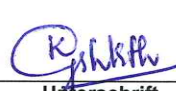


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Kunden-Referenz-Nr.: <i>Client Reference No.:</i>	468811	Auftragsdatum: <i>Order date:</i>	24-02-2015	
Auftraggeber: <i>Client:</i>	Renewsys India Pvt. Ltd, Plot. No. 21,22,23, Bommasandra Jigani Link Road, Industrial Area, Anekal Taluk Bangalore - 562106			
Prüfgegenstand: <i>Test item:</i>	Photovoltaic (PV) Module(s)			
Bezeichnung / Typ-Nr.: <i>Identification / Type No.:</i>	Proto Type			
Auftrags-Inhalt: <i>Order content:</i>	Testing against PID resistivity			
Prüfgrundlage: <i>Test specification:</i>	IEC Draft 62804 with following severities -Climatic conditions: 85°C and 85% RH -Duration: 100 hours			
Wareneingangsdatum: <i>Date of receipt:</i>	24-02-2015	Detaillierte Fotodokumentation siehe Anlage zu diesem Bericht Detailed photo documentation see appendix to this report		
Prüfmuster-Nr.: <i>Test sample No.:</i>	Refer list of test samples			
Prüfzeitraum: <i>Testing period:</i>	25-02-2015 – 02-03-2015			
Ort der Prüfung: <i>Place of testing:</i>	Bangalore			
Prüflaboratorium: <i>Testing laboratory:</i>	TUV Rheinland(India) Pvt. Ltd.,Bangalore,India			
Prüfergebnis*: <i>Test result*:</i>	Pass			
geprüft von / tested by:		kontrolliert von / reviewed by:		
05-03-2015	K. Ganesh Kamath	05-03-2015	Kamalaksha. CS	
Datum <i>Date</i>	Name / Stellung <i>Name / Position</i>	Unterschrift <i>Signature</i>	Datum <i>Date</i>	Name / Stellung <i>Name / Position</i>
				
Sonstiges / Other:	All the tests are conducted at TUV Rheinland Bangalore			
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>		Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i>		
* Legende: 1 = sehr gut 2 = gut 3 = befriedigend 4 = ausreichend 5 = mangelhaft P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet Legend: 1 = very good 2 = good 3 = satisfactory 4 = sufficient 5 = poor P(ass) = passed a.m. test specification(s) F(ail) = failed a.m. test specification(s) N/A = not applicable N/T = not tested				
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i>				

V04

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Liste der verwendeten Prüfmittel
List of used test equipment

[illegible]

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Produktbeschreibung
Product description

1 Produktdetails
Product details

Proto Type submitted by customer – 60 cell Solar module

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)

Not Applicable

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 Draft 62804 with following severities –

- Negative potential of the specified maximum system voltage between the shorted output terminals and the frame(ground), - 1000V DC
- Climatic conditions: 85°C and 85% RH
- Duration: 100 hours

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 international standard for PV module type approval testing EN IEC 61215, two modules will be tested. 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 IEC 61215:2005)

All presented results are only valid for the exact tested module type and design (cell type, encapsulation material, glass type)

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Absatz	IEC Draft 62804 with following severities	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen / <i>Requirements - Tests</i>	<i>Measuring results - Remarks</i>	<i>Evaluation</i>

-	List of test samples		
Sample No.	Sample S/N	Remarks/constructional characteristics (e.g. cell, back sheet, frame type)	—
1803065885-01	WS12149001624688	Cell: Solartech	
1803065885-02	WS12149001624689	Back Sheet: PRESERV A 125 WN(Renewsys)	
1803065885-03	WS12149001624687	EVA: CONSERV P 360-14 FC/ 10 UC(Renewsys) Glass: Borosil	

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Absatz Clause	IEC Draft 62804 with following severities Anforderungen - Prüfungen / Requirements - Tests	Messergebnisse - Bemerkungen Measuring results - Remarks	Bewertung Evaluation
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10.1	Visual inspection (Initial)		
Sample No.	Nature and position of initial findings		—
1803065885-01	No major visual defects found		P
1803065885-02	No major visual defects found		P
1803065885-03	No major visual defects found		P
Supplementary information: - None			

10.2	Maximum power determination (Initial)						
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 [%]	
1803065885-01	245.8	30.38	8.09	37.70	8.55	76.3	-
1803065885-02	245.7	30.39	8.09	37.68	8.54	76.4	-
1803065885-03	245.0	30.80	7.95	37.79	8.50	76.3	-
Supplementary information: - None							

10.3	Insulation test (Initial)					
Maximum system voltage [V _{DC}]				1000		-
High voltage applied [V _{DC}]				6000		
Insulation resistance measured at [V _{DC}]				1000		
Sample No.	Measured	Area	Result*	Dielectric breakdown		-
	[GΩ]	[m²]	[GΩ × m²]	Yes (description)	No	
1803065885-01	90.3	1.64	148.09	--	No	P
1803065885-02	87.9	1.64	144.16	--	No	P
1803065885-03	92.5	1.64	151.7	--	No	P
*Minimum requirement acc. to the standard is 0.04 GΩ × m².						
Supplementary information: - None						

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Absatz	IEC Draft 62804 with following severities	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen / Requirements - Tests	Measuring results - Remarks	Evaluation

10.15	Wet leakage current test (Initial)			
Insulation resistance measured at [V _{DC}]		1000		-
Solution resistivity [Ω cm]		< 3,500		P
Solution temperature [°C]		22 ± 3		P
Sample No.	Measured	Area	Result*	-
	[MΩ]	[m²]	[MΩ × m²]	
1803065885-01	911.0	1.64	1494.0	P
1803065885-02	1060.0	1.64	1738.4	P
1803065885-03	980.0	1.64	1607.2	P
* Minimum requirement acc. to the standard is 40 MΩ × m².				
Supplementary information: - None				

10.4	Ground continuity (Initial) - MST 13			
Maximum over-current protection rating [A]		15		—
Current applied [A]		37.5		
Location of designated grounding point		Right side Longer frame		
Location of second contacting point		Opposite frame		
Sample No.	Voltage [mV]	Resistance [mΩ]		
1803065885-01	94.0	2.47		P
1803065885-02	93.0	2.48		P
1803065885-03	295.0	7.87		P
Supplementary information: - None				

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Absatz Clause	IEC Draft 62804 with following severities Anforderungen - Prüfungen / Requirements - Tests	Messergebnisse - Bemerkungen Measuring results - Remarks	Bewertung Evaluation
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	Performance of PID Test		
Test Method	Chamber		—
Module Temperature [°C]	85		
Relative Humidity [%]	85		
Sample No.	Applied Voltage [V]	Duration[Hrs]	
1803065885-02	-1000	100	P
1803065885-03	-1000	100	P
Supplementary information: - None			

10.1	Visual inspection after PID test		
Sample No.		Nature and position of initial findings	—
1803065885-02		No major visual defects found	P
1803065885-03		No major visual defects found	P
Supplementary information: - None			

10.2	Maximum power determination after PID test							
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[%]	
1803065885-02	245.7	30.75	7.99	37.71	8.53	76.4	-	-
1803065885-03	246.2	30.66	8.03	37.74	8.55	76.2	0.5	-
Supplementary information: - None								

10.3	Insulation test after PID Test					
Maximum system voltage [V _{DC}]				1000		-
High voltage applied [V _{DC}]				6000		
Insulation resistance measured at [V _{DC}]				1000		
Sample No.	Measured	Area	Result*	Dielectric breakdown		-
	[GΩ]	[m²]	[GΩ × m²]	Yes (description)	No	
1803065885-02	10.40	1.64	17.05	--	No	P
1803065885-03	58.80	1.64	96.43	--	No	P
*Minimum requirement acc. to the standard is 0.04 GΩ × m².						
Supplementary information: - None						

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Absatz	IEC Draft 62804 with following severities	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen / Requirements - Tests	Measuring results - Remarks	Evaluation

10.15	Wet leakage current test after PID Test			
Insulation resistance measured at [V _{DC}]	1000			-
Solution resistivity [Ω cm]	< 3,500			P
Solution temperature [°C]	22 ± 3			P
Sample No.	Measured	Area	Result*	-
	[M Ω]	[m ²]	[M Ω × m ²]	
1803065885-02	293.0	1.64	480.5	P
1803065885-03	265.0	1.64	434.6	P
* Minimum requirement acc. to the standard is 40 M Ω × m ² .				
Supplementary information: - None				

10.4	Ground continuity (Initial) - MST 13			
Maximum over-current protection rating [A]	15			—
Current applied [A]	37.5			
Location of designated grounding point	Right side Longer frame			
Location of second contacting point	Opposite frame			
Sample No.	Voltage [mV]	Resistance [m Ω]		
1803065885-02	177.3	4.73		P
1803065885-03	102.4	2.73		P
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.

There is no Potential Induced degradation determined according to pass criteria

FOTO-DOKUMENTATION
PHOTO-DOCUMENTATION

Pictures of Modules



Fig.1:Front view of the module



Fig.2:Rear view of the module



Fig.3:Detail view of the Serial number

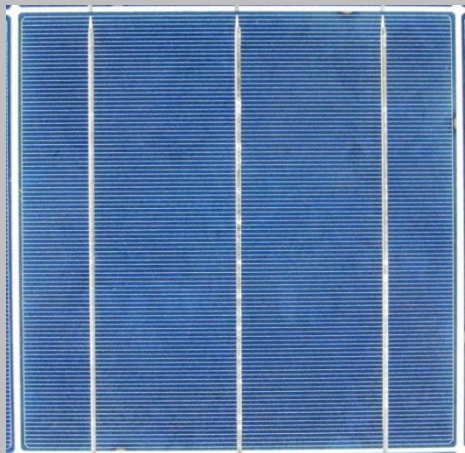


Fig.4: Detail view of Solar cell



Fig.5: detail view of the closed junction Box

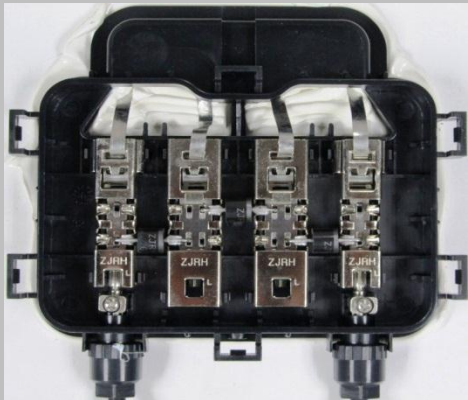


Fig.6: detail view of the open junction Box

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Statement of the estimated uncertainty of the test verdicts

- Electrical performance rating is outside the scope of IEC 61215:2005 qualification testing. The verdicts of performance rating are only related to the test samples that were subjected to the tests. They cannot be generalised to the modules from the series production.
- The calibration to STC was performed with a class AAA solar simulator. The extended measurement uncertainty is:
- Pmax measurement: 2.57% with a coverage factor $k=2$
- Current measurement: 2.30% with a coverage factor $k=2$
- Voltage measurement: 1.12% with a coverage factor $k=2$
- Relative measurements were performed with a flash type solar simulator.
- The accuracy of measurement reproduction with the solar simulator is less than ± 1 %.

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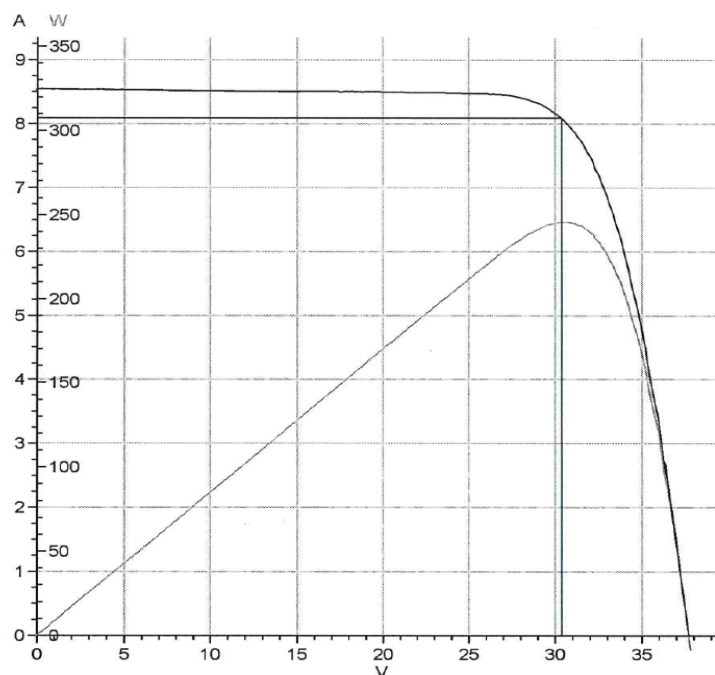
Measurement reports: Initial



Performance measurement

PASAN SLAB Tester - STC + SM V2.4.4

25-02-15 11:02



Measurement Data (Temp. compensated results)

PASAN Tester version	2.4.4	Operator	1803065885-01 Initia
Module ID Code	WS12149001624688	Serial number	
Standard temperature	25.0 °C	Monitor Cell	002-2010
Mean Irradiance	1.004 kW/m ²	Calibration Value	31.6 mV/(kW/m ²)
Module Temp.	25.5 °C	Mon. Cell Temp.	25.5 °C
Mask	NO-MASK 1.000 -	Cell Area	243.4 cm ²
Module Area	16417.4 cm ²	Cells in Parallel	1
Cells in Series	60	Measurement irradiance	1.000 kW/m ²
Isc	8.548 A	Voc	37.70 V
Imp	8.092 A	Vmp	30.38 V
Pmax	245.80 W	Reference vlt 1	0.00 V
Reference vlt 2	0.00 V	Power ar ref 1	-1.00 W
Power ar ref 2	-1.00 W	Current at ref 1	0.000 A
Current at ref 2	0.000 A	Fill Factor	76.27 %
Cell Efficiency	16.83 %	Module Efficiency	14.97 %
Shunt res.	335.74 Ohm	Serie res.	0.514 Ohm

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25-02-15

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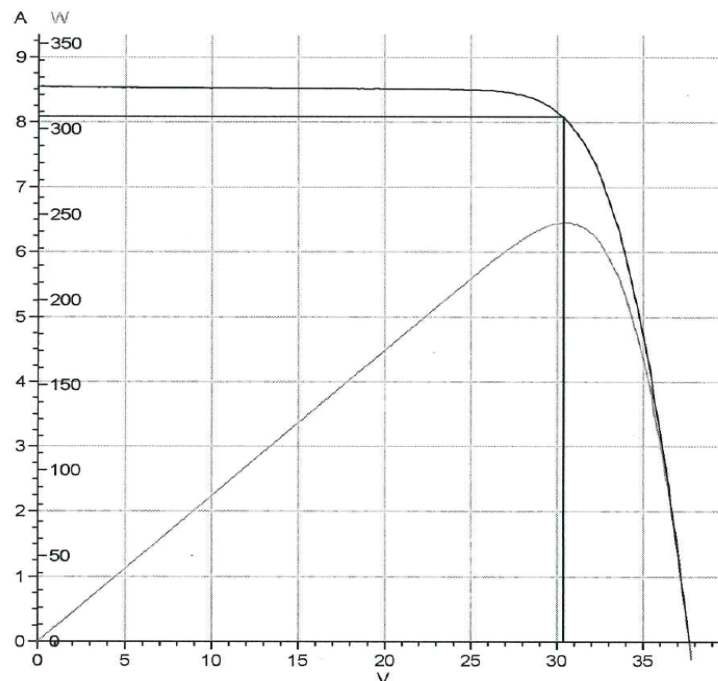
ZUSATZ-DOKUMENTATION
ADDITIONAL DOCUMENTATION



Performance measurement

PASAN SLAB Tester - STC + SM V2.4.4

25-02-15 11:09



Measurement Data (Temp. compensated results)

PASAN Tester version	2.4.4	Operator	1803065885-02 Initia
Module ID Code	WS12149001624689	Serial number	
Standard temperature	25.0 °C	Monitor Cell	002-2010
Mean Irradiance	1.004 kW/m ²	Calibration Value	31.6 mV/(kW/m ²)
Module Temp.	25.6 °C	Mon. Cell Temp.	25.6 °C
Mask	NO-MASK 1.000 -	Cell Area	243.4 cm ²
Module Area	16417.4 cm ²	Cells in Parallel	1
Cells in Series	60	Measurement irradiance	1.000 kW/m ²
Isc	8.542 A	Voc	37.68 V
Imp	8.086 A	Vmp	30.39 V
Pmax	245.74 W	Reference vlt 1	0.00 V
Reference vlt 2	0.00 V	Power ar ref 1	-1.00 W
Power ar ref 2	-1.00 W	Current at ref 1	0.000 A
Current at ref 2	0.000 A	Fill Factor	76.36 %
Cell Efficiency	16.83 %	Module Efficiency	14.97 %
Shunt res.	577.17 Ohm	Serie res.	0.507 Ohm

Recd by
25-02-15

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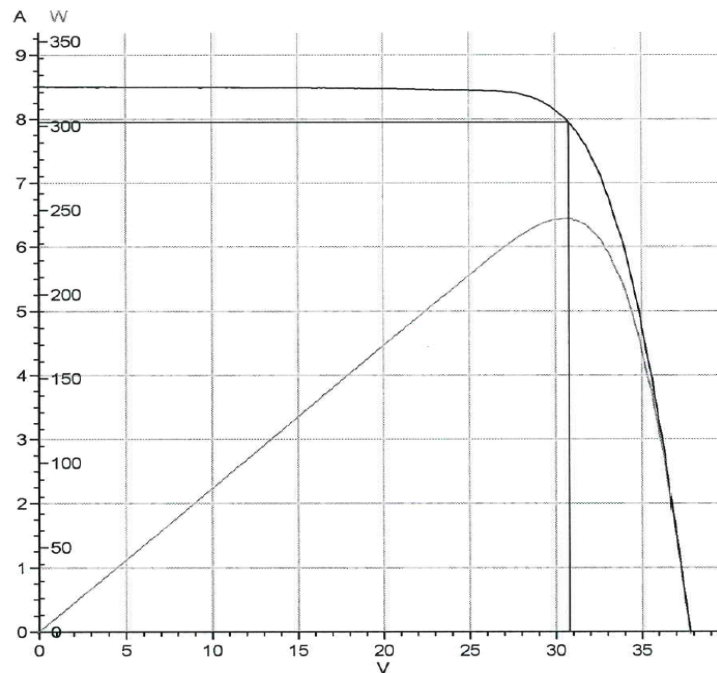
ZUSATZ-DOKUMENTATION
ADDITIONAL DOCUMENTATION



Performance measurement

PASAN SLAB Tester - STC + SM V2.4.4

25-02-15 11:19



Measurement Data (Temp. compensated results)

PASAN Tester version	2.4.4	Operator	1803065885-03 Initia
Module ID Code	WS12149001624687	Serial number	
Standard temperature	25.0 °C	Monitor Cell	002-2010
Mean Irradiance	1.004 kW/m ²	Calibration Value	31.6 mV/(kW/m ²)
Module Temp.	26.5 °C	Mon. Cell Temp.	26.5 °C
Mask	NO-MASK 1.000 -	Cell Area	243.4 cm ²
Module Area	16417.4 cm ²	Cells in Parallel	1
Cells in Series	60	Measurement irradiance	1.000 kW/m ²
Isc	8.500 A	Voc	37.79 V
Imp	7.954 A	Vmp	30.80 V
Pmax	244.99 W	Reference vlt 1	0.00 V
Reference vlt 2	0.00 V	Power ar ref 1	-1.00 W
Power ar ref 2	-1.00 W	Current at ref 1	0.000 A
Current at ref 2	0.000 A	Fill Factor	76.27 %
Cell Efficiency	16.78 %	Module Efficiency	14.92 %
Shunt res.	1037.36 Ohm	Serie res.	0.524 Ohm

Result OK
25-02-15

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ZUSATZ-DOKUMENTATION
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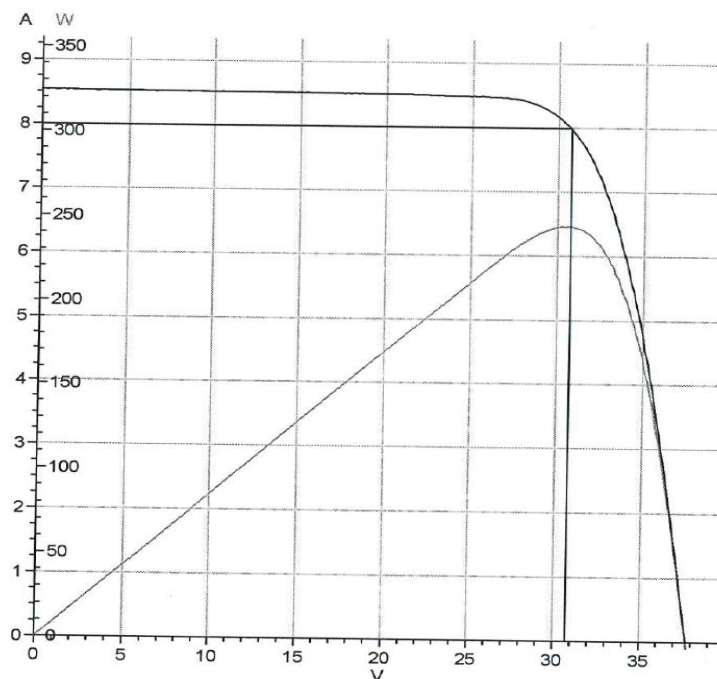
Measurement Reports after PID:



Performance measurement

PASAN SLAB Tester - STC + SM V2.4.4

02-03-15 11:56



Measurement Data (Temp. compensated results)

PASAN Tester version	2.4.4	Operator	1803065885-02 Af PID
Module ID Code	WS12149001624689	Serial number	
Standard temperature	25.0 °C	Monitor Cell	002-2010
Mean Irradiance	1.004 kW/m²	Calibration Value	31.6 mV/(kW/m²)
Module Temp.	24.8 °C	Mon. Cell Temp.	24.8 °C
Mask	NO-MASK 1.000 -	Cell Area	243.4 cm²
Module Area	16417.4 cm²	Cells in Parallel	1
Cells in Series	60	Measurement irradiance	1.000 kW/m²
Isc	8.535 A	Voc	37.71 V
Imp	7.992 A	Vmp	30.75 V
Pmax	245.75 W	Reference vlt 1	0.00 V
Reference vlt 2	0.00 V	Power at ref 1	-1.00 W
Power at ref 2	-1.00 W	Current at ref 1	0.000 A
Current at ref 2	0.000 A	Fill Factor	76.36 %
Cell Efficiency	16.83 %	Module Efficiency	14.97 %
Shunt res.	715.53 Ohm	Series res.	0.516 Ohm

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2/3/15

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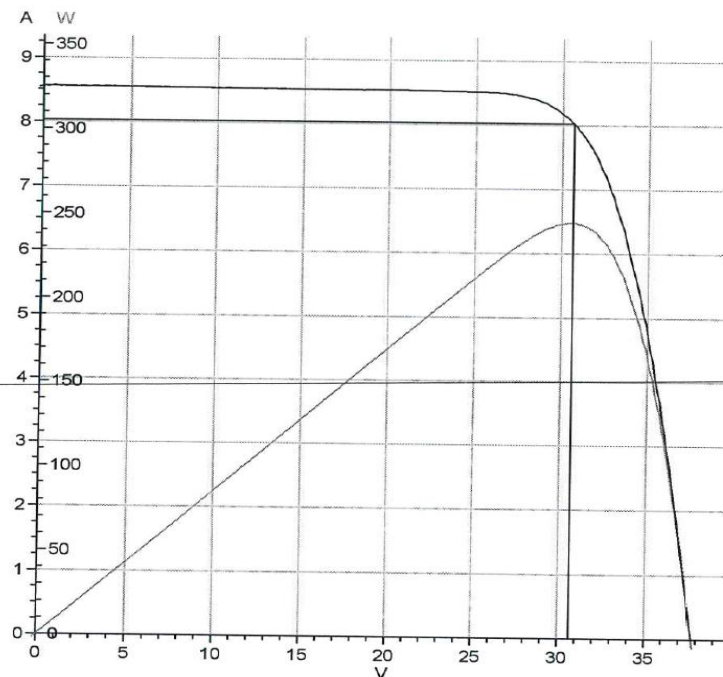
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ADDITIONAL DOCUMENTATION



Performance measurement

PASAN SLAB Tester - STC + SM V2.4.4

02-03-15 12:09



Measurement Data (Temp. compensated results)

PASAN Tester version	2.4.4	Operator	1803065885-03 Af PID
Module ID Code	WS12149001624687	Serial number	
Standard temperature	25.0 °C	Monitor Cell	002-2010
Mean Irradiance	1.004 kW/m²	Calibration Value	31.6 mV/(kW/m²)
Module Temp.	25.2 °C	Mon. Cell Temp.	25.2 °C
Mask	NO-MASK 1.000 -	Cell Area	243.4 cm²
Module Area	16417.4 cm²	Cells in Parallel	1
Cells in Series	60	Measurement irradiance	1.000 kW/m²
Isc	8.557 A	Voc	37.74 V
Imp	8.031 A	Vmp	30.66 V
Pmax	246.24 W	Reference vlt 1	0.00 V
Reference vlt 2	0.00 V	Power ar ref 1	-1.00 W
Power ar ref 2	-1.00 W	Current at ref 1	0.000 A
Current at ref 2	0.000 A	Fill Factor	76.24 %
Cell Efficiency	16.86 %	Module Efficiency	15.00 %
Shunt res.	634.35 Ohm	Serie res.	0.514 Ohm

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2/3/15

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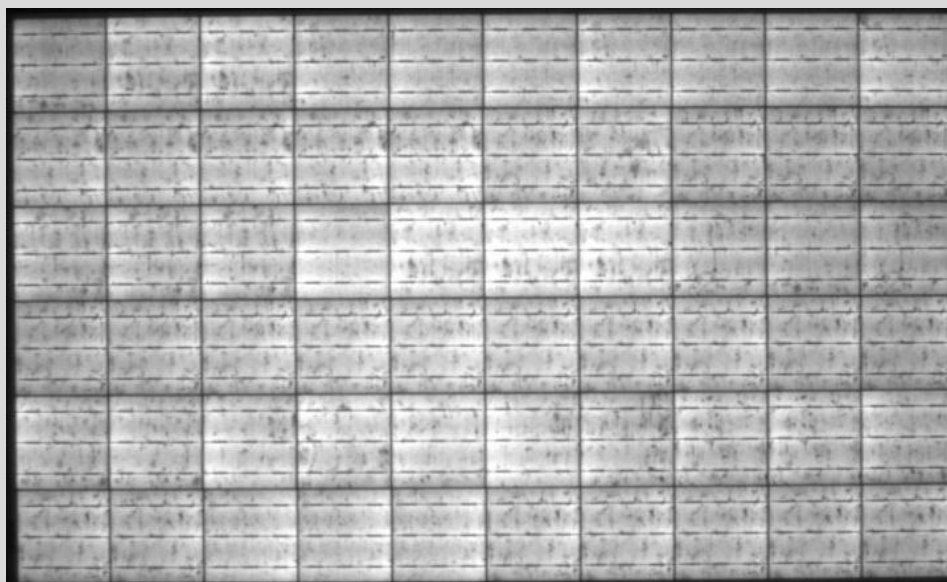
ZUSATZ-DOKUMENTATION
ADDITIONAL DOCUMENTATION

EL Images:

1803065885-02 (Initial)



1803065885-02 (After PID)

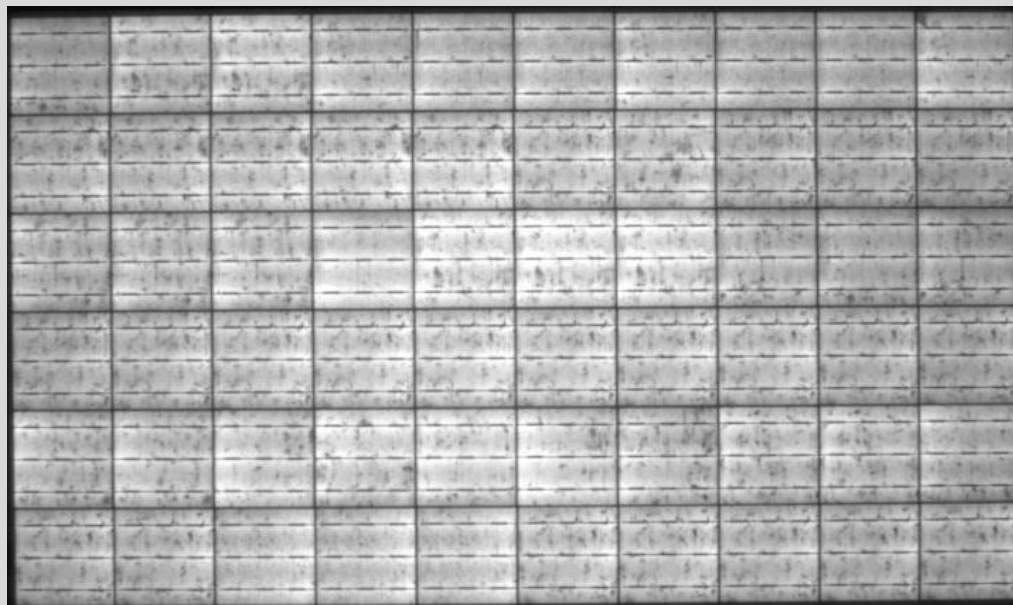


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1803065885-03 (Initial)



1803065885-03 (After PID)



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1803065885-01 (Initial) – Control Module

