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Hot Water Solutions

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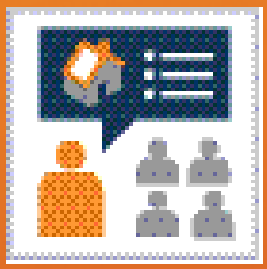
SunMaxx INFORMATION GUIDE

Evacuated Tube Solar Collectors



EVACUATED TUBE SOLAR COLLECTORS

Evacuated tube solar collectors are among the most efficient, reliable and cost-effective solar collectors on the market today. There are many types of evacuated tube solar collectors to choose from, making them extremely versatile in the applications they can be used for. This also helps in sizing the systems they will be used in, and helping with the affordability of the overall solar hot water system.

Evacuated tube systems work by using a heat transfer fluid (HTF - typically a glycol-water solution) that travels in a cycle. First it travels though a manifold, absorbing the captured solar energy produced from the evacuated tubes. The HTF then travels to a water tank, transferring the solar energy to the water, heating it. The HTF then goes back through the evacuated tubes and repeats the cycle.

Because vacuums are nature's best insulator, evacuated tube solar collectors are extremely efficient and cost-effective in every climate, including northern climates where freezing temperatures can be the norm. Evacuated tube solar collectors are efficient in all temperatures down to -60°F.

The SunMaxx ThermoPower Series contains several different types of evacuated tube solar collectors:

ThermoPower-VHP Series (Vacuum Heat Pipes)

- ThermoPower-VHP10
- ThermoPower-VHP20
- ThermoPower-VHP30
- ThermoPower-VHP30V1

ThermoPower-VDF Series (U-Pipes)

- ThermoPower-VDF20
- ThermoPower-VDF30

ThermoPower-VTS Series (Thermosyphon)

- ThermoPower-VTS30 HP
- ThermoPower-VTS30 NP
- ThermoPower-VTS P

SunMaxx offers the most complete line of evacuated tube solar collectors, with models designed and tested to meet the needs of any solar hot water system application. Our evacuated tube solar collectors are in used around the world in a variety of

A Brief History

Evacuated tube solar collectors are one of the most innovative forms of solar technology. The principle of solar thermal can best be explained using the example of the hot water that comes out of a garden hose when the hose has been left in the sun for an extended period of time.

Evacuated tube technology was first developed by Quing Hua University in Beijing, China in the early 1980s. Manufacturing of these new solar collectors began in 1985. And by 1988 Quing Hua had a manufacturing capacity of more than 30,000 tubes per year. In 1996, with aid from the Chinese Government, Quing Hua was able to reach a production capacity of 2 million tubes, while continuing to develop the infrastructure needed for further growth. In 1997, more than 2.5 Million tubes were sold.

Early on, the majority of evacuated tubes were sold to the local market, with only a small percentage (about 100,000 tubes in 1995) being exported to Japan, Europe, South America and South-East Asia. The key barrier to large scale export was the tank and manifold being used with the systems. While the evacuated tubes worked well, these other components were mediocre, and did not meet the stringent regulations of the European market. Non-pressure thermosyphon systems, however, met the needs of the local Chinese market, driving sales continuously upward.

By 1998, Quing Hua had a firm hold on 70% of the Chinese solar thermal market. However, a break-up of several key members opened the technology to new manufacturers as the patents on technology could no longer be enforced. This break-up allowed other companies with stronger business practices and manufacturing processes to enter the market place, paving the way for today's SunMaxx evacuated tube solar collectors.

While most evacuated tube solar collectors from China are built to the same specifications, SunMaxx solar collectors are manufactured using only the best, most trusted components and materials. This has resulted in the industry-leading performance and efficiency that SunMaxx customers know and trust.

Evacuated Tubes vs. Flat Plates

Both evacuated tube solar collectors and flat plate solar collectors are extremely affordable, and highly-efficient. 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.

Evacuated Tubes vs Flat Plates, cont.

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

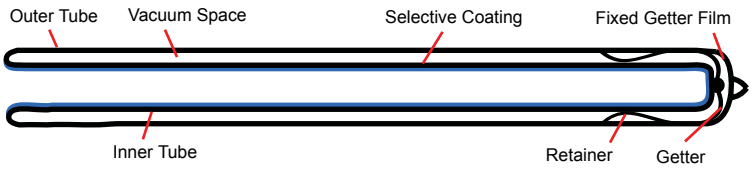
Both types of solar collectors are affordable. Flat plate solar collectors, because of their simplistic design and manufacturing have a lower initial price. But, again, in colder climates, the extended performance of evacuated tube solar collectors makes them significantly more cost-effective in the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

Durability / Reliability

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

Anatomy of Evacuated Tubes

All glass evacuated tubes are the heart of a SunMaxx evacuated tube solar collector, as the name would suggest. It is the design and production of the tubes that make SunMaxx solar collectors as efficient, affordable and cost-effective as they are. The image below shows the basic construction of a SunMaxx evacuated tube.



This construction is typical of all SunMaxx evacuated tubes. The type of selective coating used and the method of heat transfer are what differentiate SunMaxx evacuated tube solar collectors. SunMaxx evacuated tubes feature a three-target plate sputtering selective coating surface (also called “Double MALN Cerment Layers”), which was developed on the basis of TYY-AA evacuated tubes. These evacuated tubes achieve the highest thermal efficiency and good thermal stability. A solar selective coating is used to absorb a high percentage of solar radiation while suppressing thermal emittance loss. These coatings have higher absorption (>95%) and lower emittance (<5%) than traditional selective coating surfaces. These coatings also have high resistance to long-term vapor condensation, corrosive sulfur dioxide and high operating temperatures. The test conditions equaled a lifetime span of 15 years. Sputtering is a technical/manufacturing term that refers to coating a substratum with metal particles. The manufacturing process is done in a vacuum sealed room, and the “sputtering” or coating process takes place in three separate stages – stabilizing layer coating, semi-conductor layer coating (radiation absorbent layer), and anti-reflection layer coating. These stages are known as depositions because the coating is being deposited on the surface.

First deposition – This is a copper metal layer. This layer has a low emission ratio and a high transmission rate through the inner glass wall to the heat pipe.

Second deposition – This is an ionized stainless steel layer. This layer is "sputtered" in a mixture of argon and nitrogen gasses, which produces a cement layer.

Third deposition – This is an aluminum nitride layer. This layer offers a very low emissivity and high absorption – absorption: >95%; emittance: <5%.

Within the vacuum chamber, three target plates are installed above the copper fin at the bottom. When a high-tension field is created between these targets and the copper fin, and magnetic field is created parallel to the target plate. Positive helium ions react and release titanium atoms from the target plate. Due to their high kinetic energy, these atoms strike and attach themselves to the copper fin. During this process, the copper fin passes the three target plates, and a stabilizing metallic layer is laid on the copper fin to promote long-term stability. This layer is the semi-conductor layer.

These advanced solar selective coatings employ two patented technologies:

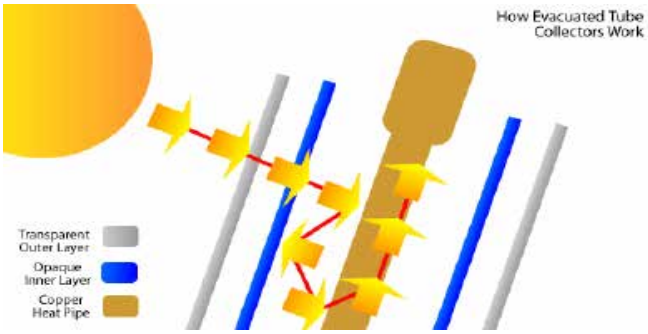
1. Double cement film structure with the highest phot thermal efficiency
2. Metal-Aluminum Nitride cerment (M-AIN) materials deposited by a new "sputtering" technology

SunMaxx Solar manufactures a number of different types of evacuated tube solar collectors. The variety of styles of evacuated tube solar collectors increases the versatility of evacuated tube technology, making SunMaxx collectors useful in nearly every solar hot water application and system.

Heat Pipe Evacuated Tubes

Heat pipes are the most common form of evacuated tube solar collector. The SunMaxx ThermoPower-VHP series is our best selling evacuated tube option. Here is how heat pipe evacuated tubes work:

- A special liquid within the heat pipe is heated by the sun to a vapor
- The vapor rises to the top of the heat pipe (condenser)
- Cold water (or HTF) runs through the header pipe
- The water, or HTF, is heated by contact with the condenser
- The vapor returns to liquid and falls to the bottom of the heat pipe
- Liquid is reheated & the process repeats



U-Pipe Evacuated Tubes

Evacuated tube solar collectors with u-pipes are another very common and popular type of solar collector. They have distinct advantages over other evacuated tube solar collectors.

How U-pipe evacuated tubes work:

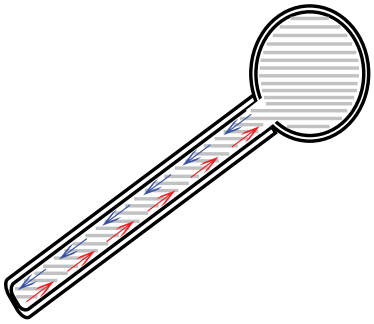
- Water, or HTF, runs through the header pipe
- The HTF travels down the copper u-pipes within the evacuated tubes
- The HTF is heated as it goes through the u-pipe

Thermosyphon Evacuated Tubes

Thermosyphons are among the most affordable of evacuated tube solar collectors. By combining storage tank and solar collector in one unique package, thermosyphons offer an all-in-one package.

How Thermosyphons work:

- Water, or HTF, fills the storage tank and each of the evacuated tubes
- Cold water falls to the bottom of the tubes, where it is heated by the sun
- As the water is heated, it rises up to the storage tank



SunMaxx offers a variety of evacuated tube solar collectors. Each comes with its own unique features, advantages, disadvantages and price levels. Our solar thermal experts are ready to help you choose which collector will best suit your needs.

For more detailed information regarding SunMaxx evacuated tube solar collectors, and assistance finding the correct collector for your application and budget, please contact SunMaxx Solar or your local SunMaxx installer. You can also visit us online at www.sunmaxxsolar. com and download specific product brochures for each of the collectors in the SunMaxx evacuated tube line.

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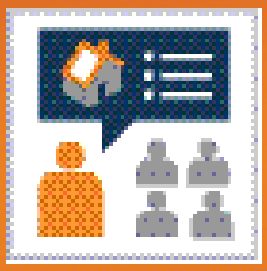

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