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NEWS

FLUID POWER

ACTUATORS

Hybrid System Offers Force and Efficiency

Smaller, less leak-prone hydraulics provide power boost only when necessary

Machine builders searching for a way to combine high force, cleanliness, and energy efficiency in large machinery may soon find a solution. Engineers at Moog, Inc. (East Aurora, NY; <http://www.moog.com/industrial>) have developed a hybrid actuation system known as the PowerShift, which shifts from high-speed electric to high-force hydraulic, thus creating a sleeker, cleaner, more energy efficient way to produce high forces.

The company plans to market the device to a variety of industries, including makers of plastic injection-molding machines and metal-forming machinery, and is open to customizing the device for other applications.

In a sense, PowerShift may be the machine builder's answer to the automotive supercharger, which allows automakers to minimize the size of an engine by adding a power boost only when it's necessary. Like the supercharger, the PowerShift device enables machine builders, especially those trying to generate forces measured in tons, to

dramatically cut the size of their power actuation system. "This is magnitudes smaller than what they used before," notes Peter Zakrzewski, senior project engineer for Moog, Inc.

Also, like the supercharger, the new device is more energy efficient because of actuation only when required. Furthermore, PowerShift provides a

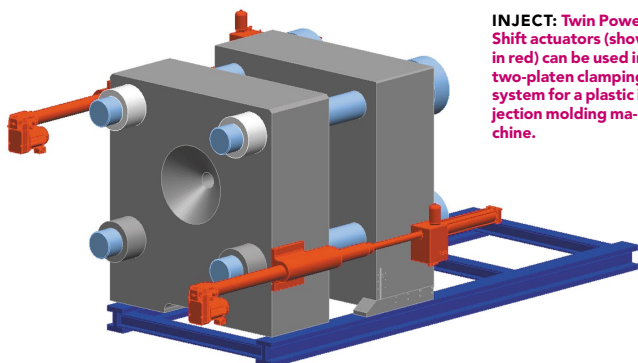
cleanliness benefit from vastly reduced amounts of hydraulic oil and potential leak points in high-force systems.

Moog engineers claim that systems up to 4,000 tons can use the device. Machines that typically would have included a hydraulic oil tank containing approximately 1,000 liters of oil, now need only about 25 liters of hydraulic oil to operate using the PowerShift.

High-force applications

The company says that the first users of the system (who were not yet ready to talk to *Design News*) are implementing the actuators on plastic injection-molding and metal-forming ma-

COMPACT: The PowerShift actuation system, used here in a press brake, cuts overall size when compared to a conventional hydraulic system.



INJECT: Twin PowerShift actuators (shown in red) can be used in a two-platen clamping system for a plastic injection molding machine.

chines.

For plastic injection-molding applications, Moog couples a hydraulic cylinder and a manifold (which together serve as a hydraulic intensifier) to a conventional electromechanical actuation system, such as a motor and ball screw.

During operation, the system uses the electric actuator to close the two halves of the mold, then shifts to the hydraulic mode to provide high clamping force. Hydraulic valves open, allowing the intensifier to extend, which in turn sends oil to a pair of conventional pancake cylinders inte-

grated into the machine. As a result, high tonnage is developed. In most applications, two PowerShift actuators would mount in place of the conventional traversing cylinders for the machine's clamp (see figure).

THE HYBRID APPROACH NOT ONLY OFFERS CLEANLINESS AND ENERGY EFFICIENCY, IT ALSO PROVIDES GREATER REPEATABILITY.

Clean, powerful

Moog engineers say that the electromechanical portion of the system provides greater energy efficiency and cleanliness, while the hydraulic intensifier provides forces that would otherwise be impossible to generate. "It's simply not possible to generate forces as large as 4,000 tons with electric actuators," says Ken Kaupila, senior project engineer for Moog. "That's why almost every injection-molding machine today uses hydraulics."

Similarly, builders of metal-forming machinery, which typically use a combination of high-speed and high-force cylinders, can employ Power-

Shift's combination of electric and hydraulic actuation. Moog replaces the high-speed cylinders with its MaxForce electric actuator, then couples that to a hydraulic cylinder and manifold. The hydraulic elements then serve as an intensifier, applying extra force to the metal-forming machine's platen.

"The machine builder just bolts on this actuator and no external hydraulic power unit is required," notes Dave Geiger, systems engineering manager for Moog. "So it saves quite a bit of time in assembly and testing, and it cleans up the leak points."

Moog engineers claim that in powder metal presses and hydroforming applications, the hybrid approach not only offers cleanliness and energy efficiency, but it also provides greater repeatability. Whereas conventional hydraulic presses provide positioning accuracy down to 0.0004 inch, PowerShift has demonstrated accuracies down to 0.0001 inch in laboratory tests. The reason for the improved accuracy, they say, is that PowerShift is not victim to the inherent non-linearities associated with hydraulics. The company's engineers claim that users can benefit from that dif-

ference in repeatability. "On powder metal presses, users want to have higher accuracy so they can reduce their secondary machining operations," Zakrzewski says.

Growing demand

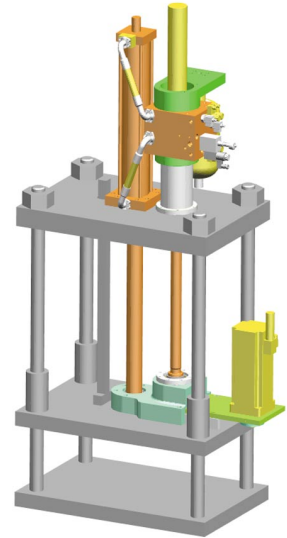
Moog, which has long manufactured and sold both electro-mechanical and hydraulic actuators, cites user demand as the reason for its patent-pending developments on the PowerShift.

"There's a movement in industry to use electric actuators, especially on smaller machines," Geiger says. "But the problem is you can't generate those larger tonnages with an electric system. The inertia of an electric motor becomes too complicated.

Besides, that's just too much force to put through a roller screw or ball screw."

Geiger adds that the move toward electric actuators has gained momentum in the past ten years, despite an inability to put electromechanical actuators in extreme high-force applications.

A greater awareness of environmental issues has contributed to that movement, along with a growing realization among users that energy-efficient systems can save



PRESS: This four-post vertical metal press employs a PowerShift actuator for greater repeatability.

them money in the long run.

"There's definitely a need out there," Geiger says. "And now the people who need larger tonnages can get what they want, and do it fairly economically."

MOOG

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