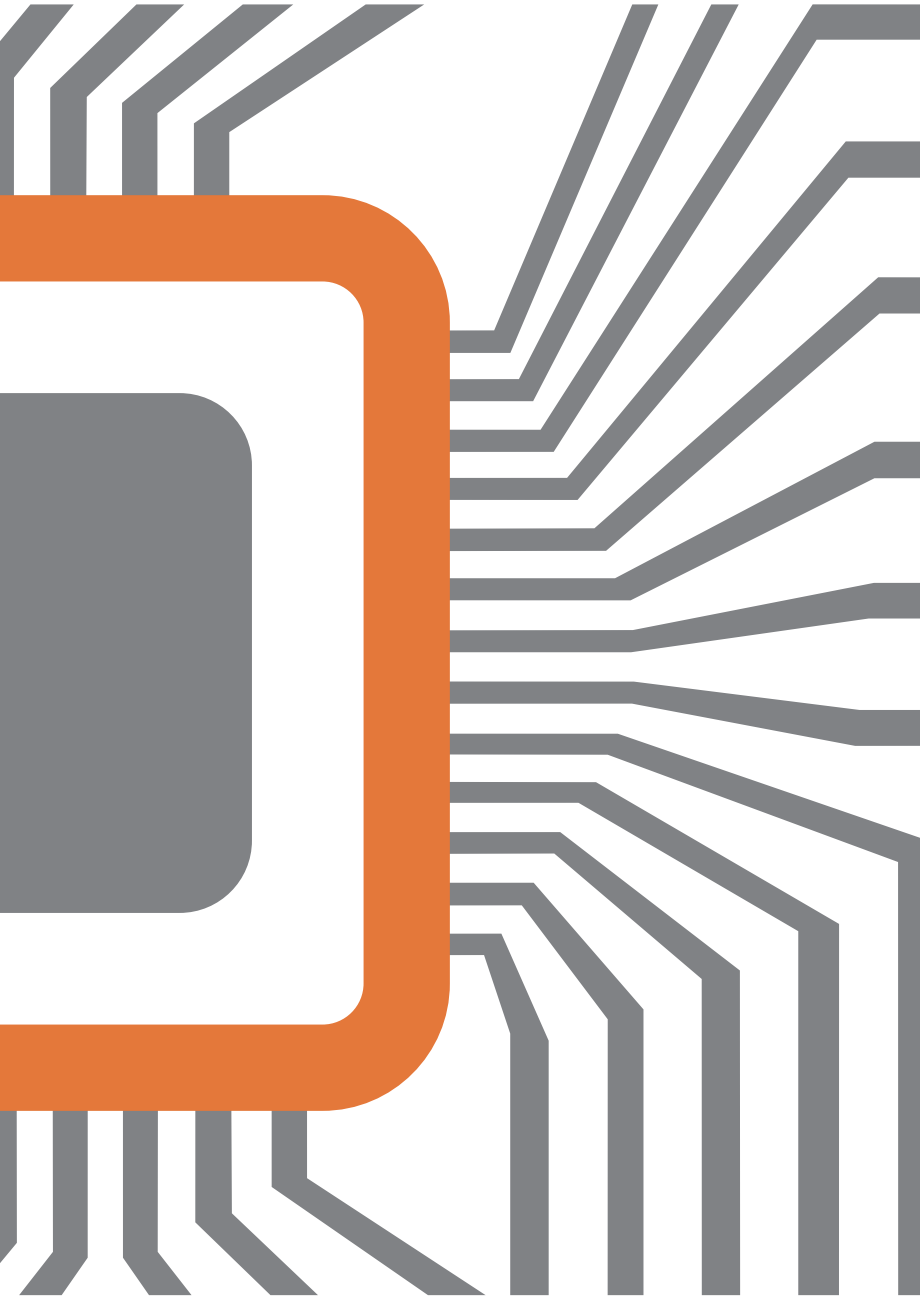


TechnoLab

QUALIFYING AND TESTING SOLUTIONS

ilac-MRA

DAkkS
Deutsche
Akkreditierungsstelle
D-PL-18119-02-00

About Us: History

TechnoLab Gesellschaft für Elektronikindustrieservice mbH was founded in 1996 as a spin-off of a medium-sized communications engineering company. The founding members still form the solid foundation for the work as a testing and inspection laboratory as engineers and management with highly qualified employees, including skilled workers and engineers. The laboratory, which has always operated in accordance with ISO 17025 and has been certified to ISO 9001 to date, has also been accredited since 2022.

How we got started

Company Timeline//

1995 //
Founding of TechnoLab GmbH

2000 //
Development of own inspection equipment

2003 //
Certification according to ISO 9001

2011 //
First self-developed test chamber

2016 //
Opening of the new location in Berlin Spandau

2022 //
Accreditation

2023 //
Opening of the second location on the island „Eiswerder“

INFO@TECHNOLAB.DE // +49 30 3641105-0

Find us on social media

TechnoLab GmbH
Labor für Umweltsimulation

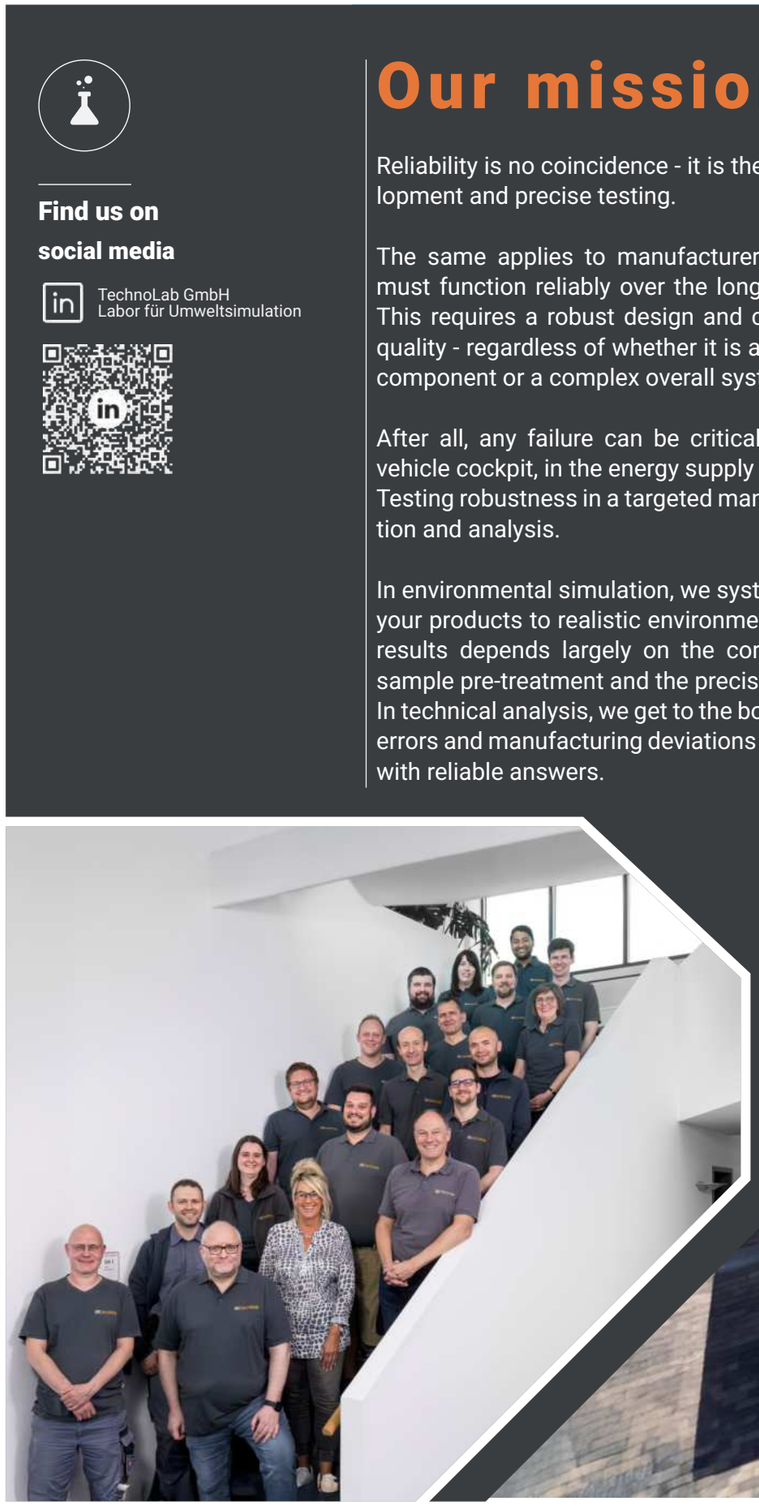
Our mission //

Reliability is no coincidence - it is the result of well thought-out development and precise testing.

The same applies to manufacturers and dealers alike: A product must function reliably over the long term and under all conditions. This requires a robust design and consistently high manufacturing quality - regardless of whether it is a single electronic or mechanical component or a complex overall system.

After all, any failure can be critical - whether in the home, in the vehicle cockpit, in the energy supply or in industrial control systems. Testing robustness in a targeted manner - with environmental simulation and analysis.

In environmental simulation, we systematically test the resistance of your products to realistic environmental stresses. The validity of the results depends largely on the correct sequence of tests, proper sample pre-treatment and the precise selection of test parameters. In technical analysis, we get to the bottom of the causes: from design errors and manufacturing deviations to improper use - we provide you with reliable answers.



Expertise you can rely on.

Our interdisciplinary team of experienced engineers and technicians will support you in the selection and application of suitable testing and analysis methods. We are guided by all relevant standards - and adapt them to your individual requirements if necessary.

Committed to Quality

We can advise you on which test is suitable for you and your product. Which standard is relevant for your application?

We will create a customized test plan for you. If we do not have the appropriate system or arrangement in stock, we will create it for you.

Whether you personally supervise the test or not, our qualified test engineers will support you you before, during and after the test.

- Our service adapts to your product
- Engineering for you - We design your chamber
- Accompany the test - We look forward to welcoming you

99.9% Perfection

Means an Error source of 0,1%

1 Hour
dirty water per month

22,000
Incorrect bookings per month

80
Defects per automobile

our expertise

Environmental simulation

Test procedures and methods for investigating the interaction between an object and its environment

Real environmental influences represent a complex load. Environmental simulation attempts to reproduce those loads that have the most important impact on the function. The task is to carry out the loads in a reproducible manner.

Analytics

Damage analysis, measurement technology, Qualifications, consulting

Analytics means asking the right questions about an investigation. This ranges from simple tasks such as measuring electrical parameters and coating thickness to the preparation of microstructures in metallography and the investigation of cause-and-effect relationships in damage analysis. Consulting means explaining results and presenting correlations.

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Environmental Simulation

Environmental simulation comprises test methods for investigating the interaction between an object and its environment. This involves structuring complex networked chains of effects in a holistic approach and analyzing causal relationships.

In environmental simulations, products or production parts must withstand loads that correspond to possible real-life conditions. Depending on the type of protection, we test for all chemical-biological, physical or other effects such as IP protection types, temperature change/shock, corrosion compatibility or light fastness. The test specimens are subjected to a time-lapse ageing process in order to make possible damage visible or to report design faults in good time before serial production. Precisely defined tests (according to DIN, ISO, EN, ASTM International, etc.) simulate relevant environmental influences and test components, materials, assemblies or entire devices with regard to their resistance. If the area of application or other factors of your product do not correspond to a common standard, we will work with you to create an individual test procedure and build the appropriate chamber.

- Temperature (Thermal stress in extreme temperature ranges)
- Relative humidity (e.g. tropical or desert climate)
- Thermal shock (rapid change between hot and cold temperatures)
- Mechanical stress (vibration, shock, impact, drop test)
- Corrosive environments (salt spray, corrosive mixed gases)
- UV and weather influences (sunlight, weathering)
- Sand and dust (IP protection types, desert storm simulation)
- Water tests (IP protection types, immersion test, splash water, rain)
- Air pressure (altitude, negative pressure, positive pressure)
- Electrical tests (insulation, high voltage, high current)

ENVIRONMENTAL SIMULATION

// Temperature & Climate

Climatic tests are used to test the function, reliability and durability of for example vehicle components and systems under extreme environmental conditions. They are a central component of quality assurance and development. The aim is to identify and eliminate sources of error at an early stage before a vehicle goes into series production.

Climatic tests aim to specifically trigger the following failures:

- Electronic failures
- Cracking and material failure
- Corrosion on metal parts
- Deformations or leaks
- Loss of function of sensors and actuators

Climate range

10% up to 98% rel. H.

Temperature range

From -70 °C to +650 °C

Chamber size

up to 15500 liter

STANDARDS

MBN LV 124-2
VW 80000
GS 95024-3-1
MIL-STD 810
RTCA DO-160
IEC 60068-2-1
IEC 60068-2-2
IEC 60068-2-14
IEC 60068-2-30
IEC 60068-2-38
IEC 60068-2-78

Additionally we work with numerous customer specific standards from the aerospace and defense sectors.

STANDARDS

MBN LV 124-2
VW 80000
GS 95024-3-1
MAN 3499-1
ISO 20653
IEC 60529
VDE 0470-1
NEMA 250
UL 50
JIS 0207
IEC 60034-5

ENVIRONMENTAL SIMULATION

// IP Protection Class

With regard to their suitability for various environmental conditions, the protected systems are divided into corresponding protection classes, so-called IP codes.
The abbreviation IP stands for International Protection. In the English-speaking world, the abbreviation is sometimes also translated as Ingress Protection.

We test your systems for protection against ingress of foreign bodies, solids and water (IP testing / protection type testing)

Protection class particles

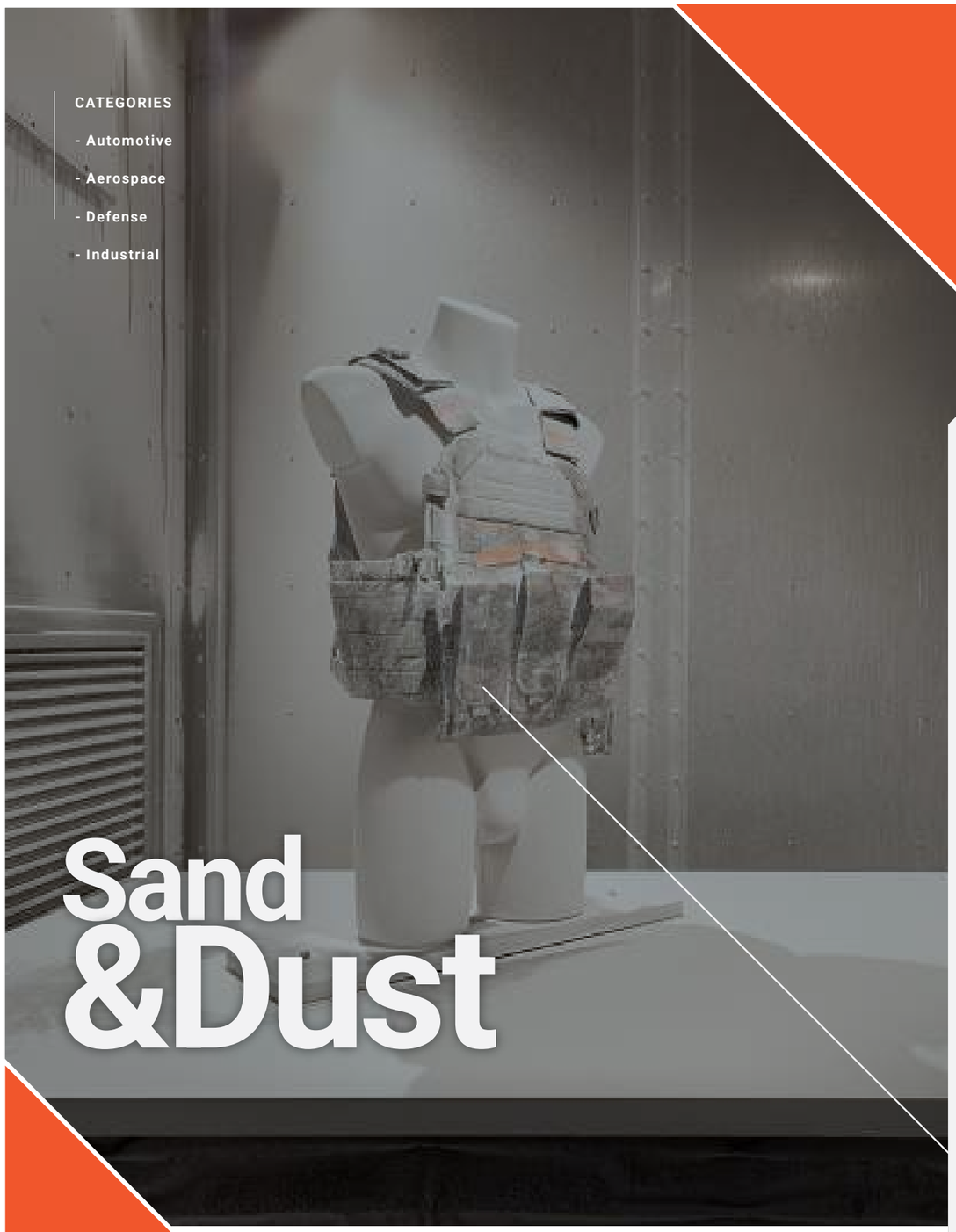
IP1X to IP6X

Protection class water

IPX1 to IPX9K

Dust medium

Arizona A2 or Talkum powder
other dusts also available on request



STANDARDS

- MIL-STD 810
- RTCA DO-160
- AECTP 300
- STANAG 4370
- IEC 60068-2-68

Additionally we work with numerous customer specific standards from the automotive, aerospace and defense sectors.

ENVIRONMENTAL SIMULATION

// Sand & Dust

Blowing dust / blowing sand tests are executed to judge the influence of dust and / or sand on various objects. These tests may cause different types of failure, such as:

- Penetration into cases or housings
- Change of electrical properties (faulty contacts, change of contact resistance, change of comparative tracking index, etc.)
- Jamming or stiffening of movable parts (bearings, axles, pivots, etc.
- Surface abrasion
- Damage to optical surfaces
- Contamination of lubricants
- Obstruction of ventilation inlets / outlets, pipes, filters, openings etc.

Technolab is proud to operate one of the largest privately operated and owned blowing sand and blowing dust chambers in the world.
Our largest chamber is a twin-fan blowing sand chamber with dimensions of 3.000 mm x 2.800 mm x 3.000 mm.

Salt Fog Corrosion

STANDARDS

MBN LV 124-2
VW 80000
GS 95024-3-1
MAN 3499-1
MIL-STD-810
RTCA DO-160
IEC 60068-2-11
IEC 60068-2-52
ISO 9227
IEC 61701
ISO 9022-4

Additionally we work with numerous customer specific standards from the aerospace and defense sectors.

ENVIRONMENTAL SIMULATION

// Salt Fog

Salt fog testing is used for more severe corrosion testing on metals and alloys. The very high degree of sharpness of the corrosion is due to the salt fog test providing a highly concentrated electrolyte, which significantly influences the corrosion rate. The severity of the test depends on the salt concentration, the test temperature and the test cycle design.

The salt spray test was developed by an automotive working group to subject certain components in motor vehicles to a life test under more stringent test conditions.

The test is primarily used for aggravated corrosion testing on metals and alloys.

Chamber Sizes

Up to 13.000 l of chamber volume

also overlaid with climate
and temperatures from -20°C to +70°C possible

CATEGORIES

- Automotive
- Aerospace
- Defense
- Industrial

Pressure &Altitude

STANDARDS

MIL-STD 810
RTCA DO-160
AECTP 300
JESD22-A102-C
IEC 60068-2-13
IEC 60068-2-39
IEC 60068-2-40

Additionally we work with numerous customer specific standards from the aerospace and defense sectors.

ENVIRONMENTAL SIMULATION

// Pressure & Altitude

In our test chambers, we can combine temperature, altitude and humidity for a real-life simulation of an ascend/ descent cycle of a commercial or military airplane.

We are able to generate climb profiles reaching up to 100,000 ft which can be used for rapid pressure loss scenarios.

Vacuum

Down to 20 mbar

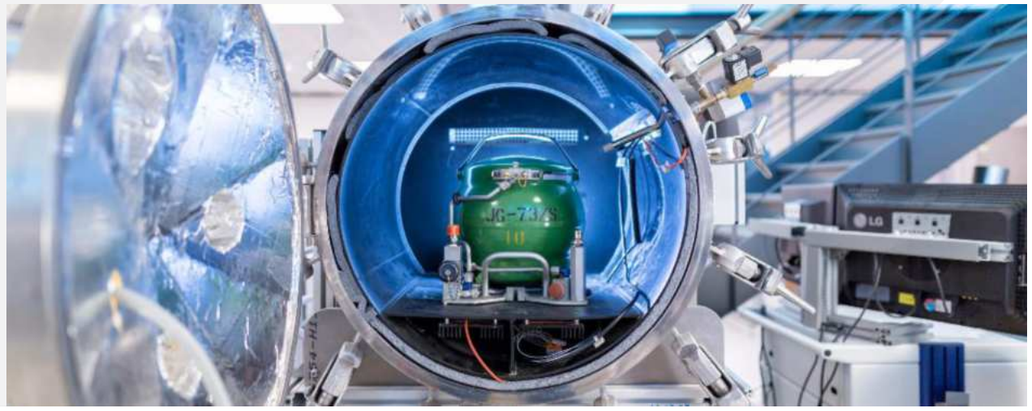
Overpressure

Up to 2 bar

Temperature range

-20°C up to +60°C

Additional rapid decompression and explosive decompression



ENVIRONMENTAL SIMULATION

// Corrosive Atmosphere

From a purely technical point of view, corrosion describes the reaction of a material with its environment. In addition to the visual damage to a final product, corrosion can cause degradation of the function of a component or system.

Hazardous gas occupies a special position among corrosive test methods and complements far more established test methods such as the salt fog test.

Increasing industrialization is leading to greatly increased levels of pollutants in the environment. As a direct result, everyday products are exposed to these same gases and must be protected.

Chamber size

125 l, 300 l

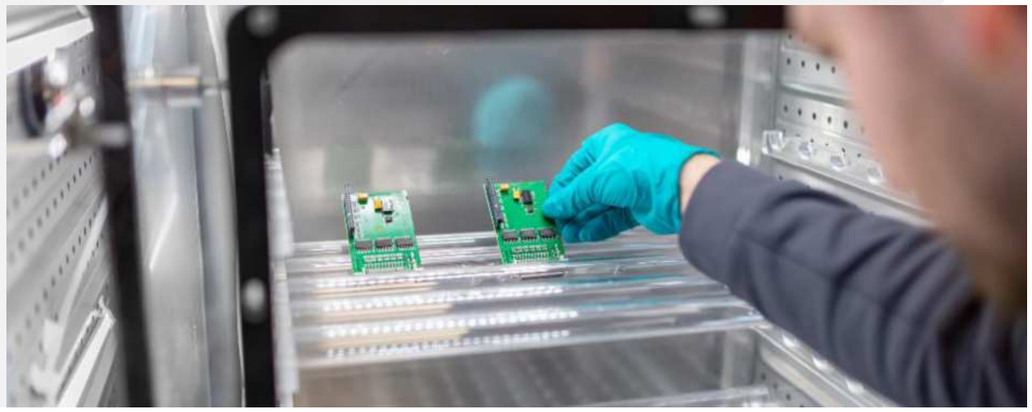
Methods

Single- and Multi-Gas

STANDARDS

MBN LV 124-2 (K-18)
VW 80000 (K-18)
GS 95024-3-1 (K-18)
IEC 60068-2-60

Additionally we work with numerous customer specific standards from the automotive, aerospace and defense sectors.



STANDARDS

MBN LV 124-2
VW 80000
GS 95024-3-1
MIL-STD 810
RTCA DO-160
IEC 2591-403
IEC 60068-2-64 /-6 /-27 /-29
IEC 60721-3-2
IEC 61373
ISO 16750-3
EN 50125-3
DIN SPEC 79009

Additionally we work with numerous customer specific standards from the automotive, aerospace and defense sectors.

ENVIRONMENTAL SIMULATION

// Vibration & Shock

Vibration tests and / or mechanical shock tests, simulate the conditions which may occur during transport or field use of the DUT (device under test).

The vibration test can be superimposed on temperature or even temperature changes to increase the load on the DUT.

Types

Sinus, noise, sinus over noise, search for resonance & dwell

Max force:

100 kN

Max. acceleration

300 G

Max. velocity:

3,5 m/s

Max amplitude:

100 mm

Temperature range

-70°C up to +160°C

Mechanical Shock

Shock Range from 30 G up to 1000 G

Shock time from 0,5 ms up to 45 ms (half sine)

Vibration tests can be carried out vertically as well as horizontally with the help of a sliptable.

STANDARDS

MIL-STD-810
ISO 20567-1
SAE J400
MBN LV 124-2
VW 80000
GS 95024-3-1
MAN 3499-1

Additionally we work with numerous customer specific standards from the automotive, aerospace and defense sectors.

ENVIRONMENTAL SIMULATION

// Gravel Bombardment & Hail

Hail and stone impact tests are carried out in the automotive industry to test the resistance of vehicle surfaces and components to mechanical stress caused by external influences. These tests are part of the quality assurance and development of chassis, glazing and paintwork.

In the case of PV modules, the resistance of solar panels to major storms is tested. In aviation, optical components or composite components are usually qualified to withstand small hailstones (flying through a thundercloud).

Stone Impact

Materials used

Pebbles & hard cast granulate

Temperature range

Room temperature, down to -40°C

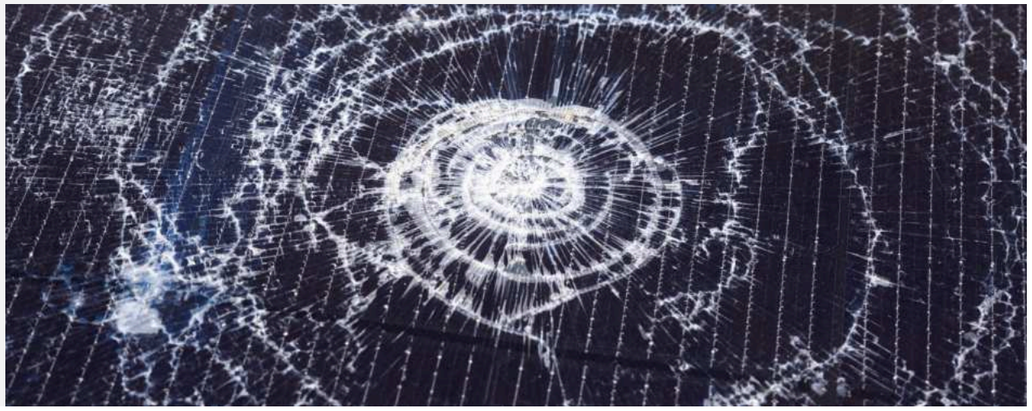
Hailstone

Materials used

Galcee ice (10 mm to 50 mm)

Shot velocities

10 m/s to 120 m/s



ENVIRONMENTAL SIMULATION

// Weathering & Solar simulation

Weathering tests and solar simulations are used to test ageing resistance, functionality and material quality under extreme environmental conditions. The aim is to evaluate the behavior and service life of materials, surfaces and components under realistic or accelerated climatic conditions.
Factors such as discoloration, yellowing or the degradation of plastics are also tested. Color imprints can no longer be read due to yellowing.

Simulation of natural weather influences such as:

- UV radiation
- Blowing Rain / Moisture
- Freeze/thaw cycles
- Temperature changes

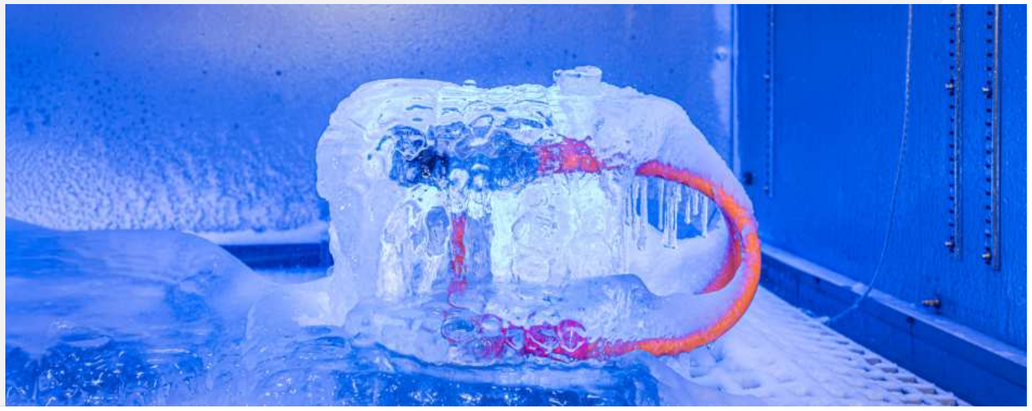
Recognition of:

- Material embrittlement
- Cracking
- Color changes / yellowing
- Overheating of electrical components due to self-heating in conjunction with solar radiation.

STANDARDS

DIN EN 75220
DIN EN ISO 4892-2
ASTM G154
MBN 10306
MBN LV 124-2
VW 80000
GS 95024-3-1
MAN 3499-1

Additionally we work with numerous customer specific standards from the automotive, aerospace and defense sectors.



ENVIRONMENTAL SIMULATION

// High Voltage Test Benches

We put together very complex variations for your tests that are individually tailored to your needs. The various voltage and current sources are combined with measurement techniques and are then connected and programmed as a test rack together with a control computer. In most cases, such tests are superimposed with environmental simulations (climate, vibration, etc.).

Component tests
Insulation testing
Testing the insulation of cables, plug connections and electronic components.

Continuity test / conductivity test
Ensuring the electrical connection without interruption or excessive resistance.

Resistance measurement
Evaluation of the cable quality (e.g. for high-voltage components).

Short circuit test
Testing for accidental short circuits in assemblies or cable harnesses.

Electrical function tests
Simulation of operating conditions

STANDARDS

MBN LV 124-2
VW 80000
GS 95024-3-1
MAN 3499-1

Additionally we work with numerous customer specific standards from the aerospace and defense sectors.

Voltage Range	Current Range
up to 1000 V	up to 2000 A

Analytics

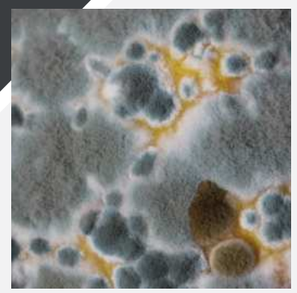
Failure analysis

Optical inspection, X-ray, SEM-EDX, FTIR, ionic contamination, layer thickness measurement

Qualifications

Printed circuit boards, flat assemblies and wiring, auxiliary materials such as flux or adhesives

Consulting and training

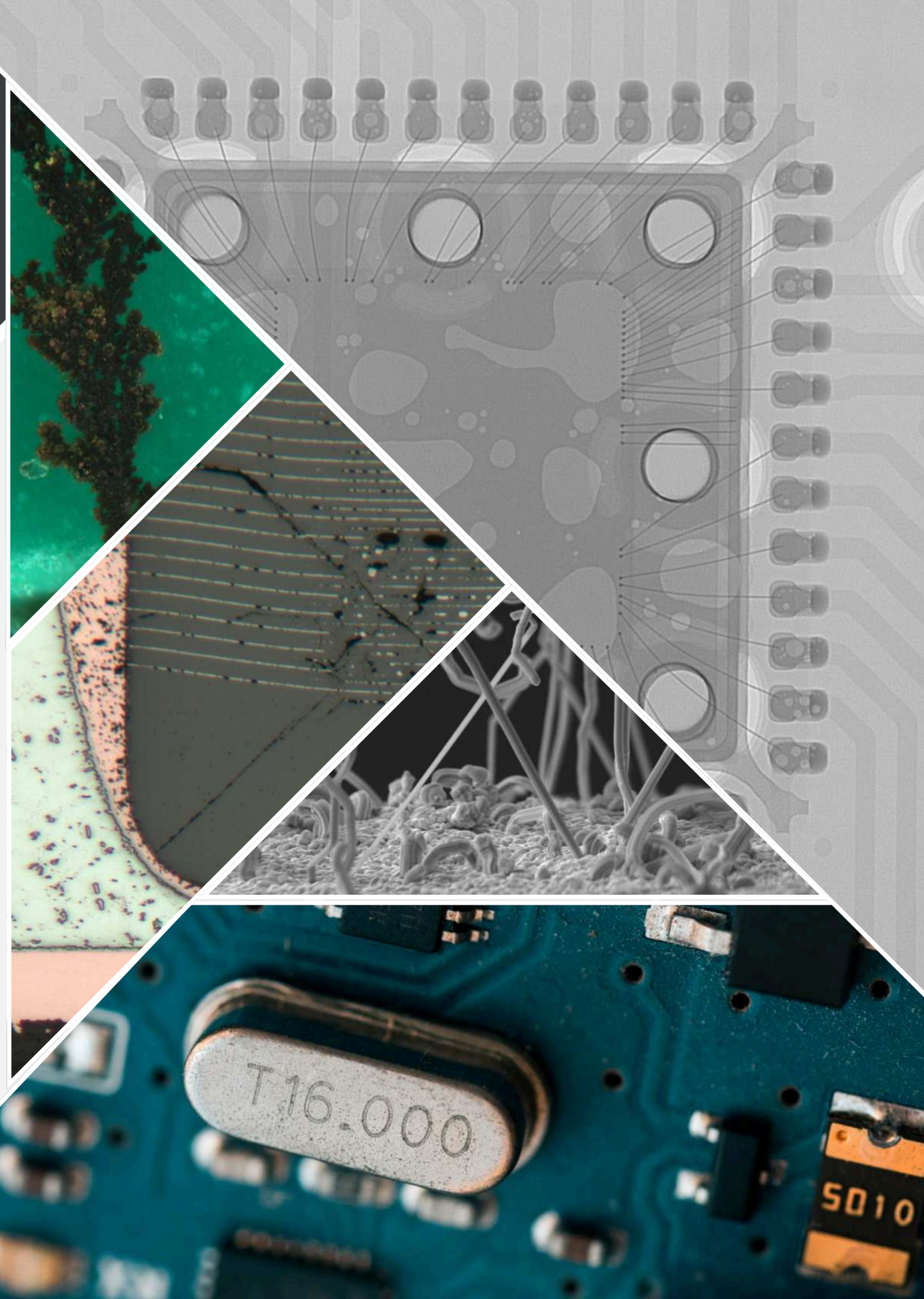


Qualifications

We ensure the qualification of your products:

The qualification of printed circuit boards, electronic components and auxiliary materials plays a central role in the electronics industry, where reliability and performance are crucial. These processes ensure that the materials and components used meet the highest quality standards.

Careful qualification of these elements not only ensures compliance with industry standards, but also helps to reduce scrap, maximize product life and improve the overall efficiency of electronics manufacturing. Qualification therefore forms the foundation for the creation of reliable and innovative electronic products.



TOPICS

- Thermal event (fire damage in connection with electronics)
- Failure mechanisms of solder connections
- Failure mechanisms of components (e.g. ceramic capacitors)
- Failure mechanisms of printed circuit boards (keyword: black pad)
- reliability of test procedures
- Evaluation of supplier agreements for technical relevance and feasibility
- Forensic investigation

Analytics

// Consulting and training

Our Services at a Glance:

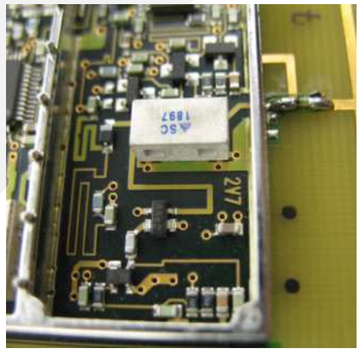
- Clarification of Roles and Responsibilities
- We help define clear roles, expectations, and responsibilities to ensure efficient collaboration and goal-oriented workflows.

- Visualization of Complex Interrelationships
- We present interdependencies and system dynamics in an understandable and actionable way to support strategic decision-making.

- Knowledge Transfer and Skills Development
- Through targeted training, workshops, and documentation, we empower your teams with the know-how they need—today and in the future.

- Change Enablement & Regulatory Adaptation
- Whether adapting to new legal requirements or market shifts, we support you in implementing changes smoothly and sustainably.

- Interpretation and Critical Discussion of Research Findings
- We analyze, contextualize, and translate research results into practical insights, fostering innovation and informed decision-making.



STANDARDS

RTCA DO-160G
DIN ISO 16750-5
MIL-STD-810
DIN SPEC 79009
DIN EN ISO 846
DIN EN 60068
VW TL 82421
VW 50180
ABD0100
DIN EN 60068-2-45
DIN EN 60068-2-10
BMW GS 95003-5
ISO 2812 Part 1

Analytics

// Chemical Resistance

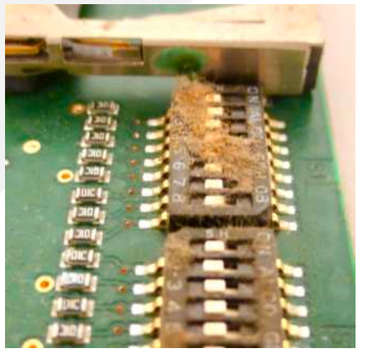
Testing Durability Against Chemical

Chemical resistance or fluids susceptibility, generally describes the resistance of materials to the effects of chemicals. In contrast to corrosion, there is no material removal, which is particularly typical for plastics and elastomers.

The test is performed by dipping the test specimen into the chemical or by dripping, brushing, spraying or wiping the chemical onto the test specimen. After a defined exposure time and temperature, the surface is cleaned of the test chemical and inspected for visual changes such as discoloration, cracking, blistering, softening or similar. Upon customer request, we also ship the test specimens uncleaned.

Mold Grow

The term "biological resistance" refers to the extent to which materials can be degraded by microorganisms such as bacteria, algae or fungi.
Depending on the material the test specimen is made of, different spores are used for the fungal or microbial test; these result from the applied test standard.
In many applications, the materials used must not promote the growth of bacteria and fungi, as this could result in deterioration, reduced durability or even destruction of the test specimen.



Metallographic examinations

STANDARDS

IPC-TM-650 Method 2.1.1
IPC-9241
DIN EN ISO 1463
ASTM E3 - 11

STANDARDS

IPC-A-600
IPC-A-610
DIN 13018
IPC-OI-645

Analytics

// Metallographic examinations

Metallographic preparation techniques can be used to analyze the microstructure of metals, polymers, ceramics and other materials on a microscopic level.

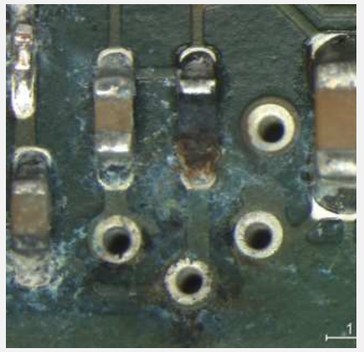
For example, the following are examined:
- Structure of ceramic multilayer capacitors
- Inner layer connections of printed circuit boards
- Solder connections of components
- Inner structure of ICs, resistors, relays, etc.
- Layer structure and layer thickness measurement
- Solder pass-through of THT solder connections
- Bond connections on semiconductors

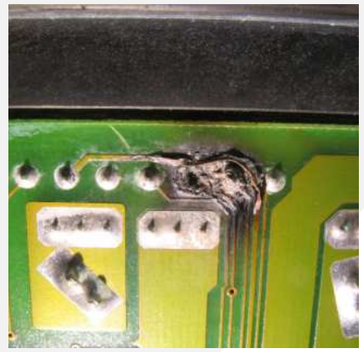
// Optical inspection

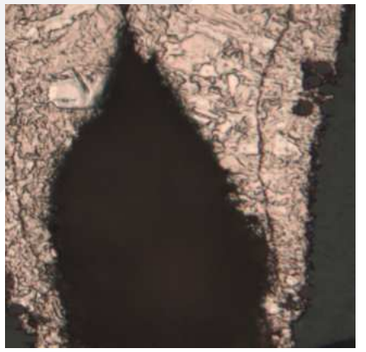
Visual quality control method using the naked eye and a microscope to detect external surface defects and external damage to components.

Typical defects detected by visual inspection:
- Missing or misplaced components.
- Soldering defects (e.g. solder bridges, missing solder material)
- Surface defects (e.g. scratches, spots, nodules)

Image documentation with microscope:
- bright field
- dark field
- interference contrast
- polarization
- UV light







CATEGORIES

- Automotive
- Aerospace
- Defense
- Industrial

Scanning electron microscopy

STANDARDS

DIN ISO 22309
MIL-STD-883
ASTM E1508-12

Analytics

// SEM with EDX material analysis

The SEM enables the imaging of surfaces with high resolution and great depth of field. Energy dispersive X-ray spectroscopy (EDX) can also be used to determine the material composition and element distribution through point measurement, linescan and element mapping.
In addition to imaging and analysis in high vacuum, operation in pressure-variable mode up to 400 Pa is also possible for sensitive or non-conductive samples.

Technical specification:

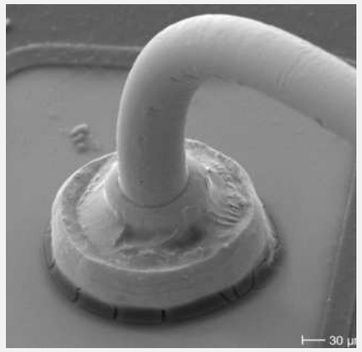
Resolution
up to 3 nm (SE, high vacuum)

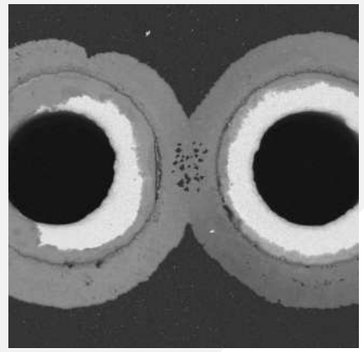
Detectors
SE, VPSE, BSE, EDX

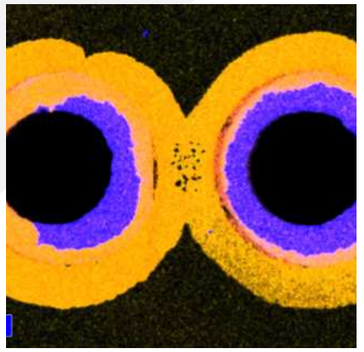
Acceleration voltage
up to 30 kV

Large sample chamber
approx. 130x130 mm/2 kg

Magnification:
5 - 1,000,000x







STANDARDS

DIN EN 61191-6

IPC-7095

MIL-STD-883

ASTM E801

Analytics

// X-ray and Planar CT

X-ray analysis is crucial in the inspection of PCBAs and their components for defect analysis and quality assurance. 3D imaging (planar CT / laminography) of the internal structures can also be used to visualize structural defects.

Examined are e.g:
- Concealed solder joints
- solder pass-through of THT solder joints
- voids in soldering
- analysis of wire bonds
- 3D visualization of BGAs
- examination of connection contacts

X-Ray Sample Size
800 x 500 mm

X-Ray Part weight
5 kg

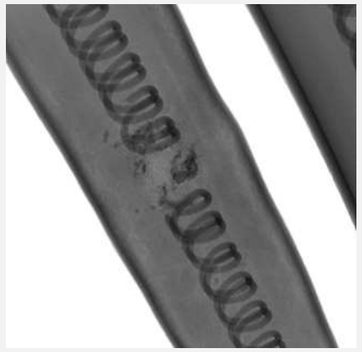
X-Ray Tube
20 - 160 kV

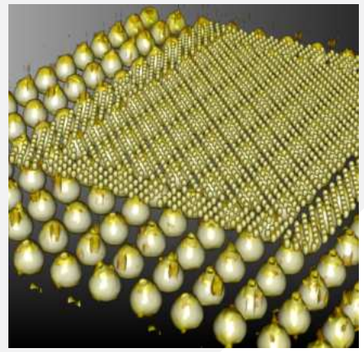
Target Power
max. 15 W

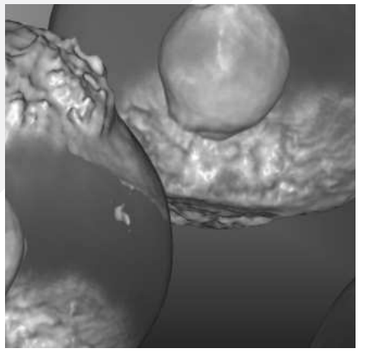
Oblique Viewing
+/- 70°

3D Mode
Laminography (micro3Dslice)

Detail detectibility
0,75 µm







STANDARDS

ASTM E168 - 06:

ASTM E334 - 01

ASTM E1252 - 98

Analytics

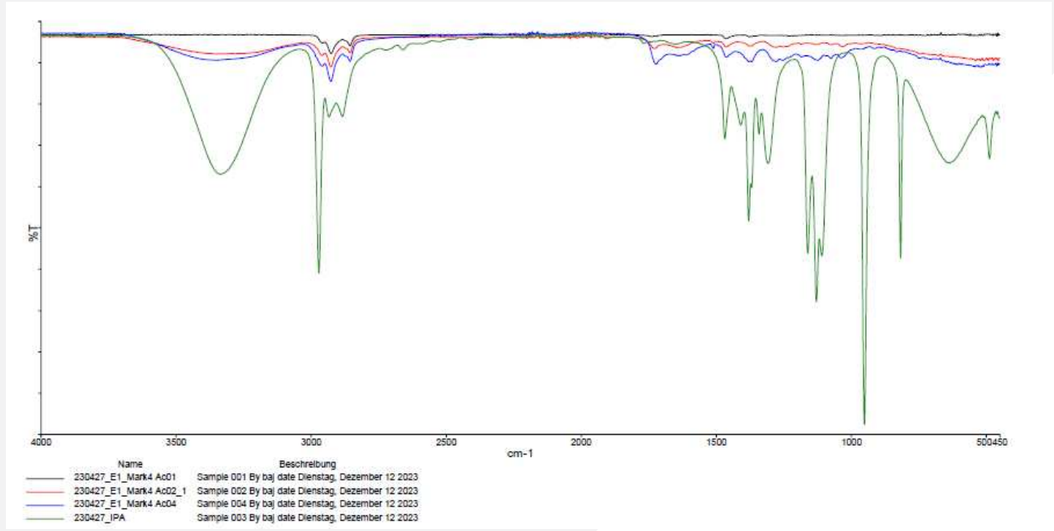
// Fourier transform infrared spectroscopy

Identification of organic materials
Examples: Polymers, cleaners, additives, adhesives, dyes, contamination, organic solvents, corrosion products

For the area of printed circuit boards and assemblies
Examples: Process residues from PCB production, residues from cleaning processes, coating, flux residues, organic coatings, corrosion products

Possible measurement method:
- FTIR spectrometer with diamond crystal
- FTIR spectrometer with germanium crystal
- FTIR spectrometer in combination with FTIR microscope (Ge crystal)

Measuring method:
Reflection and transmission



STANDARDS

IPC-J-STD-002/003
IEC 61191-9
IPC-TM-650 2.3.28
DIN EN 62137-1-1
DIN EN 62137-1-2

Analytics

// Other analytical methods

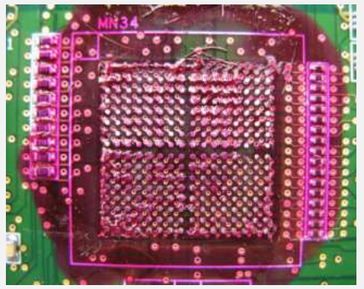
Dye & pry test
- Detection of cracks (microcracks) in soldered joints, e.g. BGA
- Evaluation of gaps
- Detection of penetration paths of electrolytes

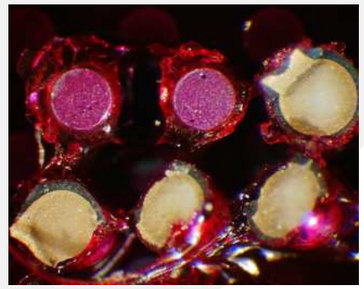
Measurement of ionic contamination
- Detection of ionogenic contamination (e.g. process residues from PCB production, flux residues, etc.) on assemblies
- Adaptation of the procedure to customer-specific requirements

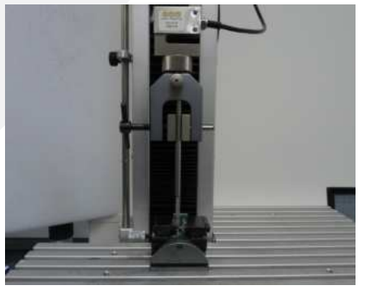
CAF and SIR test
Electrochemical migration of copper in the PCB and bridging with the neighboring conductor track or PTH, which leads to a short circuit under the influence of temperature, humidity, electric field and other factors.

Solderability test
The solderability test provides reliable information on whether a component can be soldered without problems after production or after long-term storage.

Tensile / compression / shear test
These tests are crucial for evaluating mechanical integrity and resistance to external stresses to ensure component reliability, especially in demanding applications such as aerospace and automotive.







CATEGORIES

- Automotive
- Aerospace
- Defense
- Industrial

Qualifications

Analytics

// Qualification of printed circuit boards and assemblies

- Compliance according to IPC-A-600 / IPC-A-610, IEC 61188,
- e.g. thermal resistance (solder bath, oil bath, sand bath), solderability according to J-STD-003
- Evaluation of final finishes (chemical Sn, ENIG, keyword black pad)
- Whisker test in accordance with DIN EN 60068-2-82 / JEDEC-JESD 201
- Evaluation of the inner structure (inner layer separation,Barrel crack, corner crack)
- Evaluation of condition after ageing (e.g. high/low temperature storage)
- Evaluation of condition after thermal/mechanical stress (e.g. temperature shock, vibration)
- Condition of final finishes after multiple exposure to soldering heat
- Behavior of the solder mask after aging
- Behavior of the conformal coating after aging

// Qualification of joining techniques

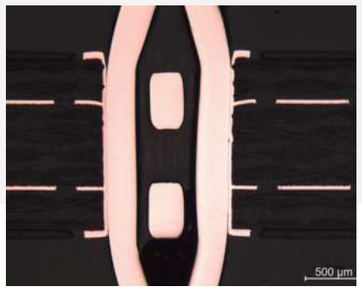
Solderless connections
- Press fit (DIN EN IEC 60352-5)
- Crimp connection (DIN EN IEC 60352-2)
- Insulation displacement connection (DIN EN IEC 60352-3)

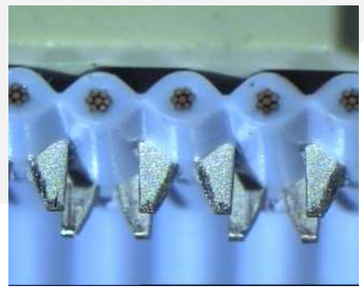
Welded connections
- Welding of inductors enameled copper wire to termination
- Internal welded connections, e.g. relays, quartz crystals
- Ultrasonic welding
- Welded joints of pipes

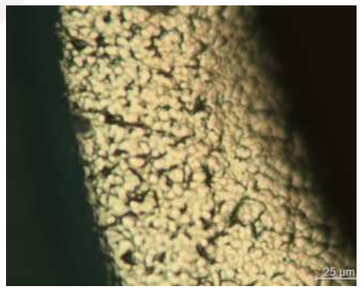
Soldered joints
- Evaluation in initial state and after ageing by environmental simulation
- Reflow simulation

// Qualification of auxiliary materials

- SMD adhesives, e.g. hot shear test according to SN 59651 / IPC-SM-817
- Chemical resistance of polymers, stress corrosion cracking, e.g. according to DIN EN VDI 3822-2.1.7
- Casting resins, e.g. dielectric strength according to IEC 243
- adhesive strength of adhesive labels
- properties of solder pastes, e.g. slumping, corrosion behavior
- flux, e.g. thermal resistance, interaction with solder







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