Quality assurance of PV modules

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

Quality minimizes risks and ensures you sustained success. We support you with a wide range of services up to qualification and certification and beyond.

Quality assurance of photovoltaic modules
Quality monitoring and quality assurance are crucial in the production of PV modules – particularly because PV module manufacturers must grant long warranty periods to remain competitive. Errors occur in the greatest variety of processes, such as the goods receipt inspection of the components, handling, the production process itself, given incorrectly adjusted machinery or operating errors on the part of personnel, and even in goods issue and transport. TÜV Rheinland offers measures in parallel with development, as well as spot checking or regular auditing of on-going production. The following listed quality assurance tests offer support to manufacturers, retailers and investors which is required for transparent quality.

PID – potential-induced degradation
Voltage-related power degradation can have different effects on modules, resulting in power loss by up to 30%. In case of successfully passed PID test it is certified via the keyword “PID resistant” that the PV module type is resistant to these effects in practice.

Electroluminescence imaging
EL imaging and differential images render micro-cracks and damage in the cell group visible. In the infrared range ultra-sensitive cameras are able to detect contacting or cell discontinuities, for contactlessly determining cell and contacting quality. Damages of the cell interconnection can arise from production, mechanical stress or transport, for example.

Infrared imaging
Infrared imaging offers another possibility for fault analysis. Poor contact points at soldered spots, degradation at the encapsulation materials and other effects, such as local hot-spots, can be quickly rendered visible. This tool also serves quality assurance during production or operation.

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Determination of the cross-linking level of EVA
Insufficient cross-linking levels in the EVA embedding material indicate process or material defects, such as inferior lamination quality. For detecting and avoiding such serious defects, determination of the cross-linking level is an important part of the module quality check. Hereby the long-term usability of the products is ensured.

Rip-off test
The test is performed on specially prepared test strips on finished modules and checks the adhesive and retaining forces of the lamination composite.

Pull tests
For determining the adhesive and contact properties and quality of adhesive bonds and soldered joints between different components (e.g. junction box, back rails and frame, etc.), the characteristic forces are studied with pull tests by means of pulling machines which lead to failed junctions.

RoHS conformity testing
The European RoHS directive limits the use of certain hazardous substances, such as lead, in electrical goods. As a neutral third party, TÜV Rheinland can test the RoHS conformity of the module and confirm the conformity with a TÜV Rheinland certificate.

Identification of products and components
Different identification methods are available, such as the creation of grinding patterns by our own materials experts. The analyses provide information on the quality and properties of the products and components. The traceability to standards is also helpful in uncovering imitations.

Pre/post-shipment inspections
Worldwide production sites, continually increasing numbers of target markets and an increasingly faster turnover of goods necessitate high-quality services for ensuring the quality of the products. TÜV Rheinland offers quality assurance measures involving production spot checking by our global network of inspectors and pre-shipment inspections, with quick quality checks on arrival of the products at the construction site or interim storage facility.

Ageing of micro-cracks
PV modules from the field may exhibit micro-cracks. The long-term effects caused by these can be determined in various lab tests by the simulation of real-life weather events at the installation site via the potentially reduced output power. These intensive lab measurements may help to derive information about potentially stressed and damaged products.

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