

Drive & Control profile

Whirlpool Upgrades Thermoforming Lines with Rexroth Retrofit



From start to finish the thermoforming process comprises the de-stacker, preheat oven, final heat oven, vacuum form press, part exit conveyor, trim press and boxing station.

“The important thing is how fast we started this up,” notes Michael J. Smith, engineering supervisor of Whirlpool Corporation’s Plastics Operations in Evansville, IN, commenting on a retrofit project the division undertook. Facing obsolescence, the Evansville division’s three thermoforming lines were in dire need of electrical and mechanical power transmission work, including shaft and motor adapters, gear boxes, servomotors and drives, wiring changes and

PLC and other modifications. “We had two other large shutdown projects over Christmas, and we didn’t have the resources to do it then, so we did it in two weekends in November to avoid a Christmas shutdown,” recalls Smith. “The small risk we took paid off from a business stance.”

With the help of distributor Doug Rodgers of Morrell, Inc. and Brian Van Laar, senior applications engineer with Bosch Rexroth Corporation’s Electric Drives and

Challenge

Quickly upgrade drives and servomotors on thermoformer machine to improve throughput and cut cycle time

Bosch Rexroth Solution

- Bosch Rexroth 40 amp DKC01.3 EcoDrive servo drives
- MKD servomotors
- DRIVETOP software

Benefits

- Rapid turnaround on thermoformer line upgrade
- De-stacker now runs 2 seconds faster
- Retrofit cuts five seconds from machine cycle time
- Brushless design and lifetime lubrication make motors maintenance free
- Switch from position to torque mode on the fly



The de-stacker's drive makes eight distinct moves when picking plastic sheets from the stack, all within 20 seconds.

Controls business unit, Whirlpool Corporation—the world's largest home appliance manufacturer—was able to update and upgrade its thermoforming lines, which produce the plastic inner door panels for more than 5,000 Whirlpool refrigerators each day. All this occurred seamlessly, which Smith attributes to the experience of his team and the efficiency and flexibility of the new components being installed.

Driving the De-stacker

Whirlpool upgraded the servomotors and drives on the de-stacker portion of the line using Rexroth 40 amp DKC01.3 EcoDrive servo drives and MKD servomotors. The de-stacker portion of a thermoforming line picks plastic sheets from a stack and indexes them into preheat ovens for eventual forming in the thermoforming press. From start to finish the process

comprises the de-stacker, preheat oven, final heat oven, vacuum form press, part exit conveyor, trim press and boxing station.

The de-stacker's drive makes eight distinct moves in this process, all within 20 seconds. In this application a stack is comprised of up to 225 thin plastic sheets. "The catch," says Smith, "is the stack height always varies after the previous sheet is picked, and the de-stacker loads from two opposing sides for quick changeover." The de-stacker rack descends at a high velocity until it trips a "whisker" switch and decelerates, moving at a slower speed until vacuum cups contact the sheet's surface.

"The difference in stack height is overcome by stopping the drive in a torque mode," explains Smith, who also noted the retrofit has removed five seconds from the original de-stacker cycle.

According to Smith, the pin chain transfer drives were also retrofit with servos on three machines. The pin chain resembles the chain on a chain saw, as teeth are embedded into the sheet to enable transfer. Photo eyes in the ovens are used to disable and retract oven beds should a sheet fall from the chain drive to avoid catastrophic plastic fires.

All told, the team upgraded the servomotors and drives on the de-stacker portion of one thermoforming line and on the transfer drives of all three lines. Whirlpool owns six other food liner thermoformers for cabinet liners. Each door liner machine produces

approximately 1,100 parts per shift during three shifts per day, five days per week. Smith said the machine is now running approximately two seconds faster, but the forming and trimming stations still limit the total product cycle. Future engineering is being considered to retrofit trim presses with alternate technology since the de-stacker now runs faster.

The Sum of Its Parts

The EcoDrive used in the Whirlpool retrofit is a compact, cost-effective servo drive system for applications of 1kW up to 27kW and is an especially economical solution for control and positioning tasks up to 27 kW. The system is characterized by its power, extensive functionality and price to power ratio, and it offers a large number of functions for various



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application requirements, including positioning block mode, angular and velocity synchronization, cam and cam-shaft functions plus an integrated virtual-axis generator. All standard encoder types can be used, depending on the requirements, via the second encoder input port, and compact drive electronics allow use of standard 300 mm cabinets for compact machine designs.

During servicing, all drive specific data can be transferred to the replacement unit by simply exchanging the programming module. The holding brake responds directly via the drive, which saves programming and wiring requirements of the PLC. The drive can be connected directly, without transformer, to all recognized mains voltages from 3 x 220 V to 3 x 480 V. Even single-

phase mains can be used, but with reduced output power. DRIVETOP, the graphical start-up software, guides setup on the control terminal or PC step-by-step.

Likewise, the Rexroth MKD servo motors are a cost-effective solution for general automation engineering applications up to 637 lb-in (72 Nm). The motors are IP65-rated and come standard with an incremental encoder. The MKD motors offer peak torque up to 187 Nm, maintenance-free operation due to a brushless design and bearings with lifetime lubrication, and a completely sealed motor design with a protection category of IP 65. The motors also include overload protection with motor temperature monitoring, a favorable power to weight ratio, and high overload capabilities.

“Our goals were to get the system upgraded in a very short time frame, integrate the drives and motors into the existing PLC program, and switch from position to torque mode on the fly,” summarizes Smith. “Our team was able to meet those challenges through the excellent local support of Morrell, our Rexroth application engineer, and the ease of use of Rexroth’s DRIVETOP software on setup.

Smith described the DRIVETOP software as user friendly, and noted that it allowed Whirlpool to improve application CAD drawing documentation and use an RS-485 link to put the software remotely on the process computer used by operators for oven heat recipe changes.

“The software is flexible, yet powerful,” says Smith. “It offers a lot of control options that competitors don’t, and its graphical design does not require a lot of programming experience to use it.”

Future plans for Whirlpool’s Evansville division include the retrofit of two existing variable frequency drives on two additional de-stacker drives.

Rexroth
Bosch Group