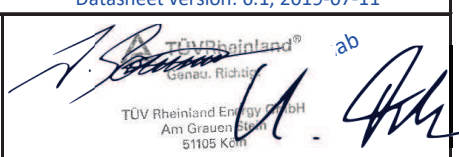


Annex to Solar Keymark Certificate					Licence Number		011-7S 1937 F																	
					Date issued		2021-01-29																	
					Issued by		TÜV Rheinland Energy GmbH																	
Licence holder		Vaillant GmbH			Country		Germany																	
Brand (optional)		Vaillant			Web		www.vaillant.com																	
Street, Number		Berghauser Str. 40			E-mail		info@vaillant.com																	
Postcode, City		42859 Remscheid			Tel		+49 2191180-0																	
Collector Type					Flat plate collector																			
Collector name					Gross area (A_G)		Gross length		Gross width		Gross height		Power output per collector											
					m ²		mm		mm		mm		$G_b = 850 \text{ W/m}^2, G_d = 150 \text{ W/m}^2 \text{ \& } u = 1.3 \text{ m/s}$ $\vartheta_m - \vartheta_a$											
VFK 155/2 V					2.51		2 033		1 233		80		0 K		10 K		30 K		50 K		70 K		100 K	
VFK 155/2 H					2.51		1 233		2 033		80		1 956		1 860		1 651		1 418		1 160		729	
Power output per m ² gross area					779		741		658		565		462		290									
Performance parameters test method					Quasi dynamic																			
Performance parameters (related to A_G)					$\eta_{0, b}$		a1		a2		a3		a4		a5		a6		a7		a8		Kd	
Units					-		W/(m ² K)		W/(m ² K ²)		J/(m ³ K)		-		J/(m ² K)		s/m		W/(m ² K ⁴)		W/(m ² K ⁴)		-	
Test results					0.784		3.69		0.012		0.000		0.00		7 573		0.000		0.00		0.0E+00		0.96	
Incidence angle modifier test method					Quasi dynamic - outdoor																			
Incidence angle modifier					Angle		10°		20°		30°		40°		50°		60°		70°		80°		90°	
Transversal					$K_{\theta T, coll}$		1.00		0.99		0.98		0.95		0.91		0.84		0.68		0.34		0.00	
Longitudinal					$K_{\theta L, coll}$		1.00		0.99		0.98		0.95		0.91		0.84		0.68		0.34		0.00	
Heat transfer medium for testing					Water																			
Flow rate for testing (per gross area, A_G)					dm/dt		0.021		kg/(sm ²)															
Maximum temperature difference during thermal performance test					$(\vartheta_m - \vartheta_a)_{max}$		70		K															
Standard stagnation temperature ($G = 1000 \text{ W/m}^2; \vartheta_a = 30 \text{ °C}$)					ϑ_{stg}		220		°C															
Maximum operating temperature					$\vartheta_{max, op}$		n.n.		°C															
Maximum operating pressure					$p_{max, op}$		1000		kPa															
Testing laboratory					TÜV Rheinland Energy GmbH							http://www.tuv.com/solar												
Test report(s)					21250536.001rev01 21250536.002rev01							Dated		29.01.2021 29.01.2021										
Comments of testing laboratory					Datasheet version: 6.1, 2019-07-11																			
																								
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Annex to Solar Keymark Certificate							Licence Number		011-7S 1937 F					
Supplementary Information							Issued		2021-01-29					
Annual collector output in kWh/collector at mean fluid temperature ϑ_m														
	Standard Locations	Athens			Davos			Stockholm			Würzburg			
Collector name	ϑ_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	
VFK 155/2 V		3 128	2 237	1 467	2 375	1 641	1 035	1 748	1 144	695	1 909	1 242	742	
VFK 155/2 H		3 128	2 237	1 467	2 375	1 641	1 035	1 748	1 144	695	1 909	1 242	742	
Annual output per m ² gross area		1 246	891	584	946	654	412	696	456	277	761	495	296	
Annual efficiency, η_a		71%	50%	33%	58%	40%	25%	60%	39%	24%	61%	40%	24%	
Fixed or tracking collector		Fixed (slope = latitude - 15°; rounded to nearest 5°)												
Annual irradiation on collector plane		1765 kWh/m ²			1630 kWh/m ²			1166 kWh/m ²			1244 kWh/m ²			
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 ϑ_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 http://www.estif.org/solarkeymarknew/														
Additional Information														
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 ²) >		1100		ϑ_a (°C) >		40		H _x (MJ/m ²) >		700				
Maximum tested positive load							5400			Pa				
Maximum tested negative load							3000			Pa				
Hail resistance using ice balls (diameter)							35			mm				
Additional collector attribute(s)														
<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)										
Energy Labelling Information						Additional Informative Technical Data								
	Reference Area, A _{sol} (m ²)					Hydraulic Designation Code			Aperture Area, A _a (m ²)					
VFK 155/2 V	2.51					1-H-1234S-A:9.2, 20630-C:16.6,1180			2.35					
VFK 155/2 H	2.51					1-H-1234S-A:9.2, 1804-C:16.6,1980			2.35					
Data required for CDR (EU) No 811/2013 - Reference Area A_{sol}						Data required for CDR (EU) No 812/2013 - Reference Area A_{sol}								
Collector efficiency (η_{col})						61%			Zero-loss efficiency (η_0)			0.78		
Remark: Collector efficiency (η_{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 ² , expressed in % and rounded to the nearest integer. Deviating from the regulation η_{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)			3.69			W/(m ² K)		
						Second-order coefficient (a ₂)			0.012			W/(m ² K ²)		
						Incidence angle modifier IAM (50°)			0.91			--		
						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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