Drive technology TODAY

Powerful drive technology

Linear and servo drive technology for compression strength test stand

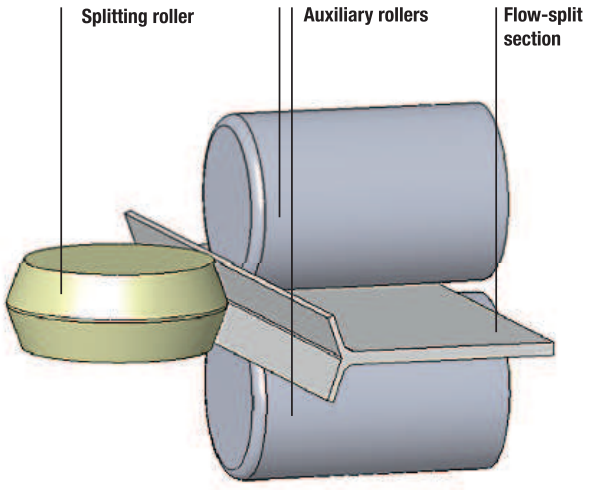
▶ The Fraunhofer LBF in Darmstadt has built a compression strength test stand for testing steel, with servo drives and control/communication technology from SEW-EURODRIVE ensuring a powerful feed motion and reliable data transmission. Intelligent capacitor modules also optimize the drive system's energy efficiency.

▶ The Fraunhofer Institute for Structural Durability and System Reliability LBF in Darmstadt-Kranichstein, Germany, has developed a test procedure to provide information about material stresses and the load state of linear components. During this process known as linear flow splitting, sheet metal is transported through several stages by auxiliary rollers and reshaped by splitting rollers. The special feature of this innovative process is that it changes the properties of the reshaped material's microstructure where it comes into contact with the splitting rollers, making it stronger and harder. These modified material properties make surfaces that have undergone linear flow splitting ideal for applications such as rolling contact zones on linear guides.

Linear-flow-split sections are tested and monitored for possible defects on a compression strength test stand that is operated by electric drives from SEW-EURODRIVE. Two linear motors act as the test stand's main drive. Each motor consists of a fixed magnet with a mobile rotor positioned above it. During material testing, the drive can achieve accelerations of up to 8 g and speeds of up to 6 m/s. The necessary feed thrust of around 5000 N is provided by the rotor current. The high torque and power levels required generate heat in the linear motors, which require water cooling. Cable carriers positioned in opposite directions supply the two motors with electricity and cooling water.

Particularly powerful forces are needed to apply the Hertzian stress (maximum stress in the center of the contact surface between two elastic bodies) required

The Fraunhofer Institute for Structural Durability and System Reliability LBF in Darmstadt-Kranichstein



Producing the flow-split section: The sheet metal is transported through several stages by auxiliary rollers and reshaped by splitting rollers, with the distance to the sheet decreasing at each stage. (Image: Fraunhofer LBF).

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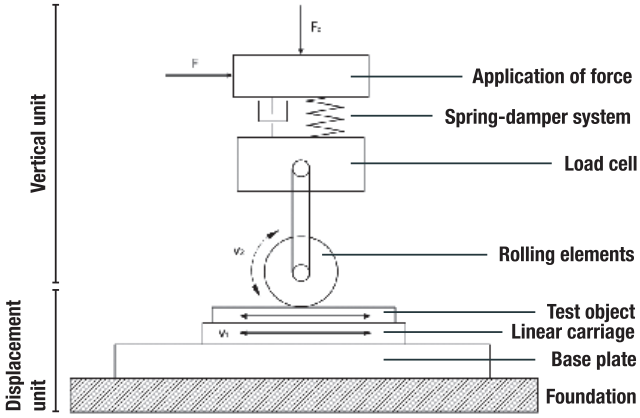
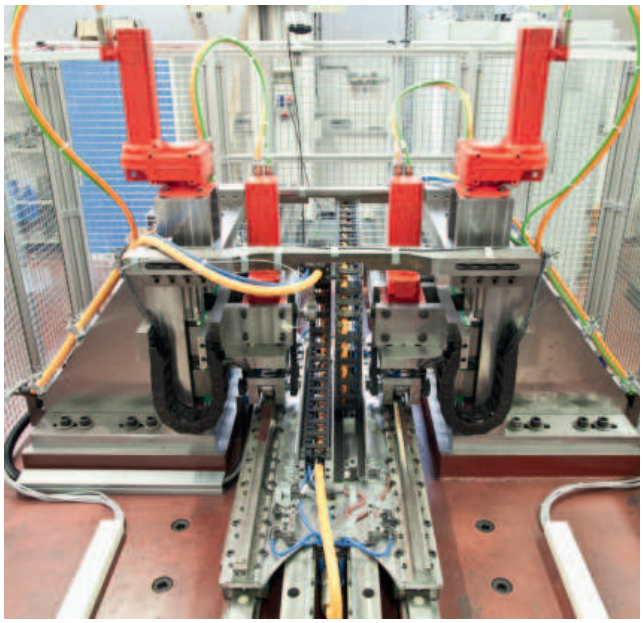
for compression strength applications. Four FF27 CMP50L feed drives from SEW-EURODRIVE subject the test object and thus the linear motor's rotor to pressing forces of up to around 20 000 N. These forces are transmitted by two rollers, each of which is driven by a BSF302B CMP63M servo gearmotor from SEW-EURODRIVE. The entire structure sits on a 40 metric ton test stand table.



Schematic diagram of the compression strength test stand with rolling elements. (image: Fraunhofer LBF)



Overview of compression strength test stand.

MOVIAXIS® servo drive system

SEW-EURODRIVE's MOVIAXIS® servo drive system is used to power the motors. It consists of a 100 A axis module for the two linear motors and further axis modules for the feed and roller drives. These are powered by an MXP supply module and the shared DC link.

The MOVIAXIS® product range includes axis and master modules, compact power supply modules, supply and additional modules, and option/expansion cards. The servo drive system is equipped with numerous features, including Ethernet TCP/ IP, USB, data storage, axis parameter/data auto reload following axis replacement, etc. The unit's onboard technology alone offers a whole host of possible solutions.

The MOVI-PLC® motion and logic controller from SEW-EURODRIVE is available in several versions and offers scalable motion control functions, which means it can grow along with a machine. Graphical interfaces that guide users make MOVIAXIS® startup quick and easy. Thanks to its compact housing dimensions, the drive system requires little installation space – while enabling integral, simple convection cooling and high power density (250% overload capacity). Other advantages include the minimal amount of installation work and the innovative temporary energy storage to eliminate/reduce losses and waste heat.

The linear drive achieves speeds of up to 6 m/s. The necessary feed thrust is provided by the rotor current. The high torque and power levels required generate heat, which makes water cooling necessary.

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Cable carriers positioned in opposite directions supply the two linear motors with electricity and cooling water

MXC capacitor modules

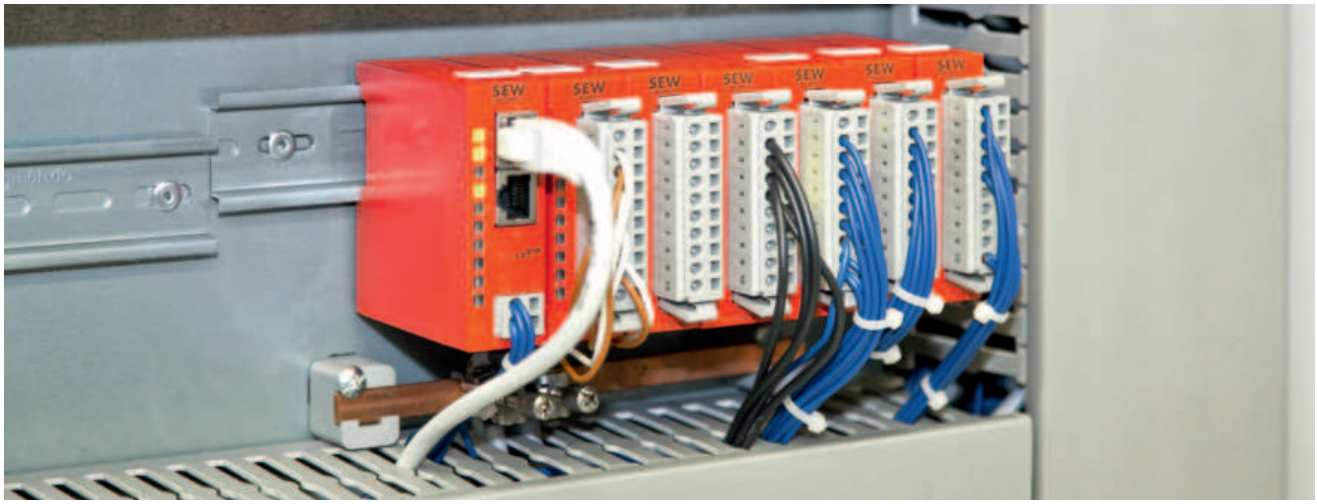
A concept for the temporary storage of energy has been developed for the MOVIAXIS® product range so as to improve capacity utilization for the entire drive system. The optional MXC capacitor modules can be installed on all MXP supply modules. Two capacitor modules in the compression strength test stand's drive ensure the entire system benefits from excellent energy efficiency. They store braking energy that is released and pass this on to the motor during acceleration processes. This relieves the strain on the grid and enables the rated power supply input to be around 20% lower, which reduces the mean power drawn from the grid and the heating effect on the control cabinet. This in turn cuts cabinet climate control costs and saves valuable installation space.

Rapid drive communication

SBus, SEW-EURODRIVE's CAN-based internal system bus, is responsible for all axis communication. It ensures the rapid exchange of measurement data between the individual axis modules and the MOVI-PLC® controller in the MOVIAXIS® servo inverter. The test stand's digital and analog signals are recorded by the MOVI-PLC® I /O system a nd linked to the MOVI-PLC® controller via the Ether-CAT®-based SBus^{Plus}.

Controlling the test stand

SEW-EURODRIVE developed the MOVI-PLC® range of freely programmable motion and logic controllers to perform complex automation tasks. Their universal operation and functionality make these scalable



The MOVI-PLC® I/O system reads in digital and analog inputs and forwards these to the MOVI-PLC® via the SBus^{Plus} EtherCAT®-based system bus. Corresponding outputs for the machine control system are also provided.

Recording measured values

The XIAIIA analog option card for recording analog measured values is available for the MOVIAXIS® servo drive system. It is used in the axis modules for position-based recording of analog values. A linear encoder on the measuring table measures the test object's position, while a Hiperface® absolute rotary encoder in the motor records the position of the feed axes. Another option card – the XGHIIA multi-encoder card – provides the encoder signal for measuring structure-borne noise. This evaluation enables early detection of any potential defect in the test object.

controllers the ideal platform for solutions. Comprehensive interfaces for visualization and external peripherals are available to fully automate entire machines.

A MOVI-PLC® DHE4IB controls the entire compression strength test stand and its peripherals. This advanced performance class controller is also responsible for the cooling water and temperature measurements. A further task of the MOVI-PLC® is collecting position-based measurement data. All data collected is systematically sent to the PC in an Ethernet

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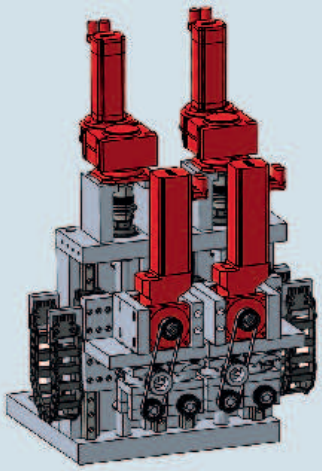
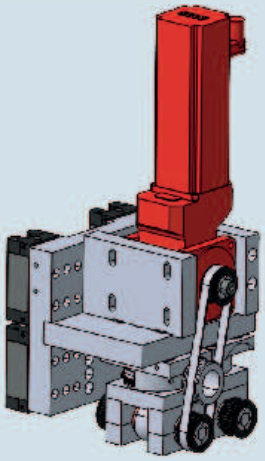
Servo motor in the vertical unit



Vertical unit



Roller unit

Illustrations: Fraunhofer LBF)

frame. The PC displays the test stand statuses and data using the LabView graphical programming environment. This platform uses graphical icons and links them to create a kind of flow chart. It offers numerous integrated libraries for advanced analysis and display functions to create virtual measuring instruments. The test stand PC also processes, analyzes and archives the measurement data.

Successful cooperation benefits customers

SEW-EURODRIVE actively supported the project management at the Fraunhofer LBF / TU Darmstadt during the project planning stage for the compression strength test stand's drives. The control system manufacturer also got in touch with SEW-EURODRIVE early on in the project. This facilitated coordination and the checking of the wiring diagram. All the project participants met regularly to discuss the current status of work and how to proceed. This ongoing coordination between everyone involved ensured rapid project progress and excellent transparency. The fact that the drive and control components and the software came from a single source proved a big advantage for the customer. A further plus point was that a small number of contacts at SEW-EURODRIVE dealt with the customer and were always available when required. This made it far easier to coordinate the project. ◀