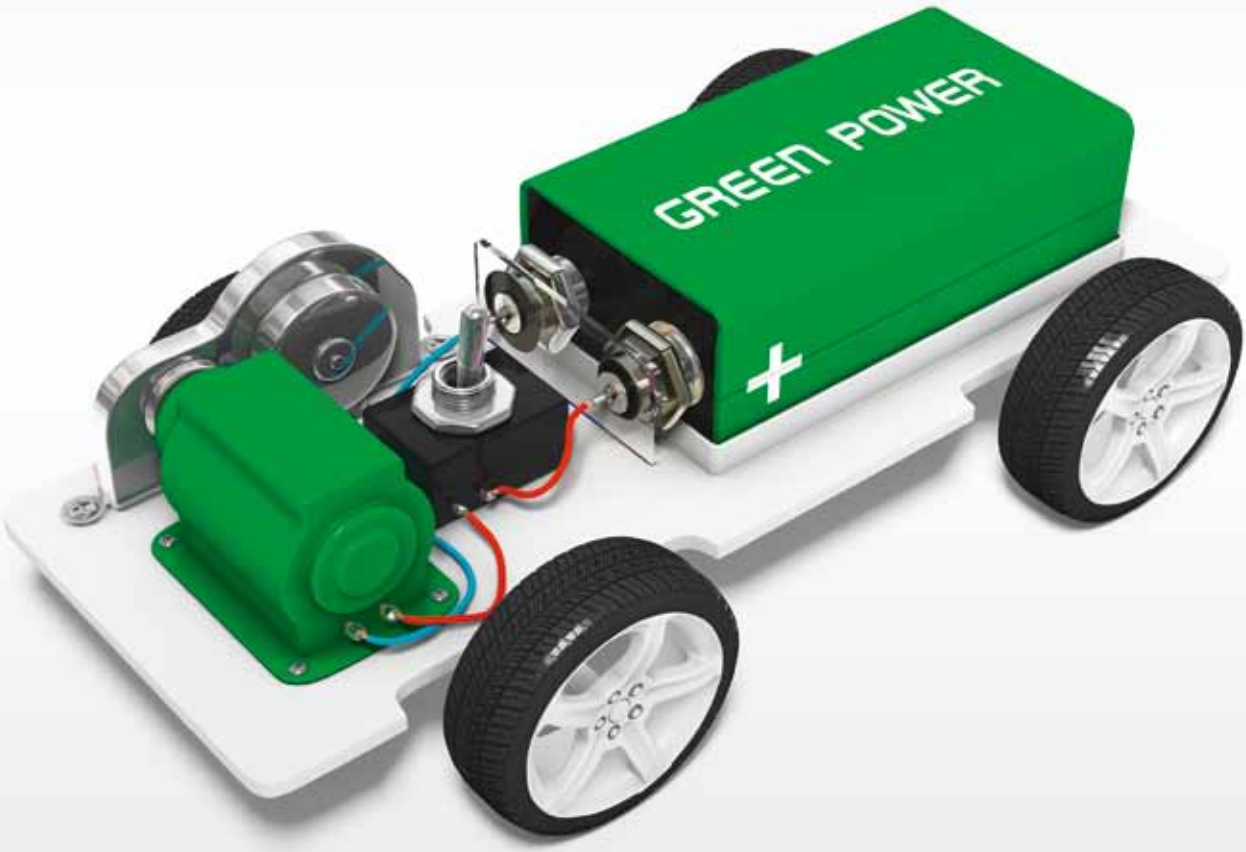


SERVICES

SAFE e-MOBILITY – FOR SURE!

CONSULTANCY – TESTING – HOMOLOGATION – CERTIFICATION

SGS CONSUMER TESTING SERVICES
SGS AUTOMOTIVE SERVICES
SGS INDUSTRIAL SERVICES

SGS TÜV

SGS-TÜV GMBH – EIN UNTERNEHMEN
DER SGS-GRUPPE UND DES TÜV SAARLAND E.V.

With 59,000 employees worldwide the SGS Group is the leader in the fields of testing, verification and certification. Founded in 1878, SGS headquartered in Geneva has been setting benchmarks for top standards that are recognized around the world. Since 1920 SGS has been successfully active in Germany.

e-MOBILITY

SGS-TÜV GmbH – Ein Unternehmen der SGS Gruppe und des TÜV Saarland e.V. – supports you in all matters relating to electric mobility as an accredited partner in the areas of consulting, testing, certification and training. We define ourselves as a global business partner along the entire value chain.

The experts from SGS TÜV are actively involved in formulating standards on the relevant standardization bodies. Consequently, we consistently operate at state-of-the-art levels of knowledge and are able to provide comprehensive and expert consultancy to our customers.

Electric mobility opens up the opportunity to take a major step forwards with respect to sustainable mobility. The automotive industry as the key player of this development has accepted the challenge and is presenting forward-thinking models at international car shows.

The trend towards the electrification of drive systems is marked by the introduction of new technologies not previously found in automobiles.

This requires new thinking and the determination to tackle the development of innovative concepts. At the same time, it implies an extension of the value chain. The electric power industry, battery manufacturers, manufacturers of electric drives and charging systems play a key role in this.

We offer you services aimed at achieving appropriate levels of safety at affordable costs. Working together with our customers in a spirit of partnership is central to this endeavour.

Our services cover the entire spectrum of electric mobility such as

- Infrastructure
- Vehicle
- Components and systems
- Information and Communications Technology (ICT)

INFRASTRUCTURE

INFRASTRUCTURE: CHARGING SYSTEMS FOR TOMORROW'S MOBILITY

Personal mobility using plug-in-hybrids and full electric vehicles requires a sufficiently developed charging infrastructure. Such charging systems may be located in public or company-owned car parks and privately used parking facilities such as garages equipped with appropriate outlets. Businesses and municipal authorities have begun to realize and test such charging infrastructures in public areas. The German pilot project billed as "Model Regions for Electric Mobility" is an example of these efforts.

The standardization of charging infrastructures has not advanced very far yet. Standardization for one implies binding standards for developments and, for the other, creates a minimum level of safety regarding the use of such systems.

SGS TÜV as a globally recognized and accredited partner supports both manufacturers and operators of charging systems. Our assessments include conductive as well as inductive systems.

The know-how of our experts in this area is based on the collaboration with renowned manufacturers of charging systems. Our accreditation, among others, includes IEC 61851-1 (General Requirements for Conductive Charging Systems).

MANUFACTURERS
receive consultancy from us on topics like

- Functional Safety (IEC 61508)
- Plug Systems (IEC 62196)
- Vehicle to Grid Communications V2G (ISO 15118/IEC 61850/ IEC 61851)
- Testing (standards-conformant/ customer-specific)
  - EMC
  - IP protection types
  - Environmental test

OPERATORS
are supported by us through

- Consultancy
  - Site selection
  - Connection to grid
- Elaboration of requirements profiles
- Determination of energy requirements and charging performance
- Load management
- Certification
- Acceptance testing
- Repeated tests during operation

FULL VEHICLE: FUNCTIONAL SAFETY, HOMOLOGATION AND TESTING

The development of innovative vehicle concepts and their implementation lead to completely new requirements. The interdisciplinary development teams are challenged to adapt the previous approach model to the technological changes.

The additional integration of high-voltage components into the on-board energy and data system requires the implementation of specific safety concepts. Verification and validation presupposes the development of respective testing and validation procedures. In addition to power-train technology factors, aspects of Functional and Electrical Safety in particular must be considered.

The integration of lithium-ion batteries requires a careful selection of protective actions considering the overall conditions for use in vehicles. They include, for example, environmental influences, mechanical stress and placement of the battery (packaging). These are new challenges with respect to development, production and support which make high demands on the technical skills of all personnel involved.

OVERVIEW OF OUR VEHICLE SERVICES

- Functional Safety
- Homologation
- Testing

FUNCTIONAL SAFETY

We offer you comprehensive services relating to safety aspects within the field of electric mobility and have the appropriate specialists.

Our services

- Training
- Consultancy
- Testing/certification
- Analyses

Training

- Technology overview
- Knowledge of standards (ISO 26262 etc.)
- Risk assessment and system design
- Analytics/probabilistics
- Electrical Safety

Consultancy

- Concepts for product safety
- Documentation concepts
- Integration of testing and verification steps
- Testing and validation of safety concepts
- Occupational health and safety

TESTING AND CERTIFICATION

Evaluation of concepts and systems to prepare concept reports, technical reports or certificates as protection against product liability claims.

- Safety assessment and safety audit
- Testing and evaluation of systems, software, hardware and tools
- Review of specifications and requirements
- Certification of components and systems
- Certification of safety processes

FUNCTIONAL SAFETY

HOMOLOGATION / TESTING

ANALYSES

Determination of safety requirements and optimization of your projects (HW/SW/system) through

- Moderation/review of hazard and risk analyses
- Identification of faults
- Determination of causes of faults
- Assessment of effects and identification of weak areas
- Derivation of safety tests
- Verification of safety concepts

HOMOLOGATION (APPROVAL)

From single approvals of prototypes all the way to homologation of components, systems and full vehicles based on the legal requirements.

Overview of our services

- Consultancy with respect to single approval and homologation
- Testing
- Homologation management
- Preparation of expert reports
- Obtaining of approvals

TESTING

Our services are complemented by a wide range of testing services by our accredited laboratories. The accreditation includes the nomination with the Federal Motor Transport Authority (KBA).

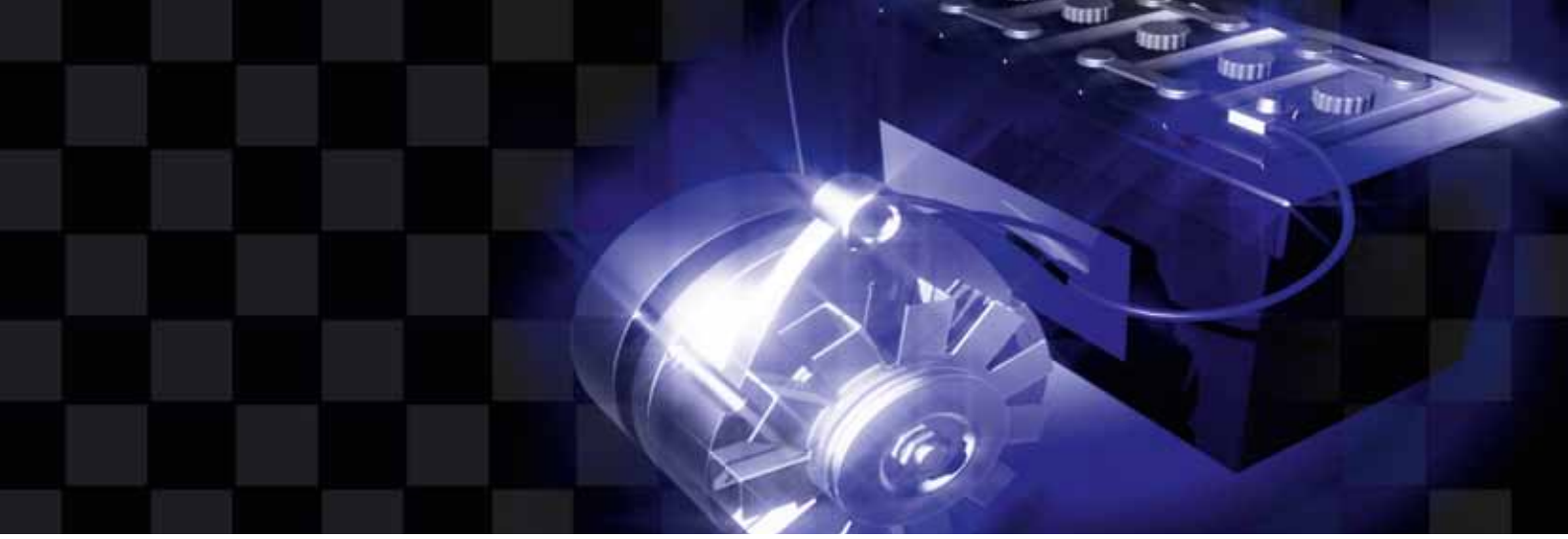
We will advise you with respect to the required tests and will also be pleased to create a customized testing programme for you.

Overview of our services

- EMC
  Performance of EMC tests in one of Europe's largest accredited EMC test labs.
  - Absorber chambers and shielded measurement cells for component and vehicle investigations
  - Performance of tests according to the relevant standards and regulations
  - Tests based on individual manufacturer-specific requirements

  The investigations can be carried our with field strengths of up to 600V/m. This also includes tests such as motor vehicle impulse and shield absorption measurements.

- Electrical Safety
  Testing of Electrical Safety is performed according to the relevant standards and regulations and includes all the specific issues resulting from the electrification of the power-train.



COMPONENTS AND SYSTEMS: CONTROLLING NETWORKS AND COMPLEXITY

Lithium-ion batteries, battery management systems and on-board high-voltage systems are technologies not previously used in the automotive sector. The integration of these systems into hybrid electric and full electric vehicles makes completely new demands on developments – both on the OEM and the supplier side of the house. In addition to Functional Safety, other safety-relevant aspects must be considered in an **integral approach to safety** such as

- Electrical Safety
- Chemical Safety
- Mechanical Safety
- Safety in electromagnetic fields

Overview of our component and system services

- Functional Safety (ISO 26262)
- Homologation
- Testing

FUNCTIONAL SAFETY

We possess expert know-how in the fields of Functional, Electrical, Chemical and Mechanical Safety. The currently emerging standards landscape requires interpretation with respect to application and selection. In this context you will benefit from the technical knowledge of our experts plus our involvement in the development of standards.

Our services relating to components and systems encompass

- Training
- Consultancy
- Testing/certification
- Analyses

HOMOLOGATION (APPROVAL)

The homologation of components and systems is performed according to ECE requirements.

Overview of our services

- Consultancy with respect to the homologation of components and systems
- Testing
- Homologation management
- Preparation of expert reports
- Obtaining of approvals

TESTING

The batteries used in the drive systems of hybrid electric and full electric vehicles play a key technological role in the further development of electric mobility. Output and energy contents have a crucial influence on the vehicle's properties.

Testing leads to confirmed results regarding their safety, life and performance in the vehicle-specific environment. Focal issues include, for example, temperature changes, vibrations, shocks and special events.

YOUR BENEFITS AT A GLANCE

- **Service from a one-stop-shop –** As a full-service provider, we support you in developing and testing your products plus the operation of complete systems. We assure optimal acceptance and product validation in international markets in all areas of electric mobility.
- **The TÜV of the world´s leading test services provider –** You profit from the name and know-how of the world's leading provider of testing services, SGS, and the outstanding acceptance of the TÜV brand in a single unit.
- **Protection against product liability claims –** Based on our accreditation for safety engineering according to ISO/IEC 17025 we protect you against product liability claims if required.

COMPONENTS/SYSTEMS

INFORMATION/COMMUNICATIONS

Electrical Safety
- Air and leakage paths
- Insulation measurement and monitoring
- Potential equalization measurement
- Disconnection switch analysis
- Energy source shut-off concept analysis
- Influencing by electromagnetic fields (EMC) and routed electrical noise
- Measurement of heat on components
- Abuse tests (overloading, short circuiting, nail intrusion, crushing etc.)

Performance
- Energy and capacity at different temperatures
- Output/performance
- SOC loss
- Energy efficiency
- Lifecycle

EMC
- Emissions
- Immunity to electrical noise

Environmental simulation
- Temperature cycling
- Thermal shock
- Vibration
- Mechanical shock
- Dew test
- IP protection type
- Contaminant gas
- Salt fog
- Immersion test
- Tauchversuch
- Drop tests

INFORMATION AND COMMUNICATIONS TECHNOLOGY: THE KEY TO TOMORROW'S MOBILITY

Information and communications technology plays a major role in establishing electric mobility.

The communication and bi-directional transmission of electrical energy between the vehicle and the charging infrastructure, Vehicle to Grid (V2G) or Grid for Vehicle (G4V), or the billing process for electrical energy "filled" into vehicles are just a few examples of numerous requirements.

Safety must be considered in this context as well, particularly with regard to the charging process which takes place unmonitored over a longer period of time.

- Adaptation of the charging process to the electrical properties and the charge condition of the battery and intended charging period (downtime)
- Recognition and adaptation of grid supply shortages
- Online billing of energy purchased/supplied depending on the current grid capacity utilization
- User authorization and abuse prevention
- Standardization of connections and interfaces to assure reliable supply at charging stations by different operators at international levels
- Implementation of new value-added services

The solution of these aspects requires intelligent communication between the electric vehicle, the charging station and the infrastructure.

The realization of the physical inter. face (WLAN, ZigBee, Ethernet, CAN bus) plus the SW protocols to be used (IP-based with SIP etc.) are currently being specified by the relevant standardization bodies.

As an accredited test laboratory for telecommunications protocols in the field of signalling and voice we assist you with our wide range of know-how.

WWW.SGS-TUEV.DE/EMOB

SGS-TÜV GmbH
Ein Unternehmen der SGS-Gruppe und des TÜV Saarland e.V
E-Mobility

Europe/Headquarters
Hofmannstr. 50
D-81379 München
Germany
t +49 89 787475 - 271
f +49 89 787475 - 217
emob@sgs.com
www.sgs-tuev.de/emob

Asia Pacific
3rd Building, No.889 Yishan Road
200233 Shanghai
China
t +86 21 61191 - 718
f +86 20 61191 - 000
cn.emob@sgs.com
www.sgs-tuv.com/emob

SGS TÜV

SGS-TÜV GMBH – EIN UNTERNEHMEN
DER SGS-GRUPPE UND DES TÜV SAARLAND E.V.