

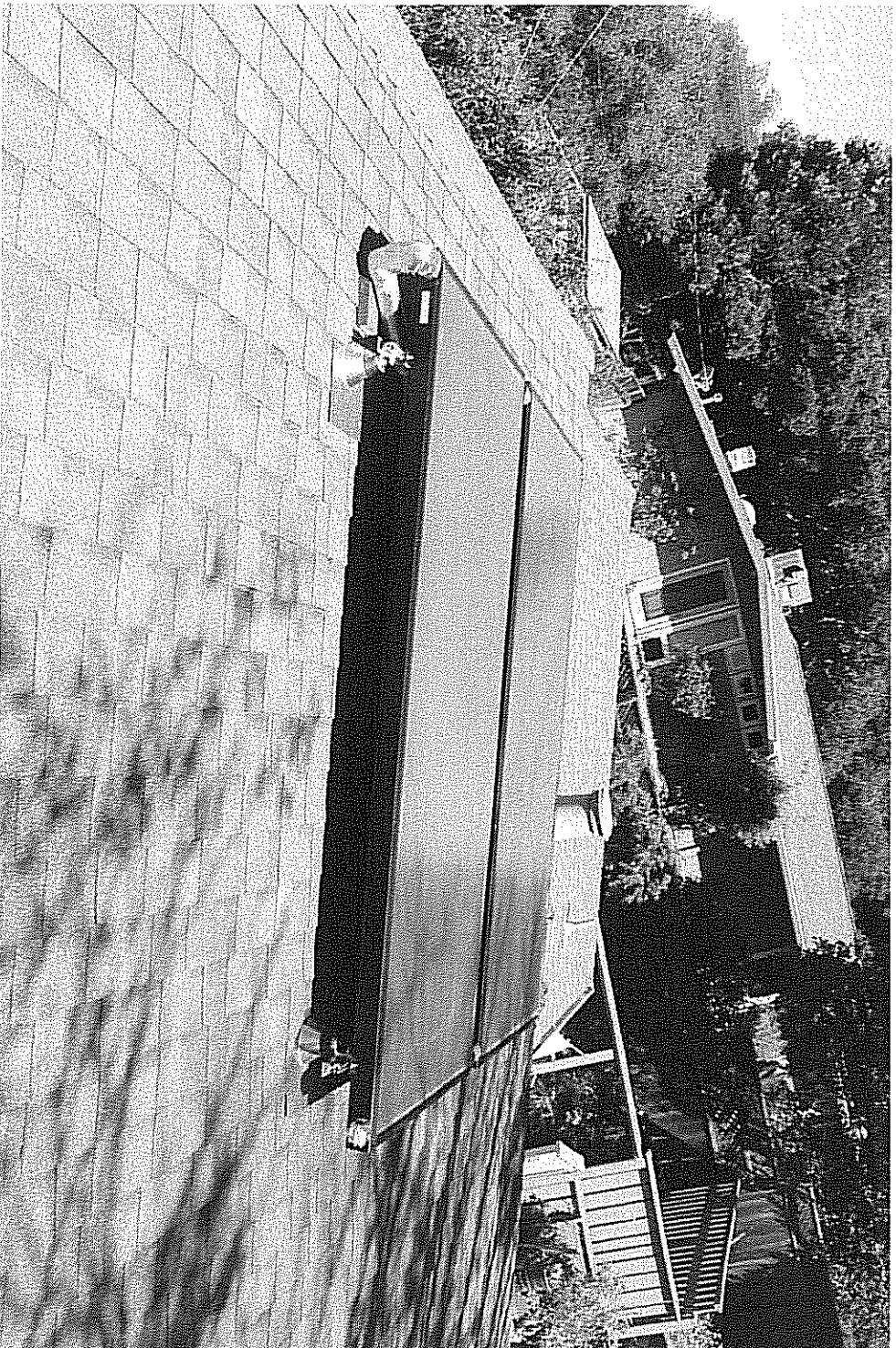
## Types of Solar Thermal Systems

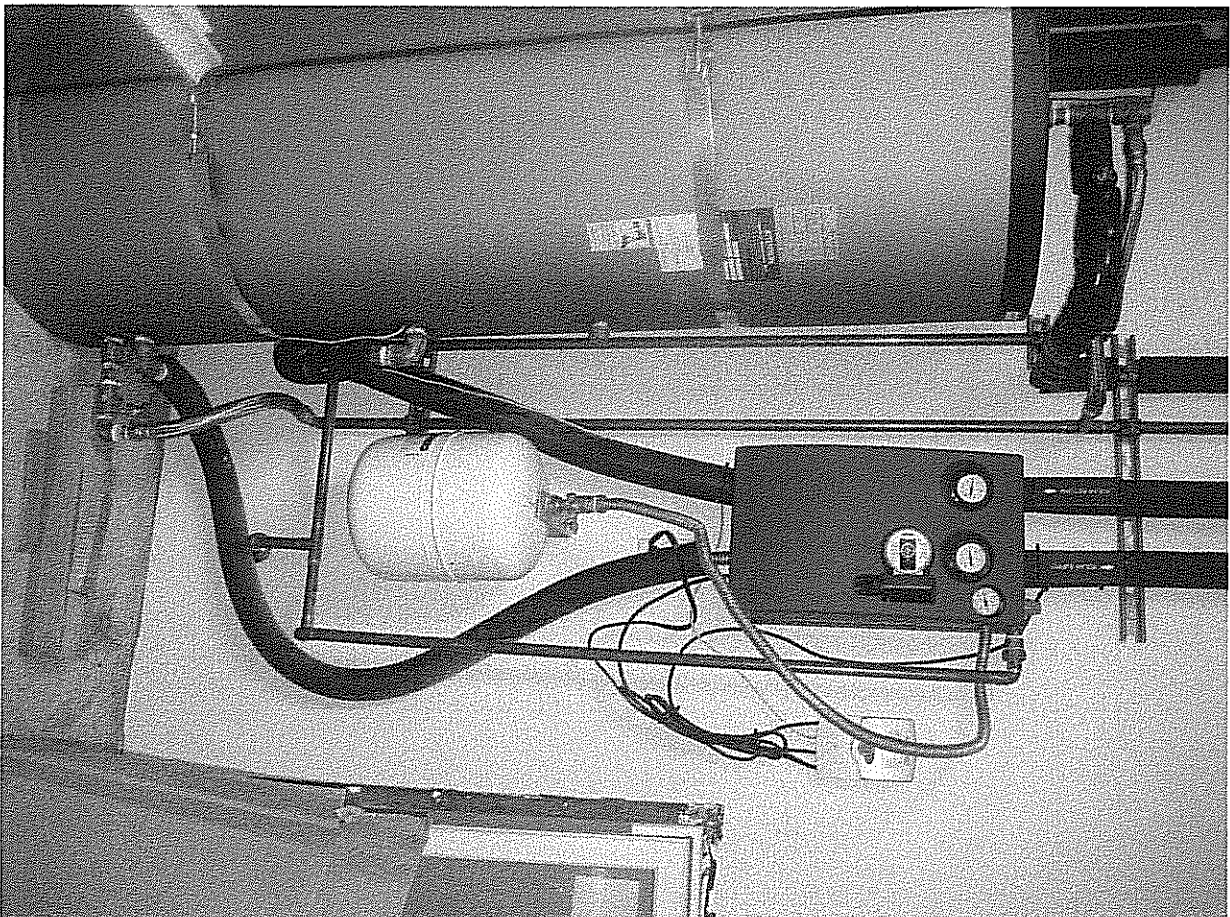
System Type	Description	Advantages	Disadvantages
<p><b>DrainBack</b></p> <p>Active, closed-loop, unpressurized with heat exchanger.</p>	<p>Requires two pumps, one to cycle water through the solar loop and one to cycle water through the heat exchanger. There is only fluid in the collectors when the pump is active. The pump is only active when the system is collecting heat.</p>	<p>Most reliable freeze and overheat protection. No fluid stagnation. can set a high limit on the collectors. No scheduled maintenance of heat exchanger fluid.</p>	<p>All piping must have slope towards the storage. Requires high head pump to lift fluid through the unpressurized solar loop. Relativity a drain-back system requires a high amount of energy to run. Complex.</p>
<p><b>Glycol Antifreeze</b></p> <p>Active, closed-loop, Pressurized with heat exchanger.</p>	<p>Solar loop is filled with a food grade glycol which is an antifreeze. The glycol is cycled through the collectors and heat exchanger by a small circulation pump.</p>	<p>Very good freeze protection. Uses much less energy than a drainback system. Can be put into a more aesthetically pleasing package.</p>	<p>Fluid may breakdown at high temperatures. Antifreeze reduces efficiency. May require fluid replacement every 3-5 years.</p>

# Types of Solar Thermal Systems

System Type	Description	Advantages	Disadvantages
<p><b>Passive ICS</b> Integrated Collector &amp; Storage</p> <p>Passive, Open-loop</p> <p>30 to 50 gallon</p>	<p>Collector is a glazed box with 4 inch copper tubes. Water is heated and stored in copper tubes. Relies on thermal mass for freeze protection.</p>	<p>Simple; no moving parts; last an extremely long time; little to no maintenance.</p>	<p>Lots of heat loss overnight. Solar hot water only from 12pm-8pm. Inefficient in fog banks and cold weather. Extremely heavy 800-900 lbs. Low Solar Fraction.</p>
<p><b>Thermosyphon</b></p> <p>Passive, open-loop</p>	<p>Glazed collector mounted below storage tank. Relies on convection; Relies on freeze bleed valves for freeze protection.</p>	<p>Simple; no moving parts; little maintenance. Higher performance than ICS systems</p>	<p>Storage tank must be located above the collectors. Relies on freeze bleed valves for protection which are prone to failure.</p>

## Glazed Collectors used on Drainback and Glycol Systems

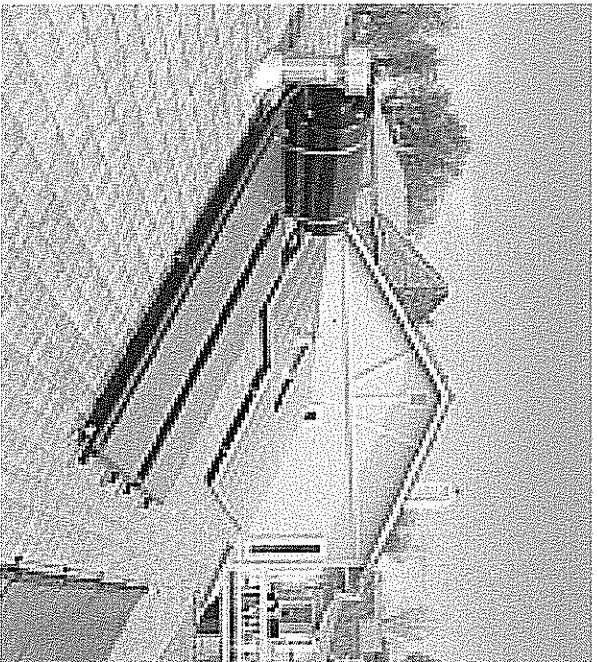




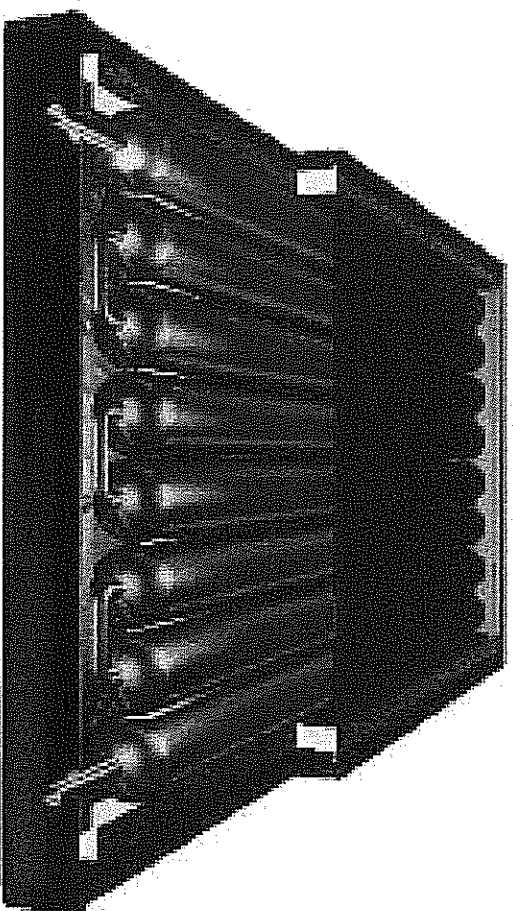
## **Schuco Glycol Systems**

- 80 gallon Storage Tank
- Expansion Tank
- Pump, Gauges and Controls

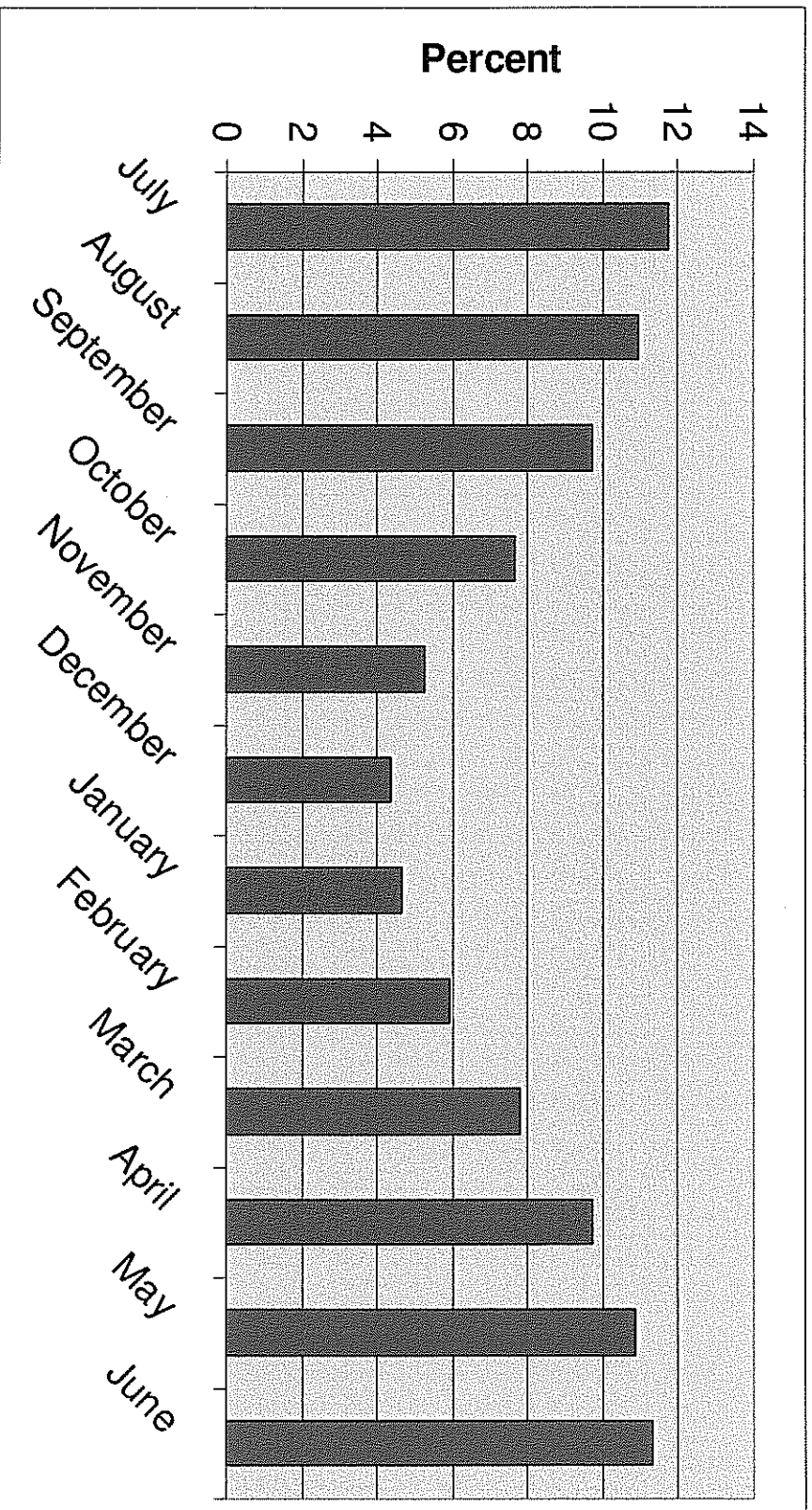
# Passive Thermosyphon



# Passive ICS “Batch”

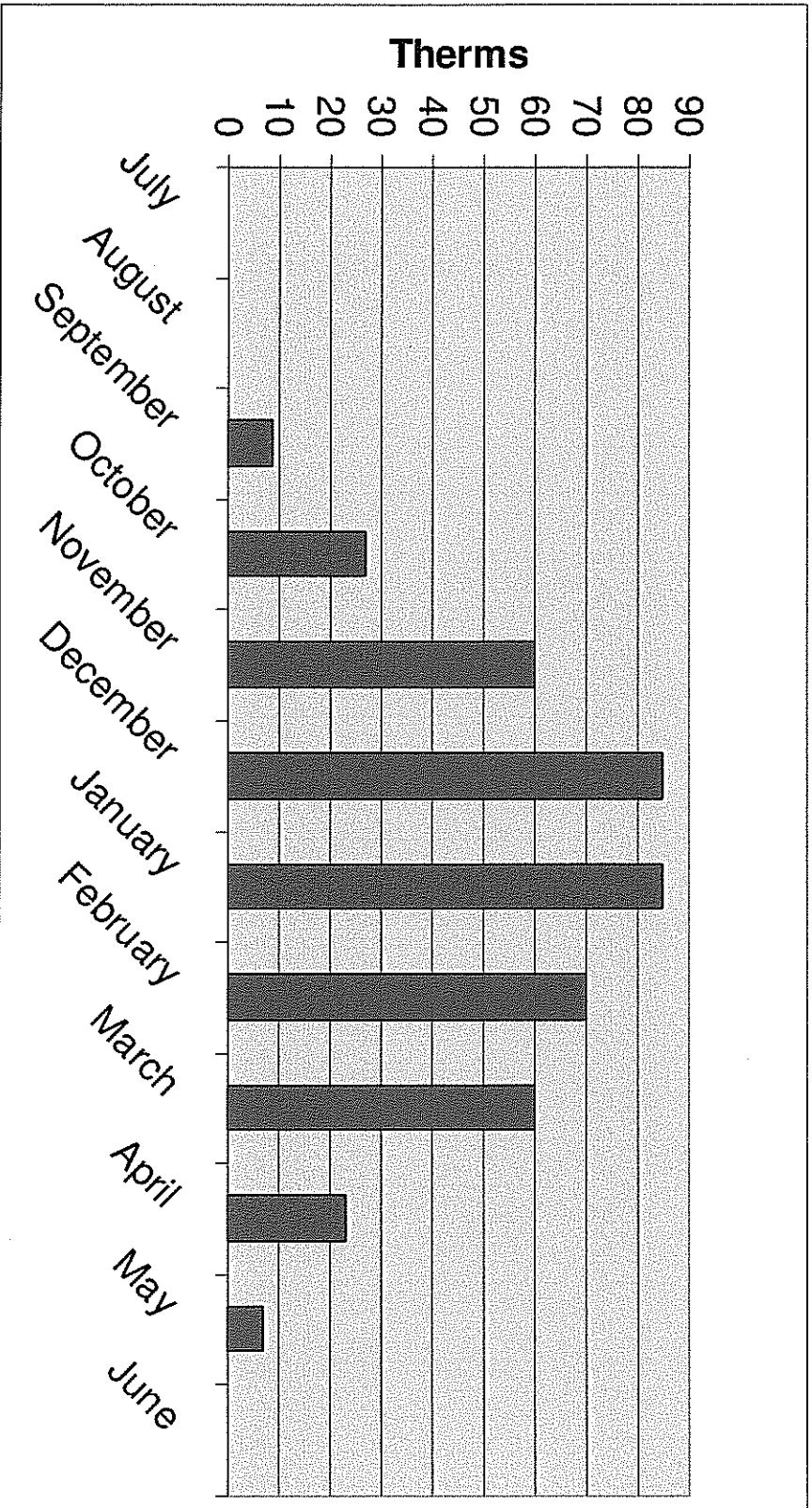


# Annual solar insolation for the Monterey Bay



# Space Heating Load

2000sqft well built home



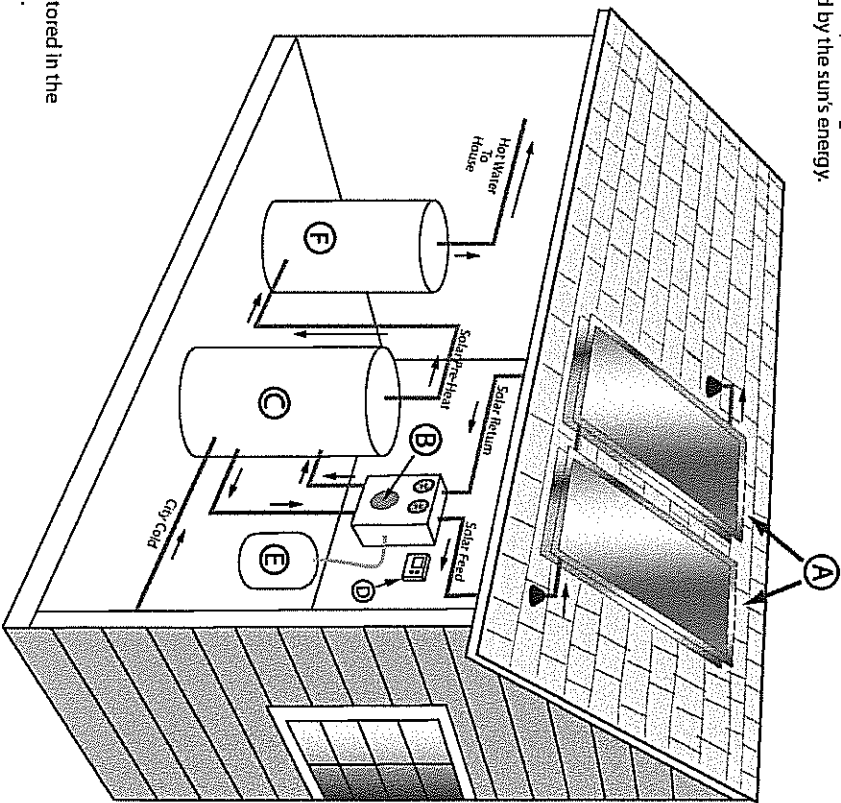
**Solar design + build**

# Solar Hot Water

1 - A heat transfer fluid is pumped through the Solar Collectors and heated by the sun's energy.

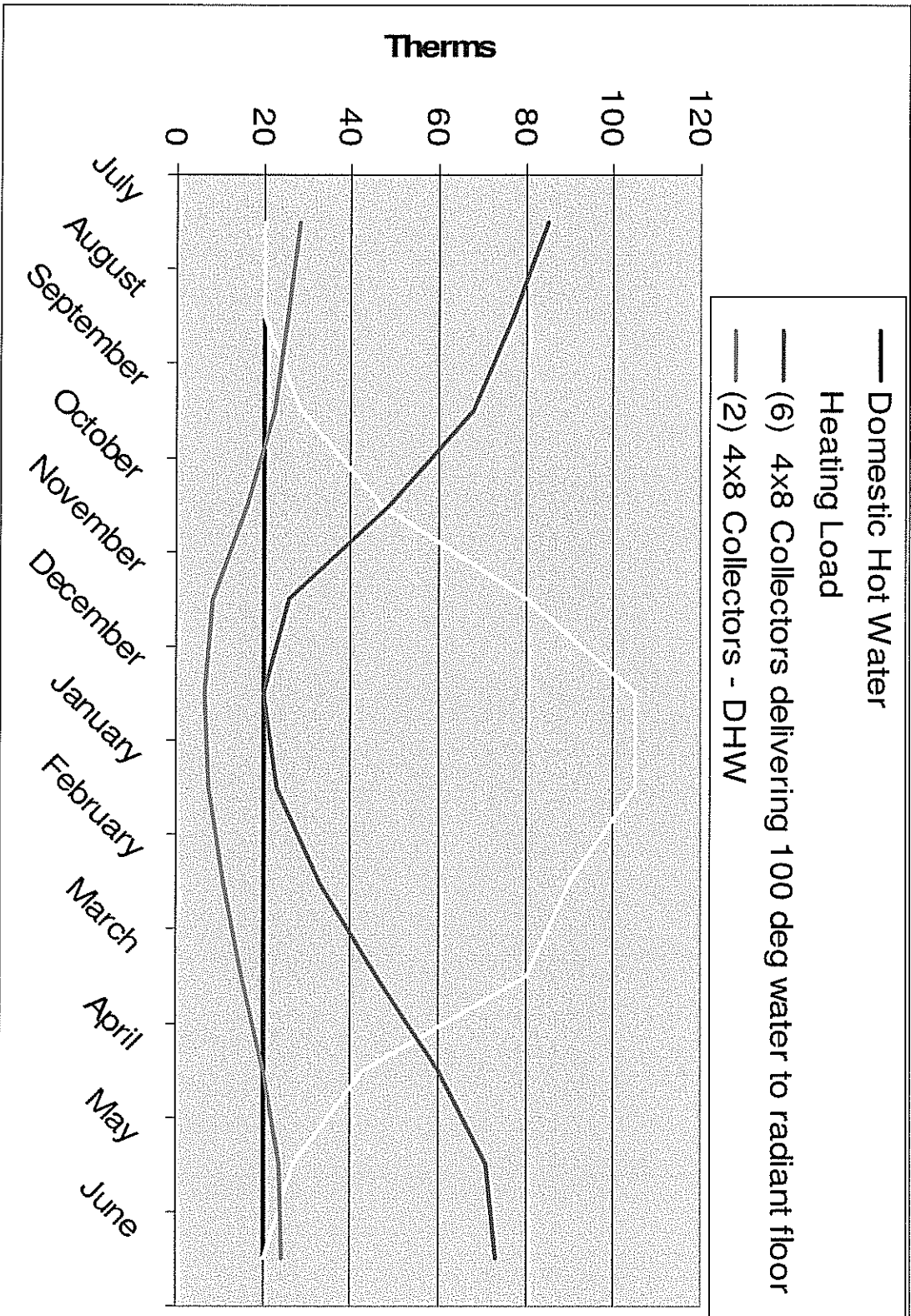
2 - The collected heat is transferred to the Solar Storage Tank Through an internal heat exchanger.

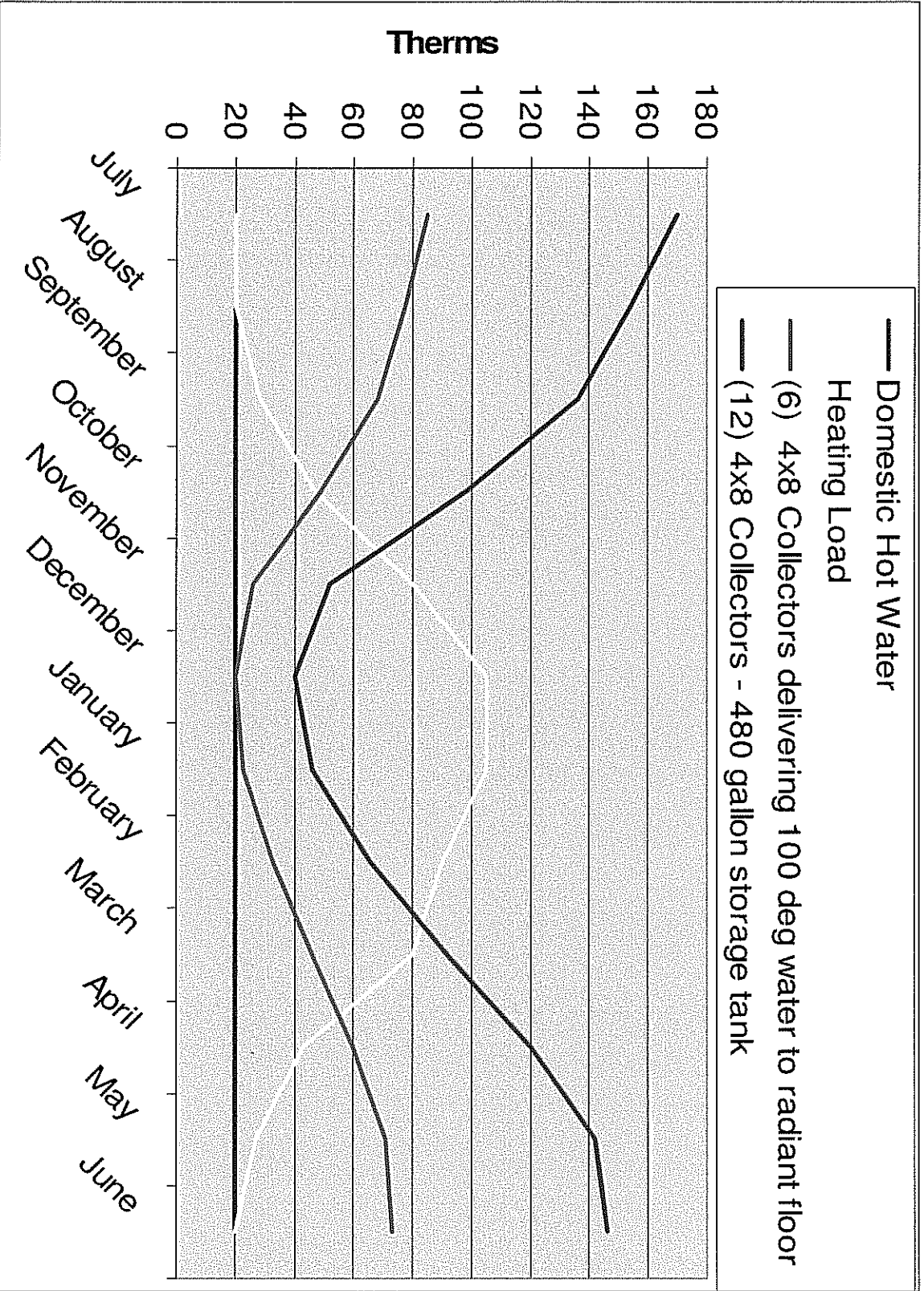
3 - Solar heated water is stored in the storage tank until needed.



Components of a Solar Thermal System

- (A) Solar Collectors
- (B) Circulation Pump
- (C) Solar Storage Tank
- (D) Differential Controller
- (E) Expansion Tank
- (F) Water Heater





# Solar Hot Water

## Pros

- Solar hot water systems are twice as efficient
- Low tech proven technology
- Familiar ground

## Cons

- Energy Storage is required
- Storage volume is tied to collector size
- **Can not bank excess energy from summer**
- Maintenance required
- Complicated system design with many fail points