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Solar Zero Cold Water Heater

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Abstract

When the traditional water heater discharges water, a section of cold water will flow out first, which not only wastes water resources and has a poor user experience; however, the new water heater also has many shortcomings. This product aims to have a better solution to it. Connect the circulating pump through the return pipe to make the cold water in the hot water pipe return to the host to reheat. The circulating pump is controlled by a temperature sensor, and the switch of the temperature sensor is determined by people. It can effectively reduce the energy consumption of ordinary zero cold water heaters and the damage to the instrument. It has a relatively broad market and at the same time has unparalleled advantages compared to similar products. However, the high-end products that are fully intelligent are too expensive, which often discourages most people. This water heater provides people with a reasonable choice. It is also the first solar zero cold water heater.

Keywords

Zero Cold Water; Water Heater; Circulation; Return Pipe.

1. Introduction

Nowadays, the development of the water heater industry is basically mature, and the water heater has basically become a necessity in the family. With the improvement of living standards, people have higher and higher requirements for the quality of life. People's requirements for water heaters are no longer limited to the ability to provide hot water, and they have begun to pursue comfort and experience. Under the premise of ensuring safety and convenience, water heater manufacturers will focus on improving customer experience in the future product development direction. Many manufacturers have successively introduced zero cold water heaters, which can effectively solve such problems. However, because the heating frequency reaches dozens of times in a day, a large amount of energy is wasted, and new drawbacks have arisen. And in the process of use, heating has caused the pressure of the water pipe to increase sharply; problems such as damage to the host due to repeated heating, and the smart water heater is more expensive, which is not suitable for ordinary households.

Traditional domestic solar water heaters or electric water heaters usually release a certain amount of cold water during use [1] before bringing the hot water to the preset temperature. This period of time can be as long as one minute. During the process, there will be hot and cold conditions, which not only produces a lot of waste of water resources, but also requires waiting time, and the user experience is extremely reduced. We have developed a solar zero cold water water heater, adding a circulating pump and an intelligent digital display electronic thermostat to the ordinary water heater to solve the problem of cold water waste and reduce a lot of costs at the same time.

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2. Water Heaters on the Market and Their Shortcomings

2.1 Existence Type

At present, due to the relatively small market share of solar energy, there is no zero-cold water heater on the market for solar water heaters. However, because the solar panel is installed farther from the bathroom, the solar hot water pipe is much longer than the gas water heater, so it wastes more water resources than the gas solar energy. At present, there are mainly three types of water heaters on the market, one type is ordinary water heaters, and all solar water heaters on the market are of this type; the other three are the zero cold water technology of gas water heaters, and the other is the zero cold water technology of gas water heaters, and the other is that the hot water pipe is not added to the return pipe. Short-circuit with the cold water pipe, one type is heated in the return pipe, and the other type is to automatically circulate the cold water into the host for heating.

2.2 Disadvantage Details

When one end of a water heater without a return pipe is using cold water, the other end will only release hot water. However, for the water heater of the return pipe heating type, the water pressure of the hot water is too high, which makes the hot water pipe extremely easy to burst. If the water heater of the main unit heating type is used, since the circulating pump will work after it senses the cold water, too much cold water is discharged into the main unit, and the main unit is heated too frequently and the service life is greatly reduced.

3. Design Principle

3.1 Principle Summary

The schematic diagram of the solar zero-cold water heater is shown in Figure 1. The intelligent electronic digital thermostat senses the temperature change in the water pipe, controls the work of the circulating pump, and circulates the cold water in the hot water pipe back to the host through the return pipe for heating. A one-way valve is installed at the farthest point of the water pipe to avoid the backflow of cold water, so as to achieve the effect of instant heating.

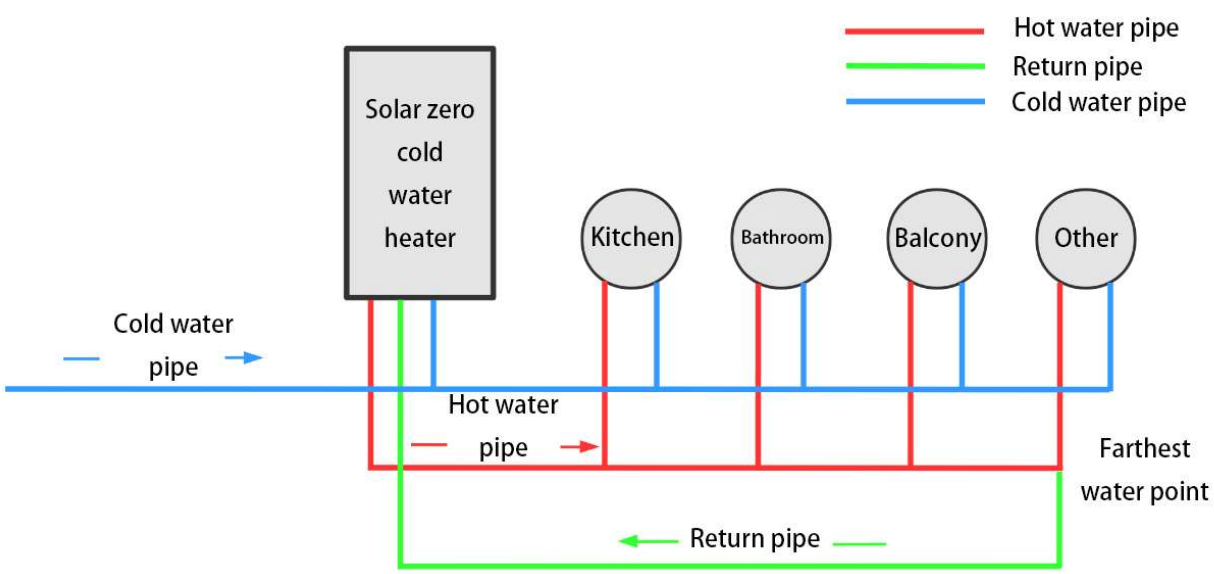

Figure 1. Design schematic

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3.2 Use Components

This product installs an intelligent digital display electronic temperature controller at the hot water pipe, and puts the water drop head of the temperature controller into the hot water pipe to sense the temperature change of the water in the hot water pipe. The water drop head is made of waterproof material to measure the temperature. In a non-corrosive liquid at 150 degrees Celsius. The thermostat sets high and low temperatures, the low temperature is the starting temperature, and the high temperature is the ending temperature. The user presses the button of the thermostat before using hot water. When the temperature in the hot water pipe is lower than the initial temperature set by the thermostat, the circulating pump starts to work, returning the cold water from the hot water pipe to the water heater through the return pipe. At the same time, in order to avoid cold water backflow caused by pressure changes in the water pipe when the circulating pump is working [1], a one-way valve [2] is installed at the farthest water point to ensure that the cold water flows from the hot water pipe to the return pipe to achieve the hot water pipe Re-inject hot water to achieve the goal of "hot water immediately after opening".

The intelligent digital display electronic temperature controller used in this product is an integrated intelligent temperature control instrument for regulating and controlling. It adopts a fully digital integrated design and has a stable and accurate temperature measurement function. It needs to convert the continuously changing analog quantity into a continuously changing digital quantity (A/D conversion), and then load the counter, register, decoder, and finally display it on the LED digital tube. The result is considerable and can be used for most people. Applicable, relatively safe, and low cost. The circulating pump adopts a 200W booster pump, the noise is less than 45dB, and there is basically no influence when working.

3.3 Degree of Savings

According to the China Report Hall, the current solar water heater market occupies 7.6%. With the strong support of the country, the proportion of gas water heaters, electric water heaters, and solar water heaters in the survey of household purchase expectations has evolved to 35.8%, 30.2%, and 23.2%. The proportion of households using zero-cold water heaters is only 2.1%[4]. Currently, water heaters generally use pp plastic pipes, and the data is shown in Table 1. Through investigation, the average length of the hot water pipe of the solar water heater is 7m. If a household uses a solar zero cold water heater, it should be bathed once a day in summer, once every three days in spring and autumn, and once every five days in winter. Then the saved water resources are 2665L.

Table 1. Water heater pipe data

Outer diameter	Thickness	Inner diameter	Average length
25mm	3.2mm	18.6mm	7m

4. Results and Discussion

4.1 Results and Discussion

The device of this product is easy to operate. It only needs to modify the existing household water heaters, and does not require large-scale construction, replacement of water heaters and other cost-increasing projects. The user only needs to install a return pipe at home, install a one-way valve at the farthest water point, and install an intelligent digital display electronic thermostat at the water point.

For traditional water heaters, by connecting the circulating pump and the return pipe, the cold water in the hot water pipe is circulated, which improves the utilization rate of water resources and the user experience. Compared with other zero-cold water heaters, by changing the working conditions of the circulating pump, the circulating pump changes from working continuously throughout the day to working only when the user uses it, which reduces the waste of energy such as electricity.

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Compared with the water heater heated in the return pipe, it not only reduces the pressure of the water pipe, but also reduces the heating times of the main engine and maximizes the service life of the main engine.

4.2 Outlook

According to the feedback from the current water heater market research information, users are pursuing product comfort[5], which also shows that the consumption pain point is the breakthrough direction of enterprise research and development. Only a few years later, the sales of zero cold water in Haier's overall gas water heater accounted for more than To reach 20%, it is no exaggeration to say that the zero cold water heater is the end point of competition in the water heater industry.

Compared with traditional fuel water heaters or solar water heaters, solar zero cold water heaters ensure the constant temperature performance during the use of the water heater, effectively prevent the long waiting time and the shortcomings of hot and cold during the use of the water heater, and significantly improve the use of the two types of users Compared with ordinary water heaters, zero cold water heaters effectively solve the waste problem of users [6].

In recent years, Rinnai, AO Smith, Wanhe, Macro and other mainstream brands in the high-end camp have zero-cold water gas water heaters[7], and consumers have three major concerns about zero-cold water water heaters: high price, waste of fuel, and fear The new product is not safe. For these concerns, the solar zero cold water heater developed by us has a certain solution. For the high price, our products only need to install the return pipe, circulating pump and intelligent digital display electronic temperature controller on the basis of the original water heater. The price is relatively low and suitable for most households in China. At the same time, the water is not heated inside the return pipe. The pressure in the tube will not be too high and there will be water leakage. Due to human control, there are fewer heating times in a day, which guarantees the life of the product.

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