Basics of Operation

An electric actuator is basically a geared motor. The motor can be of various voltages and is the primary torque-generating component. To prevent heat damage from overwork or excessive current draw, electric actuator motors are usually equipped with a thermal overload sensor embedded in the motor windings. This sensor is wired in series with the power source and opens the circuit should the motor be overheated, then closes the circuit when the motor reaches a safe operating temperature.

An electric motor consists of an armature, an electrical winding, and a gear train. When power is supplied to the winding, a magnetic field is generated causing the armature to rotate. The armature will rotate as long as there is power to the windings when the power is cut, the motor stops. Standard end of travel limit switches, which are a necessity for an electric actuator handle this task.

Electric actuators rely on a gear train, which is coupled directly from the motor to enhance the motor torque and dictate the output speed of the actuator. The only way to change the output speed is to install a cycle length control module. This module allows an *increase* in cycle time only. If a *decrease* in cycle time is required, an alternate actuator with the desired cycle time and proper output torque must be used.

Types of Motors

There are two (2) types of motors used for electric actuators; uni-directional and bi-directional (commonly known as reversing motors).

- Uni-directional motors are motors in which the armature rotates in one (1) direction, causing the valve to rotate in one direction. These actuators are typically used with a ball valve and rotate in 90 or 180 degree increments strictly for an on/off type of service.
- Reversing motors are motors in which there are two (2) sets of windings allowing the armature to rotate in either direction depending on which set of windings is powered. One (1) set of windings controls the clockwise direction for closing a valve, while the other set of winding controls the counter-clockwise direction for opening the valve. A major benefit of a bi-directional actuator is precise flow control, as the actuator is not required to travel the full stroke to begin the reverse stroke.

Electric or Pneumatic?

The pneumatic actuator will probably continue to be the actuator of choice in the process industry however there are many applications where an electric actuator should be considered.

No Air Supply:

In many remote installations, it may be impractical to run an air supply line and maintain it.

Colder Climate:

Compressed air systems are vulnerable to freezing and clogging of the air lines, or potentially damaging the equipment if located in a climate that frequently sees temperatures below freezing.

PLC/DCS Controlled Process:

In the past, standard engineering practice called for pneumatically actuated valves even when the rest of the system was electronically controlled. This required a conversion from electric to pneumatic (I/P) that made systems more complicated to startup and maintain. With the increasing popularity of PLC/DCS systems, many process and instrumentation engineers are now specifying fully electronic actuation packages.

Installation Savings:

The cost to prepare a plant for pneumatically actuating a few valves (compressor, regulators, air lines, etc) far exceeds the cost of using electrically actuated valves.
* Even though pneumatic actuators are used, electricity is still required to energize the solenoid valve coils that cycle the pneumatic actuators.