

INNOVATION FOR A CHANGING WORLD

Injection molding solutions

MOTION CONTROL SOLUTIONS FOR RELIABILITY AND HIGH PERFORMANCE

Injection molding machine builders are facing unprecedented change. Trends such as increased energy and materials costs, higher consumer expectations and increased use of engineering plastics are fueling demand for new machine solutions. The growing demand for thin-wall technical parts such as mobile phone casing, as well as the trend for automobile manufacturers to replace steel parts with plastic parts requires even higher finished parts quality. There has never been greater need to deliver improved performance and innovation in machine design.

Moog is a leader in closed-loop hydraulic servo control for injection molding with our Proportional Valves the preferred choice of nearly all of the leading machine builders. We are also a leader in providing the latest motion control solutions for all-electric injection molding. In fact, we helped develop Europe's first all-electric injection molding machine in 1992. Our proven expertise in both electric and hydraulic technologies, deep knowledge of plastic industry applications and worldwide presence allow us to provide flexible motion control solutions that significantly improve machine performance.

MEETING TODAY'S INJECTION MOLDING CHALLENGES ON A GLOBAL LEVEL

In 25 countries worldwide, Moog teams work proactively with customers to take ideas further, improve performance, reduce operating costs and facilitate the development of next generation injection molding machines. We understand the challenges you face when it comes to improving performance. That's why we utilize our expertise to provide motion control products and solutions that consistently deliver world-class performance, design flexibility and reliability.

We focus our development efforts around innovation in motion control for precise process control, higher productivity, and higher injection rates for electric, hydraulic and hybrid systems.

Precise process control

The transition from the injection to hold-on is one of the most critical, quality-relevant parts of the injection molding process. Moog's advanced closed-loop servo control technology provides a dynamic and more repeatable process which results in tighter tolerances on part weight. In fact, our servo motors, servo drives, and servo valves are all tailored to provide the exact performance requirements for your specific application.

Higher productivity

Moog has motion control solutions to speed up injection, plasticizing and clamping, reduce scrap and minimize downtime. We will work together with you to identify a performance improvement strategy to take you beyond

marginal gains. Our control and applications expertise provide the edge you need to make your ideas for higher productivity a reality.

Higher injection rates

Machines for molding complex parts require sufficient injection speed, response and injection pressure to fill complicated shaped molds in a mere fraction of a second.

At Moog, we continue to challenge the performance limits of electric technology by developing solutions that reduce system inertia for faster acceleration. We also work closely with forward-thinking hydraulic machine designers to develop solutions for reducing cycle and set-up times. Our command of both electric and hydraulic technologies and strong applications experience allow us to provide hybrid systems with the best features of both technologies.

Solutions for technical parts

Technical parts are challenging to mold because they must be produced within a very tight dimensional tolerance, maintain their shape and dimensions over time, have perfect surface quality and may need to satisfy optical specifications such as transparency. They are particularly challenging to mold on all-electric machines due to the long hold-on times often required. This is another area where Moog is in the forefront and can provide you with a unique design optimized to your specific performance requirements.

ELECTRIFYING PERFORMANCE

When one of the largest injection molding machine manufacturers wanted to develop a new series of high-end all-electric machines, Moog worked with the customer to provide a solution to satisfy their requirements.

The request

Help the customer design a high performance all-electric injection molding machine that is cost-effective, low maintenance, long life and highly competitive.

The solution

Through close collaboration with the customer, we designed an all-electric injection system, provided servo motors for clamping and ejection, and a Moog MSD Servo Drive and



PLC for total machine control. We also provided design advice for the other mechanical axes on the machine. The injection system reduced system friction for higher injection rates, reduced maintenance burden and made very long hold on times possible with minimum power consumption.

The result

Moog's solution helped the customer to move into a higher performance segment with the shortest possible lead time, enabling them to maintain their market leadership and build a reputation for higher performance all-electric machines.

TAILORED SOLUTIONS FOR HYDRAULIC MACHINES

When Bill Moog invented the first commercially viable servo valve, his name became synonymous with high performance, reliability and versatility. Moog Servo Valves work in tandem with other motion control products, using the latest technologies including fieldbus communication, embedded motion control electronics and configuration software.

PROPORTIONAL VALVES

Moog is a leader in closed-loop hydraulic servo control for injection molding with our Proportional Valves the preferred choice of nearly all of the leading machine builders. These state-of-the-art valves provide maximum performance for ultra-high speed injection molding machines, combining high speed with high dynamics for shorter response time and/or smooth transition from velocity to pressure control mode. A wide range of pilot valves is available to accommodate even the most specific needs.



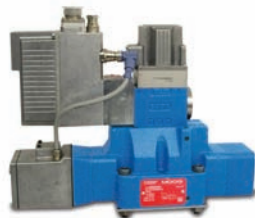
RADIAL PISTON PUMPS

Moog Radial Piston Pumps, or RKP, are high performance variable displacement pumps for diverse applications. The RKP is the ideal solution for applications requiring robust performance, low noise, contamination-resistant design and unsurpassed reliability. They are available in various sizes, single and multiple configurations, and a wide array of control options and mounting flanges. Designed to meet the needs of performance-driven machine builders, Moog's RKP units combine innovative technologies with functionality suited to demanding applications.



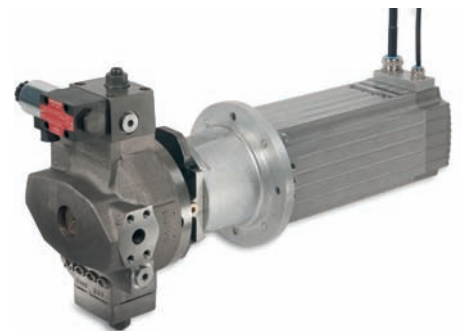
AXIS CONTROL VALVE

Clamp systems on injection molding machines require precise motion control to ensure repeatability, reduce cycle time and improve productivity. Moog's advanced state control algorithm optimizes clamp performance for better machine control. The Moog Axis Control Valve, in combination with the new state control algorithm, is an integrated solution that enhances machine control by allowing higher precision control at stage positioning. This provides dynamic control by increasing loop gain up to three times that of conventional PID controllers.



MOOG SPEED CONTROLLED PUMP SYSTEM

This unique system featuring both fixed and dual displacement pump technology reduces energy in injection molding systems by as much as 30%. It consists of high performance building block products designed by Moog. Combining Moog's Radial Piston Pump (RKP), MD Servo Motor and MSD Servo Drive, this modular system delivers improved productivity by helping the end user achieve a sustainable energy cost savings and an easier integration in a smaller machine footprint.

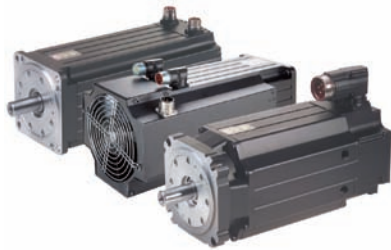


SPECIALIZED SOLUTIONS FOR ALL-ELECTRIC MACHINES

Working with Moog means you're teaming up with an expert focused on delivering a solution that is precisely tailored to your unique needs. We provide a broad range of products and systems for a number of challenging all-electric applications.

SERVO MOTORS

Moog's Maximum Dynamic Brushless Servo Motor (MD) Series is ideal for today's plastic applications. These motors are built to provide the exact torque, speed and power requirements for your application and are currently available in sizes up to 1996 Nm (1472 lbf ft) peak torque. The MD Series Servo Motors provide rapid acceleration and deceleration to maximize the period at constant speed, something not possible with standard motors. Conventional motors do not accelerate fast enough to fill thin wall parts because they are not optimized for the process. An MD Series Servo Motor with a peak torque of 105 Nm (77 lbf ft) has an acceleration time of just 22 ms and can be operated up to 7000 rpm. These performance characteristics enable machine builders to create all-electric machines with the speed and acceleration required for thin wall molding such as packaging and battery casings.



MACHINE CONTROLLER (MC600)

The MC Series 600 series includes a CPU, I/O and communications modules, as well as local and PC-based HMI units. The multitasking Linux-based real-time operating system offers fast reaction and reduced cycle times for efficiency and productivity. The hardware is complemented by the Moog Application Software Suite, a powerful yet easy-to-use tool for developing application programs based on CoDeSys, the proven IEC 61131-3 compliant programming system. Analog 16 bit I/O resolution offers greater precision positioning and higher accuracy. Combining flexibility with ease of use, these modular controllers are simple to configure and perfectly adapt to applications of all sizes.



MODULAR MULTI-AXIS PROGRAMMABLE MOTION CONTROL SERVO DRIVE (MSD)



The Moog Modular Multi-Axis Programmable Motion Control Servo Drive, also known as MSD, is a new generation of servo drives that provides the highest levels of dynamic response, smooth performance and application versatility. MSD includes modular servo drives powered by a shared power supply and a motion controller to coordinate motion across multiple axes to reduce cycle times and provide precise motion control for higher accuracy.



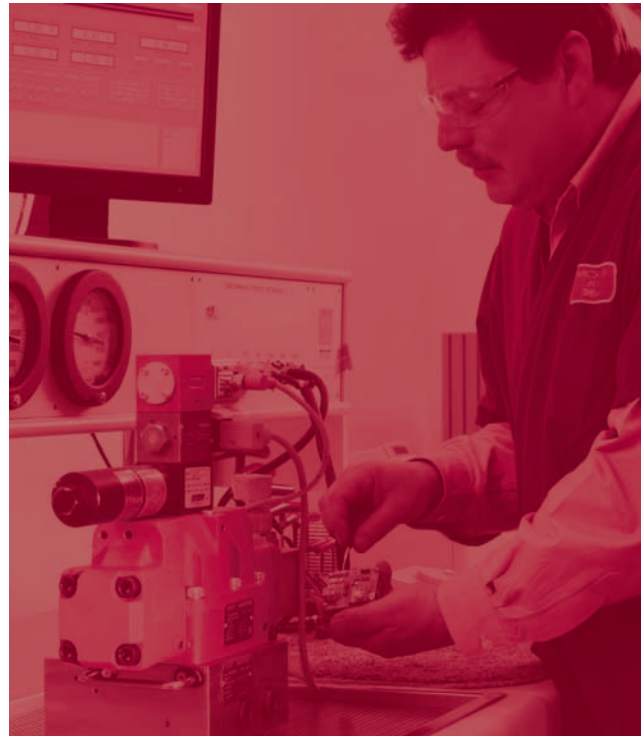
MOOG TOTAL SUPPORT

Whether you are developing a new generation machine or need ideas and support for a retrofit, Moog is here to help you find the best electric or hydraulic solution.

Our trained engineers, based in more than 25 countries around the world, bring a dynamic and collaborative approach to helping you solve your engineering challenges. Rather than starting with a product, we start with a thorough understanding of your application, your technical needs, and your overall objectives. By focusing on your specific requirements, we are able to provide high-performance solutions that realize your machine's potential.

Our commitment to you goes beyond the initial collaboration. In fact, Moog Global Support™ is as reliable and flexible as our products. Our service technicians worldwide ensure timely and precise repair of your Moog components should service be required. And we can tailor a maintenance program that is ideal for your particular needs.

Contact your nearest Moog representative to see how our world-class solutions, technical expertise and proactive support can help you design and deliver better machines today.



THE DIGITAL ADVANTAGE

A leading European injection molding machine builder was looking to improve the injection and clamping axes on a range of larger hydraulic machines to provide higher part quality. While the existing solution was fine for smaller size machines, part quality was inconsistent on larger tonnages because the valve was not responsive enough to enable the actual signal to follow the command signal profile. The customer had already tested a number of analog servo valves without success when they consulted Moog.

The request

The customer required a high response servo valve for molding high precision parts. Strict performance requirements for process stability, repeatability and accuracy had to be satisfied.



The solution

Moog's solution was a digital control servo valve enabling gain to be freely adjusted by end users in the low flow range for improved dynamics and control. This provided sufficient response to enable the command pressure and velocity profiles to be reproduced exactly without overshoot.

The result

Part quality was significantly improved, with marks no longer present on parts released from the clamp. The customer appreciated our rapid response to their problem and took advantage of our field experience on digital control servo valves. All new machines for high precision molding built by this customer will be equipped with Moog's solution.

TAKE A CLOSER LOOK.

Moog solutions for injection molding are only a click away. Visit our Web site for more information and the Moog facility nearest you.

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