# Back to BASICS: HOW TO SELECT AN ELECTRIC ACTUATOR

WHEN YOU'RE SEARCHING FOR AN ELECTRIC MOTOR ACTUATOR TO AUTOMATE A NEW OR EXISTING VALVE YOU HAVE A WIDE SELECTION FROM WHICH TO CHOOSE. IN FACT, JUST ABOUT ANY TYPE OF VALVE CAN BE AUTOMATED WITH THE RIGHT ACTUATOR. HERE IS A LIST OF QUESTIONS TO ASK AND POINTS TO CONSIDER THAT CAN HELP YOU WITH THE SELECTION PROCESS. **BY HOWARD WILLIAMS**

### How do I choose the right manufacturer as my automation partner?

As with the actuators themselves, today's choice of manufacturer is broad. There are many well-established actuator manufacturers in North America. The best manufacturers, however, offer not only a full range of products, but also the technical advice, local field support, and readily available spare parts that go with those products. While purchase price is always a consideration, you should also analyze the "cost of ownership." In other words, you need to look at factors such as the life expectancy of the actuator, its history of reliability, the cost of routine maintenance, and the ease of installation.

Keep in mind that the amount of support you get from a manufacturer after the sale is made significantly affects the cost of ownership. Because of this, you should make sure your actuator manufacturer has experience in your particular industry and is familiar with the application you have in mind. Ask potential actuator manufacturers if they have conducted similar installations at other plants in your area, then ask for a customer reference list you can use for an independent review.

### What is the leading cause of premature actuator failure?

All electric actuators contain electrical and some electronic equipment that is susceptible to catastrophic failure if that equipment comes into contact with moisture. Moisture can enter the actuator in a number of ways—through a poor cover seal ingress when covers are removed during maintenance, condensation from enclosure breathing, or flooding through the conduit that connects the power and control wiring to the actuator.

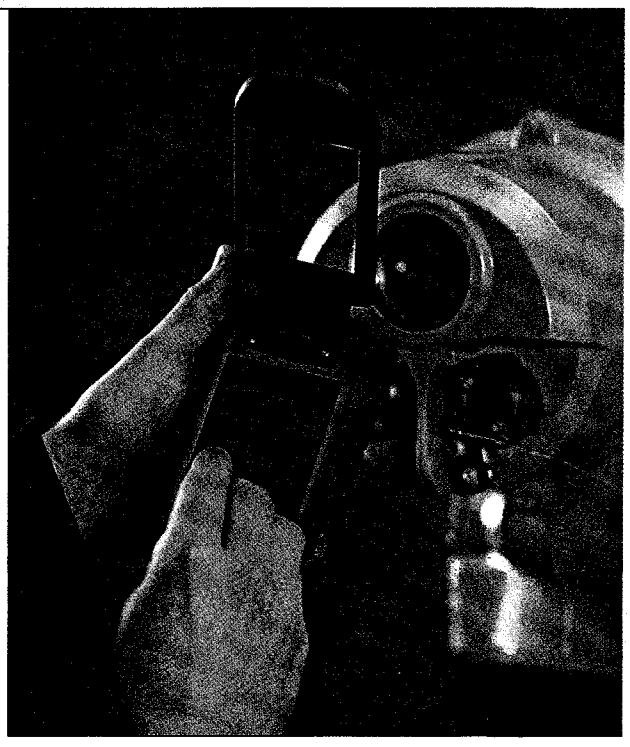

**Figure 1. An actuator being set with a setting tool**

The best method of preventing simple cover leaks is to use O-rings to seal covers attached to the actuator. This is because some actuator enclosures have natural breathing and space heaters for moisture that can collect inside the actuator enclosure. In those cases, ambient temperatures will vary, causing the air mass inside the actuator to expand and contract, which in turn causes internal condensation. The O-ring seals the environment so the enclosure will not breathe, condensation problems are eliminated, and a space heater is not needed to control the humidity. Another source of water ingress issues is local integral con-

trols, such as open/stop/ close and local/remote selector switches, when they are the older mechanical controls that penetrate the enclosure cover. Today several newer designs use non-intrusive local controls with magnets and reed switches, which eradicate the need for through-holes in the covers.

Another common area where there might be ingress of moisture is through the conduit. In these cases, a separately sealed terminal compartment can prevent moisture from getting into the motor and controls compartment.

Moisture ingress also might occur during commissioning (when the terminal cover is removed). Whenever the covers of conventional, mechanical actuators are removed for torque and limit switch adjustment, the actuators are exposed to moisture. This occurs not only during initial commissioning but at other points throughout the life of the actuator as valve wear calls for torque and limit-switch adjustments. Electronic-designed actuators now have electronic sensors that can be calibrated without removing any enclosure covers instead of the conventional torque and limit switches. This newer calibration procedure involves steps through a menu that allow you to set closing direction, limit switches, and torque switches, as well as adjust many secondary settings, such as auxiliary contacts for position feedback to the control room. These procedures are not only simpler to handle than calibrating a conventional switch mechanism with the covers off, they also are significantly faster.

Sealing an actuator is extremely important if that actuator is to survive in the field for the long term. Before purchasing an electric actuator, look closely at the enclosure to ensure it has O rings with a NEMA rating of at least 6 (temporary submergence) to tightly seal the enclosure.

When reviewing the actuator enclosure type, consider these points:

1) Does the actuator have a separately sealed terminal compartment?
2) Does the actuator require special storage requirements that would void the warranty between leaving the factory and field commissioning?
3) Will you ever have to break the enclosure seal to calibrate the actuator?
4) Are there any elements physically penetrating the actuator enclosure, such as local control switches, that could become potential leak paths?

## How can I make sure the actuator is suitable for the duty cycle of my process?

The facts and myths that surround the topic of suitability can be confusing for those not living and breathing actuators on a daily basis.

Many electric actuators are used in on/off applications or in cases where minimal positioning service is required. To do this, the electric motor must spin in one direction for seconds or minutes to open the valve. It then reverses in direction and repeats the process to close the valve. By nature of this type of operation, the motor is never required to run in one direction continuously.

Because of this, a common myth exists that electric actuators should have continuous duty-rated motors. However, consider that most electric actuator manufacturers, depending on the application, use a three-phase, AC-powered, 15- or 30-minute-rated motor. A typical definition for a 15-minute-rated motor is 15 minutes continuous operation in one direction at a steady one-third of its rated torque. Most valves need higher torque at the beginning and end of the stroke to unseat and reseat the valve, and they run fairly light during mid stroke. Some manufacturers are using specially designed high-torque/low-inertia motors for optimum performance in this service. Although significant amounts of information are available on this topic, you should be sure to have a knowledgeable person size an actuator for its given application.

As the motor temperature increases, the motor efficiency decreases. Therefore, the motor torque output must be rated accordingly. In addition, specifications for the motor need to be written in a way that includes safety as a factor when sizing an actuator for a given valve.

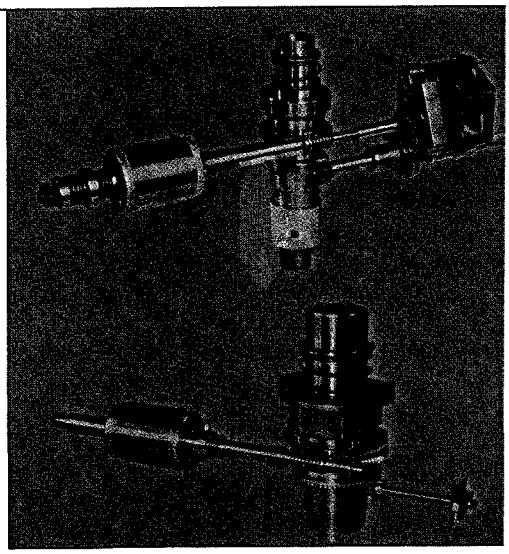

**Figure 2. A switch mechanism (top) versus a hall affect sensor (bottom)**

For modulating duty, the focus is on how many times you stop and start the motor rather than the length of time the motor is running. Standard electric actuators use a pair of electromechanical contactors to connect electricity to the motor windings, which operate the motor in the forward or reverse direction. These contactors typically are rated for 60 operations per hour at a maximum rate of 10 operations per minute. If the number of operations is exceeded, the contactors will overheat and may weld themselves shut. For higher duty cycles, substitute a solid-state motor starter for the mechanical contactors. This will increase the number of motor operations to as many as 1,200 per hour. Since modulating actuators move partial strokes frequently, it is important to make sure the actuator mechanics are also rated for the service, and no loss of motion is experienced.

## Is the available power supply adequate?

Your selection of an actuator will also be influenced by the available power supply. As plant automation expands, more remote applications with limited power availability are used. An industrial three-phase AC power supply is the best option