

Quality & Safety Assurance for Components

Independent technical expertise for testing, inspection, and certification





A part or a component of a device is similar to that of a cell in an organism. The health of the organism is determined by the sum of its parts. For electrical and electronic devices, the interweaving of small parts and components such as the motor, sensor, cable, switch-gear, actuator, terminal blocks and control units determine its stability and virility.

While small in physical size, the manufacturing of components and parts represents a massive active market. The global general electronic components market is expected to reach \$509.06 billion in 2025 and a CAGR forecast of 8%¹ indicating the continued growth to come.



Invisible parts move the world

The commercialization of electronics has made components an indispensable element quietly supporting the everyday lifestyle of billions. End consumers rarely know the depth to which components contribute to enriching their lives. The fact is, almost all of the devices people are surrounded by function as they do thanks to the countless intricate electrical components that lie within.

THE MINIATURIZATION OF EVERYTHING

Miniaturization of electronics is solving technology challenges across markets and industries alike. The demand for more conveniences, faster speed and better technological solutions continues to rise, almost as rapidly as the widening accessibility of electronic products and devices to far corners of the world. The literal downsizing has changed the way we conceptualize improvements, handle data, control machinery and approach the work processes they deliver. Designing smaller and lighter electronics has been key to the significant positive impacts realized for the military, industrial, and commercial sectors.

THE DIGITALIZED AUTOMOTIVE

Incorporation of electronics into the automotive industry doubled with the recent trend in electric vehicles and has opened up new opportunities

for component manufacturers. The significant increase in electronic content for each vehicle immediately impacts the demand for high-quality capacitors, sensors, high-voltage cables, motor controller etc. The Industrial Internet of Things – also known as IIOT – brings an altogether new level of ubiquitous interconnectivity and endless technological possibilities.

HIGH GROWTH FOR HIGH VOLTAGE

Parallel to the development of technological advances is the ever increasing desire to achieve more power and speed. Analysts estimate that high voltage power (HV) cable market is expected to grow by USD 13.63 billion during 2020-2024², progressing at a CAGR of over 5%.³

MANUFACTURING INTELLIGENCE

Devices and things are quickly becoming interconnected through IoT and this is no different for the future of manufacturing. Powered by intelligent components and parts, we have seen the emergence of Smart Home, Smart Factory and Smart City infrastructure. While the global smart motors market is still considered to be in its early stages, the segment is expected to grow steadily and reach USD 3559.07 million by 2026.⁴

¹ General Electronic Components Global Market Report 2021 | The Business Research Company

^{2,3} High-voltage Power Cable Market by Product and Geography - Forecast and Analysis 2020-2024 Technavio - <https://www.technavio.com/report/global-test-and-measurement-power-cables-market>

⁴ SMART MOTORS MARKET - GROWTH, TRENDS, COVID-19 IMPACT, AND FORECASTS (2021 - 2026) | Mordor Intelligence

Reliable future

There are many research organizations and manufacturers who continuously try to make better parts or components; devices are smaller, faster and more efficient. Despite the aggressive pace of technology advancement, there are three cornerstones which remain unchanged: safety, reliability and energy efficiency.

SAFETY IS EVERYTHING

When it comes down to product or system safety, everything is interconnected. To ensure a device stays safe throughout its entire life cycle with the end-user, it is imperative to evaluate the reliability and quality of each component.

Component safety requirements vigorously scrutinize hazards, especially heat, electrocution and chemical hazard. For parts to be declared safe, these factors must be properly mitigated and certified to do no harm to the end-user.

RELIABILITY VERSUS PERFORMANCE

Every user wants to have a high-performing device, but above all, they desire a product with exceptional stability and reliability. We have seen time and time again, that concepts delivering performance without reliability do not survive far beyond the design stage.

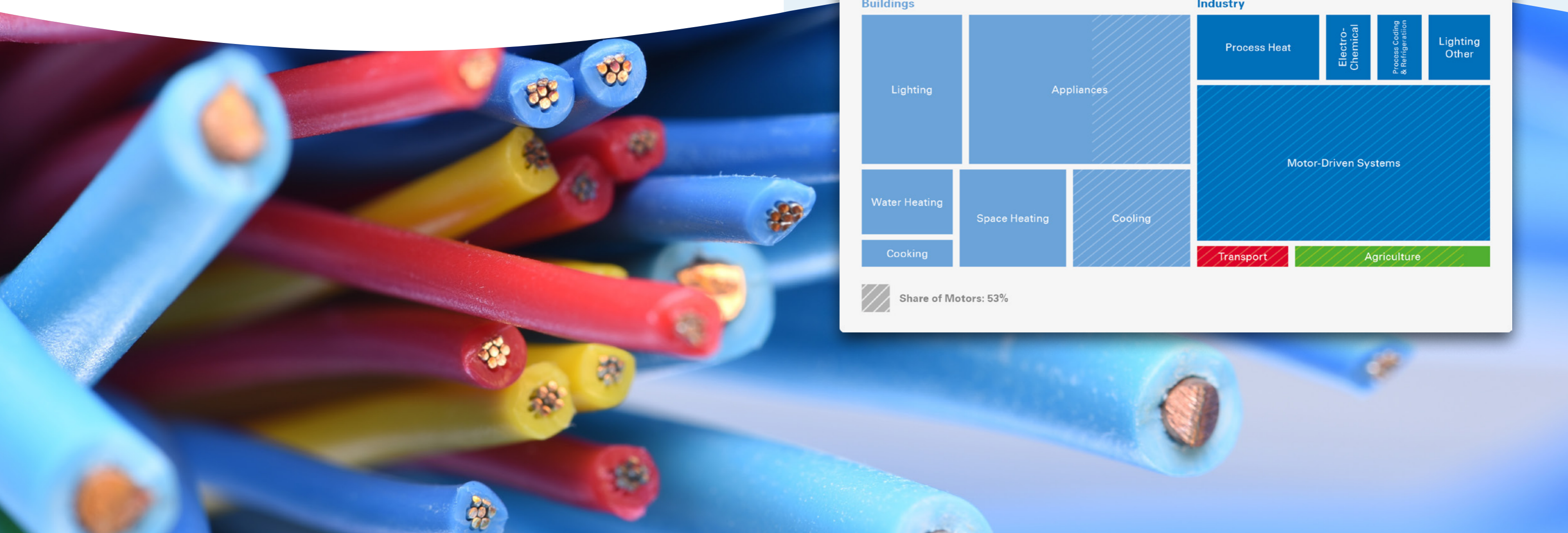
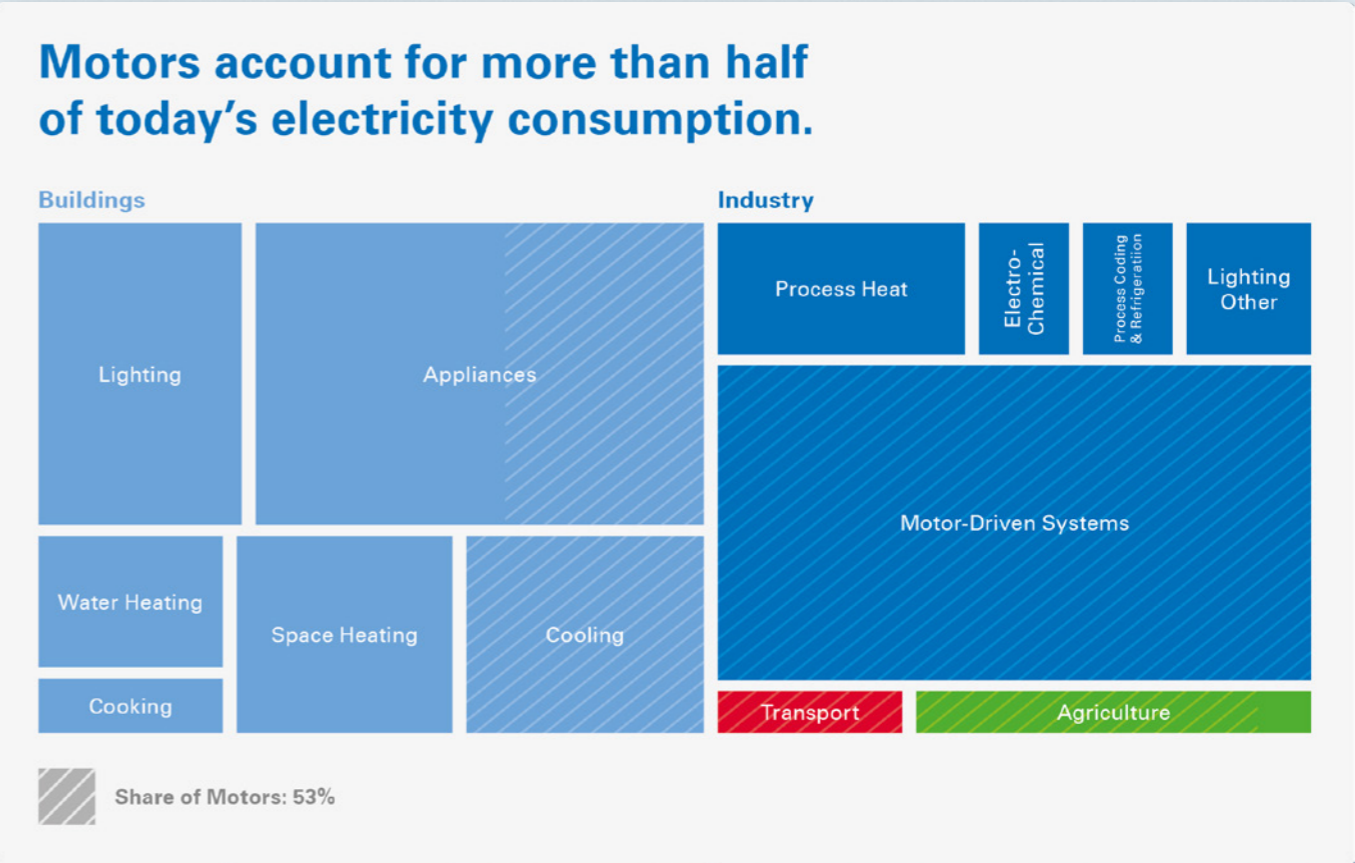
Successful product designs consider the difference in requirements for varying components, as well as each specific component type related specifications, which change depending on their application. For example, an industrial wire will need to satisfy a specific set of requirements when being used for consumer goods versus automotive applications, as is true for when it is applied in robotics, railway or photovoltaic panels respectively.

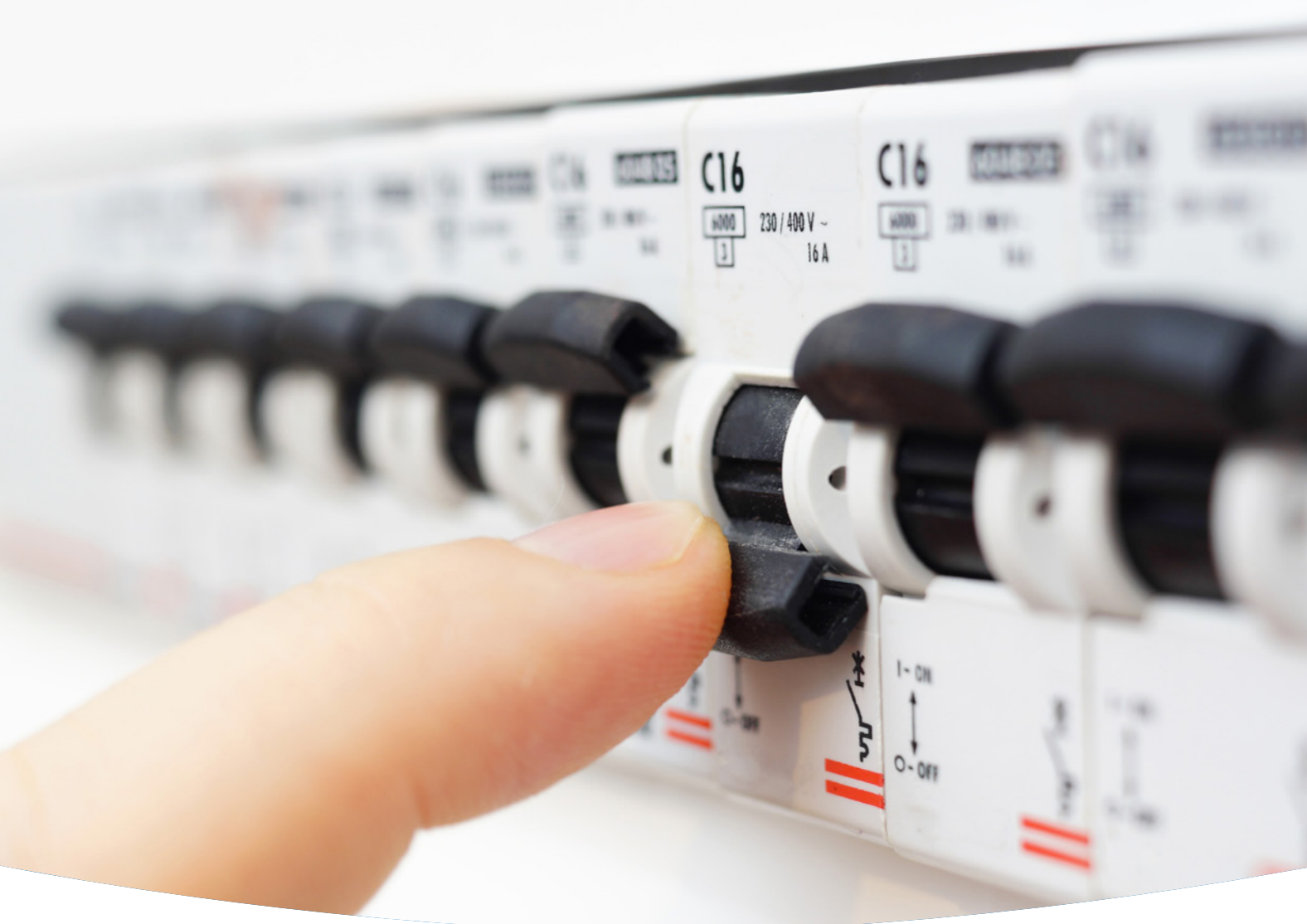
INCREASING ENERGY EFFICIENCY

Changes in economic growth and consumer behavior are increasing energy demand, especially the reliance on electricity. Electric motor systems, also referred as electric motor-driven systems (EMDS), are responsible for 53 percent of global electricity usage and continue to prevail as the single largest category at 10,700 TWh/per year.⁵ With global electricity consumption rising in a decade to nearly 33 percent and 24,740 TWh in 2018, striving for increased use of high energy efficient components and motors combined with power optimization controls is in everyone's interest.⁶

Electric motors in the industry and building sectors respectively consume 57 percent and 35 percent, together amassing 92 percent, of total global electricity used by motors.⁷ Cutting back on the industrial sector's 6,099 TWh/year consumption from electric motors will contribute to lowering energy reliance in the mid to long-term, and additionally transfer financial benefits to manufacturing operations and end-users.

^{5,6,7} Energy Efficiency Policy Opportunities for Electric Motor-Driven Systems © OECD/IEA 2011





Why TÜV Rheinland?

GLOBAL BRAND

With nearly 150 years of experience in testing, inspection and certification, we are a longstanding respected and recognized company serving major brands around the world.



EFFICIENT AND RELIABLE SOLUTIONS

Our team of qualified experts located worldwide, provide clarity on regulations specific to your product and simplify the testing process for multi-market access needs.



ONE TEAM

Our highly experienced experts have practical knowledge of the full product development lifecycle in addition to the tests, and certification requirements.



QUALITY PARTNER

Our worldwide network of accredited laboratories offers our customers access to an extensive range of services with additional support in key manufacturing and destination markets.



Solutions for the entire value chain

TÜV Rheinland is the ideal partner right from the beginning, providing one-stop service with a single point of contact. Our services and solutions portfolio covers the entire value chain, including inspection, engineering testing, type approval, training and consulting.

TESTING

- We test according to the relevant industry standard
- Test different components and finished products thoroughly under different usage conditions
- Our laboratories offer high-level, quality testing services

INSPECTION

- We inspect your production line
- Identify hidden hazards in machine interactions within a system or installation
- Helps to prevent accidents in the workplace

CERTIFICATION

- Third party Certification mark is a proof of your product safety and quality
- Certified by accredited laboratories

CONSULTATION

- Our experts guide you through challenging projects
- We offer independent and up-to-date advice to help customers deal with unidentified risks, maximize safety and avoid delays

TRAINING

- Our experts and trainers are ready to share their knowledge on a wide variety of topics.

Testing and Certification services for your needs

Understanding local and global safety regulations is critical when setting up components production or implementing them into equipment. Any failure to follow such intricate, interconnected and constantly-changing protocols can disrupt your operations.

TÜV Rheinland's components services can help. Backed by a global network and in-depth technical expertise, we can deliver a customized review of your safety implementation and help you manage strategies for every stage of the components life cycle – from development and production, to commissioning and modifications – we'll even take you all the way through recycling.

GENERAL COMPONENTS TEST AND CERTIFICATIONS

- EMC Testing
- ENEC
- International certification (CB Scheme, G-Mark, Customs Union, CCC, cTUVus, etc.)
- Pre-testing
- RoHS / REACH
- TÜV Bauart Mark

PROTECTIVE EQUIPMENT

- **Circuit breaker for household**
IEC/EN 60898
- **Fuse**
IEC/EN 60127, IEC/EN 60269, IEC/EN 60282, ISO 8820
- **High voltage switchgear and control gear**
IEC/EN 62271
- **Low voltage switchgear and control gear**
IEC/EN 60947 IEC 62026, IEC 60439, IEC 61439
- **Residual current device**
IEC/EN 61008, IEC/EN 61009, IEC 62423, IEC/EN 62640, IEC 61540, HD 639
- **Surge protective device**
IEC 61643, IEC 60099

AUTOMOTIVE EMC

- **Vehicle level**
CISPR 12
CISPR 25
CISPR 25
- **Component level**
ISO 11451-2
ISO 11452-2 (Radiated immunity)
ISO 11452-4 (BCI)
ISO 11452-9 (Portable transmitter)
ISO 10605 (ESD)
UNECE Regulation 10

ESS (ENERGY STORAGE SYSTEMS)

- **Safety of Battery Energy Storage Systems**
2PfG 2698:2019-08

DISCRETE COMPONENT OR SIMILAR

- **Capacitor**
IEC/EN 60252, IEC 60384, IEC 61048, IEC 61049, IEC 62391, IEC 62576
- **Filter**
IEC/EN 60939
- **Power capacitor**
IEC/EN 60831, IEC/EN 61912, IEC 61071, IEC 61881, IEC 60871, IEC 60931
- **PTC, NTC**
IEC 60738, IEC 60539, IEC 62319, IEC 60730
- **Resistor, Varistor**
IEC 61051, IEC 60115

ELECTROMAGNETIC COMPONENT OR SIMILAR

- **Motor**
IEC/EN 60034
- **Transformer**
IEC/EN 61558, IEC 60044, IEC 61869, IEC/EN 60076
- **Reactor**
IEC/EN 61558, IEC/EN 60076

BATTERIES

- **EV batteries**
ISO 12405 UL 2580, IEC/EN 62660, SAE J2464, SAE J2380, GB/T 31467, GB/T 31484
- **ESS (Energy Storage Systems) batteries**
IEC/EN 62619, IEC/EN 61427, EN 62620, UL 1973, UL 1642, JIS C 8715
- **Light electric vehicle batteries**
EN 50604, UL 2271
- **Portable batteries**
IEC/EN 60086, IEC/EN 62133, UL 1642, UL 2054
- **Power banks**
IEC/EN 62133 UL 2056, IEC/EN 60950, IEC/EN 62368

WIRELESS EQUIPMENTS

- **Radio Equipment Directive requirements**
EN 300 220, EN 300 330, EN 300 440, EN 300 422, EN 300 328, EN 300 893, EN 300 208, EN 300 413, EN 300 417, EN 300 447, EN 301 489, EN 301 511, EN 301 908

INSTALLATION ACCESSORIES

- **Plug, socket, adaptor for household purpose**
IEC 60884
- **Plug, socket and connector for industrial purpose**
IEC 60309
- **Conduit**
IEC 61386, IEC 60423, IEC 60614, IEC 61084
- **RCD**
IEC 61540
- **Mounting box**
IEC 60670, IEC 62208
- **Battery clip**
DIN 72553
- **Appliance couplers**
IEC 60320
- **Cable tie**
IEC 62275
- **Cable gland**
IEC 62444
- **Cable tray/ladder**
IEC 61537
- **Cable reel**
IEC 61242
- **Insulating sleeving**
IEC 60684
- **Cord set**
IEC 60799
- **Connecting device**
IEC 60998, IEC 61210, IEC 61984, IEC 61535, IEC 61238, IEC 61076, IEC 61995
- **Power track**
IEC 61534
- **PV connectors**
IEC/EN 62852
- **PV junction boxes**
IEC/EN 62790
- **PV combiner boxes**
IEC/EN 61439

SEMICONDUCTOR COMPONENT EMC

- IEC 61967-2 (TEM cell emissions)
- IEC 61967-3 (Near field emissions)
- IEC 61967-4 (Conducted emissions)
- IEC 61967-8 (Stripline emissions)
- IEC 62132-2 (TEM cell immunity)
- IEC 62132-4 (DPI)
- IEC 62132-8 (Stripline immunity)
- IEC 62132-9 (Near field immunity)
- IEC 62215-2 (Transient)
- IEC 62215-3 (Transient)

SWITCHES AND AUTOMATIC CONTROLS

- **Relays**
IEC 61810, IEC/EN 60255, IEC 62314
- **Switches for fixed electrical installation**
IEC 60669
- **Automatic controls (temperature, pressure, time, level...etc.)**
IEC/EN 60730
- **Switches for appliance**
IEC/EN 61058
- **Thermal link**
IEC/EN 60691

WIRES AND CABLES

- **Booster cable**
ISO 6722
- **Cables for EV or EV Charging Station**
ISO 6722, EN 50620, ISO 14572, 2PfGQ2473/06.18
- **Cable for photovoltaic (PV) system**
2PfG 1169/10.19, 2PfG 1940/12.11, EN 50618, IEC 62930
- **Cables for Railway**
EN 50264, EN 50306, EN 50382, EN 45545, EN 50200
- **Coaxial cables**
- **Fiber optics cable**
- **CPR (No. 305/2011) testing and certification**
EN 50575
- **Power cables**
IEC 60502, HD 603
- **PVC insulated cables**
IEC 60227, EN 50525
- **Robotics cable**
2PfG 2577/08.16
- **Rubber insulated cable**
IEC 60245, EN 50525
- **Wind power generation system cables**
2PfG 2630/06.17

OTHER SERVICES

Our full list of offerings covers an extensive range of services, which extends well beyond this page. A few of our most popular services include:

Wireless testing for smart components

Apart from regulatory requirements, the technology also needs to be tested and certified: conformance compliance testing, performance testing, environment, reliability, interoperability, compatibility, safety, functional testing, system level testing, black box, RF exposure, wireless charging and cyber security.

Market Access Services

Facilitate the export of your products by complying with the local regulations in your target markets.

Worldwide Regulatory Landscape Research and Information Service

Our global network enables us to capture the latest information on mandatory and voluntary certification procedures and export regulations.

As a single source provider, we bundle testing and global market access services to save our customers time and money.

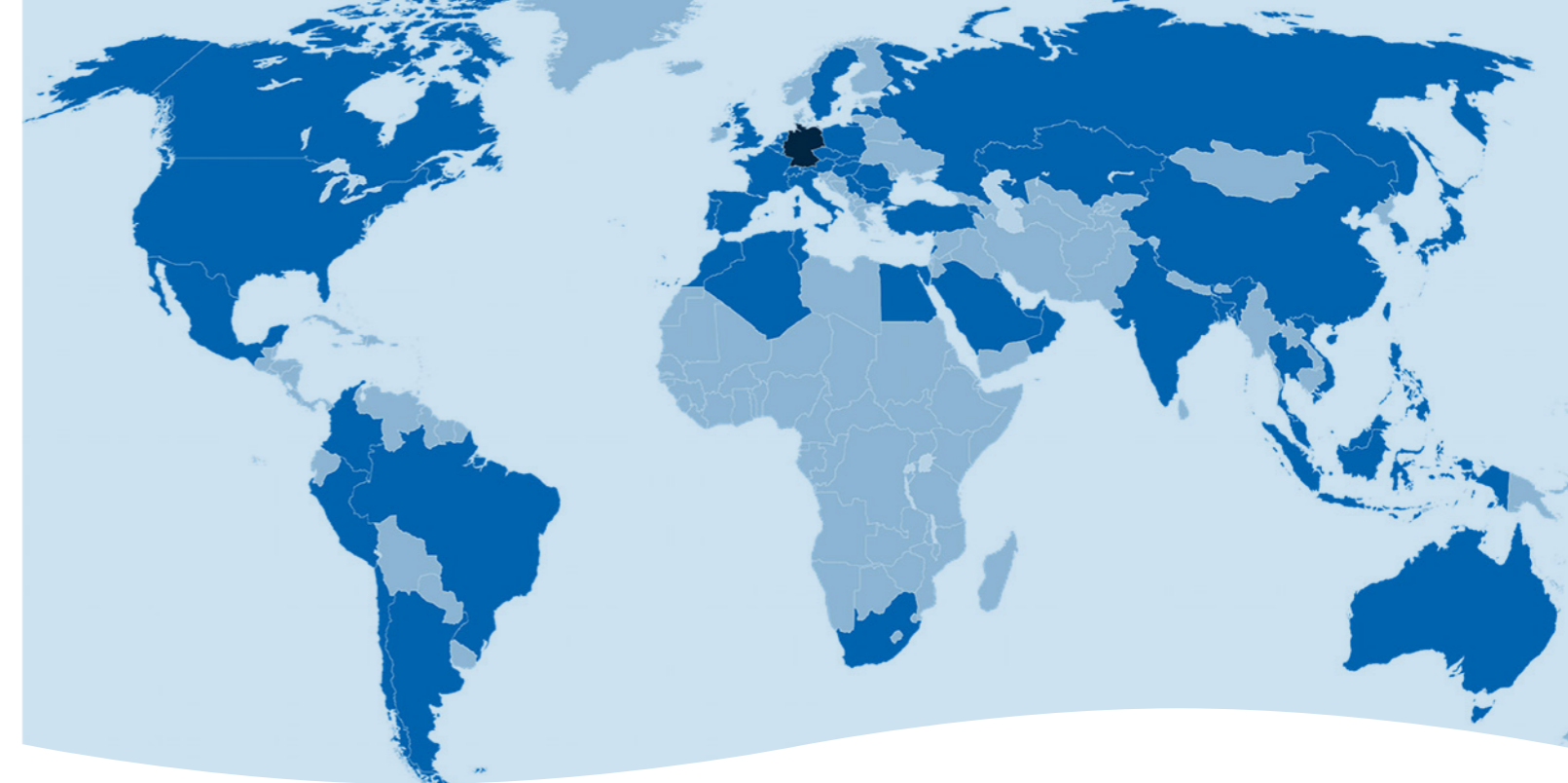
Training & Consulting

We offer customized in-house seminars on standards specifically for your products, as well as preliminary assessments for conformity with safety and quality standards.

Global laboratory network

COUNTRY	TEST / SERVICES
GERMANY	<ul style="list-style-type: none"> Full scope*
HUNGARY	<ul style="list-style-type: none"> Full scope*
CHINA	<ul style="list-style-type: none"> Full scope*
TURKEY	<ul style="list-style-type: none"> Cables Control and discrete components Sockets Switchgear Plugs
INDIA	<ul style="list-style-type: none"> Cables Control and discrete components Electrochemical elements and energy storage components (battery), Electromagnetic components Lighting components Photovoltaic components Plugs Relays and electronic components Sockets Switchgear
AUSTRALIA	<ul style="list-style-type: none"> Cables Plugs Sockets Switchgear
JAPAN	<ul style="list-style-type: none"> Cables Control and discrete components Electric vehicle components Electrochemical elements and energy storage components (battery) Electromagnetic components Photovoltaic components Plugs Relays and electronic components Socket Switchgear
SOUTH KOREA	<ul style="list-style-type: none"> Cables Control and discrete components Electric vehicle components Electrochemical elements and energy storage components (battery) Electromagnetic components Lighting components Photovoltaic components Plugs Relays and electronic components Socket Switchgear
USA	<ul style="list-style-type: none"> Control and discrete components Electric vehicle components
BRAZIL	<ul style="list-style-type: none"> Cables Control and discrete components Electromagnetic components Plugs Sockets Switchgear

* Full scope consists of following services:
 Cables, Control and discrete components, Switchgear, Electromagnetic components, Relays and electronic components, Safety control components, Electrochemical elements and energy storage components (battery), Plugs, Sockets, Electric vehicle components, Photovoltaic components



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Trust and Transparency



TÜV RHEINLAND – THE TEST MARK YOU CAN TRUST

After a product has been tested and certified to meet industry requirements, you can showcase your compliance through our Test Mark. It proves that your product has been assessed independently by TÜV Rheinland. With an individual ID number and QR code, TÜV Rheinland Test Marks offer easy access to the specifics of your products' compliance.

Surveys show that buyers place particular confidence in testing and performance assessments from a neutral third-party. Standing for quality, safety and neutrality, the TÜV Rheinland Test Mark can have a strong impact on customers, making it a powerful advertising and marketing tool.

SHARPEN YOUR COMPETITIVE EDGE WITH CERTIPEDIA

As well as its innovative Test Mark, TÜV Rheinland offers Certipedia – a transparent and consumer-friendly online certification database. It contains all the important product information and testing criteria in one IoT-enabled and QR code-capable location, which can be accessed 24x7 anywhere in the world.

Available exclusively to manufacturers certified by TÜV Rheinland, Certipedia makes product quality and safety visible instantly at the click of a mouse. All it takes to differentiate your products from your competitors is an Internet connection.

BENEFITS OF CERTIPEDIA

- Support the purchasing decisions of distributors and end-user consumers



- Showcase independently verified and certified products and services



- Download certificates and present your company's services around-the-clock



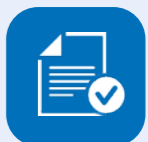
- Open up new market opportunities and appeal to new target groups



- A useful tool to organize certificates and reduce administrative costs



- Create additional customer confidence in advertising claims.



FULL DETAILS CAN BE FOUND AT WWW.CERTIPEDIA.COM

TÜV Rheinland: Other services you can benefit from

As a global leader in independent inspection, testing and certification services TÜV Rheinland evaluates technical equipment, products and services to overseeing projects, security and sustainability for companies around the world.

In addition to operating a global network of accredited labs, testing and education centers, our highly qualified experts train people across a wide range of specialties, careers and industries. Whatever you need, the chances are we either already provide the service or we are developing a solution.

TÜV Rheinland's extensive offering includes

TRAINING

- Risk Assessment Training
- Functional Safety Training
- Machinery Directive Training
- EMC Training
- Ergonomics Training

ADDITIONAL FUNCTIONAL SAFETY SERVICES

- Process industry, operations industry (oil, chemical, pharmaceutical) (IEC 61511)
- Functional Safety Calculation Verification (SIL or Class)
- Performance Level (PL) Calculation (ISO 13849)
- Functional Safety Certification
- Explosion Protection (IECEX and ATEX)
- Road Vehicle Safety (ISO 26262)
- Medical Device Safety (IEC 60601)
- Risk Assessment
- Functional Safety Management
- Support and services for other industries and Functional Safety standards

CYBERSECURITY

- Smart Factory security
- Industrial IoT security
- Wireless IoT security
- Cyber risk assessment and mitigation
- Operational Technology and Information Technology

MARKET ACCESS

- Europe: CE, GS
- North America: cTUVus NRTL Mark
- Middle East: G-Mark, SALEEM
- China: CCC, CR (China Robot Certification)
- Asia-Pacific: EK Mark, KCC Mark (for Korea), RCM, AUS Mark (for Australia), SNI (for Indonesia), and others
- Latin America: INMETRO, NR12 (for Brazil), NOM (for Mexico) and others

SUSTAINABILITY

- Green Product Mark
- Occupational Health & Safety OHSAS 18001
- Environment Management System ISO 14001
- Energy Management System ISO 50001



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See page 11 for regional
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 **TÜVRheinland**[®]
Precisely Right.