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**Attention: Mr Andrew Zhai**

**RE: Wind Pressure Testing of JA Solar Crystalline Silicon Photovoltaic Modules  
Type JAM72S30-530/MR  
Design Certification**

Dear Sir,

This Report certifies the Design Wind Pressure for the JA Solar Type JAM72S30-530/MRI PV Module for wind loads in Cyclonic Regions C and D. We verify that the PV Module is capable of withstanding a design wind load as specified in **Table 1**.

The test modules were mounted front side up in a test bed. The size of the modules was measured as 2280mm long x 1135mm wide. The fixing of the modules was fixed using the Clenergy mounting brackets and rails. The fixings were spaced at 800 mm centres giving a maximum cantilever overhang of 740mm of the module and at 1200mm centres giving a maximum span of the module. The rails were fixed to the test bed. The perimeter frame of the module was 35 x 35 x 1mm aluminium angle all round.

A pressure test was conducted and observed by this office on the 8<sup>th</sup> of April 2021 in Darwin, Northern Territory. The testing officer was Michael Hatton of this Office. A total of three individual panels were tested with two tests being conducted with the module's fixings spaced at 800mm centres and only one test was conducted with the module's fixings being spaced at 1200mm centres.

An air bag was used to apply constant pressure to the back of the module. The air bag was inflated with pressure to the required design pressure and held for 1 minute at maximum pressure.

A calibrated deflection meter was used to measure deflection at mid panel and was recorded at 1 kPa intervals. The electrical continuity of the panels was not measured during the pressure test. The behaviour of the module and supporting fixtures were observed and recorded. Photographs were taken before and at maximum pressure of the test.

A design maximum pressure that was adopted was 12 kPa. This figure was chosen on past tests and it also allows the modules to be placed on the roofs of multi storey buildings subject to the variability factor.

The applied factor of variability, for a single test specimen and adopting a coefficient of variation of structural characteristics of 10 percent, from AS 1170.0 Table B1 when applying to the allowable design wind capacity is 1.46.

The applied factor of variability, for a two test specimen and adopting a coefficient of variation of structural characteristics of 10 percent, from AS 1170.0 Table B1 when applying to the allowable design wind capacity is 1.38.

Two modules tested with supports spaced at 800mm centres sustained test pressures of 6.4kPa and 6.5kPa (short of the design pressure). During the first test conducted at 800mm support centres, a vertical deflection of 71mm was recorded at the mid of the panel at 5.0kPa for the first test. The load was then increased until the glass failed and subsequently the panel slipped from the support. Deflection recording was discontinued at 5.0kPa as the deflection went beyond the limits of the recording device.

During the second test conducted at 800mm support centres, a deflection of 67mm was recorded at the mid the mid of the panel at 4.0kPa for the second test. The load was then increased to 6.5kPa before the short edge of the frame started to yield. Deflection recording was discontinued at 4.0kPa as the deflection went beyond the limits of the recording device.

The third module was tested with the supports spaced at 1200mm centres and sustained a test pressure of 5.6kPa (short of the design pressure). A deflection of 68mm was recorded at the mid of the panel at 3.0kPa test pressure for the 1200mm support. The load was then increased to 5.6kPa before the short edge of the frame started to yield. Deflection recording was discontinued at 3.0kPa as the deflection went beyond the limits of the recording device.

Upon completion of the tests, the panels were taken out of the test bed and examined. For the first panel tested with supports spaced at 800mm centres, the glass was observed to have broken however the panel showed no signs of permanent distortion to the frame. The second panel tested with supports spaced at 800mm centres, signs of permanent distortion of the end cross member were observed thus indicating that the start of yielding of the end cross member of the frame. The 1200mm support test panel showed signs of permanent distortion of the end cross member of the frame thus indicating the start of yielding of the end cross member of the frame.

We consider that the fracturing of the glass did not destroy the panel and it still remained intact. We also consider the maximum pressure of the module can sustain 6.4 kPa and 5.6 kPa with 800 and 1200 support respectively without forming a debris hazard.

A test observation indicates that the maximum pressures related to the midspan deflection and not the cantilever at the at the end of the panels. This was observed during the test that the midspan deflection influenced the cantilever end deflection. It was noted that the larger the midspan deflection the more influence it has on the cantilever end deflection. This observation is supported by the end cross member yielding first. However, the glass protective cover reduces the mid span deflection. It was observed that when the glass cover fractured the panel deflection was excessive causing the panel to slip out of the supports.

**Table 1**

<b>Support Points (Cantilever)</b>	<b>Max Applied Load</b>	<b>Variability Factor AS 1170.0 Table B1</b>	<b>Ultimate Strength Limit State Design Capacity</b>
800 mm (740 mm)	6.4 kPa	1.38	4.6 kPa
1200 mm (500 mm)	5.6 kPa	1.46	3.8 kPa

We hereby certify the JA Solar Type JAM72S30-530/MRI PV Modules with support points located at 800 mm is suitable for a cyclonic design wind pressure of 4.6 kPa and support points located at 1200 mm a pressure of 3.8 kPa. It is our technical opinion that the same pressure of 4.6 kPa can be maintained with support points at 900 mm. Note that the test is for the PV module only and its support fixings and rails are not part of this test.

This certification excludes the module fixing clamps, the support rail or fixing to the roof as this may limit the maximum design wind pressure.

<b><u>CERTIFICATION BY STRUCTURAL ENGINEER</u></b>			
<b>Company Name</b> (if certification issued on behalf of a corporation) Asset Services Pty Ltd		<b>Company NT Registration Number</b> 152941ES	
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.			
<b>Name</b> (see below) Michael Hatton Nominee for Asset Services Pty Ltd	<b>Nominee/Individual NT Registration Number</b> 14704ES	<b>Signature</b>	<b>Date</b> 24/05/2021

Should you require any further information in relation to this report please contact this office.

Yours faithfully,

Michael Hatton  
Senior Structural Engineer | Senior Building Surveyor  
**Asset Services Pty Ltd**