Specification for the IVT Geothermal Heat Pump

The Heat Pump collects stored Solar Energy

The easiest way to describe how a Heat Pump works is to say it works like a refrigerator, however, the other way around. In a refrigerator, heat is moved from the inside to the outside. In a Heat Pump, heat stored in the ground is moved into your house, it collects a few degrees of the stored solar energy. The heat is lead into the house via a collector (Hydrodare) pipe. The temperature is then increased in the heat pump and the heat is distributed to the house's heating system.

Technology in and around the heat pump

The Heat Pump consists of four main parts

1. **Evaporator**
   Evaporates the refrigerant to gas and at the same time transfers the heat from the heat transfer fluid to the refrigerant circuit.

2. **Condenser**
   Condenses the gas to fluid again and transfers the heat to the heating system

3. **Expansion Valve**
   Lowers the pressure of the refrigerant

4. **Compressor**
   Increase the pressure of the refrigerant

These four main parts are linked in three circuits. A refrigerant circulates in the heat pump, which in some parts of the circuits is in a liquid state and in other parts in a gas state.

How it works

1. Heat transfer fluid in the collector gathers the stored solar energy from the soil, the collector contains a heat transfer fluid, which is a mixture of water, and anti freeze. The fluid collects the heat from the soil and is pumped into the heat pump and evaporator. The temperature is then approximately 0˚c.

2. In the evaporator, the heat transfer fluid meets the refrigerant which is in a fluid state and is at approximately -10˚c. When the refrigerant meets the zero degree heat transfer fluid, it starts to boil. It then forms a vapour, which is led into the compressor. The temperature of the vapour is 0˚c.

3. The pressure of the refrigerant increases in the compressor and the vapour rises from 0˚c to approximately +100˚c. The warm gas is then forced into the condenser.

4. The condenser is where the heat pump's heat is emitted. Here the heat is transferred to the house's heating system and domestic hot water system. The vapour is cooled in the condenser and becomes fluid. The pressure in the refrigerant is still high when it is led on to the expansion valve.

5. The refrigerant pressure is lowered in the expansion valve. At the same time, the temperature also drops to approximately -10˚c. When the refrigerant has passed through the valve and the evaporator it changes into vapour again.

6. The heat transfer fluid is then brought back out from the heat pump to the collector, which has new stored solar energy. The temperature of the fluid is approximately -3˚c.

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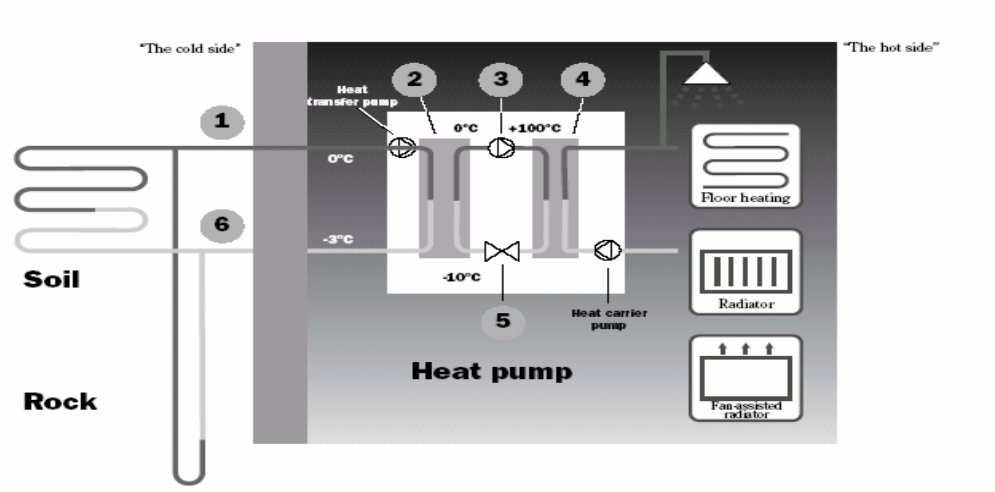


Control Unit

The control unit is the brains of the Heat Pump. It makes sure the heat pump gives the best energy savings and that it runs for many years. The control unit controls and monitors the heating of your Underfloor Heating System and your hot water supply. The control unit controls a three- way valve that switches between the heating system and the hot water.

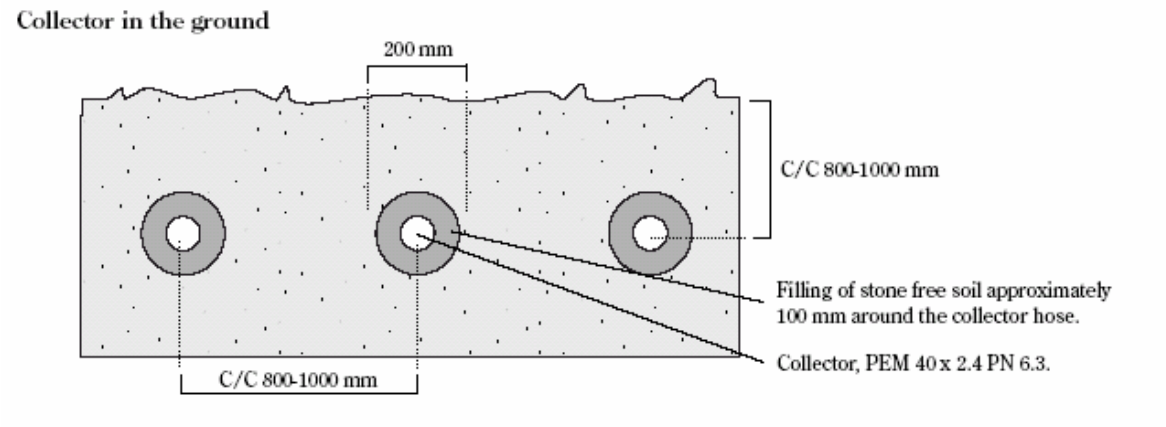
The Collector

IVT, brine-to-water Heat Pumps draw the required heating energy from the solar energy stored in the ground. The ground collector consists of 40mm Hydrodare pipe, which is buried in your garden at a depth of no more than 1 metre. A mixture of water and antifreeze, the so-called brine is then circulated in the pipe loop or loops.

The required collector surface depends on the heating capacity of the Heat Pump.
You would require roughly 800² metres for the E11 unit and 600² metres for the E9, (20 metres x 40 metres or 20 metres x 30 metres). The Hydrodare pipe would be spread around the garden at 1-metre intervals in approximately 400metres to 800metres in one to two pipe loop connections. It is important that the soil filling around the collector pipe does not contain stones or rocks, or anything sharp that may damage the pipe. The collector pipe has to make contact with soil.

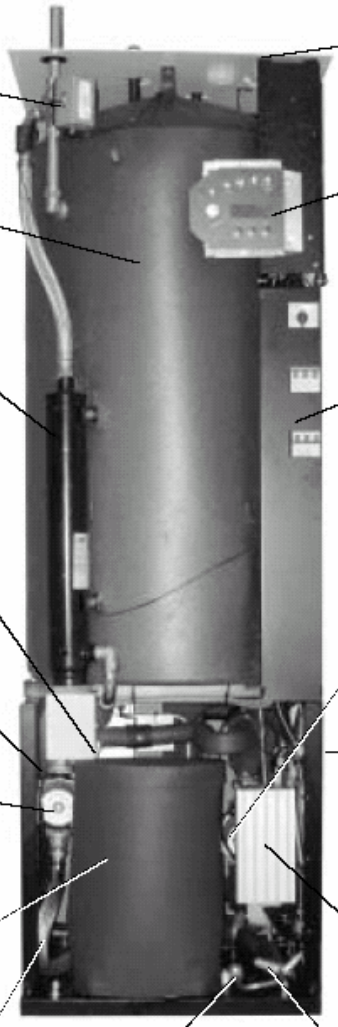
Alternatively, if you don't have enough space to put down the horizontal collector you could put down a vertical collector using bore-holes. This would only be an option if you do not have the area, as it is more expensive to install. You could also use a lake or a river as your collector source.

Heat Pump Model	Maximum pipe length in one circuit	Maximum pipe length per pipe in two circuits
Greenline HT C9/E9	400 Metres	800 Metres
Greenline HT C11/E11	400 Metres	800 Metres



Component parts of the heat pump

IVT Greenline HT Plus C



Three-way valve
The valve switches between heating the heating water and hot water.

Hot water cylinder
The cylinder is double-shelled and holds approximately 165 litres of hot water and 60 litres of the heating water.

Electric water heater
The electric cassette is used to provide extra output in cold weather conditions, with large water consumption and at hot water peaks.

Reset button
Press in the button if the overheat protector on the electric cassette has tripped. The button is located on the side.

Condenser
The condenser condenses the vapour to fluid again and transfers the heat to the heating system.

Heat carrier pump
The pump ensures the heating water circulates within the heating system.

Compressor
The compressor increases the pressure of the refrigerant. The temperature of the vapour increases from 0°C to approximately +100°C. The compressor is insulated to reduce the noise level.

Flexible hoses
The hoses counteract vibrations in the heat pump.

Sight glass
Sight glass to check the level in the refrigerant circuit. Air bubbles must not form in the sight glass when the heat pump is running. However, there might be bubbles when the heat pump is started and stopped.

Electrical connections
Connections for the mains supply as well as sensors.

Control panel
The control panel has a background lit menu display with four rows of text information, three buttons and a dial.

Electrical box
The distribution box is enclosed. It houses a reset function for the motor cut-out as well as miniature circuit breakers (MCB) for the heat pump and electric cassette.

Heat transfer fluid pump
The pump is insulated and features an anti-corrosive finish. It ensures the heat transfer fluid circulates from, e.g. the rock to the heat pump.

Evaporator
The evaporator evaporates the refrigerant to gas and transfers heat from the heat transfer fluid to the refrigerant circuit (behind the heat pump).

Control unit
The control unit is enclosed. It controls and monitors all heat pump functions.

Expansion valve
Lowers the pressure of the refrigerant that enters the evaporator and collects energy from, e.g. the rock.

Technical data Greenline HT Plus

Model Greenline HT Plus		6 C/E	7 C/E	9 C/E	11 C/E	14 E	17 E
Emitted /Supplied output at 0/35°C [1]	kW	5,9/1,3	7,3/1,6	9,1/2	10,7/2,2	14,4/3,1	16,7/3,7
Emitted /Supplied output at 0/50°C [1]	kW	5,4/1,7	6,9/2,1	8,4/2,6	10,1/3,0	13,9/4,2	16,2/4,9
Minimum flow heating medium [1]	l/s	0,14	0,18	0,22	0,26	0,35	0,40
Nominal flow heating medium	l/s	0,20	0,25	0,31	0,37	0,50	0,57
Permitted ext. pressure drop heating medium nominal flow	kPa	36	36	34	33	54	51
Nominal flow cooling medium	l/s	0,30	0,38	0,46	0,57	0,78	0,90
Permitted ext. pressure drop cooling medium at nominal flow	kPa	49	45	44	80	74	71
Max pressure radiator system	bar	1,5					
Max pressure cooling medium system	bar	4					
Highest outgoing heating medium temp.	°C	65					
Operating temperature heat transfer system	°C	-5 to +20					
Integrated heat/HTF pump		Yes					
Electrical connection		400V, N3-Phase					
Add. heat reconnectable	kW	3.0 / 6.0 / 9.0					
Recommended fuse size depends on electrical additional heat							
Electric cassette 6 kW	AT	16	16	20	25	25	25
Electric cassette 9 kW	AT	20	25	25	25	32	32
Compressor		Scroll					
Refrigerant R407C	kg	1,35	1,4	1,5	1,9	2,2	2,3
Connection, heating medium	Cu/DN	22	22	22	22	28	28
Connection, cooling medium	Cu/DN	28	28	28	28	35	35
Dimensions E-model (WxDxH)	mm	600x600x1520					
Weight E-model	kg	146	152	155	170	190	195
Dimensions C-model (WxDxH)	mm	600x600x1800					
Weight C-model Stainless hot w cylinder	kg	200	201	210	218	–	–
Integrated double-shelled hot w cylinder on the C-model. Stainless *		Stainless				–	–
Domestic hot water C-model	litres	165				–	–
Control unit		Rego 637					

[1] Output data at 0/35°C and 0/50°C and min heating medium flow are stated according to the European standard EN 255.
Additional heat not included.

* Anode included in C-models with stainless hot water cylinder.