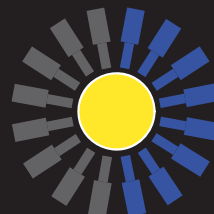
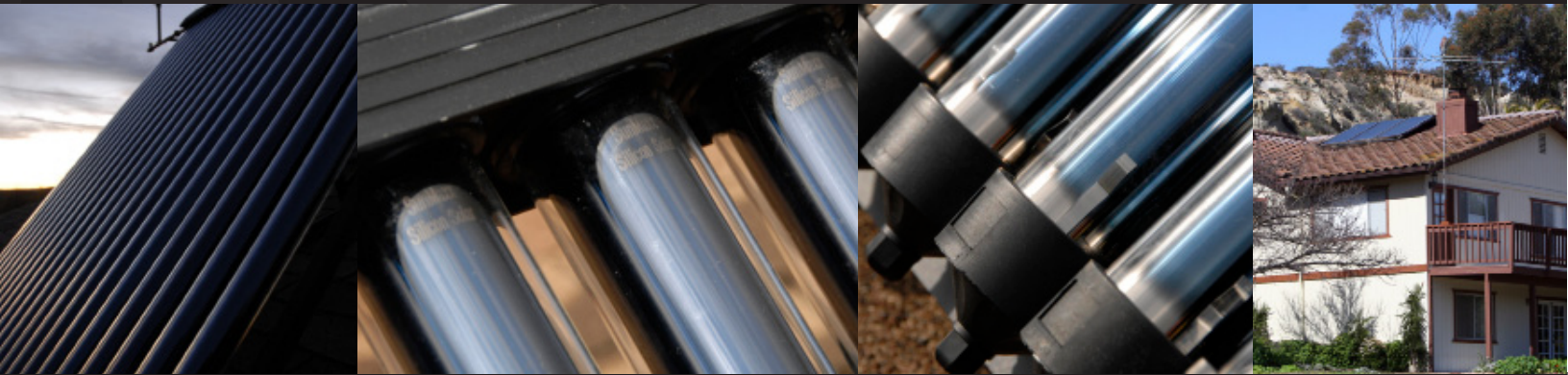


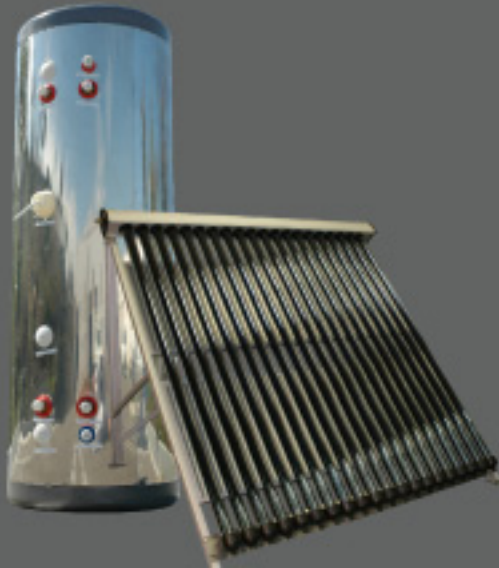
# SunMaxx™

## Information Guide: Domestic Hot Water



# SunMaxx™

## Information Guide: Domestic Hot Water



Domestic hot water is the water that you use everyday around the home for taking a shower, washing your hands, doing laundry and do the dishes. Typically, this water is heated using fossil fuels or electricity.

A SunMaxx solar thermal system can use the free heat of the sun to provide 75%, or more, of your domestic water heating needs. Reducing your dependence on oil, natural gas or electricity for water heating, cutting your energy bills dramatically in the process. In fact, the average American household spends more than 20% of their annual total energy bills on just domestic hot water.

The average American uses 20 gallons of hot water per day. Therefore, the average four family home uses about 80 Gallons of hot water per day, and a six family home around 120 gallons. With today's rising fuel and energy costs, it is not hard to see why domestic hot water accounts for such a sizable portion of your energy bills.

Luckily, every SunMaxx solar collector can be used for domestic hot water. We also carry a large selection of pre-packaged solar hot water kits featuring all of the major components needed to design and install a new solar hot water system.

Typically, a solar hot water system will include the following major components:

- Solar collectors (evacuated tube or Flat Plate)
- Solar storage tank or heat exchanger
- Differential temperature controller
- Circulator pump(s)
- Expansion tank/vessel
- Key plumbing components

SunMaxx also carries a line of thermo-syphon kits, which are designed to be a simple, on-demand hot water system for domestic hot water, which require no pumps or controllers to operate in their simplest form.

In this guide, you will learn the basics (and specifics) of solar domestic hot water systems, and to selecting the right SunMaxx components for your new SunMaxx solar hot water system.

# Domestic Hot Water

## Determining Your Hot Water Usage

You can use the table below to estimate the amount of domestic hot water used daily per occupant. This figure (or your actual hot water usage) can be used to help size a SunMaxx solar hot water system.

Type of Building	Consumption (G/day)	Peak Demand (G/hr)
Hospital	5 - 10	2
Hotel	20 - 35	10
House / Apartment	20 - 35	10
Office	5	2
College	25	4
School	3	2

Using these figures, you can estimate the amount of hot water consumed by your household in a typical day. For instance:

- House, 3 residents: 60 - 105 G/day

By knowing the amount of hot water you require, you can begin to determine the size domestic solar hot water system you will need. Typically, SunMaxx recommends that you size your solar hot water system to provide roughly 70% of the annual water heating load of your home.

The easiest way to size your SunMaxx solar hot water system is by determining the heating load in BTU's. You can determine the heating load with the following information:

- Gallons of hot water consumed per day
- Cold water temperature
- Desired hot water temperature

It takes 8.34 BTU to raise the temperature of 1 gallon of water 1 °F. So, if we assume the following:

- 3 residents: 60 g/day
- Cold water temperature: 50 °F
- Desired water temperature: 130 °F

BTU needed = (8.34 x 60) x 80

BTU needed = 40,000 BTU/day

You should size your SunMaxx solar hot water system to meet close to 100% of your need on a bright summer day.

## Solar Hot Water Buying Process

Using the following step-by-step process, you will be able to choose the right solar collectors, components, or pre-packaged solar hot water kit to meet your needs, your location and your budget. You can then refer to the following pages, which give a more extensive break down of the different steps in the process.

### 1. Select the Right SunMaxx Solar Collector

There are two main types of solar collectors from SunMaxx - flat plate solar collectors and evacuated tube solar collectors, and determining which one is best suited for your solar hot water system is as simple as looking at a map and picking the solar collector best suited to work in your location and climate.

**Flat plate solar collectors** are designed for use in warmer climates where freezing temperatures are not a major concern. This typically means the South East, South West, and most areas along the west coast of the United States.

**Evacuated tube solar collectors** are designed to provide incredible performance in colder, freezing climates, where flat plate solar collectors would begin to lose its efficiency, and may become damaged by freezing. While evacuated tube solar collectors are more expensive than flat plates, in these colder climates, they have a higher return on investment and a shorter payback period.

### 2. Choose a storage tank or heat exchanger

Your domestic solar hot water system can be designed and installed in a number of different ways. If you plan to keep your existing hot water storage tank/heater, you can use a solar hot water storage tank as a pre-heat tank in series with your current tank, or you can use a brazed plate heat exchanger to pre-heat your potable water before it enters the existing hot water tank.

If, however, there is no existing hot water tank/heater, or you plan to completely replace it, you can use just a solar hot water storage tank, which has internal heat exchangers for the solar heating and a place for a backup electric heating element, to make for the solar heating at night, or during extended periods of cloudy weather.

Whichever option you choose, you should choose a storage tank that will hold enough water for your family to use in a normal day. Typically, the average person uses 20 gallons of hot water per day.

## Solar Hot Water Buying Process *cont.*

You can undershoot the size of the storage tank a little bit, because as hot water is used, it will be replaced with cold water which will then be heated within the tank, maintaining the proper level of hot water on hand when it is needed.

### 3. Select Your pre-packaged domestic solar hot water kit

To make purchasing a solar hot water system even easier, SunMaxx offers a number of pre-packaged domestic solar hot water kits, sized for households from 2-6 people. There are two main types of pre-packaged domestic solar hot water kits:

- **Pre-packaged kits with solar hot water storage tanks**
  - Includes models built with SunMaxx evacuated tube solar collectors
  - Includes models built with SunMaxx flat plate solar collectors
- **Pre-packaged kits with solar hot water heat exchangers**
  - Includes models built with SunMaxx evacuated tube solar collectors
  - Includes models built with SunMaxx flat plate solar collectors

Please see the last page of this brochure for available pre-packaged domestic solar hot water kits from SunMaxx.

1. Select Correct Solar Collector

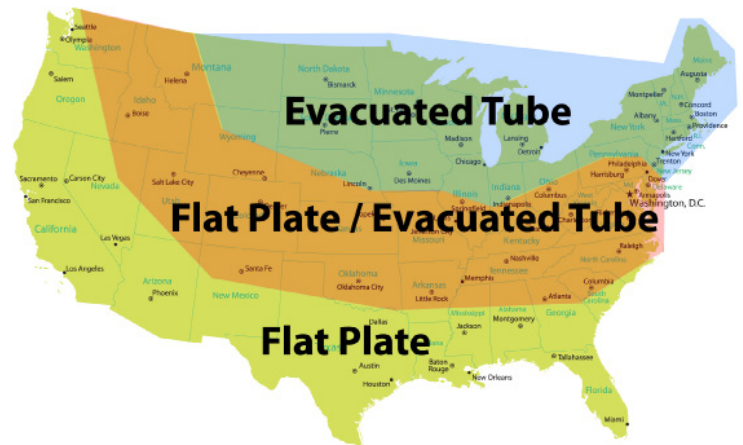
2. Storage Tank or Heat Exchanger

3. Choose Your Pre-Packaged Kit

## Evacuated Tubes vs Flat Plates

Both evacuated tube solar collectors and flat plate solar collectors are extremely affordable, and highly-efficient solar collectors. However, there are distinct differences, and advantages of these solar collectors when compared to each other.

You can use the map below to see where SunMaxx recommends that customers use flat plate solar collectors vs evacuated tube solar collectors, and vice-versa.



Below, explore the differences between evacuated tube and flat plate solar collectors to help you make a more informed decision on which solar collector is the right choice for you.

### Efficiency

Both evacuated tube and flat plate solar collectors are extremely efficient. However, flat plate solar collectors have an overall higher efficiency. But, for customers who live in colder, northern climates, evacuated tube solar collectors provide more reliable, efficient performance in colder temperatures (down to -60 °F) making them the clear choice in these locations.

### Price

Both types of solar collectors are affordable. Flat plate solar collectors, because of their simplistic design and manufacturing have a lower initial price. But, again, in colder climates, the extended performance of evacuated tube solar collectors makes them significantly more cost-effective in the long run.

### Durability / Reliability

While flat plate solar collectors are extremely reliable and durable, should a problem occur with one flat plate collector, the

## Evacuated Tubes vs Flat Plates *cont.*

entire system must be shut down, and the entire collector(s) must be replaced. Evacuated tube solar collectors, however, are modular by nature, and should a single tube (or multiple tubes) break for any reason, the system will continue to operate, and may be kept functioning while the tubes are replaced.

Choosing the solar collector that will make your new SunMaxx solar hot water system efficient, cost-effective, and affordable is the key to your investment, and will ensure long-term growth in your energy savings, especially the cost of traditional heating fuels continues to rise.

## Solar Storage Tank or Heat Exchanger

Whether you should use a solar hot water storage tank or a brazed plate heat exchanger depends on a few factors. This is also an important factor in choosing your solar hot water system because a solar hot water storage tank will cost hundreds of dollars more than a heat exchanger. However, in many applications, it is more efficient and cost-effective to purchase a solar hot water storage Tank because your return on investment tends to be higher and your payback period tends to be shorter, though your initial investment will be higher.

### Solar hot water storage tanks

Solar hot water storage tanks are an affordable way to provide to hot water storage and solar heating capacity to your solar hot water system in one component, with minimal system alteration and plumbing work.

### SunMaxx solar hot water storage tank features:

- Outer finish: stainless steel or painted steel
- Tank material: stainless steel
- Internal copper coil heat exchangers
  - 1 in 40/50 gallon tanks
  - 2 in 80 gallon tanks
- Increased efficiency and r-value

### Pros & cons:

- Designed to provide solar heating and hot water storage in one component
- Built in heat exchangers
- Designed to be used with SunMaxx solar hot water systems

### Used for system types:

- Where the solar storage tank will be a pre-heat tank for the existing hot water tank/heater
- New construction/installation where no hot water tank heater exists
- Where the existing hot water tank/heater will be completely removed and replaced

### Solar Storage Tanks

Model	Capacity	Outer Finish	Heat Exchangers
40SS1HX	40G	Stainless	1
40PS1HX	40G	Painted	1
50SS1HX	50G	Stainless	1
50SS2HX	50G	Painted	2
80SS1HX	80G	Stainless	1
80SS2HX	80G	Stainless	2
80PS1HX	80G	Painted	1
80PS2HX	80G	Stainless	2

### Solar hot water heat exchangers

Brazed plate solar hot water heat exchangers are an even more affordable to utilize SunMaxx solar collectors and systems in your current domestic hot water system. The key advantage is that these heat exchangers utilize your existing hot water storage tank/heater, eliminating the need to purchase a pricey solar hot water storage tank.

### Brazed plate heat exchanger features:

- Copper and steel construction
- Easy, quick plug 'n' play installation
- Available in 10, 20 and 30 plate models

### Pros & Cons:

- Use your existing hot water tank/heater in your solar hot water system
- Lower cost investment than a solar hot water storage tank
- Easily integrates into any domestic solar hot water system

### Used for System Types:

- Where the existing hot water tank/heater will be used to pre-heat potable water before it enters the tank

## Solar Storage Tank or Heat Exchanger *cont.*

Model	# of Plates	BTU/hr
39-0010	10	90K
39-0020	20	100 - 175K
39-0030	30	200 - 275K

## Pre-Packaged Solar Hot Water Systems

Silicon Solar manufactures a variety of pre-packaged solar hot water systems designed to meet the needs of a variety of system size needs, locations and budgets.

### Pressurized glycol systems

- Systems with solar storage tanks or brazed plate heat exchangers
- Systems with evacuated tube or flat plate solar collectors

Model	Daily Capacity (G)	Solar Collectors	Tank / Heat Exchanger
<b>with Solar Storage Tanks</b>			
3570	40 - 50	(1) SunMaxx-20	40G Tank
1704	60 - 70	(2) SunMaxx-20	40G Tank
4005	80 - 120	(2) SunMaxx-20	80G Tank
17885	50	(1) SunMaxx-FP	40G Tank
17886	80	(2) SunMaxx-FP	80G Tank
<b>with Brazed Plate Heat Exchangers</b>			
17881	40 - 50	(1) SunMaxx-20	10 Plate HE
17882	80 - 120	(2) SunMaxx-20	10 Plate HE
17883	40 - 50	(1) SunMaxx-FP	10 Plate HE
17884	80 - 120	(2) SunMaxx-FP	10 Plate HE

### Drainback systems

- Systems with storage tanks or retrofit kits (no storage tank)
- Systems with evacuated tube or flat plate solar collectors

Model	Daily Capacity (G)	Solar Collectors	Drainback Tank
<b>with Solar Storage Tanks</b>			
DBS-4050-1	40 - 50	(1) SunMaxx-20	10G
DBS-80120-1	80 - 120	(2) SunMaxx-20	10G
DBS-4050-2	40 - 50	(1) SunMaxx-FP	10G
DBS-80120-2	80 - 120	(2) SunMaxx-FP	10G
<b>without Solar Storage Tanks</b>			
DBR-4050-1	40 - 50	(1) SunMaxx-20	10G/HE
DBR-80120-1	80 - 120	(2) SunMaxx-20	10G/HE
DBR-4050-2	40 - 50	(1) SunMaxx-FP	10G/HE
DBR-80120-2	80 - 120	(2) SunMaxx-FP	10G/HE

Additionally, SunMaxx thermosyphon solar hot water heaters are ideal as on demand, passive (or active) domestic solar hot water systems.

### Thermosyphon solar hot water heaters

- Thermal storage & solar collector in one complete unit
- Can be used in active or passive systems
- Built with SunMaxx evacuated tubes
- Ideal for any climate

Model	Storage (G)	# of Tubes	People Served
SunMaxx-TS20	40	20	5 - 7
SunMaxx-TS30	80	30	8 - 10+

2917 State Hwy 7, Bainbridge, NY 13733

P: 888.765.2711 (Integrated Products)

P: 877.786.6299 (Solar Thermal)

www.siliconsolar.com | www.sunmaxxsolar.com

© 2008 Silicon Solar Inc - All Rights Reserved | shw-gib-002

*In order to maintain the highest standards of service and knowledge of the latest solar technologies, Silicon Solar is a proud member of:*



# Typical System Types

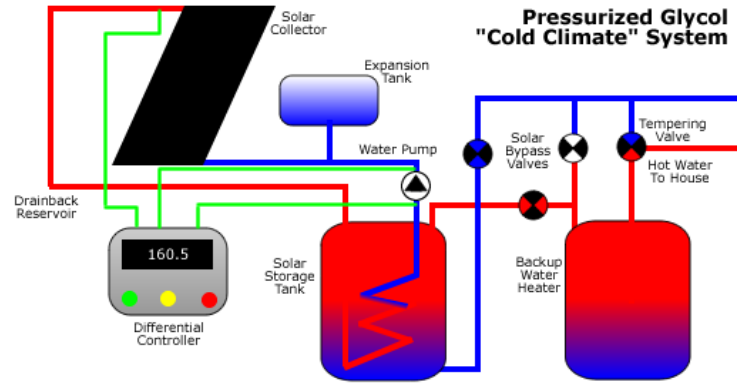
## Pressurized Glycol (Cold Climate) System

The pressurized glycol system is the most reliable configuration for solar water heaters, but the initial cost in collectors and components, and the costs of maintenance and repair are significantly higher than any other system setup configuration.

If you never want to worry about freezing damages, and are not concerned with providing the lowest initial investment, and getting the fastest possible payback, the pressurized glycol system is the right choice for you. Changing your fluid (a water/glycol solution) regularly is recommended for the protection of your investment, but will modestly raise your maintenance time and costs.

### Advantages:

- Will not freeze, except in extreme temperatures
- Uses a pressurized loop that circulates a food-grade glycol
- Indirectly transfers heat from the glycol solution to your potable water
- Requires the glycol solution to be changed every few years (at least)

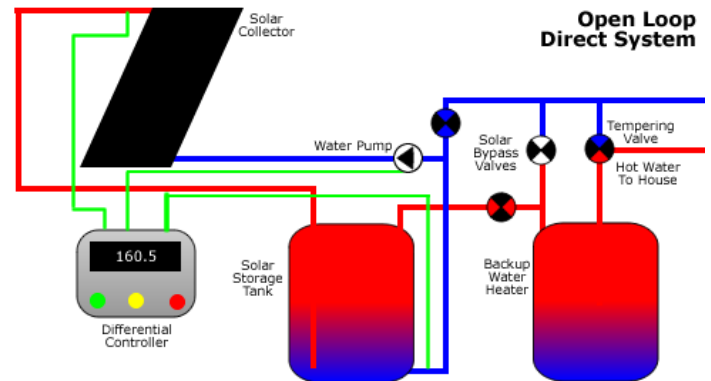


## Open-Loop Direct

The simplest of all direct systems is the thermosyphon water heater. These systems operate on a very simple principle – water is circulated by natural convection and gravity – rising and falling in response to solar heat, just as air does. In their simplest form, thermosyphon systems are not suitable for cold weather climates because water remains in the collector at all times, creating a problem with freezing conditions. However, a valve can be added to drain the collectors when freezing temperatures occur.

A direct pump system is often used as flexibility in system layout and design becomes necessary. With this forced circulation, the tank does not need to be placed above, or even near, the solar collectors. In this system, the pump moves water through the collectors only when there is enough solar radiation to provide useful heat. When the pump shuts off the collectors are drained of water (assuming the drain valve has been installed).

**Important Note:** Direct systems, whether pumped or thermosyphoning, cannot be used in areas where water is hard or acidic. Scale deposits would quickly clog the inside of the absorber tubing, and the corrosion could render the system inoperable.



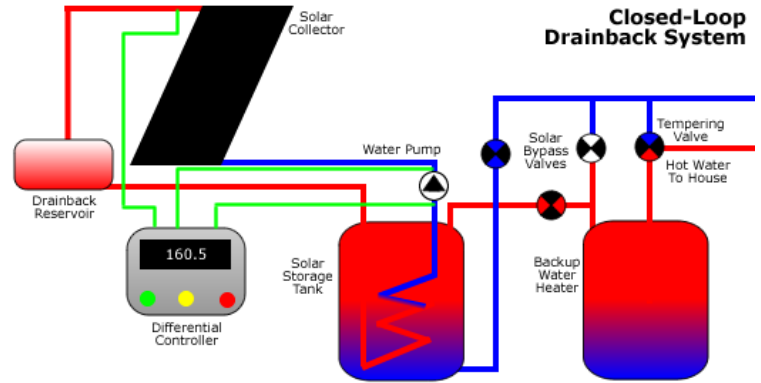
## Closed-Loop Drainback

First developed in the 1980's, the closed-loop drainback systems have proven themselves to be reliable and highly efficient. They are essentially a non-pressurized closed-loop system that uses water as a heat transfer fluid (not a glycol mix). A small drainback reservoir is added to the collector loop, and the system is filled pure water to the top of the reservoir. Because the collectors are located above the reservoir, they remain dry when the system's pump(s) is off.

How they work – when the collectors are hotter than the water in the storage tank, the system activates automatically to heat the water. Then, when the water in the storage tank is hotter than the collectors, or reaches a pre-determined cut-off temperature, the system shuts down the pump and the water drains back to the reservoir.

### Problems addressed:

- Freeze protection gravity based
- The pump is shut down when the water temperature is correct, draining all excess water from the collectors
- Fewer components than other systems, reducing the risk of problems, and lowering any repair or replacement costs



# Other Domestic Hot Water System Information

## Typical System Components

Solar hot water systems require a number of key components to operate efficiently and as cost-effectively as possible. These components work together seamlessly, and assist in incorporating your new solar hot water system with your existing hot water system, home heating system or pool/spa heater to reduce your energy bills without any hassles and huge overhead costs.

The major components of solar hot water system are:

### Solar collectors

Whether you use evacuated tube solar collectors or flat plate solar collectors, these are the heart and soul of your solar hot water system. Without today's efficient and affordable SunMaxx solar collectors, solar hot water systems would not be a viable, affordable option for millions of Americans and citizens around the world. By capturing the UV radiation from the sun, converting it to heat and transferring it to your potable water or a heat transfer fluid (HTF), SunMaxx solar collectors make it possible to generate your hot water and heating needs for a fraction of the cost of your current traditional fuel powered heating system.

### Solar hot water storage tank

A solar hot water storage tank is specifically designed to operate in concert with today's SunMaxx solar collectors and solar hot water systems. These tanks feature thick insulation, stainless steel construction, easy plug n play connections and internal copper coil heat exchangers making it extremely easy to design and install a closed-loop solar hot water system. These tanks can be coupled with an electric backup heating element to be a standalone hot water heater that can replace the current hot water boiler at a location, or plumbed in series with the existing water heater to provide a pre-heat tank that is always full of hot water to meet the demands of large households, or those that use more hot water than the average family.

### Solar hot water heat exchangers

There are a variety of solar hot water heat exchangers available today, and most are designed to fit specific needs of solar hot water systems for different applications and locations. The main types of solar hot water heat exchangers are:

- **Copper coil** - these are typically found within a solar hot water storage tank, allowing you create a closed loop solar hot water system with a new, solar specific hot water storage tank
- **Brazed plate** - these heat exchangers feature a number

of copper plates with a small space between them, allowing your HTF and potable water to pass through, separate from each other while providing adequate heat transfer to create an efficient and cost-effective closed loop system for domestic hot water or radiant heating applications

- **Shell & tube** - these heat exchangers are specifically designed for pool & spa heating as well as marine solar hot water applications. Typically they are made from stainless steel, which not susceptible to corrosion from contact with chlorinated water like a copper heat exchanger would be
- **Air-to-water** - these heat exchangers operate essentially the same as a car radiator does, allowing hot water to pass through the exchanger and heating the surrounding through a series of radiator fins as it does - These heat exchangers are ideal for using solar hot water systems in forced hot air central heating systems, and as a heat dump for releasing excess heat from your solar hot water system in the summer months when it is not needed.

### Differential temperature controller

These are designed to provide automatic operation of your SunMaxx solar hot water system, which means a more hassle-free system with less maintenance and less attention. By measuring the temperature of the water in the solar collector header (manifold) and within the storage tank, the controller will determine when your solar hot water system should operate to heat water. This will provide significant energy savings over a system that is operated manually, or allowed to run continuously with no checks in place. The differential temperature controller is the brain of your solar hot water system. Whether you have a small residential system or a large commercial array, this is a component that must be included in your installation.

### Solar hot water circulator pump

The circulator pump operates as the heart of your solar hot water system. The pump is controlled by the controller, and is told when to cycle water or HTF through the system to provide heating and to turn off when heating is not needed, or when there is not enough heat being generated by the solar collectors. solar hot water circulator pumps are available in AC models, DC models and PV/battery controlled models. Each of these types of solar hot water circulator pumps have their advantages and disadvantages - you should consult your dealer

## Typical System Components *cont.*

or installer regarding which type of pump is the most appropriate for your application, budget and desires.

### Expansion tank

An expansion tank is a necessary component in a closed-loop system. As water is heated, it expands. The expansion tank allows the expanded water a place within the system to escape to until the temperature has lowered and the water or HTF volume has returned to normal levels.

### Drainback tank

A drainback Tank is used in a drainback system, where water or HTF is drained from the solar collectors when the system is not in use. This serves as a freeze protection method for protecting the system in cold climates and weather, much like glycol does in a pressurized system. Drainback systems are one of the most common solar hot water system installation types used today.

### Plumbing hardware & additional components

There are several other components that are used in solar hot water systems. These components should not be overlooked in their importance to performance of the overall solar hot water system. These components include:

- Tempering valves
- Check valves
- 3-Way valves
- Automatic air bleeders
- Temperature and pressure gauges
- Temperature and pressure relief valves
- Copper and PEX piping
- Quick connectors, PEX-to-copper connectors, compression fittings and more

## Working with Glycol - Pressurized Systems

You can use the information below to assist in determining the correct amount of glycol to use in your domestic hot water system, if you are choosing to install a pressurized glycol system for cold-weather protection.

For safety, always use propylene (food-grade) glycol, not ethylene-glycol. Maintain a pH level of 8 - 10.

### Freezing point for glycol-water solutions

Glycol Solution (% by mass)	Temperature	
	°F	°C
00	32	0
10	26	-3
20	18	-8
30	7	14
40	-8	-22
50	-29	-34
60	-55	-48

\* Due to slush creation, you should avoid using these solutions at temperatures close to their freezing point.

### Recommended % of volume for glycol solutions

Temperature (°F)	% for Freeze Protection	% for Burst Protection
20	18	12
10	29	20
0	36	24
-10	42	28
-20	46	30
-30	50	33
-40	54	35
-50	57	35
-60	60	35

\* Neither Silicon Solar, nor the manufacturer of the glycol, guarantee that freezing damage will not occur at the temperatures listed in these tables.

2917 State Hwy 7, Bainbridge, NY 13733

P: 888.765.2711 (Integrated Products)

P: 877.786.6299 (Solar Thermal)

www.siliconsolar.com | www.sunmaxxsolar.com

© 2008 Silicon Solar Inc - All Rights Reserved | shw-gib-002

*In order to maintain the highest standards of service and knowledge of the latest solar technologies, Silicon Solar is a proud member of:*



## Solar Hot Water FAQs

### **Is solar hot water a viable alternative to my current gas or electric hot water heater?**

A SunMaxx solar hot water system should not be seen as an alternative, but rather a supplement. You should strive to size your SunMaxx solar hot water system to meet between 60 - 70% of your total annual hot water needs. A properly-sized system should produce nearly 100% of your daily hot water needs on a sunny, summer day.

### **How long will it take for my system to pay for itself?**

A SunMaxx solar hot water system is a major investment, like any heating system or major home appliance. However, unlike most major appliances that continuously cost money year after year for operation and maintenance, a SunMaxx solar hot water system will save you enough money in fuel bills to have completely paid for itself in as little as 2 - 3 years.

### **Can a SunMaxx solar hot water system be used in cold weather climates?**

Yes, any SunMaxx solar collector can be used in cold conditions, down to -60 °F. However, performance is greatly reduced in these extreme temperatures. Good heat output can still be achieved in mild sub-zero conditions. The use of a pressurized glycol or drainback system is recommended in cold climates to prevent freezing damage.

### **Will water still be heated on a cloudy day?**

Yes, SunMaxx solar collectors operate on UV radiation, not direct sunlight. Though performance is greatly increased in direct sunlight, significant efficiency can be achieved in mildly overcast conditions.

### **Can I use a SunMaxx solar hot water system with my current hot water heater?**

Yes, the idea is to tie your SunMaxx solar hot water system into your current hot water heater, using the solar heater as your main source of heating and the traditional heater as a supplement when there is not enough solar heating.

### **What else can SunMaxx solar collectors be used for?**

By combining a number of SunMaxx solar collectors (either evacuated tube or flat plate) together in series and/or parallel, a SunMaxx solar hot water system can be size large enough to be used for radiant / space heating and pool / spa heating.

## Additional Resources

If you need any additional information regarding any of the products referenced in this guide, or regarding using a SunMaxx solar hot water system for radiant heating or pool / spa heating applications, please refer to the specific information guides or product brochures.

2917 State Hwy 7, Bainbridge, NY 13733

P: 888.765.2711 (Integrated Products)

P: 877.786.6299 (Solar Thermal)

[www.siliconsolar.com](http://www.siliconsolar.com) | [www.sunmaxxsolar.com](http://www.sunmaxxsolar.com)

© 2008 Silicon Solar Inc - All Rights Reserved | shw-gib-002

*In order to maintain the highest standards of service and knowledge of the latest solar technologies, Silicon Solar is a proud member of:*

