

Check Out Valves

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Understand the basics before selecting a solenoid or motor-operated valve for fuel gas and oil shutoff.

For fuel gas service, generally a brass, aluminum, cast iron or steel bodied valve with nitrile rubber sealing is an appropriate choice for maximum life and performance.

Solenoid valves have proven to be the most reliable and cost-effective method for controlling fuel in a range of combustion applications. A solenoid valve is a combination of two basic functional units:

- A solenoid (electromagnet) with its core. This provides the force to change the state of the valve.
- A valve body containing one or more orifices. This portion provides the pressure vessel and sealing to prevent leakage and control flow.

Flow through an orifice is shut off or allowed by the movement of the core when the solenoid is energized or de-energized. The core is enclosed in a sealed tube, providing a compact, leak-proof assembly.

Valves are available in three basic configurations: two-way, three-way and four-way. Two-way valves have one inlet pipe connection and one outlet pipe connection. They are available in a normally open design for fuel gas venting purposes or a normally closed design for fuel gas and oil shut-off purposes. Three-way and four-way valves generally are used to divert flow or to drive a hydraulic or pneumatic actuator. They also can be used as a pilot for a large shutoff valve. For the purpose of this article, I will deal only with two-way valves.

Direct-Acting Valves. Direct-acting valves open the orifice of a normally closed valve or close the orifice of a normally open valve when the solenoid is energized. When de-energized, a spring returns the valve to its original position. Direct-acting valves will operate at pressures from 0 psi to its rated maximum. These valves are suitable for pilot and main fuel lines.

Internal Pilot-Operated Valves. Internal pilot-operated valves normally have a pilot and bleed orifice, which enables them to use line pressure for operation. When the solenoid is de-energized, the pilot orifice is closed and full line pressure is applied to the top of the piston or diaphragm through the bleed orifice, providing the seating force for tight closure. When the solenoid is energized, the core opens the pilot orifice, relieving pressure from the top of the piston or diaphragm via the outlet side of the valve. The line pressure then opens the valve by lifting the diaphragm or piston off the main orifice. Internal pilot-operated valves generally are used as main shutoff valves.

Electrohydraulic Linear-Actuated Valves. These valves provide users with slow-opening and quick-closing operation. When energized with line voltage, the electrohydraulic actuator pumps oil from one side of a piston to another to drive the actuator stem against the valve stem and sealing member to open the valve. When line voltage is removed from the actuator, return springs in both the actuator and valve body cause the actuator piston or stem to return to its de-energized position and cause the valve stem and sealing member to return to its closed position. These valves are important for controlling the flow of fuel to the burner upon initial system startup.

While valve manufacturers can help you understand how a valve will react under typical conditions, it is important to clearly define specific parameters of your application for proper valve selection. These parameters include, but are not limited to, the following: fuel type (gas or oil), fuel viscosity (if oil), ambient and fluid temperature range, pipe size, flow requirement, operating pressure range, voltage (AC or DC), required approvals (UL, FM, CSA, etc.), visual or electrical and visual position indication.

In considering the proper valve for your application, consider the media. Generally, natural gas is compatible with aluminum, brass, cast iron or steel body materials and nitrile rubber for the valve seal material. Natural gas can be applied from very low pressure (inches w.c.) through high pressure (30 psi or greater). Higher gas pressure often is used to reduce the line size of the fuel line and related components. If your application will see ambient temperature extremes, be sure the valve is rated accordingly. Low ambient temperatures such as -40°F (-40°C) require special low temperature elastomers for leak-tight sealing. High ambient temperatures may require Class H coil insulation to ensure reliable operation.

For fuel oil service, generally a brass-bodied valve with Viton sealing is an appropriate choice for maximum life and performance. The Viton elastomers provide a balance of material compatibility and long life. In a fuel oil system, you must consider fluid temperature (as viscosity changes with temperature), pressure and the GPM that you require.

Fuel shutoff valves typically require a third-party agency approval such as Underwriters Laboratories (UL), Factory Mutual (FM) or Canadian Standards Association (CSA). A common UL standard applied to shutoff valves is UL429 "Electrically Operated Valves." FM approves and lists products in the Factory Mutual Approval Guide. A common FM standard applied to shutoff valves is Class 7400 "Liquid and Gas Safety Shutoff Valves." The common CSA standards that apply to shutoff valves are CSA Standard C22.2, No. 139, "Electrically Operated Valves," "Automatic Gas Valves" 6.5 and ANSI Z21.21, "Automatic Gas Safety Shutoff Valves" 3.9. Additionally, organizations such as Industrial Risk Insurers (IRI) and certain other insurance companies do not approve equipment but have standards for equipment that is used in facilities they insure. Conforming to their equipment standards can result in more advantageous insurance rates.

While basic valve design and application have changed little over the years, significant

advancements have been made in power management. Electronic technology has been integrated into new solenoid designs to reduce power consumption from typically 10 W to 2 W. Additional features derived from use of electronic circuits include lower temperature rise resulting in extended life of electrical components, DC operation at AC pressure, and flow ratings as well as built-in surge suppression for coil protection.

In summary, solenoid and electrohydraulic-operated fuel shutoff valves have a proven history and a bright future for those individuals who take a few moments to diligently define their fuel shutoff valve application requirements.

Related Websites

- ASCO www.ascovalve.com