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The Severe Service Journal is published quarterly by the Emerson severe service team and is distributed by email. To subscribe, go to www.FisherSevereService.com. The Emerson severe service team provides global customers with Fisher® severe service control valve solutions. Whether it is severe service applications for the power, hydrocarbon, chemical or pulp and paper industry, these technical experts deliver sound solutions to address critical applications for aerodynamic noise, cavitation and out-gassing issues, as well as particulate erosion. Please visit our website or contact your local Emerson sales office for more information.

Control Valve Erosion Solutions

Erosion is defined as the gradual reduction and weakening of control valve bodies or trim components due to severe process conditions including dirty process, flashing, cavitation, and outgassing as described below.

- **Dirty processes** may contain abrasive particulate such as sand or rust that can "eat away" at control valve bodies and trim components. These types of particulate are common in oil and gas production.
- **Flashing** occurs when the pressure of a fluid falls below its vapor pressure, changing from a liquid to a vapor. During this process small vapor cavities form that grind away at the outlet of the control valve and its trim components. Flashing damage is marked by shiny, smooth gouges in material.
- **Cavitation** is very similar to flashing, but with one exception, the fluid pressure recovers to a pressure that is above its vapor pressure. This causes the previously-formed vapor cavities to implode, producing impinging jets that have the potential to cause severe erosive damage. This type of damage is marked by rough gouges in material.
- **Outgassing** is a very fast, hard-to-predict phenomenon that occurs when the pressure of a fluid drops below the saturation pressure of a dissolved gas. Once this point is reached, the gas separates from the solution and produces high velocity, erosive vapor droplets. Outgassing is evident when the liquid and gas exiting the control valve have dissimilar molecular weights.

Proper selection of control valve body and trim materials is the first step in combating erosion-related damage and could mean the difference between an unplanned shutdown and continued operation.

Materials with high chromium and molybdenum content such as Alloy 6 and Ultimet® (Haynes International) generally provide increased resistance to erosion and wear. Hardened stainless steels including S17400 and S41000 provide excellent hardness and durability for use as trim materials. For the most severe applications, Fisher® control valves can be outfitted with 'Very Tough' Ceramic (VTC) or tungsten carbide trim components, which provide superior erosion and wear resistance.

Emerson Process Management provides several innovative control valves designed to combat erosion and provide long-lasting performance. Contact your local Emerson Process Management sales office for more information or for a quote.

Fisher® 461 Sweep-Flo Angle Valve

Fisher® Dirty Service Trim (DST)

Fisher® Dirty Service Trim for Outgassing (DST-G)

FISHER® Severe Service

EMERSON™ Process Management

Solution for Mining Industry Seawater Application

Seawater can be a difficult application if control valves and materials have not been appropriately specified.

Due to the lack of water in the northern part of Chile, a mining operation needed to pump seawater from 145 Kilometers away at an elevation of 0 to 2,300 meters above sea level for use in their process. To do this, they constructed a 38” pipeline that included four intermediate pump stations with tank level control at each station.

Butterfly valves and ball valves were selected by the mining operation for this application because of their high capacity. They contacted INECO, the Emerson Process Management local business partner for the region, and asked for a quotation.

INECO personnel recognized that rotary valves would not be a good fit for the seawater application with cavitation, noise, and vibration problems. So after evaluating different options, INECO quoted a long-term solution using globe valves instead of the rotary valves. They submitted a quote that included Fisher® NPS 24x20 large easy-e™ globe valves with duplex stainless steel bodies and trim material. These globe valves were four times higher in price, but the mining operation accepted.

INECO coordinated with the Fisher special products group, metals and mining industry group, and manufacturing group in Marshalltown, Iowa, U.S., to manufacture the highly technical solution and deliver the Fisher large easy-e valves in 26 weeks as requested by the mining operation.

Since startup through the date of this publication, the mining operation in northern Chile has been very satisfied with its installation of Fisher large easy-e valves in their seawater application.

Your Emerson Process Management sales office understands severe service problems and can provide solutions to control them; even the most unusual of problems can be solved.

Erosion/Corrosion Phenomena

Erosion/corrosion are high-velocity process conditions in which a metal's protective, passive layer is "washed off" the surface, allowing the base material to corrode. The synergistic effect results in very high rates of attack.

Erosion/corrosion are common phenomena that can occur in nearly any industry where corrosive fluids are present and are flowing with some velocity. Thin pipes, blown out elbows, and eroded control valve bodies are often the result.

Various industries refer to these problems with different terms but the cause and the solution are generally the same. For instance, in the power industry, erosion/corrosion are often referred to as Flow Accelerated Corrosion (FAC). FAC is a common problem due to improper water chemistry that results in magnetite-related issues in control valve bodies, piping, and boiler tubes.

In control valves, erosion/corrosion problems are exhibited in a variety of ways. Sometimes, valve bodies are washed away as can been seen in Figures 1 and 2. Other times, problems result in trim damage as seen in Figure 3.

Generally, erosion/corrosion can be controlled by changing the materials of construction to ones that are more corrosion resistant and compatible with the fluid. An example of this would be replacing a carbon steel body with 316SST.

Other times, changes to the control valve design may produce the best results. This is commonly seen when upgrading a Fisher® Cavitrol™ III trim set to utilize Protected Inside Seat technology. With this design change, the seating surface is moved to the inside of the plug where it is protected from the high velocities that can occur in between the plug and cage. The outcome is long-term shutoff without the damaging effects of erosion/corrosion.

Whatever the cause of your erosion/corrosion issues, Emerson Process Management has the expertise and solutions to solve your difficult problems.

Figure 1

Figure 2

Figure 3

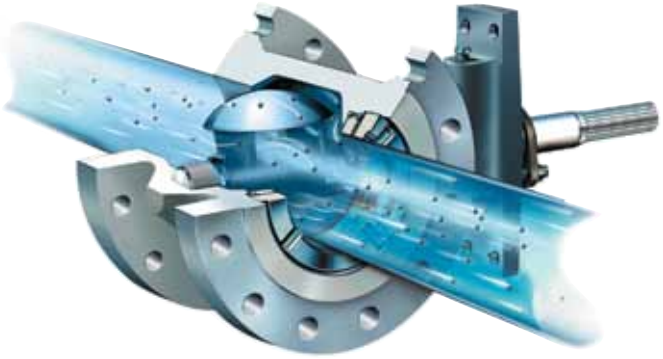
Valve Trim Erosion Eliminated in Level Control Valve

A stabilizer feed drum inlet level control valve was causing frequent disruption to a refinery's operation and impacting efficiency due to severe erosion of the valve trim.

Before oil can be shipped from an offshore platform for sale or for production, impurities such as water and gas must be removed by means of a separator. During this process the oil is floated on top of a column of water, which is controlled by a level control valve, allowing the oil to runoff into another section of the separator to be collected by a second level control valve. Level control valves in this type of application can be exposed to the effects of severe flashing, outgassing, and associated erosion and vibration.

The refinery approached Emerson Process Management for a solution to address their problems with valve trim erosion. Emerson Process Management evaluated the application and recommended using an NPS 2 Fisher® V500 rotary control valve with a reverse direction of flow and a chrome carbide internal body coating to prevent valve body and trim erosion.

The Fisher V500 rotary control valve allows the process to move directly through the valve in a straight-through flow path, which locates the vena contracta safely downstream of the valve. Locating the vena contracta



away from the valve body and trim components greatly reduces the risk of damaging erosion caused by flashing.

The overall rugged design of the Fisher V500 rotary control valve helps to ensure optimal resistance to erosion. The valve body in this application was coated with chrome carbide and the plug made from 'very tough' ceramic. The innovative eccentric shape of the plug also allows for minimal contact with the seat ring, resulting in reduced friction and wear.

Since installation through the date of this publication, the Fisher V500 rotary control valve has operated smoothly without significant trim erosion, as previously experienced with the original valve.

For more information on severe service solutions, visit www.FisherSevereService.com.

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