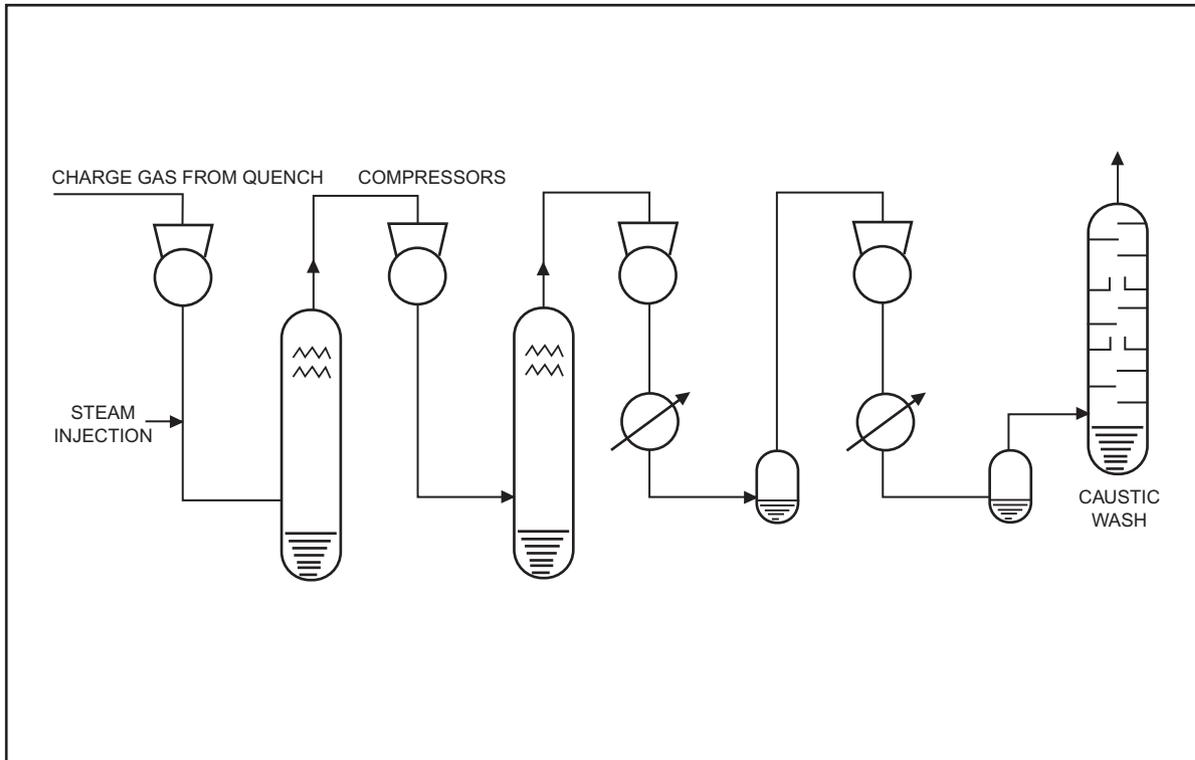


Compressor Anti-surge



Introduction

Compressors are used in many different locations in the ethylene plant, for example:

- Gas compression and drying
- Fractionation and distillation
- Product storage

They are used, for example, to compress the cracked gas before the fractionation stage, compress the purified gases for storage, or simply to supply plant air.

The Process

There is a minimum capacity for each compressor, at every speed, below which the operation becomes unstable. This instability is accompanied by a characteristic noise known as pumping or surge. The instability occurs when the pressure at the outlet of the compressor is higher than that produced by the compressor, this causes the flow to reverse momentarily. However, the reduction of flow causes the discharge pressure to drop, and the flow returns. This is referred to as surge. The resulting violent oscillation of gas pressure can cause severe and costly damage to the compressor in a few seconds.

In order to avoid this, a by-pass valve is installed between the discharge of the compressor and the inlet. When higher pressure at the outlet is detected, the valve opens fully, usually in less than one second, to dump the pressure onto the inlet side. The valve must:

- ❑ Pass approximately 100% capacity of compressor
- ❑ React quickly, usually in less than one second
- ❑ Handle a high pressure drop

Another function of the bypass valve is to recirculate the flow during startup, or when less gas is required.

At the beginning of the startup, the compressor outlet is isolated from the downstream process. Before the compressed gas can be allowed downstream, a specific head pressure must be achieved. For this, the compressor bypass valve is fully open, allowing initial compressor rotation with minimum power consumption. After the outlet pressure reaches a predetermined level, the compressor discharge valve is opened, to allow the gas downstream. The by-pass valve is gradually closed, and the system runs normally.

Process conditions: Variable

Application demands

- ❑ High capacity for quick reaction and most efficient functioning
- ❑ Noise and vibration reduction, because of high pressure ratios and volumetric flow
- ❑ Tight shutoff, to avoid energy loss in the system
- ❑ Quick opening, to prevent surge during rapid upsets
- ❑ Robust construction, to handle extreme service conditions

Valve recommended

Metso Automation experience shows that the Q-Ball® noise reduction trim, installed in Metso Automation rotary valves, provides full control performance even during different flow conditions. Many anti-surge and recycle control systems have been equipped with Metso Automation Q-Ball valves.



Metso Automation X-MBV ball valve

Features and benefits

The benefits of the Q-Trim™ in anti-surge and recycle applications are:

- ❑ The best control and stability is provided by the installed linear flow characteristic. Linear installed characteristic is achieved with an inherent flow characteristic between linear and equal percent.
- ❑ Noise and vibration due to pressure drop are reduced with Q-Trim, taking pressure drop by stages through perforated plates.
- ❑ Quick response required to react to surge conditions is achieved with high capacity of ball valve.
- ❑ Valve response is improved by double acting piston actuators, and appropriate instrumentation (boosters, etc.) to achieve quick opening (1-3 seconds or less).
- ❑ Elimination of energy loss due to valve leakage with tested tight shutoff.
- ❑ Material requirements for specific ethylene plant applications can be fulfilled. Fire safe constructions are available.
- ❑ Nelprof sizing program assists with valve layout, and makes possible a study of pipe reducers, further noise attenuating diffusers, as well as installed performance diagram and valve capacity.

Features of the valve

Valve Type: X-MBV, with Q-Trim Metso Automation piston actuator

- Full bore, metal or soft seated ball valve
- ANSI 150 or 300, DIN PN 10-40
- Flanged construction
- Carbon steel or stainless steel body
- Stainless steel trim, with pressure reducing Q-Trim
- Double acting piston actuator, with accessories

Alternative solutions

- For higher pressures, the Q-T5 can provide ANSI 600 ratings. The robust construction achieves the pressure drop and load resistance to handle extreme conditions.
- For lower pressure compressors, mainly high-flow axial type, Neldisc® eccentric disc butterfly valves are an economic and effective alternative.



Metso Automation T5 ball valve

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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