Valves Solve Seawater Problems

JACK F. BOWEN
Engineering Specialist, Fire and Gas, VECO Alaska, Inc.

Figure 1. OCV Red Valve – shows two gauges.

FROM THE SIMPLE to the most complex, the purpose of valves is to provide control of fluids flowing within a system. Valve operating systems range from the simple open-close handle to electric, pneumatic, or hydraulic systems.

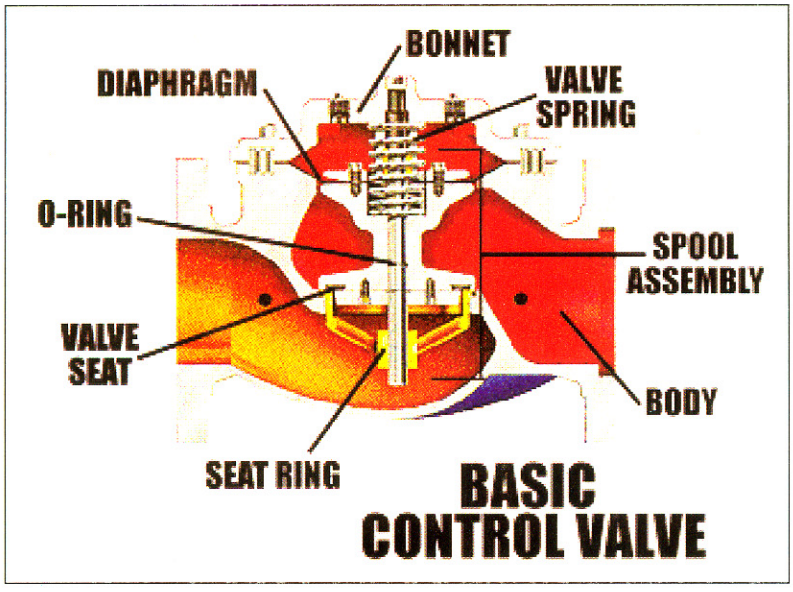
Valves operate either on or off (opened or closed), or somewhere in between. A simple fireplug is nothing more than a valve that controls flow of water to fight a fire.

Valves can also be equipped with all sorts of "bells and whistles" that cause the valve to operate at various stages between on and off as a result of pressure changes, temperature, time, or other factors. Correct application of any valve requires defining the specific purpose or function of the valve, sizing it to the operating conditions and selecting the materials of construction to the conditions and fluid. The use of valves in a salt-water environment or in piping with another corrosive product presents special challenges to the engineer and valve manufacturer.

Veco Alaska, an engineering contractor and consulting firm, faced this challenge recently when looking for valves to use in fire protection systems in Alaska. The fire-fighting agent was salt water. Veco was designing and installing fire protection systems at an oil recovery facility in Valdez, and at an oil production facility on NorthStar Island, a man-made island in the Beaufort Sea at the North Slope. Both systems would work "on demand" without human intervention.

The valves were to be installed on the discharge side of fire pumps taking water directly from the sea. Their purpose was to keep the fire system piping isolated from salt water until it was needed. This piping system would be filled with fresh water and charged to a pressure that would keep the valve closed. When the pressure on the discharge side drops, the valve opens, allowing 100 psi seawater from to the fire main to flow into the fire system. After the fire is extinguished, the fire system would be flushed with fresh water and charged, closing the valve and placing the system in standby.

Figure 2. Drawing cutaway of valve.



These valves, always subject to salt water and its corrosive effects, could leak unless protected. Industry standard materials range from cost effective, readily available ductile iron and cast steel to costly, special order alloys like nickel-aluminum-bronze or duplex stainless steel

With this problem in mind VECO worked with OCV Control Valves of Tulsa, and found a solution. Involved in the design, engineering, manufacturing and application of specialty valves for the past 50 years, they suggested the application of an epoxy coating that is resistant to saltwater corrosion, as well as to corrosion caused by refined petroleum products, sour crude and other acidic compounds. These coatings have elastomeric properties that allow expansion and contraction within a wide temperature range. Following rigid application steps, they have

Figure 3. Aerial view of NorthStar Island. *Pic: Jack Bowen © BP*

found these coatings to be durable for in excess of 15 years.

At Valdez, a new fire protection system was installed in a facility where oil is recovered from the ballast water used in tankers. Underground seawater fire mains feed the fire protection system. Three 6,000-gpm diesel driven pumps supply seawater from Prince William Sound at 275 psi to the entire Valdez terminal.

The control valve used here, and shown in Figure 1, is an OCV Series 127 pressure reducing flow control valve that controls water supply to the building sprinkler system. It controls flow and reduces the 275-psi supply pressure to 100 psi and sustains that pressure and flow in the fire system. Should the seawater fire main pressure

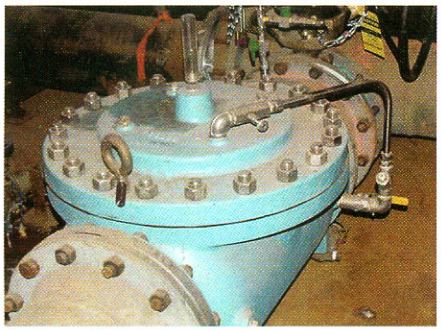


Figure 4. Blue Valve.

vary, the valve modulates until the pressure is correct. The valve seat is part of a spool assembly that opens and closes hydraulically. A diaphragm senses pressure changes and activates the valve seat, adjusting it as necessary so that preset pressure and flow are maintained. Figure 2 shows the internal workings of the basic control valve.

At the production facility on the man-made NorthStar Island in the Beaufort Sea, shown in Figure 3, a different type of control valve is used. Twelve-inch Diaphragm Check Valves are placed on the discharge side of the fire pumps that supply fire protection water taken from the Beaufort Sea to the island fire system. Shown in Figure 4, these valves have the same innerworkings of the Series 127 valve and are designed to open when inlet pressure exceeds discharge pressure on the fire system side. Should pressure reversal occur, internal control tubing carries back pressure to the bonnet, forcing the valve to close. The valve seat operates hydraulically. Like in the Series 127 installation, the fire system remains charged with fresh water. When the pump starts, and pressure in the valve exceeds fire main pressure, the valve opens. Another 12-inch valve, shown in Figure 5, is an angle valve that provides pressure relief for the fire pump. When the water supply exceeds the demand, this valve releases it back to the ocean. Elsewhere in this system are 3" and 2-$^1/_2$" inch Series 127 valves regulating fire system pressure at 150 psi. All have the epoxy coating.

Veco used these Control Valves because they were of high quality, meeting UL and FM standards for fire protection, and the delivery time was acceptable to their working schedule. The engineering staff worked with Veco engineers to make sure that the valves met all of the requirements of the application.

About the Author

Jack Bowen has worked with fire protection systems for the past 34 years, the last 11 of which have been in the oil business in Alaska. He has extensive experience in the design, testing and certification of high and low pressure CO_2, foam and chemical systems, and has worked in a number of industries, including high rise buildings, research facilities, nuclear power, data processing, and schools, as well as the petroleum industry. He attended Kearney State College in Nebraska and various fire protection seminars and training sessions. He holds Alaska State Fire Marshal permits IC, IIC and IIIC as well as NICET certifications. Please contact him at jack.bowen@veco.com

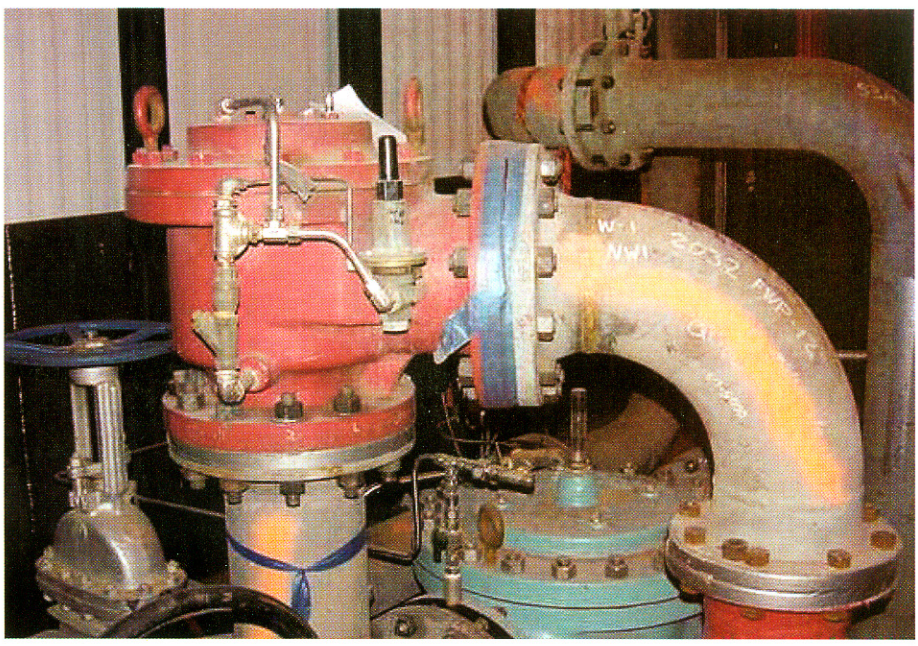


Figure 5. Another red valve. This is an angle valve.