TÜVRheinland®
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Annex to Solar Keymark Certificate

Licence Number	**011-7S3137 P**
Date issued	**2024-05-24**
Issued by	**DINCERTCO**

Licence holder	**Naked Energy Ltd**	**Country**	United Kingdom
Brand (optional)	-	**Web**	www.nakedenergy.co.uk
Street, Number	Unit 72, Basepoint Business Centre	**E-mail**	commercial@nakedenergy.co.uk
Postcode, City	Metcalf Way, CRAWLEY, RH11 7XX	**Tel**	+44 1 293 541 449

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	100 K
	m²	mm	mm	mm	W	W	W	W	W	W
Virtu PVT HD (single tube)	0.47	2 165	300	260	206	184	135	78	14	0
Virtu PVT HD (5 tube array)	2.35	2 165	1 500	260	1 030	921	675	392	71	0
Power output per m² gross area					438	392	287	167	30	0

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	0.437	4.43	0.020	0.000	0.00	16 198	0.000	0.00	0.0E+00	1.02

Incidence angle modifier test method		Quasi dynamic - outdoor								
Incidence angle modifier	Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°
Transversal	$K_{\theta T,coll}$	1.05	1.02	1.09	1.13	1.14	1.19	1.28	1.12	0.00
Longitudinal	$K_{\theta L,coll}$	1.00	1.00	1.01	1.02	1.03	1.06	1.11	1.27	0.00

Heat transfer medium for testing	Water		
Flow rate for testing (per gross area, A_G)	dm/dt	0.040	kg/(sm²)
Maximum temperature difference during thermal performance test	$(\vartheta_m-\vartheta_a)_{max}$	70	K
Standard stagnation temperature (G = 1000 W/m²; ϑ_a = 30 °C)	ϑ_{stg}	130	°C
Maximum operating temperature	$\vartheta_{max\ op}$	-	°C
Maximum operating pressure	$p_{max,op}$	600	kPa

Testing laboratory	TÜV Rheinland Solar GmbH	http://www.tuv.com/solar	
Test report(s)	21252336.002rev02	**Dated**	24.05.2024

Comments of testing laboratory Ver. 6.2 (13.01.2022)

The nominal electrical power of the virtu PVT-HD hybrid collector is 54 Wmpp.
IEC 61215 and IEC 61730 is certified by TÜV Rheinland under PV 60176550 0001 (2024-05-21) based on the test report DE22583Q 001 (2024-05-15) issued by TÜV Rheinland.

TÜVRheinland® ab
Genau. Richtig.
TÜV Rheinland Solar GmbH
Am Grauen Stein
51105 Köln

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Supplementary Information	Issued	2024-05-24

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
Virtu PVT HD (single tube)		355	178	57	227	98	21	176	73	16	194	79	19
Virtu PVT HD (5 tube array)		1 777	888	283	1 133	491	103	879	363	80	969	395	94
Gross Thermal Yield per m² gross area		756	378	120	482	209	44	374	155	34	412	168	40
Annual efficiency, η_a		43%	21%	7%	29%	13%	3%	32%	13%	3%	33%	14%	3%
Fixed or tracking collector		Fixed (slope = according to manufacturers recommendation)											
Annual irradiation on collector plane		1765 kWh/m²			1647 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, 35°			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) >	1100	ϑ_a (°C) >	40	H_x (MJ/m²) >		700
Maximum tested positive load					5400	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	Yes	Façade collector(s)	Yes

Energy Labelling Information

	Reference Area, A_{sol} (m²)
Virtu PVT HD (single tube)	0.47
Virtu PVT HD (5 tube array)	2.35

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

Collector efficiency (η_{col})	23%

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-VH-12S-A:6.4,4284-C:20.2,289	0.36
5-VH-12S-A:6.4,4284-C:20.2,1445	1.80

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

Zero-loss efficiency (η_0)	0.44	--
First-order coefficient (a_1)	4.43	W/(m²K)
Second-order coefficient (a_2)	0.020	W/(m²K²)
Incidence angle modifier IAM (50°)	1.13	--

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.