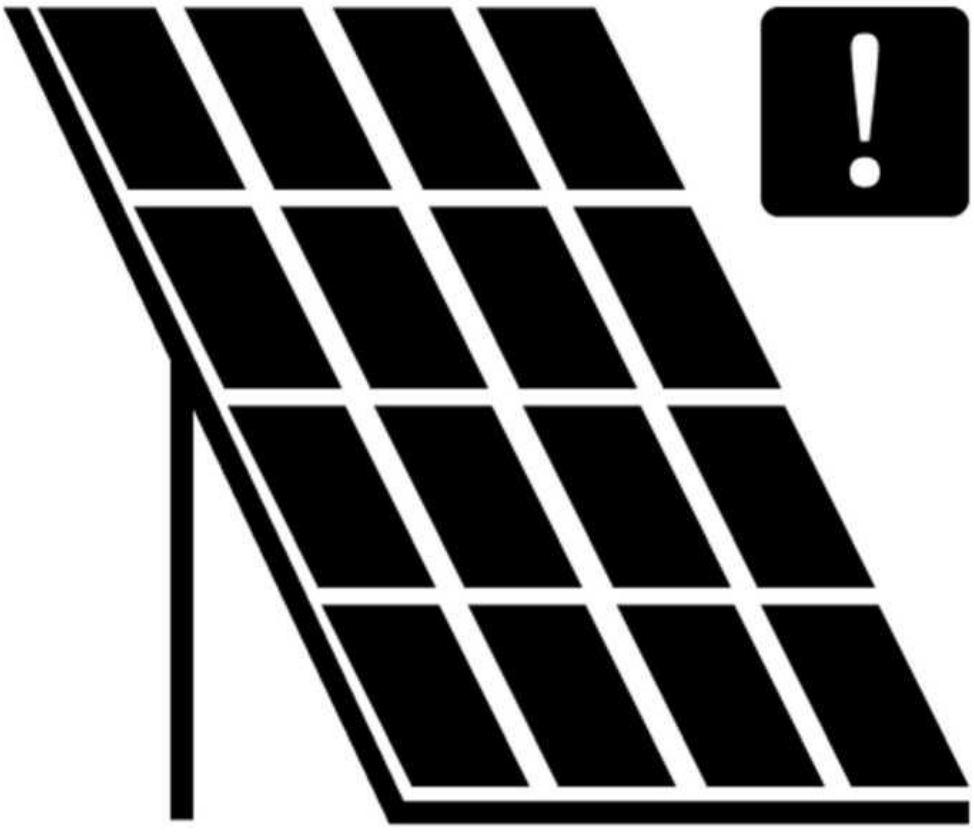
KENO
FULL OF ENERGY

CLAIM PROCEDURE

PHOTOVOLTAIC MODULES



Digitally signed by Mereacre Andrei
Date: 2022.09.02 08:47:21 EEST
Reason: MoldSign Signature
Location: Moldova

KENO SP. Z O.O. based on the provisions of General Terms of Sales section 8 gives the possibility of mediation in the processes of guarantee claims for its Contractors. The reasonableness of the request and the final decision is issued by the manufacturer of the respective module based on the provisions contained in the guarantee document.

I. PURPOSE AND USE

This document is intended to provide all our contractors with a clear, step-by-step guide to the claims process. These instructions apply only to defects in photovoltaic modules that are installed in accordance with the installation and operating instructions and are therefore covered by the manufacturer's guarantee.

II. GENERAL INFORMATION

For a smooth claim process, you must submit the necessary data outlined in this instruction. Guidelines have been established by manufacturers. The claim will be denied if the claimant refuses to provide the required documents, measurements, photographs and other information that the guarantor may require.

The remainder of this instruction will provide basic information on documenting the problematic side of a PV module and a breakdown of the common defect criteria. As a first step, the installer should inspect according to the basic information immediately after finding the defect.

Figure 4. Spacing between bridges when mounting the module on the short side (K-14N)

Completed applications should be sent to:

reklamacje@keno-energy.com

In the subject line of your message, please include the product index and the number of one of your proofs of purchase (invoice or external release document).

Then, in consultation with the guarantee provider, KENO will decide whether to replace, repair or refund the module.

The time period for processing and fulfilling the claim depends on the content of individual guarantee documents. Manufacturers reserve the right to request additional information, documents or measurements. This is tantamount to extending the claim process by the time the necessary supplemental materials are delivered.

III. PHOTOVOLTAIC MODULE - BASIC INFORMATION

a. Location of serial numbers and nameplate

FULL FRONT VIEW OF THE MODULE

FULL REAR VIEW OF THE MODULE

SERIAL NUMBER UNDER GLASS
FRONT OF MODULE

NAMEPLATE SERIAL NUMBER
BACK OF MODULE

SERIAL NUMBER BACK
OF MODULE

KENO
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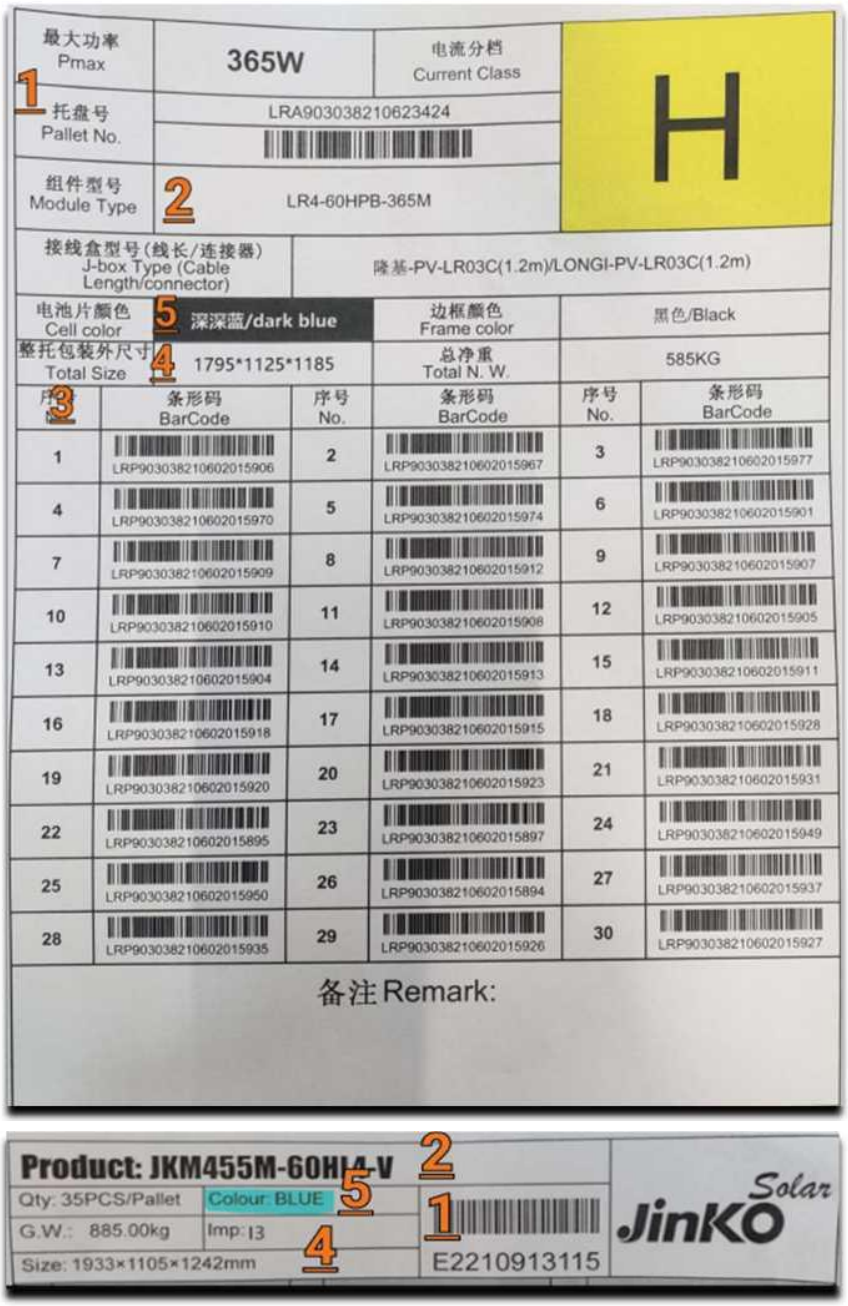
www.keno-energy.com

b. Indication on the shipment data sheet

The Shipment Data Sheet is an attachment attached to the shorter side of the original unpacked modular pallet that left the factory.

The sample sheet includes:

1. Pallet number
2. Good Index
3. Serial numbers
4. Module dimension
5. Color indications



IV. CRITERION OF FAULTS

1. MISLABELING

Problem Characteristics:

The module supplied has labels that are not consistent with the manufacturer's claims. Inconsistency is primarily related to errors in nameplate and serial numbers and the partial or complete absence of these labels.

Fig. 1 No nameplate

fig. 2 Duplicated and wrongly stuck serial number

In the event that the presented defect is discovered, the following documentation and information must be provided for each PV module that may be affected for assistance:

1) Photo of the back and front of the module;
2) For modules in manufacturer's packaging from full pallet orders, photo of shipment data sheet;
3) Accurate photographs of the inconsistencies present
4) A video showing the differences in serial numbers on a single module.

2. HOT SPOT

Problem characteristics:

A hot spot is an area of a module that tends to have a much higher temperature than the rest of the module. vThere are several causes of a hot spot. One can differentiate:

- Cracking of the module surface;
- Pressure on PV modules by washers;
- Partial shading (a reverse current begins to flow in a module cell that remains shaded);
- Improper handling of the module;
- Over-tightening of components (lack of proper tools and failure to follow manufacturer's recommendations).

Overheating of the module in the aforementioned hot spots can reach up to 250°C, which may result in loss of module efficiency, shortening the time of its proper operation.

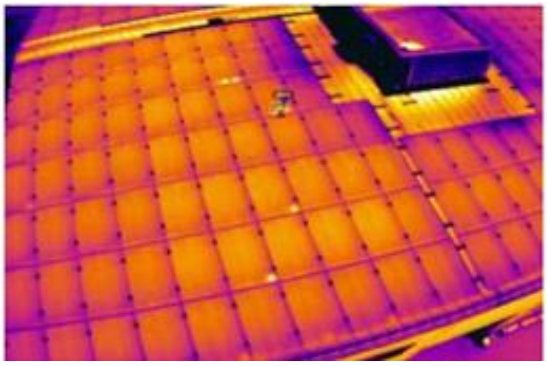


fig.1 Hot spot visible during thermal imaging

fig.2 Spot burns visible

If the presented defect in the photovoltaic module is detected, the following information must be provided immediately for assistance:

1) Image taken by a thermal imaging camera with visible temperature data;
2) Photos of the front of the module and its back with the nameplate;
3) The serial number of the claimed module;
4) Pictures of the installation environment;
5) Accurate photographs of the inconsistencies present.

3. STAINS AND DIRT

Problem characteristics:

Another disadvantage readily apparent is dirt on/under the surface of the photovoltaic panel. They can come from manufacturing processes. Visible defects on the surface of the module presents a problem for contractors. Stains on the surface/frame should be properly documented to initiate the claim process (stains occurring during and after installation are not claimable).

fig.1 Smeared silicone

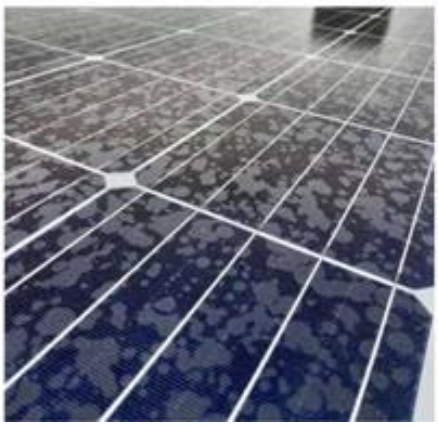


fig.2 Moisture under glass

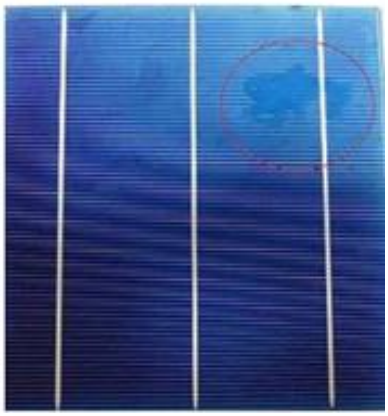


fig.3 Defect under glass

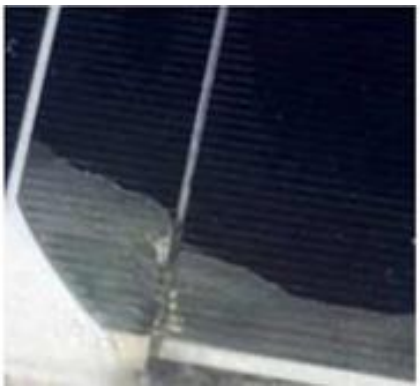


fig.4 Delamination of EVA film

fig.5 Silicone residues from the production process

In the event of a defect in PV modules, please provide the following documentation and information for each PV module that may be affected for assistance.

1) Picture of the nameplate and serial number of the module;
2) Full view of the problematic side of the module;
3) The problem area of the viewing angle that will highlight the defect.

4. CRACKED GLASS

Problem characteristics:

Damage to the glass surface is a serious failure that is the first step to corrosion of the cells and electrical circuits. The undesirable consequence is a decrease in productivity and a potential hazard. Damage to the glass surface occurs during transport, but also during and after installation. An installed module with an identified defect must be disconnected immediately.

fig.1 Spontaneous cracking - point in a “butterfly” shape

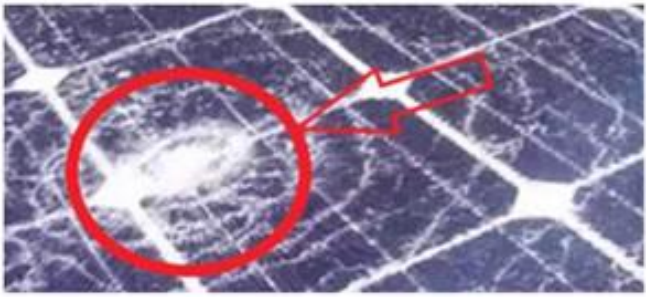
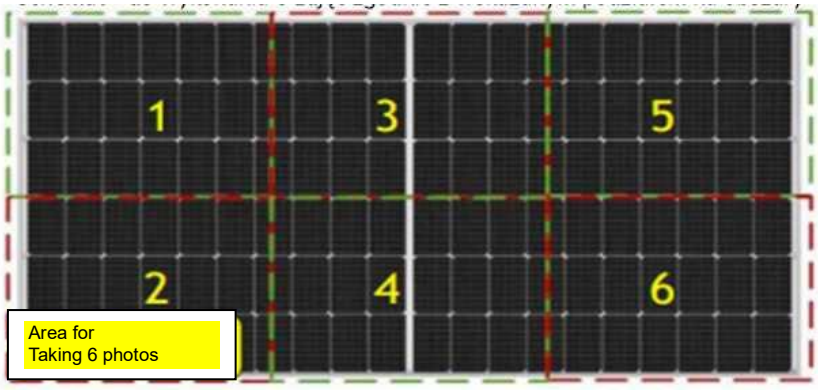


fig.2 cracking caused by an external factor

If the depicted defect in the photovoltaic module is detected, high-resolution photographs should be taken for assistance:

1) The nameplate and serial number of the module;
2) Full view of the problematic side of the module;
3) Punctuated by the chart below;
4) The back and front of the entire module;
5) For modules in manufacturer's packaging from full pallet orders, photo of shipment data sheet.



Scheme - to take 6 pictures according to the indicated division into areas

5. BYPASS DIODE FAILURE

Problem characteristics:

Failure of the bypass diode is associated with a significant drop in module performance (minimum 1/3 drop in performance). With the irregularities noticed in the operation of the installation, it can be speculated that the bypass diodes have been damaged. When diagnosing possible sources of abnormalities, however, other factors affecting plant performance must also be ruled out. If optimizers are used, the first step is to check their condition and rule out their failure.

Sample photos:

fig.1 Screenshot from Solar monitoring application *Edge*

fig.2 Example of measurement

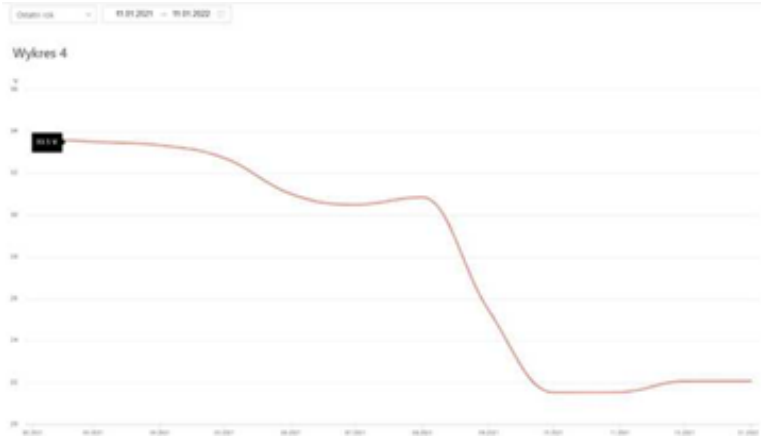


fig.3 Screenshot from Solar Edge monitoring application

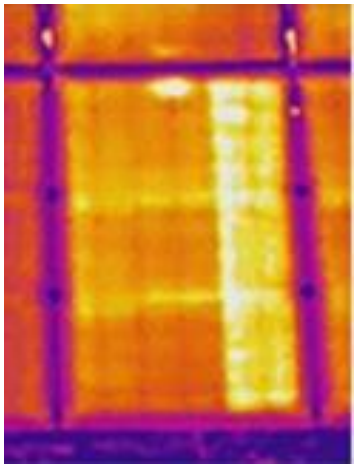


fig.4 Thermal imaging camera visible power reduction by 1/3

fig. 5 Installation environment - ground structure

fig. 6 Installation environment - pitched roof

If a defect is detected in the PV modules, please provide the following documentation and information for each PV module that may be affected:

1) A snapshot from the monitoring application with a detailed indication of the faulty module and its operating characteristics;
2) Pictures of the installation environment indicating the faulty module;
3) If there is no monitoring system, provide photos of the Voc measurements taken;
4) Photo of the defective module taken with a thermal imaging camera;
5) Picture the back and front of the entire module;
6) Picture of the nameplate and serial number;
7) Full access to monitor the installation within which the faulty panel is operating.

6. MECHANICAL DEFECTS

Problem characteristics:

Originally packed pallets may occasionally contain modules with manufacturing defects. They take a variety of forms, such as: a broken or crooked bus bar, stains under the glass coating, a foreign body in the cell, air bubbles trapped under the glass or laminate, etc. While these are often flaws that are barely visible and seemingly trivial, they have the potential to have a significant impact on module performance and safety. Therefore, any such defects should be reported immediately and you should refrain from installing the modules until the manufacturer has issued a decision.

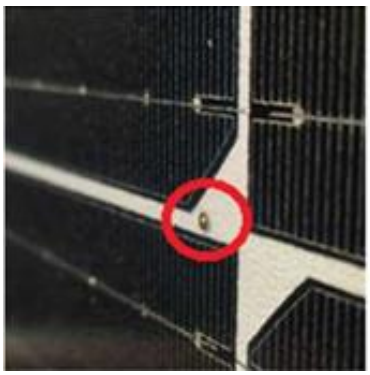


fig.1 Foreign body - glass side

fig. 2 Foreign body - laminate side

fig.3 Damaged bus bar

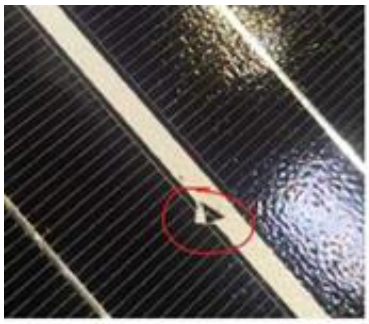


fig.4 Damaged cell

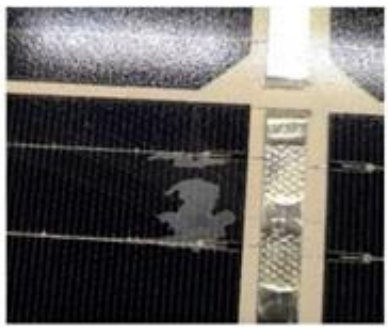


fig.5 Air bubble under glass

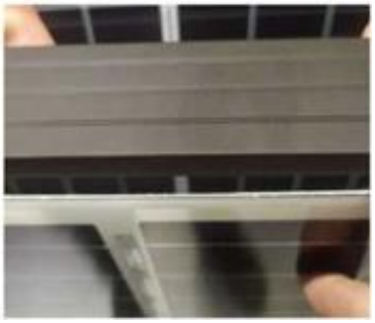


fig.6 No silicone or glue connecting the frame to the inner parts

If you discover a defect in your PV modules, please provide the following documentation and information for each PV module that may be affected for assistance:

1) Picture of the nameplate and serial number;
2) Photos with full view of the front and back side of the module;
3) If ordering modules in factory cartons, photos of panel loading list;
4) close-up photos of the flaws from different perspectives.

7. LRF EFFECT

Problem characteristics:

LRF ("redirecting light film") is a film that increases the output of photovoltaic modules used by some manufacturers. Its principle of operation is to direct the sun's rays reflected from the module's surface onto adjacent cells, which significantly increases the overall efficiency. However, the reflection angle will not be uniform over the entire surface of the module, resulting in non-uniform reflection patterns that can be seen from a distance.

fig.1 LRF effect on *a sunny* day

fig. 2 LRF effect close-up

The LRF effect does not qualify as a quality defect unless it has a direct negative impact on module production. If this is suspected, a measurement should be taken to prove that the LRF is the cause of the power drop.

If you discover a defect in your PV modules, please provide the following documentation and information for each PV module that may be affected for assistance:

1) photo showing the LRF effect;
2) measurements showing a decrease in module performance;
3) photo of nameplate and serial number;
4) photo with full view of the front and back of the module.

8. COLOR DIFFERENCES

Problem characteristics:

Color variations in photovoltaic cells are due to the manufacturing processes used and the availability of raw material. Getting the same perfect color in a photovoltaic module is impossible. Manufacturers, keeping in mind the market expectations, categorize cell colors according to the occurrence of shade of a particular batch of modules. To maintain aesthetics and visual feel, manufacturers ensure that cells of the same color grade are used in a single module.

Several factors contribute to the visual feel of a completed photovoltaic module installation:

- the angle of refraction of the incident light;
- cloudiness;
- cell used;
- the natural degradation process of module components.

Manufacturers try to ensure that modules from the same pallet and pallets from the same container are of the same color grade.

Differences in color between modules in no way adversely affect the module's operation and performance and do not qualify as a product defect.

Examples of differences excluded from guarantee by manufacturers:

fig. 1 Mixed modules from 3 pallets with different color categories

fig.2 Differences due to refractive effect of light

fig. 3 Photos taken on a cloudy day. Visual differences due to dirt and moisture.

fig.5 Example of photovoltaic installation photo documentation - REQUIRED BY THE MANUFACTURER

fig.6 JINKO designation sheet

fig. 7 LONGi designation sheet

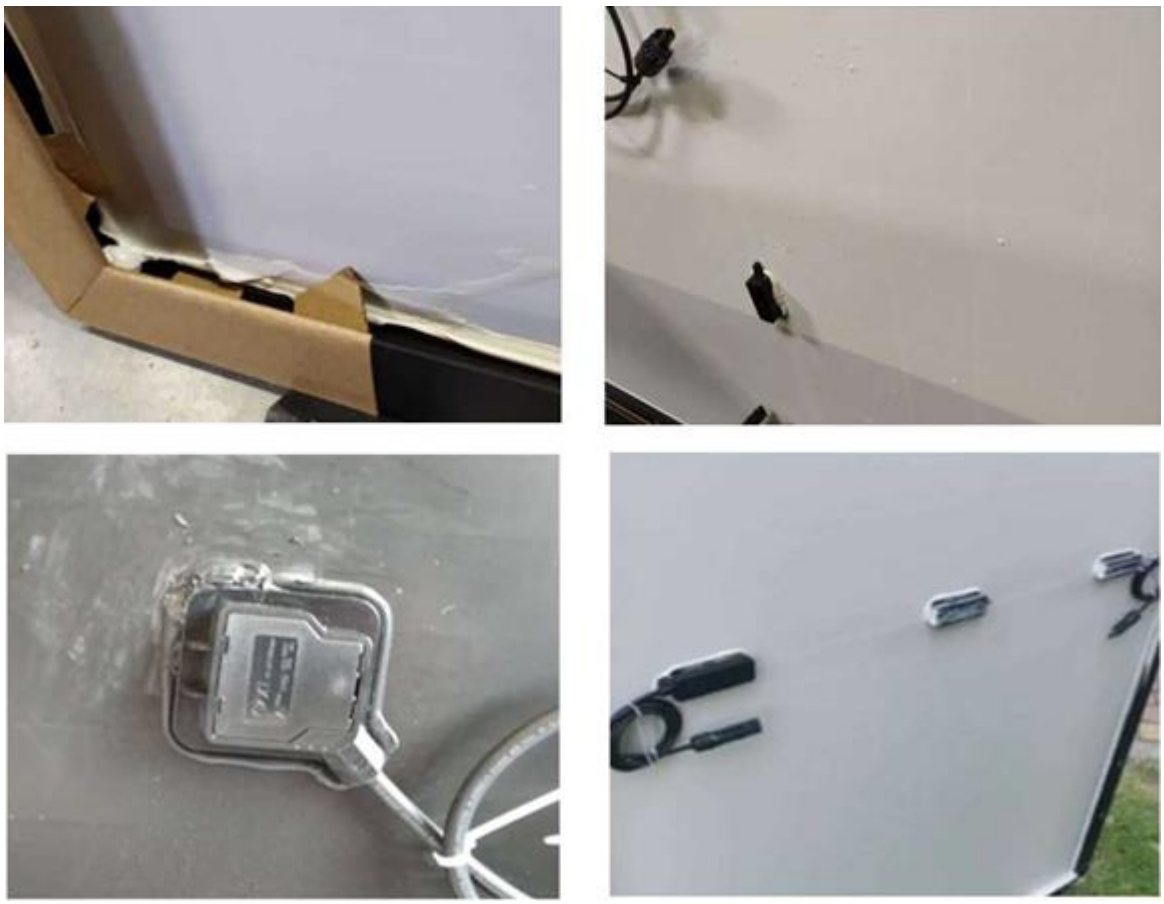
*I*f there are significant abnormal differences between modules of the same pallet, follow the steps below:

1) Prepare a list with the serial numbers of all installed modules;
2) Taking high-resolution images (on a sunny day with no cloud cover):
   - Full view of the roof - 3 photos taken from the front and left and right side of the installation (example fig.5, photos can also be taken from the ground at a distance of at least 10 meters);
   - Nameplates and serial numbers of adjacent modules showing significant differences;
3) Video recording (if possible).

9. SILICONE LEAKAGE

Problem characteristics:

Leaking silicone is a rare defect due to quality maintenance issues in the manufacturing process. Manufacturers make every effort to ensure that any irregularities are detected and corrected promptly. Keep in mind that misconduct may occur.



If a silicone leak is detected, please provide the following high-resolution images for each PV module that may be affected for assistance:

1) Spot photo of the spill site;
2) Picture of the nameplate and serial number;
3) Picture the back and front of the entire module.

ZERTIFIKAT ◆ CERTIFICATE ◆ 認證證書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

Product Service

CERTIFICATE

No. Z2 099333 0045 Rev. 08

Holder of Certificate: **LONGi Green Energy Technology Co., Ltd.**
No. 388, Middle Hangtian Road
Chang'an District
710100 Xi'an City, Shaanxi
PEOPLE'S REPUBLIC OF CHINA

Certification Mark:

Product: **Crystalline Silicon Terrestrial Photovoltaic (PV) Modules**
Mono-Crystalline Silicon Photovoltaic Module

The product was tested on a voluntary basis and complies with the essential requirements. The certification mark shown above can be affixed on the product. It is not permitted to alter the certification mark in any way. In addition the certification holder must not transfer the certificate to third parties. See also notes overleaf.

Test report no.: 704061700516-08

Valid until: 2025-04-13

Date, 2020-04-14 (Zhulin Zhang)

A4 / 07.17

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Product Service

CERTIFICATE

No. Z2 099333 0045 Rev. 08

Model(s):

LR6-72HV-xxxM, (xxx=335-360 in step of 5)
LR6-60HV-xxxM, (xxx=280-300 in step of 5)
LR6-72PH-xxxM, (xxx=340-380 in step of 5)
LR6-60PH-xxxM, (xxx=285-315 in step of 5)
LR6-72HPH-xxxM, (xxx=365-395 in step of 5)
LR6-72HIH-xxxM, (xxx=365-395 in step of 5)
LR6-60HPH-xxxM, (xxx=300-325, in step of 5)
LR6-60HIH-xxxM, (xxx=300-325 in step of 5)
LR6-72OPH-xxxM, (xxx=385-415 in step of 5)
LR6-60OPH-xxxM, (xxx=335-365 in step of 5)
LR6-72HPH-xxxMC, (xxx=375-390 in step of 5)
LR6-60HPH-xxxMC, (xxx=305-325 in step of 5)
LR6-60ZPH-xxxM, (xxx=330-355 in step of 5)
LR4-72HPH-xxxM, (xxx=420-455 in step of 5)
LR4-72HIH-xxxM, (xxx=420-440 in step of 5)
LR4-60HPH-xxxM, (xxx=350-375 in step of 5)
LR4-60HIH-xxxM, (xxx=350-370 in step of 5)
LR4-72ZPH-xxxM, (xxx=420-435 in step of 5)
LR4-60ZPH-xxxM, (xxx=350-365 in step of 5)
LR4-78ZPH-xxxM, (xxx=470-475 in step of 5)
xxx is standing for rated output power at STC

Parameters:

Fire Safety Class:	Class C according to UL790.
Safety Class:	Class II
Max. System Voltage:	1500V DC
Test Laboratory:	Yangzhou Opto-Electrical Products Testing Institute. No.10 West Kaifa Road, Yangzhou, 225009 Jiangsu, P.R.China.
Construction:	Framed, with Junction box, cable and connector.

Tested according to:

IEC 61215-1:2016
IEC 61215-1-1:2016
IEC 61215-2:2016
IEC 61730-1:2016
IEC 61730-2:2016
EN 61215-1:2016
EN 61215-1-1:2016
EN 61215-2:2017
EN IEC 61730-1:2018
EN IEC 61730-1:2018/AC:2018-06
EN IEC 61730-2:2018
EN IEC 61730-2:2018/AC:2018-06

Production Facility(ies):

099605, 099626, 099606, 090968, 001192, 002875, 096558, 102892, 097323, 103410, 103841

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TÜV SÜD

Product Service

Attestation of Conformity

No. N8A 099333 0066 Rev. 02

Holder of Certificate: **LONGi Green Energy Technology Co., Ltd.**
No. 388, Middle Hangtian Road
Chang'an District
710100 Xi'an City, Shaanxi
PEOPLE'S REPUBLIC OF CHINA

Product: **Crystalline Silicon Terrestrial Photovoltaic (PV) Modules**

Mono-Crystalline Silicon Photovoltaic Module

This Attestation of Conformity is issued on a voluntary basis according to the Low Voltage Directive 2014/35/EU relating to electrical equipment designed for use within certain voltage limits. It confirms that the listed equipment complies with the principal protection requirements of the directive and is based on the technical specifications applicable at the time of issuance.
It refers only to the particular sample submitted for testing and certification. See also notes overleaf.

Test report no.: 704061700516-07

Date, 2020-03-11 (Zhulin Zhang)

After preparation of the necessary technical documentation as well as the EU declaration of conformity the required CE marking can be affixed on the product. The declaration of conformity is issued under the sole responsibility of the manufacturer. Other relevant EU-directives have to be observed.

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TÜV®

Product Service

Attestation of Conformity

No. N8A 099333 0066 Rev. 02

Model(s):

LR6-72HV-xxxM, (xxx=335-360 in step of 5)
LR6-60HV-xxxM, (xxx=280-300 in step of 5)
LR6-72PH-xxxM, (xxx=340-380 in step of 5)
LR6-60PH-xxxM, (xxx=285-315 in step of 5)
LR6-72HPH-xxxM, (xxx=365-395 in step of 5)
LR6-72HIH-xxxM, (xxx=365-395 in step of 5)
LR6-60HPH-xxxM, (xxx=300-325, in step of 5)
LR6-60HIH-xxxM, (xxx=300-325 in step of 5)
LR6-72OPH-xxxM, (xxx=385-415 in step of 5)
LR6-60OPH-xxxM, (xxx=335-365 in step of 5)
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LR4-60HIH-xxxM, (xxx=350-370 in step of 5)
LR4-72ZPH-xxxM, (xxx=420-435 in step of 5)
LR4-60ZPH-xxxM, (xxx=350-365 in step of 5)
xxx is standing for rated output power at STC

Parameters:

Fire Safety Class:	Class C according to UL790
Safety Class:	Class II
Maximum System Voltage:	1500V DC
Test Laboratory:	Yangzhou Opto-Electrical Products Testing Institute. No.10 West Kaifa Road, Yangzhou, 225009 Jiangsu, P.R.China.
Construction:	Framed, with Junction box, cable and connector.

Tested according to:

EN IEC 61730-1:2018
EN IEC 61730-1:2018/AC:2018-06
EN IEC 61730-2:2018
EN IEC 61730-2:2018/AC:2018-06

After preparation of the necessary technical documentation as well as the EU declaration of conformity the required CE marking can be affixed on the product. The declaration of conformity is issued under the sole responsibility of the manufacturer. Other relevant EU-directives have to be observed.

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ZERTIFIKAT ◆ CERTIFICATE ◆ 認證證書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

Product Service

CERTIFICATE

No. Z2 099333 0053 Rev. 03

Holder of Certificate: **LONGi Green Energy Technology Co., Ltd.**
No. 388, Middle Hangtian Road
Chang'an District
710100 Xi'an City, Shaanxi
PEOPLE'S REPUBLIC OF CHINA

Certification Mark:

Product: **Crystalline Silicon Terrestrial Photovoltaic (PV) Modules**
Mono-crystalline Silicon Photovoltaic Module

The product was tested on a voluntary basis and complies with the essential requirements. The certification mark shown above can be affixed on the product. It is not permitted to alter the certification mark in any way. In addition the certification holder must not transfer the certificate to third parties. See also notes overleaf.

Test report no.: 704061700519-03

Valid until: 2024-12-08

Date, 2019-12-10 (David Bo)

A4 / 07.17

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ZERTIFIKAT ◆ CERTIFICATE ◆ 認證證書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

TÜV SÜD Product Service

CERTIFICATE

No. Z2 099333 0053 Rev. 03

Model(s):

LR6-72HV-xxxM, (xxx=320 to 350 in step of 5)
LR6-60HV-xxxM, (xxx=270 to 300 in step of 5)
LR6-72PH-xxxM, (xxx=340 to 385 in step of 5)
LR6-60PH-xxxM, (xxx=280 to 320 in step of 5)
LR6-72HPH-xxxM, (xxx=350 to 405 in step of 5)
LR6-72HIH-xxxM, (xxx=350 to 405 in step of 5)
LR6-60HPH-xxxM, (xxx=295 to 335 in step of 5)
LR6-60HIH-xxxM, (xxx=295 to 335 in step of 5)
LR6-72OPH-xxxM, (xxx=385 to 400 in step of 5)
LR6-60OPH-xxxM, (xxx=335 to 350 in step of 5)
LR6-72HPH-xxxMC, (xxx=375 to 390 in step of 5)
LR6-60HPH-xxxMC, (xxx=305 to 325 in step of 5)
LR4-72HPH-xxxM, (xxx=400 to 460 in step of 5)
LR4-72HIH-xxxM, (xxx=400 to 460 in step of 5)
LR4-60HPH-xxxM, (xxx=330 to 380 in step of 5)
LR4-60HIH-xxxM, (xxx=330 to 380 in step of 5)
LR4-72ZPH-xxxM, (xxx=420 to 435 in step of 5)
LR4-60ZPH-xxxM, (xxx=350 to 365 in step of 5)
LR6-60ZPH-xxxM, (xxx=330 to 355 in step of 5)
xxx is standing for rated output power at STC

Parameters:

Fire Safety Class:	Class C
Application Class:	Class A
Max. System Voltage:	1500V DC
PID Test Condition:	Test method a of IEC TS 62804-1:2015 ±1500V DC, 96 hrs, 85 % RH, 85 °C.
Construction:	Framed, with Junction box, cable and connector.

Tested according to:

PPP 58042B:2015
IEC 61215:2005
IEC 61730-1:2004
IEC 61730-1:2004/AMD1:2011
IEC 61730-1:2004/AMD2:2013
IEC 61730-2:2004
IEC 61730-2:2004/AMD1:2011

Production Facility(ies):

099626, 099606, 090968, 001192, 096558, 099605, 002875, 097323, 102892, 103410, 103841

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ZERTIFIKAT ◆ CERTIFICATE ◆ 認證證書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

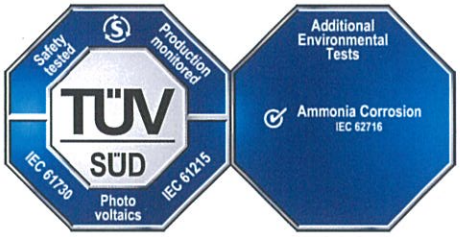
Product Service

CERTIFICATE

No. Z2 099333 0054 Rev. 03

Holder of Certificate: **LONGi Green Energy Technology Co., Ltd.**
No. 388, Middle Hangtian Road
Chang'an District
710100 Xi'an City, Shaanxi
PEOPLE'S REPUBLIC OF CHINA

Certification Mark:



Product: **Crystalline Silicon Terrestrial Photovoltaic (PV) Modules**
Mono-crystalline Silicon Photovoltaic Module

The product was tested on a voluntary basis and complies with the essential requirements. The certification mark shown above can be affixed on the product. It is not permitted to alter the certification mark in any way. In addition the certification holder must not transfer the certificate to third parties. See also notes overleaf.

Test report no.: 704061700518-03

Valid until: 2024-12-04

Date, 2019-12-06 (David Bo)

A4 / 07.17

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TÜV SÜD Product Service

CERTIFICATE

No. Z2 099333 0054 Rev. 03

Model(s):

LR6-72HV-xxxM, (xxx=320 to 350 in step of 5)
LR6-60HV-xxxM, (xxx=270 to 300 in step of 5)
LR6-72PH-xxxM, (xxx=340 to 385 in step of 5)
LR6-60PH-xxxM, (xxx=280 to 320 in step of 5)
LR6-72HPH-xxxM, (xxx=350 to 405 in step of 5)
LR6-72HIH-xxxM, (xxx=350 to 405 in step of 5)
LR6-60HPH-xxxM, (xxx=295 to 335 in step of 5)
LR6-60HIH-xxxM, (xxx=295 to 335 in step of 5)
LR6-72OPH-xxxM, (xxx=385 to 400 in step of 5)
LR6-60OPH-xxxM, (xxx=335 to 350 in step of 5)
LR6-72HPH-xxxMC, (xxx=375 to 390 in step of 5)
LR6-60HPH-xxxMC, (xxx=305 to 325 in step of 5)
LR4-72HPH-xxxM, (xxx=400 to 460 in step of 5)
LR4-72HIH-xxxM, (xxx=400 to 460 in step of 5)
LR4-60HPH-xxxM, (xxx=330 to 380 in step of 5)
LR4-60HIH-xxxM, (xxx=330 to 380 in step of 5)
LR4-72ZPH-xxxM, (xxx=420 to 435 in step of 5)
LR4-60ZPH-xxxM, (xxx=350 to 365 in step of 5)
LR6-60ZPH-xxxM, (xxx=330 to 355 in step of 5)
xxx is standing for rated output power at STC

Parameters:

Application Class:	Class A
Maximum System Voltage:	1500 V DC
Fire Safety Class:	Class C
Construction:	Framed, with Junction box, cable and connector.

Tested according to:

IEC 61215:2005
IEC 61730-1:2004
IEC 61730-1:2004/AMD1:2011
IEC 61730-1:2004/AMD2:2013
IEC 61730-2:2004
IEC 61730-2:2004/AMD1:2011
IEC 62716:2013

Production Facility(ies):

099605, 099606, 099626, 090968, 001192, 002875, 096558, 097323, 102892, 103410, 103841

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Product Service

CERTIFICATE

No. Z2 099333 0055 Rev. 03

Holder of Certificate: **LONGi Green Energy Technology Co., Ltd.**
No. 388, Middle Hangtian Road
Chang'an District
710100 Xi'an City, Shaanxi
PEOPLE'S REPUBLIC OF CHINA

Certification Mark:

Product: **Crystalline Silicon Terrestrial Photovoltaic (PV) Modules**
Mono-crystalline Silicon Photovoltaic Module

The product was tested on a voluntary basis and complies with the essential requirements. The certification mark shown above can be affixed on the product. It is not permitted to alter the certification mark in any way. In addition the certification holder must not transfer the certificate to third parties. See also notes overleaf.

Test report no.: 704061700517-03

Valid until: 2024-12-04

Date, 2019-12-06 (David Bo)

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TÜV SÜD Product Service

CERTIFICATE

No. Z2 099333 0055 Rev. 03

Model(s):

LR6-72HV-xxxM, (xxx=320 to 350 in step of 5)
LR6-60HV-xxxM, (xxx=270 to 300 in step of 5)
LR6-72PH-xxxM, (xxx=340 to 385 in step of 5)
LR6-60PH-xxxM, (xxx=280 to 320 in step of 5)
LR6-72HPH-xxxM, (xxx=350 to 405 in step of 5)
LR6-72HIH-xxxM, (xxx=350 to 405 in step of 5)
LR6-60HPH-xxxM, (xxx=295 to 335 in step of 5)
LR6-60HIH-xxxM, (xxx=295 to 335 in step of 5)
LR6-72OPH-xxxM, (xxx=385 to 400 in step of 5)
LR6-60OPH-xxxM, (xxx=335 to 350 in step of 5)
LR6-72HPH-xxxMC, (xxx=375 to 390 in step of 5)
LR6-60HPH-xxxMC, (xxx=305 to 325 in step of 5)
LR4-72HPH-xxxM, (xxx=400 to 460 in step of 5)
LR4-72HIH-xxxM, (xxx=400 to 460 in step of 5)
LR4-60HPH-xxxM, (xxx=330 to 380 in step of 5)
LR4-60HIH-xxxM, (xxx=330 to 380 in step of 5)
LR4-72ZPH-xxxM, (xxx=420 to 435 in step of 5)
LR4-60ZPH-xxxM, (xxx=350 to 365 in step of 5)
LR6-60ZPH-xxxM, (xxx=330 to 355 in step of 5)
xxx is standing for rated output power at STC

Parameters:

Severity of Salt Mist Test:	Severity 6 and severity 1
Application Class:	Class A
Maximum System Voltage:	1500 V DC
Fire Safety Class:	Class C
Construction:	Framed, with Junction box, cable and connector.

Tested according to:

IEC 61215:2005
IEC 61730-1:2004
IEC 61730-1:2004/AMD1:2011
IEC 61730-1:2004/AMD2:2013
IEC 61730-2:2004
IEC 61730-2:2004/AMD1:2011
IEC 61701:2011

Production Facility(ies):

096558, 002875, 001192, 090968, 099626, 099605, 099606, 097323, 102892, 103410, 103841

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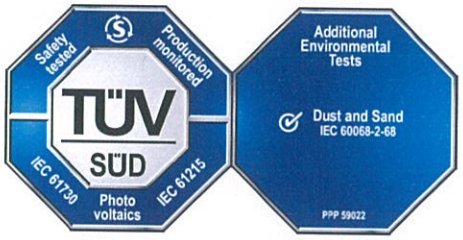
Product Service

CERTIFICATE

No. Z2 099333 0027 Rev. 03

Holder of Certificate: **LONGi Green Energy Technology Co., Ltd.**
No. 388, Middle Hangtian Road
Chang'an District
710100 Xi'an City, Shaanxi
PEOPLE'S REPUBLIC OF CHINA

Certification Mark:



Product: **Crystalline Silicon Terrestrial Photovoltaic (PV) Modules**
Mono-Crystalline Silicon Photovoltaic Module

The product was tested on a voluntary basis and complies with the essential requirements. The certification mark shown above can be affixed on the product. It is not permitted to alter the certification mark in any way. In addition the certification holder must not transfer the certificate to third parties. See also notes overleaf.

Test report no.: 704061718717-03

Valid until: 2024-12-08

Date, 2019-12-10 (David Bo)

ZERTIFIKAT ◆ CERTIFICATE ◆ 認證證書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

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Product Service

CERTIFICATE

No. Z2 099333 0027 Rev. 03

Model(s):

LR6-72HV-xxxM, (xxx=320 to 350 in step of 5)
LR6-60HV-xxxM, (xxx=270 to 300 in step of 5)
LR6-72PH-xxxM, (xxx=340 to 385 in step of 5)
LR6-60PH-xxxM, (xxx=280 to 320 in step of 5)
LR6-72HPH-xxxM, (xxx=350 to 405 in step of 5)
LR6-72HIH-xxxM, (xxx=350 to 405 in step of 5)
LR6-60HPH-xxxM, (xxx=295 to 335 in step of 5)
LR6-60HIH-xxxM, (xxx=295 to 335 in step of 5)
LR6-72OPH-xxxM, (xxx=385 to 400 in step of 5)
LR6-60OPH-xxxM, (xxx=335 to 350 in step of 5)
LR6-72HPH-xxxMC, (xxx=375 to 390 in step of 5)
LR6-60HPH-xxxMC, (xxx=305 to 325 in step of 5)
LR4-72HPH-xxxM, (xxx=400 to 460 in step of 5)
LR4-72HIH-xxxM, (xxx=400 to 460 in step of 5)
LR4-60HPH-xxxM, (xxx=330 to 380 in step of 5)
LR4-60HIH-xxxM, (xxx=330 to 380 in step of 5)
LR4-72ZPH-xxxM, (xxx=420 to 435 in step of 5)
LR4-60ZPH-xxxM, (xxx=350 to 365 in step of 5)
LR6-60ZPH-xxxM, (xxx=330 to 355 in step of 5)
xxx is standing for rated output power at STC

Parameters:

Application Class:	Class A
Max. System Voltage:	1500V DC
Fire Safety Class:	Class C
Construction:	Framed, with Junction box, cable and connector.
Dust and Sand Test Method:	IEC 60068-2-68, LC1
Dust/sand Type:	95% SiO_2
Dust /sand Concentration:	5g/m³
Testing Air Velocity:	20m/s
Test Duration:	4h/each side.

Tested according to:

PPP 59022A:2013
IEC 61215:2005
IEC 61730-1:2004
IEC 61730-1:2004/AMD1:2011
IEC 61730-1:2004/AMD2:2013
IEC 61730-2:2004
IEC 61730-2:2004/AMD1:2011

Production Facility(ies):

002875, 001192, 090968, 099626, 099605, 099606, 096558, 097323, 102892, 103410, 103841

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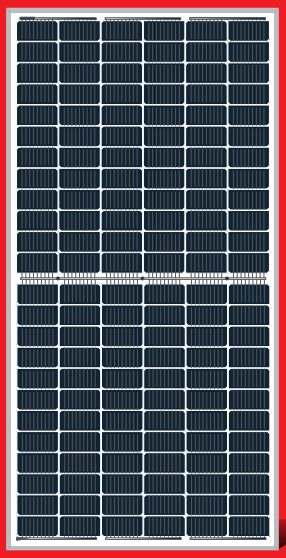
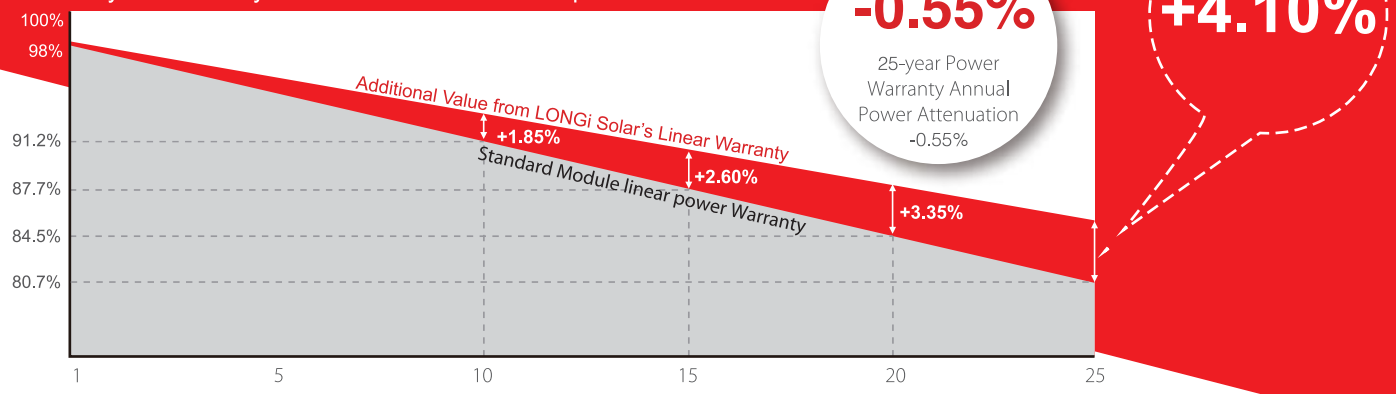
LR4-72HPH
425~455M

Hi-MO 4m
NEW



High Efficiency Low LID Mono PERC with Half-cut Technology

12-year Warranty for Materials and Processing;
25-year Warranty for Extra Linear Power Output



Complete System and Product Certifications

IEC 61215, IEC 61730, UL 61730

ISO 9001:2008: ISO Quality Management System

ISO 14001: 2004: ISO Environment Management System

TS62941: Guideline for module design qualification and type approval

OHSAS 18001: 2007 Occupational Health and Safety

* Specifications subject to technical changes and tests.
LONGi Solar reserves the right of interpretation.

Positive power tolerance (0 ~ +5W) guaranteed

High module conversion efficiency (up to 20.9%)

Slower power degradation enabled by Low LID Mono PERC technology: first year <2%, 0.55% year 2-25

Solid PID resistance ensured by solar cell process optimization and careful module BOM selection

Reduced resistive loss with lower operating current

Higher energy yield with lower operating temperature

Reduced hot spot risk with optimized electrical design and lower operating current

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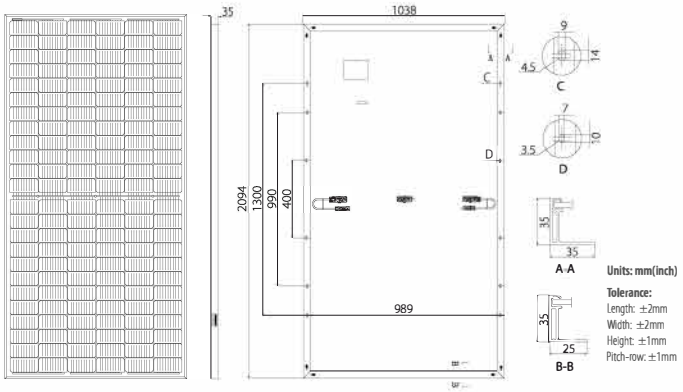
Tel: +86-21-80162606 E-mail: module@longi-silicon.com Facebook: www.facebook.com/LONGi Solar

20200414V11 for EU DG only

LR4-72HPH 425~455M

Design (mm)



Mechanical Parameters

Cell Orientation: 144 (6×24)
Junction Box: IP68, three diodes Output
Cable: 4mm², 300mm
Glass: Single glass 3.2mm coated tempered glass Frame: Anodized aluminum alloy frame
Weight: 23.5kg
Dimension: 2094×1038×35mm
Packaging: 30pcs per pallet
150pcs per 20'GP
660pcs per 40'HC

Operating Parameters

Operational Temperature: -40℃ ~+85℃
Power Output Tolerance: 0~+5 W
Voc and Isc Tolerance: ±3%
Maximum System Voltage: DC1500V (IEC/UL)
Maximum Series Fuse Rating: 20A
Nominal Operating Cell Temperature: 45±2℃
Safety Class: Class II
Fire Rating: UL type 1 or 2

Electrical Characteristics

Test uncertainty for Pmax: ±3%

Model Number	LR4-72HPH-425M		LR4-72HPH-430M		LR4-72HPH-435M		LR4-72HPH-440M		LR4-72HPH-445M		LR4-72HPH-450M		LR4-72HPH-455M	
Testing Condition	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT
Maximum Power (Pmax/W)	425	317.4	430	321.1	435	324.9	440	328.6	445	332.3	450	336.1	455	339.8
Open Circuit Voltage (Voc/V)	48.3	45.3	48.5	45.5	48.7	45.7	48.9	45.8	49.1	46.0	49.3	46.2	49.5	46.4
Short Circuit Current (Isc/A)	11.23	9.08	11.31	9.15	11.39	9.21	11.46	9.27	11.53	9.33	11.60	9.38	11.66	9.43
Voltage at Maximum Power (Vmp/V)	40.5	37.7	40.7	37.9	40.9	38.1	41.1	38.3	41.3	38.5	41.5	38.6	41.7	38.8
Current at Maximum Power (Imp/A)	10.50	8.42	10.57	8.47	10.64	8.53	10.71	8.59	10.78	8.64	10.85	8.70	10.92	8.75
Module Efficiency(%)	19.6		19.8		20.0		20.2		20.5		20.7		20.9	

STC (Standard Testing Conditions): Irradiance 1000W/m², Cell Temperature 25℃, Spectra at AM1.5

NOCT (Nominal Operating Cell Temperature): Irradiance 800W/m², Ambient Temperature 20℃, Spectra at AM1.5, Wind at 1m/S

Temperature Ratings (STC)

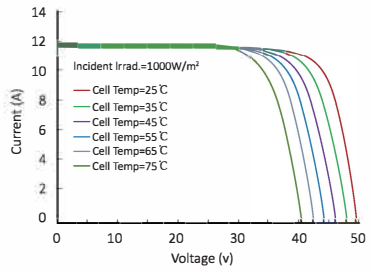
Temperature Coefficient of Isc	+0.048%/℃
Temperature Coefficient of Voc	-0.270%/℃
Temperature Coefficient of Pmax	-0.350%/℃

Mechanical Loading

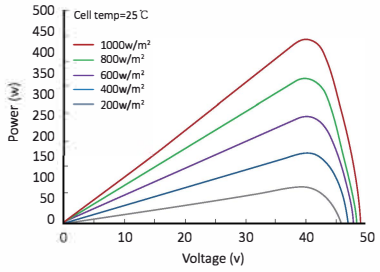
Front Side Maximum Static Loading	5400Pa
Rear Side Maximum Static Loading	2400Pa
Hailstone Test	25mm Hailstone at the speed of 23m/s

I-V Curve

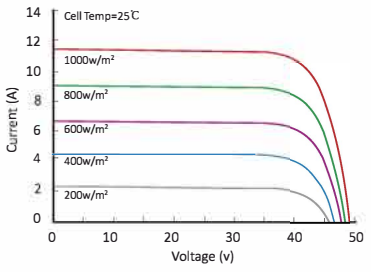
Current-Voltage Curve (LR4-72HPH-440M)



Power-Voltage Curve (LR4-72HPH-440M)



Current-Voltage Curve (LR4-72HPH-440M)



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