Prüfbericht-Nr.: *Test Report No.*:	**21246623.002rev01**	**Auftrags-Nr.:** *Order No.*:	21246623	Seite 1 von 14 *Page 1 of 14*
Kunden-Referenz-Nr.: *Client Reference No.*:	1284407	**Auftragsdatum:** *Order date*:	28 May 2019	
Auftraggeber: *Client*:	GREENoneTEC Solarindustrie GmbH (for add. information see page 3)			
Prüfgegenstand: *Test item*:	Integrated Collector Storage			
Bezeichnung / Typ-Nr.: *Identification / Type No.*:	SUNPAD E			
Auftrags-Inhalt: *Order content*:	A collector reliability test in accordance with EN ISO 9806:2017 should be performed with the aim of certification.			
Prüfgrundlage: *Test specification*:	EN ISO 9806:2017 Solar energy - Solar thermal collectors - Test methods			

Wareneingangsdatum: *Date of receipt*:	02 August 2019
Prüfmuster-Nr.: *Test sample No.*:	see "List of test samples"
Prüfzeitraum: *Testing period*:	05 August 2019 – 16 October 2019
Ort der Prüfung: *Place of testing*:	Cologne
Prüflaboratorium: *Testing laboratory*:	Solar Energy Assessment Center
Prüfergebnis*: *Test result**:	Pass

geprüft von / *tested by*:			**kontrolliert von** / *reviewed by*:		
13 November 2019	Jürgen Sommer / Project manager		13 November 2019	Ulrich Fritzsche / Team Manager	
Datum *Date*	**Name / Stellung** *Name / Position*	**Unterschrift** *Signature*	**Datum** *Date*	**Name / Stellung** *Name / Position*	**Unterschrift** *Signature*

Sonstiges / *Other*: add. test specifications: - "Solar Keymark Scheme Rules" Version 07 March 2019
- EN 12975-1:2006+A1:2010 "Thermal solar systems and components - Solar collectors - Part 1: General requirements"
- EN 12976-1:2017 "Thermal solar systems and components – Factory made systems – Part 1: General requirements"

Zustand des Prüfgegenstandes bei Anlieferung: Prüfmuster vollständig und unbeschädigt
Condition of the test item at delivery: *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

Liste der verwendeten Prüfmittel
List of used test equipment

Prüfmittel *Test equipment*	**Prüfmittel-Nr. / ID-Nr.** *Equipment No. / ID-No.*	**Nächste Kalibrierung** *Next calibration*

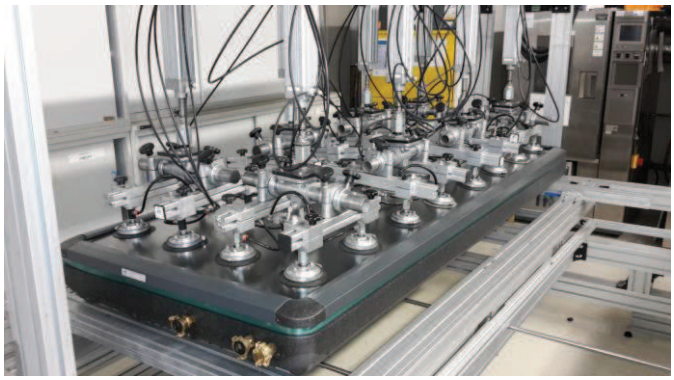
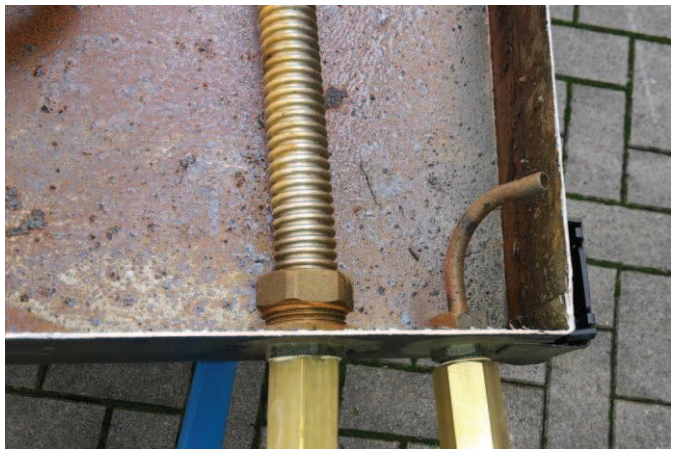
All equipment used for tests, including equipment for subsidiary measurements having a significant effect on the accuracy or validity of the result of the test is calibrated before being put into service.
The laboratory has an established programme and procedure for the calibration of its equipment according to EN ISO/IEC 17025 (Reg. no.: D-PL-11120-01-00).

Revision History

Revision	*Date*	*Nature of changes*	*Page*
-	12/11/2019	Original issue	
01	13/11/2019	Load figures attached in summary, Changing in Type name; whole report	4, div.

Absatz	**EN ISO 9806:2017**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

1	**Name/Adresse des Herstellers** *Name/Address of manufacturer*	GREENoneTEC Solarindustrie GmbH Energieplatz 1 9300 St. Veit/ Glan
2	**Name/Adresse des Berichtsinhabers** *Name/Address of owner of report*	GREENoneTEC Solarindustrie GmbH Energieplatz 1 9300 St. Veit/ Glan
3	**Handelsname** *Brand name*	SUNPAD E
4	**Zeichnungs-Nr.** *Drawing document number*	Part of „Constructional data“
5	**Sonstiges** *Additional information*	

Mechanical Load	Rain Penetration
	
Light Soaking	Endkontrolle
	

Absatz	**EN ISO 9806:2017**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

-	**Result summary table**

Test Chapter of standard*	Date [DD Month YYYY]		Summary of main test results	—
	Start	End		
Internal pressure 6[1]	-		-	N/T**
Standard Stagnation temperature 9[1]	-		-	N/T**
Exposure 10[1]	05 August 2019	04 October 2019	Class A	P
External thermal shock (1st/2nd) 11[1]	Not required due to use of tempered glass		-	N/T
			-	N/T
Internal thermal shock (1st/2nd) 12[1]	-			N/T**
				N/T**
Rain penetration 13[1]	09 October 2019		No visual damages	P
Freeze resistance 14[1]	-		-	N/T**
Mechanical load 15[1]	10 October 2019	14 October 2019	Positive: + 3000 Pa Negative: - 3000 Pa	P
Impact resistance 16[1]	15 October 2019		No visual damages; 1.6 m drop height	P
Final inspection 17[1]	09 October 2019 / 16 October 2019		No major problems	P
Thermal performance 19[1]	-	-		N/T**
Incident angle modifier 26[1]	-	-		N/T**
Pressure drop 27[1]	-			N/T**

Supplementary information:
*Chapter No.[1]: according to EN ISO 9806:2017 (chapter information used in report)
According to EN 12976-1:2017 clause 4.3.1, not all tests are required for ICS systems.

Absatz	**EN ISO 9806:2017**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

-	**Constructional Data**			
Basic data				—
Name of manufacturer	GREENoneTEC Solarindustrie GmbH			
Brand name	SUNPAD E			
Detailed type name	SUNPAD E AR2 – WT S BEF P			—
Construction type/Category	ICS Integrated Collector Storage			
Year of production	2019			
Hydraulic Designation Code	HDC=1-H-22S -C:20.2,19000			
Collector unit				—
Data		***	Drawing-/Spec.-No.	
Dimension (l / w / h) [mm]	2250 x 920 x 198	C		
Gross area [m²]	2.07	C		
Aperture area [m²]	1.68	C		
Absorber area [m²]	1.68	C		
Weight empty [kg]	73	M		—
Fluid content [l]	150	M		
Flow rate (recommended) [kg/s]	n.n.			
Absorber tube orientation	Landscape (Heat exchanger)	C		
Flow pattern	serpentine	C		
Main Materials				—
Main frame material	EPP 40	M	See initial physical inspection report 21246623.003 (2019-11-12) for more detailed information and references!	
Glass Type	AR-coated Solar Glass, Mat/ Mat	M		
Solar transmittance	>0.955	M		
Absorber Material	Steel 0.75 mm (tank)	C		
Solar absorptance α	91.5 ± 1	M		
Hemispherical emittance ε	86.0 ± 4	M		—
Absorber Piping/ Header Material	Stainless steel (heat exchanger)	C		
Bond Method	Full wetted!	C		
Absorber connection	¾” outer threat for heat exchanger	C		
Insulation Material and Thickness	EPP 40/ 36..40 mm	M		
Thermal conductivity	0.036 W/(m*K) at 10°C	M		

Supplementary information: -
*** D = determined by laboratory; C = confirmed by laboratory; M = manufacturer information

Absatz	**EN ISO 9806:2017**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

Limitations				—
Data		***	Drawing-/Spec.-No.	
Maximum operating temperature [°C]	95	M	- - -	—
Maximum operating pressure at max. temperature of operation [kPa]	1000	M		
Minimum tilt angle [°]	5	M		
Maximum tilt angle [°]	45	M		
Recommended heat transfer medium	water	M		
Collector mounting	Field, floor, flat and tilted roof	M		
Other limitations				

Supplementary information: -

*** D = determined by laboratory; C = confirmed by laboratory; M = manufacturer information

Absatz	**EN ISO 9806:2017**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

-	**List of test samples**			
Test Sample Picking according to Solar Keymark Scheme Rules (randomly)		Date [DD/MM/YYYY]	by	—
		01/08/2019	Jürgen Sommer	
Sample No.	Sample S/N	Remarks / constructional characteristics		
HV2019004024	2	-		

-	**Visual inspection (Initial)**	
Test date [DD/MM/YYYY]	05/08/2019	—
Sample No.	Nature and position of initial findings	
HV2019004024	-	P
Supplementary information: -		

Absatz	**EN ISO 9806:2017**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

10 Exposure and pre-exposure test

Summary of outdoor exposure results						—
Test date [DD/MM/YYYY]		05/08/2019 – 30/09/2019				
Collector tilt angle [° from horizontal]		30				
Sample No.	No. of days [d]	Irradiation energy [MJ/m²]	Mean ambient temperature [°C]	Min. ambient temperature [°C]	Max. ambient temperature [°C]	
	56	808.7	19.3	5.8	38.5	P
Sample No.	Climate class [W/m² and °C]	Time period in climate class [h]	Mean ambient temperature [°C]	Min. ambient temperature [°C]	Max. ambient temperature [°C]	—
	1000/20 Class A	- - -	- - -	- - -	- - -	N/A
Supplementary information: -						

Summary of solar simulator exposure results						—
Test date [DD/MM/YYYY]		01/10/2019 – 04/10/2019				
Collector tilt angle [° from horizontal]		20				
Sample No.	No. of days [d]	Irradiation energy [MJ/m²]	Climate class [W/m² and °C]	Time period in climate class [h]	Mean ambient temperature [°C]	
	4 (â 8h) + 1h	119.9	1000/20 Class A	33	28	P
Supplementary information: In parallel with over temperature test						

Total result of exposure test				—
Sample No.	Total irradiation energy [MJ/m²]	Time period in climate class [h]	Final climate class [W/m² and °C]	
	928.5	33	1000/20 Class A	P
Supplementary information: -				

Absatz	**EN ISO 9806:2017**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

13	**Rain penetration test**				
Test date [DD/MM/YYYY]		09/10/2019			—
Collector mounted on		Open frame			
Collector tilt angle [° from horizontal]		20			
Sample No.	Test duration [h]	Detection of water penetration by	Hours after spray [h]	Water ingress [g]	
HV2019004024	4	Visual inspection	4	-	P
Supplementary information: Integrated Collector Storage, water between closed cell insulation foam and water tank can drain compleately.					

15	**Mechanical load test with positive or negative pressure**				
Test date [DD/MM/YYYY]		10/10/2019 – 14/10/2019			—
Method used to load the collector		Suction cups			
Method of collector mounting		4-Point on roof mounting on horizontal bar			
Sample No.	Max. positive load [Pa]	Remaining deflection [mm]	Max. negative load [Pa]	Remaining deflection [mm]	
HV2019004024	3000	0	3000	2	P
Supplementary information: The ICS was completely filled with water during test. With the original clamps for tilted roof mounting, the maximum achievable positive load was 1500 Pa and negative load 2400 Pa, before the clamps are bending significantly. By using the fixing points of the ICS directly, loads up to 3000 Pa are achievable.					

Absatz	**EN ISO 9806:2017**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

16	**Impact resistance test (with steel ball)**

Test date [DD/MM/YYYY]			15/10/2019		—
Method used for impact resistance acc. to			Clause 17.5 “Steel balls”		
Collector tilt angle [° from horizontal]			0		
Test performed using			Vertical drop		
Diameter of ball [mm]			33.3		
Weight of steel ball [g]			151		
Resulting maximum height [m]			1.6		
Sample No.	Location of impact		Height of ball [m]	Passed drop	
HV2019004024	Edge	4	0.4	4	P
	Edge	4	0.6	4	P
	Edge	4	0.8	4	P
	Edge	1	1.0	4	P
	Edge	1	1.2	4	P
	Edge	2	1.4	4	P
	Edge	3	1.6	4	P

Supplementary information:
Because of the better handling (size of the test facility) the impact test was done with smaller test sample;

According to ICC901/SRCC 100, the steel ball test is required for collectors using not tempered glass

Absatz	**EN ISO 9806:2017**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

17	**Final inspection**			
Test date [DD/MM/YYYY]		09/10/2019 // 16/10/2019		
Scale of potential problem		0 – No problem 1 – Minor problem 2 – Major problem ~ – Inspection to establish the condition not possible		—
Sample No.	Collector component	Potential problem	Evaluation	
HV2019004024	a) Collector box/fasteners	Cracking/wrapping/corrosion/ rain penetration	0	
			0	
HV2019004024	b) Mountings/structure	Strength/safety	0	
			0	
HV2019004024	c) Seals/gaskets	Cracking/adhesion/elasticity	0	
			0	
HV2019004024	d) Cover/reflector	Cracking/crazing/buckling/delamination/ wrapping/outgassing	0	
			0	
HV2019004024	e) Absorber coating	Cracking/crazing/blistering	0	
			0	
HV2019004024	e²) Absorber tubes and headers	Deformation/corrosion/leakage/ loss of bonding	1	
			1	
HV2019004024	e³) Absorber mountings	Deformation//corrosion	0	
			0	
HV2019004024	f) Insulation	Water retention/outgassing/ degradation	0	
			0	
Supplementary information:				

Absatz *Clause*	**EN ISO 9806:2017** Anforderungen - Prüfungen / *Requirements - Tests*	Messergebnisse - Bemerkungen *Measuring results - Remarks*	Bewertung *Evaluation*
-	**General remarks and subblementary information**		
Measuring uncertainties			—
All results only refer to the test samples that were subjected to testing.			
Additional Information			—
The ICS system will also be distributed without the provision to insert an electrical backup heater under Brand SUNPAD.			

Absatz	**EN ISO 9806:2017**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

Climate data

Date	G total day	T mean day	T min day	T max day	h > 1000 W/20°C	T mean 1000 W	T min 1000 W	T max 1000 W
ddmmyyyy	MJ	°C	°C	°C	h	°C	°C	°C
05.08.2019	10.34	24.0	18.7	27.5				
06.08.2019	7.26	22.3	19.2	26.7				
07.08.2019	7.88	20.3	16.1	25.5				
08.08.2019	5.93	19.5	14.8	23.7				
09.08.2019	2.49	21.1	17.2	26.2				
10.08.2019	14.61	22.5	18.5	27.7				
11.08.2019	13.15	20.5	13.9	26.4				
12.08.2019	11.94	17.8	13.5	26.3				
13.08.2019	20.23	17.2	13.2	24.7				
14.08.2019	23.37	18.8	10.4	26.4				
15.08.2019	13.75	19.2	16.1	25.7				
16.08.2019	20.51	20.3	14.2	27.0				
17.08.2019	5.59	20.0	17.1	23.5				
18.08.2019	4.83	18.0	14.2	22.1				
19.08.2019	21.44	19.7	12.8	26.1				
20.08.2019	16.30	19.1	12.4	25.5				
21.08.2019	24.34	19.4	11.3	27.7				
22.08.2019	26.06	21.2	11.7	32.0				
23.08.2019	25.82	22.6	12.4	33.5				
24.08.2019	26.00	24.1	13.3	34.8				
25.08.2019	21.82	25.6	16.3	36.4				
26.08.2019	22.42	26.9	0.0	38.5				
27.08.2019	21.85	26.8	18.9	37.4				
28.08.2019	18.06	25.3	18.5	35.1				
29.08.2019	15.89	24.0	19.7	30.4				
30.08.2019	22.53	23.0	16.4	32.2				
31.08.2019	21.81	25.4	14.9	36.7				
01.09.2019	7.81	19.5	16.8	24.6				
02.09.2019	21.01	18.2	10.6	26.2				
03.09.2019	8.88	17.3	10.8	23.0				
04.09.2019	19.17	19.5	14.9	29.5				

—

Supplementary information: Exposure values for freeze resistance test
Colour code: not part of exposure ; indoor exposure time (not valid) ; **outdoor exposure time (valid)**

Absatz	**EN ISO 9806:2017**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

Climate data

Date	G total day	T mean day	T min day	T max day	h > 1000 W/20°C	T mean 1000 W	T min 1000 W	T max 1000 W
ddmmyyyy	MJ	°C	°C	°C	h	°C	°C	°C
05.09.2019	11.72	15.9	12.4	21.2				
06.09.2019	23.66	16.2	7.5	25.0				
07.09.2019	9.63	14.8	11.7	22.5				
08.09.2019	8.20	14.1	11.8	20.7				
09.09.2019	13.79	15.1	11.4	22.8				
10.09.2019	21.08	15.4	8.9	25.1				
11.09.2019	9.11	15.0	10.0	23.4				
12.09.2019	14.83	19.8	15.7	27.4				
13.09.2019	6.76	19.4	16.2	24.6				
14.09.2019	23.09	18.0	10.3	27.9				
15.09.2019	22.53	18.8	9.4	29.5				
16.09.2019	4.62	16.5	16.6	21.8				
17.09.2019	6.60	15.7	12.7	20.2				
18.09.2019	8.60	13.1	6.4	19.2				
19.09.2019	10.20	12.8	5.8	18.5				
20.09.2019	20.28	10.7	0.0	24.2				
21.09.2019	23.40	17.2	9.0	27.9				
22.09.2019	14.84	20.0	12.6	28.7				
23.09.2019	6.73	17.3	13.9	21.9				
24.09.2019	7.96	15.8	11.8	22.7				
25.09.2019	8.42	16.4	13.6	21.4				
26.09.2019	2.54	16.5	14.4	18.3				
27.09.2019	16.32	17.3	13.5	22.3				
28.09.2019	7.19	16.1	14.0	19.4				
29.09.2019	3.47	16.7	14.9	19.0				
30.09.2019	10.78	16.3	13.6	20.7				

—

Supplementary information: Exposure values for freeze resistance test
Colour code: not part of exposure ; indoor exposure time (not valid) ; **outdoor exposure time (valid)**