

**Achieve greater olefins yields  
with dependable process control.**



## **Control Valves for Olefins Production**

Leverage Emerson's Fisher™ control valves to improve the throughput and reliability of your olefins facility.





Olefins economics are driven by petrochemicals prices, feedstock costs, product yields, and consumer demand. Traditional feedstocks have included heavier feedstocks including gas oil, naphtha, liquefied petroleum gas (LPG), propane, and butane.

Today's availability of non-traditional feedstocks including ethane, propane, and butane from natural gas liquids (NGLs) has led to cost-advantaged olefins production with higher ethylene yields. Because of this, unprecedented capital spend is occurring to debottleneck existing plants and to build new facilities.

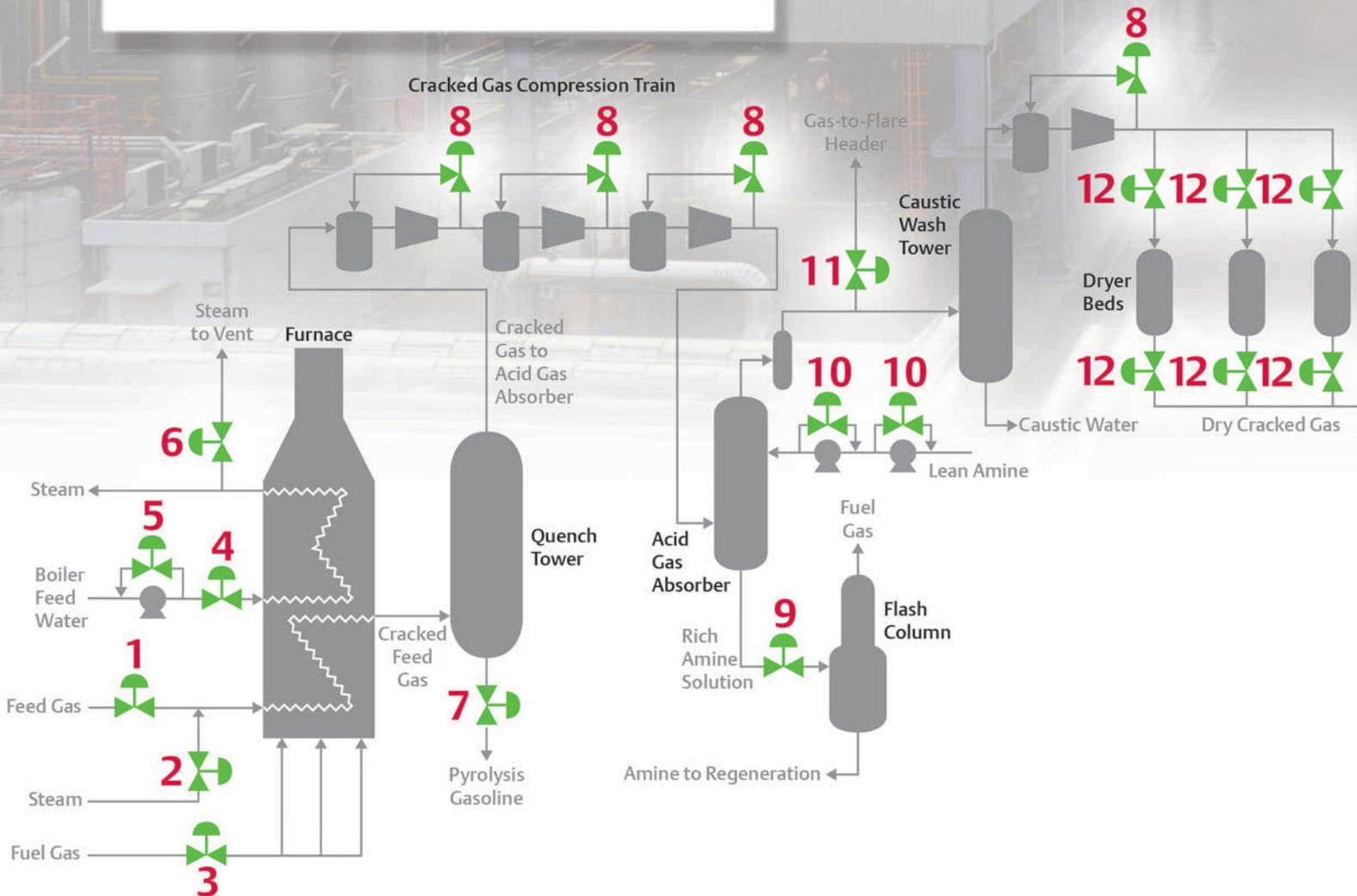
Regardless of the feedstock or process conditions, Fisher™ control valves and technologies offer the reliability you need to help you achieve your required product yields.

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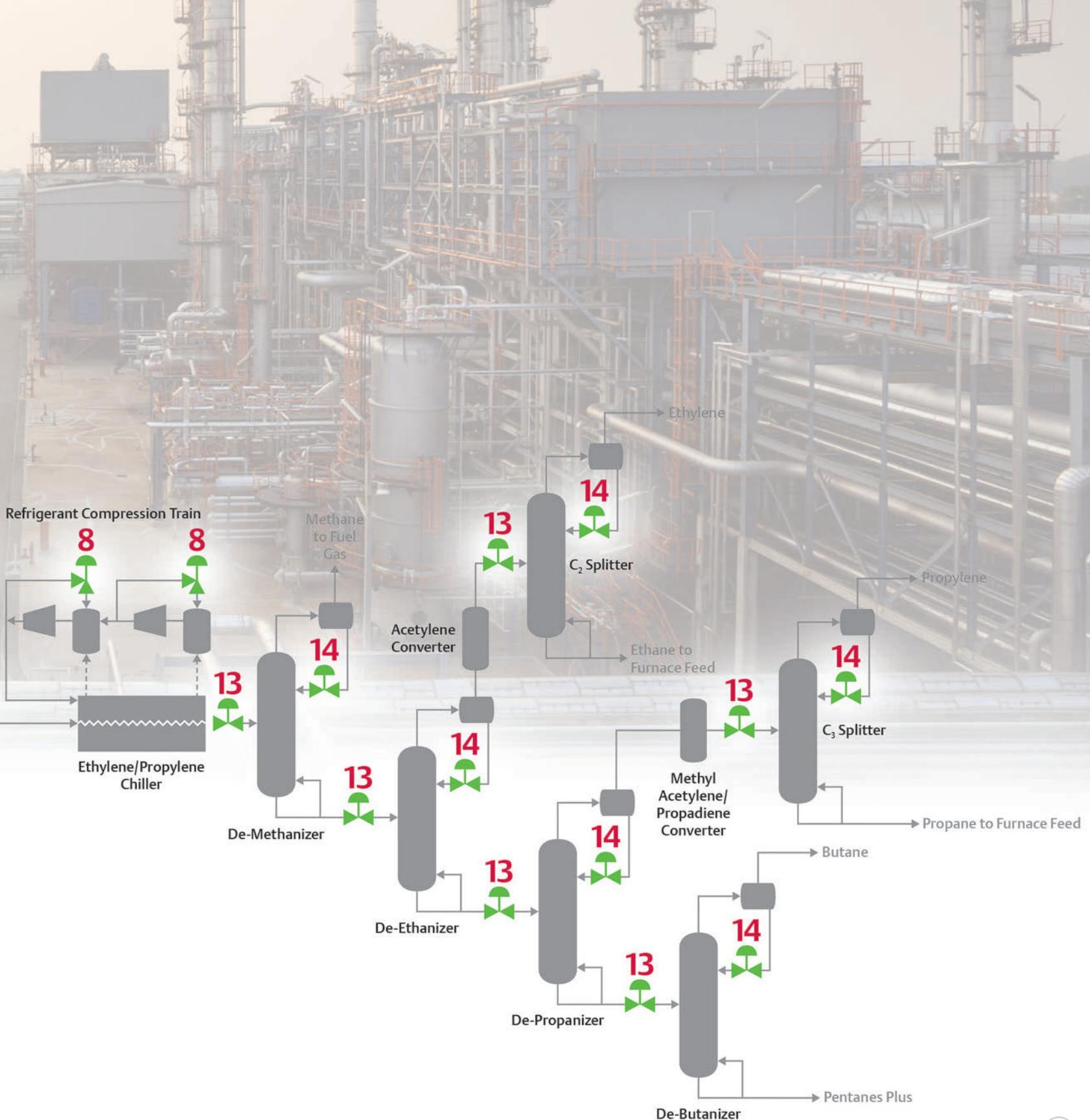
**LEGEND**

- 1** Hydrocarbon Feed Control Valve
- 2** Dilution Steam Ratio Control Valve
- 3** Burner Fuel Control Valve
- 4** Boiler Feedwater Regulator and Startup Valve
- 5** Boiler Feedwater Pump Recirculation Valve
- 6** Steam Vent Valve
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# Typical Olefins Production Process

Olefin production plants use a variety of feedstocks. The type of feedstock used will impact the type of recovery technology used. A front-end de-methanizer configuration is highlighted below because of its ability to allow for a variety of feedstocks. Alternative product recovery configurations include front-end de-ethanizer for plants utilizing light feedstocks and front-end de-propanizer for plants using heavier feedstocks. Most olefin production plants produce between 500 kilotons per annum (ktpa) and 1,500 ktpa per train. Highlighted below are the Fisher control valve solutions offered for critical applications within your facility.



Feed gas into the pyrolysis furnace can be a number of feedstocks, including ethane, propane, butane, gas oil, or naphtha. Regardless of feedstock, the feed rate must be balanced with dilution steam to lower hydrocarbon partial pressure and increase olefin yield. An improper ratio reduces efficiency of the furnace and will impact ethylene conversion. Valves in the furnace section play a critical role in maximizing ethylene production and throughput.

## Hydrocarbon Feed Control Valve

In this particular application, a number of valves in parallel are commonly used to control the flow of the feedstock into the furnace. Reliability is the foremost requirement of inlet feed valves. Unexpected maintenance or surprise failures can stop production. In addition, these valves must be able to provide precise, stable control through a wide range of flow rates from startup and commissioning through full rated output of the plant. These valves must operate with minimal variability to help ensure stable and predictable performance of all process units downstream. Depending on the operating pressure of the pipeline, these valves can also experience a significant pressure drop. If not addressed properly, damaging noise and vibration may occur.

## Dilution Steam Ratio Control Valve

An improper feed-to-steam ratio reduces efficiency of the cracker and can result in the need for additional decoking cycles, therefore reducing furnace uptime. The quantity of steam used varies with feedstock, cracking severity, and design of cracking coils. With the feed-to-steam ratio directly impacting olefin yields, it is important to maintain precise control of that ratio. In addition, steam assists to reduce coking deposits by reacting with coke to form carbon dioxide (CO<sub>2</sub>), carbon monoxide (CO), and hydrogen (H<sub>2</sub>).

### INCREASED STABILITY

*Actuator's rugged, thick-wall construction and shallow casing design increases stability and minimizes response time*

### INCREASED UPTIME

*The Fisher FIELDVUE™ digital valve controller with Performance Diagnostics can be used to monitor control valve assembly performance. Detection of a change in valve assembly performance can allow for scheduled maintenance prior to shutdown.*



#### **WEAR RESISTANCE**

*Hardened material provides exceptional wear resistance and long service life*

#### **NOISE REDUCTION**

*Trim technology uses multiple orifices of special shapes, sizes, and spacing to minimize aerodynamic noise*

#### **HIGH FLOW CAPACITY**

*Trim cage technology provides customizable valve flow characteristics with proven control for a wide range of operating conditions*

Fisher ET Control Valve with FIELDVUE DVC6200 Digital Valve Controller

## Burner Fuel Control Valve

Accurate and precise temperature is needed to maintain optimum furnace performance and prevents undesirable side reactions. Temperature profiles applied along the cracking coil are designed to avoid long residence times at low temperatures. Low temperatures favor reactions involved in the formation of secondary products, thereby reducing olefin yields. The burner fuel control valves regulate the temperature of the furnace by controlling the fuel supplied to the burners. Due to the location by the furnace, burner fuel control valves may be exposed to high ambient temperatures. Emissions from fuel gas can be an environmental concern and must be accounted for in packing design.

### HIGH TEMPERATURE ENVIRONMENTS

*Alternative valve, actuator, and accessory offerings can accommodate exposure to high temperatures*

### ACCURATE CONTROL

*Precise throttling capability of FIELDVUE digital valve controllers combined with low-friction packing technology helps to ensure responsive and stable control*



#### **LOW EMISSIONS**

*Live-loaded packing technology provides emissions control below 100 parts per million volume (ppmv) in throttling applications*

#### **APPLICATION VERSATILITY**

*Customizable and interchangeable trim options are available for accurate throttling control throughout various process conditions*

Fisher ET Control Valve with FIELDVUE DVC6200 Digital Valve Controller

## Boiler Feedwater Regulator and Startup Valve

From steam dilution to heat exchange, steam is an essential part of olefin production. The feedwater regulator control valve provides flow to the boiler during normal plant operation when the boiler is under pressure. During this time, the pressure drops are small and cavitation is not a concern. Stable, reliable throttling is most important for efficient boiler operation.

The feedwater startup and regulator applications are often combined into one valve. Combined startup and regulation can eliminate cross-over points and ease operation. During startup, the feedwater regulator control valve experiences low flow rates with high differential pressure, which can cause severe cavitation damage.

## Boiler Feedwater Pump Recirculation Valve

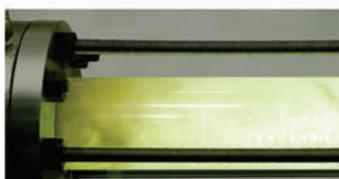
The boiler feedwater pump gets its feed from the deaerator at low pressure, and discharges at high pressure above the main steam pressure. During boiler startup or low load conditions, flow may not meet the minimum requirements of the boiler feedpump.

The boiler feedwater pump recirculation valve protects the feedpump by ensuring that adequate flow is passing through the pump at all times. A modulating boiler feedwater pump recirculation valve provides an efficient method to prevent cavitation from occurring in the pump. The high pressure drops experienced by the recirculation valve can cause severe cavitation that must be accounted for to ensure long valve trim life. Cavitation abatement trim allows for protection over a range of conditions from boiler startup to full load.

*Emerson engineers conduct noise and vibration tests on cavitating applications in many different ways. Transparent pipe allows visualization of the cavitation field.*



No cavitation.



Slight cavitation.



Full cavitation.



### QUICK RESPONSE

Spring-opposed pneumatic diaphragm actuator utilizes a shallow casing on the pressure side for reduced volume and minimized response time

### ACCURATE CONTROL

Molded actuator diaphragms allow for maximum thrust, providing excellent linearity between loading pressures and resulting travel

### REDUCED DOWNTIME

Predictive diagnostic capability of the FIELDVUE digital valve controller provides health evaluation without shutting down the process or pulling the valve assembly from the line



View our webpage on Cavitation to discover the broad range of Fisher anti-cavitation technologies for dirty service applications.

#### REDUCED MAINTENANCE

Cage-style trim allows removal and inspection of parts without taking the valve body out of the pipeline

#### EXTENDED SERVICE LIFE

Fisher Cavitol™ trim design effectively stages pressure drops above liquid vapor pressures to prevent cavitation

#### WIDE RANGEABILITY

High turndown trim provides control through extreme flow rates

Fisher HPS Control Valve with FIELDVUE DVC6200 Digital Valve Controller

## Steam Vent Valve

Boiler startup requires a gradual temperature and pressure increase in the steam distribution system in order to minimize stress on equipment. A steam vent is useful to vent low temperature and pressure steam containing a large amount of moisture. This allows for a gradual warm up of the steam system. In the event of a pressure surge, the vent system prevents overpressure of critical assets.

Vent valve applications have potential for noise and vibration due to the high flow and pressure drops experienced. Noise attenuating trim can reduce noise and vibration to acceptable levels. A vent diffuser can also be used for additional noise abatement and allow the valve to operate at a lower pressure drop ratio. Valve shutoff is important as any leakage results in wasted energy. Another consideration to make is valve trim material. Trim must be able to withstand high steam temperatures while maintaining a high level of shutoff.



*Test programs are conducted on Fisher control valves, valve trim, silencers, diffusers, and spargers as well as tees, elbows, reducers, and expansions to determine their contribution to overall noise. View our webpage on Control Valve Noise Reduction to learn about the science of noise attenuation in control valves and our history of solving noise issues in facilities like yours.*

### NOISE REDUCTION

Noise abatement trim reduces the harmful effects of noise and vibration

### HIGH TEMPERATURE OPTIONS

Trim materials engineered for high temperature service



**MINIMIZE STEAM LOSS**

*Advanced sealing technologies provides tight shutoff preventing valuable steam leakage*

*Fisher HPD Control Valve with FIELDVUE DVC6200 Digital Valve Controller*

# Quench Tower Level Control Valve

Cracked gas leaving the furnace must be cooled immediately to prevent formation of undesirable products in secondary reactions. Depending upon the feedstock, water or oil is utilized as quenching medium, with oil commonly used for heavier feedstocks. Consistent quench tower operation delivers desirable feedstock conversion.

Heavier hydrocarbons removed from the cracked gas leave the bottom of the tower and are separated downstream. Entrained carbon particles, more commonly found in heavier feedstocks, may be present in this stream and can cause control valve trim erosion. Control valves designed for erosive services should be considered to ensure long life and consistent operation. Hardened trim can provide resistance to erosive particles and extend trim service life in these applications.

## REDUCED VARIABILITY

*The Fisher 2052 actuator with clamped lever design and single pivot linkage reduces lost motion between the actuator and valve. Cumulative deadband for a Fisher rotary control valve assembly results in 0.5% or less variability.*

## EASE OF MAINTENANCE

*Seal protector ring can be removed for easy access to trim*

## EROSION MITIGATION

*Wide array of erosion resistant trim materials provide tight shutoff, preventing valuable leakage*

## EXTENDED SERVICE LIFE

*Eccentric plug path minimizes seat ring contact when opening, reducing wear and friction*

## OPERATIONAL FLEXIBILITY

*Self-centering seat ring and plug design allows forward or reverse flow with tight shutoff in either direction*



Fisher V500 Rotary Control Valve with FIELDVUE DVC6200 Digital Valve Controller

# Compressor Antisurge Valve

The availability and efficiency of a plant's compressors both have a direct impact on the profitability of the facility. Cracked gas compressor downtime will result in lost production. Unexpected operational issues with any of the plant's refrigerant loops will lead to reduced yields. Compressors also represent some of the most valuable pieces of equipment within an olefin production facility. Not only will damage to these assets cause lost production, it can also lead to very costly repairs.

Antisurge valves provide recycle flow to each stage of the multi-stage compression trains that are common to olefin production. During startup and commissioning, the valve provides throttling control to recycle a portion of the discharge flow as the compressor is brought up to capacity. During the normal operation of the plant, the antisurge valve will remain closed or slightly open to allow for a small portion of the discharge to be recycled. When closed, it is important that the valve provides tight shutoff to prevent unwanted recycle flow.

The primary purpose of antisurge valves is to protect the most critical and expensive pieces of equipment in the plant, the compressors. During a surge event, the valve must respond quickly and accurately in order to recycle the discharge flow back to the suction side of the compressor. Failure of the valve to react quickly can result in severe damage to the impellers of the compressor.

## ASSET PROTECTION

*Fast stroking capability of Fisher optimized antisurge valves protect compressors from surge events by quickly recycling flow back to the suction drum*

## EXTENDED SERVICE LIFE

*Potential seat damage due to fast stroking is reduced using cushioned actuators on long stroke installations*

## MITIGATE RISK

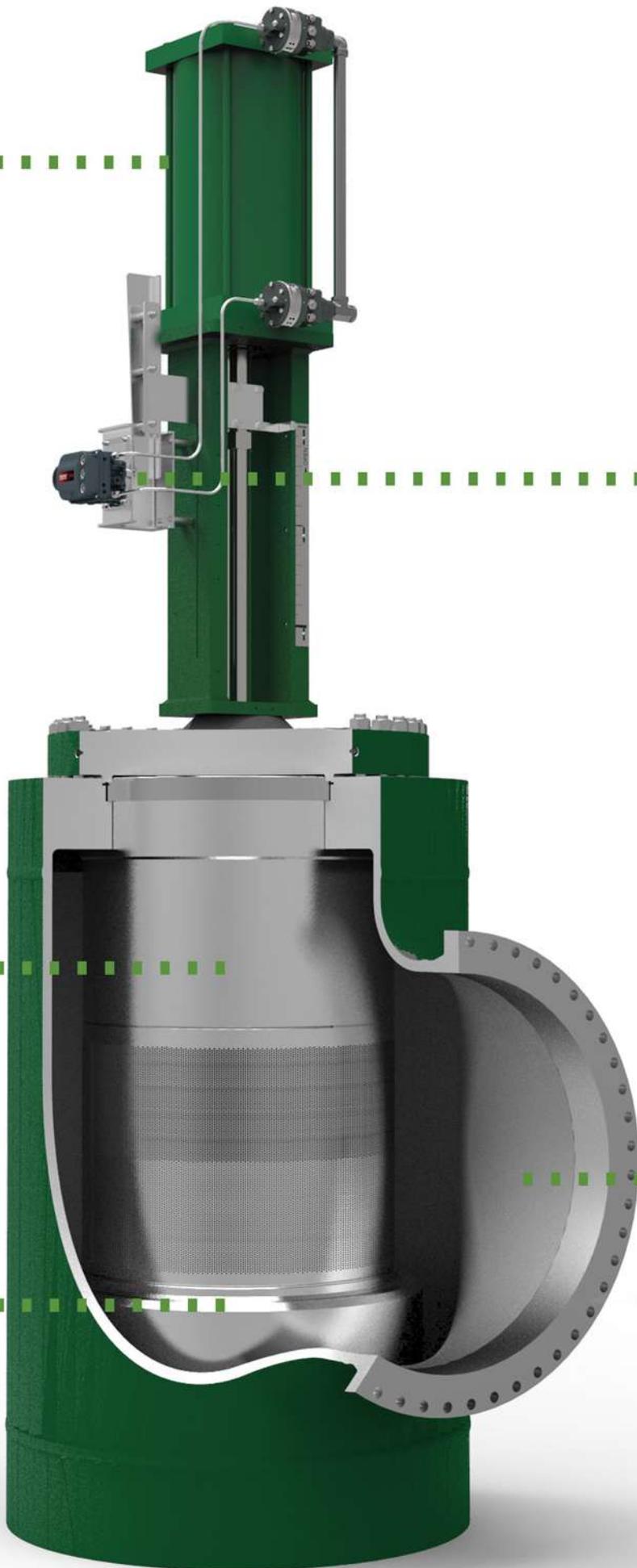
*Multiple fail safe piping hookups available to ensure fail mode upon trip*

## PRECISE CONTROL

*Fully customizable noise attenuating trim assists in providing precise control throughout the range of conditions, from startup to surge capacity*

## TIGHT SHUTOFF

*ANSI Class V or VI shutoff options available to prevent unwanted recycle flow past the valve*



#### STABLE RESPONSE

The FIELDVUE digital valve controller provides antisurge-specific control and tuning algorithms, resulting in high and stable response

#### EASE-OF-USE

Easy-to-use tuning interface reduces setup through the use of the FIELDVUE digital valve controller as part of the Optimized Digital Valve

#### COMPREHENSIVE NOISE MANAGEMENT

Noise modeling and prediction per IEC 60534-8-3 addresses both trim and valve body outlet noise when sizing

## Rich Amine Letdown Valve

Before further processing, carbon dioxide (CO<sub>2</sub>) and hydrogen sulfide (H<sub>2</sub>S) are removed from the cracked gas. The presence of H<sub>2</sub>S can cause serious corrosion issues, and CO<sub>2</sub> can freeze in heat exchange and fractionation equipment. Acid gas removal is accomplished by scrubbing with sodium hydroxide on a once-through basis or in combination with a regenerative solvent (amine).

As cracked gas enters the bottom of the acid gas scrubber and flows upward, lean amine solution flowing countercurrent strips the gas of impurities. The rich amine letdown valve serves two purposes. First, it regulates the level of rich amine solution that accumulates in the bottom of the contactor vessel. Second, it facilitates a pressure drop into the downstream flash tank, which liberates a portion of the acid gases entrained in the solution. If not addressed properly through detailed valve sizing and selection, this outgassing of the entrained gases can cause significant vibration and damage to the valve.

### PREDICTIVE MAINTENANCE

*The self-diagnosing capability of the FIELDVUE DVC6200 digital valve controller provides valve performance and health evaluation without shutting down the process or pulling the valve assembly from the line*

### SERVICE COMPATIBILITY

*Corrosion resistance is available through a full range of alloy materials*

### VALVE SIZING EXPERTISE

*Proprietary outgassing modeling ensures that the valve type selected is sized appropriately, accounting for both liquid and vapor phases*



**EXTENDED SERVICE LIFE**

*Various trim options can be utilized depending upon the severity of the pressure drop*

*Fisher ET Control Valve with FIELDVUE DVC6200 Digital Valve Controller*

# Amine Pump Recirculation Valve

Maintaining the proper flow of lean amine to the acid gas absorber is necessary to ensure sufficient removal of carbon dioxide (CO<sub>2</sub>) and hydrogen sulfide (H<sub>2</sub>S) from the cracked gas stream. The lean amine pump ensures the stable flow of amine to the absorber.

The amine pump recirculation valve is most commonly used to facilitate startup and commissioning as the acid gas absorber is brought to capacity. This valve controls the pump discharge flow that is routed back to the suction side of the pump. When needed, the recycle flow increases the suction pressure to keep it above the vapor pressure of the amine. As a result, the amine pump recirculation valve must be responsive in order to protect the pump from cavitation damage.

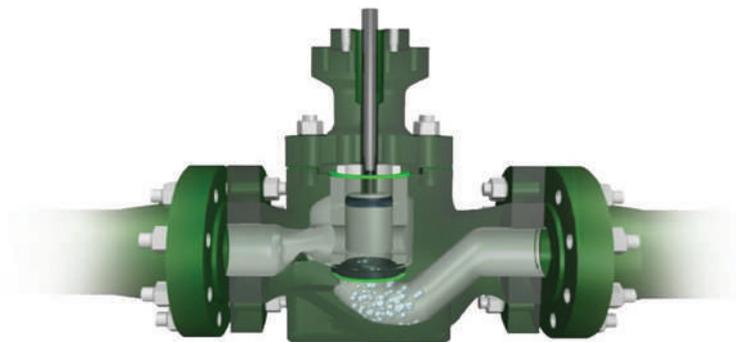
Due to the high pressure differential from discharge back to suction, the valve trim must be capable of mitigating the potentially damaging effects of cavitation as it recycles flow. Any unplanned maintenance on these valves due to cavitation damage can bring the amine pumps down and reduce plant throughput.

**PRECISE CONTROL**

*Actuator and accessories provide proper control to aid removal of carbon dioxide and hydrogen sulfide through cracked gas stream*

**QUICK RESPONSE**

*Actuator package ensures rapid response throughout setpoint changes*



*Learn more about how Fisher anti-cavitation technologies can help prevent damage to your valves. View our webpage on [Control Valve Cavitation](#).*

**WIDE RANGEABILITY**

*Valve assembly meets capacity demands from minimum through maximum flow requirements*



#### **CAVITATION RESISTANCE**

*Additional trim options are available to control and mitigate cavitation damage*

#### **HIGH RELIABILITY**

*Hardened trim materials provide excellent wear resistance and extend service life*

Fisher ET Control Valve with FIELDVUE DVC6200 Digital Valve Controller

# Gas-to-Flare Valve

Olefin production facilities have a flare system to safeguard against overpressure of critical assets within the plant and to dispose of any waste gas. Failure of the flare system to successfully relieve pressure from the process can lead to unexpected downtime or damage to costly pressure-retaining equipment.

Gas-to-flare valves are installed at numerous locations throughout the gas treatment and recovery section. They are used to control the flow of cracked gas or separated hydrocarbons to the flare stack for disposal. They are primarily used during plant startup, shutdown, or short-duration upset conditions. During these periods, flare valves will experience significant pressure differentials and high flow rates. If not addressed properly, these conditions can lead to excessive noise levels and even damaging vibration.

During the normal operation of the plant, gas-to-flare valves will remain closed. Because of this, it is important that these valves maintain tight, long-term shutoff in order to prevent loss of valuable product to the flare stack.

## QUICK RESPONSE

*Actuator and accessory technologies enable rapid response to meet demanding stroke requirements and provide dependable performance*

## RELIABLE OPERATION

*In-service FIELDVUE Performance Diagnostics enable predictive maintenance for critical valves to achieve greater reliability*



#### **NOISE REDUCTION**

*Durable noise attenuating trim options provide high flow capacity and noise attenuation throughout various process conditions*

#### **CORROSION RESISTANCE**

*A wide range of alloy materials are available to mitigate the corrosive effects of contaminants present in the flare gas*

#### **TIGHT SHUTOFF**

*Trim designs can achieve Class V shutoff requirements to prevent loss of valuable product to flare*

## Dryer Switching Valve

Cracked gas leaving the compression train is saturated with water that must be removed before fractionation. Without drying, formation of hydrates and ice could cause damage to downstream equipment. Continuous water removal requires multiple adsorption beds. Switching valves are critical for continuous operation between active and regenerating adsorption beds.

The valves responsible for switching dryer beds are exposed to high cycles between repairs requiring high reliability. Poorly performing switching valves can create bed disturbance and damage adsorption beads. Response to setpoint and overshoot are contributors to dryer inefficiency. Switching valve design should incorporate high-cycle and setpoint requirements to ensure dryer efficiency.

### REDUCED VARIABILITY

*The Fisher 2052 actuator with clamped lever design and single pivot linkage reduces lost motion between the actuator and valve. Cumulative deadband for a Fisher rotary control valve assembly results in 0.5% or less variability.*

### LOW FRICTION

*PTFE-lined PEEK bearings are low friction, low wear bearings and allow the control valve to operate under high pressure drops to ensure high cycle life while maintaining low torque.*

### LONG SERVICE LIFE

*Soft seal and bearing technology reduces friction and increases service life while providing high performance.*

### HIGH CYCLE CAPABILITY

*Fisher valve and actuator combinations are tested to over one million cycles to meet high cycle requirements.*



*Fisher 8580 Control Valve with FIELDVUE DVC6200 Digital Valve Controller*

## Distillation Feed Control Valve

The efficiency of a distillation column depends on the amount of contact between the vapor rising and the liquid falling through the column. If the amount of vapor and liquid traveling through the column becomes too great, the column can “flood”. When flooding occurs, the efficiency of the distillation column is dramatically reduced, with corresponding drops in product purity.

An accurate feed control valve is critical to the success of efficient column operation. A problem feed control valve can cause feed flow oscillations, making the distillation column difficult to control. As a result, the heat added by the reboiler oscillates as well, overheating and underheating the column. The effect of the swing, depending on design, can take anywhere from minutes to hours to reach the ends of the column. A control valve with high rangeability should be considered to maintain control.

## Distillation Reflux Control Valve

Increasing column reflux will improve the purity of the overhead product. This requires more heat for the reboiler to vaporize the lighter components in the reflux. A precise throttling control valve will assist to balance reflux needs and reduce variability. A poorly operating reflux control valve will result in the same flow instabilities as a problem feed valve. Product purities will oscillate and column efficiency will suffer. A control valve providing minimal variability will assist in stable and predictable column performance.

### ACCURATE CONTROL

*Molded actuator diaphragms allow for maximum thrust resulting in excellent linearity between loading pressures and resulting travel*

### STABLE CONTROL

*Precise throttling capability of FIELDVUE digital valve controllers combined with low-friction packing technology helps to ensure responsive and stable control*



#### **LOW EMISSIONS**

*Live-loaded packing technology provides emissions control below 100 parts per million volume (ppmv) in throttling applications*

#### **APPLICATION VERSATILITY**

*Customizable and interchangeable trim options are available for accurate throttling control throughout various process conditions*

*Fisher ET Control Valve with FIELDVUE DVC6200 Digital Valve Controller*

# Increase plant throughput and reliability with control valves known for performance integrity and longevity.



## FISHER™

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