Quality & Safety Assurance for Machinery

Independent technical expertise for testing, inspection, and certification

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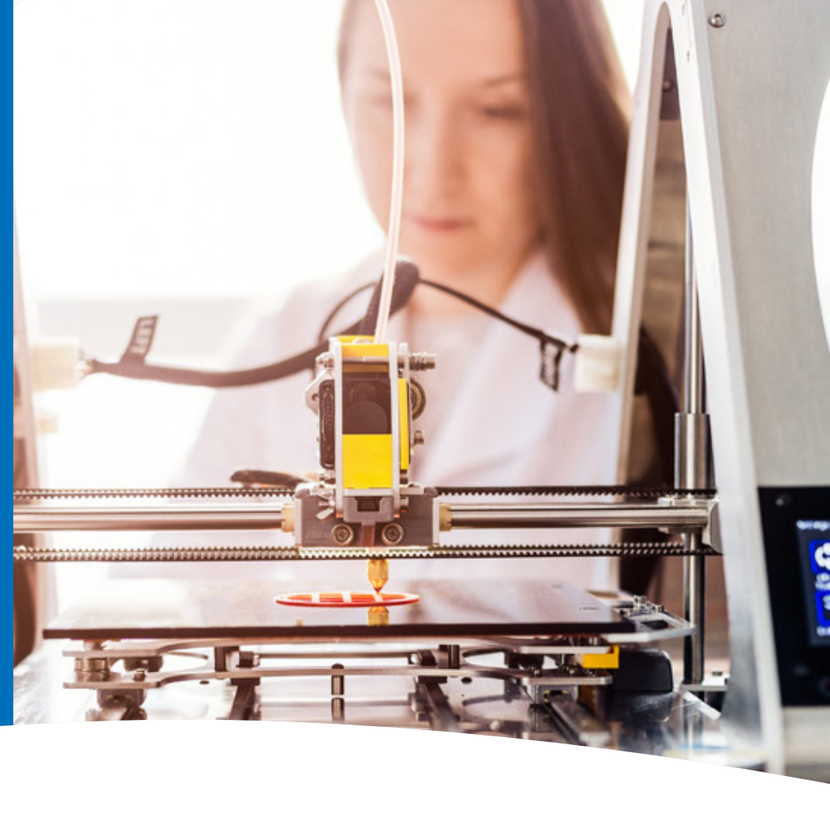
TÜVRheinland®
Precisely Right.

INDUSTRY 1.0 (1784)
The technical weaving loom, water and steam power.

INDUSTRY 2.0 (1870)
First production line. Mass production using electrical energy.

INDUSTRY 3.0 (1969)
First programmable logic controller (PLC). Use of electronics & IT for further automation.

INDUSTRY 4.0 (TODAY)
Based on cyber-physical systems (linking real objects with information-processing/ virtual objects and processes via information networks [e.g. the Internet]).



The future of manufacturing with machines

Since the Industrial revolution, global development has been driven by the adoption of machines. And, the pace of change and the speed of growth in the machinery industry is accelerating. Today, virtually everything we use is produced by means of mechanization. From agriculture to aerospace manufacturing, machinery of every kind plays a key role in increasing volume, reducing manual labor, enhancing safety, and automating production processes.

A GROWING INDUSTRY

Machinery production has significant financing requirements, such as supporting R&D and expenditure on tooling and raw materials. But, relatively long business cycles act as a buffer to short-term market variations. Experts estimate that the industrial machinery market will reach US$628 billion (~EUR 558 billion) by 2020, and it will enjoy a CAGR (compound annual growth rate) of 5.3% until 2024[1]. That reflects a rise in volume as well as value, delivered through technological advancements.

One thing is clear. Under the onslaught of automation and interconnectivity, the constantly changing machinery industry will continue to shape our future.

REDEFINING MANUFACTURING

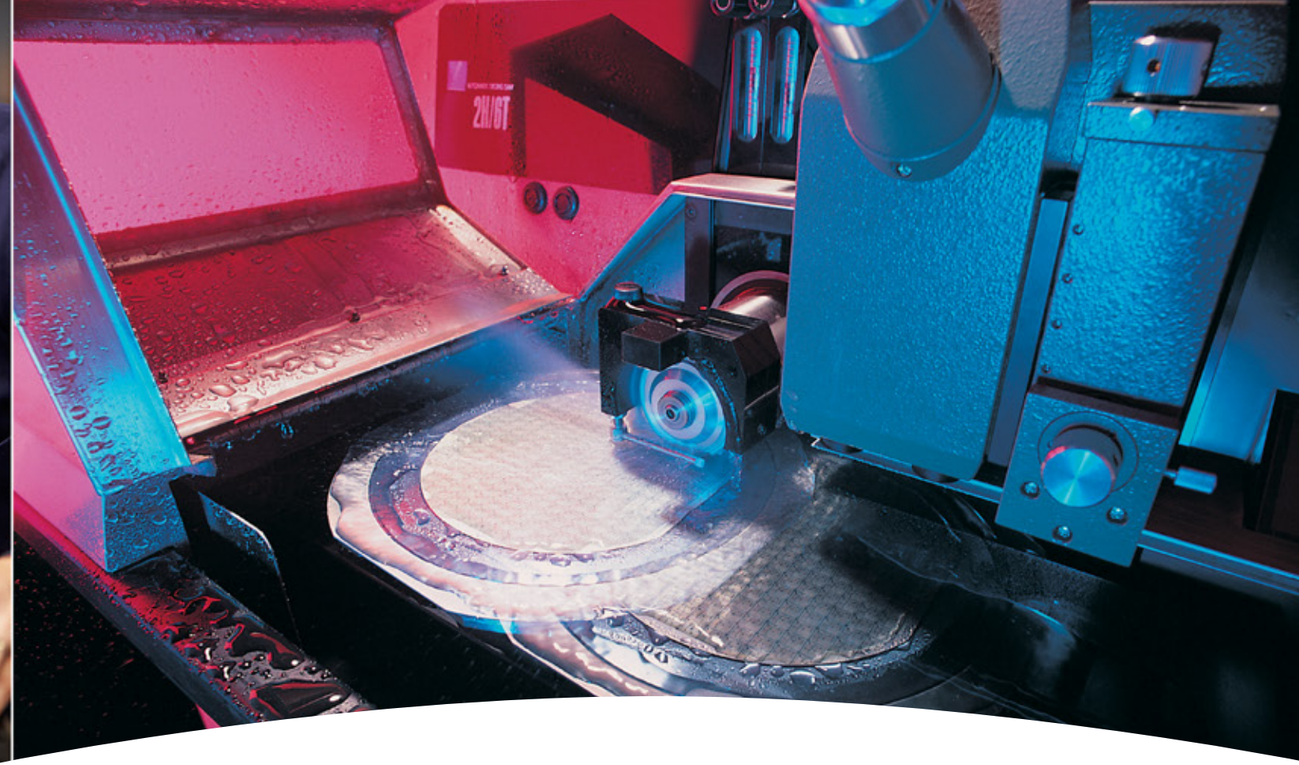
Additive Manufacturing (AM), also known as 3D printing (3DP), is an emerging technology that is redefining manufacturing. And, despite its origins in the 1980's, the advent of new processes and IT capabilities make it an extremely compelling option. Benefits include fast prototyping, instant production tooling, as well as the ability to fabricate new part geometries in extremely small batches.

Rapid improvements in technology and materials, combined with easy-to-use software and falling prices, are quickly driving it into the industrial mainstream. AM/3DP is making rapid inroads in many industry segments, including aviation, automotive, medical, consumer goods and the construction industry.

INDUSTRY 4.0: THE FUTURE IS ALREADY HERE

Advanced machinery, coupled with Artificial Intelligence (AI), is creating a more efficient manufacturing ecosystem where the need for human involvement is rapidly diminishing. This so-called Fourth Industrial Revolution (Industry 4.0) is already happening. "Smart Factories", where a variety of machines are interconnected to form an overall system, are becoming more common. Also known as IIOT – the Industrial Internet of Things – this level of ubiquitous interconnectivity opens the door to tremendous technological possibilities.

[1] https://www.gminsights.com/industry-analysis/industrial-machinery-market



Unlocking new markets

New technologies can open up new markets. But, they also bring new challenges for machinery manufacturers, plant operators and systems integrators. They include safety, compatibility, reliability and, increasingly these days, security.

FUNCTIONAL SAFETY

A study conducted by the US Occupational Safety and Health Administration (OSHA) indicates that 85% of all workplace accidents are equipment related – often occurring during installation, maintenance or repairs.

Occupational safety regulations are an important line of defense, but they aren't the ultimate solution to workplace accidents. But the likelihood of such incidents can be minimized through a process of risk assessments and the application of functional safety principles.

For example, regardless of the type of technology and energy used, the safety-related components of any machinery control system (SRP/CS) must also consider the operating environment, as well as the design and integration of the machinery within the overall system. Addressing this requirement is an essential step for anyone interested in ensuring that their machinery operates smoothly and safely.

ENSURING COMPATIBILITY

The majority of production lines are made up of machines from multiple manufacturers, each of whom specializes in their own equipment. As a result, the question of interoperability is often left unasked until an incident causing downtime occurs.

In simple operations, interconnectivity may not be an issue. But it becomes critical in larger operations, where different machines rely on machine-to-machine communication (M2M).

Assessing the compatibility of the entire system requires in-depth technical experience and expertise from installation to operation. Only when you have an overall understanding can the continuity of safety functions throughout a production line be verified.

MINIMIZING DOWNTIME

According to the US Office of Energy Efficiency and Renewable Energy (EERE)[2], more than half of plant operators take a "reactive" stance when it comes to maintenance. Reactive maintenance is the simplest and cheapest method, and it may be the recommended course of action for a non-critical part of a simple operation. Nonetheless, if it is adopted without a full risk assessment, it can also become the most expensive approach.

While the cost of unplanned downtime varies from company to company, globally it adds up to approximately US $20 billion (~EUR 17.6 billion) every year, or about 5% of an operation's planned output [3].

The decision on whether to maintain your machinery on time-based maintenance (TBM), condition-based maintenance (CBM), or run-to-failure (RTF) requires thorough assessment and planning. Taking the time to do so will reduce downtime in your operations, both planned and unplanned.

CYBERSECURITY

Technology has evolved rapidly during the emergence of Industry 4.0. Much emphasis has been placed on the technical aspects, but comparatively little on cybersecurity. This was not an issue for traditional factories, where machines operated independently and production lines were not connected to the outside world.

However, as traditional manufacturing facilities transform into Smart Factories, the increasing interconnection of machines – to each other and to other systems across the Internet – introduces new risks.

Smart Factories represent a significant capital investment, and protecting them from attacks that could lead to significant downtime can also be costly. A cybersecurity assessment can help to mitigate these risks.

NEW TECHNOLOGIES, NEW RISKS

Whenever a new technology is introduced, it brings a new set of risks and hazards. To make sure these risks are properly addressed, it is important to apply recognized industry standards.

Working with a team of experts with the experience and agility to adopt proven concepts in safety and security to new and innovative machinery technology is a sound practice. The goal is to avoid any delays in product launches or market readiness (or costly future re-designs) by demonstrating compliance to local standards, codes and directives.

[2] https://www1.eere.energy.gov/femp/pdfs/OM_5.pdf
[3] https://tinyurl.com/y6ultfr3

Complete solutions for your Machinery assurance

The machinery industry has come a long way since the invention of steam engine. And so has TÜV Rheinland. We inspected the installation, operation and safety of steam boilers during the first Industrial Revolution. And, as the use of machinery has expanded into almost every industry sector, we are using our expertise in testing, inspection, certification and consultancy in everything from agriculture and automotive, printing, manufacturing and mining.

Why TÜV Rheinland?

ADDED VALUE
With more than 140 years of experience in testing, certification, and inspection, we are recognized and respected by domestic and foreign enterprises.

EFFICIENT AND RELIABLE SOLUTIONS & SUPPORT
TÜV Rheinland provides services, solutions and support that customers can rely on during the entire product development lifecycle.

ONE TEAM
Our worldwide team of experts supports product development with up-to-date regulatory knowledge and in-depth technical experience.

QUALITY BRAND
Our brand and marks are well known in international markets, serving as an assurance of safety and quality in products and systems.

TESTING

- Globally accredited ISO/IEC 17025 testing services
- TÜV Rheinland provides testing according to the relevant local, regional or global industry standards and legal requirements
- We can accommodate the regulatory requirements for most countries (see Market Access Service)
- Testing covers components and finished products
- Advanced laboratory services extend beyond safety to include specialist, and increasingly essential areas, such as EMC, Wireless and Cybersecurity

INSPECTION

- Globally accredited ISO 17020 inspection services
- TÜV Rheinland offers comprehensive production line inspections to:
  - Identify hidden hazards from interactions between machines in a system or the surrounding installation
  - Prevent workplace incidents

CERTIFICATION

- TÜV Rheinland's third-party certification mark is proof of compliance with applicable requirements
- We are a recognized and respected notified body and an accredited ISO 17065 certification body
- Our online, QR-Code-compatible certification directory – Certipedia – offers all interested parties easy and immediate access to a wealth of standards and testing information

CONSULTATION (INDEPENDENT OF CERTIFICATION SERVICES)

- TÜV Rheinland's experts guide customers through the most challenging projects
- Independent, up-to-date advice helps machine makers and users deal with everything, from well understood dangers to unidentified risks, to maximize safety and avoid delays

Services for all your Testing, Inspection, and Certification needs

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

TÜV Rheinland's machinery 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 machinery lifecycle – from development to production and commissioning, modification, all the way through to recycling.

MACHINERY SAFETY COMPLIANCE

TÜV Rheinland delivers a full-range of services to demonstrate machinery safety compliance with major global regulatory requirements. They include:

- EU Directives such as:
  - Machinery Directive 2006/42/EC
  - EMC Directive 2014/30/EU
- GS Mark and TUV Mark
- cTUVus Mark (ANSI/UL and CSA standards for US and Canada)
- Machinery Safety according to global and domestic standards (e.g. ISO 13849)
- Risk Assessment for Machinery: ISO 12100
- Laser Safety: IEC 60825, ISO 11533
- Compliance with local regulations on machinery, including:
  - Field Evaluation Services (FES) for US and Canada
  - PUWER for UK
  - NOM 004 for Mexico
  - NR 12 for Brazil
  - KOSHA for Korea, and others

PRODUCTION LINES

Workplace safety assurance covers a complete assessment of the machinery throughout the production line, including:

- Workplace Safety Assessment
- Inter-machinery Assessment
- Review of Risk Assessment and Safety Integrity Levels (SIL)

CYBERSECURITY

Protecting machines or production lines from cyber risks brings companies closer to the Smart Factory ideal. TÜV Rheinland services include:

- Interoperability Assessment
- Penetration Tests and IT Security Analysis
- CB Scheme certification to IEC 62443-4-1 product development requirements
- ISA Secure certification to ISA 62443-4-1 and ISA 62443-4-2
- UL 2900 Series

FUNCTIONAL SAFETY

- IEC 61508
- EN 62061 Safety of machinery

SEMICONDUCTOR MANUFACTURING EQUIPMENT

As the world goes digital, compliance with industry-specific requirements for semiconductor production machinery set by industry associations and other major stakeholders has never been more important. TÜV Rheinland's offering currently includes:

- SEMI S2: Environmental, Health, and Safety (EHS)
- SEMI S8: Ergonomics Engineering
- SEMI S23: Conservation of Energy, Utilities and Materials Used
- SOP 39: safety requirements for Seagate production equipment

ROBOTICS

As human involvement in manufacturing decreases, the evaluation of robotic systems is in high demand. TÜV Rheinland's comprehensive evaluation services cover everything from the integration/ installation of fixed, mobile and autonomous robots, to related controls and recharging stations:

- Safety requirements for robots and robotic devices:
  - ISO 10218-1 & ISO 10218-2
  - ANSI / RIA 15.06
- CAN / CSA Z434 for industrial robots
- ANSI / UL 1740 for robots and robotic equipment
- ISO / TS 15066 for collaborative robots
- ISO 13482 for personal care robots

ADDITIVE MANUFACTURING

Additive Manufacturing or 3D Printing offers incredible possibilities. TÜV Rheinland can test and certify 3D printers to a host of international standards, such as:

- Safety requirements for AM machines and 3D printers
- Risk Assessment and safety evaluation
- Factory and workplace safety
- REACH and RoHS chemical safety for materials

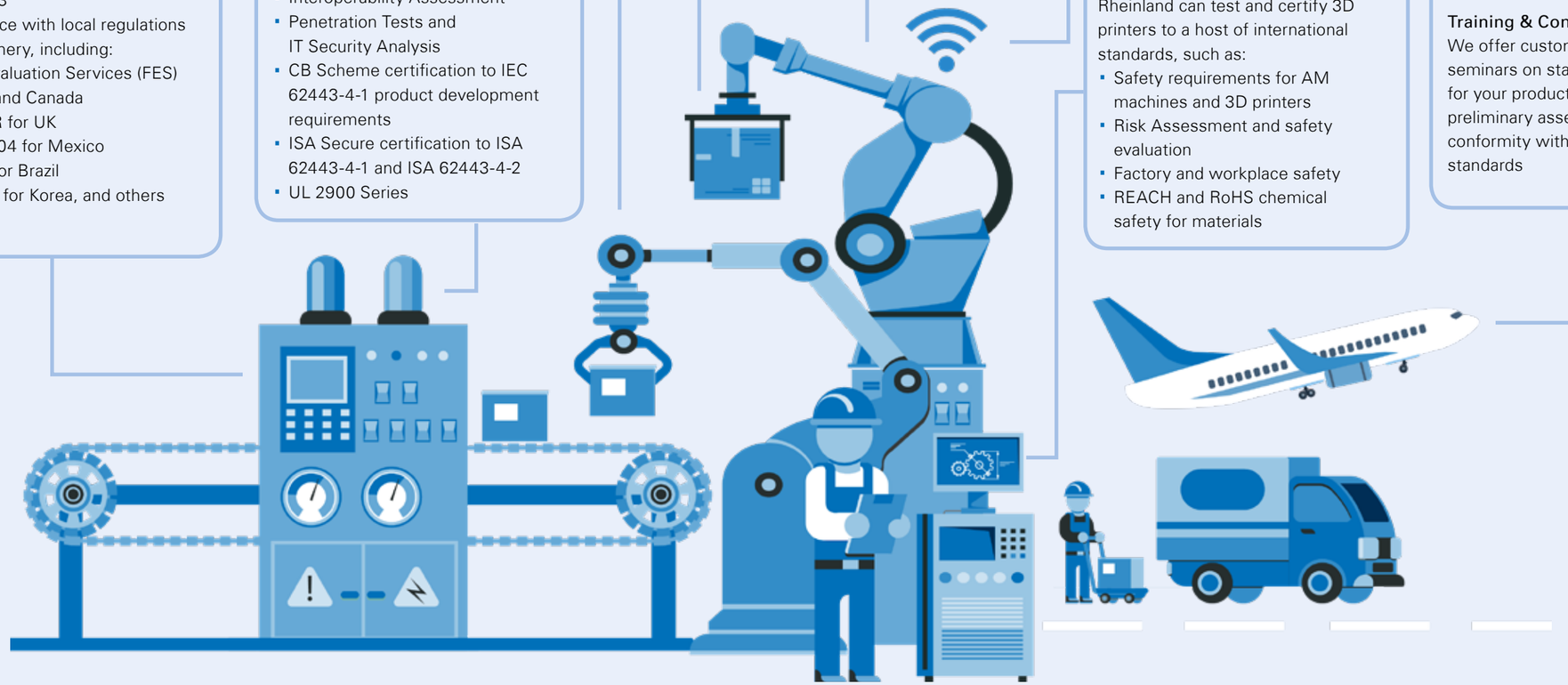
OTHER SERVICES

That is not the end of the TÜV Rheinland story. We offer a tremendous range of services – not only for machinery, but also for other industries – including:

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. We can also support customers with insight into certification procedures, and act as their representative when they apply for certification

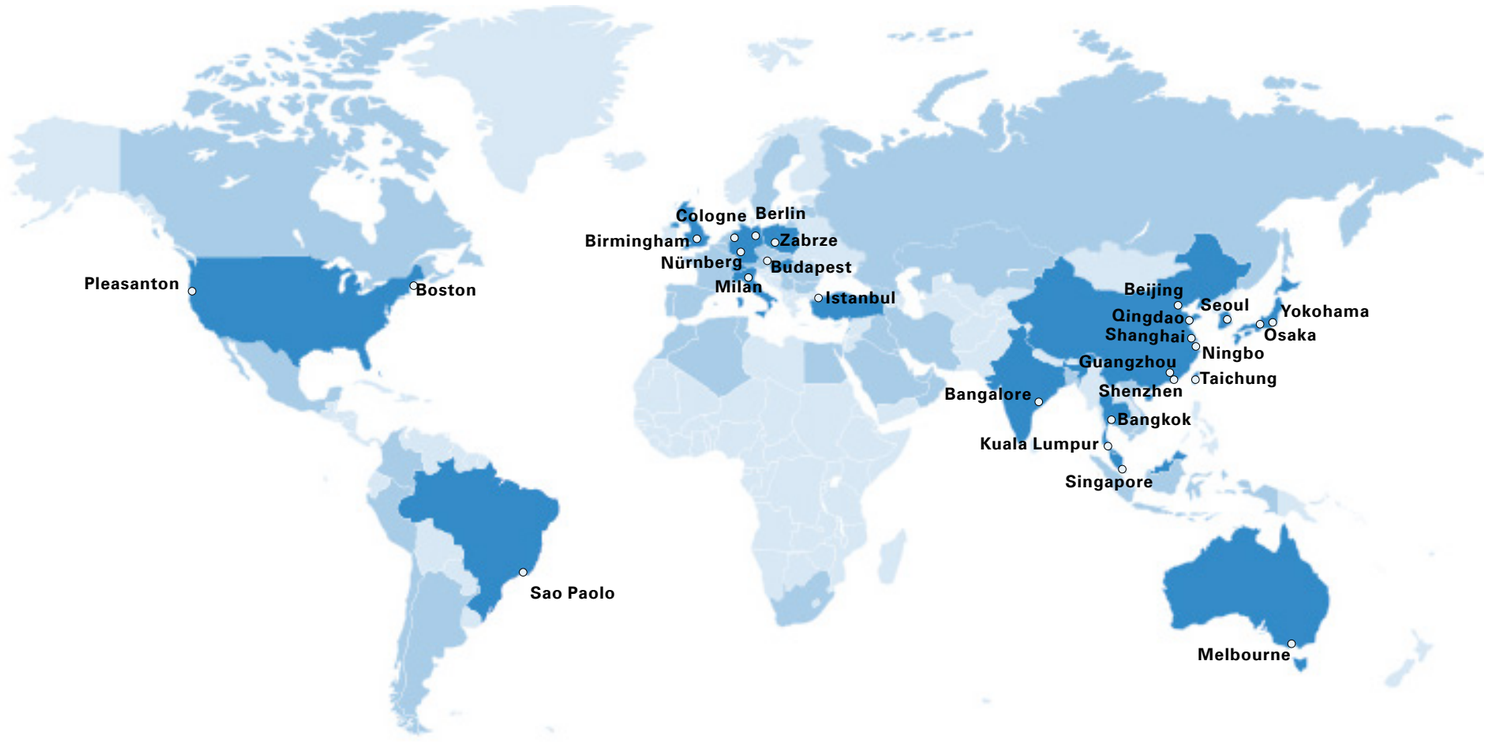
Training & Consulting
We offer customized in-house seminars on standards specifically for your products, as well as preliminary assessments for conformity with safety and quality standards



Global footprint, local presence

COUNTRY WITH OPERATIONAL PRESENCE

COUNTRY WITH LABORATORY FACILITIES



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 instantly visible 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

Beyond Machinery

As a global leader in independent inspection, testing and certification services, TÜV Rheinland evaluates technical equipment, products and services, and oversees projects, processes and information security for companies on almost every continent.

Our experts train people in a wide range of careers and industries. And we operate a global network of approved labs, testing and education centers. Whatever you need, the chances are we either already provide it, or we are developing a solution.

TÜV Rheinland's extensive offering includes

TRAINING

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

ADDITIONAL FUNCTIONAL SAFETY SERVICES

TÜV Rheinland's broad range of functional safety services also includes:

- Process industry, operations industry (oil, chemical, pharmaceutical) (IEC 61511)
- Functional Safety Calculation Verification (SIL, PL, or Class)
- Functional Safety Certification
- Explosion Protection (Ice 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
- North America: cTUVus Mark
- Middle East: G-Mark, SALEEM
- China: CCC
- Asia-Pacific: EK Mark, KCC Mark (for Korea), RCM, AUS Mark (for Australia), SNI (for Indonesia), and others
- Latin America: INMETRO (for Brazil), NOM (Mexico) and others

SUSTAINABILITY

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

AUGUST 2018

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