

# Drive & Control profile

## More Precision, Faster Setup for Pride Engineering's Die Grinding Machine with IndraMotion MTX



With Rexroth controls, Pride Engineering's Model 30 Air Bearing Grinder helps can manufacturers set new standards for die grinding accuracy and productivity.

CNC, drive, motor and interface package help improve productivity in beverage can making

In the world of beverage can manufacturing, the quality of the dies that shape each can directly impacts manufacturing quality and productivity. A die ground to ultra-precise tolerances will last longer and produce fewer tear offs.

Addressing the demand for more precise, longer-lasting dies, Pride Engineering of Minneapolis, MN, ([www.pridecan.com](http://www.pridecan.com)) has developed the Model 30 Air Bearing Grinder, a five-axis air bearing carbide die grinder that sets new standards for grinding

### Challenge

Improve accuracy; reduce setup time for die grinding

### Bosch Rexroth Solution

- IndraMotion MTX
- IndraDrive intelligent servo drives
- IndraControl HMI
- WinStudio visualization software
- IndraDyn S and T motors
- Ball Screw linear motion

### Results

- Rexroth controls accurately move each axis in 1  $\mu\text{m}$  increments
- Die grinding accuracy to .38 mm TIR (total indicator reading) roundness with a 2  $\mu\text{m}$  finish and  $\pm 1$  arc second radius
- Rexroth applications engineering expertise helped speed Model 30 development
- Automated grinding improves operator productivity
- Reduces quantity of dies needed in can production
- Die setup time reduced by up to 90%



The Rexroth IndraDrive integrated motion and logic capabilities support the Model 30's innovative "Pride Touch" control feature.

accuracy, ease of use, and fast, efficient grinder setup and changeover. To help meet these goals, Pride Engineering built the Model 30 with the reliable Bosch Rexroth IndraMotion MTX CNC controller and drive platform.

### Precision to "Die" For

Pride Engineering is one of the leading manufacturers supplying the two-piece can industry with equipment such as air bearing grinders. The company serves can manufacturers in North and South America, Asia and Europe.

The Model 30 is one of Pride Engineering's most advanced offerings, built to satisfy a growing need by can manufacturers for faster die production, reduced setup time, and more productive toolroom operation.

Can manufacturing is a high-throughput industry with conditions that can be quite punishing on production machines and tools. Aluminum or steel "cups" are drawn out of sheet metal, then "ironed" into their final shape by being pressed under

extreme pressure through a set of tungsten carbide dies, called a toolpack. Typical production is 400 to 600 cans per *minute*.

Minute imperfections in the die's roundness, inside diameter, or other areas can cause excess friction and uneven wear. This may lead to cans whose shape or diameter is off-specification, or cause a problem called *tear offs* where the can literally rips or tears as it passes through the toolpack.

Dies can be used for about four to five days of round-the-clock production before normal wear requires that they be pulled and re-ground.

"There's a constant industry demand for tighter tolerances and higher quality die finishes," said Bruce Allyn, vice president at Pride Engineering. "The Model 30 produces dies ground to extremely precise tolerances, for the closest



User-friendly controls built around the Rexroth IndraControl HMI reduce machine setup and changeover times.

thing to perfect roundness that's physically possible."

Previous versions of the grinder used manual setup and changeover procedures. Operators had to carefully center the die and find "zero" before grinding began. During the Model 30's development, engineers at Pride concluded they needed a new CNC controller to achieve their targeted levels of accuracy, reliability and ease of use. Working with local Rexroth distributor Motion Tech Automation, Pride found the perfect combination of user-friendly features, product performance and precise, automated CNC functionality: The Rexroth IndraMotion MTX.

The IndraMotion MTX system is a reliable, high-productivity machine tool CNC for grinding and forming operations. It contains all the components—drives, controller, operator software and a powerful engineering framework—optimized for machine tool automation.

IndraMotion MTX supports up to 64 axes of motion and 12 independent CNC channels. It improves machine tool performance with the shortest CNC cycle times and minimum PLC program processing times, helping tool builders achieve reliable high-speed machining and reduce non-productive setup and changeover times. It also uses an open architecture with standard interfaces such as Profibus, SERCOS, Ethernet, etc.

Pride’s Model 30 also utilizes Rexroth’s IndraDrive family of intelligent drives, offering drive-based precision loop closure and compensation functions, and optional features such as IEC 61131-3 compliant integrated motion and logic. In addition, the IndraDrive offers scalable functionality and a comprehensive range of high-performance servo (linear and rotary) and spindle motors.

**Air Bearings and MTX Controller Combine to Improve Accuracy**

In the Model 30, the air bearing workhead and wheelhead spindles are solidly mounted together on a granite surface plate that floats on air, isolating the work from high and low frequency vibrations. Dies can be ground to an accuracy of 15 millionths of an inch (.38 mm) TIR (total indicated contour).

During grinding, the die is held in the workhead, which can be pivoted in three axes while rotating the die at precisely defined speeds against a separate grinding workhead. Pivoting the workhead, it grinds the different angles needed to achieve each die’s precise specifications. The workhead must be positioned with micrometer accuracy over the pivot point to control the contour of the cut.

As the die’s diameter or other specifications change, the MTX automatically re-positions the grinding pivot point with cutting-edge accuracy. Automated advance or feed of the die can be made in one-micron increments. With Pride’s previous controller, the

smallest initial feed movement it could handle was three microns, which also required multiple commands – insufficient to today’s precise motion needs.

“The Rexroth IndraMotion MTX platform gives us much more accurate control,” said Allyn, “which gives our customers the ability to achieve a die that is ground closer to a perfect geometry than ever before possible, and do it on an automated basis to save setup and production time.”

**Grinding Made Faster, Easier, More Precise**

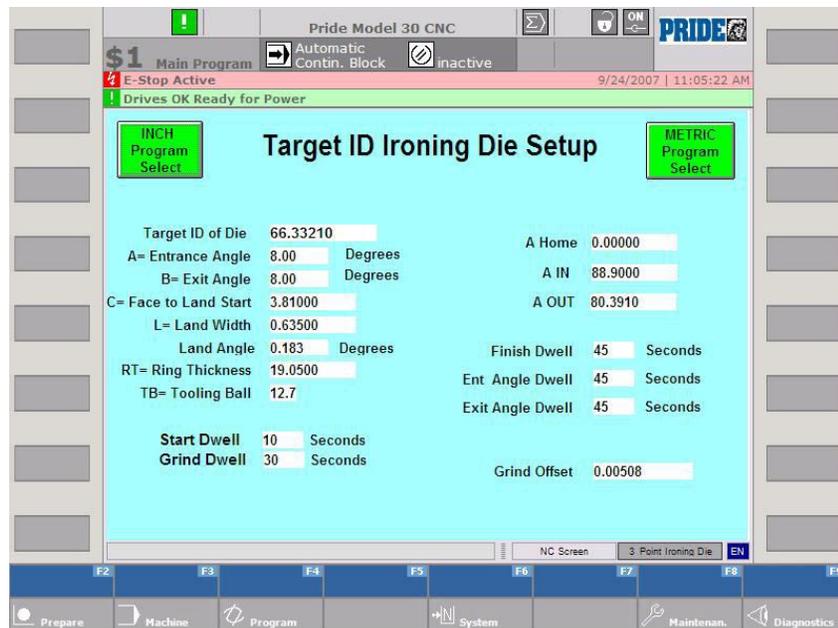
The IndraMotion MTX user-friendly interface cuts die turnaround time, a key industry need. From machine setup to die changeover, the IndraMotion MTX platform provides a fast, automated, menu-driven process,



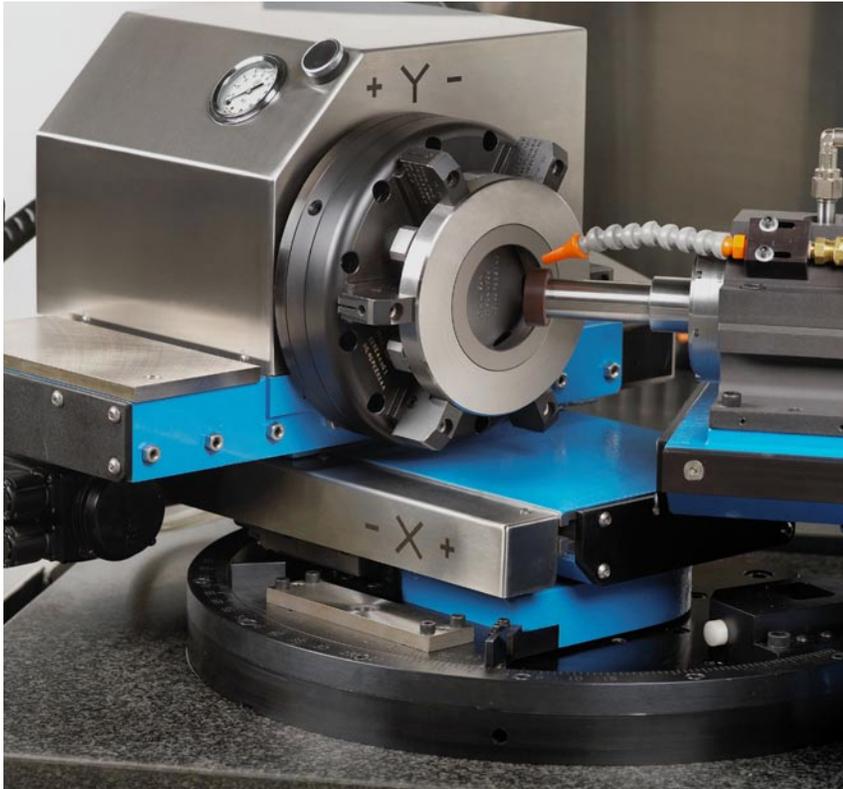
Utilities windows for setting scales or a torque meter make it easy for an operator without programming experience to maintain the grinder.

so tool operators are able to handle a variety of tasks.

Using the 12-inch Rexroth IndraControl VPP16 human machine interface (HMI), the operator selects the die to run. The operator also enters specifications such as the tooling ball, land width and ring thickness. Pride developed



The operator simply fills in the blank fields and the MTX control locates the correct pivot point and grinds the die to specification.



finds the die, minimizing non-grinding time. Once the grinding wheel touches the die, a high-speed input is sent to the MTX controller, to start the grinding cycle.

Controlled by a custom drive-based PLC technology function, the process takes advantage of the faster update times, for faster, more precise measurement of the torque of the grinding wheel.

The grind cycle is automatic; when it is complete, a blinking light tells the operator to return to the machine, since there's no need for an operator to supervise the tool.

“A grinder is only profitable when it is grinding, not when it's positioning,” Allyn said. “The less time spent setting up, the more time spent producing.”

Allyn added that Rexroth's applications engineering expertise in CNC motion control platforms helped speed the Model 30's development. “Bosch Rexroth is much more of a partner to us,” he said. “The Rexroth application engineers know how to help solve the technical problems that crop up when developing a machine tool.”

#### **IndraDyn T Frameless Torque Motor Improves Contour Control**

The motion platform on the Pride Engineering Model 30 also includes Rexroth IndraDyn S MSK motors for the X, Y and Z linear motion axes, and Rexroth Ball Screw units for extremely smooth, reliable, precise motion. In addition, a high-performance Rexroth IndraDyn T torque motor is used for the tool's



Rexroth's IndraDyn T frameless torque motor drives the Model 30's rotary, providing the most accurate radius possible in the world, repeating to an accuracy of  $\pm .077$  arc seconds with no gears or linkage to accumulate errors. The perfect radius means fewer tear-offs.

A key feature of the Model 30, called Pride Touch<sup>®</sup>, was developed with close cooperation from Rexroth's expert application engineers and takes advantage of the Rexroth IndraDrive's distributed architecture. On earlier machines, it typically took two to three minutes to set the die on the chuck and find the Z-axis zero. Pride Touch enables the grinder to automatically find zero and start the grinding cycle, all in approximately 15 seconds.

The Z axis moves the grinding wheel at a faster feed rate until it

the custom HMI screens using Rexroth's user-friendly WinStudio visualization software.

Next, the operator loads the die and then selects the “Cycle Start” button to begin operation. The controller automatically moves the X and Y axes to the correct position to maintain the precise pivot point throughout the die grinding.

rotary axis which controls the accuracy of the ground radius.

The IndraDyn T powers the rotary axis directly, with no gears, couplings, or joints, thereby eliminating mechanical elements to help ensure extremely smooth rotation and control.

“Controlling the radius of a redraw die is crucial,” Allyn said. “The frameless torque motor provides the most accurate radius possible in the world, repeating to an accuracy of  $\pm .077$  arc seconds.”

#### **Rexam Makes More Cans with Fewer Dies**

Rexam PLC ([www.rexam.com](http://www.rexam.com)) is the world’s leading manufacturer of beverage cans, producing more than 54 billion cans each year for Europe, the U.S. and South America. At the company’s Northfield plant in Buckinghamshire, UK, they recently upgraded their die grinding system with the Pride Model 30.

This plant has three aluminum can production lines that produce in excess of five million cans a day. At those production levels, the plant’s

machine tool shop needs to grind 20 new dies a day, on average.

The Model 30 improved die grinding productivity, as well as the quality and working life of the dies, according to one of the plant’s die grinding operators, Keith Berryman. Currently, the Northfield plant has been producing record numbers of cans, yet their tool usage has gone down, thanks to the Model 30.

“Previously, we had to grind 30 or more dies a day,” said Berryman. “Now, we’re under 20 dies a day. Since the machine grinds every die exactly the same, and every die is much closer to the specification, the dies are lasting longer.”

Most importantly, die grinding is much more accurate and reliable with the Model 30, Berryman said.

“In the past, I might have to grind two or three dies to get one good one,” he said. “With this machine, I know that once I’ve set the grinding parameters, it will hold the size I want, and I can produce dies much faster. I’m very impressed with how accurate the machine is, and how much time it

gives me to carry out other tasks, because die after die, it grinds everything true.”

Before Rexam began using the Model 30, die grinding was a manual operation at Northfield, Berryman said. Any time he needed to step away and take care of other duties, grinding stopped until he returned. Now he’s much more productive.

“With the Model 30, it’s an air bearing grinder, which is self-centering – there’s no clocking or truing of the die at the start,” he said. “And the Rexroth CNC system grinds the die automatically, in about six minutes. It’s a great improvement on what we used to have.”

Berryman also said the Windows-based user interface, supported by the IndraMotion MTX, was easy to learn and easy to use, and has made him much more productive. Since die grinding is now automated, he can step away from the machine and handle other tasks without have to interrupt and slow down the die grinding process.

**Rexroth**  
Bosch Group