Electric Drives for Vehicles and Industry
Content

- Test Facility for Electric Drives
- Developmental Test Beds
- Reproduction of the Entire Powertrain
- Expertise
Flexible Test Facility of Electric High-Voltage Machines

- Test facility and offices combined in one building
  - Short lines of communications for test engineers and test bed technicians
  - Quality through permanent education
  - Continuity through denomination of assigned contact persons

- Test facility currently consisting of eight modern test beds
  - Seven test beds for developmental and endurance run purposes
  - One test bed for reproduction of vehicle powertrain in conjunction with combustion engine
Flexible Test Facility of Electrical High-Voltage Machines

- Different systems for generation of high-voltage direct current up to 600 V, 600 A, and 250 kW (DC voltage supply by Horiba, Kratzer, and Heinzinger)
- Freely configurable battery simulation with different battery models
- Benchmark investigations: Universal inverters for operation of test Specimens without specific power electronics
- For damage prevention of test specimens, brake choppers are used to avoid voltage peaks
- Specially developed spindle bearings and drive shafts for a safe and exact shaft connection between test specimen and test bed
Development Test Beds

- Dynamic test beds for development of electrical machines
  - Speed up to 16,000 rpm
  - Torque up to 430 Nm
  - Electrical power up to 170 kW
  - Mechanical power up to 178 kW
  - Mass moment of inertia of load unit 0.2 kg/m²
  - Speed gradient 20,000 1/min x s

- Fast and reliable torque measurement

- Comprehensive and specific measuring equipment for development of electric drives
Powertrain Test Bench

- Powertrain test bed with up to three suitable load units with braking and driving torques of 3,200 Nm up to 5,100 Nm (each wheel)
- Transfer and summation gearbox for adaptation to different powertrain topologies and test conditions
- Scope of tests for engine, transmission, clutch, and other components within powertrain
- Simultaneous operation of combustion engine and electrified components within powertrain
Tempering and Conditioning of Test Specimens

- Flexible and dynamic simulation of ambient conditions
  - Temperature of cooling medium from -45 °C up to 140 °C
  - Temperature of ambient temperature from -60 °C up to 160 °C
  - Conditioning of ambient air humidity within in a wide range

- Different media, flow-rates, temperatures, pressures possible, e.g. for motors and power electronics

- High-quality piping technology for safe connection to test specimen

- Display of high and defined temperature gradients of the air and coolant supply via continuously refined climate technology

- Display of extreme temperature gradients (thermal shock) via heat energy storage for media tempering and nitrogen injection for ambient air tempering
Endurance Test

- Test beds for validation of durability of high voltage machines up to an electrical power of 250 kW each
- Setup in conjunction with each other (test specimen operated against test specimen) for simultaneous testing of two identical test specimens of the same voltage and thus, time and cost savings
- Intelligent monitoring strategy for maximization of daily run time
- Prevention of downtimes by KST’s own measurement analyses, e.g. prediction of the winding temperature via temperature models
- Efficient shift operation via specifically trained personnel and on-call development engineers ensured
Expertise

High Speed and High Power

- At test beds working in conjunction with one another (test specimen operated against test specimen) almost any speed can be applied, integration of a burst protection
- Maximum speed and power defined through load unit (currently 16,000 rpm, 178 kW) on development test beds with a classic setup (test specimen operated against load unit)
- Testing of drives with increased speed and power: Display of speeds up to 19,000 rpm and very high power outputs via transmissions used for high performance motorsport applications (Formula 1) in preparation
Expertise

Measuring and Electrical Analysis

Determination of engine and electrical parameters with state-of-the-art measuring instruments, e.g.

- Power meter Yokogawa WT3000 for electrical current and voltage measurement, as well as power and efficiency calculations via additional torque and speed signal
- Digital storage oscilloscope Yokogawa DL850 with eight insulated input channels, sampling rate up to 100 MS/s for transient events and continuous graph recordings for endurance run data acquisition
- Schleich engine tester MTC2 6kV for fully-automatic resistance and isolation resistance, as well as winding resistance measurement of electric motors
- High number of measuring channels available
Expertise

Vibration Analysis and Investigation

- Comprehensive metrology and experience in the field of the vibration analysis
- Extensive torsional vibration and modal analyses
- Execution of vibration analyses along the project as limit value monitoring during test run or a service
- Functional development and durability investigations
- Climatic superposition testing possible
Interaction of Components of the Electric Powertrain

Examples as an outlook for the establishment of further expertise at KST

- Supplement of the current electric powertrain test beds by using battery safety containment (air-conditioned where necessary) for reproducing the interaction between motor, powerelectronics, and battery
- Interaction of components via testing of the entire powertrain on the test bed → Effects of damage on individual components in conjunction with one another
- Component test e.g. power electronics with model-based depiction of battery and motor
KST Motorenversuch GmbH & Co. KG
Bruchstraße 24 - 36
D-67098 Bad Dürkheim
Telefon : +49 6322 - 799 0
Fax : +49 6322 - 799 353
E-Mail : info@kst-motorenversuch.de
Internet : www.kst-motorenversuch.de