



# Technical Information Service Report

**TIS Report:** 80151492

**Date:** February 6, 2023

**CLIENT:** Sunpal Power Co. Ltd.  
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China

Attention: Silvia Wang / Marketing Manager

Issued by: Sean Jiang *Sean Jiang*

**SUBJECT:** California Energy Commission Listing Tests for PV modules

## APPLICABLE REQUIREMENTS:

IEC 61215 2nd, Crystalline silicon terrestrial photovoltaic (PV) modules – Design qualification and type approval, 2005

10.2 Maximum power determination

10.3 Insulation test

10.4 Measurement of temperature coefficients

10.5 Measurement of nominal operating cell temperature (NOCT)

10.6 Performance at STC and NOCT

10.7 Performance at low irradiance

## ASSESSMENT:

Please supply a copy of this information when filing an application for CSA Certification related to the SUBJECT, as it may aid the investigation.

**THIS REPORT DOES NOT AUTHORIZE THE USE OF THE CSA MARK ON THE SUBJECT PRODUCTS.**

*The completion of this form does not imply certification or approval of the "SUBJECT" product nor any features or components thereof.*

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**General product information provided by client.**

<b>Model Type</b>	SP450M-72HB	SP545M-72HB	-
<b>Max system voltage (V)</b>	1500	1500	-
<b>Max open circuit voltage: Voc (V)</b>	49.96 ±5%	49.68 ±5%	-
<b>Short circuit current: Isc (A)</b>	11.44 ±5%	13.89 ±5%	-
<b>Vmp (V)</b>	41.32	40.95	-
<b>Imp (A)</b>	10.90	13.31	-
<b>Pmp (W)</b>	450 ±5%	545 ±5%	-
<b>Nominal power (W)</b>	450 ±5%	545 ±5%	-
<b>Total number cells</b>	144	144	-
<b>Number of cells in Series strings</b>	72	72	-
<b>Number of parallel strings</b>	2	2	-
<b>Number of cells per bypass diode</b>	48	48	-
<b>Number of bypass diode</b>	3	3	-
<b>Module dimension (mm)</b>	2094 x 1038 x 35	2279 x 1134 x 35	-
<b>Cell Technology</b>	Mono-Si	Mono-Si	-

**1, TEST SAMPLE IDENTIFICATION**

No.	Customer Series No.	Sample Card No.	Model Type
1#	SP72MH2022110200003	HA2022L-1917-001X	SP450M-72HB
2#	SP72MH2022101900007	HA2022L-1918-001X	SP545M-72HB

**2, SAMPLE ALLOCATION**

Section	Tested Model	Test name as in IEC61215
10.5	SP450M-72HB (1#) SP545M-72HB (2#)	NOCT Determination
10.4		Temperature Coefficient (including βVoc, βVpmax, αIsc, γPmax)
10.2/ 10.6		Performance at STC Maximum power determination
10.6		Performance at NOCT
10.7		Performance at low irradiance

**3, EQUIPMENT LIST**

Equipment Name	Equipment ID	Test item	Calibration Due
Flash Simulator	HYJC-YS-021	10.5, 10.4, 10.2, 10.6,10.7	2024-01-04
Temperature Controller	HYJC-YS-123	10.4, 10.6	2023-08-22
Reference Module	HYJC-YS-097	10.5, 10.4, 10.2, 10.6,10.7	2023-08-01
NMOT test system	HYJC-YS-067	10.5	2023-08-22
Anemometer	HYJC-LJ-091	10.5	2023-12-21
Anemoscope	HYJC-LJ-091	10.5	2023-12-21
Pyranometer	HYJC-YS-310	10.5	2023-07-31
Angle Gauge	HYJC-LJ-006	10.5	2023-06-26

#### 4, TEST RESULTS

##### Maximum Power Determination

Sample No	Voc (V)	Vmp (V)	Isc (A)	Imp (A)	Pmp (W)	FF (%)
1#	49.737	41.512	11.538	10.919	453.286	78.99
2#	50.218	41.891	13.696	13.057	546.977	79.53

##### Measurement of Temperature Coefficients

Radiant Source	<input checked="" type="checkbox"/> Solar Simulator	<input type="checkbox"/> Natural Sunlight
Irradiance(W/m <sup>2</sup> )	1000	
Range of module temperature (high/low) (°C)	55 to 25	
Parameter	Sample #	Calculated Value
Current: αIsc (%/°C)	SP450M-72HB (1#)	0.0503
Voltage: βVoc (%/°C)		-0.2718
Current: αIppmax(%/°C)		0.0284
Voltage: βVppmax(%/°C)		-0.3703
Peak Power: γPmax (%/C)		-0.3453

Radiant Source	<input checked="" type="checkbox"/> Solar Simulator	<input type="checkbox"/> Natural Sunlight
Irradiance(W/m <sup>2</sup> )	1000	
Range of module temperature (high/low) (°C)	55 to 25	
Parameter	Sample #	Calculated Value
Current: αIsc (%/°C)	SP545M-72HB (2#)	0.0540
Voltage: βVoc (%/°C)		-0.2595
Current: αIppmax(%/°C)		0.0199
Voltage: βVppmax(%/°C)		-0.3218
Peak Power: γPmax (%/C)		-0.3041

##### Measurement of NOCT

SP450M-72HB

Parameter	Day1 (2023-01-06)	Day2 (2023-01-07)	Day3 (2023-01-09)
Tamb Min (°C)	9.89	11.90	9.42
Tamb Max (°C)	13.24	15.56	14.28
Tamb Avg (°C)	11.49	13.83	12.13
Wind Velocity Min (m/s)	0.62	0.73	0.79
Wind Velocity Max (m/s)	1.46	1.52	1.41
Wind Velocity Avg (m/s)	1.02	1.13	1.10
Irradiance Min (W/m <sup>2</sup> )	438.34	670.53	512.09
Irradiance Max (W/m <sup>2</sup> )	711.14	914.78	849.82
Module Temp Min (°C)	35.15	37.28	34.80
Module Temp Max (°C)	39.83	42.07	40.94
NOCT Correction Factor	-1	0	0
Calculated NOCT (°C)	46.04	45.96	46.45
Average NOCT (°C)	46.15		

SP545M-72HB

Parameter	Day1 (2023-01-10)	Day2 (2023-01-11)	Day3 (2023-01-12)
Tamb Min (°C)	8.83	11.91	11.63
Tamb Max (°C)	12.68	15.70	16.34
Tamb Avg (°C)	10.69	13.68	13.79
Wind Velocity Min (m/s)	0.64	0.91	0.77
Wind Velocity Max (m/s)	1.17	1.63	1.58
Wind Velocity Avg (m/s)	0.90	1.25	1.17
Irradiance Min (W/m <sup>2</sup> )	464.39	542.12	493.32
Irradiance Max (W/m <sup>2</sup> )	846.20	808.83	782.61
Module Temp Min (°C)	33.96	37.16	36.79
Module Temp Max (°C)	38.87	41.95	42.38
NOCT Correction Factor	-1	0	0
Calculated NOCT (°C)	45.08	46.20	46.13
Average NOCT (°C)	45.80		

**Performance at STC:** (1000 W/m<sup>2</sup>, 25°C, AM 1.5)

Sample No	Voc (V)	Vmp (V)	Isc (A)	Imp (A)	Pmp (W)	FF (%)
1#	49.737	41.512	11.538	10.919	453.286	78.99
2#	50.218	41.891	13.696	13.057	546.977	79.53

**Performance at NOCT:** (800 W/ m<sup>2</sup>)

Sample No	Voc (V)	Vmp (V)	Isc (A)	Imp (A)	Pmp (W)	FF (%)
1#	46.954	38.927	9.325	8.773	341.523	78.00
2#	47.180	38.981	11.127	10.584	412.563	78.59

**Performance at Low Irradiance:** (200 W/m<sup>2</sup>, 25°C, AM 1.5)

Sample No	Voc (V)	Vmp (V)	Isc (A)	Imp (A)	Pmp (W)	FF (%)
1#	46.618	40.043	2.329	2.208	88.407	81.44
2#	47.149	40.520	2.764	2.641	106.998	82.11

## Appendix 1: Photos of modules

*Fig.1, Front view of module type SP450M-72HB*



*Fig. 2, Rear view of module type SP450M-72HB*



*Fig.3, Front view of module type SP450M-72HB*



*Fig. 4, Rear view of module type SP450M-72HB*



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