


<b>Annex to Solar Keymark Certificate</b>					<b>Licence Number</b>		<b>011-7S2215 F</b>																	
					<b>Date issued</b>		<b>2021-01-08</b>																	
					<b>Issued by</b>		<b>TÜV Rheinland Energy</b>																	
<b>Licence holder</b>		<b>Bosch Thermotechnik GmbH</b>			<b>Country</b>		Germany																	
<b>Brand (optional)</b>		Bosch			<b>Web</b>		www.bosch-thermotechnik.de																	
<b>Street, Number</b>		Junkersstrasse 20-24			<b>E-mail</b>		solarthermie@de.bosch.com																	
<b>Postcode, City</b>		73249 Wernau			<b>Tel</b>		49 (0)2557 9399-0 / -																	
<b>Collector Type</b>					Flat plate collector																			
<b>Collector name</b>					<b>Gross area (<math>A_G</math>)</b>		<b>Gross length</b>		<b>Gross width</b>		<b>Gross height</b>		<b>Power output per collector</b>											
					m <sup>2</sup>		mm		mm		mm		G <sub>b</sub> = 850 W/m <sup>2</sup> , G <sub>d</sub> = 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		115 K									
					W		W		W		W		W		W									
<b>Bosch FKC-2W</b>					2.37		1 175		2 017		87		1 723		1 627		1 419		1 191		942		305	
<b>Junkers FKC-2w</b>					2.37		1 175		2 017		87		1 723		1 627		1 419		1 191		942		305	
<b>Worcester Worcester Solar-Lifestyle landscape</b>					2.37		1 175		2 017		87		1 723		1 627		1 419		1 191		942		305	
<b>Power output per m<sup>2</sup> gross area</b>					727		686		599		503		397		129									
<b>Performance parameters test method</b>					Quasi dynamic																			
<b>Performance parameters (related to <math>A_G</math>)</b>					$\eta_{0, b}$	a1	a2	a3	a4	a5	a6	a7	a8	Kd										
<b>Units</b>					-	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> )	-										
<b>Test results</b>					0.727	3.94	0.011	0.000	0.00	12 917	0.000	0.00	0.0E+00	1.00										
<b>Incidence angle modifier test method</b>					Quasi dynamic - outdoor																			
<b>Incidence angle modifier</b>					Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°										
<b>Transversal</b>					$K_{\theta T, coll}$	1.00	0.99	0.98	0.96	0.92	0.86	0.72	0.36	0.00										
<b>Longitudinal</b>					$K_{\theta L, coll}$	1.00	0.99	0.98	0.96	0.92	0.86	0.72	0.36	0.00										
<b>Heat transfer medium for testing</b>					Water																			
<b>Flow rate for testing (per gross area, <math>A_G</math>)</b>					dm/dt		0.022		kg/(sm <sup>2</sup> )															
<b>Maximum temperature difference during thermal performance test</b>					$(\vartheta_m - \vartheta_a)_{max}$		85		K															
<b>Standard stagnation temperature (G = 1000 W/m<sup>2</sup>; <math>\vartheta_a = 30</math> °C)</b>					$\vartheta_{stg}$		210		°C															
<b>Maximum operating temperature</b>					$\vartheta_{max, op}$		n.n.		°C															
<b>Maximum operating pressure</b>					$p_{max, op}$		600		kPa															
<b>Testing laboratory</b>					TÜV Rheinland Energy GmbH						www.tuv.com/solar													
<b>Test report(s)</b>					21249400.001						<b>Dated</b>		24.08.2020											
<b>Comments of testing laboratory</b>					Datasheet version: 6.1, 2019-07-11																			
					 TÜVRheinland® General Richtlinie TÜV Rheinland Energy GmbH Am Graben 111 50669 Köln																			
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<b>Supplementary Information</b>								<b>Issued</b>		<b>2021-01-08</b>			
<b>Annual collector output in kWh/collector at mean fluid temperature <math>\vartheta_m</math></b>													
<b>Standard Locations</b>		<b>Athens</b>			<b>Davos</b>			<b>Stockholm</b>			<b>Würzburg</b>		
<b>Collector name</b>	$\vartheta_m$	<b>25°C</b>	<b>50°C</b>	<b>75°C</b>	<b>25°C</b>	<b>50°C</b>	<b>75°C</b>	<b>25°C</b>	<b>50°C</b>	<b>75°C</b>	<b>25°C</b>	<b>50°C</b>	<b>75°C</b>
Bosch FKC-2W		2 786	1 914	1 191	2 064	1 366	808	1 530	956	546	1 678	1 040	584
Junkers FKC-2w		2 786	1 914	1 191	2 064	1 366	808	1 530	956	546	1 678	1 040	584
Worcester Worcester Solar-Lifestyle landscape		2 786	1 914	1 191	2 064	1 366	808	1 530	956	546	1 678	1 040	584
Annual output per m <sup>2</sup> gross area		1 176	808	503	871	576	341	646	403	231	708	439	247
Annual efficiency, $\eta_a$		67%	46%	28%	53%	35%	21%	55%	35%	20%	57%	35%	20%
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 <sub>x</sub> (MJ/m <sup>2</sup> ) >		600			
Maximum tested positive load										4000		Pa	
Maximum tested negative load										3000		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 <sub>sol</sub> (m <sup>2</sup> )		Hydraulic Designation Code		Aperture Area, A <sub>a</sub> (m <sup>2</sup> )			
Bosch FKC-2W						2.37		22-H-1234S-A:5.2,1022-C:16.6,1971		2.25			
Junkers FKC-2w						2.37		22-H-1234S-A:5.2,1022-C:16.6,1971		2.25			
Worcester Worcester Solar-Lifestyle landscape						2.37		22-H-1234S-A:5.2,1022-C:16.6,1971		2.25			
<b>Data required for CDR (EU) No 811/2013 - Reference Area A<sub>sol</sub></b>						<b>Data required for CDR (EU) No 812/2013 - Reference Area A<sub>sol</sub></b>							
Collector efficiency ( $\eta_{col}$ )						55%		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 <sub>sol</sub> ) which is aperture area for values according to EN 12975-2 or gross area for ISO 9806:2017.						First-order coefficient (a <sub>1</sub> )		3.94		W/(m <sup>2</sup> K)			
						Second-order coefficient (a <sub>2</sub> )		0.011		W/(m <sup>2</sup> K <sup>2</sup> )			
						Incidence angle modifier IAM (50°)		0.93		--			
						Remark: The data given in this section are related to collector reference area (A <sub>sol</sub> ) 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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