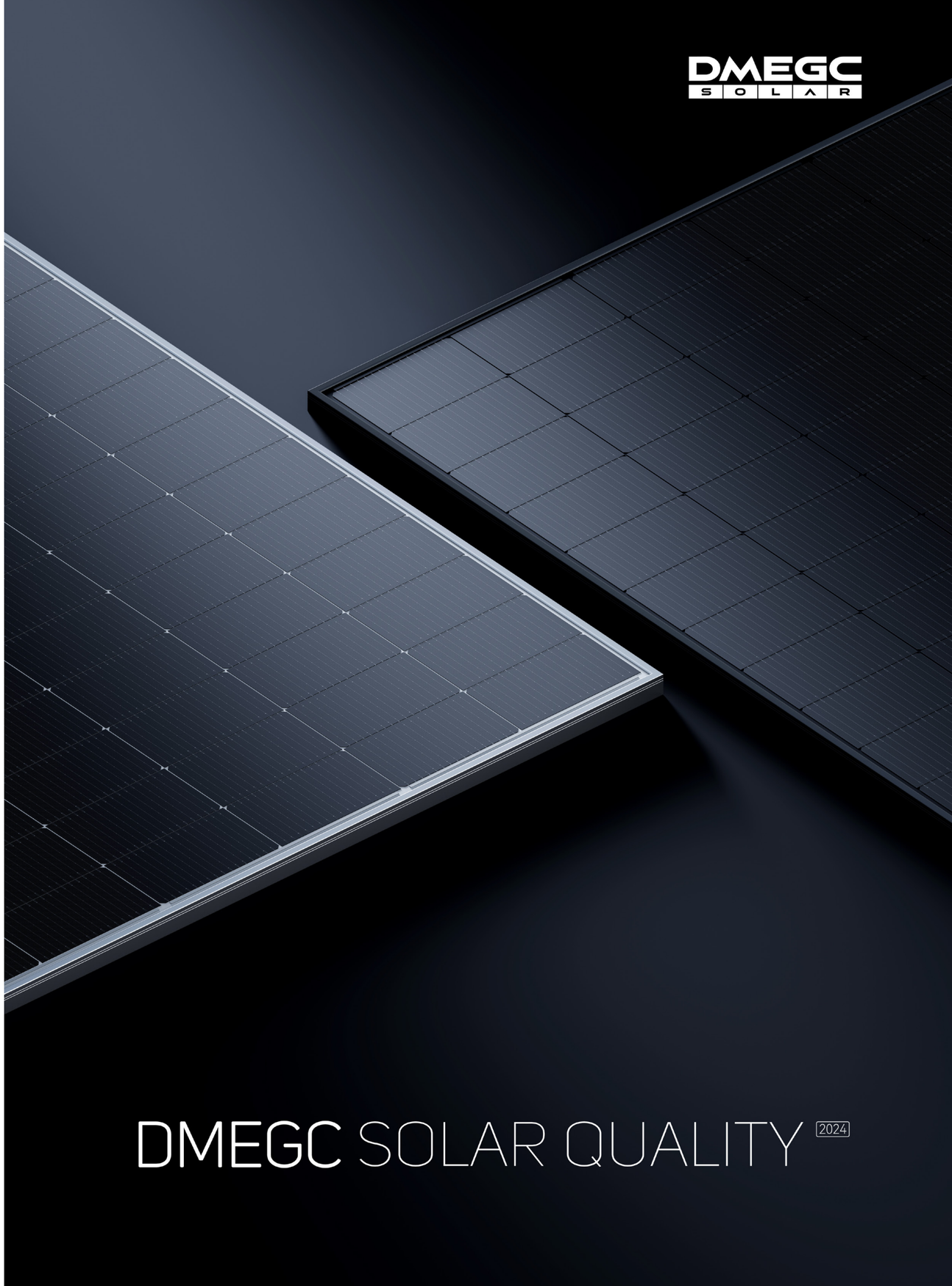
HENGDIAN GROUP DMEGC MAGNETICS CO., LTD.
Add: PV Zone, Hengdian, Dongyang, Zhejiang Province, China
Tel: +86-579-86588601. E-mail: solar@dmegc.com.cn. Website: www.dmegcsolar.com

DMEGC Renewable Energy B.V.
Add: Industrieweg 7, 2641 RM Pijnacker, The Netherlands
Tel: +31 15 369 3131. E-mail: info@dmegc.eu

DMEGC Germany GmbH
Add: Kaiserleistraße 41-43, D-63067 Offenbach am Main, Gemmany
Tel: +49 (0) 69 8008 8192. E-mail: info@dmegc.de

DMEGC Japan CO., Ltd.
Add: Daiwa Jisho Mita Building 4F 3-5-21, Mita, Minato-Ku, Tokyo, 108-0073, Japan
Tel: +81 (0) 3 6722 6601. E-mail: info@dmegc.jp



DMEGC SOLAR QUALITY 2024

Invest in a secure and sustainable future

In addition to healthy and continuous business growth, research and development is essential for guarantees and continuous product improvement.

Quality is important for EVERYONE, but what defines quality in photovoltaic modules? High quality materials, the best workmanship, state-of-the-art production facilities and years of experience - that's what DMEGC Solar stands for.

To back up our promise of the highest reliability and value, we work closely with our customers and leading independent institutes around the world. DMEGC Solar has been focusing on the production of high-quality products for over 40 years and is a long-term strategic industrial partner of the world's top 500 companies.

We are a technology group specializing in two industries. World market leader for magnetic materials and devices and one of the leading companies in the fields of photovoltaics and lithium batteries.

In 2009, the Solar division was founded within the DMEGC Group (Hengdian Group DMEGC Magnetics Co., Ltd.) with the aim of becoming one of the world's leading companies in the field of renewable energies. DMEGC Solar has numerous production facilities with a capacity of more than 30 GW of solar cells and modules.

Extended stress test to ensure long-term stability and investment security

The DMEGC photovoltaic solar modules are subject to a variety of product developments and quality tests. But that's not enough for us!
Our latest N-type double-glass modules from the Infinity series were subjected to eight months of long-term testing at TÜV Rheinland, one of the most renowned testing institutes in the world. As part of the tests, the solar modules were subjected to one of the most demanding stress tests in the industry, IEC TS 63209-1. Our tested solar modules were even able to exceed the requirements, thereby confirming the excellent quality and reliability of our products.

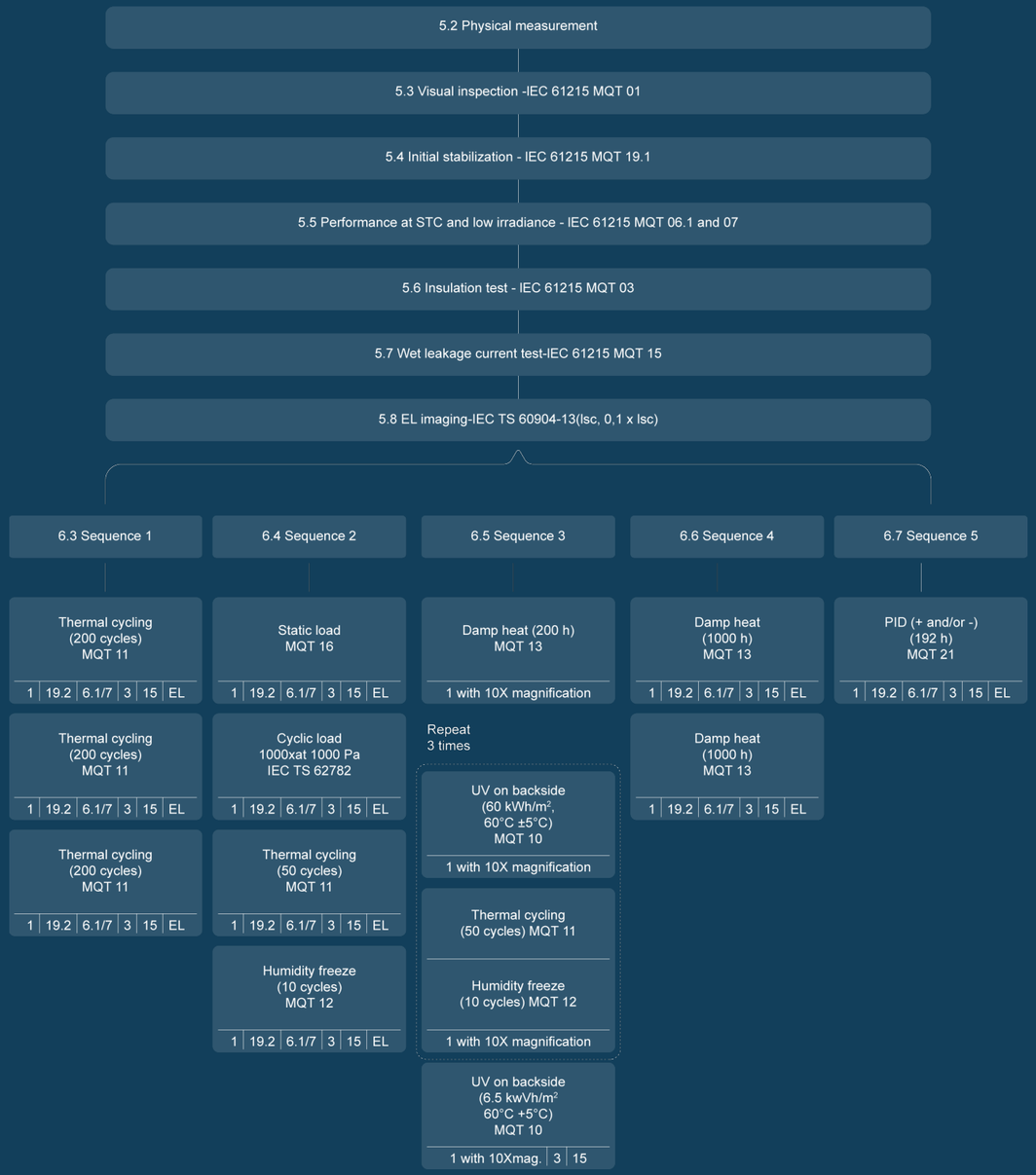
Solar modules are exposed to a wide range of weather conditions. This makes it even more important to ensure that, in addition to the classic requirements, Reliability studies to carry out more extreme stress tests to secure our customers' investions. The spectrum of updated IEC TS 63209 -1:2021 includes assessments such as maximum power point tests, performance tests, environmental adaptation tests, safety performance tests and durability tests. These rigorous tests help us comprehensively evaluate the performance and quality of photovoltaic modules and enable adjustments in product design to improve reliability and durability.

The tests included thermal cycle tests (TC200, TC400, TC600), humid heat tests (DH1000, DH2000), mechanical stress tests (static load SML, dynamic load DML, thermal cycle tests TC50, humid-freeze cycle HF10), ultraviolet composite tests and PID tests (PID192).
The tests will be discussed in more detail on the following pages.

TÜVRheinland CERTIFIED
IEC 61215
IEC 61730
Regular Production Surveillance
www.tuv.com
1D0000090000

IEC TS 63209-1:2021

Overview of certification according to IEC 63209-1



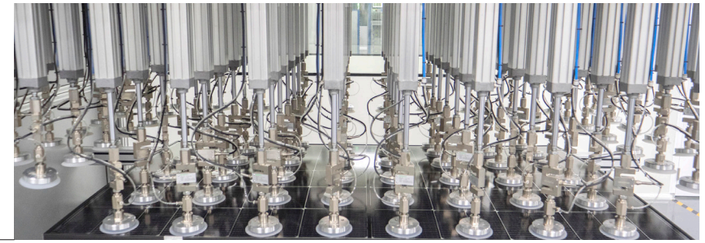
The 5 test areas at a glance - What is behind IEC TS 63209-1

01

Antarctica to desert!
Temperature cycling test (TC)

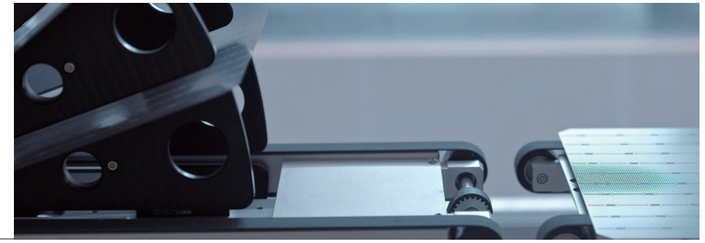
02

The powerhouse!
Mechanical stress with additional temperature changes



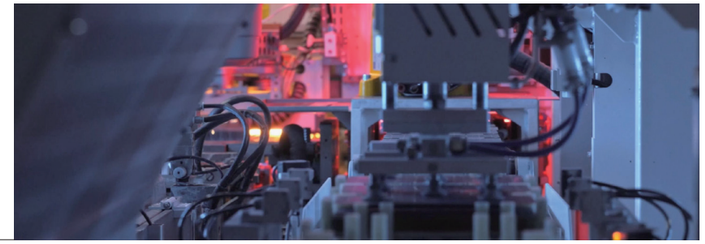
03

The long-lasting one!
To claim
Polymer components



04

Still completely tight?
Humidity and
Heat stress



05

The tension is real!
Detection of
stress-induced degradation

Ensuring test results

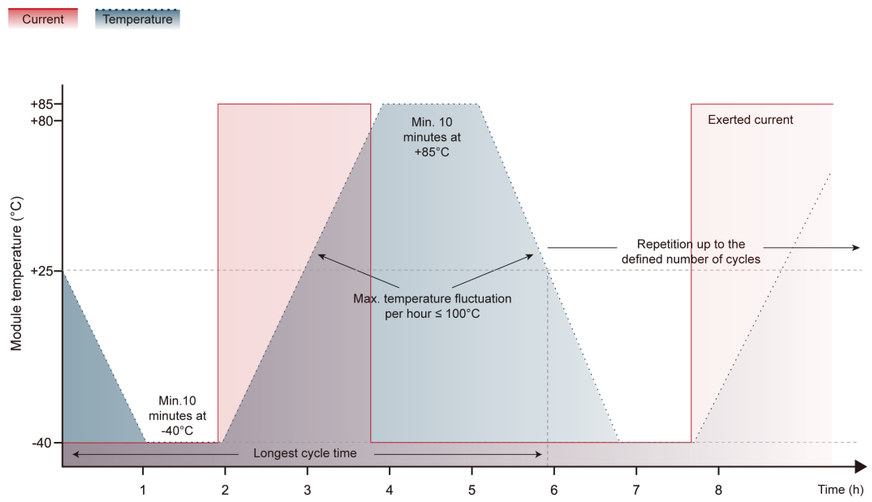
At the commencement of each test sequence, a solar module is subjected to an initial power measurement to ascertain a correlation between the pre- and post-test readings. This is part of the stress tests. In accordance with the specified conditions, the test results are evaluated to determine whether there has been a change in performance during the tests.

Climate chamber tests

Two sequences of the extended stress test are carried out in special test rooms, the climate chambers. Among other things, the solar modules are subjected to a temperature change test from -40°C to +85°C over 600 hours. This is also referred to as TCT, and the number of cycles in the standard procedure is 200 cycles. As part of the extended stress test, this number is increased to 3x200, i.e. 600 cycles.

01 - Antarctica to desert!

Sequence 1: Temperature cycling test (TC) - Thermal cycles 600 cycles = 3x IEC 61215

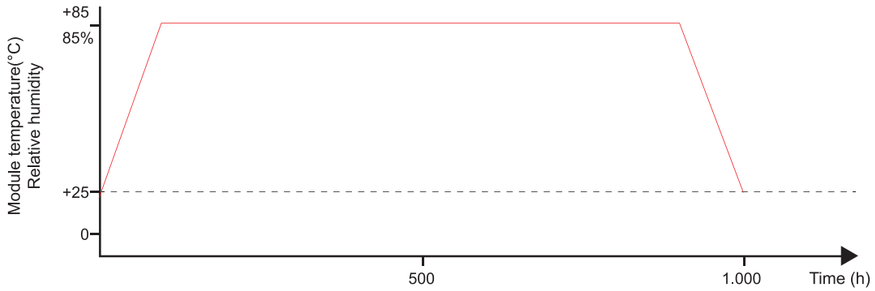


With the help of simulated temperature changes, thermal mismatches and material fatigue, e.g. on cell connectors, can be evaluated. During the test, the temperature is automatically controlled and air is circulated. The modules are first placed in the climate chamber at room temperature. The temperature influence is then determined by arctic -40°C raised to hot up to 85°C within a cycle time of 6 hours. Classic IEC tests include 200 cycles. The 600 cycles used in IEC TS 63209-1 are based on calculation models that show that between 400 and 600 cycles correspond to a service life in the open field of approximately 25 years. This depends on the installation location and the prevailing climate and allows more specific quality tests, for example with regard to the fatigue of soldered joints.

Still completely tight?

Sequence 4: Humidity and heat stress - DH 2000h = 2x IEC 61215

This test in the climate chamber assesses the suitability of solar modules to withstand long-term penetration of air humidity. An extended stress test on the materials used, in particular for the films used. The aim is to assess possible degradation and loss of performance due to excessive moisture penetration and subsequent chemical reactions with the materials used. If failure is detected in this test, it indicates a possible failure in the field.
In this double damp heat test, the modules are tested at a temperature of 85°C and a relative humidity of 85% for a total of 2000 hours.



Choosing the right materials for solar modules is crucial to ensuring quality and durability. In the standard IEC test of just 1000 hours, the solar modules must not show more than 5% performance degradation and no obvious damage after the test. Double-glass modules from DMEGC Solar, which were tested for 2000 hours by TÜV Rheinland, only showed a degradation value of 1.65%. Proof of the quality of our solar modules.

In the double test with 2000 hours, the investigation at TÜV Rheinland showed a very good value of only 1.65% degradation.

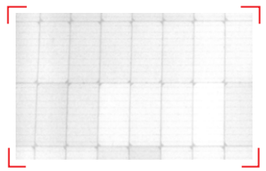
Mechanical Stress tests

The powerhouse!

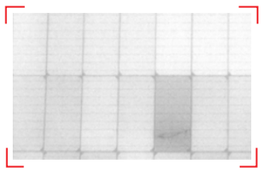
Sequence 2: Mechanical loading

The new mechanical stress test, which simulates both static and dynamic loads, shows a realistic evaluation of different stress sources in the life cycle of the solar modules, which in turn can lead to different failure modes or accelerate the same failure mode at different rates. The result would be a reduction in performance.

The results of the static load test on DMEGC solar modules using the proposed sequence showed that no cell cracks occurred in the cells. The dynamic load test also did not lead to cracks in the cells.

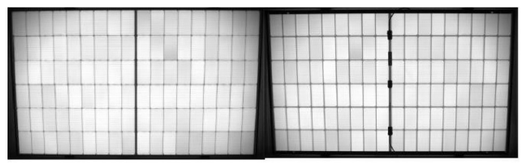


EL images of a intact
DMEGC PV module

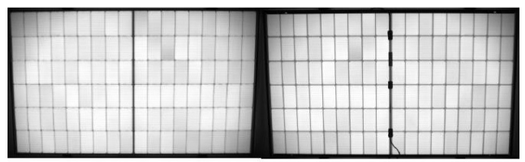


EL image of a faulty
PV module

Electroluminescence measurement



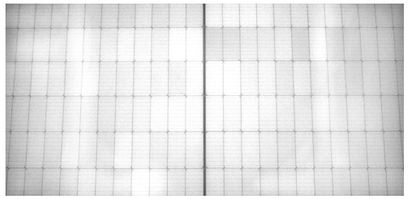
before



after

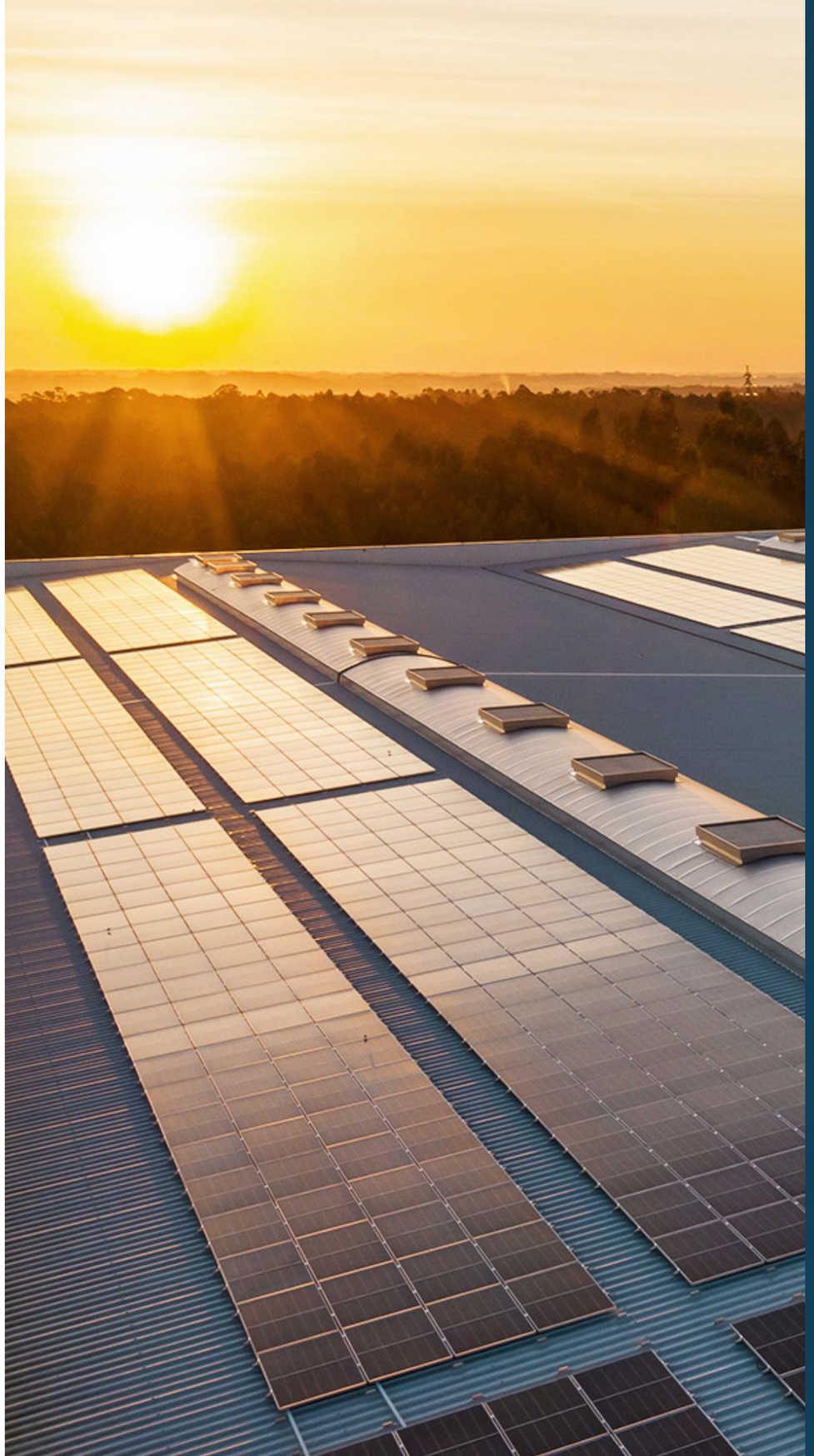
The tension is real!
Sequence 5: Voltage induced degradation detection = 2x IEC 61215 PID protocols

This test uses a high-voltage direct current source with current limitation. The modules are also located in a climate chamber in which both the temperature and the humidity can be regulated. Both the "plus" and "minus" polarity were included in the tests. The duration of the test is 196 hours at a relative humidity of 85% and a temperature of 85 °C.
The purpose of the study is to evaluate the load on the PV modules in an environment with humid heat. The quality test carried out allows the simulation of the charge on the module generated by the system voltage during operation. In this way, performance losses and yield losses can be detected early and thus avoided.



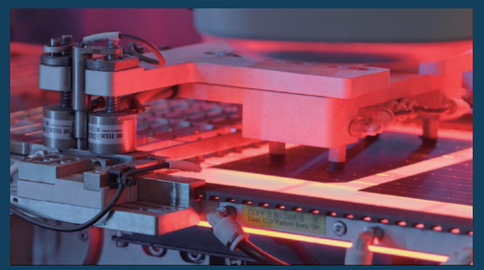
The long-lasting one!
Sequence 3: Combines UV, humidity and temperature/mechanical changes to stress polymeric components.

It is known in many industries that outdoor weathering, such as UV radiation combined with water, can cause representative degradation faster than either exposure alone. Therefore, the order of Sequence 3 aims to provide one of the toughest combinations of these variants.



In IEC 6 1 7 3 0 and in the extended exposure protocols, the UV exposure was gradually increased from 15 kWh/m^2 over 60 kWh/m^2 per side to 120 kWh/m^2 increased in some tests. The UV dose of 120 kWh/m^2 is applied to both the front and back of the modules to achieve maximum UV exposure. The addition of temperature cycling at the end of the process serves as a further stress test after the modules have already been thermally-mechanically weakened by heat and humidity.

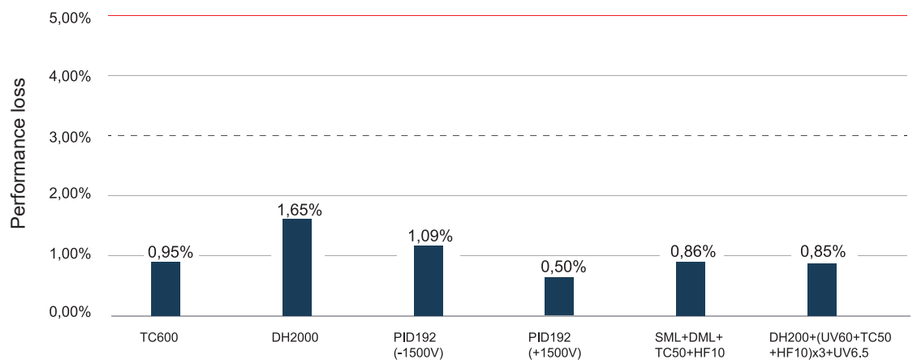
The aim is to avoid discoloration of the encapsulation, discoloration of the backsheet on the front and back, cracks in the backsheet and chalking/erosion, delamination, corrosion and integrity of the edge sealing on the solar modules.



The results of all tests demonstrate the excellent performance of the DMEGC Infinity N-type solar modules examined in terms of all reliability assessments. The degradation rate, which is well below the IEC standard of 5%, remained within 2% in all basic and enhanced test sequences including TC, PID, DH, UV and DML. Of particular note is the fact that the PID degradation dropped below 0.6%. This overall performance not only surpasses that of P-type modules of the same size, but is also better than that of most N-type modules from other manufacturers. It should be noted that no significant changes were observed before and after electroluminescence detection, which underlines the extremely high reliability of the modules.

It is noteworthy that the modules tested were randomly selected from the mass production of model DMXXXM 10T-B78. The outstanding reliability performance confirms DMEGC Solar's position as an industry leader in module reliability. The outstanding test results of DMEGC solar modules ensure their reliability in a wide range of application areas and deployments, increasing value for users and paving the way for limitless possibilities in the development of photovoltaics.

TÜV Rheinland test results



Results of the extended stress test IEC TS 63209-1

Power degradation of a bifacial N-type double glass module

The solar power itself

We are committed to greater independence - both for single-family home owners and for commercial and industrial customers. Photovoltaics as the heart of the energy transition - and you – right in the middle. Energy solutions for a livable and sustainable world from one of the leading manufacturers in the field of renewable energies and magnets since 1980.

My family, my house, my energy

High-quality ⟶ Excellent DMEGC product quality through optimally selected materials

secure ⟶ Reliability thanks to certified and tested components

Economically ⟶ High cell and therefore module efficiency at moderate costs

Guaranteed ⟶ up to 25 years product warranty and 30 years linear performance guarantee

Sustainable ⟶ 100% renewable energy in all module production facilities, the first TÜV Süd certified CO_2 - neutral module production, very low CO_2 footprint, industry leader in France EPC and project business, PFAS- free solar modules

Transparent ⟶ fair and transparent supply chains in compliance with ethical and social standards along the value chain, ESG certified, SA 8000 certification, Solar Power Europe Member, manufacturer in the world's leading Solar Stewardship Initiative

The goal is always clearly in sight. Safe, transparent, economical, high- quality and sustainable – that is what DMEGC Solar stands for. The Future Is Solar = The Future Is Sun