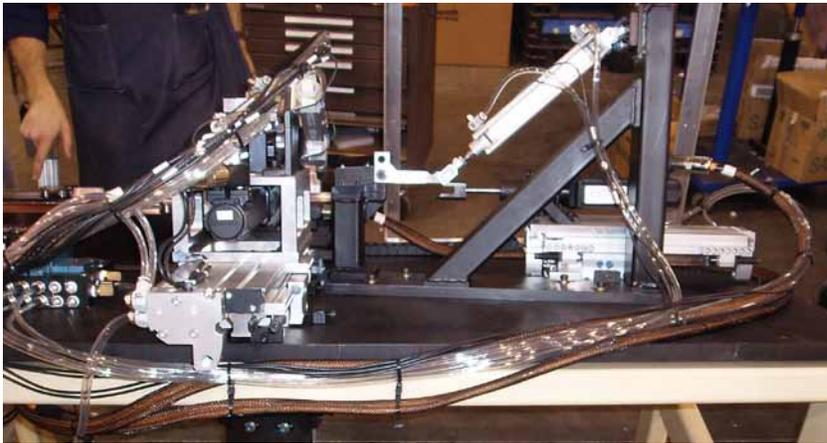


# Drive & Control profile

## Servos deliver big time, space savings for tube bending machine



With the Rexroth control system, product changeover on the four-axis tube bending machine is now handled in seconds with the push of a button.

It was a tall order when the customer came to the engineers at Specialty Tooling, a general industrial automation machine builder in Evansville, IN.

The request was to help improve a metal-forming operation used to create bends in tubing found on the bottom of refrigerators. The company wanted to improve productivity, operator safety, and efficiency of the tube-bending process. Specifically, they wanted to increase their variety of part configurations from two to four, reduce the 90-minute changeover

time, and decrease the number of machines on their production line from three to two.

To increase machine performance, they also wanted to maintain a six-second cycle on a process that included approximately 25 individual motions. In addition, they wanted to make it easier for the operator to adjust bend locations and angles to accommodate the variety of part configurations. Finally, they wanted to increase machine uptime and build in more safety functionality.

### Challenge

Improve tube-bending machine with more productivity, safer operation, faster changeover and reduced control panel layout

### Rexroth Solution:

- IndraDrive MLD-M control architecture with motion logic and integrated PLC
- SERCOS III I/O
- Safety on Board integrated drive-based safety control
- Pneumatics
- Linear motion
- IndraWorks engineering software suite

### Results:

- Product changeover in seconds with the push of a button vs. 90 minutes
- 35 percent reduction in wiring costs
- 25 percent reduction in control panel space, with cleaner layout
- Fast cycle times even with more complex product configurations
- Built in Safe Motion capabilities

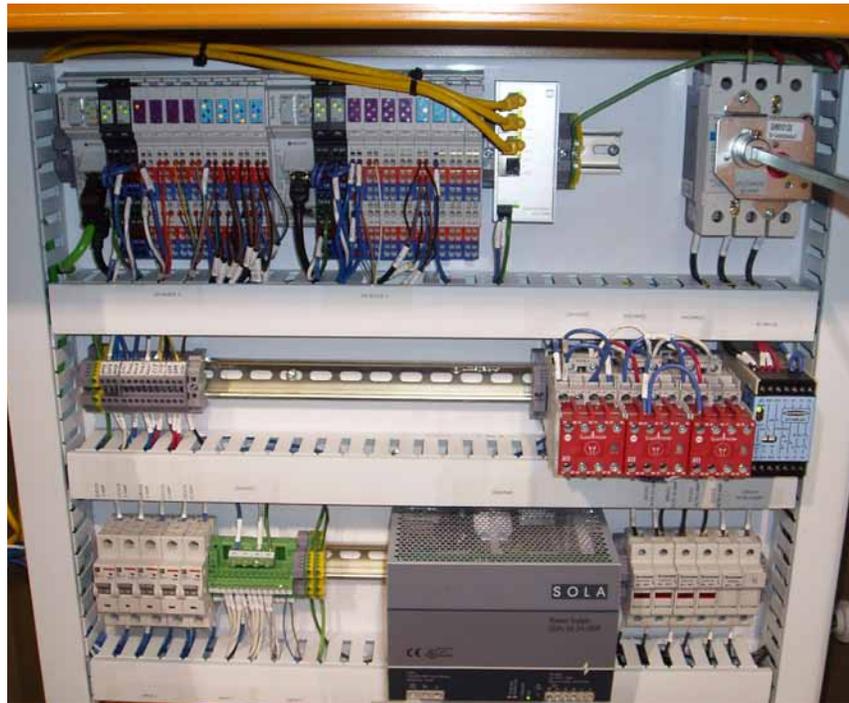
The end user provided a final bent-part drawing. One of the challenges was determining the exact sequence of operations that would work for all four configurations without creating tooling interference.

It was a tall order, indeed. In the past, tube bending for refrigeration and appliance applications used hard tooling and pneumatics. However, Specialty Tooling's engineers had a complete makeover in mind: using intelligent servo drives. They chose Bosch Rexroth's MLD-M control architecture with motion logic and integrated PLC according to IEC 61131-3 handled directly in the intelligent digital servo drives rather than in a separate controller. Rexroth's platform also included SERCOS III I/O and Safety on Board technology with built-in Safe Motion functionality. In addition, Rexroth provided pneumatic and linear motion technology used in the tube-bending machine.

#### **Why not a traditional PLC?**

Ryan Johann, an automation engineer with Specialty Tooling, opted for a drive-based system rather than a traditional control platform which would have required an external PLC or motion controller with built-in I/O cards.

"That would have required wiring the I/O points from the I/O cards to terminal blocks located in a separate portion of the panel for ease of wiring access for the end user," he explained. Instead, Johann said he's using a SERCOS III interface on the four-axis machine with a single



The machine uses a SERCOS III interface with a single wire daisy-chained from drive to drive and out to the I/O blocks.

wire, daisy-chained from drive to drive and out to the I/O blocks.

"I have two blocks with 16 inputs and 16 outputs each," Johann explained. "There are provisions for a three-wire sensor hook-up into the block, providing 24-volt DC and common power as well as the signal, which reduces space and wiring. This eliminates the requirement for other terminals if I were using a competitor's block and cable assembly. I've reduced the amount of wiring and time needed to put the panel together and it really cleans up the panel layout," he said.

#### **Improved productivity**

The Rexroth platform also significantly improved the productivity of the machine, eliminating the 60- to 90-minute hard-tooling changeover. Machine

operators now change part configurations with the push of a button. What's more, the customer reduced the number of machines needed to complete the work.

"They only needed one machine to keep up with the line," Johann elaborated. "But the customer had such a bad experience with the changeover times in their previous design, they opted for two. Later on, the customer announced plans to relocate the line to a new location. The decision to purchase two machines enabled the customer to move one of the machines to the new location, allowing continued operation in both facilities."

In addition to the improved uptime, the new machine matches the cycle times of the previous operation, while performing a more



Rexroth's IndraDrive intelligent servo drives offer Safety on Board functionality with built-in Safe Motion capabilities.

complicated bending operation and having four possible configurations instead of just two.

“So it’s actually faster,” Johann explained, “because it’s doing more work in the same amount of time.”

#### **Reducing panel size, less wiring**

Johann said the Rexroth MLD-M solution and the SERCOS III I/O blocks saved approximately 25 percent on panel space and 35 percent on wiring costs and results in a much cleaner panel layout.

“When I’m laying out a control enclosure I determine where it will be the easiest for me to bring my I/O cabling in, from the machine,” explained Johann. “I look at the type of components I have, what voltages are needed in the application, and whether there will be potential for noise problems. I also consider what kind of drives

and control are necessary, and the type of communication that will be needed. I lay out the panel to isolate the high-voltage components from the low-voltage and communication components to keep interference out of the equation. The Rexroth control architecture really helps

to save space and wiring time while accomplishing these goals,” Johann said.

#### **Drive-based safety with Safety on Board functionality**

Rather than opting for a separate safety controller, Johann used Rexroth’s intelligent IndraDrive servo drives with built-in Safety on Board certified safety technology according to EN 134849-1, EN 61800-5-2, EN 61508 category 3, PL d, SIL 2. The drive-based safety platform allows an operator to enter the machine cell to load and unload parts without having to drop the mains voltage and enable state of the drives. The machine simply enters a “safe stop” condition, without having to do a complete restart.

“We have scenarios where operators need to enter into the machine space to load and unload parts when the cycle is complete,” said Johann. “This presented a unique



Specialty Tooling used a Rexroth IndraDrive MLD-M architecture with motion and logic combined in the drive to help reduce their wiring and control panel needs.

challenge because, typically, when the operator enters the cell, the 480 voltage to the drives would have to drop in order to meet OSHA specifications. With Rexroth's Safety on Board technology, the machine automatically goes into a safe stop condition so the operator can safely move about the cell without having to completely reset the machine afterward."

#### **Single software design package**

Johann used Bosch Rexroth's IndraWorks engineering software suite to design the system.

"One reason I like using Rexroth control products is the IndraWorks single software package that allows me to build an entire project," he said. "I can have motion controllers or the MLD logic and motion control built right into a single drive for smaller applications. I can integrate my drives with all the parameters and all of my logic and motion programming. The programming with the HMIs and also the I/O is all comprehensive inside that software package so I can drag and drop, program, integrate and execute the entire project. "

#### **Positive customer reaction**

Best of all, the customer is pleased with the new equipment. "The Rexroth solution was not in the customer's original control standards specification," Johann noted. "So we convinced them to consider all the benefits. But now they love it and they're looking at it for other applications."

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