

# The TBV Advantage

A general catalog displaying a unique range of products for gas processing and the downstream chemical market.

TECHNOLOGY





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## The TBV Advantage



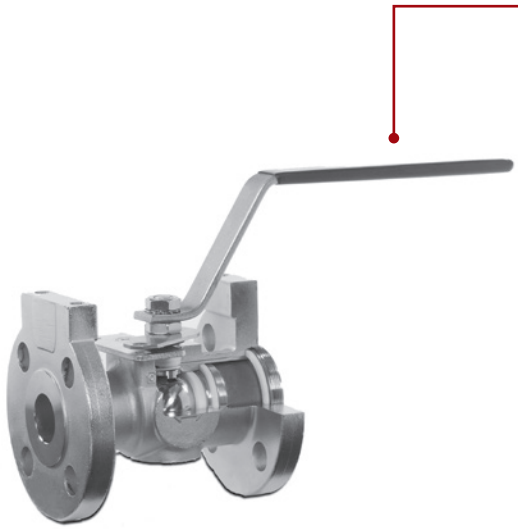
Millbury, Mass.,  
USA

Cameron is a leading provider of valves and measurement systems to the oil, and gas industry. Our products are primarily used to control, direct, and measure the flow of oil and gas as it is moved from individual wellheads through flowlines, gathering lines, transmission systems to refineries, petrochemical plants, and industrial centers for processing.

Cameron provides a wide range of valves for use in natural gas, LNG, crude oil, and refined products transmission lines. The traditional CAMERON® fully welded ball valve product line has been combined with the GROVE®, RING-O®, TOM WHEATLEY®, ENTECH™, and TK® product lines. This broad offering has strengthened Cameron's ability to serve as a single source for a wide scope of customer requirements. We also provide critical service valves for refinery, chemical, and petrochemical processing businesses, and for associated storage terminal applications, particularly through our ORBIT® and GENERAL VALVE® brands. These brands are complemented by WKM®, TBV™, and TEXSTEAM™ valve products, and considerably expand the scope of our product offerings.

Cameron's TBV brand has much to offer the marketplace. Since 1978, we have come a long way from simply supplying small titanium valves manufactured from bar stock. Today, Cameron's 100,000 sq-ft facility in Millbury, Mass., offers a large portfolio of valves manufactured from a wide range of commercially available materials. This increased manufacturing space has afforded Cameron the opportunity to expand its product offerings and size ranges. The TBV brand focuses on high alloys, instrumentation, cryogenic, and severe service, which includes LNG, high pressure acid leaching (HPAL), petrochemical, and refining.

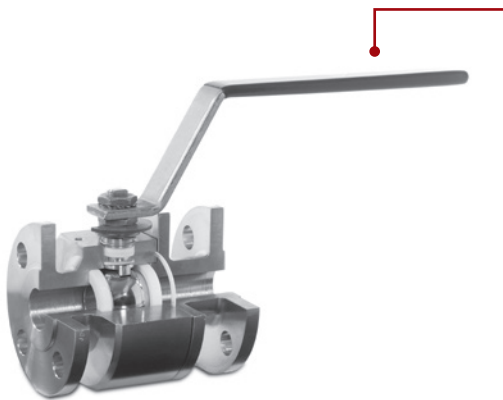
## FLANGED BALL VALVES



### Series 2000

Cameron's TBV Series 2000 is a unibody, cast, standard port flanged ball valve offering versatility with respect to materials and modifiers to satisfy today's sophisticated process valve requirements. With no breaks in the body design, the Series 2000 is the clear choice where external leakage is a concern. The valve body is designed to facilitate ease of automation by including both ISO and flange-boss mounting capabilities as standard. The TBV Series 2000 is available in 1/2" to 8" (DN 15 to DN 200) sizes bonnet with ASME Class 150 to 600 flanges.

Valve safety also is addressed by utilizing the standard blowout-proof stem design in conjunction with optional features, such as oval safety handles for sizes up to 1" (DN 25), lock-out devices, and fugitive emissions bonnets. See page 8 for FE bonnet design. They are designed to comply with the fire-safe standards of API 607. As with all TBV valves, quality, flexibility, long service life, and safety make this valve one of the best choices for integrity and application satisfaction.



### Series 1800

The TBV Series 1800 flanged valve is manufactured from bar stock or forgings. It is available in standard or full port design, and is a high-integrity, two-piece body design. A welded fugitive emissions bonnet also is available. See page 8 for FE bonnet design. It is available in sizes from 1/2" to 10" (DN 15 to DN 250) in a variety of body and seat materials with ASME Class 150 to 1500 flanges.

## FLANGED BALL VALVES (CONT.)



### Series 2800

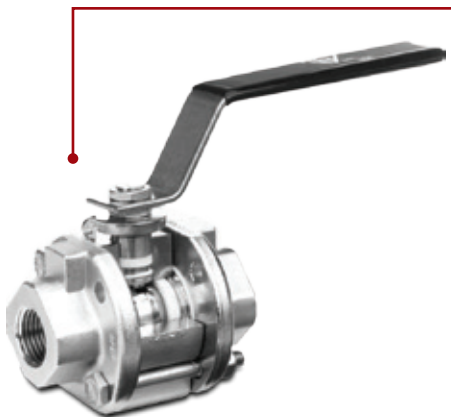
The TBV Series 2800 two-piece, cast, full-port flanged ball valve is specifically designed to tackle severe service applications. This design includes a live-loaded dual stem seal (primary and secondary seal) as standard. The body and bonnet are cast as a single piece with no welds. The TBV Series 2800 is available in sizes from 1/2" to 8" (DN 15 to DN 200) with ASME Class 150 to 600 flanges.



### Series 3300

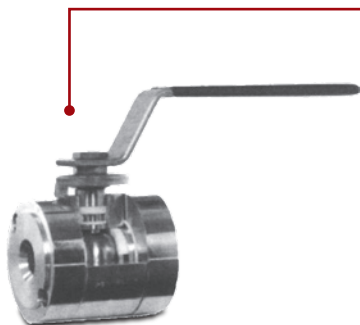
An enhanced version of the TBV Series 1800, the TBV Series 3300 is suited for erosive applications. The design includes a secured downstream seat, spring-loaded upstream seat, and enhanced ball and stem engagement. This valve is manufactured from barstock or forgings from any commercially available material. It is offered in sizes from 1" to 14" (DN 25 to DN 350) with ASME Class 150 to 1500 flanges.

## THREE-PIECE BALL VALVES – FOR THREADED AND WELDED END CONNECTIONS



### Series 1100

Along with all of the features and versatility of a three-piece valve, the TBV Series 1100 valve incorporates a raised face on the seat-bearing side of the endplate, which ensures positive alignment of the components and positive preset. The body seal is 100% enclosed. Rugged construction features a heavy-duty handle and stop plate, and body bolts with a variety of material options. The TBV Series 1100 is ASME Class 600-rated and is available in a wide variety of materials with NPT, socket-weld, and butt-weld end connections in 1/4" to 3" (DN 8 to DN 80) sizes. See page 8 for FE bonnet design. Other special end connections are available upon request.



### Series 3100

The TBV Series 3100 wafer three-piece valve combines the benefits of a standard three-piece valve with additional wafer features. The three-piece design utilizes raised-face endplates to ensure correct alignment with the body, totally encapsulated body seals, and a bottom entry blowout-proof stem. The wafer configuration provides additional benefits, including reduction of the material mass of the valve and lower cost. The TBV Series 3100 can be used between ASME Class 150 to 600 flanges with a 1500 psi pressure rating, and is available in sizes from 1/2" to 8" (DN 15 to DN 200) in a wide variety of alloys.

## DIVERTER VALVES – FOR BLENDING AND MIXING APPLICATIONS

Diverter valves' 90-degree operation allows diverting from the bottom or side port to either of the other two ports with a 90-degree turn of the handle, but the flow can never be shut off. The 180-degree operation allows diverting with a 180-degree turn of the handle, and flow can be shut off at the 90-degree position.



### Series 5100 (Fabricated from Series 1100)

Cameron's TBV brand offers the Series 5100 diverter valve to accomplish what would otherwise require two or more two-way valves. The diverter valve utilizes all of the benefits of the two-way, three-piece TBV valve, including a blowout-proof stem, raised-face endplates to reduce radial piping stresses that could cause body seal leakage, a wide variety of seals, and a large selection of end connections. The TBV Series 5100 is available in either a diverter or a three-way format with bottom or side porting. It also is available for 90- or 180-degree operations in sizes from 1/4" to 6" (DN 8 to DN 150), making it valuable for a variety of applications.



### Four-Way Diverter

The TBV four-way diverter valve is used where several two-way valves would otherwise be needed. It is available in a wide array of flow patterns utilizing an L port, a T port, or a double-L ball. Four seats ensure leak-tight sealing. The four-way diverter can be produced in a large variety of body and seat materials in sizes from 1/2" to 6" (DN 15 to DN 150), and is available with screwed, socket-weld, butt-weld, or flanged end connections. Consult Cameron for specific applications.



### Series 51/20 (Fabricated from Series 2000)

The TBV Series 2000 flanged, unibody valve has a welded bottom port flange connection for use in applications that normally would require two or more two-way valves. It is available with bottom or side porting in 90- or 180-degree operations. The TBV Series 51/20 is available in sizes from 1/2" to 8" (DN 15 to DN 200) with ASME Class 150 to 600 flanges in a variety of alloys.

## CRYOGENIC BALL VALVES



### Series 2100 (Fabricated from Series 1100)

The unique design of the TBV Series 2100 three-piece cryogenic valve incorporates features that provide long life, safety, and low torque. The high-strength, blowout-proof stem is used in conjunction with a welded, extended bonnet and a five-Chevron® V-ring packing set to provide leak-proof stem seal integrity, as well as providing live-loaded self-adjustment. The TBV Series 2100 has a temperature rating down to -452° F (-269° C). It comes in 316 stainless steel, brass, and other commercially available materials with NPT, socket-weld, and butt-weld end connections in 1/4" to 8" (DN 8 to DN 200) sizes. For applications such as vent and bleed lines or intermittent cryogenic services, non-extended stems are available.

### Series 21/18, 21/20, and 21/28 Flanged Cryogenic Valves

TBV flanged cryogenic valves provide operation down to -452° F (-269° C). The integrity of the valve is further enhanced by the welded bonnet design. The stem is blowout-proof and self-adjusting to wear and pressure due to live loading. The standard body material is 316 stainless steel, and is available with ASME Class 150 to 1500 flanges, model dependent, in 1/2" to 8" (DN 15 to DN 200) sizes. A wide variety of seating options are available. A non-extended bonnet option also is available.



Series 21/18  
(Fabricated from Series 1800)



Series 21/20  
(Fabricated from Series 2000)



Series 21/28  
(Fabricated from Series 2800)





### Series 21/80

The TBV Series 21/80 is a large-bore, 10" to 18" (DN 250 to DN 450) cryogenic valve available with ASME Class 150 to 600 flanges. This series of valve is full port, trunnion-supported, and split body.



### Series 21/51 (Fabricated from a Series 5100)

The TBV Series 21/51 cryogenic diverter incorporates all features found in the TBV Series 2100 valve, and provides diverting capabilities for use where two or more two-way valves normally would be necessary.

The TBV Series 21/51 is available in two porting arrangements, 90- and 180-degree operations, and operates like TBV standard diverter valves. It is offered as full port or standard port in sizes from 1/2" to 8" (DN 15 to DN 200), in 316 stainless steel or brass, and with or without an extended stem. NPT, socket-weld, and butt-weld end connections are available.



### Series 21/51A

The TBV Series 21/51A high-flow cryogenic diverter valve assembly for dual safety relief systems is designed to meet the high flow requirements of stationary cryogenic containers. This valve features a 180-degree operation, provides positive porting with consistently high  $C_v$  during transfer, and is suitable for tank pressures up to 600 psi. The installation of cryogenic relief valves like the TBV Series 21/51A are vital for reducing the possibility of costly field repair fabrication due to the over pressurization of cryogenic piping systems.

## SEVERE SERVICE – FUGITIVE EMISSIONS (FE) VALVES

### FE Bonnet for High Performance

For critical applications in which leakage of toxic or volatile organic compounds cannot be tolerated, the TBV brand provides the FE bonnet. The FE bonnet utilizes a unique design in which the stem packing is live-loaded between the threads on the top of the stem and a shoulder on the stem, rather than a shoulder in the packing box. Through this floating stem design, Cameron has eliminated the effect of temperature cycles on the packing arrangement. The packing consists of Chevron V-rings sandwiched between the top and bottom adapter rings, or wedge-style packing, and can be modified to accept a leak-off with a lantern ring. This unique design has been proven in thousands of installations in services including phosgene and chlorine. A fire-safe version is available.



## CHECK VALVES



### Series 7100

The TBV Series 7100 swing check valve utilizes a toggle arm and disc arrangement. This valve is available with integral metal seats. The TBV Series 7300 wafer swing check valve can be supplied for use with all ASME Class flanges up to 600, as standard. Both the TBV Series 7100 swing check and the TBV Series 7300 wafer swing check valves are available in sizes ranging from 2" to 8" (DN 50 to DN 200).



### Series 9100

The TBV Series 9100 ball check valve is available in sizes ranging from 1/2" to 2" (13 mm to 51 mm) in a wide variety of material choices such as stainless steel, Monel®, Hastelloy®, and titanium. Cameron can provide the TBV Series 9100 with all available end connections, including socket-weld, butt-weld, screw-end or ASME Class 150 to 900 flanged ends. The TBV Series 9100 is controlled by backpressure, and can be supplied with a spring set calibrated from 5 to 25 psi (0.34 to 1.72 bar).

## SPECIAL SERVICE

### Chlorine Service

For the handling of chlorine compounds, Cameron has developed special designs to withstand harsh applications. TBV chlorine valves feature Inconel® Belleville-loaded stem seals for automatic compensation of temperature and pressure fluctuations, an upstream pressure-relief hole in the ball or a slotted upstream endplate to allow expanding chlorine to escape harmlessly upstream, and a wide variety of available materials to suit each individual application. TBV chlorine valves are cleaned, assembled, and bagged following the recommendations of the Chlorine Institute Pamphlet 6. The chlorine service option is available for all TBV ball valves.

### Oxygen Service

Cameron's TBV valves are commonly applied on oxygen service in either the liquid (cryogenic) or gaseous phase. Because of the danger of oxygen reacting explosively with any grease, oil, or combustible material left in the piping system, TBV valves provided for oxygen service are:

- Inspected for chips, burrs, foreign matter, and any other defects in workmanship
- Cleaned and degreased prior to assembly (including tools and handling apparatus)
- Purged and dried with filtered, non-lubricated air
- Seats and seals are lubricated with an oxygen-compatible lubricant (Fluorolube®) on gaseous O<sub>2</sub> valves; cryogenic valves are not lubricated
- Black-light inspected before assembly
- Assembled, tested, and air-dried in a clean room
- Capped on each end
- Tagged "Cleaned for Oxygen Service"
- Polybagged and sealed closed
- In compliance with Praxair® Standard GS-38

## TBV CONTROL SEATS



- The TBV V-seated control valve greatly expands the ability of a ball valve to provide accurate control over a wide range of flow conditions.

The metal V-seat can be installed upstream or downstream. For lower pressure drops, installing the V-seat upstream will ensure bubble-tight shutoff from the resilient downstream seat. For higher pressure drops with cavitation or erosion potential, installing the V-seat downstream will extend valve life.

Bubble-tight shutoff is attained by installing a soft seat downstream. Typically, a reinforced PTFE seat is used for tight shutoff. This seat is protected from high-velocity damage since the upstream V-seat already has significantly reduced the flow rate through the valve. For higher flow rates or for abrasive media, a metal seat can be used downstream, providing Class 5 shutoff.

## TBV ADVANCED WEAR AND CORROSION-RESISTANT COATINGS

Today's process requirements are demanding metal seat performance at an ever-increasing rate. This is due because metal seat technology has drastically improved over the years, which has resulted in elevated performance and usage.

The TBV brand offers metal seats and coatings for some of the toughest applications. All TBV products, from the smallest instrumentation valve to our largest cryogenic valve, make use of our coating expertise, which was developed as the TBV brand entered the high pressure acid leaching (HPAL) niche for metal extraction several years ago. Cameron is always reviewing its coating technology for better performance.

Thermal spraying is a technology that uses a hot, fast-moving jet to partially melt and accelerate entrained particles toward a substrate. There are three technologies that are widely used commercially for the deposition of materials onto the surface of a component.

- **Atmospheric plasma spraying (APS)** that uses an extremely hot 9032° F to 27,032° F (5000° C to 15,000° C) and relatively slow-moving (subsonic) plasma jet in an open environment.
- **Vacuum plasma spraying (VPS)** that uses a cooler 5432° F to 18,032° F (3000° C to 10,000° C), but much faster (supersonic) plasma jet inside a controlled, reduced-pressure reactor.
- **High-velocity oxy fuel (HVOF)** that uses a flame with lower temperature and a higher velocity when compared to APS or VPS.

### Salient Features of VPS Coatings

- Strong metallurgical bonding between the coating and the component
- Extremely dense coatings
- Oxide-free metallic coatings
- ASME Class VI shutoff at factory, upon request (otherwise, Class V)

## HOW TO ORDER COATINGS ON YOUR VALVES

Please specify one of these coatings that should be applied to the stack height (defined as the ball and seats):

- Titanium oxide ceramic (VPS)
- Chromium oxide ceramic (VPS)
- Tungsten carbide (HVOF)
- Chrome carbide (HVOF)
- Tungsten carbide (APS)
- Chrome carbide (APS)

## INSTRUMENTATION VALVES

TBV instrumentation valves were developed in response to concerns expressed by plant engineers. Common problems such as center-to-center spacing in differential pressure installations, visual position indication, plugging of impulse lines, and tamper proofing, all have been reduced with the use of the TBV instrumentation valve line. A center-to-center spacing problem arises in competitive designs since the bonnet must be removed from the body in order to screw the valve into the orifice flange next to another valve.

Cameron has solved this problem since our TBV instrumentation valves can be installed on 2-1/8" (54 mm) centers\* by simply removing the mating valve handle, leaving the valve's factory integrity intact.

Visual position indication is achieved through the use of an oval safety handle. This handle allows easy position identification while maintaining safety. These tamper-proof valves incorporate additional safety through a full-penetration, all-welded design, which practically ensures that the body components cannot be separated. Standard valves have been subjected to bending loads exceeding 27,000 lb-ft (36,607 N·m) without weld failure.

To avoid plugging of impulse lines, all TBV instrumentation valves are fully roddable. The bore through the ball and seats is larger than the body bore. This feature prevents accidental damage to the ball or seats during the rodding operation. TBV instrumentation valves are available in any commercially available material. The TBV brand also can accommodate the entire spectrum of end connections on our instrumentation product line. All products are available with threaded, socket-weld, butt-weld, or flanged end connections, and all can be ordered as fire-safe.

\* With the exception of the TBV Series 6800 and 6900 valves.



### Series 4100

The TBV Series 4100 is an all-welded, fully roddable, double-female valve. Standard sizes range from 1/4" to 1" (DN 8 to DN 25). Material options include all commercially available alloys. The valve also meets API 607 fire-safe requirements.



### Series 41/61

The TBV Series 41/61 is an all-welded, fully roddable design with one female NPT end and one male end. The male end is available with screwed, butt-weld, socket-weld, and flanged connections. Male and female ends may be different sizes upon request. Standard sizes range from 1/4" to 1" (DN 8 to DN 25). Material options include all commercially available alloys.



### Series 5500

The TBV Series 5500 is a double-isolation valve. There are two closure members on each side of the bleed valve. For the bleed, a standard TBV instrumentation ball valve is recommended, although non-TBV brands can be utilized, such as needle or OS&Y, depending on customer preference. The Series 5500 is offered in sizes up through 3" (DN 80) and ASME Class 1500 in any commercially available material. The valve also meets API 607 fire-safe requirements.



### Series 6100

The TBV Series 6100 is fully roddable and provides three 1/2" (DN 15) female ports with one male end for attachment to an orifice flange. The TBV Series 6100 allows for different sized male ends up to 1" (DN 25) in size and is available in a variety of materials. The valve can be installed in pairs on 2-1/8" (54 mm) centers for transmitter hookups.



### Series 61/41/61

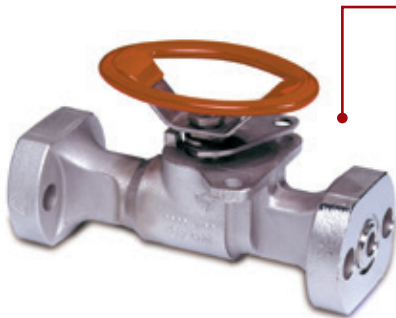
The double-male end TBV Series 61/41/61 valve is a natural offshoot of the TBV Series 4100, which reduces the need for extensions to be used with female end valves. The all-welded design also reduces the number of leak paths, and extended male ends are available upon request.

## INSTRUMENTATION VALVES (CAN BE USED AS PROCESS VALVES)



### Series 6400

The TBV Series 6400 valve includes all of the advanced TBV ball valve features in a fire-safe design that meets API 607 requirements. The TBV Series 6400 is available with a variety of seat materials in a carbon steel or stainless steel forged body from 1/2" to 1" (DN 15 to DN 25). Other materials are available upon request. The TBV Series 6400 is furnished with one NPT end and allows a choice of NPT, socket-weld, or integrally reinforced external body (IREB) end connections for the other end. This quarter-turn ball valve replaces leaky, extended body gate valves in process, block, bleed, and drain applications.



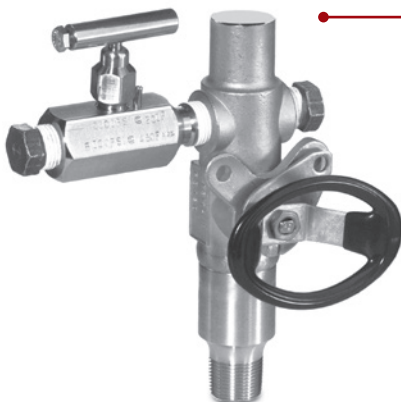
### Series 6500

The TBV Series 6500 cast body process transmitter valve replaces gate valves with advanced TBV ball valve features in a fire-safe design, meeting stringent refinery and chemical plant requirements. The TBV Series 6500 features all-welded, tamper-proof construction, an internal blowout-proof stem, and an oval safety handle to prevent accidental operation. The unique design of the TBV Series 6500 incorporates backup metal fire lips to provide sealing should the soft seals sublimate in the event of fire, and optional graphoil stem seals that ensure fire-safe protection. The TBV Series 6500 offers reliability, safety, visibility, unique mounting capability, quality, and unsurpassed leakage protection.



### Series 6800

The TBV Series 6800 is an instrumentation valve with a cast body that incorporates an integral lock-out pad and a high-performance stem packing. The valve comes equipped with a locking oval handle as a standard feature. It is seal-welded to prevent tampering or accidental unthreading when removing from the line. The TBV Series 6800 is fire-safe when ordered with appropriate seals, and is fully roddable. Because of the cast lock-out pad, it cannot be turned on 2-1/8" (54 mm) centers for transmitter hookups.



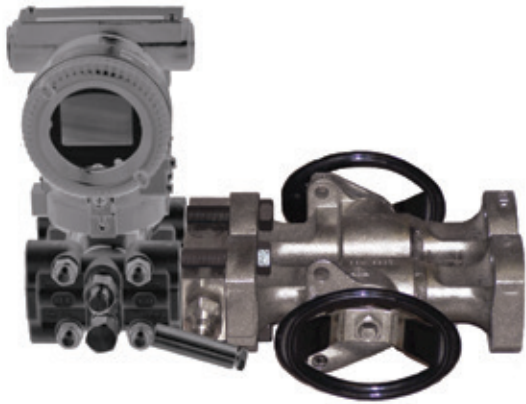
### Series 6900

Similar to the TBV Series 6100 valve, the TBV Series 6900 valve uses a cast body that incorporates an integral lock-out pad and a high-performance stem packing. In addition, like the TBV Series 6100, the TBV Series 6900 is intended as a gage isolation valve with tapped NPT side ports for flush and drain functions. It incorporates all of the other features of the TBV Series 6100 valve: roddability, fire safety, and seal welding. The valve comes equipped with a locking oval handle as a standard feature. Because of the cast lock-out pad, it cannot be turned on 2-1/8" (54 mm) centers for transmitter hookups.



## INSTRUMENTATION CONNECTION SYSTEMS

Cameron's TBV instrumentation connection systems (ICs) combine optimum measurement technology, proven mounting practices (close coupling), and hardware integration to produce not only accuracy and zero stability, but a low installed cost unequalled in performance and constructability. This system can reduce installation costs by modularizing, pre-engineering, pre-fabricating, and locking in the optimum transmitter installation in a tamper-proof, foolproof system that guarantees the rated performance of the transmitter, while lowering the installed cost per instrument loop by 30% to 80%. Cameron's TBV brand features more than 325 manifold detail types, for almost every conceivable installation situation.



Series 3411-00  
Flow Applications



Series 5571-00  
Pressure Applications

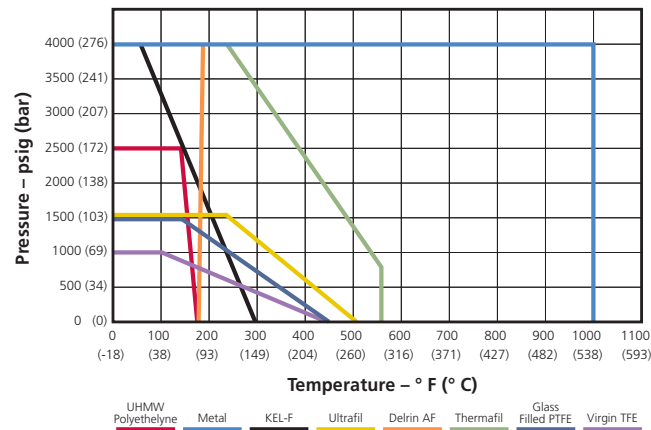


Series 5576-42  
Level Applications

## SEAT RATING CHART

Graphite and metal seats are available for services up to 1200° F (649° C) at varying pressures, dependent on media and service conditions. Consult Cameron for specific ratings.

**Seat Rating Chart**



## Seat Material Identification Code

Seat Material Identification Code	
T – Virgin PTFE	White
G – Reinforced PTFE	White with Red Speckles
U – Ultrafil	Black
F – Thermanfil (Carbon-Filled PEEK)	Black
P – UHMWP	Translucent White
D – Delrin	Dark Brown
K – CTFE	Translucent
M – Metal	Silver
H – Graphite	Black

Extended pressures and temperatures can be achieved by altering the design for specific applications. Consult Cameron with service conditions.

## ORDERING GUIDE – BASIC RULES FOR ORDERING TBV VALVES

Please use the charts on the next two pages for parts numbers and item descriptions when giving our customer service department information on quoting a job.

### Helpful Hints:

- TBV Model Numbers can be as long as 30 characters, including spaces
- TBV Model Numbers contain spaces or dashes to separate major valve features

The following list is in accordance with Cameron's TBV ordering charts on the next two pages:

1. Start with the valve size. The size will be two digits.
2. Follow the size with the designation for full (F) or standard (S) port.
3. A space will always follow the full or standard port designator.
4. Fill in the two character codes for the desired valve series.
5. A space is next.
6. Pick the three-character code to designate end connections. If a combination is required, use the single codes as needed. An "x" is used to separate these combination codes. For example, an MNPT connection by an FNPT connection is designated as 1x3.
7. A space is next.
8. Pick the desired two-character code for body and endplate material.
9. Pick the desired two-character code for ball material. Do not skip a space between the body/endplate and ball material code. Pick the desired two-digit code for stem material. If the ball and stem are the same material, you can skip a space and go to the seat code. If differing ball and stem codes are required, use a third material to designate the stem, as required. Do not leave a space between material designation codes. For example, Titanium Grade 2 body, end, and ball with Titanium Grade 5 stem would be designated as T2T2T5.
10. A space is next.
11. Pick a seat code. This is a one-character code.
12. Pick a seal/packing code. This is a one-character code and follows the seat code. Pick body seal then stem seal, if different.
13. A space is next.
14. Pick a bolting code.
15. Pick option codes, as required. These are two-character codes. List the required two-character codes in numerical/alphabetical order. Do not put spaces between the option codes.

**Example:** Code a 1", standard port, TBV 2000 Series valve with ASME Class 300 flanges, low carbon body and endplate, Hastelloy C ball and stem, Ultrafil seats, TFE seals and packing, cleaned for chlorine service, and vented ball (see next page for code).

The number of options may exceed the TBV 30-character limit, or the required valve may not be described by standard nomenclature. In this case, we will assign a Z number to designate a special valve.

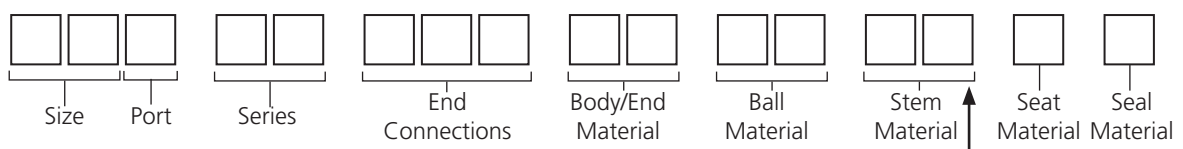
Please list any non-specified special features.

## HOW TO ORDER

Size	Porting	Series	End Connections
01 = 1/8"	S = Standard Port F = Full Port	11 = 1100 – Three-Piece	BWT = Butt-Weld Ext. and Tube Ends*
02 = 1/4"		16 = 1600 – Tank Bottom	B_ = Butt-Weld + Schedule (B40 = Schedule 40)
03 = 3/8"		18 = 1800 – Two-Piece ASME Flange	CPE = CIP (Clean-in-Place) Ends
05 = 1/2"		20 = 2000 – Cast Standard-Port Flanged	FSE = NPT Female Thread
07 = 3/4"		21 = 2100 – Cryogenic	FSW = Female Socket Weld
10 = 1"		28 = 2800 – Cast Full-Port Flanged	GRE = Graylok Ends
12 = 1-1/4"		2A = Switching Diverter Extended Stem Bottom Port	MFD = Manifold Connection
15 = 1-1/2"		2B = 21/20 – Cryogenic Unibody Flanged	MLS = Metal Seal
17 = 1-3/4"		2C = 21/31 – Cryogenic Wafer	MSE = NPT Male Thread
20 = 2"		2D = 21/51 – Cryogenic Diverter	MST = Straight Thread with O-ring
21 = 2" x 1"		2F = 21/51/20 – Cryogenic Unibody Flanged Diverter	MSW = Male Socket Weld
23 = 1/4" x 3/8"		2G = 21/18 – Cryogenic Two-Piece ASME Flanged	MWE = Male Weld End
25 = 2-1/2"		2H = 21/61 – Cryogenic	SOE = OD Tube End Socket Weld
30 = 3"		2K = 21/65 – Cryogenic	SPL = Special
32 = 3/8" x 1/4"		2L = 21/64 – Cryogenic	TCE = Ladish End
35 = 3-1/2"		2P = 21/51/18 – Series Split-Body Flanged Cryogenic Diverter	TE_ = Tube End (K, L, M) Socket Weld
40 = 4"		2R = Switching Diverter Non-Extended Stem Bottom Port	UNE = Union End
51 = 1/2" x 1"		2S = Switching Diverter Extended Stem Side Port	150 = ASME 150# Flanged RF
52 = 1/2" x 1/4"		2T = Switching Diverter Non-Extended Stem Side Port	15L = 150 Lap Joint Flange
57 = 1/2" x 3/4"		2V = 2800 – Cryogenic	15R = Class 150 RTJ
60 = 6"		2W = 21/80 – Cryogenic	300 = ASME 300# Flanged RF
71 = 3/4" x 1"		31 = 3100 – Wafer	30L = 300# Lap Joint Flange
75 = 3/4" x 1/2"		33 = Autoclave Valve	30R = Class 300 RTJ
80 = 8"		3L = 3100L – Lugged Wafer	600 = ASME 600# Flanged RF
X0 = 10"		41 = 4100 – Welded	60R = Class 600 RTJ
X2 = 12"		43 = 4300 – Welded with Downstream Relief	900 = ASME 900# Flanged RF
X4 = 14"		46 = 41/61 – Male End 4100 Welded	005 = ASME 1500# Flanged RF
1A = 1" x 1/2"		50 = 51/20 – Diverter	05R = Class 1500 RTJ
2A = 1/4" x 1/2"		51 = 5100 – Diverter	025 = Class 2500
		61 = 6100 – Orifice Tap Gauge	
		64 = 6400 – Forged Fire-Safe Valve	
		65 = 6500 Manifold	
		66 = 61/41/61 – Double-Male End All-Welded	
		68 = Cast 6400 Series Valve with Integral Lockout	
		69 = Cast Gauge Valve with Integral Lockout	
		71 = 7100 – Swing Check	
		73 = 71/31 – Wafer Swing Check	
		91 = 9100 – Ball Check	
			0 = IREB
			1 = MSE
			2 = MSW
			3 = FSE
			4 = FSW
			5 = I-Flange
			6 = BW80
			7 = BW40
			8 = BW160
			9 = I-Flange Neutral
			Example: 1 x 3 = MSE x FSE

For Mixed Combination of Endplates

\* Specify OD Wall Thickness and Length



Sample:



Stem blocks are optional if the ball and stem are made from the same material.

Body/End Material Ball/Stem Material
A2 = Alloy 20
AL = Aluminum
BR = Brass
CS = Carbon Steel
D1 = Duplex Stainless UNS-32550
D2 = Super Duplex Stainless UNS-32750
DS = Duplex Stainless AL6XN
HB = Hastelloy B
HC = Hastelloy C
H3 = Hastelloy B-3
H2 = Hastelloy C-22
IN = Inconel
IY = Incoloy
LC = LCB Carbon Steel
M4 = Monel 400
M5 = Monel K500
N2 = Nickel 200
T2 = Titanium Grade 2
T5 = Titanium Grade 5
T7 = Titanium Grade 7
T12 = Titanium Grade 12
TN = Tantalum
ZR = Zirconium
17 = 17-4 pH Stainless Steel
34 = 304 Stainless Steel
36 = 316 Stainless Steel
37 = 317 Stainless Steel
39 = Nitronic 50
4L = 304L Stainless Steel
6L = 316L Stainless Steel

Seat/Seal Material
A = Arlon 1555 PEEK
B = Buna
C = Cryofil
D = Delrin AF
E = EPR
F = Thermafil PEEK
G = 15% GF TFE
H = Grafoil/Graphite
J = TFM
K = CTFE
L = Vespel
M = Metal
N = Nylon
P = UHMWP
Q = EPDM
S = Stellite
T = Virgin TFE
U = Ultrafil 25
V = Viton
1 = Tefzel
2 = Kalrex
3 = PFA
4 = FEP
(Certain Combinations Not Available)

Bolting
B = ASTM A193 B7M x A194 7M
C = ASTM A193 B8 CL2 x A194 Grade 8
D = Alloy 20
E = ASTM A193 B8 CL1 x A194 Grade 8F
F = ASTM A540 B21 x A194 Grade 2H
G = ASTM A320 L7 x A194 Grade 4
H = Inconel 718
J = 410 Stainless Steel A193 Grade B6
K = 304L Stainless Steel
L = Hastelloy B2
M = Monel 400
N = ASTM A320 Grade B8P
Q = A193 Grade B8 x ASTM A194 Grade 8
W = All Welded
0 = None
1 = Carbon Steel
2 = 300 Stainless Steel
3 = ASTM A193 B7 x A194 2H
4 = ASTM A193 B8M x A194 8M
5 = Monel K-500
6 = Hastelloy C
7 = 316 Stainless Steel
8 = Titanium Grade 5
9 = Hastelloy C-276
Y3 = ASTM A320 B8M

Modifiers
01 = 90-Degree Operation (Diverter Valve)
02 = 180-Degree Operation (Diverter Valve)
04 = Four Seated
AH = Actuator Prep. with Standard Handle
AI = Actuator Installed
AP = Prepared for Actuation
CA = Cutaway Sample
CB = Enclosed Bolting
CS = Crusher Seats
CF = Cavity Filler
CL = Chlorine Service
EB = Extended Bonnet
EC = Corrosion Evaluation
EE = Extended Ends
EP = Electro Polish
ES = Extended Stem
FD = FE Bonnet (TFE x Graphite)
FE = Fugitive Emissions Bonnet
FL = Fire Lip
FS = Fire-Safe
GO = Gear Operator
GS = Grounding Spring
HF = Hydro-Fluoric Service
HP = High Pressure
LG = Locking Gear Operator
LH = Locking Handle
LO = Locking Oval Handle
LR = Lantern Ring
LS = Locking Stainless Steel Oval Handle
LV = Lever Handle
M1 = 15-Degree Control Seat
M3 = 30-Degree Control Seat
M4 = 45-Degree Control Seat
M6 = 60-Degree Control Seat
M9 = 90-Degree Control Seat
MB = Boronized Surface Treatment
MC = Chrome-Carbide Coating
MD = Titanium-Dioxide Ceramic Coating/ Tantalum Bond Layer
MN = Tungsten-Carbide Coating
MT = Chromium-Oxide Ceramic Coating/ Tantalum Bond Layer
MZ = 120-Degree Control Seat
NE = Non-Extended
OH = Oval Handle
OS = Stainless Steel Oval Handle
OX = Oxygen-Cleaned
PC = Phosgene-Cleaned
PM = Panel-Mounted
RS = Self-Relieving Seats
SJ = Steam Jacket
SL = Spring-Loaded/9100
SP = Side Port/5100
SR = Spring-Return Handle
TR = Trunnion
VB = Vented Ball
VS = Vacuum Service
W1 = Spiral-Wound Body Seal 316 SS TFE
W2 = Spiral-Wound Body Seal 316 SS
W3 = Spiral-Wound Body Seal Ti Grade 2 TFE
W4 = Spiral-Wound Body Ti Grade 2 Grafoil
W5 = Spiral-Wound Body Gasket Hastelloy C Grafoil

For valves with different end connections, indicate upstream (first) and downstream (second). ALL FLANGED VALVES, IF NOT TO ASME B16.10 FACE-TO-FACE, MUST STATE FACE-TO-FACE LENGTH; IN ALL CASES, ALL FLANGED DIVERTER VALVES MUST STATE FACE-TO-FACE AND CENTERLINE-TO-BOTTOM FACE DIMENSIONS AS NO ASME SPECIFICATION EXISTS; EX: 9 x 4-1/2.

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Bolting Modifiers: May have up to 10 characters. If modifier section has more than 10 characters, please contact Cameron.

Sample:

0	C	L	V	B							
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## CAMSERV™ Aftermarket Services for Valves and Actuation

WE BUILD IT. WE BACK IT.



### Global Network and Local Support

Cameron is well-positioned to deliver total aftermarket support, quickly and efficiently, with unmatched OEM expertise. Our highly skilled engineers and technicians are available around the clock, seven days a week, to respond to customer queries, troubleshoot problems, and offer reliable solutions.

### Easily Accessible Parts and Spare Valves

- OEM spare valves, actuators, and parts (including non-Cameron brands)
- Handling, storage, packaging, and delivery
- Dedicated stocking program

### Comprehensive Aftermarket Services Portfolio

- Parts and spare valves
- Repair
- Field services
- Preventative maintenance
- Equipment testing and diagnostics
- Remanufacturing
- Asset preservation
- Customer property management
- Training and recertification services
- Warranty

### Customized Total Valve Care<sup>SM</sup> (TVC) Programs

Customized asset management plans that optimize uptime, availability, and dedicated services.

- Engineering consultancy
- Site management
- Flange management
- Startup and commissioning
- Spare parts and asset management
- Operational support



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Teflon	E.I. DuPont De Nemours & Company
Viton	E.I. DuPont De Nemours & Company

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#### HSE Policy Statement

At Cameron, we are committed ethically, financially and personally to a working environment where no one gets hurt and nothing gets harmed.