HEINER STRUCTURAL ENGINEERING CONSULTANTS PTY LTD

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Building Practitioners Registration Number: (Wisnu Lim) **145651ES**

NORTHERN TERRITORY OF AUSTRALIA
STRUCTURAL ENGINEERING CERTIFICATE OF COMPLIANCE

HSEC REF: E170214.V1.06.10.2017.JINKO JKM270PP-60 &JKM305M-60 SOLAR PANEL TEST REPORT.WL

Jinko Solar
PO Box 1260 Sunnybank Hills 4109

Attention: **Thomas Bywater**

Documents Attached: Appendix A – Photographs
Appendix B - Test Configuration
Appendix C – Panel Data Sheet

10 October 2017

Dear Sir,

RE: Design Certification of Jinko Solar Modules:

- **No. 1. Type 1 (JKM270PP-60 255 – 270 W) with support points at 1200 mm apart**
- **No. 2. Type 2 (Eagle PERC 60 JKM 285-305M-60) with support points at 1200 mm apart.**
- **No. 3. Type 2 (Eagle PERC 60 JKM 285-305M-60) with support points at 800 mm apart.**

This Certificate of Compliance verifies that the Jinko Solar (JKM270PP-60 255 – 270 W & Eagle PERC 60 JKM 285-305M-60) can resist vertical loads as listed in Table 1.

Heiner Structural Engineering Consultants (HSEC) were engaged by Jinko Solar (Australia) to carry out and witness two static simulated wind load strength tests for the above mentioned solar panel modules and configurations. The test procedure followed was similar to the method as outlined in AS4040.2:1992 – Static Strength Test Regime.

The solar panel module is mounted on an air-bag test rig at four fixing points. The electrical continuity of the panel was not measured. The load is applied to the solar module evenly by increasing the air pressure of the air bag in increments of 1 kPa. The pressure in the air bag is measured by using a monometer calibrated to 9.81 mm equal to 1.0 kPa. The mid span vertical deflection of the panel is measured using a digital measuring device. The air pressure is increased in increments and held constant for a period of one minute and the deflection recorded. This air pressure is increased until failure of the system is achieved or the required design value is achieved.

The tests were carried out on 27/06/2017, 03/07/2017 & 04/10/2017 by Simon Andropof and witnessed by a representative from HSEC, Wisnu Lim at Lot 6032 Unit 7 No 8 Andrews Street, Berrimah, Hundred of Bagot, NT 0828.

Test no.1: Type 1
The panel is mounted to the air bag test rig with support points at 1200 mm and 220 mm overhangs at each end. The system maintained an equivalent 10 kPa load for a period of 1 minute without any signs of failure and the mid span deflection was measured at 33 mm. The mid span deflection was excessive with the aluminium frame rotated inward by 2 mm approximately from both the end clamps and no signs of damage to the solar module. In summary, the system capacity is not limited by the solar module but by the connection of the rail fixing to the immediate support structure.

Test no.2: Type 2
The panel is mounted to the air bag test rig with support points at 1200 mm and 220 mm overhangs at each end. The system maintained an equivalent 10 kPa load for a period of 1 minute without any signs of failure and the mid span deflection was measured at 33 mm. The mid span deflection was excessive with the aluminium frame rotated inward by 2 mm approximately from both the end clamps and no signs of damage to the solar module. In summary, the system capacity is not limited by the solar module but by the connection of the rail fixing to the immediate support structure.

Test no.3: Type 2
The panel is mounted to the air bag test rig with support points at 800 mm and 420 mm overhangs at each end. The system maintained an equivalent 12 kPa load for a period of 1 minute without any signs of failure and the mid span deflection was measured at 48 mm. In this test, middle clamps and "L" foot bracket were used at four support points instead of end clamps. "L"feet bracket is used as a packer to prevent the middle clamp from rotation. Please refer to photo 1. The mounting method was introduced to achieve maximum Ultimate Limit Capacity of the solar panel and to reduce rotation of the end clamp. The deflection of the solar module was excessive with no signs of damage to the solar module. In summary, the system capacity is not limited by the solar module but by the connection of the module to the rail and the connection of the rail fixing to the immediate support structure. It is recommended to install solar module at the end panel using middle clamps and "L" foot bracket as a packer.

Please refer to Appendix A for the test set arrangement and Appendix B for Photographs taken during the test.
Table1.

Test	**Panel Type & Size**	**Support Points (mm)**	**Maximum Applied Load (kPa)**	**Material Variability Factor AS/NZS 1170.0 Tb B1 – kt**	**Recommended Ultimate Design Strength Limit State Design Capacity (kPa)**
No.1 Type 1	**Jinko Solar JKM270PP-60 255 – 270 W** (992 x 1650 x 40mm)	1200	10.0	1.46	6.85
No.2 Type 2	**Jinko Solar Eagle PERC 60 JKM 285-305M-60** (992 x 1650 x 40mm)	1200	10.0	1.46	6.85
No.3 Type 2	**Jinko Solar Eagle PERC 60 JKM 285-305M-60** (992 x 1650 x 40mm)	800	12.0	1.46	8.22

The Ultimate Strength Limit Design Capacity for the tested solar modules can be back- calculated from the static test results by dividing the maximum applied load by the material variability factor in accordance with

AS/NZS 1170.0 Table B1. Where no reliable data for the co-efficient of variation of structural characteristics (Vsc) are available, a value of 10.0% maybe adopted for roof assembly cyclic testing, as recommended in Clause 6.1 of *the Draft Guide to LHL Cyclic Testing (Version 1)*, dated 9 April 2009 and issued by the Cyclone Testing Station.

The recommended Ultimate Strength Limit State design capacity of the Jinko Solar (JKM270PP-60 255 – 270 W & Eagle PERC 60 JKM 285-305M-60) solar modules are summarized in Table 1. Note that these design capacities are only applicable for the solar module tested. It should be noted the recommended ultimate design strength capacity of the panels are 6.85 kPa (Test 1&2) and 8.22kPa (Test 3). However, the overall design capacity of the system will be determined by the capacity of the connection bracket used. Please note the maximum design wind loads for a building located in terrain category 2.0 region C with a maximum height of 30 m is 6.1 kPa.

We hereby certify that the Jinko Solar (JKM270PP-60 255 – 270 W) with support points 1200 mm apart, and Jinko Solar (Eagle PERC 60 JKM 285-305M-60) with support points 1200mm and 800mm apart can resist vertical design loads as listed in Table 1.

This certificate of compliance has been prepared on behalf of and for the exclusive use of Jinko Solar Pty Ltd and form part of the A.I.P certificate of compliance valid for three years from the date of approval. After the three year period the certificate of compliance shall be renewed.

Yours sincerely
HEINER STRACTURAL ENGINEERING CONSULTANTS PTY LTD

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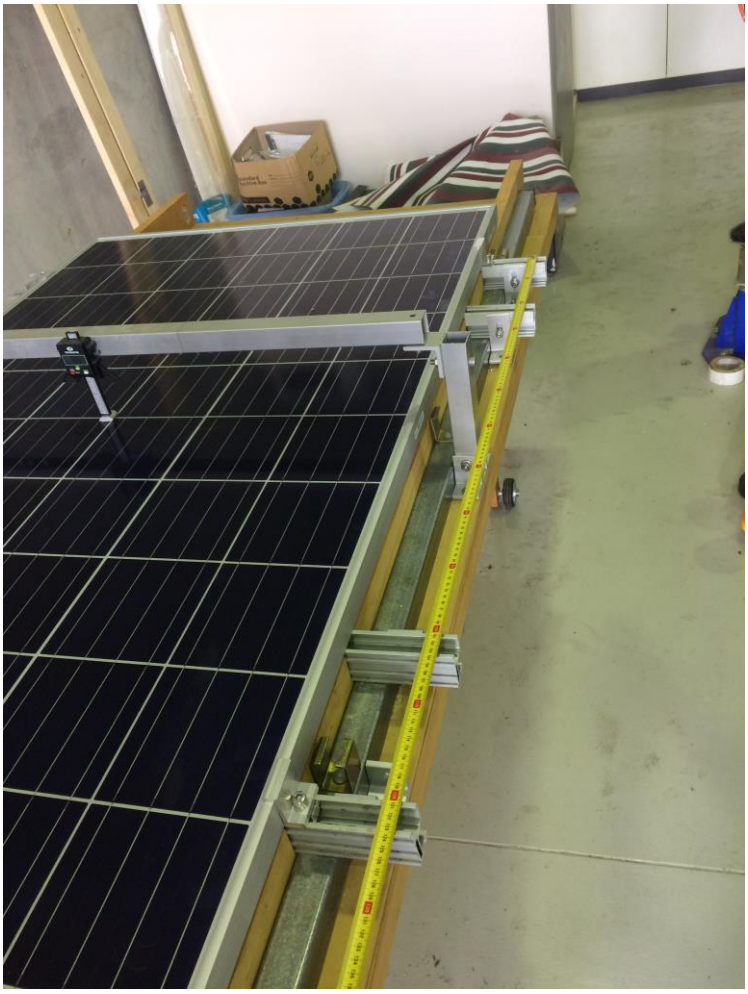
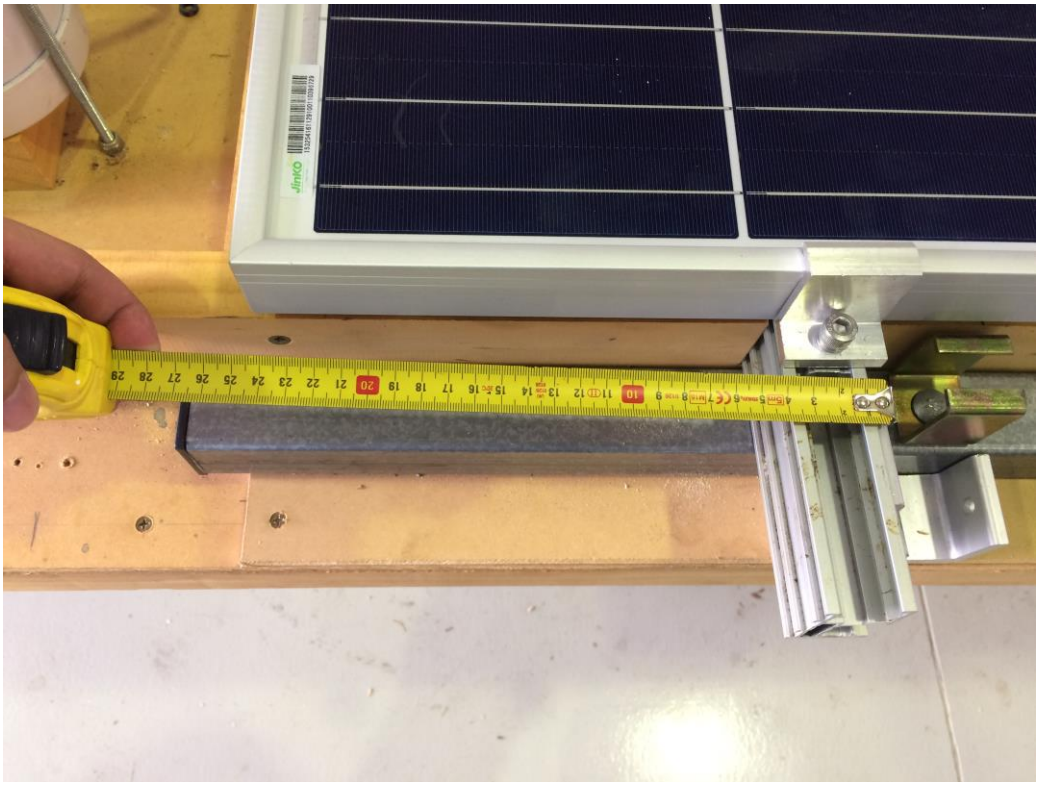
WISNU LIM
NT Reg. No. 145651ES
Structural Engineer
Nominee for HSEC
NT Reg. No. 52229ES

HSEC – E170214 - APPENDIX A

Photo 1 - Solar module mounted with middle clamp and a "L" foot bracket as a packer


BLACK RIDGE






JinKO
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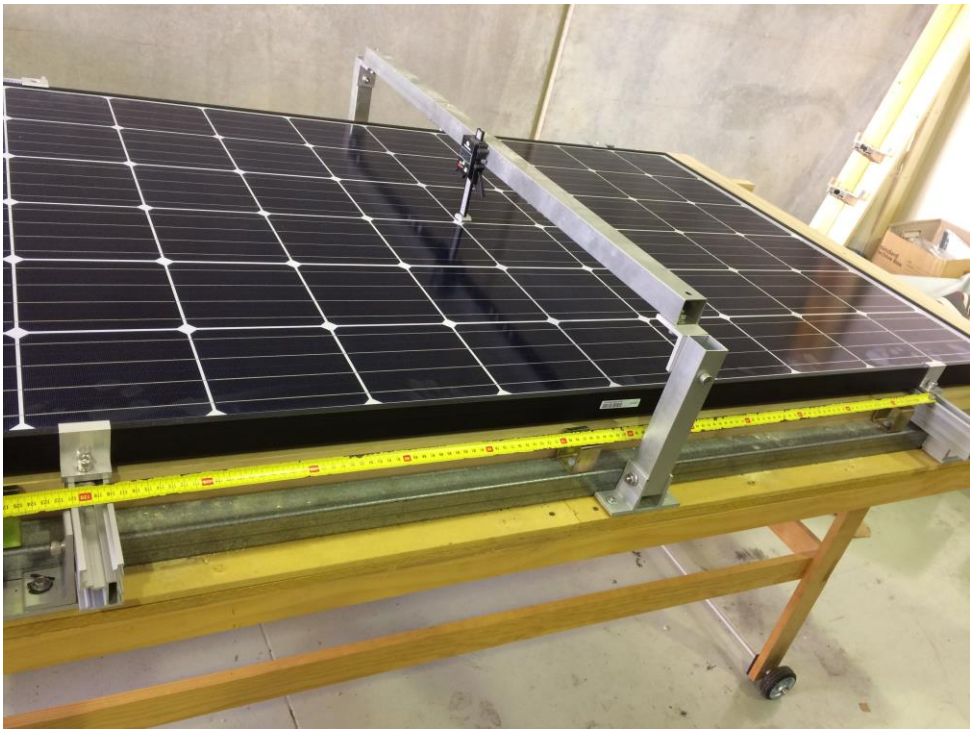
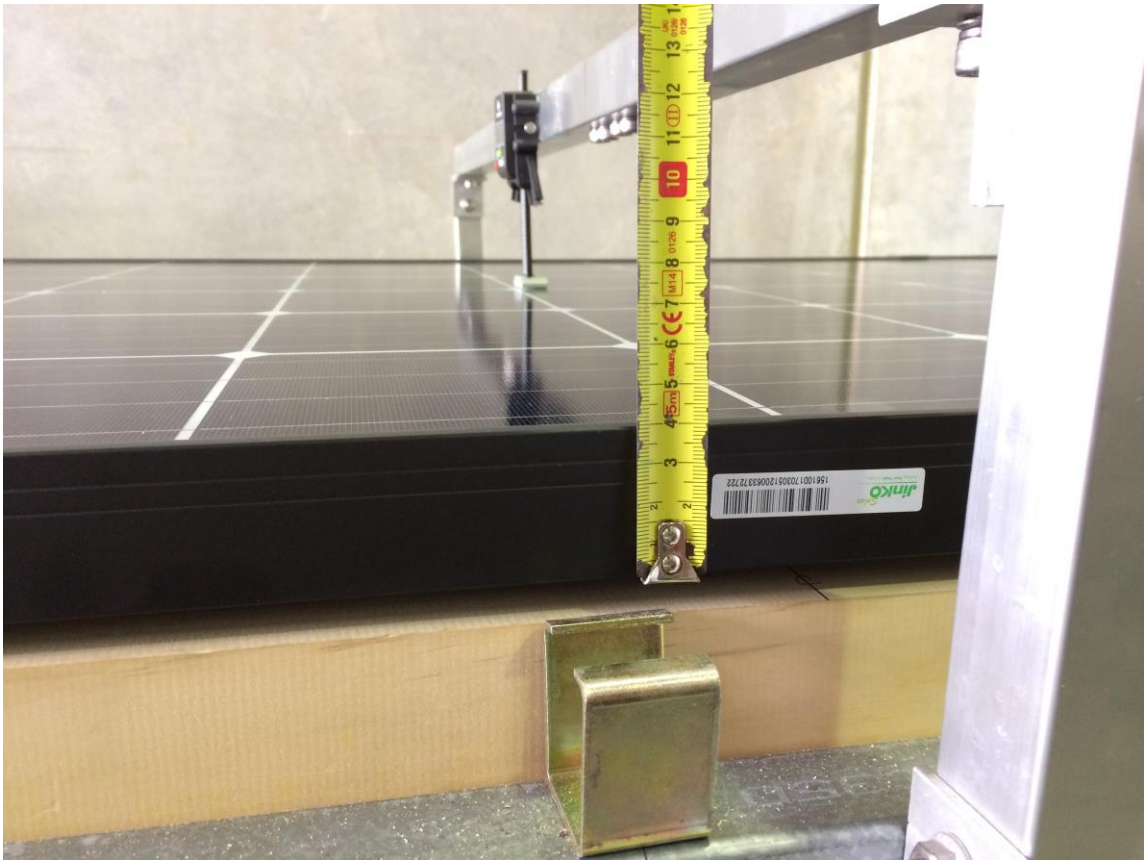
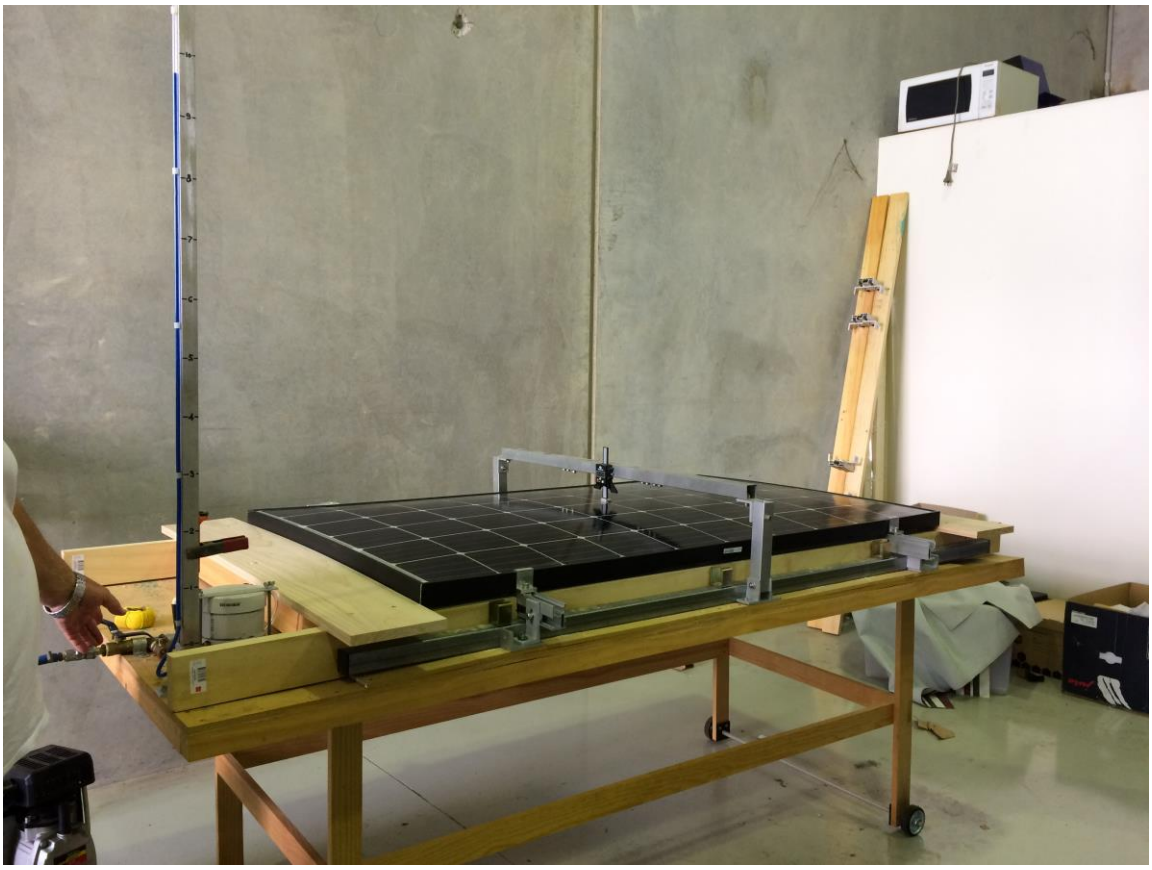
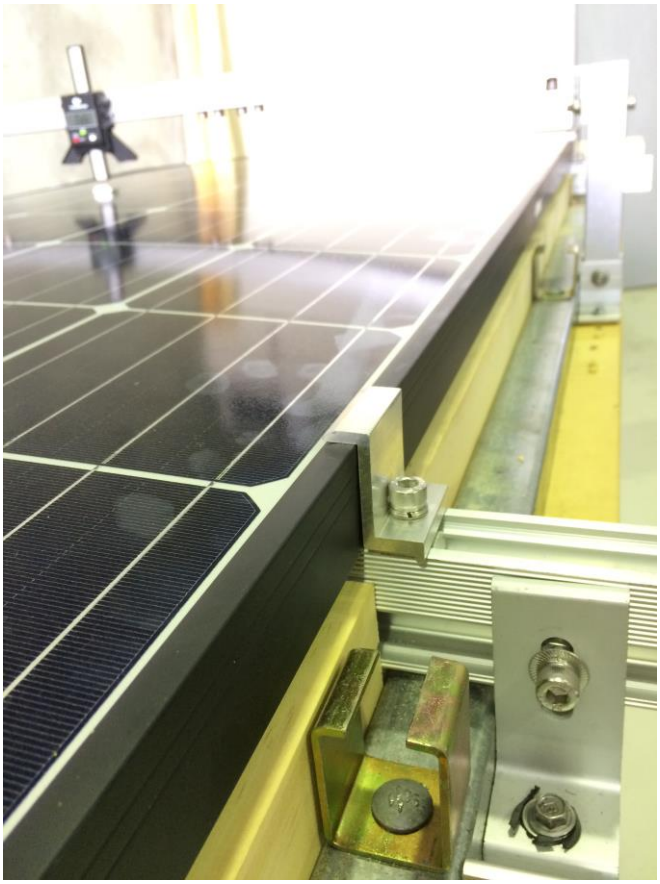
Jinko Solar
Building Your Trust in Solar
Jinko Solar Co., Ltd
NO.1 Jinko Road Shangrao Economic Development Zone
Jiangxi Province 334100 China
www.jinkosolar.com
PHOTOVOLTAIC MODULE
Made in China
Solar Module Type : JKM270PP-60
Maximum Power (Pmax) 270W
Power Tolerance 0~+3%
Maximum Power Voltage (Vmp) 31.7V
Maximum Power Current (Imp) 8.52A
Open Circuit Voltage (Voc) 38.8V
Short Circuit Current (Isc) 9.09A
Nominal Operating Cell Temp (NOCT) 45±2℃
Maximum System Voltage 1000VDC
Maximum Series Fuse Rating 15A
Operating Temperature -40℃~+85℃
Application Class A
Fire Class C
Weight 19.0(kg)
Dimension 1650×992×40(mm)
STC: 1000W/m², AM1.5, 25℃
WARNING
ONLY qualified personnel should install or perform maintenance work on these modules
BE AWARE of dangerous high DC voltage when connecting modules
DO NOT damage or scratch the rear surface of the module
PV CYCLE
CE

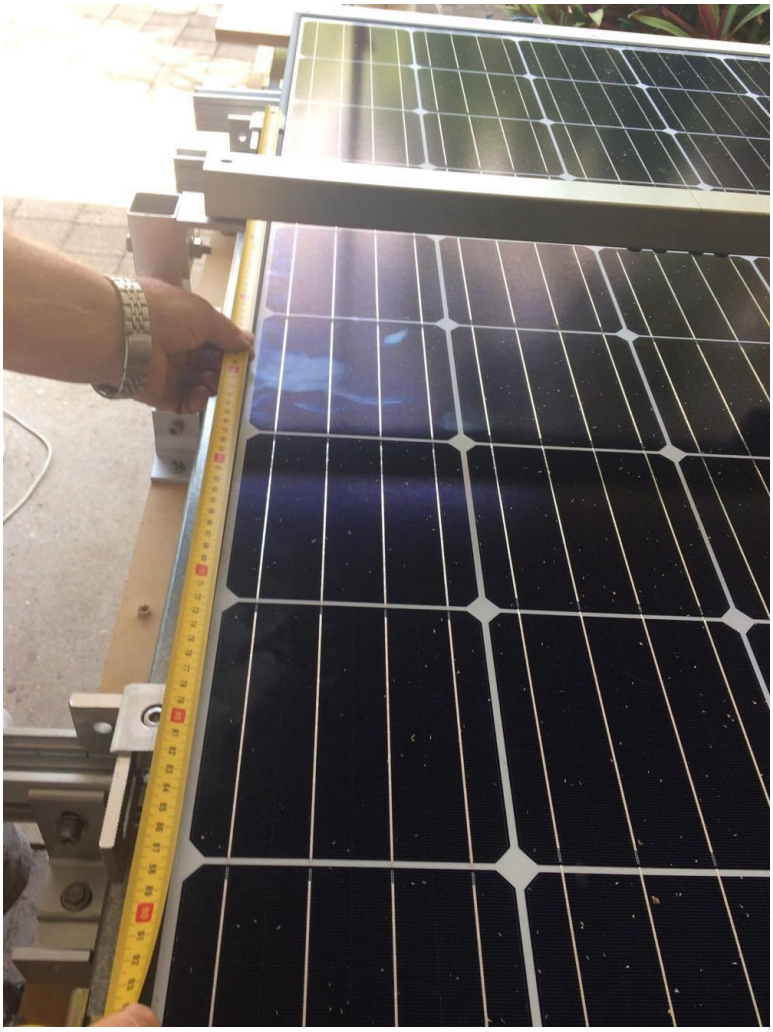


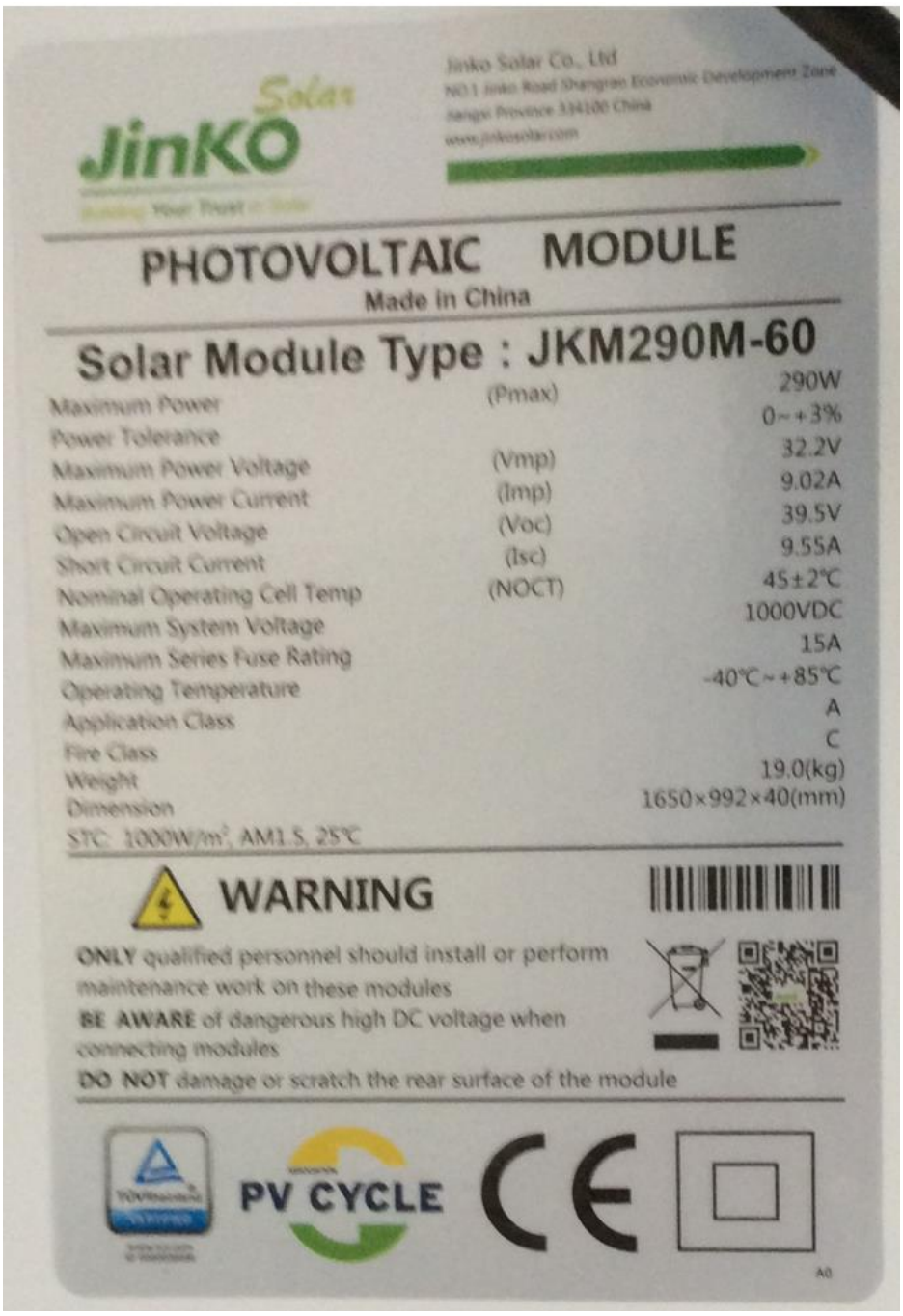







JinKO Solar
Jinko Solar Co., Ltd
PHOTOVOLTAIC MODULE
Made in China
Solar Module Type : JKM290M-60
Maximum Power (Pmax) 290W
Power Tolerance 0~+3%
Maximum Power Voltage (Vmp) 32.2V
Maximum Power Current (Imp) 9.02A
Open Circuit Voltage (Voc) 39.5V
Short Circuit Current (Isc) 9.55A
Nominal Operating Cell Temp (NOCT) 45±2℃
Maximum System Voltage 1000VDC
Maximum Series Fuse Rating 15A
Operating Temperature -40℃~+85℃
Application Class A
Fire Class C
Weight 19.0(kg)
Dimension 1650×992×40(mm)
STC: 1000W/m², AM1.5, 25℃
WARNING
ONLY qualified personnel should install or perform maintenance work on these modules
BE AWARE of dangerous high DC voltage when connecting modules
DO NOT damage or scratch the rear surface of the module
PV CYCLE




Jinko Solar Co., Ltd
JinKO Solar
PHOTOVOLTAIC MODULE
Made in China
Solar Module Type : JKM290M-60
Maximum Power (Pmax) 290W
Power Tolerance 0~+3%
Maximum Power Voltage (Vmp) 32.2V
Maximum Power Current (Imp) 9.02A
Open Circuit Voltage (Voc) 39.5V
Short Circuit Current (Isc) 9.55A
Nominal Operating Cell Temp (NOCT) 45±2℃
Maximum System Voltage 1000VDC
Maximum Series Fuse Rating 15A
Operating Temperature -40℃~+85℃
Application Class A
Fire Class C
Weight 19.0(kg)
Dimension 1650×992×40(mm)
STC: 1000W/m², AM1.5, 25℃
WARNING
ONLY qualified personnel should install or perform maintenance work on these modules
BE AWARE of dangerous high DC voltage when connecting modules
DO NOT damage or scratch the rear surface of the module
PV CYCLE
A0