TESTING AND MEASURING EQUIPMENT/ALLOWED SUBCONTRACTING

Crystalline silicon terrestrial photovoltaic (PV) modules – Design qualification and type approval

IEC 61215 2nd Edition (2005)

R = Required by Lab
S = May be subcontracted

Clause	Measurement / testing	Testing / measuring equipment / material needed	Sub-contracting
10.1	Visual inspection	- Lamp: Illumination > 1000 lux - Camera - Vernier calliper, measuring tape	R
10.2	Maximum power determination	- Class A or Class B sunlight simulator in accordance with IEC 60904-9 or test installation using natural sunlight - PV reference device in accordance with IEC 60904-2 or IEC 60904-6 - Means to measure temperature with accuracy +/-1°C and repeatability of +/-0.5°C - Equipment to determine the current-voltage characteristic in accordance with IEC 60904-1	R
10.3	Insulation test	- DC voltage source capable of applying 1 000 V plus twice the sample's maximum system voltage - Insulation resistance meter	R
10.4	Measurement of temperature coefficients	- All equipment for 10.2 - Equipment as described in section 10.14 for heating/cooling the module -	R
10.5	Measurement of nominal operation cell temperature (NOCT)	- Test fixture as described in section 10.5 - Pyranometer - Wind speed sensor: Measurement range down to 0.25 m/s - Ambient temperature sensor - Instrument to measure wind direction - Data acquisition system: Temperature measurement accuracy +/- 1°C, data recording interval < 60 s - Reference plates (Reference plate method only)	R
10.6	Performance at STC and NOCT	- All equipment for 10.2 - Equipment to heat the module uniformly to NOCT	R

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10.7	Performance at low irradiance	- All equipment for 10.2 - Means for reducing irradiance to 200 W/m²: • Filters and use of matched-technology secondary reference cell, or • Spectral-neutral irradiance filters.	R
10.8	Outdoor exposure test	- Solar irradiance monitor, accurate to +/- 5% - Means to mount the module co-planar with the irradiance monitor - Resistive load to operate the module near the maximum power point at STC	R
10.9	Hot-spot endurance test	- Natural sunlight or steady-state sunlight simulator (Irradiance >700 W/m², non-uniformity <+/- 2%, Temporal stability <+/- 5%) - Natural sunlight or Class C or better steady-state sunlight simulator (irradiance 1000 W/m² ± 10%) - Equipment to measure the current-voltage characteristic of the module - Opaque covers: Test cell shadowing in 5% increments - Temperature detector	R
10.10	UV preconditioning test	- UV meters working in wavelength ranges 280–320 nm and 320–385 nm with accuracy +/- 15% - UV light source with irradiance non-uniformity in the test plane +/- 15% and total UV irradiance < 250 W/m² - Equipment to control the module temperature in the range 60 ± 5°C - Temperature monitoring equipment with accuracy +/- 2°C	R
10.11	Thermal cycling test	- Climatic chamber capable to produce a temperature cycle in accordance to figure 11 with accuracy +/- 2°C at the low and high extremes. - Means for measuring and recording the module temperature to an accuracy of +/- 1°C. - Means for applying current to the modules - Means for monitoring current through the modules	R

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10.12	Humidity-freeze test	- Climatic chambers capable to produce a temperature/humidity cycle according to figure 12 with accuracy +/- 2°C and +/- 5% relative humidity at the low and high extremes. - Means for measuring and recording the module temperature to an accuracy of +/- 1°C. - Means for monitoring the continuity of the internal circuit of the module	R
10.13	Damp heat test	Climatic chamber capable to carry out the test in accordance with IEC 60068-2-3 (85 ± 2°C, 85 ± 5% relative humidity)	R
10.14	Robustness of terminations test	- Torque test equipment in accordance with IEC 60068-2-21 - Tensile and bending test equipment in accordance with IEC 60068-2-21	R
10.15	Wet leakage current test	- Test apparatus as described in section 10.15.2 - Insulation resistance meter - DC voltage source capable of applying a test voltage >500 V	R
10.16	Mechanical load test	- Test apparatus, capable of applying a uniform load corresponding to 2400 Pa on the module surfaces - Means for monitoring the continuity of the internal circuit of the module	R
10.17	Hail test	- Test apparatus as described in section 10.17 with a velocity repeatability of +/- 5%. - Instrument for velocity measurement with an accuracy of +/- 2%, no more than 1 m from module impact surface - Weighing instrument with an accuracy of +/- 2% - Freezer and container for production and storage of ice balls - Apparatus to verify ice ball diameter to within +/- 5% of requirement and mass within +/- 5% of requirement.	R

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10.18	Bypass diode thermal test	- Test apparatus to heat the module to temperature 75°C +/- 5°C - Equipment for monitoring diode temperatures with accuracy +/- 1°C - Equipment for applying a constant current through the bypass diodes - Equipment for monitoring current	R