



HOT WATER SYSTEM

In general, the plumbing system in MAGIC BOX is designed to concentrate all devices, be they storage, pressure unit or heating system in one single area: in case of failure at any point, water supply is gravity fed. Water is stored and distributed from the bathroom ceiling to each outlet. Only the supply tank and the wastewater tank are out of the enclosed conditioned space.

The solar water heating system is optimized to guarantee its maximum efficiency, although an electric backup has been installed which will only be used if needed. Storage and distribution systems, as well as a pressure unit, are placed above the bathroom –a folding stepladder is fixed in the ceiling for checking. The placement of evacuated hot water tube collectors above the bathroom skylight reduces temperature and pressure losses in the primary circuit.

Heating of domestic water is carried out through solar radiation. The system consists of a closed circuit containing water, heated by evacuated tube collectors. Water is then conducted to tanks, where heat is transferred from the primary circuit (only heating) to the secondary circuit (consumption). The primary circuit is monitored by means of a regulation device, controlling pumps, temperature sensors, valves, etc. Heat from evacuated tube collectors keeps water warm for consumption in these tanks. Besides, hot water coming from the washing machine and the shower is used to partially heat the biggest tank, that will be colder since it contains a bigger amount of water.

Evacuated tube solar collectors lean on steel purlins and are made up of two tubes: an internal tube where water flows; and an external tube, enclosing the internal one and having the capacity to absorb the maximum amount of radiation, based on the greenhouse effect and on the reflection and refraction properties of certain materials. To take most advantage of sun radiation, evacuated tube hot water collectors are located on the roof with the most adequate inclination, i.e. at about 42° in Madrid and Washington, D.C.

In contrast to the conventional solar water heating systems, MAGIC BOX presents the following innovations:

- Instead of one big water tank, two small tanks (60 l.) and a bigger one (150 l.-vertical coil exchanger tank) are installed to provide hot water at any time of the day. When there is not enough solar radiation to heat all the water, at least one of the two smaller tanks will be heated. This makes our hot water installation versatile, allowing to concentrate heat production in a small volume for immediate use. The continuous supply of hot water is guaranteed, since one of the smaller tanks has an auxiliary electrical resistor, allowing to cover any failure in heat generation in the evacuated tube collectors.
- Wastewater from the shower and the washing machine will be re-circulated to take advantage of its thermal energy to partially heat the tanks. Transferred heat is not usually taken into account, but it is useful to create a more efficient hot water system. For this purpose, a 25-liter tank is placed at the laundry closet,

in the raised technical floor. Two pumps are installed, one next to the tank and the other in the bathroom ceiling, next to the heat exchanger.

The following figure shows a schematic diagram of the solar water heating system:

