



*Application Story: Trumpf, Inc.*

## IMPROVED PRODUCTION OF LASER COMPONENTS AT TRUMPF

### Results from three-way partnership

TRUMPF, Inc. sought a better way to produce the high-precision components of their lasers, fabricating machine structures and related assemblies. They required a flexible solution that would still yield maximum accuracy, reduced time-to-part, and material cost savings. The solution was found in two DMG five-axis universal machining centers, equipped with twin rotating pallets and a Fastems automated loading system, powered by Siemens CNCs.

The company produces virtually all of its laser and machine components in-house, affording it greater quality control, faster response, the ability to customize equipment and overall cost containment. For many of the components, which range in material composition from aluminum alloys to mild steel, tool steel and stainless, the work was previously performed on a series of HMCs and a stand-alone five-axis milling machine at TRUMPF's manufacturing facility in Farmington, CT, according to components manager Peter Hafner.

As director of manufacturing, Kai Moellendorf, explains, "The implementation of the two five-axis machines, working in concert with the pallet changer system from Fastems, allowed us to replace the HMCs with this newer technology, transfer 70% of the work from the stand-alone mill and overall keep our production running in a more streamlined manner."

On one laser resonator frame, measuring 23.6 in. sq. and 4.7 in. height, eight holes are required with true position of 0.0016 in. with a 0.39 in. H7 dia. and 0.39 in. depth that must be held precisely. Also, the parallelism and perpendicularity on eight surfaces of the frame must be within a 0.0008 in. tolerance. This welded steel frame holds a laser resonator in position and thus the accuracy is paramount. TRUMPF manufacturing engineer

Edin Meskic confirms the DMG machine is maintaining the tolerances at better than twice that requirement. Plus, the overall machining time has reduced by 45 minutes per piece, a 28% improvement.

On the two DMG Model DMC 100 U duoBLOCK™ machining centers, various other steel and aluminum housings and structures are machined. A twin pallet system on each machine allows the loading and unloading of a fixtured workpiece by the Fastems automated system, while machining is under way. Each machine is equipped with an automatic tool changer and an additional 240-position tool magazine. Each tool is equipped with a data tag/chip, which contains all information required to identify the tool and its properties/length/diameter/tool number etc. Controlling all axis, tool changes and pallet movements on each machining center is a Siemens SINUMERIK 840D powerline CNC with SIMODRIVE 611D drive package. The PCU has a video link to the operator terminal. Peter Hafner comments that this arrangement has substantial savings in time and labor for his department, plus the tool id chips are read by a sensor, prior to entering the machine magazine, so there's an additional safeguard against the wrong tool entering the work area. "We strive to take every variable out of the machining center to keep it running at maximum efficiency," he notes. The company's goal is 24/7 operation of these machining centers within one year and Hafner is optimistic that goal is realizable.

The CNC utilizes proprietary DMG interface software, as well as the Siemens ShopMill suite, with Ethernet communication of all machine condition status to the internal TRUMPF server for production monitoring. Throughout the facility, performance data are

**Above Left:** Machining of laser resonator frame at TRUMPF, on a DMG Model DMC 100 U duoBLOCK, a five-axis, five-sided machining center with Siemens Sinumerik 840D powerline CNC and SIMODRIVE 611D drive package onboard. The machine reduced the cutting time on this part by 28%, while holding better tolerances than the TRUMPF requirement.

**Above Right:** TRUMPF Director of Manufacturing Kai Moellendorf (l) and Manufacturing Engineer Edin Meskic (r) at the DMG machining center

**Below:** The laser resonator frame must be made to exact specifications, as it provides the critical stability to the beam-generating device.



displayed for all to see. According to Kai Moellendorf, "This gives everyone here a sense of accomplishment, when we meet or exceed our goals, plus it provides the incentive for all of us to maintain those levels of productivity. We all take pride in keeping the curves on the upswing!"

Typically, parts are designed by TRUMPF engineers with the CAD software SolidWorks, then fed into the CAM software TOPCAM, where the NC files are created. These files are then transferred to the machining centers via Ethernet connection.

At the outset of the evaluation process that led to the purchase of these machining centers, according to Moellendorf, the decision was made to purchase medium-sized units. Peter Hafner adds, "We established a questionnaire, based on technology, engineering assistance, sales support, training and other factors. We'd worked with DMG in the U.S. previously and they were deemed the most capable of handling our complex requirements, as the machine builder. Control was the next issue. Our emphasis there was on quality, functionality, expandability and price, of course. With five-axis, spindle and ancillary motion control involved, the CNC and drive package needed to be very adaptable to our numerous short runs, varying sizes, extremely tight tolerances and expansive tool handling requirements. Plus, our SYNCHRO policy of lean manufacturing and continuous process improvement demanded the most sophisticated control data transmission capabilities be onboard. Finally, the extra demand of integrating the Fastems pallet changing system was critical, both in terms of speed and reliable delivery of the correct workpieces to the two machining centers. When all these factors were considered, plus their status as our existing OE supplier for controls, the choice of the Siemens CNC and drives was relatively easy."

DMG wrote the software to integrate the pallet system with the two machining centers, working with Siemens hardware and the Fastems controller.

TRUMPF also operates a full department of Index CNC turning machines to produce other components and these machines are also equipped with Siemens 840D CNCs and 611D drive packages. A variety of parts for TRUMPF's TLF and TCF lasers are produced on these machines, as well as other components for TRUMPF's punch and laser machines.

Troubleshooting on all the machines in this department, as well as the machining centers, is performed through remote diagnostics via NetService.

In addition to building hundreds of lasers and laser systems every year, for applications ranging from cutting, welding and forming to marking, scanning and even semiconductor production, TRUMPF operates a medical/electronics division and a power tools group. The largest division of the company, however, produces fabricating machinery, including punching, forming and bending machines, plus industrial lasers, all used for sheet-metal processing.

Among the company's hallmark achievements has been the introduction of the TCF 1, the only diffusion-cooled CO2 laser with a coaxial arrangement of the electrodes in the 2000-watt category on the market today. This laser is built into the company's TC 3000 L combination laser/punch machine and TC L 2510 laser cutter, plus it's sold as an OEM component for assembly line and robotic system integration. As Kai Moellendorf notes, the TCF 1 was designed and developed entirely in the USA and is built exclusively at the company's U.S. plant in Farmington, CT.

On the TRUMPF laser machines, Siemens CNCs are utilized exclusively. This partnership extends worldwide, as the control supplier and machine builder have joined together to develop operating interfaces, both at their respective headquarters in Germany, in the U.S. and at other mutual corporate locations

**Below:** Fastems automated pallet load/unload system feeds the workpieces into the DMG machining centers, which also utilize a 240-position tool station for all tooling, fed by a robotic handling device. Each tool has an integral microchip preset by TRUMPF for proper identification on every job.





**Left:** The TRUMPF TCL 2510 is a CO2 laser cell with 5' x 10', 1/2" thick sheetmetal capacity, integral load/unload device and 6650 ipm speed. It also uses Siemens CNC technology to control all laser functions and machine movements. Tele-diagnostics are provided via an onboard modem.

around the world. "We utilize Siemens CNCs as our standard platform, whether for laser, combination, forming, welding or other TRUMPF machines," says Michael Reuster, manager of software development for the company.

As parts are required, the shop orders are fed directly to the appropriate machine tool department equipment and its onboard CNC. The workpiece and proper tooling are called up and the process can begin at a specified time. Furthermore, the company's internal SYNCHRO system of lean manufacturing and continuous process improvement has added even greater efficiencies to the overall

production scenario at this company. As Kai Moellendorf explains, "Our own ERP system tells us about our productivity and there is an ongoing evaluation of leading indicators within our operation to maintain a constantly updated status on performance. It pushes us and we respond," he notes with a smile.

TRUMPF currently designs and builds fabricating machinery and industrial lasers at its Farmington campus, where it also maintains a full customer training center, R&D facility and demonstration showroom for its ND:YAG and CO2 laser capabilities. ■

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