Prüfbericht-Nr.: *Test Report No.:*	**19631402.001**	**Auftrags-Nr.:** *Order No.:*	1803205679	Seite 1 von 7 *Page 1 of 7*
Kunden-Referenz-Nr.: *Client Reference No.:*	410949	**Auftragsdatum:** *Order date:*	14-02-2017	
Auftraggeber: *Client:*	Renewsys India Pvt Ltd.Division: Hyderabad,Fab City (SEZ), Plot No.6,Survey #114/P, Srinagar Village, Maheswaram, R.R District Hyderabad -501359. India			
Prüfgegenstand: *Test item:*	Photovoltaic (PV) modules			
Bezeichnung / Typ-Nr.: *Identification / Type No.:*	For detailed type designation see Page no 3 of this report			
Auftrags-Inhalt: *Order content:*	Measurement of NOCT			
Prüfgrundlage: *Test specification:*	IEC 61215:2005, EN 61215:2005 Crystalline silicone terrestrial photovoltaic (PV) modules – Design qualification and type approval			

Wareneingangsdatum: *Date of receipt:*	20-03-2017
Prüfmuster-Nr.: *Test sample No.:*	Refer list of test samples
Prüfzeitraum: *Testing period:*	27-03-2017 – 25-05-2017
Ort der Prüfung: *Place of testing:*	Bangalore, India
Prüflaboratorium: *Testing laboratory:*	TUV Rheinland(India) Pvt. Ltd.,Bangalore,India
Prüfergebnis*: *Test result*:*	Pass

Detaillierte Fotodokumentation
siehe Anlage zu diesem Bericht

Detailed photo documentation
see appendix to this report

geprüft von / *tested by*:			**kontrolliert von** / *reviewed by*:		
07-07-2017	K. Ganesh Kamath		07-07-2017	Kamalaksha CS	
Datum *Date*	**Name / Stellung** *Name / Position*	**Unterschrift** *Signature*	**Datum** *Date*	**Name / Stellung** *Name / Position*	**Unterschrift** *Signature*

Sonstiges / *Other*:

Zustand des Prüfgegenstandes bei Anlieferung: *Condition of the test item at delivery:* — Prüfmuster vollständig und unbeschädigt / *Test item complete and undamaged*

* 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*

V04

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Liste der verwendeten Prüfmittel
List of used test equipment

Prüfmittel *Test equipment*	**Prüfmittel-Nr. / ID-Nr.** *Equipment No. / ID-No.*	**Nächste Kalibrierung** *Next calibration*
Insulation Resistance Tester	50-2010-0109	23-07-2017
Insulation Resistance Tester	50-2010-0110	20-07-2017
Pyrnometer	50-2010-0101	05-04-2018
Solar Simulator Pulsed	50-2010-0111	07-07-2017
Reference Modules	50-2010-0221	16-12-2017
Infrared sensor	50-2010-0111B	27-08-2017
Reference cell	50-2010-0111C	11-11-2017

Produktbeschreibung
Product description

1	**Produktdetails** *Product details* with 6" Poly cells: DESERV-3M6-xxx(xxx = 280-345 in steps of 1, 72 cells) DESERV-3M6-xxx(xxx = 235-285 in steps of 1, 60 cells) DESERV-3M6-xxx(xxx = 210-260 in steps of 1, 54 cells) DESERV-3M6-xxx(xxx = 185-230 in steps of 1, 48 cells) DESERV-3M6-xxx(xxx = 140-170 in steps of 1, 36 cells) **xxx represents Output power in Wp**
2	**Verwendete Materialien** *Used materials* see constructional characteristics in the list of test samples
3	**Adresse(n) der Fertigungsstätte(n)** *Address(es) of the manufacturing site(s)* Renewsys India Pvt Ltd.Division: Hyderabad,Fab City (SEZ), Plot No.6,Survey #114/P, Srinagar Village, Maheswaram, R.R District Hyderabad -501359. India
4	**Zusammenfassung der Prüfergebnisse** *Summary of test results* According to the inquiry of the customer for a measurement of NOCT value acc. to EN IEC 61215:2005 should be performed for a Multi Crystalline photovoltaic module type family" NOCT test was conducted on **DESERV-3M6- 315** modules and results were incorporated in this report: **19631402.001** Extension qualification to new cells: **Test failures:** …None This test report includes a Additional Documentation" and appendix "Foto-Dokumentation/Photo Documentation".

Absatz	**IEC 61215:2005, EN 61215:2005**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

-	**Marking**		
Name, monogram or symbol of manufacturer		Available on Type label	P
Type or model number		Available on Type label and inside the glass from front side	P
Serial number		On the laminate from front side and on Type label	P
Polarity of terminals or leads		Tags provided on cable and provided on JB	P
Maximum system voltage		Provided on Type label	P
Date and place of manufacture		Place of manufacture can be found on Type label and date can be traced from serial number.	P

-	**List of test samples**		
Sample No.	Sample S/N	Type/Model	Remarks/constructional characteristics (e.g. cell, back sheet, frame type
1803205679-04	R100000003171238058	DESERV-3M6-315	Cell: RenewSys -Multicrystalline 4BB EVA: Renewsys - CONSERV A 360.2 14 FC Back Sheet – Renewsys PRESERV 1 - 190WD

Absatz	**IEC 61215:2005, EN 61215:2005**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*
-	**Test procedures**		
10	Preconditioning (min. 5.5 kWh)	Performed	-
10.1	Visual inspection	See table 10.1	P
10.2	Maximum power determination	See table 10.2	P
10.3	Insulation test	See table 10.3	P
10.15	Wet leakage current test	See table 10.15	P
10.4	Measurement of temperature coefficients	N/A	-
10.6	Performance at STC	See table 10.2	P
10.5	Measurement of Nominal Operating Cell Temperature (NOCT)	See table 10.5	P
10.6	Performance at NOCT	See table 10.6	P
10.7	Performance at low irradiance	N/A	-
10.8	Outdoor exposure test	N/A	-
10.18	Bypass diode thermal test	N/A	-
10.9	Hot-spot endurance test	N/A	-
10.10	UV preconditioning test	N/A	-
10.11	Thermal cycling test (50 cycles)	N/A	-
10.12	Humidity-freeze test (10 cycles)	N/A	-
10.14	Robustness of terminations test	N/A	-
10.11	Thermal cycling test (200 cycles)	N/A	-
10.13	Damp heat test	N/A	-
10.16	Mechanical load test	N/A	-
10.17	Hail test	N/A	-

Absatz	**IEC 61215:2005, EN 61215:2005**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

10.1	**Visual inspection (Initial)**	
Sample No.	Nature and position of initial findings	-
1803205679-04	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 [%]	
1803205679-04	312.0	37.46	8.33	45.32	8.85	77.8	-
Supplementary information: - None							

10.3	**Insulation test (Initial)**					
Maximum system voltage [V_{DC}]				1000		-
High voltage applied [V_{DC}]				3000		
Insulation resistance measured at [V_{DC}]				1000		
Sample No.	Measured	Area	Result*	Dielectric breakdown		-
	[GΩ]	[m²]	[GΩ × m²]	Yes (description)	No	
1803205679-04	37.10	1.93	71.60	--	No	P
*Minimum requirement acc. to the standard is 0.04 GΩ × m².						
Supplementary information: - None						

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]	
1803205679-04	1260.0	1.93	2431.8	P
* Minimum requirement acc. to the standard is 40 MΩ × m².				
Supplementary information: - None				

Absatz	**IEC 61215:2005, EN 61215:2005**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

10.5 Measurement of Nominal Operating Cell Temperature (NOCT)

Wind velocity [m/s] high/low	1.70/0.25	1.70/0.31	1.67/0.71		-
Ambient temperature [°C] high/low	30.72/24.57	30.27/22.29	23.02/22.76		
Irradiance [W/m²] high/low	805/795	805/795	805/795		
Module temperature [°C] high/low	54.35/44.59	55.17/44.00	45.04/44.02		
Average module Temperature [°C]	51.22	50.70	44.45		
Wind velocity [m/s] (average)	1.21	0.95	1.27		
NOCT correction factor [°C]	01	01	01		
Calculated NOCT [°C]	43.55	44.57	42.54		
Sample No.	Average NOCT [°C]				
1803205679-04	43.55 +1 = 44.55				

Supplementary information: Primary method was used.

Cell junction temperature readings have been taken on the Back sheet, hence difference between cell and back sheet is 1°C

10.6 Performance at NOCT

Test method			☒ indoor		☐ outdoor		-
Ambient temperature [°C]			25 ± 2				
Irradiance [W/m²]			1000				
Module temperature [°C]			44.5				
Sample No.	P_{max} [W]	V_{mpp} [V]	I_{mpp} [A]	V_{oc} [V]	I_{sc} [A]	FF [%]	
1803205679-04	232.2	34.26	6.78	42.14	7.23	76.2	

Supplementary information: - None

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ZUSATZ-DOKUMENTATION
ADDITIONAL DOCUMENTATION

Abbreviations used in the report

NOCT	Nominal Operating Cell Temperature
STC	Standard Test Conditions
Pmax	Maximum power
Impp	Maximum power point current
Vmpp	Maximum power point voltage
Isc	Short circuit current
Voc	Open circuit voltage
FF	Fill factor
α	Current temperature coefficient
β	Voltage temperature coefficient
γ	Power temperature coefficient
S	Series connection
SP	Series-parallel connection
SPS	Series-parallel-series connection

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ZUSATZ-DOKUMENTATION
ADDITIONAL DOCUMENTATION

Statement of the estimated uncertainty of the test verdicts

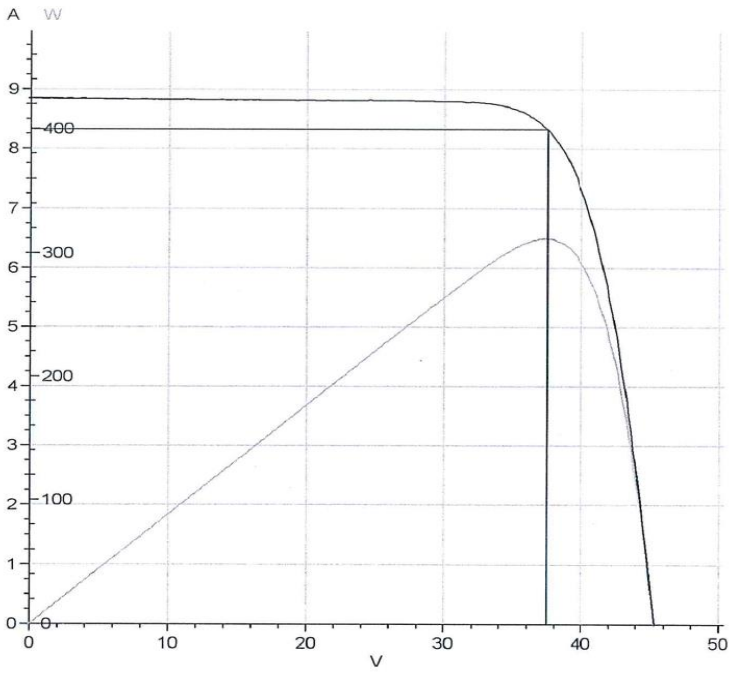
- Electrical performance rating is outside the scope of IEC 61215:2005 qualification testing. The verdicts of performance rating are only related to the test samples that were subjected to the tests. They cannot be generalised to the modules from the series production.
- The calibration to STC was performed with a class AAA solar simulator. The extended measurement uncertainty is:
- Pmax measurement:2.14% with a coverage factor k=2
- Current measurement: 1.87% with a coverage factor k=2
- Voltage measurement:1.63% 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 %.

ZUSATZ-DOKUMENTATION
ADDITIONAL DOCUMENTATION

Measurement reports:

Performance measurement

PASAN SLAB Tester - STC + SM V2.4.4 03-04-17 17:07



Measurement Data (Temp. compensated results)

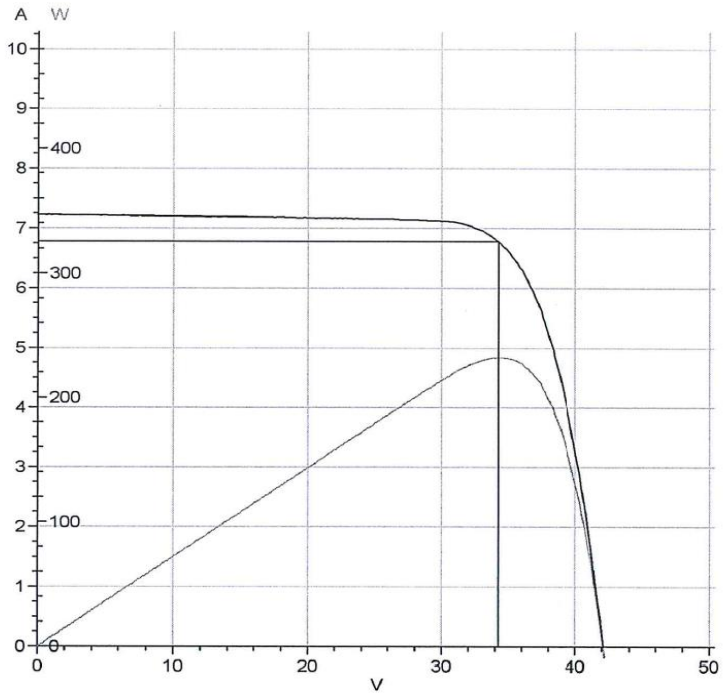
PASAN Tester version	2.4.4		Operator	1803205679-04 initia	
Module ID Code	1238058		Serial number		
Standard temperature	25.0	°C	Monitor Cell	071-2014	
Mean Irradiance	1.004	kW/m²	Calibration Value	33.39	mV/(kW/m²)
Module Temp.	26.3	°C	Mon. Cell Temp.	26.3	°C
Mask	NO-MASK 1.000	-	Cell Area	243.360	cm²
Module Area	19334.951	cm²	Cells in Parallel	1	
Cells in Series	72		Measurement irradiance	1.000	kW/m²
Isc	8.849	A	Voc	45.322	V
Imp	8.328	A	Vmp	37.465	V
Pmax	312.003	W	Reference vlt 1	0.000	V
Reference vlt 2	0.000	V	Power ar ref 1	-1.000	W
Power ar ref 2	-1.000	W	Current at ref 1	0.000	A
Current at ref 2	0.000	A	Fill Factor	77.797	%
Cell Efficiency	17.806	%	Module Efficiency	16.137	%
Shunt res.	582.272	Ohm	Serie res.	0.510	Ohm

ZUSATZ-DOKUMENTATION
ADDITIONAL DOCUMENTATION

TÜVRheinland®

Performance measurement

PASAN SLAB Tester - STC + SM V2.4.4 25-05-17 14:27



Measurement Data (Temp. compensated results)

PASAN Tester version	2.4.4		Operator	1803205679-04@NOCT	
Module ID Code	1238058		Serial number		
Standard temperature	44.5	°C	Monitor Cell	071-2014	
Mean Irradiance	0.801	kW/m²	Calibration Value	33.39	mV/(kW/m²)
Module Temp.	44.7	°C	Mon. Cell Temp.	44.7	°C
Mask	NO-MASK 1.000	-	Cell Area	243.360	cm²
Module Area	19334.951	cm²	Cells in Parallel	1	
Cells in Series	72		Measurement irradiance	0.800	kW/m²
Isc	7.226	A	Voc	42.144	V
Imp	6.778	A	Vmp	34.263	V
Pmax	232.248	W	Reference vlt 1	0.000	V
Reference vlt 2	0.000	V	Power ar ref 1	-1.000	W
Power ar ref 2	-1.000	W	Current at ref 1	0.000	A
Current at ref 2	0.000	A	Fill Factor	76.258	%
Cell Efficiency	16.568	%	Module Efficiency	15.015	%
Shunt res.	398.844	Ohm	Serie res.	0.602	Ohm

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FOTO-DOKUMENTATION
PHOTO-DOCUMENTATION

Pictures of Modules – DESERV- 3M6-315 (Multi)

Fig.1:Front view of the module

Fig.2:Rear view of the module

Fig.3:Detail view of closed junction Box

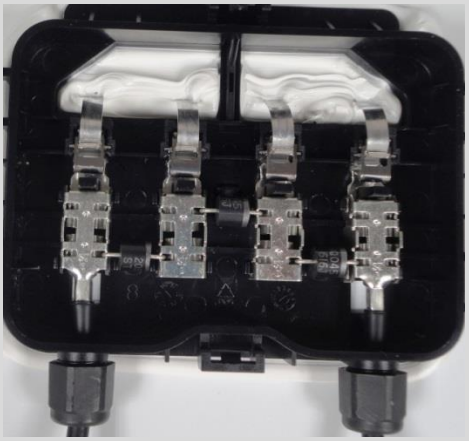

Fig.4:detail view of the Open junction Box

Fig.5:detail view of the connector

Fig.6:Detail view of Cable

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FOTO-DOKUMENTATION
PHOTO-DOCUMENTATION

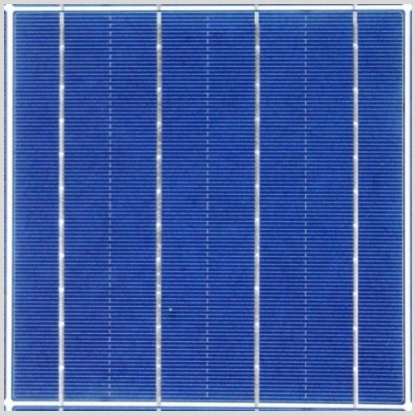

Fig.7: Detail view of Cell

Fig.8:Detail view of the Type label

Fig.9: Detail view of Grounding hole