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SOLAR-ENERGY

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PRODUCTS

PRODUCT RANGES

ESP- Solar Energy “Solar Thermal-Vacuum Tubes” systems are mainly used for generating hot water for any application.

There are two main categories in “ Solar Thermal-Vacuum Tubes” systems:

“Passive” & “Active”

A **“Passive”** system relies on a natural principle “Thermosiphon”. In these system, the storage cylinder is always located higher than the Vacuum Tube collectors. As the sun’s rays hit the surface of the collector, the temperature of the fluid in the collectors rises making it less dense or lighter. This hot and lighter fluid naturally moves to the top of the collector and after that to the top of the storage cylinder, transferring the energy from the Vacuum Tubes collector to the storage cylinder after that to the heat exchanger. This makes the fluid colder and heavier and moves to the bottom of the Vacuum Tubes collector. This continuous displacement occurs naturally. These are often referred to as:
“PASSIVE” OR “ THERMOSPHON” systems.

An **“Active”** system uses a circulation pump, operated by an electronic controller, which circulate the closed circuit fluid or potable water, through the Vacuum Tube collectors, normally located on the roof, is transferred to the closed circuit fluid or potable water and returned to a storage cylinder, normally located at ground level below the level of the Vacuum Tube collectors. These systems are referred to as:
“ACTIVE” OR “PUMPED” OR “SPLIT” systems.

A further classification in solar thermal system is the **“Open Circuit”** system and the **“Closed Circuit”** system.

In an **“Open Circuit”** system the potable water flows through the Vacuum Tube collectors after that to the storage cylinder after that to the out let connection.
In a **“Closed Circuit”** system the potable water flows through the Vacuum Tube collectors after that to the storage cylinder and transfer the heat to the heat exchanger which is connected to the out let connection.

THE PRODUCT RANGE

Passive “Thermosphon” system – “Open Circuit”
Passive “Thermosphon” system – “Closed Circuit”
Active “ Pumped” system – “Open Circuit”
Active “ Pumped” system – “Closed Circuit”

PRODUCTS

"PASSIVE" OR "THERMOSIPHON" SYSTEMS

This group of products is normally referred to as **"Passive" or " Thermosiphon"** systems and comprises

- A Storage Cylinder
- 15 to 30 Vacuum Tubes collector

The storage cylinder is of two types:

- "E" Cylinder for "Closed Circuit" systems
- "O" Cylinder for "Open Circuit" systems

The "E" Cylinder is constructed with HEAT EXCHANGER
The "O" Cylinder is constructed without HEAT EXCHANGER

All the above cylinders are insulated with high density CFC free polyurethane foam and encased in galvanized heat painted iron

Each type of cylinders is manufactured in several storage capacities:

- 150 liters
- 200 liters
- 300 liters

All types of cylinders are suitable for mains pressure connection with maximum inlet pressure of 8 bar

Vacuum Tubes are manufactured and supplied to suit both the open circuit and closed circuit systems.

- "NP" Vacuum Tubes "Nun Pressure" suitable for both "Open & Closed circuit" systems.

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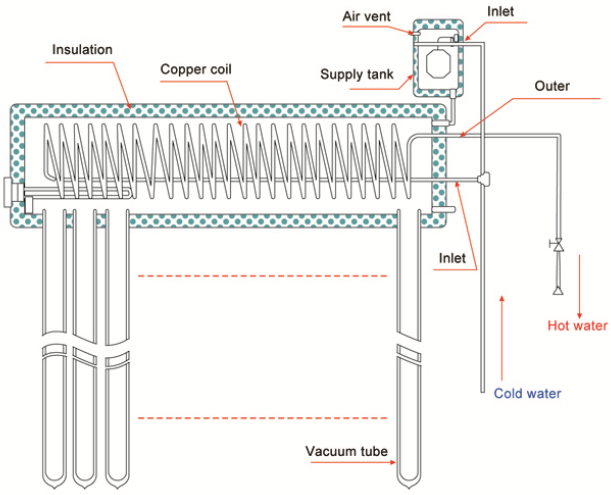
HOW PRODUCTS WORK AND PRODUCT FEATURES

"PASSIVE" OR "THERMOSIPHON" SYSTEMS

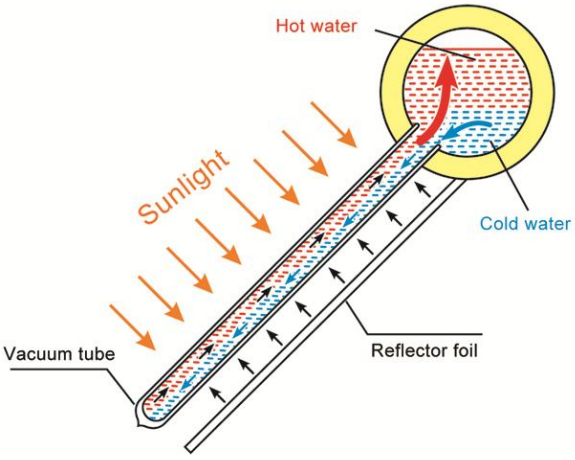
The ESP-Solar Energy "Passive" solar hot water systems rely on the natural thermosiphon principle for circulation of the heated water or fluid in the Vacuum Tubes collector to the storage cylinder. As the solar radiation heats the water or fluid within the Vacuum Tubes collector it becomes less dense and therefore lighter than the water or fluid stored above it in the storage cylinder. This cause the cold (heavier) water or fluid to flow down to the vacuum Tubes collector and push the heated (lighter) water or fluid up into the storage cylinder.

The flow rate through the Vacuum Tubes collector circuit is dependant upon the temperature difference between the storage cylinder and the Vacuum Tubes collector. The greater the temperature difference, the higher the flow rate. As the sun leaves this cause the thermosiphon circulation to stop. There is no heat loss from the storage cylinder.



CLOSED CIRCUIT THERMOSIPHON FLOW PATTERN

The Vacuum Tubes collector is heating the water and transfer it to the storage cylinder using the natural thermosiphon principle for circulation of heated water in the Vacuum Tubes collector to the storage cylinder, the hot water in storage cylinder transferring the energy (Heat) to the heat exchanger witch coming in circles and the heat exchanger transferring the heat energy to the water witch moving inside the heat exchanger for use.
This movement of the water is a continuous process.



OPEN CIRCUIT THERMOSIPHON FLOW PATTERN

The Vacuum Tubes collector is heating the water and transfer it to the storage cylinder using the natural thermosiphon principle for circulation of heated water in the Vacuum Tubes collector to the storage cylinder for direct use.
This movement of the water is a continuous process.

HOW PRODUCTS WORK AND PRODUCT FEATURES

"PASSIVE" OR "THERMOSIPHON" SYSTEMS

STORAGE CYLINDER – Special Features

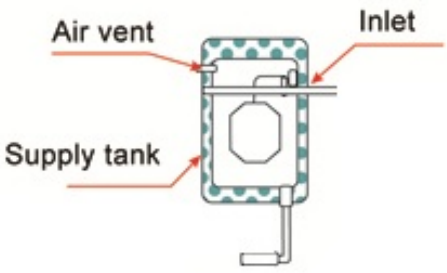
ESP-Solar Energy storage cylinders are fabricated from Stainless steel (SUS-304 BA) food grade Un-magnetic for (Inner tank) and from Painted Galvanized steel sheet for (Outer Tank)

STORAGE CYLINDER – Insulation

ESP-Solar Energy storage cylinder is fully encased in pressure injected polyurethane foam with thickness of (50-60 mm). This has a very low thermal conductivity

STORAGE CYLINDER – Heat Exchanger

The Heat Exchanger is made of copper because it's one of the best metals and it's very high thermal conductivity. The heat exchanger is fabricated with diameter of 19mm to confirm high flow rate from the system



FEEDING & PRESSURE TANK

The Supply or feeding & pressure tank it's coming in the top of the storage cylinder right side and it's responsible of :

- Feeding the storage cylinder with water
- Saving the storage cylinder and the vacuum tubes collector from the high pressure (when the storage cylinder is full with water the float inside the feeding tank will close the valve).
- Release the steam inside the storage cylinder by the "Air Vent" valve

REMOTE-CONTROL SYSTEM

The remote control system is coming with each system to help the user to control his system easily from home, and the benefits of this system is:

- Control of water temperature
- Ability to feed water manually or automatically
- Alarm notification when there is a water shortage in the tank
- Simultaneous control of temperature and water quantity
- Programming of timing & Operation of the electric heater when necessary
- Programmable timer for water feeding
- Possibility to control feeding pumps if required
- Automatic correction of errors
- Light signal notification to show temperature of activated electric valves, feeding, water volume in to the system, Pump, electric heater, etc..
- Facilitated adjustment of the water level depending on specific temperature
- long memory to save the user setting for 72 hour without electricity
- Automated timer to control both the water level & temperature

HOW PRODUCTS WORK AND PRODUCT FEATURES

"PASSIVE" OR "THERMOSIPHON" SYSTEMS

IMPORTANT INFORMATION

• We must use one of this devices ("Feeding & pressure tank" OR "Remote control system") with each ESP-Solar Energy thermosiphon unit to control the feeding & pressure of the unit.
• Don't connect the feeding connection directly to the storage cylinder, the vacuum tubes will be damage with the pressure.
• The remote control system is in-door system, Don't install it out door.

APPLICATIONS

The "Passive" or Thermosiphon ESP-Solar Energy systems can be used in domestic hoses, Villa's, Palaces, Restaurants, Health Clinics, Health clubs and similar establishments.
For greater hot water demands, multiples of these systems can be used.

HOW PRODUCTS WORK AND PRODUCT FEATURES

VACUMM TUBES OR COLLECTORS

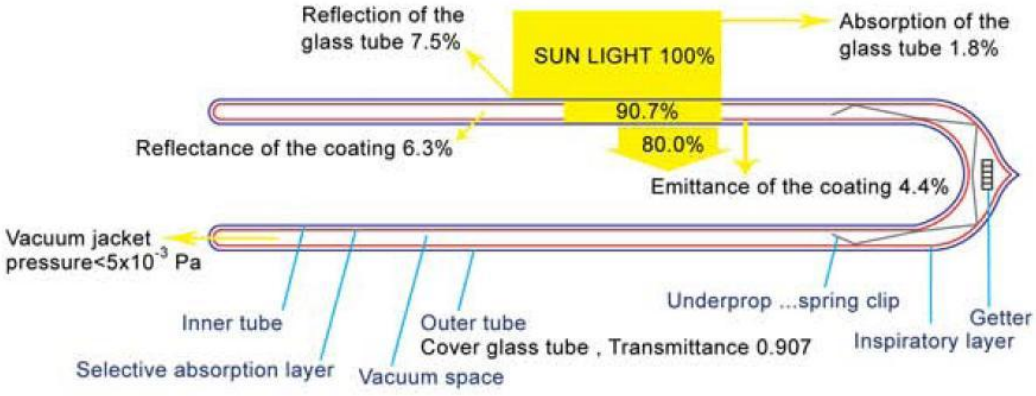
VACUMM TUBES 58/1800:

They are the tubes that absorb sunray and convert it to heat for use in heating water, either directly (thermal siphon) or indirectly (thermal copper pipes).
These tubes were first used in Germany then spread to Canada, Australia and U.K. and China and Other world countries gradually.

There are many types of vacuum tubes which are used in a number of fields for heating water. Double glass pipes are the most common in use.
This type is usually chosen for its easy use and Low cost (practical apparatus easily used) and for its high output and long life.
The long life of the vacuum tube from (ESP-Solar Energy) comes from the high stability of the tube characteristics such as (absorption capacity – insulation – reflection) which do not change with the passage of time, a thing resulting from 36 stages of manufacturing processes and testing which the tube passes through in order to realize this quality.

VACUMM TUBES SPECIFICATIONS:

• The outer pipe is transparent that allows sunray and light to penetrate it easily and with a very low reflection rate because it is cylindrical in shape and as a result sunray falls vertically on the pipe at all times.
• The inner pipe is electro-statically plated with three layers:
1-The first layer: a metal one its function is to absorb the infrared ray which enters the pipe.
2-The second layer: Porcelain one which prevents the reflection of the sunray entering the pipe.
3-The third layer: Carbon film its function is to absorb sunray.
• The space between the two pipes is vacuumed at a rate larger than ($5x10^{-4}$) Pascal, which forms a highly efficient insulating layer which secures the high duty of the pipe, in the way that absorbed sunray shall not be lost.
• The insulation capacity of the pipe is high so that the inside temperature of the pipe may reach 150C° while the outer pipe is cool on touch. This Means that the vacuumed pipes can work at heavy duty even at very low temperature, while the solar flat plate cannot operate in such climates.



SYSTEM SELECTION

Step By Step Process

This Section – SYSTEM SELECTION is dedicated to selecting an appropriate system for a particular project.

A step by step method guides the reader through the selection process

The relevant information sheets are included in this section as a quick guide and reference.

- Step 1: Determine Hot Water Requirement.
  Refer " Load Calculation"

- Step 2: Load Calculation "EXAMPLES"

- Step 3: Important Pointers.

SYSTEM SELECTION

LOAD CALCULATIONS

The hot water requirement for showers, hand washes, dish washing, laundry etc, are based on industry experience. The table below is a guide to determine the hot water demand for most facilities.

HOT WATER REQUIREMENTS GUIDE:

DEVICE	LOCATION	HOT WATER REQUIREMENTS IN LITRES @ 60^0 C	
Shower	Aged Homes	18	Per Person
	Domestic Dwelling	18	Per Person
	Caravan Parks	18	Per Person
	Hotels/Motels	18	Per Person
	Mining Towns	25	Per Person
Baths	Domestic Dwellings & Hotels	60	Per Person per day
	Hand Wash Domestic Dwellings	2	Per Person per day
	Offices	1	Per Person per day
	Hotel Guests & Staff	5	Per Person per day
Dish Washing Sinks	Domestic Dwellings	7	Per Sink Full
	Hotels/Motels	10	Per Sink Full
Glass Washers	Hotels/Motels/Bars	2	Per Person
	Restaurants	5	Per Person
Laundry	Domestic Dwellings	10	Per Person
	Mine Site	15	Per Person
	Hotels/Motels	10	Per Person
	Hospitals	10	Per Person
Ring Main Losses	Good Condition-Small (< 100m)	Add 10%	To Total Demand
	Good Condition-Large (>100m)	Add 15%	To Total Demand
	Large or Poorly Insulated	Add 30%	To Total Demand

SYSTEM SELECTION

LOAD CALCULATIONS

IMPORTANT POINTERS:

To determine the hot water demand for new project or existing facilities the above table can be used as a guide. This table has been devised based on industry experience and provides an estimate for the designer to select an appropriate system.

The best and most recommended method for accurately determining the hot water demand or consumption of an existing facility is to measure the actual consumption. Over a two weeks period, record the water and energy consumption of the existing hot water service by installing relevant meters as detailed below:

- Water Meter at the cold inlet to the existing hot water service to measure the water consumed in liters.

- Hour Meter to the electric element to record the number of hours the element is on. This figure along with the element rating in kilowatts will give the amount of electric energy used.

- Gas Meter to measure the amount of gas consumed if the existing hot water service is a gas fired boiler.

- Record the oil consumption if the existing hot water service is an oil fired boiler.

- The above information will help accurately determine the water consumed, the corresponding energy consumed and also the performance or efficiency of the existing hot water service.

SYSTEM SELECTION

LOAD CALCULATIONS (EXAMPLES)

RESIDENTIAL DWELLINGS - HOUSEHOLD			
Number of Persons	4		
Number of Showers Per Person Per Day	2		
Total Number of Showers Per Day	8		
Total Hot Water Per Shower @ @ 60^0 C	18		Liters
Total Hot Water For Showers		**144**	**Liters/Day**
Hand Washes Per Person Per Day	2		
Total Number of Hand Washes	8		
Hot Water Per Hand Wash @ 60^0 C	2		Liters
Total Hot Water For Hand Wash		**16**	**Liters/Day**
Number of Meals Per Day	3		
Hot Water Per Dish Wash @ 60^0 C	10		Liters
Total Hot Water For Dish Washing		**30**	**Liters/Day**
Hot Water for Laundry Per Person Per Day @ 60^0 C	10		Liters
Total Hot Water For Laundry		**40**	**Liters/Day**
TOTAL HOT WATER REQUIREMENT @ 60^0 C		**230**	**Liters/Day**

RESIDENTIAL DWELLINGS – DUAL OCCUPANCY			
Number of Persons	2		
Number of Showers Per Person Per Day	2		
Total Number of Showers Per Day	4		
Total Hot Water Per Shower @ @ 60^0 C	18		Liters
Total Hot Water For Showers		**72**	**Liters/Day**
Hand Washes Per Person Per Day	2		
Total Number of Hand Washes	4		
Hot Water Per Hand Wash @ 60^0 C	2		Liters
Total Hot Water For Hand Wash		**8**	**Liters/Day**
Number of Meals Per Day	3		
Hot Water Per Dish Wash @ 60^0 C	5		Liters
Total Hot Water For Dish Washing		**15**	**Liters/Day**
Hot Water for Laundry Per Person Per Day @ 60^0 C	10		Liters
Total Hot Water For Laundry		**20**	**Liters/Day**
TOTAL HOT WATER REQUIREMENT @ 60^0 C		**115**	**Liters/Day**

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SYSTEM SELECTION

LOAD CALCULATIONS (EXAMPLES)

MINE SITE			
Number of Persons	4		
Number of Showers Per Person Per Day	2		
Total Number of Showers Per Day	8		
Total Hot Water Per Shower @ 60^0 C	25		Liters
Total Hot Water For Showers		**200**	**Liters/Day**
Hand Washes Per Person Per Day	2		
Total Number of Hand Washes	8		
Hot Water Per Hand Wash @ 60^0 C	2		Liters
Total Hot Water For Hand Wash		**16**	**Liters/Day**
Number of Meals Per Day	3		
Hot Water Per Dish Wash @ 60^0 C	10		Liters
Total Hot Water For Dish Washing		**30**	**Liters/Day**
Hot Water for Laundry Per Person Per Day @ 60^0 C	15		Liters
Total Hot Water For Laundry		**60**	**Liters/Day**
TOTAL HOT WATER REQUIREMENT @ 60^0 C		**306**	**Liters/Day**

CARAVAN PARK			
Number of Persons	20		
Number of Showers Per Person Per Day	2		
Total Number of Showers Per Day	40		
Total Hot Water Per Shower @ @ 60^0 C	18		Liters
Total Hot Water For Showers		**720**	**Liters/Day**
Hand Washes Per Person Per Day	2		
Total Number of Hand Washes	40		
Hot Water Per Hand Wash @ 60^0 C	2		Liters
Total Hot Water For Hand Wash		**80**	**Liters/Day**
Number of Meals Per Person Per Day	3		
Number of Meals Per Day	60		
Hot Water Per Dish Wash @ 60^0 C	6		Liters
Total Hot Water For Dish Washing		**360**	**Liters/Day**
Hot Water for Laundry Per Person Per Day @ 60^0 C	10		Liters
Total Hot Water For Laundry		**200**	**Liters/Day**
TOTAL HOT WATER REQUIREMENT @ 60^0 C		**1360**	**Liters/Day**

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SYSTEM SELECTION

LOAD CALCULATIONS (EXAMPLES)

HOTEL			
Number of Rooms	100		
Number of Person Per Room	2		
Total Number of Persons	200		
Hot Water Per Person Per Shower @ @ 60^0 C	18		Liters
Hot Water Per Person For Hand Washes @ 60^0 C	5		Liters
Hot Water Per Person For Dish Wash (Kitchen) @ 60^0 C	5		Liters
Hot Water Per Person For Laundry Per Day @ 60^0 C	10		Liters
Total Hot Water Per Person Per Day	38		Liters
Total Hot Water For Hotel Guests		**7,600**	**Liters/Day**
Total Staff	25		
Hot Water Per Staff Per Day @ 60^0 C	5		Liters
Total Hot Water Per Staff Per Day		**125**	**Liters/Day**
Hot Water Requirement Per Day @ 60^0 C		**7,725**	**Liters/Day**
Ring Main Losses – Small (<100m) @ 10^0 C		**773**	**Liters/Day**
TOTAL HOT WATER REQUIREMENT @ 60^0 C		**8,498**	**Liters/Day**

HOSPITAL			
Number of Beds	100		
Hot Water Per Person Per Shower @ @ 60^0 C	20		Liters
Hot Water Per Person For Hand Washes @ 60^0 C	5		Liters
Hot Water Per Person For Dish Wash (Kitchen) @ 60^0 C	5		Liters
Hot Water Per Person For Laundry Per Day @ 60^0 C	10		Liters
Hot Water Per Person For Clinic Per Day @ 60^0 C	5		Liters
Hot Water in Surgery Per Person Per Day @ 60^0 C	5		Liters
Total Hot Water Per Person Per Day	50		Liters
Hot Water Requirement Per Day @ 60^0 C		**5,000**	**Liters/Day**
Ring Main Losses – Small (<100m) @ 10^0 C		**1,500**	**Liters/Day**
TOTAL HOT WATER REQUIREMENT @ 60^0 C		**6,500**	**Liters/Day**

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