THE SOLAR LOOP

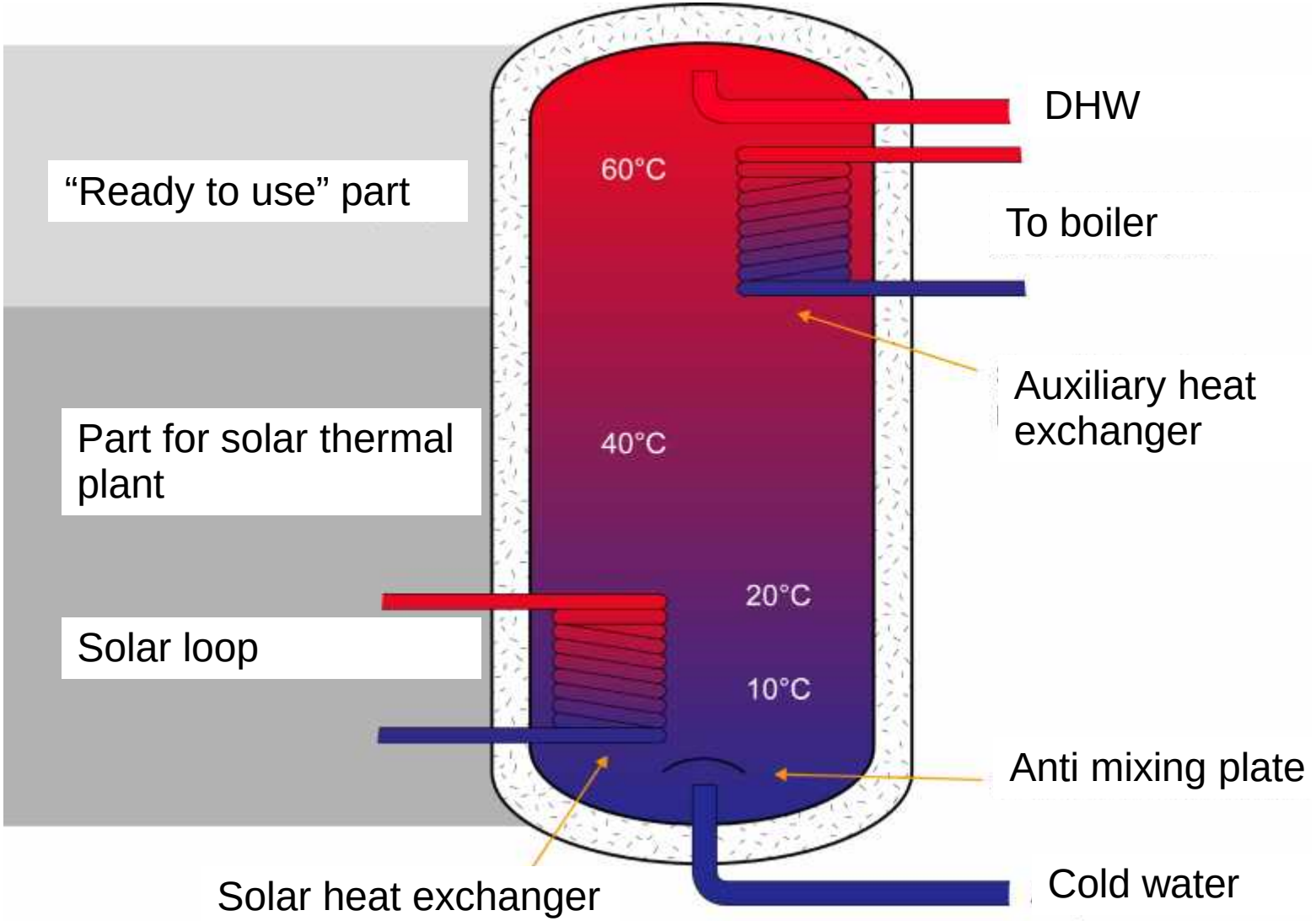
Dr. Osama Ayadi

The solar loop

- Storage tank
- Natural circulation systems
- Pump and control unit
- Safety components
- Stagnation

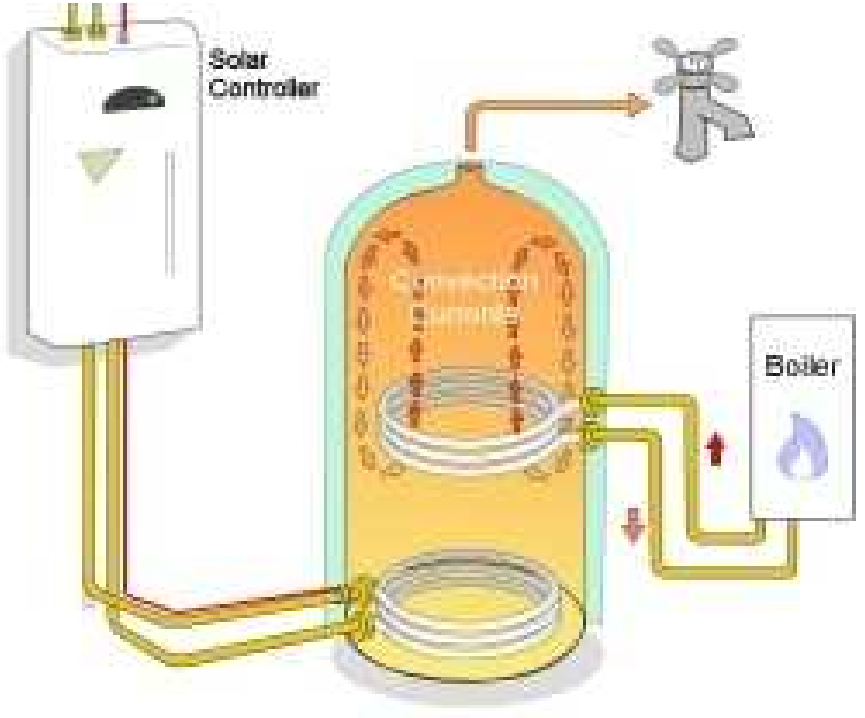
Storage tank

Storage tank



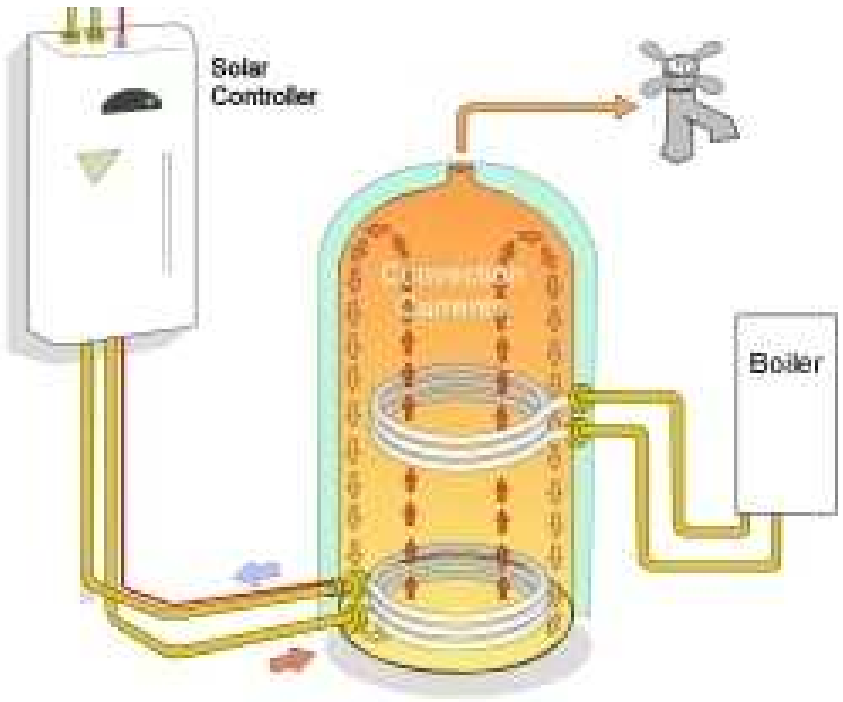
Source: Target

When the boiler is providing heat to the cylinder a heating fluid is pumped from the boiler to the cylinder, where it flows inside the coil. The coil has thin metal walls which conduct the heat into the surrounding water. The heated water near the coil expands and becomes less dense than the surrounding cooler water, and so rises. Cooler water at the top of the cylinder falls to replace the rising hot water. This so called "convection current" means that the boiler heats the top part of the cylinder above the boiler coil



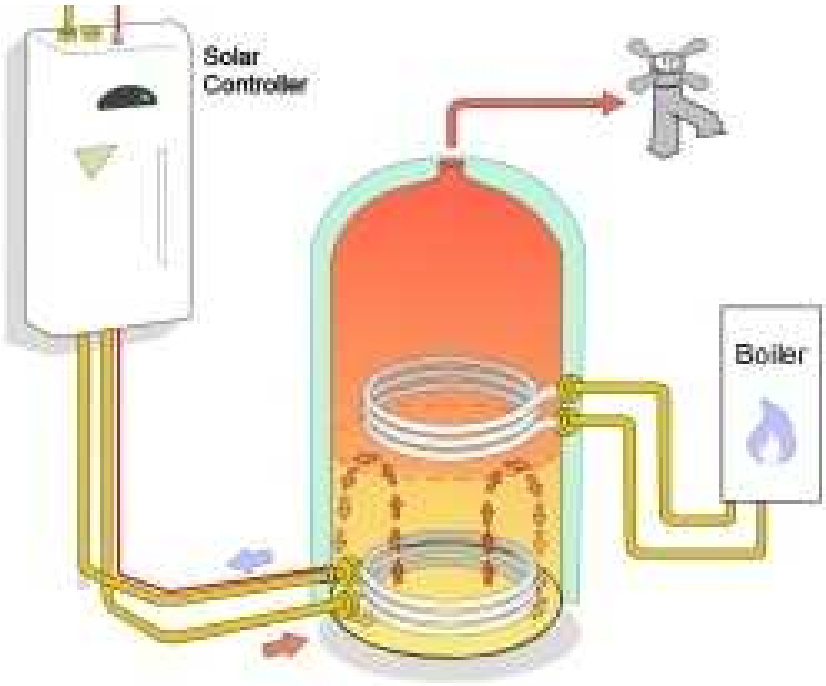
Source: Viridian

The solar coil works in the same way, but because it is at the bottom of the cylinder, it can heat the whole height of the cylinder.



Source: Viridian

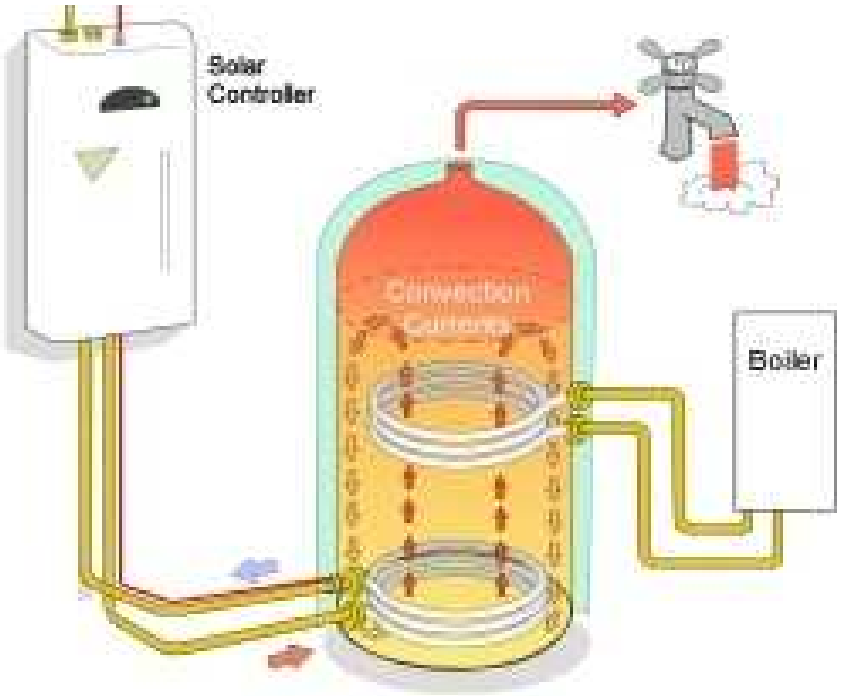
If the zone above the solar coil is already hot from the boiler, then the convection currents from the solar coil only heat the volume of water below the boiler coil. This volume is termed the "Solar Dedicated Volume". UK Building regulations requires that this volume is at least 25 litres per square meter of solar panel area, or 80% of the hot water demand of the household (whichever is the lower). The reason for setting a minimum solar dedicated volume is to ensure that the solar panels have somewhere to put the energy they collect, even if the residents run the boiler during the day.



Source: Viridian

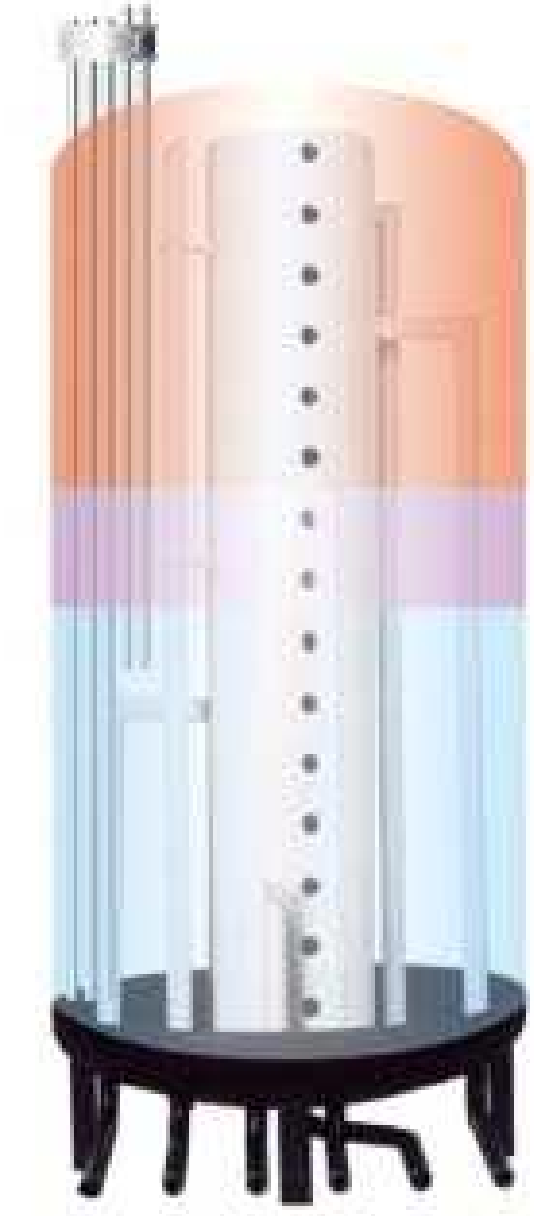
The way to get the best out of a twin coil solar cylinder is to use a timer programmer to have the boiler come on only in the evening after the solar panels have had all day to heat the cylinder. The cylinder thermostat will ensure that the boiler will only switch on if the cylinder is not hot enough from
the solar heating.

As hot water is drawn out of the cylinder for bathing in the evening and the following morning, cold water is introduced at the bottom, and the hot water layer floats on top.



Source: Viridian

Stratification of hot water



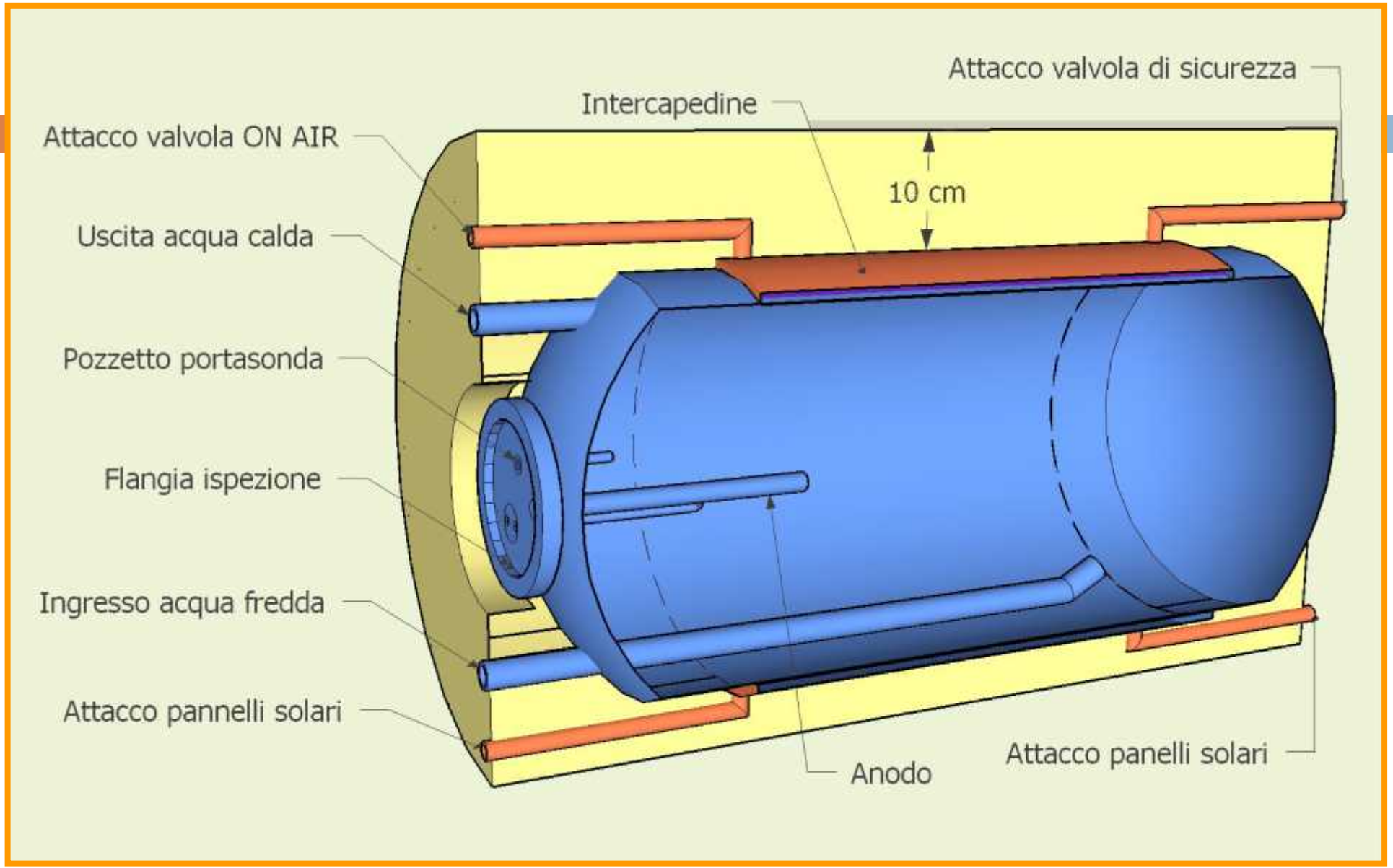
Source: B&B Hydra Solar

Source: Target/Solvis

Storage tank

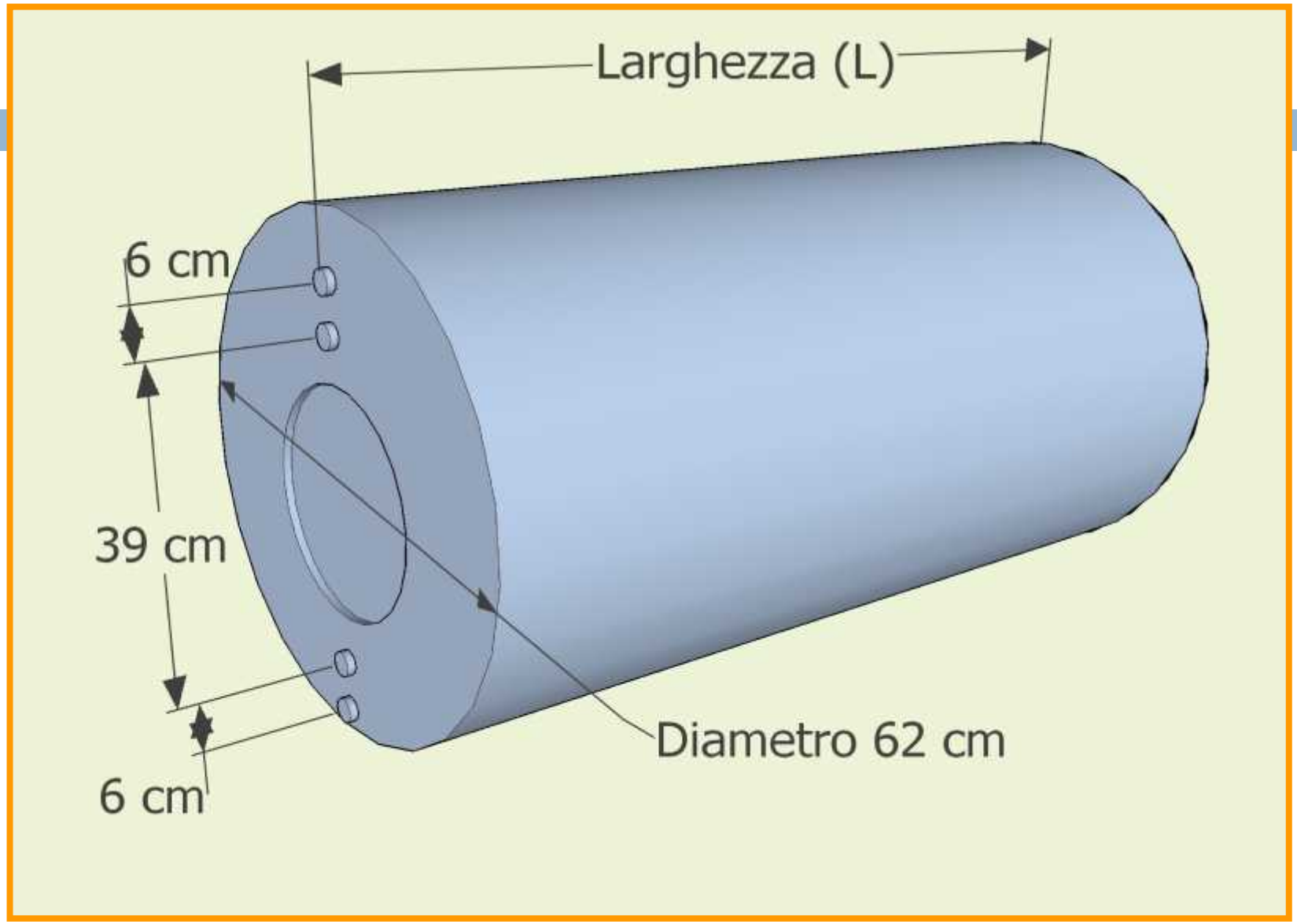
Storage tank

Natural circulation systems – storage tank



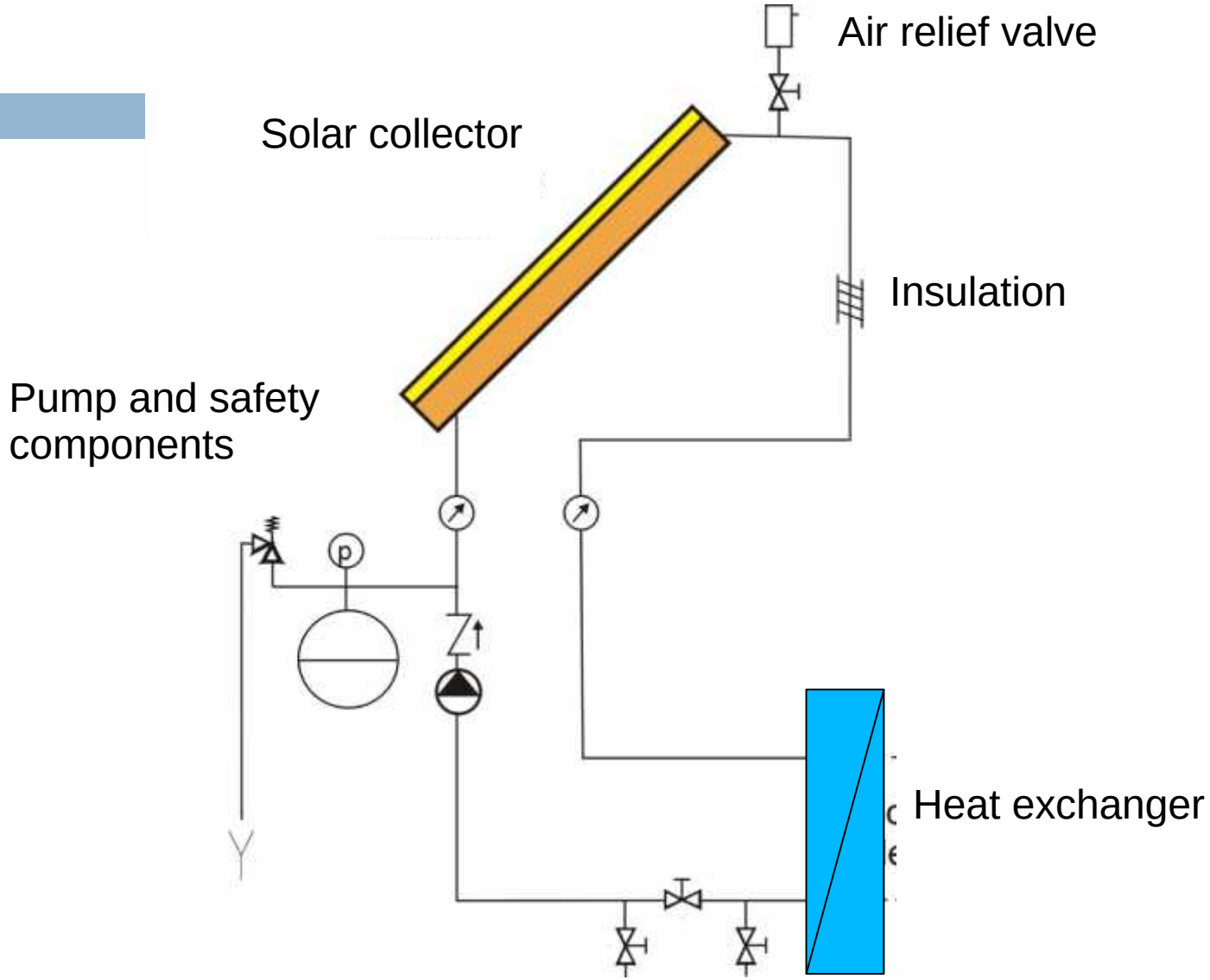
Source: Idaltermo

Natural circulation systems – storage tank

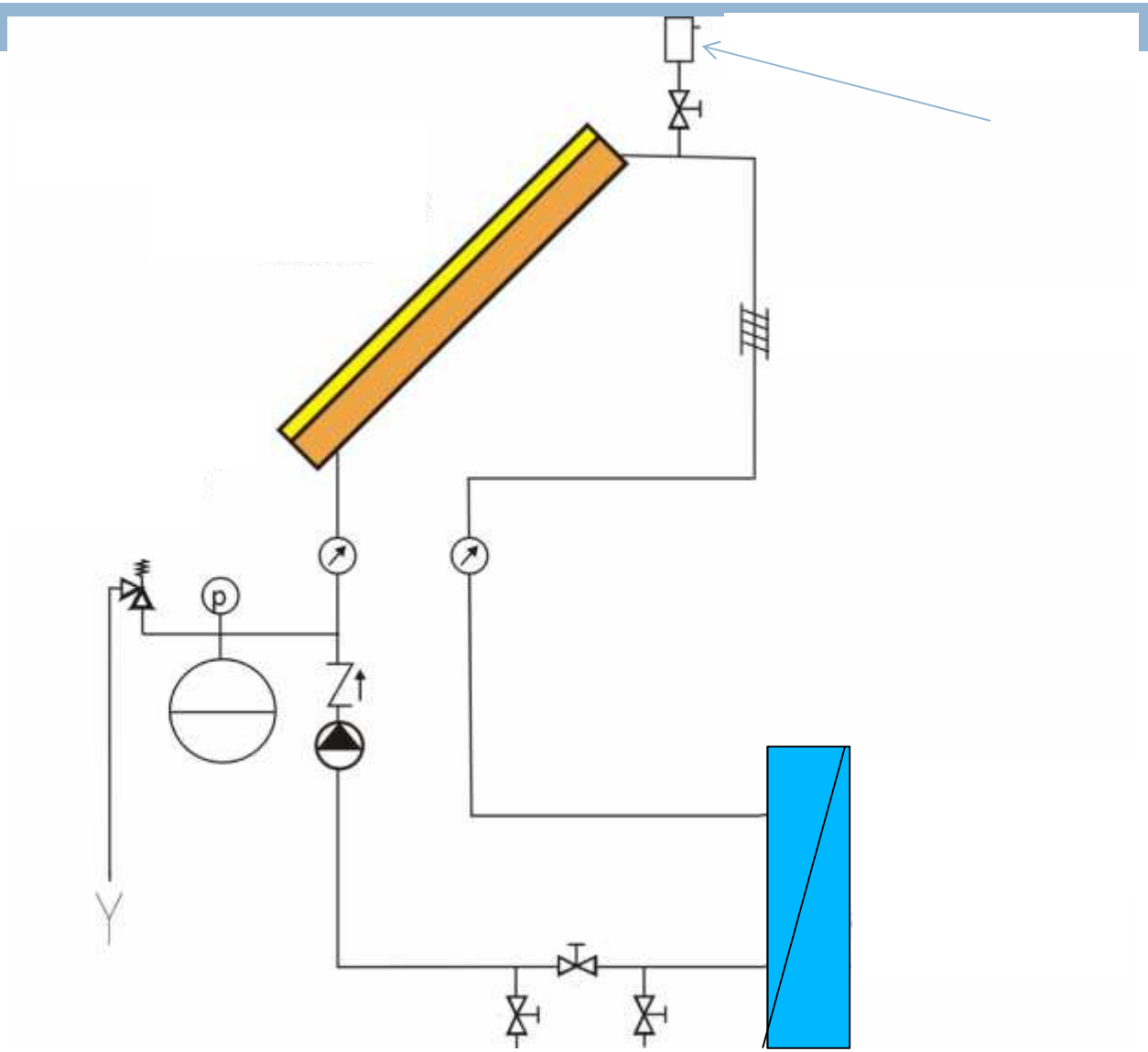


Source: Idaltermo

Primary circuit components



Source: Ambiente Italia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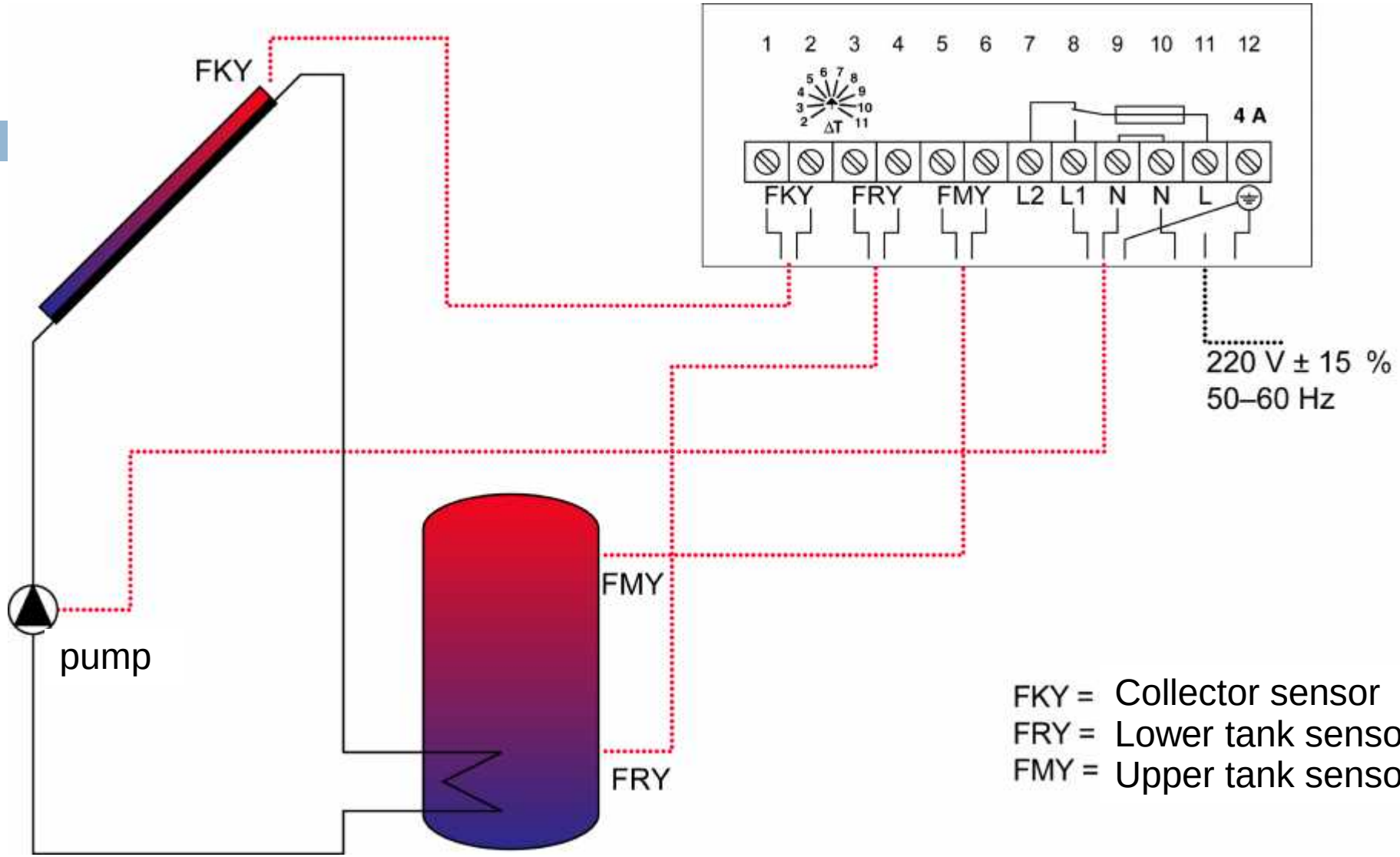
Differential control unit



Source: Target/Solvis

Air relief valve

- enables air to be released
- can be manual or automatic – if automatic, a shut-off valve is needed before the valve
- must be resistant to high temperature

Safety valve

- needed in case pressure raises too much due to overheating
- opens usually at about 6 bar

Pump and safety devices

Pump and safety devices

Primary circuit insulation
(DN – insulation thickness

Inside	Outside
DN 15 – 20 mm	DN 20 – 40 mm
DN 20 – 30 mm	DN 25 – 40 mm
DN 25 – 30 mm	DN 32 – 40 mm
DN 32 – 40 mm	DN 40 – 50 mm
DN 40 – 40 mm	DN 50 – 60 mm
DN 50 – 50 mm	

Source: RESEDA onlus

This material is not suitable for high T applications!

Source: RESEDA onlus

Polyurethan

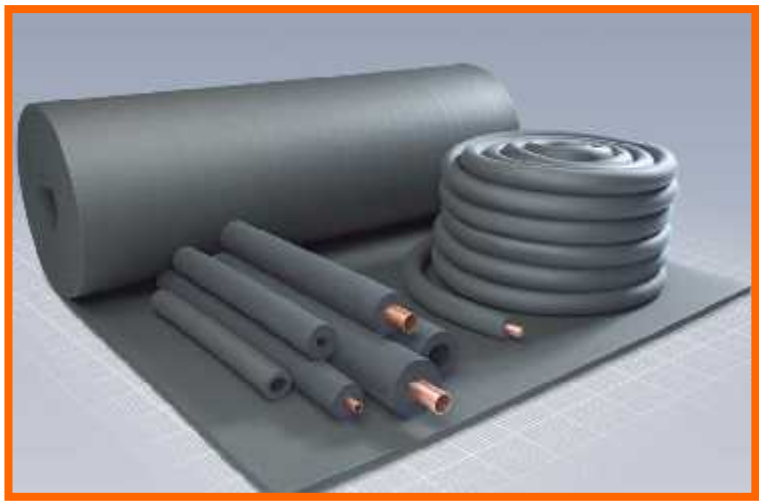
Suitable for low T [90°C], short durability, 0,04 W/mK

Mineral wools

Do not withstand humidity, suitable for high T [650°C], 0,047 W/mK

Elastometers

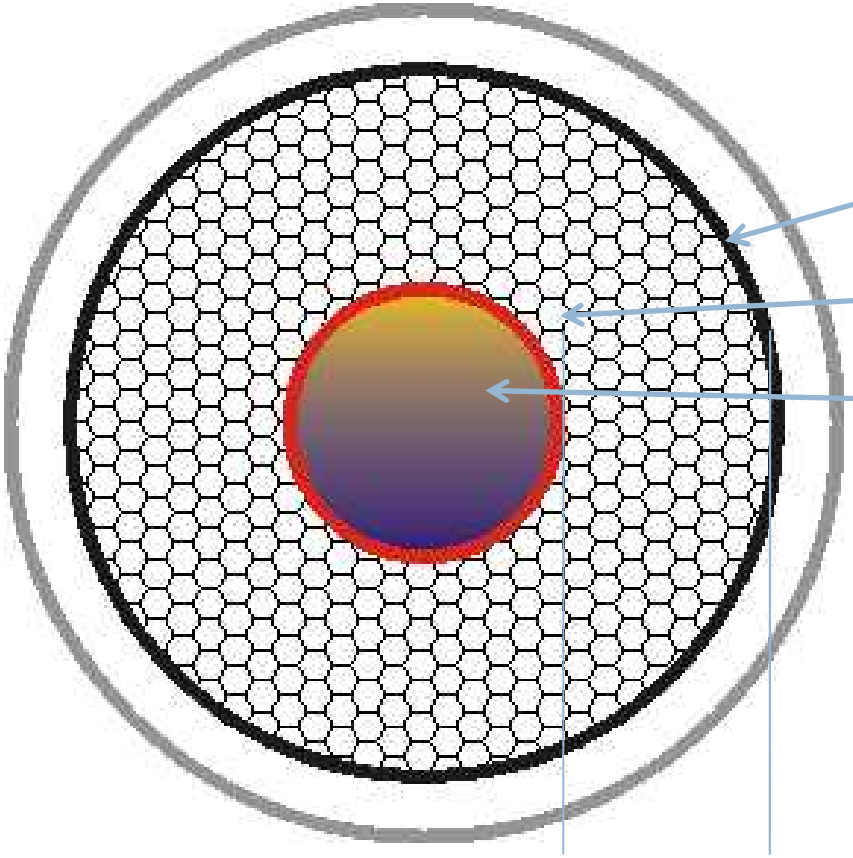
Are most common, [150°C], 0,045 W/mK



Source: Armacell, RESEDA onlus

Aluminium protection tubes for external installation

Source: Armacell, RESEDA onlus



External protection

Insulation

Pipe

Insulation thickness

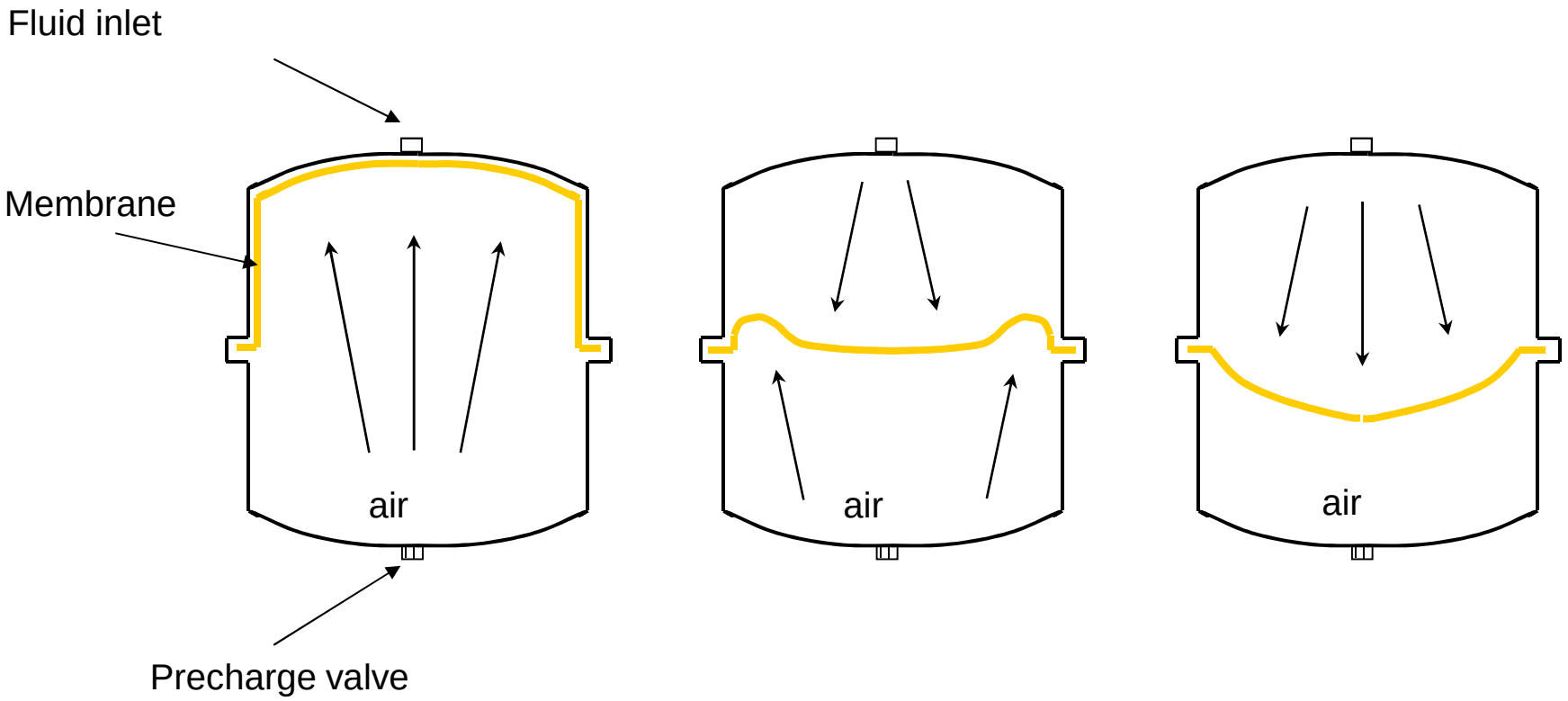
Piping matarial: copper, stainless steel, black steel
Not to be used: zinc steel (if glycol is used), multilayer pipes

Source: RESEDA onlus

Expansion vessel

Source: Idaltermo

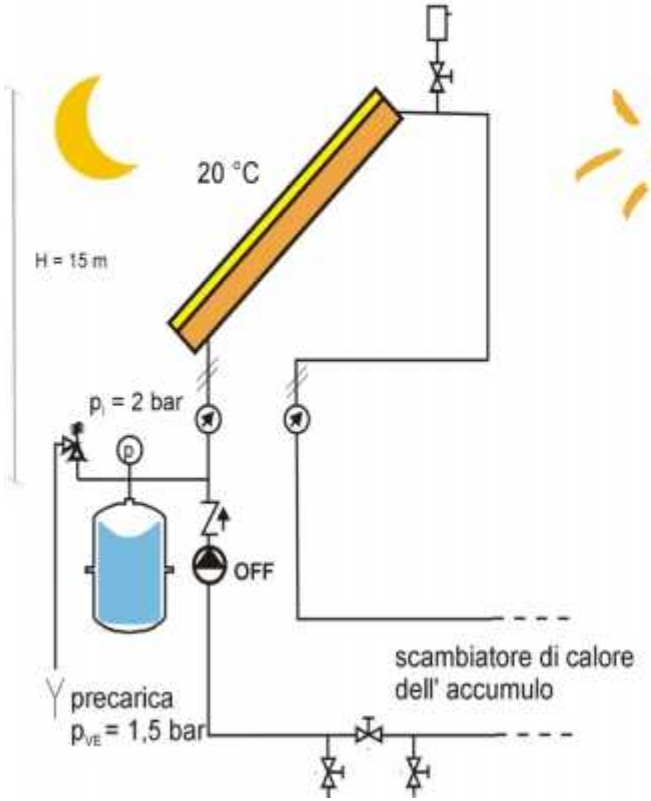
Expansion vessel



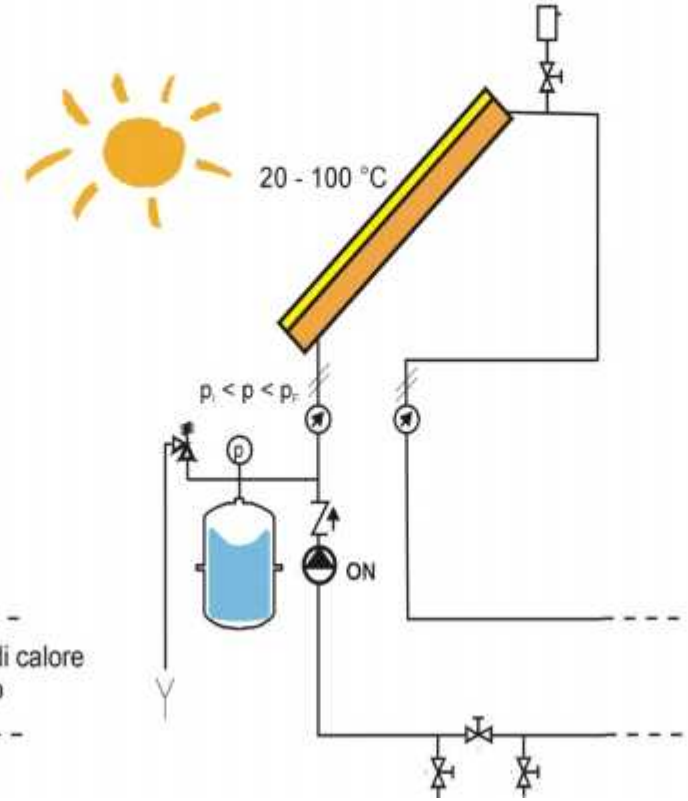
Source: Ambiente Italia

Stagnation

Stillstand



Normal operation



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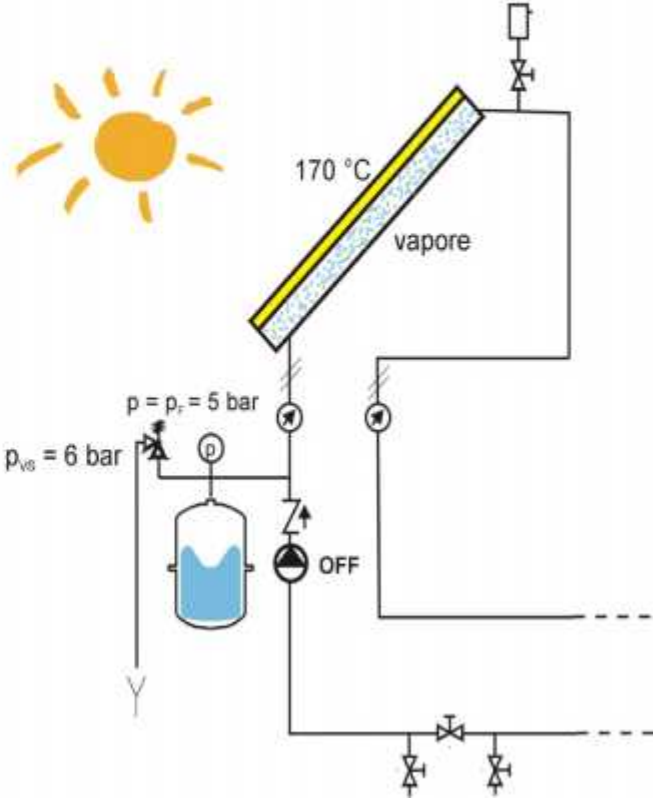

Source: Ambiente Italia