Academia Globe: Inderscience Research

ISSN: 2776-1010 Volume 4, Issue 4, April, 2023

DEVELOPMENT AND STRAPPING OF SOLAR HOT WATER SUPPLY IN THE EXAMPLE OF THE CITY OF NUKUS

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Annotation:
The article is devoted to the study of the operation of the installation and strapping of hot water supply based on a solar collector. The algorithm for calculating the efficiency of the installation is described step by step.

Keywords: collector, heat loss, thermal insulation, heat carrier

РАЗРАБОТКА И ОБВЯЗКА СОЛНЕЧНОГО ГОРЯЧЕГО ВОДОСНАБЖЕНИИ В ПРИМЕРЕ ГОРОДА НУКУСА

Аннотация:
Статья посвящена исследованию работы установки и обвязки горячего водоснабжения на основе солнечного коллектора. Поэтапно описан алгоритм расчета эффективности установки.

Ключевые слова: коллектор, теплопотеря, теплоизоляция, теплоноситель

The possibilities of using environmentally friendly, universally available renewable energy from solar radiation are attracting increasing attention. According to forecasts, within the next 15-20 years, renewable energy sources (solar, wind, biomass) should take a prominent place in the global energy balance, providing replacement of dwindling reserves of organic fuel and ecological improvement of the environment.

ISSN: 2776-1010 Volume 4, Issue 4, April, 2023

Solar collector — this is an installation that collects solar energy and then converts it into heat. Solar collectors are used in summer to supply the house with hot water, as well as heating water in swimming pools. And in winter — for heating in conjunction with solid fuel, liquid fuel or electric heating. The use of solar collectors allows you to reduce heating costs by fifty percent or more. Despite the fact that in our climatic zone the number of cloudy days is significant, even at this time the collector continues to work, but for the full functionality of the hot water or heating system in this case an additional energy source is needed. On the territory of Nukus, it is possible to receive a total of 1,632 kWh annually, which is about half of the radiation balance of Southern Europe and the Middle East. With a properly designed and installed system, you will not experience problems with operation in the future for many years. The solar collector pays for its cost approximately during the first five years of operation. Therefore, the next 25-30 years, the solar system will reduce energy consumption.

Calculation of a flat solar collector

Practice shows that an average of 900 watts of thermal energy per square meter of the surface installed perpendicular to bright sunlight (with a cloudless sky). The calculation of the SC will be made on the basis of a model with an area of 1 m^2. The front side is matte, black (has close to 100% absorption of thermal energy). The back side is insulated with a 10 cm layer of expanded polystyrene. It is required to calculate the heat loss that occurs on the reverse, shadow side. The coefficient of thermal insulation of expanded polystyrene is 0.05 W/m × deg. Knowing the thickness and assuming that the temperature difference on opposite sides of the material is within 50 degrees, we calculate the heat loss:

0,05/0,1 × 50 = 25 watts.

Approximately the same losses are expected from the ends and pipes, that is, the total amount will be 50 watts. The sky is rarely cloudless, in addition, the effect of dirt on the collector should be taken into account. Therefore, we will reduce the amount of thermal energy per 1 m^2 to 800 watts. Water used as a heat carrier in flat solar collectors has a heat capacity equal to 4200 J/kg × deg or 1.16 W/kg × deg. This means that in order to increase the temperature of one liter of water by one degree, it will take 1.16 watts of energy. Taking into account these calculations, we obtain the following value for our model of a solar collector of 1 m^2 of area:

800/1,16 = 689,65.

We round it up to 700 /kg × deg for convenience. This expression denotes the amount of water that can be heated in the collector (1 m^2 model) for an hour. This does not take into account the heat loss from the front side, which will increase as it warms up. These losses will limit the heating of the coolant in the solar collector within 70-90 degrees. In this regard, the value 700 can be applied to low temperatures (from 10 to 60 degrees). The calculation of the solar collector shows that the system with an area of 1 m^2 is able to heat 10 liters of water at 70 degrees, which is quite enough to provide a house with hot water. It is possible to reduce the heating time of water by reducing the volume of the solar collector while maintaining its area. If the number of people living in the house requires a larger volume of water, several collectors of such an area should be used, which are connected into one system. In order for sunlight to affect the radiator as efficiently as possible, the collector must be oriented at an

Academicia Globe: Inderscience Research
ISSN: 2776-1010 Volume 4, Issue 4, April, 2023

angle to the horizon line equal to the latitude of the terrain. On average, 50 liters of hot water is needed to ensure the vital activity of one person. Considering that the water before heating has a temperature of about 10 ° C, the temperature difference is 70 – 10 = 60 ° C. The amount of heat needed to heat the water is as follows:

W=Q × V × Tp = 1,16 × 50× 60 = 3,48 kW of energy.

Dividing W by the amount of solar energy per 1 m² of surface in a given area (hydrometeocenter data), we get the collector area. The calculation of the solar collector for heating is carried out similarly. However, the volume of water (coolant) needs more, which depends on the volume of the heated room. It can be concluded that improvements in the efficiency of a water heating system of this type can be achieved by reducing the volume and simultaneously increasing the area.

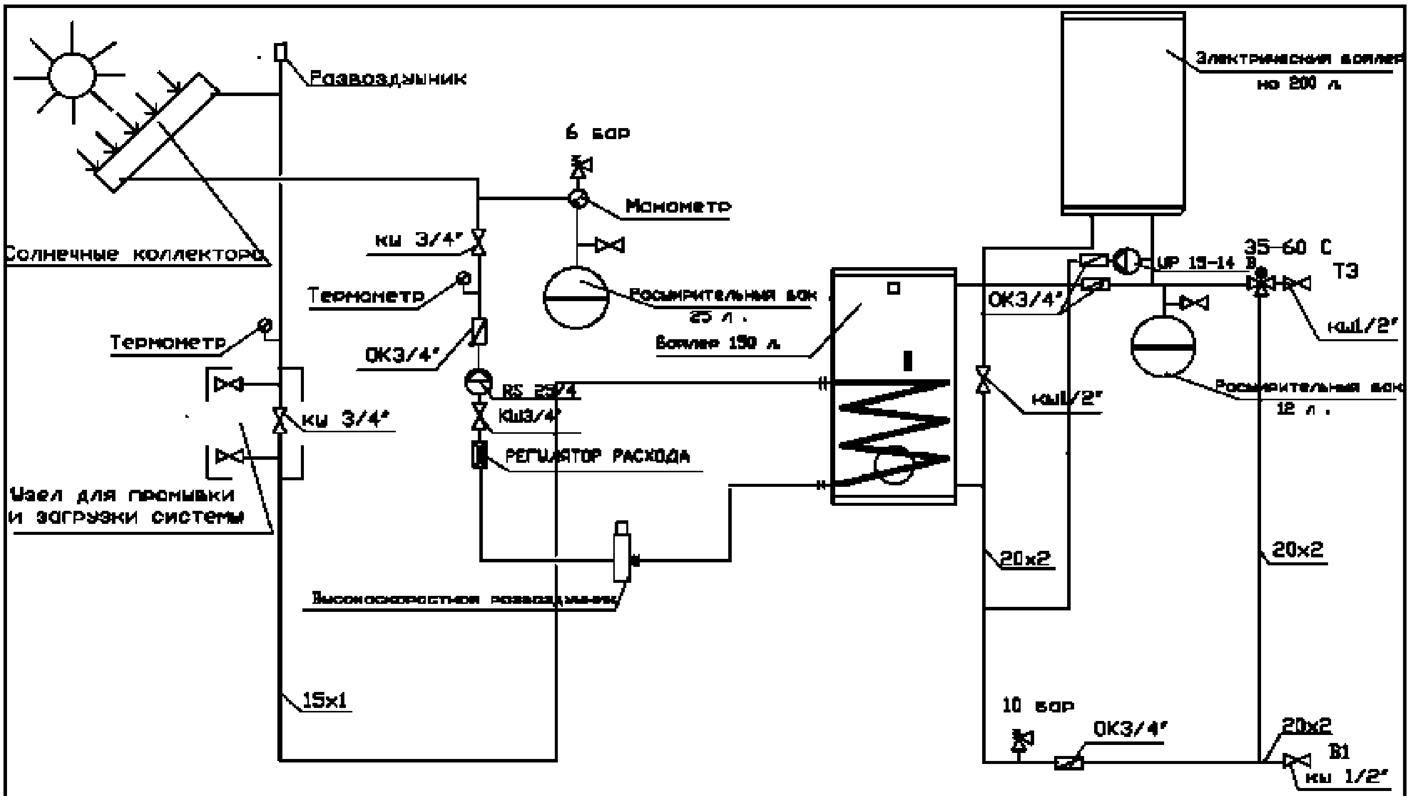

Fig. 1 scheme of strapping and installation of a solar collector

Installation of a solar collector

The quality of the solar collector, or rather the amount of energy produced, may depend on many factors. But some factors can be taken into account when installing the collector, for example, this includes the angle of inclination and orientation of the installation, the azimuth must be taken as the orientation criterion in this case. The angle of inclination is considered to be the angle between the battery and the horizon. During the installation of the collector on a pitched roof, the slope angle is taken by the ramp itself. As practice shows, the ideal angle of inclination is considered to be an angle from 30 to 45 degrees. The azimuth will show the deviation of the collector with respect to the south, if

ISSN: 2776-1010 Volume 4, Issue 4, April, 2023

its plane is oriented to the south, then it should be zero. In our latitude, it considered that the deviation to the south can be equal to 45 degrees to the southwest or southeast.

References

1. Overview studies on the development of a national renewable energy system in Uzbekistan. UNDP. Report on component 1 of the Tashkent project, 2005
2. BCH-52-86 Departmental building codes. Solar hot water supply installations. Design standards. M.: Gosgrazhdanstroy, 1988.
3. http://www.znaytovar.ru/gost/2/Posobie%20%20koefficient%20obluchennosti_Spr.html
4. http://www.uzbekenergo.uz/ru/news/tariffs-electric-power/