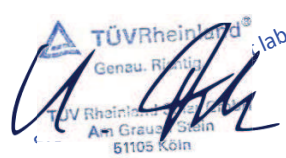


Annex to Solar Keymark Certificate					Licence Number		011-7S 3136P																																																																																																																																
					Date issued		2024-10-09																																																																																																																																
					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					Power output per collector Gb = 850 W/m ² , Gd = 150 W/m ² & u = 1.3 m/s $\vartheta_m - \vartheta_a$																																																																																																																																		
					0 K	10 K	30 K	50 K	70 K	100 K																																																																																																																													
					m ²	mm	mm	mm	W	W	W	W	W	W																																																																																																																									
Virtu PVT (single tube)					0.65	2 165	300	260	221	201	155	102	41	0																																																																																																																									
Virtu PVT (5 tube array)					3.25	2 165	1 500	260	1 107	1 006	776	509	206	0																																																																																																																									
Power output per m ² gross area					341	309	239	157	63	0																																																																																																																													
Performance parameters test method		Quasi dynamic																																																																																																																																					
Performance parameters (related to A _G)		η_0, b	a1	a2	a3	a4	a5	a6	a7	a8	Kd																																																																																																																												
Units		-	W/(m ² K)	W/(m ² K ²)	J/(m ³ K)	-	J/(m ² K)	s/m	W/(m ² K ⁴)	W/(m ² K ⁴)	-																																																																																																																												
Test results		0.348	2.98	0.014	0.000	0.00	10 300	0.000	0.00	0.0E+00	0.86																																																																																																																												
Incidence angle modifier test method		Quasi dynamic - outdoor																																																																																																																																					
Incidence angle modifier		Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°																																																																																																																												
Transversal		K _{GT, coll}	1.10	1.31	1.33	1.34	1.38	1.53	1.34	0.60	0.00																																																																																																																												
Longitudinal		K _{GL, coll}	1.00	1.00	1.01	1.01	1.02	1.04	1.07	1.17	0.00																																																																																																																												
Heat transfer medium for testing					Water																																																																																																																																		
Flow rate for testing (per gross area, A _G)					dm/dt	0.025	kg/(sm ²)																																																																																																																																
Maximum temperature difference during thermal performance test					($\vartheta_m - \vartheta_a$) _{max}	70	K																																																																																																																																
Standard stagnation temperature (G = 1000 W/m ² ; $\vartheta_a = 30$ °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)		21252336.001rev02					Dated		11.09.2024																																																																																																																														
Comments of testing laboratory					Ver. 6.2 (13.01.2022)																																																																																																																																		
<p>The Virtu PVT collect has an asymmetrical transversal incidence angle modifier because the absorber has a slope of 35deg relative to the collector plane. The collector is normally mounted with the longitudinal direction in E-W direction and the transversal in N-S direction. The full IAM is shown below.</p> <table border="1"> <tr> <td></td> <td colspan="10">← South</td> <td></td> <td colspan="10">North →</td> </tr> <tr> <td>θ_{INS}</td> <td>-90°</td><td>-80°</td><td>-70°</td><td>-60°</td><td>-50°</td><td>-40°</td><td>-30°</td><td>-20°</td><td>-10°</td><td>0</td> <td>+10°</td><td>+20°</td><td>+30°</td><td>+40°</td><td>+50°</td><td>+60°</td><td>+70°</td><td>+80°</td><td>+90°</td> </tr> <tr> <td>K_{sb, NS}</td> <td>0</td><td>0.60</td><td>1.34</td><td>1.53</td><td>1.38</td><td>1.34</td><td>1.33</td><td>1.31</td><td>1.10</td><td>1.00</td> <td>0.77</td><td>0.55</td><td>0.42</td><td>0.27</td><td>0.12</td><td>0.03</td><td>0.00</td><td>0.00</td><td>0</td> </tr> <tr> <td></td> <td colspan="10">← East</td> <td></td> <td colspan="10">West →</td> </tr> <tr> <td>θ_{IEW}</td> <td>-90°</td><td>-80°</td><td>-70°</td><td>-60°</td><td>-50°</td><td>-40°</td><td>-30°</td><td>-20°</td><td>-10°</td><td>0</td> <td>+10°</td><td>+20°</td><td>+30°</td><td>+40°</td><td>+50°</td><td>+60°</td><td>+70°</td><td>+80°</td><td>+90°</td> </tr> <tr> <td>K_{sb, EW}</td> <td>0</td><td>1.17</td><td>1.07</td><td>1.04</td><td>1.02</td><td>1.01</td><td>1.01</td><td>1.00</td><td>1.00</td><td>1.00</td> <td>1.00</td><td>1.00</td><td>1.01</td><td>1.01</td><td>1.02</td><td>1.04</td><td>1.07</td><td>1.17</td><td>0</td> </tr> </table> <p>The virtu PVT tube is certified according to IEC 61215:2016 and IEC 61730:2018 by TÜV Rheinland. Certificate PV 60176550 0002 date of issue: 2024-09-03. The electrical nominal power of the virtu PVT hybrid collector is 74 Wmpp. The maximum thermal power of the VirtuPVT collector under blue sky condition is 277 Wth, and is achieved at a sun angle of 25 degrees south of the collector normal. Gb = 850 W/m², Gd = 150 W/m², u = 1.3 m/s & $\vartheta_m - \vartheta_a = 0K$</p>						← South											North →										θ_{INS}	-90°	-80°	-70°	-60°	-50°	-40°	-30°	-20°	-10°	0	+10°	+20°	+30°	+40°	+50°	+60°	+70°	+80°	+90°	K _{sb, NS}	0	0.60	1.34	1.53	1.38	1.34	1.33	1.31	1.10	1.00	0.77	0.55	0.42	0.27	0.12	0.03	0.00	0.00	0		← East											West →										θ_{IEW}	-90°	-80°	-70°	-60°	-50°	-40°	-30°	-20°	-10°	0	+10°	+20°	+30°	+40°	+50°	+60°	+70°	+80°	+90°	K _{sb, EW}	0	1.17	1.07	1.04	1.02	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.02	1.04	1.07	1.17	0							
	← South											North →																																																																																																																											
θ_{INS}	-90°	-80°	-70°	-60°	-50°	-40°	-30°	-20°	-10°	0	+10°	+20°	+30°	+40°	+50°	+60°	+70°	+80°	+90°																																																																																																																				
K _{sb, NS}	0	0.60	1.34	1.53	1.38	1.34	1.33	1.31	1.10	1.00	0.77	0.55	0.42	0.27	0.12	0.03	0.00	0.00	0																																																																																																																				
	← East											West →																																																																																																																											
θ_{IEW}	-90°	-80°	-70°	-60°	-50°	-40°	-30°	-20°	-10°	0	+10°	+20°	+30°	+40°	+50°	+60°	+70°	+80°	+90°																																																																																																																				
K _{sb, EW}	0	1.17	1.07	1.04	1.02	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.02	1.04	1.07	1.17	0																																																																																																																				
DIN CERTCO • Alboinstraße 56 • 12103 Berlin, Germany																																																																																																																																							
Tel: +49 30 7562-1131 • Fax: +49 30 7562-1141 • E-Mail: info@dincertco.de • www.dincertco.de																																																																																																																																							

Annex to Solar Keymark Certificate							Licence Number		011-7S 3136P					
Supplementary Information							Issued		2024-10-09					
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 (single tube)		364	199	84	250	128	43	192	93	33	204	95	33	
Virtu PVT (5 tube array)		1 820	995	420	1 250	640	215	960	465	165	1 020	475	165	
Gross Thermal Yield per m ² gross area		560	306	129	385	197	66	295	143	51	314	146	51	
Annual efficiency, η_a		35%	19%	8%	24%	12%	4%	26%	13%	4%	25%	12%	4%	
Fixed or tracking collector		Fixed (slope = 25°)												
Annual irradiation on collector plane		1607 kWh/m ²			1604 kWh/m ²			1142 kWh/m ²			1234 kWh/m ²			
Mean annual ambient air temperature		18.5°C			3.2°C			7.5°C			9.0°C			
Collector orientation or tracking mode		South, 0°			South, 25°			South, 25°			South, 25°			
The collector is operated at constant temperature ϑ_m (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/m ²) >		1000		ϑ_a (°C) >		20		H_x (MJ/m ²) >		600				
Maximum tested positive load							2400			Pa				
Maximum tested negative load							2400			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					Additional Informative Technical Data									
		Reference Area, A_{sol} (m ²)			Hydraulic Designation Code				Aperture Area, A_a (m ²)					
Virtu PVT (single tube)		0.65			1-VH-12S-A;;6.4,4284-C:20.2,289				0.64					
Virtu PVT (5 tube array)		3.25			5-VH-12S-A;;6.4,4284-C:20.2,1445				3.20					
Data required for CDR (EU) No 811/2013 - Reference Area A_{sol}					Data required for CDR (EU) No 812/2013 - Reference Area A_{sol}									
Collector efficiency (η_{col})		20%			Zero-loss efficiency (η_0)				0.34		--			
Remark: Collector efficiency (η_{col}) 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/m ² , expressed in % and rounded to the nearest integer. Deviating from the regulation η_{col} is based on reference area (A_{sol}) which is aperture area for values according to EN 12975-2 or gross area for ISO 9806:2017.		First-order coefficient (a_1)				2.98				W/(m ² K)				
		Second-order coefficient (a_2)				0.014				W/(m ² K ²)				
		Incidence angle modifier IAM (50°)				1.28				--				
		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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