Question 23: In continuously regenerated reforming units, are there valves in cyclic service that have demonstrated superior performance compared to the originally installed valves? How can maintenance of these valves have an impact on their longterm performance and reliability?

PATEL (Valero Energy Corporation)

The major issues with some of those originally installed ball valves in CCR cyclic service are packing leaks. Hydrogen leaking into the atmosphere causes small packing fires. All too often, these failures cause process interruption and frequent ball valve changeouts. Repair and replacement create a situation that places personnel and others in danger. Our licensor dropped the old ball valve vendors from the approved vendor list.

There are better performing walls in the cyclic service that provide longer life and better reliability: the common failures experienced in the older design. All of those styles are minimized due to their superior design in the areas of packing seal and coating of the stem, which handles the frequent cycling. The detailed specification of these walls and approved supplier list, as well as their installation and the testing procedures, can be found in the licensor process specifications.

We changed eight of the old-design ball valves. They were replaced with the licensor-approved double-seated ball valves. Six were in hydrogen service and two in nitrogen service. The reason for the upgrade was poor MTBF (mean time before failure) due to numerous packing fires, leaks, and seating problems. Those valves were also removed from the licensor approved list.

After initial installation, we had to make few modifications. We had to install a stronger ball valve actuator. We had to change out the packing and lubrication because they were designed for the temperature that was specified in the original valve spec. We were not reaching that temperature. After addressing those issues, we have not had any incidents with the packing fire in the last two years, and the internal leak problems are also at minimum.

KEADY (Technip)

A gentleman I know was an Operations engineer at a client startup. He said that one of the units he worked on had issues with some of the original valves. There was wear and leakage after only a brief number of cycles, and the client had all sorts of trials with other valves and materials, including ceramics. Eventually, the client sorted out the problem, and then it became less of an issue. We do have a client in India who did not have problems with the ball valves on the CCR platform where this has been for 10plus years.

FRY (Delek Refining)

All I can add is that we use a metal-seated ball valve in our service, and it is generally reliable.

ALMA SCHURIG (Big West Oil)

We see some extreme cycles in the valves in our reformer, which uses a unique catalyst regen system (CycleX). One of the issues that we experienced, which has not yet been discussed, is that, in addition to the valve selection, we had some fairly severe piping stresses that were put on these valves just due to the piping configuration. We installed some expansion loops in the piping, and it helped a lot. We also went through several rounds trying different valve manufacturers and valve types. We have had best success with Argus metal-seated ball valves and good success with Everlasting metal-seated disc valves. The combination of piping modifications and improved valve selection has helped us quite a bit.

WAYNE WOODWARD (Valero)

With respect to the maintenance, a point lost on the turnaround folks is that you commonly pull all of these lock hopper valves (20, 30, or 40 of them) and have them serviced, and then they come back to the unit. The metal balls and metal seats always leak. If you ask your instrument man if the valves passed a bubble type of test, he will say, “Yes, it did.” Well, brand-new valves leak. My point is that you need to do the right leak check in the maintenance cycle on these valves. A brand-new valve fresh from the factory leaks 10% of allowable. Talk with your licensor about the leak check and its limits and understand that all metal-seated ball valves leak. You will need to do the leak check correctly to ensure that the valves only leak an acceptable amount. You also need to know that you are installing valves fit for service after you have done your turnaround.

GRAHAM NEWMAN (Emerson Process Management)

From the question, it is not clear which style of valve in cyclic service is of the highest interest. There are two types of cyclic services that are specific to the CCR process, each with different requirements and potential pitfalls. There are on/off valves in vapor service with catalyst dust, such as those that vent the lock hoppers, and the on/off valves in flowing catalyst service, such as those used for catalyst flowing in and out of the lock hoppers. The on/off valves in the dust-laden vapor flow require tight shutoff and the capability to withstand the erosive effects of flowing catalyst. Early solutions to this application used a complicated plug design which involved moving parts and springs exposed to the process fluid, which often became jammed due to catalyst buildup. This additional complexity often meant that regular maintenance could not be performed onsite for these valves; they had to be sent back to the factory. Fisher’s EZ-OVT design solved these issues by using a valve plug with no moving parts, using a dual seal and a deflector ring to keep erosive flow away from the soft sealing surface of the plug that provides

the tight shutoff. This extends the operating life of the valve between service intervals. The soft components that are in contact with the process fluid are entirely replaceable, including the soft material in the plug which provides the tight shutoff. Maintenance procedures are almost identical between the EZ-OVT and the standard Fisher EZ, and the majority of the valve's components are common to the regular EZ. This ease of maintenance and lowered parts consumption reduces these valves to a standard maintenance item at turnaround time rather than a valve that needs special attention.

The challenge for control valves in flowing catalyst service in the CCR section is to avoid damaging catalyst as much as possible when the valves close against the downward flow of catalyst. A segmented ball valve with a clearance gap between the ball and seal is specified. This clearance minimizes catalyst from being crushed between the ball and seal when the segmented ball rotates during valve closure, which would increase catalyst attrition. The segmented ball valve with clearance gap is specified for units that operate the regenerator close to atmospheric pressure. For more current designs, the regenerator operates at the fuel gas header pressure, typically around 35 psig. The same concerns about crushing catalyst apply in the pressurized units, with the additional requirement that the control valve provide bi-directional shutoff capability. For these services, a segmented ball valve with a zero-deflection seal can provide shutoff without excessively damaging catalyst during valve movement. Fisher has seen success using another variant of the Fisher Vee-Ball™ line, the SS-252B, which includes these design features. These valves are not in a high cycle service but typically only close during abnormal operation, which also minimizes catalyst damage.

GINGER KEADY (Technip)

The original UOP CCR used Hills McCanna ball valves, and there were issues with wear and leakage after only a brief number of cycles. There were trials using other valves and materials including ceramics. Eventually, the valves became less of an issue.

We have an Indian client that has had no problems with ball valves on its CCR platformer which has been in service 10+ years.

Tags

Catalysts

Hydrogen

Reforming

Reliability

Year

2015