Eight Critical Factors in Purchasing Offshore Pilot Valves

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ASCO Valve, Inc.

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Introduction

Stainless steel pilot valves play small but critical roles in the control of offshore platforms and other demanding oil and gas production operations. Acting as pilots for process and larger emergency shutdown (ESD) valves, these valves are typically installed in a platform's pneumatic logic control panels.

The valves are usually exposed to salt water and other challenging elements, so valve manufacturers all standardize on 316L stainless steel valve bodies. Panel builders, assemblers, OEMs, contractors, and end users can choose from a wide variety of models, including air-operated, manually operated, solenoid-operated, and many more.

Specifiers and buyers must consider all the critical factors that bear on a given design's reliability. The April 2010 platform loss and oil spill in the Gulf of Mexico have only sharpened the industry's focus. In the case of pilot valves, this means that operators must have robust valves that perform efficiently each time, every time.

This report considers several problems that interfere with the efficient, reliable performance of conventional pilot valves in offshore use. It also highlights design changes that have addressed these problems in newer models.

Note: Onshore drillers may also specify these valves, taking advantage of their robust construction or consolidating purchasing when operating both onshore and offshore sites.

Dormancy

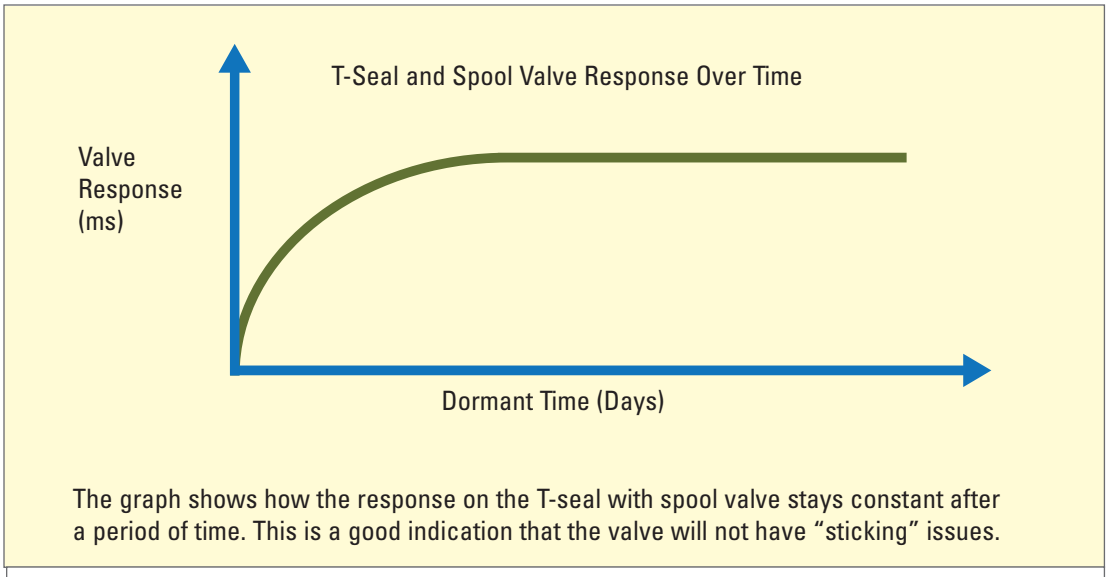
Pilot valves installed on offshore platforms are activated whenever operators or programmable logic controllers (PLCs) intervene to open or close valves, start or stop a process, or perform a routine check.

The problem: this valve activation occurs only at infrequent intervals. The elastomer O-ring seals used in conventional pilot valves stay in uninterrupted contact with the body

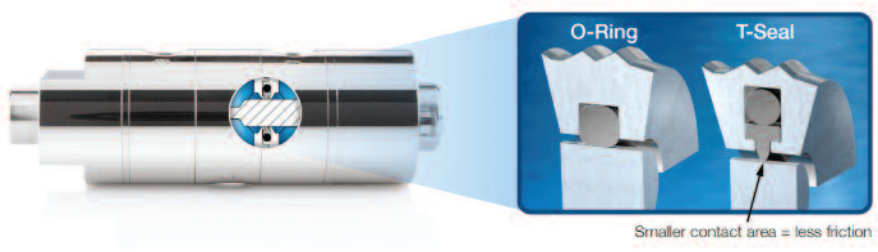
or main stem of the valve for days, weeks — even months. So the seal can actually get stuck against grooves or imperfections in the machined surfaces of its mating components.

The valve becomes dormant, that is, sluggish in operation or inactive and fixed in position — therefore producing a slow response or not responding at all.

To cope, some operators regularly perform extra preventive maintenance. They must take each valve offline, check it, and perhaps add lubrication to each seal, hoping the valve will work when required. Others adopt a more extreme method. Faced with a suspicious or balky valve, they actually hit the side of the valve with a wrench or hammer, forcing the valve to shift!



The graph shows how the response on the T-seal with spool valve stays constant after a period of time. This is a good indication that the valve will not have "sticking" issues.



This "stickiness" problem has long been a fact of life with conventional pilot valve designs. Nevertheless, it clearly poses a threat to uninterrupted uptime operations.

That's why much interest has been generated by the recent introduction of a solution designed to "stop the stickiness." This adopts a technology proven by decades of use elsewhere in the process industry.

For the O-ring seal commonly used in pilot valves, the maker substitutes a T-shaped seal. This elastomer T-seal design seals as well as an O-ring, but presents a much smaller surface area at the point of contact with the valve body or stem. In use, this design has virtually eliminated the dormancy concern!

The eradication of this nagging problem, plus the prospect of less maintenance and a longer product lifetime, may move valves using the T-seal design to the top of the list for many prospective purchasers.

Corrosion

Salt in air and water; birds and insects; dirt and grease: the offshore environment contains numerous elements that accelerate contamination and corrosion of equipment. Pilot valve manufacturers have already standardized on stainless steel bodies. How can purchasers select valves that further stand up to these challenges?

Non-breathing designs. Most current valves are "breathing" designs, which vent to the atmosphere during cycling. These allow contaminants — never in short supply offshore — to enter the valve, eventually degrading performance and reliability. A few newer models feature optional non-breathing construction. Completely isolated from the corrosive/contaminated atmosphere, the valve instead vents internally into the exhaust port. This stops contaminants from entering the valve.

Availability

While it is not a matter of product technology, availability — having the right valve available for service at the right time — represents a critical factor in pilot valve choice.

This factor comes into play as early as the configuration process. How can purchasers evaluate a complex variety of offerings and specify exactly the ones they need? They should look for catalog and ordering materials that are clear and easy to use. Today, some suppliers have gone beyond the conventional process to offer well-organized, instantly accessible configuration and online ordering. Some suppliers let users download 2D and 3D models and insert them directly into their specific CAD software — a real advantage for OEM designers.

Convenient stocking and fast delivery also remain important. Purchasers should favor suppliers with adequate local distribution, and inquire if their pilot valves qualify for fast-ship programs. For purchasers operating in multiple countries, international distribution and service may be of great importance.

Power consumption

Most pilot valves used on offshore platforms are rated to consume 1.5 W to 1.8 W each. Yet DC power is usually at a premium in the offshore world. And new alternatives are available.

Specifiers and buyers should seek out models that take advantage of lower-power designs. In fact, among solenoid-operated choices, newer models that approach the 0.5 W mark — an emerging standard for other types of solenoid valves — are beginning to appear in offshore designs. By definition, these consume only one third the power of conventional pilot valves.

In another issue tangentially related to power, some smaller pilot valve makers may not meet all required standards. When considering solenoid models, for instance, purchasers should make sure that the solenoid has received approvals from the appropriate agencies.

Design balance

A pilot valve is sometimes used as a diverter. In this arrangement, flow is diverted from the valve cylinder port to either its exhaust or its inlet. Panel design becomes unnecessarily complicated when flow to both ports are not equal; here flow balance is a desirable characteristic.

Specifiers and buyers should look for newer models that offer balanced flow. These maintain identical flow characteristics in all modes of operation, from normally open to normally closed. This is particularly helpful for panel builders, since predictable flow enables a simpler, more flexible design process for pneumatic logic control panels.

Purchasers may also prefer models where operating force and pilot pressure are not functions of inlet process pressure. In these designs, manually operated models require consistent force from the operator to actuate the valve, regardless of the inlet process pressure. The same is true for air pilot models that can operate with one minimum pilot pressure and are not affected by inlet process pressure.

Piloting choices

In the case of solenoid valves, it's important to distinguish between applications where the valve is piloting an actuator with a positioner from the more common cases where it's simply piloting an on/off actuator. When a positioner is used, the process flow pressure is generally very low, in the range of 3 to 15 psi (0.2 to 1.0 bar). So an external air

supply is required to pilot the solenoid valve. The valve also needs to be specified as bidirectional, so that it allows the flow to move from inlet to valve and vice versa. Finally, the valve must have a large flow capacity, so it can quickly exhaust the air from the actuator in the case of an emergency shutdown.

In most other applications, where no positioner is involved and the valve is used with an on/off actuator, an internally piloted valve — which uses pressure from the inlet to pilot or move the piston and overcome the spring pressure — is sufficient.

Thus it is usually necessary to specify if solenoid valves will be externally or internally piloted. One useful exception is valves that allow simple selection of externally or internally piloted modes in the field. These models permit the same solenoid valve to be used on different applications, minimizing part number totals.

Temperature

Users report that operations in Canadian waters and other cold-weather environments can challenge efficient operation of much of their equipment, including conventional pilot valves.

Fortunately, some newer pilot valve lines offer models designed with special seal material. Result: untroubled operation in cold temperatures. Such models often carry the same upper temperature limit as the standard valves. Again, buyers operating at sites across a wide temperature range may standardize on the use of these models everywhere.

Finally, O-ring seal dormancy may be even more pronounced in extreme temperature ranges. So a design that combines innovative sealing technology with other low-temperature build features may well offer the best solution.

Lifetime

Pilot valves used offshore in ESD panels are typically subject to low cycle demand and infrequent valve actuation. Nevertheless, a given design's expected service life may well provide an indication of its general build, robustness, and likelihood of providing reliable uptime and performance.

Seals and springs. Specifiers and buyers are urged to consider newer designs. Models that avoid O-rings, such as the T-seal design mentioned earlier, exhibit longer life. Some models also ensure continued reliability by using springs rated for severe service of 1 million cycles.

Solenoids. When solenoid models are needed, buyers reap advantages when the valve manufacturer also makes the included solenoid. Experience suggests this yields fewer coil failures. High-quality solenoids are typically rated at well over 1 million cycles.

Low power. Lower power consumption means less heat stress for the coil and solenoid. Since coil life cycles may roughly double with every 10° C decrease in operating temperature, specifying newer low-power models will add even more reliability.

Solutions: new but proven

For reasons of both tradition and safety, offshore drilling remains a conservative business. A production platform in the middle of a hurricane is no place to try out untested technology. Recognizing this, several manufacturers have incrementally adapted solutions already proven in other process industry valves. These solutions resolve long-standing design and performance problems offshore. Example: ASCO Numatics offers a new line of stainless steel pilot valves.

Valves in this class are designed for the industry's highest reliability, lowest maintenance, longest life, and lowest cost of ownership. In the ASCO example, they eliminate troublesome dormancy issues with proven, highly dependable T-seal technology, while their solenoid models incorporate the ultra-reliable RedHat® solenoid. (Naturally, ASCO's solenoids are available with electrical approvals from all leading global agencies, including CSA, UL, FM, ATEX, and IECEx.) They provide balanced design for even, predictable flow and flexible setup of pneumatic logic. The low-power version operates with only 0.55 W of power. Options include a non-breathing construction to prevent contaminants from entering the valve, plus a field-selectable single construction for internal and external pilot operation. They are available via fast, accessible online configuration, including 2D and 3D drawing capabilities, plus quick shipping, and are covered with international distribution and support.

Conclusion

Selecting the right pilot valve for offshore applications can be challenging. Specifiers and buyers must consider multiple critical factors, including features of conventional valve supplies that may present problems with dormancy, corrosion, availability, power consumption, design balance, piloting choices, temperature, and service life. Newer models include design elements that address each of these difficulties, promising more efficient and more reliable performance than ever before.

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