Summary of EN 12975 Test Results, annex to Solar KEYMARK Certificate	**Certificate No.**	**SKM 9965/2**
	Date of issue	30/10/2013

Company	NOBEL INTERNATIONAL EAD	**Country**		BULGARIA
Brand (optional)		**Website**		
Street, number	48, VITOSHA BLV	**E-mail**		info1@nobel.gr
Postal Code	2100	**Tel.**	+0359	2 4210232
City	SOFIA BULGARIA	**Fax**	+0359	

Collector Type (flat plate / evacuate tubular / un-glazed)	Flat plate collector
Integration in the roof possible ?	Yes

Collector name	**Aperture area (Aa)** [m²]	**Gross length** [mm]	**Gross width** [mm]	**Gross height** [mm]	**Gross area (AG)** [m²]	**Power output per collector unit** G = 1000 W/m² Tm-Ta : 0 K [W]	10 K [W]	30 K [W]	50 K [W]	70 K [W]
APOLLON Cu 1500	1,35	1.510	1.010	110	1,53	1.040	978	856	732	607
APOLLON Cu 2000	1,82	2.010	1.010	110	2,03	1.401	1.319	1.154	986	818
APOLLON Cu 2600	2,32	2.010	1.270	110	2,53	1768	1.682	1.470	1.257	1.043

Collector efficiency parameters related to aperture area (Aa) Note 1	η_{0a}	0,77	-
	a_{1a}	4,51	W/(m²K)
	a_{2a}	0,001	W/(m²K²)
Stagnation temperature - Note 2	t_{stg}	160	°C
Effective thermal capacity	$c_{eff} = C/A_a$	7,2	kJ/(m²K)
Max. operation pressure - Note 3	p_{max}	1000	kPa

Incidence angle modifiers $K_\theta(\theta)$	G_{DIF}/G_{TOT} min	G_{DIF}/G_{TOT} max	θ_T / θ_L	50°	*10°*	*20°*	*30°*	*40°*	*60°*	*70°*
	0,06	0,11	$K_\theta(\theta_T)$	0,89	*1,00*	*1,00*	*1,00*	*0,95*	*0,73*	*0,49*
			$K_\theta(\theta_L)$	0,89	*1,00*	*1,00*	*1,00*	*0,95*	*0,73*	*0,49*
G_{DIF}/G_{TOT}: min&max - while measuring					***Optional values***					

Testing Laboratory	Demokritos
Website	www.solar.demokritos.gr
Test report id. number	4062DE5, 4063DE5, 4064DQ2
Date of test report	5/9/2013
Perf. test method	EN 12975-2 6.1.4 (outdoor/außen/extérieur)

Comments of testing laboratory :

Example data sheet

Note 1	**Test conditions**	**Fluid**	Water	**Flow rate**	0,020	kg/s per m²	Stamp & signature of test lab
Note 2	**Irradiance, Gs=1000 W/m²** **Ambient temperature , Ta=30 °C**						
Note 3	**Given by manufacturer**						

VERSION 3.4, 30-11-2011

Annual collector output based on EN 12975 Test Results, annex to Solar KEYMARK Certificate	Certificate No.	SKM 9965/2
	Issued	30/10/2013

Annual collector output kWh / Jährliche Kollektor Leistung kWh / Energie annuelle produite par le capteur

	Location and collector temperature (Tm)														
	Athens			Davos			Stockholm			Würzburg					
Collector name	25°C	50°C	75°C	25°C	50°C	75°C	25°C	50°C	75°C	25°C	50°C	75°C	25°C	50°C	75°C
APOLLON Cu 1500	1.575	1.062	689	1.239	833	537	853	540	336	928	578	352			
APOLLON Cu 2000	2.124	1.432	928	1.671	1.123	724	1.150	728	453	1.251	779	475			
APOLLON Cu 2600	2.707	1.826	1.183	2.130	1.432	923	1.466	928	577	1.594	993	605			

Collector mounting: Fixed or tracking /	Fixed; slope = latitude - 15° (rounded to nearest 5°)

Overview of locations

Location	Latitude °	Gtot kWh/m²	Ta °C	Collector orientation or tracking mode
Athens	38	1.765	18,5	South, 25°
Davos	47	1.714	3,2	South, 30°
Stockholm	59	1.166	7,5	South, 45°
Würzburg	50	1.244	9,0	South, 35°

Gtot	Annual total irradiation on collector plane	kWh/m²
Ta	Mean annual ambient air temperature	°C
Tm	Constant collector operating temperature (mean of in- and outlet temperatures)	°C

Calculation of the annual collector performance is done by the official Solar Keymark spreadsheet tool. Hour by hour the collector output is calculated according to the efficiency parameters from the Keymark test using constant collector operating temperature (Tm). Detailed description with all equations used is available from the Solar Keymark web site (direct link: http://www.estif.org/solarkeymark/annexb1.php)

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Datasheet version:
VERSION 3.4, 30-11-2011
Calculation program version:
3.07 October 2011