



ENVIRONMENTAL TESTING

Environmental Testing

Tests

Heat - Cold - Climate	Page 3
Thermal Shock	Page 4
Low - High Pressure	Page 4
Vibration	Page 5
Mechanical Shock	Page 6
Corrosive Atmospheres	Page 7
Rain - Dust - IP Enclosure	Page 8
Ice- Snow	Page 8
Solar Radiation	Page 9
Supplement	
Overview	Page 10
Testing Equipment	Page 11

Foreword & Introduction

Reliability, Quality, Safety and Compatibility

If these or similar slogans apply to your products we can and would like to support you in your work.

The AIT Mobility Department and its staff have many years of know-how as an independent, ISO 9001 certified testing center. We are accredited to EN ISO/IEC 17025. Experienced experts of our team are active in both Austrian and international standards boards, forming a link between standards theory and testing practice.

The competitive edge provided by your staff and our technical equipment is assured in the complete product life cycle from engineering to maintenance.

We support you in

- | Selection of test methods
- | Practice oriented test planning

We offer you

- | Conducting of the tests
- | Conducting of acceptance tests
- | Long-term and life cycle tests
- | Reports and certificates



I would be pleased if you would place your trust in us.

Best regards

Ing. Robert Meier
Electric Drive Technologies
T +43 (0) 50 550-6247
F +43 (0) 50 550-6595



Heat - Cold - Climate

Applications

- | Materials testing
- | Electronic and electrical components, machines and devices
- | Display models also in 1:1 scale, doors, windows and fascade elements
- | Vehicle parts and vehicles, e.g. electric scooters, automobiles and rail vehicles

Scope of Service

- | High temperature tests up to +250 °C
- | Low temperature tests up to -70 °C
- | Dew point tests from -3°C to 94°C
- | Climate tests: 10 % r.F up to 95 % r.F (Temperature range 10 °C up to 90 °C)
- | Rapid change of temperature: rate of temperature up to 11°C/min.
- | Further services upon request

Testing Equipment

- | Temperature Chambers
-70 °C up to +250 °C
- | Climate Chambers
-70 °C up to +180 °C
- | Heat/Cold/Climate Test Cells (walk-in)
-40 °C up to +90 °C
- | Heat/Cold/Climate Test Cells (walk-in)
-75 °C up to +90 °C
- | Heat/Cold/Climate Test Cells (drive-in)
-40 °C up to +80 °C

Standards

- | IEC 60068-2-1 Environmental Testing: Test A: cold
- | IEC 60068-2-2 Environmental Testing: Test B: dry heat
- | IEC 60068-2-14 Environmental Testing: Test N: change of temp.
- | IEC 60068-2-30 Environmental Testing: Test Db: damp heat, cyclic
- | IEC 60068-2-38 Environmental Testing: Test Z/AD: composite temperature/humidity cyclic test
- | IEC 60068-2-61 Environmental Testing: Test Z/ABDM: climatic sequence
- | IEC 60068-2-78 Environmental Testing: Test Cab: damp heat, steady state
- | IEC 60749 Semiconductor devices - Mechanical and climatic test methods
- | MIL-STD-810E Test Method Standard for Environmental Engineering Considerations and Laboratory Tests

Environmental Testing



Drive-in climate cell



Climate chamber

Thermal Shock

Applications

- I Materials testing
- I Electronic and electrical components and devices

Scope of Service

- I Rapid change between two temperatures (thermal shock) in air

Testing Equipment

- I Freely programmable sample exposure time.
- I Unlimited number of test cycles.
- I Two test chambers:
 - High Temperature Chamber up to +220 °C
 - Low Temperature Chamber down to -80 °C
- I Transfer time: < 10 sec.
- I Automatic sample transport
- I Capacity of the chambers:
 - 47 x 65 x 41 cm
- I Max. weight of sample: 20 kg

Standards

- I IEC 60068-2-14 Environmental Testing: Test N: Change of temperature
- I IEC 60749 Semiconductor Devices – Mechanical and climatic test methods

Low Pressure - High Pressure

Applications

- I Materials testing
- I Electronic and electrical components, machines and devices
- I Mechanical constructions and structures
- I Vehicle parts (automobiles, aircraft and spacecraft)

Scope of Service

- I Low pressure (flight test, alpine test, etc.)

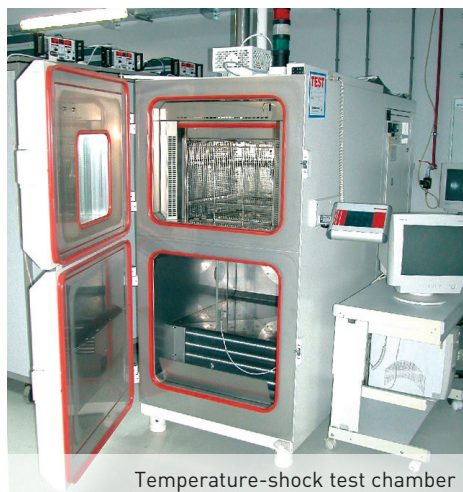
Testing Equipment

Low Pressure Chamber (walk-in)

- I Size of chamber: 1.2 m x 1.2 m x 2.3 m
- I Pressure: 1 mbar up to 1300 mbar

Standards

- I IEC 60068-2-13 Environmental Testing: Test M: low air pressure
- I IEC 60068-2-40 Environmental Testing: Test Z/AM: combined cold/low air pressure tests
- I IEC 60068-2-41 Environmental Testing: Test Z/BM: combined dry heat/low air pressure tests
- I IEC 60749 Semiconductor Devices - Mechanical and climatic test methods
- I MIL-STD-810F Test Method Standard for Environmental Engineering Considerations and Laboratory Tests



Temperature-shock test chamber



Vacuum chamber

Vibration

Applications

- | Electronic and electrical components, machines and devices
- | Mechanical constructions and structures
- | Vehicle parts (automobiles, aircrafts and spacecrafts)
- | Simulation of transportation

Scope of Service

Sinus Vibration

- | Range of frequency: 5 Hz up to 3 kHz
- | Control of distance, speed and acceleration
- | Max. distance: 2 inches (peak-peak)
- | Max. speed: 1.8 m/s
- | Max. acceleration: depending on the mass of the sample incl. table 110 g (without mass) up to 40 g (with appr. 60 kg payload)

Random Vibration

- | Range of frequency: 10 Hz up to 2 kHz
- | Max. acceleration: 75 g (without mass) up to 10 g (with appr. 330 kg payload)

Testing Equipment

Electrodynamical Shaker

- | Sway-direction vertical or horizontal on coupled horizontal table.
- | Force: 35585 N

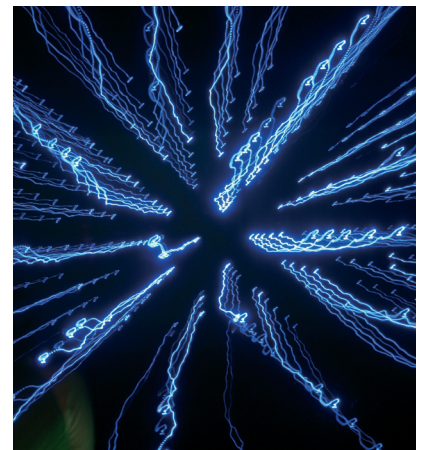
Climate Equipment

- | Temperature range -70 °C up to +180 °C, Change of temperature: 5 K/min.
- | Climate: 10 % r.h. up to 95 % humidity in a temperature range from 10 °C up to 90 °C.

Standards

- | EN 22247 Packaging - complete, filled transport packages - vibration test at f fixed low frequency
- | EN 28318 Packaging - complete, filled transport packages - vibration test using a sinusoidal variable frequency
- | IEC 60068-2-6 Environmental Testing: Test Fc: vibration
- | IEC 60068-2-50 Environmental Testing: Test Z/AFc: combined cold/vibration tests
- | IEC 60068-2-51 Environmental Testing: Test Z/BFc: combined dry heat/vibration tests
- | IEC 60068-2-64 Environmental Testing: Test Fh: vibration broad-band random
- | MIL-STD-810E Test Method Standard for Environmental Engineering Considerations and Laboratory Tests
- | MIL-STD-883E Test Method Standard, Microcircuits
- | IEC 62759 Transportation testing of PV modules

Environmental Testing



Electrodynamical shaker with adapted climate chamber

Mechanical Shock

Applications

- I Electronic and electrical components, machines and devices
- I Mechanical constructions and structures
- I Vehicle parts (automobiles, aircrafts and spacecrafts)

Scope of Service

Single and Steady Shock

Mass of sample depends on the acceleration and duration of the shock.

Test duration, e.g.:

6 ms:	11 ms:
232 kg at 30 g	223 kg at 30 g
126 kg at 50 g	64 kg at 50 g
6 kg at 100 g	7 kg at 60 g

Testing Equipment

Electrodynamic Shaker

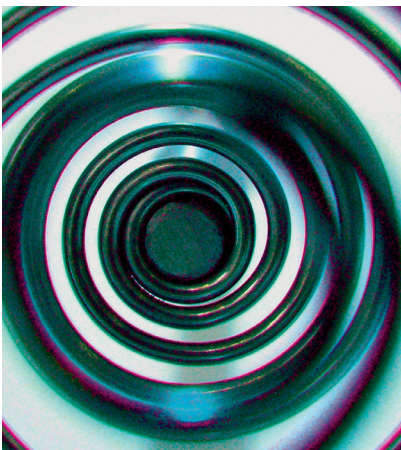
- I Sway-direction vertical or horizontal on coupled horizontal table
- I Force: 35585 N

Climate Equipment

- I Temperature range -70 °C up to +180 °C, Change of temperature: 5 K/min.
- I Climate: 10 % RH up to 95 % humidity in a temperature range of 10 °C up to 90 °C

Standards

- I IEC 60068-2-27 Environmental Testing: Test Ea: shock
- I IEC 60068-2-29 Environmental Testing: Test Eb: bump
- I IEC 60068-2-31 Environmental Testing: Test Ec: drop and topple
- I IEC 60068-2-32 Environmental Testing: Test Ed: free fall
- I IEC 60068-2-55 Environmental Testing: Test Ee: bounce
- I IEC 60068-2-75 Environmental Testing: Test Eh: hammer test
- I MIL-STD-810E Test Method Standard for Environmental Engineering Considerations and Laboratory Tests



Electrodynamic shaker with climatic exposure test cabinet

Corrosive Atmospheres

Applications

- | Materials testing
- | Electronic and electrical components, machines and devices
- | Mechanical constructions and structures
- | Vehicle parts (automobiles, aircrafts and spacecrafts)
- | Additional tests for PV modules

Scope of Service

- | Salt Spray (Fog) Test chamber with condensation water test
- | Sulphur Dioxide SO₂ and Hydrogen Sulfide H₂S test

Testing Equipment

Salt Chamber

- | Size of chamber:
L=165 cm H=120 cm D=57 cm
- | Temperature range:
Ambient temperature up to +55 °C
- | Also suitable for condensation water test

Sulphur and Hydrogen Climate Chamber

- | Size of chamber:
L=60 cm H=60 cm D=55 cm
- | Temperature range:
+15 °C up to +60 °C
- | Humidity range:
10 % r.h. up to 80 % r.h.,
dependent on the temperature
- | Gas concentration:
0.5 ppm up to 25 ppm SO₂ and H₂S
- | Also suitable for mixed corrosion gas tests

Standards

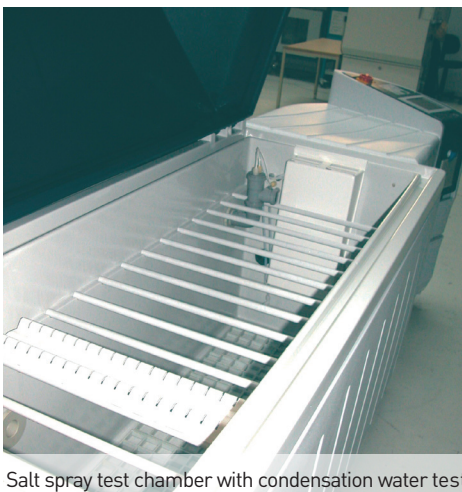
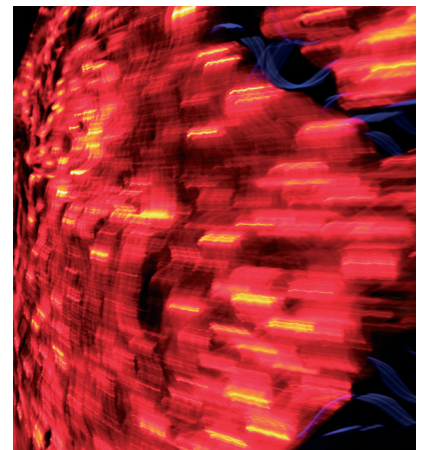
Salt mist test with condensation water test

- | ASTM B117 Standard Method of Salt Spray (Fog) Testing
- | IEC 60068-2-11 Environmental Testing: Test Ka: salt mist
- | IEC 60068-2-52 Environmental Testing: Test Kb: salt mist, cyclic Corrosion tests in artificial atmospheres - salt spray tests
- | ISO 9227 Corrosion tests in artificial atmospheres - salt spray tests
- | MIL-STD-883E Test Method Standard, Microcircuits

Gas tests

- | IEC 60068-2-42 Environmental Testing: Test Kc: sulphur dioxide test
- | IEC 60068-2-43 Environmental Testing: Test Kd: hydrogen sulfide test
- | IEC 62716 Ammonia corrosion testing

Environmental Testing



Salt spray test chamber with condensation water test



Climate chamber with sulphur hydrogen cell

Rain - Dust - IP Enclosure

Applications

- I Electronic and electrical components, machines and devices
- I Machines and technical facilities
- I Mechanical constructions and structures
- I Vehicle parts (automobiles, aircrafts- and spacecrafts)
- I Blowing sand and blowing dust testing

Scope of Service

- I IP classification
- I Testing and classification of all degrees of protection for enclosures (against access to dangerous parts, solid particles, water)

Testing Equipment

- I Water Protection Tests: spray water, dripping water, water jet propulsion, steam jet propulsion
- I Dust Chamber - Dust: talcum
- I Several test probes

Standards

Depending on the Standard applicable

- I IEC 60529 Degrees of protection provided by enclosures (IP Code)
- I EN 60529 Degrees of protection provided by enclosures (IP Code)
- I ÖVE-A/EN 60529 Degrees of protection provided by enclosures (IP Code)
- I DIN 40050 - Part 9 Degrees of protection provided by enclosures (IP Code)
- I ISO 20653 Degrees of protection provided by enclosures (IP Code)

Ice - Snow

Applications

- I Electronic and electrical components, machines and devices
- I Mechanical constructions and structures
- I Electric, pneumatic, hydraulic and mechanical drives
- I Display models also in 1:1 scale, doors, windows and fascade elements
- I Vehicle parts
- I Vehicles (automobiles, rail vehicles, aircraft and spacecraft)
- I Additional tests for PV modules

Scope of Service

Analysis of samples under extreme weather conditions:

- I Rain
 - I Snow
 - I Hail
 - I Freezing
 - I Wind
- Expert reports and certificates

Testing Equipment

- I Water test (indoor/outdoor)
- I Rain/Ice/Snow/Climate Chamber
- I Hail test stand up to 55 mm ice ball diameter

Standards

Depending on the applicable product standard (examples):

- I IEC 62271-102 High-voltage switchgear and controlgear Part 102: High-voltage alternating current disconnectors and earthing switches
- I IEC 61215 „Crystalline silicon terrestrial photovoltaic (PV) modules design qualification and type approval“



Water protection test equipment



Dust Chamber SK 2000

Solar Radiation

Applications

- | Materials testing
- | Building climate
- | Solar collectors and photovoltaic elements
- | Electronic and electrical components, machines and devices
- | Mechanical constructions and structures
- | Electric, pneumatic, hydraulic and mechanical drives
- | Display models also in 1:1 scale, doors, windows and facade elements
- | Vehicle parts
- | Vehicles (automobiles, rail vehicles, aircraft and spacecraft)
- | Characterization of PV modules and cells for accelerated aging of materials

Scope of Service

- | Solar collector tests according to the standards
- | Simulation of solar radiation on the earth`s surface
- | Simulation of UV radiation
UV radiation range from 0.28 μm up to 0.40 μm
- | Determination of the spectral response of PV modules and measurement of the power at STC (Standard Test conditions) of PV modules

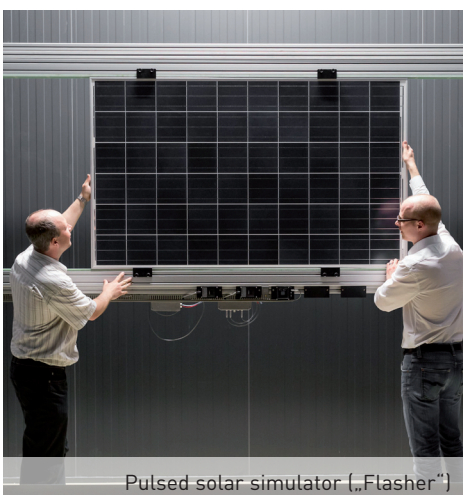
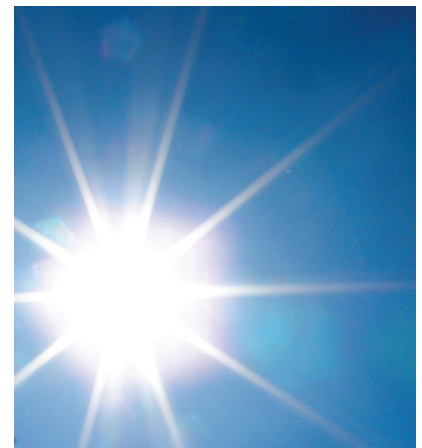
Testing Equipment

- | Steady state sun simulator
Class BBB (IEC 060904-9)
9m² test area
0-1100 W/m²
- | Pulsed solar simulator (Flasher)
Class A+A+A+ (IEC 060904-9)
3 m x 3 m test area
Homogeneity $\pm 0,3 \%$
- | PV cell sun-simulator
Class AAA (IEC 060904-9); 20 cm x 20 cm
- | UV-simulation
UV-A& UV-B; 0-250 W/m²; 2,2 m x 2,6 m
- | Measurement of the spectral response (for PV cells and modules)

Standards

- | EN 12975-2 Termal solar systems and components - solar collectors
Part 2: test methods
- | IEC 60068-2-5 Environmental Testing:
Test Sa: simulated solar radiation at ground level
- | MIL-STD-810E Test Method Standard for Environmental Engineering Considerations and Laboratory Tests
- | IEC 61215 Crystalline Silicon terrestrial photovoltaic (PV) modules - design qualification and type approval
- | IEC 61730 Photovoltaic (PV) module safety qualification
- | IEC 60904-8 Spectral response measurement

Environmental Testing



Pulsed solar simulator („Flasher“)



Steady state sun simulator

SUPPLEMENT

Standards

- I ASTM B117 Standard Method of Salt Spray (Fog) Testing
- I EN 12975-2 Thermal Solar Systems and Components - Solar Collectors Part 2: Test Methods
- I EN 22247 Packaging - Complete, filled transport packages - Vibration test at fixed low frequency
- I EN 28318 Packaging - Complete, filled transport packages - Vibration test using a sinusoidal variable frequency

- I IEC 60068-2-1 Environmental Testing: Test A: Cold
- I IEC 60068-2-2 Environmental Testing: Test B: Dry heat
- I IEC 60068-2-5 Environmental Testing: Test Sa: Simulated solar radiation at ground level
- I IEC 60068-2-6 Environmental Testing: Test Fc: Vibration
- I IEC 60068-2-11 Environmental Testing: Test Ka: Salt mist
- I IEC 60068-2-13 Environmental Testing: Test M: Low air pressure
- I IEC 60068-2-14 Environmental Testing: Test N: Change of temperature
- I IEC 60068-2-27 Environmental Testing: Test Ea: Shock
- I IEC 60068-2-29 Environmental Testing: Test Eb: Bump
- I IEC 60068-2-30 Environmental Testing: Test Db: Damp heat, cyclic
- I IEC 60068-2-31 Environmental Testing: Test Ec: Drop and topple
- I IEC 60068-2-32 Environmental Testing: Test Ed: Free fall
- I IEC 60068-2-38 Environmental Testing: Test Z/AD: Composite temperature/humidity cyclic test
- I IEC 60068-2-40 Environmental Testing: Test Z/AM: Combined cold/low air pressure tests
- I IEC 60068-2-41 Environmental Testing: Test Z/BM: Combined dry heat/low air pressure tests
- I IEC 60068-2-42 Environmental Testing: Test Kc: Sulphur dioxide test
- I IEC 60068-2-43 Environmental Testing: Test Kd: Hydrogen sulfide test
- I IEC 60068-2-50 Environmental Testing: Test Z/AFc: Combined cold/vibration tests
- I IEC 60068-2-51 Environmental Testing: Test Z/BFc: Combined dry heat/vibration tests
- I IEC 60068-2-52 Environmental Testing: Test Kb: Salt mist, cyclic
- I IEC 60068-2-55 Environmental Testing: Test Ee: Bounce
- I IEC 60068-2-61 Environmental Testing: Test Z/ABDM: Climatic sequence
- I IEC 60068-2-64 Environmental Testing: Test Fh: Vibration broad-band random
- I IEC 60068-2-75 Environmental Testing: Test Eh: Hammer test
- I IEC 60068-2-78 Environmental Testing: Test Cab: Damp heat, steady state
- I IEC 60749 Semiconductor devices - Mechanical and climatic test methods

- I ISO 9227 Corrosion tests in artificial atmospheres - Salt spray tests

- I MIL-STD-810F Test Method Standard for Environmental Engineering Considerations and Laboratory Tests



SUPPLEMENT

Test Equipment

Test equipment	Temperature range	Humidity range	Size (L x W x D)
Temperature chamber	-70 °C bis +180 °C	-	58 x 62 x 75 cm
Temperature chamber	-70 °C bis +180 °C	-	80 x 65 x 95 cm
Temperature chamber	-70 °C bis +180 °C	-	58 x 62 x 75 cm
Oven	RT bis +250 °C	-	40 x 40 x 40 cm
Oven	RT bis +250 °C	-	80 x 50 x 60 cm
Climatic chamber	-70 °C bis +180 °C	10 % r.F. bis 98 % r.F.	80 x 65 x 95 cm
Climatic chamber	-70 °C bis +180 °C	10 % r.F. bis 98 % r.F.	80 x 80 x 95 cm
Climatic chamber	-70 °C bis +180 °C	10 % r.F. bis 98 % r.F.	58 x 62 x 75 cm
Climatic chamber	-70 °C bis +180 °C	10 % r.F. bis 98 % r.F.	80 x 65 x 95 cm
Climatic chamber	-40 °C bis +90 °C	15 % r.F. bis 95 % r.F.	3,2 x 2,0 x 2,0 m
Climatic chamber (UV cell)	-20 °C bis +80 °C	-	2,3 x 2,3 x 1,6 m
Climatic chamber	-75 °C bis +120 °C	15 % r.F. bis 95 % r.F.	2,0 x 1,3 x 2,6 m
Climatic chamber	-40 °C bis +80 °C	15 % r.F. bis 95 % r.F.	4,1 x 5,3 x 3,1 m
Shock temperature chamber	-80 °C bis +220 °C	-	47 x 65 x 41 cm
Gas climate chamber	-70 °C bis +180 °C	12 % r.F. bis 98 % r.F.	82 x 80 x 85 cm
Salt spray chamber	RT bis +55 °C	50 % r.F. bis 100 % r.F.	120 x 165 x 57 cm
Low pressure chamber	-40 °C bis +80 °C	-	1,2 x 1,2 x 2,3 m
Dust chamber	-	-	1,0 x 1,7 x 1,5 m
Dust chamber	-	-	80 x 100 x 200 cm
Spray water test equipment	-	-	4,0 x 2,5 x 3,0 m
Vibration and mechanical shock test equipment	-70 °C bis +180 °C	10 % r.F. bis 95 % r.F.	100 x 100 x 100 cm
Solar collector test equipment	-	-	-
Solar simulator	-	-	Modular up to 20 m ²

Environmental Testing



Contact

AIT Austrian Institute of Technology
Mobility Department
Giefinggasse 2 | 1210 Wien, Austria

www.ait.ac.at/mobility

Nancy Brandt
Marketing and Communications

T +43 50550 - 6322

F +43 50550 - 6642

E nancy.brandt@ait.ac.at