

Polymer Engineering Department

Environmental simulation and product qualification

Environmental simulation

Throughout their service life, technical products are exposed to a wide variety of environmental influences. These affect their function, reliability and lifespan.

Technical products must be designed and manufactured to ensure their load resistance and reliability. This is important for both technical and economic reasons. In its laboratories Fraunhofer ICT simulates environmental influences on technical products. Experienced engineers ensure a fast and solution-oriented implementation of test requirements, and achieve reliable test results even using customized testing programs. Fraunhofer ICT is a member of the German Society for Environmental Simulation GUS.

Below you can find an overview of our technical equipment with the corresponding performance characteristics. We have flexible accreditation for various environmental simulation tests and combinations of tests (qualification tests on technical products). The flexible accreditation certifies that the environmental simulation laboratory has the high level of technical and scientific expertise needed to apply both standardized testing methods and methods with equivalent standards that are not included in the accreditation certificate within this area of expertise.

Service portfolio

The environmental simulation laboratory at Fraunhofer ICT offers solutions to

- approve your quality requirements,
- optimize the properties of your product,
- carry out failure or weak-point analyses,
- meet your customers' requirements.

Corrosion | corrosive gases | salt mist | chemical resistance

Available tests

- combined alternating corrosion tests
- salt spray mist
- condensation atmosphere with constant climate and alternation of climate with and without SO₂ (Kesternich)
- corrosive gas test (single gas or mixed gas)
- ozone test
- chemical resistance tests

Applications for these tests

- assessment of coatings
- corrosion resistance of materials
- investigation of contact materials
- functional testing
- service life prediction
- simulation of industrial climates

Corrosive gas

- sulfur dioxide SO₂
- Hydrogen sulfide H₂S
- Chlorine Cl₂
- Nitrous oxides NO_x
- Ozone O₃
- Ammonium NH₃
- Other gases on request
- Test chamber volume: 105 liters to 990 liters
- Temperature: 25 °C
- Humidity: 75 %
- Other temperatures / humidities on request

Salt mists (selection)

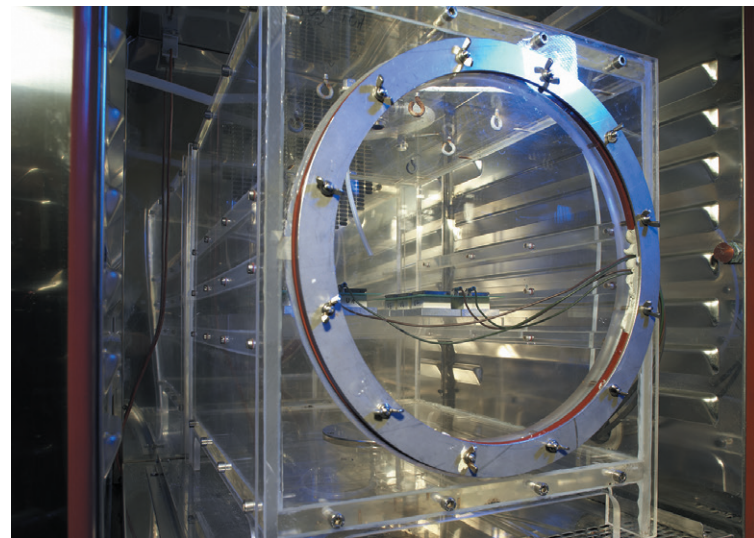
- NSS
- CASS
- ESS
- SWAAT
- Nissan specification
- sea water
- further options on request
- test chamber volume: 1000 liters to 2000 liters
- condensation
- controlled humidity: 10 % to 95 %
- temperature range: -20 °C to +70 °C

Ozone

- test chamber volume 580 l
- temperature: up to +70 °C
- ozone: up to 1000 ppm

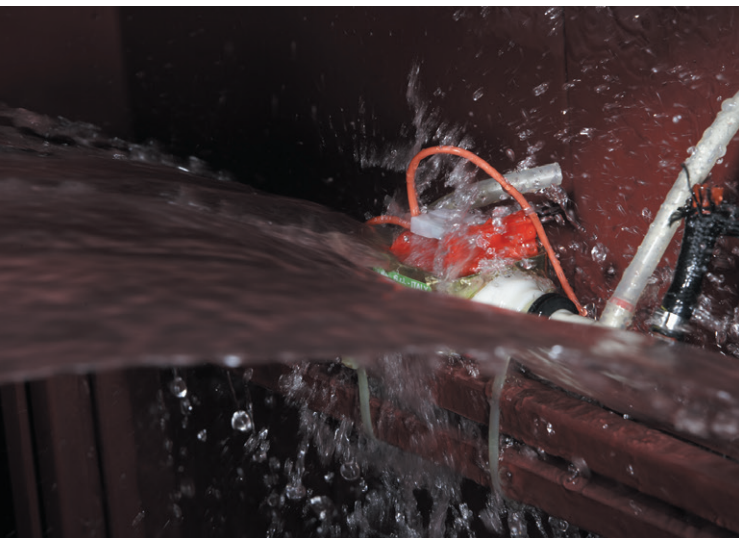
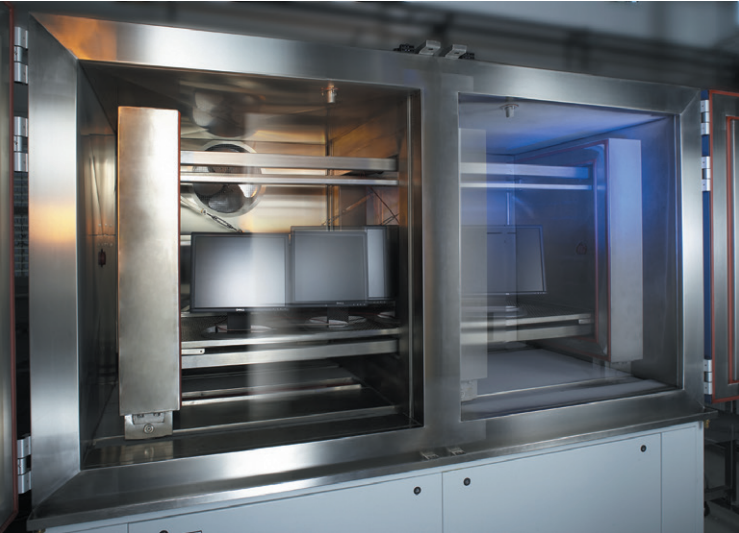
Chemical resistance

- test chamber volume: 240 liters to 720 liters
- temperature: up to +300 °C
- all conventional media and further options on request



Images (from top to bottom):
Corrosion test chamber
Corrosive gas test chamber

Climate | temperature | shock



*Images (from top to bottom):
Temperature shock cabinet (two chamber method)
Splash water test*

Available tests

- constant / cyclic temperature and climate tests
- hot / cold storage
- condensation test
- temperature shock test (two chamber method)
- splash water test

Applications for these tests

- fitness-for-service in the tropics
- corrosion resistance
- functional testing
- service life prediction
- aging

Temperature and climate chambers

- minimum temperature: -75 °C
- maximum temperature: +300 °C
- humidity range: 5 % to 100 %
- ramp: up to 15 Kelvin per minute
- volumes: 300 liters to 1300 liters

Temperature shock air-water (splash water / immersion test)

- air temperature: up to +180 °C
- water temperature: from 0 °C to +4 °C

Temperature shock air-air (two chamber method)

- minimum temperature: -75 °C
- maximum temperature: +220 °C and +180 °C
- volume: 120 liters and 600 liters
- transition time: <10 s

IP protection | high- and low-pressure tests

Available tests

- constant / cyclic dust tests
- protection against foreign particles
- protection against contact
- steam jet test
- immersion tests

Determination of protection category

- protection against water and dust
- protection against access to dangerous parts

Dusts

- talc (IP5X, IP6X)
- "Portland cement" / flue dust (IP5KX, IP6KX)
- Arizona dust (IP5KX, IP6KX)
- JIS dusts
- other dusts on request

Water

- dripping water (IPX1, IPX2)
- splash water (IPX4, IPX4K)
- spray water (IPX3)
- water jet (IPX5, IPX6, IPX6K)
- immersion (IPX7, IPX8)
- high pressure / steam jet cleaning (IPX9K and IPX9)
- hot water jet
- engine cleaning

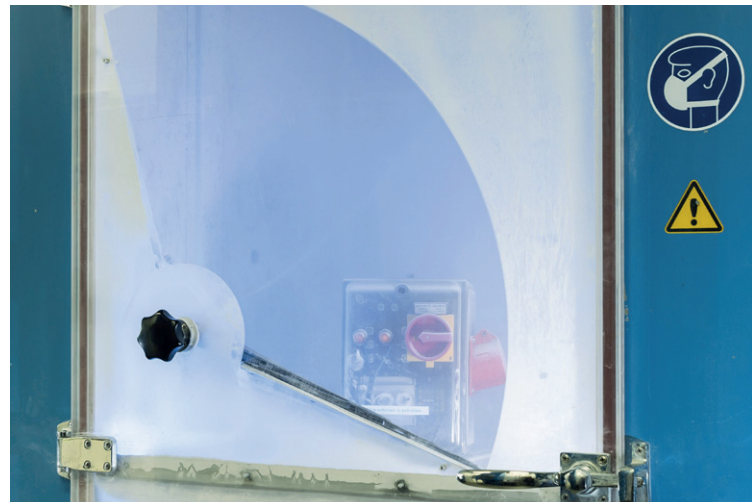
High / low pressure (pressurizing medium: air)

Tests conducted with:

- constant pressures
- pressure ramps
- pressure change

Low pressure:

- temperature:
-55 °C to +80 °C



Images (from top to bottom):

Dust chambers | Steam jet test | Immersion test

Vibration and mechanical shock

Types of load in combination with temperature and humidity

- swept sine
- random noise
- shock

Applications

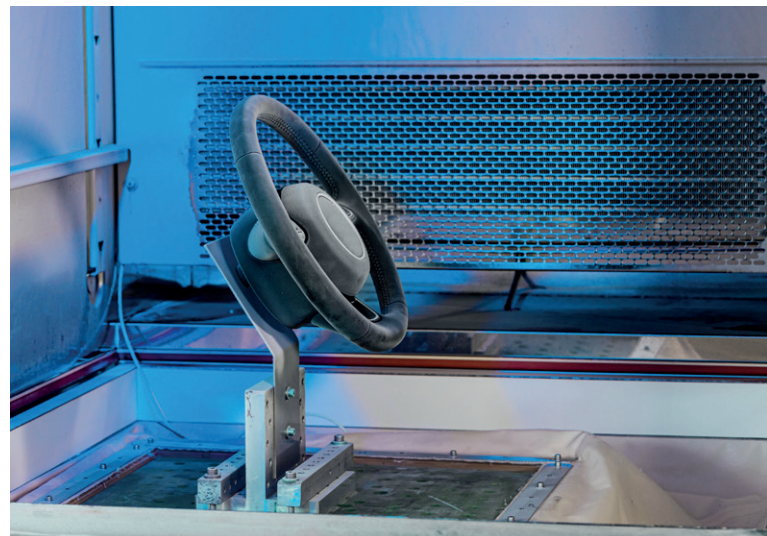
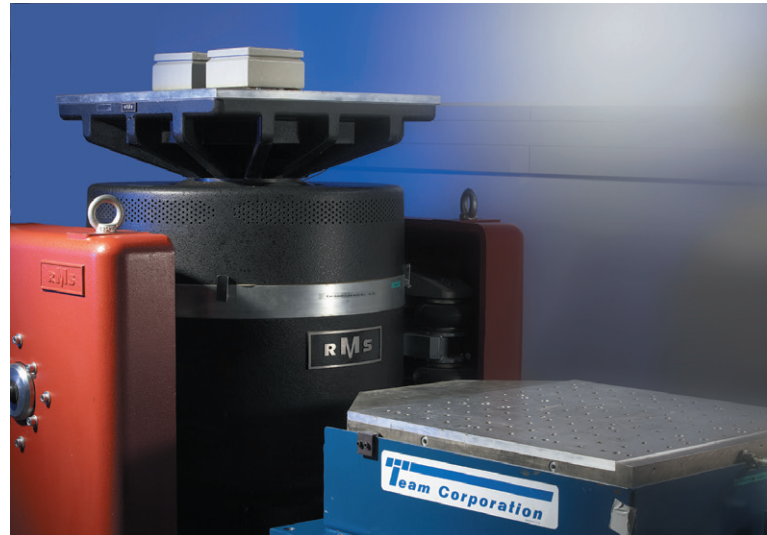
- transport simulation
- packaging optimization
- strength / durability measurement
- functional testing
- service life prediction
- resonance measurement

Shock

- type of shock: half sine
- maximum acceleration: 20,000 m/s²
- duration of shock: up to 60 milliseconds

Vibration

- force: 18 kilonewtons
- amplitude: ± 12.7 millimeters
- temperature: -70 °C to +180 °C
- humidity: 5 % to 98 %
- sliding table



Images (from top to bottom):
Shaker
Climate-vibration test

Selection of standardized tests available (further options on request)

Corrosion | corrosive gases | salt mist | chemical resistance

DIN EN IEC 60068-2-11	Environmental testing – Part 2-11: Tests – Test Ka: Salt mist
DIN EN 60068-2-42	Environmental testing – Part 2-42: Tests – Test Kc: Sulfur dioxide test for contacts and connections
DIN EN 60068-2-43	Environmental testing – Part 2-43: Tests – Test Kd: Hydrogen sulfide test for contacts and connections
DIN EN 60068-2-45	Environmental testing – Part 2-45: Tests – Test XA: Immersion in cleaning solvents
DIN EN IEC 60068-2-52	Environmental testing – Part 2-52: Tests – Test Kb: Salt mist, cyclic (sodium chloride solution)
DIN EN 60068-2-60	Environmental testing – Part 2-60: Tests – Test Ke: Flowing mixed gas corrosion test
DIN EN 60512-11-6	Connectors for electronic equipment - Tests and measurements - Part 11-6: Climatic tests; Test 11f: Corrosion, salt mist
DIN EN 60512-11-7	Connectors for electronic equipment – Tests and measurements – Part 11-7: Climatic tests – Test 11g: Flowing mixed gas corrosion test
DIN EN 60512-11-14	Connectors for electronic equipment – Tests and measurements – Part 11-14: Climatic tests – Test 11p: Flowing single gas corrosion test
DIN EN ISO 6270-2	Paints and varnishes – Determination of resistance to humidity – Part 2: Condensation (in-cabinet exposure with heated water reservoir)
DIN EN ISO 9227	Corrosion tests in artificial atmospheres – Salt spray tests
DIN ISO 9022-20	Optics and photonics – Environmental test methods – Part 20: Humid atmosphere containing sulfur dioxide or hydrogen sulfide
DIN EN ISO 22479	Corrosion of metals and alloys – Sulfur dioxide test in a humid atmosphere (fixed gas method)
DIN ISO 1431-1	Rubber, vulcanized or thermoplastic – Resistance to ozone cracking – Part 1: Static and dynamic strain testing
ISO 16750-5	Road vehicles – Environmental conditions and testing for electrical and electronic equipment – Part 5: Chemical loads

Climate | temperature | shock

DIN EN 60068-2-1	Environmental testing – Part 2-1: Tests – Test A: Cold
DIN EN 60068-2-2	Environmental testing – Part 2-2: Tests – Test B: Dry heat
DIN EN IEC 60068-2-14	Environmental testing – Part 2-14: Tests – Test N: Change of temperature
DIN EN 60068-2-30	Environmental testing – Part 2-30: Tests – Test Db: Damp heat, cyclic (12 h + 12 h cycle)
DIN EN IEC 60068-2-38	Environmental testing – Part 2-38: Tests – Test Z/AD: Composite temperature/humidity cyclic test
DIN EN 60068-2-40	Environmental testing – Part 2-40: Tests – Test Z/AM: Combined cold/low air pressure tests
DIN EN 60068-2-41	Environmental testing – Part 2-41: Tests – Test Z/BM: Combined dry heat/low air pressure tests
DIN EN 60068-2-61	Environmental testing – Part 2-61: Tests – Test Z/ABDM: Climatic sequence
DIN EN 60068-2-67	Environmental testing – Part 2-67: Tests – Test Cy: Damp heat, steady state, accelerated test primarily intended for components
DIN EN 60068-2-78	Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state
ISO 16750-4	Road vehicles – Environmental conditions and testing for electrical and electronic equipment – Part 4: Climatic loads

IP protection | high- and low- pressure tests

DIN EN IEC 60068-2-13	Environmental testing – Part 2-13: Tests – Test M: Low air pressure
DIN EN 60068-2-18	Environmental testing – Part 2-18: Tests – Test R and guidance: Water
DIN EN 60068-2-68	Environmental testing – Part 2-68: Tests – Test L: Dust and sand
DIN EN 60529	Degrees of protection provided by enclosures (IP Code)
DIN EN 62262	Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)
ISO 20653	Road vehicles – Degrees of protection (IP code) – Protection against foreign objects, water and access
DIN 40050-9	Road vehicles – Degrees of protection (IP code) – protection against foreign objects; water and contact – electrical equipment
JIS D0207	General rules of dust test for automobile parts

Vibration and mechanical shock

DIN EN 60068-2-6	Environmental testing – Part 2-6: Tests – Test Fc: Vibration (sinusoidal)
DIN EN 60068-2-27	Environmental testing – Part 2-27: Tests – Test Ea and guidance: Shock
DIN EN 60068-2-31	Environmental testing – Part 2-31: Tests – Test Ec: Rough handling shocks, primarily for equipment-type specimens
DIN EN 60068-2-53	Environmental testing – Part 2-53: Tests – Tests and guidance: Combined climatic (temperature/humidity) and dynamic (vibration/shock) tests
DIN EN 60068-2-64	Environmental testing – Part 2-64: Tests – Test Fh: Vibration, broadband random and guidance
DIN EN 60068-2-75	Environmental testing – Part 2-75: Tests – Test Eh: Hammer tests
ISO 16750-3	Road vehicles – Environmental conditions and testing for electrical and electronic equipment – Part 3: Mechanical loads

Electric measurements

DIN EN 60512-2-1:	Connectors for electronic equipment – Tests and measurements – Part 2-1: Electrical continuity and contact resistance tests, Test 2a: Contact resistance – Millivolt level method
DIN EN 60512-3-1	Connectors for electronic equipment – Tests and measurements – Part 3-1: Insulation tests – Test 3a: Insulation resistance
DIN EN 60512-4-1	Connectors for electronic equipment – Tests and measurements – Part 4-1: Voltage stress tests – Test 4a: Voltage proof

Akkreditierung



Die Deutsche Akkreditierungsstelle bestätigt mit dieser **Akkreditierungsurkunde**, dass das Prüflaboratorium

Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e. V.
Hansastraße 27c, 80686 München

die Anforderungen gemäß DIN EN ISO/IEC 17025:2018 für die in der Anlage zu dieser Urkunde aufgeführten Konformitätsbewertungstätigkeiten erfüllt. Dies schließt zusätzliche bestehende gesetzliche und normative Anforderungen an das Prüflaboratorium ein, einschließlich solcher in relevanten sektoralen Programmen, sofern diese in der Anlage zu dieser Urkunde ausdrücklich bestätigt werden.

Die Anforderungen an das Managementsystem in der DIN EN ISO/IEC 17025 sind in einer für Prüflaboratorien relevanten Sprache verfasst und stehen insgesamt in Übereinstimmung mit den Prinzipien der DIN EN ISO 9001.

Diese Akkreditierung wurde gemäß Art. 5 Abs. 1 Satz 2 VO (EG) 765/2008, nach Durchführung eines Akkreditierungsverfahrens unter Beachtung der Mindestanforderungen der DIN EN ISO/IEC 17011 und auf Grundlage einer Bewertung und Entscheidung durch den eingesetzten Akkreditierungsausschuss ausgestellt.

Diese Akkreditierungsurkunde gilt nur in Verbindung mit dem Bescheid vom 18.03.2024 mit der Akkreditierungsnummer D-PL-11140-16.

Sie besteht aus diesem Deckblatt, der Rückseite des Deckblatts und der folgenden Anlage mit insgesamt 7 Seiten.

Registrierungsnummer der Akkreditierungsurkunde: **D-PL-11140-16-00**



Berlin, 18.03.2024

Im Auftrag Dr.-Ing. Tobias Poeste
Fachbereichsleitung

Diese Urkunde gibt den Stand zum Zeitpunkt des Ausstellungsdatums wieder. Der jeweils aktuelle Stand der gültigen und überwachten Akkreditierung ist der Datenbank akkreditierter Stellen der Deutschen Akkreditierungsstelle zu entnehmen (www.dakks.de).

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