

Solar Module Testing - Electrical

WHAT IS ELECTRICAL SOLAR MODULE TESTING?

Electrical tests are conducted to verify that the solar module can withstand electrical overloads without compromising safety, performance or integrity. Additionally electrical tests are conducted after environmental and mechanical test inputs to confirm that the module has not been adversely affected. We are continually working to expand our solar testing capabilities; please go to our website (www.westpak.com) for the most current list of tests that we offer. Additional ASTM, IEC, IEEE, UL or other test inputs may be available upon request.



Electrical Tests

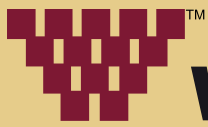
Name of Test	Brief Explanation (Test Specifications may vary)	Typical Test Specs
Ground Path Continuity / Bonding Path Resistance	Electrical continuity test. Verifies adequacy of all electrical continuity between all exposed conductive parts and the grounding point under high current conditions.	IEC 62108 -10.3 IEC 61730-2-10.4 UL 1703 - 25 IEEE 1262 - 5.3 IEEE 1513 - 5.3 ASTM E 1462 - 7.3
Electrical Isolation (Including Wet / Dry Hipot, Leakage Current and Dielectric Voltage Withstand Tests)	Measures the quality of electrical insulation under various conditions. Verifies the adequacy of electrical insulation between all active parts of the power generating circuit and the frame or the outside world.	IEC 61215 -10.3 IEC 62108 -10.4 / 10.5 IEC 61646 - 10.3 UL 1703 - 21/26/27 IEC 61730 -10.6 ASTM E 1462 -7.1/7.2 IEEE 1262 - 5.4, 5.5, 5.6 IEEE 1513 - 5.4, 5.5, 5.6
Bypass/Blocking Diode Terminal Test (Non-intrusive)	Electrical performance of blocking and bypass diodes. Assesses the adequacy of the thermal design and the relative long-term reliability of bypass/blocking diodes used to limit the detrimental effects of system hot-spot susceptibility.	IEC 61215 -10.18 IEC 61646 -10.18 IEC 62108 -10.11 IEEE 1262 - 5.15 IEEE 1513 - 5.12
Impulse Voltage	Verify insulation can withstand over-voltages.	U. L. 1703 --21

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Solar Module Testing - Mechanical

WHAT IS MECHANICAL SOLAR MODULE TESTING?

Mechanical test inputs are used to simulate physical hazards that the module may see in the field. Verifying the robustness of the product's materials and construction is vital in developing a module that will withstand the test of time. We are continually working to expand our mechanical solar testing capabilities; please go to our website (www.westpak.com) for the most current list of tests that we offer. Additional ASTM, IEC, IEEE, UL or other test inputs may be available upon request.



Mechanical Tests

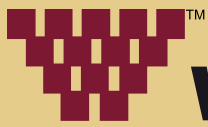
Name of Test	Brief Explanation (Test Specifications may vary)	Typical Test Specs
Terminal Robustness	Tensile and/or torque test on electrical terminations. Assesses the ability to withstand the normal stresses associated with handling and installation.	IEC 61215 -10.14 IEC 61646 -10.14 IEC 62108 -10.12 UL 1703 - 22 UL 1703 - 28 IEEE 1262 - 5.9 IEEE 1513 - 5.9
Static Mechanical Load Test	Mechanical loading to simulate extreme wind conditions. Determines the ability of the module to withstand wind, snow, ice, or other static loads.	IEC 61215 - 10.16 IEC 61646 - 10.16 IEC 62108 - 10.13 UL 1703 - 39 IEEE 1262 - 5.11
Impact Test	Verifies the system under test can withstand impact forces.	U. L. 1703 --29
Surface Cut Susceptibility	Verifies the covering substrate can withstand surface cuts.	UL 1703 - 24 IEEE 1262 - 5.12 IEC 61730 - 10.3
Junction Box Securement	Verifies the junction box can withstand tensile pull forces.	UL 1703 - 39
Hail Impact Test	Simulated hail impacts. Determines the ability to withstand and survive a severe hailstorm. (Available May 2009).	IEC 61215 - 10.17 IEC 61646 - 10.17 IEC 62108 - 10.9 ASTM E 1038 ASTM E 822 IEEE 1262 - 5.14 IEEE 1513 - 5.11

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Solar Module Testing - Environmental

WHAT IS ENVIRONMENTAL SOLAR MODULE TESTING?

Environmental tests are extremely important as they simulate extreme temperature and humidity conditions and fluctuations in an accelerated manner. Measuring the performance and reliability of modules exposed to these adverse conditions helps to insure they will survive years of inclement weather once they are in use. Westpak can offer module temperature and electrical data logging throughout the duration of the test, as well as a simulated load input. We are continually working to expand our solar-related environmental testing capabilities; please go to our website (www.westpak.com) for the most current list of tests that we offer. Additional ASTM, IEC, IEEE, UL or other test inputs may be available upon request.



Environmental Tests

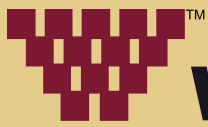
Name of Test	Brief Explanation (Test Specifications may vary)	Typical Test Specs
Thermal Cycling	Rapid cycling of temperature extremes between -40°C and +85°C or +90°C for 200 cycles at 6 hours per cycle. Test for the ability to withstand thermal mismatch, fatigue, or other stresses caused by rapid, non-uniform, or repeated changes of temperature.	UL 1703 - 35 IEC 61215 - 10.11 IEC 62108 - 10.6 IEC 61646 - 10.11 IEEE 1262 - 5.7 ASTM E 1171 - 6.5 IEEE 1513 - 5.7
Humidity Freeze Cycling	Rapid cycling of both temperature and humidity extremes. Similar to thermal cycling with high humidity. Typically ten 24 hour cycles. Determines the ability to withstand high temperature and high humidity followed by freezing temperatures.	UL 1703 - 36 IEC 61215 - 10.12 IEC 61646 - 10.8 IEC 62108 - 10.8 ASTM E 1171 - 6.6 IEEE 1262 - 5.8 IEEE 1513 - 5.8
Damp Heat Test	+85° C & 85% RH for 1000 hours. Tests for the ability to withstand the effects of long-term penetration of humidity.	IEC 61215 - 10.13 IEC 62108 - 10.7 IEC 61646 - 10.13 IEEE 1262 - 5.13 ASTM E1171 - 6.7 IEEE 1513 - 5.10

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Solar Module Testing - Other

OTHER SOLAR MODULE TESTING CAPABILITIES

Photovoltaic technologies will play a vital part in the world's energy supply as the costs and negative impacts of traditional energy technologies continue to grow. One of the challenges of this technology is producing modules that are robust enough to withstand the environmental, mechanical, electrical and other challenges that will be encountered throughout the product's life cycle. Westpak has the knowledge and expertise to help you verify your product's durability; giving you a high degree of confidence in a module's real-world reliability.

With the complex construction of solar modules some test inputs don't clearly fall under a given category. Westpak understands that the development of photovoltaic systems require a multitude of specialized testing services. In addition to the listed test inputs Westpak has the capability to perform various tensile, compression, vibration, shock, pressure and other tests as required by your product's design. Westpak can also perform fragility and transit testing of packaged units. Please go to our website (www.westpak.com) for more information about other testing services that we can provide.

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Other Tests

Name of Test	Brief Explanation (Test Specifications may vary)	Typical Test Specs
Temperature Coefficients	Determines the effect of temperature on the current, voltage, and peak power output of a module.	IEC 61215 -10.4 IEC 61646 -10.4
Temperature Test	Verify the system can withstand high heat without showing signs of stress or deformation.	IEC 61730 - 2 -10.7 UL 1703 -19
Visual Inspection	Visually inspect systems for damage and compliance with design criteria.	IEC 61215 -10.1 IEC 62108 -10.1 IEC 61646 -10.1 IEC 61730 - 2 -10.1 IEEE 1262 - 5.1 IEEE 1513 - 5.1 ASTM E 1799