

RENEWABLE ENERGY SOURCES

8.3. Solar power plants and heat supply systems

8.3.4. Installations and systems of solar heat supply

8.3.4.1. Basic equipment of solar heat supply system

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Solar energy is transformed into heat by simple enough technical means, and therefore, it is widespread in the world. Key equipment, applied in installations and systems of solar heat supply and hot water supply, is a flat solar collector. Its basic constructive element is an absorbing blackened, as a rule, metallic plate with canals for heat-carrier (water, air). The absorbing plate is placed in heat-isolated box, which is covered by glass on top. Depending on the set amount of hot water, collectors are hydraulically joint, forming the required total area. Water flows through the collectors either by natural circulation (for small installations), or by a circulating pump. Collectors are connected with reservoir-accumulator, in which hot water, supplied for consumption, is accumulated.

In fig. 8.17 block-diagrams of solar water-heating installations with natural circulation are shown.

In Russia the technology of solar water heating is well mastered. A number of enterprises produce solar collectors, which do not yield by their efficiency to foreign analogues. The price of solar collectors of domestic production is about 2500...4000 rub/m², but specific capital investments in solar installations of hot water supply at estimation per 1 m² of solar collector is about 5000...6000 rub. Cost of heat, produced

by solar water heating installation in the south regions of Russia, is 700...900 rub/Gcal.

Solar collector efficiency depends on environmental conditions, that is, density of flux radiation and air temperature. The average efficiency factor of domestic solar collectors is more than 0,5.

In climatic conditions of Russia, application of liquid solar collectors for covering the heating load, as a whole, is not reasonable, but use of solar water heating installations is rather effective in the regions southward of 50...55° of north latitude.

Constructive, and technical and economic characteristics of installations and systems of solar heat supply are shown in [32 – 37].

In the foreign practice in addition to flat solar collectors, pipe vacuum collectors are produced and applied. In these collectors absorbing element is a pipe, which is in the glass pipe coverage, inside which vacuum is created, that significantly reduces heat losses. In such collectors water can be heated up to higher temperature in comparison with solar collectors of other configurations. Nevertheless, they are significantly more expensive and can be recommended for application in the current Russian conditions.

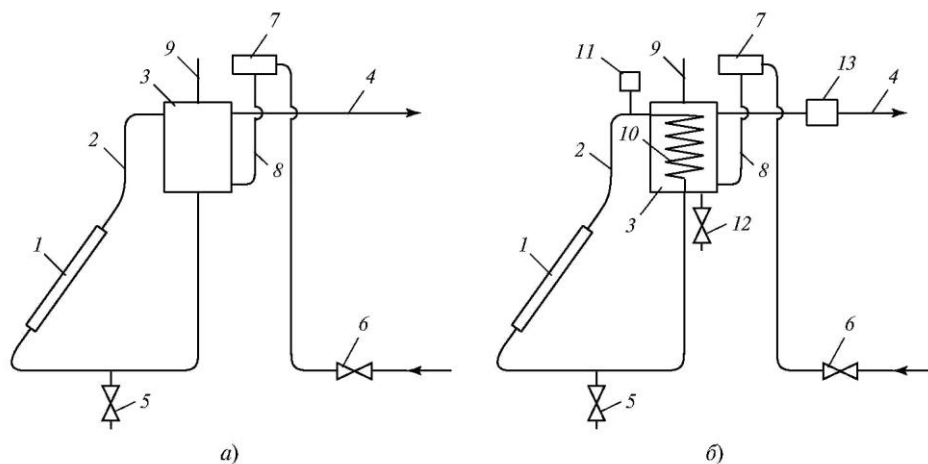


Fig. 8.17. Block-diagrams of solar water heating installations with natural circulation:

a — single-circuit of seasonal operation; *b* — double-circuit, year-round operation; 1 — solar collectors; 2 — circulation pipeline; 3 — reservoir - accumulator; 4 — pipeline of hot water distribution; 5 — drain valve; 6 — valve at the water supply line; 7 — float level regulator; 8 — pipeline of cool water supply; 9 — air pipe; 10 — heat-exchanger; 11 — expansion tank; 12 — drain valve of reservoir-accumulator; 13 — doubler.