



## Stress tests

<b>PV module qualification</b>	<b>Benchmarking</b>	<b>Components</b>
<b>PV module certifications</b>	<b>BIPV</b>	<b>PV plants</b>
<b>Performance characterisation</b>	<b>Mounting systems</b>	<b>Certification of installation firms</b>
<b>Stress tests</b>	<b>Calibration</b>	<b>Solar thermal systems</b>
<b>Quality assurance</b>	<b>R&amp;D and consulting</b>	<b>Other product tests</b>

Test your products also outside the specified standard test conditions in order to include particular stress factors, and thereby create added value and a unique selling point.

### Why do we need expanded stress tests?

The tests according to the international standards on design and safety certification include mechanical and climatic stress tests for the accelerated ageing of PV modules. These tests are intended to ensure that even after many years of operation under the different weather conditions the PV modules will continue to perform reliably and safely. There exist environmental conditions, however, under which the tests at standard test conditions cannot be regarded as sufficient. TÜV Rheinland therefore offers in addition to the standard tests numerous other possibilities in the form of individual tests incorporating particular stress factors.

Manufacturers profit from the support of development, from the tested safety for actual load capacity and warranty conditions and from the employee benefits of sales & marketing through the creation of a unique selling point.

The expanded stress tests are also of interest to investors and owners. The tests aid selections for specific purposes, and also serve as indicators for ensuring yields and the return on investment.

TÜV Rheinland provides all testing equipment. Thanks to our own research activities, new market requirements can be quickly implemented and brought to test maturity. In this way we're also pressing ahead with the development of PV module technology.

Basically TÜV Rheinland offers the following expanded test methods:

**Fire tests**

- Fire tests and determination of normal flammability (DIBt) according to national and international regulations
- Flammability tests for the Italian market

TÜV Rheinland is intensively concerned with the requirements on fire tests and actively participates in the continued development of test methods with the aim of realistic test conducting.

**Corrosion tests**

- Salt spray corrosion test (IEC 61701)  
Severely corrosive atmospheres can cause permanent damage to PV modules. TÜV Rheinland tests modules according to the new test specification, which provides for a cyclical salt spray test and distinguishes between 6 degrees of severity.
- Ammonia corrosion test (IEC 62716)  
PV modules on roofs of agricultural operations may be subject to high ammonia concentrations. Condensation can cause intensified corrosion. On the basis of existing test standards, TÜV Rheinland has developed a new test method for documenting the resistance of PV modules to the effects of ammonia.
- Sulphur dioxide tests  
The Kesternich test is a corrosion test with sulphur dioxide under the conditions of general moisture condensation. The damaging effects of acid rain are simulated.

**Mechanical stress tests**

- Heavy snow load test (5400 Pa)  
The standards require 2400 Pa; in regions with high snow loads testing with 5400 Pa is recommended.
- Inhomogeneous snow load test  
In an elaborate series of trials TÜV Rheinland has developed a new test bench and a test programme for closing an important gap in the checking of compliance with quali-

ty requirements on solar systems. For the first time, snow loads on PV systems mounted on inclined roofs can be realistically simulated.

▪ **Dynamic stress test**

The testing systems from TÜV Rheinland allow dynamic stressing of PV modules with pneumatic push & pull-type cylinders for practically any type of installation. Wind pressure and suction situations can then be reconstructed.

**Combined long-term tests**

In many cases, manufacturers today guarantee a minimum performance capacity of over 25 years for PV modules. The standardisation tests are designed to verify basic suitability under usual climatic conditions and to identify early failures. With a duration of about nine months, combined long-term tests by TÜV Rheinland extend far beyond the requirements and assess the performance characteristics of the solar modules on the basis of several combined external variables. A test method is amongst others applied in which UV irradiation and damp heat are combined.

**Outdoor long-term tests in different climate zones**

The global distribution of TÜV Rheinland's solar laboratories allows installing specimens in the widest variety of climate zones over long and variable periods of time and tracking the quality characteristics as well as the energy yield.

**Indoor long-term tests**

Each climate chamber test conforming to the standard can be performed for an arbitrary period of time at TÜV Rheinland – the process 'test to failure' is being of interest here.

**Transport and environmental simulation on PV module shipping units**

During transport, PV modules are subject to mechanical stress from vibrations and shocks. A combined test sequence of transport simulation and subsequently simulated environmental stress can determine whether preliminary damage from transport has occurred that can affect the longevity and performance of the PV module.

Always a good sign.



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