CSA 6.5 C/I Rated Gas Appliance Solenoid Valves & Applications

Whitepaper

By The Engineering Department at PeterPaul

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Contents

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Executive Summary

**This Peter Paul Electronics white paper was developed to provide information regarding the use of electronically controlled solenoid valves in the oil and natural gas industries. Please note that this paper is not meant as a comprehensive technical standard regarding usage and is not meant to provide instruction for nor serve as an instructional document for state and or federal regulatory compliance.*

The oil and natural gas producers, transporters and refiners in North America all face similar challenges with safety issues, ecological issues and regulatory issues as they perform their services of bringing oil and natural gas to the end user. These industries heavily rely on manufacturers and sub manufacturers of their process equipment to develop reliable devices to allow them to perform their tasks in a safe and cost effective manner.

The process of getting oil and or natural gas to the end user is typically described in 5 distinctly different processes.

1 Extraction : Once a producer identifies an oil/gas deposit, a well is drilled and the process of bringing the oil/gas to the earth's surface through the well begins.

2 Separation : When the oil/ is brought to the surface, it will contain contaminants, water, wax or other substances that are not desired in the next stages. Heating is typically required to remove some or all of these contaminants in preparation for transportation to a refinery.

3 Transportation : Natural gas is most often piped to a refinery, oil typically is transported by either truck or pipe. Once again, heating is important to maintain proper flow characteristics.

4 Refinery: Oil is refined to make gasoline and various other petroleum distillates and gas is treated prior to distribution

5 Delivery : The refined oil/gas is then delivered via pipeline or truck to local areas for use.

Our discussion will revolve around processes 1-3 above and the usage, applications and approval requirements for solenoid valves. Also for the purposes of this discussion, a solenoid valve is a valve which is opened by a plunger whose movement is controlled by an electrically energized coil. The valve may be closed by the action of a spring, by gravity, or by an electronically energized coil.

Challenges

In the oil and natural gas industry, most processes and corresponding equipment (e.g. tanks, line heaters, separators, dehydrators, boilers, etc.) used in the production, storage and transportation of oil and natural gas require flow, which in turn often requires pressure and heat. Heating the products helps facilitate and ease the process of flow and in most cases, a burner is used to apply heat to the application.

Because of the remote locations of many wells, tanks and other equipment, the use of burner management systems has become prevalent. Burner management systems use thermocouples and solenoid valves in order to control the lighting of natural gas burners for various heating applications associated with the production of oil and natural gas. Using these automated systems reduces the need for manual monitoring and lighting of systems.

Naturally, applying heat to pipes and or vessels containing flammable materials requires a great deal of caution and therefore devices used for this purpose are highly regulated by various governmental agencies.

In addition many of the materials withdrawn from wells and stored or transported contain substances that are regulated by environmental agencies in their respective countries. These substances are typically referred to as green house gases or GHG. Natural gas is primarily made up of methane, which is considered a potent GHG lingering in the atmosphere many times longer than CO2.

Through the use of burner management systems, fugitive gases are reduced where remote heating is used since the system shuts down gas flow upon upset of the system, only restoring the flow to relight the burner electronically. Reducing methane vented to the atmosphere not only reduces GHG levels but preempts potential carbon offset penalties and taxes.

For the purposes of our discussion, we will concentrate on the safety applications regarding the use of electronically controlled solenoid valves for the U.S. and Canada. It is by use of these same systems that we see opportunities to reduce the amount of fugitive GHG's being dispelled into the atmosphere.

Safety

In North America, there are two primary agencies that certify electronically controlled solenoids for use in various environments, for our purposes we are dealing with hazardous location Specifications and standards, primarily with regards to safety shutoff valves.

UL Listed/Recognized: The UL Mark on a product means that UL has tested and evaluated representative samples of that product and determined that they meet UL requirements. Under a variety of programs products are periodically checked by UL at the manufacturing facility to make sure they continue to meet UL requirements. The UL Marks may be only used on or in connection with products certified by UL and under the terms of written agreement with UL. In addition to these marks, UL also provides access to the marks required in a number of other key world markets. www.ul.com

UL standards that are used to evaluate commercial or industrial gas fired equipment generally fall under these UL numbers:

UL 795 – Commercial – Industrial Gas Heating Equipment

UL 2096 – Gas and /or Oil Burning Assemblies with Emission Reduction

UL 2196 – Field Erected Boiler Assemblies

CSA Listed/Recognized: CSA certification mark indicates a product has been tested and meets applicable standards for safety and/or performance, including the applicable standards written or administered by the American National Standards Institute (ANSI). The CSA mark provides assurance to customers of product quality and performance. www.csa.ca

CSA 6.5 C/I (ANSI Z21.21) *Automatic Valve for Gas Appliances* standard was established to ensure safe operation, durable constructions, and adequate performance for automatic valves used in oil/gas applications. The safe and operational performance is greatly dependent on proper installation and maintenance of automatic valves in the oil/gas system. The automatic valves must be installed and maintained in accordance with *Natural Gas and Propane Installation Code* (CSA 149.1).

There have been many standards drafted by CSA along with other agencies such as NFPA (National Fire Protection Association) and NBBI (National Board of Boilers and Pressure Vessel Board) dictating the certification of automatic valves for us in oil/gas industry. CSA standard B149.3-10 *Code of Fuel Related Components on Appliances and*

Equipment states that any automatic valve used on an ignition system, burner, or safety shut-off train must be ANSI Z21.21 (C/I 6.5) certified.

Environmental

Methane, which is the predominant constituent of natural gas, is considered to be a potent GHG, many times more likely than carbon dioxide to cause heat to be trapped in the atmosphere and will remain for a longer period of time than CO2.

Methane is emitted during all stages of oil production and throughout all processes involved in the extraction delivery and storage of natural gas. Minimizing the release of natural gas, or CO2 which is the constituent left after burning, either through reduction of fugitive gases due to burner flame outs or by the use of pilotless burner systems is both cost reducing and more environmentally friendly.

Applications

Extraction - After oil/gas is located, a well is drilled and production begins (i.e. oil/gas is brought to the earth's surface through the well). Oil often contains a percentage of natural gas, this gas is considered associate gas when it is removed with the oil, non associated gas comes from wells containing natural gas but no oil.

Natural gas is a hydrocarbon which is comprised of two elements - carbon and hydrogen. Crude oil, along with the petroleum distillates derived from it, such as gasoline, all fall into the category of hydrocarbons. It is after the oil/natural gas is brought to the surface that the processes of separating and refining the materials begins.

Separation - When the oil/gas surfaces, the oil/gas is first separated from contaminants (e.g. wax, water, etc.), in preparation for transportation to a refinery. Proper heating is important during this process, particularly in colder climates.

In the separation process at an oil field or well head, a pressure vessel is typically used for separating the liquid, gas and oil components. Heating the mixture will reduce the viscosity of the oil and allow liquids and gases to escape which can then be recaptured and piped to appropriate storage tanks.

Heating of the oil can be done through use of a heated water bath, which is effective but not always practical in most oil field situations. In many cases the heat is added either by direct or indirect heating through the use of natural gas fired heaters.

Once again, heating the products throughout the process allows for increased flow and ease of movement, particularly of the heavier oil components of the mixture. Many systems are available such as tank heating systems and line heaters for accomplishing this. Solenoid valves are used in these systems to control the flow of gas used for heating and for safety shutoff purposes, primarily in burner management systems which electronically control the amount of heat applied to the process.

Higher demand for natural gas in the past 30 years has made the capture and use of natural gas vented from wells more economically attractive. The gas can be used for sale at the point of capture, re-injected into the well to increase pressure and therefore increase the flow of oil through the well, or shipped for further refinement. Prior to the increase in demand, the gas was burned at the point of capture in a process called flaring, which is now illegal in most countries.

Some gas fields yield sour gas containing hydrogen sulfide (H2S). Sour gas refers to any gas that contains hydrogen sulfide in significant amounts, typically a gas is considered to be sour if it contains more than 5.7 milligrams per cubic meter. This designation can vary based upon state, country or agency standards.

These higher levels of hydrogen sulfide render the gas toxic as well as highly corrosive when mixed with water. Before natural gas containing hydrogen sulfide can be used, the raw gas is treated therefore reducing the unwanted impurities

to acceptable levels. This is accomplished via an amine gas treating process and the hydrogen sulfide removed is converted to sulfur or sulfuric acid. Any solenoid valves used in this process must meet NACE standards.

Solutions

A properly engineered burner management system can improve oil and gas industry safety, efficiency and regulatory compliance issues.

Safety –

- Can reduce on site injuries by automatically relighting burners, eliminating the need for manual relights.
- Reduce the reliance on gas detector units
- Reduce Human Error through integrated sensors and systems
- Automatic High Temperature Shut-Down
- Automatic Loss of Flame Shut-Down

Efficiency –

- One Button Burner Re-Ignition
- Centrally Control Ignition Sources at all times
- Run Status / Alarm Output
- efficiently managing your process so fuel is burned and process heat is generated only when the process requires it
- Eliminate the costs of using contracted burner lighters
- Reduced Fuel Gas Use

Environmental/Regulatory Compliance

- Utilizes pilotless and no standing pilot systems, no constant burning of gas and subsequent CO2 emissions
- Gas shutoff system prevents uncontrolled venting of gas during flame outs
- Monitor run times for verification of compliance
- Reduce Carbon Tax Exposure

Peter Paul Electronics manufactures a comprehensive line of automatic safety shut off solenoid valves designed specifically for broad temperature ranges. These valves meet the standards for Commercial / Industrial Safety Shut-Off Valves (C/I) per ANSI Z21.21 CSA 6.5. They are well suited for use in heating equipment, furnaces, ovens, kilns, boilers, gas generators, incinerators, flare stacks, oil batteries, tank heaters, line heaters, etc.

The Peter Paul C/I rated safety shutdown valves come standard with the following features:

- Hazardous Location, explosion proof (Class I, Division 1 Groups C and D, Class II, Division 1 Groups E, F and G) approved. Temperature code T3C.
- ANSI Z21.21 CSA 6.5 C/I certified
- NEMA 4 solenoid coil for outdoor usage
- Wide ambient operating temperature range from -40°C to +65°C
- Low power draw of 1.8 watts which is ideal for locations where power is limited
- Availability of three popular voltages; 12 VDC, 24 VDC and 120 Volts/60 Hertz AC
- Operating pressure differential of 3 – 30 psi (pilot-operated)
- Availability of high flow capacity sizes
    - ¾” NPT – 5.8 CV (3,375,000 BTU/Hr capacity)
    - 1” NPT – 13 CV (7,575,000 BTU/Hr capacity)
    - 1 ½” NPT – 29 CV (16,875,000 BTU/Hr capacity)

Our newest addition to the line – 1/4" NPT

- Body is made of stainless steel
- Potted coil for outdoor service
- Voltages: 120/60, 12/DC and 24/DC
- Power Input: 7.3 watts AC, 9.5 watts DC
- Rated for ambient temperatures of -40°C to +65°C
- 1/4" NPT threaded connections
- Gas Capacity: 400,000 BTU/hr
- CV Factor: .404
- Pressure rating: 0 to 50 psi (direct-lift)

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