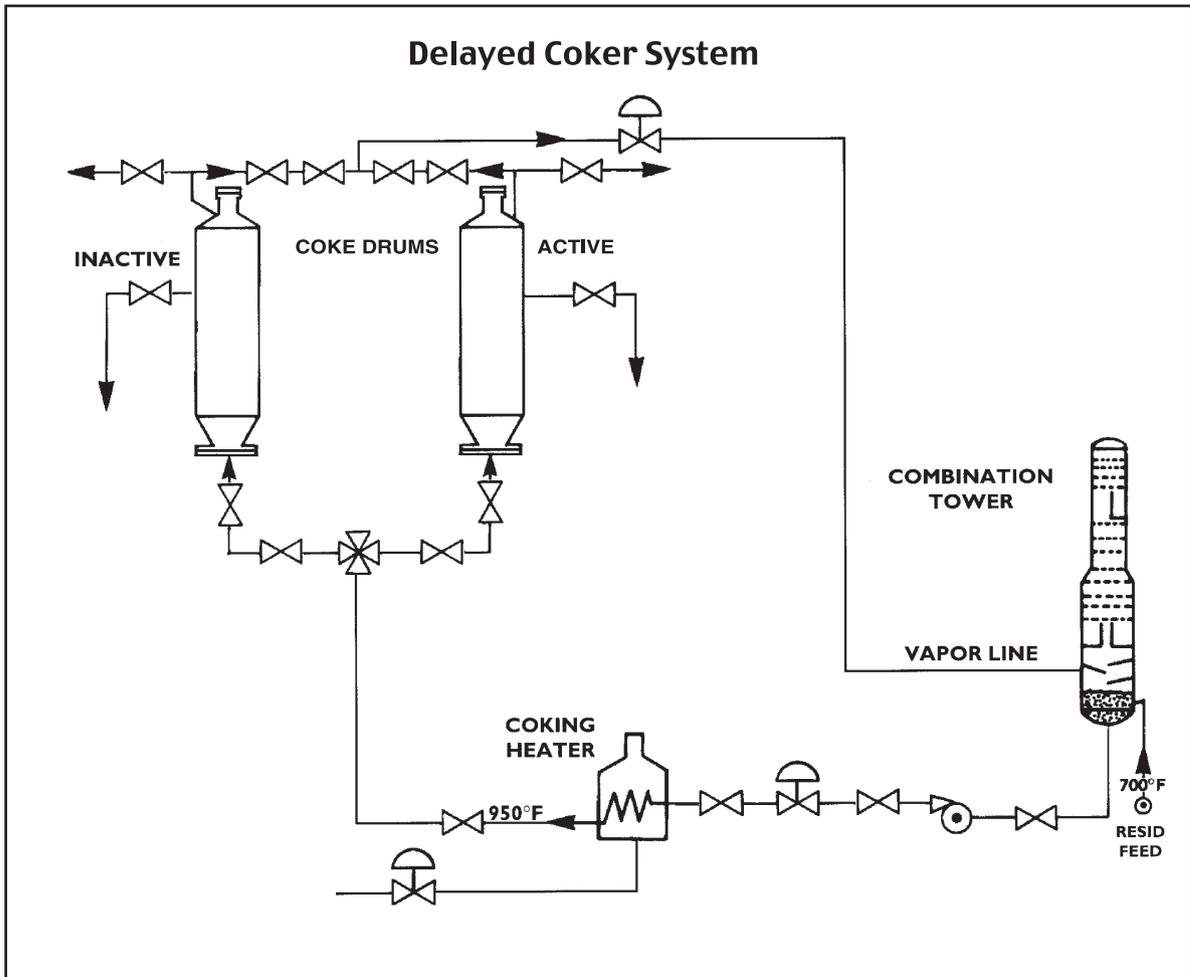


# Coke feed control & isolation valves



## Introduction

The function of a delayed coker is production of clean transportation fuels from heavy “bottom of the barrel” crude oil. Early refinery cokers experienced severe thermal cracking of residuum that resulted in deposits of unwanted coke in the heaters. Constant cleaning and decoking requirements of these early designs caused them to be uneconomical to operate.

Modern heater designs make it possible to rapidly raise the temperature of the residuum above

the thermal cracking temperature (the coking point) without depositing coke in the heater itself. Provision of an insulated drum downstream of the heater, so that coking takes place after the heater but before subsequent processing, results in the name “delayed coking”.

The elevated process temperature and potential for the sudden formation of solid coke present significant application challenges. Metso Automation manufactures several designs that meet the challenge of delayed coker service.

### The Process

The delayed coker is comprised of four main sections; feed, coking, fractionating and decoking. Focus here is on the feed section.

Typical feed to the delayed coker is either heavy residuum (heavy resid.), drawn from the bottom of a fractionator or vacuum residuum (vacuum resid.), drawn from a vacuum flash tank. Feed is pre-heated to approximately 371 °C / 700 °F by contact with gas oil in the fractionator. It is then mixed with recycle oil and pumped to the coke heater by the heater charge pump. The charge pump increases feed pressure from 2,4 bar / 35 psi at the exit of the fractionator to between 10-14 bar / 150-200 psi. The ultimate feed pressure is a function of the particular delayed coker design being used.

### Valve applications

There are four critical valve applications between the bottom of the fractionator and the coke heater.

- 1. Tower bottoms and charge pump isolation valve.** This valve is called upon to provide reliable tight shutoff (Class V) during feed pump maintenance. Process conditions at the valve are 382 °C / 720 °F at 2,4-3,5 bar / 35-50 psi heavy resid.
- 2. & 3. Heater flow control isolation valves.** These valves must effectively isolate the heater flow control valve during maintenance. Typical process conditions are 382 °C / 720 °F heavy resid. The process pressure at the point would be pump discharge pressure that can range 10-35 psi / 150-500 psi, dependent on the specific delayed coker design
- 4. Heater flow control valve.** This valve must accurately regulate the flow of feed to the coke heater. The heater flow control valve must have wide rangeability for handling low flow during start-up and full flow during normal operation.

### Valve solutions

Construction for these four applications is the Metso Automation model X-MBV.

The full-bore metal-seated design is desired to achieve both the high flow and Class V shutoff requirements of isolation service. The series X-MBV also exhibits the high rangeability (100:1 to 300:1) required for control service. The full-bore design reduces fluid turbulence and minimizes residence time of the fluid in the valve body, while insuring the highest possible flow rate.

Typical process conditions of 382 °C / 720 °F at 10 bar / 150 psi permit the economical choice of carbon steel as a body material. Hard chrome plate electro deposited over a 316 stainless steel substrate has a material hardness of HRC 68 to 70. This presents a surface that is resistant to wear by abrasion and galling as well as providing low friction surface. This promotes smooth interface of the seat while exhibiting the lowest possible torque. A surface finish of 8 to 12 RMS minimizes the adhesion of the deposits on the ball surface and facilitates their removal by the scraper seat. Metso Automation "H" style Celsit 50 NB seats mechanically load to the ball via Inconel 718 seat spring. This configuration allows the seats scraper profile to remove surface deposits, while providing bi-directional shutoff.

### Conclusion

The versatile, rugged Metso Automation series X-MBV is the ideal choice for applications in the delayed coker feed system. Metso Automation also offers a line of actuators and instrumentation to meet specific design requirements.

The information provided in this bulletin is advisory in nature, and is intended as a guideline only. For specific circumstances and more detailed information, please consult with your local automation expert at Metso.

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