

5 Reasons to Switch From Pneumatic to Electromechanical Actuators

A common trend in the industrial automation and robotics industries is that people are looking for electric alternatives to their pneumatic components. This can be seen with – but not limited to – electric robotic grippers, electromechanical cylinders, and linear actuators. Many of pneumatic end effector manufacturers are starting to venture into the world of electromechanical actuators, which all begs the question:

What is the benefit of switching from pneumatic to electromechanical actuators?

Since the Cross Company Automation Group provides both pneumatic and electromechanical solutions, we see the advantages and limitations of each technology. We've seen these five reasons for OEM's, machine builders, and end users to make the switch from air to electric.

1. Control

For linear motion, different applications call for different types of control. If you only require point to point motion and the timing is not critical, pneumatic actuators may be the best choice. However, air is "squishy" and difficult to control in terms of positioning, accuracy, and repeatability. So, if you need to control the acceleration and speed or index to multiple positions, you would be better served using a stepper or servo drive ball screw or belt driven actuator. These electromechanical actuators would also provide high levels of repeatability, down to the micron level.

Applications that require multiple actuators may also be better served by using an electric solution. Servo or stepper driven actuators, controlled by a single motion controller, can accomplish the coordinated motion that is commonly required for CNC, 3D printing, or dispensing applications. All in all, electric actuators are much more flexible than pneumatic.

2. Power

Over the past few years, manufacturers have started to utilize roller screw technology and oversized ball screws to achieve extremely high levels of force. For example, the Parker XFC (eXtreme Force Cylinder) utilizes a roller screw, large bearings, and a heavy duty steel body to achieve forces up to 40,000 lbs (178 kN). Pneumatic systems are typically limited to 6,000 lbs and we have seen many applications where customers wanted to replace high force pneumatic toggle presses with a servo driven actuator.

Not only does this give them higher forces, but better force control. The electromechanical enables them to measure and store the applied current and position during the cycle, which can be used to ensure that the proper force was applied. They can then keep a log of these files for quality assurance.

3. Life

While the electromechanical actuator has more components than a pneumatic equivalent, the entire air system has many more critical components (compressor, filter/regulator, valves, seals, tubing....etc). If these components have issues, it only leads to problems and failures downstream. The pneumatic

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system is also very contamination sensitive. For example, if a facility switches to synthetic oil in order to extend the life of a compressor, the synthetic oil can eventually clog standard filters and cause seals inside the cylinder to fail.

With electromechanical systems, the most common point of failure is the bearings. These bearings have L10 life ratings, which can be calculated based on the life equations typically found in the catalogs and manuals. This greatly helps with preventative maintenance.

4. Environment

Electromechanical linear motion is also a much cleaner technology, because it has a self contained unit with only a cable connecting to the actuator. These actuators can be rated up IP69K and are great for Food & Beverage and Pharmaceutical applications. Typical air systems have some sort of lubrication that could potentially leak out if seals fail.

Other than wash-down applications, standard electromechanical actuators have a temperature range of -30 to 70°C and can even go higher or lower with special bearings and grease. Since air is compressible, these temperature swings have a direct effect on the pressure in a cylinder.

5. Operating Cost

If you compare the initial cost of a pneumatic actuator versus an electromechanical equivalent, the electromechanical solution can be 3 to 5 times more expensive. However, if you look at the life long operating costs of the actuators, you will almost always save money by using electromechanical, assuming it is sized properly.

There are a few reasons for this:

- Air systems are susceptible to leaks, especially where there is lack of maintenance or air contamination. Our team was recently at a large facility with over 100 pneumatic presses and they calculated that they lost over \$50,000 in 2013 due to air leaks alone.
- Pneumatic systems are always on and using energy. Electromechanical systems use very little energy while not in use.
- Electromechanical systems require fewer overall components than a pneumatic system. Typical components of each include:
 - Electromechanical system: actuator, motor, cables, and a control box
 - Pneumatic system: actuator, cables, control box, regulator, air hose, valves, compressor, as well as a proportional valve and linear scale – if trying to achieve multiple positions. Many of these items (like compressors) may require continuous maintenance.

The choice of pneumatic or electromechanical actuators is truly dependent on your linear motion application. Our automation group has specialists that focus on both technologies and can help determine which solution is best for your application. Learn more about incorporating pneumatic or electromechanical actuators into your process.