TechTalk

Non-floating seats subject to performance limitations

High-temperature and High-pressure Applications Require Seats Independent of the Body

Having a non-floating (integral) seat with different materials used for the ball and other seat will result in a poor seal at elevated working temperatures. Different materials have unique rates of thermal expansion. Therefore, the seal attained at room temperature in the manufacturing plant between the ball and seats will not be the same due to dimentional changes when the plant heats up to the elevated operating temperatures necessary. The resulting line contact between the ball and seats has a heightened potential to fail soon after start-up in an abrasive, solids laden process environment. When cycled in this abrasive, high temperature service, the line contact is ground off by the hard catalyst particulate. For this reason major licensors have not permitted non-floating seats in the 2500 Class systems.

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Summary

Non-floating seats at elevated temperature will wear faster and leak sooner than floating seats due to differential size changes in the ball and seat sealing surfaces. This results in non-floating seat valves being acceptable only in temperatures below 428° F (220° C), medium or low pressure, and no solids applications.

The superior solution for severe service conditions including high temperature, high pressure, abrasive, and solidifying media is to follow the MOGAS approach and use a separate seat lapped into the end connection. This design matches the ball and seat material for proper functioning at all temperatures while still maintaining a lapped, metal-to-metal seal so that flexible graphite is not required. This combination maintains constant contact between the ball and downstream seat better than a non-floating seat design can. Furthermore, when the non-floating seat does leak, erosion from the high pressure fluid will damage the valve requiring replacement of half the valve body, in addition to normal wear components.

Competitor with Integral Seat vs MOGAS C-Series

Competitor Claim	MOGAS Response
The integral seat makes possible many of the benefits, which could not be accomplished with valves utilizing inserted seats.	The predominant sealing technology used by severe service ball valve manufactures is to employ replaceable seats on either side of the ball, not an integral seat.
The integral seat makes possible constant contact between ball and seat	Same as MOGAS valves, where a floating spring-loaded seat preloads the ball into the primary seat
The integral seat makes possible constant contact during thermal expansion	Same as MOGAS, though MOGAS has a greater sealing surface on the seat. MOGAS also uses identical ball and seat materials for equal thermal expansion.
The integral seat makes possible for stem to stay on center during rotation.	The ball's growth is a common factor between all designs. Furthermore, MOGAS' dual-guided stem design provides two points of stem alignment near each stem end for best alignment.
Secondary Leak Path	
Most ball valves used an inserted seat design where the seat is made of a material (typically different from the body) and inserted into a machined cavity in the body.	The replaceable seat allows the seat material to match that of the ball; matching corrosion resistance and thermal expansion rates. The seats are not simply inserted into a machined cavity, but the replaceable seats are mate-lapped to the pockets in valves.
The idea of using this type of seat is to make maintenance easer.	Not using a replaceable seat is simply a production decision to make a cheaper valve. Most major severe service valve manufacturers employ a replaceable seat.
The irony is that the use of inserted seats is the root of why maintenance is often necessary.	Whether a seat is integral or replaceable, the central causes of seat damage remains the same: coating failure due to base material corrosion or coating failure due to impact damage. Addressing these common failure modes with a replaceable, sacrificial seat is much more attractive than replacing half the valve body.
This is due to the inability to lap the seat pockets and use of soft materials which break down.	MOGAS laps in both the upstream and down stream replaceable seats and do not use soft materials, such as a graphite gasket.
The ability to lap a bored pocket area inside of the valve cavity is very difficult. One of the most common methods of achieving a seal on the back side of an inserted seat is to use flexible graphite (graphoil).	MOGAS' end-connects are design to provide convenient access for lapping the seat into the land in the seat pocket that provide a positive seal without using graphite. The land is designed to concentrate the contact to increase the sealing stress and locate it properly under the seat for maximum effectiveness.

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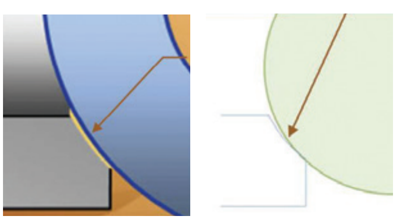
Once a leak forms across the seat back it is not possible to stop the leak without bringing the system down for maintenance. If it is not maintained immediately, erosion from high pressure will cause body damage in an inserted seat design. This would result in the need to replace the damaged body or endcap.	Seat coating failure due to base metal corrosion or impact to the coated seat face results in the same erosive damage. In the case of the integral seat design, repairing the damage requires changing the end connect.
Constant Contact Between Ball & Seat	
The design of the integral seat promotes constant contact of the ball and downstream seat.	MOGAS' replaceable seat has more freedom of motion to remain in contact with the ball under all its dynamic loading conditions, than a fixed seat.
The rigid integral design of the isolation seating face allows it to outperform inserted seat designs in applications where the flowing media solidifies when it stops moving	MOGAS' sharp leading edge techology addresses this more effectively than a fixed seat.
Thermal Expansion	
One of the most difficult concepts to understand about the benefits of the integral seat design is its ability to maintain seal during thermal expansion and why an inserted seat design has inherent issues with thermal expansion.	A mate-lapped ball and seat insert constructed of the same material maintain the highest seal during thermal expansion. An integral seat is constructed of different material to the ball, and expands at a different rates.
This is typically not a major issue for anything operating at less than 225°C but plays a major role in inserted seat failure at higher temperatures.	Another reason why MOGAS is superior, the ball and seat expand at the same rate at higher temperatures.
The ball of our valve is designed to have a similar coefficient of thermal expansion as the integral seat. When the ball and seat are not growing at a similar rate, a reduced sealing area develops. Uneven thermal growth causes a mismatched surface with high stress and galling of the materials eventually leading to valve failure. 	This is exactly MOGAS' position. MOGAS utilizes identical ball and seat materials to avoid just this phenomena. High stresses are created when the sealing surface area moves from full face contact to line contact.
In our valve, the ball is matched with the seating surface to ensure constant contact and seal longevity.	Its only matched at "room" temperature when they were lapped. But as temperatures increase, the miss-match become more prevalent. The ball is heated by and surrounded by the process media. The body is heated by the process media and cooled by the surrounding environment guarantying a dimensional miss-match.
Another issue common with inserted seats at high temperature is the uneven growth during thermal expansion.	Uneven heating or cooling affects balls and bodies the same, no matter if integral seat or not.
The inserted seat warps as it grows creating a leak path behind it and a poor contact band to the ball.	If there were significant variations in the seat's cross section, this might be true, but that's not the case with MOGAS' valve.

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Stem Maintains Centerline	
A significant advantage of integral seat supported design is that it maintains the stem centerline throughout its rotation.	The ball's growth under temperature will side-load the stem as well if not properly accounted for. Tolerance stack-up can easily outweigh the impact of the fixed seat.
An integral seat supported design that maintains the stem centerline throughout its rotation gives the benefits of a trunnion-mounted valve while pressure from the process fluid still increases the force generated to effect a seal.	FALSE. In a trunnion valve, the ball is supported in the center of the valve and both seats (upstream and downstream) are spring loaded into and follow the ball. Both seats of a trunnion valve are pressure energized, not just the ball.

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