LNG INDUSTRY

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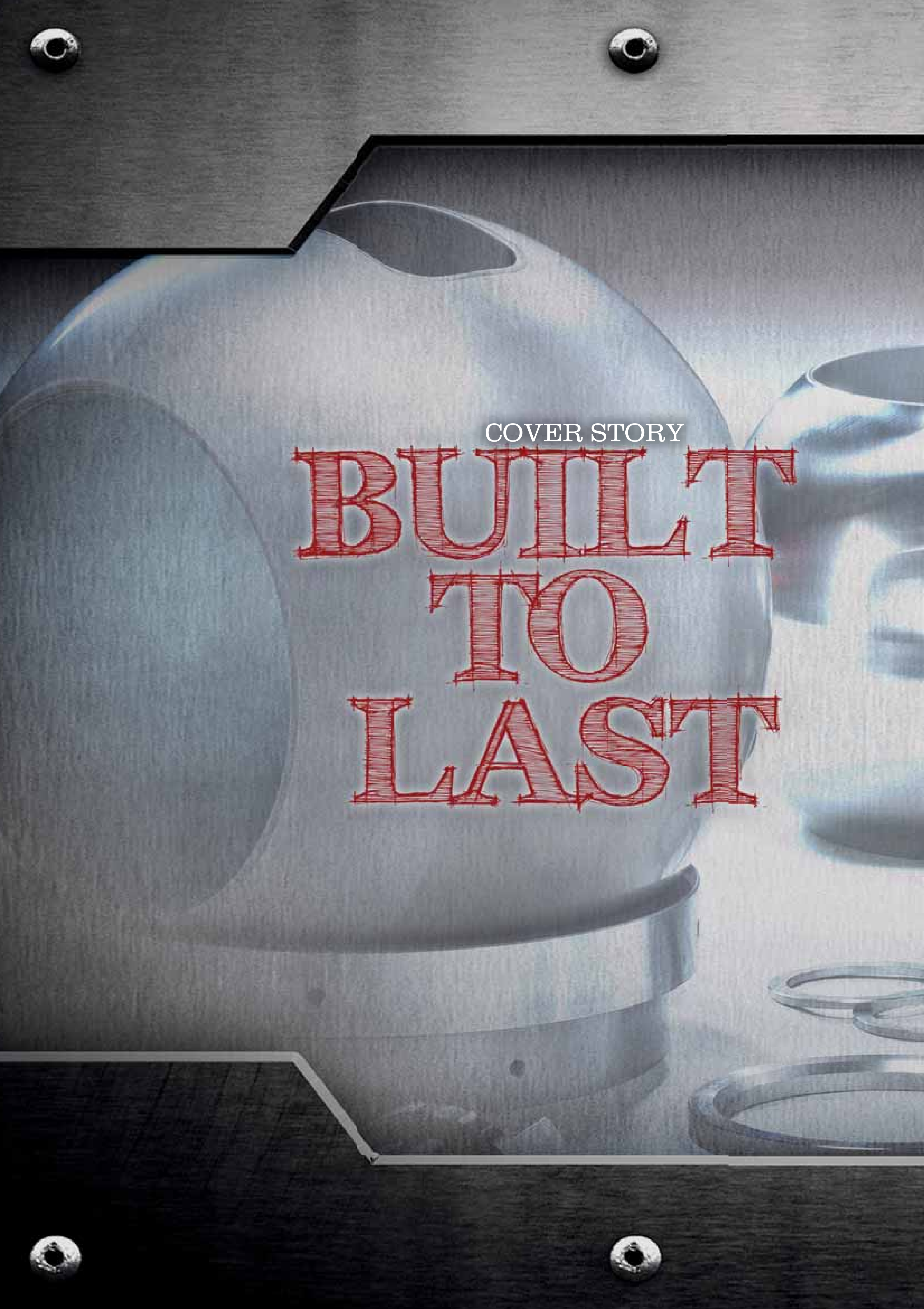


COVER STORY

BUILT TO LAST

Kevin Jackson, MOGAS Industries Inc., USA, examines the benefits of using severe service, dual metal-seated ball valves over single seated lift-and-turn ball valves in LNG molecular sieve applications.

For years, the oil and gas industry has used molecular sieves in specially designed plants to purify gas streams by absorbing water within the flow. Mol sieves are materials that have very small, uniform holes. The principle is that liquid molecules that are small enough to pass through the pores within mol sieves are trapped by pressure, while other, larger molecules cannot penetrate into the mol sieves. In many cases they function as a desiccant by reducing or sustaining a state of relative dryness. Mol sieves can absorb water up to 22% of its own weight.

Operational concerns with traditional designs

From a valve perspective, the challenges that this application brings are just becoming clear. The industry has long relied on a single technical solution, which may have been the preferred technology decades ago, however, operating conditions have changed. Today's ever increasing pressures and flow rates, combined with extended life cycles and 'value engineering' have brought operators to a point where they are experiencing increased failure rates, higher maintenance costs and lower production through unscheduled shutdowns.

Innovative solution

MOGAS Industries believes that the best valve design comes from 'failure analysis'. It is an iterative process to keep evolving technological advancements in design, manufacturing, materials and coatings through R&D, performance analysis and field experience. Successful installations in some of the most arduous applications (such as hydrocarbon and chemical processing, mineral processing and transportation, power generation, and oil and gas production and distribution), coupled with the newly developing industries of gasification, liquefaction, and oil and gas conversion, have given engineers and service technicians a virtual laboratory to discover the best solutions for tough applications.

When looking at changing a traditional technology, the company takes on a great deal of responsibility to ensure that its due diligence can withstand any challenge. When selecting a different valve technology, there are a number of key factors to consider:

- Associated risks in changing technologies – whether technology has been used in this, or a similar, application. Performance and safety should also be considered.
- Understanding the application – that technology will satisfy operational requirements.
- Cost of the new technology – capital expenditure vs. cost of ownership.

Understanding the application

Prior to entering the mol sieve plant, water and other contaminants are removed from the gas by a traditional separator or coalesce; a system primarily used to separate emulsions into their components. A typical mol sieve plant consists of three reactors: absorption, regeneration and cooling. The mol sieve generally consists of zeolite-based adsorbents and clay, filling the columns accordingly. As the wet or sour gas is processed in the absorption reactor, the other reactors are regenerating and cooling. The mol sieves adsorb impurities as the gas flows downwards through the absorption reactor. Most mol sieves require a temperature of approximately 212 ˚F (100 ˚C) to be fully efficient. When they approach their maximum saturation point, the gas is switched to regeneration, and the regeneration process is started in the absorption reactor. Mol sieves can be regenerated by heating with hot gas or by oscillation of the pressure.

Regeneration gas flows in the opposite direction to the process gas at temperatures ranging between 390 to 570 ˚F (200 to 320 ˚C). Regeneration is used to prolong the cycle life of the mol sieves. The regeneration process is followed by the cooling process, which is carried out with dry gas flowing in the same direction as the adsorption gas, to the regeneration gas separator to remove condensed water. Gas exiting the regeneration gas separator is recycled back to the inlet of the adsorption column through a gas compressor.

In understanding the process, valve engineers can now begin to realise that there are key elements not always seen at first glance, such as:

- Thermal cycling.
- Presence of mol sieve particulate.
- High cycles.
- Low risk and service support.

Thermal cycling is an extremely difficult scenario for most isolating valves. Rapid changes in temperatures can significantly impact the valve's materials of construction. Bodies, balls, seats and stems may all have different coefficient of thermal expansion (CTE) rates, but not necessarily expand/contract at the same rates, which prevents the valve from operating due to 'seizing'. Seizing can happen where the sealing surface and/or the sealing mechanism expands faster than the body. This is a particular hazard for single-seated and standard trunnion valve constructions due to the seat grabbing the ball or expanding into the seat pocket. This can create a 'leak' where the ball and seats separate, causing the gas to pass between the ball and seats sealing surface.

MOGAS C-Series isolation valves have over four decades of experience performing metal-to-metal isolation in industries where temperatures are as high as 1560 ˚F (850 ˚C). The C-Series floating ball construction has been developed to ensure that tolerances allow for thermal expansion, by engineering and machining a calculated allowance for expansion growth of the ball, seat and body. Ball and seat materials are carefully selected to ensure that they always have the same rate of CTE. In using this approach, MOGAS is able to clearly define the amount of expansion and avoid seizure or leakage.

Mol sieve particulate

The presence of mol sieve particulate in the fluid is the most difficult obstacle to overcome in isolating process lines. In this application the particulates can be:

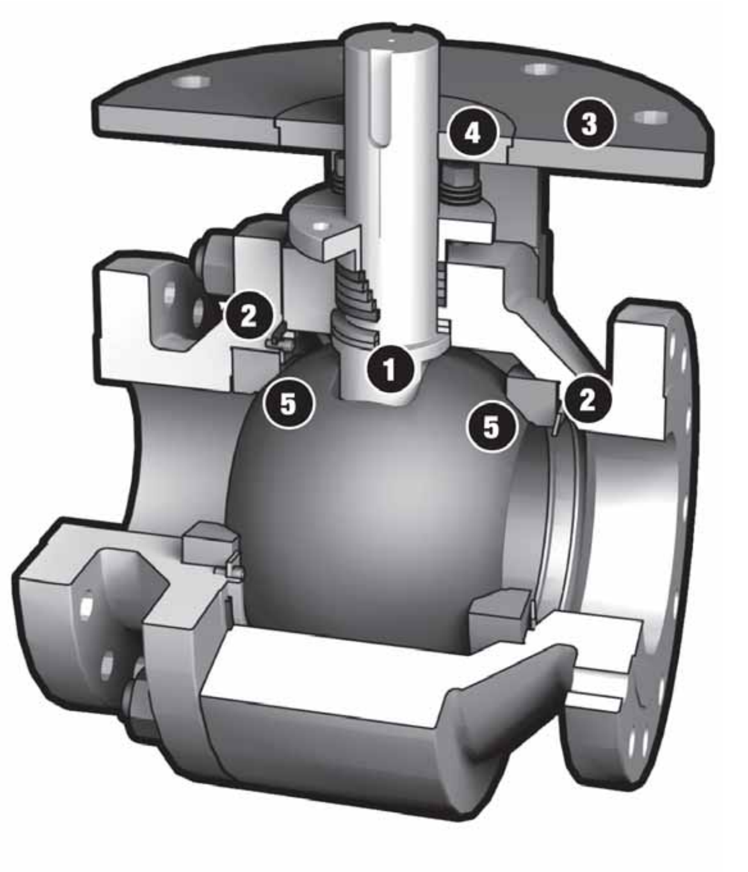
- Whole beads of the mol sieve.
- Crushed and pulverised beads with clay dust.
- Any combination of the above.

Any valve technology where the sealing components separate and allow particulates to get between the sealing surfaces can potentially create a leak path. This could lead to a valve failure and possibly cause an unplanned shutdown. Trunnion valve designs that require the ball to be fixed and the seats to be pushed onto the ball will suffer from the particulate gathering behind the seat. This buildup causes the seats to be pushed onto the ball at increasing pressures and eventual seizure or failure to complete a 90˚ turn. Also, in this design, solids under pressure can enter the area between the stem and the body, causing galling between the stem's anti-blowout shoulder and the body, and then work their way into the gland packing, causing an escape to atmosphere, which is a safety issue.

MOGAS C-Series isolation valves have experience performing metal-to-metal isolation in industries where the slurries and solids present include: hot catalyst fines, heavy oil with fines, heavy coke, copper slurries and steam with the presence of nickel or gold ore. The C-Series floating ball construction has been developed in conjunction with the refining and minerals industries to ensure that the solids do not inhibit the function of the C-Series valve to isolate. Key design features in the floating ball construction include the ability to be able to stop ingress at the stem shoulder by having metal-to-metal inner stem seals (Figure 1, item 1) that protect the shoulder and stem packing, thus producing a seal that is suitable for ISO 15848 Class A. A fixed downstream seat with upstream seat (Figure 1, item 2) and bellville spring ensure the ball and seats stay together through the 90˚ turn. The extra wide seats have a unique 'sharp' edge that wipes the ball surface clean as it rotates, stopping any particles getting trapped between the sealing surfaces.

High cycles can attack the weak points in the valve causing safety issues, as possible stem packing leaks and sealing surfaces struggle to maintain shut-off. This will eventually lead to high costs of ownership through high maintenance costs and continual replacement. Even when performing maintenance, the re-assembly of the actuator can increase the cost of ownership by not being mounted precisely the way it was removed. This can add 'side loads' to the stem and packing and shorten the service life even further.

MOGAS C-Series valves are used in the most stringent applications across a great number of industries to perform critical plant shut-off. The C-series has features that have been built-in to ensure a low cost of ownership. One of these features is the inner stem seals that not only act as a seal for the stem packing, but anchor the stem at its base. Together with the body-mounted actuator flange (Figure 1, item 3), which houses an upper stem bushing (Figure 1, item 4), the stem is able to rotate around its true centre, perpendicular to the flow and not be affected by actuators being disassembled and reassembled. True 100% mate-lapped ball and seats (Figure 1, item 5) produce a large contact area for low ball-to-seat stress, which is an important factor when considering seat design. Narrow seats reduce torque, but increase the contact stress at the sealing surface that will lead to excess wear. Determining the materials of the ball and seat is key. Coating technology has advanced tremendously over recent years and MOGAS has been at the forefront, patenting and developing coatings for many different applications, including high cycling. With low coefficient of friction coatings, tens of thousands of cycles can be performed.



1 Metal-to-metal inner stem seals
2 Fixed downstream seat with spring-loaded upstream seat
3 Heavy-duty actuator mounting flange
4 Valve stem bushing serves as upper stem guide
5 Mate-lapped ball and seats provide large contact area for lower stress

Figure 1. MOGAS C-Series metal seated floating ball valve.

Low risk and service support are crucial to the success of any operating plant. Many manufacturers 'adapt' existing products to meet specifications, and in doing so create high risk and low service support because the product becomes a hybrid and no one really understands or supports it.

Summary

No one likes to change, but when a single technology becomes dominant because of familiarity, and does not commit to continual research, the industry has no alternative but to turn to other types of technology. In doing so, the industry has a responsibility to source the safest, proven, lowest total cost of ownership technology in the market by using manufacturers that completely understand the application and can apply the latest technology in a safe working environment. MOGAS severe service metal-seated isolating ball valves have the proven technology to deal with all the nuances that make changing valves in a complex application a confident choice. LNG

Severe plant conditions can quickly turn into severe consequences for your business. That's why companies worldwide turn to MOGAS Industries—the leading provider of severe-service, metal-seated isolation and control valves.

Combining over four decades of experience with the most advanced manufacturing practices available, MOGAS helps ensure process integrity, uptime reliability and personnel safety. The result—immediate business efficiencies and lower total cost of ownership in the long term.

In short, MOGAS valves perform in the harshest environments so your company can too.

PERFORMANCE GUARANTEE

ASK ABOUT OUR PERFORMANCE GUARANTEE PLUS LIFETIME WARRANTY ON MATERIALS AND WORKMANSHIP.

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