Guide Valve Limited

GVS® BRAND SERIES

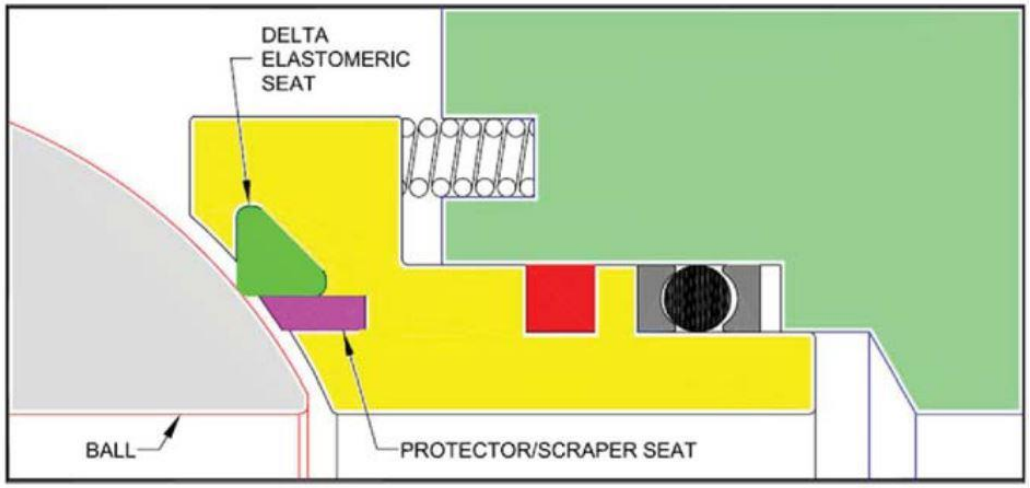
B1 and GB1
SEAT DESIGN
FEATURES AND BENEFITS

SEAT RINGS WITH AN ELASTOMERIC INSERT

The seal of the seat ring is carried out by a ring that has a triangular cross-section and rounded corners. It is named “Delta” from the Greek symbol Δ and is made of elastomer (Viton and/or GLT, AED, Nitrile, Therban, etc.)

The **Delta** is mounted into its housing in the seat ring and is blocked by means of a protector seat.

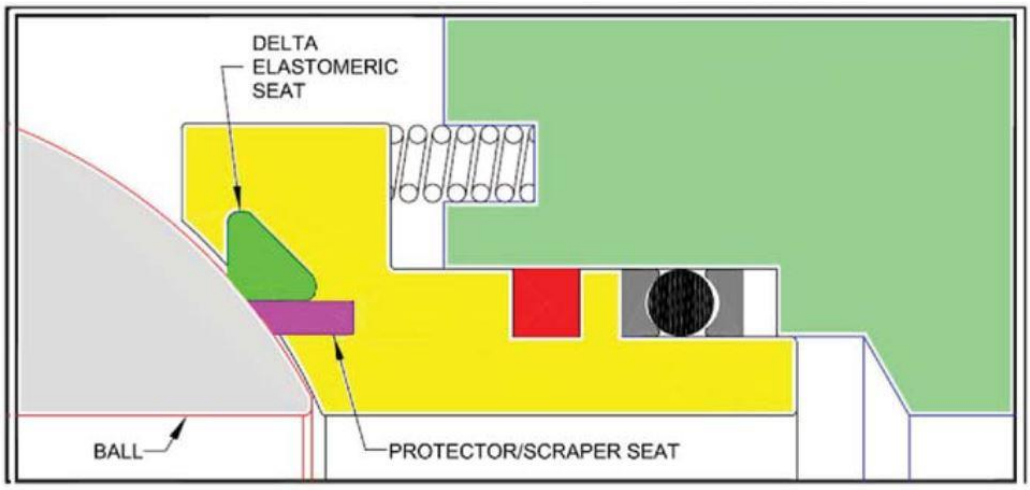
In cases when there is zero pressure or very low pressure, the seat ring is pushed against the ball by pre-load springs with a force (F_M) [see Figure 1] and the **Delta** is subject to partial compression in its housing.



[Figure 1]

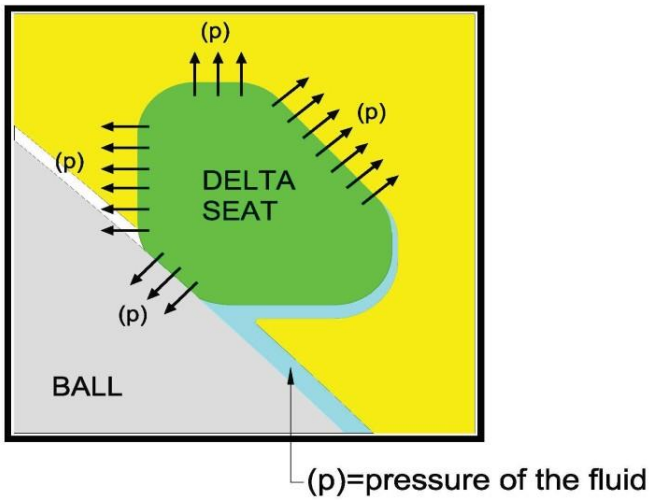
With the valve closed and a differential pressure between upstream and downstream of the ball, the seat ring is further pushed against the ball by differential pressure affecting the annular surface Ω (F_p).

The **Delta** is additionally compressed into its housing in the seat ring, and over a certain Δ_p the Protector Seat is in contact with the ball. [see Figure 2]



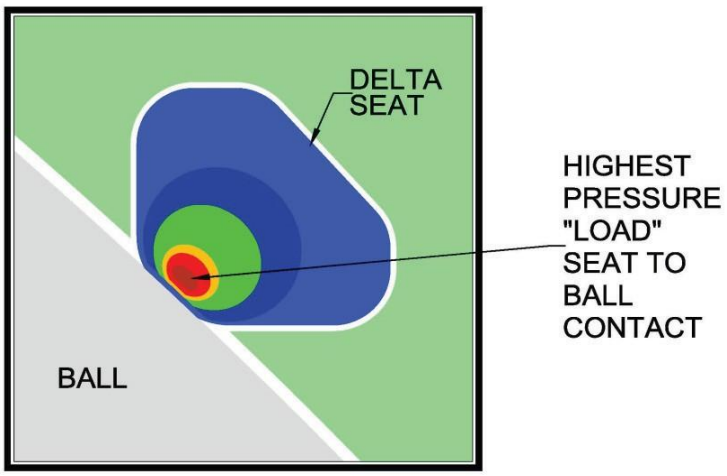
[Figure 2]

The unit pressure between the ball and the elastomeric **Delta** is partially due to the elastic deformation of the insert when it is completely compressed into its housing on the seat ring, and the pressure of the fluid that goes into the housing and compresses the **Delta** against the walls of the housing and the ball. The behavior of the elastomeric insert is similar to that of a liquid that, when subject to a certain pressure on a certain zone (contact with the process fluid), exerts the same pressure on the walls that are wetted by itself [Figure 3].



[Figure 3]

Mathematical models and experimental tests demonstrate that the pressures of contact are distributed as shown in the map [Figure 4]. The **Delta** is one of the family Of "self-energized" seals, i.e. as the fluid pressure increases, the pressure due to contact between the **Delta** and the ball rises too, exceeding in certain zones the differential pressure Δp of the process fluid and thus creating the seal.



[Figure 4]

SEAT DESIGN FEATURES

SEATING TYPE

Guide Valve Limited Series B1 & GB1 ball valves are designed with an elastomeric (soft rubber) special **Delta** shaped seat and with a Protector seat of hard resin material. Our valves have two shut-off sealing surfaces per seat. It could be stated that the "sweet spot" in a GVS valve is significantly greater.
Note: Soft Seated Trunnion mounted ball valves are strictly for full open and close position/function. They are not to be used for control applications nor left in any partially open of close positions.

By our seat design having two shut-off seal contacts to the ball's outer surface we are obtaining the benefits that are provided by the **resin** and **elastomeric** materials without the disadvantages.

We believe that valves relying on only Nylon, Teflon, Devlon, Peek, and other resin type of material seat inserts are predisposed to disadvantages of valve performance when in cold temperatures, due to shrinking of the seat ring. Resins have no memory, and therefore cannot flow into the scores or damages that form on the ball surface. If the scores or damages are caused by solid debris, the problem becomes significantly more severe.

SELECTION OF A SEAT SEAL INSERT MATERIAL

Selection of an appropriate seat seal insert material is based upon the nature of the service fluid and service temperature. For instance, Guide Valve Limited recommends using elastomer seat (i.e. Viton GLT AED) with Protector Resin seat (i.e. Peek) for low temperature service.

Following are some additional technical comparison between resins and elastomers:

ADVANTAGES OF RESIN SEATS

- Resins are inert to many types of fluids, and their use has high flexibility.
- Resins are virtually impermeable to gas, so there is a much smaller risk of damage by explosive decompression if rapid decompression occurs.
- Resins have better mechanical properties that enable the insert to act as a spacer between the seat ring and the ball surface, preventing metal-to-metal contact between them. This is a particularly useful in some exotic applications where it is necessary to increase the surface hardness of the ENP or chrome plating in order to prevent galling.
- Resins have higher abrasion (wear) strength.

DISADVANTAGES OF RESIN SEATS

- Higher unit pressure – Resins need a high working pressure for sealing, and therefore, a greater force to push the seat ring against the ball in comparison to an Elastomeric Seat Seal.
- To provide the same level of sealing as performed by elastomeric seals, resin seals require a better spherical profile, geometry, ball surface finish, and the associated machining costs are higher due to their stiffness and lack of memory. Therefore, it is very difficult to achieve a "perfect" seal at very low pressure in contrast with elastomers seat seal.
- Unlike elastomeric seals, the low elasticity (small compression set) of resin seals prevents metal contact between the seat ring and the ball when the insert is pushed against the ball for sealing creating no additional metal to metal sealing.
- In cases where small damage to the seat insert or ball surface (caused by solid particles entrained in the fluid) occurs, the more rigid resin seal is incapable of self-restoration or to fill up the grooves and scratches on the ball surface, both of which are possible with elastomeric seals.

CONCLUSION

We believe that the **Delta** elastomeric seat insert, with its special triangular shape, is a superior design, when compared to a simple O-ring seat seal, that has been proved through thousands of ball valves installed throughout the world.

We believe that our dual seat seal design, which houses both a resin seat and an elastomeric Delta shaped seat, can withstand more debris related abuse than a single solid hard resin type of seat seal. This further more provides a greater seat-to-ball contact shut-off area.