Solar thermal system– basics

A solar water heating system is made up of several important elements:

a. One or more solar collectors mounted on the roof.
b. A storage tank, with or without an inner heat exchanger.
c. An electrical pump for circulating the heat transfer fluid (in Forced systems only).

There are two solar water heating circulation types:

a. Thermosyphon (TS)
b. Forced circulation (FC)

Forced circulation systems use electricity to power pumps that move liquid through the system. Thermosyphon systems rely on gravity to move liquid through the system. In both systems, the absorber plate of the collector gathers the sun's heat energy, which in turn warms the water or the antifreeze solution that flows through an array of tubes. Once heated, the liquid flows through the tubes to the storage tank. The heated liquid warms the cooler water in the storage tank directly or through a heat exchanger. A backup energy source, normally electricity or gas, supplies the energy deficit.

Forced circulation system

FC systems use electrical pumps, valves, and controllers to circulate water or other heat-transfer fluids through the collectors. FC systems are slightly less efficient and more expensive than TS systems, however they enable high flexibility in the positioning of the system components, storage tanks do not need to be installed above or near to the collectors. The collectors in a FC system will also operate more effectively at lower temperatures.

Closed-Loop Systems

In a closed-loop system, heat transfer fluid (water or antifreeze solution) circulates through the system's tubes without mixing with the potable water inside the water storage tank. Closed-loop systems are better-suited for colder climates, since the antifreeze solution keeps the system from freezing. In places with hard water the system limits scale development inside the collector's tubes. Closed loop systems can be operated in FC or TS systems.

Water Requirements

Water quality

City water is a controlled water source and should not cause any difficulty with the system. Some water may have elevated mineral content and require more frequent system maintenance.

In regions where calcium carbonate content of water exceeds 250 mg/L

(or 250 ppm) it is highly recommended that a closed loop system is used. Collector clogging from mineral deposits is likely to impair collectors' functionality and shorten systems' life span wherever hard water is supplied to open loop systems.

Water Pressure

A water pressure range of 1 to 6 bars (15-87 psi) is required for a correct operation. Pressure above 6 bars (87 psi) requires the installation of a pressure regulator on the main supply.

Approval

Notes

- All plumbing installation must conform to local codes. NZ3500
- All piping must be adequately supported: supports must conform to local codes.
- All piping must be adequately insulated: insulation must conform to local codes.
- All piping must slope towards a drain.
- Plumbing must be installed so that the performance of any flow rate is not reduced.

Notes

- A concentration of 40% to 50% glycol is accepted as a standard in central Europe.
- Anti-freeze protection is essential, as a single freeze event can destroy a collector. (Even in warm areas, collector tubes have frozen and burst during hard winter freezes).
- The Food and Drug Administration (FDA) has determined propylene glycol to be "generally recognized as safe" for use in food, cosmetics, and medicines.
- Corrosion is usually minimized through pH control and corrosion inhibitor use; however corrosion problems are unlikely to occur in air-free closed circuit systems.