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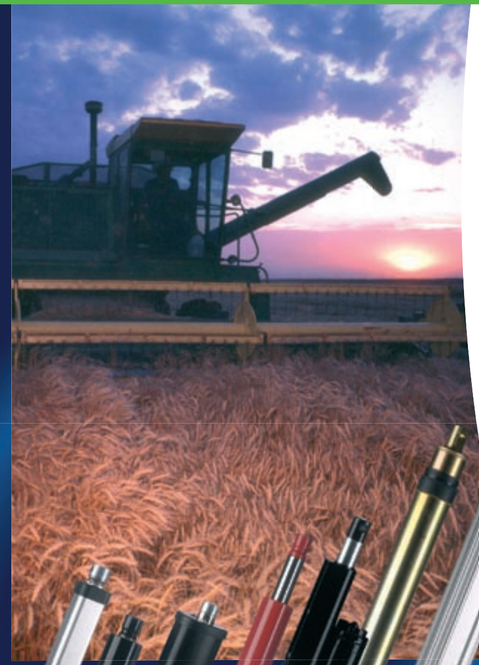

LINEAR ACTUATORS

Millions of Thomson Tollo actuators go to work every day. In the field, in the quarry, at sea and on the construction site.

They deal with dirt, dust, mud, water and extremes of heat and cold, day in, day out.

Thomson Tollo provides an unmatched range of standard electro-mechanical linear actuators, with just-in-time deliveries and over 30 years of linear actuator engineering experience. And when a standard unit won't do the job, our engineers will produce a custom design to suit.

Many of the World's leading Mobile-off-Highway manufacturers rely on rugged, cost-effective Thomson Tollo linear actuators. Call us to find out how.

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*Linear Motion. **Optimized.***

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Automatic for the People

The benefits of Electromechanical Actuation

GB

AUTOMATIC FOR THE PEOPLE

Electromechanical linear actuation provides economical automation of manual tasks that would be impractical using hydraulics. But the benefits don't stop there…

Reducing costs while improving ergonomics and reducing operator fatigue has long been a prime objective for vehicle designers. The rapid increase in the use of electromechanical actuators in off-highway vehicles is a direct result of this and other market drivers, and is opening up possibilities for automation that may have previously been thought impractical.

Automation of many manual operations has often been considered impractical, particularly when hydraulic actuation is considered as a solution. The resulting increase in the size of the hydraulic system can increase cost and complexity to a prohibitive level. In addition, the need for many of these tasks to be performed without the engine running has supported the decision to keep things manual.

Use of electromechanical actuators can overcome many of the associated difficulties of applying hydraulic solutions – they are clean, efficient, easy to install and only require electrical power to drive and position. Concerns regarding potential contamination from hydraulic fluid are eliminated, as well as enabling a reduction in the size of the hydraulic system.

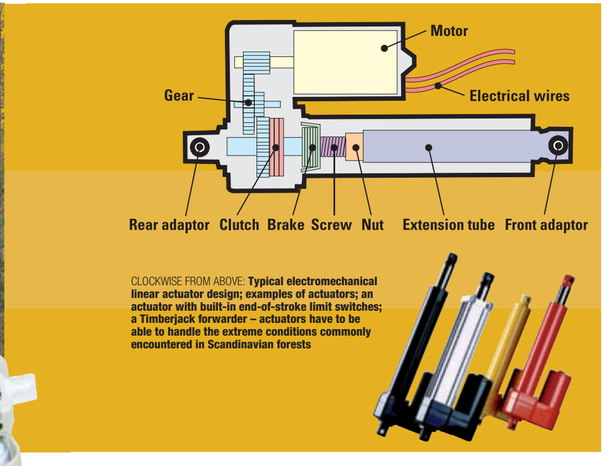
The facility to drive an actuator electrically, without the engine running, means that applications such as hood-lift or cabin-tilt automation are possible. Designers can also give the operator much more controllability, given that only an electrical signal is needed to drive and position an actuator, positional feedback can be integrated, and electrical cables are much easier to manage than hoses. The possibilities and realities of machine automation have been significantly widened as a result of these developments.

In most cases, an actuator consists of an electric motor and gearing to drive a ball screw or lead screw and a lift-arm, packaged into a compact form that can be easily installed in almost any space. They are typically mounted in the same way as a hydraulic cylinder, using clevis or trunnion mountings, and are very similar in terms of size – positional feedback can also be incorporated into the package. Use of a ball screw to convert the rotary motion to linear motion results in a device that is extremely efficient, has very low wear and a long and predictable life.

When considering whether an application is suitable for electrical actuation, several factors need to be examined. Firstly, engineering fundamentals such as load, speed, stroke length and electrical power have to be considered, then factors such as robustness, sealing, and duty cycle should be taken into account.

There are many different standard actuators on the market – most designed for indoor use, in applications such as office furniture or hospital beds. But off-highway applications demand robustness to another order of magnitude. Reliability and resistance to vibration and shock loads are essential in most cases, requiring the actuator to be designed and manufactured specifically to handle these demanding factors.

In many cases, the off-highway equipment designer requires flexibility in terms of the actuator design, while features such as mounting configuration, electrical connection, and position feedback are often customized to the requirement of the application.



CLOCKWISE FROM ABOVE: **Typical electromechanical linear actuator design; examples of actuators; an actuator with built-in end-of-stroke limit switches; a Timberjack forwarder – actuators have to be able to handle the extreme conditions commonly encountered in Scandinavian forests**

Where are linear actuators applied?

Automation of manual or awkwardly positioned functions can be easily and cost-efficiently solved with electrical actuators, as many of the world's leading off-highway equipment manufacturers have proven. The Thomson Tollo actuator range has been proven over 30 years of successful application, and during this time actuators have been used within multiple off-highway areas such as agricultural, forestry, construction and marine machinery.

Modern combine harvesters can carry up to as many as 10 actuators for various functions. Some of these applications were originally manual, such as the concave adjustment that was operated by a lead screw with a manual crank function. Today, the onboard computer controls functions such as concave adjustment, sieve adjustment and self-levelling of the entire threshing unit. The reliable and cost-efficient feedback system that can be offered with an electrical actuator is ideal for these applications as the demand for safe functioning and reliability is high.

An actuator that is designed into a machine such as this has to have a long and reliable life and must be able to perform even after months of not being used or after long hours of operation covered in dirt and moisture. With modern precision farming technologies employing GPS navigation, towed equipment such as fertilizers and seeders use numerous actuators for applications such as volume control, pre-emergency marking and many types of valve control.

A common function on many hydrostatically driven machines is throttle control using electrical actuators. By mounting miniature actuators directly on the diesel pump, the onboard computer regulates the motor rpm to any desired speed that fits the use of the machine, and results in smooth and precise control of the throttle position, and more efficient engine utilisation.

This concept is also widely used on applications that are remote controlled, such as winches and tractors used within the forestry industry.

In many cases, an actuator can be the connecting link between a radio controller and a hydraulic valve. The advantage of using an actuator instead of a solenoid or magnetic valve is that it can be smoothly adjusted and controlled to any position, and also keeps its position when the power is off. With highly efficient and long-lasting actuator designs, extremely demanding applications such as spool valve control can be achieved, allowing millions of operations – something that only a few years ago was considered impossible to achieve with small, compact actuators.

Within the demanding forestry industry the use of actuators is increasing rapidly. Here, functions such as engine-hood lift and cabin tilt are among the most common applications. The reasons to select electromechanical actuation over manual or hydraulic actuation are numerous.

An engine hood or the complete cabin is normally only opened for servicing. For safety reasons, the engine must be switched off but the power required for an electric actuator is available directly from the battery. Another safety factor is that the actuators are self-locking, meaning that even if the electrical power to the motor is cut, the position of the actuator is held until the motor is re-activated. This situation could be a problem for hydraulic or pneumatic actuators, where loss of pressure might mean that the actuator will collapse, resulting in a hazard to the operator or damage to the machine.

In addition, many actuators can be delivered with a manual override function, allowing operation even if battery power is lost. This is a vital function in many applications, being common in construction equipment, and within the railway industry for train couplers and pantographs, or remote power switching.

To be able to handle the extreme and rough conditions of Scandinavian forests, actuators have been designed with high protection against the elements. IP65 protection is considered a standard, and features such as resistance to temperature change from far below freezing point to extreme temperatures within the engine compartment are essential.

Ever-growing demands for higher productivity are increasing the desire for good driver ergonomics and environment. Applications such as automatic driver-seat levelling and access-ladder folding are therefore increasingly popular. On larger machines, even the doors can be electrically powered to allow the driver to open and close them if the machine is working on a hillside.

Hood assistance

Engine-hood actuation is not just needed for large forestry machines, but is increasingly common in vehicles such as articulated haulers, large compactors and road construction equipment. Many agricultural tractors are now so large that opening and closing the engine hood demands automation.

These functions do not just add convenience for the operator but also significantly improve safety, ensuring that large masses are controlled and misuse or dangerous operation can be avoided.

Marine applications such as engine hatch or trim plane actuation and gearshift and throttle control demand corrosion resistance, due to the salty off-shore environment. Actuators within engine compartments often need to be ignition protected.

The focus on health aspects has even brought actuators to applications that earlier were considered to be too domestic to be automated. For producers of lawn and garden tractors, actuators are greatly appreciated due to their reliability and robustness. These machines often lack hydraulic power and the demand for cost-efficient automation of grass catchers and cutter decks has given the actuators a natural place here.

Larger lawn and municipal machines that have been hydraulically operated are increasingly using electrical actuators because the reduced need for hydraulic power means the system can be downsized, resulting in cost reductions.

In almost all applications, cost savings are achieved when using electrical rather than hydraulic actuators, as an electrical connection is generally easier to perform and, in contrast to large and stiff hoses, reduces the risk of vibration spreading to driver compartments or control units.

Serving such a wide range of applications demands a broad standard product range with highly flexible design capability. A large degree of customization is often required to meet the unique criteria of each application. Design modifications such as special electrical connections and mounting methods, as well as dimensional and key performance changes, are often necessary to provide OEMs with a design that meets their exact requirements.

There is a strong trend towards increased application of electromechanical automation. The resultant advantages of oil-free operation, elimination of contamination, and reduced energy consumption are opening up new possibilities for the off-highway equipment designer, and providing more automated, ergonomic, cleaner and efficient equipment for the consumer. ***iVT***

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