

# Drive technology

## TODAY

### Retrofit of drives used in automobile production

Container shipping facility at Volkswagen's Kassel plant boosts productivity and helps the environment

► High energy and maintenance costs coupled with diminishing system availability caused by obsolete electronic components prompted the overhaul of the existing container shipping facility at Volkswagen's Kassel plant. Modular transverse matrix products, increased capacity and lower energy consumption determined the technical requirements. This meant completely replacing the horizontal conveyor technology and hoists and modifying the storage and retrieval units. Volkswagen chose Lödige Industries and SEW-EURODRIVE to provide the best possible solutions for its current and future logistics requirements.

► "If only everything in life was as reliable as a Volkswagen"... The proverbial quality of Volkswagen automobiles also applies to the technology it uses to manufacture its vehicles and car components. The plant's production lines and logistics facilities have been running reliably for many years. Yet there comes a time when such facilities need adapting to keep pace with technological progress, new logistics processes and economic demands. When the Volkswagen plant in Kassel needed to increase the volume of bodywork parts of the modular transverse matrix, this required a high level of system availability from the 25-year-old logistics facility. With a workforce of more than 16 000, the plant in North Hesse is the second-largest Volkswagen production location in Germany. Besides VW's main gear unit production facility, the plant also houses the Group's biggest foundry and largest hot-working area for metal parts and vehicle body parts. Exhaust systems and Vw's electric motor are also produced at the site, and it is also the global headquarters for Volkswagen original parts.

#### Modular transverse matrix

One of the Volkswagen Group's key innovations has been the modular transverse matrix (MQB) it introduced in 2012, which represents a revolutionary approach to manufacturing automobiles. The system succeeds in reducing the variety of drive and chassis components by

around 90 percent. The Kassel plant produces several dozen parts for the MQB platform and supplies these for eleven models in the Audi, Porsche, SEAT, Skoda and Volkswagen series. MQB metal parts are dispatched via road or rail from Kassel to the Group's other plants.

The container shipping facility is located in Hall 2 of the plant's spacious building complex. Once they have been hot-worked and laser-treated here, the metal parts from the "modular transverse matrix" are placed in VW's standard containers and stored in a high-bay warehouse, then they are picked and moved to the lower shipping level using hoists. The parts are loaded onto trucks or trains directly in Hall 2.

The previous facility, which was constructed in 1987, was not adequate for the production volumes planned for the modular transverse matrix due to increasing periods of downtime and high maintenance costs. Thus the container shipping facility needed adapting to meet the latest requirements. This involved retrofitting the storage and retrieval units and replacing the hoists and chain conveyors. Engineer Frank Hölting – the responsible project manager in the Kassel VW plant – brought a reliable local partner for plant construction on board in the shape of Lödige Industries. This company already had relevant previous experience with complex logistics operations in material handling engineering at other renowned automakers. ►

The system manufacturer opted to use the same chain pitch for the conveyor technology as in the previous system. There are three different lengths of conveyor to accommodate one, two or three container bays. In other words, one pallet sits on one length of chain, there is room for two pallets on a longer chain, and three pallets can fit on long stretches. In all, 87 chain conveyors, 28 corner transfer units and twelve lifting stations for 1.5 metric tons of material, 43 chain conveyors for 3 metric tons and 51 chain conveyors for 4.5 metric tons of material were installed.

### Energy efficiency from Bruchsal

The old facility also used drive technology from SEW-EURODRIVE. However, the chain conveyors were still driven via contactors in the control cabinet by non-controlled asynchronous motors, which was bound to exert a high level of loading on the mechanics whenever the system started up. The corresponding control cabinet specifications and wiring work required for the 221 conveyors were also considerable. The design was re-evaluated in regard to energy consumption.

The Board of the Volkswagen Group has set ambitious goals for all its employees – to reduce energy requirements in production and logistics by 25 percent by 2018. The company is therefore turning to innovative and energy-saving technology both in its cars and in its production plants. SEW-EURODRIVE's decades of experience in the field of mechanical and electrical drive technology make it the ideal partner for implementing energy-efficient motion concepts in production and logistics facilities. Engineer Stefan Kattner from the technical office in Kassel says: "SEW-EURODRIVE has enjoyed a very healthy collaboration with Volkswagen for many years at a number of sites in Germany and all over the world. We can deliver the perfect technical and cost-efficient solution for any given demand in drive engineering. VW can rely on SEW-EURODRIVE to consistently meet its engineering and service needs – and to always deliver on time."

In the end, the decision went in favor of helical gearmotors with integrated MOVIMOT® frequency inverters. The communication with the system control is performed via AS-Interface. This bus technology is preferred in intralogistics because it delivers the



MOVIMOT® helical gearmotors are used to drive the chain conveyors.

necessary performance and is simple to integrate into systems. Tried-and-tested combinations of gearmotor and decentralized frequency inverter – which exist in various power ratings – are used to meet each specific material transportation need. The modular drive electronics offer the customer all the advantages of inverteroperation, such as configurable acceleration. What's more, this relieves the network load and brake wear as the system starts up, which places less strain on the mechanics. The MOVIMOT® D series can be combined with the DR... motor series for different efficiency levels as standard. Volkswagen opted for a drive solution using DRU...J IE4 motors. These AC motors contain a squirrel cage and permanent magnets in the rotor and thus avoid rotor losses. This combines the motor's servo-electrical properties with the economical standard components of the DR... motor modular system. The motors' synchronous speed allows the speed of the chain conveyors to be synchronized irrespective of load, which ensures a smooth handover of the containers. MOVIMOT® gearmotors require little more installation space than conventional motors – and the compact design of the synchronous rotor makes up for any difference.

## Dynamic lifting and lowering

Once VW's standard containers have been picked from storage in the high-bay warehouse, they are moved to the lower shipping level in Hall 2 using hoists. Mechanical equipment "Made in Germany", the land of mechanical engineering, is often very long-lasting. In contrast, technological progress means electrical components are subject to more frequent changes. As



The corner hoist is controlled by the MOVIPRO® decentralized drive and positioning controller.

part of the modernization work, a total of seven drum hoists were fitted, each equipped with a size R97 helical gear unit and a DRL132S4 asynchronous servomotor from SEW-EURODRIVE. This special model of the DR... motor is particularly well-suited to meeting high dynamic demands. It is controlled by the MOVIPRO® decentralized drive and positioning controller. This perfectly matched drive solution for conveyor technology enables exact positioning with freely configurable software components. The hoists in VW's container shipping facility use units with a power rating of 15 kW.

## Frequency inverters that recycle energy

The high-bay warehouse for the MQB components has six aisles and a total of 1 096 bays. It is 28 m high and the



All six storage and retrieval units use tried-and-tested MOVIPRO® drive inverters in their travel and hoist drives.

aisles are 100 m in length. The storage and retrieval unit (SRU) uses telescopic forks to move goods in and out of the storage slots. This enables 1 600 storage and retrieval actions – or 800 double cycles – to be performed each day. Production and downstream logistics are performed in a triple-shift system, six days a week. This high degree of utilization exerts extreme stress on the material. Lödige Industries overhauled or replaced the mechanical components during the retrofit, which included polishing the runners, exchanging the gear sets, guide wheels, guide rails, safety brakes and SRU, laying new conductor rails and reconditioning the forks. A new electrical system and completely new sensors were also installed.

The drivelines were replaced in all of the SRU's travel, hoist and fork drives. The speed and performance levels were configured to the technical specifications of the old drives. The fact that the temperature in the high-bay warehouse can drop below freezing during winter had to be taken into account during the planning of the project. An additional special challenge lay in integrating the new control cabinets for the drive electronics that move to and fro on the SRU's travel and hoist drives. All six storage and retrieval units use tried-and-tested MOVIPRO® drive inverters in their travel and hoist drives. The DC link connection allows any energy

### **MOVIMOT® with IE4 motor**

Compared to standard drives with IE2 or IE3 motors, the combination of the IE4 gearmotor DRU (ultra-high efficiency) and MOVIMOT® frequency inverter is the most energy-efficient. Operation at the inverter protects the mechanics and brakes and avoids unnecessary strain on the network at startup. All drives work with synchronized speed irrespective of their load. The rotor contains permanent magnets, hence rotor losses are prevented and, furthermore, the rotor's mass inertia is reduced and less energy is required at startup. Compact drives and the reduction in variants offer benefits in regard to design and the storage of spare parts. Decentralized drives from the MOVIMOT® series are well-established in Volkswagen's maintenance departments, the central workshops and the Volkswagen Academy's training program.

released by the one axis to be transferred to the other, thus recycling the regenerative energy. This can save a great deal of energy on average. A MOVIPRO® is also located on the traveling hoist frame for the decentralized control of the fork drive.

### **Drive solution with potential**

The drive solution combining the well-established MOVIMOT® inverter and the super-efficient DRU...J synchronous rotor represents a milestone in horizontal conveyor technology. It can be used for practically any application that calls for speed control. This first use of an IE4 motor by Volkswagen is more than a pilot project – it is a cost-effective standard solution for other drive tasks. The use of decentralized frequency inverters for the hoists and chain conveyors meant many fewer control cabinets were needed. The previous 12 m row of cabinets has been shortened three-quarters in length. Savings have also been made in regard to the climate control for the cabinets, which will also lower energy consumption.

Any new installations at Volkswagen are subject to an extremely thorough energy efficiency analysis during the planning phase. Thus energy consumption was measured prior to these retrofit works. The final measurements at the container shipping facility were taken in January 2014. The results showed increased productivity and approximately 15 percent less energy consumption. This was achieved primarily by the cutting-edge electric motors and new control technology.

### **Completed on time**

Lödige's outstanding project management enabled the retrofit of the container shipping facility to progress at good speed and be completed on schedule. After the initial discussions were held in September 2012, SEW-EURODRIVE delivered the electrical drives by the end of 2012/start of 2013. The system manufacturer then provided the chain conveyors and all other mechanical components for assembly. The startup procedure and run-up phase commenced in April 2013 and the new

### **Individual solutions for intralogistics**

The Lödige Industries group of companies plans and implements flows of goods and materials for industrial applications, the automotive sector, air freight and lift technology. Its reliable systems are custom-designed and based on meticulous mechanical and electrical engineering. Lödige delivers all services as a complete package covering system analysis, planning, construction, the manufacture and supply of conveyor technology and administrative software, assembly, startup and subsequent system maintenance. The company was founded in 1948, has its headquarters in Warburg-Scherfede near Kassel and runs operations in more than 40 countries. With over 1 000 employees worldwide, it generates average annual sales of 110 million euros.

facility was handed over to the operator at the start of July 2013. Hölting was full of praise: "Lödige and SEW-EURODRIVE performed some excellent teamwork to ensure the relaunch went as planned on July 2, 2013."

#### Preemptive maintenance schedule

Wolfgang Dippel, manager of the electric motors department in the central workshops, said: "We maintain very close contact with SEW-EURODRIVE's technical office in Kassel. SEW-EURODRIVE provides a very good maintenance service. If ever we need it, expert help is always quickly on hand." Hölting's extensive professional experience meant he

bore the needs of the maintenance team and central workshops in mind while leading the retrofit project for the container shipping facility. As a result, the electric motors workshop at VW's Kassel plant has a special test facility installed by SEW-EURODRIVE that can perform error analysis on all the MOVIMOT® drives in the container shipping facility. The VW maintenance team received the appropriate training and was thus fully involved in the adoption of MOVIMOT® technology. Thorough training makes for a quick response if anything goes wrong. Dippel jokes that "the only problem is that we seldom experience a drive malfunction. Actually, we haven't had any. ◀



SEW-EURODRIVE's MOVIMOT® servo drive system includes supply and axis modules. The two MNC capacitor modules (bottom row on left) optimize the entire system's energy efficiency. They store braking energy that is released and pass this on to the motor during acceleration processes.

Top row, left to right: Master module with MOVIPLOC, MXP61 compact supply module (integrated capacitor module and integrated braking resistor), axis modules.

Bottom row, left to right: Two MNC capacitor modules, MXP supply module (with 7-segment display), 100 A axis module, other axis modules.