

Tube Bending Cell Changes Production Of Heat Exchanger Elements



RathGibson is a leading provider of precision engineered stainless steel, nickel, and titanium welded, welded and drawn, and seamless straight lengths, coil, and U-bend tubing to a wide variety of markets such as chemical, petrochemical, power generation, oil and gas, food and beverage, pharmaceutical, biopharmaceutical, medical, biotechnology, and general commercial.

Unison has developed a novel bending cell for RathGibson to serve the growing demand for U-shaped heat exchanger components. A version of Unison's servomotor-based tube bending machine uses a roll-forming tool to create custom-radius tubular parts under software control, eliminating much of the expensive tooling and set-up time conventionally required for this application.

The automatic bending cell is directly linked to the tube manufacturing process at RathGibson's Janesville, WI facility. At the start of the cell is a saw and infeed conveyor. Once a U-shape part is programmed by the operator or selected from a database of existing designs, the control program computes the length of tube required and issues a command to the saw. The cut tube length is fed into the cell's conveyor system, and then accurately positioned for bending with the aid of laser reflection sensors.

Unison's tube bending machine incorporates a special roll-forming tool. Under software control, roll form tools are accurately positioned to create the desired U shape with the correct bend radius and leg lengths. As the bending machine can produce U-shape parts with leg lengths of 15 or more meters, a special swinging cantilever structure is fitted on the output section to support tubing as it progresses through the forming process. Once the U-shape is formed, the cantilever gantry swings away, and the conveyor then lifts and tilts the tubing to free it from the

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machine and slide it laterally onto a second conveyor which takes it onto the final annealing stage. This sideways offloading action cuts cycle time significantly as it eliminates the need to drive the remaining 15 meters of tubing through the machine.

The novel action of the tube bending cell allows RathGibson to make the majority of parts for any heat exchanger using just a single software-controlled tool, and in a single rapid stage of less than 10 minutes, including annealing. The very innermost elements of the heat exchanger bundle, which have very tight radii, are bent on the Unison machine with the aid of conventional tube bending dies.

The bending cell has allowed RathGibson to offer a complete range of tubing for heat exchanger applications in the power generation industry and processing sectors such as chemical, petrochemical, and food.

RathGibson's choice of Unison's novel bending cell has eliminated several hundreds of thousands of dollars worth of tooling that would typically have been required to meet the wide ranging demand for different heat exchange element sizes. It also provided a very simple software set-up process that allows parts to be created easily by entering a few simple parameters, or repeated on demand by recalling an existing design from a database.

The software-based configuration also means that RathGibson avoids the operational complexities associated with traditional batch processing production techniques, where die-based bending machines are used to produce progressive batches of heat exchanger parts of different sizes. As a complete U-shape part can be sawn to length, bent, and annealed in less than 10 minutes, and both the tube mill and bending cell operators are located right next to each other, RathGibson has complete control over the entire processing chain. This avoids any issues that might result from using tubing with different material characteristics and ensuring that these large and difficult-to-handle components are fabricated right the first time.

"The software-based flexibility of this cell has helped us to offer high quality U-bend tubing to our customers quickly and efficiently," says RathGibson's Director of Continuous Improvement, Anthony Massini.

"Roll forming is often used for shaping tube in low cost applications, but this is the first time we have made a machine for such a high precision and physically large task," says Alan Pickering of Unison. "Creating the algorithms that drive the precision roll forming tools involved a lot of theoretical and practical investigation, which we believe might now benefit other bending applications."

RathGibson's new U-bend tubing cell is able to supply custom-bent heat exchanger elements using a large variety of tubing materials including all major stainless steel grades, numerous types of duplex stainless steel, super austenitic steel, and ferritic or super ferritic steel. As the heat exchanger elements come direct from the tube mill, RathGibson is able to supply detailed quality and traceability information as required. The company's low oxidation, acid-free annealing process also complies with the ASTM/ASME 688 and 803 Feedwater Heater specifications used in this

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application sector.

Unison tube bending machines are available in the U.S. from Horn Machine Tools.

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