


Annex to Solar Keymark Certificate					Licence Number		011-7S2981 R																																																																		
					Date issued		2020-10-16																																																																		
					Issued by		TÜV Rheinland Energy GmbH																																																																		
Licence holder		Naked Energy Ltd			Country		United Kingdom																																																																		
Brand (optional)					Web		http://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 1293 541449																																																																		
Collector Type					Evacuated tubular collector																																																																				
Collector name					Gross area (A_G)		Gross length		Gross width		Gross height		Power output per collector $G_b = 850 \text{ W/m}^2$, $G_d = 150 \text{ W/m}^2$ & $u = 1.3 \text{ m/s}$ $\vartheta_m - \vartheta_a$																																																												
					m ²		mm		mm		mm		0 K		10 K		30 K		50 K		70 K		110 K																																																		
Virtu HOT HD					0.47		2 165		220		260		265		255		233		209		182		121																																																		
Power output per m ² gross area					564		542		496		444		387		258																																																										
Performance parameters test method					Quasi dynamic																																																																				
Performance parameters (related to A_G)					$\eta_{0, b}$		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					0.546		2.06		0.007		0.000		0.00		10 165		0.000		0.00		0.0E+00		1.21																																																		
Incidence angle modifier test method					Quasi dynamic - outdoor																																																																				
Incidence angle modifier					Angle		10°		20°		30°		40°		50°		60°		70°		80°		90°																																																		
Transversal					$K_{\theta T, coll}$		1.10		1.18		1.36		1.52		1.59		1.68		1.84		0.92		0.00																																																		
Longitudinal					$K_{\theta L, coll}$		1.00		1.00		0.99		0.99		0.98		0.96		0.93		0.82		0.00																																																		
Heat transfer medium for testing					Water																																																																				
Flow rate for testing (per gross area, A_G)					dm/dt		0.066																kg/(sm ²)																																																		
Maximum temperature difference during thermal performance test					$(\vartheta_m - \vartheta_a)_{max}$		80																K																																																		
Standard stagnation temperature ($G = 1000 \text{ W/m}^2$; $\vartheta_a = 30 \text{ °C}$)					ϑ_{stg}		250																°C																																																		
Maximum operating temperature					$\vartheta_{max, op}$		120																°C																																																		
Maximum operating pressure					$p_{max, op}$		600																kPa																																																		
Testing laboratory					TÜV Rheinland Energy GmbH							www.tuv.com/solar																																																													
Test report(s)					21249579.004							Dated		16.10.2020																																																											
Comments of testing laboratory					Virtu HOT HD is showing an unsymmetric transversal incidence angle modifier and is mainly mounted horizontal in E-W direction (with absorber slope of 20°). These special conditions are considered on page 2. The full transversal IAM is given below:																																																																				
					<table border="1"> <tr> <td>-70</td><td>-65</td><td>-60</td><td>-55</td><td>-50</td><td>-45</td><td>-40</td><td>-35</td><td>-30</td><td>-25</td><td>-20</td><td>-15</td><td>-10</td><td>-5</td><td>0</td><td>5</td><td>10</td><td>15</td><td>20</td><td>25</td><td>30</td><td>35</td><td>40</td><td>45</td><td>50</td><td>55</td> </tr> <tr> <td>1.84</td><td>1.61</td><td>1.68</td><td>1.60</td><td>1.59</td><td>1.56</td><td>1.52</td><td>1.46</td><td>1.36</td><td>1.29</td><td>1.17</td><td>1.16</td><td>1.10</td><td>1.03</td><td>1.00</td><td>0.86</td><td>0.95</td><td>0.81</td><td>0.68</td><td>0.74</td><td>0.83</td><td>0.76</td><td>0.68</td><td>0.81</td><td>0.69</td><td>0.75</td> </tr> </table>																	-70	-65	-60	-55	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30	35	40	45	50	55	1.84	1.61	1.68	1.60	1.59	1.56	1.52	1.46	1.36	1.29	1.17	1.16	1.10	1.03	1.00	0.86	0.95	0.81	0.68	0.74	0.83	0.76	0.68	0.81	0.69	0.75
-70	-65	-60	-55	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30	35	40	45	50	55																																																
1.84	1.61	1.68	1.60	1.59	1.56	1.52	1.46	1.36	1.29	1.17	1.16	1.10	1.03	1.00	0.86	0.95	0.81	0.68	0.74	0.83	0.76	0.68	0.81	0.69	0.75																																																
					The interconnection between the single tubes is not part of considered gross area.																																																																				
					Datasheet version: 6.1, 2019-07-11																																																																				
					 TÜV Rheinland Energy GmbH Am Graue Bogen 51105 Köln																																																																				
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																																																																									

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Supplementary Information								Issued		2020-10-16			
Annual collector output 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 HOT HD		492	391	295	417	326	245	300	224	159	325	243	171
Annual output per m ² gross area		1 047	832	628	887	694	521	639	476	338	691	516	365
Annual efficiency, η_a		59%	47%	36%	55%	43%	32%	56%	42%	30%	56%	42%	30%
Fixed or tracking collector		Fixed (slope = 25°)											
Annual irradiation on collector plane		1765 kWh/m ²			1604 kWh/m ²			1143 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, 25°			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. 6.1 (July 2019). 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) >		1100		ϑ_a (°C) >		40		H_x (MJ/m ²) >		700			
Maximum tested positive load										5400		Pa	
Maximum tested negative load										2400		Pa	
Hail resistance using ice balls (diameter)										35		mm	
Additional collector attribute(s)													
<input type="checkbox"/> Using external power source(s) for normal operation					<input type="checkbox"/> Active or passive measure(s) for self-protection								
<input type="checkbox"/> Co-generating thermal and electrical power					<input checked="" type="checkbox"/> Façade collector(s)								
Energy Labelling Information						Additional Informative Technical Data							
		Reference Area, A_{sol} (m ²)		Hydraulic Designation Code				Aperture Area, A_a (m ²)					
Virtu HOT HD		0.47		1-VH-12S-A:6.4,4284-C:20.2,289				0.36					
Data required for CDR (EU) No 811/2013 - Reference Area A_{sol}													
Collector efficiency (η_{col})		47%		Zero-loss efficiency (η_0)				0.56		--			
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)				2.06		W/(m ² K)					
		Second-order coefficient (a_2)				0.007		W/(m ² K ²)					
		Incidence angle modifier IAM (50°)				1.46		--					
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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