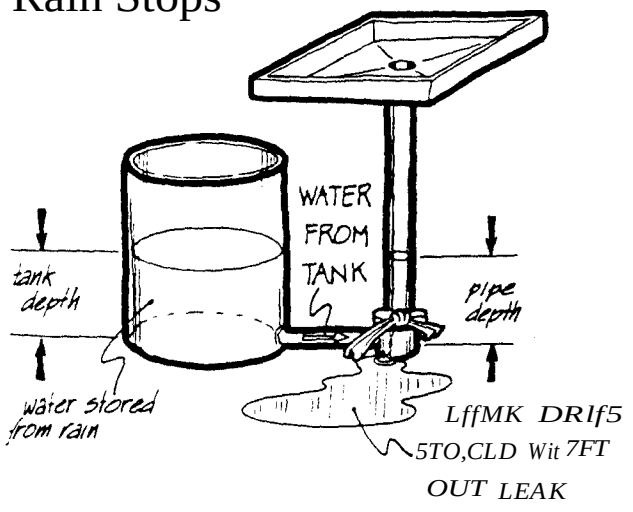
NIGHTTIME HEAT LOSS 15

The solar collector has captured the sun's heat during the day, and the captured heat has been pumped to storage. But what happens when the sun goes down or the sky clouds over? Again, we'll use our rainwater apparatus to understand what happens.

Suppose the rainwater tank is nearly filled and the rain stops. What will happen? With no rain falling on the rain collecting tray, no rainwater flows down the pipe. But water can still flow into the pipe from *the tank* through the tube that connects the two. The water depth in the pipe, then, will have almost the same depth as the water in the tank, since water can flow easily between them. However, when there is water in the pipe it leaks out-the higher the depth, the more the leakage.

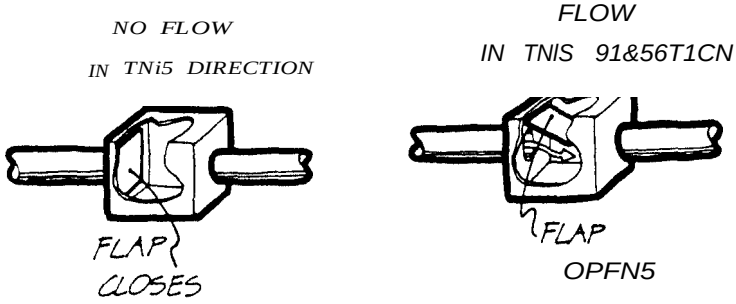
Tank Loses Water when Rain Stops



The net result is that stored water can flow out of storage and into the pipe and then flow out the leak. All the carefully collected rainwater leaks away as soon as the rain stops.

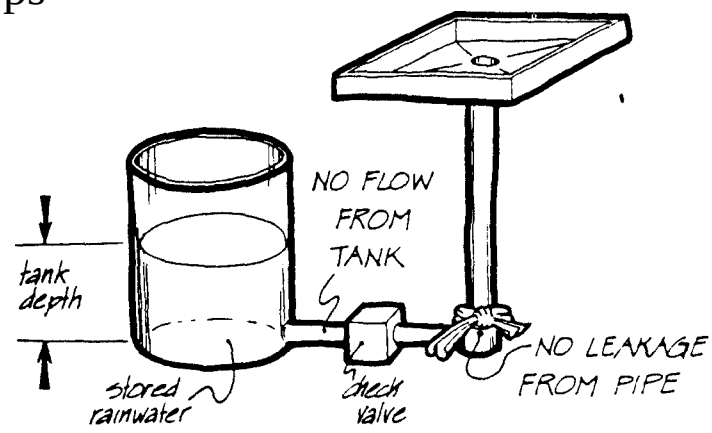
To prevent loss from the tank when the rain stops, we can put a *check valve* in the tube connecting the pipe and the tank. A check valve is a device that blocks the flow of water in one direction but allows it to flow In the other direction. Check valves are common devices to let a liquid flow in only one direction; in fact, your own heart has several such valves to keep your blood flowing In the right direction.

Water Flows One Way through Check Valve



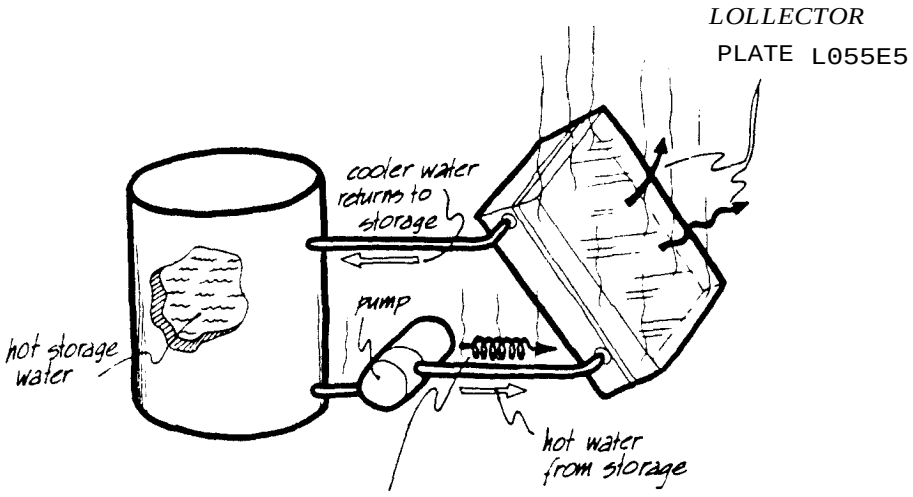
With a check valve inserted in the tube between the pipe and the tank, rainwater can flow easily from the pipe to the tank when the tray is catching rainwater. But when the rain stops, the check valve prevents any stored water from flowing back out the tank and into the pipe where it leaks away.

Check Valve Prevents Leakage when Rain Stops



The same process can occur in a solar heating system. Heat in the heat storage tank can be lost after the sun goes down. When solar radiation is not being absorbed by the collec tor plate, the water loses heat as it passes through the collector; it does not gain heat. Hot water pumped from the storage tank to the collector is hotter than the outdoors temperature, so heat flows by radiation and convection to the outdoors.

Storage
Loses Heat at Night



As stored water from the rainwater collector tank leaks away when the rain stops, so stored heat leaks from the solar collector tank when the sun is not out. In the rainwater system, we can use a check valve to prevent rainwater from flowing back from the tank to the pipe. The check valve lets rainwater into the tank, not out of it where it can leak away. In our solar heating system, the same effect can be achieved simply by stopping the pump whenever the sun isn't shining. Just as the check valve senses when the tank depth Is greater than the pipe depth-in other words, when rainwater is leaving the tank-temperature sensors detect when the heat storage tank is hotter than the collector-when heat Is leaving storage-and they control the

pump. If the storage tank is hotter than the collector, the pump Is shut off; If the collector Is hotter than the storage tank, the pump Is turned on.

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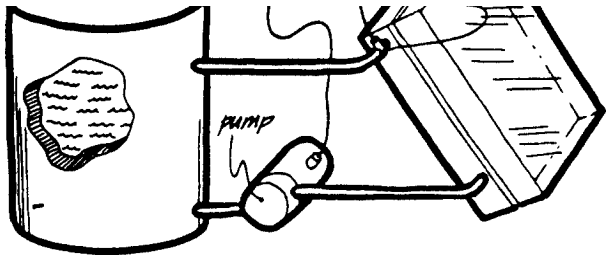

Controller Prevents Nighttime Heat Loss