



Thermia Inverter Mini

a dedicated solution for energy-efficient houses

With global warming and energy conservation high up on the international agenda, energy-efficient houses are constantly gaining in popularity. The Thermia Inverter Mini ground-source heat pump is one of the best solutions for heating and cooling energy-efficient houses.



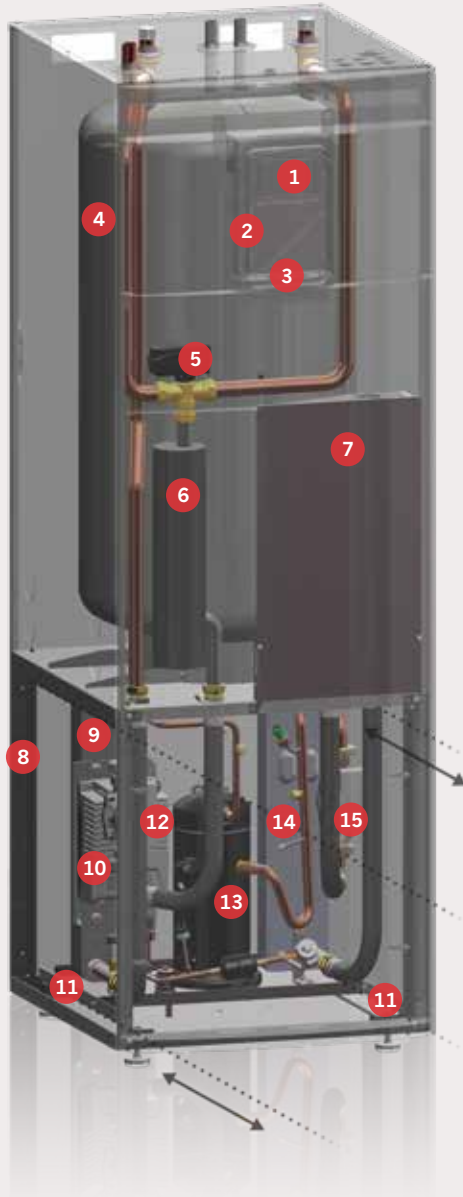
All new buildings constructed after 2020 will be built to European standards for high energy performance and will incorporate renewable energy sources to meet the low-energy demand of each building. In the coming decade, new buildings must be low-energy. Today, many countries have already begun retrofitting and renovation programs to meet energy performance targets in older buildings. This trend towards technology-rich, nearly-zero-energy homes or passive houses calls for the best available solutions. Solutions that use efficient, renewable sources to reduce the amount of energy used for heating and cooling.

The heating system, which often features a heat pump and floor heating, is a key component of the energy-efficient house. So why inverter technology might be important and what needs to be considered when choosing an inverter-driven ground-source heat pump for an energy-efficient house?

Thermia inverter technology

The compressor is the “heart” of the heat pump and consumes most of the electricity used by the whole unit. For this reason, its design, capacity and control have a highly significant impact on the heat pump’s operating efficiency. What makes the Inverter Mini different from inverter ground-source heat pumps is the combination of three components: compressor, inverter and heat pump controlling system.

Figure 1: What's inside a Mini Inverter?



1. Color touchscreen
2. New controller (Genesis)
3. USB slot for plug-and-play software update
4. 180 litre stainless hot water cylinder with TWS (Tap Water Stratification) technology
5. Three way valve for heating or hot water production
6. Auxiliary heater
7. Electric board
8. Heat pump "box"
9. Condenser
10. Frequency converter (Inverter)
11. Mounting rail for loading and unloading "box"
12. Primary circulation pump
13. Scroll Compressor
14. Evaporator
15. Brine circulation pump

The inverter compressor can operate at various speeds, smoothly adjusting capacity to the needs of the building until the necessary capacity is achieved. The efficiency of this process is determined by the controller.

The Thermia Inverter Mini is the only heat pump on the market that controls the compressor operation process and visually displays its operating envelope. With the compressor running constantly within the operating envelope, the best operating conditions are ensured for the compressor and the whole system. This is confirmed by a seasonal coefficient of performance (SCOP) of 5.77*, one of the highest performance ratings among any currently available ground-source heat pumps.

The refrigerant system features the latest Copeland variable speed scroll compressor designed for use with the efficient R410A refrigerant. A wide operating envelope ensures a broad operating range and allows higher condensation temperatures to be obtained at low evaporation temperatures. The inverter used in the Thermia Inverter Mini heat pump has been specifically programmed for use in a heat pump application.

A heat pump with an inverter-con-

trolled compressor has two basic advantages from the user's point of view. First, it continuously adjusts heat output to current demand, which provides full thermal comfort at reduced energy consumption. This is particularly important when there is a significant difference in heat demand between winter and spring or autumn. The second advantage is that inverter technology can combine large heating demand in winter and reduced hot water demand during summer (no need for large hot water tanks). This further reduces both operating costs and environmental impact.

A heat pump with capacity modulation means that the user only pays for the heat or cooling actually required at any given time. It is worth noting that heat pumps with an inverter compressor are approx. 20-30% more efficient than pumps with a constant-speed compressor.

* SCOP Floor heating 35°C, in accordance with PN-EN 14825, cold climate (Helsinki), P_{design} (design heat load) 6.39 kW (BOW55), 7.11 kW (BOW35)

Plenty of hot water – a new standard of comfort

In the hot water cylinder, the Thermia Inverter Mini heat pump uses Tap Water Stratification (TWS) technology.

The stratification effect is obtained thanks to a coil that extends over the entire height of the 180-liter stainless steel hot water cylinder.

Coils are nothing new and are widely used today. What makes the Inverter Mini unique is that the coil's heat ex-

ter production priority, combined with the compressor continuously adjusting its speed and capacity, quickly produces the required quantity of water. An Inverter Mini with a 180-liter cylinder can provide the user with over 250 liters of water at 40°C.

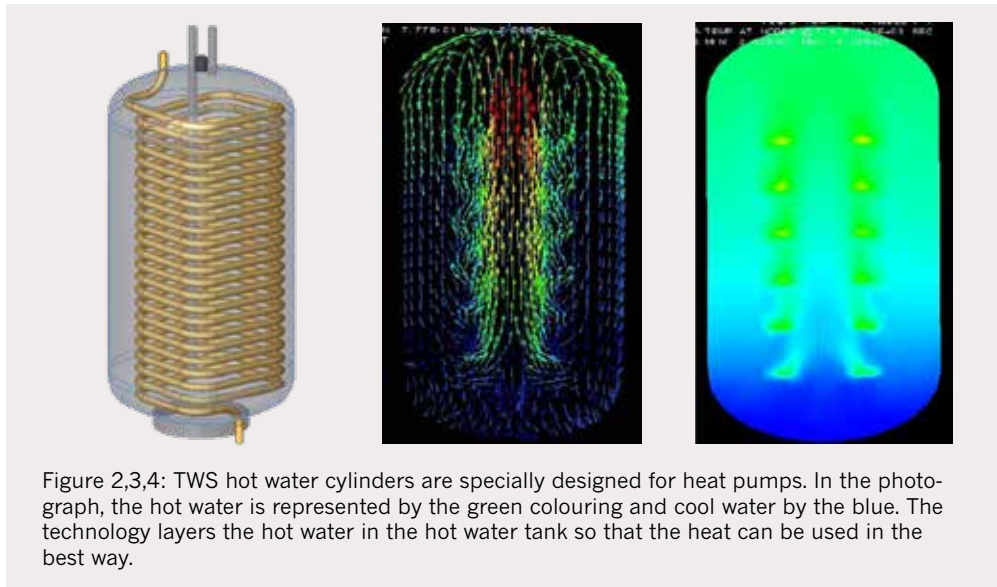


Figure 2,3,4: TWS hot water cylinders are specially designed for heat pumps. In the photograph, the hot water is represented by the green colouring and cool water by the blue. The technology layers the hot water in the hot water tank so that the heat can be used in the best way.

change area and shape are designed in such a way as to deliver large volumes of hot water at the required temperature within the shortest possible time. The TWS system provides 15% more hot water 50% faster than traditional alternatives. The secret lies in the way that the different components interact. Inverter technology and hot wa-

Ultra-low sound level

All heat pumps equipped with a compressor generate a characteristic sound. The Inverter Mini has been designed so as to reduce both the vibrations coming from the compressor and the noise it emits. Vibration and noise reduction is ensured by rubber spacers, sound attenuating enclosures and

flexible conduits.

Depending on the speed of the compressor, the sound level of the Inverter Mini heat pump ranges between 29 and 43 dB(A). To put that into context, 20 dB(A) is the sound of human whisper and 29 dB(A) is the sound of rustling leaves. The Thermia Inverter Mini is currently the quietest heat pump on the market in its segment.

Intelligent controller

The controller coordinates the operation of the heating system and manages its functions. The Inverter Mini's controller is equipped with a color touch display that makes it easy to exploit the full potential of the heat pump. The intuitive user interface, simple infographics and touch navigation ensure ease of use. At the same time, a special algorithm ensures the lowest possible running costs while maintaining the desired indoor temperature.

Thermia controllers are extremely easy to use. It takes just one touch to increase or reduce temperature. The controller displays the heat curve, which only needs to be configured during initial setup. Further use of the device is automatic and does not require any additional settings.

Example features of the controller:

- Color touchscreen and intuitive menu
- Full overview of the cooling system temperatures and heat curves
- Plug-and-play software update via USB slot
- Interface to smart home BMS (Building Management System)

Top-quality components

The heat pump's refrigerant system uses special, high-performance heat



Figure 5: Color touchscreen - controller

exchangers (condenser and evaporator). Because of this arrangement, the

brine/water to refrigerant ratio is 10:1, which means that exchangers designed for a 1:1 ratio do not operate with full capacity. By using asymmetric channel geometry in the exchanger, we are able to better adjust to the requirements of the heat pump. In the Inverter Mini heat pump, the condensation function is provided by the asymmetric Micro Plate Heat Exchanger (MPHE).

The exchanger's innovative feature lies in the different shapes and heat exchange surface areas of the refrigerant and the water/brine sides. Instead of a typical herringbone pattern, the exchanger wall features micro-channels with a much more wrinkled surface and irregular shapes. This improves flow and heat exchange, decreases the required refrigerant quantity, and reduces pressure drop on the water/brine side. This directly boosts the operation of the circulation pump. Asymmetric micro plate heat exchangers enhance the quality of the cooling circuit, thus improving the overall operating efficiency of the heat pump.

The Inverter Mini's cooling circuit is equipped with an electronic expansion valve, which has two essential advantages: operation within a wide capacity range and precision in re-

frigerant flow modulation. Changing the temperature of the brine flowing through the evaporator increases the refrigerant evaporation pressure. As a result, a refrigerant vapor and liquid mixture can appear downstream of the evaporator. The electronic expan-

sion valve supplies precisely batched quantities of refrigerant to the evaporator, thus optimizing refrigerant vapor superheating by varying the brine temperature.

The Inverter Mini features newly devel-

oped Wilo energy efficiency Class A circulation pumps on both the brine and heating system sides. The Wilo pumps we use are specifically designed for use in heating applications.

All the components installed in the Thermia Inverter Mini heat pump are sourced from leading European and global manufacturers.

Staying cool in summer

By adding a cooling function to the heat pump, a comprehensive system can be created that guarantees perfect thermal comfort throughout the year. In passive cooling, the brine circulating in the underground loops cools the house at a cost equivalent to the energy consumption of a 50-inch modern LCD television. On days when the heat gets really bad and additional cooling efficiency is needed, active cooling can be used. Using a heat pump to provide both passive and active cooling is significantly more cost efficient than traditional air conditioning.

The installer's dream – simple and quick installation

Simplicity of installation and plumbing connections are what installers like best. The Inverter Mini has a pullout cooling module that makes it signifi-

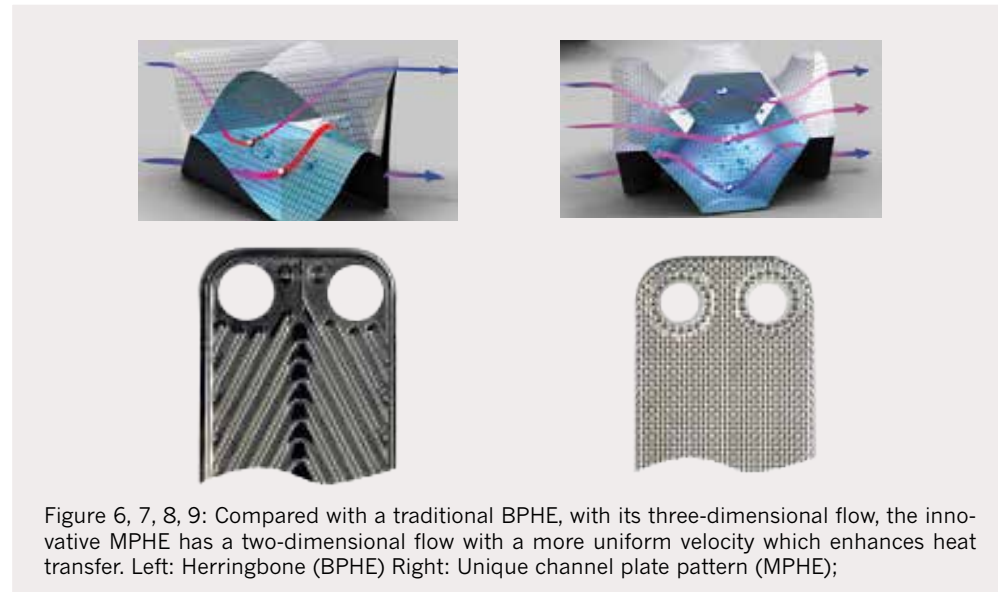


Figure 6, 7, 8, 9: Compared with a traditional BPHE, with its three-dimensional flow, the innovative MPHE has a two-dimensional flow with a more uniform velocity which enhances heat transfer. Left: Herringbone (BPHE) Right: Unique channel plate pattern (MPHE);

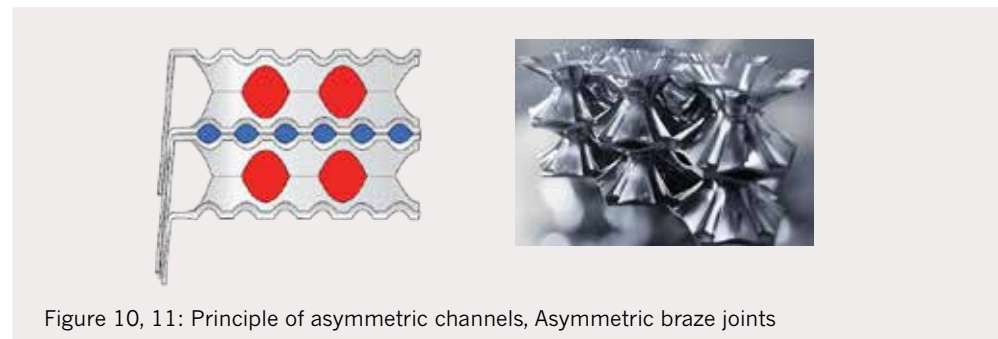


Figure 10, 11: Principle of asymmetric channels, Asymmetric braze joints

cantly easier to transport and install the pump, and to access its individual components. To ensure complete freedom of location and connection to the brine circuit, openings are provided on the left and right side, as well as at the top of the heat pump. Flexible connectors located inside the cooling module minimize vibrations and the design of the cooling module means that it can be connected to the system much more quickly and with less effort. The Inverter Mini heat pump also ships with a brine filling device, outdoor sensor and brine level vessel, as well as pressure safety valves and a ball valve with filter.

Worth noting: the new design and construction of the Inverter Mini has reduced the weight of the unit to just 156 kg. This is 11% less than the Thermia Diplomat Optimum model and 30% (64 kg) less than a comparable competitor in the same segment.

Online – full control

The Inverter Mini heat pump offers effortless remote control via Thermia's online system. This monitors the operating status of the pump, its key parameters and provides information on any alarms triggered. The Thermia Online app operates over the Internet with the

use of any iOS or Android laptop, tablet or smartphone. No further accessories or costs are needed to monitor the operation of the pump.

Thermia - a wide-ranging and comprehensive portfolio

Inverter Mini is the smallest and youngest product in Thermia portfolio but it is worth to underline that this leading heat pump manufacturer can provide energy solution from 1 kW up to 88 kW in one unit and up to 1400 kW with cascade option. Wide range of inverter-driven ground source heat pumps

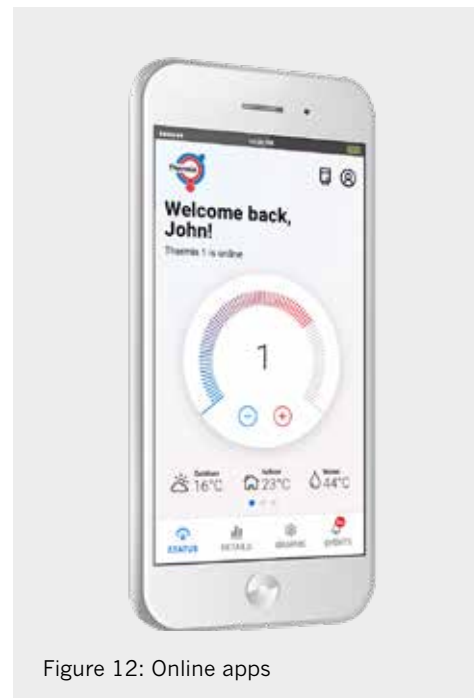


Figure 12: Online apps

Proven value for the user

The many advantages of the Thermia Inverter Mini heat pump and inverter technology include:

- Top SCOP rating of 5.77, which means low electricity bills (energy class A+++/A++)
- Outstanding hot water production capacity and speed for maximum comfort
- Almost silent operation, which allows the heat pump to be situated anywhere in the house
- Quick and easy assembly and connection
- Ideal for use in either new systems or building renovation projects (65°C supply temp.)
- Efficient operation with floor heating systems and/or radiators
- The inverter technology, means that the heat pump can supply 100 % of your energy requirements, this means you don't need any auxiliary heating
- The inverter technology let you combine larger heating demand in winter and smaller hot water demand during summer (no need for big or additional hot water tanks)
- Cooling function (optional)
- Thermia Online – heat pump operation monitoring via the Internet and apps

Amazing but true

A correctly selected and installed Thermia heat pump can continuously control the comfort temperature of a house for around 20-25 years – although we have documented cases of our heat pumps lasting far longer than that. Thermia heat pumps provide up to 80% energy savings compared with natural gas or oil. At the same time, the environment benefits from a carbon footprint reduction of 50-90%, depending on the green credentials of the electricity used to power it.



allow Thermia cover from small low energy house up to shopping gallery or apartment buildings.

Current portfolio with Thermia inverter technology:

- Inverter Mini: 1.5-7 kW
- Inverter M: 3-12 kW
- Inverter L: 5-17 kW
- Mega S: 10-33 kW
- Mega L: 11-44 kW
- Mega X: 14-59 kW
- Mega XL: 21-88 kW

Thermia – Swedish quality

Thermia started as one man’s passion. As early as 1889, Per Anderson began developing stoves for cooking and systems for hot water production, which

were characterized by exceptional energy efficiency. His business grew dynamically and has been operating under the Thermia brand since 1923.

For nearly 130 years, we have been guided by Per’s vision: “The products one releases must be not only the best of their time, but before their time, over time.” This was best evidenced in 1973, at the height of the global fuel crisis, when Thermia launched the world’s first heat pump with its own integrated hot water tank. Since then, Thermia has been fully dedicated to developing, refining and manufacturing the most energy-efficient and reliable heat pumps possible. We are pioneers in this field.



Figure 13, 14, 15: Per Andersson (1861–1942), Thermia’s founder; The very first heat pump with integrated hot water tank is developed by Thermia as a result of a collaboration project; The kitchen stoves



Figure 16, 17, 18: Factory, Testing in one of the R&D climate chambers, set to severe weather conditions

THERMIA

THE ULTIMATE ENERGY PROVIDER SINCE 1923



Pioneering heat pumps

For the last 50 years, we have dedicated all our resources and knowledge to developing and endlessly refining one product: the heat pump. Our focus on geothermal energy has given us world leading knowledge in heat pump technology.



Engineered with passion

Developing truly sustainable renewable energy solutions can only be achieved with passionate, dedicated, and uncompromising experts. Some of Europe’s most highly qualified engineers can be found in our own R&D center.



Born in Sweden

All our products are designed, manufactured, and tested in Sweden using the latest technology and the highest quality components. All components inside our ground source heat pumps are made in Europe by world-leading industry specialists.