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Melbourne, Victoria

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Attention: Mr Andrew Zhai

**RE: Wind Pressure Testing of JA Solar Crystalline Silicon Photovoltaic Modules
Type JAM72D09 – 390/BP
Design Certification**

Dear Sir,

This Report certifies the Design Wind Pressure for the JA Solar Type JAM72D09 – 390/BP PV Module for wind loads in Cyclonic Region C. We verify that the PV Module is capable of withstanding a design wind load as specified in Table 1.

A pressure test was conducted and observed by this office on the 11th December 2019 in Darwin, Northern Territory. The testing officer was Michael Hatton from this office.

The test module (serial number 18CM6F7224000554) was mounted front side up in a test bed. The size of the module was measured as 1.0 m wide x 2.0 m long. The fixing of the module was fixed using the Clenergy mounting brackets and rails. The fixings were spaced at 1200 mm centres giving a cantilever overhang of 400 mm of the module. The rails were fixed to the test bed. The perimeter frame of the module is 30 x 28 x 1.2 mm on the long edge and 30 x 10 x 1.2 on the short edge aluminium angle.

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 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 module sustained a test pressure of 10 kPa (short of the design pressure) and showed no signs of cracking of the polycarbonate / glass protective covering. A deflection of 61.2 mm was recorded at mid panel at the 10 kPa test pressure. At this point the short edge angles were starting to yield. A maximum test pressure of 10 kPa was achieved prior to failure of panel frame yielding. The module was removed from the test bed for further inspection. From our inspection the cross member at the end of the panels (short edge) had started to yield. We consider that even though the frame started to yield, the panel remained on the test rails with no further damage. We consider the maximum pressure of the module can sustain 10 kPa without forming a debris hazard.


Table 1

Module Sn	Support Points (Cantilever)	Max Applied Load	Variability Factor AS 1170.0 Table B1	Ultimate Strength Limit State Design Capacity
18CM6F7224000554	1200 mm (400 mm)	10.0 kPa	1.46	6.8 kPa

We hereby certify the JA Solar Type JAM72D09 – 390/BP PV Module with support points located at 1200 mm is suitable for a cyclonic design wind pressure of 6.8 kPa. From our previous PV panel testing experience closer support spacing would decrease the cyclonic design wind pressure due to the increase of the free end cantilever effect.

It is our technical opinion that the pressure would be decreased by approximately by 30% with support points at 900 mm. Our opinion that the PV Module is suitable for a cyclonic design wind pressure of 4.8 kPa for 900 mm support points. 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.

<u>CERTIFICATION BY STRUCTURAL ENGINEER</u>			
Company Name if certification issued on behalf of a corporation Asset Services Pty Ltd		Company NT Registration Number 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.			
Name (see *below) Michael Hatton Nominee for Asset Services Pty Ltd	Nominee/Individual NT Registration Number 14704ES	Signature 	Date 10/11/2019

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