

Then we shall list the essential variants of each and consider the most important systems, which can be combined from these. *Note that, for clarity, the schematic diagrams in this chapter do not show safety valves or vents.*

3.2 Systems for charging/discharging the store

3.2.1 Charging by means of solar energy

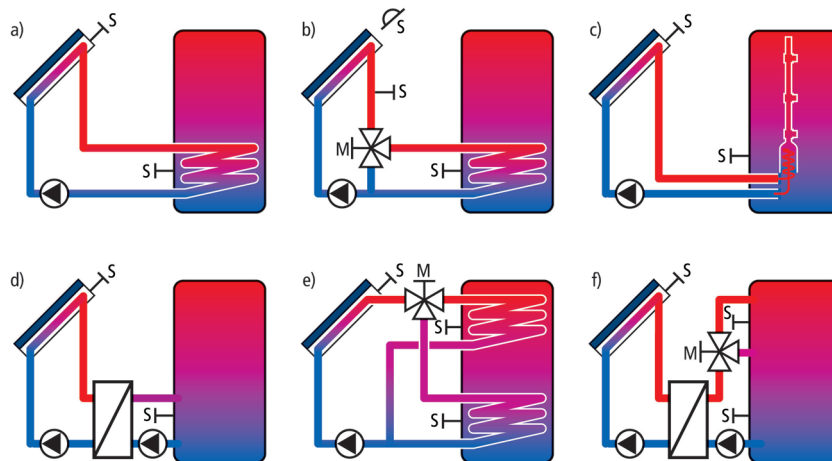


Figure 3.2.
Types of store charging with solar energy
(S = sensor)

- Internal solar heat exchanger.* The heat exchanger is normally designed as a finned or plain tube coil, which is arranged in the lower area of the store. Thermal transmission to the domestic water takes place through thermal conduction, and as a result of this convection takes place: that is, the heated water rises as a result of its lower density.
- Internal solar heat exchanger with bypass circuit.* This is a variant of system (a) for larger systems. A radiation sensor measures the solar radiation. At a threshold value of, for example, 200 W/m^2 the controller switches on the solar pump, and the three-way valve initially bypasses the heat exchanger. The solar circuit heats up. When the set temperature difference with the store has been reached at the flow sensor, the controller switches over the valve and the store is charged with heat.
- Stratum charging with self-regulating stratified charger.* The central core of this store-charging method is a riser pipe with two or more admission ports at different heights and a heat exchanger installed below. The heat exchanger heats up the water surrounding it in the riser pipe, and the water rises up. This causes a pronounced temperature-stratification effect, and in the upper area a useful temperature is very soon achieved.
- External heat exchanger.* The solar liquid flows through the primary side of an external plate heat exchanger. For charging the store a second circulating pump draws cold water from the bottom of the store. This flows through the secondary side of the heat exchanger in a counter-flow and then flows back into the middle of the store. An external heat exchanger has better thermal transfer properties than an internal type. Stores without internal fittings can also be used. The bypass circuit (b) can be implemented without the three-way valve by controlling the two pumps separately. For this purpose sensor arrangement (b) should be selected.
- Stratified charging system with two internal heat exchangers and feed via a three-way valve at two different heights.*
- As (e) but with an *external heat exchanger*.

The advantage of stratified charging systems (rapid reaching of useful temperatures in the standby area) is greatest in connection with the *low-flow* concept. In low-flow systems, sometimes also called *matched-flow* or *single-pass* systems, only about 25 l of heat transfer fluid circulates per square metre of collector area. The effect of this is