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IBC SOLAR

# IBC SOLAR QUALITY: MODULE TEST PROCEDURE

Tested, inspected and certified

# VALUE-ADDED MODULES IBC SOLAR LINE

Certified quality at its best

## Your benefits

- **High-performance cells**
- **Maximum reliability**
- **Outstanding warranties**
- **Extensive quality tests**
- **Independent certifications**
- **German engineering**

### Our products

- Polycrystalline and monocrystalline solar modules are part of the versatile portfolio of the IBC SOLAR LINE.
- Whether it be photovoltaic systems for homes, industry or solar parks - with IBC SOLAR LINE Value-Added modules, you will find the perfect solution for your requirements.

### Our requirements

- All IBC SOLAR LINE modules undergo strict quality tests. We take the opportunity to perform various tests at our own laboratory and at our 3,000 m² test facility.
- Products are only launched once the quality inspections have been passed according to our requirements as well as legal requirements and standards.

### Our promise

- We ensure the best quality at a fair price and provide comprehensive performance commitments and warranties due to the constant enhancement of our test procedure.
- Our internal quality control measures are unmatched throughout the industry, and help us maintain the highest possible standards.
- We also hold international, independent quality certificates from recognised institutes such as TÜV Rheinland, TÜV Süd, Intertek, Fraunhofer ISE and Fraunhofer CSP.

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# THERMAL CYCLING TEST

(MQT 11) – TCT | DIN EN 61215-2:2017-08

**Purpose**

Determining the suitability of PV modules. Thermal mismatches or material fatigue, for example, can be prevented in advance as a result of simulated temperature fluctuations.

**Test device**

Climate chamber with:

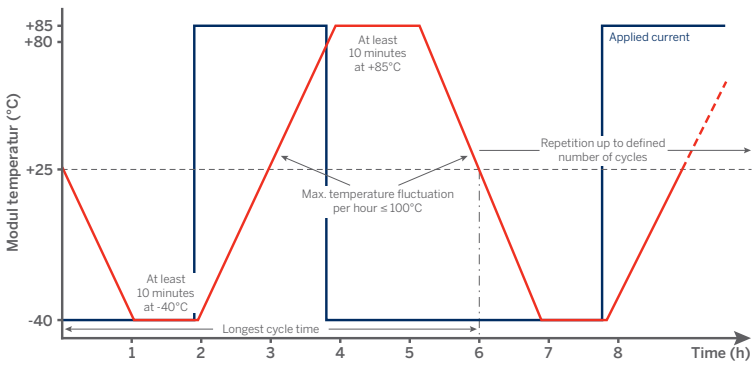
- Automatic temperature control and air circulation
- Function for preventing condensation on the PV module
- Integrated module fastening rails for improved air circulation
- Temperature gauge
- Continuous electricity supply

**Process**

- Attachment and inclusion of PV modules at room temperature
- Temperature influence of -40°C to +80°C with power supply to the PV modules
- Total cycle duration: 6 hours
- Number of cycles: 200
- At least 1 hour recovery time at room temperature

**Tests before and after the inspection**

- Visual inspection (DIN EN 61215/10.1)
- Measurement to determine the maximum output with electroluminescence imaging (DIN EN 61215/10.2)
- Testing the insulation resistance subject to water submergence (DIN EN 61215/10.15)

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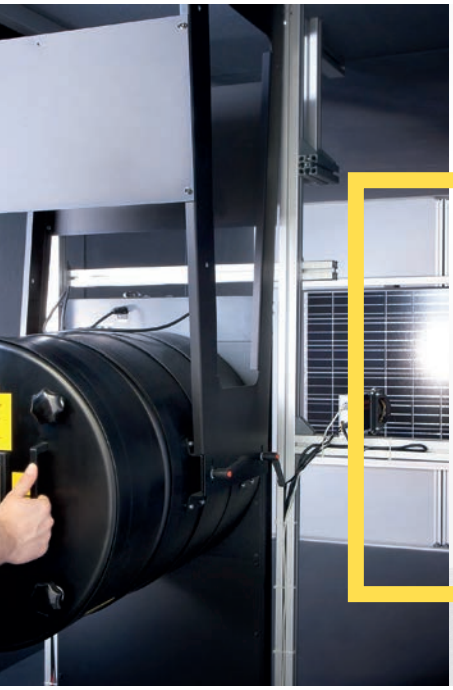


# MAXIMUM POWER DETERMINATION

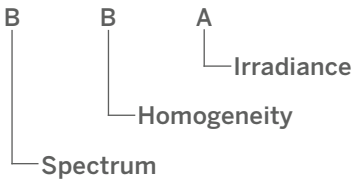
(MQT 02) | DIN EN 61215-2:2017-08

**Purpose**

Determining the highest output of the PV modules before and after environmental impact tests. The defined value is used as the starting point for the incoming goods inspection and processing complaints.

**Test device**

BBA sunlight simulator according to the IEC 60904-9 standard




**Process**

- Comparison object is a PV reference module according to IEC 60904-2 that is stored in a darkroom with UV-reduced light and at a constant temperature of +25°C (±2), therefore its photovoltaic parameters are stable
- The PV reference module and the test module are mounted in a recording device that is vertical to the radiation direction
- The voltage curve is measured according to IEC 60904-1

**Standard**
**Test parameter**

- Radiation strength: 1,000 W/m²
- Test temperature: +25°C (±5)
- Measurement period: 10 ms
- Test period: 2 minutes
- Possibility of low-light measurement from 100 W/m² to 1,000 W/m² in increments of 100

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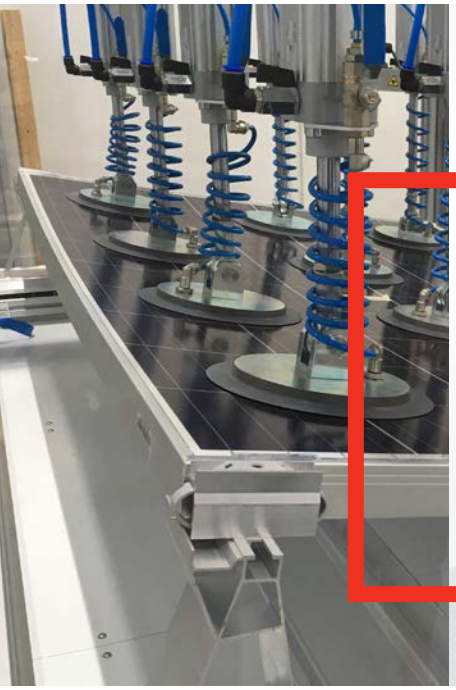

# STATIC MECHANICAL LOAD TEST

(MQT 16) | DIN EN 61215-2:2017-08

**Purpose**

Determining the suitability of the PV module to withstand a static minimum load.

**Test device**

Loading table

- Test rig with a frame made from extruded aluminium profiles for absorbing the mechanical test loads
- 12 pneumatically-controlled test cylinders
- Vacuum cups at the ends of the cylinders enable pressure and suction loads
- Force measurement frame with 4 force sensors to calculate the force exerted on the module/the holder
- Control software to calculate the total force based on signals from the 4 force sensors

**Process**

- Assembling the PV module with the holder stipulated by the manufacturer. If there are numerous attachment variants, all of these variants will be tested
- The design load stipulated by the manufacturer will be applied
  - Positive design load → Download pressure
  - Negative design load → Upward tension
- The same procedure is also applied to the reverse side

**Standard Test parameter**

- Minimum test force: 2,400 Pa (≙244.73 kg/m²)
- Test temperature: +25°C (±5)
- Load duration: 1 hour
- Repetition: 3 cycles
- Load evenness: ±5%

**Tests before and after the inspection**

- Visual inspection (DIN EN 61215/10.1)
- Measurement to determine the maximum output with electroluminescence imaging (DIN EN 61215/10.2)
- Testing the insulation resistance subject to water submergence (DIN EN 61215/10.15)

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# DAMP HEAT TEST

(MQT 13) | DIN EN 61215-2:2017-08

**Purpose**

Determining the suitability of PV modules to withstand the long-term penetration of moisture.

**Test device**

Climate chamber with:

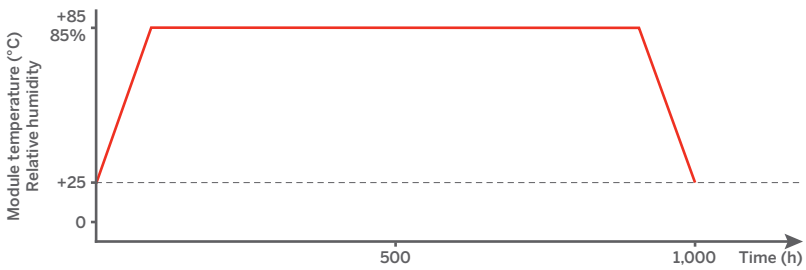
- Automatic temperature control and air circulation
- Function for preventing condensation on the PV module
- Integrated module fastening rails for improved air circulation
- Temperature gauge

**Process**

- Attachment and inclusion of PV modules at room temperature
- Conducting the test according to IEC 60068-2-78 at +85°C and a relative humidity of 85%
- Total cycle duration: 1,000 hours
- At least 2 to 4 hours recovery time at room temperature and a relative humidity below 75%

**Tests before and after the inspection**

- Visual inspection (DIN EN 61215/10.1)
- Measurement to determine the maximum output with electroluminescence imaging (DIN EN 61215/10.2)
- Testing the insulation resistance subject to water submergence (DIN EN 61215/10.15)

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# ELECTROLUMINESCENCE OF PV MODULES

IEC 82/1062/CD:2016

**Explanation**

When applying an electrical voltage to the PV module, light will be emitted by the materials (EL for short) that is captured by an electroluminescent camera.

**Purpose**

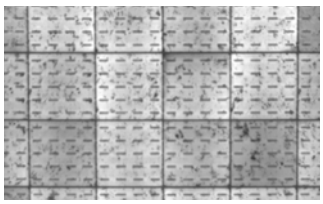
Process of taking and editing electroluminescence images of PV modules and obtaining metrics through this in order to be able to assess the quality of the image results.

**Test device**

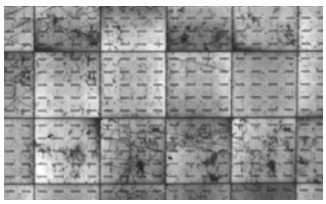
- Camera: Great Eyes GE 2048 2048 FI model
- CCD sensor specification: 2048 x 2048 pixel format
- Camera specifications: Hermetically sealed vacuum head
- Software: Integrated and can be controlled with a PC
  Freely-selectable current and voltage values

**Process**

- The PV module is brought into a darkroom to ensure high-quality images
- The image angle to the surface must be observed
- The connecting cables (+) (-) are connected correctly to the test object
- A foreign light source must not be used
- The electrical DC power supply is fed in with a voltage that Isc must reach. In order to ensure identical image quality, the DC power supply that is applied is not changed for the same module types
- Test temperature: +20°C to +25°C
- A temperature fluctuation of 1°C must not be exceeded during the measurement



*Electroluminescence image of an intact PV module*



*Electroluminescence image of a faulty PV module*

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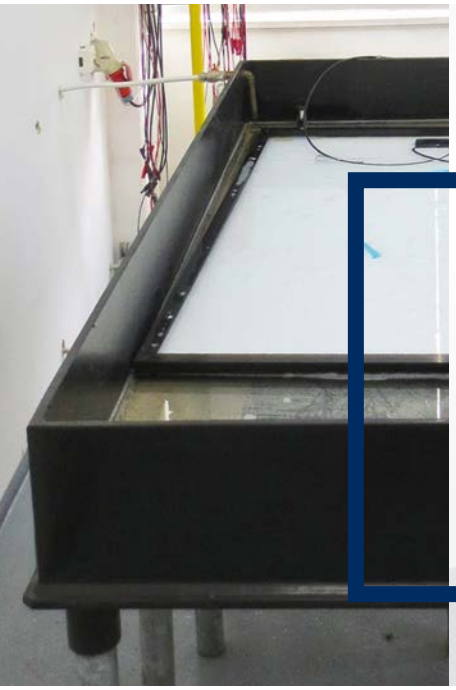


# WET LEAKAGE CURRENT TEST

(MQT 15) | DIN EN 61215-2:2017-08

**Purpose**

Evaluating the insulation of the PV module when exposed to moisture. Rain, dew or melted snow must not enter active parts of the PV module in order to prevent corrosion, earth faults and safety hazards.

**Test device**

Water tank for PV modules with:

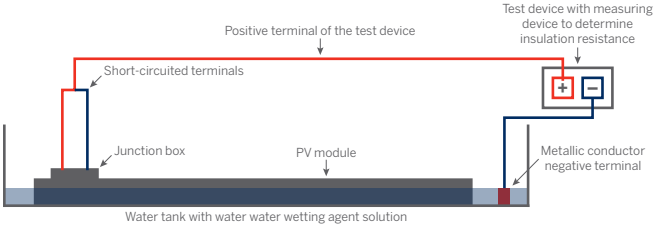
- a DC voltage source that can generate a 1,000 V system voltage and is equipped with a current limiter
- Measuring device to determine the insulation resistance

**Process**

- Prepare water solution agent so that the resistance corresponds to a maximum 3,500 Ω/cm and the temperature is at +22°C (±2)
- Immerse the water wetting agent solution in the water tank until the PV module is covered
- Do not immerse the junction boxes too. They will be covered with the solution
- The short-circuited output terminals of the PV module will be connected to the positive terminal of the test device
- The solution must be connected to the negative terminal of the test device with a suitable metallic conductor
- Test period: 2 minutes
- If modules have an area of greater than 0.1 m², the measured insulation resistance multiplied by the module area must not be less than 40 MΩ x m²

**Example**

Measured insulation resistance for module area exceeding 0.1 m²
IBC SOLAR standard size = 1,600 mm x 990 mm = 1.58 m²
40 MΩ x 1.58 m² = 63.36 MΩ

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# DETECTING VOLTAGE-INDUCED DEGRADATION

DIN IEC/TS 62804-1:2017-05

**Purpose**

System load of PV modules in an environment with humid heat.
Qualification requirement of PV modules for the charge produced by the system voltage during operations. Early detection of degradation to prevent output losses and losses of earnings at an early stage.

**Test device**

Climate chamber

**Process**

- Using a high DC voltage source with current limiter
- Attaching and introducing the PV modules into the climate chambers with temperature and moisture control

**Standard Test parameter**

- Air temperature: +60°C (±2)
  IBC SOLAR conducts tests in a stringent process at +85°C (±2)
- Relative humidity: 85% (±5)
- Test period: 96 hours
- Voltage: 1,000V – 1,500V

**Tests before and after the inspection**

- Determining the maximum output according to DIN EN 612162:2017-08 (MQT02)
- Electroluminescence test according to IEC 82/1062/CD:2016


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