



CHANGING FREQUENCIES

Controlling weld frequency and other variables helps achieve a weld HAZ with the best performance properties for a pipe or tube's end application.

Patented technology helps **Metal-Matic** achieve better tube welds with less scrap

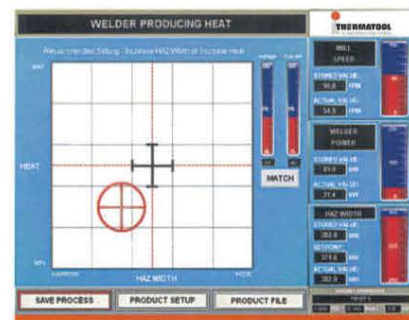
“A good weld is crucial,” says Terry Kalvestran, director of engineering, Metal-Matic Inc., Minneapolis. “Depending on the component, if you have a poor weld, it can mean part failure or worse, a product recall.”

A leading producer of as-welded and DOM or drawn-over-mandrel carbon steel tubing for standard and specialty applications for automotive, appliance and construction markets worldwide, Metal-Matic aggressively works to continually improve product quality. “We’re always trying to achieve the best weld quality possible,” says Kalvestran. When steady growth prompted the manufacturer to replace an older welder on one of its eight tube mills, Metal-Matic looked for technology that could take its already-high performance standards higher.

“We chose ThermoTool’s HAZ control

technology high-frequency welder because we felt the capability to vary frequency would allow us to accommodate different steel chemistries and provide a better weld with less scrap,” Kalvestran says. ThermoTool Corp., East Haven, Conn., supplies the tube and pipe industry with high-frequency welding and heat-treating equipment and high-speed flying cut-off machines. ThermoTool is part of 40 companies making up the Inductotherm Group, a multitechnology, global organization serving the thermal processing industry with a range of products and services.

Metal-Matic produces as-welded car-



When variables change, a visual display helps operators adjust the HAZ in real time.

bon steel tubing in sizes ranging from an outside diameter of 0.375 in. with a wall thickness of 0.025 in. up to an outside diameter of 3.5 in. with a wall

Tube & Pipe

thickness of 0.2 in.

DOM round tubing is made by cold drawing a tube over a carbide mandrel and through a carbide die. It's produced in sizes ranging from an outside diameter of 0.25 in. with a wall thickness of 0.025 in. up to an outside diameter of 3.25 in. with a wall thickness of 0.19 in. The process allows Metal-Matic to control the outside diameter and inside diameter of the tube to meet tighter tolerances, achieve a smooth inner finish and increase physical properties. "The DOM process starts with welded tube, which is cleaned and lubricated then drawn. Once the tube is drawn, it's straightened, re-tested and indexed for trimming or cutting," says Kalvestran.

Metal-Matic supplies DOM tubing to the automotive industry, and weld quality is critical for the end uses, which can include shock absorbers, hydraulic cylinders and fluid lines, steering components and the struts that hold trunk and hood lids open. Metal-Matic's DOM tubing also is used in the appliance and heavy equipment markets as well as other industries.

Optimizing HAZ control

The HCT welder couples variable-frequency technology with proprietary software to give operators a tool that allows them to optimize control of the heat affected zone, known as HAZ, and determine the right combination of both welding frequency (hertz) and welding power (kilowatts). HAZ is the area of base metal that has had its microstructure and properties altered by welding.

People long thought variables like welder output power, mill speed and vee length primarily affected the HAZ. "During the last few years, ThermoTool has been able to demonstrate that welding frequency is a key process variable," says Michael DiDonato, engineering systems product manager. "By precisely controlling these variables, an operator can achieve a weld HAZ that has the best performance properties, such as strength, ductility or cosmetic finish, for a pipe or tube's end application."

Metal-Matic's original welder did not have the capability to adjust frequency in real time and required operators to sort out weaker welds, which generated more

scrap and made the process more costly.

The company installed the HCT welder in December 2010, integrating the machine into its tube mill. "DOM production constitutes the majority of our business with as-welded steel tubing making up the balance," Kalvestran says. "We make our tubing from materials that include low-carbon, high-strength low alloy and aluminized steel in a variety of grades. Based on customer requirements, our steel suppliers provide us with the chemistries we need, and we adjust the welders to accommodate the steel grade."

Metal-Matic's tube mills run continuously, consuming flat sheets of steel to form tubes that are welded, sized, straightened and cut on the fly into appropriate lengths. When a coil begins to run out, the operator butt welds the next coil of steel on to the end of the previous coil. During this process, an accumulator continues to feed material, allowing time for the splicing process to be completed. The operator at the mill's exit end monitors the cutoff process to ensure the machine is cutting properly.

"It's important to have advanced technology like the HCT welder to support our output," says Kalvestran. Once the tube is welded, an in-line eddy current test is used to aid in verifying weld quality. If irregularities such as a weld void are detected, a trigger from the monitoring unit is sent to mark the defect with spray paint. "With the HCT welder, we've found that in addition to the stability of the weld, our production yield has increased and our scrap has been reduced. The quality we're able to achieve supports our goal of zero defects," he says.

Simple, repeatable welding

"The HCT welder redefines the high-frequency welding process," says DiDonato. "The patented software combines variables that include weld frequency, power, vee length, tube outside diameter and wall thickness. Using mill speed as an input, the software guides the operator to the best weld using a simple graphic representation. The system makes even the most difficult-to-weld alloys simple and repeatable," he says.

The technology allows the operator to



The ability to vary frequency accommodates different steel chemistries and provides a better weld with less scrap.

adjust welding frequency from the console without shutting down the line and making a mechanical adjustment inside the welder. If an operator changes mill speed or vee length or needs to make tubing with a different diameter or wall thickness, the software console's visual display allows the operator to anticipate changes in the welding process and adjust the HAZ in real time back to the optimum weld target zone to ensure the machine is operating at the same HAZ width.

"It's a high-tech approach but easy for the operators to use," Kalvestran adds. "ThermoTool provided installation assistance and start-up training, effectively communicating with all levels of staff. We actually initiated start-up ahead of schedule."

The HCT welder's software also allows Metal-Matic to store production recipes from previously run products, which workers can retrieve the next time they produce a product with the same properties. For companies like Metal-Matic that run multiple shifts manned by different operators, the tracking system ensures repeatable process control from part run to part run. In addition to removing potential human error, the system ensures part consistency and quality. "This is a very competitive business," says Kalvestran. "Our service and commitment to our customers makes the difference along with the value of the product we produce." **FFJ**

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