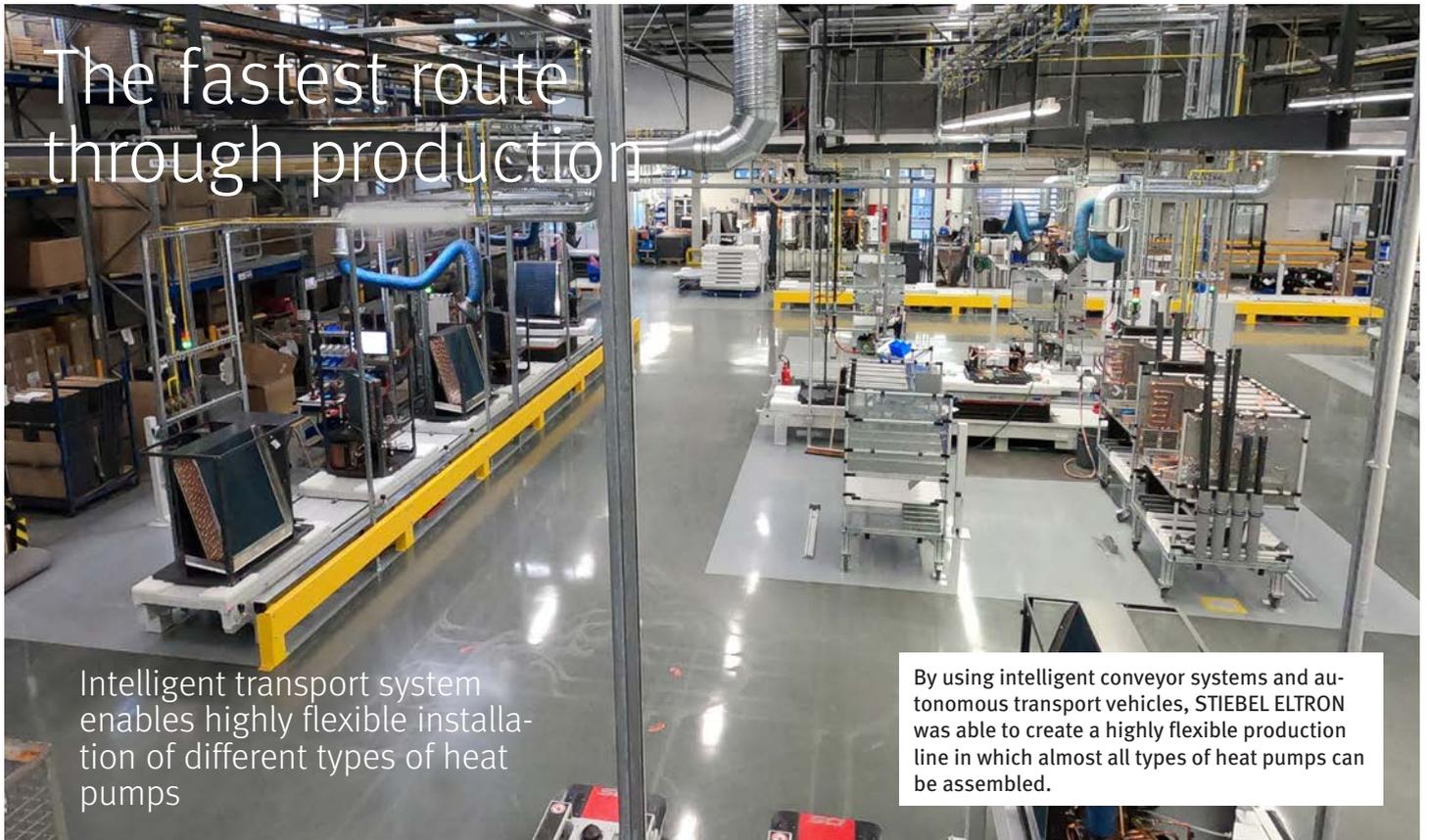


AT STIEBEL ELTRON IN HOLZMINDEN



The fastest route
through production

Intelligent transport system
enables highly flexible installation
of different types of heat
pumps

By using intelligent conveyor systems and autonomous transport vehicles, STIEBEL ELTRON was able to create a highly flexible production line in which almost all types of heat pumps can be assembled.

STIEBEL ELTRON describes its new, highly flexible production system for heat pumps as "multiline." Its special feature: Rigid conveyor lines with manual workplaces are connected to individual work and test stations via AGVs. A head controller ensures that the various heat pump models find their individual ways to the required assembly stations. KNOLL Maschinenbau supplied the conveyor technology and took care of the intelligent linking of the sensors and software.

Heat pumps are the trend. The sales statistics for the BDH (Bundesverband der Deutschen Heizungsindustrie, Federal Association of the German Heating Industry) and the BWP (Bundesverband Wärmepumpe, Federal Heat Pump Association) report record figures year after year. In 2021, around 154,000 heating heat pumps were newly installed in Germany alone. There are also 23,500 hot water heat pumps.

STIEBEL ELTRON is one of the leading providers of heat pumps for heating, cooling and hot water preparation. For more than forty years, the company has been involved in their development and production at its headquarters in Holzminden. The product range includes various models – heat pumps installed indoors and outdoors, solutions based on the air-water, brine-water or water-water principle, in various performance classes and much more.

In order to meet the increasing demand in the long term, the company decided to further optimize heat pump production. A task for the "Rationalization and Equipment" department. As Manager Jens Knaup describes it; "Our area of responsibility is very diverse. We provide support in the selection, procurement and implementation of different equipment. This ranges from a single machine up to extensive projects, such as an optimized production system for our heat pumps."

Knaup and his team always work in close coordination with the relevant department, the "in-house customer" so to speak. As a rule, various concepts are developed and evaluated. Before the detailed planning begins, coordination with the clients takes place. If necessary, external partners are then involved with whom the plans can be implemented.

New concept: the multiline for heat pumps

This was also the case when optimizing heat pump production at the Holzminden site. Roman Flegel, one of Jens Knaup's employees, took over the management of the project: "At the beginning of 2019, we started with the analysis of the initial situation." At that time, there were various model-related production lines where heat pumps were pushed by hand onto



Left in the figure: the first conveyor line. At the two assembly locations, first the base plate and then the compressor for the respective heat pump model are installed.



At the end of the first conveyor section is the transfer point to the AGV; on the right on the figure are two parking/loading stations for the AGVs.

assembly carts from workplace to workplace – a little flexible and, in the event of a fault, also a time-intensive concept.

"Right from the start, the task was to implement a highly flexible production solution," reports the mechanical and industrial engineer, "in which we can produce all the heat pump types on one production line despite the high level of diversification. In this way, it can be ensured that production will also continue to be efficient and economical in the future."

Roman Flegel and his colleagues worked out a concept. Since the assembly sequence of the individual models is different, a consistently rigid assembly line was ruled out from the start. "We need a high level of flexibility," explains Flegel. "We achieve this by combining two short conveyor lines, each with two assembly workplaces, with separate brazing and testing stations." Individual transport between these units is handled by automated guided vehicles (AGVs). An order and head controller anchored in the ERP system is responsible for organizing the processes and includes all the heat pump types and workplaces. "Shorter response times and the option to even run new product types or pilot series over the multiline are the benefits," says Flegel.

Jens Knaup points out the main requirement that the innovative plant concept had to meet: "We have to link our product information with intelligent conveyor systems and auto-



In addition to the conveyor systems and assembly workplaces, KNOLL also designed and supplied the carrier plates, which are compatible with all STIEBEL ELTRON heat pump variants.

nous transport vehicles, as well as create interfaces with each other and with our SAP ME system. Together with our partners, we succeeded brilliantly in this – a real showcase project in terms of digitalization and Industry 4.0."

Successful partner search

After the concept had been drawn up, the specifications were already very specific. With them, the plant planners approached various AGV and conveyor technology providers and finally decided on KNOLL. Roman Flegel: "With the conveyor technology from KNOLL Maschinenbau, we are using a system that has a standardized, modular design and has therefore grown up to the challenge of our multiline. The opportunity to experience the system live in production at KNOLL naturally helped us in our decision."

When it came to choosing an AGV supplier, the decision was made in favour of DS Automotion. "The KNOLL transport and assembly systems have to harmonize perfectly with the AGVs," explains Flegel. "The fact that DS had already successfully cooperated with KNOLL on other projects was an important criterion." The SAP integration was handled by IGZ's engineering team in Falkenberg.

A central element of the multiline is the interaction of conveyor belts, assembly stations, AGVs and SAP ME with the integrated plant control system. "Therefore, it was important for us to have a partner in KNOLL who is very knowledgeable both on the PLC side for controlling the drives, lifting tables, rotary movements, etc., but also has interface know-how," emphasizes Roman Flegel. "KNOLL also contributes all the sensor technology that is required at the transfer points."

Multiline was created in the bypass, so to speak

In the summer of 2020, the project was awarded to the suppliers and service providers indicated above. In the course of

just under a year, STIEBEL ELTRON and its partners succeeded in building the multiline ready for production. According to Jens Knaup, this is an enormous achievement, because production operations had to continue in parallel due to the large number of orders. "In some cases, the floor was refurbished, including the colour difference between travel sections and assembly zones," says Knaup. "This required high organizational skills and, above all, maximum flexibility from all the partners and trades involved."

The result: At three stations, the multiline contains individually configured transport systems from KNOLL, which are linked together via AGVs. The AGVs drive into the stations and perform a load change there in order to deliver or pick up a transport pallet. In addition to these pick-up and delivery stations, additional processing and buffer stations were implemented with the KNOLL modules. Most of the processing stations contain a lifting table, including a rotating platform, with which the employees can individually and ergonomically adapt their workplaces to their own needs.

KNOLL also developed the universal workpiece carrier, which is designed to accommodate all heat pump models. 100 of these pallets are on the move in production. The workpiece carrier with the units to be produced is moved by conveyor belt from the base plate assembly to the compressor assem-



The stationary conveyor technology is networked by means of driverless transport systems. Order management for the transport orders takes place in SAP ME, to which all systems of the entire plant have an interface.



The "evaporator line" – this conveyor line contains two workstations where the evaporator is first installed and then brazed.



Most of the workplaces are equipped with a lifting table and rotating platform for ergonomic assembly.

bly and then by the AGVs to the brazing of the refrigeration circuit. Four different workstations are available for this purpose. The next step is the so-called "evaporator line," an assembly line with two stations in which the evaporator is first installed and then brazed. Depending on the pump model, the sequence can also vary. At the end, however, there is always the pressure and leak test in the test chamber.

Success all along the line

The line has been running in productive operation since it was commissioned in the summer of 2021. Jens Knaup is very satisfied with the results and the partnership with KNOLL: "This applies to the quality of the hardware supplied in the form of the conveyor belts and manual workplaces, as well as to the operation of the lifting and rotary tables via control units at the workplaces: It has been implemented easily and, thanks to hardware pushbuttons, trouble-free."

Project manager Roman Flegel praises the service provided by KNOLL in the area of plant control: "The cooperation was always professional and results-oriented. KNOLL was significantly involved in programming the interfaces to the driverless transport system and the SAP ME. KNOLL's systems monitor the loading and unloading stations and transmit the corresponding data to the SAP ME, which routes the products through the plant." He also emphasizes the flexibility of all the employees involved, which made it possible to set up the multiline in the first place while the old plant was in full operation. Those responsible for production are also satisfied. By implementing future-oriented systems and processes, they have succeeded in significantly increasing productivity and achieving great transparency. Jens Knaup: "We can now trace at any time where which product is, and in what condition. As a result, we can see where bottlenecks are occurring, make the necessary improvements, and ultimately increase capacity. The plant is designed in such a way that we can double the number of units – in the same area with the same number of employees."

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Roman Flegel (right), Process Engineer and Project Manager, and Jens Knaup (centre), Head of Rationalization and Equipment, are pleased with the successful teamwork together with Christian Spohn, KNOLL Automation Department Manager.

This project has been completed, says Knaup, but the conversion of the heat pump production foresees a further step: "The final assembly of the heat pumps also takes place in the same hall where they are finally wired and insulated. At the end, the final inspection and packaging take place. In all likelihood, we will automate these steps as well."

A company full of energy

STIEBEL ELTRON is one of the world's market and technology leaders in the fields of "home technology and "renewable energy." With three national and four international production sites, 26 distribution companies worldwide, as well as sales organizations and representatives in over 120 countries, the company group is globally positioned. Sales in 2021 amounted to a good 800 million euros, over 50 percent of which was generated abroad. With over 4,000 employees worldwide, the company consistently relies on its own know-how, from product development up to production.

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KNOLL Maschinenbau GmbH

KNOLL is the leading provider of conveyor systems, filtration units and pumps for metalworking. These transport and separate chips and cooling lubricants. The comprehensive product range offers systems for decentralised or centralised applications. Its Automation division deals with solutions for demanding assembly and logistics tasks. These include stationary transport systems with chain and roller conveyors. With the integration of handling units (robots, cobots) and transport robots (AGV), flexible systems are created from a single source.

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