The sun rises for everyone...

... absorbs all its benefits for you

INSTALLATION INSTRUCTIONS
FORCED CIRCULATION SYSTEMS

VORMANN SOLAR
INTRODUCTION

A company that proposes sunny solutions, working with passion and devotion, for three decades now, to always offer the best.

A philosophy that leads our steps, and makes us, as professionals, feel the weight of responsibility and obligation to offer products and services that are in harmony with the environment and man. So that we hand over a better world to our children.

We live in times with great ecological problems. Planet Earth is sounding the alarm of ecological danger. The thoughtless use of mineral energy sources is resulting in increased pollution of the atmosphere, above tolerance levels.

Ecosystems are either being transformed or destroyed. While mineral energy reserves are continuously decreasing and prices continuously rising, we look at the sun and consider that it radiates over 15,000 times the energy needs of our planet.

So why not direct ourselves to the inexhaustible, free, and above all clean solar energy?
Why should we use a Solar System

A solar system is Ecologically friendly. Economical, Simple, Aesthetic, Effective and Autonomous:

- **Ecologically friendly:**
  with a VORMANN VS 500E system, the emissions of CO2 avoided annually are equivalent to the fuel emissions of a car having run for 10,000 km.

- **Economical:**
  will decrease your cost for energy by 70 -100% because the burner and electric resistance will not need to operate for at least 7-12 months of the year, depends on the sun radiation of each area and the size of the system.

- **Simple:**
  The well-studied selection of materials of VORMANN make Its Installation safe and easy, reducing the time needed for Its Installation to a minimum.

- **Aesthetic:**
  The excellent exterior design of the VORMANN collectors in combination with their well-studied support base, offer the possibility of a tangent Installation on tiled roofs matching aesthetically with every architectural building design.

- **Effective and Autonomous:**
  You have hot water at will 7-12 months per year. During winter time you secure the pre-heating of the water, and the extra hot water needed is secured from conventional energy.
The forced circulation system VORMANN consists of

Thank you for choosing to buy a solar system VORMANN VS - BL1 or VS - BL2.

Every system which you acquire consists of:
1. Boiler with one tube heat exchanger (type VS-BL1) or with two tube heat exchangers (type VS-BL2) on a wooden palette and wrapped with stretch film.

2. One (1), Two (2), or Three (3) collectors which are protected during their transport with 4 plastic elbows of hard plastic.

3. Cardboard box with all of the accessories (except pipes and wires) which are required for the installation of the system like hydraulic kit, expansion pot, differential thermostat with plastic case, antifreeze liquid and various connection accessories in individual plastic packaging. Externally the box refers to the model of the system for which the accessories are for.

4. Cardboard box with the metal plates of the support base, the screws, moly plugs, the bolts etc...

Kits can be delivered packaged on one palette upon a special request.

- The merchandise travels under buyers responsibility and risk.
- The specifications of the products and their accessories can change any time without prior notice.
- Settlement of any dispute are under the jurisdiction of the courts of Athens in Greece.

HELIOAKMI S.A. reserves the right to change all specifications of the products and their accessories without prior notice.
General Information on needs of hot water

General Information

When choosing a solar system for hot water we must first determine our needs for hot water, in quantity as well as in preferred temperature of consumption. The typical calculation for the temperature for consumption is 45ºC, but for the calculation of required quantity you must take into account the daily needs.

Calculation of needs for hot water usage

1) RESIDENCES
In family residences, the needs for hot water remain stable during the whole year. An indication for the needs is given by the number of individuals living in the building (or apartment). Usually, the per capita daily consumption of hot water at 45ºC is calculated taking into consideration the following:

- Low consumption: 35 liters per capita /day
- Medium consumption: 60 liters per capita /day
- High consumption: 80 liters per capita /day

In the case where we want to connect to the solar installation the washing machine and the dishwasher, we would have to increase the calculated daily needs of consumption as follows:

- Washing Machine: 20 liters/day (1 wash per day)
- Dishwasher: 20 liters/day (1 wash per day)

Example:
A family of 4 persons needs around 240 liters of hot water daily in order to have a medium daily consumption. (60 liters per capita x 4 persons). If we include a washing machine and dishwasher, then we must calculate a consumption of 280 liters per day.

2) HOTELS - HOSTELS
In buildings such as hotels, hostels, etc..., the needs for hot water are related to the amount of customers. In this case the daily consumption is calculated by the average occupancy of the rooms, from the period of May up until August. Using this basis, the size of the proposed installation is determined. Here below we indicate the per capita daily need for hot water at 45ºC

- Hostels with rooms with shared bath: 35 liters/person/day
- Hostels: 40 liters/person/day
- 2 Star Hotels: 50 liters/person/day
- 3 Star Hotels: 80 liters/person/day
- 4 Star Hotels: 100 liters/person/day
- Camping: 60 liters/person/day

Example:
An installation of agrotourism is maintained by a family of 4 persons, that live in the residence. During the period between May and August the average occupancy is 15 clients per day. For the occupants 2 meals are prepared per day and the dishwasher washes 5 times per day.

- Needs of family: 4 x 60 lt = 240 litres/day
- Needs of the clients: 15 x 50 lt = 750 litres/day
- Kitchen: 30 x 10 lt = 300 litres/day
- Dishwasher: 5 x 20 lt = 100 litres/day
- Total: 1390 litres/day
3) OTHER APPLICATIONS
In the next table we present the daily consumption for other applications:

<table>
<thead>
<tr>
<th>Application</th>
<th>Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospitals and clinics</td>
<td>80 litres / bed</td>
</tr>
<tr>
<td>University residences</td>
<td>80 litres / bed</td>
</tr>
<tr>
<td>Dressing rooms, public showers</td>
<td>20 litres / person</td>
</tr>
<tr>
<td>Schools</td>
<td>5 litres / student</td>
</tr>
<tr>
<td>Restaurants</td>
<td>8 to 15 litres / meal</td>
</tr>
<tr>
<td>Bars</td>
<td>2 litres / client</td>
</tr>
<tr>
<td>Prisons</td>
<td>30 litres / person</td>
</tr>
<tr>
<td>Factories</td>
<td>20 litres / persona</td>
</tr>
<tr>
<td>Offices</td>
<td>5 litres / employee</td>
</tr>
<tr>
<td>Gymnasiums</td>
<td>30 litres / user</td>
</tr>
</tbody>
</table>

The information of the above table can also be used in combinations so that in every case the average daily consumption can be properly calculated.

FACTORS OF INCREASED NEEDS
In the case that a recirculation system exists for the hot water usage, you will also have to take this into account for the needs. The calculation will have to be made every time individually from the above tables and depends on the dimensions of the circuit and it’s thermal insulation. Additionally, in the determination of the total needs, the thermal losses of the total distribution circuit from the point of storage to the points of final consumption must be taken into consideration.

REAL NEEDS
In every case, the real needs for hot water are related to the personal attitude, the possible special characteristics and habits of every place and application and also the way each application functions.

For this reason, a specific calculation can be made by using the information on the gas/petrol or electric bill. A flow meter installed on the hot water pipes could also be used.
SOLAR COLLECTORS MODELS ST-2000 AND ST-2500

Description
Flat solar collector, firmly built, of new technology suitable for all forced circulation solar systems. The production process and the raw materials that are used produce a high thermal energy efficiency even during periods with insufficient radiation.

Models
The solar collectors VORMANN are produced in two types, ST-2000 (2.10 m²) and ST-2500 (2.61 m²), with black paint coating or selective treatment in titan, which either in solo or in combinations cover all of the requirements of solar systems.

Basic Technical Characteristics
• Frame made from stainless aluminum, which is extremely durable to adverse climatic conditions (high humidity - coastal areas).
• Strong side and back insulation (20mm glass wool and 40mm rock wool), minimize thermal losses in areas with low seasonal temperatures.
• Special prismatic glass, resistant to hale (solar tempered glass).
• One single absorber sheet with high selective blue titatium coating. The absorber with titanium coating is ideal for regions with high diffused radiation and low temperatures, absorbing up to 16% more solar radiation in winter months compared to simple black chrome absorbers. This method of coating is non toxic and does not pollute the environment, while keeping stable its mechanical and optical properties during high and low temperatures.

DIMENSIONS OF THE SOLAR COLLECTORS

<table>
<thead>
<tr>
<th>TYPE</th>
<th>Dimensions</th>
<th>Gross Surface (m²)</th>
<th>Net Surface (m²)</th>
<th>Weight (kg)</th>
<th>Capacity (L)</th>
<th>Test Pressure (bar)</th>
<th>Absorber</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST-2000</td>
<td>2050x1010x90</td>
<td>2.10</td>
<td>1.80</td>
<td>43</td>
<td>1.67</td>
<td>10</td>
<td>95%±2%</td>
</tr>
<tr>
<td>ST-2500</td>
<td>2050x1275x90</td>
<td>2.61</td>
<td>2.31</td>
<td>51</td>
<td>2.09</td>
<td>10</td>
<td>5%±3%</td>
</tr>
</tbody>
</table>

HELOAKM S.A. reserves the right to change all specifications of the products and their accessories without prior notice.
SOLAR COLLECTORS MODELS ST-2000 AND ST-2500 SELECTIVES

Technical Characteristics:
Absorber: One single absorber sheet welded onto copper tube.
Thermal Absorption: 95%
Thermal loss: 5%
Thickness: 0,2mm
Coating: selective titanium

Characteristics of the tubes:
Diameter of the horizontal tubes: (Ø 22mm)
Diameter of the vertical tubes: (Ø 10mm ou Ø 8mm)
Material: copper
Test Pressure: 10 bars
Maximum functional pressure: 7 bars

Frame:
Material: heavy aluminum profile
Back insulation: 35-40 mm insulation
Side insulation: 20 mm glasswool

Cover:
Material: solar tempered glass
Thickness: 3,5-4 mm
Watertightness: joint EPDM and transparent silicone

General Characteristics:
Total thermal efficiency: 95% ± 2%
Total thermal losses: 5% ± 3%
Antifreeze: glicol appropriate for solar systems

Support base:
The characteristics of the support base for the collector(s) with the ways of installation on the various types of roofs, are described analytically on page 32, Chapter 5, Installation Instructions.

HELIOSKIKI S.A. reserves the right to change all specifications of the products and their accessories without prior notice.
Efficiency curves of VORMANN solar collectors

The collector instantaneous efficiency curve is expressed by the following relation in linear or second-order form:

\[ n = n_0 - \frac{U_0 \cdot T_m \cdot T_a}{G} \]
\[ n = n_0 - a_1 \frac{T_m \cdot T_a}{G} - a_2 \frac{(T_m - T_a)^2}{G} \]

where \( n \) is the collector instantaneous efficiency, \( T_m \) is the mean temperature of water inside the collector, in °C, \( T_a \) is the ambient air temperature, in °C and \( G \) is the total solar radiation that falls in the collector, in W/m². The parameters of the above equations of the instantaneous efficiency curve \( n_0 \) and \( U_0 \) are determined by testing according to the standards EN 12975-2 and ISO 9806-1.

The estimated energy output of the collector is calculated using the values of parameters \( n_0 \) and \( U_0 \) determined by testing from several accredited laboratories of Europe, for a number of cities and under the following conditions:
- solar radiation, ambient air temperature and temperature of cold water (average monthly values as given in the tables of the following page)
- temperature of hot water delivered by the collector to the user equal to 45°C and 40°C.

For every day of the month the efficiency of the collector is calculated, where the maximum efficiency and the heat losses of the collector are taken into account depending on the existing climatic conditions of the day and the desired temperature of hot water delivered by the collector to the user. Also, the latitude of the area of installation and the slope of the collector are taken into account. Following this, the mean monthly output of the collector is calculated using the climatic data of the month.

Finally, the sum of the mean monthly outputs of the collector gives the total annual output. It is noted that the values of the estimated energy output of the collector that are calculated and given in the next tables are the maximum estimated and therefore they are achieved only by the optimum design and installation of the solar collector and the solar system. This means that that must not be any shading of the collector during the hours of sunshine and operation of the system, any water penetration inside the collector from the rain, any accumulation of water in the inside part of the collector cover, any accumulation of dust or other substances on the outside part of the collector cover, any deformation of any part or area or material of the collector and system, any leakage in the hydraulic connections in any part of the collector or system, bad or no insulation of the piping of the solar system, bad operation of the valves of the solar system, non proper maintenance of the collector and the system and problems caused by deposition of salts within the tubes of the collector by the usage water.
### Daily solar radiation in horizontal level, in MJ/m²

<table>
<thead>
<tr>
<th>No</th>
<th>CITY</th>
<th>JAN</th>
<th>FEB</th>
<th>MAR</th>
<th>APR</th>
<th>MAY</th>
<th>JUN</th>
<th>JUL</th>
<th>AUG</th>
<th>SEP</th>
<th>OCT</th>
<th>NOV</th>
<th>DEC</th>
<th>YEAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tashkent, UZB</td>
<td>15.9</td>
<td>16.3</td>
<td>15.2</td>
<td>14.6</td>
<td>13.2</td>
<td>12.2</td>
<td>11.5</td>
<td>11.5</td>
<td>11.5</td>
<td>12.4</td>
<td>14.4</td>
<td>16.5</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Tashkent, KIRGIZ</td>
<td>15.9</td>
<td>16.3</td>
<td>15.2</td>
<td>14.6</td>
<td>13.2</td>
<td>12.2</td>
<td>11.5</td>
<td>11.5</td>
<td>11.5</td>
<td>12.4</td>
<td>14.4</td>
<td>16.5</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Novosibirsk, RUS</td>
<td>16.5</td>
<td>16.6</td>
<td>15.5</td>
<td>14.6</td>
<td>13.7</td>
<td>12.9</td>
<td>12.2</td>
<td>11.7</td>
<td>11.7</td>
<td>12.7</td>
<td>14.7</td>
<td>16.7</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Moskow City, MOC</td>
<td>16.5</td>
<td>16.6</td>
<td>15.5</td>
<td>14.6</td>
<td>13.7</td>
<td>12.9</td>
<td>12.2</td>
<td>11.7</td>
<td>11.7</td>
<td>12.7</td>
<td>14.7</td>
<td>16.7</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Munich City, GER</td>
<td>16.5</td>
<td>16.6</td>
<td>15.5</td>
<td>14.6</td>
<td>13.7</td>
<td>12.9</td>
<td>12.2</td>
<td>11.7</td>
<td>11.7</td>
<td>12.7</td>
<td>14.7</td>
<td>16.7</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Los Angeles, USA</td>
<td>16.5</td>
<td>16.6</td>
<td>15.5</td>
<td>14.6</td>
<td>13.7</td>
<td>12.9</td>
<td>12.2</td>
<td>11.7</td>
<td>11.7</td>
<td>12.7</td>
<td>14.7</td>
<td>16.7</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Barcelona, ESP</td>
<td>16.5</td>
<td>16.6</td>
<td>15.5</td>
<td>14.6</td>
<td>13.7</td>
<td>12.9</td>
<td>12.2</td>
<td>11.7</td>
<td>11.7</td>
<td>12.7</td>
<td>14.7</td>
<td>16.7</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Athens, GRE</td>
<td>16.5</td>
<td>16.6</td>
<td>15.5</td>
<td>14.6</td>
<td>13.7</td>
<td>12.9</td>
<td>12.2</td>
<td>11.7</td>
<td>11.7</td>
<td>12.7</td>
<td>14.7</td>
<td>16.7</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Stockholm, SWE</td>
<td>16.5</td>
<td>16.6</td>
<td>15.5</td>
<td>14.6</td>
<td>13.7</td>
<td>12.9</td>
<td>12.2</td>
<td>11.7</td>
<td>11.7</td>
<td>12.7</td>
<td>14.7</td>
<td>16.7</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Copenhagen, DEN</td>
<td>16.5</td>
<td>16.6</td>
<td>15.5</td>
<td>14.6</td>
<td>13.7</td>
<td>12.9</td>
<td>12.2</td>
<td>11.7</td>
<td>11.7</td>
<td>12.7</td>
<td>14.7</td>
<td>16.7</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Helsinki, FIN</td>
<td>16.5</td>
<td>16.6</td>
<td>15.5</td>
<td>14.6</td>
<td>13.7</td>
<td>12.9</td>
<td>12.2</td>
<td>11.7</td>
<td>11.7</td>
<td>12.7</td>
<td>14.7</td>
<td>16.7</td>
<td></td>
</tr>
</tbody>
</table>

### Ambient air temperature, in °C

<table>
<thead>
<tr>
<th>No</th>
<th>CITY</th>
<th>JAN</th>
<th>FEB</th>
<th>MAR</th>
<th>APR</th>
<th>MAY</th>
<th>JUN</th>
<th>JUL</th>
<th>AUG</th>
<th>SEP</th>
<th>OCT</th>
<th>NOV</th>
<th>DEC</th>
<th>YEAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tashkent, UZB</td>
<td>5.2</td>
<td>7.1</td>
<td>9.0</td>
<td>10.9</td>
<td>12.7</td>
<td>14.3</td>
<td>15.7</td>
<td>16.3</td>
<td>16.3</td>
<td>15.9</td>
<td>9.4</td>
<td>4.5</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Tashkent, KIRGIZ</td>
<td>5.2</td>
<td>7.1</td>
<td>9.0</td>
<td>10.9</td>
<td>12.7</td>
<td>14.3</td>
<td>15.7</td>
<td>16.3</td>
<td>16.3</td>
<td>15.9</td>
<td>9.4</td>
<td>4.5</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Novosibirsk, RUS</td>
<td>5.2</td>
<td>7.1</td>
<td>9.0</td>
<td>10.9</td>
<td>12.7</td>
<td>14.3</td>
<td>15.7</td>
<td>16.3</td>
<td>16.3</td>
<td>15.9</td>
<td>9.4</td>
<td>4.5</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Moskow City, MOC</td>
<td>5.2</td>
<td>7.1</td>
<td>9.0</td>
<td>10.9</td>
<td>12.7</td>
<td>14.3</td>
<td>15.7</td>
<td>16.3</td>
<td>16.3</td>
<td>15.9</td>
<td>9.4</td>
<td>4.5</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Munich City, GER</td>
<td>5.2</td>
<td>7.1</td>
<td>9.0</td>
<td>10.9</td>
<td>12.7</td>
<td>14.3</td>
<td>15.7</td>
<td>16.3</td>
<td>16.3</td>
<td>15.9</td>
<td>9.4</td>
<td>4.5</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Los Angeles, USA</td>
<td>5.2</td>
<td>7.1</td>
<td>9.0</td>
<td>10.9</td>
<td>12.7</td>
<td>14.3</td>
<td>15.7</td>
<td>16.3</td>
<td>16.3</td>
<td>15.9</td>
<td>9.4</td>
<td>4.5</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Barcelona, ESP</td>
<td>5.2</td>
<td>7.1</td>
<td>9.0</td>
<td>10.9</td>
<td>12.7</td>
<td>14.3</td>
<td>15.7</td>
<td>16.3</td>
<td>16.3</td>
<td>15.9</td>
<td>9.4</td>
<td>4.5</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Athens, GRE</td>
<td>5.2</td>
<td>7.1</td>
<td>9.0</td>
<td>10.9</td>
<td>12.7</td>
<td>14.3</td>
<td>15.7</td>
<td>16.3</td>
<td>16.3</td>
<td>15.9</td>
<td>9.4</td>
<td>4.5</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Stockholm, SWE</td>
<td>5.2</td>
<td>7.1</td>
<td>9.0</td>
<td>10.9</td>
<td>12.7</td>
<td>14.3</td>
<td>15.7</td>
<td>16.3</td>
<td>16.3</td>
<td>15.9</td>
<td>9.4</td>
<td>4.5</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Copenhagen, DEN</td>
<td>5.2</td>
<td>7.1</td>
<td>9.0</td>
<td>10.9</td>
<td>12.7</td>
<td>14.3</td>
<td>15.7</td>
<td>16.3</td>
<td>16.3</td>
<td>15.9</td>
<td>9.4</td>
<td>4.5</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Helsinki, FIN</td>
<td>5.2</td>
<td>7.1</td>
<td>9.0</td>
<td>10.9</td>
<td>12.7</td>
<td>14.3</td>
<td>15.7</td>
<td>16.3</td>
<td>16.3</td>
<td>15.9</td>
<td>9.4</td>
<td>4.5</td>
<td></td>
</tr>
</tbody>
</table>

### Mean temperature of cold (mains) water, in °C

<table>
<thead>
<tr>
<th>No</th>
<th>CITY</th>
<th>JAN</th>
<th>FEB</th>
<th>MAR</th>
<th>APR</th>
<th>MAY</th>
<th>JUN</th>
<th>JUL</th>
<th>AUG</th>
<th>SEP</th>
<th>OCT</th>
<th>NOV</th>
<th>DEC</th>
<th>YEAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tashkent, UZB</td>
<td>14.3</td>
<td>14.1</td>
<td>13.9</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
</tr>
<tr>
<td>2</td>
<td>Tashkent, KIRGIZ</td>
<td>14.3</td>
<td>14.1</td>
<td>13.9</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
</tr>
<tr>
<td>3</td>
<td>Novosibirsk, RUS</td>
<td>14.3</td>
<td>14.1</td>
<td>13.9</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
</tr>
<tr>
<td>4</td>
<td>Moskow City, MOC</td>
<td>14.3</td>
<td>14.1</td>
<td>13.9</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
</tr>
<tr>
<td>5</td>
<td>Munich City, GER</td>
<td>14.3</td>
<td>14.1</td>
<td>13.9</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
</tr>
<tr>
<td>6</td>
<td>Los Angeles, USA</td>
<td>14.3</td>
<td>14.1</td>
<td>13.9</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
</tr>
<tr>
<td>7</td>
<td>Barcelona, ESP</td>
<td>14.3</td>
<td>14.1</td>
<td>13.9</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
</tr>
<tr>
<td>8</td>
<td>Athens, GRE</td>
<td>14.3</td>
<td>14.1</td>
<td>13.9</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
</tr>
<tr>
<td>9</td>
<td>Stockholm, SWE</td>
<td>14.3</td>
<td>14.1</td>
<td>13.9</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
</tr>
<tr>
<td>10</td>
<td>Copenhagen, DEN</td>
<td>14.3</td>
<td>14.1</td>
<td>13.9</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
</tr>
<tr>
<td>11</td>
<td>Helsinki, FIN</td>
<td>14.3</td>
<td>14.1</td>
<td>13.9</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
<td>13.6</td>
</tr>
</tbody>
</table>
## Base of results: Test of DEMOKRITOS

<table>
<thead>
<tr>
<th>No</th>
<th>CITY</th>
<th>JAN</th>
<th>FEB</th>
<th>MAR</th>
<th>APR</th>
<th>MAY</th>
<th>JUL</th>
<th>AUG</th>
<th>SEP</th>
<th>OCT</th>
<th>NOV</th>
<th>DEC</th>
<th>NET</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Halkida, GRE</td>
<td>66</td>
<td>74</td>
<td>93</td>
<td>105</td>
<td>104</td>
<td>102</td>
<td>116</td>
<td>104</td>
<td>94</td>
<td>81</td>
<td>72</td>
<td>6.6</td>
</tr>
<tr>
<td>2</td>
<td>Patras, GRE</td>
<td>61</td>
<td>72</td>
<td>98</td>
<td>109</td>
<td>106</td>
<td>107</td>
<td>117</td>
<td>109</td>
<td>97</td>
<td>82</td>
<td>73</td>
<td>6.7</td>
</tr>
<tr>
<td>3</td>
<td>Nauplia, GRE</td>
<td>58</td>
<td>68</td>
<td>88</td>
<td>98</td>
<td>93</td>
<td>92</td>
<td>100</td>
<td>96</td>
<td>82</td>
<td>70</td>
<td>62</td>
<td>5.0</td>
</tr>
<tr>
<td>4</td>
<td>Kavalla, GRE</td>
<td>60</td>
<td>66</td>
<td>82</td>
<td>93</td>
<td>90</td>
<td>91</td>
<td>102</td>
<td>96</td>
<td>84</td>
<td>70</td>
<td>61</td>
<td>5.2</td>
</tr>
<tr>
<td>5</td>
<td>Larissa, GRE</td>
<td>42</td>
<td>49</td>
<td>70</td>
<td>82</td>
<td>81</td>
<td>79</td>
<td>83</td>
<td>79</td>
<td>68</td>
<td>57</td>
<td>49</td>
<td>4.1</td>
</tr>
</tbody>
</table>

## Base of results: Test of SOLAR COLLECTORS

<table>
<thead>
<tr>
<th>No</th>
<th>CITY</th>
<th>JAN</th>
<th>FEB</th>
<th>MAR</th>
<th>APR</th>
<th>MAY</th>
<th>JUN</th>
<th>JUL</th>
<th>AUG</th>
<th>SEP</th>
<th>OCT</th>
<th>NOV</th>
<th>DEC</th>
<th>NET</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Halkida, GRE</td>
<td>66</td>
<td>74</td>
<td>93</td>
<td>105</td>
<td>104</td>
<td>102</td>
<td>116</td>
<td>104</td>
<td>94</td>
<td>81</td>
<td>72</td>
<td>6.6</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Patras, GRE</td>
<td>61</td>
<td>72</td>
<td>98</td>
<td>109</td>
<td>106</td>
<td>107</td>
<td>117</td>
<td>109</td>
<td>97</td>
<td>82</td>
<td>73</td>
<td>6.7</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Nauplia, GRE</td>
<td>58</td>
<td>68</td>
<td>88</td>
<td>98</td>
<td>93</td>
<td>92</td>
<td>100</td>
<td>96</td>
<td>82</td>
<td>70</td>
<td>62</td>
<td>5.0</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Kavalla, GRE</td>
<td>60</td>
<td>66</td>
<td>82</td>
<td>93</td>
<td>90</td>
<td>91</td>
<td>102</td>
<td>96</td>
<td>84</td>
<td>70</td>
<td>61</td>
<td>5.2</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Larissa, GRE</td>
<td>42</td>
<td>49</td>
<td>70</td>
<td>82</td>
<td>81</td>
<td>79</td>
<td>83</td>
<td>79</td>
<td>68</td>
<td>57</td>
<td>49</td>
<td>4.1</td>
<td></td>
</tr>
</tbody>
</table>

## Base of results: Test of TUV BAYERN

<table>
<thead>
<tr>
<th>No</th>
<th>CITY</th>
<th>JAN</th>
<th>FEB</th>
<th>MAR</th>
<th>APR</th>
<th>MAY</th>
<th>JUN</th>
<th>JUL</th>
<th>AUG</th>
<th>SEP</th>
<th>OCT</th>
<th>NOV</th>
<th>DEC</th>
<th>NET</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Halkida, GRE</td>
<td>66</td>
<td>74</td>
<td>93</td>
<td>105</td>
<td>104</td>
<td>102</td>
<td>116</td>
<td>104</td>
<td>94</td>
<td>81</td>
<td>72</td>
<td>6.6</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Patras, GRE</td>
<td>61</td>
<td>72</td>
<td>98</td>
<td>109</td>
<td>106</td>
<td>107</td>
<td>117</td>
<td>109</td>
<td>97</td>
<td>82</td>
<td>73</td>
<td>6.7</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Nauplia, GRE</td>
<td>58</td>
<td>68</td>
<td>88</td>
<td>98</td>
<td>93</td>
<td>92</td>
<td>100</td>
<td>96</td>
<td>82</td>
<td>70</td>
<td>62</td>
<td>5.0</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Kavalla, GRE</td>
<td>60</td>
<td>66</td>
<td>82</td>
<td>93</td>
<td>90</td>
<td>91</td>
<td>102</td>
<td>96</td>
<td>84</td>
<td>70</td>
<td>61</td>
<td>5.2</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Larissa, GRE</td>
<td>42</td>
<td>49</td>
<td>70</td>
<td>82</td>
<td>81</td>
<td>79</td>
<td>83</td>
<td>79</td>
<td>68</td>
<td>57</td>
<td>49</td>
<td>4.1</td>
<td></td>
</tr>
</tbody>
</table>

### Acknowledgments

Energy output of the collector in several cities of the world (in kWh/m²).
GRAPHICAL PRESENTATION OF ENERGY OUTPUT OF COLLECTORS IN SELECTED CITIES OF THE WORLD (in KWh/m²), in temperature 40°C

Collector: ST 2000 selective- Base of results: Test of DEMOKRITOS, GREECE

cities: No 1 - 35

Collector: ST 2000 selective- Base of results: Test of DEMOKRITOS, GREECE

cities: No 1 - 35

Collector: ST 2000 selective (SUN-POWER) - Base of results: Test of TÜV BAYERN, GERMANY

cities: No 1 - 35
Pressure drop in collectors - Calculations of Demokritos

For the systems VS 150 - 500, BL1 or BL2, the parallel connection of the solar collectors is recommended.

In this case the pressure drop in one collector is about equal to the pressure drop in the whole row of collectors for the supply that is equivalent to the total of installed square meters.

The required flow of the pump for the forced circulation is approximately 40 - 80 liters / h for each installed square meter and depends on the design of each installation.

Example:
For one system VS-300 E/BL1 with 3 collectors ST-2000 in a parallel connection, total surface area 6,30m², we can choose a medium flowrate of 60lt/h per square meter of installed collectors. This means that the necessary flowrate of the pump must be 60lt/hm²x6,30m²=378lt/h approximately. When dividing by 3 (number of collectors), we obtain 126lt/h. When transforming to liters/second (by dividing by 3.600) we will have 0,035 liters/second. From the above graph of pressure drop of the collector ST 2000, we estimate that the flowrate of 0,035 liters/second corresponds to a pressure drop of approximately 100 Pa.
Boiler VORMANN type V - BL1 and V- BL2
with one or two tube heat exchangers

Description
The VORMANN boilers are manufactured according to European and German standards in the new state of the art solar boilers manufacturing facility and offer absolute safety in operation, great savings and a long lifespan:

Basic Technical Characteristics:
• Manufactured from extra thick and high quality USD 37.2 steel plate.
• Double tested for watertightness.
• The internal cleaning of the cylinder is not done chemically but in the most modern sand blasting facility, resulting in the perfect addiction of the enamelling on the steel surface.
• The enamelling is made with double ‘direct’ enamel process and it is heated at a temperature of 850°C.
• Supplied with a big magnesium rod DN 32mm for additional anti-corrosive protection.
• Large side flange DN 115mm for easy interior cleaning.
• Top flange DN 115mm for easy replacement of the magnesium rod.
• Optional electric resistance 2 - 9 KW.
• Available with one or two tube heat exchangers, suitable for every application
• Upon a special order, buffers can be delivered (150lt - 1000lt models BL0) without a tube heat exchanger.

Models

<table>
<thead>
<tr>
<th>Models V - BL1 (with 1 tube heat exchanger)</th>
<th>Models V - BL2 (with 2 tube heat exchangers)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>Insulation exterior</td>
</tr>
<tr>
<td>V-150BL1</td>
<td>Yes</td>
</tr>
<tr>
<td>V-200BL1</td>
<td>Yes</td>
</tr>
<tr>
<td>V-300BL1</td>
<td>Yes</td>
</tr>
<tr>
<td>V-420BL1</td>
<td>Yes</td>
</tr>
<tr>
<td>V-800BL1</td>
<td>No</td>
</tr>
<tr>
<td>V-1000BL1</td>
<td>No</td>
</tr>
</tbody>
</table>

V: vertical

HELIOAKMI S.A. reserves the right to change all specifications of the products and their accessories without prior notice.
Boiler VORMANN type V - BL1 and V- BL2
with one or two tube heat exchangers

Tank:

- **Material:** Steel plate USD37.2 quality
- **Welding:** Robotically welded in inert gas environment
- **Cleaning:** 6 point metal blasting
- **Internal treatment:** Glass enameling heated at 850°C
- **Function Pmax:** 6 bar
- **Testing Pmax:** 15 bar for 5 minutes
- **Function Tmax:** +95°C

Insulation:

- **Material:** Polyurethane CFC & FCKW Free
- **Density:** 40 kg/m³
- **Thickness:** 65 mm

(For storage tanks BL800 - BL1000 for all the models, the insulation is made from flexible polyurethane 75 mm and is detachable for easier passage during installation)

Outer covering:

- **Material:** PVC in various colors

Tube heat exchanger:

Coil heat exchanger made of heavy duty steel tube 33mm (tubo)

Electrical Backup (upon request):

2 to 4 KW (230 V) with thermostat or 6KW or 9KW (400 V) without thermostat

HELIOAKMI S.A. reserves the right to change all specifications of the products and their accessories without prior notice.
DESCRIPTION OF STORAGE TANKS

Dimensions - hydraulic connections

1. Hot water outlet
2. Magnesium rod
3. Top flange Φ115
4. Sensor inlet
5. Recirculation connexion
6. Electric back-up inlet
7. Collector inlet
8. Sensor inlet
9. Side flange Φ115
10. Collector outlet
11. Cold water inlet

1. Top flange Φ115
2. Magnesium Φ115
3. Hot water outlet
4. Back-up heat exchanger inlet
5. Sensor inlet
6. Recirculation connexion
7. Sensor inlet
8. Back-up heat exchanger outlet
9. Electric back-up inlet
10. Collector inlet
11. Sensor inlet
12. Collector outlet
13. Cold water inlet
14. Side flange Φ115

Outer Cover Material:
Color PVC jacket

Storage tanks weight empty (kg)

<table>
<thead>
<tr>
<th>LITTER/MODEL</th>
<th>BL1</th>
<th>BL2</th>
<th>DIAMETER</th>
<th>HEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>150</td>
<td>64</td>
<td>69</td>
<td>603</td>
<td>1050</td>
</tr>
<tr>
<td>200</td>
<td>85</td>
<td>93</td>
<td>603</td>
<td>1400</td>
</tr>
<tr>
<td>300</td>
<td>108</td>
<td>128</td>
<td>603</td>
<td>1930</td>
</tr>
<tr>
<td>420</td>
<td>146</td>
<td>156</td>
<td>730</td>
<td>1730</td>
</tr>
<tr>
<td>500</td>
<td>165</td>
<td>182</td>
<td>730</td>
<td>1970</td>
</tr>
<tr>
<td>800</td>
<td>176</td>
<td>210</td>
<td>805*</td>
<td>1735*</td>
</tr>
<tr>
<td>1000</td>
<td>201</td>
<td>235</td>
<td>805*</td>
<td>1985*</td>
</tr>
</tbody>
</table>

* DIMENSIONS WITHOUT INSULATION

Thermal Insulation:
Polyurethane Foam CFC & FCKW free
Density: 40 kg/m³
Thickness: 65 mm.
Thermal Conductivity: 0,023 W/mk
Fire Class: B3, auto extinguishable.

Hydraulic Connexions BL:

<table>
<thead>
<tr>
<th>Volume</th>
<th>150 l</th>
<th>200 l</th>
<th>300 l</th>
<th>420 l</th>
<th>500 l</th>
<th>800 l</th>
<th>1000 l</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor</td>
<td>1/2&quot;</td>
<td>1/2&quot;</td>
<td>1/2&quot;</td>
<td>1/2&quot;</td>
<td>1/2&quot;</td>
<td>1/2&quot;</td>
<td>1/2&quot;</td>
</tr>
<tr>
<td>Heat exchangers</td>
<td>1&quot;</td>
<td>1&quot;</td>
<td>1&quot;</td>
<td>11/4&quot;</td>
<td>11/4&quot;</td>
<td>11/4&quot;</td>
<td>11/4&quot;</td>
</tr>
<tr>
<td>Hot-Cold inlets</td>
<td>1&quot;</td>
<td>1&quot;</td>
<td>11/4&quot;</td>
<td>11/4&quot;</td>
<td>11/4&quot;</td>
<td>11/4&quot;</td>
<td>11/4&quot;</td>
</tr>
<tr>
<td>Electric Element</td>
<td>11/2&quot;</td>
<td>11/2&quot;</td>
<td>11/2&quot;</td>
<td>11/2&quot;</td>
<td>11/2&quot;</td>
<td>11/2&quot;</td>
<td>11/2&quot;</td>
</tr>
<tr>
<td>Recirculation</td>
<td>1&quot;</td>
<td>1&quot;</td>
<td>1&quot;</td>
<td>1&quot;</td>
<td>1&quot;</td>
<td>1&quot;</td>
<td>1&quot;</td>
</tr>
</tbody>
</table>

Corrosion Protection
Inner cleaning of the tank with automated sand blasting (not chemically) resulting in a perfect adherence of the enamel.
Food grade enamel quality applied with a “double direct” method and baked at 850°C (BUFFER tanks are excluded).
Extra corrosion protection is offered by magnesium rods that must be checked and replaced if necessary every 2 to 5 years, depending on the quality of the water.

Backup Heating Source Using the Second, Upper Heat Exchanger
Coil type heat exchanger, from heavy duty steel (type Tubo) integrated in the upper part of the tank, in order for the secondary heating source to heat only the upper part of the tank.
Further technical data concerning the upper heat exchanger refer to the table concerning BL2 tanks.

ATTENTION: Tanks have a maximum service pressure of 6 bar. It is highly recommended to install a 6 bar TP Valve and an expansion vessel in the cold inlet.

HELIOAKMI S.A. reserves the right to change all specifications of the products and their accessories without prior notice.
## Technical Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>BL 150</th>
<th>BL 200</th>
<th>BL 300</th>
<th>BL 420</th>
<th>BL 500</th>
<th>BL 800</th>
<th>BL 1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat Exchanger Capacity</td>
<td>Lt</td>
<td>3.45</td>
<td>2.7</td>
<td>5.7</td>
<td>2.7</td>
<td>11.5</td>
<td>6</td>
</tr>
<tr>
<td>Heat Exchanger surface area</td>
<td>m²</td>
<td>0.6</td>
<td>0.5</td>
<td>1</td>
<td>0.5</td>
<td>2.2</td>
<td>1.3</td>
</tr>
<tr>
<td>Lower Heat Exch. Flow Rate</td>
<td>m³/h</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Pressure drop</td>
<td>mbar</td>
<td>65</td>
<td>52</td>
<td>120</td>
<td>60</td>
<td>150</td>
<td>130</td>
</tr>
<tr>
<td>Inlet temperature</td>
<td>°C</td>
<td>55</td>
<td>70</td>
<td>80</td>
<td>90</td>
<td>55</td>
<td>70</td>
</tr>
<tr>
<td>Heat Exchanger Power*</td>
<td>KW</td>
<td>7.8</td>
<td>15.6</td>
<td>20.4</td>
<td>25.5</td>
<td>4.7</td>
<td>9.4</td>
</tr>
<tr>
<td>Hot water continuous supply</td>
<td>Lt/h</td>
<td>190</td>
<td>385</td>
<td>500</td>
<td>625</td>
<td>115</td>
<td>232</td>
</tr>
<tr>
<td>Thermal losses **</td>
<td>KWh/24H</td>
<td>1.2</td>
<td>1.65</td>
<td>2.24</td>
<td>2.68</td>
<td>2.91</td>
<td>3.22</td>
</tr>
</tbody>
</table>

*Cold water temperature 10 °C. Hot water outlet temperature 45 °C. Storage temperature 60 °C.
** Water storage temperature 65 °C - Ambient temperature 20°C.

**ATTENTION:** Tanks have a maximum service pressure of 6 bar. It is highly recommended to install a 6 bar TP Valve and an expansion vessel in the cold inlet.

HELIODAKMI S.A. reserves the right to change all specifications of the products and their accessories without prior notice.
Hydraulic kit

Application
As a pump, regulator and air venting valve in solar heating systems. With the hydraulic kit, hydraulic balancing, flow measurement and venting can be performed directly in the station.

The built-in SETTER Inline UN allows the required quantity of fluid in the primary circuit to be exactly and simply set and checked. The continuous venting system meets the most demanding requirements and keeps the system free of air.

Systems which are correctly balanced hydraulically and air-free guarantee optimal energy extraction, and are thus more cost-effective in the sense of the energy-saving directives laid down by law.

Using the scale, which is pre-calibrated for glycol, the technician can set and check the exact flow-rate values on-site. Neither training courses nor expensive measuring devices are required. Installation and venting can be carried out by one person working unaided.

Installation position
The solar station must be mounted vertically to ensure problem-free functioning of the venting unit.

Advantages
- Cost-effective installation and filling
- Multi-functional ball valve, which greatly simplifies the filling and draining of the system
- Collector and reservoir sections can be separated for installation work
- Straightforward pump replacement (suction and pressure side can be shut off)
- Precise and rapid regulation adjustments, requiring no diagrams, tables or expensive measuring devices
- Function checking using the direct flow rate indicator in the SETTER Inline UN
- Visual scale in l/min pre-calibrated for glycol mixes $u=2.3 \text{ mm}^2/\text{s}$
- Constant air release while system is running
- Straightforward venting directly in the station
- Can be connected to any readily-available controller
- Reliable operation, and maintenance-free
- Rugged design

Operation
The flow-rate measurement is based on the proven principle of a baffle float.

The basis for the air venting are special flow technology measures which accumulate the air in the top of the venting space, from where it can be released from time to time. At the same time, acts as a check on whether air is building up in the system. There are no mechanical parts, so the design ensures a long service life.
Flow circuit components (venting side)

Stop ball valve with safety valve (response pressure 6 bar)
The ball valve allows the flow circuit line to be divided between the collector and the heat accumulator. As required by safety regulations, the connection between the collector and safety valve is not interrupted in any of the ball valve positions.
The safety valve thus protects the system components against excessive over-pressure in all operating phases.
Holes are provided in the handle of the ball valve so that it can be sealed to protect against unintentional closing. This prevents unintentional disconnection of the connecting line between the collector and the expansion vessel at this point.

Venting tank with bleeder valve
The purpose of the venting tank is to remove air from the medium flowing through the tank.
The venting tank can hold up to approx. 2.5 dl of air and has a bleeder valve for releasing the air.
The bleeder valve is routed to the outside through the insulation which means that it can be accessed even when the insulating casing is on. The outlet has a suitable fitting for easy attachment of a hose.
The frequency and quantity of the collected air can be used to check the leak tightness of the system.

Pressure gage
The pressure gage with a range from 0 to 10 bar indicates the system pressure.

Thermometer
The thermometer with a range from 0 to 160°C constantly indicates the medium temperature in the flow circuit. The temperature is recorded directly in the medium to minimize the reaction time.
The sensor is inserted in a protective pipe so that it can be exchanged without having to empty the system.

Return circuit components (pump side)

Stop ball valve with fill and drain cock and integrated check valve
The ball valve allows the return line to be split between the collector and the heat accumulator. The special ball cock design provides various functions. If the handle is pointing in the direction of flow the system medium can circulate. An integrated check valve stops the medium flowing in the opposite direction and also acts as a gravity brake.

Turning the handle 90° to the right closes the ball cock in the direction of the medium flow and allows the upper system part (collector) to be filled and emptied using the fill and drain cock.

Turning the handle 90° to the left closes the ball cock in the direction of the medium flow and allows the lower system part (reservoir) to be filled using the fill and drain cock.
A male thread G 3/4" is provided on the fill and drain cock for connecting a hose. Holes are provided in the handle of the ball valve so that it can be sealed to pro-tect against unintentional closing.

WILLO ST 25/6-3 circulation pump, solar version
This circulation pump, included as standard in the scope of delivery and integrated in the hydraulic kit, covers a large delivery range.
The required operating point can be preselected using one of the three levels.
A defective pump can be replaced without having to empty the system using the stop cocks on the suction side (Setter Inline UN) and the pressure side (ball valve).

SETTER Inline UN balancing valve
Precision adjustment at the balancing valve allows the required delivery quantity to be adapted to system requirements. The proven combination of balancing valve and flow indicator in one housing in the hydraulic kit balancing valves means that no additional measuring components are required for the SETTER Inline UN. Flow rate indication is constant, i.e. the adjustment can be immediately verified by means via the flow rate indicator. The indicator is pre-calibrated for a medium viscosity of 2.3 mm2/s. This does away with the need for correction curves.
The connection flange on the outlet side is directly screwed onto the 1 1/2" pump connector fittings which means there are no seal locations for further adapter components.

Connector ADG
The connector fitting with G 3/4” connecting thread for the expansion vessel is connected in series with the circulation pump. This arrangement prevents negative working pressure conditions in even critical systems and avoids reductions in the working pressure, one of the main causes of early evaporation of the medium.

Thermometer
The thermometer with a range from 0 to 160°C constantly indicates the medium temperature of the flow circuit. The temperature is recorded directly in the medium to minimize the reaction time.
The sensor is inserted in a protective pipe so that it can be exchanged without having to empty the system.

HELOAKMI S.A. reserves the right to change all specifications of the products and their accessories without prior notice.
Hydraulic kit

**Specification text**
Is a ready-to-connect solar station for circulation and venting of solar circuit medium with mounting attachments. With integrated SETTER Inline UN regulating and check valve with direct indication of the set flow rate in l/min. Optimized for use in solar applications. Measured values with medium viscosity \( u = 2.3 \text{ mm}^2/\text{s} \) can be read directly at the sight glass during adjustment without the need for tables, diagrams or measuring devices.

**Technical data**

- **Max. operating temperature:**
  - Flow circuit (venting side): TB 160°C
  - Return circuit (pump side): TB 110°C
- **Max. operating pressure:** 8 bar.
- Safety valve response pressure: 6 bar
- \( k_v \) value and measurement range as per table «Type Program».

**Vent pipe:** Painted steel
**Valve housing components:** Brass
**Internal components:** Stainless steel, brass and plastic
**Sight glass:** Boric silicate
**O-ring seals:** EPDM

- Flat seals with high temperature resistance suitable for use in solar applications
- **Insulating material:** EPP
- **Thread according to DIN 2999 / ISO 7 and ISO 228**
- **Measuring accuracy** \( \pm 10\% \) (of the highest nominal value)

**Fluids**
- Water and proprietary additives used against corrosion and freezing (display scale for medium viscosity \( u = 2.3 \text{ mm}^2/\text{s} \))
- Heating water and cooling water

---

**Includes: flow phase (venting side) and return phase (pump side)**

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>( k_v )</th>
<th>( k_v )</th>
<th>Circulation pump</th>
</tr>
</thead>
<tbody>
<tr>
<td>4,0 - 16,0 l/min</td>
<td>3,3</td>
<td>6,0</td>
<td>WILO ST 20/6-3</td>
</tr>
</tbody>
</table>

1) \( k_v \) \([\text{m}^3/\text{h}]\) with \( U = 1 \text{ mm}^2/\text{s} \) in the return phase (pump side)
2) \( k_v \) \([\text{m}^3/\text{h}]\) with \( U = 1 \text{ mm}^2/\text{s} \) in the flow phase (venting side)
3) Visual scale for water/glycol mix with \( U = 2.3 \text{ mm}^2/\text{s} \)

---

**Dimensional drawing**

1 Male thread ISO 228, G 1" (line from the collector)
2 Male thread ISO 228, G 1" (line to the collector)
3 Male thread ISO 228, G 1" (line to the reservoir)
4 Male thread ISO 228, G 1" (line from the reservoir)
5 Male thread ISO 228, G 3/4" (expansion vessel line)
6 Female thread DIN 2999 / ISO 7, Rp 3/4" (safety valve blow-off line)
Connection Accessories
All of the necessary connection accessories of each unit are located in an incorporated packaging which consists of the following:

- Screws, bolts, nuts, moly plugs, etc.
- Bronze cross
- Connection raccords of collectors and plugs
- Flexible tube for the expansion vessel
- Sensor-socket (boiler-collectors)
- Degasser of the collectors

Hydraulic kit
Description on page 19, 20, 21, 38 and 39

Differential thermostats TCD1 PLUS
Description on page 23-24

Expansion pot
The expansion pot of 18 liters is suitable for all of the systems (VS-150 up to VS-500) and the maximum length of 50m of pipes Ø22mm for the closed circuit. It is connected to the hydraulic kit with the flexible tube which is included in the package.

Antifreeze Liquid
Glicol is used to avoid the freezing of the thermal liquid of the solar collectors of the closed circuit. It is delivered in a plastic bottle of 10 liters. It must be mixed with water depending on the weather conditions (minimal environmental temperature) in the area where the solar system is installed. The table on the left shows the analogy of Water / Glicol to the environmental temperature.

<table>
<thead>
<tr>
<th>Dilution</th>
<th>Freezing Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>% v. in water</td>
<td>°C</td>
</tr>
<tr>
<td>20%</td>
<td>- 7°C</td>
</tr>
<tr>
<td>30%</td>
<td>- 13°C</td>
</tr>
<tr>
<td>40%</td>
<td>- 23°C</td>
</tr>
<tr>
<td>50%</td>
<td>- 34°C</td>
</tr>
</tbody>
</table>

HELIOAKMI S.A. reserves the right to change all specifications of the products and their accessories without prior notice.
Optional Accessories (not included in kit)

Electric Resistance
On all BL1 & BL2 boilers, an electric resistance can be installed which is delivered upon a special order. The electric resistance 2 or 4 kW / 1-230V is delivered with the thermostat and a plastic cover. The electric resistance 6 or 9 kW / 3-400 V is delivered without the thermostat (obligation of the installer).

The existence of a back up energy source secures the availability of hot water in the cases of low sunshine and/or inavailability of other back up energy source (central heating system or heat pump).

Technical Characteristics of the electric resistance:
- Material: copper
- Connection inlet: N 40 (1 ½”) M.
- Power: 2 or 4 kW (1-230 V) with thermostat
- 6 or 9 kW (3-400 V) without thermostat

Thermostat
All of the single-phase electric resistances (up to 4 kW) are delivered with a thermostat with a uni-polar interruption function as well as a bi-polar interruption thermal safety button with manual reset.

Technical Characteristics of the thermostat:
- Control: incorporated
- Model of thermostat: B2-10
- Protection at IP: 00
- Tmax - maximum environmental temperature: 105 °C
- Cycles start / pause: 10,000 times (cycles)
- Fire resistance category: B
- Environmental function: Clean Environment

Always follow the installation instructions as described in chapter 5, page 45.

Notes:
- When the electric resistance is installed, you must also fix a protective cover so that to ensure a complete water tightness and security.
- All the installations and connections must be done according to the rules and regulations (electrical, plumbing, urbanism and others) applicable in your area.
Forced Circulation Systems

Models
The systems are delivered with 1 tube heat exchanger on the boiler (BL1) for connection to solar collectors or with 2 tube heat exchangers on the boiler (BL2) for connection to solar collectors and central heating system. Every system can be delivered with an electric resistance 2kW or 4kW (upon request).

General
The forced circulation systems are used for the production of hot water.
Their basic characteristics are:
• High efficiency
• Easy installation
• Economic Function

Models BL1 (with 1 tube heat exchanger)

<table>
<thead>
<tr>
<th>Model</th>
<th>Capacity (litres)</th>
<th>Number of collectors</th>
<th>Total surface area of the collectors (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>150 / BL1</td>
<td>150</td>
<td>1</td>
<td>2,61</td>
</tr>
<tr>
<td>150 / BL1-M</td>
<td>150</td>
<td>1</td>
<td>2,10</td>
</tr>
<tr>
<td>200 / BL1</td>
<td>200</td>
<td>2</td>
<td>2 x 2,10</td>
</tr>
<tr>
<td>200 / BL1-M</td>
<td>200</td>
<td>1</td>
<td>2,61</td>
</tr>
<tr>
<td>300 / BL1</td>
<td>300</td>
<td>2</td>
<td>2 x 2,61</td>
</tr>
<tr>
<td>300E / BL1</td>
<td>300</td>
<td>3</td>
<td>3 x 2,61</td>
</tr>
<tr>
<td>300 / BL1-M</td>
<td>300</td>
<td>2</td>
<td>2 x 2,10</td>
</tr>
<tr>
<td>420 / BL1</td>
<td>420</td>
<td>3</td>
<td>3 x 2,10</td>
</tr>
<tr>
<td>420E / BL1</td>
<td>420</td>
<td>3</td>
<td>3 x 2,61</td>
</tr>
<tr>
<td>500 / BL1</td>
<td>500</td>
<td>3</td>
<td>3 x 2,10</td>
</tr>
<tr>
<td>500E / BL1</td>
<td>500</td>
<td>3</td>
<td>3 x 2,61</td>
</tr>
<tr>
<td>800 / BL1</td>
<td>800</td>
<td>6</td>
<td>6 x 2,10</td>
</tr>
<tr>
<td>800E / BL1</td>
<td>800</td>
<td>6</td>
<td>6 x 2,61</td>
</tr>
<tr>
<td>1000 / BL1</td>
<td>1000</td>
<td>8</td>
<td>8 x 2,10</td>
</tr>
<tr>
<td>1000E/ BL1</td>
<td>1000</td>
<td>8</td>
<td>8 x 2,61</td>
</tr>
</tbody>
</table>

Models BL2 (with 2 tube heat exchangers)

<table>
<thead>
<tr>
<th>Model</th>
<th>Capacity (litres)</th>
<th>Number of collectors</th>
<th>Total surface area of the collectors (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>150 / BL2</td>
<td>150</td>
<td>1</td>
<td>2,61</td>
</tr>
<tr>
<td>150 / BL2-M</td>
<td>150</td>
<td>1</td>
<td>2,10</td>
</tr>
<tr>
<td>200 / BL2</td>
<td>200</td>
<td>2</td>
<td>2 x 2,10</td>
</tr>
<tr>
<td>200 / BL2-M</td>
<td>200</td>
<td>1</td>
<td>2,61</td>
</tr>
<tr>
<td>300 / BL2</td>
<td>300</td>
<td>2</td>
<td>2 x 2,61</td>
</tr>
<tr>
<td>300E / BL2</td>
<td>300</td>
<td>3</td>
<td>3 x 2,10</td>
</tr>
<tr>
<td>300 / BL2-M</td>
<td>300</td>
<td>2</td>
<td>2 x 2,10</td>
</tr>
<tr>
<td>420 / BL2</td>
<td>420</td>
<td>3</td>
<td>3 x 2,10</td>
</tr>
<tr>
<td>420E / BL2</td>
<td>420</td>
<td>3</td>
<td>3 x 2,61</td>
</tr>
<tr>
<td>500 / BL2</td>
<td>500</td>
<td>3</td>
<td>3 x 2,10</td>
</tr>
<tr>
<td>500E / BL2</td>
<td>500</td>
<td>3</td>
<td>3 x 2,61</td>
</tr>
<tr>
<td>800 / BL2</td>
<td>800</td>
<td>6</td>
<td>6 x 2,10</td>
</tr>
<tr>
<td>800 / EBL2</td>
<td>800</td>
<td>6</td>
<td>6 x 2,61</td>
</tr>
<tr>
<td>1000 / BL2</td>
<td>1000</td>
<td>8</td>
<td>8 x 2,10</td>
</tr>
<tr>
<td>1000E/BL2</td>
<td>1000</td>
<td>8</td>
<td>8 x 2,61</td>
</tr>
</tbody>
</table>

HELIOMAR S.A. reserves the right to change all specifications of the products and their accessories without prior notice.
Forced circulation solar systems Model BL 1
(without a helping source of energy - central heating boiler)

1. Solar collectors
2. Storage tank (boiler)
3. Hydraulic kit
4. Expansion vessel
5. Differential Thermostat
6. Circulator for recirculation of hot water (optional)
7. Cold water inlet
8. Non return / safety valve
9. Mixing valve

Forced circulation solar systems Model BL 2
(with a helping source of energy - central heating boiler)

1. Solar collectors
2. Storage tank (boiler)
3. Hydraulic kit
4. Expansion vessel
5. Differential Thermostat
6. Circulator for recirculation of hot water (optional)
7. Cold water inlet
8. Non return / safety valve
9. Mixing valve
10. Central heating system

Attention: A safety pressure releaf valve is mandatory in the cold inlet of a tank.

NOTE: The above drawings are typical drawings of basic principles. You must always consult a specialized engineer for your own installation.
Installation Instructions

1. Before you start installing the solar water heater, please read carefully all the installation instructions stated and illustrated in this manual.
2. Before the installation of the solar water heater, it is very important that the customer and the installer agree on all the details concerning the correct and safe installation of the appliance, (such as location, placement point, static resistance and control of the surface on which the appliance will be placed, piping and wiring run etc).
3. The installation should be done according to the local electric and plumbing regulations.
4. The location you will choose for the installation of the solar collector(s) should not be shaded by any obstacles (trees, buildings...etc.) all around the year. (see obstacle table here below).
5. For optimum performance of the solar system, the collector(s) must face South, for countries located in the Northern hemisphere and North for countries located in the Southern hemisphere. In case that it is not totally possible for the solar collector(s) to face the equator, you must turn it (them) towards East up to 30° if major hot water draw is before 14:00 p.m., or towards West up to 30° if major hot water draw is after 14:00 p.m. The ideal inclination of the solar collector(s) should be equal to the latitude in which the installation is done.
6. The support base of the collector(s) is the same for both flat and inclined roofs. It is diversified only in the way of it’s assembly (see installation instructions on the following pages.)
7. If the surface on which the solar collector(s) will be installed (inclined or flat) is not compatible with the standard equipment supplied with each appliance, then alternate equipment must be used. The installer has to choose, propose and install this alternate equipment, always under the concurrent opinion of the customer.
8. For installation on an inclined roof, the «D» plates must be screwed with the appropriate screws and nuts on the roof timber, in order to secure the right and safe installation of the collector(s).
9. In regions subject to heavy snowfalls, rainfall, storms, strong winds, cyclones, tornadoes it is very important to ensure that the supports of the standard equipment are sufficient to withstand the weight of the expected snow or the intensity of the weather conditions. In these cases the collector(s) must be placed in a stable way on the roof and must be tightened with additional metal straps.

Insulation considerations

Continuity in pipework insulation must be maintained, although, sometimes, many lengths may need to be joined to cover the full length of pipework. In those instances, the join should be taped, and UV-resistant tape used where the join is made on external pipework.

Where pipework penetrates the roof material, the insulation should go through the penetration with the pipework, as shown in figure on the right.

Roof flashings

Roof penetrations for pipework, electrical conduits or support frames should be sealed with roof flashings to prevent water leaking into the roof cavity. These flashings are usually made of EPDM or silicon rubber, with an aluminium frame that can be moulded to the shape of the roof, as shown in figure below. Where possible, penetration should be done on the high part of the roof profile to avoid the possibility that water will pool around a penetration that is located in the valley of the profile.

Lead flashing should not be used on a roof that is collecting rainwater for drinking and it must be compatible with other roof cladding material.
Installation Instructions

ASSEMBLY INSTRUCTIONS

The same support base is used for both flat and inclined surfaces for the collector models ST-2000 and ST-2500.

INSTALLATION ON FLAT SURFACES
Connect the plates A, B, C, and D by screwing them tight to each other as shown on the illustrations on the following pages. Loosely screw the bottom plate E onto the plates B. 
Attention: The top plate E is adjusted after the placement of the collector(s). Level the support base on the flat surface. Place the collector(s) on the support base and then screw it with the moly plugs and the bolts onto the concrete, according to your country’s regulations.

INSTALLATION ON AN INCLINED SURFACE
Connect the plates (A) and (E) so that to form a rectangular frame, on the support bases with one and three collectors while the plates (A) and (C) on the support base with two collectors (as shown on the following pages). 
Bend the 4 plates (D) as shown in the illustrations. Remove the tiles, and place the bent plates (D) on the wooden timbers or on the concrete of the roof. Screw tightly the rectangular frame (A)+(C) or (E) onto the plates (D). Level the support base and screw the plates (D) onto the wooden timbers of the roof as shown in the illustrations. For the safe installation of the support base you must always use the additional metal straps. 
Lift the tiles and pass the metal straps under the horizontal wooden timbers of the roof. Tighten them onto the plates (C) for the support base with two collectors or to plates (E) for the support bases with one or three collectors, so that the support base can not move in any direction. 
Screw the plates (B) onto the rectangular frame (A) + (C) or (E). Ensure that the plates (B) are tightly screwed on the holes of the plate (A). Loosely screw the bottom plate (E) or (C) onto the plates (B). 
Attention: the top plate E or C is adjusted after the placement of the collector(s). 
Place the collector(s) on the support base and secure them with the plates (E) or (C) and tightly screw them onto the plates (B).

TECHNICAL CHARACTERISTICS OF THE SUPPORT BASE
Material: heat dipped galvanized metal plates
Thickness: 2,5mm - 3,0mm
Form: Angle of 90°, 35mm x 35mm

DIMENSIONS OF THE PLATES OF THE SUPPORT BASE

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>2150 mm</td>
<td>2150 mm</td>
<td>1430 mm</td>
<td>1180 mm</td>
<td>1150 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1150 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1180 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1220 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1220 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1430 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1430 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2355 mm</td>
</tr>
</tbody>
</table>

Note: The specifications of the products, their accessories (e.g. electric resistances, thermostats, valves, liquid, etc.) and their materials are in accordance with the Greek standards. You must be informed and check if the specifications of the products and their accessories are in accordance with the local and national standards and regulations that apply in your country. The importer/distributor is responsible for the importation, commercialization and installation of the products. 

HELIOAKMI S.A. in no case is liable for any damages caused to third parties for any reason, such as wrong installation of the appliances and their accessories, from the non-observation of the regulations and laws (electrical, urban planning, plumbing, sanitary, etc.) applying in your country/area. In case of a defective product apply the terms and conditions of the warranty.
Installation Instructions

Support base for 1 collector
ST 2000 or ST 2500 (p. 34-35)

Support base for 2 collectors
ST 2000 or ST 2500 (p. 36-37)

Support base for 3 collectors
ST 2000 or ST 2500 (p. 36-37)
INSTALLATION INSTRUCTIONS

Assemble diagram of the support base for one collector ST 2500 on a flat or inclined surface

HELIOAKMI S.A. reserves the right to change all specifications of the products and their accessories without prior notice.
Attention: the plate (A) is connected to the plate (B) exactly as shown in the detailed.
Attention:
for the installation of two collectors on a tiled roof, the plates C are installed in the middle hole of the plates A.

Assemble diagram of the support base for two collectors ST 2500 on a flat or inclined surface

HELIOAKMI S.A. reserves the right to change all specifications of the products and their accessories without prior notice.
Attention: the plate A is connected to the plate B exactly as shown in the detailed diagram.
Assemble diagram of the support base for three collectors ST 2500 on a flat or inclined surface.
Attention:
in the installation of the support base with three collectors on a tiled roof the three plates C are not used.
Connection of collectors and accessories

For the connection of two and three collectors to each other you must use the bronze connecting raccords as shown in the diagrams. The bronze plugs 1/2” are connected diagonally on the collector(s). The bronze cross, the degasser and the sensor socket are connected to the outlet on the highest point of the collector(s) as shown in the photo. In order to achieve the best contact between the sensor and the sensor socket, use thermal conductive material before connecting. The above accessories are found in a plastic bag which is included in the accessories box.

The sensor socket (1) of length 135mm is connected to the boiler, while the small sensor socket (2) of length 65mm is connected to the collectors.
INSTALLATION INSTRUCTIONS
INSTALLATION INSTRUCTIONS

Hydraulic KIT

- For the connection of the hydraulic kit with the closed circuit (collectors, tube heat exchanger which is located at the bottom part of the boiler) refer to the hydraulic diagram of the solar system on page 30.
- The connection of the expansion pot with the safety valve of the hydraulic kit must have greatest length of 2 meters, without any corners and without any high air gathering area. The diameter is 3/4”.
- After the plumbing installation, the closed circuit must be cleaned. The cleaning of the system is achieved with water for 15 minutes by isolating the circulator from its two valves which are located before and after it and by opening the two inlets / outlets of the system. The inlets / outlets have raccords (male) for connection to a plastic pipe.
- Before the filling of the closed circuit, we must check the watertightness of all of the connections. We can, for instance, during the cleaning, turn-off one of the emptying-filling valves and use a pressure pump or the pressure of the water supply so that we can raise the pressure to 5 bar for 15 minutes. **Attention:** the expansion pot must be isolated so as to minimize the overload of the maximum functioning pressure.
- The mixing of the antifreeze liquid must be done before the filling and in accordance to the lowest environmental temperature (see table on page 27).
- The filling of the system can be done either from the top part of the collector, by the gravity or with a pump from the hydraulic kit. The functioning pressure, between 1,5 and 3 bar, can be achieved with the pressure pump or the pressure of the water supply. We constantly check all of the points of degassing, while filling simultaneously with liquid.
- All of the installations and connections of the system must be done according to the electric, plumbing, and construction etc... regulations applicable in your country.
- It is recommended that a pail is placed under the hydraulic kit in which water or liquid will be accumulated from the dripping of the safety valve. This is really useful during the filling and degassing or the hydraulic testing since the valve opens at 6 bar.

Piping of the closed circuit

- All of the piping that leave and return from and to the collectors have to be properly insulated so that they can withstand temperatures from -30°C up to +120°C. It is also necessary to use an anti-UV (solar radiation) for the insulation.
- The insulation must have suitable thickness in accordance to the local climatic conditions.
- The distance between the collectors and the tube heat exchanger of the boiler must be the least possible so as to minimize the thermal losses.
- Air trapping areas must be avoided. If this is not possible, an automatic degasser must be installed at that point.
- The diameter of the pipes must be from Ø18mm - 22mm for distance up to 20m and Ø15mm for distance down to 12m.
- All of the connection raccords which will be used must withstand pressure of 6 bar and temperatures between -30°C and + 200°C.
- After the guarantee has expired, it is recommended that a yearly check is made on the installation and the connections.
ELECTRIC CONNECTIONS

- For the installation of the differential thermostat, refer to the producer’s manual which is included in the package.
- All of the units function with 230V / 50Hz.
- In the case where an electric resistance is installed, the voltage must be checked. The electric resistances up to 4kW are 1~230 V with thermostat, while for the electric resistances 6kW - 9kW the voltage is 3~400V and the installation of a thermostat is the installer’s obligation.
- The thermostat once installed and adjusted functions automatically on the boiler. According to the needs of the client, the temperature of the water can be adjusted by the installer to lower or higher levels from the original adjustment and between 30ºc - 80ºc. In the case that for some reason the temperature exceeds the tolerated safety level, the safety unit is activated. This is adjusted to be activated when the temperature of the thermostat reaches 100ºc (±10). In the case that this happens, you must determine it’s cause. After the water cools down, we can reactivate it manually by pressing the red button.
- During the transport of the thermostats and during the process of installation avoid the hitting / banging, dropping of the thermostats, because they can cause serious damage to the thermostat with very dangerous consequences to it’s operation. The electric installation should be made by a licensed electrician. A faulty electric connection can cause an explosion of the boiler.
- In the case where the hot water consumption needs are during periods of the day with little or no sunlight, for instance after 17:00 or before 10:00 a.m., the use of a timer is recommended. This will automatically activate the electric resistance and as long as there is a need for hot water.
- All the connections must conform with the regulations (electrical, plumbing, urbanism and others) that apply in your area.

After completing the installation of the system, clean the area where you have worked, fill out the guarantee and send it by registered post to Helioakmi S.A.

ELECTRIC CONNECTIONS OF THE ELECTRIC RESISTANCE AND THERMOSTAT*

HELIOAKMI S.A. is not responsible for damages to the products or third parties, which arise from the faulty installation of the unit.

The technical characteristics can change without prior notification.

Overheating
If your Solar Collector will be stagnant in the sun for an extended period of time, you should cover the collector to protect against overheating and damaging the collector and your Solar Hot Water System. A heat dissipation device may be needed to protect against overheating.

Snow and Wind loads
Snow and wind loads are a significant factor for structural planning. European norms were established, albeit without specifically taking solar installations into account. Wind and snow loads affect the collectors and the installation system. Depending on the conditions and height of the installation site as well as the collector inclination, the mechanical loads on the system can vary considerably. Also see guidelines for the planning of structural frameworks and standards EUROCODE 1, (European guidelines for structural planning). With combined snow and wind loads the maximum strain for the solar collector is 1,000 N/m². Note that wind suction spikes may occur on roof edges.

It is mandatory to follow best practice rules for static planning, especially related to snow and wind loads. Different codes and regulations apply in different countries and regions. In case of doubt and/or in absence of exact static calculations (not recommended) always allow for additional fixtures, weight, anchors, and screws, especially in regions with known weather extremes.

Lightning protection
This type of installation, do not increase the risk of attracting lightning and there are no records of ever happened such incident. However we suggest that you check for a lightning rod in your area and also check if it gives protection to the place of your system. If it exists, and if it is not enough, we suggest that you provide a lightning rod according to your country rules and to EN 61024-1. We suggest that you connect the visible metallic parts (solar collectors, piping and support devices) to the lightning rod installation with copper cable never less 50 mm² cross section.

Note: the lightning protection must be done by qualified professionals.
Hydraulic KIT
The solar system can operate at extremely high temperatures. Please do not attempt to decommission the system yourself, as there is a risk of serious injury.

There is also a risk of electrocution from 240VAC electricity.

1. Always wear appropriate Personal Protective Equipment such as gloves and eye protection.
2. Even if the pipework near the cylinder seems cool, the panels can be at high temperature. Decommissioning should therefore only be attempted when there is no solar input, or the panels should be covered with light proof covers and left for at least 5 hours.
3. Turn off the switched fused spur and remove the fuse. Leave the fuse holder open and use a padlock or similar to lock it open. Leave a conspicuous sign stating the power should not be reconnected.
4. Connect a short length of hose to the drain point situated at the lowest point of the system and place in a suitably sized container - do not drain into the public sewerage system. Antifreeze liquid must be disposed of correctly.
5. Open the check valve.
6. Slowly open the drain tap. When the initial flow created by pressure has stopped, open the air-vent at the top of the solar panels.
7. When the fluid has finished draining, disconnect the pipework starting at the upper part of the system. Caution - there may still be fluid in the pipework.
8. Dispose of any materials correctly.
9. Panels should only be removed by qualified professionals using appropriate access and safety equipment.

The law requires employers to appoint one or more competent persons to assist them in identifying and implementing the preventive and protective measures required.

Maintenance schedule
TO BE SIGNED ON COMPLETION OF COMMISSIONING

Date of site visits for bacterial, water quality and access risk assessments. .................................................................
Commissioned by. ............................................................................................................................................................
Competent persons scheme unique identification number. ..................................................................................................
On behalf of. ........................................................................................................................................................................
Date system commissioned and handed over. ...................................................................................................................
Signature of commissioning engineer. ................................................................................................................................
Signature of user to confirm receipt and understanding (optional). ..................................................................................

Maintenance Log

<table>
<thead>
<tr>
<th>Date:</th>
<th>Name of engineer/company:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Installation Instructions

#### General data

<table>
<thead>
<tr>
<th>Registration no.</th>
<th>...........................................</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inspection</td>
<td>installation/maintenance</td>
</tr>
<tr>
<td>type of Inspection date</td>
<td>...........................................</td>
</tr>
<tr>
<td>inspector name</td>
<td>...........................................</td>
</tr>
<tr>
<td>SWH user</td>
<td>...........................................</td>
</tr>
<tr>
<td>name</td>
<td>...........................................</td>
</tr>
<tr>
<td>address</td>
<td>...........................................</td>
</tr>
<tr>
<td>postal code, city</td>
<td>...........................................</td>
</tr>
<tr>
<td>phone</td>
<td>...........................................</td>
</tr>
<tr>
<td>SWH brand and type</td>
<td>...........................................</td>
</tr>
<tr>
<td>kind of system</td>
<td>thermosyphon/forced circulation</td>
</tr>
<tr>
<td>year of manufacture</td>
<td>...........................................</td>
</tr>
<tr>
<td>Collector area (m²)</td>
<td>...........................................</td>
</tr>
<tr>
<td>number of collectors</td>
<td>...........................................</td>
</tr>
<tr>
<td>type of collectors</td>
<td>...........................................</td>
</tr>
<tr>
<td>orientation</td>
<td>...........................................</td>
</tr>
<tr>
<td>slope (ο)</td>
<td>...........................................</td>
</tr>
<tr>
<td>Backup heating</td>
<td>...........................................</td>
</tr>
<tr>
<td>energy source</td>
<td>electricity / gas / oil</td>
</tr>
<tr>
<td>hot water storage</td>
<td>integrated / separate tank / flow through</td>
</tr>
<tr>
<td>brand and type</td>
<td>...........................................</td>
</tr>
<tr>
<td>power in kW</td>
<td>...........................................</td>
</tr>
</tbody>
</table>

#### Visual inspection

| Supporting frame (strong, attached to roof/ grouting) | ........................................... |
| Storage tank (location, no leaks, material)          | ........................................... |
| Storage tank insulation (tight, no gaps)             | ........................................... |
| If known: overnight temperature drop ... °C           | ........................................... |
| Connection of pipes to storage tank and user points (right position, insulation, air release valve, proper roof penetrations) | ........................................... |
| Non-return valve (right position)                    | ........................................... |
| Positioning of circulation pipes between collector and tank (right slope, no sharp bends, air release valve) | ........................................... |
| Insulation circulation pipes (complete length, weather-resistant material, condition of insulation) | ........................................... |
| Position expansion tank, vent pipe or safety valve   | ........................................... |
| Backup heating                                      | ........................................... |
| a. manual switch (location)                         | ........................................... |
| b. thermostat setting ... °C, range ... °C           | ........................................... |
| c. proper electrical wiring                         | ........................................... |
| Collector glass cover (clean, no cracks, water- tight, no condensation) | ........................................... |
| Absorber (no corrosion, no leaks, paint/coating in good condition) | ........................................... |
| Collector sensors (correctly attached to hot and cold water circulation pipes) | ........................................... |
| Circulation pump (position, power ... W)            | ........................................... |
| Control unit (position, settings)                   | ........................................... |
| Sensor cables (proper connections, right size and insulation cables) | ........................................... |

#### Testing and measurements

| Hot water outlet temperature ... °C                | ........................................... |
| Circulation with thermosyphon systems (temperature difference between hot and cold junctions) | ........................................... |
| Forced circulation Important: for this test, the sun should be shining and the pump running. Check circulation by feeling or measuring the temperature difference between the hot and cold pipes | ........................................... |
| Differential Temperature Control (DTC) 1) Switch on test: Note DTC - setting: TDTC = ... °C. Measure collector inlet temperature Tin = ... °C. Check: (Tout - Tin) should be higher than TDTC | ........................................... |
| 2) Switch off test (optional) If possible cool down the “hot” sensor or warm up the “cold” sensor: Check: pump should switch off | ........................................... |

#### Action list

<table>
<thead>
<tr>
<th>Part</th>
<th>Action required</th>
<th>By whom</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Instructions to the end user and installer

INSTRUCTIONS TO THE END USER AND INSTALLER

- The solar systems do not require the intervention of the user. It is recommended that, after the first 15 days of functioning, to check the pressure of the closed circuit (collector - boiler) and that the temperatures and at normal levels in relation with the time of the inspection, the sunlight and the «installation sheet».
- After two years of functioning, it is recommended that a program of annual service is begun. The maintenance program is to replace the fluid loop circuit and maintain the proportions of propylene glycol, replacing the magnesium anode and check the operation of all existing valves.
- If there is a breakage of collector’s glass, it must be replaced immediately so that the absorber will not be damaged.
- In dusty conditions or small rainfall, it is recommended to clean the glass with a damp cloth, if the collectors are dirty. It is also recommended to replace the glass of the collectors were washed at least twice a year with water, except if it often rains.
- After the installation is complete, the installer will have to inform the client about the functioning of the system.
- In the case of any malfunction of the system, we recommend the client to contact the installer as he knows all of the various parameters and the possible particular characteristics of the installation.
- The valves must be periodically checked to assure their correct functioning.
- The installer who will make the disassembly must be a specialized and certified installer in accordance with the national regulations that apply in your country. When the installation is completed he must leave the place in the same conditions as before the installation.
- The mixing valve (when installed by the installer) must not be regulated in a temperature above 60°C. There is only one thermostat and should not be set up above 60°C.
- Before putting the system in operation, the installer must check all the valves and fittings, including also the loop circuit as well as the main water tank.
- The safety valves must be checked periodically to assure their proper functioning.
- If there is a danger of frost, please check the loop circuit to confirm if the antifreeze liquid conforms with the rules. In case of overheating check the overheating valve to assure that it is functioning properly.
- Do not start the system operation if the weather conditions are around 0°C. Check the loop circuit and the quantity of the antifreeze liquid. Consult the standards of the builder.
- The thermal efficiency and the solar quantity of the system is according to paragraph 5.9 of EN 12976-2, for loads defined on the proposed load.
- NOTE: during high radiation do not close the supply of water and do not empty the system.
- NOTE: the water consumption of the system can be withdrawn during high radiations to prevent the overheating of the system.
- The heat transfer liquid is propylene glycol.
- During periods of prolonged absence it is recommended the collectors to be covered with an opaque covering so that to avoid working unnecessarily. Do not use plastic material or glass material for their cover.
- The system does not use any electrical device for freeze protection, because it works with propylene glycol.
- The overheating protection of this system it is not electrical dependent, however it should never be disconnected from the electricity or water supply network.

INSTALLATION INSTRUCTIONS

- The piping system used on the system is resistant to rain and moisture.
- The hot water piping system is thermal insulated.
- Sk maximum (snow load) is 2kn/m² according to ENV 01/03/1991, and Vm (mean wind speed) is 180 km/h.
- The operation of the system can start since the circulator is functioning if the weather conditions allow for its function. By touching the pipes in their highest points (outlet of collectors) should be warm (be careful with the metallic structure as well, screws and nuts, furthermore, it should check the general state of technical aspects of installation, to agree with him all the details in this way, a secure installation and aesthetics possible, respecting the appearance of the building where it will be performed.
- The system can be installed on the roof, terrace or garden, on a firm surface and sturdy, which does not receive shade of nearby obstacles in any season.
- Comply with current regulations on water and electricity installations. Keep in mind the local conditions of wind, especially during assembly. The damage resulting from faulty installation are not covered under warranty.
- The tank must be full of water before filling the primary circuit or filled with the heat transfer fluid before connecting the electrical resistance backup.
- After finished the system installation, make sure that all leftover materials used on the installation, are collected, since they may cause injury or damage to third parties.
- The reading of this instruction manual is very important, since its not checked, may void the warranty.
- The piping system used in this system is water-proof and moisture.
- All pipes for conducting hot water are thermally isolated.
- A hose must be used for hot water draining to the nearest gutter, to avoid damage in materials or people.

WARNING: THE INSTALLATION SHOULD NOT COMPROMISE THE STRUCTURAL INTEGRITY OF THE BUILDING ON WHICH IS INSTALLED.

IN THE CASE OF MALFUNCTION

Instructions to the installer

Ensure that:
- The climate conditions permit the functioning of the solar system.
- There is no shading of the collectors by any obstacles and that they are clean from dust.
- That there is no leakage in the closed circuit and that all of the connections, raccords, and pipes are tightly screwed and water-tight.
- That the function of the circulator is correctly programmed.
- The mixing valve for hot / cold water in the outlet of the boiler is correctly adjusted and its function was not opened.
- The temperature of the closed circuit (indication of the manometer on the hydraulic kit) is the same, with the one described on the «setup sheet» (around 1.5 - 2.5 bar). To start immediately the system fill the closed circuit with a mixture or water and antifreeze liquid or adjust the automatic filling tap, until reaching the indicated pressure in the «installation sheet».
- There is enough liquid in the closed circuit of collectors - tank. During days with high radiation and normal operation of the pump, the pipes in their highest points (outlet of collectors) should be warm (be careful with the high heating due to solar radiation).
- The circulator is functioning if the weather conditions allow for it’s function. By touching the circulator we can feel the vibrations of the system. Check the electric current on the electric board and
- There is no air in the expansion vessel and the safety valve was not opened.

Note: All the connections and the installations must be done according to the regulations (electrical, plumbing, urbanism and others) that apply in your area. Instructions to the customer referred to the installer. In the case of the malfunction of the system and before contacting the installer, distributor or agent, please have at hand the information on the next page.

The product warranty terms and condition apply.
INSTALLATION SHEET (Filled out by installer, kept by client)

Full name of client ..................................................

Address / Telephone ................................................................

Model ..........................................................

Date of Installation ..................................................

Installation of the collectors (tiled roof, flat roof, other) ..........................................

Collectors facing : South .... East .... West ........

Inclination of the collectors ........................................... (in ºC)

Characteristics of plumbing

• Test pressure of the closed circuit ........................................ (bar)
• Test pressure of the expansion pot (nitrogen) ................................ (bar)
• Relation of glicol .................................. (%) water ........ (% glicol
• Existence of automatic filling .................................. YES / NO
• Initial filling with pump ........................................ YES / NO

Electric characteristics / adjustment of differential thermostat

• Model of Differential Thermostat ........................................
• Adjustment of maximum temperature for the protection of the boiler ........... (ºC)
• Adjustment of starting differential temperature ............................... (ºC)
• Adjustment of the hysteresis temperature ........................................ (ºC)
• Adjustment of antifreeze protection ................................. (ºC)

• Description of the electric connection of the circulator (for example: direct in the differential thermostat or use of electric board with safety switch especially for the circulator).

General comments:

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................

..............................................................................................................
After the installation is complete, the installer with the help of the check list below has to check all of the points which are noted and mark in the relevant column if it has been correctly done with YES or NO.

### LIST

<table>
<thead>
<tr>
<th>COLLECTORS AND EXTERNAL PIPING</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is the installation and the fixing of the support base according to the instructions and local regulations?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is there an ideal location and facing of the collectors?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is there humidity inside the collectors?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is water allowed to flow under the collectors?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are the hydraulic connections of the collectors correct?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Has the function and installment of the sensor on the collectors been done correctly?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Has there been good UV protection on the thermal insulation?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Has there been good insulation of all the piping?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Has the installation on the roof been done according to the local regulations?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### PRIMARY CIRCUIT (SOLAR)

<table>
<thead>
<tr>
<th></th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Does the inclination of the pipes allow the degassing from the highest point?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Does the closed circuit have the right pressure?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are there any leaks in the closed circuit, the connections, or in the tube heat exchanger?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is there a manometer in the closed circuit of the collectors?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is the loading valve installed properly?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Was a non-return valve installed?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Was a discharge valve installed in the lowest points?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Does a receptacle exist for the leaking of liquid or thermal fluid / water?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is there a safety valve connected?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is there an indication of the make and type of thermal liquid on a label installed in a viewable area?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### DIFFERENTIAL THERMOSTAT - ELECTRIC CONNECTIONS

<table>
<thead>
<tr>
<th></th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is the differential thermostat programmed for the right temperatures?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Does the differential thermostat function properly?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is the maximum temperature of the boiler adjusted properly?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(if a mixing valve has not been installed for hot / cold water at the outlet of the boiler)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have the sensors of the boiler and collectors been properly connected?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do the sensors of the boiler and collectors function properly?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are the electric cables properly fixed?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Has the electric connection been done according to the local regulations? (insulation, grounding, etc...)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### BOILER AND HOT WATER CIRCUIT

<table>
<thead>
<tr>
<th></th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is the electric resistance connected properly? (if it exists)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Does a mixing valve of hot / cold water exist?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is the insulation of the boiler in good condition?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is the safety valve connected to the sewer?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### GENERAL

<table>
<thead>
<tr>
<th></th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Was the guarantee properly filled and given to the client?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Were the instructions of use given to the client?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Was the proper selection of the model made according to the needs of the client?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Was the client informed with the other choices that exist for the production of hot water?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This check list must be sent along with the guarantee to the manufacturer
HELIIOAKMI S.A., Nea Zoi, Aspropyrgos Attiki, 19300 Greece

**Personal data of the installer:**
- Full name ........................................
- Address ...........................................
- Telephone ......................................

**Personal data of the distributor or agent:**
- Full name ........................................
- Address ...........................................
- Telephone ......................................
- Signature of installer: .......................