Enviro Energy Solutions Ltd

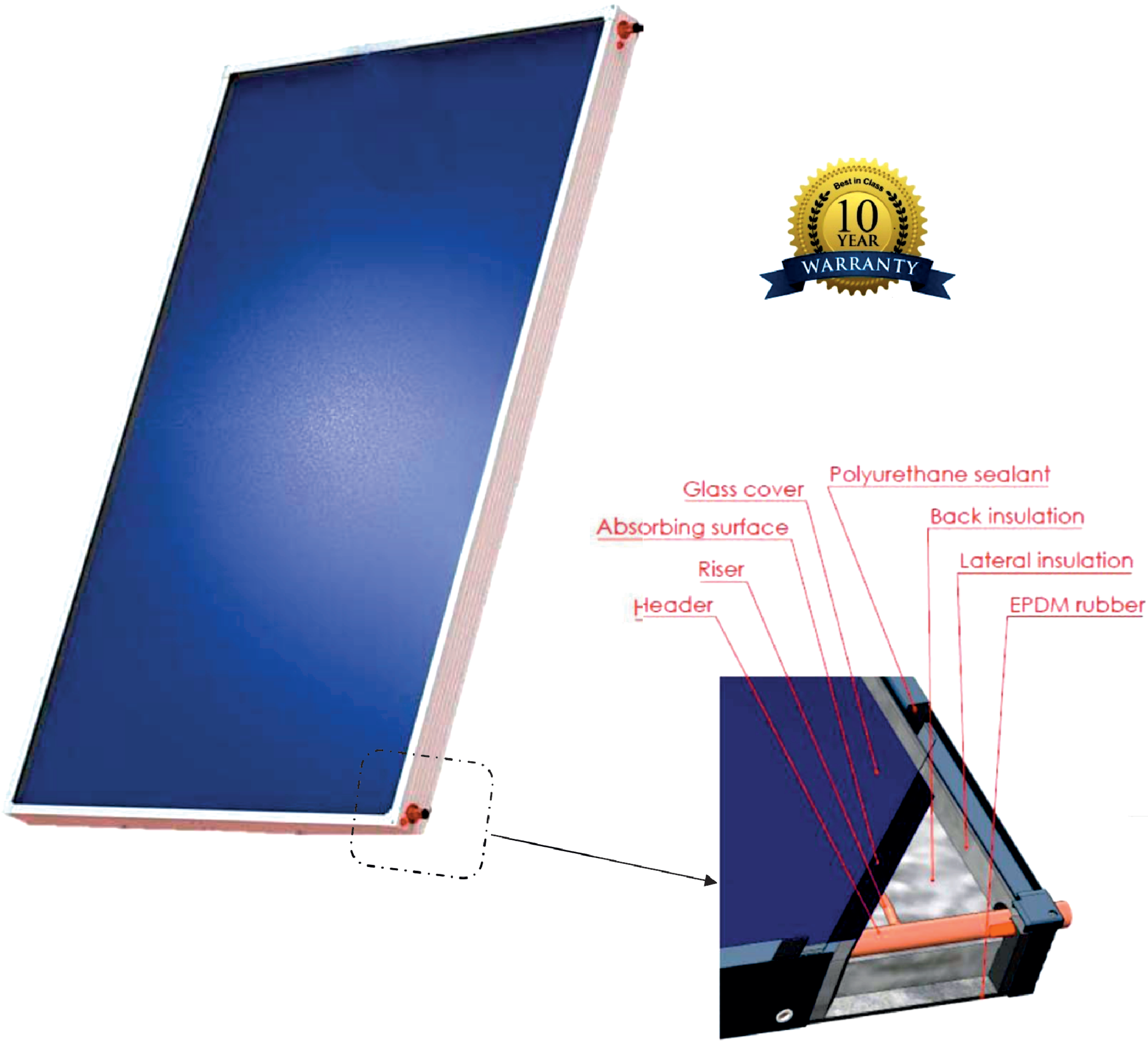
Your Gateway to the Sun

EFM SERIES SOLAR COLLECTORS
TECHNICAL SPECIFICATIONS

...BECAUSE WITH ENVIROENERGY SOLUTIONS THE SUN SHINES FOR EVERYONE...

V1-1.17

EFM SERIES SOLAR COLLECOTRS TECHNICAL SPECIFICATIONS



1. General Characteristics

- Low Iron, Mistlite, Tempered Solar Glass (Security)
- Laser Welded Al/Cu Titanium Selective Absorber 5mm
- Rear Insulation: Rock Wool 40mm
- Copper Headers and Risers
- Aluzinc Rear Cover of the Collector
- Side Insulation: Rock Wool 20mm
- Aluminium Alloy Collector Frame with “Sea Side” Class Treatment

2. Technical Characteristics

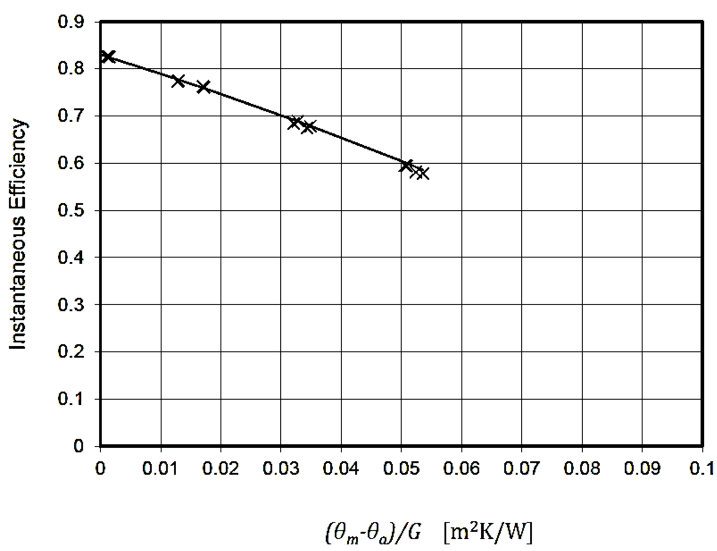
- **Frame:** Special aluminium alloy Casing with Electrostatic Treatment
- **Absorber Type:** Laser Welded Single Sheet Selective Aluminium on Copper Harp (Grid)
- **Absorber Surface:** Highly Selective Blue Titanium Treatment ($\alpha \geq$ 0,95 +/-0,02, $\varepsilon \leq$ 0,05 +/-0,02).
- **Headers:** Copper tubes Ø 22 mm
- **Risers:** Copper tubes Ø 8 mm
- **Transparent Cover:** Low Iron, Securit, Prismatic Solar Glass – Transmissibility: t≥0,91 – Thickness: 3.2mm or 4mm,
- **Back Side Collector Cover:** in aluzinc, thickness 0,4 mm with EPDM rubber joint to avoid all possibility of humidity infiltration.
- **Rear insulation:** in 40mm thick rock wool - density 50kg/m^3 (0,035W/m k)
- **Side insulation:** in 20mm thick glass wool - density 70kg/m^3 (0,034W/m k)
- **Water tightness:** black silicone and EPDM rubber

EFM SELECTIVE COLLECTORS TECHNICAL DATA							
Model	**Dimensions**	**Absorber Treatment**	**Number of Risers**	**Total Area (m^2)**	**Aperture Area (m^2)**	**Volume (lt)**	**Weight empty (kg)**
EFM 150	1480x1010x86	Titanium Selective	9	1,50	1,38	1,21	26,20
EFM 150H	1010x1480x86	Titanium Selective	14	1,50	1,38	1,56	28,20
EFM 182	1480x1230x86	Titanium Selective	11	1,82	1,72	1,46	31,50
EFM 182H	1230x1480x86	Titanium Selective	14	1,82	1,72	1,68	32,00
EFM 200	1980x1010x86	Titanium Selective	9	2,00	1,86	1,40	34,00
EFM 200H	1010x1980x86	Titanium Selective	18	2,00	1,86	2,05	34,80
EFM 237	1930x1230x86	Titanium Selective	11	2,37	2,23	1,70	41,50
EFM 237H	1230x1930x86	Titanium Selective	18	2,37	2,23	2,20	42,50
EFM 272	2160x1260x86	Titanium Selective	11	2,72	2,57	1,82	47,50
EFM 272H	2160x1260x86	Titanium Selective	19	2,72	2,57	2,30	48,50

TITANIUM SELECTIVE COLLECTORS DATA

- Instant Efficiency* η0: 0,830
- First degree heat loss* α1: 3,93W/m^2K
- Second degree heat loss*: α2: 0,015W/m^2K^2
- Stagnation temperature (at 1000 W/m^2 at 30°C): 231,09°C
- Effective Thermal Capacity: 10.85 kJ/(m^2K)

Flow Rate: 0.021kg/(s m^2)
Irradiance G=1000W/m^2 – Ambient temperature Ta= 30°C
*Compared to collector aperture area as per EN12975 – Solar Keymark Certification



CERTIFICATION
LICENCE TO USE KEYMARK

Certificate No OEM 9999/1/1

DQS Hellas grants the present certificate to the enterprise:

ENVIROENERGY SOLUTIONS E.S. Ltd

for the product / type:

Flat plate Solar Collectors with type
EFM 150, 150H, 182, 182H, 200, 200H, 237, 237H, 272, 272H

which is produced in conformity with the normative document:

EN 12975-1 : 2006
EN ISO 9806:2013

at the following location:

1o Km Inofyta – St. Thomas, Viotia

E 31

The present certificate is granted in accordance with:

- *the DQS Hellas General Rules for the Certification of Products ,*
- *the Specific Rule for Certification EKΠΠ.001 «Specific Rule for Certification of Solar Collectors, and Thermal Solar Heating Systems for Domestic Hot Water»,*
- *the Specific CEN Keymark Scheme Rules for Solar Thermal Products,*

and is ruled by the terms of the relevant contract between DQS Hellas and the enterprise.

Date of issue: ***2017-02-10***
Date of valid: ***2019-05-30***

Panagiotis Giannoutsos
Director of Certification

Dr. Emmanuel Deliyannakis
Managing Director

Accredited Body: 4, Kalavriton Street, 14564 Kifisia - Athens, Greece

EEK.001-07 – 10/11/2011

Summary of EN 12975 Test Results	Licence Number	-
	Issued	-

Company holding the	ENVIROENERGY SOLUTIONS LTD	Countr	Cyprus
Brand (optional)		Website	www.enviroenergysolutions.com
Street, street number	12, Th. Dervi str.	E-mail	info@enviroenergy-solutions.com
Postal Code / City,	1305 Nicosia	Tel/Fax	30 6984612259

Collector Type (flat plate glazed/un-glazed; evacuate tubular)	Flat plate collector - glazed
Thermal / photo voltaic hybid collector? (PVT collector)	No
Integration in the roof possible ? (manufacturers declaration)	No

	Aperture area (Aa)	Gross length	Gross width	Gross height	Gross area (AG)	Power output per collector module G = 1000 W/m² Tm-Ta 0 K	10 K	30 K	50 K	70 K
Collector name	m²	mm	mm	mm	m²	W	W	W	W	W
EFM 150	1.38	1,480	1,010	86	1.50	1,145	1,089	964	822	664
EFM 150H	1.38	1,010	1,480	86	1.50	1,145	1,089	964	822	664
EFM 182	1.72	1,480	1,230	86	1.82	1,428	1,357	1,202	1,025	828
EFM 182H	1.72	1,230	1,480	86	1.82	1,428	1,357	1,202	1,025	828
EFM 200	1.86	1,980	1,010	86	2.00	1,544	1,468	1,299	1,109	895
EFM 200H	1.86	1,010	1,980	86	2.00	1,544	1,468	1,299	1,109	895
EFM 237	2.23	1,930	1,230	86	2.37	1,851	1,760	1,558	1,329	1,074
EFM 237H	2.23	1,230	1,930	86	2.37	1,851	1,760	1,558	1,329	1,074
EFM 272	2.57	2,160	1,260	86	2.72	2,133	2,028	1,795	1,532	1,237
EFM 272H	2.57	1,260	2,160	86	2.72	2,133	2,028	1,795	1,532	1,237

Performance test method	Glazed liquid heating collector - steady state - outdoor		
Performance parameters related to aperture	η0	a1	a2
Units	-	W/(m²K)	W/(m²K²)
Test results - Flow rate and fluid see note 1	0.830	3.930	0.015

Bi-directional incidence angle	No	*Kθ values are obligatory for 50°.*								
Incidence angle modifiers Kθ(θ)	Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°
	Kθ(θ)					0.96				0.00
Incidence angle modifier not bi-directional - leave fields blank										

Stagnation temperature - Weather conditions see note 2	Tstg	231.09	°C
Effective thermal capacity	ceff = C/Ag	10.85	kJ/(m²K)
Max. intende operation temperature - see note 3	Tmax,op	200	°C
Max. operation pressure - see note 3	pmax,op	1000	kPa

Pressure drop table - for a collector family, the values shall be for the module with highest ΔP per m² aperture area

Flow rate	kg/(s m²)	0.000	0.008	0.013	0.018	0.023	0.028	0.038	0.055	
Pressure drop, ΔP	Pa	0	40	79	116	163	211	335	594	

Optional weather data	Location		Link	
Testing Laboratory	NCSR Demokritos / Solar & other Energy System Laboratory			
Website	www.solar.demokritos.gr			
Test report id. number	4195DE2, 4196DE2, 4197DQ1		Date of test report	16/11/16,30/10/16
During the test GDIF/GTOT was always between	0.05	and	0.09	

Comments of testing laboratory:

This data sheet issued upon manufacturer request

Tstg: Calculated using efficiency parameters

Note 1	Flow rate	0.021	kg/(s m²)	Fluid	Water
Note 2	Irradiance, G = 1000 W/m²; Ambient temperature , Ta=30 °C				
Note 3	Given by manufacturer				

N.C.S.R "DEMOKRITOS"
SOLAR ENERGY LABORATORY
Head: Dr Vassilis Belessiotis
Tel. +210 6503815 - Fax: +210 6544592
153 10 Ag. Paraskevi - Attiki - Greece

Annex to Solar Keymark Certificate - Summary of EN ISO 9806:2013 Test Results

Licence Number	**OEM 9999/1/1**
Date issued	**2017-02-10**
Issued by	**DQS Hellas**

Licence holder	ENVIROENERGY SOLUTIONS E.S. Ltd	**Country**	Cyprus
Brand (optional)		**Web**	http://www.enviroenergy-solutions.com
Street, Number	12, Th. Dervi Str.	**E-mail**	info@enviroenergy-solutions.com
	1305 Nicosia	**Tel**	+30 6984 612259

Flat plate collector, glazed

					Power output per collector Gb = 850 W/m²; Gd = 150 W/m² ϑm - ϑa					
	Gross area (A_G)	**Gross length**	**Gross width**	**Gross height**	0 K	10 K	30 K	50 K	70 K	50 K
Collector name	m²	mm	mm	mm	W	W	W	W	W	W
EFM 150	1,50	1.480	1.010	86	1.142	1.085	961	819	661	819
EFM 150H	1,50	1.010	1.480	86	1.142	1.085	961	819	661	819
EFM 182	1,82	1.480	1.230	86	1.385	1.317	1.166	994	802	994
EFM 182H	1,82	1.230	1.480	86	1.385	1.317	1.166	994	802	994
EFM 200	2,00	1.980	1.010	86	1.522	1.447	1.281	1.092	881	1.092
EFM 200H	2,00	1.010	1.980	86	1.522	1.447	1.281	1.092	881	1.092
EFM 237	2,37	1.930	1.230	86	1.804	1.715	1.518	1.294	1.044	1.294
EFM 237H	2,37	1.230	1.930	86	1.804	1.715	1.518	1.294	1.044	1.294
EFM 272	2,72	2.160	1.260	86	2.070	1.968	1.742	1.485	1.198	1.485
EFM 272H	2,72	1.260	2.160	86	2.070	1.968	1.742	1.485	1.198	1.485
Power output per m² gross area					761	724	640	546	440	546

Performance parameters test method	Steady state - outdoor		
Performance parameters (related to AG)	η0,hem	a1	a2
Units	-	W/(m²K)	W/(m²K²)
Test results	0,761	3,600	0,014

Incidence angle modifier test method		Steady state - outdoor								
Bi-directional incidence angle modifiers	No									
Incidence angle modifier	Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°
Transversal	$K_{\theta T,coll}$					0,96				0,00
	$K_{\theta L,coll}$					0,96				0,00

	Water - Glycole		
Flow rate for testing (per gross area, A_G)	dm/dt	0,021	kg/(sm²)
Maximum temperature difference for thermal performance calculations	$(\vartheta_m - \vartheta_a)_{max}$	50	K
Standard stagnation temperature (G = 1000 W/m²; ϑ_a = 30 °C)	ϑ_{stg}	190,5	°C
Effective thermal capacity, incl. fluid (per gross area, A_G)	C/m^2	10,85	kJ/(Km²)
Maximum operating temperature	ϑ_{max_op}	200	°C
Maximum operating pressure	$p_{max,op}$	1000	kPa

Testing laboratory	NCSR Demokritos	www.solar.demokritos.gr	
Test report(s)	4195 DE2	**Dated**	16/11/2016
	4196 DE2		16/11/2016
	4197 DQ1		30/10/2016

Comments of testing laboratory Datasheet version: 5.01, 2016-03-01

This data sheet was issued based on data appeared in the first SKM certificate.

Central Offices: Kalavriton 4, 145 64 kifisia, Athens, Tel: +301 6233493-4 , Fax: +301 6233495, http://www.dqshellas.gr, e-mail: ioannisalexiou@dqshellas.gr

Annex to Solar Keymark Certificate	**Licence Number**	**OEM 9999/1/1**
Supplementary Information	**Issued**	**2017-02-10**

Annual collector output in kWh/collector at mean fluid temperature ϑ_m, based on ISO 9806:2013 test results

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
EFM 150	1.856	1.324	859	1.406	966	597	1.040	675	402	1.131	732	428
EFM 150H	1.856	1.324	859	1.406	966	597	1.040	675	402	1.131	732	428
EFM 182	2.252	1.606	1.042	1.706	1.172	724	1.262	819	487	1.372	888	519
EFM 182H	2.252	1.606	1.042	1.706	1.172	724	1.262	819	487	1.372	888	519
EFM 200	2.475	1.765	1.145	1.875	1.288	795	1.387	900	535	1.508	976	571
EFM 200H	2.475	1.765	1.145	1.875	1.288	795	1.387	900	535	1.508	976	571
EFM 237	2.932	2.092	1.357	2.222	1.527	943	1.643	1.067	635	1.787	1.157	676
EFM 237H	2.932	2.092	1.357	2.222	1.527	943	1.643	1.067	635	1.787	1.157	676
EFM 272	3.366	2.400	1.557	2.550	1.752	1.082	1.886	1.224	728	2.051	1.328	776
EFM 272H	3.366	2.400	1.557	2.550	1.752	1.082	1.886	1.224	728	2.051	1.328	776
Annual output per m² gross area	1.237	883	572	938	644	398	693	450	268	754	488	285
Fixed or tracking collector	Fixed (slope = latitude - 15°; rounded to nearest 5°)											
Annual irradiation on collector plane	1765 kWh/m²			1714 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. 5.01 (March 2016). A detailed description of the calculations is available at www.solarkeymark.org/scenocalc

Additional Information

Collector heat transfer medium	Water-Glycole	
Hybrid Thermal and Photo Voltaic collector	No	
The collector is deemed to be suitable for roof integration	No	
The collector was tested successfully according to EN ISO 9806:2013 under the following conditions:		
Climate class (A, B or C)	A	--
Maximum tested positive load	2400	Pa
Maximum tested negative load	2400	Pa
Hail resistance using steel ball (maximum drop height)	2	m

Energy Labelling Information

	Reference Area, A_{sol} (m^2)	**Data required for CDR (EU) No 811/2013 - Reference Area A_{sol}**		
EFM 150	1,50	Collector efficiency (η_{col})		%
EFM 150H	1,50	*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/m², 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 9806:2013.*		
EFM 182	1,82			
EFM 182H	1,82			
EFM 200	2,00			
EFM 200H	2,00			
EFM 237	2,37			
EFM 237H	2,37			
EFM 272	2,72	**Data required for CDR (EU) No 812/2013 - Reference Area A_{sol}**		
EFM 272H	2,72	Zero-loss efficiency (η_0)	0,761	--
		First-order coefficient (a_1)	3,60	W/(m²K)
		Second-order coefficient (a_2)	0,014	W/(m²K²)
		Incidence angle modifier IAM (50°)	0,96	--
		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.		

Central Offices: Kalavriton 4, 145 64 kifisia, Athens, Tel: +301 6233493-4 , Fax: +301 6233495, http://www.dqshellas.gr, e-mail: ioannisalexiou@dqshellas.gr

WARRANTY CONDITIONS

1. The present warranty covers the repair or substitution of the defective parts or part of the system from authorised personnel. The replacement of the complete system can only happen if the repair is not possible. In any case of failure or malfunction of the system, the buyer must immediately inform the company as well as the distributor.
2. The present warranty covers only the free supply of spare parts and in any case does not cover any expenses for shipping costs. Dispatch costs as well as any authorized personnel expenses or expenses for replacement of the defective parts are on clients charge.
3. In case of malfunction, the dispatch of the defective parts/products to the company headquarters or place of repair of the defective product is on clients charge. Otherwise, all costs for on-spot repair from authorised personnel at the clients location is at client's expense. The company reserves the right of decision on the type and how the repair will be made according to its judgment. Every repair crew visit, even for just auditing and checking the system is charged with the expenses and fees of the technician.
4. Any warranty claim can only be valid if this original warranty card is presented accompanied with the original purchase receipt edited by the distributor. Furthermore, for the warranty to be valid the buyer must complete and sign both parts of the warranty (clients copy and distributors copy) and send the relative parts to the parties intended within 10 days from the date of installation.
5. All spare parts or parts repaired or replaced have the same benefit of warranty period as the remaining period of the general warranty of the system.
6. The electric parts of the system (electric element, thermostat, etc…) carry only two (2) years warranty from the date of purchase.
7. The manufacturer assumes no responsibility and the present warranty is invalid in the following cases:
   A. When the product has not been checked, repaired, altered or installed by non-authorized personnel by the manufacturer or the distributor – or his partners
   B. If the ordinary services of the system have not been performed by authorised by the company personnel and as per Maintenance Schedule in the product Installation Manual. The 1st service must be conducted within 1 year (12 months) after the date of purchase of the product at the clients care and expense. Proof of service is the signature and stamp of the authorised personnel at the bottom of the present warranty card in combination with the original invoice of the service from the service technician.
   C. When any damage or malfunction is done to people or thing or the product itself due to accident, mishandling, improper or inappropriate use (intentional or unintentional), negligence, maltreatment or bad installation of the product, lack of servicing of the product, wrong technical intervention on the product or its parts, or to wrong connexions – cabling of the electrical resistance or other electrical parts, other the instructions provides by the manufacturer.
   D. If damage or malfunction of the system is due to bad weather conditions and natural disasters (such as: natural disaster, frost, storms, floods, hail, earthquakes, fires, arson, etc…)
   E. Damage or breakage of the collector glass
   F. In case of normal wear and deterioration (due to time, etc…) of the external parts of the product which do not affect the proper use of the system.
8. Manufacturer retains the right of control of the validity of the warranty at each stage of product repair and to charge the owner for the costs of the repairs (value of the parts included) in this case the conditions described in detail in the present warranty card are not met.
9. The present warranty does not affect the owner's and consumer's rights, as these are foreseen by Greek law

1st	2nd	3rd	4th	5th	6th	7th	8th

DATE STAMP AND SIGNITURE OF MAINTENANCE

Enviro Energy Solutions Ltd

Your Gateway to the Sun

**We do not inherit the earth
from our fathers,
We borrow it
from our children..."**

...BECAUSE WITH ENVIROENERGY SOLUTIONS THE SUN SHINES FOR EVERYONE...

Head Office: Enviroenergy Solutions E.S. Ltd
10, Th. Dervi Str. - 1305 Nicosia - Cyprus

Factory: 1st Km. Inofyta – St. Thomas Rd
32011 Inofyta – Viotia - Greece