SIEMENS

Case study

Catalytic converter can production

Improved by 20 percent with roll former and laser welder

Eberspaecher N.A., based in Novi, Michigan, is a Tier-One supplier of complete exhaust systems. They manufacture stainless steel catalytic converters and exhaust products required by its impressive list of automotive customers, including Chrysler, Dodge, Jeep, Pontiac, Buick, Chevrolet and Mercedes-Benz. Founded in 1865 and in the automotive exhaust business since 1931, this German-based company has operated facilities in the USA and Canada since 2000. It currently manufactures in Brighton, Michigan, as well as Tuscaloosa, Alabama and Brampton, Ontario.

For their new catalytic converter can production line, Eberspaecher N.A. installed a laser-welding short-tube production cell. At the heart of this system is a "Twinmaster" roll-forming and laser-welding production system supplied by Weil Engineering North America of Troy, Michigan, which is a subsidiary of Weil Engineering GmbH. of Muellheim, Germany. Currently, Weil Engineering has over 60 tube forming and welding systems in operation in North America, most of them using lasers for welding application. Sixty percent of Weil Engineering's business activities are in the automotive fields, followed by HVAC, chimney, household appliances and motor shell applications.

The "Twinmaster" combines two major functions in one machine: roll-forming and welding. Secondary processes such as blank feeding and post-welding expansion of tubes for perfect roundness are directly linked to the "Twinmaster", creating one complete production center. The control functions for the entire system are supplied by Siemens, using the Sinumerik 840D CNC platform. The HMI is configured by Weil Engineering in "ProTool" for the particular performance requirements of this unique production system.

Above: TWINMASTER machine from Weil Engineering combines a destacker, roll former and laser welder to produce various lengths and shapes. Eberspaecher uses these machines to make stainless steel catalytic converter cans and other exhaust/silencer system components for many major auto builders.

The sequences of these operations, the exact timing for each process and the control of all movements are monitored and operated by the Siemens Sinumerik 840D CNC.

Left: drawing station

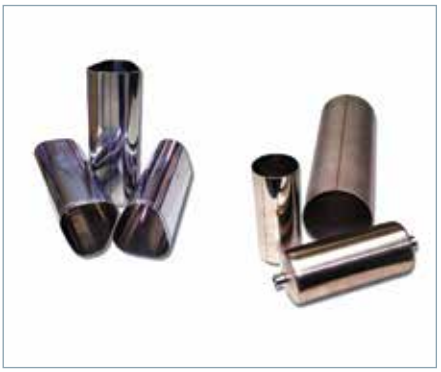
Center: laser station

Right: bending station

Production capabilities of this short-tube manufacturing system	
Min. and max. tube diameter	3–8″
Min. and max. tube length	8–50″
Tube shapes	Round or oval
Wall thickness range	0.020–0.080″
Materials	Mild and stainless steels
Output	up to 500 parts/hour
Welding speed (3.2 kW laser)	4–5 meters/min

Sequence of operation
▪ Two sheet-metal destackers, mounted on a rotary table, are loaded each with approx. one hour's production material and feed the blanks into the roll-former. The blanks are inspected for double-sheet condition during the transfer movement. Once the first destacker is empty, the rotary table moves the second destacker into place and the first one can be re-loaded, ensuring a non-stop supply of material.
▪ Depending on the length of the tubes, multiple blanks (up to 4) can be rolled into tubes during the same machine cycle.
▪ The rolled tube blanks are automatically transferred from the roller to the seam welder, where they are automatically clamped and butt-welded using a laser-beam generated by the Trumpf TLF 3200 laser. (TIG welding is another option for this process, being more economical in cost initially, but also slower in welding speed compared to laser.).
▪ Once the welding process is done, the finished cans are extracted from the tooling and transferred onto an inline weld annealing system, which heats the welding zone to approx. 1000° C (~ 1800° F) to relieve the stress in the welded seam.
▪ After a cooling section, the CNC-controlled handling system introduces the cans into a hydraulically operated tube expander, where they receive a pre-selected inside dimension. This final dimension is calculated from the diameter of the converter substrates, the thickness of the insulation mats and the spring-back of the stainless steel material used for the converter cans.

The Siemens Sinumerik 840D, a powerful CNC, controls all of the operations on the machine. Once programmed, the blank will be processed through each stage in the machine.



Some of the shapes produced on the TWINMASTER machines.

From the Siemens operator panel, each step in the TWINMASTER process is monitored and controlled. Weil Engineering uses ProTool software to custom configure the HMI on the machine.

The Siemens CNC also monitors the position, the power and the on/off condition of the laser beam, as well as all the transfer mechanisms and the tooling. According to Weil Engineering's service manager, Matthias Philipp, "The open architecture and substantial power of the CNC make it possible to easily monitor and control all these various functions. We also produce our own HMI protocols for the CNC and PLC on the operator panel. The Siemens system makes this much easier to accomplish."

Onboard the Twinmaster, the Siemens CNC technology controls eight rotary axes, with the Simodrive 611U drive system on the destacker and chamfering device. Another Simodrive 611U operates four axes on the expander and handling system. With the Profibus field bus system pioneered by Siemens, all CNC, PLC, HMI and drive systems can communicate in a more reliable fashion. This permits one CNC program to be written, and then adapted by the machine builders, such as Weil Engineering, to modify their controls based on the particular functionalities of their equipment. In this case, for example, two analog outputs are utilized for power and sequencing to control ramping, on/off and other parameters of the laser. The Trumpf laser on the Twinmaster machine has a 200mm optics bifocal mirror with a constant focal length. When the material thickness changes, the CNC tooling varies the position of the workpiece.

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