STRUCTURAL ENGINEERING CONSULTANTS AUSTRALIA PTY LTD

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NORTHERN TERRITORY OF AUSTRALIA

STRUCTURAL ENGINEERING CERTIFICATE OF COMPLIANCE

SECA REFERENCE: 24374 – YLXXXCF48 i/2 800mm & 1200mm

Date of Issue: 11 November 2024

Yingli Green Energy Australia Pty Ltd
Level 10, 210 Clarence Street
Sydney NSW 2000
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The Recommended Ultimate Design Strength of the Yingli **YLXXXCF48 i/2 - 1762 x 1134 x 30mm** Solar Panel Module can resist vertical wind force at the Limit State Design Capacity for the following support conditions:

When supported at 800mm centres	**4.45 kPa**
When supported at 1200mm centres	**4.11 kPa**

SCOPE

Structural Engineering Consultants Australia (SECA) Pty Ltd were engaged by Aqib Aziz of Yingli Green Energy Australia Pty Ltd to carry out and witness two individual mechanical load tests (simulated static, wind load strength test). The test procedure followed was similar to the method outlined in AS4040.2:1992, Static Strength Test Regime. The testing was performed on new panels supplied by the client.

TEST PROCEDURE

The solar panel module(s) were mounted front side up and were free to deflect, this was to imitate a real-world situation. The electrical continuity or the cells themselves were not monitored during or after the tests. The load was applied by an airbag to the back of the panel and the centre deflection was monitored at 1kPa intervals as the load was applied by slowly inflating an air bag. A calibrated digital manometer was used to measure and track the test pressures, while a calibrated digital deflection meter was used to measure the centre (vertical) deflection of the solar panel.

The tests were observed by Ray Colley and Wisnu Lim on behalf of SECA in Darwin, Northern Territory. A total of two panels were tested, one supported at 800mm centres and one supported at 1200mm centres, each test was carried out once on 2nd November 2024. The applied factor for variability in accordance with AS/NZS 1170.0 Table B1 when determining the allowable design capacity for 1 test unit is 1.46.

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Test Results

Test: Model: Yingli YL440CF48 i/2 , Serial Number: 243201118501373
The panel **1762 x 1134 x 30mm** was mounted to the test rig with support points at **1200mm** centres apart on each side with a cantilever/ overhang of approximately **281mm** at each end (measured from centre of supports).

The solar panel was observed to be able to support an equivalent design test pressure of **6.0 kPa** with a centre vertical deflection of **76.1mm.**

Test: Model: Yingli YL440CF48 i/2, Serial Number: 243201118501306
The panel **1762 x 1134 x 30mm** was mounted to the test rig with support points at **800mm** centres apart on each side with a cantilever/ overhang of approximately **481m** at each end (measured from centre of supports).

The solar panel was observed to be able to support an equivalent design test pressure of **6.5 kPa** with a centre vertical deflection of **90.5mm.**

Table 1: Test Summary
Recommended Ultimate Design Strength, Limit Design Capacity

Test	Panel Manufacturer, Model & Size (mm)	Support Points (mm)	Maximum Applied Load (kPa)	Material Variability Factor AS/NZS 1170.0 Table B1 – kt	Recommended Ultimate Design Strength Limit State Design Capacity (kPa)
1	**Yingli YL440CF48 i/2** 1762 x 1134 x 30mm Serial Number: 243201118501373	1200	6.0	1.46	4.11
3	**Yingli YL440CF48 i/2** 1762 x 1134 x 30mm **Serial Number:** 243201118501306	800	6.5	1.46	4.45

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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.

Mechanical Properties

Cell Type	N type monocrystalline
Thickness of glass	1.6mm / 1.6mm
Dimensions (L x W x Frame thickness)	1762 x 1134 x 30mm
Weight	21 kg
Frame	Anodised Aluminium Alloy

Summary

The Recommended Ultimate Design Strength of the Yingli **YLXXXCF48 i/2 - 1762 x 1134 x 30mm** Solar Panel Module can resist vertical wind force at the Limit State Design Capacity for the following support conditions:

**Refer to Appendix B: Yingli Green Solar Panel Mechanical Statement*
xxx = wattage of panel (430W – 455W)

When supported at 800mm centres	**4.45 kPa**
When supported at 1200mm centres	**4.11 kPa**

Limitations

This certificate of compliance has been prepared on behalf of and for the exclusive use of Yingli Green Energy Australia Pty Ltd and forms part of the A.I.P certificate of compliance. These design capacities are only applicable for the panel size, model and support spacing as used in these tests. We accept that the wattage of the panel may vary, however this certificate is no longer valid if the any of the applicable Mechanical Properties used in the manufacture of these solar panel module or if the manufacturing processes or techniques is changed or altered in any way. It is the responsibility of the manufacturer to advise or confirm if they are altered in any way as new tests and certification will be required.

Please note: The panel fixing clamps, the support rail or their associated fixings, may limit the structural design for installation.

Ray Colley **Director** **Structural Engineering Consultants Australia Pty Ltd**			**Company NT Registration Number** 169894ES
I certify that reasonable care has been taken to ensure that the structural engineering aspects of the works as described above have been designed in accordance with the requirements of the Building Code of Australia and the Northern Territory Building Regulations			
Name **Wisnu Lim** Nominee for Structural Engineering Consultants Australia Pty Ltd	**Nominee/Individual NT Registration Number** 145651ES	**Signature**	**Date** 11 November 2024

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Appendix A

Test Results

Test Pressure	Test 1200mm C/C Supports	Test 800mm C/C Supports
Load Applied (kPa)	Recorded Deflection (mm)	Recorded Deflection (mm)
1	15.4	16.0
2	26.5	32.7
3	38.7	47.5
4	50.2	60.0
5	63.1	72.2
6	76.1	84.4
6.5		90.5

Appendix B

Yingli Green Energy Australia Pty Ltd
Level 10, 210 Clarence Street
Sydney, NSW, 2000
ABN: 38 159 202 132

SECA Pty Ltd
7 Hidden Valley Road
Berrimah
NT 0831
Date: 11 Nov 2024

To whom it may concern:

We, Yingli Energy Development Co., Ltd. (hereinafter "Yingli Solar"), hereby declare that the PV Modules YLXXXCF48 i/2 (XXX=430W-455W) share the same panel size (1762 x 1134 x 30mm) and similar BOMs for applicable Mechanical Properties.

The wattage and efficiency of each power class may vary, however, Yingli Green Energy Development Co., Ltd confirms the applicable Mechanical Properties used during the manufacture of the PV modules and the manufacturing process and techniques have not been changed in any way.

The modules' electrical parameters at standard test conditions and footprint details are given below.

MODULE TYPE YLxxxCF48 i/2 (xxx=Pmax)
DIMENSIONS 1762 mm / 1134 mm / 30 mm **WEIGHT** 21.0 kg **FIRE RESISTANCE RATING** Class A + C

Electrical Parameters at Standard Test Conditions (STC*)

Power output-Pmax (W)	430	435	440	445	450	455
Power output tolerances-ΔPmax (W)	0 / + 5	0 / + 5	0 / + 5	0 / + 5	0 / + 5	0 / + 5
Module efficiency-ηm (%)	21.5	21.8	22.0	22.3	22.5	22.8
Voltage at Pmax - Vmpp (V)	29.22	29.45	29.68	29.91	30.14	30.37
Current at Pmax-Impp (A)	14.72	14.78	14.83	14.88	14.94	14.99
Open-circuit voltage-Voc (V)	35.42	35.63	35.84	36.05	36.26	36.47
Short-circuit current-Isc (A)	15.40	15.46	15.52	15.58	15.64	15.70

*STC: 1000 W·m^{-2} irradiance, 25°C cell temperature, AM 1.5.

This declaration is valid for solar PV projects located in Australia. For more details about the mounting method, please refer to the Yingli PV installation manual

Best Regards,

Tim Feng
Managing Director
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