

KROMBACH TUFSEAT Perf

50% Longer Service Life in the

The newest innovation from Crane ChemPharma and Energy stacks a host of critical safety features alongside advanced performance improvements for the highest reliability in demanding service applications in chemical and refining markets.

A legacy of innovation since 1855 drives Crane to solve the toughest challenges with the highest reliability, and with the growing focus and demand for stronger fugitive emissions standards and zero-leak performance, thus one of Crane's leading brands, Krombach® set out to expand the applications and specific scenarios where their metal seated ball valves (MSBV) could be used.



Crane ChemPharma & Energy and Angelica Pajkovic

With the market demanding reputedly manufactured ball valves for severe service applications at cost-competitive price points with lower lead times, Krombach's TUFSEAT Performance Series MSBV was designed to meet demanding expectations, covering a wide array of application conditions without the need to customize every valve—all while remaining configurable.

To address high-cycle, high-torque automated applications and applications with erosive solids that demand superior seat leak performance these new metal seated ball valves were designed and developed with two trim options (floating ball and trunnion designs) that meet Class V seat leak up to 500F and Class VI seat leak up to 800F, with API 641 and ISO 15848-1 FE certifications.

Built to Perform — Features and Benefits

Krombach's TUFSEAT Performance Series Valves were designed to deliver longer service life, lower operating torques, superior fugitive emissions ratings, and Class VI standard inline leakage.

Innovating on features and designs developed through 40 years of engineering expertise, these valves incorporate state-of-the-art technology to offer the best seat leakage performance at a wide range of differential pressure and temperature over an extended number of cycles, even in the presence of slurry media.

Valves operating in these demanding applications are usually required to withstand high torque; yet, the Krombach's TUFSEAT Performance Series valves were designed to require torque levels that are among the lowest in the industry, even while delivering the highest seat leak and fugitive emissions performance, extending the service life of the valves as well as auxiliary equipment.

Machine Lapped Seat and Ball

With a seat and ball that are fully machine lapped, with precise tolerances not achievable through hand lapping, the Krombach's TUFSEAT Performance Series Ball Valves ensure near-perfect matching and optimal contact between ball and seat. This advanced engineering means that these valves outperform Class V or VI seat leak standards, bi-directionally, even at elevated pressures and temperatures. Live-loaded seats can offset temperature swings ensuring that consistent contact pressure is maintained, without sacrificing shut-off

performance at lower torque.

Consistent Contact Pressure

The unique seat system technology takes advantage of the elasticity of the graphite seal behind the seat and combined with metallic wave springs, ensures consistent contact pressure between the seat and the ball, independent of the operating pressure or temperature, for both trim versions.

These components are also protected by an "S" shaped backup ring that minimizes the intrusion of solids and protects the graphite seal from over compression in the event of upset conditions. Seats with graphite wiper rings are available as an option for abrasive services, catalysts, slurries, and other viscous fluids. The graphite rings protect internal components from coming in contact with solids, thus preventing seizing and extending the life of the valve.

Self-cleaning Scraper Design

The unique seat geometry creates a scraper self-cleaning effect, protecting the area behind the seat. Krombach's TUFSEAT Performance Series valves offer a standard scraper seat design, and a high-temperature scraper seat design, which includes an additional wiper ring that stops media particulates from collecting behind the seat and around the seat spring. This design prevents media from packing into the spring cavity behind the seat, thus preventing valve lock-up that results in reduced seat compression and inline leakage that ultimately causes the valve to stop functioning.

Stem Seal and Fugitive Emissions Protection

The trunnion-mounted ball design includes a square polygon stem-to-ball connection that reduces stress and offers more efficient torque transmission. Polished stem and coating options offered on balls and seats prevent extensive wear and erosion, which could cause torque spikes.

Patented pressure-assisted SX and S2 stem seals provide protection against fugitive emissions as well as side-load protection, further enhancing the life of the packing, ensuring proper stem alignment and smooth valve operation. In standard trim valves a secondary spring-energized lip seal functions independently to compensate for wear, manufacturing tolerance, or eccentricity and provide live loading of the stem

Application	Customer Challenge	TUFSEAT Solution
Polyethylene and Polypropylene Reactor and Reactor transfer lines in Petrochemical Plants	Polymerization inside valve cavity and behind seat pockets causes the required operating torque to increase and damage the drive train components reducing life of the valve	<ul style="list-style-type: none"> Robust stem design to better handle fatigue stresses caused by high cycles Square polygonal stem to ball connection for more efficient torque transmission Patented SX and S2 seals and stem bearing support for better alignment and more consistent torque Wiper seal ring to prevent polymerization behind the seats Dual spring effect with graphite seal and wave springs for consistent thrust on seats and constant contact pressure between seat and ball to avoid deposition of product in between them Backup "S" ring design aids in preventing over compression and degradation of graphite seal behind the seat in high thermal cycle applications or during upset conditions
Reactor valves, catalyst regeneration and handling lines, and slurry discharge lines in FCCU and CCR units in refineries	Excessive erosion due to solids at high temperature, solids deposition behind the seats, coke build-up on the ball cause excessive seat leak and reduce life of the valve	<ul style="list-style-type: none"> Scraper seat design as a standard in all Krombach's Performance Series MSBV reduce deposition of coke or solids on the ball and seats Wiper seal ring and backup "S" ring design avoid contamination of wave spring and graphite seal behind the seat with catalyst powder or other solids and debris Hardened ball and seats with strongly bonded and thicker hardened surface increase the life of the components in the presence of solids 100% through full bore design prevent the erosion from high velocity fluid on the sealing surfaces in the open position as the ball inherently protects these surfaces
Black, green and white liquor applications in Pulp and Paper Mills	Scale buildup in cavity and seat areas prevent the valves, that are most of the time in open position, from closing when needed	<ul style="list-style-type: none"> Scraper seat design as a standard in all Krombach's Performance Series MSBV and are key in removing any scale buildup Wiper seal ring and backup "S" ring design avoid contamination of wave spring and graphite seal behind the seat with solids and debris Robust drive train allow higher torque as needed to be used when closing the valve, even in the presence of solids and scale blocking its operation Lower and consistent torque requirement for normal operation of the valve due to the inherent seat seal system and packing designs provide added safety margin to operate the valve at higher torque during upset conditions
All chemical, petrochemical and refining applications in the presence of hydrocarbon or hazardous media	Stem leakage of media to atmosphere not only creates a safety hazard to employees and public in general but also results in additional burden to the operation of the plant to perform required tests and pay fines caused by general emissions levels	<ul style="list-style-type: none"> Robust packing system with diffusion barriers and backup seals design for the specific design temperature for each valve model was instrumental in obtaining full certification as per below to demonstrate outstanding performance: <ul style="list-style-type: none"> API 641 certification of the complete product line (both trims, 150# and 300#, ½" to 12") ISO 15848-1 BH-CO3 certification of the high temperature trim version (both 150# and 300# in the complete size range from ½" to 12") with all tests complete with temperature cycles up to 750F as per the standard requirements. All valves passing AH levels at CO1 endurance limits and two out of three valves achieving AH levels even at CO3 (2500 mechanical cycles). API 607 for full fire test certification of the complete product line

Performance Series Ball Valves

Face of the Toughest Challenges



seal. For valves with high temperature trim option, a stack of packing and diffusion barrier rings produce the most outstanding FE performance at 800F in any ball valve without an extended bonnet while maintaining low torque requirements and full fire safe certification. This state-of-the-art packing system allows these valves to perform at ISO 15848-1 AH levels at the full temperature range.

Longer Service Life in High-Cycle Applications

Lowered valve operating torque means that the initial investment required for automation systems is greatly reduced. The consistent leakage performance, self-cleaning, and reduced torque stress combine to ensure that the service life of these valves is 50% longer in high-cycle and slurry applications.

Additionally, all Krombach's TUFSEAT Performance Series Ball Valves are fitted with fire-safe body gaskets in compliance and fully tested as per API 607.

Testing and Certifications

Krombach's TUFSEAT Performance Series Ball Valves are designed to face up to the toughest challenges, and Crane put them through rigorous testing to demonstrate their performance in the toughest applications.

Fugitive emissions and seat leak performance were of critical importance while designing the valve, and 62 certification and performance tests were completed for various sizes and pressure ratings.

Service Life in Slurry Applications

In a closed-loop system, with 60 m³/h of slurry with 10% solids containing highly erosive foundry sand, flowing at a fluid

velocity of 3.6 m/s, the valve continued to perform at Class V seat leakage even after 1500 cycles at 6 bar, with the operating torque remaining stable, and all soft seals in good condition.

Seat Leak Performance

The valves routinely outperformed standards that were set and advertised. When seat leak performance was evaluated, the valves were designed to meet either Class V or Class VI, but consistently performed much better. FCI 70-2 standards define seat leakage performance at 3.5 bar only, at ambient temperature. Actual test results show valves intended to perform at Class V, actually exceeding Class VI performance benchmarks up to 10 bar, even performing within Class V standards at 50 bar.

In field applications, this performance means that customer expectations are surpassed, service life is greatly increased before these valves have to be repaired or replaced due to excessive leakage.

Torque Testing

Once fugitive emissions and seat leak performance were achieved, the focus was on minimizing operational torque and maintaining a consistent torque regardless of the pressure and temperature to minimize disruptions in the operation due to failure of components in the drive train.

In torque tests too, at different pressures and temperatures, Krombach's TUFSEAT Performance Series valves demonstrate some of the lowest torque requirements in the industry that almost perfectly match theoretically calculated torque used to recommend actuator and gearbox sizes, which will result in longer valve and auxiliary equipment life.

Fugitive Emissions

When it came to fugitive emissions, the set goal was to achieve BH leakage levels with CO₂ endurance (1500 mechanical cycles). Again, all valves in the portfolio outperformed their targets, performing to AH levels for CO₁ endurance (210 cycles), and easily achieving BH-CO₃ endurance level (2500 cycles). All of this was achieved without bonnet extensions or similar features that could add large costs to initial investments while trying to get systems to meet important fugitive emissions performance standards.

Certifications

Because the Krombach's TUFSEAT Performance Series valves were designed and developed as a complete portfolio of products, every valve in the series is fully certified.

From ISO 9001 quality and ISO 5211 actuator mounting to API 608 and ASME B16.34; EN 1983 valve design, and API 607 fire safety standards to ISO 15848, Class BH, level CO₃, and API-641 for fugitive emissions and leakage as per FCI 70-2 Class VI or Class V (tested to API-598), all valves in the series are covered.

The Krombach's TUFSEAT Ball Valve is also SIL 3 certified by IEC 61508. This

certification process conducted by Exida included a full development process evaluation, considering prototype testing on newly developed valve models as well as historic performance of other metal seated ball valves designed and manufactured by Krombach. Detailed Failure Modes, and Diagnostics Analysis (FMEDA) and a thorough review of the manufacturing quality system factors used by Crane across all plants were also considered.

Country and region-specific certifications like CE-marking according to DGRL 2014/68/EU and CRN (Canada) have already been granted.

All of the new Krombach's TUFSEAT Performance Series valves meet all these certifications, without the need for customization or added features.

Why choose the Krombach's TUFSEAT Performance Series?

Krombach's TUFSEAT Performance Series offers many high-end features as standard, including fewer variations in the series, which makes for a more cost-competitive offering with easier availability and shorter lead times, while still offering customization options, if needed.

The Krombach's TUFSEAT Performance Series valves were designed to perform in a wide range of application conditions without the need for customization. With the standard trim, applications with less than 10% content of solids, and operating temperatures under 500F, can be serviced.

For applications with higher solid content and operating temperature up to 800F, the high-temperature trim option is available.

These valves offer reliable near zero-leakage performance in critical process applications, steam isolation, and temperature extremes. They can be used in a wide range of applications, from systems dealing with erosive solids and slurries to high viscosity and sticky fluids, while meeting stringent demands thanks to their advanced engineered seat seal system.

Designed for applications that require full flow with the highest possible Cv in the market, these valves feature quarter-turn operation for easy automation and fully-protected metal seats that are not exposed to the media either in the open or closed position. This level of protection makes them best suited for all refining applications that contain solid debris or catalysts inherent to the process, such as crude atmospheric and vacuum tower bottoms, FCCU and CCR units, or even wastewater applications.

By meeting ISO 15848 and API 641 without the addition of packing rings or excessive tightening of packing glands, these valves maintain lower operating torques. This gives the end customer a two-fold benefit, helping them meet stringent government fugitive emis-

sions requirements while allowing cost savings thanks to smaller gear boxes or automation packages.

The robust drive train and ISO mounting pad available in all sizes make it an excellent choice for automated applications with high mechanical or thermal cycles such as in polyethylene, polypropylene, polycarbonate, BPA, and similar applications in petrochemical units.

Designed to prevent viscous material from penetrating the spring cavity and causing the valve to lock up, the natural self-cleaning scraping design keeps media off the face of the ball and seat and pushes it downstream. This is especially beneficial for polymer production applications.

Other chemical processing applications for Krombach's TUFSEAT Performance Series Ball Valves include MDI, PMDI, EDC/VCM, polysilicon, and slurry services. In the petrochemical domain, these valves can be used in production of polyethylene, polypropylene, ethylene, ethylene oxide (EO), and polycarbonates.

Hydrocracking, reforming and catalytic applications (FCCU/CCR), hydrogenation, and delayed cooking are applications that these valves are suited for, in the refining sector.

From mining to pulp and paper or other niche applications including mole sieve gas processing and dehydration, food and fragrances industries, and liquid gases and steam, Krombach's TUFSEAT Performance Series Ball Valves can take on the toughest challenges with ease.

Solving Customers' Toughest Challenges

Crane ChemPharma and Energy, a segment of Crane Process Flow Technologies is dedicated to innovation and committed to exceeding expectations with the highest reliability.

The Krombach's TUFSEAT Performance Series is testament to this, with its advanced engineering and design innovation that outperforms standards, and delivers in the most severe applications — Solving Customers' Toughest Challenges.



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