TÜVRheinland®
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Annex to Solar Keymark Certificate		Licence Number	011-7S2959 R
		Date issued	2019-11-15
		Issued by	DIN CERTCO

Licence holder	NMT Heizsysteme GmbH	Country	Germany	
Brand (optional)	–	Web	www.nmt-systeme.de	
Street, Number	Hohe Straße 12	E-mail	info@nmt-systeme.de	
Postcode, City	DE-01558 Großenhain	Tel	+49	3522 529 580

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	120 K
	m²	mm	mm	mm	W	W	W	W	W	W
NMT VHP	2.27	1’907	1’189	136	905	875	815	752	688	520
Power output per m² gross area					398	385	359	331	303	229

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	0.392	1.29	0.001	0.000	0.00	8’249	0.000	0.00	0.0E+00	1.11

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	1.06	1.15	1.30	1.47	1.42	1.11	0.60	0.00
Longitudinal	$K_{\theta L,coll}$	1.00	1.00	1.00	0.99	0.96	0.90	0.78	0.53	0.00

Heat transfer medium for testing		Water-Glycole	
Flow rate for testing (per gross area, A_G)		dm/dt	0.022 kg/(sm²)
Maximum temperature difference during thermal performance test		$(\vartheta_m-\vartheta_a)_{max}$	90 K
Standard stagnation temperature (G = 1000 W/m²; ϑ_a = 30 °C)		ϑ_{stg}	230 °C
Maximum operating temperature		$\vartheta_{max\ op}$	217 °C
Maximum operating pressure		$p_{max,op}$	600 kPa
Testing laboratory	SPF Testing, CH-8640 Rapperswil, Switzerland	www.spf.ch	
Test report(s)	C1744ISO	Dated	16.03.2019

Comments of testing laboratory	Datasheet version: 6.1, 2019-09-26
–	SPF INSTITUT FÜR SOLARTECHNIK

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Supplementary Information	Issued	2019-11-15

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
NMT VHP	1'739	1'451	1'195	1'423	1'174	960	1'039	828	655	1'125	896	706
Annual output per m² gross area	766	639	526	627	517	423	458	365	289	495	395	311
Annual efficiency, η_a	43%	36%	30%	38%	32%	26%	39%	31%	25%	40%	32%	25%
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. 6.1 (September 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/m²) >	1000	ϑ_a (°C) >	20	H_x (MJ/m²) >		600
Maximum tested positive load					1500	Pa
Maximum tested negative load					1500	Pa
Hail resistance using ice balls (diameter)					25	mm

Additional collector attribute(s)

☐ Using external power source(s) for normal operation	☐ Active or passive measure(s) for self-protection
☐ Co-generating thermal and electrical power	☑ Façade collector(s)

Energy Labelling Information

	Reference Area, A_{sol} (m²)
NMT VHP	2.27

Data required for CDR (EU) No 811/2013 - Reference Area

Collector efficiency (η_{col})	35%

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	Aperature Area, A_a (m²)
1-H-12S-C:19,1260	1.40

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

Zero-loss efficiency (η_0)	0.40	--
First-order coefficient (a_1)	1.29	W/(m²K)
Second-order coefficient (a_2)	0.001	W/(m²K²)
Incidence angle modifier IAM (50°)	1.26	--

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.

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