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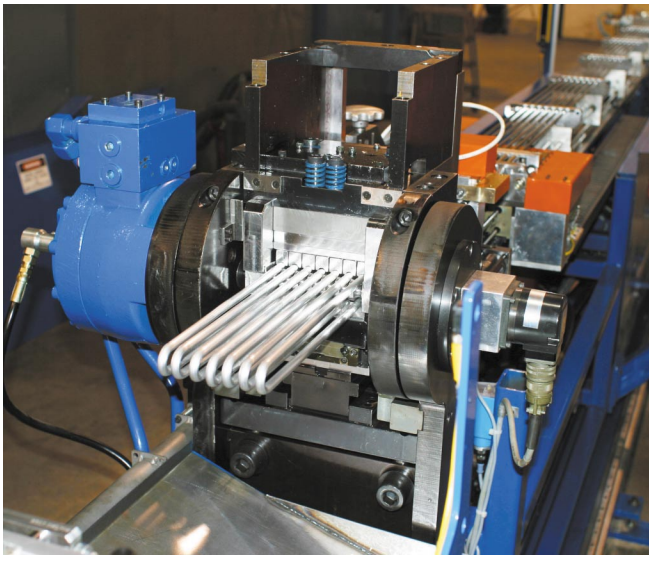
NEWS

MOTION CONTROL + POWER TRANSMISSION



BEND ME, SHAPE ME: Berkeley Process Control's BXi controller has transformed bending heat exchanger tubes, or "hairpins," from an operator-dependent art to a tightly controlled process. In the past, material variability often required end-product rework by hand.

AUTOMATION

Control Retrofit Tightens Tolerances, Simplifies Operations

Ethernet controller takes guesswork out of material variability in heat exchanger fabrication

In HVAC parlance, "hairpins" are not fine-wire clips for holding one's tresses in place. Rather, they are 1/4-5/8-inch ID aluminum or copper tubes bent 180°, for an end product ranging in length from a few inches to upwards of 16 ft. The tubes are then laced onto cooling fins to form heat-exchanger condensers and evaporator coils.

Up to eight coils of tube material can feed a hairpin bender at one time. Because tube reels can come from different suppliers, and different batches from the same supplier, material differences in hardness (heat treat), wall thickness, and diameter, as well as the amount of bending lubrication, can play havoc in producing a consistent result in hairpin leg length (to within ±0.020 inch). Hand rework of the end-product to correct errors leads to production slowdowns. And machine operators have to develop experience to know what parts of the machine to adjust to try and minimize errors.

When engineers at Sturgis, MI-based Burr Oak Tool and Gauge Co. (http://burroak.com) looked to redesign such legacy machinery they not only wanted to improve process control to cut rework and scrap but produce a control system, including diagnostics, that could be scalable across their product line—literally hundreds of machine configurations. "We couldn't afford to install a simple PLC with a set of low-end options only to redevelop a new software package for higher end options," says Galen Harman, VP of engineering. Because of such scalability and the capability to control both hydraulic and electric drives directly, they turned to the BXi control platform from Richmond, CA-based Berkeley Process Control (www.berkeleyprocess.com). The BXi not only deployed the significant software Burr Oak developed across company products but also reduced parts count—dedicated hydraulic and electric control algorithms eliminated the need for servo controllers, their integration, and diagnostics on the two hydraulic and three electric bender axes. And Ethernet I/O allowed convenient rack location, reducing machine wiring.

THE CONTROLLER ALLOWED SOFTWARE USE ACROSS COMPANY PRODUCTS AND REDUCED PARTS COUNT.

A touch-screen interface not only provides for control and automatic setup but furnishes operators with the diagnostics to correct problems. Operators are directed by a set of questions. If the machine fails to display an accurate error message, then the operator can use a "process tracker menu" and a state logic diagram to determine the software step that caused the problem. In addition, graphing axis motion on the display helps tune the system even at high speeds and varying loads on the rotating tube support assemblies, or booms as they are called, which bend the tubes.

Light curtains protect the perimeter of the bender from intrusions. But while these can be accidentally triggered several times a day, notes Harman, the controller allows easy recovery from a stoppage at any point in the machine cycle. In addition to cutting inputs to mechanical and hydraulic devices, "We developed cycle pausing that permitted the control logic to be paused anywhere in the machine cycle," he adds. The software treats a light curtain trigger exactly like a cycle pause, picking up the process where it was interrupted rather than restarting a cycle with possible scrapping of material.

—Rick DeMeis