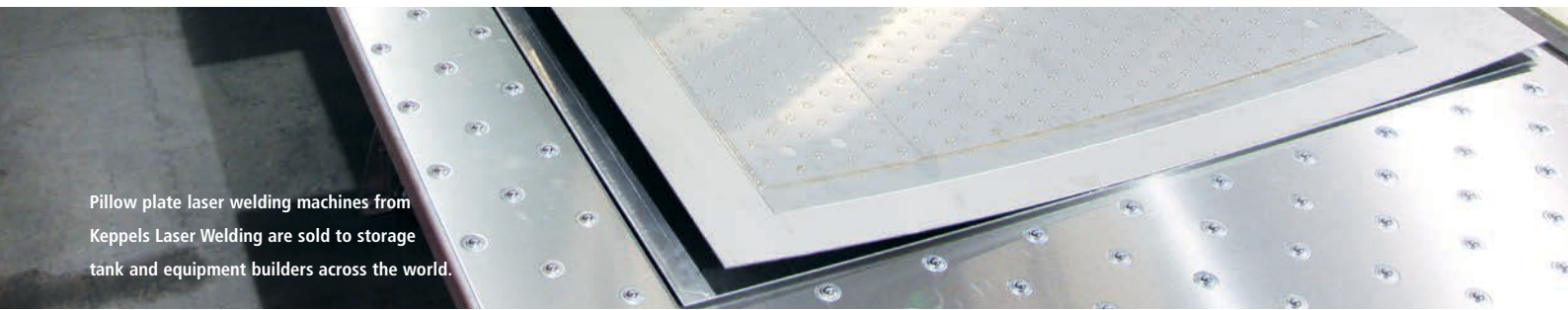
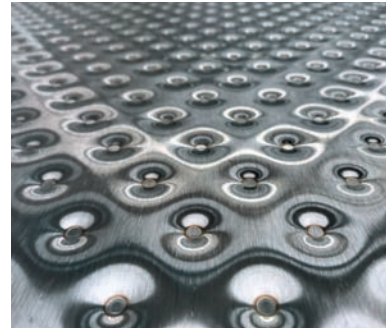




PC-based control platform promotes lean machine design and ease of use

## High-tech CNC laser welding machine produces pillow plates



Pillow plate laser welding machines from Keppels Laser Welding are sold to storage tank and equipment builders across the world.

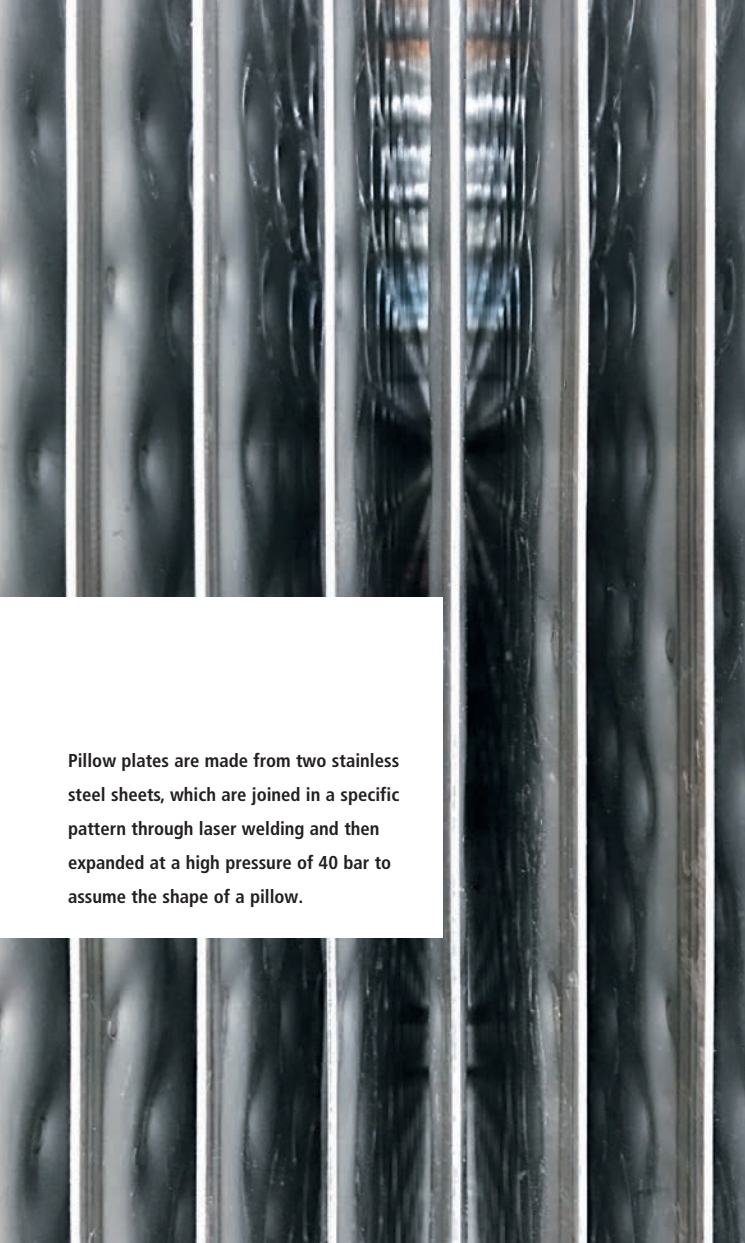
Pillow plates are made from two stainless steel sheets, which are joined in a particular pattern through laser or spot welding and then expanded under high pressure to assume the shape of a pillow. With heating or cooling media flowing through them under pressure, they serve as heat exchangers in a wide range of industries, including the food industry, storage tank and equipment manufacturing, and processing systems for a wide range of bulk materials.

The machines required for producing the different types of pillow plates are as varied as the applications they serve. Dutch company Keppels Laser Welding BV, based in Enschede, specializes in special-purpose machines for laser welding of pillow plates. Henk-Jan Keppels, mechanical engineer and owner of KLV BV, states: "We worked with a team of experts at Soft-O-Matic right from the start to develop the automation for our machines. Soft-O-Matic engineers have already implemented many successful projects based on the TwinCAT automation platform from Beckhoff, and we quickly learned to appreciate the benefits of PC-based control." Rogier van Staple, software expert and owner of Soft-O-Matic, adds: "Laser welding machines demand high dynamics and a high level of quality; both are hallmarks of the Beckhoff system."

A laser welding machine involves numerous processes that must be monitored meticulously. Gases such as argon, nitrogen and helium are used to create the laser weld processes. Since the laser light can only be emitted when the glass protecting the optics is totally clean, comprehensive monitoring functionality was integrated into the control system. Another challenge is to maintain correct oil pressure in the multi-stage hydraulic clamping system, which holds the stainless steel plates in the correct position during welding.

### Lean controller design and easy operation

Pillow plate laser welding machines from Keppels Laser Welding are sold to storage tank and equipment builders across the world. "One of our primary



Pillow plates are made from two stainless steel sheets, which are joined in a specific pattern through laser welding and then expanded at a high pressure of 40 bar to assume the shape of a pillow.

goals in the design and construction of laser welding machines is to reduce the number of parts and suppliers required." According to Henk-Jan Keppels, a modular control system which enables efficient machine configuration and modeling is ideal for achieving a "lean and mean" machine design.

A Beckhoff CX2040 Embedded PC with directly connected EtherCAT I/O Terminals is used as the control platform. TwinCAT NC I automation software integrates motion control as well as sequential control. "The control platform is so compact that it fits on a one-meter-long DIN rail in the control cabinet," says Keppels. "Moreover, the AX5805 EtherCAT Servo Drives with integrated safety technology and servomotors with One Cable Technology (OCT) provide significant space-savings in a complete motion control solution. In the future, we are also considering the use of EtherCAT P in order to make our machines even more compact and reduce wiring efforts even further."

"Another important quality criterion for Keppels Laser Welding's customers is easy operation of the laser welding machines," says Henk-Jan Keppels: "We use a remote CP3919 Control Panel as the HMI, which is linked to the CX2040 controller via CP-Link 4. It is important for us that the HMI is simple and

intuitive. This means that no specialist-level CNC knowledge should be required to operate the machine, regardless of job complexity." The HMI screens show all process data in the form of a live image, so that operator errors are avoided.

"In the development of the control software, we focused on reducing complexity by using independent, simple modules. This makes the software robust and manageable for future developments," explains Rogier van Staple. "We modeled and generated the software application using UML (Unified Modeling Language), which results in code that is easy to expand and easy to reuse. The detailed coding can then be carried out in TwinCAT based on the UML design and using the existing editors."

### Product definition file initiates the production process

In contrast to many CNC machines, Keppels machine operators do not work directly with CNC programs. Instead, the production process is guided by a file that is generated using CAM tools during job preparation. This is based on pre-selected production parameters and a CAD design provided by the customer. The file defines the product to be manufactured, creates a visualization on the HMI, and automatically sets the machine. In other words, when the start button is pressed, the machine automatically creates a new CNC program and carries out its execution. Product and machine status are taken into account, so that if the production process is interrupted, the unfinished product can subsequently be finished. Processing steps can be repeated or omitted at the operator's request. In a double laser machine, the currently set configuration (1 or 2 lasers, only laser 1, or only laser 2) is also processed in the CNC program. Another advantage of using the product definition file instead of a conventional CNC program is that products can be produced on different machine generations or variants without adjustments, since the product definitions are machine-independent.

### Online process monitoring

"Since we started using the CX2040 as our control platform, and with the benefit of communication via Ethernet, we are able to offer a wide range of additional features in our laser welding machine," recalls Henk-Jan Keppels. "Naturally, we use EtherCAT as the communication system. TwinCAT software scans all I/Os and monitors all events that occur." A database application logs all diagnostic and event data provided by the PC Control platform. DataLog is available through the Internet connection on the machine, so data storage is also automated. "With the PC platform, the machine can be monitored online and programmed via a remote service module. For security reasons, we use a VPN connection. The ability to monitor all our machines on a smartphone is another benefit," emphasizes Keppels.

Further information:

[www.keppels.nl](http://www.keppels.nl)

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