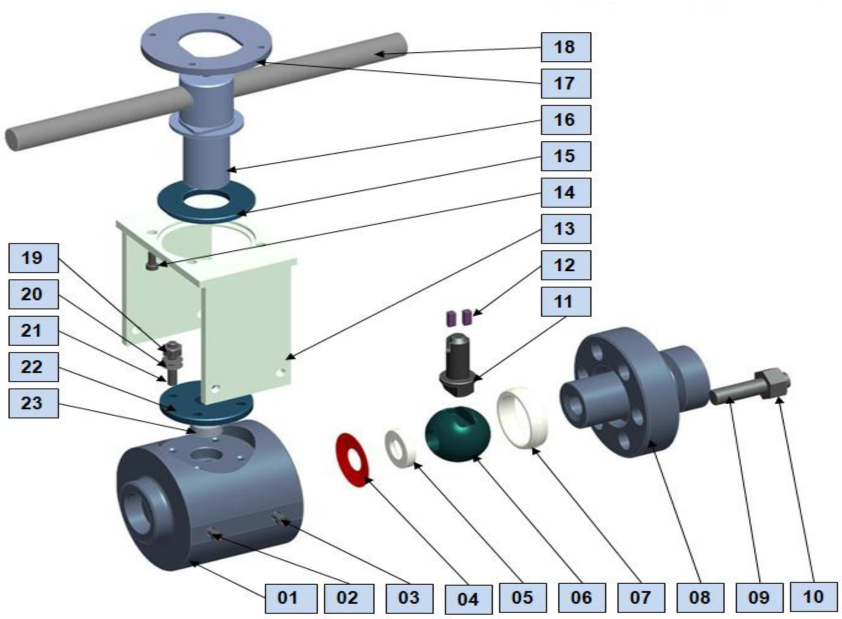
EVS Valves Inc.

Your Engineered Valve Solution Company

EVS Valves Inc. designs and manufactures valves for only SEVERE services. We do NOT modify a standard ball valve to try to operate in a severe service application. We work on solving problems by utilizing technology and simplicity in design. To better understand our approach, please review the following:



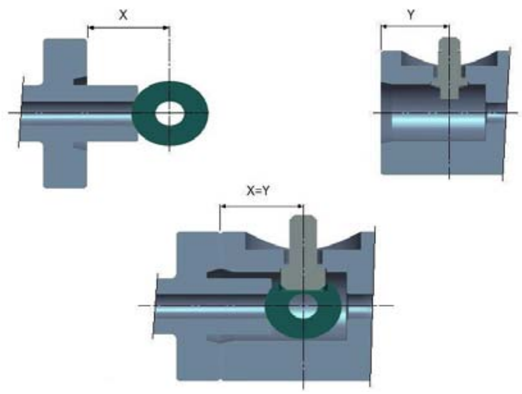
Item. No.	Part Name	Item. No.	Part Name	Item. No.	Part Name
1	Body	9	Body Bolts	17	Lock Plate
2	Mounting Bolts	10	Body Nuts	18	Handle Lever
3	Mounting Nuts	11	Stem	19	Gland Nuts
4	Belleville Spring	12	Stem Key	20	Gland Spring
5	Upstream Seat / Guide	13	Mounting Bracket	21	Gland Bolts
6	Ball	14	Cap Screw	22	Gland Plate
7	Body Gasket	15	Support Bush	23	Stem Packing
8	End Piece Adapter	16	Stem Adapter		

A. Seat/Sealing Design

A standard **floating ball valve or trunnion mounted ball valve** uses a floating separate seat with a seal and a spring to seal against the ball. This allows the ball to "float" against the seat and as the seat moves, it energizes a seal behind or on the side of the seat. In clean low temperature services, this concept works well; however, when abrasive particles are present, the sealing surfaces wear, causing leakage. Also, as the seat moves, the particles will **pack** behind the seat and around the ball, eliminating the movement and causing the seat to jam against the ball, not allowing rotation to open and close.

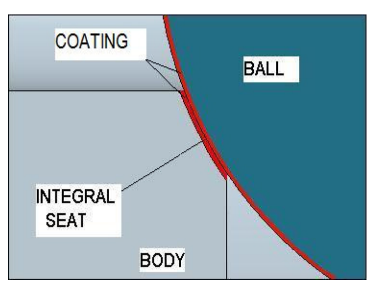
Fixed Centerlines X=Y

We coincidently fix our centerlines. The large spring load continuously holds the ball in the integral seat preventing floatation. In this configuration, the centerline of the stem and the centerline of the sealing are the same, thus reducing offset leads and resultant seat damage.



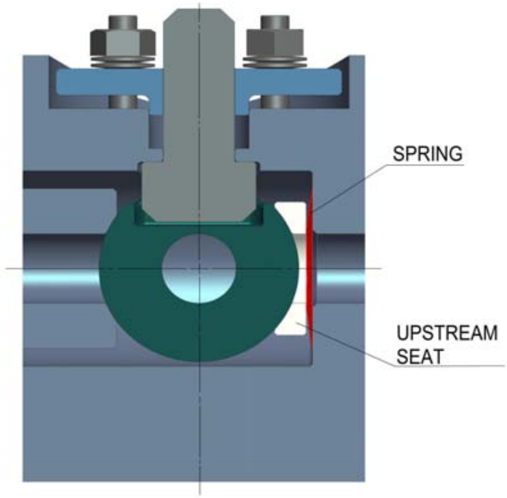
Another concept in attempting to control the **"floating"** ball and seat problem is to fix or capture the seat in a seat pocket. Unfortunately, when this design is exposed to high temperature or rapid thermal transients the seat can become misaligned in the seat pocket, causing uneven seat load and leakage. This concept depends on pins or bolting to hold the seat against a soft Graphoil® seal behind the seat to prevent leakage. During rapid thermal transients, this load will be reduced causing leakage behind the seat.

The **SOLUTION** to the problems identified above is the **EVS INTEGRAL SEAT DESIGN**. First, this design is **simple**, eliminating at least 3 moving parts. Second, since the seat is **integral**, there is no floating of the seat or ball. The ball is held in the seat much like a ball bearing in a race, allowing open and close rotation and <u>not</u> allowing floating. Third, the integral seat is **rigid**. Since the seal is not separable, there is no flexure under load and thermal transients, causing uneven sealing forces and jamming. Fourth, the seat is not exposed to the process stream when fully opened or closed. Fifth, the integral seat eliminates side loads on the packing as described in section D. Last, we have eliminated one critical leak path and area of possible failure. There is no cavity behind the seat to become packed with particles. For high temperature, high thermal transient, and high abrasive services, the **integral seat** design <u>must</u> <u>be</u> <u>specified</u>.



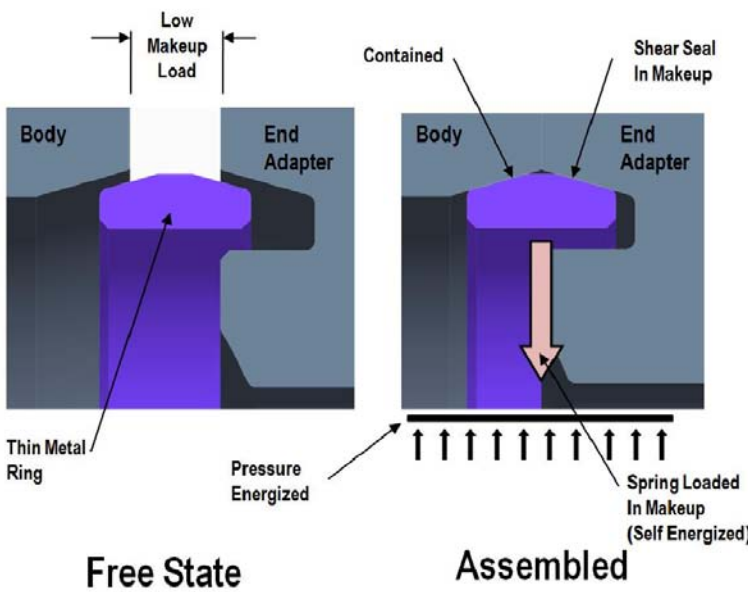
B. <u>Spring Design</u>

In ball valves the spring holds the ball in the seat creating the seal across the seat. In services with thermal transients and dirty abrasive particles, you must ensure that the spring provides enough seating force to prevent the transients or abrasives from lifting the ball off the seat, causing leakage. This design also eliminates the need for lubrication. EVS designs and manufactures the largest spring in the valve industry, providing enough seating force to prevent such lifting. The most significant feature of the spring is that it provides the force for a self cleaning action. If buildup is present as the ball rotates, the spring force will overcome this adhesion and the seat will clean the ball, much like a windshield wiper on a car. The springs are **machined** out of bar, not **stamped**. Stamping could allow relieving at higher temperatures.



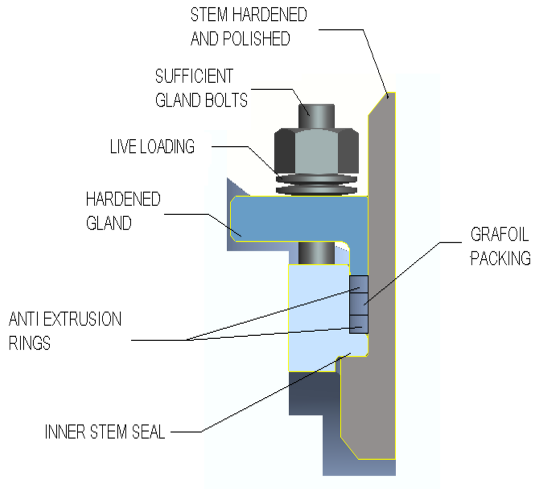
C. **<u>Gasket Designs</u>**

Standard valves utilize a crush style gasket to seal the two body halves. A soft material is placed between the two body halves and crushed by exerting a force through the body bolting. During thermal transients, the bolting (sealing) force can be lowered allowing leakage. EVS's body gasket is a self-energized and pressure-energized metal body gasket. As the body halves are bolted together, the gasket is contracted radially exerting a sealing force outward. During thermal transients, since the gasket is self energized, the sealing force does not decrease as in the crushed style of gasket. Therefore, a metal self energized gasket must be specified in services with thermal transients.



D. **<u>Packing Area Design</u>**

The packing area has several components that must work correctly. These are the stem, stuffing box, packing and the stem and gland finishes. First, as discussed earlier, conventional floating ball valves allow the ball to float internally. This floating of the ball will exert a side load against the stem. This is minimized by using an integral seat design; however, multiple parts associated with a separate fixed seat create problems in controlling ball and stem centerline which again causes side loads on the stem. These side loads on the stem will cause packing deformation and packing leakage. The **Integral Seat Design** allows for easy control of ball to stem centerline. This reduce side loads on the packing so that fugitive emissions are eliminated.

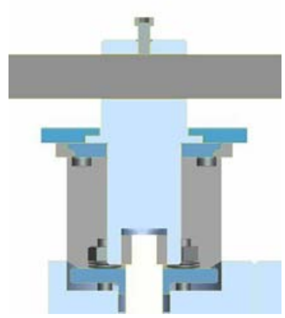


1. Since the centerlines are controlled, there are no side loads on the stem and no packing deformation.
2. The stuffing box must be designed as small as possible. Large and deep stuffing boxes do not allow packing to be energized its entire length.
3. EVS packing design does allow the packing to be fully energized its entire length.
4. Live loaded design gland bolts should be specified to insure that packing continues to be loaded during service conditions.
5. Both the stem and the gland must be hard coated and polished to a 16 RMS finish to prevent wear during operation.

E. <u>Other Design Considerations</u>

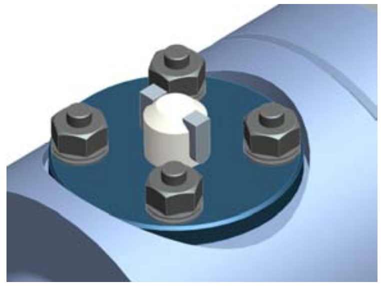
Body – The Main Body is One Piece with integral flanges or other end connections.

Stem Adaptor – Contact proof ***stem adaptor*** design prevents the stem from being "knocked" into the ball slot and causing mis-alignment and leakage.

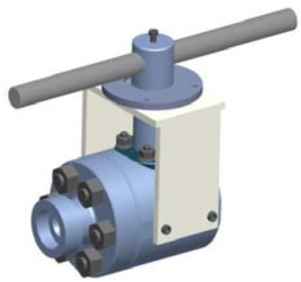


Blow Out Proof Stem – Large one-piece machined, hardened and polished stem is a true ***"blow-out proof"*** design. There are no pins to depend on. It is easily installed through the body bore of the valve.

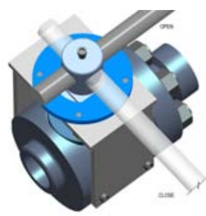
4-Bolt Gland – Generously spaced ***4 bolt gland*** plate allows easy access to “live loaded” packing bolts.



Standard ISO Bracket – Mounting bracket prevents “side load” and “bolt stress loads” by attaching to **the side of the body**, versus top of the valve. The bracket can be provided with standard ISO mounting arrangement.



Machined Stops – Integral 90 degree stop plate design prevents over rotation and maintains critical alignment on manual operated valves.



2. HARD COATING

When the process media contains particles that are harder than the sealing materials, the particles will deteriorate the seals rapidly and **FREQUENT MAINTENANCE** must be performed. For preventative maintenance, sealing surfaces must be harder than the process particles. When a hard metal seat is selected, the seal that is created between the ball and seat is a surface seal. The sealing surface must be lapped free of all imperfections that could allow leakage. Also, the coating must be extremely hard (min. Rc 65) to prevent wear from the ball and seat rubbing together and also to prevent damage from abrasive particles. Attempts are made to use Stellite® (RC 38), however this material is too soft to prevent damage due to wear to the two surfaces rubbing together. EVS coatings are 3-5 times more wear resistant than common Stellite®. The types of coating that are primarily used in severe services are:

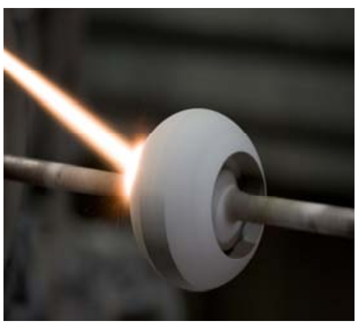
A) Diffused,
B) High Velocity Oxygen Fueled (H.V.O.F.)
C) Fused coating.

A. Diffused Coating

Diffused coating is a surface modification process by placing a finished part in a bath or a controlled atmosphere at elevated temperatures and diffusing ions like nitrogen into the metal to form a hard surface. This very hard surface allows a case depth hardness around .002" - .004" (.05 - .1mm). This type of coating provides excellent wear resistance to stem and gland areas.

B. H.V.O.F. Coating

This is a process taking oxygen, hydrogen and a powder like chromium carbide or tungsten carbide and detonating it in a gun, accelerating the powder at MACH 5 velocities at the surface of the base material. This forms a very hard and dense coating (.008" or .2mm) with a **MECHANICAL BOND** strength of approximately 25,000 PSI tensile. This mechanical bond is much like a "brick wall". The hard particles (carbides) are the bricks while the soft metal matrix is the mortar that mechanically bonds the coating. After lapping, this coating provides excellent finish (2-5 RMS) preventing process adhesion, excellent wear, erosion and corrosion resistance. This is an excellent and very successful coating used in very abrasive services. However, care must be taken when considering this coating for high temperatures above 1200°F or high cycling services. During high cycling operations the sealing materials are constantly rubbing together, inducing shear forces against the mechanical bond, weakening the bond and causing failure. This coating is not recommended for use in high cycling service.



C. Fused Coating

This process takes a nickel or cobalt based coating and utilizes the H.V.O.F. process for application to the base material. The coating is fused at elevated temperatures (similar to welding) forming a **METALLURGICAL BOND**. This Metallurgical Bond is created by a small amount of coating and base material mixing together between the coating and the base material. The bond is as strong as the base material or the coating, whichever is the weakest. The fused coating eliminates the problems associated with temperature and wear in high cycling service.

3. Maintenance

The EVS design **EMPHASIZES SIMPLICITY**. There are only 5 internal parts (ball, guide, spring, gasket and stem) with only 2 of these parts being the moving parts of the valve (ball and stem). This simplicity and the use of hard coatings, allow for years of trouble-free and maintenance-free service. However, when maintenance is required, the valve is very **ECONOMICAL AND SIMPLE** to maintain. The hardest concept to overcome is the assumption that a separate seat design enables the valve to be easily repaired or maintained.

As discussed earlier, valves with separate seats have seat and ball assemblies with as many as 11 replacement parts. Having so many internal parts increases the time for disassembly and inspection and the chance of failure. Also, when the old seat assembly is removed from the body half that holds it in place, polishing, machining or welding and machining must be done to the critical areas on the body half. This is expensive, difficult and time consuming especially in DIRTY service and the extent of this work cannot be predicted until the valve is removed from service and disassembled. The replacement parts themselves are HIGH TOLERANCE items which cause them to be very **LABOR INTENSIVE** to manufacture and repair.

The EVS **Integral Seat Design** machines the seat directly to one body half. Since there are ONLY TWO PARTS to remove, the disassembly and inspection are performed very simply, easily and quickly thus eliminating many areas of probable failure. This also eliminates the need for machining and polishing in the field. Either the ball or seat can be replaced or both if required. Since these parts are simple in design and easy to manufacture, with few close tolerance areas, the cost to replace these two items is competitive, if not lower than the cost of the replacement of the separate seat design. Also, USED BALL AND SEAT COMPONENTS ARE REPAIRABLE once replaced, for additional savings over buying new parts.

SPECIAL DESIGN FEATURES:
Special design features are often incorporated in applications where solids, sticky, or viscous service media is present. Many hydrocarbon processing units such as Coker and FCC's require these enhanced features that extend valve service life.

Scraper Seats: Sharp corners are machined on the edge of the seating surfaces. These "knife edges" cut into the service media and scrap it off the ball as it rotates. Hard coating technologies are utilized in order to prevent damage to the components. This prevents build-up that leads to higher torques and possible valve lock-up, providing extending valve service life in the harshest of services.

Purge Ports: Tangential purge ports also prevent build-up of service media inside the valve body; enhancing service life and reducing maintenance. Typically two ports are drilled, entering the cavity in a tangential fashion so that the purge fluid velocity is used to clean the cavity, exiting behind the spring. Tangential purges do not dissipate or lose purging energy, as in traditional design purges. Purge pressure is normally about 25-40 psi above process pressure. Consumption is greatly reduced over typical purge designs.

BI-DIRECTIONAL SEALING DESIGN:
The exceptional sealing capability of EVS Valves in now available in a bi-directional option.

In the event of back pressure, standard uni-directional valves may fail, decreasing line integrity and possibly creating safety hazards. EVS Valves offer a bi-directional valve design engineered to handle back pressure with the same integrity found in our uni-directional valves. The Patent Pending EVS design is subjected to rigorous testing procedures to ensure that your reverse leak rate requirements are met.

With a few manufacturing modifications, a standard uni-directional valve is transformed into a bi-directional valve, ensuring your line integrity both forward and backward.

For more information on EVS Valves, please visit www.evsvalves.com