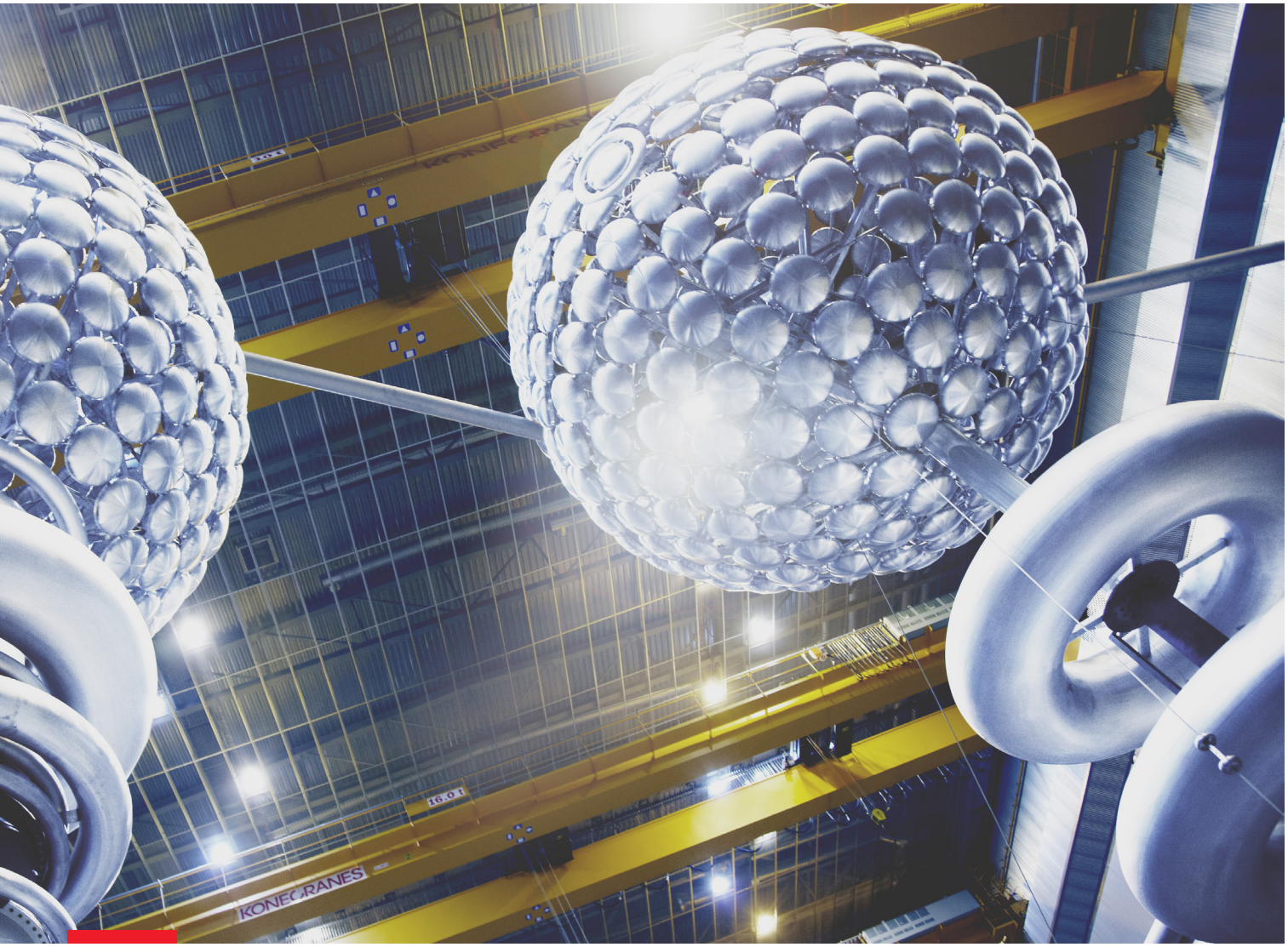


R&D Laboratories
Centers of innovation and guarantee of reliability

R&D Laboratories
An essential part of design engineering

—

The experience acquired by the medium voltage unit in designing and manufacturing electrical distribution apparatus goes back a long way. The factory comprises several R&D facilities, laboratories and production departments covering a built-up area of over 43,000 square meters.

It's a factory with international market responsibilities. Within the ABB Group, it acts as a Global Focused Feeder Factory, Global Technology Center and Competence Center focused on Embedded Electronics for the design and construction of medium voltage circuit-breakers and switchgear. Market leader, it exports about 85% of its products throughout the world.

Thanks to the in-house Service organization, the unit is able to provide backup for the customers by analysing and altering existing installations, performing equipment state diagnosis assessments, energy cost reduction studies, adaptations to laws and standards, retrofitting, revamping and emergency interventions, and organizing training and refresher courses for maintenance staff.

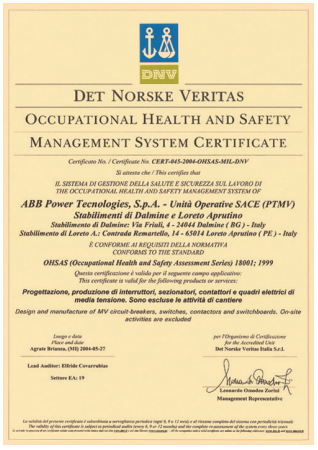
The unit functions in accordance with the corporate quality and management systems, certified by an independent third-party certifier:

- Quality System, conforming to ISO 9001 Standards
- Environmental Management System, conforming to ISO 14001 Standards
- Health and Safety Management System, conforming to OHSAS 18001 Standards, also regarding its application in construction site activities.

To market almost all the mechanical and electronic components - be they simple appliances or complex systems -buyers must be guaranteed that performance and reliability levels for which they are designed are maintained in all operating and environmental conditions to which they could be subjected during their life. For products made at Dalmine plant, the guarantee of their resistance to certain environmental conditions and therefore of their compliance with regulatory requirements and customer specifications, is based on the results of appropriate laboratory tests.

DET NORSKE VERITAS
ENVIRONMENTAL MANAGEMENT SYSTEM CERTIFICATE
ABB Trasmissione & Distribuzione S.p.A.
Divisione SACE - T.M.S.
Via Friuli, 4 - 24044 Dalmine (BG) - Italy
Contrada Remartello - 65014 Loreto Aprutino (PE) - Italy
UNI EN ISO 14001: 1996 (ISO 14001: 1996)
Progettazione, produzione e service di interruttori, sezionatori, contattori e quadri elettrici di Media Tensione
Design, manufacture and service of Medium Voltage circuit-breakers, switches, contactors and switchboards
SINCERT


DET NORSKE VERITAS
QUALITY SYSTEM CERTIFICATE
ABB Trasmissione & Distribuzione S.p.A.
Divisione SACE - T.M.S.
Via Friuli, 4 - 24044 Dalmine (BG) - Italy
Contrada Remartello - 65014 Loreto Aprutino (PE) - Italy
UNI EN ISO 9001:2000 (ISO 9001:2000)
Progettazione, produzione e service di interruttori, sezionatori, contattori e quadri elettrici di Media Tensione
Design, manufacture and service of Medium Voltage circuit-breakers, switches, contactors and switchboards
SINCERT


DET NORSKE VERITAS
OCCUPATIONAL HEALTH AND SAFETY MANAGEMENT SYSTEM CERTIFICATE
ABB Power Tecnologies, S.p.A. - Unità Operative SACE (PTMV)
Stabilimenti di Dalmine e Loreto Aprutino
Stabilimento di Dalmine: Via Friuli, 4 - 24044 Dalmine (BG) - Italy
Stabilimento di Loreto A.: Contrada Remartello, 14 - 65014 Loreto Aprutino (PE) - Italy
OHSAS (Occupational Health and Safety Assessment Series) 18001: 1999
Progettazione, produzione di interruttori, sezionatori, contattori e quadri elettrici di media tensione. Sono escluse le attività di cantiere
Design and manufacture of MV circuit-breakers, switches, contactors and switchboards. On-site activities are excluded

R&D Laboratories

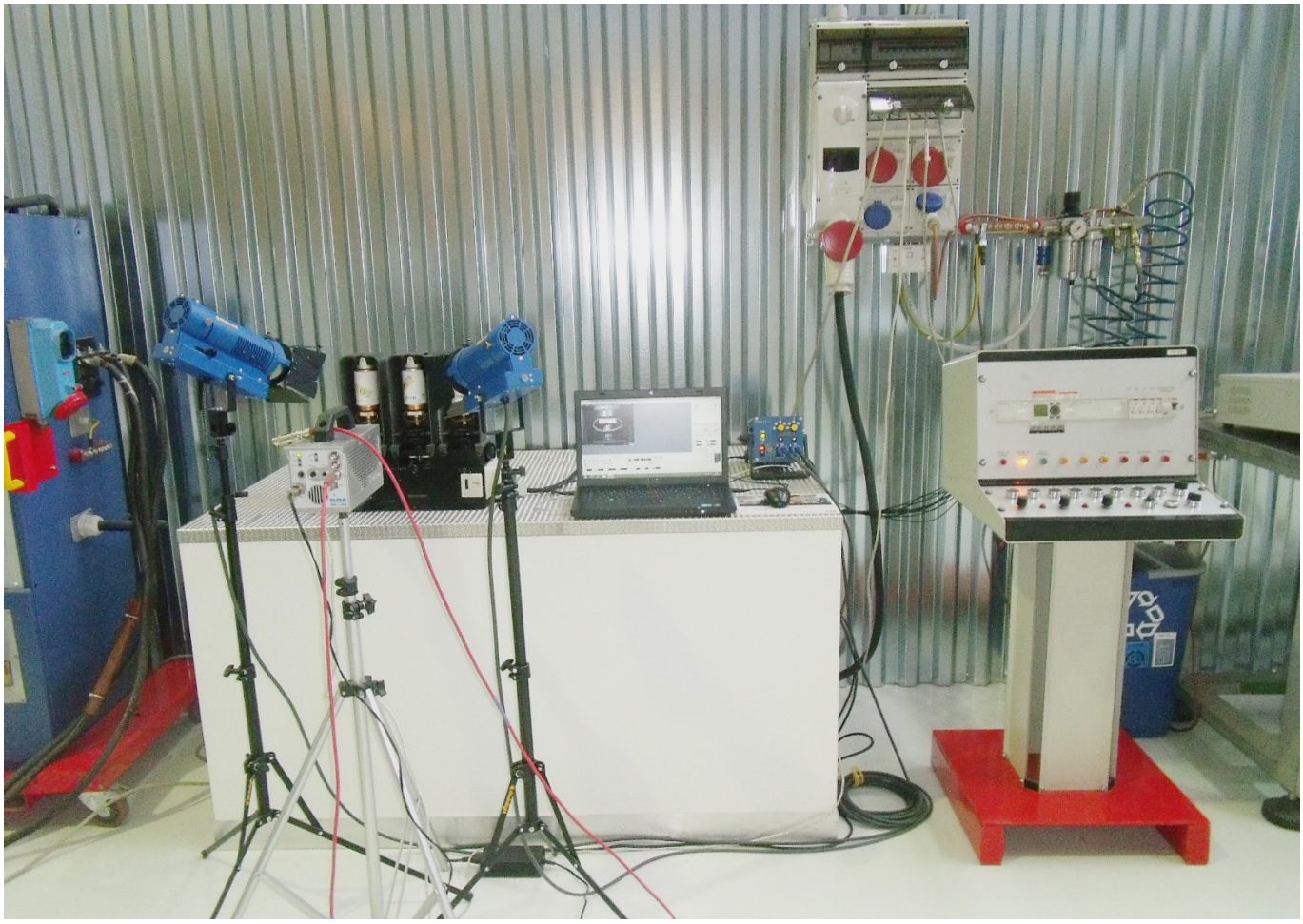
The factory has a system of laboratories with advanced equipment for conducting material, experimental, climatic, mechanical life, electromagnetic compatibility, performance and dielectric tests.

The laboratory system involves several internal divisions, which are responsible for the type and routine tests to which the mass production is subjected. These tests ensure that the components, manufacturing processes and finished products conform to the reference standards and product specifications.

Safety, method and reliable processes
All the testing processes are based on an analysis of the standards that apply to the methodologies of the actual tests that can be performed in the laboratory system.

Besides periodic routine inspections, the laboratories are also subjected to audits by third-party certifiers. Compliance of the processes and fitness of the laboratories themselves are guaranteed by the certificates issued by these authorities.

Filing of the test reports
The test reports, the relative results and all the documentation acquired for the actual tests are all kept in the laboratories.



Main divisions of the laboratory system

- **Prototypes lab.** Works in close contact with the R&D offices. Creates and assembles prototypes in accordance with project specifications.
- **Experimental test lab.** Performs research tests and the main type tests on the prototypes so as to assess compliance with the reference standards and the customers' specifications (certification and/or type approval).
- **Electromagnetic compatibility test lab.** Measures conducted and radiated emissions, and tests the conducted and radiated susceptibility of magnetic and electric fields.
- **Electronic lab.** It assessed and validates the electronic equipment.

Dalmine Unit also includes the Smart Lab, the laboratory demonstrator of components, systems and services for the digitalization of electricity networks and industrial installations.

Certifications

The procedures, equipment, measuring systems and reporting methods used in the laboratories are periodically checked to ascertain skills, devices, processes and compliance with the criteria established by the latest standards.

The laboratory system actively collaborates with internationally recognized outsourced organizations when special or specific tests are requested by the customers. It functions in a fully independent way and has been accredited by independent third-party certifiers such as ACCREDIA and ACAE, in compliance with UNI CEI EN ISO/IEC 17025 Standards.

ACCREDIA Certification
Experimental test lab and EMC Lab are accredited by the Italian Accreditation Body, ACCREDIA. Accreditation number 0253.

SI DICHIARA CHE
WE DECLARE THAT

ABB S.p.A.
Sede/Headquarters:
- Via Friuli 4 - 24044 Dalmine BG

È CONFORME AI REQUISITI DELLA NORMA
MEETS THE REQUIREMENTS OF THE STANDARD

UNI CEI EN ISO/IEC 17025:2018
ISO/IEC 17025:2017

QUALE / AS
Laboratorio di Prova
Testing Laboratory

Data di 1ª emissione *1st issue date*	Data di modifica *Modification date*	Data di scadenza *Expiring date*
08-07-1999	**26-06-2019**	**10-07-2023**
Dott.ssa Silvia Tramontin Il Direttore di Dipartimento *The Department Director*	Dott. Filippo Trifiletti Il Direttore Generale *The General Director*	Ing. Giuseppe Rossi Il Presidente *The President*

L'accreditamento attesta la competenza tecnica del Laboratorio relativamente al campo di accreditamento riportato nell'Elenco Prove allegato al presente certificato di accreditamento.
Il presente certificato non è da ritenersi valido se non accompagnato dagli Elenchi Prove, che possono variare nel tempo.
La vigenza dell'accreditamento può essere verificata sul sito web (www.accredia.it) o richiesta al Dipartimento di competenza.
I requisiti di sistema riportati nella norma ISO/IEC 17025 sono scritti in un linguaggio attinente alle attività di laboratorio e sono generalmente in accordo con i principi della ISO 9001.

The accreditation certifies the technical competence of the laboratory limited to the scope detailed in the attached Enclosure.
The present certificate is valid only if associated to the annexed schedule, that may vary in the time.
Confirmation of the validity of accreditation can be verified on website www.accredia.it or by contacting the relevant Department.
The management system requirements in ISO/IEC 17025 are written in language relevant to testing laboratories operations and generally operate in accordance with the principles of ISO 9001.

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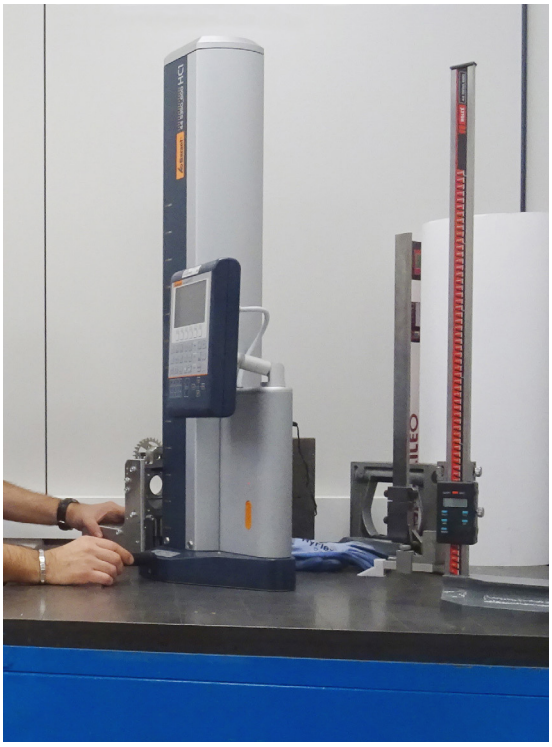
ACCREDIA

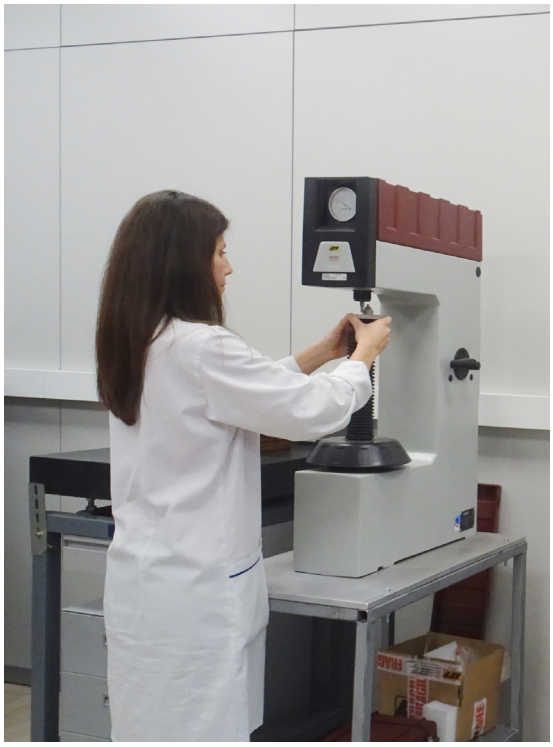
Sede operativa e legale: Via Guglielmo Saliceto, 7/9 | 00161 Roma - Italy | Tel. +39 06 8440991 | Fax +39 06 8841199
info@accredia.it | www.accredia.it | Partita IVA - Codice Fiscale 10566361001

Qualified technical assistance and consultancy

The laboratory system can provide specialized technical assistance and consultancy services for the preparation of prototypes and for conducting tests in both the in-house laboratories and internationally recognized outsourced laboratories.

Laboratories are organized in such a way to offer the widest and most versatile consultancy and specialized technical assistance for the preparation of prototype equipment on which tests are performed, both at internal laboratories and at external laboratories internationally recognized.
The support team is not only able to perform the main tests, but also to check the compliance of prototypes with standards and specifications defined by the customer. In addition, it is given great attention to the customer who is supported from the most delicate phases of preparation of the prototypes up to the test, as well as is provided operational assistance needed at all laboratories for product qualification.
This activity is also offered to Panel Builders, which produce MV electrical panels equipped with ABB components under a Technical Cooperation Agreement.





Laboratories activity

The tasks performed in the various divisions of the laboratory system comply with the main CEI, CENELEC, IEC/CISPR, ANSI, ANSI-IEEE, GOST, GB, UL standards and those of numerous domestic and foreign undertakings such as Electric power generation and distribution enterprises, Shipping Registers, the Navy, the U.L. (Underwriters Laboratories Inc.) and the authorities that supervise the qualification activities of nuclear power plants.

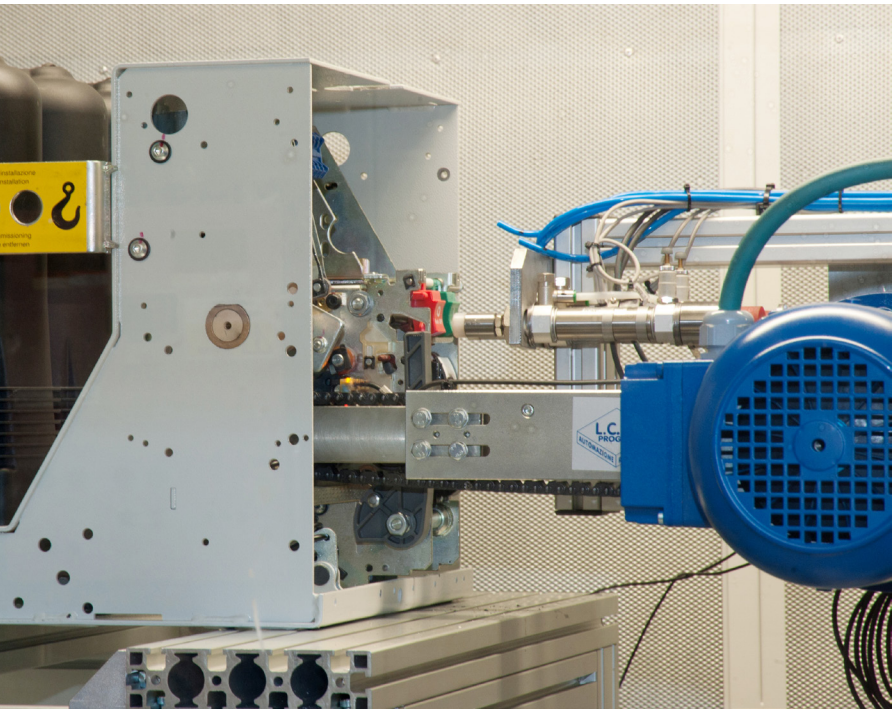
The prototype laboratory

The prototype laboratory collaborates in synergy with the R&D department and is able to acquire the project documentation through which build and supply components for assemble and test the equipment, with the aim of submitting them to the product certification. Thanks to their competences, the specialized technicians of the laboratory follow the prototype from the early stages and during construction propose appropriate changes and technical suggestions useful for improving the product, also supervising it during the tests.
The prototype laboratory is equipped with machinery suitable for the construction of mechanical components as well as assembly of MV equipment, and a metrological corner for dimensional and mechanical verification and of critical components. Since many years the laboratory is equipped with machines for the rapid prototyping, including 3D printers for Additive Manufacturing and 3D Optical Scanners for Reverse Engineering activities required for the activities of the Service department, which uses more and more through virtual reality and augmented reality.
The laboratory, for reasons of confidentiality, has its own fenced area ad restricted access; team members guarantee the necessary confidentiality on managed products.

Laboratories activity

The Experimental Test Lab

The Experimental Test Lab was created in the late 90s in order to support the development of switchboards and apparatus operating in the field of Medium Voltage. The structure of the laboratory relies on specialized technicians and advanced equipment for the execution of different types of tests, both development tests and type tests. The laboratory, in fact, boasts for several years accreditation in accordance with ISO / IEC 17025, recognized by the Italian accreditation body ACCREDIA. Thanks to this the structure of the Experimental Laboratory is available to the Dalmine site, to the others ABB group companies



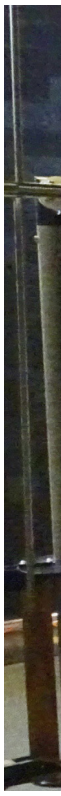
Development and Type tests are performed according with the following list:

- temperature rise test
- dielectric test
- partial discharge test
- functionality test
- mechanical endurance test
- climatic (with controlled temperature and humidity, accelerated ageing tests) test
- protection degree test
- tigthness test

The experimental tests lab also provides technical support during tests simulating earthquakes and vibrations, performed by qualified out-sourced laboratories.

All the equipments used for research and type tests are fitted for the severity of the tests.

Experimental test lab	Standards
Mechanical endurance tests, interlocks, operational tests and impact tests (IK 07)	IEC/EN 62271-100, 62271-200, 62271-106, 62271-102, 62271-103, IEC 60077-1, IEC 60077-2, IEC 60077-3
Degree of protection provided enclosure: IP4X	IEC/EN 60529
Measurement of the resistance of the main circuit	IEC/EN 62271-100, 62271-200, 62271-106, 62271-103
Temperature rise Tests: 6000 A 50Hz; 2500 A 60 Hz; 2000 A DC	IEC/EN 62271-100, 62271-200, 62271-106, 62271-102, 62271-103, IEC 60077-1, IEC 60077-2, IEC 60077-3
Dielictric Tests: 400 kV BIL - 100 kV power frequency and partial discharge test	IEC/EN 62271-100, 62271-200, 62271-106, 62271-102, 62271-103, IEC 60077-1, IEC 60077-2, IEC 60077-3
Climatic Tests: -70 / + 180 °C - Ur % 10-98%. Warming gradient 4 °C/min. Cooling gradient 3 °C/min. Volume: 1.1 mc to 90 mc	IEC 62271-100, - IEC 60068-2-1 (Test A: cold) - IEC 60068-2-2 (Test B: Dry heat) - IEC 60068-2-14 (Test N: Change of temperature) - IEC 60068-2-30 (Test Db: Damp heat, cyclic) - IEC 60068-2-78 (Test Cab: Damp heat, steady state) IEC/EN 62271-304, IEC 60077-1, IEC 60077-2, IEC 60077-3
Tightness Tests	IEC/EN 62271-100, 62271-200, 62271-102, 62271-103
Static and dynamic inclination tests	Various Naval Registers



LOVAG

The experimental test laboratory, being a laboratory accredited according to IEC standard 17025, has received a Testing Authorization by ACAE (www.acae.it) which allows it to perform tests in accordance with LV regulatory standards LOVAG, releasing documents with LOVAG logo.
Authorized tests on distribution boards and low voltage control according to regulations IEC 61439-1: 2011-08, IEC 61439-2: 2011-08 and IEC 61439-5: 2014-08 par. 10.2.3.101 are:

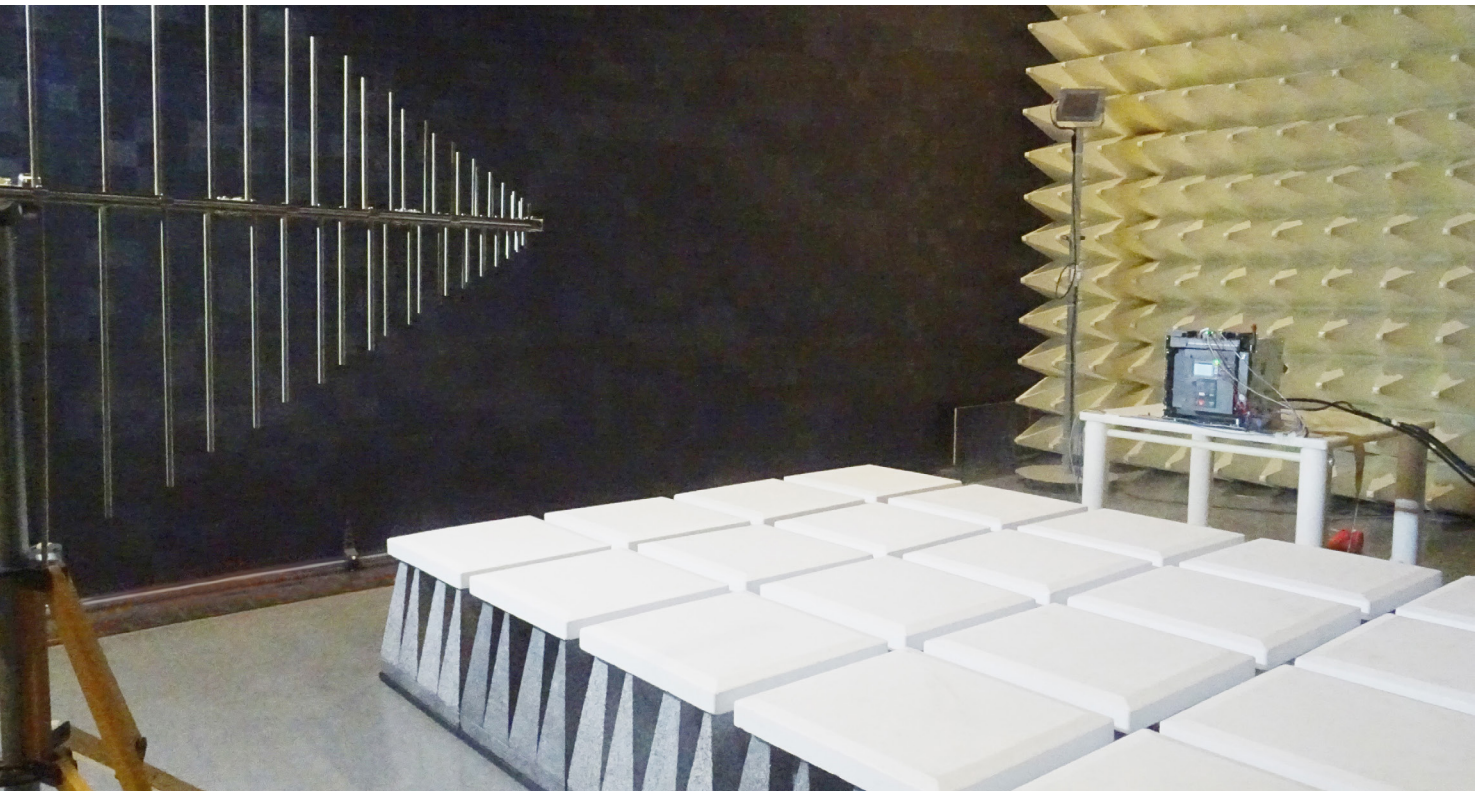
- Verification of dielectric withstand voltage
- Verification of temperature - rise limit
- Verification of the auxiliary circuits
- Mechanical operation and operational performance capability
- Degree of protection of enclosures (IP Code-Up to IP4X)
- Clearances and creepage distances
- Dry heat test

Electromagnetic compatibility test lab

This laboratory performs all the tests required for certifying low, medium and high voltage apparatus as well as many other tests for the information Technology, Automotive and Telecommunication areas.
It is able to comply with severity level test requirements, such as:

- conducted immunity tests at low and high frequencies, fast transients/burst, surge, ring wave, 100 kHz to 30 (and 50) MHz damped oscillatory waves and all types of low frequency disturbance in single-phase apparatus (voltage fluctuation, frequency pulling, ripple, voltage and current drops and dips, etc.)
- radiated immunity tests of electric fields (up to 3 GHz) and power frequency and pulse magnetic fields
- electrostatic discharge immunity tests
- measurement of conducted and radiated emissions.

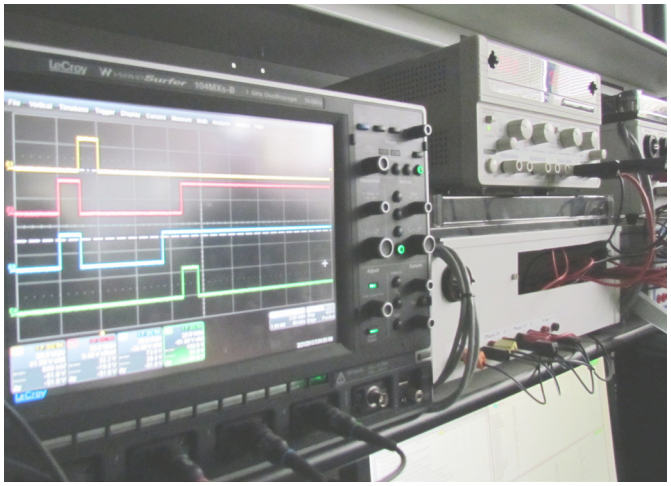
Besides numerous other tests conforming to the various requirements established by standards and specifications for different types of equipment.

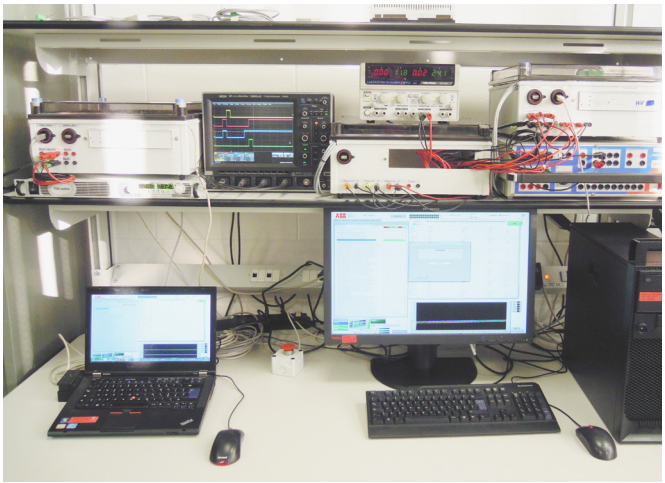


Laboratories activity

EMC test laboratory	Standards
Product Standards	ANSI C37.90.1; C37.90.2 / EN 298 / IEC 60255-26 / IEC 60947-1 / IEC 60947-2 / IEC 61000-6-5 / IEC 62271-1 / IEC 62271-106 / IEC 62271-200
Marine Standards	ABS / DNV / BV / GL / LR / DNGL / RINA
Conducted & Radiated Electromagnetic Interferences (all class) (1)	CISPR 11 / EN55011 / CISPR32 / EN55032; IEC/EN 60255-26
Overloading of auxiliary circuits	ENEL DV1500 / 1501A
Harmonic Emission	IEC/EN 61000-3-2
Electrostatic Discharges: 8 / 15 kV (2)	IEC/EN 61000-4-2
Radiated Electromagnetic Susceptibility: 30 V/m	IEC/EN 61000-4-3
Electrical Fast Transients/Burst: 6 kV	IEC/EN 61000-4-4
Voltage & Current Surge: 6.6 kV / 3 kA	IEC/EN 61000-4-5
Radio-Frequency Conducted Disturbances: 30 Vrms (3)	IEC/EN 61000-4-6
Power Frequency Magnetic Field: 1200 A/m	IEC/EN 61000-4-8
Pulse Magnetic Field: 3 kA/m	IEC/EN 61000-4-9
AC Dips and interruptions	IEC/EN 61000-4-11
Voltage Variations on AC ports	IEC/EN 61000-4-11 / IEC 60092-504 / DNV 2.4 § 3.5
Ring Wave Current/Voltage: 6 kV	IEC/EN 61000-4-12
Harmonics and interharmonics susceptibilities	IEC/EN 61000-4-13
Voltage Fluctuations: +/- 20%	IEC/EN 61000-4-14
Common Mode Low Frequency Disturbances: 30Vrms, 150 kHz	IEC/EN 61000-4-16
Ripple on DC power supply: 15%	IEC/EN 61000-4-17
Damped oscillatory wave (0.1 MHz – 1 MHz – 3 MHz – 10 MHz – 30 MHz): 3 kV / 4.5 kV	IEC/EN 61000-4-18
Variations of Power Frequency: + 30%	IEC/EN 61000-4-28
DC Dips and interruptions	IEC/EN 61000-4-29
Voltage Variations on DC ports	IEC/EN 61000-4-29 / IEC 60092-504 / DNV 2.4 § 3.5

(1) All classes
(2) in air / in contact, direct / indirect
(3) induced by electromagnetic fields



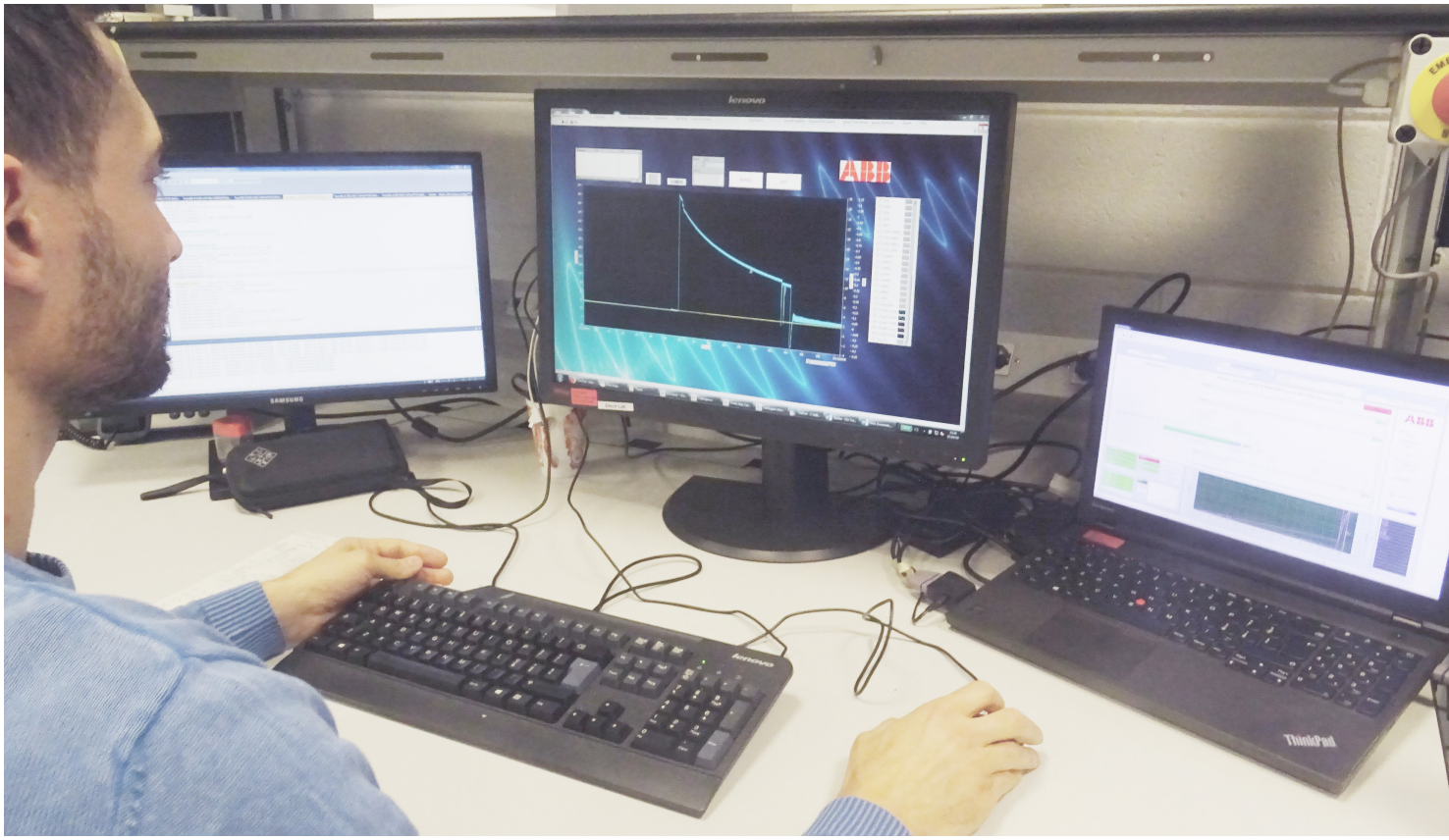


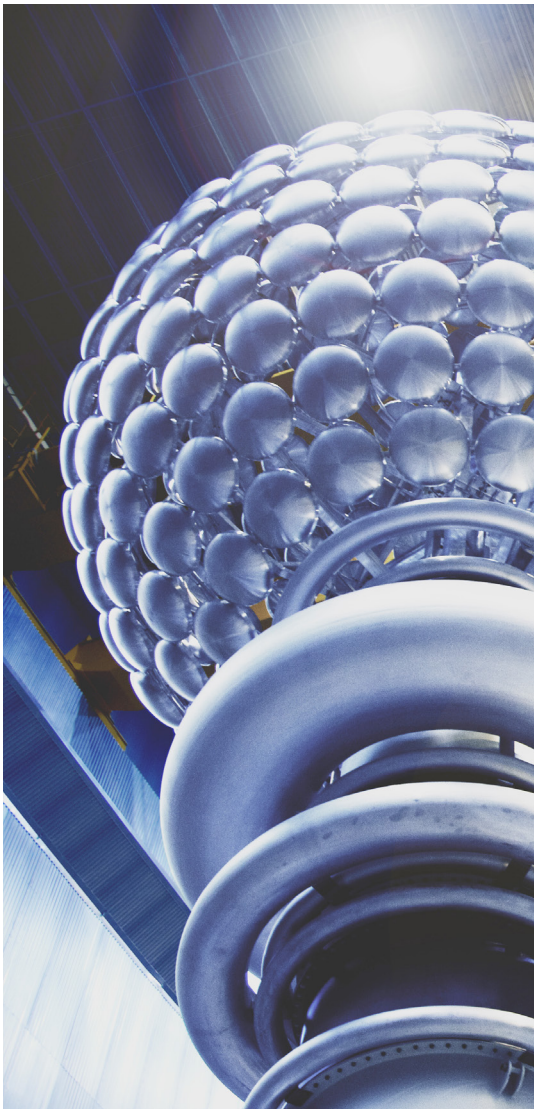
The Electronic laboratory

The electronic laboratory was born as a support to R&D electronic design activities. It provides a great variety of tools that allow to perform multiple verification and validation activities, such as:

- Automatic Test System (ATS)
- Thermal analysis and climatic tests
- Design and planning of the vibration test
- Design and planning of life tests accelerated (MEOST, HALT, ALT)
- Debugging on electronic prototypes
- Search for causes of failure

Automatic Test System (ATS)
Through an internally developed software and programmable equipment, the ATS performs automatically a functional verification of the electronic equipment requirements.
ATS sequentially performs tests by creating, towards the object under test, a sequence of stimuli, commands and requests also using various types of protocols (Modbus, IEC61850, ABB protocols, etc.). It also measures currents, voltages and states of the object as well as the timing between different electrical quantities. Finally, it checks if the measurements are within the acceptability criterion and prepares the test report. ATS can perform up to 300 functional tests in about 24h.





For further details please contact:

More product information:
abb.com/mediumvoltage
Your contact center:
abb.com/contactcenters
More service information:
abb.com/service

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