CERTIFICATE

Certificate number	16084 Rev.2	Replaces	16084 Rev.1
Issued	18/12/2023	First edition	20/12/2018
Report number	PKC0002533	Expiry date	17/12/2028
Page	1 of 1	Contract number	PKC0002392

Product Certificate Solar Thermal Products

License holder: **Pleion S.p.A.**
Via Venezia 11 – 37053 Cerea (VR), Italy

Production site(s): Pleion S.p.A.
Via Venezia 11 – 37053 Cerea (VR), Italy

Product Solar thermal collector

Model(s): X-RAY 10 R; X-RAY 11 R; X-RAY 12 R; X-RAY 13 R

Kiwa Cermet Italia hereby declares that the product can be considered complying to the testing requirements and is entitled to use the Solar Keymark Label, based upon the following aspects:

Laboratory testing of the solar thermal products, which are performed by an accredited laboratory in accordance to EN ISO/IEC 17025:2005 -see annex-, using the following standards:

- ISO 9806:2013
  Solar Energy – Solar Thermal Collectors – Test Methods

Specific CEN Keymark Scheme Rules for Solar Thermal Products SKN_N0444R6.

Periodic Inspection of the Factory site(s) performed by Kiwa Cermet Italia.
A description of the test results is given in the annex to this certificate.

This certificate is issued in accordance with the Kiwa Cermet Italia regulations.
Publication of the certificate is allowed.
The validity of this certificate is subject to the positive result of periodic surveillance visits.
The validity of this certificate can be verified on request at the following e-mail address: energy@kiwacermet.it.
Any total or partial reproduction of this document in any form, without Kiwa Cermet Italia express authorization, is prohibited.

Industry Division Manager
Maurizio Lorenzon

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PRD N° 069B

Membro degli Accordi di Mutuo Riconoscimento EA, IAF e ILAC
Signatory of EA, IAF and ILAC Mutual Recognition Agreements

Annex to Solar Keymark Certificate

Licence Number	**16084 Rev.2**
Date issued	**2023-12-18**
Issued by	**Kiwa Cermet Italia S.p.A.**

Licence holder	**Pleion S.p.A.**	**Country**	Italy
Brand (optional)		**Web**	https://www.pleion.it
Street, Number	Via Venezia, 11	**E-mail**	info@pleion.it
Postcode, City	37053, Cerea (VR)	**Tel**	+39 0442320295

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	92 K
	m²	mm	mm	mm	W	W	W	W	W	W
X-RAY 10 R	2.12	1,106	1,921	114	1,272	1,250	1,190	1,107	1,002	862
X-RAY 11 R	2.34	1,216	1,921	114	1,404	1,380	1,313	1,222	1,106	951
X-RAY 12 R	2.55	1,326	1,921	114	1,530	1,504	1,431	1,332	1,206	1,036
X-RAY 13 R	2.76	1,436	1,921	114	1,657	1,628	1,549	1,441	1,305	1,122
Power output per m² gross area					600	590	561	522	473	406

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	0.602	0.91	0.013	0.000	0.00	50,900	0.000	0.00	0.0E+00	0.98

Incidence angle modifier test method		Steady state - outdoor							
Incidence angle modifier	Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°
Transversal	$K_{\theta T,coll}$	1.01	1.02	1.06	1.10	1.14	1.16	1.12	0.56	0.00
Longitudinal	$K_{\theta L,coll}$	1.00	0.99	0.98	0.95	0.91	0.84	0.69	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		$(\vartheta_m-\vartheta_a)_{max}$	62 K
Standard stagnation temperature (G = 1000 W/m²; ϑ_a = 30 °C)		ϑ_{stg}	279 °C
Maximum operating temperature		ϑ_{max_op}	130 °C
Maximum operating pressure		$p_{max,op}$	1000 kPa

Testing laboratory	ENEA Centro Ricerche Trisaia	http://www.trisaia.enea.it	
Test report(s)	RP.2018.COL.202.1 RP.2018.COL.202a.1	**Dated**	18/12/2018 18/12/2018

Comments of testing laboratory Ver. 6.2 (13.01.2022)

ENEA
TERIN-STSN
Dr. Vincenzo Sabatelli

Annex to Solar Keymark Certificate	Licence Number	16084 Rev.2
Supplementary Information	Issued	2023-12-11

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
X-RAY 10 R		2,248	1,970	1,612	1,916	1,606	1,264	1,390	1,145	878	1,494	1,234	946
X-RAY 11 R		2,481	2,174	1,779	2,115	1,772	1,395	1,534	1,263	969	1,649	1,363	1,045
X-RAY 12 R		2,704	2,370	1,939	2,304	1,932	1,520	1,672	1,377	1,056	1,797	1,485	1,138
X-RAY 13 R		2,927	2,565	2,099	2,494	2,091	1,645	1,809	1,490	1,143	1,945	1,607	1,232
Gross Thermal Yield per m² gross area		1,060	929	760	904	757	596	656	540	414	705	582	446
Annual efficiency, η_a		60%	53%	43%	55%	46%	37%	56%	46%	36%	57%	47%	36%
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)				B	--
G (W/m²) >	900	ϑ_a (°C) >	15	H_x (MJ/m²) >	540
Maximum tested positive load				2416	Pa
Maximum tested negative load				2014	Pa
					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)
X-RAY 10 R	2.12
X-RAY 11 R	2.34
X-RAY 12 R	2.55
X-RAY 13 R	2.76

Additional Informative Technical Data

	Hydraulic Designation Code	Aperture Area, A_a (m²)
X-RAY 10 R	10-V-1122S-A:X-C:X	1.91
X-RAY 11 R	11-V-1122S-A:X-C:X	2.11
X-RAY 12 R	12-V-1122S-A:X-C:X	2.30
X-RAY 13 R	13-V-1122S-A:X-C:X	2.49

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

Collector efficiency (η_{col})	54%

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)	0.60	--
First-order coefficient (a_1)	0.91	W/(m²K)
Second-order coefficient (a_2)	0.013	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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