

# Ball valves

Trunnion mounted



**TECHNICAL BROCHURE**

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# Who we are

We are a leading company in designing and manufacturing technologically advanced products and systems for natural gas treatment, transmission and distribution.

We are the ideal partner for operators in the Oil & Gas sector, with a business offer that spans the whole natural gas chain.

We are in constant evolution to meet our customers' highest expectations in terms of quality and reliability.

Our aim is to be a step ahead of the competition, with a customized technology and an after-sale service program always marked by a high level of professionalism.



## Pietro Fiorentini advantages



Localised technical support

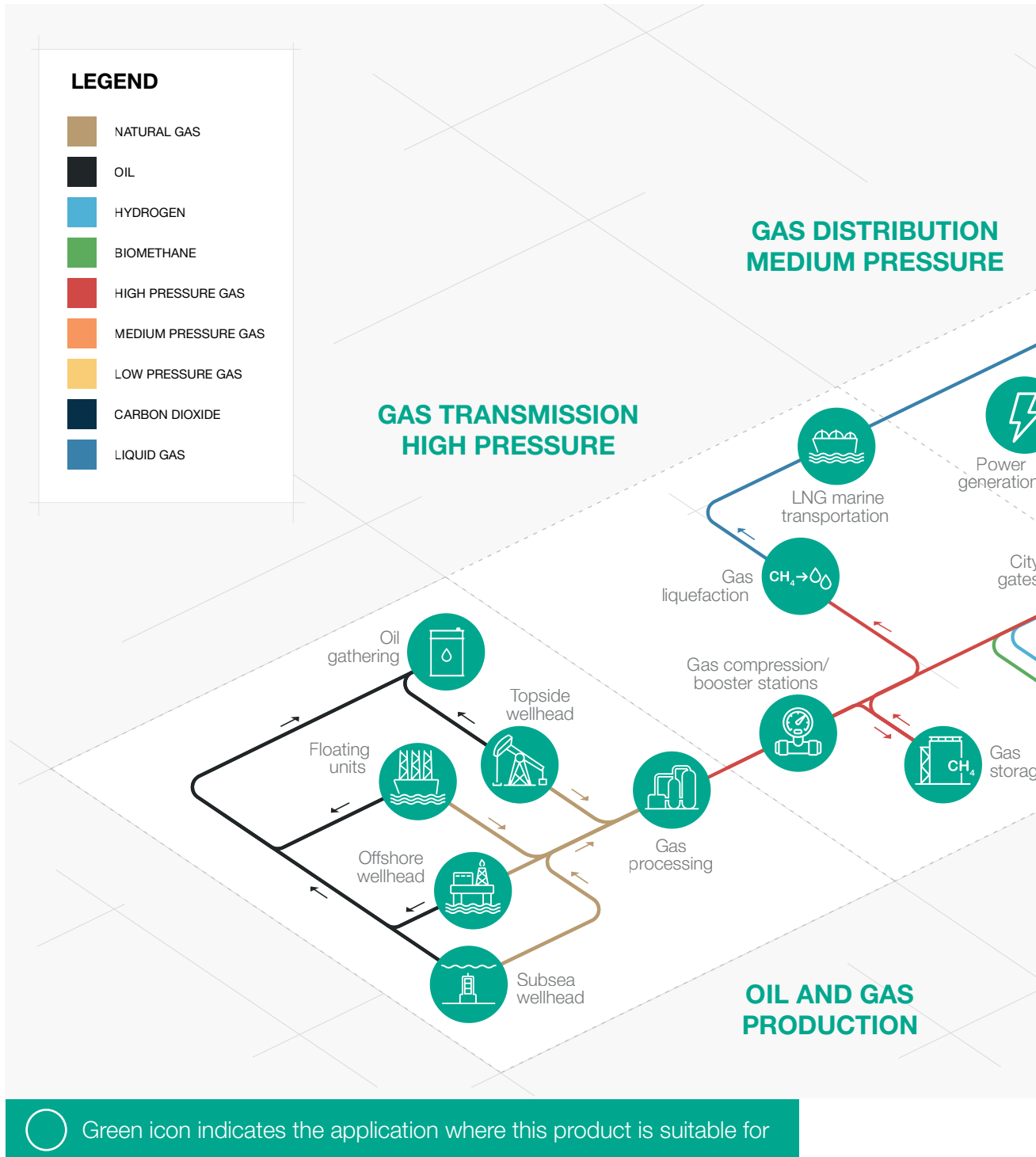


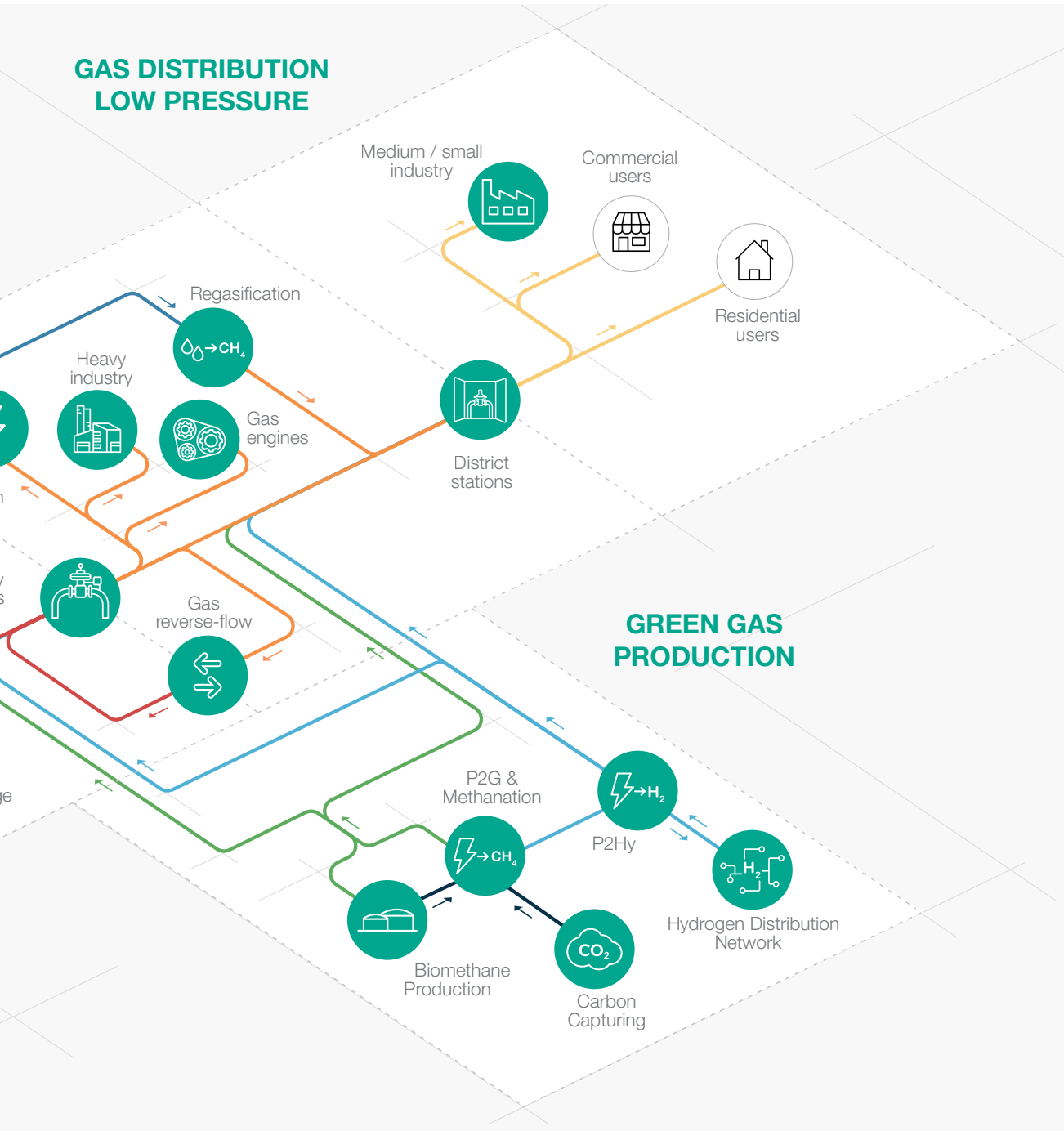
Experience since 1940



We operate in over 100 countries

# Area of Application





**Figure 1** Area of Application Map



# TIV Valves



## Company profile

We are an **Italian manufacturer** of **high-quality ball valves**, striving to be your most valuable partner in **Oil&Gas, sustainable energy, green** and **industrial applications**. We offer on-time delivery of engineered technical solutions thanks to our specialized team of experienced managers and engineers. Our technical and operations experience allows us to cover a wide range of applications, supporting our customers to find the best solution for each specific service condition.

Based in the northern Italy, **TIV Valves** was founded in January 2010. Since then, we shipped our valves in five continents to all main end users and EPC's companies. We provide customized valves to fit a wide range of applications. Severe service designed valves include corrosive and abrasive fluids, high temperature, cryogenic, underground and any special customer requirement.

The **main product** specifications are API 6D, API 6A, API 6DSS, while design can meet the requirements of ASME BPVC Sect. VIII and ASME B16.34, in addition to customers' specifications.

We can provide total **service** and **support** with our valves and, if requested, **testing** and **quality control** procedures can be conducted on site.



## Production capability

Our brand-new facility has been specifically designed for ball valves manufacturing from small to big sizes, allowing us to easily manage elevated quantities with a wide production mix without losing our focus to quality, lead-time and customer satisfaction.



**25,000 m<sup>2</sup> overall area, 3,000 m<sup>2</sup> offices area, 10,000 m<sup>2</sup> covered area.**

Wide spaces to manage a wide range of products at the same time. Four production lines grouped by valves size allow the correct workflow and quality checks.



**Up to 90 tons lifting capability.**

The combined use of two cranes allows to manage valves over 60" size.



**Crane height 11m at the hook.**

The overall height of the facility and cranes is designed to manage big sized valves with stem extension, e.g., for underground installation.



## Design & test capability

TIV Valves engineering department relies on high-skilled personnel with long-term experience in valve design and manufacturing. Customers' requests are processed one by one to find the best solution to fit the specific application.

Tailor-made design is developed through a wide use of Finite Elements Analysis (FEA) and Computational Flow Dynamics (CFD).



Testing department includes all equipment for standard and special testing, a precious resource both for standard production and design validation purposes:

- **Hydrostatic and pneumatic test benches.**

5 test benches allow hydraulic high pressure and pneumatic low pressure tests up to 48" size and up to ANSI 2500 pressure rating. Bigger valves are test with blind flanges and with a portable skid capable to reach up to 690 bar pressure.

- **High pressure gas.**

A bunkered area allows safe execution of high pressure nitrogen tests when required for critical valves.

- **High temperature.**

High temperature testing is often required for special application valves. TIV test fixtures allow to reach up to 550 °C.

- **Cryogenic.**

Valves for LNG application are frequently tested to check tightness capabilities at service temperature, down to -196 °C.

- **Fugitive emissions.**

Environmental issues are becoming a critical factor for valves performance evaluation. We can verify fugitive emission both with helium and hydrogen as tracing gases.

- **Non Destructive Examinations (NDE – PMI-VT-PT-MT-UT-RT).**

Volumetric examinations (UT and RT) are out-sourced to a qualified partner, while all the other are performed in-house.



# Introduction

TIV trunnion mounted ball valves are customized, high-quality and reliable valves for a wide range of application, from traditional Oil & Gas (upstream, midstream and downstream) to green and renewable energies services.



## **Twin business model.**

We can offer both standardized valves for non-critical application and highly engineered valves to solve specific process issues. The first approach allows to offer a competitive product with very short lead time, while the second aims to support customer with a specific design.



## **Field-prove experience.**

We can be proud of our installed base worldwide covering a wide range of applications and a huge number of customers among the main energy companies and EPC contractors.



## **Lean culture.**

Pietro Fiorentini Group lean culture pervades our strategy, leading us through management choices with a constant focus on continuous improvement and cost reduction, while customer needs and satisfaction remain the first decision driver.



Trunnion mounted ball valve | Standard version



# Description

A ball valve is a form of quarter turn valve which uses a hollow, perforated and pivoting ball to control flow through it. It is open when the ball's hole is in line with the flow and closed when it is pivoted 90 degrees.

Compared to other valve types, trunnion mounted ball valves ensure the following advantages:

- **Straight flow passage.**  
This means reduced pressure loss, hence limiting noise and erosion phenomena.
- **Tight shut off.**  
Compared to other valve types, ball valves can achieve zero leakage capability throughout a wide set of configurations.
- **Fast operating time.**  
Quarter turn obturator is suitable for quick closing or opening applications.
- **Suitability for high pressure application.**  
Proper design features allow to face the challenges of very high pressure ratings.

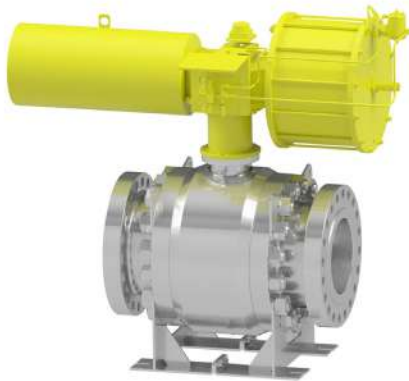
The trunnion mounted ball valve is a valve type in which the obturator has two supports at the bottom and top to fix the position of the ball itself, so that it can't move in the axial direction. This design has been developed to reduce the valve operating torque, allowing to use ball valves even for very big sizes and high-pressure classes.

TIV standard trunnion mounted ball valves are side entry. In this configuration the valve is composed of a body to which are affixed one or two connectors that contain the valve seats and ensure the connection of the valve to the pipeline.

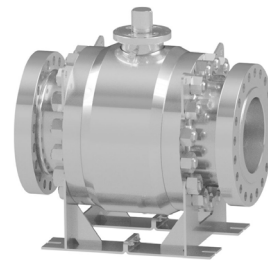
On request top-entry valve configuration can be provided. This one requires only one body that includes the connection to the line and a top cover. Top-entry construction allows to perform the valve maintenance without removing the valve from the line.

Materials of construction are selected based on service conditions. Valves for standard applications are usually made in carbon steel or low temperature carbon steel and have soft seats. When the application involves high or low temperature, corrosive or abrasive fluids, or a combination of them special steels and metal seals may be selected to reach the expected field performance.

Valves can be supplied bare stem, gear operated or actuated (with pneumatic, hydraulic, gas over oil or electric actuators) as per customers' request. Operating devices are outsourced to a set of selected partners that follow us joining valve's operations requirements and client's specifications and needs.



**Figure 1** Actuator



**Figure 2** Bare stem



**Figure 3** Gear



# Applications by Purpose

TIV valves have a wide range of applications, not only related to Oil & Gas production, processing, transmission and distribution, but also along the energy transition value chain (first of all LNG, CO<sub>2</sub> and H<sub>2</sub>) and water management.



## **Oil & Gas.**

The value chain of oil and gas includes complex and dynamic process with high goals to achieve, becoming more and more demanding over the years. In this external market environment, characterized by a high level of competitiveness and instability, valves play an important role to optimize assets and end users' investments. Engineered and extensively customized valves could solve specific service issues, while standardized and cost-effective solutions may help customers to keep their business sustainable in the long term.



## **Renewable energies.**

Worldwide governments are pushing more and more towards energy transition. We aim to be part of this historic change offering a product range specifically developed to answer emerging need of energy companies. While LNG will represent the pillar of the energy transition, we completed our offer with solutions for the entire hydrogen value chain from extraction to distribution. This product range covers both blending with methane and pure hydrogen management. Specific solutions are available also for carbon capture applications.



## **Water management.**

Water is a precious and rare resource. Treatment processes, transmission and distribution are strategic to preserve water availability and accessibility. We offer a product range both for severe services (e.g. desalination, wastewater treatment) and transmission and distribution applications.

# Applications by Use

Whatever is the sector of application, TIV ball valves can adopt specific engineering solutions to fit different process and fluid conditions, from basic services up to the most severe and demanding processes.



## **Sweet gases.**

Valves intended for clean gas applications (e.g., methane transmission and distribution, included hydrogen blending). These valves do not require special materials or extensively engineered solutions.



## **Liquid hydrocarbons.**

These valves may include different materials compared to sweet gas. Soft material selection is based on fluid composition.



## **Sour fluids.**

Depending on medium components special materials shall be selected to ensure valve reliability.



## **Abrasive fluids.**

Special hard coating are applied to ball and seat when solid particles in the process fluid would determine a rapid wear of soft parts exposed to the medium.



## **Cryogenic service.**

When required for liquid gases services (e.g., LNG), valve's materials shall be properly selected, and special sealing arrangement ensure proper tightness capabilities.



## **High temperature service.**

For applications where process fluid can overcome the temperature limits of polymers and elastomers, sealing materials and coatings shall be chosen accordingly.



## **Other special services.**

Where different services or a combination of the above are requested, our engineering team is able to support the client along the design process in order to find the best solution to fit the specific application.

# Approvals

## Product certification:



API 6D  
Cert. no.  
6D-1170



API 6A  
Cert. no.  
6A-1252



API 6DSS  
Cert. no.  
6DSS-0057



IEC 61508 SIL 2  
Cert. no.  
50 100 13288  
REV.005

## System certifications:



ISO 9001  
Cert. no.  
50 100 9927  
Rev.006



Pressure Equipment  
Directive (PED)  
2014/68/EU  
Certificate no.  
PED-0948-QSH-490-16  
REV. 3



ISO 14001  
Cert. no.  
50 100 13288  
REV.005



ISO 45001  
Cert. no.  
50 100 13322  
REV.005

TIV Valves production range has also a wide coverage for fire-safety as per API 607 and API 6FA and for fugitive emissions as per ISO 15848-1. In addition, thanks to a long-term cooperation with international energy companies and EPC contractors, TIV complies with many customers specifications, including design validation procedures.

# Device operation

All TIV trunnion mounted ball valves are Double Block & Bleed (DBB) design according to API 6D: “Single valve with two seating surfaces that, in the closed position, provides a seal against pressure from both ends of the valve with a means of venting/bleeding the cavity between the seating surfaces.

Seat configurations may be selected among one of the following:

- **Both seats unidirectional.**  
Self-relieving
- **Double Isolation & Bleed 1 (DIB-1) as per API 6D.**  
Both seats bidirectional (Double Piston Effect, i.e., DPE)
- **Double Isolation & Bleed 2 (DIB-2) as per API 6D.**  
Upstream seat unidirectional (self-relieving), downstream seat bidirectional (DPE)

The choice between these configurations depends on the process conditions and on the valve function.

# General features

Features	Values
Pressure rating*	<ul style="list-style-type: none"> <li>ANSI classes from 150 to 2500</li> <li>API pressure ratings from 13.8 MPa to 103.5 MPa from 138 barg to 1035 barg</li> </ul>
Design temperature*	from -196 °C to +538 °C from -321 °F to +1000 °F
Nominal sizes*	1/2" to 60" NPS 15 to NPS 1500
Connections*	<ul style="list-style-type: none"> <li>RF and RTJ flanges as per ASME B16.5, B16.47 and MSS SP-44</li> <li>Butt welding ends as per ASME B16.25</li> <li>6B and 6BX flanges as per API 6A</li> <li>Threaded and socket weld ends</li> <li>Hub ends as per customer specifications</li> </ul>
End to end dimensions*	<ul style="list-style-type: none"> <li>ASME B16.10</li> <li>API 6A</li> <li>TIV standard for sizes not covered by above specifications</li> <li>As per customer specifications</li> </ul>
Top mounting	ISO 5211
Construction*	<ul style="list-style-type: none"> <li>Side entry bolted body</li> <li>Top entry bolted body</li> <li>Side entry welded body</li> <li>Modular bolted body (two balls in one body)</li> </ul>
Operator*	<ul style="list-style-type: none"> <li>Bare stem</li> <li>Gear operated</li> <li>Motor operated (pneumatic, hydraulic, gas over oil or electric actuator)</li> </ul>
Part	Material
Metallic materials*	<ul style="list-style-type: none"> <li>Carbon steel and low temperature carbon steel</li> <li>Stainless, duplex and super-duplex stainless steel</li> <li>Exotic alloys</li> </ul>
Soft parts*	<ul style="list-style-type: none"> <li>Polymeric (PTFE, RPTFE, PEEK, Devlon-V, PCTFE)</li> <li>Elastomeric (FKM, FFKM, HNBR)</li> <li>Graphite</li> </ul>
Coatings*	<ul style="list-style-type: none"> <li>Electroless Nickel Plating (ENP)</li> <li>Weld overlay (316SS, N06625)</li> <li>HVOF (Tungsten or Chromium Carbide Coating)</li> </ul>
<p><b>(*) REMARK: Due to normative limitations or technical feasibility, not all combinations of above features and materials are available. Please contact TIV Valves for further information about actual configurations based on service requirements.</b></p>	

**Table 1** Features & materials



# Versions

## Standard

The standard trunnion mounted ball valve is designed for sweet clean gas applications and moderate minimum and maximum design temperature. This valve configuration is the most competitive in term of price and lead-time.



Features	Values
Pressure rating*	ANSI classes from 150 to 900
Design temperature*	From -29 °C to +150 °C From -20 °F to +302 °F
Nominal sizes*	2" to 36" NPS 50 to NPS 900
Connections*	RF and RTJ flanges as per ASME B16.5, B16.47 and MSS SP-44
End to end dimensions*	ASME B16.10
Construction*	Side entry bolted body
Operator*	<ul style="list-style-type: none"> <li>• Bare stem</li> <li>• Gear operated</li> <li>• Motor operated (pneumatic, hydraulic, gas over oil or electric actuator)</li> </ul>
Part	Material
Metallic materials*	<ul style="list-style-type: none"> <li>• Low temperature carbon steel (body, ball, seats, cover)</li> <li>• Stainless steel (stem)</li> </ul>
Soft parts*	<ul style="list-style-type: none"> <li>• Polymeric (Devlon-V)</li> <li>• Elastomeric (FKM, HNBR)</li> <li>• Graphite</li> </ul>
Coatings*	Electroless Nickel Plating (ENP)
<p><b>(*) REMARK: Different functional features and/or materials available on request. Stated temperature ranges are the maximum for which the standard equipment's full performance is fulfilled.</b></p>	

**Table 2** Standard version features & materials



## Welded body

Valves intended for clean gas service are often required to be welded body. This construction allows to eliminate two important potential leak paths and to reduce the valve overall cost with a reduced raw material use.

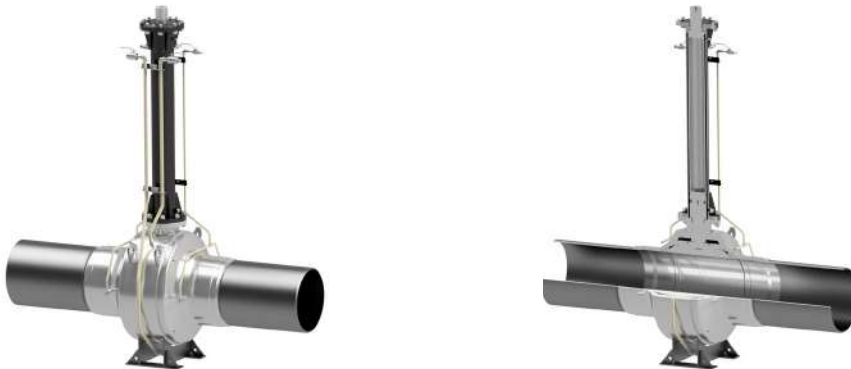


Features	Values
Pressure rating*	ANSI classes from 150 to 1500
Design temperature*	From -46 °C to +150 °C From -51 °F to +302 °F
Nominal sizes*	2" to 60" NPS 50 to NPS 1500
Connections*	Butt welding ends as per ASME B16.25
End to end dimensions*	ASME B16.10
Construction*	Side entry welded body
Operator*	<ul style="list-style-type: none"> <li>• Bare stem</li> <li>• Gear operated</li> <li>• Motor operated (pneumatic, hydraulic, gas over oil or electric actuator)</li> </ul>
Part	Material
Metallic materials*	<ul style="list-style-type: none"> <li>• Low temperature carbon steel (body, connectors**, ball, seats, cover, top flange)</li> <li>• Stainless steel (stem)</li> </ul>
Soft parts*	<ul style="list-style-type: none"> <li>• Elastomeric (FKM, HNBR)</li> <li>• Graphite</li> </ul>
Coatings*	Electroless Nickel Plating (ENP)
<p><b>(*) REMARK: Different functional features and/or materials available on request. Stated temperature ranges are the maximum for which the standard equipment's full performance is fulfilled.</b></p> <p><b>(**) REMARK: If necessary, proper material pups can be welded to the valve to fit connecting pipe material.</b></p>	

**Table 3** Welded body version features & materials

## Underground version

When valves for pipeline service need to be installed underground, a stem extension shall be added to the valve to easily operate it. In addition, drain, vent and sealant lines are required to manage the valve from the ground level.



Features	Values
Pressure rating*	ANSI classes from 150 to 900
Design temperature*	From -46 °C to +150 °C From -51 °F to +302 °F
Nominal sizes*	2" to 36" NPS 50 to NPS 900
Connections*	Butt welding ends as per ASME B16.25
End to end dimensions*	ASME B16.10
Construction*	Side entry welded body
Operator*	<ul style="list-style-type: none"> <li>• Bare stem</li> <li>• Gear operated</li> <li>• Motor operated (pneumatic, hydraulic, gas over oil or electric actuator)</li> </ul>
Part	Material
Metallic materials*	<ul style="list-style-type: none"> <li>• Low temperature carbon steel (body, connectors**, ball, seats, cover, top flange)</li> <li>• Stainless steel (stem)</li> </ul>
Soft parts*	<ul style="list-style-type: none"> <li>• Elastomeric (FKM, HNBR)</li> <li>• Graphite</li> </ul>
Coatings*	Electroless Nickel Plating (ENP)

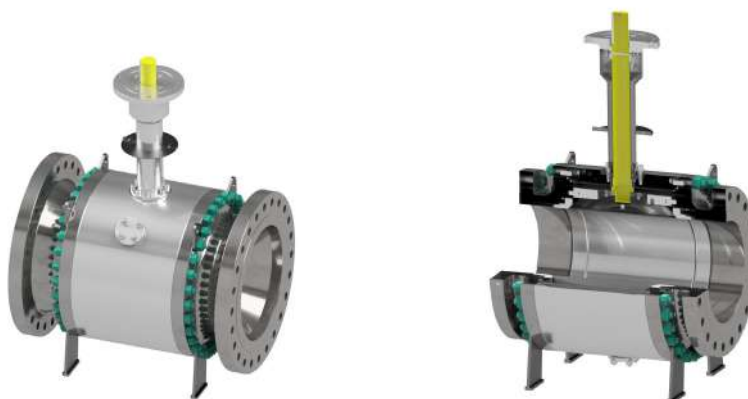
**(\*) REMARK: Different functional features and/or materials available on request. Stated temperature ranges are the maximum for which the standard equipment's full performance is fulfilled.**

**(\*\*) REMARK: If necessary, proper material pups can be welded to the valve to fit connecting pipe material.**

**Table 4** Underground version features & materials

## Cryogenic applications

When the valve operating temperature is lower than  $-50\text{ }^{\circ}\text{C}$  ( $-58\text{ }^{\circ}\text{F}$ ), special materials selection, design and production features are required. This know-how is the key factor to ensure tightness capability and smooth operability even with liquefied gases.

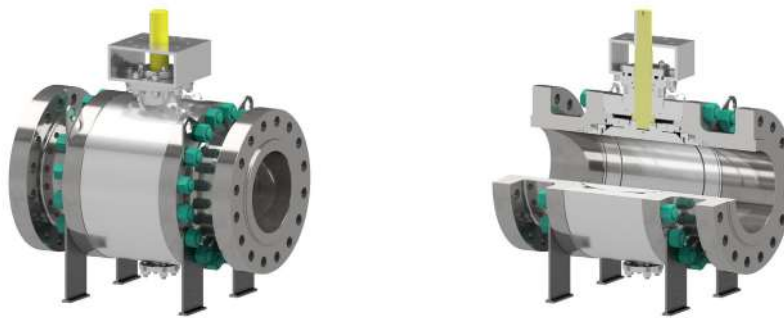


Features	Values
Pressure rating*	ANSI classes from 150 to 2500
Design temperature*	From $-196\text{ }^{\circ}\text{C}$ to $+150\text{ }^{\circ}\text{C}$ From $-321\text{ }^{\circ}\text{F}$ to $+302\text{ }^{\circ}\text{F}$
Nominal sizes*	1/2" to 36" NPS 15 to NPS 900
Connections*	<ul style="list-style-type: none"> <li>RF and RTJ flanges as per ASME B16.5, B16.47 and MSS SP-44</li> <li>Butt welding ends as per ASME B16.25</li> <li>Threaded and socket weld ends</li> </ul>
End to end dimensions*	ASME B16.10
Construction*	Side entry bolted body Extended stem for insulation purposes
Operator*	<ul style="list-style-type: none"> <li>Bare stem</li> <li>Gear operated</li> <li>Motor operated (pneumatic, hydraulic or electric actuator)</li> </ul>
Part	Material
Metallic materials*	<ul style="list-style-type: none"> <li>Austenitic stainless steel (body, connectors**, ball, seats, cover, top flange)</li> <li>High strength austenitic stainless steel (stem)</li> </ul>
Soft parts*	<ul style="list-style-type: none"> <li>Thermoplastic (RPTFE + Elgiloy lip-seals)</li> <li>Graphite</li> </ul>
Coatings*	HVOF tungsten carbide coating (TCC) if metal to metal sealing is required
<p><b>(*) REMARK: Different functional features and/or materials available on request. Stated temperature ranges are the maximum for which the standard equipment's full performance is fulfilled.</b></p> <p><b>(**) REMARK: If necessary, proper material pups can be welded to the valve to fit connecting pipe material.</b></p>	

**Table 5** Cryogenic version features & materials

## High temperature applications

For continuous operating temperatures over 200 °C (392 °F), standard polymers and elastomers are no longer feasible. In this harsh environment static and dynamic seals are built in graphite-based materials, while the trim is metal seated.



Features	Values
Pressure rating*	ANSI classes from 150 to 2500
Design temperature*	From -29 °C to +538 °C From -20 °F to +1000 °F
Nominal sizes*	1/2" to 36" NPS 15 to NPS 900
Connections*	<ul style="list-style-type: none"> <li>• RF and RTJ flanges as per ASME B16.5, B16.47 and MSS SP-44</li> <li>• Butt welding ends as per ASME B16.25</li> <li>• Threaded and socket weld ends</li> </ul>
End to end dimensions*	ASME B16.10
Construction*	Side entry bolted body Extended stem for insulation purposes
Operator*	<ul style="list-style-type: none"> <li>• Bare stem</li> <li>• Gear operated</li> <li>• Motor operated (pneumatic, hydraulic, gas over oil or electric actuator)</li> </ul>
Part	Material
Metallic materials*	<ul style="list-style-type: none"> <li>• High temperature carbon steel</li> <li>• (body, connectors**, ball, seats, cover, top flange)</li> <li>• Stainless steel (stem)</li> </ul>
Soft parts*	<ul style="list-style-type: none"> <li>• Graphite both for static and dynamic seals</li> <li>• Elastomers (FKM, HNBR) back-up seals on top of stem extension</li> </ul>
Coatings*	HVOF chromium carbide coating (CCC)
<p><b>(*) REMARK: Different functional features and/or materials available on request. Stated temperature ranges are the maximum for which the standard equipment's full performance is fulfilled.</b></p> <p><b>(**) REMARK: If necessary, proper material pups can be welded to the valve to fit connecting pipe material.</b></p>	

**Table 6** High temperature version features & materials



## Modular double block&bleed

The modular design allows to have two balls in one body. This design is the best solutions where space and weight saving is a key factor while safety or process issues require a double seal. For an additional length reduction and even more cost effective solutions, compact or threaded holes flange arrangement can be selected.



Features	Values
Pressure rating*	ANSI classes from 150 to 2500
Design temperature*	From -46 °C to +200 °C From -51 °F to +392 °F
Nominal sizes*	1/2" to 24" NPS 15 to NPS 600
Connections*	<ul style="list-style-type: none"> <li>• RF and RTJ flanges as per ASME B16.5, B16.47 and MSS SP-44</li> <li>• 6B and 6BX flanges as per API 6A</li> <li>• Threaded and socket weld ends</li> <li>• Hub ends as per customer specifications</li> <li>• Compact or threaded holes arrangement flanges</li> </ul>
End to end dimensions*	ASME B16.10
Construction*	Side entry bolted body
Operator*	<ul style="list-style-type: none"> <li>• Bare stem</li> <li>• Gear operated</li> <li>• Motor operated (pneumatic, hydraulic or electric actuator)</li> </ul>
Part	Material
Metallic materials*	<ul style="list-style-type: none"> <li>• Low temperature carbon steel (body, connectors**, ball, seats, cover, top flange)</li> <li>• Stainless steel (stem)</li> </ul>
Soft parts*	<ul style="list-style-type: none"> <li>• Elastomeric (FKM, HNBR)</li> <li>• Graphite</li> </ul>
Coatings*	<ul style="list-style-type: none"> <li>• Electroless Nickel Plating (ENP)</li> <li>• HVOF tungsten carbide coating (TCC) if metal to metal sealing is required</li> </ul>
<p><b>(*) REMARK: Different functional features and/or materials available on request. Stated temperature ranges are the maximum for which the standard equipment's full performance is fulfilled.</b></p> <p><b>(**) REMARK: If necessary, proper material pups can be welded to the valve to fit connecting pipe material.</b></p>	

**Table 7** Modular double block&bleed version features & materials

## Top entry

This design is specifically developed when in-line valve maintenance is a crucial request. In this case the valve can be disassembled from the top cover without removing the valve from the pipe. Special tools are usually required for the service activities.



Features	Values
Pressure rating*	ANSI classes from 150 to 2500
Design temperature*	From -46 °C to +200 °C From -51 °F to +392 °F
Nominal sizes*	2" to 48" NPS 50 to NPS 1200
Connections*	<ul style="list-style-type: none"> <li>RF and RTJ flanges as per ASME B16.5, B16.47 and MSS SP-44</li> <li>6B and 6BX flanges as per API 6A</li> <li>Threaded and socket weld ends</li> <li>Hub ends as per customer specifications</li> </ul>
End to end dimensions*	ASME B16.10
Construction*	Top entry bolted body
Operator*	<ul style="list-style-type: none"> <li>Bare stem</li> <li>Gear operated</li> <li>Motor operated (pneumatic, hydraulic, gas over oil or electric actuator)</li> </ul>
Part	Material
Metallic materials*	<ul style="list-style-type: none"> <li>Low temperature carbon steel (body, connectors**, ball, seats, cover, top flange)</li> <li>Stainless steel (stem)</li> </ul>
Soft parts*	<ul style="list-style-type: none"> <li>Elastomeric (FKM, HNBR)</li> <li>Graphite</li> </ul>
Coatings*	<ul style="list-style-type: none"> <li>Electroless Nickel Plating (ENP)</li> <li>HVOF tungsten carbide coating (TCC) if metal to metal sealing is required</li> </ul>
<p><b>(*) REMARK: Different functional features and/or materials available on request. Stated temperature ranges are the maximum for which the standard equipment's full performance is fulfilled.</b></p> <p><b>(**) REMARK: If necessary, proper material pups can be welded to the valve to fit connecting pipe material.</b></p>	

**Table 8** Top entry version features & materials



**TB0036ENG**



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