

Electric Motor Laboratory: Testing and Validation

IDIADA offers first-class facilities and **engineering services for the testing and development of electric motors** and electric traction units.



Electric motor testing and validation

Endurance testing in back-to-back configuration

We have **15 test benches** to evaluate the endurance of your electric motors or your electric traction units by means of **durability cycles** with a wide range of temperatures, with independent control for ambient and for coolant, powerful battery simulators, and humidity control.

- Endurance tests with customer-customized profiles
- 24 / 7 / 365 automatized operation
- Very fast failure reporting as if we were next door to you
- Worldwide OEM standards, i.e. LV124, including parameter tests
- Damage pre-detection system based on vibration analysis
- ISO17025 certification
- Fixtures' design and manufacture
- Tailor-made coolant and oil conditioning

Performance and characterization testing

Through a comprehensive program of electrical, mechanical and thermal testing we can perform full validation services. At IDIADA, we validate your electric motors or electric

drive traction units, assuring they are fit to be marketed through tests adapted to various worldwide standards and regulations.

- Nominal and peak torque/power measurements. R85 certification
- Efficiency map and trend analysis during aging
- Thermal characterization and derating evaluation
- Dielectric strength, isolation resistance, equipotential bonding and quiescent current tests
- Back electromagnetic force, locked rotor, park lock actuation tests
- Cooling circuit leak and pressure drop tests
- Vibration characterization

Component testing

We also have **3 climatic chambers** equipped with DC and AC power supplies to evaluate any kind of HV component:

- e-motor rotors and stators
- Power electronics: DC/DC converters, OBCs, home chargers ...
- HV ancillaries: PTC heaters, heat pumps ...

Full design validation plan generation and execution (DVP)

We generate a **full design validation plan (DVP)** for the electric traction unit as a system and for each of its subsystems (e-motor, inverter and transmission) based on product philosophy and specifications, market and user requirements and legal and certification requirements.

- Simulation, test, and homologation plan
- Prototype list and configuration
- DVP execution in our facilities

Other electric motor tests:

- Vibration tests under climatic conditions
- Environmental: Water, Dust, Damp heat
- Mechanical shocks, thermal shocks...

E-Motor Durability Testing Facility Specifications

IDIADA is well-equipped with cutting-edge facilities designed to perform various types of tests of electric motors and traction units:

- Climatic chambers from -40°C up to 120°C. with 1,400 × 1,400 × 1,000 mm dimensions and up to 1,000 kg. Possibility for humidity control in some benches
- Coolant conditioner of 25kW @ -20°C cooling power with independent flow and temperature control
- Battery simulators up to 400kW / 1000V / 1400A
- Damage pre-detection systems
- High precision sensor for all the mechanical, electrical and thermal parameters
- State-of-the-art CAN communication and control equipment

E-Motor Characterization Facility Specifications

Key features of the dynamometer:

- 2 × 4,000 NM (Nominal) / 2 x 630kW / 4,000 rpm
- Coolant and oil conditioning down from -40°C
- Powerful battery simulators up to 1.000V
- High precision HBK power analyzer
- Equipped with vibration sensor

Electric motor engineering services

The electric motor or traction unit engineering services, combined with our complementary services in the electric (EV) and hybrid (HEV, PHEV) vehicle field, place IDIADA in a leading position to support your component or systems development, from concept to full vehicle validation.

IDIADA unifies **multidisciplinary virtual development working groups** in areas such as: Electronics, electrical, mechanical, rigid body and NVH.

- 1D Electronic drive unit simulation for obtaining current patterns (AMESIM and SIMULINK)
- 1D and 3D Thermal simulation for the evaluation of the heat distribution over the machine (STARCCM+)
- 3D Structural simulation to determine the forces applied to the motor (SIMCENTER 3D)
- 3D Electromagnetic simulation to calculate the flux and the torque response (PLM MAGNET)
- NVH analysis for the determination of the acoustical response of the machine (SIMCENTER 3D)

Main simulation activities

Troubleshooting



Electric motors can be replicated into a magnetic model in order to emulate its electromagnetic behavior. This model can help to identify possible flaws of design, such as hot spots, flux leakages, electromagnetic forces imbalances, etc.

Optimization

Parallely, the electromagnetic model can be used for design optimization, modifying its own parameters to produce improved performance. This can be achieved by increasing air gap magnetic flux density, reduction of Eddy current losses, end ring copper losses reduction, etc.