

Solar Thermal Collectors

Solar thermal collectors are the key component of solar heating systems and work by capturing solar energy in the form of heat. The four main types of collectors are:

- ⊗ Selective Surface Flat Plate Collectors
- ⊗ Painted Flat Plate Collectors
- ⊗ Evacuated Tube Collectors
- ⊗ Plastic Collectors

⊗ Selective-Surface Flat Plate Collectors

These collectors absorb more energy per unit surface area than other flat plate collectors. We use them almost exclusively because they perform very well in cold conditions and fairly well in low-light conditions while remaining cost-effective compared with more efficient technologies. They typically operate at temperatures between 110 and 160 degrees. This range is suitable for domestic water heating and for several types of space heating systems including radiant floors, hydronic air-handling units, and some baseboards.

Selective-surface flat plate collectors are usually very well insulated on the back and sides, and glazed with low-iron tempered glass. This type of glass allows as much sunlight through as possible, similar to greenhouse windows, while withstanding hail and other abuses. Underneath the glass a network of pipes exists, consisting of a header across the top and bottom and several risers connecting the headers to one another. These pipes are typically made of copper, with the headers having a 3/4" or 1" diameter and the risers much smaller, almost like capillaries. Fluid is pumped into the lower header and as it heats up it rises by convection through the risers into the top header. Different methods ranging from brazing to gluing are used to fuse the risers to the headers. Beneath this network of pipes is the absorber, to which the risers and header are fused. In selective surface collectors, the absorber is usually chrome or copper plated to maximize the energy absorption of the collector. As the absorber heats up, that heat is transferred to the risers and thereby to the fluid in the collectors.

⊗ Painted Flat Plate Collectors

These collectors use methodology very similar to that of the selective-surface collector described above. The main difference is the quality and cost of the absorber. Instead of being coated with chrome or copper plating, the absorber plates inside such collectors are painted black. This practice limits cost and also reduces efficiency and performance. These collectors are appropriate in some applications, as in high altitude installations with very intense sunlight, or for pool heating where lower fluid temperatures are acceptable.



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✧ **Evacuated Tube Collectors**

In this type of collector the absorber is enclosed in an air-evacuated tube. This allows for better insulation as well as more efficient energy absorption compared to flat-plate collectors. Temperatures over 300 degrees F can be reached, which can be appropriate for steam and other high-temperature heating applications. Evacuated tube collectors also produce a useful amount of heat in partly cloudy and very cold conditions, making them a suitable choice in some climates in which these conditions are common. They are also used in industrial applications such as steam process heating and district hydronic heating.

The manufacturing process of evacuated tube collectors is more expensive than that of flat plate collectors, and in many climates the higher efficiency does not justify the additional cost. The installation of these collectors can also be more expensive than that of flat plate collectors, as all components in the collector loop must be selected for their ability to withstand very high temperatures.

✧ **Plastic Collectors**

Plastic collectors are basically arrangements of black plastic pipe, treated to withstand UV degradation and other environmental hardships. They are popular for heating pools in seasonal applications or year-round in warm climates.

Plastic collectors are impacted by ambient temperature to a much greater degree than the other collector technologies discussed here. When the outside temperature is cold even on a clear day, these collectors will deliver little or no heat. This is because they are neither glazed nor insulated. Since pool heating, especially of outdoor pools, is often a seasonal concern, plastic collectors can be very effective. However, for domestic hot water and space heat, or for year-round pool heating, higher temperatures are required, and plastic collectors can't keep up.

A developing application for plastic collectors is nighttime heat radiation for cooling purposes. Since they are not insulated or glazed, plastic collectors release heat as readily as they absorb it. Fluid can therefore be pumped from radiant floor tubing in a home through these collectors, and will return to the floor cooled.