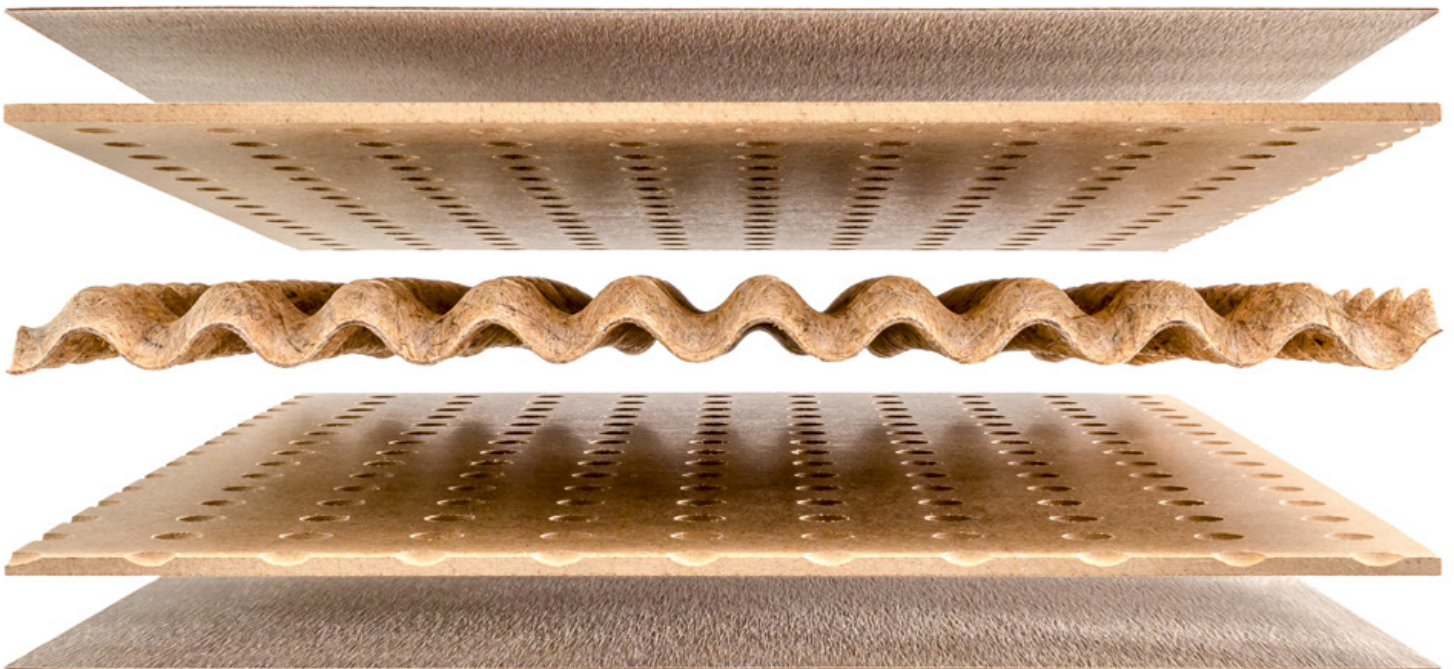


Lightweight construction material lisocore® – drilling and bonding with precision

Drilling 15,000 holes in less than 20 seconds with TwinCAT multi-core technology

With the company's lisocore® lightweight construction material, lightweight solutions is a pioneer both in terms of the end product and the manufacturing equipment that makes it. Advanced PC-based control technology from Beckhoff has been onboard the company's machinery from the start. Beckhoff multi-core technology, implemented via a C6650 Industrial PC and TwinCAT 3 automation software, provides the required flexibility for lightweight solutions' unique processes.



The structure of the lisocore® panel



Daniel Rauh, Head of Production at lightweight solutions, Michael Schäper, Managing Director of lightweight solutions, and Jens Hülsebusch, Project Manager Systems Engineering at Beckhoff, show off the control system.

The idea for lisocore® came to Michael Schäpers in 2004 during a lecture on statics at the Rosenheim University of Applied Sciences. This is when he realized that a shell structure as the center layer in a sandwich construction would be ideal as a load-bearing material. .

Based in Bad Aibling, Germany, lightweight solutions GmbH is the result of that original idea. The company's lisocore® product is an extremely efficient, lightweight construction material that consists of two thin cover layers over a three-dimensional core structure. Point-milling the cover layers creates indentations that lock the core structure firmly in place with the help of high-strength adhesive. The result is a classic sandwich-style element, but one with unique load-bearing properties compared to common chipboard, says lightweight solutions Managing Director Michael Schäpers: "Half the weight and twice the bending modulus of elasticity is what makes this material so special."

Customized solutions for special machinery

When you manufacture a totally new product, traditional machines don't get you very far – you need a customized automation solution, as Michael Schäpers remembers: "When we developed the first machine together with Beckhoff in 2005, we had to do some pioneering work. There were no standards and

very little experience to design the machines we needed, so flexibility in automation was the top priority. We actually developed the exact production parameters while we were building the system. Accordingly, we had to be able to quickly respond to any changes, meaning that the entire system had to be connected by fieldbus technology. We also needed the ability to easily add new drives and safety modules that were not part of the original design. Pre-assembled modules or devices that could not be subsequently changed were not permitted."

A multi-core IPC controls the entire system

Today, lisocore® is built on a line developed by lws maschinenbau GmbH, a subsidiary of lightweight solutions. Covering a floor area of 500 square meters, the line drills cover layers, applies the adhesive and combines the layers with the 3 D core to form the sandwich boards before stacking and packaging steps. The core panels, in turn, are manufactured from a special non-woven fabric on one of four internally-developed down stroke presses, each of which is controlled by a C6920 control cabinet Industrial PC (IPC). The main challenge for this very large production line was the implementation of the complete automation system on a single IPC. What made this possible was the ability provided by PC-based control from Beckhoff to assign certain control operations to individual processor cores.

“Such a multi-core system would have been impossible without TwinCAT 3,” says Michael Schäpers. “To process the various tasks, we had four CPU cores at our disposal. Moreover, with the EtherCAT-based technology from Beckhoff, we did not have to worry about the communication lines within the system. It was very easy to feed the process data gathered from the machine back into the control system – a special feature that helps us when we develop new procedures and products. We must be able to fully interact with the machine and access the control data. Another Beckhoff benefit is the TwinCAT Scope tool, a software oscilloscope that lets you analyze workflows in detail and call up all necessary data for a new process. All of these features deliver huge speed benefits for your production and process development.”

TwinCAT 3 offers broad multi-core support

According to Michael Schäpers, the multi-core capabilities of TwinCAT 3 software were at the forefront of the decision to use the automation solution. These capabilities are used in the following ways: The first core runs the HMI under Windows. The second core handles additional HMI tasks and runs TwinCAT NC PTP to control the NC axes. The third core runs the TwinCAT software for servo-hydraulics of the flat press, and TwinCAT PLC runs on the fourth core.

One special feature of the servo-hydraulics, particularly with their large number of NC axes, is the way they interact with the control technology. Both the electrical and the hydraulic controls run under TwinCAT, which makes it possible to map the process cycle with great precision.

Leveraging these features of PC-based control technology, all functions can be bundled onto a single PC, delivering an additional margin of safety with regard to component availability. Since all programs run on a single computer, keeping a second IPC ready as a backup for redundancy is easy.

Flexible access to all control data

Although the system may look highly complex, it is actually quite manageable. The architecture is divided into various groups, each of which has its own control cabinet and its own I/Os. Michael Schäpers: “To optimize the line, we must be able to add or remove functions easily. To operate such a large system professionally, you need a controller with flexible access options, and the Beckhoff control system meets these requirements perfectly.”

Jens Hülsebusch, Project Manager Systems Engineering at Beckhoff, lists some of the key components to demonstrate the system size and complexity: “The C6650 cabinet-mounted IPC with quad-core Intel® Core™ i7 processor controls almost 900 EtherCAT slaves, including EtherCAT Terminals and EtherCAT Box I/O modules, as well as AX5000 Servo Drives split between two EtherCAT masters in the field. A total of 130 NC axes are calculated in a 2-ms task and moved via 73 AX5000 Servo Drives that, in turn, are equipped with AX5805 TwinSAFE cards and control AM8000 servomotors with One Cable Technology (OCT). The line also employs XFC (eXtreme Fast Control) technology, TwinCAT ‘Flying Saw’ functionality and four CP79xx Control Panels, making machine operation easy.”

Among the most difficult tasks that the machines have to perform at lightweight solutions is traveling to the immense numbers of drilling and gluing points. Adhesive must be applied to 15,000 drill holes in less than 20 seconds with high accuracy. “No one had ever done this before,” remembers Michael Schäpers,



A C6650 control cabinet IPC with multi-core processor technology controls and monitors the entire production system for Iisocore® composite panels.



The control system for the whole line handles more than 2,500 data points. The hardware includes 73 AX5000 Servo Drives (shown here), 51 EtherCAT Couplers, 778 EtherCAT Terminals, and 22 EtherCAT Box I/O modules.



Ergonomic machine operation with the easy-to-use CP79xx Control Panels from Beckhoff.



The rectilinear arrangement of the processing stations results in a highly compact and powerful machine installation.

“so the flexible Beckhoff control technology was the only means available to handle this complex process required to manufacture lisocore® economically.”

Since commencing production in Bad Aibling, lightweight solutions has steadily ramped up its production output to keep up with demand. Future plans call for a system with two- to three-times the capacity of the current line. “We will operate with four feed-in stations and two drill-and-glue stations,” explains Michael Schäpers.

PC-based control can be scaled up to accommodate Industrie 4.0 requirements

The Beckhoff IPC proves its performance not just with regard to the increase in production capacity. Since the multi-core capability of TwinCAT 3 enables the IPC to handle additional tasks, lightweight solutions decided to integrate its building control system into the PC-based controller.

Industrie 4.0 is another important aspect for the future. As a first step on its implementation of this concept, the company has already connected the entire automation platform to its SAP system, which is why Michael Schäpers has already decided that “as a specialty machine builder, we will continue to count on support from Beckhoff as we move towards Industrie 4.0.”



Different versions of lisocore® panels for furniture production and interior construction applications.

Further information:

www.lightweight-solutions.de/lisocore

www.beckhoff.com/TwinCAT3