Prüfbericht - Produkte
Test Report - Products

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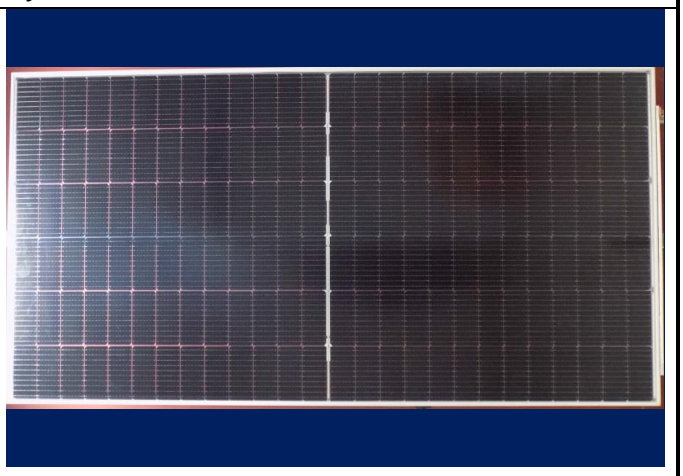
Prüfbericht-Nr.: *Test report no.*:	**IN24P0NY 001** **ULR:TC568823400000641F**	**Auftrags-Nr.:** *Order no.*:	146795584	Seite 1 von 31 *Page 1 of 31*
Kunden-Referenz-Nr.: *Client reference no.*:	1433811	**Auftragsdatum:** *Order date:*	29/05/2023	
Auftraggeber: *Client*:	Swelect Energy Systems Limited. "SWELECT HOUSE" No.5 Sir P.S Sivasamy Salai, Mylapore, Chennai -600 004. India			
Prüfgegenstand: *Test item*:	Photovoltaic (PV) modules			
Bezeichnung / Typ-Nr.: *Identification / Type no.*:	SWM11BT8595			
Auftrags-Inhalt: *Order content*:	Testing against PID resistivity			
Prüfgrundlage: *Test specification*:	Solar Photovoltaic Modules IEC TS 62804-1:2015, IS 17210(Part 1):2019, Test methods for the detection of potential-induced degradation – Part 1: Crystalline silicon with following severities - *Climatic conditions: 85°C and 85% RH* - *Duration: 288 hours- 3 cycles of 96 hours each*			
Wareneingangsdatum: *Date of sample receipt*:	08-09-2023			
Prüfmuster-Nr.: *Test sample no:*	Refer list of test samples			
Prüfzeitraum: *Testing period*:	15/09/2023 – 16/10/2023			
Ort der Prüfung: *Place of testing*:	Bangalore, India			
Prüflaboratorium: *Testing laboratory:*	TUV Rheinland(India) Pvt. Ltd.,Bangalore,India			
Prüfergebnis*: *Test result**:	Pass			



geprüft von: tested by: Kumaragowda G		**genehmigt von:** *authorized by*: K. Ganesh Kamath	
Datum: *Date:* 03-01-2024		**Ausstellungsdatum:** *Issue date:* 03-01-2024	
Stellung / Position:	Sr.Engineer-Products(S&C)	**Stellung** / Position:	Sr.Manager-Products(S&C)

Sonstiges / *Other*:	None
Zustand des Prüfgegenstandes bei Anlieferung: *Condition of the test item at delivery*:	Prüfmuster vollständig und unbeschädigt *Test item complete and undamaged*

* Legende:	P(ass) = entspricht o.g. Prüfgrundlage(n)	F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	N/A = nicht anwendbar	N/T = nicht getestet
* *Legend:*	*P(ass) = passed a.m. test specification(s)*	*F(ail) = failed a.m. test specification(s)*	*N/A = not applicable*	*N/T = not tested*

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Anmerkungen
Remarks

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4	Die Entscheidungsregel für Konformitätserklärungen in diesem Prüfbericht basiert auf der "Null-Grenzwert-Regel" und der "Einfachen Akzeptanz" gemäß ILAC G8:2019 und IEC Guide 115:2021, es sei denn, in der auf Seite 1 dieses Berichts genannten angewandten Norm ist etwas anderes festgelegt oder vom Kunden gewünscht. Dies bedeutet, dass die Messunsicherheit nicht berücksichtigt wird und daher auch nicht im Prüfbericht angegeben wird. *The decision rule for statements of conformity in this test report is based on the "Zero Guard Band Rule" and "Simple Acceptance" in accordance with ILAC G8:2019 and IEC Guide 115:2021, unless otherwise specified in the applied standard mentioned on Page 1 of this report or requested by the customer. This means that measurement uncertainty is not taken in account and hence also not declared in the test report.*

Produktbeschreibung
Product description

1	**Produktdetails** *Product details* **SWM11BT8595**
2	**Verwendete Materialien** *Used materials* Refer constructional characteristics in the “List of test samples”
3	**Adresse(n) der Fertigungsstätte(n)** *Address(es) of the manufacturing site(s)* 1. Swelect HHV Solar Photovoltaics Private Limited.No. 169, 166, Sembagoundan Pudur, Kuppeplayam Village, Coimbatore North Taluk, Coimbatore District Tamil Nadu-641107
4	**Zusammenfassung der Prüfergebnisse** *Summary of test results* "According to the enquiry of the manufacturer for a testing against PID resistivity shall be performed according to IEC TS 62804 with following severities – - Negative potential of the specified maximum system voltage between the shorted output terminals and the frame(ground), - 1500V DC - Climatic conditions: 85°C and 85% RH - Duration: 288 hours (*3 cycles of 96 hours each)* Before and after the PID test, Visual inspection, maximum power determination, Ground continuity and documentation by electroluminescence imaging shall be performed. In line with the standard for PV module type approval testing EN IEC 61215, two modules will be tested and one additional module will be used as a reference sample. **Pass Criteria:** A module design shall be judged to have passed the PID test , if each test sample meets all the following criteria: • The degradation of maximum output power does not exceed 5%. • No evidence of a major visual defect (as defined in EN IEC 61215,) **All presented results are only valid for the exact tested module type and design (cell type, encapsulation material, glass type)**

Absatz *Clause*	**Anforderungen - Prüfungen /** *Requirements - Tests*	**Messergebnisse – Bemerkungen/** *Measuring results - Remarks*	**Ergebnis** *Result*
—	**Test specification**		
Photovoltaic (PV) modules – Test methods for the detection of potential-induced degradation - Part 1: Crystalline silicon	IEC TS 62804-1:2015-08, Edition 1.0 IS 17210 (Part 1):2019	—	
—	**Marking**		
Name, monogram or symbol of manufacturer	On Type label and on module front	P	
Type or model number	On Type label	P	
Serial number	On laminate from front side	P	
Polarity of terminals or leads	On JB and cable	P	
Maximum system voltage	On Type label	P	
Date and place of manufacture	Date traceable from serial number and Manufacturing address mentioned on type label	P	
-	**List of test samples**		

Sample No.	Sample S/N	Type/Model	Remarks/constructional characteristics (e.g. cell, back sheet, frame type
A003546092-001	SW12723A33699	SWM11BT8595	Cell: 10bb Mono Bifacial cell by United Renewable Energy Co., Ltd Back Sheet: Cynagard 465A(R) by Cybrid Technologies Inc. EVA: F406PS(Front), EP308(Back), by Hangzhou First Applied Material Co., Ltd. Glass: ARC coated tempered glass, manufactured by Dongguan CSG Solar Glass Co., Ltd JB: DSJB12y(y=c), by DhaSh PV Technologies Private Ltd.
A003485904-036	SW12723A33712	SWM11BT8595	
A003485904-037	SW12723A33801	SWM11BT8595	

Absatz *Clause*	**Anforderungen - Prüfungen /** *Requirements - Tests*	**Messergebnisse – Bemerkungen/** *Measuring results - Remarks*	**Ergebnis** *Result*

10.1	**Visual inspection (Initial)**	
Test date (DD/MM/YYYY)	15-09-2023	
Sample No.	Nature and position of initial findings	—
A003546092-001	No Major visual defects found	P
A003485904-036	No Major visual defects found	P
A003485904-037	No Major visual defects found	P
Supplementary information: - None		

10.2	**Maximum power determination (Initial)**						
Test date (DD/MM/YYYY)			22-09-2023				
Module temperature [°C]			Corrected to 25				
Irradiance [W/m²]			1000				—
Sample No.	P_{max} [W]	V_{mpp} [V]	I_{mpp} [A]	V_{oc} [V]	I_{sc} [A]	FF [%]	
A003546092-001	590.56	45.55	12.92	54.21	13.48	80.50	P
A003485904-036	591.55	45.62	12.97	54.35	13.53	80.47	P
A003485904-037	593.04	45.64	12.99	54.39	13.54	80.55	P
Supplementary information: - Modules are preconditioned and stabilized according to IEC 61215:2021							

10.3	**Insulation test (Initial)**					
Test date (DD/MM/YYYY)				22-09-2023		
Maximum system voltage [V_{DC}]				1500V		
High voltage applied [V_{DC}]				8000V		
Insulation resistance measured at [V_{DC}]				1500V		—
Sample No.	Measured	Area	Result*	Dielectric breakdown		
	[GΩ]	[m²]	[GΩ × m²]	Yes (description)	No	
A003546092-001	44.2	2.81	124.20	--	No	P
A003485904-036	39.5	2.81	111.00	--	No	P
A003485904-037	39.4	2.81	110.71	--	No	P
* Minimum requirement acc. to the standard is 0.04 GΩ × m²						
Supplementary information: - None						

Absatz *Clause*	**Anforderungen - Prüfungen /** *Requirements - Tests*	**Messergebnisse – Bemerkungen/** *Measuring results - Remarks*	**Ergebnis** *Result*

10.15	**Wet leakage current test (Initial)**			
Test date (DD/MM/YYYY)		22-09-2023		—
Insulation resistance measured at [V_{DC}]		1500V		
Solution resistivity [Ω cm]		< 3,500		P
Solution temperature [°C]		22 ± 3		P
Sample No.	Measured [MΩ]	Area [m²]	Result* [MΩ × m²]	—
A003546092-001	1300.00	2.81	3653.00	P
A003485904-036	1900.00	2.81	5339.00	P
A003485904-037	1400.00	2.81	3934.00	P
* Minimum requirement acc. to the standard is 40 MΩ × m²				
Supplementary information: - None				

10.4	**Ground continuity test (Initial)**		
Test date (DD/MM/YYYY)	22-09-2023		—
Maximum over-current protection rating [A]	25		
Current applied [A]	62.5		
Location of designated grounding point	Right side Longer frame		
Location of second contacting point	Opposite frame		
Sample No.	Voltage [mV]	Resistance [mΩ]	
A003546092-001	322.5	5.16	P
A003485904-036	265.2	4.24	P
A003485904-037	315.3	5.04	P
Supplementary information: - None			

Absatz *Clause*	**Anforderungen - Prüfungen /** *Requirements - Tests*	**Messergebnisse – Bemerkungen/** *Measuring results - Remarks*	**Ergebnis** *Result*

	Performance of PID Test -1st Cycle			
Test Method	Chamber			—
Module Temperature [°C]	85			
Relative Humidity [%]	85			
Grounding polarity	+ve			
Test date [DD/MM/YYYY]	Sample No.	Applied Voltage [V]	Duration[Hrs]	
30/09/2023 – 05/10/2023	A003485904-036	-1500	96	P
	A003485904-037	-1500	96	P
Supplementary information: - None				

10.1	**Visual inspection after 1st PID Cycle**	
Test date (DD/MM/YYYY)	05/10/2023	
Sample No.	Nature and position of initial findings	—
A003485904-036	No Major visual defects found	P
A003485904-037	No Major visual defects found	P
Supplementary information: - None		

10.2	**Maximum power determination after 1st PID Cycle**							
Test date (DD/MM/YYYY)		05/10/2023						—
Module temperature [°C]		Corrected to 25						
Irradiance [W/m²]		1000						
Sample No.	P_{max} [W]	V_{mpp} [V]	I_{mpp} [A]	V_{oc} [V]	I_{sc} [A]	FF [%]	Degradation [%]	
A003485904-036	592.11	45.57	12.99	54.43	13.57	80.20	0.09	P
A003485904-037	593.07	45.58	13.01	54.38	13.59	80.25	-0.01	P
Supplementary information: - None								

Absatz *Clause*	**Anforderungen - Prüfungen /** *Requirements - Tests*	**Messergebnisse – Bemerkungen/** *Measuring results - Remarks*	**Ergebnis** *Result*

10.3 Insulation test after 1st PID Cycle

Test date (DD/MM/YYYY)				05/10/2023		—
Maximum system voltage [V_{DC}]				1500V		
High voltage applied [V_{DC}]				8000V		
Insulation resistance measured at [V_{DC}]				1500V		
Sample No.	Measured	Area	Result*	Dielectric breakdown		
	[GΩ]	[m²]	[GΩ × m²]	Yes (description)	No	
A003485904-036	35.60	2.81	100.04	--	No	P
A003485904-037	41.50	2.81	116.62	--	No	P
* Minimum requirement acc. to the standard is 0.04 GΩ × m²						
Supplementary information: - None						

10.15 Wet leakage current test after 1st PID Cycle

Test date (DD/MM/YYYY)		05/10/2023		—
Insulation resistance measured at [V_{DC}]		1500V		
Solution resistivity [Ω cm]		< 3,500		P
Solution temperature [°C]		22 ± 3		P
Sample No.	Measured	Area	Result*	—
	[MΩ]	[m²]	[MΩ × m²]	
A003485904-036	2300.00	2.81	6463.00	P
A003485904-037	5300.00	2.81	14893.00	P
* Minimum requirement acc. to the standard is 40 MΩ × m²				
Supplementary information: - None				

Absatz *Clause*	**Anforderungen - Prüfungen /** *Requirements - Tests*	**Messergebnisse – Bemerkungen/** *Measuring results - Remarks*	**Ergebnis** *Result*

	Performance of PID Test – IInd Cycle			
Test Method	Chamber			—
Module Temperature [°C]	85			
Relative Humidity [%]	85			
Grounding polarity	+ve			
Test date [DD/MM/YYYY]	Sample No.	Applied Voltage [V]	Duration[Hrs.]	
05/10/2023 – 10/10/2023	A003485904-036	-1500	96	P
	A003485904-037	-1500	96	P
Supplementary information: - None				

10.1	**Visual inspection after IInd PID Cycle**	
Test date (DD/MM/YYYY)	10/10/2023	
Sample No.	Nature and position of initial findings	—
A003485904-036	No Major visual defects found	P
A003485904-037	No Major visual defects found	P
Supplementary information: - None		

10.2	**Maximum power determination after IInd PID Cycle**							
Test date (DD/MM/YYYY)		10/10/2023						—
Module temperature [°C]		Corrected to 25						
Irradiance [W/m²]		1000						
Sample No.	P_{max} [W]	V_{mpp} [V]	I_{mpp} [A]	V_{oc} [V]	I_{sc} [A]	FF [%]	Degradation [%]	
A003485904-036	590.66	45.49	12.99	54.46	13.56	79.98	-0.24	P
A003485904-037	591.00	45.46	13.00	54.44	13.59	79.87	-0.35	P
Supplementary information: - None								

Absatz *Clause*	**Anforderungen - Prüfungen /** *Requirements - Tests*	**Messergebnisse – Bemerkungen/** *Measuring results - Remarks*	**Ergebnis** *Result*

10.3 Insulation test after IInd PID Cycle

Test date (DD/MM/YYYY)				10/10/2023		—
Maximum system voltage [V_{DC}]				1500V		
High voltage applied [V_{DC}]				8000V		
Insulation resistance measured at [V_{DC}]				1500V		
Sample No.	Measured	Area	Result*	Dielectric breakdown		
	[GΩ]	[m²]	[GΩ × m²]	Yes (description)	No	
A003485904-036	30.6	2.81	85.99	--	No	P
A003485904-037	35.5	2.81	99.76	--	No	P
* Minimum requirement acc. to the standard is 0.04 GΩ × m²						
Supplementary information: - None						

10.15 Wet leakage current test after IInd PID Cycle

Test date (DD/MM/YYYY)		10/10/2023		—
Insulation resistance measured at [V_{DC}]		1500V		
Solution resistivity [Ω cm]		< 3,500		P
Solution temperature [°C]		22 ± 3		P
Sample No.	Measured	Area	Result*	—
	[MΩ]	[m²]	[MΩ × m²]	
A003485904-036	1700.00	2.81	6463.00	P
A003485904-037	3200.00	2.81	14893.00	P
* Minimum requirement acc. to the standard is 40 MΩ × m²				
Supplementary information: - None				

Absatz *Clause*	**Anforderungen - Prüfungen /** *Requirements - Tests*	**Messergebnisse – Bemerkungen/** *Measuring results - Remarks*	**Ergebnis** *Result*

	Performance of PID Test – III[rd] Cycle			
Test Method	Chamber			—
Module Temperature [°C]	85			
Relative Humidity [%]	85			
Grounding polarity	+ve			
Test date [DD/MM/YYYY]	Sample No.	Applied Voltage [V]	Duration[Hrs.]	
11/10/2023 – 16/10/2023	A003485904-036	-1500	96	P
	A003485904-037	-1500	96	P
Supplementary information: - None				

10.1	**Visual inspection after III[rd] PID Cycle**	
Test date (DD/MM/YYYY)	16/10/2023	
Sample No.	Nature and position of initial findings	—
A003485904-036	No Major visual defects found	P
A003485904-037	No Major visual defects found	P
Supplementary information: - None		

10.2	**Maximum power determination after III[rd] PID Cycle**							
Test date (DD/MM/YYYY)		16/10/2023						—
Module temperature [°C]		Corrected to 25						
Irradiance [W/m²]		1000						
Sample No.	P_{max} [W]	V_{mpp} [V]	I_{mpp} [A]	V_{oc} [V]	I_{sc} [A]	FF [%]	Degradation [%]	
A003485904-036	588.71	45.42	12.96	54.37	13.54	80.00	-0.33	P
A003485904-037	589.64	45.43	12.98	54.33	13.56	80.03	-0.23	P
Supplementary information: - None								

Absatz *Clause*	**Anforderungen - Prüfungen /** *Requirements - Tests*	**Messergebnisse – Bemerkungen/** *Measuring results - Remarks*	**Ergebnis** *Result*

10.3	**Insulation test after III[rd] PID Cycle**					
Test date (DD/MM/YYYY)				16/10/2023		—
Maximum system voltage [V_{DC}]				1500V		
High voltage applied [V_{DC}]				8000V		
Insulation resistance measured at [V_{DC}]				1500V		
Sample No.	Measured	Area	Result*	Dielectric breakdown		
	[GΩ]	[m²]	[GΩ × m²]	Yes (description)	No	
A003485904-036	28.20	2.81	100.04	--	No	P
A003485904-037	35.10	2.81	116.62	--	No	P
* Minimum requirement acc. to the standard is 0.04 GΩ × m²						
Supplementary information: - None						

10.15	**Wet leakage current test after III[rd] PID Cycle**			
Test date (DD/MM/YYYY)		16/10/2023		—
Insulation resistance measured at [V_{DC}]		1500V		
Solution resistivity [Ω cm]		< 3,500		P
Solution temperature [°C]		22 ± 3		P
Sample No.	Measured	Area	Result*	—
	[MΩ]	[m²]	[MΩ × m²]	
A003485904-036	1200.00	2.81	3372.00	P
A003485904-037	1500.00	2.81	4215.00	P
* Minimum requirement acc. to the standard is 40 MΩ × m²				
Supplementary information: - None				

Result:

1. The degradation of maximum output power does not exceed 5%
2. There is no evidence of a major local degradation in electroluminescence inspection.

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Annexure 1: Abbreviations used in the report

STC	Standard Test Conditions
Pmax	Maximum power
Imp	Maximum power point current
Vmp	Maximum power point voltage
Isc	Short circuit current
Voc	Open circuit voltage
FF	Fill factor
PID	Potentially induced degradation

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ADDITIONAL DOCUMENTATION

Annexure 2: Constructional Data Form for Photovoltaic Modules:

Module type:			
Object	Manufacturer /trademark	Type / model	Technical data / ratings
Front cover	CSG Solar Glass Co., Ltd.	AR Coated Tempered solar glass	3.2mm
Rear cover	Cybrid Technologies Inc.	Cynagard 465A(R)	Total thickness: 322±22µm
EVA	Hangzhou First Applied Material Co., Ltd.	Front: F406PS Back: EP308	Thickness [mm]: 0.60±0.05 0.55±0.05,
Solar Cell	United Renewable Energy Co., Ltd.	10BB-11B35–Black 22 series	Mono Bifacial cell - 10BB 182 x 91 175 +20/-10
Junction box	DhaSh PV Technologies Private Ltd	DSJB12y(y=c),	Max. voltage [V]: 1500 Max. current [A]: 30
Bypass diode	PANJIT Semi-Conductor	GF4045	Tj [°C]: 200
Cable	DhaSh PV Technologies Private Ltd	62930 IEC 131,	Max. voltage [V]: 1500 V RTI [°C]: 120
Connector	DhaSh PV Technologies Private Ltd	DS01	Max. voltage [V]:1500 Max. current [A]: 35

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Annexure 3: Measurement reports: Initial

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Performance measurement

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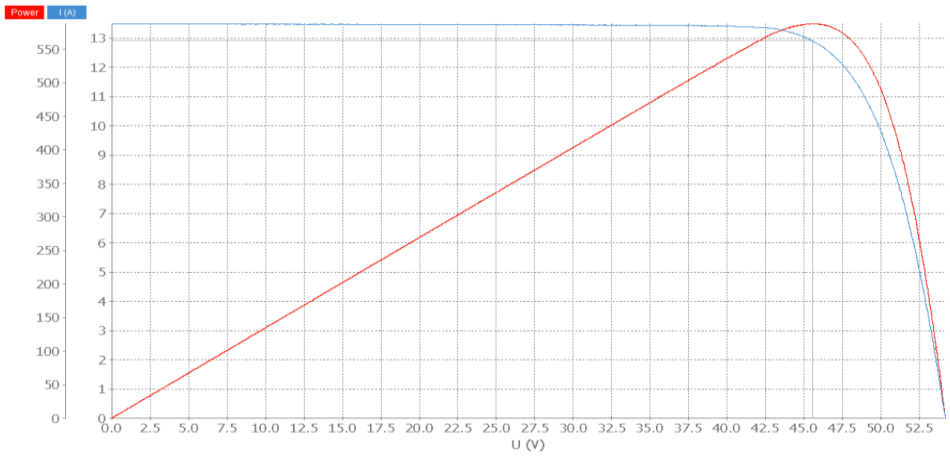

PV module under test

Module sample ID	A003546092-001	Module area	28059.20	cm²
Module serial number	SW12723A33699	Cell area	164.98	cm²
Test sequence	p3	Number of cells in series	78	
Model/type	SWM11BT8595	Number of cells in parallel	2	
Manufacturer	Swelect HHV Solar Photovoltaics Private Ltd.			

Measurement data

Module temperature	21.51	°C	Module efficiency	20.98	%
Standard temperature	25.00	°C	Cell efficiency	22.87	%
Mean irradiance	1002.99	W/m²	Shunt resistance	1061.589	Ohm
Standard irradiance	1000.00	W/m²	Series resistance	0.321	Ohm
			Reference voltage 1		
Short circuit current (Isc)	13.49	A	Power at reference voltage 1		
Open circuit voltage (Voc)	54.21	V	Current at reference voltage 1		
Current at maximum power (Imp)	12.92	A	Reference voltage 2		
Voltage at maximum power (Vmp)	45.55	V	Power at reference voltage 2		
Maximum power (Pmax)	588.56	W	Current at reference voltage 2		
Fill factor (FF)	80.50	%			
Measurement method	Direct				

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Performance measurement

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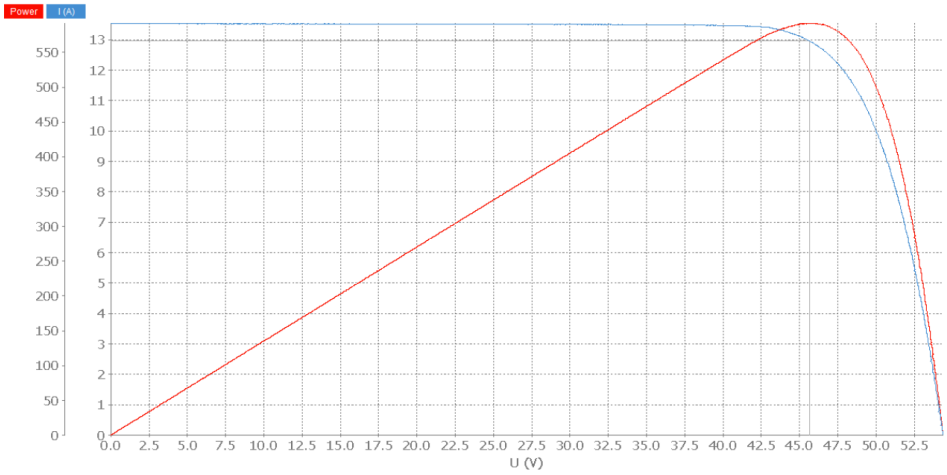

PV module under test

Module sample ID	A003485904-036	Module area	28059.20	cm²
Module serial number	SW12723A33801	Cell area	164.98	cm²
Test sequence	p3	Number of cells in series	78	
Model/type	SWM11BT8595	Number of cells in parallel	2	
Manufacturer	Swelect HHV Solar Photovoltaics Private Ltd.			

Measurement data

Module temperature	22.95	°C	Module efficiency	21.11	%
Standard temperature	25.00	°C	Cell efficiency	23.02	%
Mean irradiance	1002.65	W/m²	Shunt resistance	885.028	Ohm
Standard irradiance	1000.00	W/m²	Series resistance	0.323	Ohm
			Reference voltage 1		
Short circuit current (Isc)	13.54	A	Power at reference voltage 1		
Open circuit voltage (Voc)	54.41	V	Current at reference voltage 1		
Current at maximum power (Imp)	12.98	A	Reference voltage 2		
Voltage at maximum power (Vmp)	45.66	V	Power at reference voltage 2		
Maximum power (Pmax)	592.46	W	Current at reference voltage 2		
Fill factor (FF)	80.45	%			
Measurement method	Direct				

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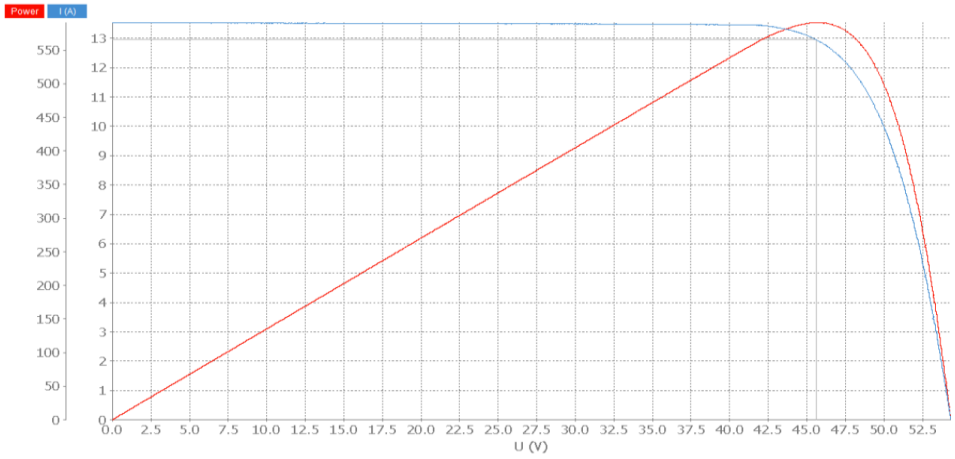
Performance measurement

PASAN HighLight 2.5.10 2023/09/22 10:36



PV module under test

Module sample ID	A003485904-037	Module area	28059.20	cm²
Module serial number	SW12723A33712	Cell area	164.98	cm²
Test sequence	p3	Number of cells in series	78	
Model/type	SWM11BT8595	Number of cells in parallel	2	
Manufacturer	Swelect HHV Solar Photovoltaics Private Ltd.			

Measurement data

Module temperature	22.50	°C	Module efficiency	21.08	%
Standard temperature	25.00	°C	Cell efficiency	22.98	%
Mean irradiance	1003.05	W/m²	Shunt resistance	849.592	Ohm
Standard irradiance	1000.00	W/m²	Series resistance	0.325	Ohm
			Reference voltage 1		
Short circuit current (Isc)	13.53	A	Power at reference voltage 1		
Open circuit voltage (Voc)	54.35	V	Current at reference voltage 1		
Current at maximum power (Imp)	12.97	A	Reference voltage 2		
Voltage at maximum power (Vmp)	45.62	V	Power at reference voltage 2		
Maximum power (Pmax)	591.55	W	Current at reference voltage 2		
Fill factor (FF)	80.47	%			
Measurement method	Direct				

Measurement Reports after PID 1ST Cycle:

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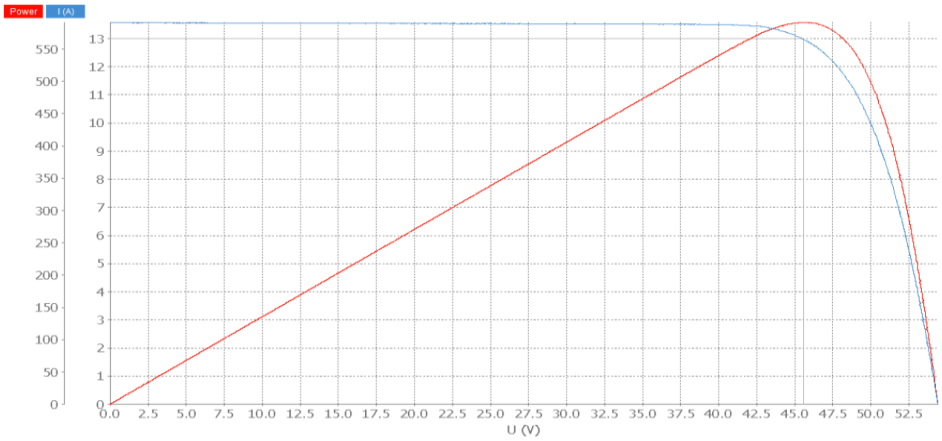
Performance measurement

PASAN HighLight 2.5.10 2023/10/05 16:57



PV module under test

Module sample ID	A003485904-036	Module area	28059.20	cm²
Module serial number	SW12723A33801	Cell area	164.98	cm²
Test sequence	af 1st	Number of cells in series	78	
Model/type	SWM11BT8595	Number of cells in parallel	2	
Manufacturer	Swelect HHV Solar Photovoltaics Private Ltd.			

Measurement data

Module temperature	24.23	°C	Module efficiency	21.10	%
Standard temperature	25.00	°C	Cell efficiency	23.01	%
Mean irradiance	1001.90	W/m²	Shunt resistance	576.082	Ohm
Standard irradiance	1000.00	W/m²	Series resistance	0.331	Ohm
			Reference voltage 1		
Short circuit current (Isc)	13.57	A	Power at reference voltage 1		
Open circuit voltage (Voc)	54.43	V	Current at reference voltage 1		
Current at maximum power (Imp)	12.99	A	Reference voltage 2		
Voltage at maximum power (Vmp)	45.57	V	Power at reference voltage 2		
Maximum power (Pmax)	592.11	W	Current at reference voltage 2		
Fill factor (FF)	80.20	%			
Measurement method	Direct				

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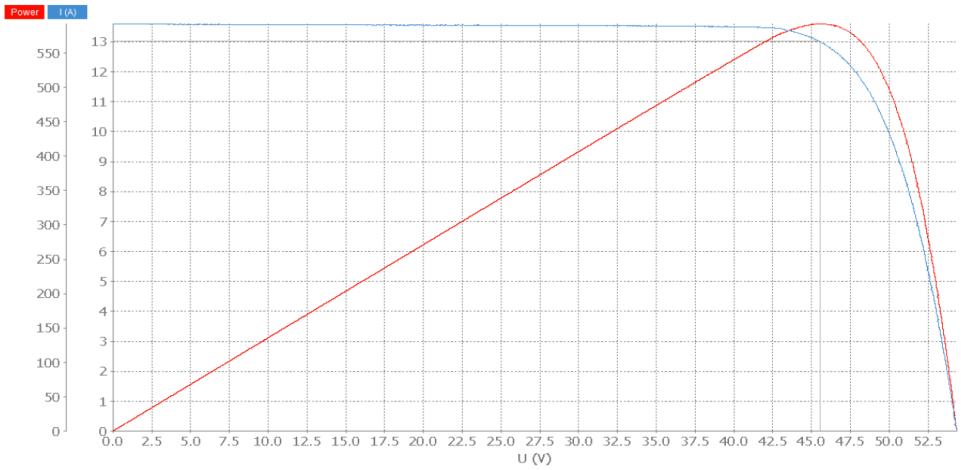
Performance measurement

PASAN HighLight 2.5.10 2023/10/05 17:04



PV module under test

Module sample ID	A003485904-037	Module area	28059.20	cm²
Module serial number	SW12723A33712	Cell area	164.98	cm²
Test sequence	af 1st	Number of cells in series	78	
Model/type	SWM11BT8595	Number of cells in parallel	2	
Manufacturer	Swelect HHV Solar Photovoltaics Private Ltd.			

Measurement data

Module temperature	24.18	°C	Module efficiency	21.14	%
Standard temperature	25.00	°C	Cell efficiency	23.04	%
Mean irradiance	1002.07	W/m²	Shunt resistance	546.035	Ohm
Standard irradiance	1000.00	W/m²	Series resistance	0.327	Ohm
			Reference voltage 1		
Short circuit current (Isc)	13.59	A	Power at reference voltage 1		
Open circuit voltage (Voc)	54.38	V	Current at reference voltage 1		
Current at maximum power (Imp)	13.01	A	Reference voltage 2		
Voltage at maximum power (Vmp)	45.58	V	Power at reference voltage 2		
Maximum power (Pmax)	593.07	W	Current at reference voltage 2		
Fill factor (FF)	80.25	%			
Measurement method	Direct				

Measurement Reports after PID 2ND Cycle:

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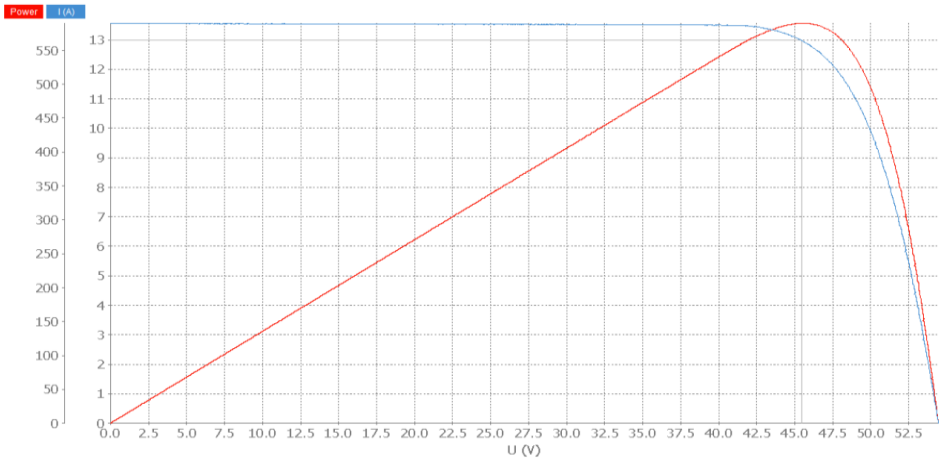
Performance measurement

PASAN HighLight 2.5.10 2023/10/10 12:16



PV module under test

Module sample ID	A003485904-036	Module area	28059.20	cm²
Module serial number	SW12723A33801	Cell area	164.98	cm²
Test sequence	af 2nd	Number of cells in series	78	
Model/type	SWM11BT8595	Number of cells in parallel	2	
Manufacturer	Swelect HHV Solar Photovoltaics Private Ltd.			

Measurement data

Module temperature	24.44	°C	Module efficiency	21.05	%
Standard temperature	25.00	°C	Cell efficiency	22.95	%
Mean irradiance	1002.08	W/m²	Shunt resistance	587.320	Ohm
Standard irradiance	1000.00	W/m²	Series resistance	0.340	Ohm
			Reference voltage 1		
Short circuit current (Isc)	13.56	A	Power at reference voltage 1		
Open circuit voltage (Voc)	54.46	V	Current at reference voltage 1		
Current at maximum power (Imp)	12.99	A	Reference voltage 2		
Voltage at maximum power (Vmp)	45.48	V	Power at reference voltage 2		
Maximum power (Pmax)	590.66	W	Current at reference voltage 2		
Fill factor (FF)	79.98	%			
Measurement method	Direct				

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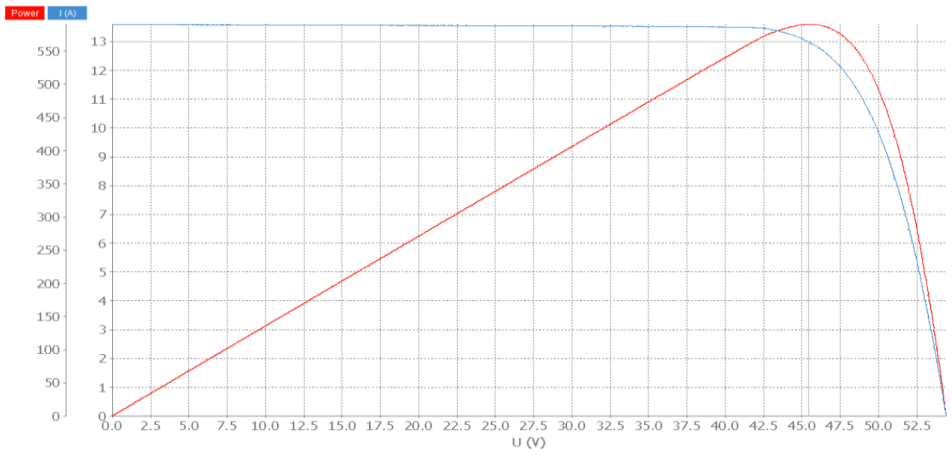
Performance measurement

PASAN HighLight 2.5.10 2023/10/10 11:52



PV module under test

Module sample ID	A003485904-037	Module area	28059.20	cm²
Module serial number	SW12723A33712	Cell area	164.98	cm²
Test sequence	af 2nd	Number of cells in series	78	
Model/type	SWM11BT8595	Number of cells in parallel	2	
Manufacturer	Swelect HHV Solar Photovoltaics Private Ltd.			

Measurement data

Module temperature	24.75	°C	Module efficiency	21.06	%
Standard temperature	25.00	°C	Cell efficiency	22.96	%
Mean irradiance	1001.63	W/m²	Shunt resistance	536.540	Ohm
Standard irradiance	1000.00	W/m²	Series resistance	0.341	Ohm
			Reference voltage 1		
Short circuit current (Isc)	13.59	A	Power at reference voltage 1		
Open circuit voltage (Voc)	54.44	V	Current at reference voltage 1		
Current at maximum power (Imp)	13.00	A	Reference voltage 2		
Voltage at maximum power (Vmp)	45.46	V	Power at reference voltage 2		
Maximum power (Pmax)	591.00	W	Current at reference voltage 2		
Fill factor (FF)	79.87	%			
Measurement method	Direct				

Measurement Reports after PID 3RD Cycle:

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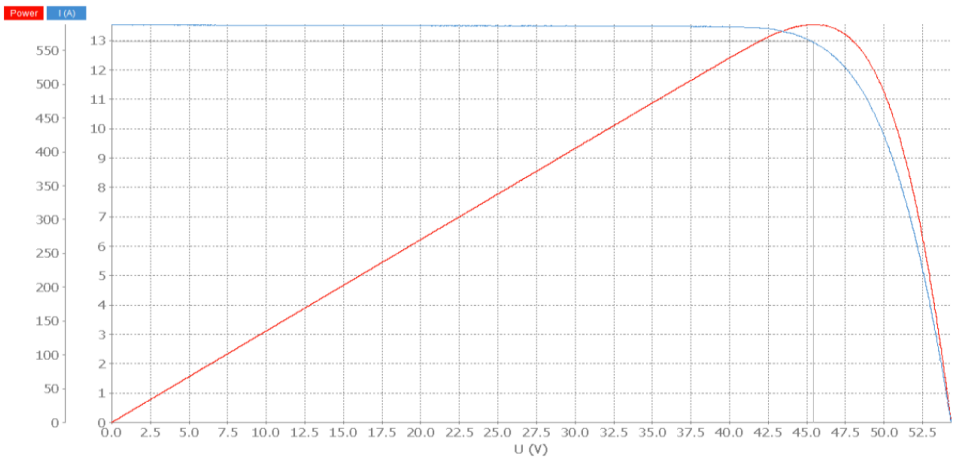
Performance measurement

PASAN HighLight 2.5.10 2023/10/16 17:17



PV module under test

Module sample ID	A003485904-036	Module area	28059.20	cm²
Module serial number	SW12723A33801	Cell area	164.98	cm²
Test sequence	af	Number of cells in series	78	
Model/type	SWM11BT8595	Number of cells in parallel	2	
Manufacturer	Swelect HHV Solar Photovoltaics Private Ltd.			

Measurement data

Module temperature	22.63	°C	Module efficiency	20.98	%
Standard temperature	25.00	°C	Cell efficiency	22.87	%
Mean irradiance	1003.27	W/m²	Shunt resistance	581.726	Ohm
Standard irradiance	1000.00	W/m²	Series resistance	0.341	Ohm
			Reference voltage 1		
Short circuit current (Isc)	13.54	A	Power at reference voltage 1		
Open circuit voltage (Voc)	54.37	V	Current at reference voltage 1		
Current at maximum power (Imp)	12.96	A	Reference voltage 2		
Voltage at maximum power (Vmp)	45.42	V	Power at reference voltage 2		
Maximum power (Pmax)	588.71	W	Current at reference voltage 2		
Fill factor (FF)	80.00	%			
Measurement method	Direct				

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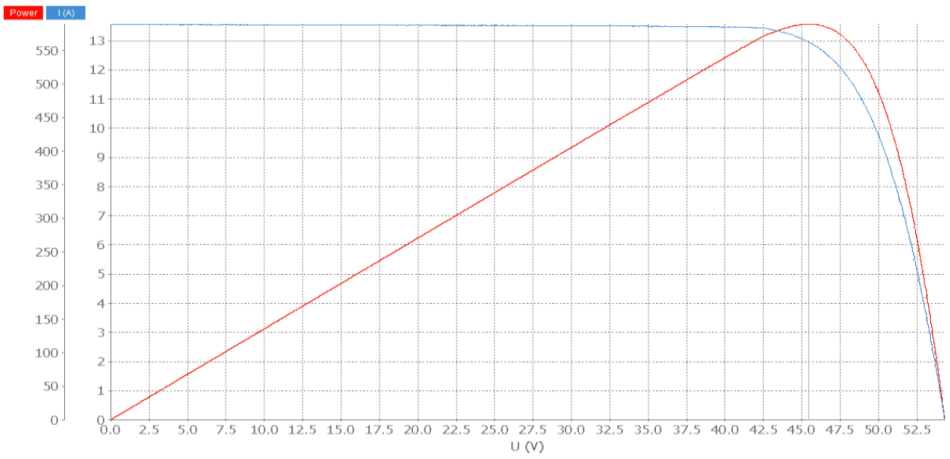
Performance measurement

PASAN HighLight 2.5.10 2023/10/16 17:25



PV module under test

Module sample ID	A003485904-037	Module area	28059.20	cm²
Module serial number	SW12723A33712	Cell area	164.98	cm²
Test sequence	af	Number of cells in series	78	
Model/type	SWM11BT8595	Number of cells in parallel	2	
Manufacturer	Swelect HHV Solar Photovoltaics Private Ltd.			

Measurement data

Module temperature	22.46	°C	Module efficiency	21.01	%
Standard temperature	25.00	°C	Cell efficiency	22.91	%
Mean irradiance	1003.07	W/m²	Shunt resistance	563.765	Ohm
Standard irradiance	1000.00	W/m²	Series resistance	0.340	Ohm
			Reference voltage 1		
Short circuit current (Isc)	13.56	A	Power at reference voltage 1		
Open circuit voltage (Voc)	54.33	V	Current at reference voltage 1		
Current at maximum power (Imp)	12.98	A	Reference voltage 2		
Voltage at maximum power (Vmp)	45.43	V	Power at reference voltage 2		
Maximum power (Pmax)	589.64	W	Current at reference voltage 2		
Fill factor (FF)	80.03	%			
Measurement method	Direct				

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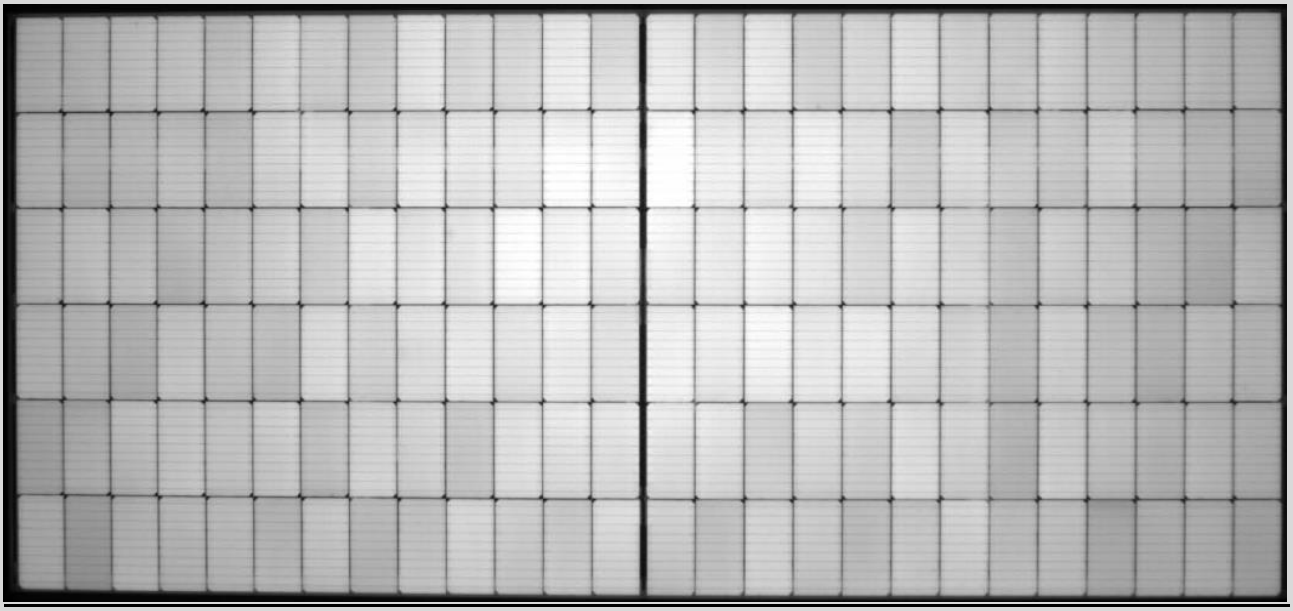
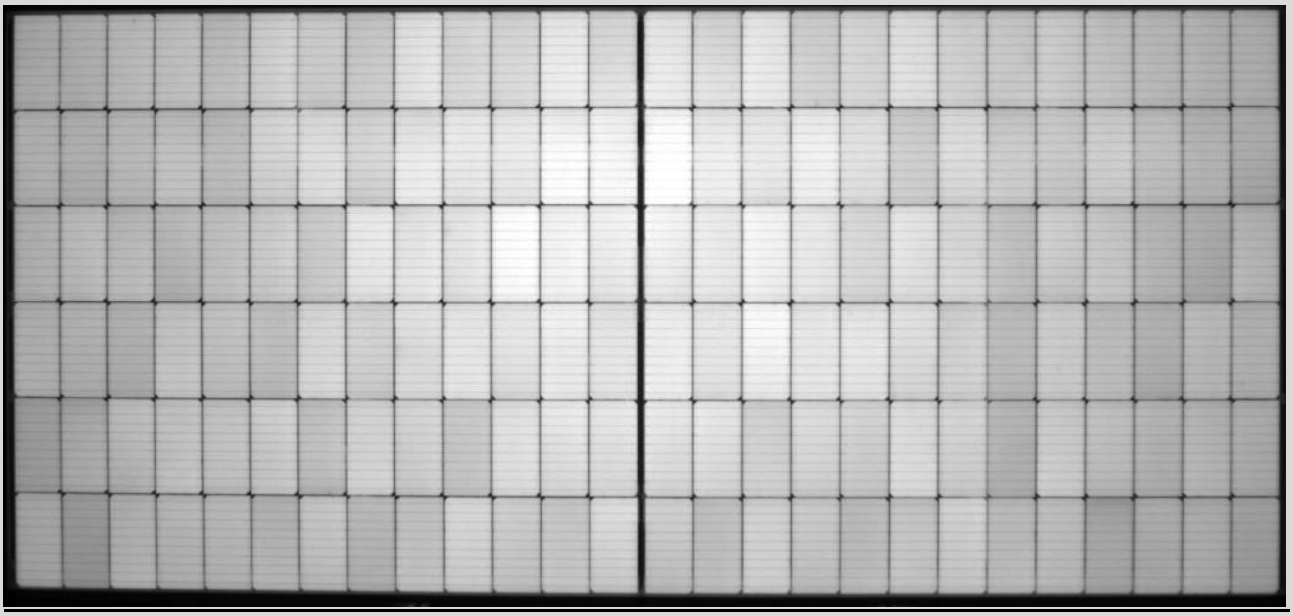
ADDITIONAL DOCUMENTATION

Annexure 5: EL Images of Test samples:

A003485904-036 (Initial)



A003485904-036(After- PID 1st Cycle)



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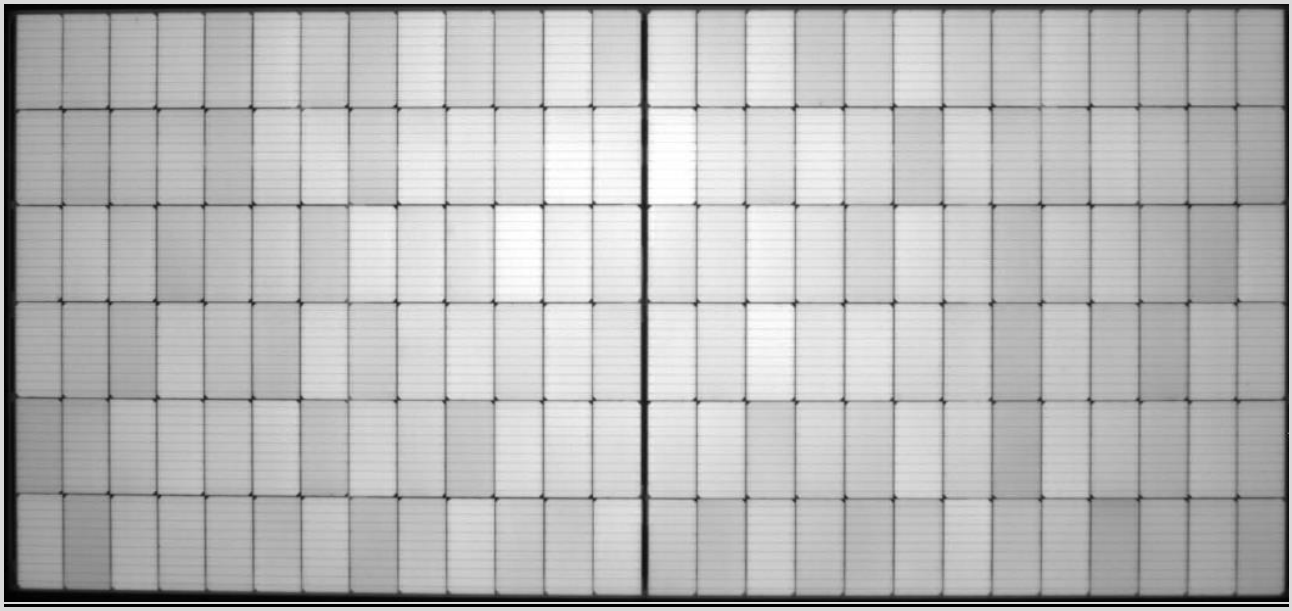
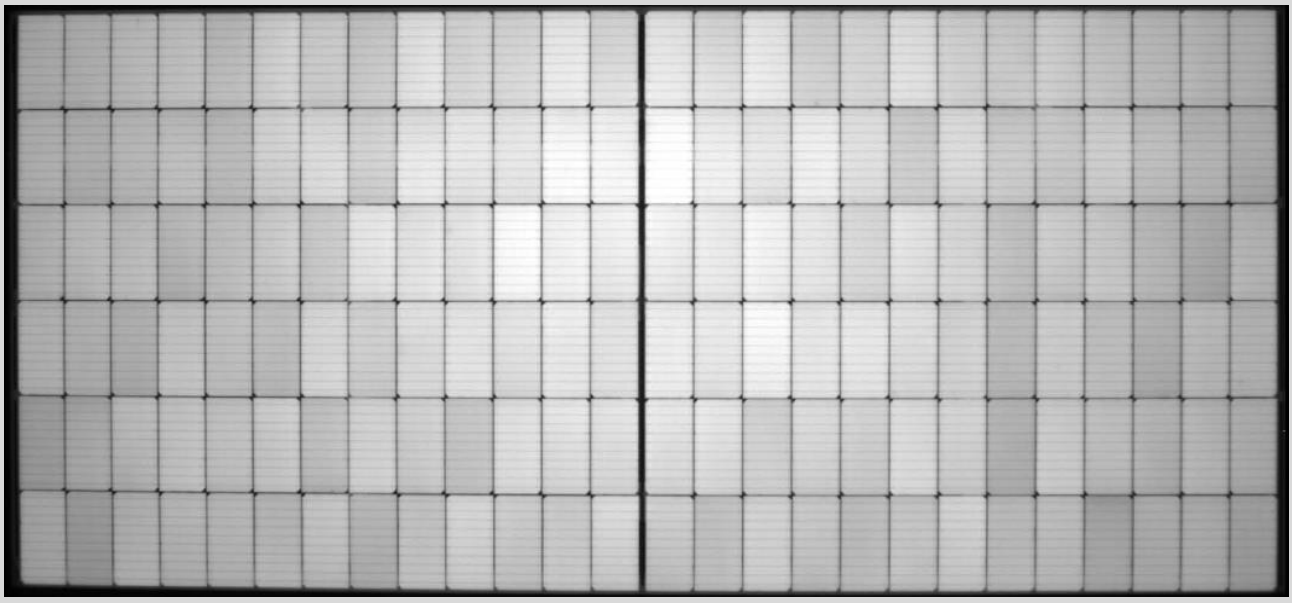
A003485904-036 (After- PID 2nd Cycle)



A003485904-036 (After- PID 3rd Cycle)



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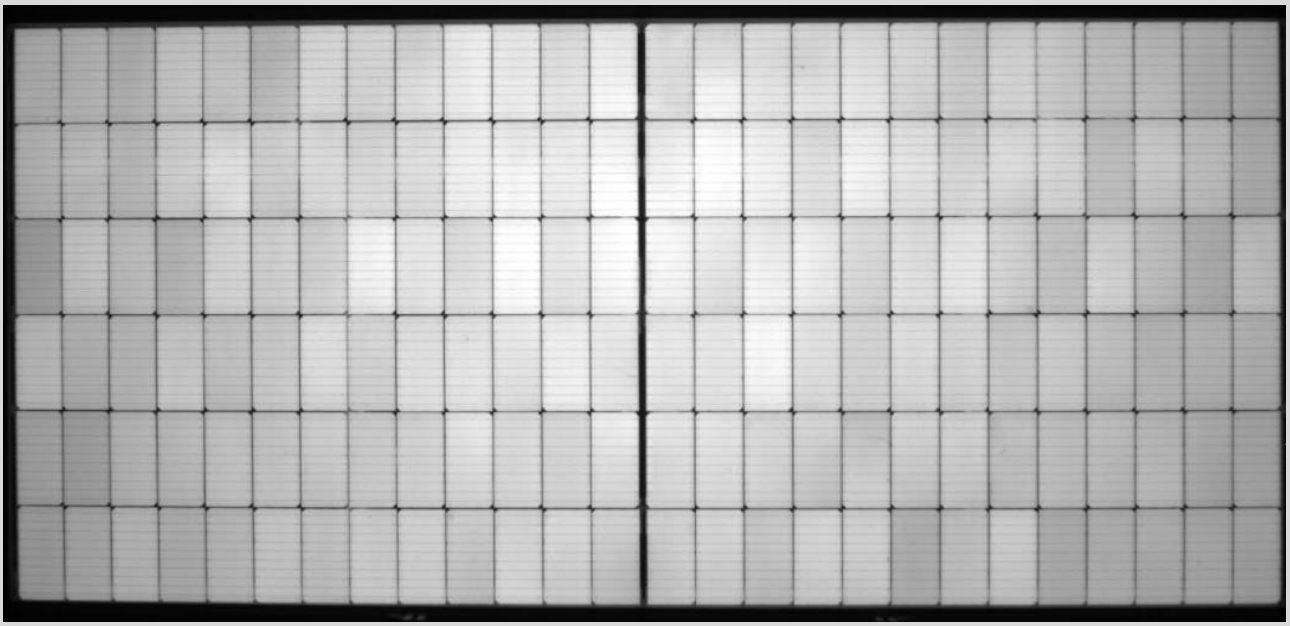
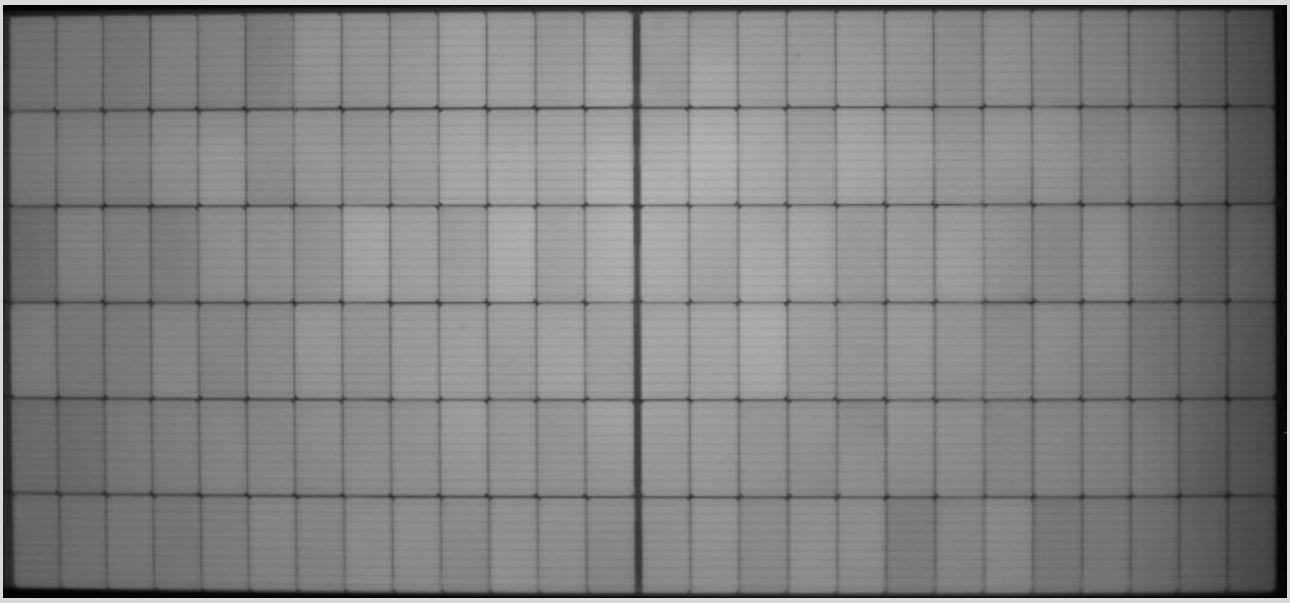
ADDITIONAL DOCUMENTATION

A003485904-037(Initial)



A003485904-037(After- PID 1st Cycle)



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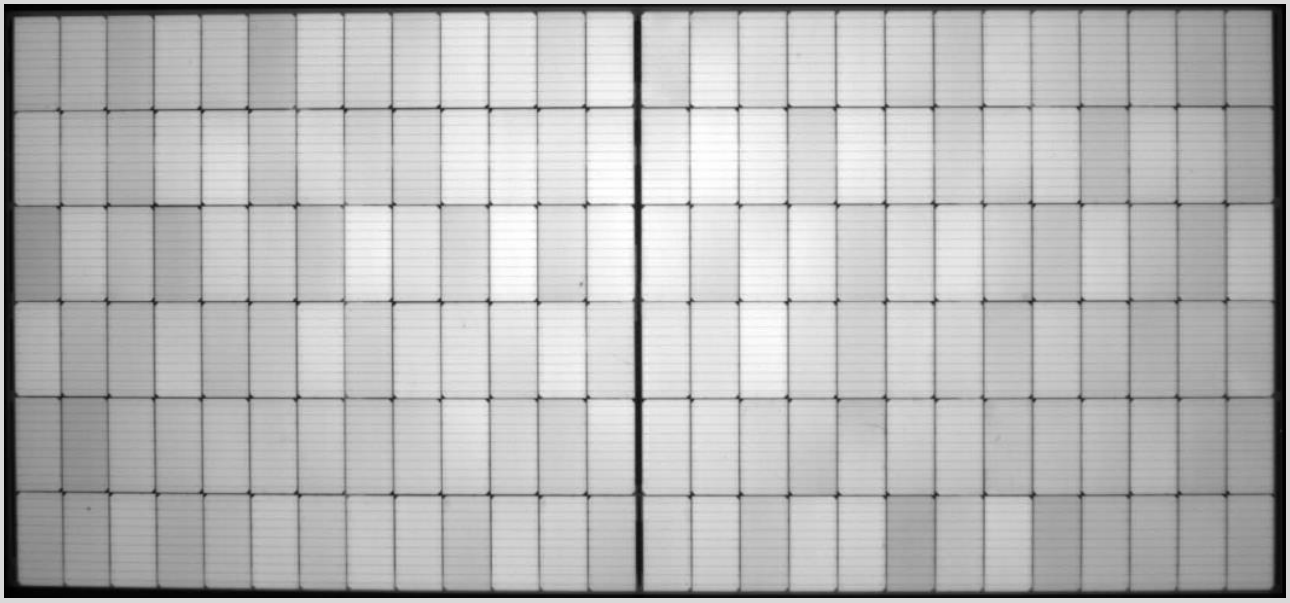
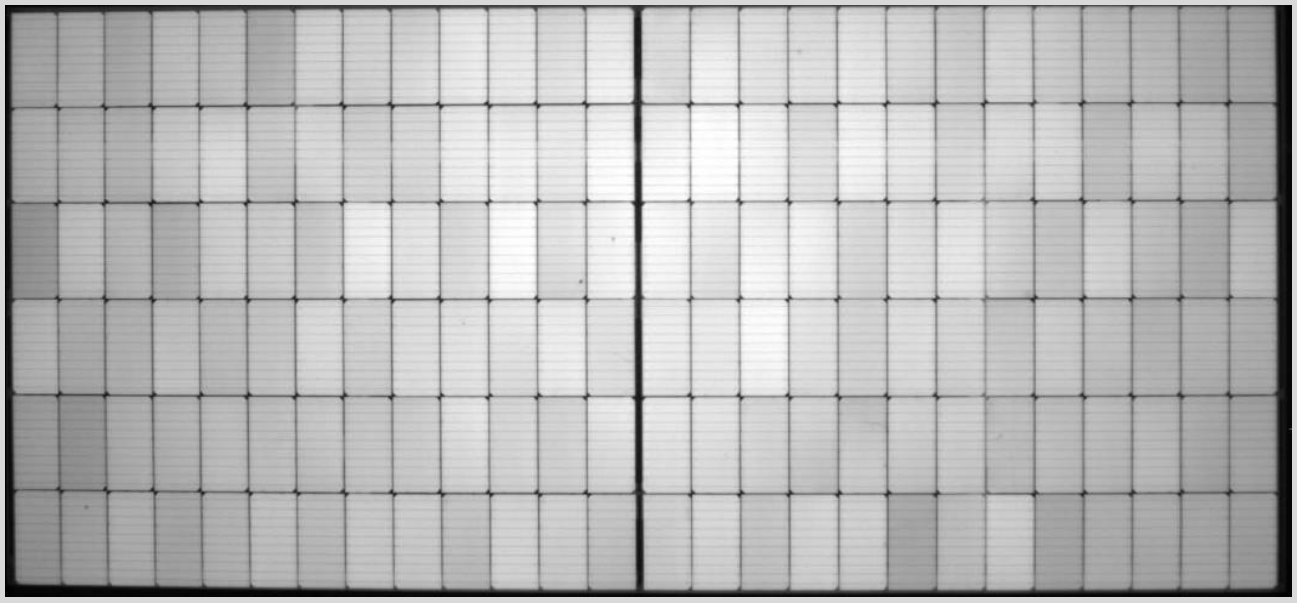
ADDITIONAL DOCUMENTATION

A003485904-037(After- PID 2nd Cycle)



A003485904-037(After- PID 3rd Cycle)



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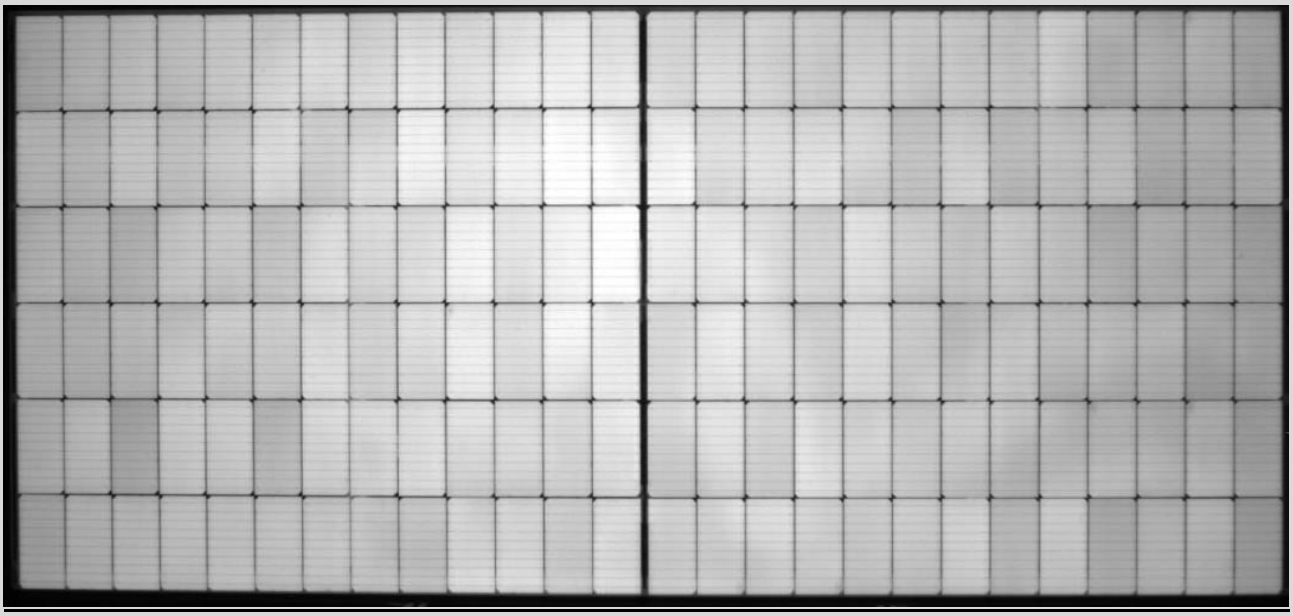
A003546092-001 (Control module)



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Annexure 6: Pictures of Test sample

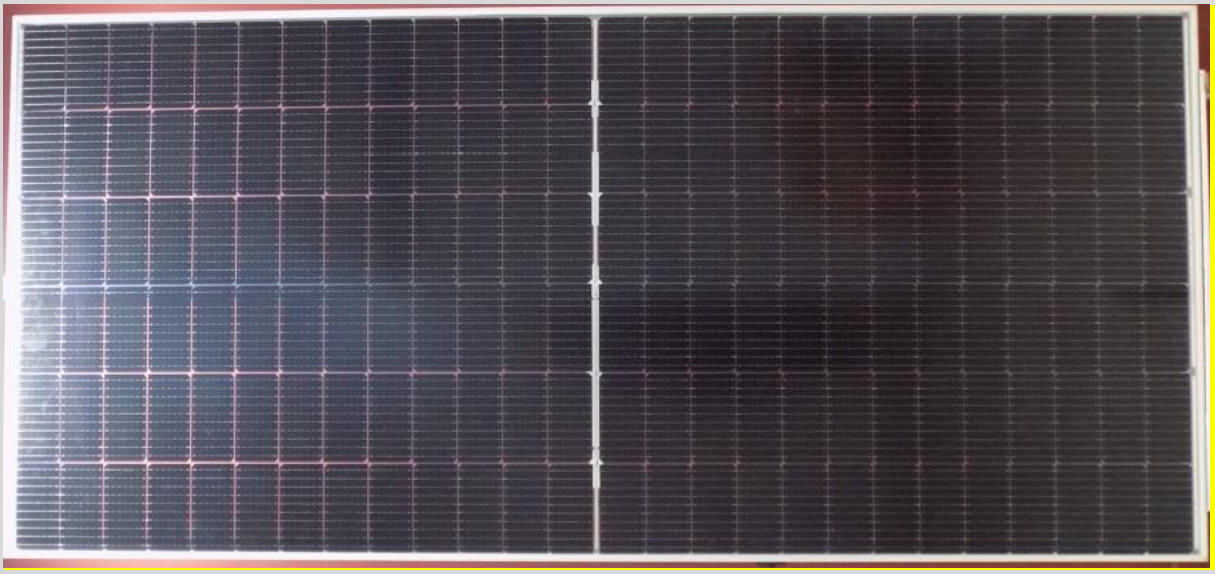

Fig.1: Front view of the module

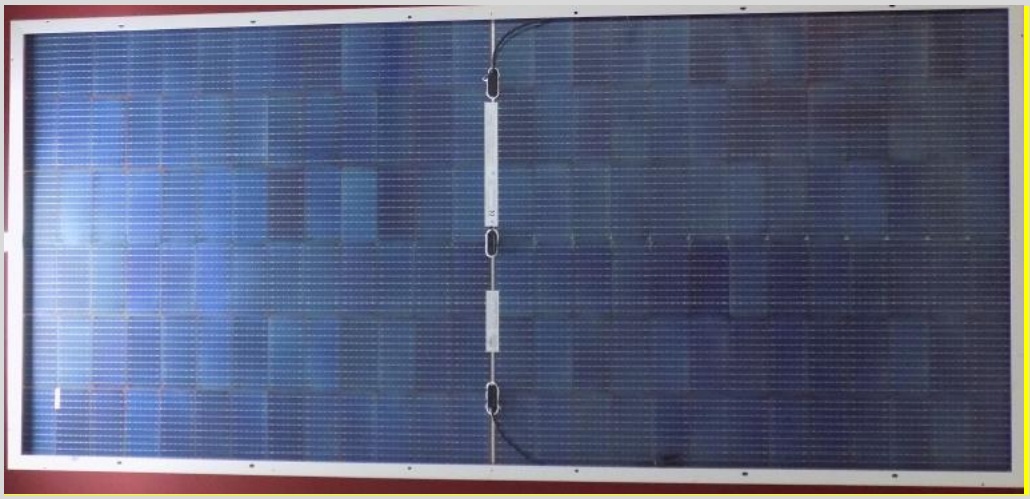

Fig.2: Rear view of the module

FOTO-DOKUMENTATION
PHOTO-DOCUMENTATION

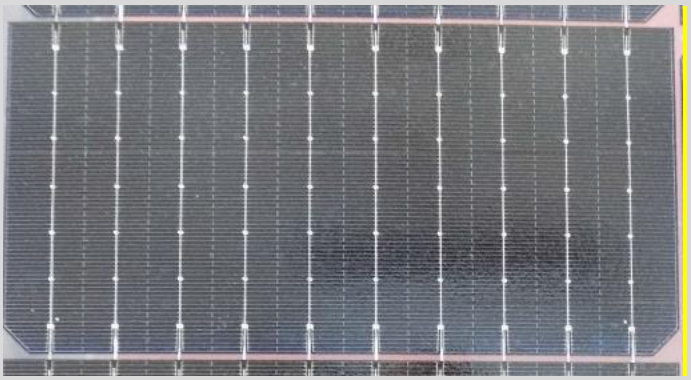

Fig.3:Detail view of the Solar cell

Fig.4: Detail view of Junction Box

FOTO-DOKUMENTATION
PHOTO-DOCUMENTATION

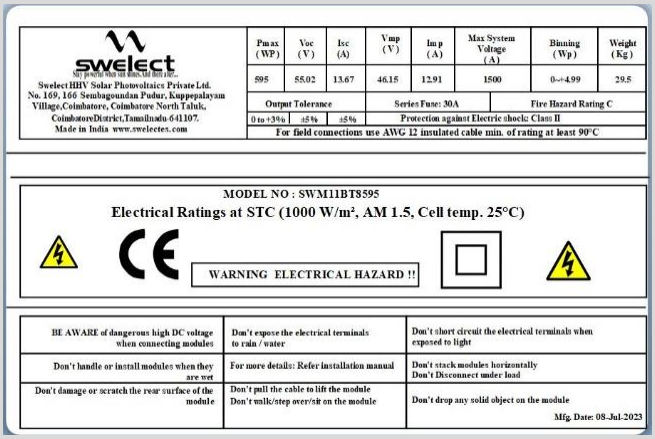

Fig.5: Detail view of the Type label

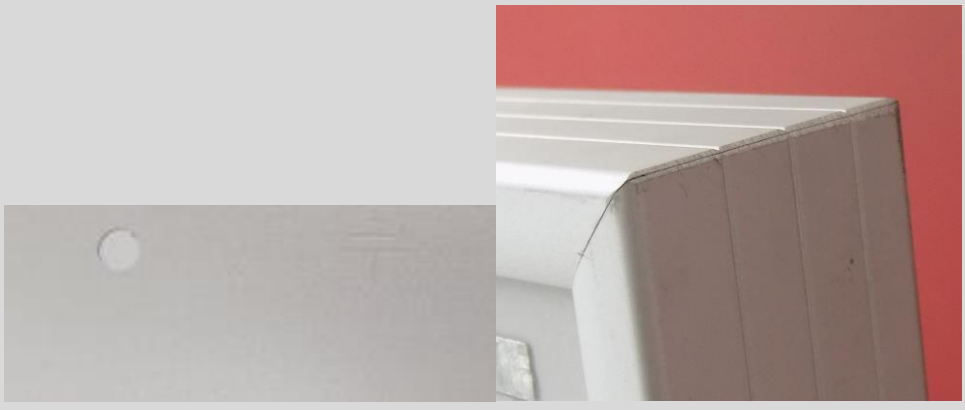

Fig.6: Detail view of the frame with ground mark