate (Soda Ash) | B | A | A | B | B | B | | A | A | A | A |
| Sodium Chlorate | C | B | B | C | B | B | | B | A | A | A |
| Sodium Chloride | C | B | A | A | B | B | | A | A | A | A |
| Sodium Chromate | B | A | B | B | | B | | | A | A | |
| Sodium Citrate | | B | B | | | | | A | A | A | |
| Sodium Cyanide | B | A | A | B | | B | | A | A | A | |
| Sodium Ferricyanide | | A | A | B | | | | A | A | A | A |
| Sodium Fluoride | D | B | A | B | | B | A | A | A | D | A |
| Sodium Hydroxide, 20% Cold | A | A | B | A | | B | A | A | A | D | A |
| Sodium Hydroxide, 20% Hot | B | A | A | A | | B | | A | A | D | A |
| Sodium Hydroxide, 50% Cold | A | A | A | A | | B | | A | A | D | A |
| Sodium Hydroxide, 50% Hot | B | A | A | B | | | | A | A | D | A |
| Sodium Hydroxide, 70% Cold | A | A | B | A | | B | | A | A | D | A |
| Sodium Hydroxide, 70% Hot | B | A | B | B | | B | | A | A | D | A |
| Sodium Hypochlorite (Bleach) | D | D | C | D | A | | | A | A | A | A |
| Sodium Hyposulfite | | B | B | B | | | | A | A | A | |
| Sodium Lactate | | A | A | B | | | | A | A | A | |
| Sodium Metaphosphate | B | B | B | | A | B | | A | A | A | |
| Sodium Metasilicate Cold | C | A | A | A | | | | A | A | A | |
| Sodium Metasilicate Hot | D | A | A | A | A | | | A | A | A | |
| Sodium Nitrate | B | A | A | B | B | B | D | | A | A | A |
| Sodium Nitrite | | B | B | C | B | A | | B | A | A | A |
| Sodium Perborate | B | B | B | B | B | A | | A | A | A | |
| Sodium Peroxide | C | B | B | B | B | A | | A | A | A | |

| Chemicals | Body/Trim | | | | | Seats/Packing | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Carbon Steel | 316 Stainless Steel | Alloy 20 | Monel | Hastelloy C | EPDM | PEEK | Graphite | PTFE | Reinforced (PTFE) | UHMWP |
| Sodium Phosphate | C | B | B | B | B | A | | A | A | A | A |
| Sodium Phosphate, Di-basic | C | B | B | B | B | A | | A | A | A | |
| Sodium Phosphate, Tri-basic | C | B | B | B | B | A | | A | A | A | |
| Sodium Polyphosphate | | B | B | B | B | A | | A | A | A | |
| Sodium Salicylate | | A | A | | | | | A | A | A | |
| Sodium Silicate | B | B | B | B | | B | A | A | A | A | A |
| Sodium Silicate, Hot | C | B | B | B | | B | A | A | A | A | A |
| Sodium Stearate | | B | | | | | | | A | A | |
| Sodium Sulfate | B | A | A | A | | A | | A | A | A | A |
| Sodium Sulfide | B | B | B | B | | B | | A | A | A | A |
| Sodium Sulfite | | A | A | B | B | B | | A | A | A | A |
| Sodium Tetraborate | | A | A | | | B | | A | A | A | |
| Sodium Thiosulfate | B | B | B | B | | A | | A | A | A | |
| Soybean Oil | C | A | A | A | | B | A | A | A | A | A |
| Stannous Chloride | D | B | A | C | | | | | A | A | |
| Stannous Fluoride | | B | B | | | | | | A | D | |
| Starch | C | B | A | A | | C | A | A | A | A | A |
| Steam (212°F) | A | A | A | B | | B | A | A | A | A | A |
| Stearic Acid | C | B | B | B | A | B | | A | A | A | A |
| Styrene | A | A | A | B | A | D | A | A | A | A | |
| Succinic Acid | B | B | B | | | | | | A | A | |
| Sulfate, Black Liquor | C | B | B | B | | B | | A | A | A | |
| Sulfate, Green Liquor | C | B | B | B | | | | A | A | A | |
| Sulfate, White Liquor | C | B | D | C | | | | A | A | A | |
| Sulfite Liquors | D | B | | D | | | | | A | A | |
| Sulfonic Acid | | B | | B | | | | | A | A | |
| Sulfur | C | B | A | B | | B | A | A | A | A | A |
| Sulfur Chlorides | D | D | A | B | | C | | A | A | A | |
| Sulfur Dioxide, Dry | B | A | B | B | A | A | | A | A | A | A |
| Sulfur Dioxide, Wet | | A | B | A | B | B | | A | A | A | A |
| Sulfur Hexafluoride | | | A | A | | | | A | A | D | |
| Sulfur, Molten | C | B | A | D | B | B | D | A | A | A | |
| Sulfur Trioxide | B | B | B | | B | | | D | A | A | |
| Sulfur Trioxide, Dry | B | B | B | B | B | B | | D | A | A | |
| Sulfuric Acid (0-7%) | D | B | C | C | | | | | A | A | |
| Sulfuric Acid (7-40%) | D | D | B | C | | | | | A | A | |
| Sulfuric Acid (40-75%) | D | D | C | B | | | B | | A | A | |
| Sulfuric Acid (75-95%) | C | D | B | D | | | | | A | A | |
| Sulfuric Acid (95-100%) | C | C | D | B | | | | | A | A | |
| Sulfurous Acid | D | B | B | D | B | C | | A | A | A | A |
| Synthesis Gas | B | B | B | A | | | | | A | A | |

A = Excellent B = Fair C = Poor D = Not Recommended

# Service Guide

| Chemicals | Body/Trim | | | | | Seats/Packing | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Carbon Steel | 316 Stainless Steel | Alloy 20 | Monel | Hastelloy C | EPDM | PEEK | Graphite | PTFE | Reinforced (PTFE) | UHMWP |
| Tall Oil | B | B | B | B | A | D | A | A | A | A | |
| Tannic Acid | C | B | B | B | B | B | A | A | A | A | A |
| Tartaric Acid | D | A | A | B | B | B | | A | A | A | A |
| Tetraethyl Lead | C | B | B | A | | | A | A | A | A | |
| Thioglycolic Acid | | B | B | | | | | | A | A | |
| Toluol (Toluene) | A | A | A | A | A | D | A | A | A | A | D |
| Toluene Diisocyanate | | A | A | | | | | | A | A | |
| Transformer Oil | A | A | A | A | | | A | A | A | A | C |
| Tributyl Phosphate | A | A | A | A | | B | | A | A | A | |
| Trichlorethylene | B | B | B | B | A | D | | A | A | A | D |
| Trichloroacetic Acid | | D | B | B | A | | | | A | A | C |
| Triethanolamine | | B | B | B | A | B | | A | A | A | C |
| Triethylamine | | B | B | | A | | | | A | A | |
| Triethylene Glycol | C | B | B | B | | | | | A | A | |
| Trisodium Phosphate | | B | B | | A | B | | A | A | A | A |
| Tung Oil | B | A | A | C | A | D | A | A | A | A | |
| Turpentine | B | B | B | B | A | D | A | A | A | A | D |
| Urea | C | B | B | B | A | B | A | A | A | A | A |
| Uric Acid | | A | A | | A | | A | A | A | A | |

| Chemicals | Body/Trim | | | | | Seats/Packing | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Carbon Steel | 316 Stainless Steel | Alloy 20 | Monel | Hastelloy C | EPDM | PEEK | Graphite | PTFE | Reinforced (PTFE) | UHMWP |
| Varnish | C | A | A | A | A | D | A | A | A | A | A |
| Vegetable Oils | B | A | A | B | A | D | | A | A | A | |
| Vinegar | D | A | A | B | A | A | A | A | A | A | A |
| Vinyl Acetate | | B | B | B | A | A | A | A | A | A | |
| Vinyl Chloride, Dry | A | B | B | B | | | | | A | A | |
| Water, Deionized | D | A | A | A | | | | | A | A | |
| Water, Distilled | D | A | A | A | A | B | A | A | A | A | A |
| Water, Fresh | C | A | A | A | A | B | A | A | A | A | A |
| Water, Sea | D | B | B | A | | | | | A | A | |
| Water, Acid Mine | D | B | | D | C | A | A | A | A | A | A |
| Wax Emulsions | A | A | A | A | | | | | A | A | |
| White Water | C | B | B | C | | | | | A | A | |
| Xylene (Xylol), Dry | B | A | A | A | A | D | A | A | A | A | D |
| Zinc Acetate | | B | | | | | | | A | A | |
| Zinc Chloride | D | D | A | B | | | | | A | A | |
| Zinc Bromide | | B | B | B | A | B | | A | A | A | |
| Zinc Hydrosulfite | A | A | A | B | A | A | | | A | A | |
| Zinc Sulfate | D | B | A | B | A | A | A | A | A | A | A |

A = Excellent B = Fair C = Poor D = Not Recommended

# Ordering Information

## How to Order Cam-Tite® Ball Valves

The Cam-Tite Ball Valve is designated by a series of configuration numbers that define the valve size (block A); base body construction (blocks B1–B4); cover type (block C); ball/stem material (block D1); seat material (block S1); stem seal / gasket materials (blocks S2-S3); actuation (blocks N1-N6); and additional options (blocks D3-L). By selecting the proper code for each of the required blocks, the configuration number can be specified. For a complete listing of the available codes, see pages 44 and 45. A blank Production Specification Worksheet can be found on page 48 of the catalog.

| BLOCK | FEATURES | Example 1 | Example 2 |
|---|---|---|---|
| A | Size | 2 | 1 |
| B1 | Body | 3010 | 3215 |
| B2 | Buttweld Schedule | | |
| B4 | Drain Port | | |
| C | Cover | 1 | 1 |
| D1 | Ball / Stem Material | T1 | T3 |
| S1 | Seat Material | ST1 | ST2 |
| S2 | Stem Seal / Gasket Material | SL1 | SL2 |
| S3 | Gasket material / Bellows Only | | |
| N1 | Actuation | | |
| N2 | Actuator Mode | | |
| N3 | Actuator Springs | | |
| N4 | Fail Position | | |
| N5 | Solenoid Valve | | |
| N6 | Limit Switches | | |
| D3 | Exterior Trim | | |
| D2 | Extended Stem | | |
| D4 | Optional Fasteners | | |
| E | Handle Options | | HD3 |
| F | Locking Device | | LDS |
| K | Optional Preparations | | |
| L | Nace Service | | |

**Example 1: 2-3010-1-T1-ST1-SL1**

2" ANSI Class 150# Flanged Carbon Steel Ball Valve with Standard Cover, 316 Stainless Steel Trim, PTFE Seats and Seals, and Hand Lever Operator.

**Example 2: 3215-1-T3-ST2-SL2-HD3-LDS**

1" ANSI Class 150-300# Socketweld End Alloy 20 Ball Valve with Standard Cover, Alloy 20 Trim, RTFE Seats and Seals, and Oval Handwheel Operator with Stainless Steel Locking Device.

# Figure Numbers - Bodies, Covers & Trim

## Size Range
### Cam-Tite Ball Valves (Block A)

| Code | Valve Size |
|---|---|
| 0.5 | 1/2" |
| 0.75 | 3/4" |
| 1 | 1" |
| 1.5 | 1 1/2" |
| 2 | 2" |
| 3 | 3" |
| 4 | 4" |
| 6 | 6" |

## Flanged Ends
### Cam-Tite Ball Valves (Block B1)

| Code | Body Material |
|---|---|
| 150# | |
| 3010 | Carbon Steel WCB |
| 3110 | Carbon Steel LCB |
| 3810 | Carbon Steel LC-1 |
| 3011 | 316L Stainless Steel |
| 3211 | Alloy 20 |
| 3311 | Monel |
| 3411 | Hastelloy C |
| 3511 | Nickel |
| 3611 | Titanium |
| 3711 | Inconel |
| 300# | |
| 3018 | Carbon Steel WCB |
| 3118 | Carbon Steel LCB |
| 3818 | Carbon Steel LC-1 |
| 3019 | 316L Stainless Steel |
| 3219 | Alloy 20 |
| 3319 | Monel |
| 3419 | Hastelloy C |
| 3519 | Nickel |
| 3619 | Titanium |
| 3719 | Inconel |
| 600# | |
| 3026 | Carbon Steel WCB |
| 3126 | Carbon Steel LCB |
| 3826 | Carbon Steel LC-1 |
| 3027 | 316L Stainless Steel |
| 3227 | Alloy 20 |
| 3327 | Monel |
| 3427 | Hastelloy C |
| 3527 | Nickel |
| 3627 | Titanium |
| 3727 | Inconel |

## Buttweld Ends
### Cam-Tite Ball Valves (Block B1)

| Code | Body Material |
|---|---|
| 150# | |
| 3012 | Carbon Steel WCB |
| 3112 | Carbon Steel LCB |
| 3812 | Carbon Steel LC-1 |
| 3113 | 316L Stainless Steel |
| 3213 | Alloy 20 |
| 3313 | Monel |
| 3413 | Hastelloy C |
| 3513 | Nickel |
| 3613 | Titanium |
| 3713 | Inconel |

## Buttweld Ends
### Cam-Tite Ball Valves (Block B1)

| Code | Body Material |
|---|---|
| 300# | |
| 3020 | Carbon Steel WCB |
| 3120 | Carbon Steel LCB |
| 3820 | Carbon Steel LC-1 |
| 3121 | 316L Stainless Steel |
| 3221 | Alloy 20 |
| 3321 | Monel |
| 3421 | Hastelloy C |
| 3521 | Nickel |
| 3621 | Titanium |
| 3721 | Inconel |
| 600# | |
| 3028 | Carbon Steel WCB |
| 3128 | Carbon Steel LCB |
| 3828 | Carbon Steel LC-1 |
| 3129 | 316L Stainless Steel |
| 3229 | Alloy 20 |
| 3329 | Monel |
| 3429 | Hastelloy C |
| 3529 | Nickel |
| 3629 | Titanium |
| 3729 | Inconel |

## Socketweld Ends
### Cam-Tite Ball Valves (Block B1)

| Code | Body Material |
|---|---|
| 150#–300# | |
| 3014 | Carbon Steel WCB |
| 3114 | Carbon Steel LCB |
| 3814 | Carbon Steel LC-1 |
| 3115 | 316L Stainless Steel |
| 3215 | Alloy 20 |
| 3315 | Monel |
| 3415 | Hastelloy C |
| 3515 | Nickel |
| 3615 | Titanium |
| 3715 | Inconel |
| 600# | |
| 3022 | Carbon Steel WCB |
| 3122 | Carbon Steel LCB |
| 3822 | Carbon Steel LC-1 |
| 3123 | 316L Stainless Steel |
| 3223 | Alloy 20 |
| 3323 | Monel |
| 3423 | Hastelloy C |
| 3523 | Nickel |
| 3623 | Titanium |
| 3723 | Inconel |

## Threaded Ends
### Cam-Tite Ball Valves (Block B1)

| Code | Body Material |
|---|---|
| 150#–300# | |
| 3016 | Carbon Steel WCB |
| 3116 | Carbon Steel LCB |
| 3816 | Carbon Steel LC-1 |
| 3117 | 316L Stainless Steel |
| 3217 | Alloy 20 |
| 3317 | Monel |
| 3417 | Hastelloy C |
| 3517 | Nickel |
| 3617 | Titanium |
| 3717 | Inconel |

## Threaded Ends
### Cam-Tite Ball Valves (Block B1)

| Code | Body Material |
|---|---|
| 600# | |
| 3024 | Carbon Steel WCB |
| 3124 | Carbon Steel LCB |
| 3824 | Carbon Steel LC-1 |
| 3125 | 316L Stainless Steel |
| 3225 | Alloy 20 |
| 3325 | Monel |
| 3425 | Hastelloy C |
| 3525 | Nickel |
| 3625 | Titanium |
| 3725 | Inconel |

## Buttweld Schedule (Block B2)

| Code | End Preparation |
|---|---|
| SCH10 | Schedule 10 |
| SCH40 | Schedule 40 |
| SCH80 | Schedule 80 |

## Drain Port (Block B4)

| Code | Drain Port |
|---|---|
| D | Body Port with Plug |

## Cover (Block C)

| Code | Cover |
|---|---|
| 1 | Standard |
| 2 | Extended |
| 3 | Severe Service |
| 4 | Severe Service with Lantern Ring |
| 5 | Bellows Seal / Manual |
| 6 | Bellows Seal / Actuated |
| 7 | Fire Safe Bellows Seal / Manual |
| 8 | Standard with Internals Cage |
| 9 | Extended with Internals Cage |
| 10 | Severe Service with Internals Cage |
| 11 | Severe Service with Lantern Ring and Internals Cage |
| 12 | Body Only |

## Ball / Stem (Block D1)

| Code | Ball / Stem Material |
|---|---|
| T1 | 316SS / 316SS |
| T2 | Monel / Monel |
| T3 | Alloy 20 / Alloy 20 |
| T4 | Hastelloy C / Hastelloy C |
| T5 | Hastelloy C / Monel |
| T6 | Monel / Hastelloy C |
| T7 | 316SS / Hastelloy C |
| T8 | Inconel 625 / Inconel 625 |
| T9 | Ceramic / 316SS |
| T10 | Ceramic / Monel |
| T11 | Ceramic / Alloy 20 |
| T12 | Ceramic / Hastelloy C |
| T13 | Nickel / Nickel |
| T14 | Titanium / Titanium |
| T15 | Tantalum / Hastelloy C |
| T16 | 304SS / 304SS |
| T17 | Alloy 20 / Inconel 718 |
| T18 | Tantalum / Nickel |
| T19 | 316SS/17-4 PhSS |

# Figure Numbers - Actuators, Actuator Accessories & Bonnet Options

## Seat Material (Block S1)

| Code | Seat Material |
|---|---|
| ST1 | PTFE |
| ST2 | RTFE |
| ST3 | Firesafe RTFE |
| ST4 | Firesafe PTFE |
| ST5 | UHMW Polyethylene |
| ST6 | G2000 PEEK |
| ST7 | G3000 PEEK |
| ST9 | PTFE/Carbon Filled |
| ST10 | Firesafe Design PTFE/ Carbon Filled |

## Stem Seal / Gasket Material (Block S2)

| Code | Stem Seal / Gasket Material |
|---|---|
| SL1 | PTFE/PTFE |
| SL2 | RTFE/RTFE |
| SL3 | UHMWP / UHMWP |
| SL4 | Graphite / Graphite |
| SL5 | Graphite / PTFE |
| SLT6 | Graphite / RTFE |
| SL7 | Graphite / G2000 PEEK |
| SL8 | Graphite / G3000 PEEK |

## Gasket Material / Bellows Only (Block S3)

| Code | Gasket Material |
|---|---|
| G1 | PTFE |
| G2 | RTFE |
| G3 | UHMWP |
| G4 | Graphite |
| G5 | G2000 PEEK |
| G6 | G3000 PEEK |

## Actuator (Block N1)

| Code | Actuator Model |
|---|---|
| H15 | H15 Compact Actuator |
| H20 | H20 Compact Actuator |
| H25 | H25 Compact Actuator |
| H30 | H30 Compact Actuator |
| H35 | H35 Compact Actuator |
| H45 | H45 Compact Actuator |
| H60 | H60 Compact Actuator |
| H75 | H75 Compact Actuator |
| G80 | Mastergear Model 980 |
| G81 | Mastergear Model 981 |
| G84 | Mastergear Model 984 |
| G87 | Mastergear Model 987 |

## Compact Actuator Mode (Block N2)

| Code | Actuator Model |
|---|---|
| DA | Double Acting |
| SR | Spring Return |

## Compact Actuator Mode (Block N3)

| Code | Actuator Springs |
|---|---|
| 1A | 1A |
| 1B | 1B |
| 2 | 2 |
| 2A | 2A |
| 2B | 2B |
| 2C | 2C |
| 3 | 3 |

## Compact Actuator Failure Position (Block N4)

| Code | Failure Position |
|---|---|
| FO | Fail Open |
| FC | Fail Closed |

## Solenoid Valve (Block N5)

| Code | Description |
|---|---|
| SV1 | Asco 8320G184 |
| SV2 | Asco EF8320G184 |
| SV3 | Asco 8345G1 |
| SV4 | Asco EF8345G1 |

## Actuator Limit Switches (Block N6)

| Code | Description |
|---|---|
| LS1 | Westlock 1065 |
| LS2 | Westlock 1040 |
| LS3 | Westlock 2004BY |
| LS4 | Westlock 2007XBY |
| LS5 | Posiflex F30A-A-A |
| LS7 | Posiflex F30A-C-A |
| LS9 | Westlock 3030BY |
| LS10 | Westlock 9479BY |

## Exterior Trim (Block D3)

| Code | Trim Material |
|---|---|
| ET1 | Stainless Steel Gland, Bellevilles, Washers and Nuts |
| ET2 | Stainless Steel Gland, Washers and Nuts / Inconel Bellevilles |
| ET3 | Inconel Gland, Washers, Nuts and Bellevilles |
| ET4 | Hastelloy Gland, Washers and Nuts / Inconel Bellevilles |

## Extended Stem (Block D3)

| Code | Extension Type |
|---|---|
| EXTSP | Stem Extension w/out Bracket |
| EXTSPBK | Stem Extension with Bracket |

## Optional Fasteners (Block D4)

| Code | Material |
|---|---|
| BOLTING | |
| B1 | A193 GR B7 |
| B2 | A320 GR L7 |

## Optional Fasteners (Block D4)

| Code | Material |
|---|---|
| BOLTING (cont.) | |
| B3 | A193 GR B8 |
| B4 | Inconel |
| B5 | Hastelloy |
| B6 | Alloy 20 |
| B7 | A193 GR B7/PTFE Coated |
| B8 | Monel |
| B9 | A193 GR B7M |
| STUDS / NUTS | |
| SN1 | A193 GR B7 / A194 GR 2H |
| SN2 | A320 GR L7 / A194 GR L7 |
| SN3 | A193 GR B8 / A194 GR B8 |
| SN4 | Inconel / Inconel |
| SN5 | Hastelloy / Hastelloy |
| SN6 | Alloy 20 / Alloy 20 |
| SN7 | A193 GR B7/PTFE Coated |
| SN8 | Monel / Monel |

## Handle Options (Block E)

| Code | Material |
|---|---|
| HANDLE | |
| HD1 | Stainless Steel |
| OVAL HANDWHEEL | |
| HD2 | Carbon Steel |
| HD3 | Stainless Steel |
| CHAINWHEEL | |
| HD5 | Carbon Steel Horizontal Line |
| HD6 | Carbon Steel Vertical Line |
| HD7 | Stainless Steel Horiz. Line |
| HD8 | Stainless Steel Vertical Line |

## Locking Device (Block F)

| Code | Material |
|---|---|
| LDS | Stainless Steel |

## Optional Preparation (Block K)

| Code | Preparation |
|---|---|
| CLV | Chlorine / Vented Body |
| HF | Hydroflouric Acid |
| HFV | HF Acid / Vented Body |
| OX | Oxygen |
| PHO | Phosgene |
| PHOV | Phosgene / Vented Body |
| TOB | Tobacco Service (No PTFE) |
| TOBV | Tobacco Service / Vented |
| V | Vented Body |
| NL | No Lubricant |
| VNL | Vented Body / No Lubricant |
| VB | Vented Ball |
| CLN | Cleaned and bagged |
| CLNV | Vented body/cleaned and bagged |

## Nace Service (Block L)

| Code | Nace Service |
|---|---|
| NACE1 | Nace 1 Service |
| NACE2 | Nace 2 Service |
| NACE3 | Nace 3 Service |

# Metric Conversion Table

| Inches | Millimeters |
|---|---|
| 0 | 0.0000 |
| 1/128 | 0.1984 |
| 1/64 | 0.3969 |
| 3/128 | 0.5953 |
| 1/32 | 0.7937 |
| 5/128 | 0.9921 |
| 3/64 | 1.1906 |
| 7/128 | 1.3890 |

Convert 3.7643 meters to feet, inches and fractions

3.7643 meters
3.6556 = 12 ft.
108.70 mm
107.95 = 4¼ in.
.75 = 1/32"
3.7643 meters = 12'—4-9/32"

Convert 15'—6-7/16" to meters

15' = 4.5720 meters
6-7/16" = .163513 meters
15'—6-7/16" = 4.735513 meters

## INCHES AND FRACTIONS — MILLIMETERS

| Inches | Millimeters | Inches | Millimeters | Inches | Millimeters | Inches | Millimeters | Inches | Millimeters | Inches | Millimeters |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/16 | 1.5875 | 2-1/16 | 52.3876 | 4-1/16 | 103.188 | 6-1/16 | 153.988 | 8-1/16 | 204.788 | 10-1/16 | 255.588 |
| 1/8 | 3.1750 | 2-1/8 | 53.9751 | 4-1/8 | 104.775 | 6-1/8 | 155.575 | 8-1/8 | 206.375 | 10-1/8 | 257.176 |
| 3/16 | 4.7625 | 2-3/16 | 55.5626 | 4-3/16 | 106.363 | 6-3/16 | 157.163 | 8-3/16 | 207.963 | 10-3/16 | 258.763 |
| 1/4 | 6.3500 | 2-1/4 | 57.1501 | 4-1/4 | 107.950 | 6-1/4 | 158.750 | 8-1/4 | 209.550 | 10-1/4 | 260.351 |
| 5/16 | 7.9375 | 2-5/16 | 58.7376 | 4-5/16 | 109.538 | 6-5/16 | 160.338 | 8-5/16 | 211.138 | 10-5/16 | 261.938 |
| 3/8 | 9.5250 | 2-3/8 | 60.3251 | 4-3/8 | 111.125 | 6-3/8 | 161.925 | 8-3/8 | 212.725 | 10-3/8 | 263.526 |
| 7/16 | 11.1125 | 2-7/16 | 61.9126 | 4-7/16 | 112.713 | 6-7/16 | 163.513 | 8-7/16 | 214.313 | 10-7/16 | 265.113 |
| 1/2 | 12.7000 | 2-1/2 | 63.5001 | 4-1/2 | 114.300 | 6-1/2 | 165.100 | 8-1/2 | 215.900 | 10-1/2 | 266.701 |
| 9/16 | 14.2875 | 2-9/16 | 65.0876 | 4-9/16 | 115.888 | 6-9/16 | 166.688 | 8-9/16 | 217.488 | 10-9/16 | 268.288 |
| 5/8 | 15.8750 | 2-5/8 | 66.6751 | 4-5/8 | 117.475 | 6-5/8 | 168.275 | 8-5/8 | 219.075 | 10-5/8 | 269.876 |
| 11/16 | 17.4625 | 2-11/16 | 68.2626 | 4-11/16 | 119.063 | 6-11/16 | 169.863 | 8-11/16 | 220.663 | 10-11/16 | 271.463 |
| 3/4 | 19.0500 | 2-3/4 | 69.8501 | 4-3/4 | 120.650 | 6-3/4 | 171.450 | 8-3/4 | 222.250 | 10-3/4 | 273.051 |
| 13/16 | 20.6375 | 2-13/16 | 71.4376 | 4-13/16 | 122.238 | 6-13/16 | 173.038 | 8-13/16 | 223.838 | 10-13/16 | 274.638 |
| 7/8 | 22.2250 | 2-7/8 | 73.0251 | 4-7/8 | 123.825 | 6-7/8 | 174.625 | 8-7/8 | 225.425 | 10-7/8 | 276.226 |
| 15/16 | 23.8125 | 2-15/16 | 74.6126 | 4-15/16 | 125.413 | 6-15/16 | 176.213 | 8-15/16 | 227.013 | 10-15/16 | 277.813 |
| 1 | 25.4001 | 3 | 76.2002 | 5 | 127.00 | 7 | 177.800 | 9 | 228.600 | 11 | 279.401 |
| 1-1/16 | 26.9876 | 3-1/16 | 77.7877 | 5-1/16 | 128.588 | 7-1/16 | 179.388 | 9-1/16 | 230.188 | 11-1/16 | 280.988 |
| 1-1/8 | 28.5751 | 3-1/8 | 79.3752 | 5-1/8 | 130.175 | 7-1/8 | 180.975 | 9-1/8 | 231.775 | 11-1/8 | 282.576 |
| 1-3/16 | 30.1626 | 3-3/16 | 80.9627 | 5-3/16 | 131.763 | 7-3/16 | 182.563 | 9-3/16 | 233.363 | 11-3/16 | 284.163 |
| 1-1/4 | 31.7501 | 3-1/4 | 82.5502 | 5-1/4 | 133.350 | 7-1/4 | 184.150 | 9-1/4 | 234.950 | 11-1/4 | 285.751 |
| 1-5/16 | 33.3376 | 3-5/16 | 84.1377 | 5-5/16 | 134.938 | 7-5/16 | 184.738 | 9-5/16 | 236.538 | 11-5/16 | 287.338 |
| 1-3/8 | 34.9251 | 3-3/8 | 85.7252 | 5-3/8 | 136.525 | 7-3/8 | 187.325 | 9-3/8 | 238.125 | 11-3/8 | 288.926 |
| 1-7/16 | 36.5126 | 3-7/16 | 87.3127 | 5-7/16 | 138.113 | 7-7/16 | 188.913 | 9-7/16 | 239.713 | 11-7/16 | 290.513 |
| 1-1/2 | 38.1001 | 3-1/2 | 88.9002 | 5-1/2 | 139.700 | 7-1/2 | 190.500 | 9-1/2 | 241.300 | 11-1/2 | 292.101 |
| 1-9/16 | 39.6876 | 3-9/16 | 90.4877 | 5-9/16 | 141.288 | 7-9/16 | 192.088 | 9-9/16 | 242.888 | 11-9/16 | 293.688 |
| 1-5/8 | 41.2751 | 3-5/8 | 92.0752 | 5-5/8 | 142.875 | 7-5/8 | 193.675 | 9-5/8 | 244.475 | 11-5/8 | 295.276 |
| 1-11/16 | 42.8626 | 3-11/16 | 93.6627 | 5-11/16 | 144.463 | 7-11/16 | 195.263 | 9-11/16 | 246.063 | 11-11/16 | 296-863 |
| 1-3/4 | 44.4501 | 3-3/4 | 95.2502 | 5-3/4 | 146.051 | 7-3/4 | 196.850 | 9-3/4 | 247.650 | 11-3/4 | 298.451 |
| 1-13/16 | 46.0376 | 3-13/16 | 96.8377 | 5-13/16 | 147.638 | 7-13/16 | 198.438 | 9-13/16 | 249.238 | 11-13/16 | 300.038 |
| 1-7/8 | 47.6251 | 3-7/8 | 98.4252 | 5-7/8 | 149.225 | 7-7/8 | 200.025 | 9-7/8 | 250.825 | 11-7/8 | 301.626 |
| 1-15/16 | 49.2126 | 3-15/16 | 100.013 | 5-15/16 | 150.813 | 7-15/16 | 201.613 | 9-15/16 | 252.413 | 11-15/16 | 303.213 |
| 2 | 500.8001 | 4 | 101.600 | 6 | 152.400 | 8 | 203.200 | 10 | 254.001 | 12 | 304.801 |

## TORQUE CONVERSION FACTORS

| Units to be converted ▼ | AMERICAN STD. | | | METRIC | | | INTERNATIONAL SYSTEM — S.I. | | |
|---|---|---|---|---|---|---|---|---|---|
| | oz-in | lb-in | lb-ft | g-cm | kg-cm | kg-m | mN-m | cN-m | N-m |
| 1 oz - in = | 1 | 0.0625 | 0.0005 | 72 | 0.072 | 0.0007 | 7.062 | 0.706 | 0.007 |
| 1 lb - in = | 16 | 1 | 0.083 | 1152.1 | 1.152 | 0.0115 | 113 | 11.3 | 0.113 |
| 1 lbl - ft = | 192 | 12 | 1 | 13 826 | 13.83 | 0.138 | 1356 | 135.6 | 1.356 |
| 1 g - cm = | 0.014 | 0.0009 | 0.000 07 | 1 | 0.001 | 0.0001 | 0.098 | 0.01 | 0.0001 |
| 1 kg - cm = | 13.89 | 0.868 | 0.072 | 1000 | 1 | 0.01 | 98.07 | 9.807 | 0.098 |
| 1 kg - m = | 1389 | 86.8 | 7.233 | 100000 | 100 | 1 | 9807 | 980.7 | 9.807 |
| 1 mN - m = | 0.142 | 0.009 | 0.0007 | 10.2 | 0.01 | 0.0001 | 1 | 0.1 | 0.001 |
| 1 cN - m = | 14.16 | 0.088 | 0.007 | 102 | 0.102 | 0.001 | 10 | 1 | 0.01 |
| 1 N - m = | 141.6 | 8.851 | 0.738 | 10 197 | 10.20 | 0.102 | 1000 | 100 | 1 |

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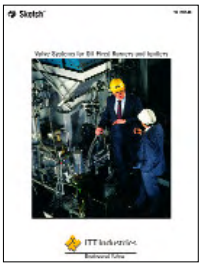


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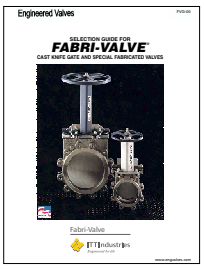


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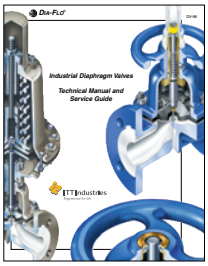


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