

Drive & Control profile

Servo-driven Hydraulic System Saves Over 40% Energy



New Series "IntelliDrive Model 85S" getting ready to head to Dusseldorf for the K Show.

Servo-driven Hydraulic System Incorporated into Injection Blowing Machine

What does it take to melt plastic and then inject it into molds tens of millions times a year? It takes two machine systems known as the plastifier and the clamp. As the plastifier screw turns, it introduces the plastic into the cavities of the mold. The clamp opens and closes the molds while supplying a holding force to keep the molds clamped closed against the plastic injection pressure. In other words, it takes a lot of energy.

Jomar Corporation (www.jomarcorp.com, Egg Harbor Twp, NJ) is the world's leading manufacturer of injection blow molding machinery for the pharmaceutical, health care, personal care, beauty, food, beverage and household products markets. With over 45 years of experience, Jomar is the choice of some of the world's most recognized brands to create high-quality injection blow-molded packaging for their products. Jomar machines are known throughout the industry as being brilliantly simple and built to last. The company's desire

Challenge:

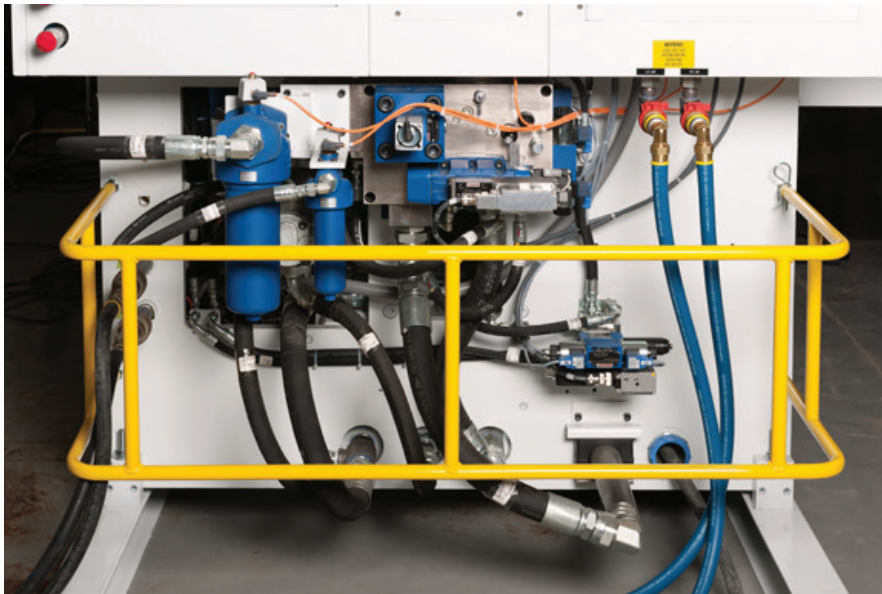
Reduce energy consumption in blow molding machine while maintaining the same production output and machine footprint

Solution:

Sytronix servo-driven hydraulic system incorporated into the Jomar Model 85S machine

Results:

- Bosch Rexroth regional sales successfully worked with distributor, Airline Hydraulics, to calculate parameters of the operation
- Sizing of the Rexroth Sytronix variable speed hydraulic drive using MSK servo motor and IndraDrive C was accomplished by the Rexroth plastics machinery application engineers
- New Rexroth Hägglunds radial piston motor CAB "The Beast" specially designed for plastifier drives to be smaller and quieter than competitive products
- Energy consumption reduced by 42 percent



Blow Clamp Manifold with Bosch Rexroth 4WRLE Proportional Valve and Bosch Rexroth Pressure Filters.

to improve its machines' energy efficiency drove it to choose a Bosch Rexroth servo-driven hydraulic system, and to have it incorporated into its plastic injection blow molding machines.

In March of 2015, Tom Aufiero, regional sales engineer for Bosch Rexroth, and Neal Gigliotti, plastics manager at Bosch Rexroth met with Matt Jefferson, Kevin Adams and Bill Sherburne from Jomar's engineering department to talk about their needs during the National Plastics Expo (NPE Show) in Orlando. They discussed the benefits of incorporating servo-driven hydraulics in place of an all-electric platform to help Jomar achieve their goal of introducing a next-generation machine to bring to the global plastics show—the "K" Show—in Dusseldorf this year. The Rexroth team was already familiar with the Jomar machines and saw an opportunity to increase efficiency by using a Rexroth servo motor in conjunction with a Rexroth hydraulic pump system on Jomar's extruder drive, the largest

energy consumer on the machine. The new servo-driven pump would operate in four quadrants, controlling both pressure and flow, in a closed circuit with changing direction of rotation and two pressure sides, eliminating a proportional directional control valve and saving both costs and energy. The executives at Jomar liked the idea, leading to a machine design that would be the first of its kind in North America.

Torque, Speed and Horsepower

Jomar's goal was to reduce energy consumption while maintaining the same production output, all on the same machine frame within the identical footprint of the machine. Of the two main systems, the plastifier consumes the most energy on a present Jomar machine. Therefore, a decision was made to address the motion for this system. Rexroth's regional sales worked with Rob Panzarella, hydraulic product manager, at their long-time distributor, Airline Hydraulics, to tackle the problem. The first step

was to calculate the parameters of torque, speed and horsepower required for optimum performance of the plastifier operation. Next, a circuit was designed to accomplish this function. The sizing of the servo motor and drive was completed by the Bosch Rexroth plastics engineers.

Driving the Pump

The circuit uses a Rexroth MSK Servo Motor with an IndraDrive C to drive a Rexroth Axial Piston Pump, a new version of our proven A10 pump that has been developed to be driven by a servo motor. This pump is a relatively new design which operates at higher rpms and can take advantage of the capabilities of a servo motor. It can also operate in all four quadrants of hydraulic operation. This particular model and size pump is the first one sold in North America.

An Industry First

In creating a more efficient solution, the project also broke new ground. The pump supplies hydraulic oil to turn a hydraulic motor, which in turn is connected to the plastifier screw. The hydraulic motor is the new Hägglunds CAB radial piston motor, which is specifically designed for plastics industry plastifier drives. Known as "the hidden beast" because of the exceptional power packed in its compact design, the CAB is not just smaller and more powerful; it is also quieter than competing products. According to Neal Gigliotti, "we combined our SVP hydraulics with the Hägglunds motor in a way that hadn't been done anywhere – a closed loop pump driving a hydraulic motor on an extruder in bidirectional operation."

Ron Gabriele, sales manager at Jomar added, "Bosch Rexroth helped us implement technology with proven

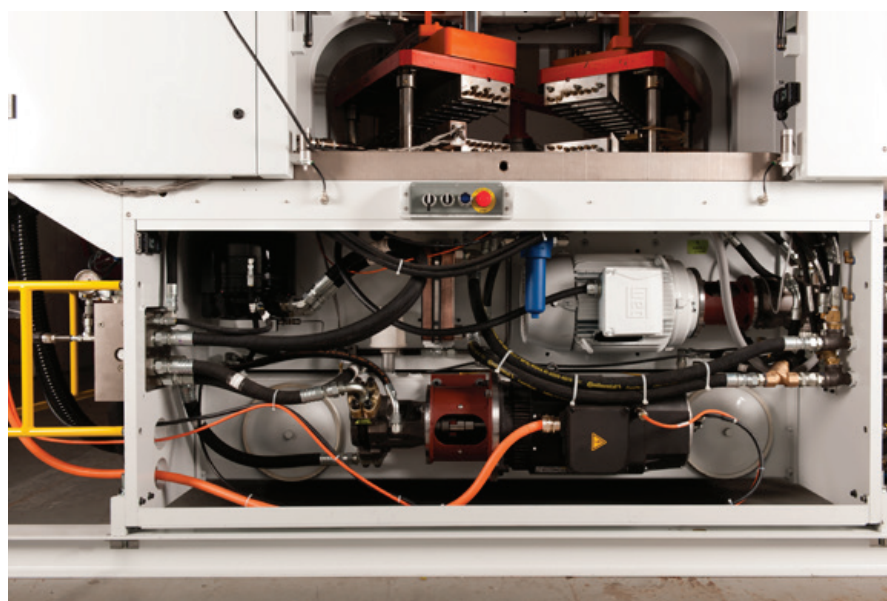
performance records such as servo motors and axial piston pumps, but also helped us innovate by adapting other equipment to our specific needs. For example, our machine will be the first in the plastics industry to use a radial piston motor to drive a vertical plastifier.” The just-introduced Häggblunds motor is also the first to be sold in North America.

In addition to the new technology introduced on the Jomar extruder, Bosch Rexroth added their latest piece of energy-saving Sytronix technology to the conventional hydraulic pump system that supplies oil to the injection and blow clamps. This device is a frequency drive with intelligence, called the DRn. It can convert almost any hydraulic system with a variable displacement pump and conventional electric motor into an energy saving variable speed drive. The intelligence of the DRn calculates the most efficient motor speed based on current pump operating conditions, which allows the system to run at its optimal motor speed in real time without any programming by the customer.

The final piece of the puzzle on this high tech machine was fully closed loop control of velocity and position for the injection and blow clamps. Adding closed loop control to the Jomar clamps allowed for a faster overall machine cycle, better closing cushion control for the molds, and less wear on the hydraulic cylinders. Bosch Rexroth’s VT-HACD handles all the closed loop duties for both clamp axis from one controller device.

Working Small

Along with durability, Jomar machines are known for their high output and small footprint. “We have the greatest



Bosch Rexroth Servo Motor with A10FZG Hydraulic Pump connected to Häggblunds new “Beast” Motor installed on vertical plastifier.

output per square foot ratio for any injection blowing machine in the industry and have customers who have designed their entire plant’s layout upon the compact size of the Jomar 85S,” states Gabriele. The Bosch Rexroth team knew that they simply couldn’t make any change to the Jomar machine that would increase the footprint of the machine. “They’ve always touted that you can fit more of their machines into a factory floor space,” says Gigliotti. “When they wanted to develop a new technology they wanted to keep the same footprint. They had tried a direct electric drive, but they had to stretch the frame, so we knew maintaining the small footprint was a priority.”

The solution the team created together not only kept the footprint the same, but also enabled Rexroth to reduce the size of some major components. According to Tom Aufiero, “most machines in the industry would use a horizontal extruder. Jomar uses a vertical extruder which allows the machine

to have a smaller footprint. We had some challenges as the motor was not designed for a vertical screw, but we adapted it, made minor modifications and it turned out to be a great combination—volumetrically efficient and quieter. Our circuit reduced the hydraulic reservoir size by 40%, so the customer can buy and maintain 40% less oil in the machine. This circuit only generates the power required to turn the screw and therefore allows the machine to run cooler. A reduced heat load means a much smaller heat exchanger. This translates into a lot less water usage.”

Keeping the Faithful

Jomar’s durability is in their DNA. According to Gabriele, “Reliability is at the core of our brand and the defining characteristic for the hundreds of machines we’ve manufactured.” He went on to explain that the company had to take a leap of faith in updating a tried and true machine. “We had to mitigate the need to evolve with the need to preserve our brand’s identity and not change what has been

working for years. By collaborating with Bosch Rexroth, a company with a brand that's also recognized for quality and durability, we've been able to take an enormous leap forward in the machine's capabilities without sacrificing the ruggedness that is key to our company's success. I think our experience with Bosch Rexroth helped us reevaluate our position on modifying the major functions of our machine."

A High-five Moment

Jomar hired an independent energy audit firm to calculate the energy usage of the new prototype machine. The company calculated the energy used by a standard Model 85S to establish a baseline. They then performed the same audit for the machine running with the servo-driven hydraulic system performing the same production. Gigliotti describes what happened when they got the call after the test results came in. "It was a high-five moment. The tests determined that the energy usage of the machine was reduced by 42 percent."

According to Gabriele, "It's critical that the improvements to the machine don't come with huge increases in costs to the customer." Jomar and Bosch Rexroth devised a solution that yields many of the benefits of

all-electric machines without the huge increase in the initial price or the long-term costs of ownership. When repairs are needed, the replacement of parts will be quick, easy and cost-efficient. "As a result of our work with Bosch Rexroth, we've achieved energy savings of over 40 percent and built a machine that addresses the needs of the modern marketplace", comments Gabriele. "It's been a tremendous success at every level."

A True Partnership

Through all of the challenges and successes, the Jomar team appreciated the atmosphere of collaboration. "Bosch Rexroth was a true partner in this project," says Gabriele. "Its engineers and representatives were frequently in our R&D lab and, when not here, they were still always available to answer questions or discuss new ideas. We felt that they were as motivated as us to see the project succeed, which made the whole endeavor not only more interesting, but also fun." The experience fundamentally changed the way Jomar views innovation. Gabriele summed it up. "The success of our undertaking and the atmosphere of curiosity and interest engendered by our two groups will lead to more innovations and improvement in the near future."

Do you have an application worthy of a case study?

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