COKE DRUM ISOLATION VALVES

Introduction
Coking is severe thermal cracking. High feed temperature and rapid transfer velocity will postpone the formation of solids, referred to as coke, until the feed reaches an insulated tank called the coke drum. In order for the process to be effective, the valves and other equipment that the feed passes through must not decrease its velocity. Metso Automation manufacturers valve designs ideally suited to this specific service and many others encountered in the delayed coker process.

The Process
After a short time in the coke furnace, heavy residuum at 510 °C / 950 °F and 4-7 bar / 60-100 psi, is charged at high velocity to the active coke drum. Downstream of the coke heater, the feed passes through a heater isolation valve, followed by the 4-way switching valve, and finally through a pair of coke drum isolation valves.

The coke drum isolation valves are required to flow and isolate in both directions. When the coke drum is active, the pair of valves is open to admit the charge. When the drum becomes inactive for decoking and cleaning, this isolation valve must allow for the flow of steam, water and coke in the reverse flow direction. This fluid is
the result of the decoking process and is abrasive in nature. Fluid is then removed from the system through the coke drum drain valve. At the same time, the second coke drum isolation valve must isolate to prevent the back-flow of decoking slurry to the 4-way switching valve.

**Valve Selections**

This is a very challenging application due to the variety of fluids and service parameters. The valve must handle high pressure, heavy residuum at an elevated temperature (510 °C / 950 °F). The fluid is also prone to heavy coking at this temperature.

Two valve designs commonly found in coke drum isolation service are wedge plug and wedge gate valves. Both of these designs present problems when applied to coke drum isolation.

Wedge plug designs require the plug to lift out of the seat, rotate to the open or close position and drop back into the seat. Experience shows that coke accumulates between the wedge plug and body during operation. This may cause improper reseating, resulting in unacceptable seat leakage. Also, if improperly purged, coke accumulation on the wedge plug while the valve is closed can cause it to jam in this position.

Wedge gate valves open by withdrawing the gate up from the seat and into the bonnet. In this position coke accumulates on the seats and body recesses, making it nearly impossible to properly reseat the gate. This results in unacceptable seat leakage. Also, while the gate is drawn up into the bonnet, it is at a lower temperature than the body. The cooler gate is then pushed into the hot seats when required to close. Hot process fluid is stopped and the body begins to cool, while the gate is conducting heat away from the body and expanding. This results in the wedge gate becoming jammed in the closed position.

**Valve Solution**

Metso Automation’s solution is the MBV Series in ANSI class 300 or 600 full port ball valve. The full-bore design is desirable because of its ability to pass the maximum amount of flow with the minimal decrease in fluid velocity and residence time inside the valve. This minimizes the tendency for the fluid stream to coke in the valve. The erosion resistant chrome moly body (typically A217 C5 or A217 C12) is capable of providing long service life in process conditions of heavy residuum at 510 °C / 950 °F and 7 bar / 100 psi. Massive solid Stellited seats are mechanically loaded to the ball by Inconel 718 convoluted “E” type springs. The loading is set to allow the efficient removal of coke deposits from the ball surface, while presenting the lowest possible required torque to the actuator. This allows for long service life, smooth valve operations, economical actuator selection and reliable tight shutoff.
A steam purge system is required for proper operation of the coke drum isolation valves. The purge system keeps the critical areas of the valve flushed free of the coking fluid stream. Purged areas include the seat energizers inside and outside diameters, the body halves and the packing gland/bearing area. Metso Automation recommends that the purge system be set to a pressure 1.4 bar / 20 psi greater than the process pressure and be operational at all times.

**Conclusion**
With over 25 year of experience, the series MBV isolation valve is another example of Metso Automations commitment to technological leadership through design excellence. With our enhanced steam purging system, current installations have exhibited an extended service life of greater than 5 years. What’s more, Metso Automation Service Centers can efficiently refurbish these isolation valves, furthering your return on investment.