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Annex to Solar Keymark Certificate		Licence Number	011-7S3141 R
		Date issued	2022-09-08
		Issued by	DIN CERTCO
Licence holder	IES (Asia) Limited	Country	CHINA
Brand (optional)	IES	Web	ies-group.com
Street, Number	Suite 1009, 10/F, Chevalier Commercial Centre, 8 Wang Hoi Road, Kowloon Bay	E-mail	info@ies-group.com.hk
Postcode, City	Hong Kong	Tel	+852 29920830
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	80 K
	m²	mm	mm	mm	W	W	W	W	W	W
FKA-VP100-16	4.31	2,195	1,964	174	2,269	2,205	2,041	1,829	1,569	1,427
					0	0	0	0	0	0
Power output per m² gross area					526	512	474	424	364	331

Performance parameters test method	Steady state - outdoor									
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	0.528	1.341	0.014	0.000	0.000	8,511	0.000	0.000	0.000	0.979

Incidence angle modifier test method		Steady state - outdoor								
Incidence angle modifier	Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°
Transversal	$K_{\theta T,coll}$	1.00	1.01	1.01	1.06	1.12	1.28	0.85	0.43	0.00
Longitudinal	$K_{\theta L,coll}$	1.00	1.00	1.00	0.99	0.96	0.91	0.79	0.53	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	$(\vartheta_m-\vartheta_a)_{max}$	50	K
Standard stagnation temperature (G = 1000 W/m²; ϑ_a = 30 °C)	ϑ_{stg}	200	°C
Maximum operating temperature	ϑ_{max_op}	95	°C
Maximum operating pressure	$p_{max,op}$	600	kPa

Testing laboratory	Intertek Testing Services Shenzhen Ltd. Guangzhou Branch	http://www.intertek.com	
Test report(s)	211228129GZU-001	Dated	2022/9/8

Comments of testing laboratory

Draft Ver. 6.2 (22.09.2021)

None

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Stamp: Steve Zhu

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Supplementary Information	Issued	2022-09-08

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
FKA-VP100-16	3,939	3,211	2,388	3,224	2,497	1,764	2,346	1,765	1,214	2,540	1,918	1,303
Gross Thermal Yield per m² gross area	914	745	554	748	579	409	544	410	282	589	445	302
Annual efficiency, η_a	52%	42%	31%	46%	36%	25%	47%	35%	24%	47%	36%	24%
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 Draft Ver. 6.2 (22.09.2021). 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)				B	--
G (W/m²) >	900	ϑ_a (°C) >	15	H_x (MJ/m²) >	540
Maximum tested positive load				2000	Pa
Maximum tested negative load				500	Pa
Hail resistance using steel ball (maximum drop height)				0.4	m

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)
FKA-VP100-16	4.31

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

Collector efficiency (η_{col})	45%

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)
1-H-12S-C:8,1905-D	2.90

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

Zero-loss efficiency (η_0)	0.53	--
First-order coefficient (a_1)	1.34	W/(m²K)
Second-order coefficient (a_2)	0.014	W/(m²K²)
Incidence angle modifier IAM (50°)	1.04	--

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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