


Annex to Solar Keymark Certificate					Licence Number		011-7S2149 F							
					Date issued		2021-06-23							
					Issued by		TÜV Rheinland DIN CERTCO							
Licence holder		Harreither Ges. m.b.H.			Country		Austria							
Brand (optional)		-			Web		www.harreither.com							
Street, Number		Oberland 71			E-mail		office@harreither.com							
Postcode, City		A-3334 Gafenz			Tel		+43 7353 666-0							
Collector Type					Flat plate collector									
Collector name					Power output per collector									
					Gb = 850 W/m <sup>2</sup> , Gd = 150 W/m <sup>2</sup> & u = 1.3 m/s $\vartheta_m - \vartheta_a$									
					0 K	10 K	30 K	50 K	70 K	120 K				
					m <sup>2</sup>	mm	mm	mm	mm	mm	mm			
Solar Star S 2.4					2.40	20 614	1 154	98	1 751	1 668	1 482	1 268	1 029	311
Power output per m <sup>2</sup> gross area					729	695	617	529	429	130				
Performance parameters test method		Quasi dynamic												
Performance parameters (related to A <sub>G</sub> )		$\eta_0, b$	a1	a2	a3	a4	a5	a6	a7	a8	Kd			
Units		-	W/(m <sup>2</sup> K)	W/(m <sup>2</sup> K <sup>2</sup> )	J/(m <sup>3</sup> K)	-	J/(m <sup>2</sup> K)	s/m	W/(m <sup>2</sup> K <sup>4</sup> )	W/(m <sup>2</sup> K <sup>4</sup> )	-			
Test results		0.737	3.32	0.014	0.000	0.00	9 536	0.000	0.00	0.0E+00	0.93			
Incidence angle modifier test method		Quasi dynamic - outdoor												
Incidence angle modifier		Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°			
Transversal		K <sub>GT, coll</sub>	1.00	0.99	0.98	0.96	0.93	0.87	0.75	0.39	0.00			
Longitudinal		K <sub>GL, coll</sub>	1.00	0.99	0.98	0.96	0.93	0.87	0.75	0.39	0.00			
Heat transfer medium for testing					Water									
Flow rate for testing (per gross area, A <sub>G</sub> )					dm/dt	0.055	kg/(sm <sup>2</sup> )							
Maximum temperature difference during thermal performance test					( $\vartheta_m - \vartheta_a$ ) <sub>max</sub>	90	K							
Standard stagnation temperature (G = 1000 W/m <sup>2</sup> ; $\vartheta_a = 30$ °C)					$\vartheta_{stg}$	210	°C							
Maximum operating temperature					$\vartheta_{max, op}$	100	°C							
Maximum operating pressure					p <sub>max, op</sub>	1000	kPa							
Testing laboratory		TÜV Rheinland Energy GmbH					www.tuv.com\solarenergy							
Test report(s)		21246747.001 (Reliability)//21250086.001 (Performance) 21248537.001 (Hail Impact) 21243422.001 (Document Check)					Dated		12.09.2019 // 22.09.2020 22.06.2020 22.06.2021					
Comments of testing laboratory					Datasheet version: 6.1, 2019-07-11									
The collector performance parameter related to the aperture area of 2.22 m <sup>2</sup> are h <sub>0</sub> , hem, a=0.785, a1a=3.559 and a2a=0.015.					 TÜV Rheinland Energy GmbH Am Graubühl 51105 Köln									
DIN CERTCO • Alboinstraße 56 • 12103 Berlin, Germany Tel: +49 30 7562-1131 • Fax: +49 30 7562-1141 • E-Mail: info@dincertco.de • www.dincertco.de														

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Supplementary Information		Issued		2021-06-23																	
<b>Annual collector output in kWh/collector at mean fluid temperature <math>\vartheta_m</math></b>																					
	Standard Locations	Athens			Davos			Stockholm			Würzburg										
Collector name	$\vartheta_m$	25°C	50°C	75°C	25°C	50°C	75°C	25°C	50°C	75°C	25°C	50°C	75°C								
Solar Star S 2.4		2 802	2 009	1 309	2 134	1 474	915	1 571	1 030	617	1 712	1 116	658								
Annual output per m <sup>2</sup> gross area		1 168	837	545	889	614	381	655	429	257	713	465	274								
Annual efficiency, $\eta_a$		66%	47%	31%	55%	38%	23%	56%	37%	22%	57%	37%	22%								
Fixed or tracking collector		Fixed (slope = latitude - 15°; rounded to nearest 5°)																			
Annual irradiation on collector plane		1765 kWh/m <sup>2</sup>			1630 kWh/m <sup>2</sup>			1166 kWh/m <sup>2</sup>			1244 kWh/m <sup>2</sup>										
Mean annual ambient air temperature		18.5°C			3.2°C			7.5°C			9.0°C										
Collector orientation or tracking mode		South, 25°			South, 30°			South, 45°			South, 35°										
The collector is operated at constant temperature $\vartheta_m$ (mean of in- and outlet temperatures). The calculation of the annual collector performance is performed with the official Solar Keymark spreadsheet tool Scenocalc Ver. 6.1 (July 2019). A detailed description of the calculations is available at <a href="http://www.estif.org/solarkeymarknew/">http://www.estif.org/solarkeymarknew/</a>																					
<b>Additional Information</b>																					
Collector heat transfer medium										Water-Glycole											
The collector is deemed to be suitable for roof integration										Yes											
The collector was tested successfully under the following conditions:																					
Climate class (A+, A, B or C)										A		--									
G (W/m <sup>2</sup> ) >		1000		$\vartheta_a$ (°C) >		20		$H_x$ (MJ/m <sup>2</sup> ) >		600											
Maximum tested positive load										3250		Pa									
Maximum tested negative load										2400		Pa									
Hail resistance using ice balls (diameter)										35		mm									
<b>Additional collector attribute(s)</b>																					
<input type="checkbox"/> Using external power source(s) for normal operation					<input type="checkbox"/> Active or passive measure(s) for self-protection																
<input type="checkbox"/> Co-generating thermal and electrical power					<input type="checkbox"/> Façade collector(s)																
<b>Energy Labelling Information</b>						<b>Additional Informative Technical Data</b>															
Reference Area, $A_{sol}$ (m <sup>2</sup> )						Hydraulic Designation Code				Aperture Area, $A_a$ (m <sup>2</sup> )											
Solar Star S 2.4						2.40				10-V-12345-A:7.3,1920-C:20.8,1200				2.22							
<b>Data required for CDR (EU) No 811/2013 - Reference Area <math>A_{sol}</math></b>						<b>Data required for CDR (EU) No 812/2013 - Reference Area <math>A_{sol}</math></b>															
Collector efficiency ( $\eta_{col}$ )						57%				Zero-loss efficiency ( $\eta_0$ )				0.73				--			
Remark: Collector efficiency ( $\eta_{col}$ ) is defined in CDR (EU) No 811/2013 as collector efficiency of the solar collector at a temperature difference between the solar collector and the surrounding air of 40 K and a global solar irradiance of 1000 W/m <sup>2</sup> , expressed in % and rounded to the nearest integer. Deviating from the regulation $\eta_{col}$ is based on reference area ( $A_{sol}$ ) which is aperture area for values according to EN 12975-2 or gross area for ISO 9806:2017.						First-order coefficient ( $a_1$ )				3.32				W/(m <sup>2</sup> K)							
						Second-order coefficient ( $a_2$ )				0.014				W/(m <sup>2</sup> K <sup>2</sup> )							
						Incidence angle modifier IAM (50°)				0.92				--							
Remark: The data given in this section are related to collector reference area ( $A_{sol}$ ) which is aperture area for values according to EN 12975-2 or gross area for ISO 9806. Consistent data sets for either aperture or gross area can be used in calculations like in the regulation 811 and 812 and simulation programs.																					
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