System Test Fields of the HELMKE Group

The implementation of performance tests is an important part of the quality assurance in the development and production process of electrical machines and drive systems. To meet the ever increasing demand of the market and our customers, the HELMKE Group is operating three test fields able to perform a full load test power of 6000 kW. Furthermore, concurrent trends in the design and manufacturing technology of those systems, introducing new electrotechnical materials and even more intensive thermal-electromagnetic utilization of the existing ones, render system testing as a process of paramount necessity and importance for the development of prototypes.

Site Pulversheim (France, near Mulhouse): Two load test fields for low and high voltage machines and drive systems:

- Power of max. 6 MW alternatively 1.5 MW
- Max. torque of 120 kNm for speeds up to 500 rpm
- Voltages up to 33 kV
- Supply frequency - standard value 50/60 Hz (other frequency values on request)
- Maximum speed 4000 rpm
- Self-contained water cooling circuits for customer machine and converter having a re-cooling power of 330 kW

Site Sarstedt (near Hannover): Load test field for low voltage machines and drives

- Power of max. 315 kW
- Voltages up to 400/550/690V, 50 Hz
- Max. speed 3000 rpm
- Max. torque of 2 kNm

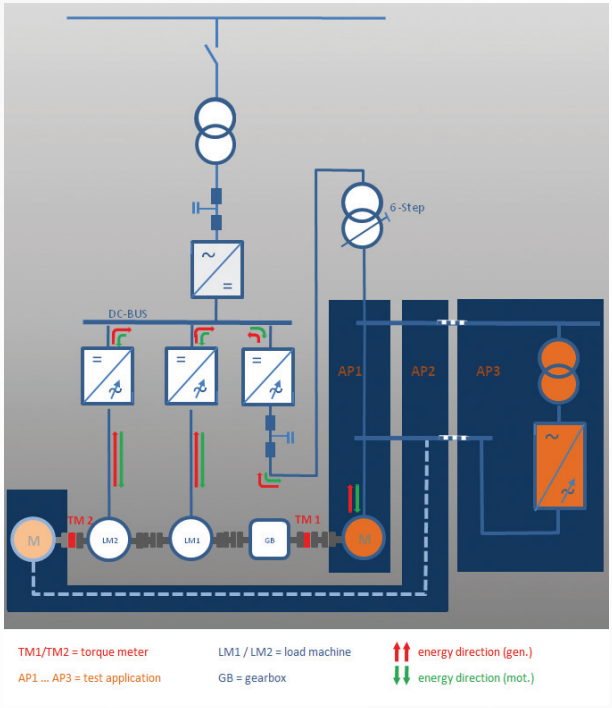
Both sites have state-of-the-art, Fieldbus based, modular and programmable test equipment for the determination of electrical and mechanical parameters. For special requirements with regard to noise- and vibration measurement we have a cooperation with highly qualified partner companies.

System Test Fields of the HELMKE Group

Testing culture by the HELMKE Group:

- **Testing technology "moving" around your product. Not the opposite.**

The layout of drive systems is quite variable and components are subject to strict specifications from the Eco-Design Regulation, now already applicable or in the near future. Optimized solutions, minimum commissioning times and the observance of regulations are hardly achievable without tests. The HELMKE Group test fields, introduce state of the art load machines and mechanical components, in an architecture that maximizes the number of applicable test bench configurations. Furthermore, the design of our electrical test supplies in conjunction to the control and data acquisition platforms, enable the emulation of both steady-state as well as transient-state test scenarios. Our emulation capabilities are limited only by the physical limits of these power supplies, as our testing software is using a transparent, object oriented graphical interface, which allows for quick and versatile programming of test scenarios.



Single line diagram of the 6MW test field: Principal power components of the 4Q drive and possible configurations.

High precision as a standard service:

- Reliable measurement of structural and mechanical performance: Each test bench is built on massive foundation blocks, suspending on spring and damper elements, all designed to produce low resonance frequency of the foundation. The latter is a necessary condition for high quality measurement of mechanical parameters, which becomes of paramount importance when it comes to MW range testing: Then the combination of forces and mass inertias are in scales that can excite unpredictable vibration modes in case of uncoupled (merged to the surrounding infrastructure) foundation.
- Noise free and high bandwidth data acquisition of all test field sensor and control data: All the HELMKE test fields use Fieldbus digital signal transmission technology. Furthermore, decentralized measurement boxes for standard sensors (temperature, pressure, vibration, current, voltage, torque) as well as for general purpose analog, digital and pulse input, are arranged around the test benches. This arrangement serves both in minimizing transmission paths for analog signals (thus minimizing noise) as well as maximizing the versatility of the test-field workspace.

Open eyes on latest market demands and future applications:

- In addition to the determination of losses and efficiency of electrical machines, the test field configuration also allows data acquisition within the scope of efficiency evaluation of drive systems, motor starters, power electronics and devices driven thereby at variable speed, like it is specified in the new DIN EN 50598. Thus, HELMKE test fields enable the determination of IE classes not only for mains-operated motors, but also for further components and operating conditions like converters and converter-fed motors. For drive systems the determination of IES-classes is also possible.
- Emulation of electrical and mechanical transients as well as system faults for traction applications: Voltage source emulation, including under- and overvoltage testing, as well as emulation of load profiles including transient overloading, enables performance, efficiency and reliability validation under realistic operating/fault conditions. To support such features, our test and load machine supplies are by default capable for 4Q operation and full parametric, closed loop control.

Range of Test Services

HELMKE System Test Fields

The HELMKE Group is a world-wide full-range supplier of drive systems for mechanical engineering and plant construction in a large power range. This comprises individual solutions for single electrical machines of various, optimally customized technologies as well as complete drive systems which are integrated into existing systems in conjunction with customer-specific control functions. The power of components and applications available is covering a range from less than 100 W up to 25.000 kW.

Our technical focus lies on performance, development and acceptance tests of:

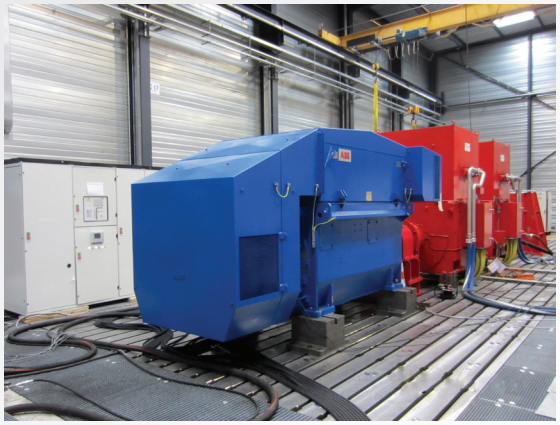
- Industrial motors and generators for mains operation
- Industrial and traction drives, incorporating the power supply and power electronics modules

Our Services:

- Type and routine tests of electrical machines and drive systems acc. to national and international standards
- Acceptance tests in the presence of the customer resp. intermediate inspection organizations acc. to common standards and customer specific quality specifications
- Prototype and pre-series tests of single components or complete systems (integration of customer specific measurement systems if required)
- Complex measurements of the vibration performance and the range of noise under no load and load
- High customization flexibility, example: programming of additional functional features for simulation of load cycles
- Motor losses and efficiency acc. to DIN EN 60034-2-1: determination of IE-class (regulation no. 640/2009 implementing Directive 2005/32/EC) for motors with min. efficiency requirement

In addition to the realization of tests for own needs, HELMKE allocates its test fields to third parties. HELMKE is a worldwide known and established reference for test services, especially in the field of drive systems in the oil and gas branch.

Examples of System Tests



Project Kandym-Lukoil, 4350 kW/10 kV, Shell-DEP

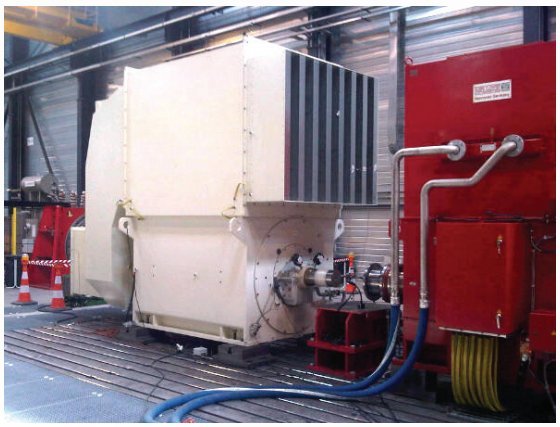
Components
- Oil transformer
- High voltage converter in a container: 24-pulse, water cooled
- Induction machine: 4-pole, air cooled, Ex nA IIC T3

Tests
- Temperature rise run under full load
- Determination of efficiencies
- Measurement of harmonic levels and motor vibrations
- Evaluation of noise under load by sound power measurement at low distance
- Function tests at frequency converter
- Fault simulation

Project TOTAL-Gabon, 1450 kW/20 kV

Components
- Oil transformer
- High voltage converter: 12-pulse, water cooled
- Induction machine: 4-pole, air cooled, Ex de IIB T3

Tests
- Temperature rise run under full load
- Determination of efficiencies
- Measurement of harmonic levels and motor vibrations
- Function tests at frequency converter



Type test, project ERES-Nigeria

Components
- Induction machine: 7728 kW, 11 kV, 4-pole, air cooled, Ex nA IIC T3

Tests
- Type test incl. temperature rise run under partial load acc. to IEC partial load method
- Determination of efficiencies
- Measurement of motor vibrations
- Evaluation of noise under load by sound power measurement at low distance