



# Gulf Renewables Laboratory

A UL-GCCLAB Joint Venture



**GCC Electrical  
Testing Laboratory**

المفتبر الفليجي لفحص المعدات الكهربائية

## GCC Electrical Testing Laboratory

المختبر الفليبي لفحص المعدات الكهربائية

GCC Lab, in a joint venture with UL, established the first and most sophisticated independent Renewable Innovation center in MENA region; namely Gulf Renewables Lab (GRL), to enable major transformation in utilizing renewable energy resources, including solar, wind and others.

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**GCC Electrical Testing Laboratory**  
المختبر الفليبي لفحص المعدات الكهربائية





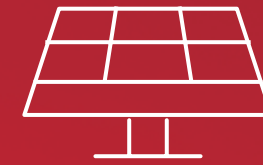
**GCC Electrical Testing Laboratory**  
المختبر الخليجي للمعدات الكهربائية

GRL is a unique localization enabler that provides advanced Testing, Inspection and Certification (TIC) services, for components, materials, products and systems, covering the entire value chain. The GRL services portfolio also covers advisory services, resources assessment and bankability studies, technical services, performance assessment, specialized training and certification and RandD services.

Based in KSA — Eastern Provenance — Third Industrial City, GRL will contribute fundamentally to the achievement of localizing renewables knowledge, manufacturing, standards, innovation and promoting alternative energy applications in-line with the regional climatic conditions. GRL services covering GCC countries, Iraq, Yemen, Jordan, Lebanon and Egypt.



**GRL Business Portfolio**



**Solar PV Product Qualification**



**Bankability and Engineering**



**Training and Certification**



**Research and Development**



**Mission**

Advance safety, efficiency and innovation in the renewables sector by delivering world class services and solutions enabled by highly skilled people, efficient workflows and state of the art operating facilities.



**Vision**

Achieve global leadership in testing, inspection, certification, consultation, and innovation in renewables sector.



# Solar PV Product Qualification

Solar has been proven as a cost effective and reliable energy source. Technological advancements over the last five years have placed solar energy in a firm position to compete with conventional power generation technologies. GCC region has a vast uninhabited land area with high solar resources presenting opportunities for Solar PV Systems.

Polymeric materials are essential to the fabrication of PV modules and used in critical components such as substrates, encapsulants, back sheets and adhesives. Design and safety compliance with established standards minimizes risk of failure and helps ensure safe operation, covering such areas as flammability, resistance to ignition, thermal endurance and electrical properties.



## Visual Inspection Test

### Objective

To detect any visual defects in the module under no less than 1000 Lux.

Examples: Broken, cracks, Bubbles or delamination, cells overlaps.

### Equipment

- Inspection board (vertical)
- Camera
- Caliper
- Luxmeter

### Reference

IEC/UL 61215 and IEC/UL 61730



## Performance Measurement

### Objective

- Verify Power, voltage and current at STC (1000 W/m<sup>2</sup> ±10 % , 25 °C cell temperature)
- Determine electrical parameters of PV modules including power, voltage and current at various conditions.

### Equipment

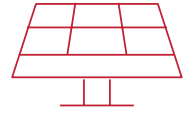
AAA+ Pulse sun simulator

### Reference

IEC/UL 61215 and IEC/UL 61730







## Solar PV Product Qualification



### Wet Leakage Test

#### Objective

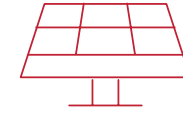
To evaluate insulation under wet operating conditions and verify that moisture from rain, fog, melted snow do not enter the active parts.

#### Equipment

- Insulation resistance tester
- High voltage D.C. source
- Water container (for standard and oversized modules)

#### Reference

IEC/UL 61215 and IEC/UL 61730



## Solar PV Product Qualification



### Thermal Cycling Test

#### Objective

To determine the ability of the module to withstand thermal mismatch, fatigue and other stresses caused by repeated changes of temperature.

#### Equipment

- Climatic chamber (simulates heat, cold , humidity).
- Power supply rack and temperature sensors

#### Reference

IEC/UL 61215 and IEC/UL 61730



### Insulation Test

#### Objective

To determine whether or not the module is sufficiently well insulated between live parts and accessible parts.

#### Equipment

- Insulation resistance tester
- High voltage D.C. source
- Dry table

#### Reference

IEC/UL 61215 and IEC/UL 61730

### Humidity Freeze Test

#### Objective

To determine the ability of the module to withstand the effects of high temperature and humidity followed by zero temperature.

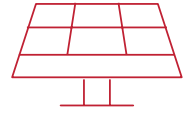
#### Equipment

Climatic chamber - Power supply rack and temperature sensors

#### Reference

IEC/UL 61215 and IEC/UL 61730





## Solar PV Product Qualification



### Damp Heat Test

**Objective**

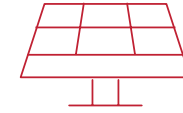
To determine the ability of the module to withstand the effects of long-term penetration of humidity

**Equipment**

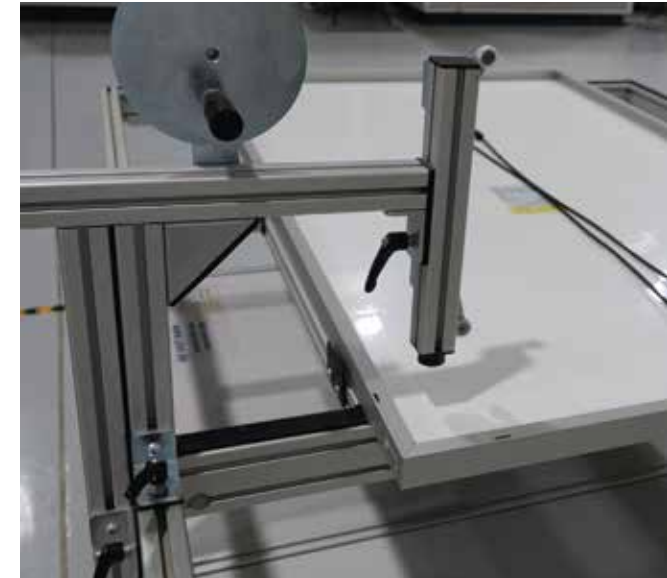
Climatic chamber-Temperature sensors

**Reference**

IEC/UL 61215 and IEC/UL 61730



## Solar PV Product Qualification



### Robustness of Termination Test

**Objective**

To determine the terminations, attachment of terminations, and attachment of cables to body of module will withstand stresses that are likely to be applied during normal assembly or handling operations.

**Equipment**

- Set of weights
- Fixing device
- Table
- Torque force sensor

**Reference**

IEC/UL 61215 and IEC/UL 61730



### Hail Test

**Objective**

To verify that the module is capable of withstanding the impact of hail.

**Equipment**

- Launcher of ice ball
- A Freezer
- Control system

**Reference**

IEC 61215

### Static/Dynamic Mechanical Load Test

**Objective**

To determine the ability of the module to withstand a minimum static load under certain installations and climate.

**Equipment**

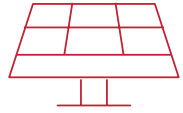
- Instrument to monitor the electrical continuity of the module during the test.
- A rigid test base for mounting the PV module and apply the load

**Reference**

IEC/UL 61215 and IEC/UL 61730







## Solar PV Product Qualification



### Bypass Diode Test

#### Objective

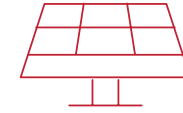
To assess the adequacy of the thermal design and relative long-term reliability of the bypass diodes used to limit the detrimental effects of module hot-spot susceptibility

#### Equipment

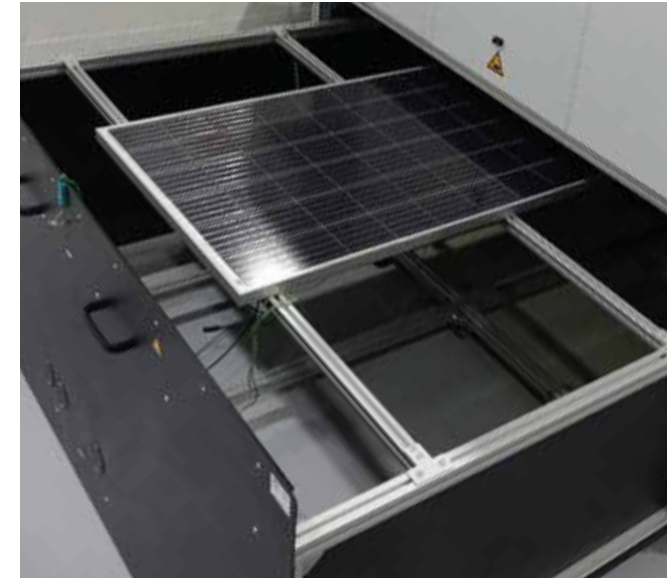
- Heating table
- Instrument to apply multiple of rated current and to measure the voltage drop in diode

#### Reference

IEC/UL 61215 and IEC/UL 61730



## Solar PV Product Qualification



### UV Preconditioning Test

#### Objective

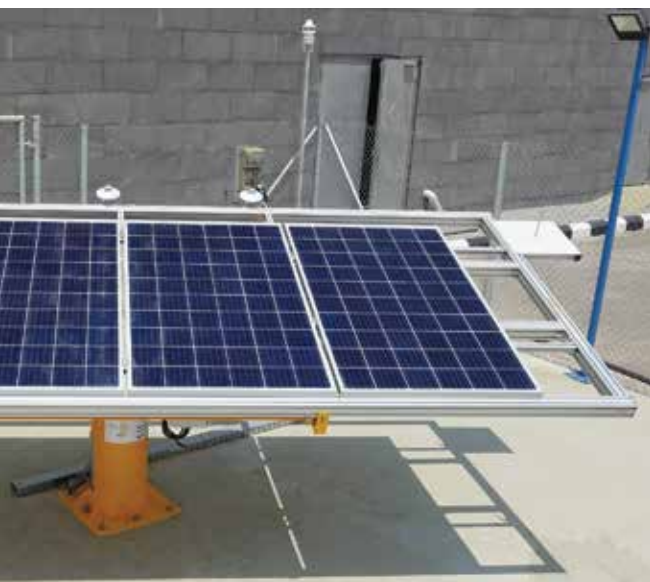
- To evaluate the effect of UV radiation on the module.
- Focus on material made from polymers such as EVA and back sheet.
- To precondition the module with UV radiation before climatic tests.
- Maintain module

#### Equipment

UV Chamber

#### Reference

IEC 61215 and IEC 61730



### Tests in Outdoor advanced System

#### Objective

To perform wide range of outdoor assessments such as:

- Hotspot Endurance test.
- Temperature test.
- Outdoor Exposure test.
- Stabilization test

#### Equipment

- Open rack to support PV module
- Solar irradiation sensor
- Resistive load to measure MPPT
- Monitoring system

#### Reference

IEC/UL 61215 and IEC/UL 61730

### Continuity Test

#### Objective

To verify the continuous path between accessible conductive parts that are in direct contact with each other. (ie metallic frame)

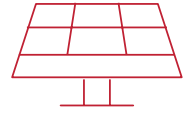
#### Equipment

- Constant current supply
- Voltmeter
- Dry table

#### Reference

IEC 61730





## Solar PV Product Qualification



### Reverse Current Test

#### Objective

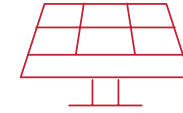
To determine the acceptability of the risk of ignition or fire under reverse current fault conditions the electrical conductors and the cells of the PV module are forced to dissipate energy as heat prior to circuit interruption by an over-current protector installed in the system.

#### Equipment

- Constant current supply
- Voltmeter
- Dry table

#### Reference

IEC 61730



## Solar PV Product Qualification

### Accessibility Test

#### Objective

To provide confidence that risk To determine if PV modules are constructed to provide adequate protection against accessibility to hazardous live parts (> 35 V).

#### Equipment

- A Cylindrical test Fixture
- Ohm meter or continuity tester

#### Reference

IEC 61730



### Module Breakage Test

#### Objective

To provide confidence that risk of physical injuries can be minimized if the PV module is broken in its specified installation.

#### Equipment

- Mounted frame
- Impactor
- Lifting system

#### Reference

IEC 61730

### Peel off Test

#### Objective

Purpose of this test is to qualify insulation as a cemented joint. It shall provide confidence regarding the durability of the adhesion between different layers of rigid-to-flexible or flexible-to-flexible constructions of the PV module stack.

#### Equipment

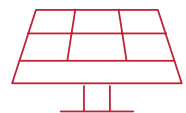
- Tensile testing machine,
- Fixture, for holding the test piece

#### Reference

IEC 61730







## Solar PV Product Qualification



### Cut Susceptibility Test

#### Objective

To determine whether any front and rear surfaces of the PV module made of polymeric materials are capable of withstanding routine handling during installation and maintenance without exposing personnel to the danger of electric shock.

#### Equipment

The defined shaped object shall be a 0,64 mm  $\pm$  0,05 mm thick hardened steel blade sufficiently rigid as not to bend sideways during the test.

#### Reference

IEC 61730







# Solar PV Product Qualification

## Special Tests

### Electro Luminescence (E.L) Imaging

#### Objective

Looking for invisible cracks or micro cracks of the PV cells, defects and failures

#### Equipment

Special camera

#### Reference

IEC 60904-13



### Salt Mist Test

#### Objective

- To determine the resistance of different PV modules to corrosion from salt mist
- 6 Severities test scenarios according to site condition

#### Equipment

- Salt mist chamber
- NaCl solution

#### Reference

IEC 61701



### Potential Induced Degradation Test

#### Objective

To perform a repeatable test which evaluates the crystalline silicon PV module's performance against system voltage stress. Screen for PID susceptibility of Si solar cells in a given module package (glass, encapsulant) with related PID safeguards bypassed.

#### Equipment

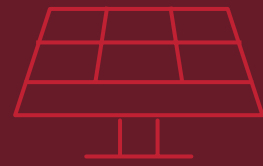
- High voltage source
- Temperature sensors
- Combined temperature and humidity sensor

#### Reference

IEC TS 62804-1







# Solar PV Product Qualification

## On-Site Tests

## Hot Spot Identification

### Objective

To determine the possible locations that could cause a hotspot which might lead to fire hazard.

- Shadowing or soiling
- Mismatched cells
- Faulty cells
- Poor soldering

### Equipment

Special infrared camera

### Reference

IEC 61215 , IEC 61730



## Portable I-V Tracer

### Objective

- Verify Power, voltage and current at STC conditions.
- To measure the current, voltage and power of the each module, row and entire string.

### Equipment

Portable IV tracer

### Reference

IEC 61215 , IEC 61730



## Electro Luminescence (E.L) Imaging

### Objective

Looking for invisible cracks or micro cracks of the PV cells, defects and failures

### Equipment

Special camera

### Reference

IEC 60904-13





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