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**TÜV Rheinland (Shanghai) Co., Ltd.**
**Solar & Commercial Products**

# Test Report

Photovoltaic Module Tests

according to Client's Requirements

**TÜV Report No. CN25LJ7Z 002**

**Shanghai, November 2025**

| **Test report No.:** *Prüfbericht - Nr.:* | **CN25LJ7Z 002** | | Page 2 / 16 |
|---|---|---|---|
| **Client (Customer No. + address):** *Auftraggeber (Kunden-Nr. + Adresse):* | **LONGi Green Energy Technology Co., Ltd.** No. 388, Middle Hangtian Road, Chang'an District, Xi'an, Shaanxi, P.R. China | | |
| **Test Item:** *Gegenstand der Prüfung:* | Photovoltaic (PV) Module(s) | **Date of receipt:** *Eingangsdatum:* | 11/09/2025 |
| **Identification:** *Bezeichnung:* | LR8-66HVD-650M | | |
| **Order No.:** *Auftragsnummer:* | 326137250 | **Quotation No.:** *Angebotsnummer:* | P02116756 |
| **Testing location:** *Prüfort:* | **TÜV Rheinland (Suzhou) Co., Ltd.** Building 14, Plainvim (Taicang) Modern Industrial Park, No. 525 South Lingang Road, Shaxi Town, Taicang, Suzhou, Jiangsu | | |
| **Test specification:** *Prüfgrundlage:* | Refer to section 3 for test methodology | | |
| **Test Result:** *Prüfergebnis:* | See section 5 for detailed results | | |

| **tested by** / *geprüft:* | | | **reviewed by** / *kontrolliert:* | | |
|---|---|---|---|---|---|
| 05/11/2025 | Project Engineer/ Daniel Wang | | 05/11/2025 | Reviewer/ Wenyao Lu | |
| **Date** *Datum* | **Title/Name** *Titel/Name* | **Signature** *Unterschrift* | **Date** *Datum* | **Title/Name** *Titel/Name* | **Signature** *Unterschrift* |

**Other Aspects** / *Sonstiges:* N/A

| *Abkürzungen:* | | | | *Abbreviations:* | | | |
|---|---|---|---|---|---|---|---|
| | *P(ass)* | = | *entspricht Prüfgrundlage* | | *P(ass)* | = | *passed* |
| | *F(ail)* | = | *entspricht nicht Prüfgrundlage* | | *F(ail)* | = | *failed* |
| | *N/A* | = | *nicht anwendbar* | | *N/A* | = | *not applicable* |
| | *N/T* | = | *nicht getestet* | | *N/T* | = | *not tested* |

## Table of Content

## List of Tables

# 1 General Information

Date(s) of performance of tests： 28/09/2025 – 23/10/2025

**Abbreviations used in this report:**

| | | | |
|---|---|---|---|
| Pmax | – Maximum power | Vmpp | – Maximum power point voltage |
| Impp | – Maximum power point current | Voc | – Open circuit voltage |
| Isc | – Short circuit current | FF | – Fill factor |
| VI | – Visual inspection | MPD | – Maximum power determination |
| EL | – Electroluminescence | INS | – Insulation test |
| WLC | – Wet leakage current test | HI | – Hail test |

**Possible test case verdicts:**

- Test case does not apply to the test object.....: N/A
- Test object does meet the requirement .....: Pass (P)
- Test object does not meet the requirement .....: Fail (F)

**Further Remarks**

- The test verdicts presented in this report relate only to the test specimen.
- This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.
- I-V curves are only included in this report if they show any deviations. If required, other I-V curves will be provided upon request.
- Any question in regard to this report, please contact TÜV Rheinland (Shanghai) Co., Ltd. within one week after report issued.
- Acceptance criteria mentioned in this report are provided by client.

## 2 Executive Summary

TÜV Rheinland has performed module tests for LONGi Green Energy Technology Co., Ltd. at TÜV Rheinland (Suzhou) Co., Ltd.

**Table 1: Test result summary**

| Test | Quantity | Results | Report no. |
|---|---|---|---|
| VI | 1 | See section 5.1 for details | CN25LJ7Z 002 |
| MPD | 1 | See section 5.2 for details | |
| EL | 1 | See section 5.3 for details | |
| INS | 1 | See section 5.4 for details | |
| WLC | 1 | See section 5.5 for details | |
| Hail | 1 | See section 5.6 for details | |

# 3 Test Methodology

## 3.1 Visual inspection

The Visual inspection is performed in accordance with IEC 61215-2: 2021, MQT 01 and comprises the verification of the following:

- Front of the module
  - Inclusions in the laminate
  - Inclusions in the glass
  - Broken cells
  - Scratches, bubbles or defects in the glass that may compromise the performance or safety of the module
  - Bubbles
  - Yellowing
  - Condition of the frame
  - Condition of welded parts
- Back of the module
  - Scratches or cuts in the back sheet
  - Any kind of bubbles or delamination
  - Bumps or depressions on the back sheet

**Table 2: Measuring equipment for visual inspection**

| Device | Index no. | Measured variable | Application |
|---|---|---|---|
| Ruler | PV-454 | Measure defects | Visual inspection |

## 3.2 Maximum power determination

Maximum power determination test is performed in accordance with IEC 61215-2: 2021, MQT 02. Power measurements are performed with an AAA pulsed solar simulator in a dark chamber designed to reduce the impact of indirect light. Temperature correction is applied by using the temperature coefficient which was provided by the manufacturer. The measurement reproducibility is confined within ±0.8%, k=2. The described experimental setup shows a combined expanded measurement uncertainty, which is less than ±2.5%, k=2 under the commonly referred Standard Test Condition (as detailed in IEC 61215: 1000W/m², 25°C and AM1.5G)

**Table 3: Measuring equipment for maximum power determination**

| Device | Index no. | Measured variable | Application |
|---|---|---|---|
| Primary calibrated reference solar cell | PV-012 | Global irradiance coplanar with specimen | Pulsed solar simulator measurements |
| Solar simulator | PV-481 | Current, voltage, irradiance | Pulsed solar simulator measurements |
| IR-sensor | PV-209<br>PV-210<br>PV-216<br>PV-499 | Specimen temperature | Pulsed solar simulator measurements |

**Table 4: Measurement related software for maximum power determination**

| Program | Version no. | Date | Application |
|---|---|---|---|
| PASAN SPROD Tester | STC V2.9.2 | 26.01.2018 | Operating software pulsed solar simulator |

**Statement of the estimated uncertainty of the test verdicts**

- The verdicts of performance rating are only related to the test samples that were subjected to the tests.
- The STC measurement was performed with a pulsed solar simulator of Class AAA according to IEC60904-9: 2020. The extended measurement uncertainty is:
  - Uncertainty in $P_{MAX}$ within ± 2.5 %, k=2
  - Uncertainty in $I_{SC}$ within ± 2.4 %, k=2
  - Uncertainty in $V_{OC}$ within ± 0.9 %, k=2

## 3.3 Electroluminescence

The electroluminescence test makes cracks and other cell related defects visible.

This test is to be performed referring to standard IEC TS 60904-13: 2018.

## 3.4 Insulation test

This test is to be performed referring to standard IEC 61215-2: 2021, MQT 03.

**Acceptance criteria:**

Measured insulation resistance times the area of the module shall not be less than 40 MΩ·m².

## 3.5 Wet leakage current test

This test is to be performed referring to standard IEC 61215-2: 2021, MQT 15.

**Acceptance criteria:**

Measured insulation resistance times the area of the module shall not be less than 40 MΩ·m².

## 3.6 Hail test

This test is to be performed referring to standard IEC 61215-2: 2021, MQT 17.

# 4 Sampling and Test Assignment

## 4.1 Sampling procedure

| | |
|---|---|
| ☐ | Random sampling from production (e.g. during factory audit (FA) or inline inspection) |
| ☐ | Random sampling from the warehouse, container or transportation boxes |
| ☒ | Modules have been submitted by the manufacturer/ client without random sampling by TÜV Rheinland |

## 4.2 Module test assignment

**Table 5: Module assignment**

| **Module manufacturer** | | LONGi Green Energy Technology Co., Ltd. | | | | | |
|---|---|---|---|---|---|---|---|
| **Module type** | | LR8-66HVD-650M | | | | | |
| **Module technology** | | Mono-crystalline BC Bi-facial half-cell c-Si module, 132 pcs | | | | | |
| **No.** | **S/N** | **VI** | **MPD** | **EL** | **INS** | **WLC** | **Hail** |
| 1 | LRP011136250612228799 | x | x | x | x | x | x |
| x: selected samples for test | | | | | | | |
| Supplementary information: N/A | | | | | | | |

# 5 Test Results

## 5.1 Visual inspection

| Test date [DD/MM/YYYY] | 28/09/2025 | |
|---|---|---|
| Sample # | Nature and position of findings | Verdict |
| 1 | No visual defect | P |
| Supplementary information: N/A. | | |

## 5.2 Maximum power determination

| Test date [DD/MM/YYYY] | | | 28/09/2025 | | | |
|---|---|---|---|---|---|---|
| Module temperature [°C] | | | 25 ± 1 | | | |
| Irradiance [W/m²] | | | 1000 | | | |
| Illuminating direction | | | ☒ Front | | ☐ Rear | |
| Sample # | Pmax [W] | Vmpp [V] | Impp [A] | Voc [V] | Isc [A] | FF [%] |
| 1 | 640.8 | 42.11 | 15.219 | 49.06 | 16.158 | 80.8 |
| Supplementary information: N/A. | | | | | | |

## 5.3 Electroluminescence

| Test date [DD/MM/YYYY] | 28/09/2025 |
|---|---|
| Current applied | Isc ± 5% |
| Sample # | Remarks |
| 1 | N/A |
| Supplementary information: Refer to Annex 2: EL Imaging. | |

## 5.4 Insulation test

| | | | | | | |
|---|---|---|---|---|---|---|
| Test date [DD/MM/YYYY] | | | 29/09/2025 | | | |
| Maximum system voltage [VDC] | | | 1500 | | | |
| High voltage applied [VDC] | | | 8000 | | | |
| Insulation resistance measured at [VDC] | | | 1500 | | | |
| Sample # | Measured | Area | Result* | Dielectric breakdown | | Verdict |
| | GΩ | m² | GΩ·m² | Yes (description) | No | |
| 1 | 15.20 | 2.70 | 41.04 | — | No | P |
| * Pass criteria: No dielectric breakdown, insulation resistance shall be greater than 40 MΩ·m². | | | | | | |

## 5.5 Wet leakage current test

| | | | | |
|---|---|---|---|---|
| Test date [DD/MM/YYYY] | 29/09/2025 | | | |
| Insulation resistance measured at [VDC] | 1500 | | | |
| Solution resistivity [Ω·cm] | < 3500 | | | |
| Solution temperature [°C] | 22 ± 2 | | | |
| Sample # | Measured | Area | Result | Verdict |
| | MΩ | m² | MΩ·m² | |
| 1 | 5260.0 | 2.70 | 14202.0 | P |
| Pass criteria: No dielectric breakdown, insulation resistance shall be greater than 40 MΩ·m². | | | | |

## 5.6 Hail test

| | | |
|---|---|---|
| Test date [DD/MM/YYYY] | 10/10/2025 | |
| Ice ball diameter [mm] | 45 | |
| Ice ball mass [g] | 43.9 ± 5 % | |
| Ice ball velocity [m/s] | 30.7 ± 5 % | |
| Number of impact locations | 11 | |
| Sample # | — | Verdict |
| 1 | — | P |
| Supplementary information: N/A. | | |

### 5.6.1 Visual inspection after HI

| | | |
|---|---|---|
| Test date [DD/MM/YYYY] | 10/10/2025 | |
| Sample # | Nature and position of findings | Verdict |
| 1 | No visual defect | P |
| Supplementary information: N/A. | | |

### 5.6.2 Maximum power determination after HI

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Test date [DD/MM/YYYY] | | | 23/10/2025 | | | | | |
| Module temperature [°C] | | | 25 ± 1 | | | | | |
| Irradiance [W/m²] | | | 1000 | | | | | |
| Illuminating direction | | | ☒ Front | | | ☐ Rear | | |
| Sample # | Pmax[W] | Vmpp [V] | Impp [A] | Voc [V] | Isc [A] | FF [%] | Degradation [%] | Verdict |
| 1 | 641.2 | 42.27 | 15.169 | 49.17 | 16.205 | 80.5 | 0.05 | P |
| Supplementary information: N/A. | | | | | | | | |

### 5.6.3 Electroluminescence after HI

| | |
|---|---|
| Test date [DD/MM/YYYY] | 23/10/2025 |
| Current applied | Isc ± 5% |
| Sample # | Remarks |
| 1 | N/A |
| Supplementary information: Refer to Annex 2: EL Imaging. | |

5.6.4 Insulation test after HI

| | | | | | | |
|---|---|---|---|---|---|---|
| Test date [DD/MM/YYYY] | | | | 23/10/2025 | | |
| Maximum system voltage [VDC] | | | | 1500 | | |
| High voltage applied [VDC] | | | | 8000 | | |
| Insulation resistance measured at [VDC] | | | | 1500 | | |
| Sample # | Measured | Area | Result* | Dielectric breakdown | | Verdict |
| | GΩ | m² | GΩ·m² | Yes (description) | No | |
| 1 | 13.90 | 2.70 | 37.53 | — | No | P |
| * Pass criteria: No dielectric breakdown, insulation resistance shall be greater than 40 MΩ·m². | | | | | | |

5.6.5 Wet leakage current test after HI

| | | | | |
|---|---|---|---|---|
| Test date [DD/MM/YYYY] | 23/10/2025 | | | |
| Insulation resistance measured at [VDC] | 1500 | | | |
| Solution resistivity [Ω·cm] | < 3500 | | | |
| Solution temperature [°C] | 22 ± 2 | | | |
| Sample # | Measured | Area | Result | Verdict |
| | MΩ | m² | MΩ·m² | |
| 1 | 4270.0 | 2.70 | 11529.0 | P |
| Pass criteria: No dielectric breakdown, insulation resistance shall be greater than 40 MΩ·m². | | | | |

# 6 Annex

## 6.1 Annex 1: Photos of test module

**Figure 1: Front view of module LR8-66HVD-650M**

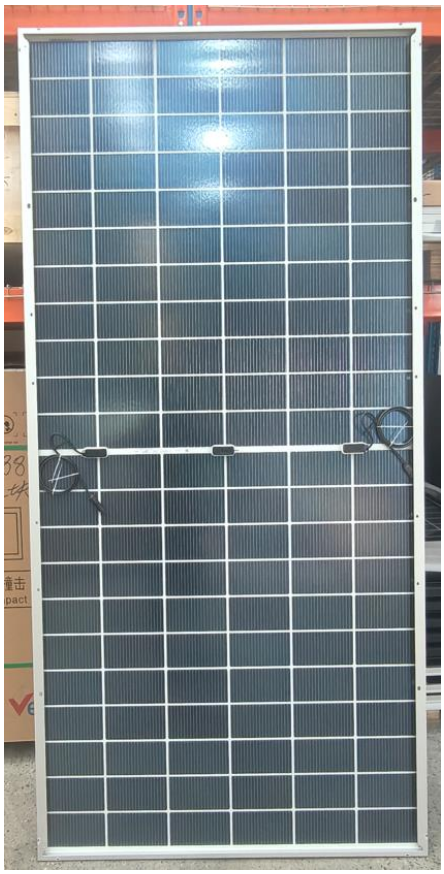

**Figure 2: Rear view of module LR8-66HVD-650M**

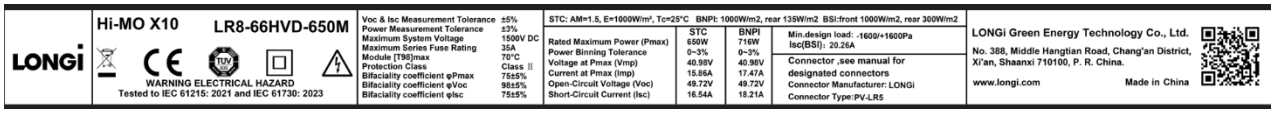


**Figure 3: Rating label of module type LR8-66HVD-650M**

**Figure 4: Junction boxes of module type LR8-66HVD-650M**

## 6.2 Annex 2: EL-imaging

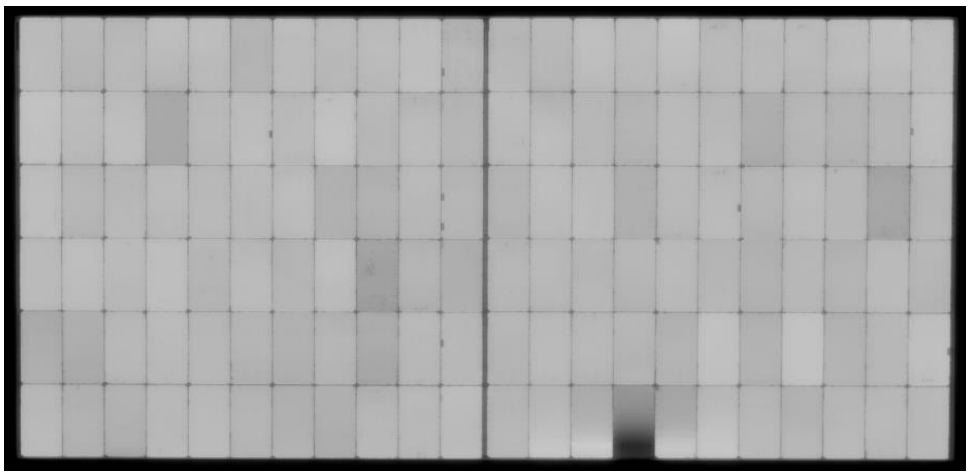

**Figure 5: EL-image of sample no. 1 (initial)**

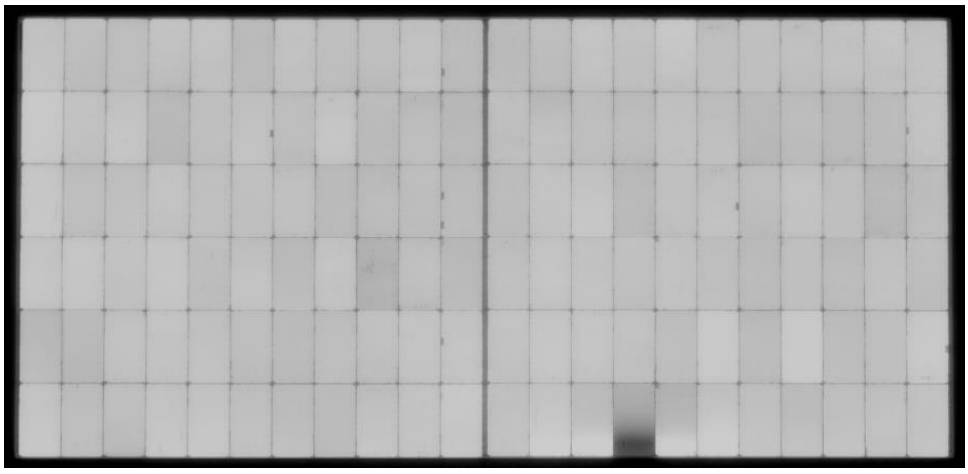

**Figure 6: EL-image of sample no. 1 (after Hail test)**

# End of Test Report CN25LJ7Z 002