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Annex to Solar Keymark Certificate

Licence Number	**011-7S1719 F**
Date issued	**2021-01-08**
Issued by	**TÜV Rheinland Energy GmbH**

Licence holder	**Bosch Thermotechnik GmbH**	**Country**	Germany
Brand (optional)	Buderus	**Web**	www.bosch-thermotechnik.de
Street, Number	Sophienstr. 30-32	**E-mail**	solarthermie@de.bosch.com
Postcode, City	35576 Wetzlar	**Tel**	49 (0)2557 9399-0 / -

Collector Type	Flat plate collector

Collector name	**Gross area (A_G)**	**Gross length**	**Gross width**	**Gross height**	**Power output per collector** Gb = 850 W/m2, Gd = 150 W/m2 & u = 1.3 m/s $\vartheta_m - \vartheta_a$					
					0 K	10 K	30 K	50 K	70 K	115 K
	m²	mm	mm	mm	W	W	W	W	W	W
Buderus Logasol SKN 4.0-w	2.37	1 175	2 017	87	1 723	1 627	1 419	1 191	942	305
Power output per m² gross area					727	686	599	503	397	129

Performance parameters test method	Quasi dynamic									
Performance parameters (related to A_G)	η0, b	a1	a2	a3	a4	a5	a6	a7	a8	Kd
Units	-	W/(m²K)	W/(m²K²)	J/(m³K)	-	J/(m²K)	s/m	W/(m²K⁴)	W/(m²K⁴)	-
Test results	0.727	3.94	0.011	0.000	0.00	12 917	0.000	0.00	0.0E+00	1.00

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	0.96	0.92	0.86	0.72	0.36	0.00
Longitudinal	$K_{\theta L,coll}$	1.00	0.99	0.98	0.96	0.92	0.86	0.72	0.36	0.00

Heat transfer medium for testing	Water		
Flow rate for testing (per gross area, A_G)	dm/dt	0.022	kg/(sm²)
Maximum temperature difference during thermal performance test	$(\vartheta_m-\vartheta_a)_{max}$	85	K
Standard stagnation temperature (G = 1000 W/m²; ϑ_a = 30 °C)	ϑ_{stg}	210	°C
Maximum operating temperature	$\vartheta_{max\ op}$	n.n.	°C
Maximum operating pressure	$p_{max,op}$	600	kPa

Testing laboratory	TÜV Rheinland Energy GmbH	www.tuv.com/solar	
Test report(s)	21249400.001	**Dated**	24.08.2020

Comments of testing laboratory — Datasheet version: 6.1, 2019-07-11

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Supplementary Information	Issued	2021-01-08

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
Buderus Logasol SKN 4.0-w	2 786	1 914	1 191	2 064	1 366	808	1 530	956	546	1 678	1 040	584
Annual output per m² gross area	1 176	808	503	871	576	341	646	403	231	708	439	247
Annual efficiency, η_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/m²			1630 kWh/m²			1166 kWh/m²			1244 kWh/m²		
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 ϑm (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/m²) >	1000	ϑ_a (°C) >	20	H_x (MJ/m²) >		600
Maximum tested positive load					4000	Pa
Maximum tested negative load					3000	Pa
Hail resistance using ice balls (diameter)					35	mm

Additional collector attribute(s)

- ☐ Using external power source(s) for normal operation
- ☐ Active or passive measure(s) for self-protection
- ☐ Co-generating thermal and electrical power
- ☐ Façade collector(s)

Energy Labelling Information

	Reference Area, A_{sol} (m²)
Buderus Logasol SKN 4.0-w	2.37

Additional Informative Technical Data

Hydraulic Designation Code	Aperature Area, A_a (m²)
22-H-1234S-A:5.2,1022-C:16.6,1971	2.25

Data required for CDR (EU) No 811/2013 - Reference Area A_{sol}

Collector efficiency (η_{col})	55%

Remark: Collector efficiency (ηcol) 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/m², expressed in % and rounded to the nearest integer. Deviating from the regulation ηcol is based on reference area (Asol) which is aperture area for values according to EN 12975-2 or gross area for ISO 9806:2017.

Data required for CDR (EU) No 812/2013 - Reference Area A_{sol}

Zero-loss efficiency (η_0)	0.73	--
First-order coefficient (a_1)	3.94	W/(m²K)
Second-order coefficient (a_2)	0.011	W/(m²K²)
Incidence angle modifier IAM (50°)	0.93	--

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.