PC-based control reduces costs and increases production quality

The fully automated production line from Randek represents a big step forward in speed, economy and quality for the manufacture of nailed roof trusses. A new roof truss, the load-bearing component of the roof frame, rolls off the conveyor belt every 81 seconds. The production plant is controlled by a PC- and EtherCAT-based control platform from Beckhoff.

Fully automated production line manufactures roof trusses in record time

Randek AB, a company based in Falkenberg in Sweden, creates high-performance machines and production lines that manufacture components for prefabricated wooden houses. The company history of Randek stretches back into the 1940s and is closely connected to the concept and development of prefabricated houses.

The roof truss, i.e. the supporting structure for a roof frame, consists of compression and tension members which are joined at the nodes using plates and nails according to an exact nailing pattern. This is why it is also known as a "nailed truss." Nailed trusses are usually made from several layers of wood. Since the 1970s the traditional nailed truss has largely been replaced by the much more economical nail plate truss. In this method the timber components are joined by industrially manufactured nail plates which are pressed into the wood on both sides using special presses.

Fully-automated process replaces time-consuming manual work

Traditional roof truss manufacturing methods are both labor-intensive and costly because most of the processes such as positioning the clamping devices, laying out the timbers, positioning the nail plates, fixing the plates using the truss press and stacking the finished roof trusses are done by hand.

The new AutoEyeTruss system SF022 from Randek provides a fully automated production unit to manufacture traditional or scissor-shaped roof trusses. Manual handling is only required at the beginning of the process when two operators lay out the building timber on the machine. Everything else runs automatically: the timber is placed and positioned against stop pucks on what is known as the puck table. The joints are automatically fixed with corrugated nails using the nailing bridge and the timbers are marked with production data by an ink-jet printer. In the next stage the roof truss is transported to the press which picks the appropriate nail plates from the correct container and feeds them to the press. The press visually identifies the butt joints in the roof truss design in order to position the nail plate exactly. The pressing force adapts automatically to the size of the nail plate and the thickness of the timber, making the result perfect. The butt joints that are fixed with nail plates to the roof truss are then transported to quality control. This is followed by automatic stacking and loading onto a truck for shipping.

"The annual production capacity in a three-shift operation is around 187,000 roof trusses," explained the Randek Sales Manager Johan Larsson, adding: "One of the great benefits of the production unit is its high degree of automation. Work that was previously carried out by 15-20 employees now only requires three."

Convenient operation and short machine set-up times

The AutoEyeTruss system controls all processes automatically using a CAD system selected by the operator on the 19" screen of the Beckhoff CP7203 Panel PC. The CAD files which contain all the data for the roof truss being produced are processed directly in the system. There is almost unlimited flexibility with regards to different designs and the set-up time is very short. "With manual production it takes almost an hour to change from one roof truss design to another when resetting the various clamping devices," Johan Larsson explained. The new production unit requires about 30 seconds to adjust the clamping table as the stop pucks move into position automatically.

PC-based control solution handles PLC and NC functionality

An important component of the automation concept is EtherCAT, the ultra-fast communication system for connection to EtherCAT I/O terminals and the drive system. A total of 16 AX5000 EtherCAT Servo Drives plus the AM3000 and AM3500 servomotors are responsible for the various movements in the produc-

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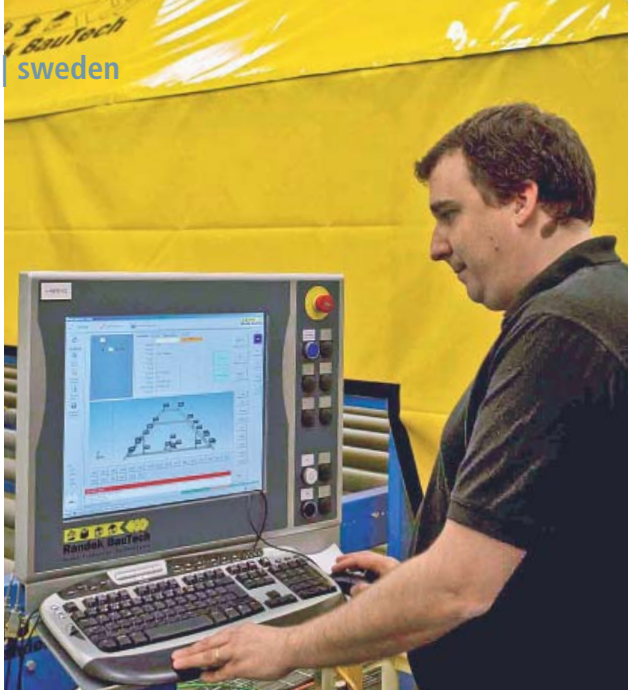
tion line. The TwinCAT NC PTP automation software integrates NC and PLC functionality into one system. The roof truss design is converted directly from the CAD file and loaded into TwinCAT to define all the parameters.



All processes are controlled automatically via a CAD file which the operator selects on the 19" screen of the Beckhoff "Economy" CP7203 Panel PC.

Well-established cooperation yields results

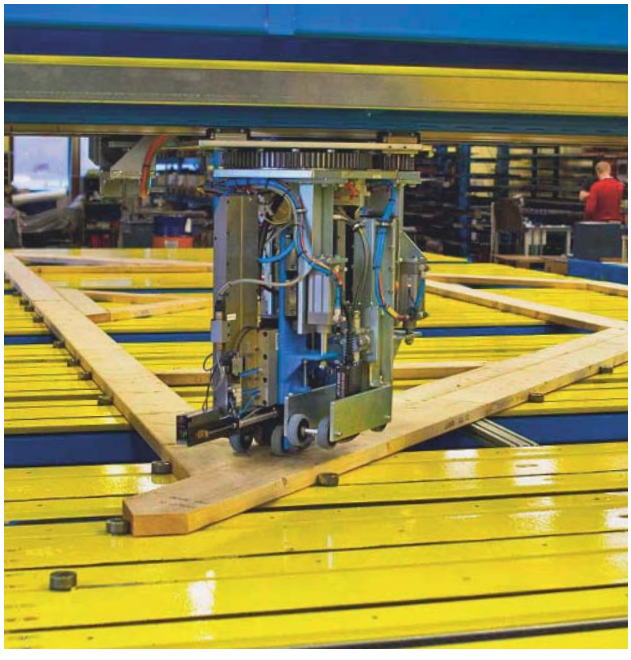
Randek and Beckhoff Sweden are also cooperating on the automation of other production lines. "The benefit lies in the fact that we have an integrated system with which we are familiar. Our partner Beckhoff has given us expert advice for developing the AutoEyeTruss system as well as for implementing the Servo Drives. The result is a machine which is unrivalled worldwide," stated Åke Svensson, development manager for Randek.

Norway creates European record

The new AutoEyeTruss roof truss production unit combines high production capacity with industrial quality conforming to building standards and will be marketed throughout the world, according to Randek's plans for the future. The standard production line can process roof trusses up to 4.5 m (14.7-ft) high and 12 m (39-ft) wide. The system can also be adapted for longer roof trusses, should this be necessary.

"The first client to implement the new roof truss production line is Pretre AS, Norway's largest manufacturer of roof trusses whose production plant is in Gausdal," explained Johan Larsson. "The new production unit was officially opened in autumn 2010 and is the most efficient and progressive in Europe. Production capacity is 126,000 roof trusses per year in a two-shift operation. Each roof truss requires 81 seconds to manufacture – a European record.

Clamping table with pretensioning gantry for the roof trusses. The timber is placed and positioned automatically against stop pucks on what is known as the puck table.



The automatic press visually identifies the butt joints in the roof truss design and positions the nail plate exactly on the joint. It then presses this into the timber with the necessary pressing force and creates a perfect joint. After all the butt joints have been fixed with nail plates, the roof truss is transported to the next station.

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www.randek.com
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