TEBV Series
Trunnion Mounted Top Entry Ball Valves

Description

Ringo Válvulas TEBV top entry ball valves series are designed and produced according to API 6D/ ISO 14313, API 6A, API 6DSS / ISO 14723, BS5351, ASME B16.34 and other international standards as well as customer specifications on request.

These valves are built of a single piece body with a bolted bonnet. This design is a robust construction that provides a good performance, smooth operation, minimum pressure loss, high Cv values and also allows bonnet disassembly on site to perform inspection, maintenance or repair without removing the valve body from the pipeline. The Top-entry valve types have a major application when a frequent maintenance must be carried out and the valve cannot be easily removed from the pipe. In this valve series, all the internals can be easily dismounted by loosening the bonnet of the valve and removing the ball, the seat-holders and the shaft. When mounting the valve again, the seat-holders have a system to regulate the compression of these to the ball.

Valves can be supplied manual operated or with any kind of operator for ESDV, SDV, BDV, MOV, GOV or LBV functions (electric drive, pneumatic, hydraulic, electro hydraulic or pneumo-hydraulic actuator)

Manufacturing range:
Valve Size-pressure rating

	SIZE - API 6D VALVES																				
RATING	2"	3"	4"	6"	8"	10"	12"	14"	16"	18"	20"	24"	26"	28"	30"	32"	36"	40"	42"	48"	56"	60"
150#																						
300#																						
600#																						
900#																						
1500#																						
2500#																						

	SIZE - API 6A VALVES					
RATING	1-13/16"	2-1/16"	3-1/8"	4-1/16"	5-1/8"	7-1/16"
2000 psi						
3000 psi						
5000 psi						
10000 psi						
15000 psi						
20000 psi						

Remark: For those sizes where class 15000 and 20000 are not included in the API 6A standard, Ringo is able to manufacture the valves on request. For such cases, valves will be supplied without API monogram.

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Design characteristics range

Design Temperature	Up to 850°C
Connection types	Flanged: RF, RTJ, FF according to ASME B16.5, B16.47 BW according to ASME B16.25 SW according to ASME B16.11 NPT according to ASME 1.20.1 HUB ends (supplied with or without clamps) Other connections according to NORSOK, GOST, DIN are available on request

Working Principle

TEBV Ball Valves have a ball which is supported by a trunnion and with a quarter turn movement made by the stem rotation. When the bore is oriented to the pipeline direction, valve is in the open position, allowing the fluid pass through. When ball is turning towards the close position (90°), flow is restricted till it is finally cut off (at 90°).

Ringo Válvulas can supply TEBV ball valves in two configurations:

- Full Bore: Size of the trim is the same of the pipeline. In this case valve is suitable for pigging. Special large bores for particular PIG dimensions are available on request.
- Reduced bore: Size of the trim is smaller than the pipeline size. Number of reduced sizes is according to API 6D unless otherwise is agreed for the particular job.

How seating is made

The seat assembly, either soft seat or metal seat, which seals against the ball is provided with coil springs on its back side. The coil springs press the seat assembly against the ball making sure the contact between the seat area and the ball even in absence of line pressure. When line pressure increases, the seat differential area (C = A-B) creates a piston effect forcing the seat against the ball. This additional load increases the effectiveness of the seat/ball interface (see figure 1). The higher the line pressure the greater the piston effect is.

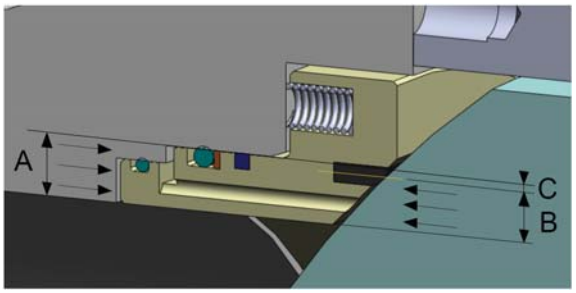

Figure 1

Ringo can supply two different ball valves seat configuration: soft or metal seats.

A) Soft seats

The seat assembly consists in an outer metallic seat carrier with a soft seat insert. The soft insert is located into a groove in the metallic seat carrier (see figure 2).

The complete seat assembly is floating inside valve body and it is energized by a set of springs which load the seat assembly against the ball preventing leakage between the seats and the ball. Seat assembly is provided with outer O-ring to avoid leakage through the seat carrier and a graphite back up ring which ensure the tightness in case the O-ring is damaged, ensuring the fire safe capability.

MATERIAL	TEMPERATURE	PRESSURE
PTFE (VIRGIN OR FILLED)	From -100°C to +220°C	Up to 300#
DEVLON V API	From -100°C to +150°C	From 300# up to 900#
PEEK	From -100°C to +260°C	From 900# up to 2500#
KELF	From -250°C to +150°C	Up to 900#
VITON	From -20°C to + 200°C	Up to 600#

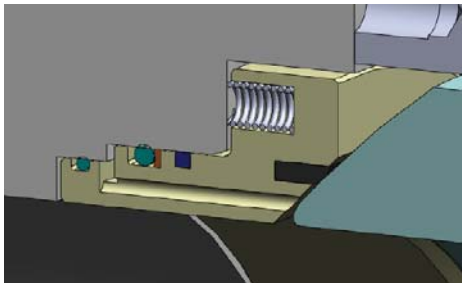

Figure 2

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B) Metal seats:

When there is presence of solid particles in the fluid that could damage the soft seat insert or for either high temperature services or high pressures, where soft insert cannot withstand it, Ringo offers the metal seated ball valves solution (see figure 3): Seats consist of a metallic ring where surface in contact with the ball is hardfaced with Tungsten Carbide, Chromium Carbide, Stellite etc., achieving a hardness up to 74 HRC (Tungsten Carbide).

This makes the design long durable and reliable and able to achieve classes C & D leakage class metal seated.

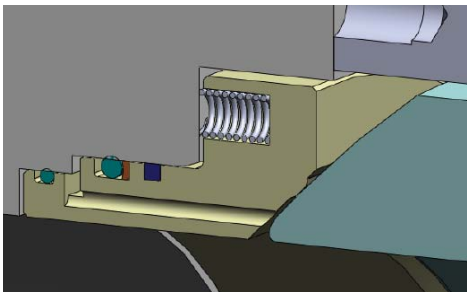

Figure 3

MATERIAL	TEMPERATURE	HARDNESS
STELLITE	< 500°C (932°F)	36-45 HRC
TUNGSTEN CARBIDE	< 540°C (1004°F)	70-74 HRC
CHROMIUM CARBIDE	< 850°C (1562°F)	65-68 HRC

Standard features

Bidirectional flow

Standard RV valves are suitable for bidirectional sealing.

Trunnion Design for Low Torque Operation

Trunnion valves are provided with trunnion bearings to guarantee smooth, easy operation and extended bearing life. As standard, the trunnion bearings are stainless steel with heavy-duty PTFE coated in order to reduce the friction and get a smooth operation even when valve is under full rated pressure (see figure 4).

For extreme high temperatures or pressures, heavy duty bearings are provided suitable for working conditions agreed on.

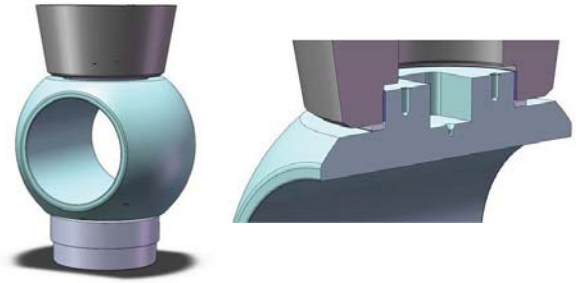

Figure 4

Automatic Cavity Pressure Relief

The pressure-actuated seat construction, used in trunnion ball valves ensures positive relief of excess of valve central cavity pressure. If valve central cavity pressure exceeds a pre-set pressure in the seat, the seat assembly will automatically back-off to relieve the excess of pressure. TEBV valves are designed to relief the cavity pressure before reaching the 1,33 times the maximum rating working pressure (see figure 5).

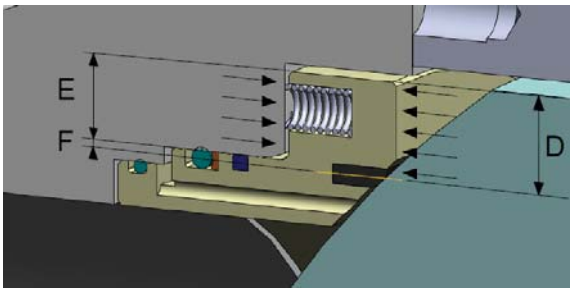

Figure 5

Double Block-Bleed

Because the floating seats seal, both upstream and downstream, simultaneously, double block and bleed procedures can be performed in TEBV valves. With the valve under pressure, the body cavity may be vented or drained to the atmosphere through the bleed valve.

Anti-Blow Out Stem

RV valves are always provided with anti-blow out stem design, which ensures total safety and integrity (see figure 6).

Constructions allowing replacement of upper stem seals with valves under pressure are available under request.

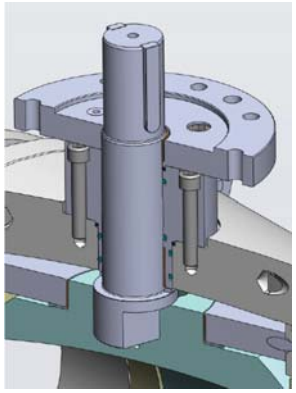

Figure 6

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Grease Fittings

TEBV valves are supplied with grease fittings providing the ability to inject lubricant into both seat pockets and stem area, to use them as an emergency sealing device. TEBV standard supplied grease fittings are one for stem / packing area in all the valves and two, one for each seat in valves 4" and above.
Grease fittings are screwed. Socket welded option as well as double O-ring configuration are available on request (see figure 7).

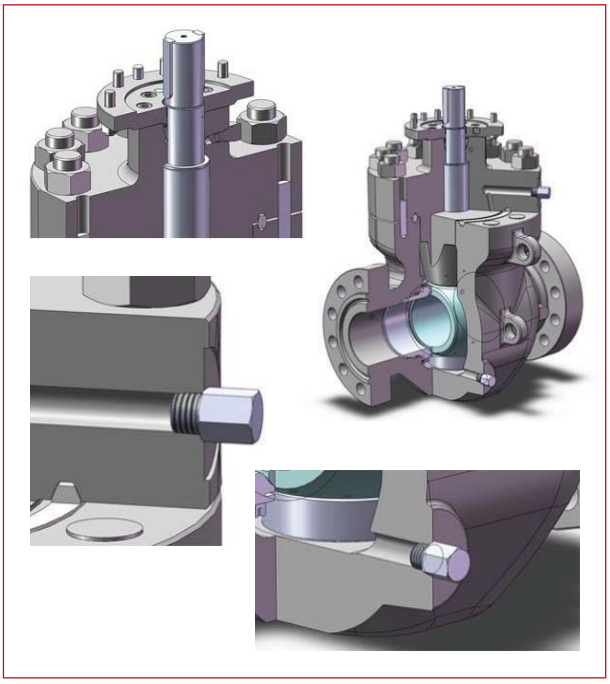

Figure 7

Drain and vent

TEBV valves include screwed drain and vent connections.
Socket welded option as well as double O-ring configuration is available on request.

Antistatic Device

Electrical continuity is ensured by the adoption of coil springs to ensure electrical continuity between body, ball and stem.
(see figure 8).

Fire Safe Design

All TEBV series valves are of FIRE SAFE design, which substantially prevent the leakage when valve is subject to high temperatures. In case of fire accident inside the valve, seals, and seat inserts (for soft seated valves) are melted and then a metal to metal seat is made between the metallic seat and the ball ensuring the necessary degree of internal sealing tightness.
All o-ring are also destroyed and only graphite back-up rings remain in seats and valve stem, making the valve tight for leakages to the atmosphere.
RV valve designs conform requirements of API 6FA, API607 and BS6755.

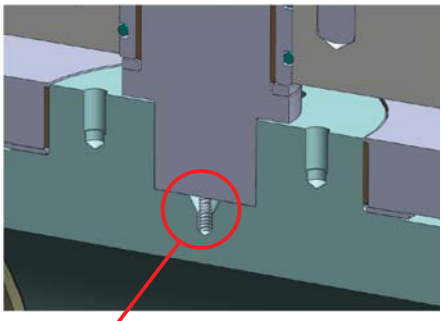

Figure 8

Materials

Body and trim materials

Ringo Válvulas ball valves are supplied with all material types to fulfill all the different combinations of service fluid, design pressure and temperature. Valves can be supplied either forged or casted based on customer specifications. Following materials are under the scope of supply of Ringo:

- Carbon Steel valves
- Low temperature carbon steel
- High temperature alloy steel
- Stainless Steel Valves
- Super Austenitic Stainless Steel
- Duplex Stainless Steel
- Super Duplex Stainless Steel
- Ni Alloy
- Titanium
- Aluminum bronze

TEBV can be supplied also with CRA´s cladding (such as stainless steel, monel or Inconel) on dynamic and/or static sealing areas as well as full cladding for all wetted parts.

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See below a table with the main guidelines of material selection:

SERVICE	TEMPERATURE	BODY MATERIAL	TRIM MATERIAL
General Purpose	-29° to 150°	WCB/A105	A105+ENP
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Moderate Corrosive	-29° to 150°	WCB/A105	316SS or 321SS
Low Temperature	-46° to 150°	LCB/LCC/LF2	LF2+ENP
High Corrosive	-29° to 150°	CF8M/CF3M/CF8/ CF3/CF8C/A890 4A/ F316/F321/F51	F316/F321/F51
Sour service	-29° to 150°	WCB/A105	A105+ENP
Offshore	-29° to 150°	A890 Gr 4A/F51	F51
Seawater	-29° to 150°	A351 CK3MCuN/F44	F44
Cryogenic	-196° to 150°	CF8M/F316/F321	F316/F321
High Temperature	-29° to 650°	C12A/C12/WC6/WC9/ F91/F9/F11/F22	F6A Cl 2
High Temperature/ Corrosive Service	-29° to 850°	Inconel 625	Inconel 625

TEBV Series are typically requested in cast construction but Ringo Válvulas produces and supplies both cast and forged TEBV valves.

Sealing materials

Commonly, O-rings are used as sealing element of ball valves (body-adaptors, seat carriers and stem area). Standard material for sealing of Ringo ball valves is VITON including its alternatives of high temperature (up to 210°C) and VITON for explosive decompression (Viton AED).
Additionally to Viton, there is a back-up seal of graphite in order to make the design to be fire safe.

Ringo can supply any other kind of sealing materials to fulfill the service requirements:
- Anti-Explosive Decompression (AED) o-rings: normally recommended for high pressures valves
- Lip seals are used normally for more severe applications such as cryogenic services or high temperature. The lip seal is made from thermoplastic material PTFE and it is self-energized by an internal spring of stainless or Inconel alloy. Lip seals must be mounted in the positive direction of pressure in such a way that fluid improves the sealing load of spring.
- Graphite seals: used for high temperature services

See table with a brief guide used to select the standard sealing materials

MATERIAL	TEMPERATURE	REMARKS
BUNA (NBR)	From -45 to +120°C	AED feature for 600# and above
BUNA HIDROGENATED (HNBR)	From -48°C to +150°C	AED feature for 600# and above
VITON (FKM)	From -20°C to +240°C	AED feature for 600# and above. NOT TO BE USED FOR METHANOL SERVICE
VITON GLT (FKM GLT)	From -40°C to +240°C	AED feature for 600# and above. NOT TO BE USED FOR METHANOL SERVICE
PTFE LIP SEAL	From -200°C to +250°C	
GRAPHITE	From -200°C to +650°C	
ORGANIC FIBRES	From 0°C to 850°C	

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Actuation

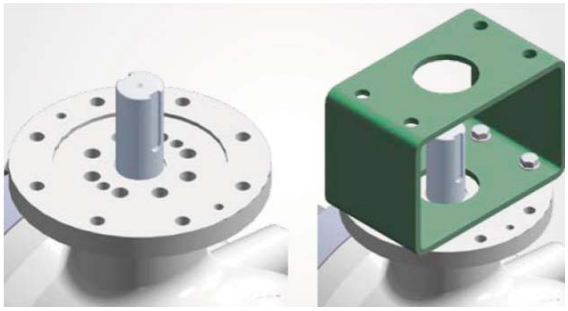


Figure 9

Ringo Válvulas covers all the possibilities regarding ball valves actuation.
Valves can be supplied with the following operator types:
- Manual: Lever, gear operated
- Electrical actuator
- Pneumatic actuator
- Gas Over Oil actuator
- Direct Gas actuator
- Hydraulic actuator
- Electro-hydraulic actuator

Bare shaft with ISO 5210 flange for actuator coupling suitable either for actuator to be assembled by customer or actuator to be supplied by customer and assembled, regulated and tested by Ringo.
(See figure 9).

Optional Features

Double Piston Effect

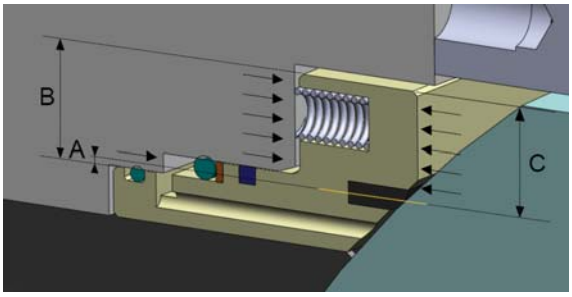
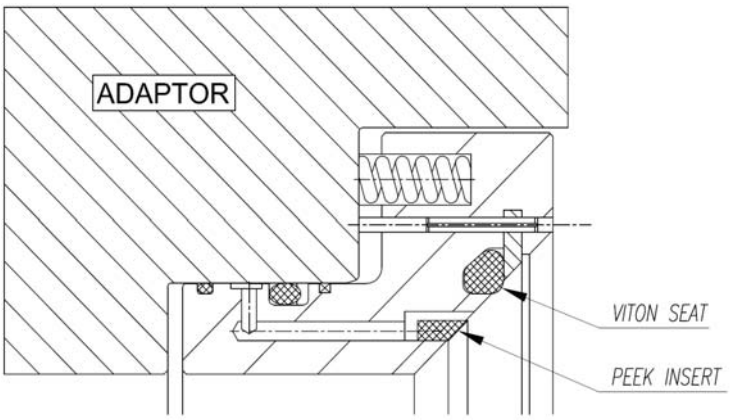


Figure 10

TEBV valves can be supplied with double piston effect: in this case the outer diameter of the seat is designed exposing more surface area to cavity pressure that a normal floating seat. In the case of an upstream leak, the differential area (A = B-C) creates a piston effect forcing the seat against the ball and this enhances the contact pressure between downstream seat and ball (see figure 10).
This feature can be applied in only one seat or in both:
- Double piston effect one side: Valve is unidirectional
- Double piston effect: Valve is bidirectional and needs a pressure relief valve in order to avoid overpressure in the body cavity (maximum set pressure shall be 1,33 times the maximum rating pressure of the valve), unless otherwise customer specifically waives the use of this relief valve.

Seat with Scrapper



TEBV can be supplied with a special seat design, including a scrapper. In this case, there is a Peek insert which is performing as a scraper avoiding the ingress of dust and dirt into the soft seat. Peek insert is also supporting compression forces when the pressure increases. Standard material for the seat is Viton.
This seat design is performing successfully scraping and enlarging soft seat effective life more than for metal contact design.
(See figure 11).

Locking Device

Valves can be supplied with locking devices to block the valve operation either in open or close position.

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Stem extension

Valves can be provided with stem extension when required by customer (length is adapted to customer requirement. This extension is designed according to the different purposes of the same:
- Underground installation
- Remote operation
- High temperature services
- Cryogenic Service

When valves have vent and drain, lines can be supplied also with isolation valves when required.
(See figure 12)

Figure 12

Low emission packaging

In order to protect environment from poisonous, explosive or flammable media, valves can be supplied with special packing to comply with fugitive emission requirement according to ISO 15848 standard.
(See figure 13)

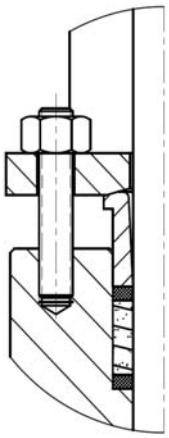

figure 13

Live loaded packing

Valve packing is tightened by means of a gland and its related bolting. After long working time withstanding the service pressure, gland load retention may be reduced and could cause leakage in some cases so Ringo offers also a solution for that by means of using Belleville springs installed on gland bolting in order to assure a continuous compression force on gland, to guarantee the load retention of the stem packing to avoid leakage to atmosphere.
(See figure 14)

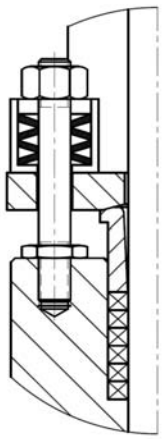

figure 14

Figure 15: Exploded view of a TEBV series valve.

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