



Servo-Driven Injection Molding Machine Reduces Energy Consumption and Cycle Time

KOLLMORGEN

Seref Karaoglan, Project Manager, Kollmorgen - Turkey

Because Motion Matters™

Traditional injection molding machines use fixed-speed, three-phase motors that run continuously to drive the hydraulic pumps that power the machine. Excess hydraulic oil, which is especially generated during the “clamp hold” and “cooling” portion of the cycle, is bled out through relief valves. This approach wastes large volumes of energy and also shortens the life of the oil.

Tisse Plastic Injection Molding Machines Company, a leading Turkish supplier of injection molding machines, has partnered with Kollmorgen to deliver a new machine that substantially reduces energy consumption by combining servo motors with hydraulics. The new machine uses Kollmorgen [AKM servo motors](#) and [AKD servo drives](#) to control the hydraulic pumps used to power the pack and hold, clamp and eject mechanisms and another servo motor to directly power the positive-displacement injection pump. The servo motors can vary the speed of the pumps from zero to full speed based on the machine’s demand for hydraulic power. The hydraulic pumps used in the new machine are electrically adjustable axial piston pumps with variable displacement volume. Oil delivery is regulated by changing the motor speed and the pivoting angle of the hydraulic pump.

Higher energy efficiency

Stopping or slowing down the servo motors when they are not needed, such as during the pack and hold portion of the cycle, provides substantial energy savings. These savings typically amount to 1/3 or more of the 50% of total energy costs involving hydraulics. The energy savings vary depending on the design of the part and mold and are greatest for larger parts with longer clamp hold and cooling times. Further improvements in energy efficiency are provided by a hydraulic regeneration system that compresses oil when the hydraulic pump is operating, holds oil when the pump is idle, then releases oil when the pump starts up again.

Lower cycle time

Kollmorgen servos can dramatically reduce cycle time, especially on thin-walled packaging products such as the lids of butter containers. These parts cool very quickly so the ability of the servo-motor to more

precisely control the injection pump can shave significant time off the molding cycle.

Tisse also offers the potential for further improvements in cycle time by offering the option of using servo drives to control other machine functions such as



AKD Servo Drive

clamping and ejection. Kollmorgen engineers estimate that using servo motors to drive the clamping and ejection systems will provide a 50% time savings on that portion of the injection cycle since hydraulic motors run at only one speed. Kollmorgen servo motors can much more rapidly accelerate and decelerate at the beginning and end of the motion profile: this approach makes it possible to run at a much faster speed than is possible with hydraulic motors, which must operate more slowly to avoid damage when the drive hits a hard stop at the end of the motion profile.

The servo-driven injection pump delivers injection speeds of 300 mm/h which is considerably faster than can be achieved with a hydraulic driven system.



Omer Sengelen - Tisse
Production Manager

“The combination of the [Kollmorgen Automation Suite™ \(KAS\)](#) development programming environment, AKD gain scheduling, and pulse width modulation (PWM) braking also contributes to achieving a higher level of dynamic control than hydraulic machines,” said

Omer Sengelen, Production Manager for Tisse Machine. “We can maintain pressure within +/- 2 bar and reach the programmed speed in 250 milliseconds. This higher level of motion control contributes to quality and cycle-time improvements.”

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Another advantage of using servo motors is that the injection and pack and hold profiles can be controlled with a much higher degree of precision. “We set up the human machine interface (HMI) so that the operator can use 10 different injection speeds and 10 different pressure levels during the molding cycle in order to optimize the cycle to achieve the highest possible level of quality at the lowest cycle time,” said Seref Karaoglan, Project Manager for Kollmorgen Turkey.

Less downtime and fewer maintenance requirements

Electric servo motors take advantage of the dramatically improved dependability of all electronic and electrical products to reduce the downtime of the new machine. Electronic technology, with far fewer points of failure, has improved the reliability of electric servo motors to the point that in the vast majority of applications they will outlive the equipment they are installed on.

Conclusion

Tisse and Kollmorgen have partnered to co-engineer a servo-hydraulic hybrid injection molding machine designed to manufacture difficult and sensitive products — with precision at high speeds — while providing energy efficiency improvements up to 20% compared to the machines provided by Tisse’s competitors.



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The use of servo motors also reduces maintenance requirements: maintenance with hydraulic systems



AKM Servo Motor

begins with changing the fluid and filter on a regular basis and ensuring that the system always has sufficient fluid. In contrast, today’s servo motors require zero maintenance - not even lubrication. Servo motors run independently with every axis being powered by a different

motor so a failure in an electric application affects only that single motor, which makes them much easier to troubleshoot and repair.

Servo drives also lengthen the service life of the machine’s hydraulic oil because eliminating the need to bleed the oil out through relief valves generates less frictional heating. Furthermore, servo motors reduce the environmental risks presented by hydraulics such as leaking and venting through hydraulic hoses and couplings.

ABOUT KOLLMORGEN

Since its founding in 1916, Kollmorgen’s innovative solutions have brought big ideas to life, kept the world safer, and improved peoples’ lives. Today, its world-class knowledge of motion systems and components, industry-leading quality, and deep expertise in linking and integrating standard and custom products continually delivers breakthrough solutions that are unmatched in performance, reliability, and ease-of-use. This gives machine builders around the world an irrefutable marketplace advantage and provides their customers with ultimate peace-of-mind.

For more information visit www.kollmorgen.com, email support@kollmorgen.com, or call 540-633-3545.