SUNNYDAY SOLAR COLLECTOR
instructions handbook

SOLAR PANEL DESCRIPTION

Absorbing surface

It is obtained by an extruded strip of polypropylene, 310 mm width and some meters long, depending on the models; along the strip there are 37 channels having a diameter of 5 mm.

The **Sunnyday** solar panels are identified by the code SD followed by the length in mm (SD 3000 is 3 m long).

Collector's headers

Two headers having inner diameter of 38 mm are welded at the extremities of the strip; they distribute and collect the water flowing through the channels; the headers end with two ***connecting orifices***, ***male and female***, diagonally opposite at the extremities of the panel.

Collector Accessories and Accessories Battery

Many panels of the same length can be quickly connected each other with the special fittings contained in the package **Accessories** for the **Collector (**code ***AC*****)** and **Accessories** for the **Battery (**code ***AB***) in order to obtain a battery of considerable dimensions (up to 50 m²).

INSTALLATION

Position and inclination

Choose a sunny surface, better having a 20 - 55 % slope toward South; anyway, considering that the use is mostly during summer, also a horizontal surface or a surface having a slight slope (e. g. no more than 10%) not toward the South is acceptable.

Nevertheless, if the drainage of the panels during winter is planned, in order to avoid that the inner water freeze, a slope of almost 40 % must be assured; it is also possible to prevent the freezing without draining the plant (see. ***Winter protection)***

Supporting surface

Whichever flat surface is suitable, provided that no asperities such as nails, sharp sheets, splintery tiles and so on can damage the collectors; small movements due the thermal dilatation and vibrations exerted by the wind may in fact produce abrasion by friction against sharp bodies.

If a framework is utilised as support, for instance in order to realise a shading roof for a parking, the panels must be sustained almost each 50 – 100 cm of their length. The panels, in fact, are not auto supporting and must be avoided that they bend under the weight of the contained water or be shacked by the wind.

A supporting continuous surface is preferable in order to avoid the ventilation of the back side of the collectors; utilising a wooden or metallic framework, a fiberglas sheet could be put between solar panels and framework.

The solar panels themselves are very light but the designer and the installer must carefully take into account the thrust that they can impress to the supporting structure due to the wind.

Battery assembling

The connection of the panels each other is made by means of the package ***Collector Accessories*** .

The feeding of the water must be done at one of the lower extremity of the battery, in correspondence with the ***male connecting orifice***; the outlet pipe is necessarily connected with the upper extremity of the battery diagonally opposite to the inlet, in correspondence with the other ***male connecting orifice***; this obliged connection assures the best balancing of the water flows. Before starting to connect the panel each other, verify that they have been stretched out with the connecting orifices in the right position.

Decide the maximum quantity of panels to assemble in a single battery both in function of the maximum water flow admitted by the headers and as in function of the thermal dilatation (see the **DATA SHEETS**); anyway it is recommended not to assemble together more then 50 panels to whom correspond a transversal dilatation of about 130 mm for a temperature variation of 100 °C. More over, the water flow is more uniform trough smaller batteries. If the plant needs more solar collectors, it will utilise various batteries connected each other in parallel.

In the package ***Battery Accessories*** are contained two special male fittings of a 1"½ diameter for the connection of the pipes and two taps for the plugging of the other two free extremities of the batteries, in correspondence of the ***female orifice***.

Fastening of the panels

Particular attention must be paid to the fastening of the panels to avoid that they can be displaced or removed by the wind; the simplest and most reliable solution is to place galvanised steel 3/8" pipes or structural shapes transversally to the panels at 50 - 100 cm of distance each other; for aesthetical reasons, use preferably black painted bars; the bars shall be fastened to the supporting surface in the most suitable way according with the kind of surface (roof, ground or whatever else). The panels must not be fastened onto the underlying surface; a gap of about 1 mm must be left; in fact the thermal dilatation and contractions due to temperature variation must be allowed.

Under responsibility of the installer the strength of the fastening and the integrity of the impermeabilization of the underlying surface - when this is a roof - must be controlled.

It is not allowed to cover the panels with a transparent surface, of whatever kind; this could cause unacceptable over-heating of the solar collector.

Connection to the plant

Provide:

. a blow-down valve to discharge the air

at the battery outlet, if the panels lay on a slope surface

at the descent of the outlet pipe if the panels lay on a horizontal surface

if the plant if a "once trough plant", the valve is not necessary.

.a sheath for the differential thermostat sensor, at the outlet

if the plant is a forced circulation one

. connections for the introduction of anti-freeze salt

and

. check valves to intercept the outer part of the plant

if such a kind of anti-frost protection has been chosen (see ***winter protection***),

. a drainage valve at the lower part of the plant

. a pressure discharge valve, set at 3 bar, on the lower part of the plant, on the inlet to the battery pipe

The pipes diameter, their material, the opportunity of thermal insulation shall be decided each time according to the dimension of the plant and its purpose; for the following reasons plastic pipe are preferable (indispensable for swimming pools):

. less pressure drop with the same diameter,

. the calcium scales are reduced or eliminated

. resistance to corrosion, absolutely important in the case of swimming-pools plant or for winter protection by sodium chloride brine

. lightness and assembly quickness.

The plastic pipes must withstand at the operating conditions of the solar panels (pressure, temperature UV.) and must be made of materials allowed to alimentary applications.

The solar panel can not operate at a pressure higher than 3 bar; hence, when necessary, a pressure reducer must be provided.

If the water has many impurities, it is preferable to install a filter.

Almost one of the 2 pipes, preferably that of the outlet, must not be fixed to the supporting surface; it must be left free to move according to the thermal dilatation of the battery.

MAINTENANCE

ntegrity of the plant

Installed the plant, perform the final inspection in order to verify the hydraulic tightness, the predicted water flow rates and the proper operating of the controls; for small plant it could be sufficient just a qualitative inspection.

Periodically, monthly at the first times, repeat the same tests performed during the final inspection in order to notice possible operating variations; in particular a reduction of the water flow would signalise the forming of obstructions.

Almost once a year and after periods with especially strong wind, verify the connections between the solar panels and the fastening to the supporting surface. Verify that there is no deterioration of the fastening structure.

Spry water to clean the panels if they are dirty with sand or earth; dirtiness reduces the performances.

Calcium scales deposits and dirtiness into the channels

Direct heating of water from the mains.

The calcium does not adhere to the compound with which the **Sunnyday** solar panel are made; also the thermal dilatation collaborate to continuously prevent any adhesion: thus **Sunnyday** is the ideal solar panel for the direct heating of running water.

Notwithstanding that, a gradual deposit of impurities of whichever nature, organic and inorganic, always present in running water, can lead to the starting of scales deposits and then to the necessity of a periodic cleaning. If this would happen it would be revealed by a progressive reduction of the water flow. The cleaning of the panels can be performed with the liquids normally utilised to remove scales from pipes, furnaces and heat exchangers; **Sunnyday** is perfectly compatible with the acid substances utilised at the scope: if for lack of attention the cleaning is acted when relevant occlusions have permitted the deposit of scales in a compact form, they can be broken dismounting the panels and rolling or simply shacking them.

Swimming-pools heating

Sunnyday is made with the most suitable material to withstand to the chlorinated swimming-pool water; moreover, being the water filtered, there is no risk of occlusion of the channels.

Winter protection

In the sea resorts, where the winter garaging of all the equipment is a normal practise, also the solar panels can be easily dismounted as the rest.

Anyway this is no necessary, since **Sunnyday** is flexible down to -20, -25 °C; a breakage due to fragility under the action of the wind is possible just under these temperature if the panels are not well fixed.

the contrary, the freezing of the water within the channels must be prevented; two methods are suggested:

Emptying of the plant

(For panels installed on surfaces having a slope of almost 40%)

Empty almost all the outer part of the plant, panels and pipes. To assure a complete drainage, verify that the air can go in from the upper side and that there are not loops in the panels, counter slopes in the pipes or occlusions in which the water could stagnate.

The drainage should not considered certain for a slope less than 40 %.

Water and sodium chloride brine

(especially for small slopes or horizontal installation)

The plant shall not be drained but a solution of sodium chloride (in the commercial form of salt for alimentation or agriculture) can be introduced in the plant ad anti-freezing system. The table 3 indicates the theoretic concentrations of pure sodium chloride for various freezing temperatures; utilising commercial salt, of unknown purity, the freezing temperatures will be higher. The necessary quantity of salt is calculated by the total weight of water contained in the plant (panels + outer pipes); increase the theoretic quantity of at least the 10%.

A method is suggested to put into solution the sodium chloride:

.connect, by means of two shut-off valves, a tank provided of a cap to the extremities of the part of plant exposed to the frost (the transparent container of the cartridge filter will be suitable at the scope);

.in sequence to the tank put a small circulating pump having stainless steel or plastic impeller and scroll;

.pour in the container the necessary salt ad fill with water;

.put into circulation the brine until the salt continues to dissolve; if all the salt dissolves introduce more of it, until a residual part will remain solid in the container.

Air gap in the loop could not allow the complete diffusion of the salt.

The sodium chloride does not cause damages to the solar panels but the rest of the plant must be made of compatible materials (see ***Connection to the plant***).

For forced circulation plant the same pump of the normal operation will be used; the storage tank shall be cut out from the loop by-passing it through the container of the brine.

WARNING

The present information and suggestions, as far as they are detailed, cannot be exhaustive for all the possible kind of plant and situations; they presume therefore the experience and the responsibility of skilled installers; our offices are at disposition for further clarification and particular applications.

The characteristics of the **Sunnyday** solar panel as well as the data and information here contained can be changed without warning.

DATA SHEETS

Tab. 1

Chemical and physical characteristics

Material	Polypropylene compound admitted for alimentary utilisation
Chemical resistance	Corrosion-proof Not degradable by electrolysis Not degradable by UV- Flexible until -25 °C approx.
Thermal dilatation	About 10 mm/m for a variation of 100 °C

Tab. 2

Mechanical characteristics

Maximum operating temperature 93 °C
Maximum operating pressure 3 bar at 80 °C

		SD3000	SD4000	SD6000	SD9000	SD12000	non-standard models
Absorbing surface	m2	0,93	1,24	1,86	2,79	3,72	0,31 m2/m length
Collector weight	kg	2,3	2,97	4,24	6,16	8,07	0,45 + 0,63 kg/m length
Water content	kg	3,16	3,95	5,52	7,87	10,23	0,76 kg + 0,79 kg/m length
Minimum suggested water flow	l/h	46,5	62	93	139,5	186	50 l/h m2 of solar panel
Corresp. pressure drop	mm	0,83	1,8	5,6	16,9	37,4	
Optimal suggested water flow	l/h	93	124	186	279	372	100 l/h m2 of solar panel
Corresp. pressure drop	mm	2,86	6,1	18,7	57	125,7	

Tab. 3

Head losses trough the inlet - outlet headers as a function of the flow trough the collectors battery

G	**lt/h**	- flow at the header inlet
v	**m/s**	- water speed at the header inlet
Dp	**mm/m**	- head losses of the inlet - outlet headers per m of width of the battery

G	100	200	300	500	750	1000	1250	1500	2000	2500	3000	4000	5000	6000	7000	8000
v	0,02	0,050	0,07	0,12	0,17	0,24	0,29	0,35	0,47	0,58	0,70	0,93	1,16	1,40	1,63	1,86
Dp	0,04	0,137	0,28	0,68	1,38	2,29	3,38	4,65	7,70	11,40	15,60	25,60	38,30	52,60	68,90	87,18

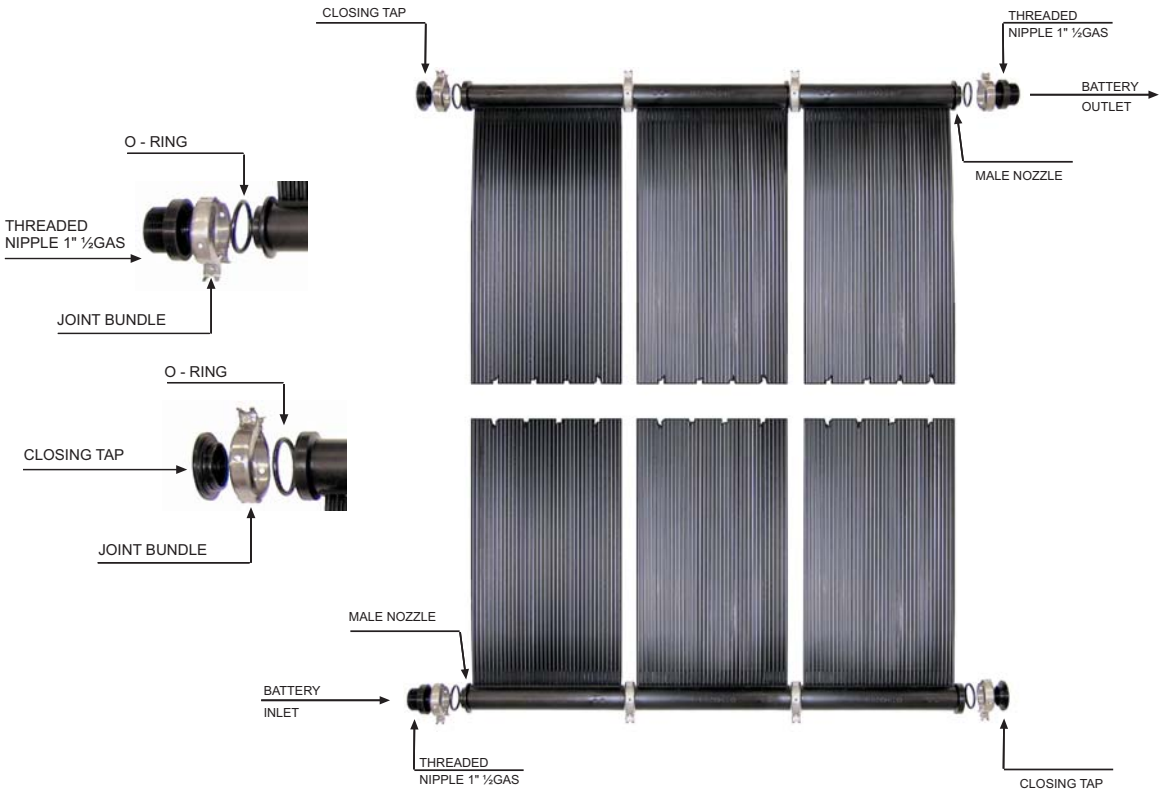
Tab. 4

Pure sodium chloride (NaCl) concentration necessary to decrease the freezing temperature

freezing temperatures	°C	-5	-10	-15	-20,6
NaCl concentration	% in weight	8	15	20	23

It is impossible, utilising NaCl, to avoid frost under -20.6 °C

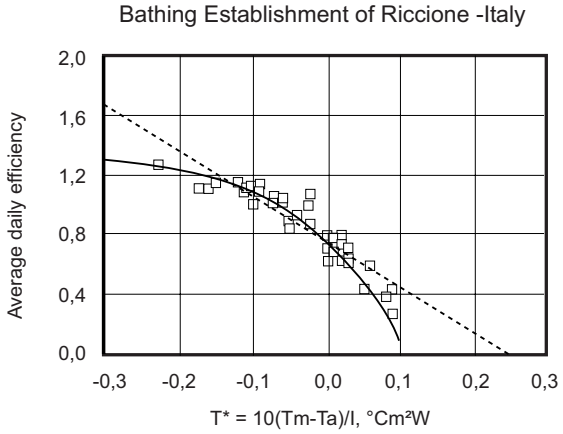
DRAWINGS AND DIAGRAMS



EFFICIENCY FIGURES

Average daily efficiency

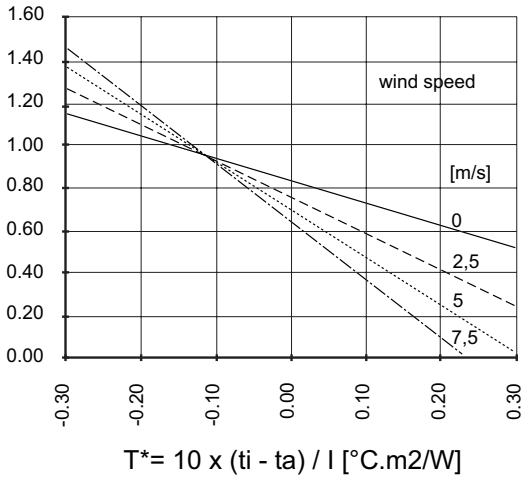
Measured by ENEA, Italian Board for Alternative Energies, on the field(Presented at 44° Congresso Nazionale della Associazione Termotecnica Italiana - Cosenza 1989)



Tm = aver. temp. within the collector [°C]
Ta = aver. daily ambient temp. [°C]
I = aver. daily radiation on horizontal surface [W/m2.°C]

Instantaneous efficiency

For various wind speeds



T*= 10 x (ti - ta) / I [°C.m2/W]

ti = inlet water temperature [°C]
ta = ambient temperature [°C]
I = radiation on horizontal surface[W/m2.°C]