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Annex to Solar Keymark Certificate		Licence Number	011-7S2434 R
		Date issued	2023-02-27
		Issued by	DIN CERTCO

Licence holder	Ritter Energie- und Umwelttechnik GmbH & Co. KG	**Country**	Germany	
Brand (optional)	Ritter XL Solar	**Web**	http://www.ritter-xl-solar.de	
Street, Number	Kuchenäcker 2	**E-mail**	info@ritter-xl-solar.de	
Postcode, City	72135 Dettenhausen	**Tel**	+49	7157 5359 1305

Collector Type	Evacuated tubular 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	120 K
	m²	mm	mm	mm	W	W	W	W	W	W
XL 15/26 P	2,67	1.642	1.627	111	1566	1552	1521	1482	1438	1299
XL 15/39 P	3,99	1.642	2.432	111	2340	2320	2272	2215	2149	1941
XL 19/33 P	3,35	2.058	1.627	111	1964	1947	1908	1860	1804	1629
XL 19/49 P	5,01	2.058	2.432	111	2938	2913	2853	2782	2698	2437
Power output per m² gross area					586	581	569	555	539	486

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	0,576	0,47	0,003	0,000	0,00	13.340	0,000	0,00	0,00	1,12

Incidence angle modifier test method		Quasi dynamic - outdoor								
Incidence angle modifier	Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°
Transversal	$K_{\theta T,coll}$	1,01	1,01	1,03	1,04	0,97	1,06	1,13	0,57	0,00
Longitudinal	$K_{\theta L,coll}$	1,00	1,00	0,99	0,97	0,91	0,85	0,70	0,35	0,00

Heat transfer medium for testing	Water		
Flow rate for testing (per gross area, A_G)	dm/dt	0,020	kg/(sm²)
Maximum temperature difference during thermal performance test	$(\vartheta_m-\vartheta_a)_{max}$	90	K
Standard stagnation temperature (G = 1000 W/m²; ϑ_a = 30 °C)	ϑ_{stg}	330	°C
Maximum operating temperature	ϑ_{max_op}	160	°C
Maximum operating pressure	$p_{max,op}$	1000	kPa

Testing laboratory	Institut für Gebäudeenergetik, Thermotechnik und Energiespeicherung (IGTE)	http://www.igte.uni-stuttgart.de	
Test report(s)	21COL1623OEM01 21COL1624OEM01 21COL1624QOEM01	**Dated**	30.11.2022 30.11.2022 30.11.2022

Comments of testing laboratory Ver. 6.2 (13.01.2022)

Documented performance parameters are taken from 22COL1623 OEM01 (XL 15/26 P).
This data sheet replaces the data sheet issued on 09.01.2023. (Following comment on gross areas was added)
The dimensions and characteristic values of the collectors were taken from data sheet 011-7S1889 R. The differences between the gross areas are below 2 %, there are no changes in the aperture areas. Thus Annex P1, Section 5.7 of the Scheme Rules has to be followed. Physical gross areas are:
XL 15/26 P A_G = 2,63 m²; XL 15/39 P A_G = 3,93 m²; XL 19/33 P A_G = 3,31 m²; XL 19/49 P A_G = 4,94 m².

TZS Forschungs- und Testzentrum für Solaranlagen
Institut für Thermodynamik und Wärmetechnik
Universität Stuttgart
Pfaffenwaldring 6, 70550 Stuttgart (Vaihingen)

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Supplementary Information	Issued	2023-02-27

Gross Thermal Yield 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
XL 15/26 P	2.838	2.679	2.492	2.517	2.342	2.147	1.809	1.658	1.500	1.953	1.797	1.627
XL 15/39 P	4.241	4.004	3.724	3.762	3.500	3.209	2.704	2.478	2.241	2.918	2.685	2.431
XL 19/33 P	3.561	3.362	3.127	3.159	2.938	2.694	2.270	2.081	1.882	2.450	2.254	2.041
XL 19/49 P	5.325	5.028	4.676	4.724	4.394	4.029	3.395	3.112	2.815	3.664	3.372	3.052
Gross Thermal Yield per m² gross area	1.063	1.004	933	943	877	804	678	621	562	731	673	609
Annual efficiency, η_a	60%	57%	53%	58%	54%	49%	58%	53%	48%	59%	54%	49%
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. 6.2 (13.01.2022). A detailed description of the calculations is available at http://www.estif.org/solarkeymarknew/

Additional Information

Collector heat transfer medium				Water	
The collector is deemed to be suitable for roof integration				No	
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				3000	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	No	Active or passive measure(s) for self-protection	No
Co-generating thermal and electrical power	No	Façade collector(s)	No

Energy Labelling Information

	Reference Area, A_{sol} (m²)
XL 15/26 P	2,67
XL 15/39 P	3,99
XL 19/33 P	3,35
XL 19/49 P	5,01

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

Collector efficiency (η_{col})	56%

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.

Additional Informative Technical Data

Hydraulic Designation Code	Aperture Area, A_a (m²)
7-V-12S	2,33
7-V-12S	3,49
7-V-12S	3,00
7-V-12S	4,50

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

Zero-loss efficiency (η_0)	0,59	--
First-order coefficient (a_1)	0,47	W/(m²K)
Second-order coefficient (a_2)	0,003	W/(m²K²)
Incidence angle modifier IAM (50°)	1,03	--

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.