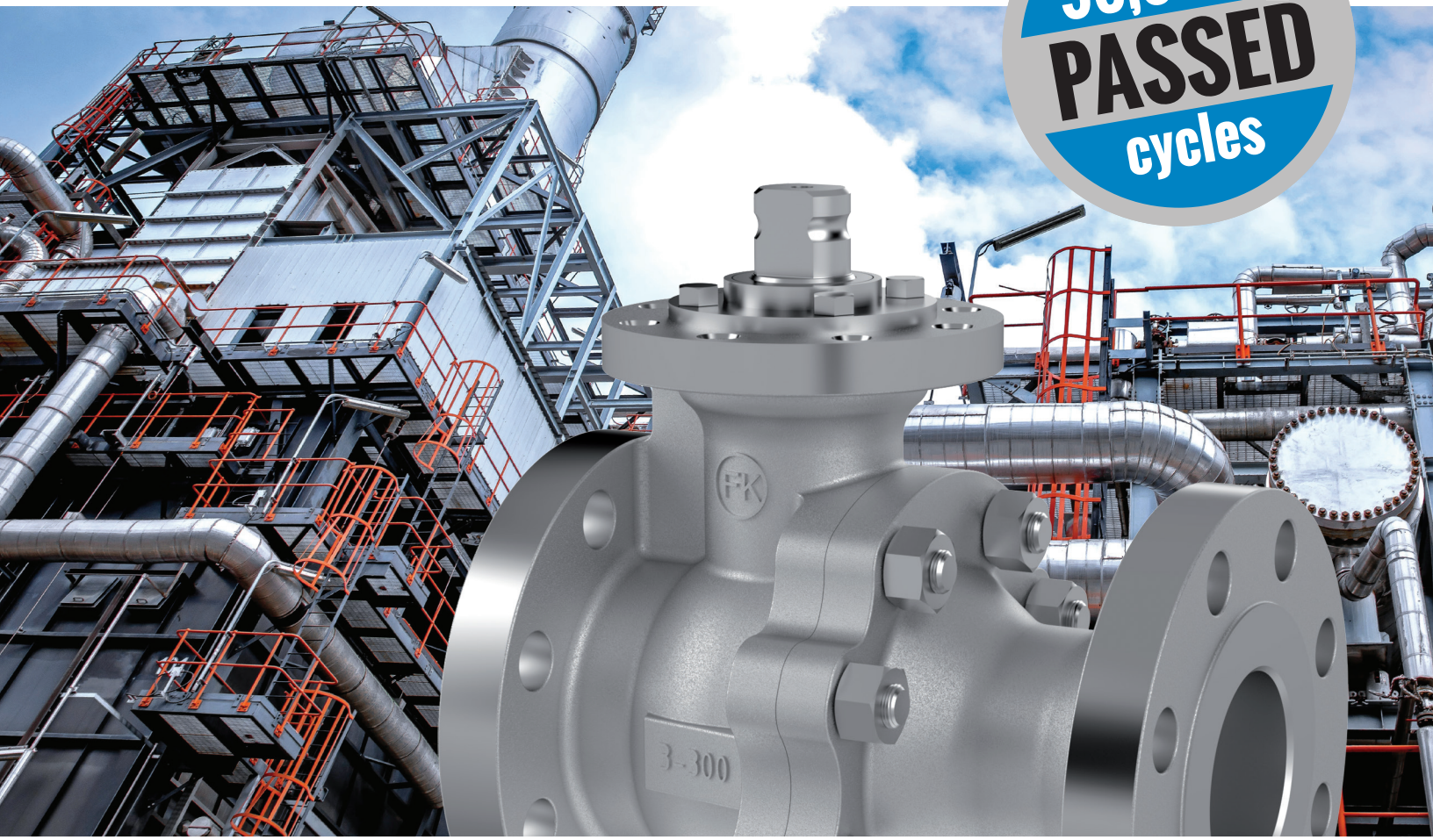


TUFSEAT

95,000+  
PASSED  
cycles



**NEW!** REVOLUTIONARY SEAT DESIGN RESULTS IN **50% LONGER LIFE**  
NOW ALSO AVAILABLE IN ASME CLASS 600 AND 900!

## KROMBACH® TUFSEAT™ Performance Series Ball Valves

TUFSEAT by KROMBACH - THE SUPERIOR MSBV

CRANE®

 [www.cranecpe.com](http://www.cranecpe.com)

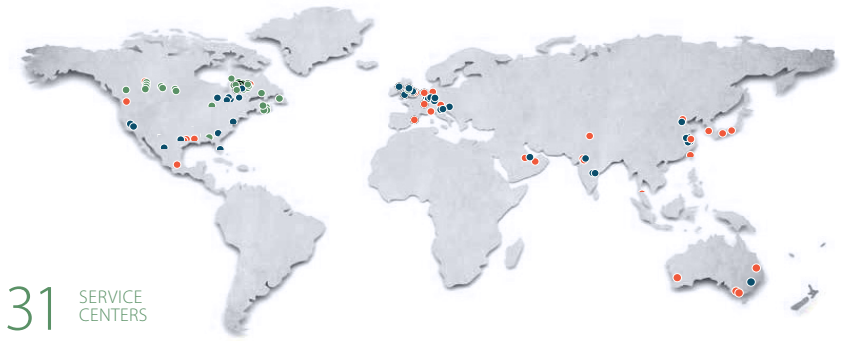


# Heritage of Innovation & Quality

Crane Co. is a diversified manufacturer of highly engineered industrial products, founded in 1855. Crane has approximately 11,000 employees in the Americas, Europe, Asia and Australia, and is traded on the New York Stock Exchange (NYSE:CR).

## Global Presence, Local Support.

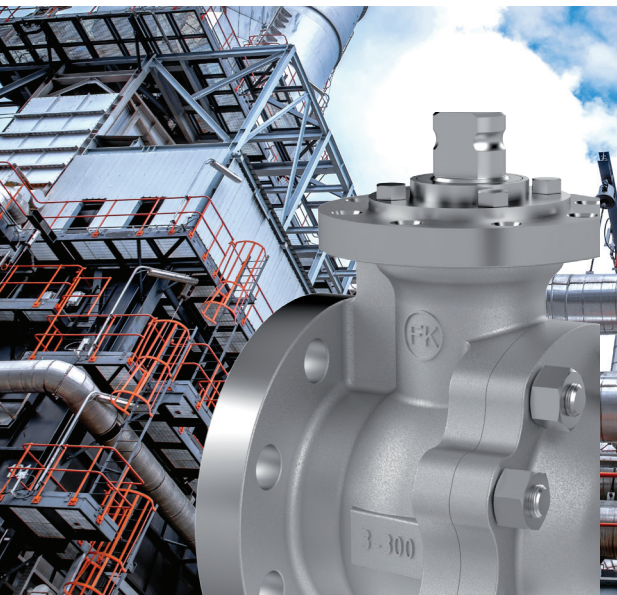
With offices, manufacturing plants, distribution networks, and sales & service centers that span the globe, Crane CP&E is a worldwide leader in fluid handling products and solutions.



- 31** SERVICE CENTERS
- 32** REGIONAL DISTRIBUTION CENTERS
- 33** MANUFACTURING SITES

## About KROMBACH®

The company started its production activities in 1948 in Hilchenbach with 8 employees and initially focused on machined parts for the textile industry. After relocating to its present site in Kreuztal, the focus shifted to the design and production of offset valves and ball valves. The company soon became one of the leading suppliers of high-quality valves for the chemical and petrochemical markets as well as the energy sector, but also for the oil and gas industry. The product portfolio now comprises soft and metal seated ball valves, gate valves, strainers, sight glasses and shut-off valves.



### Traceability

A stainless steel tag is attached to all manufactured and modified valves. It includes standard ASME or DIN information.

### Fully Tested

All of our valves are tested in accordance with Crane CP&E's strict manufacturing procedures and industry regulations.

### Field Repair Services

Crane CP&E technicians are available for field repair and emergency service at your site.

### Consistent Quality

Crane CP&E's high quality standards are supported by our extensive practical experience, state-of-the-art manufacturing, and quality assurance certified by international inspections authorities. Please visit our website for details.

## About KROMBACH



The NEW! Performance Series KROMBACH® TUFSEAT™ Ball Valve combines critical safety and performance features required for demanding service applications in chemical and refining markets.

50% ↑



### LONGER SERVICE LIFE

Consistent seat leak performance and torque throughout the life of the valve for **HIGH CYCLE AND SLURRY APPLICATIONS**.



### LOW VALVE OPERATING TORQUE

Reduced initial investment cost of automation through **HIGH EFFICIENCY PACKING** and **LIVE LOADED SEATS**.

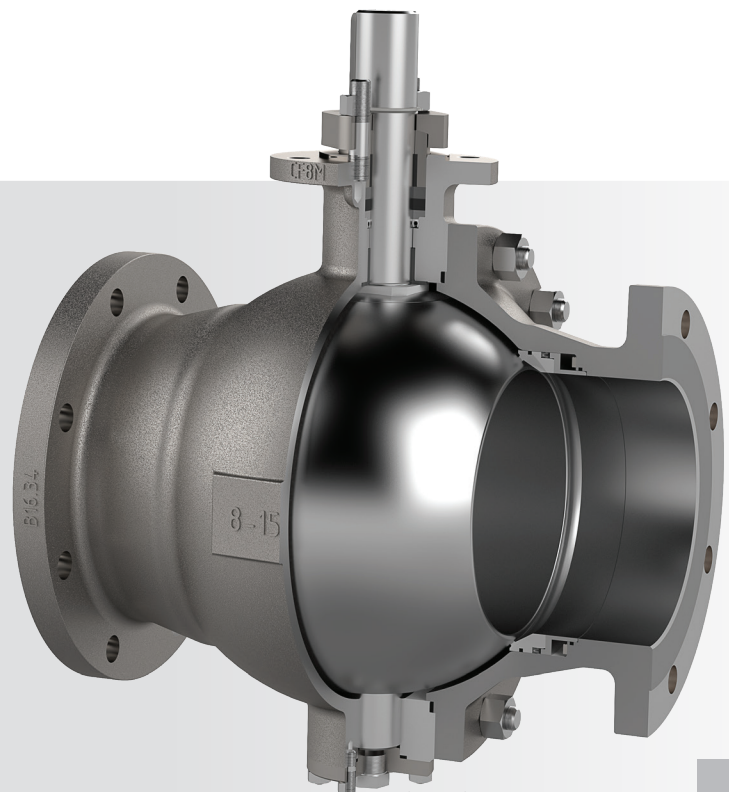


### OUTPERFORMS SEAT LEAK STANDARDS

Bi-directional, Class V or VI seat leakage (API-598/FCI 70.2) at elevated pressure and temperature through **PRECISION LAPPING**.

The KROMBACH® TUFSEAT™ Performance Series Ball Valve's ball and seat are fully machine lapped [not hand-lapped]. The lapping process uses very precise tolerances to ensure optimal contact between ball and seat resulting in the required leakage class without excessive operating torque at the stem. Its trunnion-mounted ball design offers a square polygon stem-to-ball connection which reduces stress for a more efficient torque transmission.

An additional standard feature is its self-cleaning system which removes excess particles, minimizes leakage, and extends product life. All valves in this line are fitted with fire-safe body gaskets in compliance with API 607.



# Product Overview

## Materials of Construction

- Standard: A216 Gr. WCB, A351 Gr. CF8M; 1.0619, 1.4408
- Options upon request: Duplex, Superduplex, LCC/LCB, WC6, CF3M, Monel®, Inconel®, Hastelloy®, Alloy 20; 1.4469, 1.7357, 1.4409, 2.4460

## Size Range

- 1/2" up to 12" / DN15 up to DN300

## Pressure Ratings

- ASME Class 150, Class 300, Class 600, Class 900 / PN 10, 16, 25 and 40

## Temperature Range

- -40°F up to 800°F; -40°C up to 425°C, depending on valve type and material selection

## Body Configurations

- Flanged End ASME B16.5 and EN1092-1
- Long Pattern ASME B16.10, long pattern EN558 series 1, short pattern EN558 series 27
- Floating Ball Design (1/2"-6" / DN15-DN150)
- Trunnion Design (8"-12" / DN200-DN300)

## Regional Market Registration

- PED (Europa)
- CRN (Canada)
- TSG (China)
- EAC (Russia)
- UKCA (Great Britain) pending

## Standard Features and Compliance General Standards

- API 608, API 6D and ASME B16.34 compliant; EN 1983 valve design standard
- NAMUR NE167; EN 17292; EN 12569 ; EN 13942
- Quality certification as per ISO 9001
- CE-marking according to DGRL 2014/68/EU
- ISO 5211 actuator mounting

## Product Standard Features

- ISO 15848-1, Class BH, level CO3 up to 752°F/ 400°C is our standard offering
- API 641
- TA-Luft compliance acc. to VDI 2440
- EPA Method 21 (Fugitive Emissions Compliance)
- Leakage as per FCI 70-2 Class VI (tested to API-598); ISO5208/ EN12266 rate B
- API 607, 7th edition; EN-ISO 10497 Fire Tested
- SIL 2 and 3 certification

## Special Options

- Capable of meeting ISO 15848-1, Class AH, CO1 up to 752°F/ 400°C
- Alternative Inline Leakage rates & tests: FCI 70-2 class V; API598; ISO5208/ EN12266 rate A; API 6D
- Stem Extension for pipe insulation
- Flushing & Purging Connections
- Heating Jacket

Pressure Ratings			Sizes													
ASME Class	DIN / PN		ASME / NPS	1/2"	3/4"	1"	1 1/2"	2"	3"	4"	6"	8"	10"	12"	14"	16"
			DIN / DN	15	20	25	40	50	80	100	150	200	250	300	350	400
150	10	16		●	●	●	●	●	●	●	●	●	●	●	-	-
300	25	40		●	●	●	●	●	●	●	●	●	●	●	-	-
600	-	-		●	●	●	●	●	●	●	●	●	●	●	-	-
900	-	-		●	●	●	●	●	●	●	●	●	●	●	-	-

● Floating ● Trunnion



# Applications

**KROMBACH® TUFSEAT™** Ball Valves offer reliable near zero-leakage performance in critical process applications, steam isolation, and temperature extremes.

Function	
ON / OFF	●
Throttling	●
Modulation System	●

Media Types	
Clean Liquids & Gases	●
Dirty Liquids & Gasses	●
Corrosive Liquids & Gases	●
Hazardous Liquids	●
Viscous Liquids	●
Abrasive Slurries	●
Extreme Temperatures	●
Vacuum Service	●

● Well Suited    ● Limited Application

## Chemical Processing

- Applications in MDI, PMDI, EDC/VCM
- Polysilicon
- Slurry Services

## Petrochemical Applications

- Polyethylene
- Polypropylene
- Ethylene
- Ethylene Oxide (EO)
- Polycarbonate

## Refining

- Hydrocracking
- Reforming and Catalytic Applications (FCCU/CCR)
- Hydrogenation
- Delayed Coking

## Mining

## Pulp and Paper

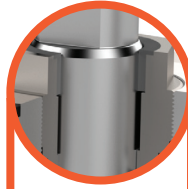
## Other

- Mole Sieve (Gas Processing and dehydration)
- Food and Fragrances
- Liquid Gases and Steam

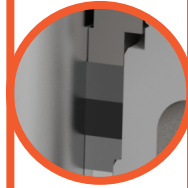
# Features and Benefits Floating Ball Design



Precision lapping of the metal ball and seat provides sealing integrity, assuring **TIGHT SEALING** even at low pressure. Seat geometry creates a scraper self-cleaning effect. Seat springs offset the effects of thermal expansion for **LOWER CONSTANT TORQUE**.



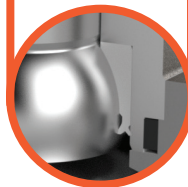
In compliance with API 608, smaller valve sizes are fitted with a threaded gland to optimize space for proper **ISO 5211 MOUNTING**.



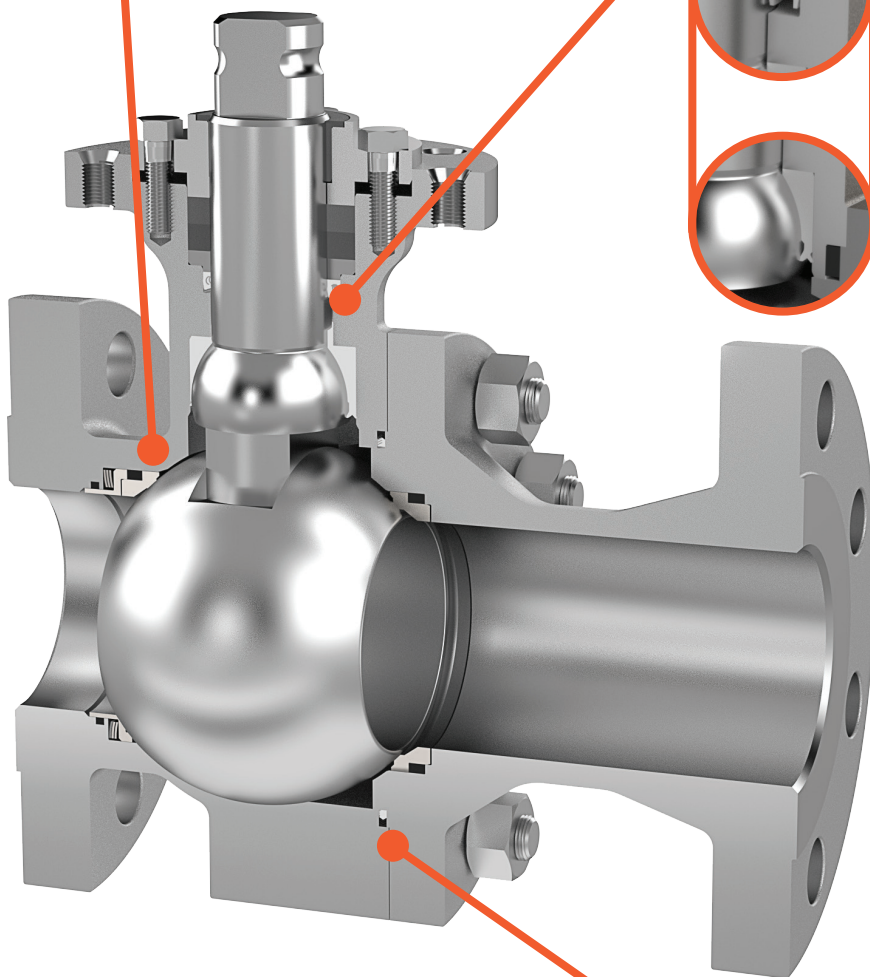
Fully adjustable graphite packing arrangement provides Fire Safe protection without excessive friction for **LOWER TORQUE OPERATION**.



A secondary independent Spring-Energized lip seal compensates for any wear, manufacturing tolerance or eccentricity and provides live loading of the stem seal to **EXTEND THE LIFE** of the packing system.



The patented pressure assisted SX stem seal provides the highest protection against fugitive emissions while supplying side-load protection further enhancing the longer life of the packing.



To avoid the effects of pressure and temperature fluctuation, spiral wound dual material body gaskets are standard in the KROMBACH® TUFSEAT™ Performance Series with an inert PTFE inner seal, a fire proof external graphite seal and a full graphite option for high temperature applications and **LONGER LIFE** without static leaks.

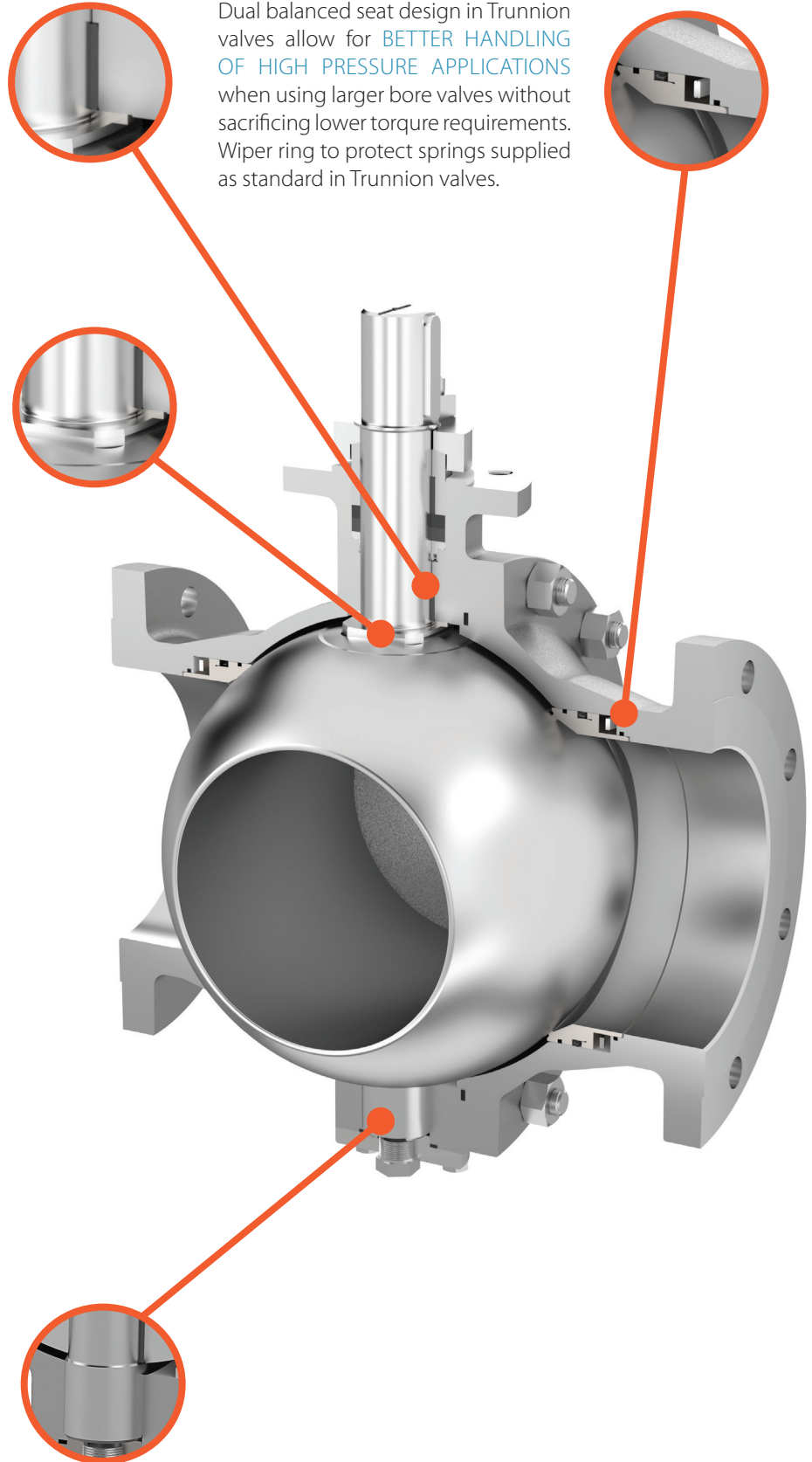


## Features and Benefits Trunnion Design

In addition to the features used on the Floating Ball Design, the bearing supplies side-load protection further enhancing the **LONGER LIFE OF THE PACKING**.

Polygon-to-ball connection according to DIN 32711/32712 for **BETTER TORQUE RESISTANCE** and better distribution of pressure when compared to a similar diameter stem using alternative designs.

Dual balanced seat design in Trunnion valves allow for **BETTER HANDLING OF HIGH PRESSURE APPLICATIONS** when using larger bore valves without sacrificing lower torque requirements. Wiper ring to protect springs supplied as standard in Trunnion valves.



Bottom shaft supported by bearings protected from the media to ensure adequate alignment and **MAINTAIN LOWER TORQUE REQUIREMENTS**.

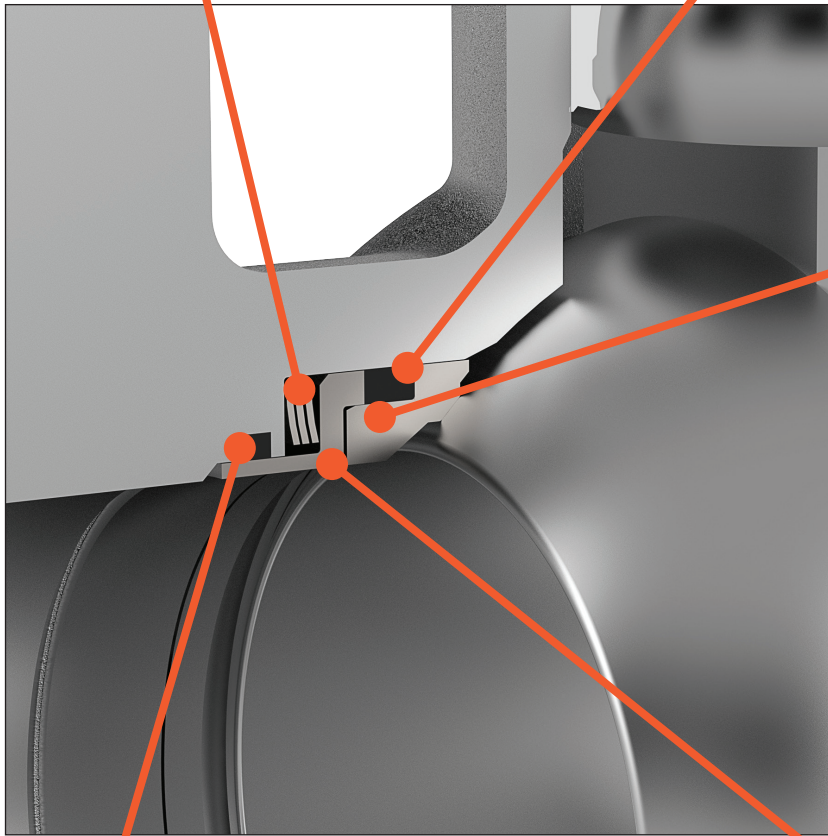
# Design Features Metal Seat

## METALLIC WAVE SPRING FOR THERMAL CYCLING

Maintains the seating force required to ensure a tight inline seal between the seat and ball during temperature swings

## GRAPHITE SEAL AGAINST SOLIDS

KROMBACH® takes advantage of the dual function of graphite rings as seals and primary springs for small variations in operating conditions



## FULL METAL-TO METAL CONTACT WITH OPTIONAL HARDFACE COATINGS MATERIALS

All seats feature a scraper design as standard Hard Chrome, Hard Nickel Alloy, Chrome Carbide, Tungsten Carbide, and Cobalt

## OPTIONAL WIPER GRAPHITE SEAL

Offers enhanced protection of springs and seals behind seats to eliminate effects of solids damaging critical components

## "S" RING TO PROTECT BACK OF SEAT

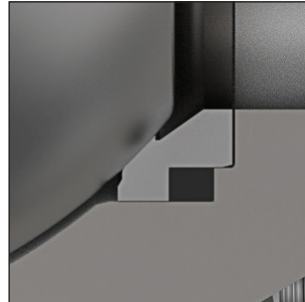
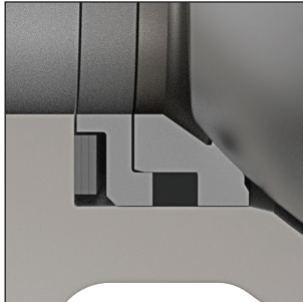
Maintains consistent compression force of the main seat seal; ensures that the seal does not become over compressed



# Design Features Metal Seat Types

## Floating Ball Design

Class 150-300: 1/2"-6"



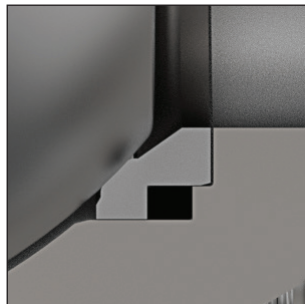
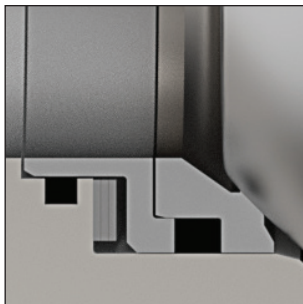
### Standard Scraper Design

- Ball Seat:** Stainless Steel and hard facing
- Seat Seal:** Graphite
- Temp. Range:** - 40 to 500°F  
- 40 to 260°C
- Application:** Bi-direction design, ideally suited for abrasive services and viscous fluids

## Floating Ball Design

Class 150-300 / PN10-40: 1/2"-6" / DN15-DN150

Class 600-900: 1/2"-1 1/2"

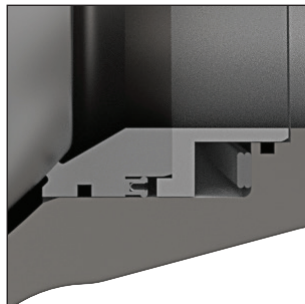
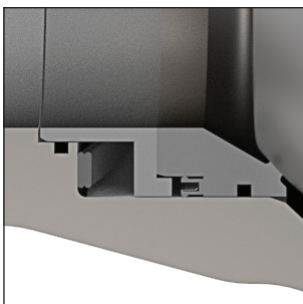


### High Temperature Scraper Design

- Ball Seat:** Stainless Steel and hard facing
- Seat Seal:** Graphite
- Temp. Range:** - 40 to 800°F  
- 40 to 425°C
- Application:** Bi-direction design, ideally suited for abrasive services handling slurries and other viscous fluids

## Trunnion Design

Class 150-300: 8"-12"



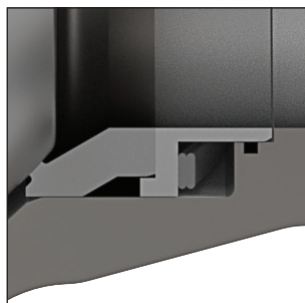
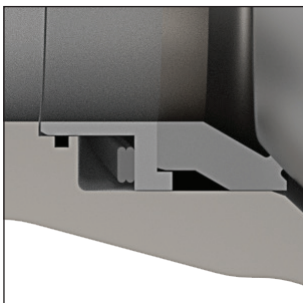
### Standard Scraper Design

- Ball Seat:** Stainless Steel and hard facing
- Seat Seal:** Graphite
- Temp. Range:** - 40 to 500°F  
- 40 to 260°C
- Application:** Bi-direction design, ideally suited for abrasive services and viscous fluids

## Trunnion Design

Class 150-300 / PN10-40: 8"-12" / DN200-DN300

Class 600-900: 2"-12"



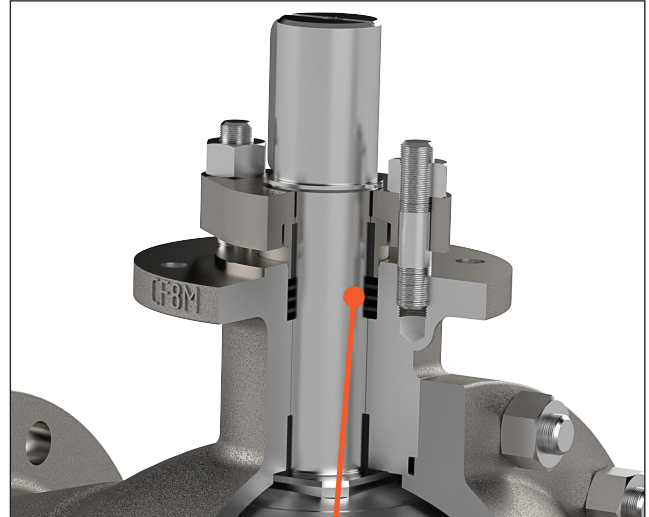
### High Temperature Scraper Design

- Ball Seat:** Stainless Steel and hard facing
- Seat Seal:** Graphite
- Temp. Range:** - 40 to 800°F  
- 40 to 425°C
- Application:** Bi-direction design, ideally suited for abrasive services handling slurries and other viscous fluids

# Design Features Stem Seal Design

## Stem in packing area with super fine roller burnished surface

- Fugitive emission safe (API 641, EPA 21, EN ISO15848-1, TA-Luft)
- Vacuum tightness
- Less wear of packing gaskets
- Reduced friction
- Less torque
- Less expensive automation
- Minimum cost and time for maintenance
- Less spare parts
- Superior process safety



**Packing Area**

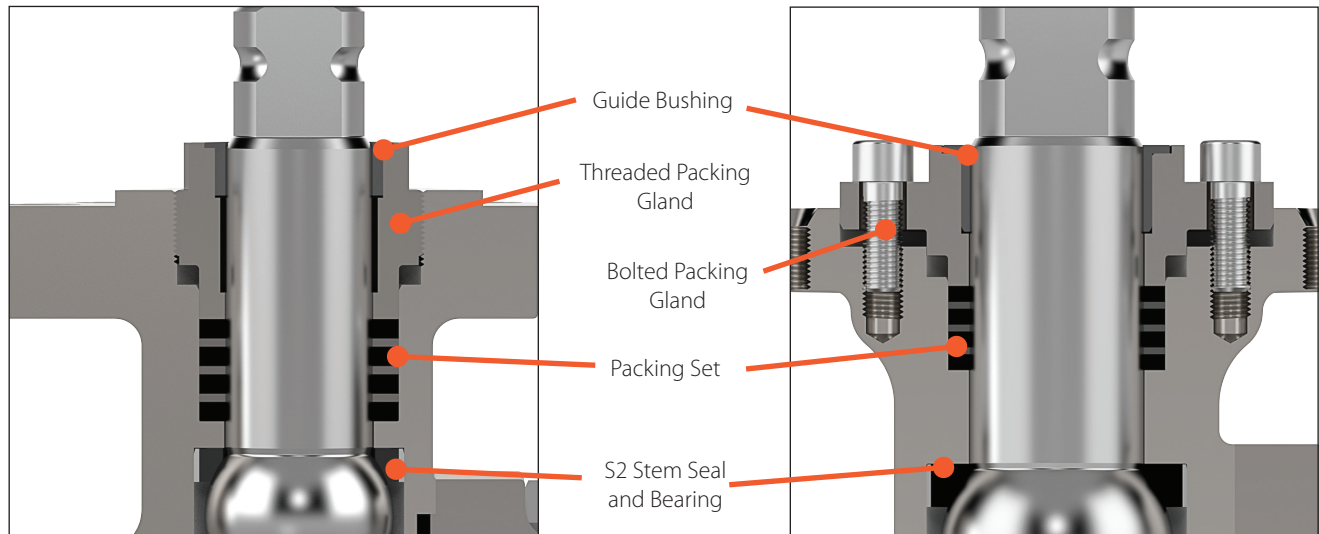
Surface roughness Quality  
 Rz < 1µm ; AARH < 30µin





# Design Features High Temperature Stem Seal Design

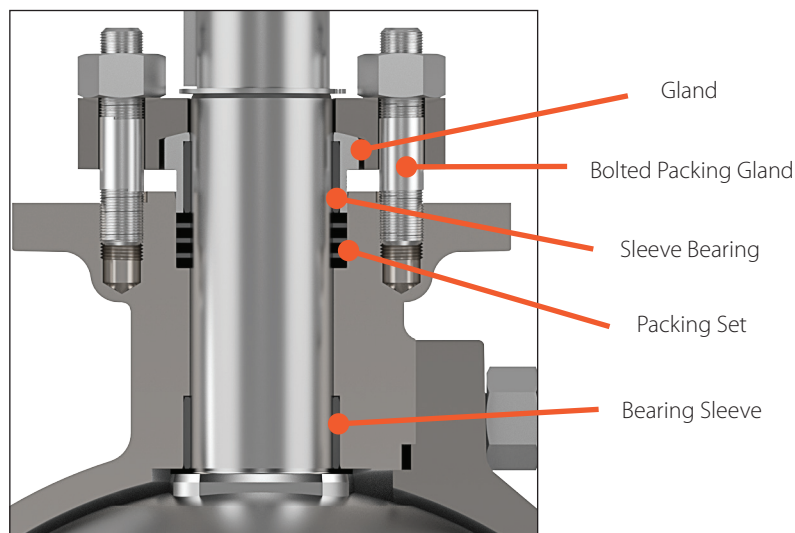
## Floating Ball Design



½" to 3" - Class 150 / DN15 to DN80 - PN10 & PN16  
 ½" to 2" - Class 300 / DN15 to DN50 - PN25 & PN40  
 ½" to 1 ½" - Class 600 & 900

4" to 6" - Class 150 / DN100 to DN150 - PN10 & PN16  
 3" to 6" - Class 300 / DN80 to DN150 - PN25 & PN40

## Trunnion Design



8" to 12" - Class 150 / DN200 to DN300 - PN10 & PN16  
 8" to 12" - Class 300 / DN200 to DN300 - PN25 & PN40  
 2" to 12" - Class 600-900

High temperature packing to pass API 641 and ISO 15848-1 BH-CO3 tests at 400°C (752°F).

Graphite packing to withstand high temperatures with metallic barriers to avoid dispersion of process media through packing.

# Testing Torque Benefits

## PACKING

Through the use of 3 layers of seals in the packing arrangement, the design meets required fugitive emissions standards with minimal compression resulting in lower friction and operating torque.

## SEAT DESIGN

Live-loaded seats designed to offset temperature swings during normal valve operation ensure consistent contact pressure between ball and seats to maintain steady torque without sacrificing shut off performance.

## STEM and COATINGS

Polished stem and adequate coating selection on ball and seats avoid extensive wear and erosion that could result in preventable torque spikes affecting the operation of the unit.

## 1 CAPITAL INVESTMENT

Lower initial torque enables the use of smaller actuators, reducing capital cost and overall weight.

## 2 LOW COST OF OWNERSHIP

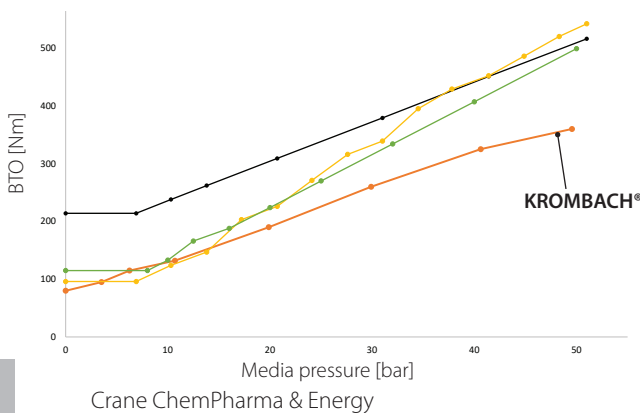
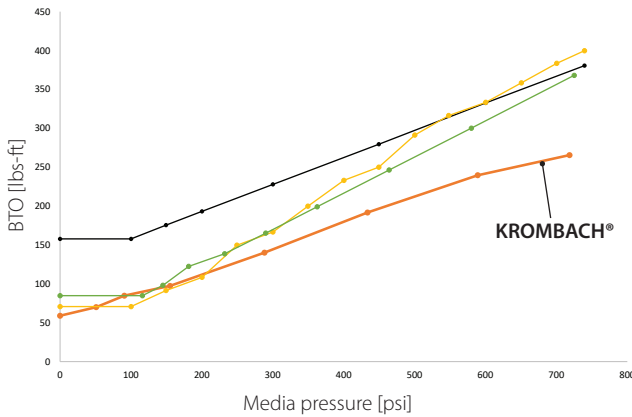
Consistency in required torque throughout the life of the valve prevents operational challenges that could result in lengthy shut downs and expensive maintenance procedures.

## 3 PERFORMANCE

Low torque is achieved through the highly-engineered seat design and coating selection which maintains its tight seat-leak performance even at a wide range of operating pressures and temperatures.

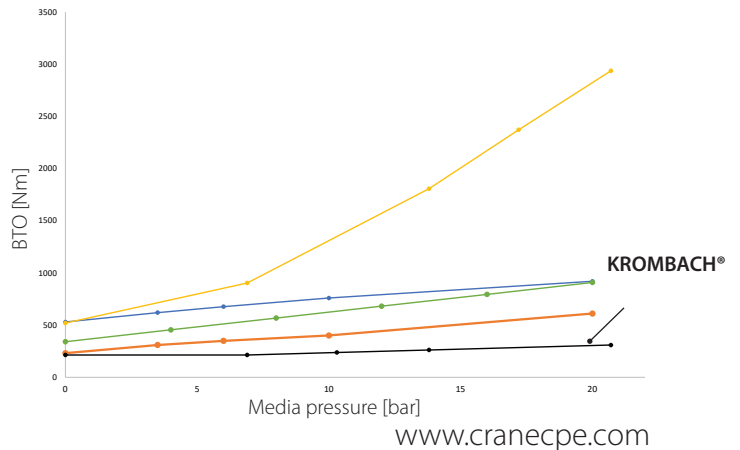
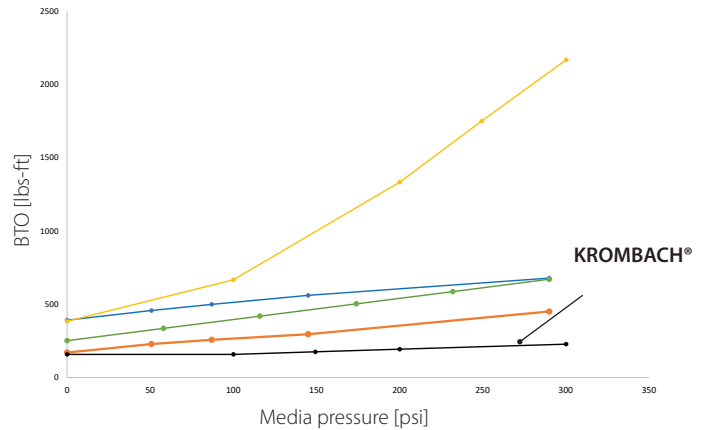
### TORQUE COMPARISON

Floating Ball Design 3" Class 300  
Valve Break to Open Torque (BTO)  
KROMBACH® vs. Others



### TORQUE COMPARISON

Trunnion Design 8" Class 150  
Valve Break to Open Torque (BTO)  
KROMBACH® vs. Others





# Testing Life in Slurry Applications

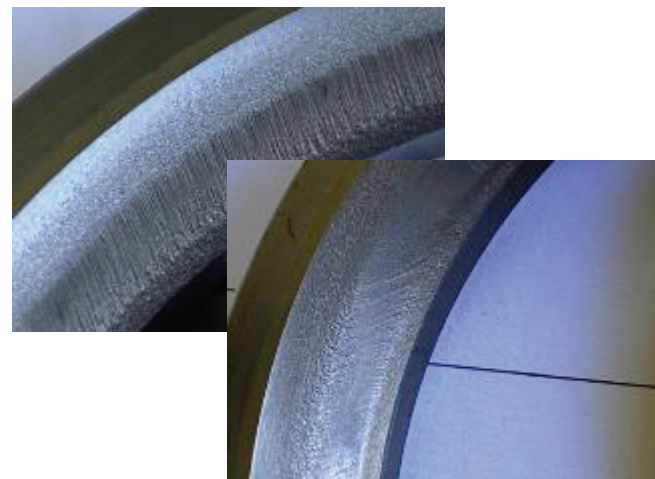
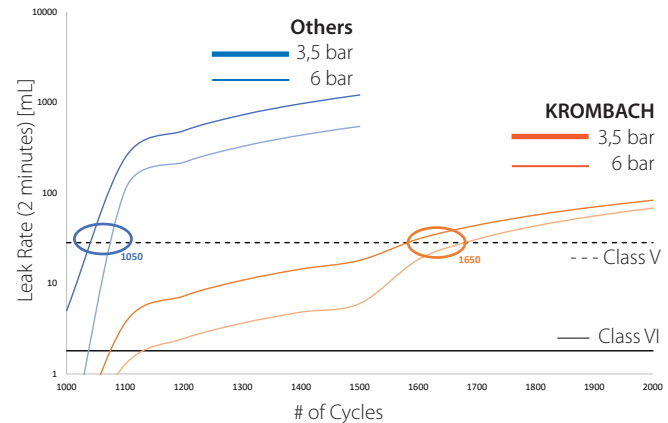
To demonstrate performance in the toughest slurry applications, Crane ChemPharma & Energy has recently tested a KROMBACH® TUFSEAT™ Ball Valve (3" - Class 300) in a closed loop system. It was tested under the following unprecedented conditions:

- Slurry with 10% Solids
- Highly erosive foundry sand: 0.15-0.6 mm, or 6-24 thousands of an inch
- Fluid velocity: 3.6 m/s (from 60 m<sup>3</sup>/h ), or 12 ft/s (from 264 gpm)

The valve has successfully passed the sand slurry test, 1500 cycles at 6 bar. The KROMBACH® TUFSEAT™ Ball Valve continued to perform at Class V seat leakage after the 1500 cycles. Torque stayed stable throughout the test. In summary, the valve was not damaged, and all soft seals were in good condition.

Thanks to the combined operation of the graphite rings and wave springs in a heavily protected design of the valve seats, the failure mode was limited to normal wear and tear allowing the valve to exceed expectations by reaching 1500 cycles without any kind of catastrophic failure. Smooth torque performance throughout the test and subsequent teardown of the valve further confirm these findings.

## Slurry Test Results in closed loop lab environment



*Failure mode of the KROMBACH® TUFSEAT™ Ball Valve identified to be normal wear and tear that can be easily addressed through proper selection of coatings*

**More than 50% longer life in slurry applications!**

**Exceeded 1500 cycles before passing the threshold of Class V leakage rate in a harsh erosive test environment.**





**KROMBACH® TUFSEAT™  
PERFORMANCE SERIES DELIVERS  
BEST-IN-CLASS TORQUES IN  
BOTH FLOATING BALL AND  
TRUNNION DESIGNS**



# Testing Fugitive Emission ISO 15848

## Fugitive Emissions Testing According to ISO 15848-1: 2017

Capitalizing on the standard Metal Seated Ball Valve design features, Crane's next-generation KROMBACH®'s TUFSEAT™ Ball Valve is capable of better handling the harsh conditions of critical process applications, steam isolation, and temperature extremes. The unique stem seal design provides superior fugitive emissions control (ISO 15848, Class BH-CO2, BH-CO3 and API 641 as a standard) under recurrent and extreme thermal cycling not typically seen in Metal Seated Ball Valves.

Also available, this new valve can perform at AH-CO1 at 400C (752F).

Additionally, depending on the application in which it is used, the packing offering of new Metal Seated Ball Valves can be differentiated so users can choose which works best for their needs:

- TA-Luft Edition 2021
- Standard (Process Industry): ISO 15848-1&2: Class BH CO2 (< 50 ppmv)
- High Endurance Low-E Option: ISO 15848-1&2: Class BH CO3 (< 50 ppmv)
- EPA Method 21 (Fugitive Emissions Compliance)
- API 641

### ISO FE BH - CO3 - SSA 1 - t(RT, 400°C) - Class 300 - ISO 15848-1

Class	Measured leak rate <sup>a</sup> mg s <sup>-1</sup> m <sup>-1</sup>	Remarks
A <sup>b</sup>	≤ 10 <sup>-5</sup>	Typically achieved with bellow seals or equivalent stem (shaft) sealing system for quarter turn valves.
B <sup>a</sup>	≤ 10 <sup>-4</sup>	Typically achieved with PTFE based packings or elastomeric seals.
C <sup>a</sup>	≤ 10 <sup>-2</sup>	Typically achieved with flexible graphite based packings.

<sup>a</sup> Expressed in mg s<sup>-1</sup> m<sup>-1</sup> measured with total leakage method.  
<sup>b</sup> Class A can be measured only with helium using the vacuum method.

Test Fluid	Class
H - Helium	AH, BH, CH
M - Methane	BM, CM

When the test fluid is helium, classes are identified as AH, BH and CH. When the test fluid is methane, classes are identified as BM and CM.

Classification	Minimum number of mechanical cycles
CO1	205 cycles, with two thermal cycles (except for RT)
CO2	1.500 cycles, with three thermal cycles
CO3	2.500 cycles, with four thermal cycles

Number of Adjustments
0 / 1 / 2 / 3

Temperature Classes					
(t-196 °C)	(t-46 °C)	(t-29 °C)	(tRT °C)	(t200 °C)	(t400 °C)
-196 °C - RT	-46 °C - RT	-29 °C - RT	+5°C - 40°C	RT - 200 °C	RT - 400 °C

Part Composition	
Part 1 (Design)	Part 2 (Production)
System of classification and procedures of qualification for the tests of the type of the valves.	Acceptance tests in production of the valves - Non-destructive.

Pressure Rate
Class 150
Class 300
Class 600
Class 900
PN 10
PN 16
PN 25
PN 40
PN 63
PN 100
PN 160



**CRANE**®

**CRANE CHEMPHARMA & ENERGY**

Xomox International GmbH & Co. OHG  
Marburger Str. 364  
57223 Kreuztal  
Germany  
Tel.: +49 2732 520 00

4526 Research Forest Drive,  
Suite 400  
The Woodlands  
Texas 77381, U.S.A.  
Tel.: +1 936 271 6500

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