

# FLUSH TANK AND ANGLE STEM FLUSH TANK BALL VALVES



## F Series & AF Series

- For Industrial and Sanitary Applications



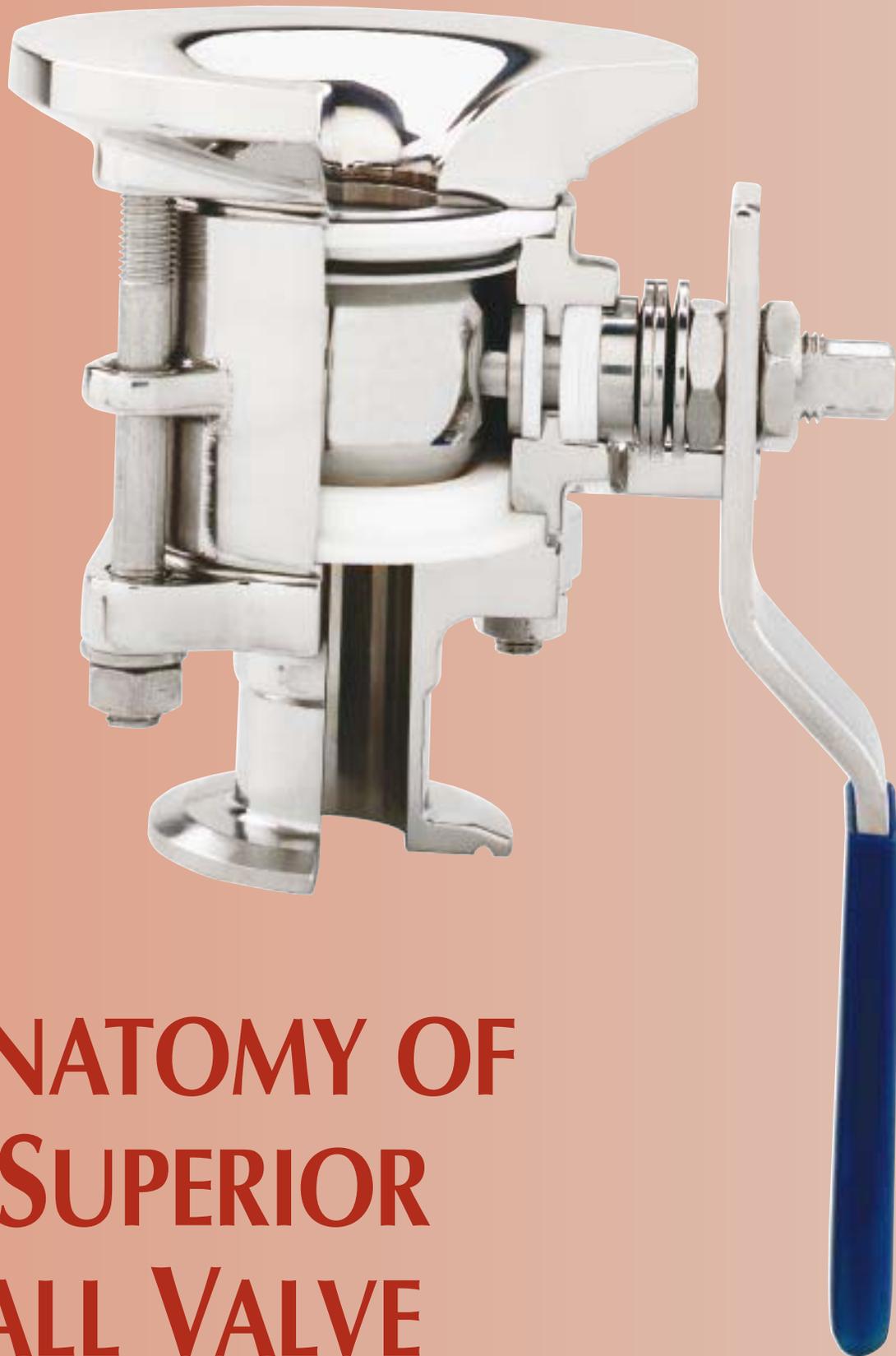
design

engineering

quality

innovation





# ANATOMY OF A SUPERIOR BALL VALVE

- The Adjust-O-Seal® design incorporates an engineered space between the valve body and end-fittings. This unique feature allows the valve seats to be restored to a leak-tight condition without draining the tank and removing the valve from the processing line. This adjustment can be repeated several times to compensate for normal wear.
- Top sealing feature prevents leakage.
- Valve opens and closes with easy quarter-turn operation.
- Internal seat design produces a bubble-tight seal.
- Spring-loaded washers create a live-loaded stem assembly for positive sealing.
- Encapsulated body gaskets minimize cold flow and reduce recesses where media could accumulate and contaminate the process.
- Optional body cavity fillers minimize areas where media could become trapped and contaminate the process.
- Standard bottom-entry stem provides protection from inadvertent stem removal. Engagement between the slot and ball is specially designed for high torque applications.
- Stainless steel handles with vinyl end cover are designed for a sure grip. The handle position visually indicates whether the valve is open or closed.
- Stem assembly can accommodate PBM Direct Mount Actuation for improved alignment and increased cycling life.
- Stainless steel ball is precision machined and polished to reduce torque and flow resistance.
- Unique pad radius facilitates efficient drainage and reduces the pocket area above the ball.

## DESIGN FLEXIBILITY

*The best way to assure good valve performance is to customize the valve to the process.*

PBM offers a comprehensive ball valve line for optimum performance in controlling and automating process lines. Product offerings include 2-way, Flush Tank, Diverter Port, Multi-Port and specialty ball valves.

Selecting the ideal valve for a process starts with a choice of 18 different metals and alloys for basic valve construction, plus a wide variety of trim and soft part materials. Twenty-eight different end fittings are readily available for easy installation without additional unions.

Special options include angle stem, fire test, actuation, body cavity fillers, sanitary and aseptic valves and special testing. Should an application require a configuration not mentioned, PBM's engineering and manufacturing staffs will work with you to design one.

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# FLUSH TANK BALL VALVES

## INDUSTRIAL VALVES

PBM's Two-Way Industrial Flush Tank ball valves are designed for general purpose, non-sanitary process applications. They are suitable for use on tanks, reactors, and other vessels.

## SANITARY VALVES

PBM's Two-Way Sanitary Flush Tank ball valves are designed for pure process applications, where cracks and crevices within the valve need to be minimized. These valves are ideal for pharmaceutical, biotechnological and microelectronic applications. Valves are assembled lubricant-free with Virgin Polytetrafluoroethylene (VTFE) soft parts and either 316 or 316L wetted metal parts. When equipped with body cavity fillers and ID polish, Igenix valves are USDA approved for federally inspected meat and poultry plants. FDA approved materials allow inclusion within an FDA approved process. These valves are also used successfully in sanitary validation systems.

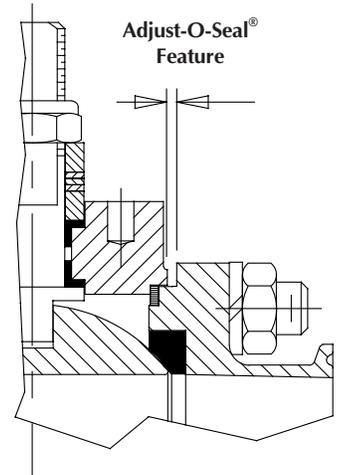
## FEATURES

### ADJUST-O-SEAL®

The Adjust-O-Seal design feature allows in-line adjustment to compensate for normal wear on seats, reducing downtime, maintenance and repair costs, by increasing the time between seat replacements.

The adjustment can usually be done several times before the seats have to be replaced. The adjustment is accomplished by slightly tightening the body bolts (1/8 turn), which compresses the seats against the ball and restores the valve to a leak tight condition.

The valve seats are always compressed against the ball which keeps process media out of the body chamber surrounding the ball. This seal also creates a double chamber or "Dual Chamber™". One chamber is inboard of the seats, and the other chamber is outboard of the seats. The Dual Chamber allows process flow through the ball while CIP/SIP media flows around the ball. Media may only enter the ball port or the body cavity as the valve is cycled.

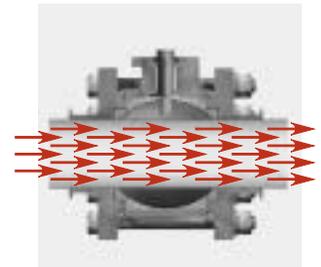


## PORT SIZES

### TRUE-BORE®

In many applications, it is critical that the flow path have no restrictions. If a pocket is present, puddling or incomplete drainage of the valve will occur. This puddling of condensate or biological fluids in the ball or end fittings provides an area where bacteria could grow.

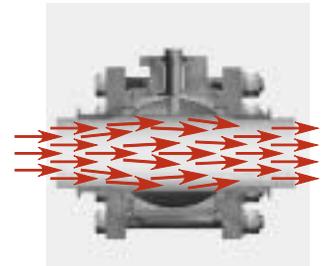
True-Bore means that the I.D. of the ball, seats and end fittings are identical to the I.D. of the tubing. For example, a 2" valve has a 1.87" diameter ball port, a 4" valve has a 3.84" diameter ball port. Therefore, there are no pockets or dead space in the through path, and high pressure drops will not occur. True-Bore is standard on PBM's FI, FC, FA, and FJ ball valves.



### FULL PORT

Full Port means that the ball port equals the nominal size of the valve. For example, a 2" valve has a 2.00" diameter ball port; a 4" valve has a 4.00" diameter ball port. While the features and benefits of a Full Port are similar as those of the True-Bore port size, the through path in a Full Port valve narrows slightly at the end fittings to match the O.D. of the surrounding piping.

Full Port is standard on PBM's FT, FD, FG, and FK ball valves.

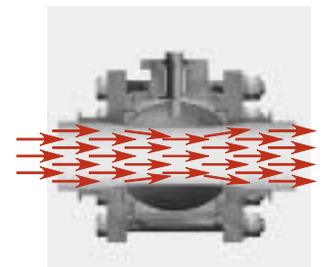


### REDUCED PORT

In a ball valve with a Reduced Port, the bore through the flush tank pad and the ball is one size smaller than the end fitting of the valve. For example, a 1" valve has a 0.75" port through the ball and pad and connects to 1" piping. Due to the smaller I.D. of the ball and pad, a larger pressure drop will occur as the flow stream passes in and out of the smaller end fitting and ball port.

Selecting a Reduced Port Flush Tank valve is an economical alternative in applications where a full port Flush Tank valve is not needed.

Reduced Port is standard on PBM's FE, FS, FH, and FL ball valves.



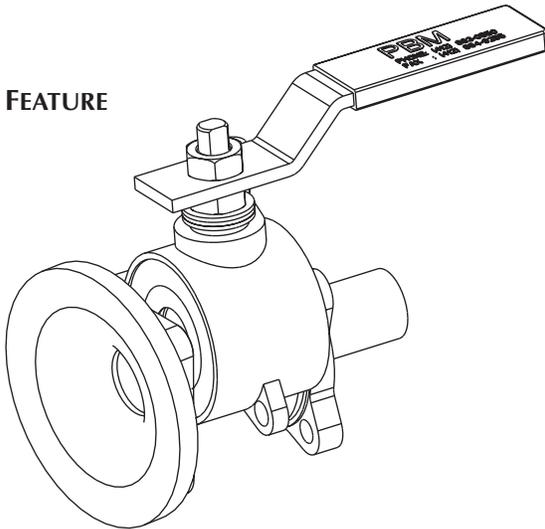
## FEATURES

### SWING OUT/LIFT OUT

This feature is valuable for welded piping systems or wherever in-line valve maintenance is required. With minimal spreading of the piping, remove one body bolt from the valve body and swing the body away from the installed position for easy maintenance. Swing the body back to reinstall the body bolt and return the valve to a leak-tight seal. Extended Butt Weld for Tube end fittings may be welded in-line without disassembly.

For maintenance that requires complete removal of the valve body from the system, the center sections of Series 5 valves can easily be lifted out of the installed position with minimal spreading of the pipe. Simply remove two body bolts and lift the body out.

### LIFT OUT FEATURE



SK-A060 ▲

### INTERCHANGEABLE SEATS

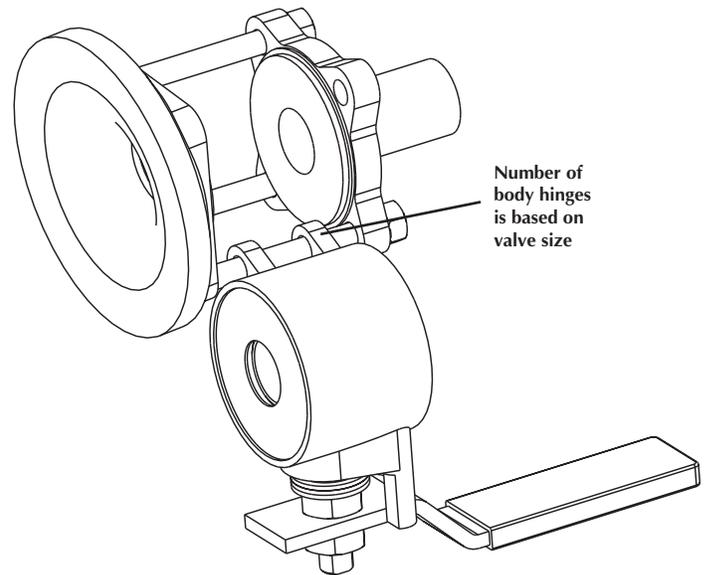
When the valve is swung out or lifted out from the installed position, seats may be interchangeable. Series 5 valve design allows seats to be exchanged for a different seat material as needed. In some valves, non-encapsulated seats may be changed to encapsulated seats and O-rings without changing the valve body. This easy seat exchange saves the cost of purchasing a new valve.

A one-piece seat and gasket assembly is suited for applications where temperature is constant or where a valve is not required to seal cold after operating hot.

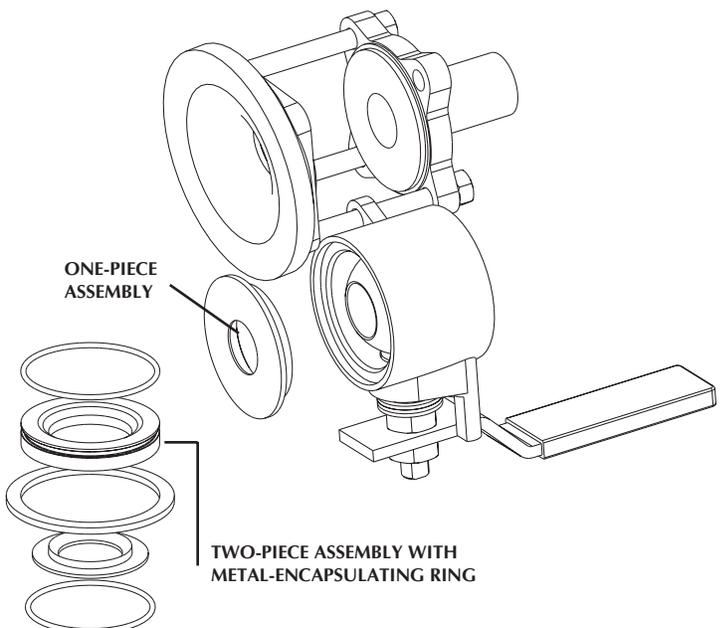
A two-piece seat and gasket assembly includes a separate seat and gasket, O-ring seals behind and around the seat, and a metal encapsulating ring that supports the inner bore of the seat. These valves are suited for applications in which a valve must seal cold after operating hot.

For more on these assemblies, see the Valve Selection Table on page 10.

### SWING OUT FEATURE



SK-A061 ▲



SK-A062 ▲

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## OPTIONS

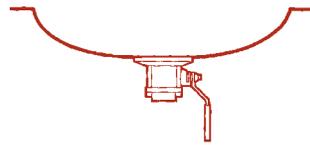
### PAD DESIGN

PBM's standard flush tank pad incorporates a unique radius that facilitates flow to the valve and reduces dead space where media could stagnate. The pad is designed to weld flush with the inside tank surface for strategic positioning of the ball.

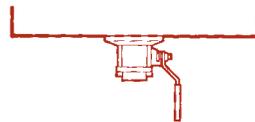


*Direct flow enables quarter-turn operation with higher  $C_v$  than conventional flush tank valves. Reduced dead space provides for more complete mixing and drainage.*

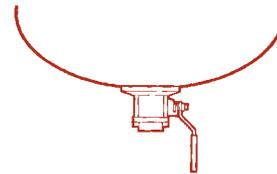
PBM's standard flush tank pad will fit most tank configurations, such as dished, flat, ellipsoidal, jacketed, conical or spherical.



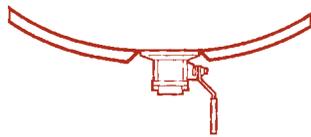
**DISHED**



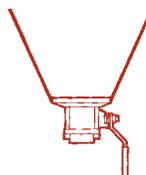
**FLAT**



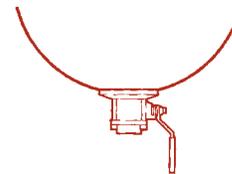
**ELLIPSOIDAL**



**JACKETED**

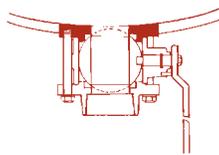


**CONICAL**

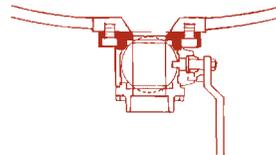


**SPHERICAL**

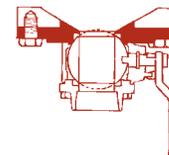
For special applications, PBM has custom pads such as the Cylindrical Radius Pad or ANSI Bolt-On Flat Pad. PBM also manufactures special adapter pads to accommodate customer-specified or existing valve products. With any unique application, you are encouraged to work directly with PBM for a custom solution. Also, pads may be shipped separately, at customer request, to accommodate welding. (See note regarding pad thickness on page 18.)



**CYLINDRICAL RADIUS PAD**



**BOLT-ON FLAT PAD**



**SPECIAL ADAPTER PAD**

### ANGLE STEM

For greater accessibility on tanks or batch mixers, PBM's Angle Stem (AF-Series) Flush Tank Valve incorporates a modified stem assembly that allows actuator clearance on jacketed or insulated tanks.

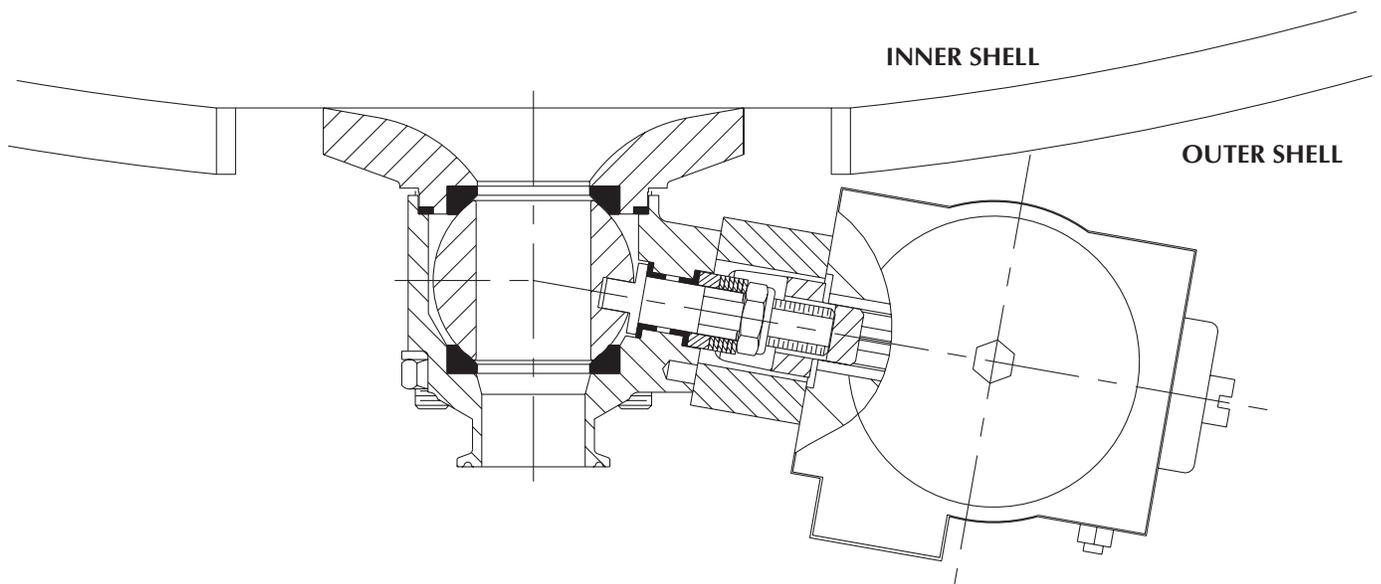
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## ADVANTAGES OF THE ANGLE STEM FLUSH TANK BALL VALVE

A wide variety of tanks and vessels commonly used in process industries have size and/or shape configurations that make valve mounting, valve actuator mounting, or accessibility a problem. Modifying the valve to solve this problem could reduce its efficiency. Adapting the tank is expensive and could compromise the tank's stability and uniformity. The unique angled stem of PBM's Angle Stem Flush Tank ball valve solves this accessibility problem by offsetting the actuator to clear tank obstructions.

- Improves access to tank mounted valves — even on jacketed and/or insulated tanks.
- Unique Adjust-O-Seal® feature allows in-line valve adjustment to compensate for normal wear on valve seats.
- Eliminates costly and time-consuming tank modifications.
- Eliminates need for stem extensions and double bracketing of valve/actuator.
- Top sealing Flush Tank valve has fewer leak paths than any standard 2-way valve configuration.
- Unique pad design facilitates draining and minimizes areas where media could become trapped and contaminate the process.
- Unique design allows installation of larger actuation units, without altering the tank or valve mounting design, to compensate for highly viscous material.
- Optional purge and condensate ports create an aseptic CIP/SIP valve.
- Optional API-607, Edition 4 Fire-Rated Design with PTFE seals and secondary graphite seals.
- Optional body cavity fillers minimize trapped media in the valve body that could contaminate the process or prevent smooth operation of the valve.
- Ideally suited for Direct Mount Actuation with improved operation and reduced profile.
- Also well-suited for use with flush tank valve pads already in service.
- Variety of polishes available.

The AF Series Angle Stem valve is available in 316 stainless steel with Tri-Clamp (1" to 6"), 150# Flanged (1" to 6"), or Female NPT (1" to 4") end fittings. Other materials and end fittings are also available.

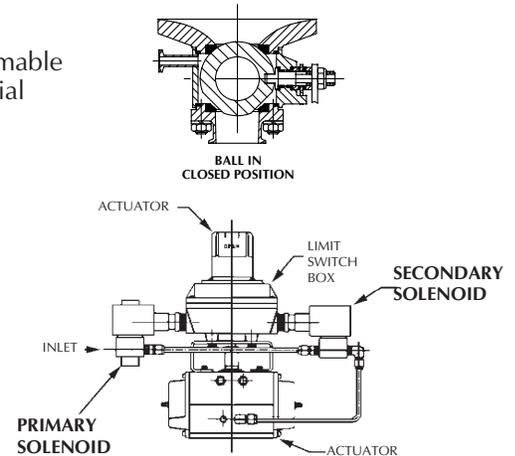


## FIRE TEST DESIGN

PBM's API-607, Edition 4 Fire Test Design valves accommodate media with flammable ingredients. This design necessitates a non-Adjust-O-Seal configuration with special graphite gaskets and stem packing. See Page 15 for more information.

## ACTUATION

PBM offers a selection of pneumatic and electric actuation packages. PBM valves are designed to accept Direct Mount Actuation that uses the valve stem as an integral part of the actuator drive. This design eliminates the need for additional brackets or extensions and improves cycling life and performance, while reducing the total package profile. Direct mount actuation also eliminates the need for an additional mounting adapter, or extensions. PBM Direct mount actuator includes a stainless steel bracket and insert as standard. PBM can easily direct-mount a PBM valve to any actuator with a female adapter and ISO bolt pattern.

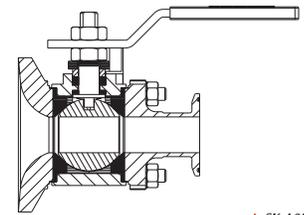


## DRIBBLE CONTROL

Obtain accurate fill and reduce water hammer and associated wear on equipment and instruments with PBM's fully integrated, three-position Tank Topper. The Tank Topper is used to reduce flow at the end of a cycle or when otherwise required.

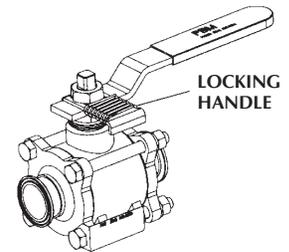
## BODY CAVITY FILLERS

Body cavity fillers are designed to fill the cavity of the valve between the body and the ball. Cavity fillers minimize problems with trapped fluid in the valve body that could contaminate the process or prevent smooth operation of the valve.



## LOCKING HANDLE

PBM's locking handle is designed for applications in which accidental turning of a valve handle could result in bodily injury or compromise product integrity. The handle's spring-loaded mechanism will lock the valve open or closed and can be secured using a customer-supplied locking device.



## POLISHING

Polishing benefits processing by minimizing rough surfaces where media could become trapped. Electropolishing increases material passivity, improves contamination control and greatly enhances cleanability of the polished surface.

PBM Polishing Code	Definition
—	No Polish
A	20 R <sub>a</sub> Max. I.D.
B	32 R <sub>a</sub> Max. O.D.
C	20 R <sub>a</sub> Max. I.D. & 32 R <sub>a</sub> Max. O.D.
D	15 R <sub>a</sub> Max. I.D.
E	10 R <sub>a</sub> Max. I.D.
F	20 R <sub>a</sub> Max. I.D. after Electropolish
G	15 R <sub>a</sub> Max I.D. after Electropolish
H	10 R <sub>a</sub> Max I.D. after Electropolish
I	5 R <sub>a</sub> Max I.D.
K	5 R <sub>a</sub> Max. I.D. & 32 R <sub>a</sub> Max. O.D.
L	20 R <sub>a</sub> Max. I.D. & 32 R <sub>a</sub> Max. O.D. after Electropolish
M	Electropolish Only (I.D. & O.D.)
N	10 R <sub>a</sub> Max. I.D. & 32 R <sub>a</sub> Max. O.D. after Electropolish
O	15 R <sub>a</sub> Max. I.D. & 32 R <sub>a</sub> Max. O.D. after Electropolish
Q	15 R <sub>a</sub> Max. I.D. & 32 R <sub>a</sub> Max. O.D.
S	10 R <sub>a</sub> Max. I.D. & 32 R <sub>a</sub> Max. O.D. after Electropolish

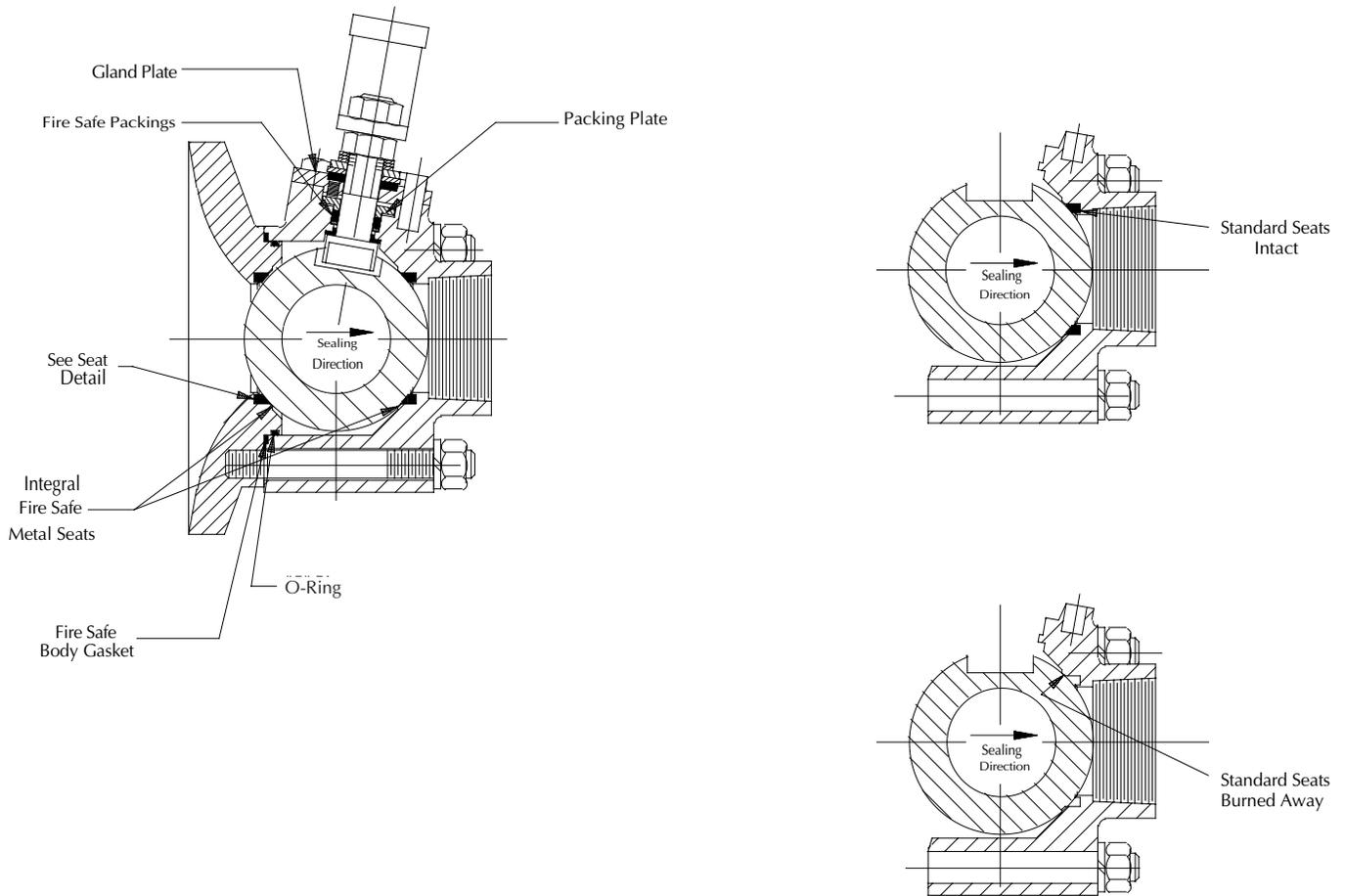
Conversion Chart				
Standard Grit	R <sub>a</sub>		RMS	
	µin	µ	µin	µ
150g	27-32	.68-.80	30-35	.76-.89
180g	18-23	.46-.58	20-25	.51-.64
240g	14-18	.34-.46	15-20	.38-.51
320g	8-10	.21-.25	9-11	.23-.28
400g	5-7	.13-.16	6-8	.14-.18

**Grit:** Measures the number of scratches per linear inch of abrasive pad. Higher numbers indicate a smoother finish.

**RMS:** Defined as Root Mean Square roughness, this method measures a sample for peaks and valleys. Lower numbers indicate a smoother finish.

**R<sub>a</sub>:** Known as the Arithmetic Mean, this measurement represents the average value of all peaks and valleys. Lower numbers indicate a smoother finish.

## API 607 FIRE TEST DESIGN VALVES



PBM's API-607, Edition 4 Fire Test Angle Stem Flush Tank valve accommodates media with flammable ingredients, or operation in a critical service environment. This design necessitates a non-Adjust-O-Seal configuration and includes special graphite gaskets and stem packing.

Fire Test valves are available in sizes from 1" through 6" and in 150# and 300# classes. The API-607 qualified valves feature a backup metal seat against which the ball seals if the normal polytetrafluoroethylene seats melt under fire conditions. This metal to metal seal allows only limited leakage under fire conditions.

Packing leakage is minimized by use of graphite packing which backs up the normal elastomeric seal. Body to end fitting leakage is similarly minimized by use of a backup sealing graphite gasket which retains its integrity under high temperature conditions. Tests have demonstrated zero or near zero leakage from these joints during and after fire exposure.

Fire Test valves are offered with virgin (VTFE), glass-reinforced (RTFE), stainless steel reinforced (S/S TFE), or carbon and glass reinforced (PLUS) polytetrafluoroethylene seats and packings. Choose from a wide variety of wetted materials in accordance with ASME/ANSI B16.34, Table 1. Numerous end fitting configurations are available.

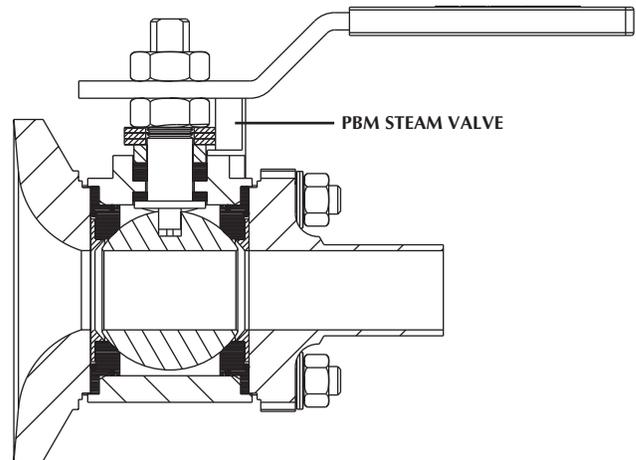
**PBM recommends replacement of valves exposed to fire.**

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## STEAM VALVES

Steam valves are designed to accommodate the high temperature requirements (above 200°F) and temperature swings of steam applications and other elevated temperature applications. PBM's Steam valves feature:

- Metal-encapsulated ring that minimizes “tear-dropping” or seat flow due to heat softening the seat and dragging it into the process stream.
- Metal-encapsulated body seal to eliminate cold flow (compression deforming the seal) and reduce recesses where media could accumulate and contaminate the process. This body seal is the secondary seal.
- O-ring primary body seals to provide a tight seal, preventing external leakage.
- Belleville washers on body bolts to maintain pre-load on body bolts.
- Enhanced live-loaded stem packing design to provide compensation for wear and differential thermal expansion.
- Optional cavity fillers to minimize body cavity voids.
- Optional extended stem to allow space to clear insulation.



For a complete list of Steam valves, see page 10.

▲ SK-A056

## CIP/SIP VALVES

Valves designed to provide Clean-In-Place/Steam-In-Place capability can be used in applications where product can become trapped in the cavity between the outside of the ball and the I.D. of the body, or where it may be necessary to sanitize the valve with steam or cleaning agent or to block bacteria from contaminating upstream or downstream piping. PBM's Adjust-O-Seal feature maintains compression of the seats against the ball and provides simultaneous upstream and downstream sealing creating a “Dual Chamber”. This keeps the process media out of the body cavity. Media may only enter the ball port or the body cavity as the valve is cycled.

- For service above 200°F, it is recommended that CIP/SIP valves use a separate seat and gasket. For service under 200°F, either a one-piece seat and gasket or a separate seat and gasket may be used (see page 10).

PBM's CIP/SIP valves have a combination of inlet and outlet body purge ports and milled flats on the ball or ball purge holes to suit specific application needs.

For a complete list of CIP/SIP valves, see page 10.

## MILLED FLATS AND PURGE HOLES

Milled flats are flat spots machined on the ball to allow flow between the inner diameter of the seat and the ball. Purge holes are holes drilled in the ball around the seat band area that allow flow to pass around the seat. Both ball modifications allow the valve cavity to drain to the downstream piping.

The milled ball flats or purge holes are located on the valve's closed ball near where the stem engages the ball, and also 180 degrees away from this location. In horizontal or nearly horizontal pipe runs, it is important to have the stem of the valve positioned vertically (either upward or downward) so that the milled ball flats or ball purge holes can drain the valve cavity and not allow solvent or condensate to collect when purging is complete.

The use of milled ball flats is recommended for applications where the flats will be used to drain the valve cavity without the use of a purge port (as shown in Example 3). Milled ball flats have a tendency to allow seat leakage into the valve cavity in the open ball position due to uneven seat deformation on the seat where the milled ball flats are located. It is not recommended that flats be used in conjunction with a purge port unless the purge piping is isolated by another valve or such leakage is tolerable.

Ball purge holes are located in the same position on the ball as the milled ball flats. The advantage to using ball purge holes is that they do not allow seat leakage when the ball is in the open position. In applications where such leakage cannot be tolerated, ball purge holes should be used instead of milled flats.

Milled ball flats allow for better drainage of the valve cavity than ball purge holes, making them a preferred option where drainage is of primary importance. However, where open position seat leakage cannot be tolerated, ball purge holes are recommended as they drain nearly as well as milled ball flats.

For a valve that is to be CIP/SIP cleaned, the following options are available:

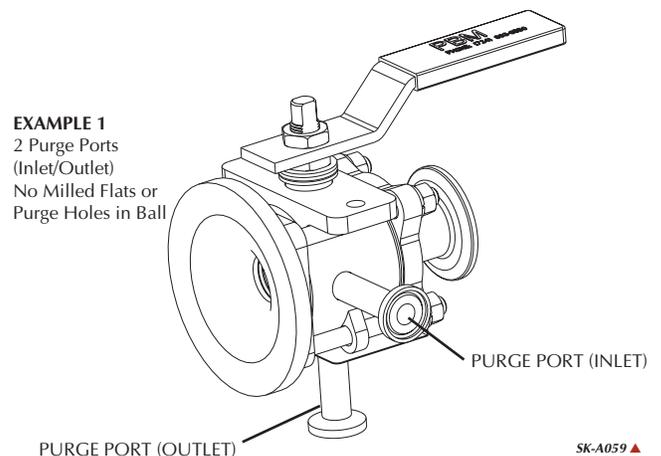
	2 Body Purge Ports	1 Body Purge Port	No Body Purge Ports	2 Milled Ball Flats	2 Ball Purge Holes
<b>Example 1</b>	X				
<b>Example 2</b>		X			X
<b>Example 3</b>			X	X	

### EXAMPLE 1: CIP/SIP VALVES WITH TWO PURGE PORTS, NO MILLED FLATS, AND NO PURGE HOLES

Two purge ports can be used to clean or sanitize the valve cavity. The purge ports are positioned to provide optimum contact with the flushing solvent or steam and the valve cavity. The inlet purge port is normally opposite the ball hole in the center of the body for valves that are purged in the closed position. The outlet is normally positioned low in the valve body to allow for drainage of the flushing solvent or steam/condensate. The position of this port is dependent on whether the valve is in a vertical pipe run or a horizontal pipe run. For valves in a horizontal pipe run, the position of the valve stem is important as well for locating the outlet purge port.

Standard purge ports are 1/2" Tri-Clamp, 1/2" Extended Butt Weld for 16 gauge tubing, and 1/4" Female NPT for pipe. Purge port position and type options are listed on page 23.

#### CIP/SIP WITH TWO PURGE PORTS AND NO MILLED FLATS



▲ SK-A058

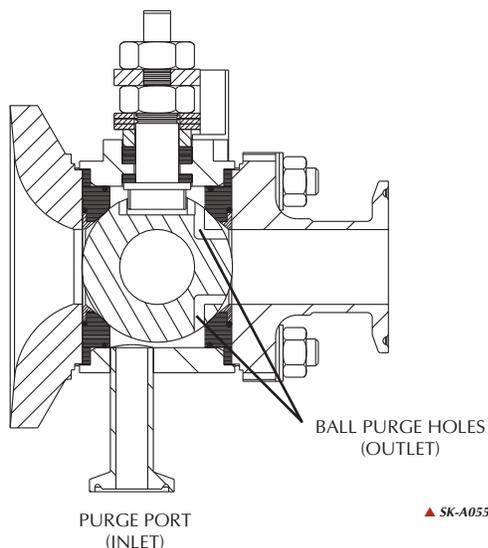
SK-A059 ▲

### CIP/SIP WITH ONE PURGE PORT AND BALL PURGE HOLES

#### EXAMPLE 2: CIP/SIP VALVES WITH ONE PURGE PORT AND BALL PURGE HOLES

In a CIP/SIP valve with a single purge port and ball purge holes on the closed position of the ball, steam enters the valve through the horizontal purge ports and exits downstream via the purge holes. Both the valve and the downstream piping are sterilized at the same time in this configuration while the valve is closed. If the valve is repositioned, the purge port can become the outlet and the purge holes can function as the inlet.

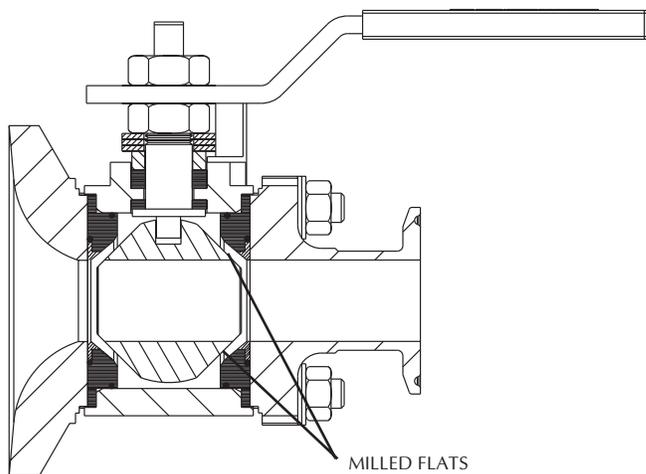
**EXAMPLE 2**  
1 Purge Port  
(Steam Inlet)  
Purge Holes  
(Steam Outlet)



### CIP/SIP WITH MILLED FLATS AND NO PURGE PORTS

#### EXAMPLE 3: CIP/SIP VALVES WITH MILLED FLATS AND NO PURGE PORTS

This example shows milled flats on the open position on both ends of the ball. This configuration might be used to CIP the valve ball and body cavity by pumping a cleaning solution through the piping. The CIP solution enters the valve body cavity via the flats on the open position on the upstream side and exits via the flats on the open position on the downstream side. In this example, the valve is cleaned at the same time as the piping.



**EXAMPLE 3**  
Milled Flats  
No Purge Ports

▲ SK-A054

## SERIES 5 VALVE SELECTION

Valve Type								Port Sizes <sup>1</sup>			Seat & Gasket Assemblies <sup>2</sup>		Temperature
Industrial				Sanitary				Full Port	True-Bore™	Reduced Port	1-Piece <sup>3</sup>	2-Piece <sup>4</sup>	
Standard	CIP/SIP	Steam	Steam w/ CIP/SIP	Standard	CIP/SIP	Steam	Steam w/ CIP/SIP						
FT								√			√		Constant <sup>5</sup>
FS										√	√		Constant
				FI					√		√		Constant
	FG							√			√		Constant <sup>6</sup>
	FH									√	√		Constant
					FA				√		√		Constant <sup>6</sup>
		FD						√				√	Fluctuating
		FE								√		√	Fluctuating
						FC			√			√	Fluctuating
			FK					√				√	Fluctuating
			FL							√		√	Fluctuating
							FJ		√			√	Fluctuating

### NOTES:

- For port size definitions, please turn to page 4.
- The Seat and Gasket assemblies for valves with the same port size can be interchanged. For example, an FT valve can be changed to an FT valve by removing the FT seats and installing FD seats, gaskets, metal encapsulating ring, and O-rings. There is no change necessary to the body, end fittings, or packing area of the valve. Similarly, an FD valve can be converted to an FT valve simply by removing the FD seats, gaskets, metal encapsulating ring, and O-rings and installing the one-piece seat and gasket. With PBM's Series 5 swing out/lift out design, the changeover is easy.
- A one-piece seat and gasket assembly is suited for applications where temperature is constant or where a valve is not required to seal cold after operating hot. It is ideally suited for applications in which the valve operates at a temperature that does not fluctuate over 75°, or when the temperature does not exceed 200°F.
- A two-piece seat and gasket assembly includes a separate seat and gasket, O-ring seals behind and around the seat, and a metal encapsulating ring that supports the inner bore of the seat. These valves are sited for applications in which a valve must seal cold after operating hot. The O-rings behind the seat act like springs to regain seat loading against the ball when the valve is cooled after being hot. The metal encapsulating ring prevents the seat from extruding into the waterway.
- Constant temperature, or temperature that does not fluctuate more than 75°, and is under 200°F.
- Temperature that fluctuates more than 75°, or is over 200°F.

## METAL MATERIALS

When specifying a Flush Tank Valve, the pad material should be the same as the tank material. The process media composition, temperature and application will dictate appropriate metal and soft parts materials. Common tank pad and valve metals and their general characteristics are listed below. Consult PBM if additional information is required.

### PAD MATERIALS

#### 316L Stainless Steel, SA351-GR-CF3M

This material is ideal for a wide variety of applications including sanitary.

#### Carbon Steel, SA216-WCB

For Carbon Steel tanks.

#### Other

Flush Tank Pads also can be fabricated from other materials such as Hastelloy Alloys, Duplex Stainless Steels, Alloy 20, Titanium, Inconel and Nickel-Copper alloys.

### VALVE MATERIALS

#### 316 Stainless Steel, A351-GR-CF8M.

This metal is exceptionally corrosion-resistant to acidic and basic environments and is the leading material for sanitary and biotechnological processes.

#### Carbon Steel, A216-WCB

This versatile material efficiently handles mildly-corrosive media.

#### Other

PBM also supplies valves fabricated from other metals, including 316L Stainless Steel, Aluminum, Titanium, Alloy 20, Hastelloy, Ni-Cu, Cu-Ni and Inconel. Low and zero ferrite materials are also available. Contact PBM for information on the corrosion resistance of these and other metals and alloys.

## ALLOWABLE WORKING PRESSURES (PSIG) AND TEMPERATURE GUIDELINES FOR FLUSH TANK PADS

Allowable Working Pressure, psig (barg)								
Valve Size	Stainless Steel, SA351 CF3M				Carbon Steel, SA 216, WCB			
	Series 5		Series 1 AF		Series 5		Series 1 AF	
	100 °F	400 °F	100 °F	400 °F	100 °F	400 °F	100 °F	400 °F
1/2" - 1- 1/2"	720 (49.6)	515 (35.5)	900 (62)	735 (50.6)	740 (51)	635 (43.8)	900 (62)	770 (53.1)
2"	720 (49.6)	515 (35.5)	550 (37.9)	450 (31)	740 (51)	635 (43.8)	550 (37.9)	472 (32.5)
3"	720 (49.6)	515 (35.5)	625 (43.1)	510 (35.1)	740 (51)	635 (43.8)	625 (43.1)	536 (37)
4"	720 (49.6)	515 (35.5)	550 (37.9)	450 (31)	740 (51)	635 (43.8)	550 (37.9)	472 (32.5)
6" & 8"	720 (49.6)	515 (35.5)	375 (25.8)	300 (20.6)	740 (51)	635 (43.8)	375 (25.8)	321 (22.2)

#### NOTES:

- Working pressures at temperatures between the values shown can be interpolated linearly.
- Seat and seal materials may limit allowable pressures and temperatures. For limitations, see page 7.
- Pressures assume bubble-tight seal.
- Valves having mechanical end fittings, such as Tri-Clamp, may have lower pressure ratings.

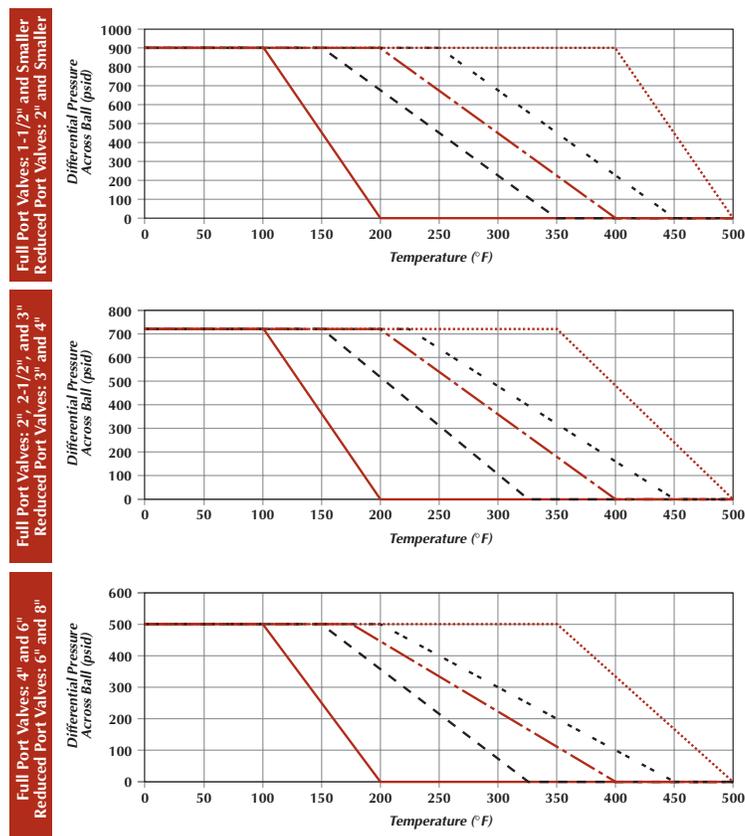
## VALVE SEAT AND SEAL MATERIALS

Designation	Description	Color	Purpose
RTFE	Glass Reinforced PTFE <i>PBM standard for seats, seals and stem packing</i>	Slightly Off-White	Used in a wide variety of applications.
VTFE	Virgin PTFE <i>PBM standard for all cavity fillers.</i>	Bright White	Specified for applications requiring low torque, or where other seat and seal composites might contaminate the process. Ideal for sanitary use. FDA compliant.
S/STFE	Stainless Steel Reinforced PTFE	Dark Gray	Specified for applications requiring slightly higher pressure/temperature ratings or where the process fluid might absorb glass fibers from RTFE. Slightly higher stem torque than RTFE.
PLUS	Carbon, Graphite & Glass-Reinforced PTFE	Charcoal Black	Ideal for higher temperature/pressure applications and/or steam applications. Three times the cyclic lifetime of RTFE.
UHMWPE	Ultra High Molecular Weight Polyethylene	Glossy Off-White	An excellent abrasion and wear-resistant material. Stem torque is similar to RTFE. Wear rate of UHMWPE is approximately 1/10 the wear rate of PTFE parts. Maximum temperature rating is 200°F. FDA compliant.
PEEK	Polyetheretherketone	Putty	Recommended for high temperature (up to 500°F)/long wear applications. Includes special 17-4 PH stainless steel stem to accommodate higher stem torque experienced at higher temperatures. Virgin grades are FDA compliant.
KYNAR®	Polyvinylidene Fluoride	Slightly Transparent White	High strength polymer suitable for temperatures to 275°F. Often used in radiation-related service and has been exposure tested to 1,000 megarads with minimal property degradation. FDA compliant.

### NOTES:

1. PTFE is Polytetrafluoroethylene.
2. With the exception of PEEK and Kynar, all seating materials meet the Class VI seat leakage criterion of ANSI/FCI 70-2 and the zero leakage criterion of MSS SP-61. For PEEK and Kynar seats, the liquid criterion of Class V of ANSI/FCI 70-2 applies. (PEEK seats are normally not tested with air.)
3. Seat and seal materials may be mixed in a valve in order to provide media-compatibility and the appropriate torque, temperature and pressure ratings.

## SEAT AND SEAL PRESSURE/TEMPERATURE RATINGS



### LEGEND



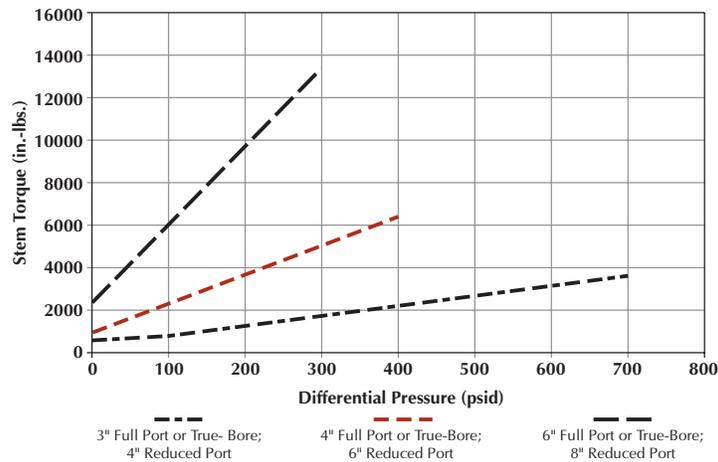
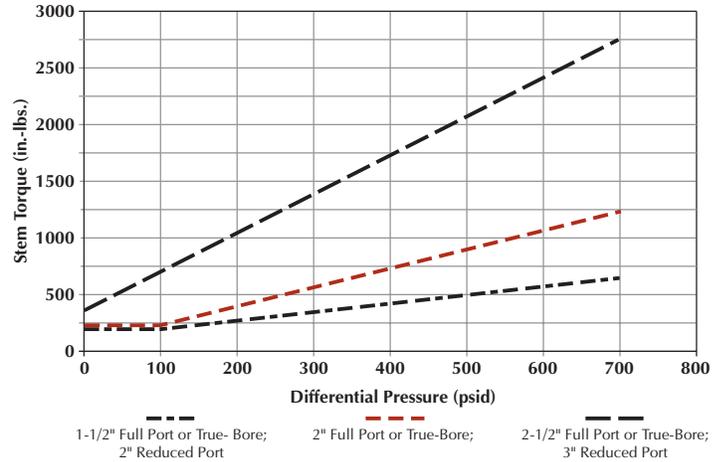
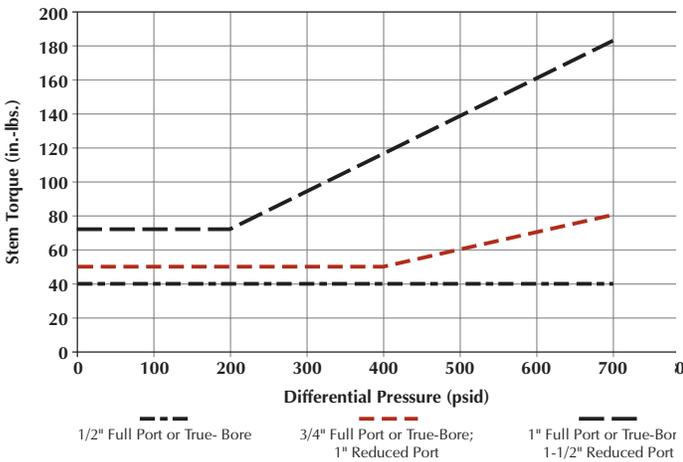
### NOTES

- For 1/2" to 4" valves, where pressures are in excess of 1000 psig, consult PBM.
- Ratings are for seats and seals only. PBM body rating may be different depending upon valve configuration and body material.

## VALVE TORQUE

The figures below are presented as a guide to estimating the forces needed to operate a given sized valve assuming new condition at ambient temperature with a neutral lubricating fluid in the body (such as air or water) and RTFE seats and seals. When using other seat and packing materials, the stem torque should be proportioned according to the as-built torque of that specific material.

If the process involves abrasive or viscous material, the use of elevated temperatures, or if the seat or ball of the valve is worn, then an additional margin should be added.



## TORQUE VALUES

STEM TORQUE VALUES								
Valve Series			Breakaway Torque (in.-lbs)			Actuator Sizing Torque (in.-lbs.)		
Series 1 AF	Series 5 FT, FI, FA, FG	Series 5 FC, FD, FJ, FK	w/ RTFE, PLUS, UHMWPE	w/ SS/TFE	w/ VTFE	w/ RTFE, PLUS, UHMWPE	w/ SS/TFE	w/ VTFE
—	1/2"	1/2"	40	50	32	80	100	64
—	3/4"	3/4"	50	63	40	100	125	80
1"	1"	1"	72	90	58	144	180	115
1-1/2"	—	—	168	210	134	336	420	269
2"	1-1/2"	1-1/2"	192	240	154	384	480	307
—	2"	2"	228	285	182	456	570	365
—	2-1/2"	—	360	450	288	720	450	576
—	—	2-1/2"	360	450	288	900	1080	720
3	—	—	420	525	336	840	1050	672
—	3	—	480	600	384	960	1200	768
—	—	3	480	600	384	1200	1500	960
4	—	—	540	675	432	1080	1350	864
—	4	—	984	1230	787	1968	2460	1574
—	—	4	984	1230	787	2460	3075	1968
6	—	—	1920	2400	1536	3840	4800	3072
—	—	—	1920	2400	1536	4800	6000	4800
—	6	—	2400	3000	1920	4800	6000	3840
—	—	6	2400	3000	1920	6000	7500	4800

### NOTES:

1. When sizing actuators, use the *actuator sizing torque* not the *breakaway torque*.
2. Using cavity fillers does not affect torque values. Product buildup between the filler and the ball, however, may raise torque.
3. For Series 5 FS, FH, FE, and FL valves, use torques and actuator sizes according to the following table:

Valve Size	Type	Use Torque in Table for:
1"	FS or FH	3/4" FT
1"	FE or FL	3/4" FC
1-1/2"	FS or FH	1" FT
1-1/2"	FE or FL	1" FC
2"	FS or FH	1-1/2" FT
2"	FE or FL	1-1/2" FC
2-1/2"	FS or FH	2" FT
2-1/2"	FE or FL	2" FC
3"	FS or FH	2-1/2" FT
3"	FE or FL	2-1/2" FC
4"	FS or FH	3" FT
4"	FE or FL	3" FC
6"	FS or FH	4" FT
6"	FE or FL	4" FC
8"	FS or FH	6" FT
8"	FE or FL	6" FC

## C<sub>V</sub> FACTORS FOR FLUSH TANK VALVES

C<sub>V</sub> is defined as the number of U.S. gallons of water per minute, at ambient temperature, that will flow through a valve at 1 psi pressure drop.

AF SERIES		
Pipe Size	Port Size	C <sub>V</sub> Factor (gpm)
1"	1"	55
1-1/2"	1-1/2"	130
2"	2"	240
3"	2-3/4"	450
4"	3-1/2"	600
6"	5-1/4"	1250
8"	6-1/4"	1600

SERIES 5 FLUSH TANK VALVE C <sub>V</sub> VALUES (GPM)					
Pipe Size (in. – Sched.)	Tubing Size (in. – Gauge)	Valve Series	Description	Port Dia. (in.)	C <sub>V</sub> (gpm)
1/2 – 40S	1/2 – 16	FT, FD, FG, FK	Full Port, pipe outlet	0.50	19
		FI, FC, FA, FJ	True bore, tubing outlet	0.37	9
3/4 – 40S	3/4 – 16	FT, FD, FG, FK	Full Port, pipe outlet	0.75	49
		FI, FC, FA, FJ	True bore, tubing outlet	0.62	30
1 – 40S	1 – 16	FT, FD, FG, FK	Full Port, pipe outlet	1.00	86
		FI, FC, FA, FJ	True bore, tubing outlet	0.87	62
1 – 40S	1 – 16	FS, FE, FH, FL	Reduced port, pipe outlet	0.75	29
		FS, FE, FH, FL	Reduced port, tubing outlet	0.75	41
1-1/2 – 40S	1-1/2 – 16	FT, FD, FG, FK	Full port, pipe outlet	1.50	210
		FI, FC, FA, FJ	True bore, tubing outlet	1.37	170
1-1/2 – 40S	1-1/2 – 16	FS, FE, FH, FL	Reduced port, pipe outlet	1.00	46
		FS, FE, FH, FL	Reduced port, tubing outlet	1.00	57
2 – 40S	2 – 16	FT, FD, FG, FK	Full port, pipe outlet	2.00	450
		FI, FC, FA, FJ	True bore, tubing outlet	1.87	390
2 – 40S	2 – 16	FS, FE, FH, FL	Reduced port, pipe outlet	1.50	140
		FS, FE, FH, FL	Reduced port, tubing outlet	1.50	170
2-1/2 – 40S	2-1/2 – 16	FT, FD, FG, FK	Full port, pipe outlet	2.50	610
		FI, FC, FA, FJ	True bore, tubing outlet	2.37	540
2-1/2 – 40S	2-1/2 – 16	FS, FE, FH, FL	Reduced port, pipe outlet	2.00	310
		FS, FE, FH, FL	Reduced port, tubing outlet	1.87	340
3 – 40S	3 – 16	FT, FD, FG, FK	Full port, pipe outlet	3.00	950
		FI, FC, FA, FJ	True bore, tubing outlet	2.87	870
3 – 40S	3 – 16	FS, FE, FH, FL	Reduced port, pipe outlet	2.50	490
		FS, FE, FH, FL	Reduced port, tubing outlet	2.50	510
4 – 40S	4 – 14	FT, FD, FG, FK	Full port, pipe outlet	4.00	1700
		FI, FC, FA, FJ	True bore, tubing outlet	3.84	1560
4 – 40S	4 – 14	FS, FE, FH, FL	Reduced port, pipe outlet	3.00	525
		FS, FE, FH, FL	Reduced port, tubing outlet	3.00	580
6 – 40S	6 – 12	FT, FD, FG, FK	Full port, pipe outlet	6.00	4000
		FI, FC, FA, FJ	True bore, tubing outlet	5.78	3800
6 – 40S	6 – 12	FS, FE, FH, FL	Reduced port, pipe outlet	4.00	821
		FS, FE, FH, FL	Reduced port, tubing outlet	4.00	865
8 – 40S	8 – 12	FS, FE, FH, FL	Reduced port, pipe outlet	6.00	2240
		FS, FE, FH, FL	Reduced port, tubing outlet	6.00	2365

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## **PBM TEST INFORMATION**

### **VACUUM TESTING**

PBM valves are ideally suited for vacuum service. For valves intended for vacuum service, PBM offers optional helium leakage test of the seats and shell. This test consists of an inboard vacuum test where the exterior of the valve is flooded with helium and, through valve, inward helium leakage is measured. Also, the seats of the valve are helium leakage tested. PBM valves will meet a leakage rate of  $1 \times 10^{-6}$  std. cc/sec. helium leakage for both tests.

### **CYCLE TESTING**

The life of a ball valve is dependent upon service conditions, and therefore, impossible to predict. However, PBM cycle-tests valves using 100 psid of ambient temperature water pressure across the seats with the valve in the closed position. These test conditions represent a typical wear-causing force on the seats and packings. PBM also tests valves in a steam environment up to 380°F.

Replacement of valve gaskets or O-rings is recommended at each disassembly. Replacement of other non-moving parts is dictated by the corrosion caused by the flow media. In most applications, PBM ball valves will operate trouble-free for many years.

## **PBM FLUSH TANK SPECIFICATIONS**

PBM valves meet and/or exceed the specifications outlined by many agencies, including:

- API-607 Fire Test (Edition IV)
- ASME Boiler & Pressure Vessel Code, Section VIII, Division 1.

Designed in accordance with ASME Pressure Vessel Code, Section VIII, Division I, PBM's flush tank pad has proven its worth in thousands of installations where clean, fast drainage and reduced maintenance are critical. For any application where liquids or slurries are stored and dispensed, the minimal pocket area of PBM's flush tank pad allows thorough mixing in the tank for improved media consistency and the reduction or elimination of deposits.

## FT, FD, FG & FK SERIES 5 DIMENSIONAL DATA (INCHES)

Female NPT (Q-), Socket Weld (U-), Butt Weld for Sched. 40 (B-), 150# Flange (L-)

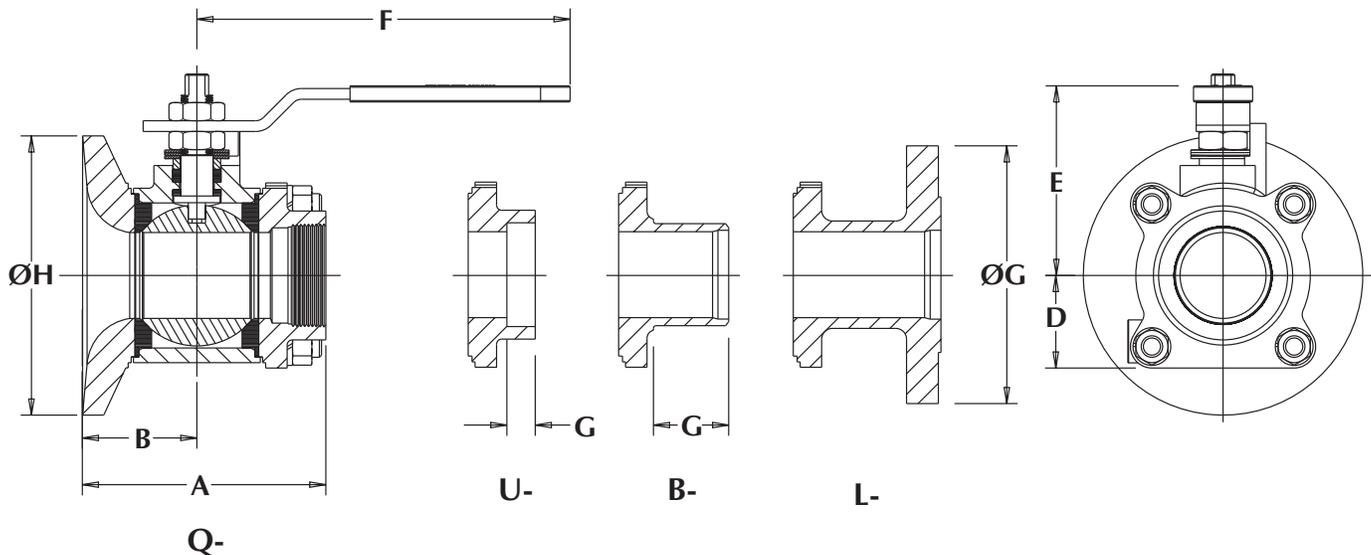
Valve Size	Size Code	Port <sup>1</sup> Dia.	A			B			F	E	G		Pad Dia.	Pad Thickness*	Approx. Weight (lbs.) S/S	
			Face-to-Face			C to Face			C to Top of Handle	Handle Length from C	End Fitting				B-Q-U-	L-
			Q-U-	B-	L-	Q-U-	B-	L-			B-Length	L-Dia.				
1/2"	C	0.50	2.83	4.02	4.02	1.56	2.75	2.75	2.63	4.15	1.50	3.50	2.75	0.28	2	3
3/4"	D	0.75	3.07	4.10	4.23	1.72	2.75	2.88	2.78	4.15	1.50	3.88	3.00	0.31	2.5	4
1"	E	1.00	3.84	4.71	4.96	2.13	3.00	3.25	3.03	5.09	1.50	4.25	3.75	0.32	5	7
1-1/2"	G	1.50	5.07	6.07	6.32	2.75	3.75	4.00	4.10	8.68	1.50	5.00	5.50	0.46	13	16
2"	H	2.00	5.66	6.66	7.54	3.00	4.00	4.88	4.41	8.68	1.75	6.00	6.50	0.49	19	25
3"	K	3.00	8.38	10.63	10.26	4.50	6.75	6.38	6.78	12.44	2.31	7.50	9.00	0.77	57	68
4"	L	4.00	10.81	12.81	12.31	6.00	8.00	7.50	7.34	24.44	2.31	9.00	11.50	0.90	120	133
6"	M	6.00	—	17.80	16.80	—	11.00	10.00	Note 2	Note 2	3.75	11.00	17.00	1.23	CF	CF

### END FITTING SIZE AVAILABILITY

Item	Stainless Steel	Carbon Steel
Female NPT (Q-) .....	1/2" - 4"	1/2" - 4"
Socket Weld (U-) .....	1/2" - 4"	1/2" - 4"
Butt Weld for Pipe (B-) .....	1/2" - 6"	1/2" - 6"
150# Flange (L-) .....	1/2" - 6"	1/2" - 6"

#### NOTES:

- \* For pad thickness requirements greater than those listed, consult PBM.
- 1. Full Port
- 2. Gear Operator recommended.
- 3. CF = Consult Factory
- 4. Consult factory for approximate weight of 6" valves with Butt Weld for Sched. 40 (B-) end fitting.
- 5. Male NPT, Solder Joint, Sil-Braze, Camlock, and Grooved end fittings are also available.
- 6. B- dimensions shown meet Schedule 40. End fittings are also available to meet Schedule 10s or Schedule 5s.
- 7. 1/2" through 3" have 4 bolts. 4" through 8" valves have 8 bolts.
- 8. Flange holes straddle the center line, except for the 1-1/2" size.
- 9. Drawings are for illustration purposes only. Consult PBM prior to any fabrication or installation.



# FC, FA, FI & FJ SERIES 5 DIMENSIONAL DATA (INCHES)

Tri-Clamp (X-), Extended Butt Weld for Tube (F-)

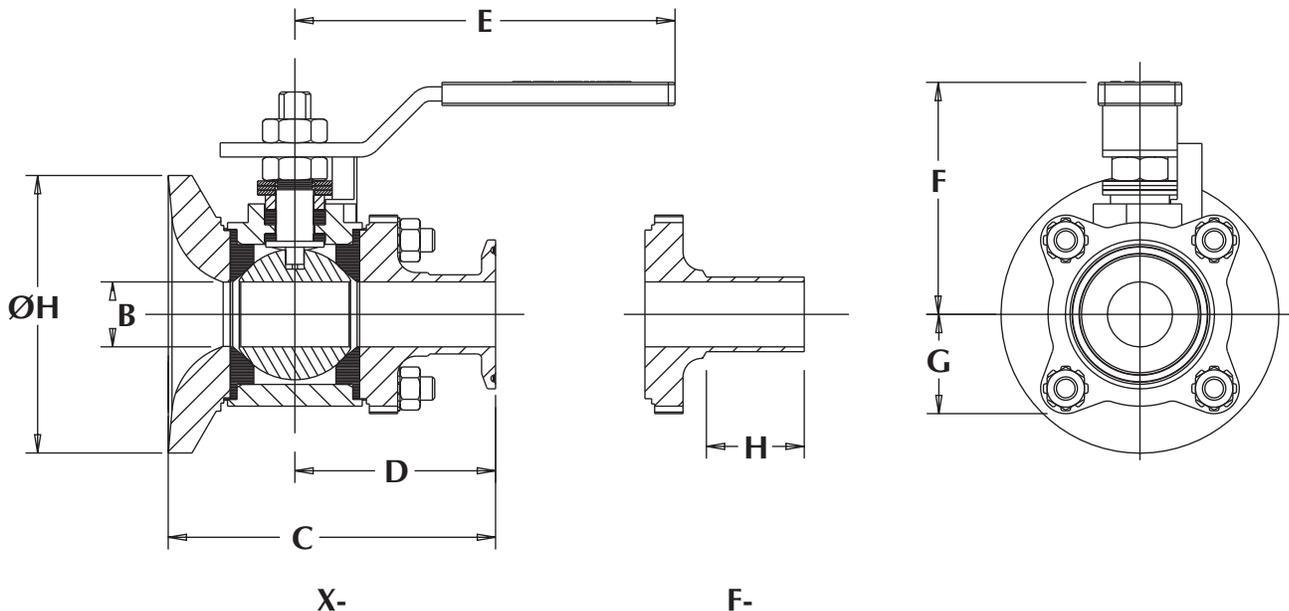
Valve Size	Size Code	Port <sup>1</sup> Dia.	A		B		F	E	Pad Dia.	Pad Thickness*	Approx. Weight (lbs.) S/S	
			Face-to-Face		C <sub>l</sub> to Face		C <sub>l</sub> to Top of Handle	Handle Length from C <sub>l</sub>			X-	F-
			X-	F-	X-	F-						
1/2"	C	0.37	3.02	4.02	1.75	2.75	2.63	4.15	2.75	0.28	2	2
3/4"	D	0.62	3.35	4.10	2.00	2.75	2.78	4.15	3.00	0.31	2.5	2.5
1"	E	0.87	4.40	4.71	2.69	3.00	3.03	5.09	3.75	0.32	5	5
1-1/2"	G	1.37	5.79	6.07	2.75	3.75	4.10	8.68	5.50	0.46	13	13
2"	H	1.87	8.38	6.66	3.13	4.00	4.41	8.68	6.50	0.49	19	19
3"	K	2.87	8.38	10.63	4.50	6.75	6.78	12.44	9.00	0.77	56	58
4"	L	3.83	10.81	12.81	6.00	8.00	7.34	24.44	11.50	0.90	117	120
6"	M	5.78	14.55	17.80	7.75	11.00	Note 2	Note 2	17.00	1.23	CF	CF

## END FITTING SIZE AVAILABILITY

Item	Stainless Steel
Tri-Clamp for tubing (X-) .....	1/2" - 8"
Butt Weld for tubing (B-) .....	1/2" - 8"
Extended Butt Weld for tubing (F-) .....	1/2" - 6"

### NOTES:

- \* For pad thickness requirements greater than those listed, consult PBM.
- 1. True-Bore<sup>®</sup>
- 2. Gear Operator recommended.
- 3. CF = Consult Factory
- 4. Extended Butt Weld for Tube (F-) end fittings through 3" size match 16 gauge tubing dimensions. 4" size matches 14 gauge tubing. 6" size matches 12 gauge tubing.
- 5. 1/2" through 3" valves have 4 bolts. 4" through 8" valves have 8 bolts.
- 6. Cherry Burrell and ACME end fittings are also available.
- 7. Drawings are for illustration purposes only. Consult PBM prior to any fabrication or installation.



## FS, FE, FH & FL SERIES 5 DIMENSIONAL DATA (INCHES)

Female NPT (Q-), Socket Weld (U-), Butt Weld for Schedule 40 (B-)

Valve Size	Size Code	Port <sup>1</sup> Dia.	A		B		F	E	B- Length	Pad Dia.	Pad Thickness*	Approx. Weight (lbs.) S/S	
			Face-to-Face		C to Face		C to Top of Handle	Handle Length from C				Q-U-	B-
			Q-U-	B-	Q-U-	B-							
1"	E	0.75	3.47	4.10	2.12	2.75	2.78	4.15	1.50	3.00	0.31	2.7	2.5
1-1/2"	G	1.00	4.46	4.71	2.75	3.00	3.03	5.09	1.50	3.75	0.32	5.4	5
2"	H	1.50	5.07	6.07	2.75	3.75	4.10	8.68	1.50	5.50	0.46	13	13
2-1/2"	J	2.00	5.66	6.66	3.00	4.00	4.41	8.68	1.75	6.50	0.49	17	18
3"	K	2.50	7.28	9.00	4.00	5.75	6.45	12.44	2.31	8.00	0.75	36	38
4"	L	3.00	8.38	10.63	4.50	6.75	6.78	12.44	2.31	9.00	0.77	57	58
6"	M	4.00	—	12.81	—	8.00	7.34	24.44	2.31	11.50	0.90	—	150
8"	N	6.00	—	17.80	—	11.00	Note 2	Note 2	3.75	17.00	1.23	—	CF

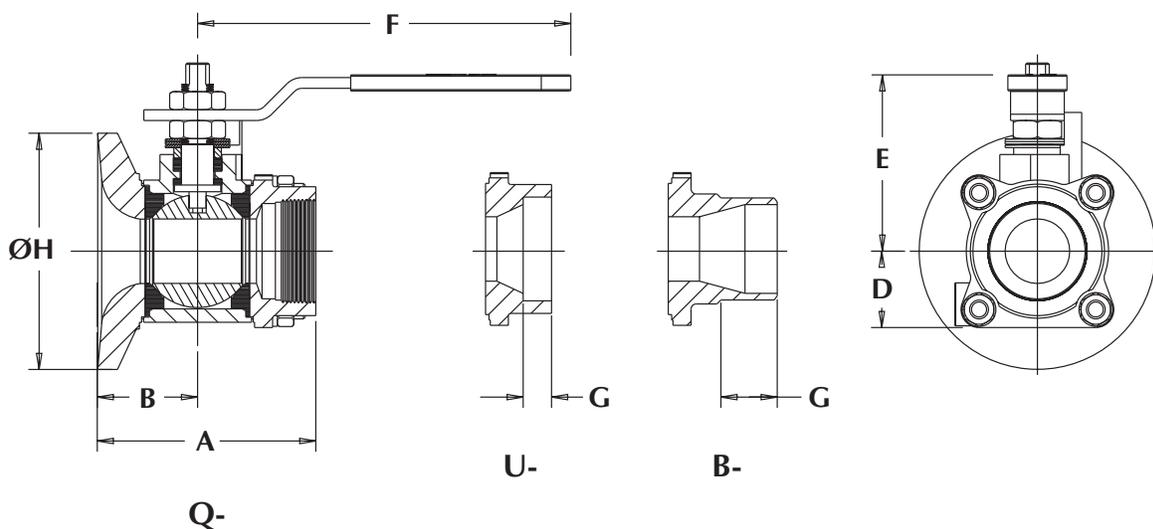
### END FITTING SIZE AVAILABILITY

Item	316 S/S
Female NPT (Q-) .....	1" – 4"
Socket Weld (U-) .....	1" – 4"
Butt Weld for Sched. 40 (B-) .....	1" – 8"

#### NOTES:

\* For Pad Thickness requirements greater than those listed, consult PBM.

1. Reduced Port
2. Gear Operator recommended.
3. CF = Consult Factory

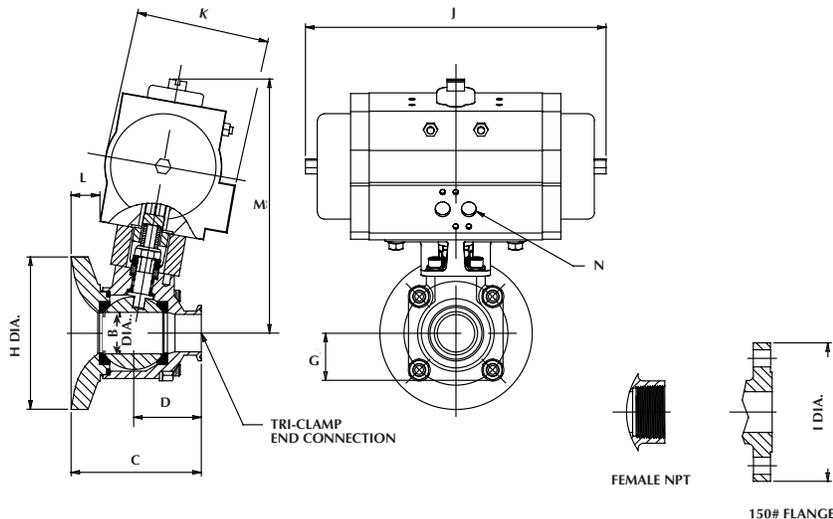


## AF SERIES DIMENSIONAL DATA (INCHES)

Angle Stem Flush Tank Valves with Tri-Clamp (X-), Female NPT (Q-) and 150# Flange (L-) End Fittings.

Size	B Port	C			D			G C to Bottom	H Pad Diameter	I Flange Diameter
		Face-to-Face			C to End					
		TT	S	F15	TT	S	F15			
1"	1.00	3.9	3.6	4.1	2.2	1.9	2.5	1.7	3.7	4.3
1-1/2"	1.50	4.7	5.0	5.5	2.4	2.7	3.3	1.7	5.5	5.0
2"	1.94	5.5	5.5	6.2	2.9	2.9	3.5	2.0	7.0	6.0
3"	2.75	7.9	8.4	9.2	3.8	4.3	5.1	3.9	10.0	7.5
4"	3.50	8.9	9.5	10.5	4.7	5.2	6.2	4.5	11.5	9.0
6"	5.24	14.6	12.1	15.6	9.0	6.6	10.1	6.3	15.0	11.0

Size	B Port	ACTUATOR			J Actuator Length	K Actuator Width	L Pad Face to Actuator	M C to Top of Actuator	N NPT Air Inlet	
		Code	Type	Air Supply						
1"	1.00	5D	Double Acting	80 psig	6.3	2.8	.5	6.8	1/8	
		6D	Double Acting	60 psig	6.3	2.8	.5	6.8	1/8	
		7D	Spring Return	80 psig	8.5	3.6	.2	7.7	1/8	
		8D	Spring Return	60 psig	10.9	3.6	.2	7.7	1/8	
1-1/2"	1.50	5D	Double Acting	80 psig	6.3	3.6	.9	8.7	1/8	
		6D	Double Acting	60 psig	6.3	3.6	.9	8.7	1/8	
		7D	Spring Return	80 psig	10.9	3.9	.7	9.0	1/8	
		8D	Spring Return	60 psig	14.6	3.9	.7	9.0	1/8	
2"	1.94	5D	Double Acting	80 psig	6.3	3.6	1.9	8.9	1/8	
		6D	Double Acting	60 psig	6.3	3.6	1.9	8.9	1/8	
		7D	Spring Return	80 psig	10.9	3.9	1.7	9.2	1/8	
		8D	Spring Return	60 psig	14.6	4.7	1.5	10.8	1/4	
3"	2.75	5D	Double Acting	80 psig	7.6	3.9	3.4	11.2	1/8	
		6D	Double Acting	60 psig	10.6	3.9	3.4	11.2	1/8	
		7D	Spring Return	80 psig	14.6	5.4	2.8	13.4	1/4	
		8D	Spring Return	60 psig	19.1	6.8	2.4	15.0	1/4	
4"	3.50	5D	Double Acting	80 psig	10.6	4.7	3.7	11.7	1/4	
		6D	Double Acting	60 psig	10.6	4.7	3.7	11.7	1/4	
		7D	Spring Return	80 psig	19.1	6.8	2.7	15.5	1/4	
		8D	Spring Return	60 psig	19.1	6.8	2.7	15.5	1/4	
6"	5.25	5D	Double Acting	80 psig	14.2	5.4	6.3	17.9	1/4	
		6D	Double Acting	60 psig	14.2	5.4	6.3	17.9	1/4	
		7D	Spring Return	80 psig	Consult PBM					
		8D	Spring Return	60 psig	Consult PBM					



## SERIES 5 INDUSTRIAL & SANITARY FLUSH TANK BALL VALVES

PRODUCT Position 1 + 2	MATERIAL 3 + 4	SIZE 5	SERIES 6	END FITTING 7 + 8	SEAT/SEAL 9
<b>FT</b> Two-Way Flush Tank Full Port <b>FS</b> Two-Way Flush Tank Reduced Port <b>FG</b> Two-Way Flush Tank CIP/SIP True-Bore <b>FH</b> Two-Way Flush Tank CIP/SIP Reduced Port <b>FI</b> Igenix Sanitary Two-Way Flush Tank True-Bore <sup>1</sup> <b>FA</b> Igenix Sanitary Two-Way Flush Tank CIP/SIP True-Bore	<b>E*</b> C/S <b>H-</b> 316 S/S <b>HL-</b> 316L S/S	<b>C*</b> 1/2" <b>D</b> 3/4" <b>E</b> 1" <b>G</b> 1-1/2" <b>H</b> 2" <b>K</b> 3" <b>L</b> 4" <b>M</b> 6" <b>N</b> 8"	<b>5</b>	<b>A-</b> Acme Bevel <b>B-</b> Butt Weld Sch. 40 <b>C-</b> Butt Weld Sch. 5 <b>D-</b> Butt Weld Sch. 10 <b>E-</b> Butt Weld (Tube) <b>F-</b> Extended Butt Weld for Tube <b>G-</b> Cherry Burrell Female I-Line <b>H-</b> Cherry Burrell Male I-Line <b>J-</b> Cherry Burrell Q-Line <b>K-</b> Camlock <b>L-*</b> 150# Flange <b>M-</b> 300# Flange <b>N-</b> 600# Flange <b>O-</b> Grooved <b>P-</b> Male NPT <b>Q-*</b> Female NPT <b>U-</b> Socket Weld <b>V-</b> Socket Weld (Tube) <b>X-</b> Tri-Clamp (Tube) <b>-Z</b> No End Fittings  If using the code <b>-Z</b> to purchase a center body (or a combination of one end fitting and <b>-Z</b> ), you must indicate the end fittings already in-line in order to receive the appropriate hardware.  <b>Other end fittings available.</b>	<b>A*</b> RTFE <b>B</b> RTFE w/ VTFE Filler <b>C**</b> VTFE <b>D</b> VTFE w/ VTFE Filler <b>E</b> PLUS <b>F</b> PLUS w/ VTFE Filler <b>G</b> PLUS w/ PLUS Filler <b>H</b> S/STFE <b>I</b> S/STFE w/ VTFE Filler <b>J</b> S/S w/ S/STFE Filler <b>K</b> UHMWPE <b>L</b> UHMWPE w/ VTFE Filler <b>M</b> UHMWPE w/ UHMWPE Filler <b>N</b> PEEK <b>O</b> PEEK w/ VTFE Filler <b>P</b> PEEK w/ PEEK Filler <b>Q</b> Carbon Graphite <b>R</b> Kynar <b>S</b> Kynar w/Kynar Filler  *FT standard. **FI standard.
	* FG/FH/FS/FT only.	* FI/FA/FT/FG only.			

### EXAMPLE:

STANDARD							OPTIONS		
Position 1 + 2 Product	3 + 4 Material	5 Size	6 Series	7 + 8 End Fitting	9 Seat/Seal	10 + 11 Flow Pattern	12 Ball/Stem	13 + 14 Operator	15 Polish
<b>FI</b>	<b>H-</b>	<b>H</b>	<b>5</b>	<b>X-</b>	<b>C</b>	<b>01</b>	<b>-</b>	<b>02</b>	<b>A</b>

**FIH-H5X-C01-02A** is the code for an Igenix Flush Tank, 316 S/S w/S/S pad, 2" valve, series 5, with Tri-Clamp ends, VTFE seats and seals, no pad w/o UHMWPE shipping pad, without handle and prepared for actator mounting with 20 R<sub>a</sub> Max. I.D. polish.

### WORK SPACE: FOR YOU TO FILL IN THE BLANKS

STANDARD							OPTIONS		
Position 1 + 2 Product	3 + 4 Material	5 Size	6 Series	7 + 8 End Fitting	9 Seat/Seal	10 + 11 Flow Pattern	12 Ball/Stem	13 + 14 Operator	15 Polish
			<b>5</b>						

FLOW PATTERN 10 + 11/Ball & Port Configuration		BALL/STEM 12	OPERATOR 13 + 14	POLISH 15
Flow Pattern not applicable. For all CIP/SIP valves, use the codes below: --Non-CIP/SIP standard FT pad <b>01</b> No Pad w/o UHMWPE shipping pad <b>02</b> No Pad w/ UHMWPE shipping pad <b>04</b> w/ 316L barstock pad <b>05</b> w/ 1" 150# bolt-on pad <b>06</b> w/ 1.5" 150# bolt-on pad <b>07</b> w/ 2" 150# bolt-on pad <b>08</b> w/ 3" 150# bolt-on pad <b>09</b> w/ 4" 150# bolt-on pad <b>10</b> w/ 6" 150# bolt-on pad For all CIP/SIP valves, use the codes below:		- No option <b>A</b> 300 S/S w/ 2" Extension <b>B</b> 300 S/S w/ 4" Extension <b>C</b> 300 S/S w/ 6" Extension <b>F</b> with ground device <b>G</b> 17-4 PH S/S stem <b>I</b> with Monel ball <b>J</b> with 932 Bronze ball <b>K</b> with Monel stem & followers <b>L</b> with Monel ball, stem and followers <b>M</b> with Aluminum ball <b>N</b> with 922 Bronze ball <b>O</b> with H/C ball <b>P</b> with H/C ball, stem and followers <b>Q</b> with 922 bronze ball, Monel stem and followers <b>R</b> with Monel stem, followers, and bolting <b>S</b> with Monel ball, stem, followers and bolting	-- Manual lever handle <b>01</b> Without Handle <b>02</b> Without Handle, prepared for actuator mounting <b>03</b> With Handle, prepared for actuator mounting <b>04</b> Locking Device <b>05</b> Stainless Oval Handwheel <b>06</b> Manual Safety Nut <b>07</b> 45 Degree Handle <b>08</b> Manual Gear Operator <b>09</b> T-Handle (24" long) <b>10</b> Manual Spring Return Unit <b>11</b> Fusible Link Spring Return Unit <b>12</b> Coupled Vane Actuator for 80 psi <b>13</b> NEMA 4 Electric Actuator (120 vac) <b>14</b> NEMA 7 Electric Actuator (120 vac) <b>15</b> Square Operating Nut <b>16</b> Locking Handle and actuator mount body <b>17</b> Extended Locking Oval Handwheel <b>18</b> Extended Locking Lever Handle <b>20</b> D/A Actuator 80 psi <b>21</b> D/A Actuator 80 psi w/ NEMA 4 limit switch <b>22</b> D/A Actuator 80 psi w/ NEMA 4 solenoid <b>23</b> D/A Actuator 80 psi w/ NEMA 4 limit switch/solenoid <b>24</b> D/A Actuator 80 psi w/ NEMA 7 limit switch <b>25</b> D/A Actuator 80 psi w/ NEMA 7 solenoid <b>26</b> D/A Actuator 80 psi w/ NEMA 7 limit switch/solenoid <b>27</b> D/A Actuator 60 psi <b>28</b> D/A Actuator 60 psi w/ NEMA 4 limit switch <b>29</b> D/A Actuator 60 psi w/ NEMA 4 solenoid <b>30</b> D/A Actuator 60 psi w/ NEMA 4 limit switch/solenoid <b>31</b> D/A Actuator 60 psi w/ NEMA 7 limit switch <b>32</b> D/A Actuator 60 psi w/ NEMA 7 solenoid <b>33</b> D/A Actuator 60 psi w/ NEMA 7 limit switch/solenoid <b>34</b> S/R Actuator 80 psi <b>35</b> S/R Actuator 80 psi w/ NEMA 4 limit switch <b>36</b> S/R Actuator 80 psi w/ NEMA 4 solenoid <b>37</b> S/R Actuator 80 psi w/ NEMA 4 limit switch/solenoid <b>38</b> S/R Actuator 80 psi w/ NEMA 7 limit switch <b>39</b> S/R Actuator 80 psi w/ NEMA 7 solenoid <b>40</b> S/R Actuator 80 psi w/ NEMA 7 limit switch/solenoid <b>41</b> S/R Actuator 60 psi <b>42</b> S/R Actuator 60 psi w/ NEMA 4 limit switch <b>43</b> S/R Actuator 60 psi w/ NEMA 4 solenoid <b>44</b> S/R Actuator 60 psi w/ NEMA 4 limit switch/solenoid <b>45</b> S/R Actuator 60 psi w/ NEMA 7 limit switch <b>46</b> S/R Actuator 60 psi w/ NEMA 7 solenoid <b>47</b> S/R Actuator 60 psi w/ NEMA 7 limit switch/solenoid <b>50</b> without Handle, prepared for actuator mounting (Bray)  Other actuator options available.	- No Polish <b>A</b> 20 R <sub>a</sub> Max. I.D. <b>B</b> 32 R <sub>a</sub> Max. O.D. <b>C</b> 20 R <sub>a</sub> Max. I.D. & 32 R <sub>a</sub> Max. O.D. <b>D</b> 15 R <sub>a</sub> Max. I.D. <b>E</b> 10 R <sub>a</sub> Max. I.D. <b>F</b> 20 R <sub>a</sub> Max. I.D. after Electropolish <b>G</b> 15 R <sub>a</sub> Max. I.D. after Electropolish <b>H</b> 10 R <sub>a</sub> Max. I.D. after Electropolish <b>I</b> 5 R <sub>a</sub> Max. I.D. <b>K</b> 5 R <sub>a</sub> Max. I.D. & 32 R <sub>a</sub> Max. O.D. <b>L</b> 20 R <sub>a</sub> Max. I.D. & 32 R <sub>a</sub> Max. O.D. after Electropolish <b>M</b> Electropolish only (I.D. & O.D.) <b>N</b> 10 R <sub>a</sub> Max. I.D. & 32 R <sub>a</sub> Max. O.D. <b>O</b> 15 R <sub>a</sub> Max. I.D. & 32 R <sub>a</sub> Max. O.D. after Electropolish <b>Q</b> 15 R <sub>a</sub> Max. I.D. & 32 R <sub>a</sub> Max. O.D. <b>S</b> 10 R <sub>a</sub> Max. I.D. & 32 R <sub>a</sub> Max. O.D. after Electropolish
Purge Ports 10	Milled Flats & Holes in Ball 11			
<b>A</b> (1) 1/2" Tri-Clamp on Center, 90° from Stem <b>B</b> (1) 1/2" Tri-Clamp on Center, Opposite Stem <b>C</b> (1) 1/2" Tri-Clamp Upstream, 90° from Stem <b>D</b> (1) 1/2" Tri-Clamp Downstream, Opposite Stem <b>E</b> (2) 1/2" Tri-Clamp on Center, 90° from & Opposite Stem <b>F</b> (2) 1/2" Tri-Clamp Upstream 90° from & Downstream Opposite Stem <b>G</b> (1) 1/2" BWTE on Center, 90° from Stem <b>H</b> (1) 1/2" BWTE on Center, Opposite Stem <b>I</b> (1) 1/2" BWTE Upstream, 90° from Stem <b>J</b> (1) 1/2" BWTE Downstream, Opposite Stem <b>K</b> (2) 1/2" BWTE on Center, 90° from & Opposite Stem <b>L</b> (2) 1/2" BWTE Upstream 90° from & Downstream Opposite Stem <b>M</b> (1) 1/4" F.N.P.T. on Center, 90° from Stem <b>N</b> (1) 1/4" F.N.P.T. on Center, 90°, Opposite Stem <b>O</b> (1) 1/4" F.N.P.T. Upstream, 90° from Stem <b>P</b> (1) 1/4" F.N.P.T. Downstream, Opposite Stem <b>Q</b> (2) 1/4" F.N.P.T. on Center, 90° from Opposite Stem <b>R</b> (2) 1/4" F.N.P.T. Upstream 90° from & Downstream Opposite Stem - No Purges, Use if Adding only Flats or Drain Holes	Use Column #1 for CIP/SIP Flush Tank with Std. FT Pad. Use Column #2 for CIP/SIP Flush Tank with Shipping Pad.  #1 #2 <b>A K</b> Flats, Closed, Downstream <b>B L</b> Flats, Closed, Upstream <b>C M</b> Flats, Open, Upstream <b>D N</b> Flats, Open, Downstream <b>E O</b> Flats, Open, Up & Downstream <b>F P</b> Holes, Closed, Downstream <b>G Q</b> Holes, Closed, Upstream <b>H R</b> Holes, Open, Upstream <b>I S</b> Holes, Open, Downstream <b>J T</b> Holes, Open, Up & Downstream - <b>U</b> No Flats or Holes			
* Pad Description category is exclusive to the FT, FI series.				



FLOW PATTERN 10 + 11/Ball & Port Configuration		BALL/STEM 12	OPERATOR 13 + 14	POLISH 15																																				
Flow Pattern not applicable. For all CIP/SIP valves, use the codes below: --Non-CIP/SIP standard FT pad <b>01</b> No Pad w/o UHMWPE shipping pad <b>02</b> No Pad w/ UHMWPE shipping pad <b>04</b> w/ 316L barstock pad <b>05</b> w/ 1" 150# bolt-on pad <b>06</b> w/ 1.5" 150# bolt-on pad <b>07</b> w/ 2" 150# bolt-on pad <b>08</b> w/ 3" 150# bolt-on pad <b>09</b> w/ 4" 150# bolt-on pad <b>10</b> w/ 6" 150# bolt-on pad For all CIP/SIP valves, use the codes below:		- No option <b>A</b> 300 S/S w/ 2" Extension <b>B</b> 300 S/S w/ 4" Extension <b>C</b> 300 S/S w/ 6" Extension <b>F</b> with ground device <b>G</b> 17-4 PH S/S stem <b>I</b> with Monel ball <b>J</b> with 932 Bronze ball <b>K</b> with Monel stem & followers <b>L</b> with Monel ball, stem and followers <b>M</b> with Aluminum ball <b>N</b> with 922 Bronze ball <b>O</b> with H/C ball <b>P</b> with H/C ball, stem and followers <b>Q</b> with 922 bronze ball, Monel stem and followers <b>R</b> with Monel stem, followers, and bolting with Monel ball, stem, followers and bolting <b>S</b>	-- Manual lever handle <b>01</b> Without Handle <b>02</b> Without Handle, prepared for actuator mounting <b>03</b> With Handle, prepared for actuator mounting <b>04</b> Locking Device <b>05</b> Stainless Oval Handwheel <b>06</b> Manual Safety Nut <b>07</b> 45 Degree Handle <b>08</b> Manual Gear Operator <b>09</b> T-Handle (24" long) <b>10</b> Manual Spring Return Unit <b>11</b> Fusible Link Spring Return Unit <b>12</b> Coupled Vane Actuator for 80 psi <b>13</b> NEMA 4 Electric Actuator (120 vac) <b>14</b> NEMA 7 Electric Actuator (120 vac) <b>15</b> Square Operating Nut <b>16</b> Locking Handle and actuator mount body <b>17</b> Extended Locking Oval Handwheel <b>18</b> Extended Locking Lever Handle <b>20</b> D/A Actuator 80 psi <b>21</b> D/A Actuator 80 psi w/ NEMA 4 limit switch <b>22</b> D/A Actuator 80 psi w/ NEMA 4 solenoid <b>23</b> D/A Actuator 80 psi w/ NEMA 4 limit switch/solenoid <b>24</b> D/A Actuator 80 psi w/ NEMA 7 limit switch <b>25</b> D/A Actuator 80 psi w/ NEMA 7 solenoid <b>26</b> D/A Actuator 80 psi w/ NEMA 7 limit switch/solenoid <b>27</b> D/A Actuator 60 psi <b>28</b> D/A Actuator 60 psi w/ NEMA 4 limit switch <b>29</b> D/A Actuator 60 psi w/ NEMA 4 solenoid <b>30</b> D/A Actuator 60 psi w/ NEMA 4 limit switch/solenoid <b>31</b> D/A Actuator 60 psi w/ NEMA 7 limit switch <b>32</b> D/A Actuator 60 psi w/ NEMA 7 solenoid <b>33</b> D/A Actuator 60 psi w/ NEMA 7 limit switch/solenoid <b>34</b> S/R Actuator 80 psi <b>35</b> S/R Actuator 80 psi w/ NEMA 4 limit switch <b>36</b> S/R Actuator 80 psi w/ NEMA 4 solenoid <b>37</b> S/R Actuator 80 psi w/ NEMA 4 limit switch/solenoid <b>38</b> S/R Actuator 80 psi w/ NEMA 7 limit switch <b>39</b> S/R Actuator 80 psi w/ NEMA 7 solenoid <b>40</b> S/R Actuator 80 psi w/ NEMA 7 limit switch/solenoid <b>41</b> S/R Actuator 60 psi <b>42</b> S/R Actuator 60 psi w/ NEMA 4 limit switch <b>43</b> S/R Actuator 60 psi w/ NEMA 4 solenoid <b>44</b> S/R Actuator 60 psi w/ NEMA 4 limit switch/solenoid <b>45</b> S/R Actuator 60 psi w/ NEMA 7 limit switch <b>46</b> S/R Actuator 60 psi w/ NEMA 7 solenoid <b>47</b> S/R Actuator 60 psi w/ NEMA 7 limit switch/solenoid <b>50</b> without Handle, prepared for actuator mounting (Bray)  Other actuator options available.	- No Polish <b>A</b> 20 R <sub>a</sub> Max. I.D. <b>B</b> 32 R <sub>a</sub> Max. O.D. <b>C</b> 20 R <sub>a</sub> Max. I.D. & 32 R <sub>a</sub> Max. O.D. <b>D</b> 15 R <sub>a</sub> Max. I.D. <b>E</b> 10 R <sub>a</sub> Max. I.D. <b>F</b> 20 R <sub>a</sub> Max. I.D. after Electropolish <b>G</b> 15 R <sub>a</sub> Max. I.D. after Electropolish <b>H</b> 10 R <sub>a</sub> Max. I.D. after Electropolish <b>I</b> 5 R <sub>a</sub> Max. I.D. <b>K</b> 5 R <sub>a</sub> Max. I.D. & 32 R <sub>a</sub> Max. O.D. <b>L</b> 20 R <sub>a</sub> Max. I.D. & 32 R <sub>a</sub> Max. O.D. after Electropolish <b>M</b> Electropolish only (I.D. & O.D.) <b>N</b> 10 R <sub>a</sub> Max. I.D. & 32 R <sub>a</sub> Max. O.D. <b>O</b> 15 R <sub>a</sub> Max. I.D. & 32 R <sub>a</sub> Max. O.D. after Electropolish <b>Q</b> 15 R <sub>a</sub> Max. I.D. & 32 R <sub>a</sub> Max. O.D. <b>S</b> 10 R <sub>a</sub> Max. I.D. & 32 R <sub>a</sub> Max. O.D. after Electropolish																																				
Purge Ports 10	Milled Flats & Holes in Ball 11																																							
<b>A</b> (1) 1/2" Tri-Clamp on Center, 90° from Stem <b>B</b> (1) 1/2" Tri-Clamp on Center, Opposite Stem <b>C</b> (1) 1/2" Tri-Clamp Upstream, 90° from Stem <b>D</b> (1) 1/2" Tri-Clamp Downstream, Opposite Stem <b>E</b> (2) 1/2" Tri-Clamp on Center, 90° from & Opposite Stem <b>F</b> (2) 1/2" Tri-Clamp Upstream 90° from & Downstream Opposite Stem <b>G</b> (1) 1/2" BWTE on Center, 90° from Stem <b>H</b> (1) 1/2" BWTE on Center, Opposite Stem <b>I</b> (1) 1/2" BWTE Upstream, 90° from Stem <b>J</b> (1) 1/2" BWTE Downstream, Opposite Stem <b>K</b> (2) 1/2" BWTE on Center, 90° from & Opposite Stem <b>L</b> (2) 1/2" BWTE Upstream 90° from & Downstream Opposite Stem <b>M</b> (1) 1/4" F.N.P.T. on Center, 90° from Stem <b>N</b> (1) 1/4" F.N.P.T. on Center, 90°, Opposite Stem <b>O</b> (1) 1/4" F.N.P.T. Upstream, 90° from Stem <b>P</b> (1) 1/4" F.N.P.T. Downstream, Opposite Stem <b>Q</b> (2) 1/4" F.N.P.T. on Center, 90° from Opposite Stem <b>R</b> (2) 1/4" F.N.P.T. Upstream 90° from & Downstream Opposite Stem - No Purges, Use if Adding only Flats or Drain Holes	Use Column #1 for CIP/SIP Flush Tank with Std. FT Pad. Use Column #2 for CIP/SIP Flush Tank with Shipping Pad.  <table border="1"> <thead> <tr> <th>#1</th> <th>#2</th> <th></th> </tr> </thead> <tbody> <tr> <td><b>A</b></td> <td><b>K</b></td> <td>Flats, Closed, Downstream</td> </tr> <tr> <td><b>B</b></td> <td><b>L</b></td> <td>Flats, Closed, Upstream</td> </tr> <tr> <td><b>C</b></td> <td><b>M</b></td> <td>Flats, Open, Upstream</td> </tr> <tr> <td><b>D</b></td> <td><b>N</b></td> <td>Flats, Open, Downstream</td> </tr> <tr> <td><b>E</b></td> <td><b>O</b></td> <td>Flats, Open, Up &amp; Downstream</td> </tr> <tr> <td><b>F</b></td> <td><b>P</b></td> <td>Holes, Closed, Downstream</td> </tr> <tr> <td><b>G</b></td> <td><b>Q</b></td> <td>Holes, Closed, Upstream</td> </tr> <tr> <td><b>H</b></td> <td><b>R</b></td> <td>Holes, Open, Upstream</td> </tr> <tr> <td><b>I</b></td> <td><b>S</b></td> <td>Holes, Open, Downstream</td> </tr> <tr> <td><b>J</b></td> <td><b>T</b></td> <td>Holes, Open, Up &amp; Downstream</td> </tr> <tr> <td>-</td> <td><b>U</b></td> <td>No Flats or Holes</td> </tr> </tbody> </table>	#1	#2		<b>A</b>	<b>K</b>	Flats, Closed, Downstream	<b>B</b>	<b>L</b>	Flats, Closed, Upstream	<b>C</b>	<b>M</b>	Flats, Open, Upstream	<b>D</b>	<b>N</b>	Flats, Open, Downstream	<b>E</b>	<b>O</b>	Flats, Open, Up & Downstream	<b>F</b>	<b>P</b>	Holes, Closed, Downstream	<b>G</b>	<b>Q</b>	Holes, Closed, Upstream	<b>H</b>	<b>R</b>	Holes, Open, Upstream	<b>I</b>	<b>S</b>	Holes, Open, Downstream	<b>J</b>	<b>T</b>	Holes, Open, Up & Downstream	-	<b>U</b>	No Flats or Holes			
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* Pad Description category is exclusive to the FT, FI series.																																								

## ANGLE STEM FLUSH TANK BALL VALVES

PRODUCT Position 1 + 2		MATERIAL 3 + 4		SIZE 5		SERIES 6		END FITTING 7 + 8		SEAT/SEAL 9																	
AF	Angle Stem Flush Tank	E- C/S (w/ C/S Pad)	H- 316 S/S (w/ 316L S/S Pad)	E 1" G 1-1/2" H 2" K 3" L 4" M 6"	1 30/40 3 Fire Test API-607 Ed. 4	L- 150# Flange Q- Female NPT** X- Tri-Clamp (Tube)	Other end fittings available. **Only available in 1" - 4".		A RTFE*	B RTFE w/ VTFE Filler	C VTFE	D VTFE w/ VTFE Filler	E PLUS	F PLUS w/ VTFE Filler	G PLUS w/ PLUS Filler	H S/STFE	I S/STFE w/ VTFE Filler	J S/S w/ S/STFE Filler	K UHMWPE**	L UHMWPE w/ VTFE Filler**	M UHMWPE w/ UHMWPE Filler**	N PEEK**	O PEEK w/ VTFE Filler**	P PEEK w/ PEEK Filler**	Q Carbon Graphite**	R Kynar**	S Kynar w/Kynar Filler**
										*AF standard. **Not available in Fire Test Design.																	

### EXAMPLE:

STANDARD							OPTIONS		
Position 1 + 2 Product	3 + 4 Material	5 Size	6 Series	7 + 8 End Fitting	9 Seat/Seal	10 + 11 Pad Description	12 Ball/Stem	13 + 14 Operator	15 Polish
AF	H-	H	1	X-	A	01	G	02	A

AFH-H1X-A01-G02A is the code for an Angle Stem ball valve, 316 S/S w/ S/S pad, 2" size, Series 1, with Tri-Clamp ends, RTFE seats and seals, no pad w/o UHMWPE shipping pad, 17-4 PH S/S stem, without handle and prepared for actuator mounting, with 20 R<sub>a</sub> Max. I.D. polish.

### WORK SPACE: FOR YOU TO FILL IN THE BLANKS

STANDARD							OPTIONS		
Position 1 + 2 Product	3 + 4 Material	5 Size	6 Series	7 + 8 End Fitting	9 Seat/Seal	10 + 11 Flow Pattern	12 Ball/Stem	13 + 14 Operator	15 Polish
			5						

PAD DESCRIPTION 10 + 11/Ball & Port Configuration		BALL/STEM 12	OPERATOR 13 + 14	POLISH 15
<b>01</b> No pad w/o UHMWPE shipping pad	<b>A</b> 300 S/S w/ 2" Extension	-- Manual lever handle	- No Polish	
<b>02</b> No pad w/ UHMWPE shipping pad	<b>B</b> 300 S/S w/ 4" Extension	<b>01</b> Without Handle	<b>A</b> 20 R <sub>a</sub> Max. I.D.	
<b>04</b> w/ 316L barstock pad	<b>C</b> 300 S/S w/ 6" Extension	<b>02</b> Without Handle, prepared for actuator mounting	<b>B</b> 32 R <sub>a</sub> Max. O.D.	
<b>05</b> w/ 1" 150# bolt-on pad	<b>F</b> with ground device	<b>03</b> With Handle, prepared for actuator mounting	<b>C</b> 20 R <sub>a</sub> Max. I.D. & 32 R <sub>a</sub> Max. O.D.	
<b>06</b> w/ 1.5" 150# bolt-on pad	<b>G</b> 17-4 PH S/S stem	<b>04</b> Locking Device	<b>D</b> 15 R <sub>a</sub> Max. I.D.	
<b>07</b> w/ 2" 150# bolt-on pad	<b>O</b> with H/C ball	<b>05</b> Stainless Oval Handwheel	<b>E</b> 10 R <sub>a</sub> Max. I.D.	
<b>08</b> w/ 3" 150# bolt-on pad	<b>P</b> with H/C ball, stem and follower	<b>06</b> Manual Safety Nut	<b>F</b> 20 R <sub>a</sub> Max. I.D. after Electropolish	
<b>09</b> w/ 4" 150# bolt-on pad		<b>07</b> 45 Degree Handle	<b>G</b> 15 R <sub>a</sub> Max. I.D. after Electropolish	
<b>10</b> w/ 6" 150# bolt-on pad		<b>08</b> Manual Gear Operator	<b>H</b> 10 R <sub>a</sub> Max. I.D. after Electropolish	
		<b>09</b> T-Handle (24" long)	<b>I</b> 5 R <sub>a</sub> Max. I.D.	
		<b>10</b> Manual Spring Return Unit	<b>K</b> 5 R <sub>a</sub> Max. I.D. & 32 R <sub>a</sub> Max. O.D.	
		<b>11</b> Fusible Link Spring Return Unit	<b>L</b> 20 R <sub>a</sub> Max. I.D. & 32 R <sub>a</sub> Max. O.D. after Electropolish	
		<b>12</b> Coupled Vane Actuator for 80 psi	<b>M</b> Electropolish only (I.D. & O.D.)	
		<b>13</b> NEMA 4 Electric Actuator (120 vac)	<b>N</b> 10 R <sub>a</sub> Max. I.D. & 32 R <sub>a</sub> Max. O.D.	
		<b>14</b> NEMA 7 Electric Actuator (120 vac)	<b>O</b> 15 R <sub>a</sub> Max. I.D. & 32 R <sub>a</sub> Max. O.D. after Electropolish	
		<b>15</b> Square Operating Nut	<b>Q</b> 15 R <sub>a</sub> Max. I.D. & 32 R <sub>a</sub> Max. O.D.	
		<b>16</b> Locking Handle and actuator mount body	<b>S</b> 10 R <sub>a</sub> Max. I.D. & 32 R <sub>a</sub> Max. O.D. after Electropolish	
		<b>17</b> Extended Locking Oval Handwheel		
		<b>18</b> Extended Locking Lever Handle		
		<b>20</b> D/A Actuator 80 psi		
		<b>21</b> D/A Actuator 80 psi w/ NEMA 4 limit switch		
		<b>22</b> D/A Actuator 80 psi w/ NEMA 4 solenoid		
		<b>23</b> D/A Actuator 80 psi w/ NEMA 4 limit switch/solenoid		
		<b>24</b> D/A Actuator 80 psi w/ NEMA 7 limit switch		
		<b>25</b> D/A Actuator 80 psi w/ NEMA 7 solenoid		
		<b>26</b> D/A Actuator 80 psi w/ NEMA 7 limit switch/solenoid		
		<b>27</b> D/A Actuator 60 psi		
		<b>28</b> D/A Actuator 60 psi w/ NEMA 4 limit switch		
		<b>29</b> D/A Actuator 60 psi w/ NEMA 4 solenoid		
		<b>30</b> D/A Actuator 60 psi w/ NEMA 4 limit switch/solenoid		
		<b>31</b> D/A Actuator 60 psi w/ NEMA 7 limit switch		
		<b>32</b> D/A Actuator 60 psi w/ NEMA 7 solenoid		
		<b>33</b> D/A Actuator 60 psi w/ NEMA 7 limit switch/solenoid		
		<b>34</b> S/R Actuator 80 psi		
		<b>35</b> S/R Actuator 80 psi w/ NEMA 4 limit switch		
		<b>36</b> S/R Actuator 80 psi w/ NEMA 4 solenoid		
		<b>37</b> S/R Actuator 80 psi w/ NEMA 4 limit switch/solenoid		
		<b>38</b> S/R Actuator 80 psi w/ NEMA 7 limit switch		
		<b>39</b> S/R Actuator 80 psi w/ NEMA 7 solenoid		
		<b>40</b> S/R Actuator 80 psi w/ NEMA 7 limit switch/solenoid		
		<b>41</b> S/R Actuator 60 psi		
		<b>42</b> S/R Actuator 60 psi w/ NEMA 4 limit switch		
		<b>43</b> S/R Actuator 60 psi w/ NEMA 4 solenoid		
		<b>44</b> S/R Actuator 60 psi w/ NEMA 4 limit switch/solenoid		
		<b>45</b> S/R Actuator 60 psi w/ NEMA 7 limit switch		
		<b>46</b> S/R Actuator 60 psi w/ NEMA 7 solenoid		
		<b>47</b> S/R Actuator 60 psi w/ NEMA 7 limit switch/solenoid		
		Other actuator options available.		

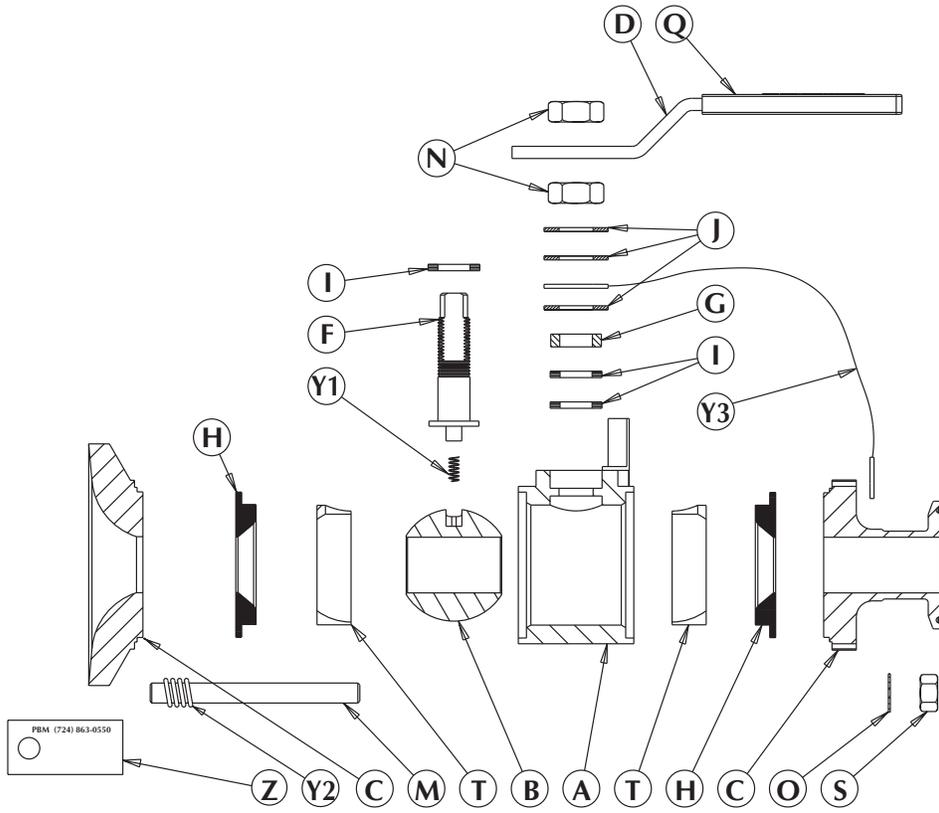
## PARTS LIST

Item	Description	Materials	
		Series 5	Series 5 — Steam
A	Body	316 S/S	
B	Ball	316 Stainless Steel	
C	End Fitting	316 S/S	
D	Handle	300 Series S/S	
F	Stem	316 S/S	
G	Follower	300 Series S/S	
H	Seat	RTFE <sup>2</sup>	
H2	Metal Encapsulated Ring		
I	Stem Packing	RTFE <sup>2</sup>	
J1	Large Spring Washer		
J2	Small Spring Washer	Stainless Steel	
L1	Large O-ring	VTFE <sup>3</sup>	
L2	Small O-ring		
M	End Fitting Fastener	18-8 S/S	
N	Jam Nut	18-8 S/S	
O		18-8 S/S	
Q	Handle Cover	Vinyl	
S	Hex Nut		
T	Cavity Filler		
Y1	Internal Ground Spring		
Y2	Coil Ground Spring		
Y3	External Ground Wire		
Z	Tag		

### NOTES:

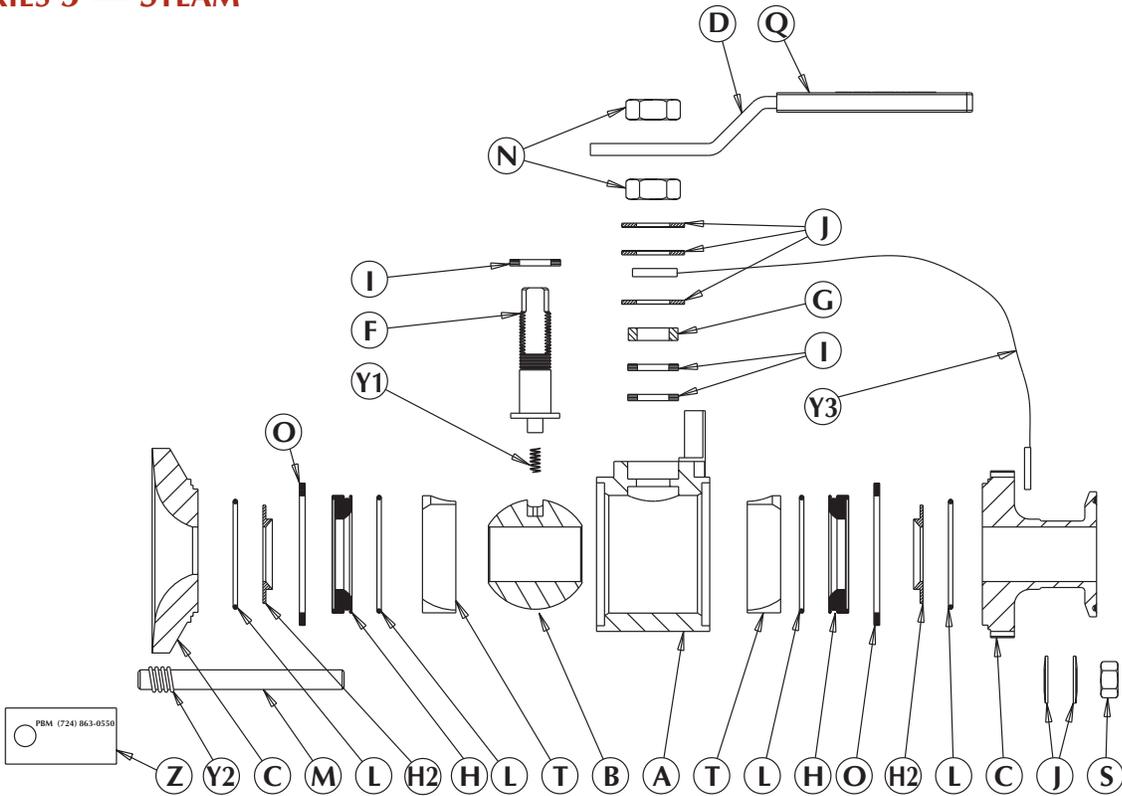
1. Other metals and materials are available.
2. Illustration and parts list shown apply to 1/4" through 4" manual FT Series Valves. 6" and 8" FT Series Valves have 4 spring washers and O-rings. FT Series Valves prepped for actuation have 3 additional spring washers and one less follower; 6" and 8" valves have only 2 additional spring washers.

**SERIES 5**



▲ SK-A050

**SERIES 5 — STEAM**



▲ SK-A049