LG Solar, Module Testing

LG MonoX®

LG NeON®

LG Solar Power
LG solar panels are built to a very high quality standard

They are tested rigorously during design and production

All input materials for panels— from aluminum, to glass & silicon— undergo regular quality control processes

LG expects its panels to be identical so the allowable variances are minimal

In Australia, from 270,000 panels installed between 2011 & April 2016, only 2 panels have been returned. Worldwide, the return rate is less than 10 in 1 million
LG's quality control systems

More than 500 quality control processes and tests applied to every module

- **Input Material checks**
  - Ongoing input material testing

- **Production process control**
  - 2 x 100% EL Test

- **Finished product check**
  - Reliability sampling test every month
  - Each module's data stored for 30yrs in LG system for 100% traceability

- **Loading & transport control**
Long term performance security

LG modules pass key longevity tests

for VDE registration
for PID Test
for Salt Mist Corrosion Test
for Ammonia Resistance Test
* Potential Induced Degradation is a power degradation from exposure to High Voltage Stress.

At the internal PID test, LG tests 4x the IEC standard.
The Damp / Heat test is designed to evaluate a module's performance under high temperatures and high humidity. LG's Damp Heat Test consists of 4 x IEC standard being 4000 hours.

**Power (%)**

- 1000 hrs, 1x IEC: LG 99.9%, LG 95%
- 4000 hrs, 4x IEC: LG 96.5%

*Criteria of 1x IEC standard for pass*
Many manufacturers test their panels to pass IEC standards

LG tests its panels $4x$ the IEC standard to ensure maximum longevity

At the Thermal Cycling Test LG also tests to higher temperatures than IEC standards.

* Criteria of 1x IEC standard for pass
LG Quality Control - Sequential Test

<table>
<thead>
<tr>
<th>Test</th>
<th>International Standards (IEC)</th>
<th>LG Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No IEC Sequential Standard</td>
<td>Damp /Heat 2000 hrs</td>
</tr>
<tr>
<td></td>
<td>(LG’s own developed test)</td>
<td>Thermal Cycle 400 cycles</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Humidity/Freeze Test 40 Cycles</td>
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<tr>
<td></td>
<td></td>
<td>PASS</td>
</tr>
</tbody>
</table>

LG undertakes an extreme sequential Damp/Heat, Thermal/Cycle & Humidity/Freeze Test for its modules. This replicates extreme and prolonged weather conditions.
LG Quality Control – other tests

Tests

盐雾腐蚀耐久性

动态机械载荷耐久性

静态机械载荷耐久性

5% 盐雾

持续振动

6000PA / 5400PA
Front / Rear
Std 5400PA / Std 2400PA

通过

通过

通过
Azərəyin əhəndəlik məsələsi
Summary of key tests

Tests are conducted in LG's UL/TUV certified test labs

- Temperature & Damp test for extreme weather cond.
- Load Test 1 Dynamic Mechanical Load
- Hail Impact Test
- Salt Spray Test
- Ammonia Resistance Test
- Maximum Power Test
- Impact Fracture Test
- UV Test
- Field Test
- Humidity Freeze Test
- Wafer Resistance Test
- Wafer Impurity Test
- Micro Crack (EL) Test
- Load Test 2 Static Mechanical Load
- Backing Sheet Stress Test
Low Hot Spot Risk due to two EL Tests

To find module defects during the production process, LG conducts EL (Electroluminescence) tests, prior and post lamination.

<table>
<thead>
<tr>
<th>Details</th>
<th>Soldering Check</th>
<th>Micro Crack Check</th>
</tr>
</thead>
<tbody>
<tr>
<td>Image</td>
<td><img src="image1.png" alt="Image" /></td>
<td><img src="image2.png" alt="Image" /></td>
</tr>
<tr>
<td>Missing soldering spots</td>
<td>Missing soldering spots between the ribbon and cell surface may cause hot spots</td>
<td>Micro-cracks in the cell can make the current mismatch, altering front Ag paste colour and material characteristics</td>
</tr>
</tbody>
</table>
Thank you for your time

LG Solar

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