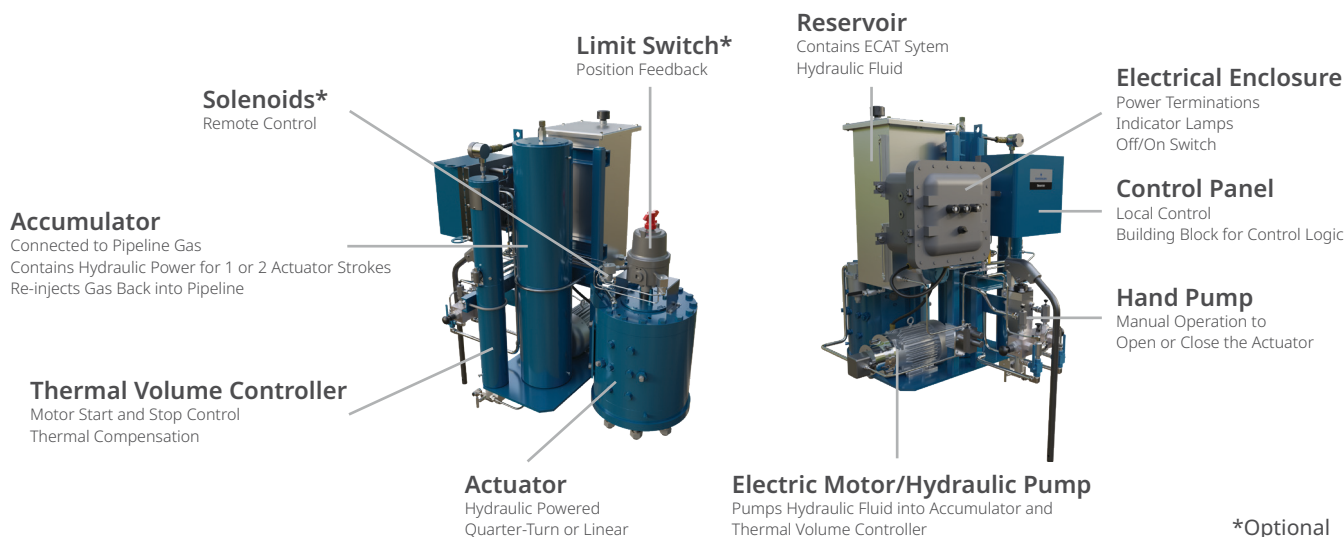


Shafer™ Emissions Controlled Actuator Technology (ECAT)

A field proven and highly reliable 'Gas-Under-Oil' actuator system with no associated gas emissions



SHAFER™ ECAT Valve Operating System Components



We design, build and test the complete valve operating system, including the actuator, controls and accessories. When you specify Shafer, you receive a complete factory-tested system with the longest warranty in the industry. The Shafer rotary vane actuator is backed by a 10-year warranty.

The Shafer ECAT can be operated locally, remotely or automatically by a variety of sensory and control devices. We have developed over 4000 individual control systems to meet our customers' specific requirements. Typical applications for the ECAT include the following:

- Emergency shutdown (ESD)
- Mainline isolation
- Linebreak protection
- Remote valve control
- Station fire-gate and blowdown
- High/low pressure shutoff
- Prevention of mercaptan odor

The Shafer ECAT produces constant torque output over the full 90° valve rotation. Constant torque output is an exceptional performance advantage if abnormal, high flow conditions are present, such as linebreak.

In addition to its availability as a complete valve operating system, including the actuator, the solution can also be installed as a retrofit to existing actuators in the field. The gas re-injection system can be powered by utility electrical power, UPS systems or solar power. This allows for installation in remote areas where utility power may be unavailable or unreliable.

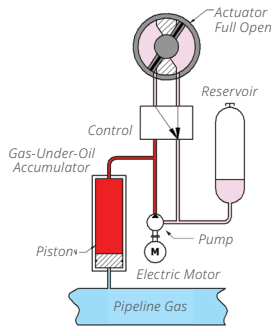
The entire ECAT valve operating system is weatherproof and explosion-proof (Class I, Div I) with a standard temperature rating down to -20 °F or an optional rating down to -50 °F.



Principle of Operations

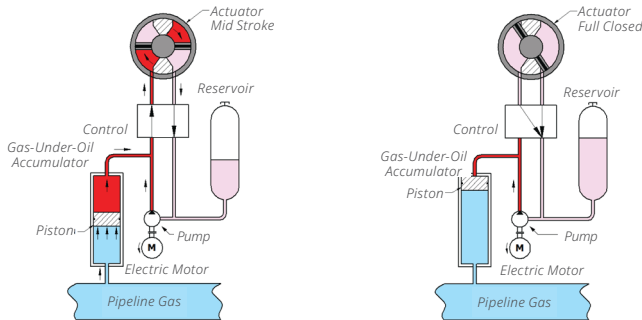
The Shafer rotary vane actuator and conventional, field proven control components are still used to provide torque output and the required valve control function. Refer to the Shafer RV-Series brochure for additional information.

Sequence 1: The actuator is shown in the fully charged, ready-to-close position



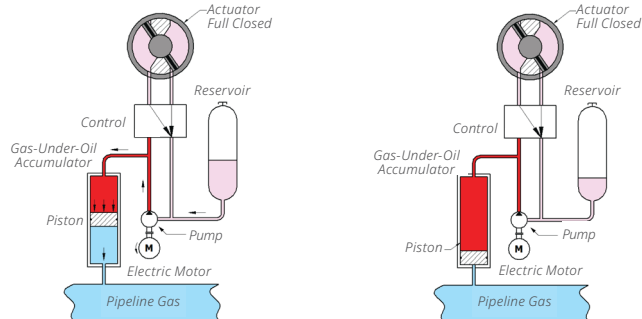
In the first sequence the actuator is in the open position awaiting a demand to close signal. The valve may be operated locally, remotely or automatically by a variety of sensory and control devices. Until a demand signal is received, the piston accumulator remains in the fully charged state at the same pressure as the pipeline.

Sequence 2: The actuator is now midway through the closing stroke and then fully closed



In the second sequence, the actuator has received a demand to close signal and the actuator control system opens the flow paths to the rotary vane. The pressurized gas in the accumulator forces hydraulic fluid into the actuator's closing port and powers the actuator in the clockwise direction. At the same time, nonpressurized fluid from the actuator's opening port returns to the reservoir. Finally, the actuator has reached the fully closed position.

Sequence 3: With the closing stroke complete, the actuator begins the gas re-injection process



The ECAT system utilizes a compact electro-hydraulic motor and pump as the energy source to re-inject power gas back into the pipeline. Following valve operation, the motor/pump will automatically start, forcing hydraulic fluid back into the accumulator. As the accumulator fills with fluid, the power gas is re-injected back into the pipeline. The motor only runs for a short time during the gas re-injection process. Once the gas re-injection process is complete, the motor automatically stops and the system remains in a fully charged "ready to stroke" state awaiting a command to open the valve. When an open command is received, the control directs the flow paths to rotate the actuator in the counter-clockwise direction and the gas re-injection process repeats.

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