TÜVRheinland®
DIN CERTCO
Precisely Right.

Annex to Solar Keymark Certificate

Licence Number	**011-7S3118 P**
Date issued	**2023-02-02**
Issued by	**DIN CERTCO**

Licence holder	**Abora Energy S.L.**	**Country**	Spain
Brand (optional)		**Web**	https://abora-solar.com/
Street, Number	P.I. Malpica. Calle C, parcela 102B	**E-mail**	info@abora-solar.com
Postcode, City	C.P. 50016. Zaragoza (Spain)	**Tel**	+34 876 24 70 96

Collector Type	Flat plate collector, unglazed

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
Abora aH72SK	1.96	1 970	995	83	1 312	1 222	1 042	862	682	592
Power output per m² gross area					669	623	532	440	348	302

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	0.668	4.59	0.000	0.893	0.57	26 124	0.001	0.00	0.0E+00	0.92

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	1.00	0.99	0.98	0.95	0.90	0.79	0.54	0.00
Longitudinal	$K_{\theta L,coll}$	1.00	1.00	0.99	0.98	0.95	0.90	0.79	0.54	0.00

Heat transfer medium for testing	Water-Glycole		
Flow rate for testing (per gross area, A_G)	dm/dt	0.033	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}	126	°C
Maximum operating temperature	ϑ_{max_op}	155	°C
Maximum operating pressure	$p_{max,op}$	1000	kPa

Testing laboratory	CTCV	http://www.ctcv.pt	
Test report(s)	R06/2019 R07/2019	**Dated**	02-05-2019 12-07-2019

Comments of testing laboratory Ver. 6.2 (13.01.2022)

Thermal performance parameters are given for the PV-module working with max. electrical power output ('MPP mode')

Manufacturer declares that the collector can be operated at 155°C without damage.

CTCV
CENTRO TECNOLÓGICO DA CERÂMICA E DO VIDRO
Rua Coronel Veiga Simão 3025 - 307 COIMBRA

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Supplementary Information	Issued	2023-02-02

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
Abora aH72SK		1 691	1 108	680	1 318	923	625	933	611	391	1 032	681	440
Gross Thermal Yield per m² gross area		863	565	347	672	471	319	476	312	200	527	347	224
Annual efficiency, η_a		49%	32%	20%	41%	29%	20%	41%	27%	17%	42%	28%	18%
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-Glycole	
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				1000	Pa
Maximum tested negative load				1000	Pa
Hail resistance using steel ball (maximum drop height)				2	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	Yes	Façade collector(s)	No

Energy Labelling Information

	Reference Area, A_{sol} (m²)
Abora aH72SK	1.96

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

Collector efficiency (η_{col})	48%

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)
10-VH-1234S-A:7.2,1859-C:20.4,994	1.88

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

Zero-loss efficiency (η_0)	0.67	--
First-order coefficient (a_1)	3.07	W/(m²K)
Second-order coefficient (a_2)	0.000	W/(m²K²)
Incidence angle modifier IAM (50°)	0.95	--

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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