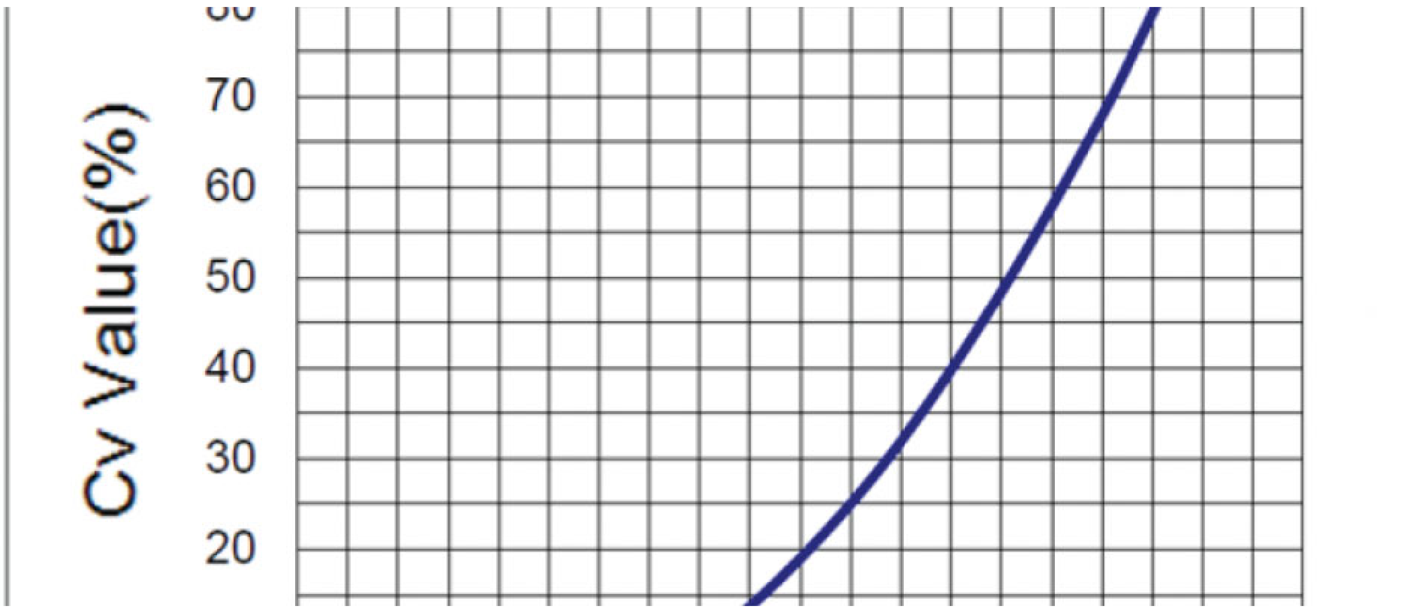
4 Considerations for Valve Automation



The application, cost and control system scheme can all play a part in choosing an actuator.

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Aside from the control system itself, the most comprehensively discussed component of any process system is the valve. Whether the application is a simple open/closed manual valve, severe service flow control valve or critical isolation valve, engineers and suppliers spend hours discussing, specifying and designing valve packages that can withstand a multitude of factors for operation. One component of that package that is equally critical, yet sometimes overlooked, is the actuator.

The decision to automate a valve requires several considerations. Below are some factors, but certainly not all, that an engineer must consider when choosing an actuator:

- application
- control system scheme
- asset reliability and criticality
- cost

1. Application

What are we trying to accomplish in the system with this valve? Is this a flow control loop, an isolation valve, pump protection? What are the factors in the process—such as pressure, temperature and flow rates—required for the application? While these are typically considered when specifying a valve, they are still critical to understanding how they can impact the performance of an actuator.

For example, if an actuator is undersized, or not specified correctly to the valve and process variables, it may not have the proper amount of force to fully close the valve, resulting in unreliable process control. A typical given multiple of the valve's operating torques to ensure proper operation of the actuator is 25%. This difference between valve torque requirement and the output capability of the actuator ensures the unit will continue to function well and provide a measure of protection against process changes.

Image 1: Type-14 diaphragm valve with a PST A202DN pneumatic positioner.
Image 2: Type-14 diaphragm valve with PST 101 pneumatic positioner.

2. Control System Scheme

Users should consider how the control system will interact with the actuator. They should also determine if the actuator will utilize air or electricity to operate. Will there be a control signal in the form of a relay output and solenoid or 4-20 milliamp (mA) signal to a controller? What feedback requirements are required from the actuator? For example, a requirement could be a feedback signal in the form of 0-10 volts to verify valve position back to the programmable logic controller (PLC).

3. Asset Reliability & Criticality

Another negative result of choosing the wrong actuator is the loss of repeatability in control. The wrong actuator can work in an application for a short time but, if this valve were to malfunction, there may be an impact on the process that could affect the users or possibly the environment. Users should examine what action the unit needs to take in the event of loss of control or power. Understanding how the valve, actuator and any controls work together is critical to success. The various actuation technologies and the benefits they provide are critical to success. Furthermore, look into any legal requirements, codes or standards that demand a specific level of performance. The regulations and certifications may vary across industries and applications.

4. Cost

While this is not the only deciding factor to make the most technical and economic choice, every engineer must consider the overall project budget when making their actuator selection. While there is the consideration of the initial investment cost, there is also the need to operate and maintain an asset over its life cycle. Depending on the air or electric consumption or cost to maintain and repair, a lower initial cost benefit may be lost over time when trying to resolve issues with a troubled unit.

Every actuator has to perform, at minimum, the following functional purposes:

1. Actuators process the control input to move the valve closing member—whether ball, disc or plug—to the desired travel location; they must be able to hold the closure member in that position reliably until the control signal changes. In a pneumatic actuator, this is achieved by applying air to a diaphragm or piston to move the valve. Pneumatic positioners and electropneumatic positioners are common ways to convert small pneumatic or electronic signals for modulating service. An electric actuator receives a control signal of a change in voltage, current or resistance and responds by using an electric motor and gear train to convert rotational force into torque or thrust. When fully closing or opening a shutoff valve, actuators must have the torque or thrust available to provide the desired shutoff and breakout torque available to move the closure member out of the seat. In pneumatic actuators, the amount of torque is dependent on the surface size receiving the supply air, such as a piston, and the pressure applied, typically measured in pounds per square inch (psi). Electric actuators utilize motor size and gear ratio to achieve torque and speed outputs.
2. Actuators should operate the valve at a speed necessary to achieve optimal results for the process while reducing mechanical wear and ensuring the longest possible life cycle for the package. Applying a large amount of rapid and repeated force can and will lead to damage of the valve and actuator if not specified correctly. In a pneumatic application, it may be necessary to increase the size of the actuator to ensure more power is available, or specialized control accessories such as positioners, solenoids, boosters or quick-exhaust may be employed to increase cycle times. The speed of an electric actuator can be manipulated in a few ways. Some actuators have electronic boards that manipulate the speed output, while still maintaining constant torque. Other actuators must be assembled with the appropriate gear ratio and motor configurations, limiting this adjustment to purely mechanical.
3. Actuators should have some level of failsafe, whether fail closed, fail open or fail in position, and be able to maintain that position until normal operation can resume. In a pneumatic system, this requirement has varying levels of complexity depending on the failsafe requirement. The most common option is a spring return unit that forces the actuator open or closed upon loss of supply air or control signal. At times, it may be required to add extra accessories such as an accumulator tank, specialized solenoids and pneumatic relays to provide air to units without a spring or meet fail in position requirements. In an electric actuator, battery or capacitor, failsafes are quite common solutions. A battery, bank or capacitor stores energy and provides it as needed when power or control signal is lost. The mechanical tension of the motor and gear train then holds the valve in place until power is restored.

Engineers are looking for suppliers who provide technologies and equipment that not only serve the basic purpose of process control in their facilities but also more features and benefits that maximize productivity, increase results and solve problems that contribute to lost uptime and profitability.

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