

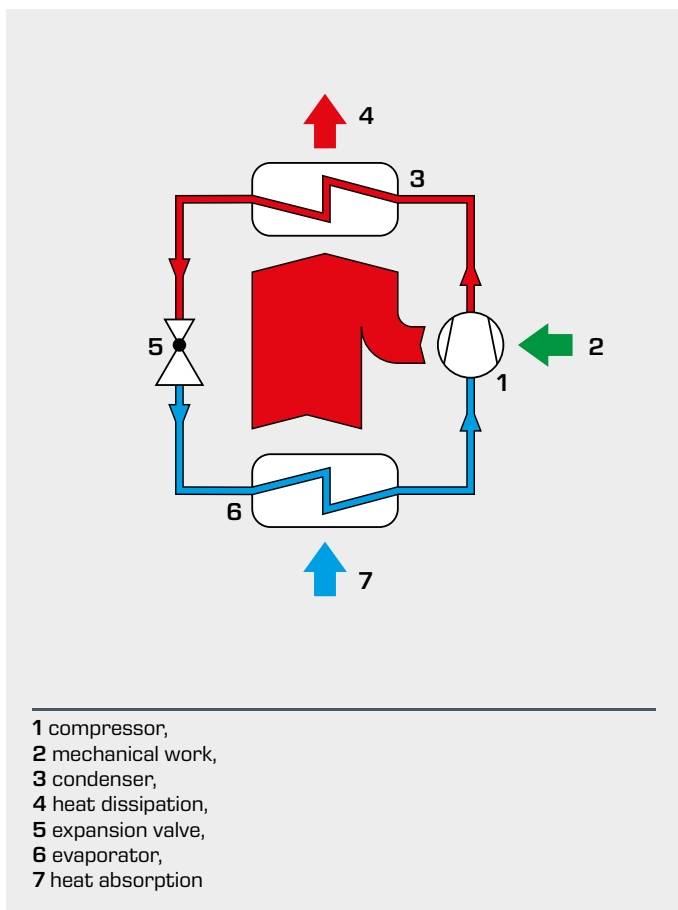
Basic knowledge  
**Heat pumps**

**What is a heat pump?**

A heat pump transports heat from a low temperature level to a higher temperature level. To do this, the heat pump requires drive power. This can be mechanical, electrical or thermal. Usually heat pumps which operate according to the principle of a compression refrigeration system are used. Less often, heat pumps running on the absorption process are used.

The COP is an important indicator for the operation of heat pumps. COP stands for "Coefficient of Performance". The COP indicates how efficiently a heat pump works. The COP indicates the ratio of heat capacity and the required drive power. This value allows an easy comparison between different heat pumps.

The COP is directly dependent on the temperature of the heat source and the heating temperature in the building. Therefore, the COP changes at each operating point of the heat pump. The larger the COP, the more effective the heat pump.



**Where does the heat pump get its energy from?**

A heat pump usually extracts the energy from the environment. Air, groundwater, the earth or river water are common. If the energy is extracted from the ground, this is known as shallow geothermal energy. An energy source temperature which is as high and constant as possible is the key for high efficiency. The temperature must not drop off too much in winter, when the most heating power has to be provided. For groundwater

and the ground, the heat exchangers have to be very large in order to avoid any local sub-cooling. When choosing the heat source, factors such as investment cost, efficiency, availability and obtaining permission have to be weighed against each other. Using low-order waste heat such as exhaust air or cooling water is particularly cost-effective.

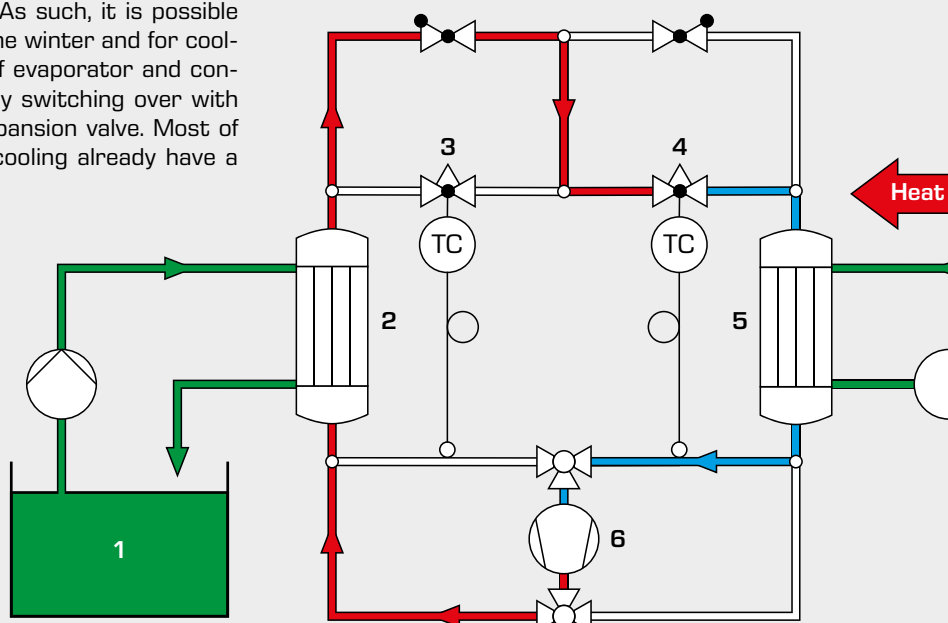
Energy source	Advantage	Disadvantage
outside air	low investment	low COP in winter
river water	low investment	low COP in winter
groundwater	good, constant power	high investment, permission
ground	good, constant power	large space requirement

**A heat pump can be used for cooling or heating**

Because they have the same principle of operation, a heat pump can function as a refrigeration system. As such, it is possible to use the same system for heating in the winter and for cooling in the summer. Only the functions of evaporator and condenser are swapped. This takes place by switching over with two non-return valves and a second expansion valve. Most of these so-called split devices for room cooling already have a heater function included.

**Summer**

- 1 heat sink, 2 condenser, 3 expansion valve 1,
- 4 expansion valve 2, 5 evaporator,
- 6 compressor,
- water/solar circuit, ■ refrigerant (low pressure), ■ refrigerant (high pressure)



**Winter**

- 1 heat source, 2 condenser, 3 expansion valve 1,
- 4 expansion valve 2, 5 evaporator, 6 compressor,
- water/solar circuit, ■ refrigerant (low pressure), ■ refrigerant (high pressure)

