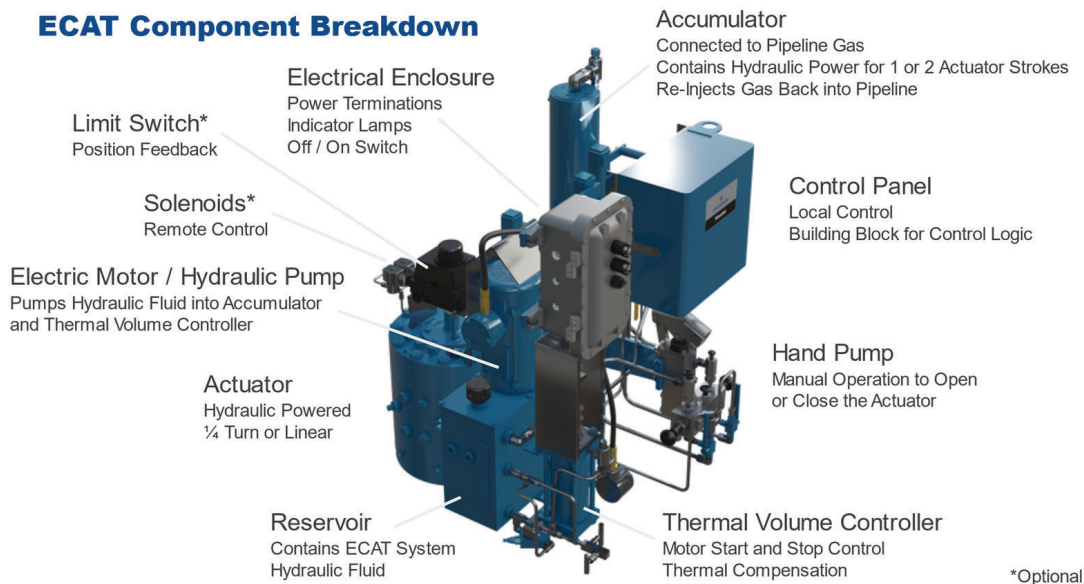


Shafer™ ECAT Emissions Controlled Actuator Technology

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



ECAT Component Breakdown



We design, build and test the complete valve operating system, including the actuator, controls and accessories. When you specify Shafer, you receive a complete system, factory tested, field proven with the longest warranty in the industry. The Shafer™ ECAT is backed by a ten 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 the many requirements of our customers. Typical applications for the ECAT include the following:

- Emergency Shut Down
- 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.

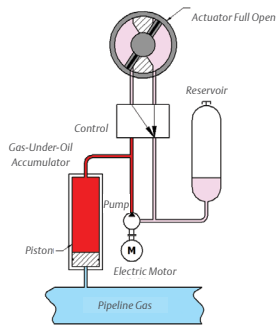
The ECAT system can be configured as a versatile solution for both new actuators and upgrades of existing equipment. ECAT gas re-injection system can be powered utility electrical power, UPS systems or solar power. This allows for installation in remote areas where utility power may be unavailable or unreliable.

The entire ECAT based valve operating system is weather proof 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

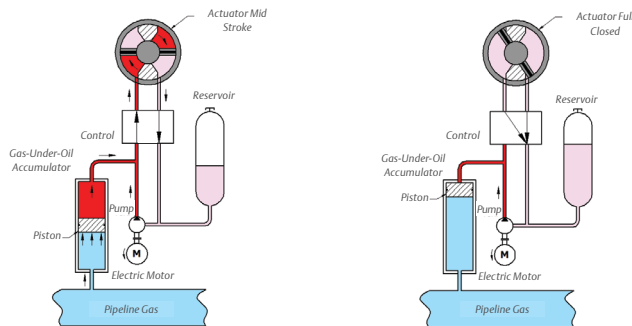
The Shafer rotary vane actuator and conventional, field proven control components are still used to provide torque output and the required valve control function. Refer to the Shafer RV-Series brochure (DOC.6P.SRV) for additional information.

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



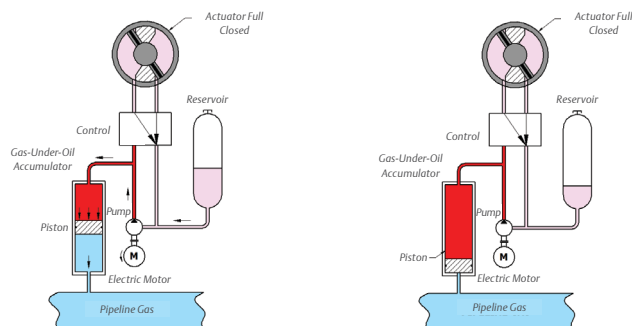
In the first sequence the actuator is in the open position awaiting a demand to close signal. The valve may be operated locally, remotely or automatically by a variety of sensory and control devices. Until a demand signal is received, the piston accumulator remains in the fully charged state at the same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

Sequence 2: The actuator is now midway through the closing stroke and then finally 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 actuators closing port and powers the actuator in the clockwise direction. At the same time, non-pressurized 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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