

Smaller and Mightier Electric Actuators Help Advance Medical Applications

Last Printed Dec 15, 2010; Author: John Walker, Vice President, Exlar Corp, Chanhassen, MN

Technological advances and changes in environmental, safety, and ergonomic requirements have increased motion control options and their capabilities.

Among those options are electric actuators with advanced power capacities, force, speed, and control. Providing rotary and linear motion for all types of motion control applications, electric actuators are compact, low-maintenance and high- efficiency motion control solutions for medical applications.

Electric actuators continue to replace hydraulic and pneumatic actuators in a variety of medical applications. When using oil-powered hydraulic actuators, users risk dealing with oil leaks and hazardous fluid. Requiring constant maintenance to ensure the actuators are completely sealed, hydraulic actuators can result in additional costs for cleanup and equipment damage. Air-powered systems, using pneumatic actuators, can also produce leaks, releasing polluting air from the system. The leaks ultimately result in more energy use, less efficiency, and higher costs.

Without the use of oil or air power generation, electric actuators are a clean-technology solution for medical applications. In sterile environments, oil-powered hydraulic actuators are not a desired solution due to potential oil leaks that can contaminate equipment, product, personnel, and patients. Pneumatic actuators also can cause contamination to the area through probable air

leaks, which can result in stale air, mold, and mildew being released into the environment. Both types of leakage can threaten the cleanliness of not only the environment, but also the medical equipment. In using electric actuators, medical institutions can reduce potential health and safety hazards caused by other types of actuators.

Applications

Electric actuators are used in a variety of medical applications, ranging from simple applications to more complex applications that require greater force, speed, and control from the actuator. An example of a common, low end performance actuator application is a simple hospital bed adjustment. The electric actuator applies minimal force to adjust the bed height up or down to accommodate operator and patient use.

In addition to simple applications, electric actuators also are used for high-performance applications such as volumetric filling and fluid dispensing, which require higher forces and high cycle rates. For example, consider an application in which the electric actuator is used as a piston pump to inject fluid into the patient. Before patients receive treatments, operations, or medical imaging tests, dyes, or other media are injected to help detect any abnormalities. To successfully inject the media, the electric actuator must be compact, produce a high force to create sufficient pressure, and maintain accurate velocity for consistent rate of injection.

If the actuator does not produce enough force, the injection volume will not be correct, resulting in potential harm to the patient and possible failure of the subsequent test. The combination of elevated forces and velocity control produces better results for the doctors and an easier procedure for the patients.

Other higher performance applications include laser positioning, which requires high precision, and ultrasonic welding, which requires stability, accurate position, and velocity control. Precision position, velocity control, and force sensing allow electric actuators to effectively perform these applications.

Integration is key

With enhanced features, electric actuators have become a primary option for medical applications. Today, electric actuators offer more power, force, load capabilities, and control than earlier versions, with other advancements including smaller size and integration of power and control components.

With advances in technology, electric actuators are able to deliver higher forces, with load ratings to 100,000 lbs. and above. In meeting requirements for applications requiring high-load capacities, electric actuators still offer position and velocity control, including high-capacity presses and injection molding for medical products.

Many electric actuators now integrate the motor and linear actuator into one package, reducing the overall size of the actuator. Instead of combining the size of the motor and actuator, the latest versions feature a compact size of only

the motor. The smaller footprint allows them to be designed into compact medical equipment, providing the manufacturer with advantages offered by a more compact product. Ergonomics and safety issues can also be reduced through the smaller size.

In addition to a compact design, electric actuators now offer the electric controls and power circuitry integrated within the actuator. Earlier versions require separately mounted controls and power amplifiers. Now, the actuator, drive and control are completely integrated into one piece of equipment, eliminating the need for additional power supplies, separate power amplifiers, and expensive cables. This allows the manufacturer to distribute the entire motion system within their mobile medical device, and not be tethered to a stationary electrical cabinet.

Electric actuators also produce less noise than their fluid-power counterparts, which ultimately results in a better experience and smoother operation for the doctors and patients. Since equipment is often located in close proximity to the patient, it is important for the equipment to operate quietly to reduce patient anxiety levels.

Looking ahead

Electric actuator advancements are changing how medical equipment designers view equipment designs. Many medical institutions are now demanding more compact sizes and more power. The integration of all of the components of a motion system within the actuator package is only the first step to the future design of electric actuators. As technology advances, designers will continue to expand electric actuators' capabilities, delivering more force, speed, and control in a single, compact package.