- **FLAT-PLATE COLLECTORS**

When solar radiation passes through a transparent cover and impinges on the blackened absorber surface of high absorptivity, a large portion of this energy is absorbed by the plate and then transferred to the transport medium in the fluid tubes to be carried away for storage or use. The underside of the absorber plate and the side of casing are well insulated to reduce conduction losses. The liquid tubes can be welded to the absorbing plate, or they can be an integral part of the plate. The liquid tubes are connected at both ends by large diameter header tubes.

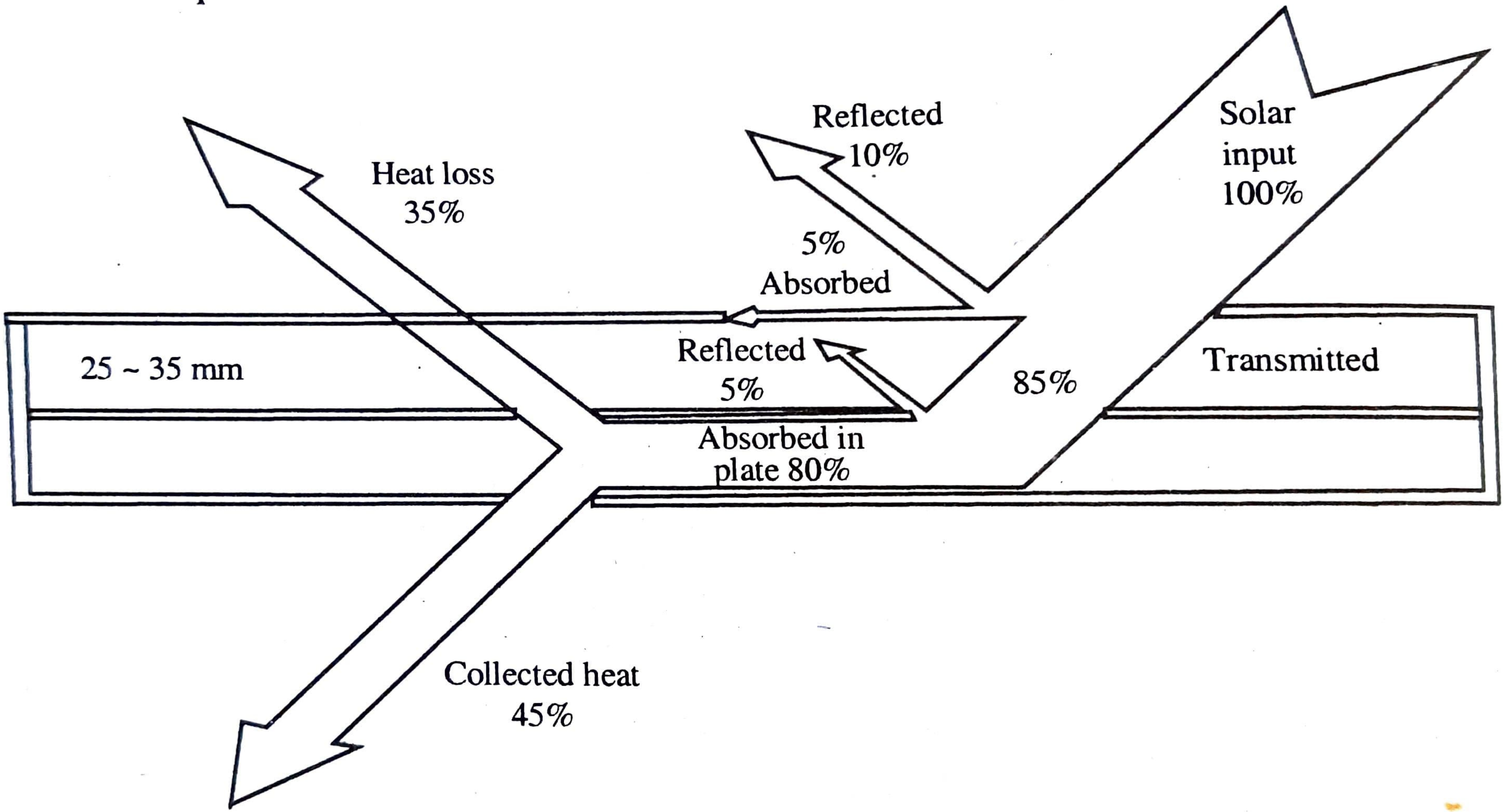


Figure 5 : hosses of a basic flat plate collector

The transparent cover is used to reduce convection losses from the absorber plate through the restraint of the stagnant air layer between the absorber plate and the glass. It also reduces radiation losses from the collector as the glass is transparent to the short wave radiation received by the Sun but it is nearly opaque to long-wave thermal radiation emitted by the absorber plate (greenhouse effect).

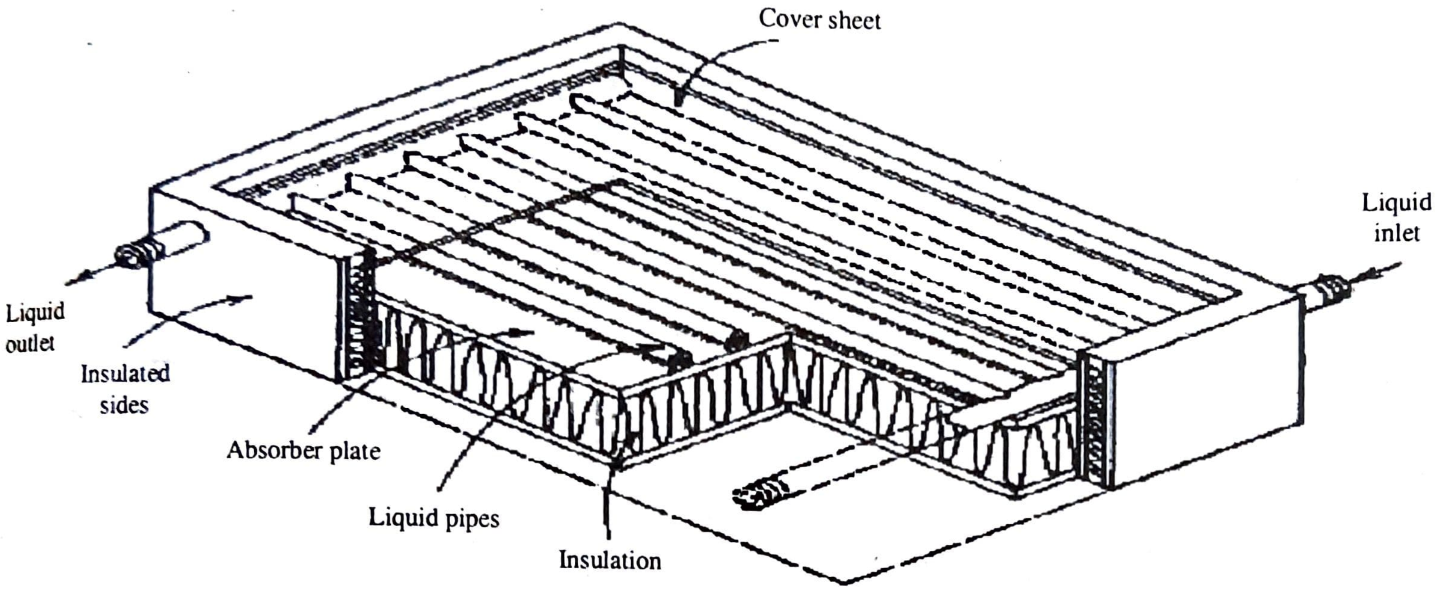


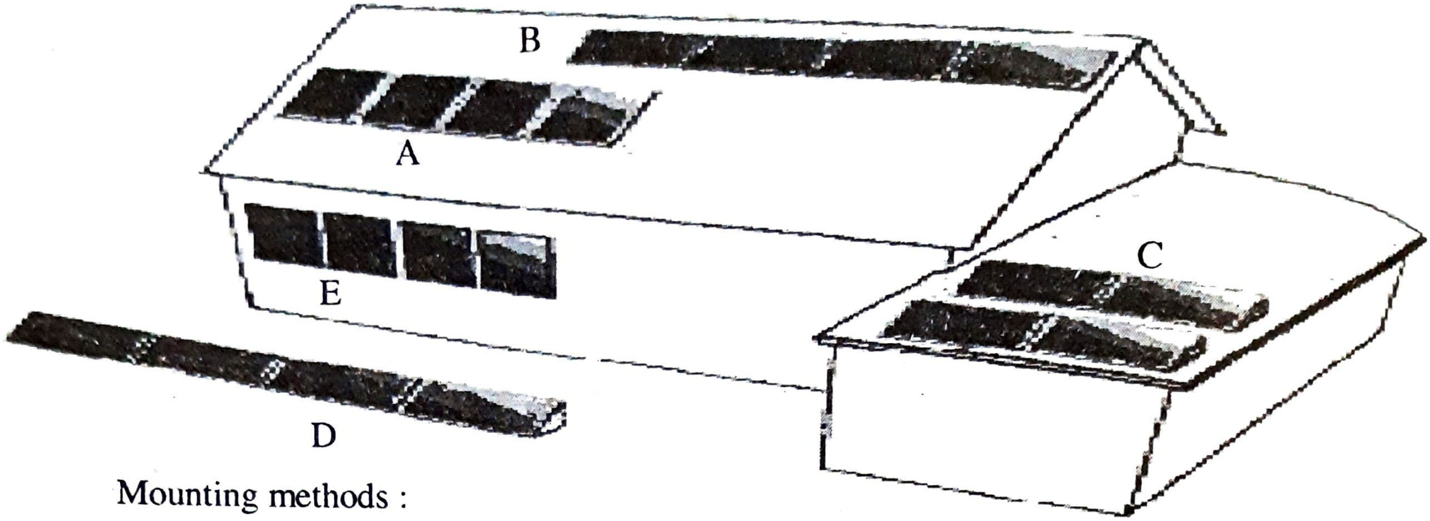
Figure 6 : Flat Plate Collector

FPC is usually permanently fixed in position and requires no tracking of the Sun. The collectors should be oriented directly towards the equator, facing south in the northern hemisphere and north in the southern. The optimum tilt angle of the collector is equal to the latitude of the location with angle variations of 10-15° more or less depending on the application.

- Glazing. One or more sheets of glass or other diathermanous (radiation-transmitting) material.
- Tubes, fins, or passages. To conduct or direct the heat transfer fluid from the inlet to the outlet.
- Absorber plates. Flat, corrugated, or grooved plates, to which the tubes, fins, or passages are attached. The plate may be integral with the tubes.
- Headers or manifolds. To admit and discharge the fluid.
- Insulation. To minimize the heat loss from the back and sides of the collector.
- Container or casing. To surround the aforementioned components and keep them free from dust, moisture, etc.

Collector Direction

The collector should face the equator. In the northern hemisphere, this is due south, and in the southern hemisphere, due north. Facing the collector in the correct direction and angle is important to ensure optimal heat output. A deviation of up to 15 from due south is acceptable, and will have minimal effect on heat output.



Mounting methods :
A.B. Stoped roof
C Flat roof
D Ground mount
E Facede

Figure 7 : Suggested placement of solar collectors

COLLECTOR ANGLE (TILT)

It is common for collectors to be installed at an angle that corresponds to the installation latitude. While adhering to this guideline, an angle of latitude +/- 10° is acceptable, and will not greatly reduce solar output. The solar collector should be installed at an angle of between 20 - 80° to ensure optimal operation.

For year-round domestic hot water, the collector should be tilted to an angle of equal to the latitude of the installation site. Add 15° to the latitude to optimize for winter performance (space heating). Subtract 15° from the latitude to optimize for summer performance (pool heating).

Given the formula above, a solar collector installed at 30°N latitude should face due south at an angle of 45° for wintertime advantage, and 15° for summertime heating.

Preventing Overheating

To reduce summer heat output, angle the collector for optimal winter absorption. This is achieved by installing the collector at an angle of around 15° above the latitude angle (e.g. 45° at 30oN latitude). This angle corresponds closely to the angle of the Sun in the sky during the winter months, thus maximizing winter output. Conversely, during the summer when the Sun is high in the sky, the relative collector surface area exposed to Sunlight is reduced, cutting overall heat production considerably (by about 15%). This option is ideal for installations where solar thermal is being used for space heating.