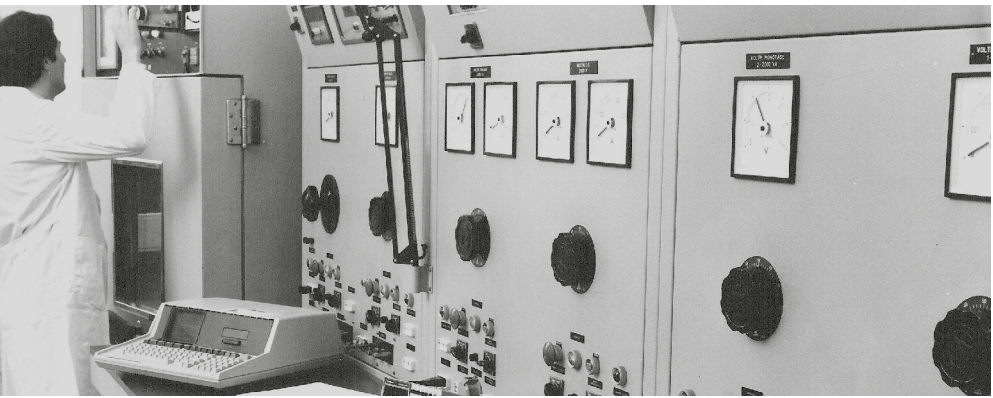


POWER TESTING AND CERTIFICATION





L  B



LOVATO LAB

LOVATO LAB is the **R&D** laboratory of **LOVATO Electric** specialised in R&D testing.

The laboratory is born from the need to expand the company's testing capabilities for the development of new high-performance products, ensuring the highest standards of safety and reliability while reducing time to market.

With this laboratory **LOVATO Electric** joins a very small group of companies able to run power tests at high current values. There are 3 types of test:

- development testing of new products;
- validation testing for compliance with regulations and standards;
- periodic testing of existing products.

The laboratory has a **total area of 2100 m²** and has a large technical staff.

The LOVATO Electric laboratory quality system complies with the international EN ISO/IEC 17025 standard and is accredited by leading national and international bodies such as ACAE and **IMQ** to run the tests required to obtain product certifications.

The laboratory has been included by IMQ in its monitoring programme as CTF2 for testing products for compliance with established standards. This enables us to test products for conformity with applicable standards and for CB certification at the same time, thus reducing test times and obtaining third party validation of product performance.

A **history** that goes back to 1922.



ADVANCED HIGH LEVEL TESTING EQUIPMENT

LOVATO LAB is equipped with the most advanced machines. They include medium voltage synchronous alternators, a GTEM cell for EMC tests, a synthetic short circuit system rated to 65kA, programmable current generators for temperature and thermal

cutout testing, high precision current generators, isolated high sample rate data loggers and static power breakers. The lab is also equipped with high-speed cameras and thermal chambers for the study of physical phenomena related to products.

For electrical and mechanical service life testing, it has numerous test benches and a low voltage synchronous alternator for the generation of power up to 1800kVA.



LAB

LOVATO LAB runs high current power tests, short circuit tests pursuant to IEC and UL standards up to 30kA at 690V, closing and interruption power tests (overload tests), conventional duty performance tests (endurance tests) up to 6300A at 690V, low voltage continuous heating tests

up to 1500A, energy measurement accuracy tests using high precision current and voltage generators, environmental tests using climate chambers and saline mist, a vibrating table for impact and vibration testing, and a chamber for IP protection rating tests. A Glow-wire test chamber

for plastic materials and several dielectric test stations complete the range of tests available. There is also a 225kV tomograph for testing the most varied and stringent quality requirements, which analyses the structure of parts in their entirety, both internally and externally.



LOVATO LAB is emblematic of our commitment to making high technology products which comply with the most stringent quality specifications.

Massimiliano Cacciavillani
CEO

- | **SHORT CIRCUIT** | **OVERLOAD** AND ENDURANCE
- | **GLOW-WIRE TEST** | **IP PROTECTION RATING**
- | **3D X-RAY DIMENSIONAL CONTROLS**

SHORT CIRCUIT

Short circuit testing simulates a fault which drastically reduces the impedance of the electrical circuit. The test part is subjected to a high current and power, and must be able to handle them without risk of injury or damage.

The results of this test enable us to improve the characteristics of the product, whether it is required to break the short circuit or handle it without damage.



30MVA

Current generator: 30MVA 50/60Hz.
Output voltage: 11000V.
Maximum speed: 3600 rpm.

30kArms 690V

Short circuit current:
• 30kArms 690VAC;
• 50kArms 400VAC.

Transient current:

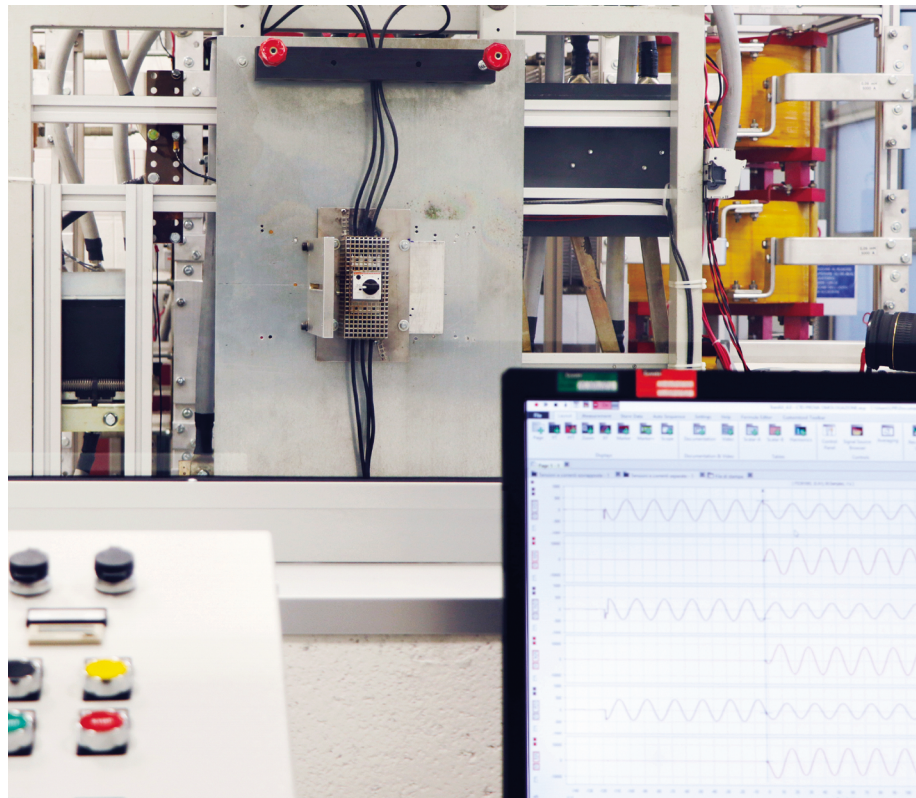
- 1.0s 10kA;
- 0.3s 20kA.



OVERLOAD AND ENDURANCE

Overload and **Endurance** tests subject the product to anomalous operating conditions to test their service life. Depending on the application, a product may be required to handle up to 10 times

its rated current and interrupt 8 times that value (overload), as well as execute a high number of operations at its rated current (endurance).



1000VAC	1250VDC	6300A AC	1500A DC
Two test facilities are available, for improved flexibility. The transformer output voltage can be regulated from 200VAC to 1000VAC.	The transformer output voltage varies from 250VDC to 1250VDC.	Overload current up to 6300A. Endurance current up to 2500A.	Overload current up to 1500A DC. Endurance current up to 1000A DC.





RADIATED IMMUNITIES

Radiated immunities tests measure electromagnetic field emitted by an electronic device in the surrounding environment with the objective of not disturbing other devices within

the vicinity. The reference standards are CISPR in the 30MHz...6GHz frequency range. The test is conducted in a semi-anechoic chamber that is specially designed to shield the

test objects from the external electromagnetic environment with a structure composed of steel panels, ferrite tiles and pyramid-shaped absorbers.



ANECHOIC CHAMBER

The LOVATO Electric anechoic chamber has external dimensions of 9 x 5 x 6 meters (length x width x height) and allows for tests/measurements at a reference distance of 3 meters. Two additional rooms complete the equipment: a control room and an amplifier room to ensure a fully shielded environment during testing.

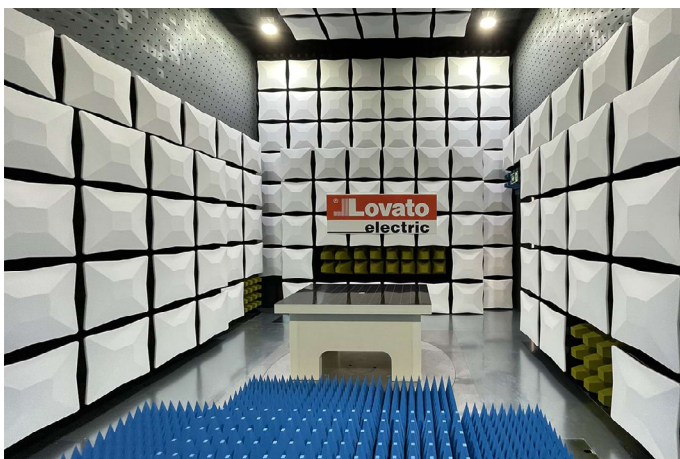


RADIATED EMISSION

Radiated emission tests measure a device's ability to function properly in the presence of external modulated electromagnetic fields. These fields simulate disturbances generated by radio transmitters,

cell phones, nearby devices and other sources of radio frequency electromagnetic field. The reference standard is IEC 61000-4-3 in the frequency range 80MHz...6GHz.

The test is done in an anechoic chamber by generating an electromagnetic field using a radio frequency generator, amplifier and antenna.



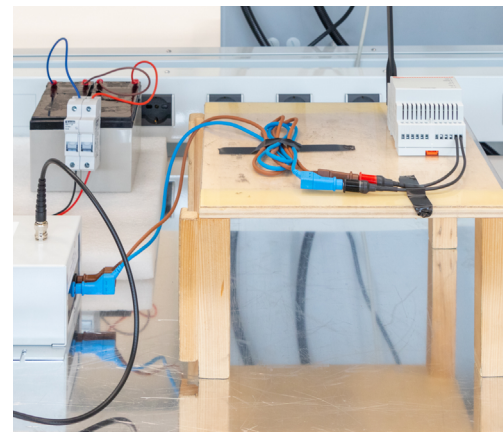
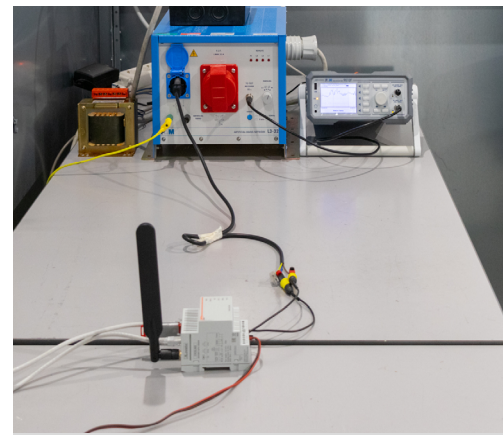


EMC TEST



Conducted emissions

The purpose of the test is to detect electromagnetic disturbances that a device emits on the power supply network and that may cause malfunctions to equipment connected to the same network or nearby. The reference standards are CISPR in the frequency range 9kHz...30MHz. The measurement is made in a shielded room, using an impedance adapter called an AMN (Artificial Mains Network) and a receiver that performs FFT analysis on the detected signal. Measurements can be made on three-phase AC or DC power networks.



Conducted immunity

The test is used to verify the ability of a device to function properly in the presence of radio frequency disturbance applied directly to power cables, signal, control and command lines. The reference standard is IEC 61000-4-6 in the frequency range 150kHz...80MHz. The test is conducted by injecting a disturbance into the ports of the device under test via a radio frequency generator, an amplifier and a dedicated CDN (coupling/decoupling network).

Electrostatic discharge immunity test / ESD

Immunity to electrostatic discharge is the ability of a piece of equipment to continue to function properly during and after an abrupt passage of electrostatic charge. The moment the operator approaches or touches the test object, with the appropriate instrument, a discharge is generated that can cause malfunction or damage. The reference standard is IEC 61000-4-2. The equipment provided allows test voltages up to 10kV for contact tests and 16kV for air tests.

Impulse immunity test / Surge

The test is to verify immunity to unidirectional pulses caused by high-voltage pulses resulting from switching transients or lightning strikes to power lines or grounding. These disturbances propagate, always in a conducted manner, in the power, communication and signal lines of electronic products. Depending on the environmental and installation conditions, different levels of testing with various severity levels are applied. The reference standard is IEC 61000-4-5. The equipment provided allows test voltages up to 7000V.

Fast electrical pulse transients / Burst

The BURST immunity test verifies the ability of a device to function properly in the presence of electromagnetic disturbances generated by fast pulses coming from the power grid produced, for example, by other switching devices that result in a series of fast pulses disrupting power, communication and signal lines. During the test, it is observed whether the device maintains proper operation despite the electromagnetic disturbances present on the power grid. The reference standard is IEC 61000-4-4. The supplied equipment allows test voltages up to 5000V - 5 or 100kHz.

Oscillatory wave immunity test / Ring Wave

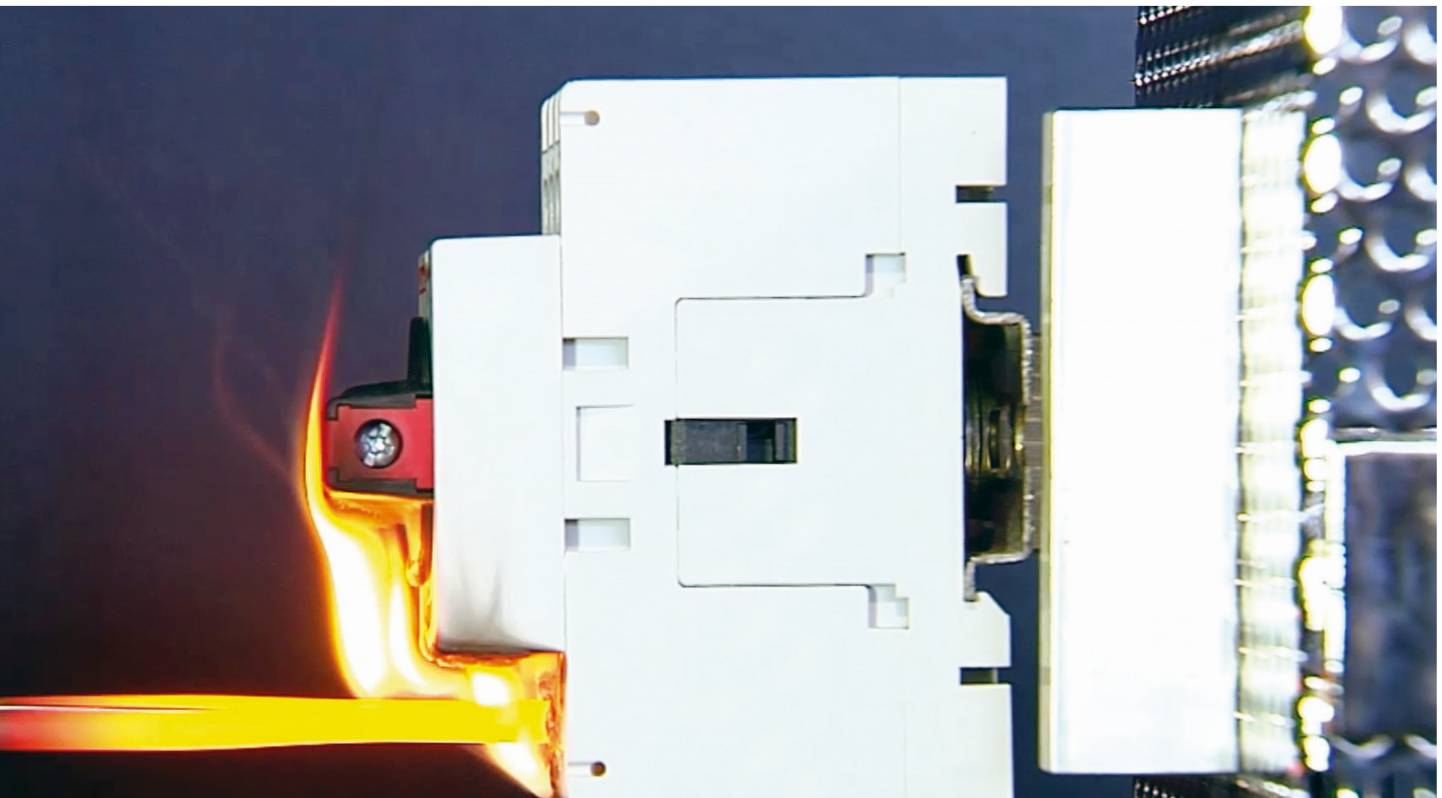
This test is used to verify the extent to which an electrical and electronic equipment, under operating conditions, is immune to ring waves occurring in power, communication and signal lines, low voltage provided by public and non-public networks. Ring wave is characterized as a damped bipolar oscillating wave. The reference standard is IEC 61000-4-12. The supplied equipment allows test voltages up to 7000V to be delivered.



GLOW-WIRE TEST

The **Glow-Wire test** is one of the most important tests for verifying the fire resistance of electrical and electronic equipment. Connections and components can overheat in case of overload or short circuit.

The test verifies the flammability of plastic materials under high thermal stress, their ability to extinguish themselves and their propensity to propagate fire.



550°C - 960°C

The temperature of the heating element (the glow-wire) ranges from 550°C to 960°C. Product standards prescribe a variety of temperatures and heat application times, depending on the function of the materials and the products they are used in.





IP PROTECTION RATING

Standards bodies have established a protection rating classification for electrical equipment housings subject to the ingress of foreign bodies.

The second digit in an **IP rating** refers to the capacity of the housing to prevent the ingress of water in specific installation conditions and at given water flow rates and speeds.



100L/MIN	240L/MIN
The protection rating may be verified pursuant to IEC standards: <ul style="list-style-type: none">• IP x5, flow rate 12.5l/min.;• IP x6, flow rate 100l/min.	The protection rating may be verified pursuant to UL standards: <ul style="list-style-type: none">• Type 4/4X, flow rate 240l/min.

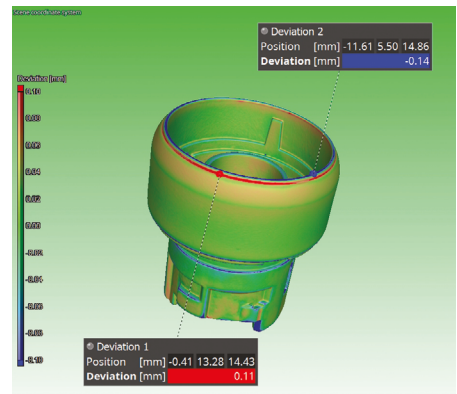
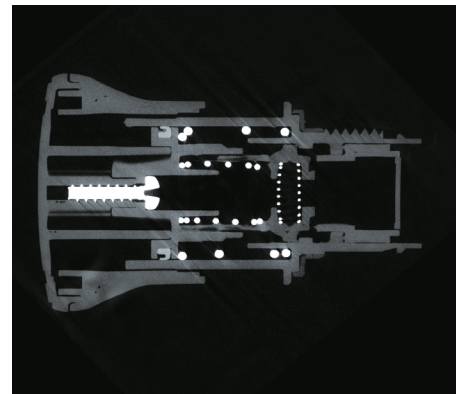




3D X-RAY DIMENSIONAL CONTROLS

INDUSTRIAL TOMOGRAPHY APPLIED TO METROLOGY AND MATERIALS ANALYSIS

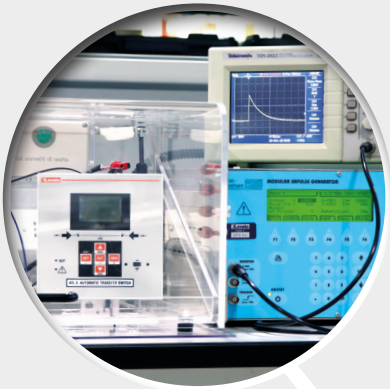
- Metrology with the computerised 3D tomograph.
- 3D comparison of the scanned part with the CAD file (in the .STEP or .STL format).
- 3D comparison of scanned parts from different production lots.
- Creation of .STL (MESH) files for reverse engineering.
- Porosity analysis of plastic, zamak and aluminium parts.
- Assembly control / internal inspection of mixed material parts.
- PCB solder joint inspection.



Instrument: Zeiss Metrotom 800 225kV	
Voltage	max 225kV
Current	max 3000µA
Power output	max 500W
Detector resolution	1024 x 1024 pixels
Measured volume	170 x 150mm single scan (170 x 400mm multi-scan)
Measurement uncertainty for lengths	MPEE(TS): 8µm + L/100
Centre-centre distance uncertainty for spheres	MPESD(TS): 4µm + L/100
Max part weight	5Kg



SUPPLEMENTARY TESTS



12KV 50HZ 18KV IMPULSE

Dielectric tests:
- 50Hz up to 12kV;
- 1.2µs / 50µs impulse up to 18kV.



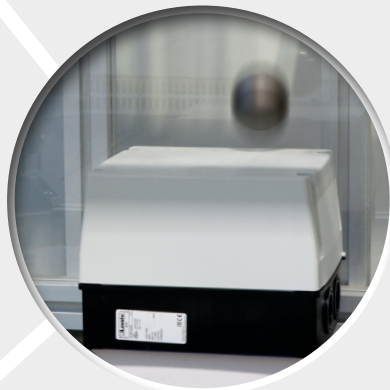
5 - 500HZ VIBRATION 30G IMPACT

Vibration testing at the frequencies encountered on ships, trains and during earthquakes.



ENVIRONMENTAL TESTS

Environmental tests: resistance to heat, damp heat and saline mist in climate chambers.



IMPACT RESISTANCE

UL "Resistance to impact" testing with a 50mm ball weighing 0.5kg dropped from 1.3m and 2.6m.



HEATING TEST

Single-phase amperometric sources at 50Hz up to 1500A. The test can be supplemented with thermal imaging to highlight any hot points.



XENON TEST

The Xenon Test is a stability test used to determine the durability of components exposed to sunlight.



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