SOLAR HEATING of a HOUSE in NORTHERN CYPRUS

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INRODUCTION

Solar heating in a house can be categorised into two groups. One is solar water heating and the other is solar space heating. There are various methods for both of these applications in houses where the report aims to discuss these.

2 CLASSIFICATION OF SOLAR THERMAL SYSTEMS FOR SPACE AND WATER HEALTING

Solar thermal systems can be also be classified as:

1.STAND ALONE
2.SOLAR SUPPLEMENTED

Solar thermal systems can also be classified by means of energy collection as:

1.ACTIVE
2.PASSIVE

Solar thermal systems can also be classified by means of energy collection as:

1.DOMESTIC
2.INDUSTRIAL

2.1 PASSIVE SYSTEMS

Systems which collect or use solar energy without direct resource to any source of Conventional power, such as electricity, to aid in the collection. These systems operate either by natural thermosyphon Between collector, storage and load or in the case of space heating, the architecture of the building is to favor optimal use of solar energy.

2.2 ACTIVE SYSTEMS

These are systems which need electric pumps or blowers to collect solar energy. The amount of solar energy collected should be more than the electrical energy used.

3 ACTIVE SOLAR SYSTEMS FOR WATER HEATING

There are 2 possible configurations of such solar systems with daily storage for water heating:

3.1 Closed-Loop Systems.

With this type, the fluid circulating in the collectors does not mix with the fluid supplying thermal energy to the load.

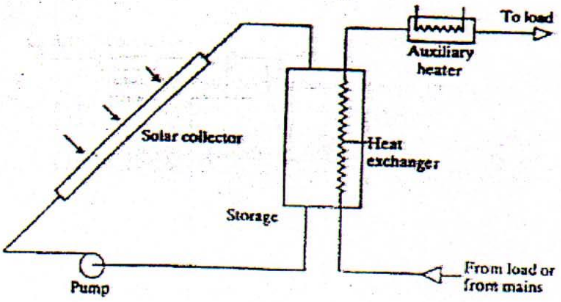

Fig. 1.2. Schematic of a closed-loop solar thermal system.

With a closed loop system, an expansion tank and a check valve to prevent reverse thermosyphoning at nights are essential.

THERMOSYOPHON EFFECT:

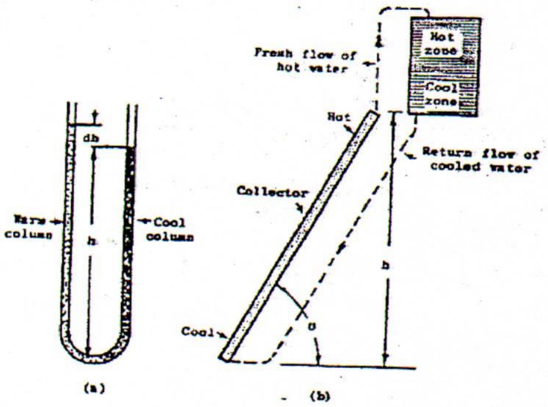

Fig. 10.24 Schematic diagram of the thermosiphon system for hot water. For proper operation the storage tank must be placed above the top of the solar collector.

The density differential created by temperature gradients is used to cause the fluid being heated being heated to flow without any external power source other than the sunlight. The effect of convective self-flow is generally termed the ***THERMOSYOPHON EFFECT***.

3.2 Open-Loop Systems

These are systems in which the collector performance is independent of the storage temperature. As can be seen in the figure below, the fluid through an open-loop system is directly used.

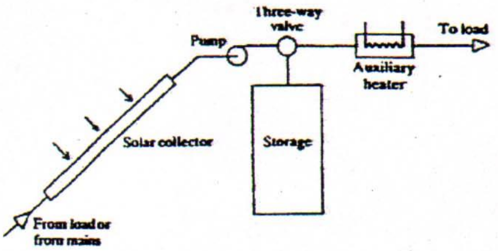

Fig. 1.3. Schematic of an open-loop solar thermal system.

3.2 SCHEMATIC OF A TYPICAL SOLAR HOT WATER SYSTEM

The figure below shows a closed-loop system for water heating.

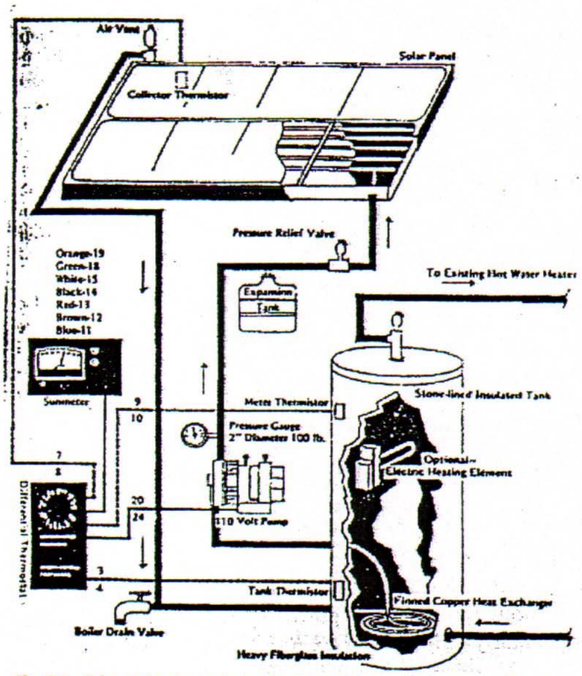

Fig. 5.9 Schematic of a typical solar domestic hot water system. (Courtesy American Solar Heat Corp.)

An antifreeze solution (e.g. mixture of water and propylene glycol) is circulated through the collectors, heat exchange coil in the storage tank and back into the collectors.

Solar collectors are one of the most important components of the system where there are various types. Flat plate collectors are the most appropriate considering the costs and thermal efficiencies.

Figure below shows the schematics of a flat-plate solar collector of header-riser configuration.

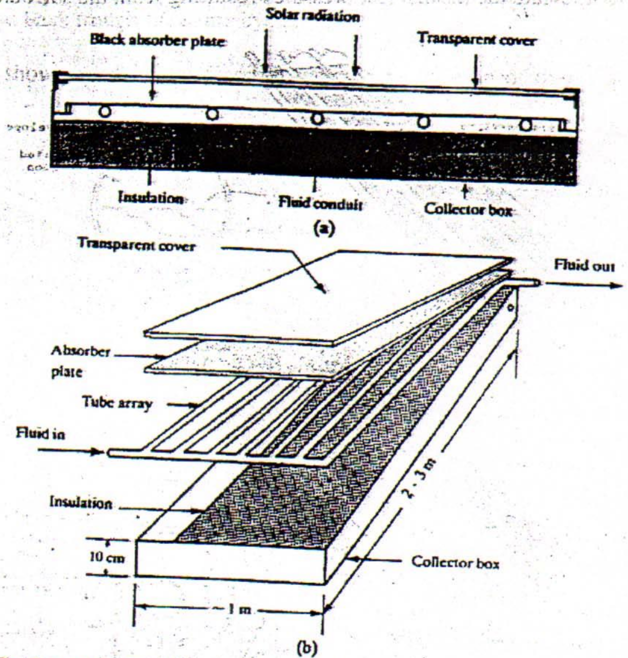

Fig. 1.1. Schematic of flat-plate solar collector of header–riser configuration. (*a*) Cross-sectional view (adapted from Duffie and Beckman 1980). (*b*) Isometric view (from Howell *et al.* 1982).

The instantaneous (or hourly) useful energy q_c in watts delivered by a solar collector of surface area A_c is given by.

$$q_c = A_c F' \left[I_T \eta_o - U_L (T_{cm} - T_a) \right]$$

Where, **F'** is the plate efficiency factor

ή₀ is the optical efficiency (The product of the transmittance and absorption of the cover and the absorber of the collector)

U_L is the overall heat loss coefficient of the collector

T_{cm} is the mean fluid temperature in the collector

I_T is the radiation intensity on the plane of the collector.

A compact pump mounted near the storage tank circulates the fluid at a rate selected for optimum heat collection and exchange efficiency. This pump does not operate continuously for energy consumption. This is done by installing a Hermistor into one of the collectors and another thermistor into the tank. When the readings from these two sensors indicate that the temperature at the collector is sufficiently higher than the that in the tank, the pump is automatically activated by differential thermostat and heated fluid will start to flow down from the collectors, through the exchange cycle, and back trough the same cycle.

The figure below shows a schematic diagram showing he location of thermistors and differential thermostat.

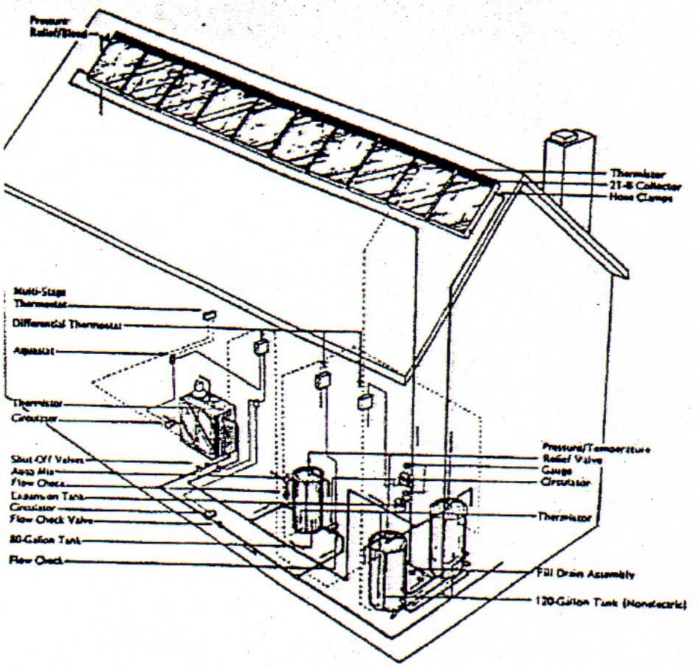

Fig. 5.12 Schematic diagram of a solar hydronic space and domestic hot water system. Note location of thermistors; these sense difference in temperature between collectors and storage, instructing circulator pumps to start and stop accordingly. (Courtesy Daystar Corp.)

The desired effect in a closed system is to have the fluid circulating in the heat exchange coil give up as much of its heat as possible before it leaves the coil and head backs up to the collectors. The storage tank is also playing an important role since it holds certain amount of hot water for as long as possible where size and insulation is very important.

Most tanks are insulated as shown below:

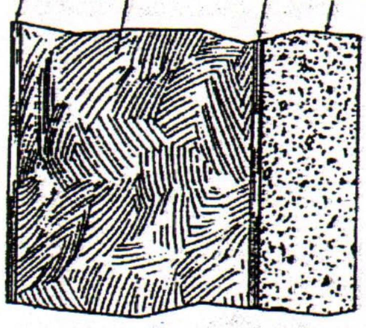

Fig. 5.13 Cutaway of typical solar hot water storage tank wall.

- The figure below shows the storage tank, pump, and controls for a solar domestic hot water system.

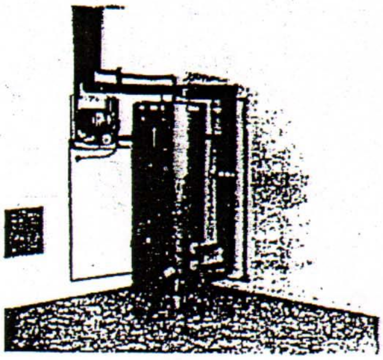

Fig. 5.14 **Storage tank, pump, and controls for a solar domestic hot water system. Note insulation of pipes. Small cylinder mounted horizontally on wall is expansion tank. (Courtesy Lennox Industries.)**