

Heat Recovery based on Exhaust Air

Heating Domestic Hot Water Controlled Ventilation Preheated Supply Air



Ventilation, which means totally hygienic inside air, is a basic requirement for living in a healthy house.

Ventilation – health aspects

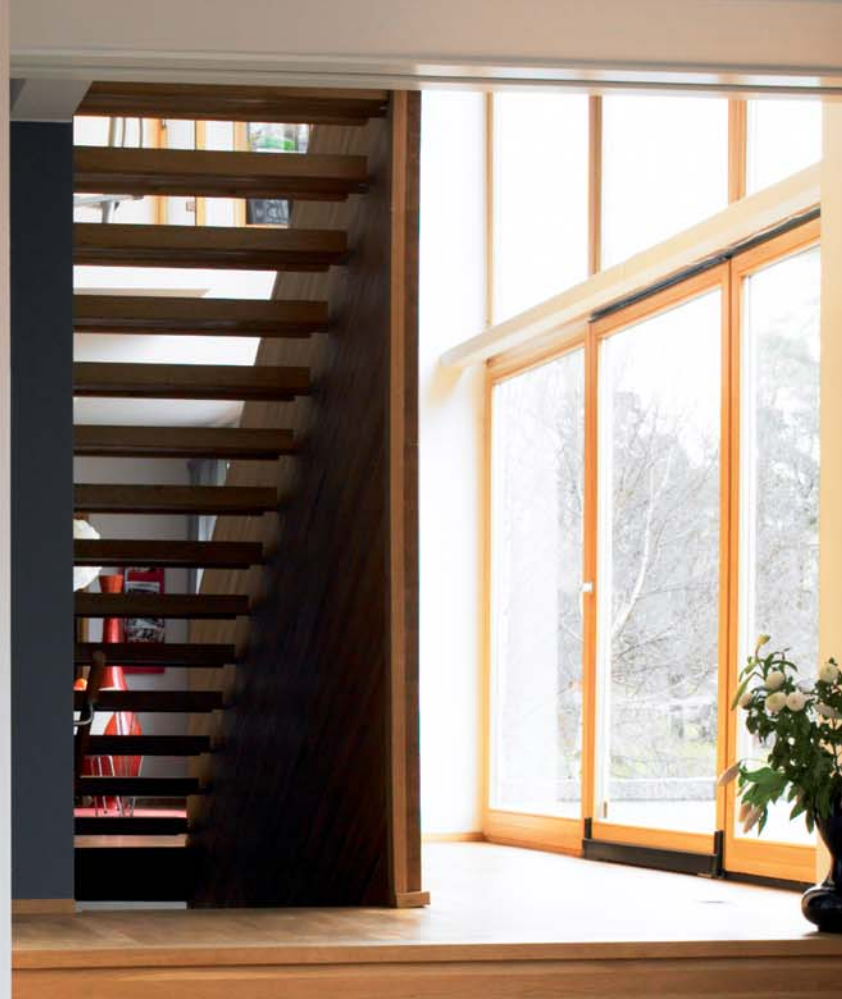
Since the early 1980s there has been much discussion about Sick Building Syndrome (SBS). This refers to allergic disorders, and even illness symptoms, which frequently occur in certain buildings and rooms. This can lead to chronic illness, reducing the person's ability to work and function in general. This in turn results not only in the individual losing his or her quality of life, but it also has a major detrimental impact on the economy and incurs huge costs.

Basically, the following potential risks jeopardising people's health are to be found inside buildings:

1. Toxic pollution caused by harmful chemical substances and dust.
2. Effects of noise, light, odours, dampness and climate.
3. Accumulation of microbes (bacteria, viruses, mould) in terms of infection risks.
4. Exposure to allergens.

These pollutants vary considerably according to the inside climate conditions, the state of ventilation and the design and use of the inside area. When energy-saving measures were introduced in the early 1970s, considerable efforts were made to improve the insulation used in the construction industry. This led to a reduction in the air exchange rate inside buildings. From a health and allergy perspective, the ideal air exchange rate would be 0.5 – 1.0, but in actual fact, air exchange rates in appropriately insulated houses are only between 0.3 and 0.5, which means that the polluted inside air is exchanged far too infrequently. Based on the reasons given above, an increase in the incidence of complaints affecting the population is inevitable.

This is where controlled domestic ventilation can have a particular role to play. Its purpose is to control temperature and dampness, while ensuring that the quality of the inside air is totally hygienic. The relevant technical guidelines and hygiene regulations are stipulated by DIN 1946.



Controlled domestic ventilation

Introduction

Nowadays we spend around 90% of the time indoors. This undoubtedly places great demands on the climate inside. The inside climate is affected considerably by odours, harmful substances, noise and temperature.

In every building there is a certain amount of basic ventilation, even if it is only produced by air coming through windows, doors, pipe ducts and walls. This type of ventilation, in older houses in particular, provides the necessary exchange of air. Ventilation is also provided through opening windows and doors, perhaps also when one or more windows are opened at an angle. Strong wind pressure and a difference in temperature between inside and outside also increase the exchange of air. On the other hand, a weak wind or small temperature difference will reduce the required air exchange rate.

This uncontrolled ventilation also accounts for a significant part of the heating costs and causes a considerable proportion of non-renewable energy resources to be wasted.

Low-energy house

In contrast to this, there is the low-energy house concept. A construction design is used in this type of house which prevents heat from escaping through effective thermal insulation. This also means that low-energy houses benefit the environment. But even with this construction design, there is still the problem that the required hourly air exchange rate of 0.5 – 1.0 is not achieved.

To achieve the required air exchange rate either the windows would have to be opened, which would run counter to the whole low-energy house concept, or installing a controlled domestic ventilation system with heat recovery would have to be considered.

Controlled domestic ventilation

Controlled domestic ventilation can be used in both low-energy and older houses. In low-energy houses the controlled ventilation system guarantees the required air exchange rate, even with the doors and windows closed.

When older houses are renovated better thermal insulation could be used, along with fitting new windows to enable controlled domestic ventilation to achieve the necessary air exchange rate. These types of older building are often affected by street noise. A ventilation system would therefore be beneficial in these cases too.

Controlled domestic ventilation with heat recovery

When ventilation based on opening windows and controlled domestic ventilation without heat recovery are used, the energy from the inside air is not used. The ventilation heat requirement accounts, however, for a considerable part (40 – 50%) of the total heat requirement.

In contrast to this, controlled domestic ventilation with heat recovery reuses the energy from the exhaust air. Not only that, the additional heat generated internally from lighting, people and domestic appliances is also utilised through heat recovery.

Our FIGHTER exhaust air heat pumps facilitate heat recovery and supply the energy recovered from exhaust air for the domestic hot water and even the heating.

Not only does energy recovery ensure a healthy and comfortable form of heating, it also produces considerable savings in terms of heat energy, along with CO₂ emissions.



NIBE FIGHTER 100P



Mechanical ventilation system with local outside air inlets using a heat pump, which heats domestic hot water using exhaust air energy.



Technical description

In the FIGHTER 100P the controlled domestic ventilation system with heat recovery via the heat pump is only combined with heating the domestic hot water.

Where a large volume of hot water is required a 1.5 kW cartridge heater automatically switches on.

The FIGHTER 100P is a complete system to replace both the conventional hot water tank and the separate heat recovery ventilation system.

The FIGHTER 100P is extremely easy to operate.

It has control lights and switches, which are easy to access on the control panel at the front of the unit.

It is also easy to maintain. For instance, the exhaust air filter is located in a removable cartridge.

Area of application

The FIGHTER 100P is ideal for single and two-family houses, as well as for public housing.

In a room with an average height of 2.5 m a living area of 60 – 200 m² can be ventilated.

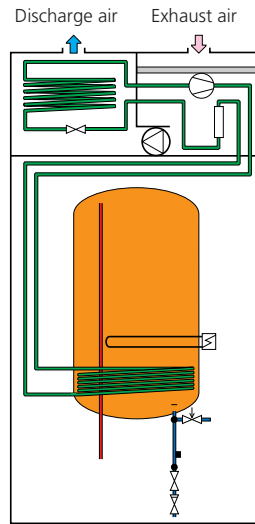
Accessories

Mixer valve

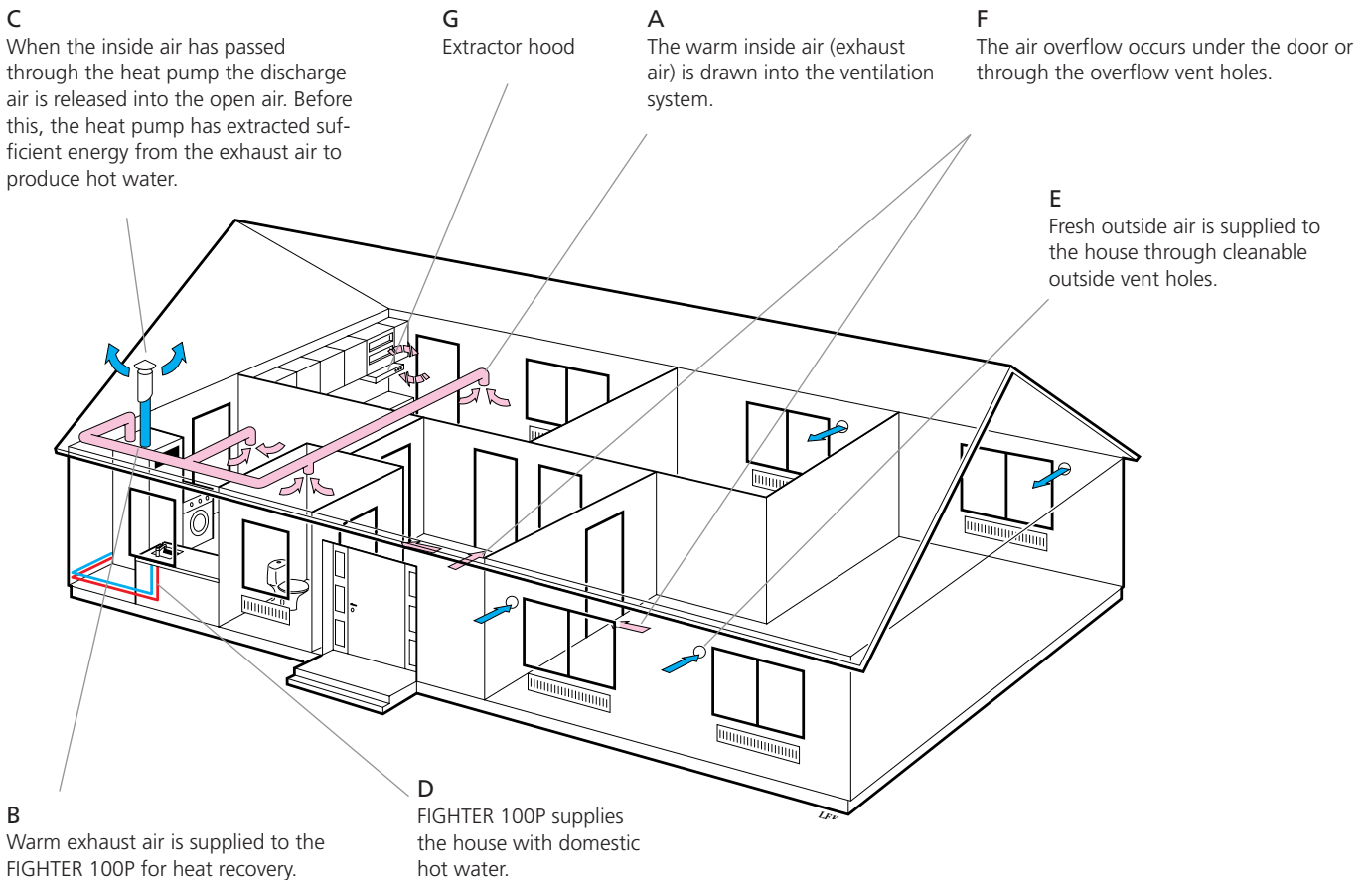
Structural design

The FIGHTER 100P is a heat pump unit for recovering thermal energy from exhaust air. Warm inside air is channelled from the connected rooms through the ventilation unit built into the system via a heat exchanger located in the heat pump circuit.

This transfers the recovered heat to the domestic hot water tank, which is protected against corrosion on the hot water side by a copper lining.



System diagram



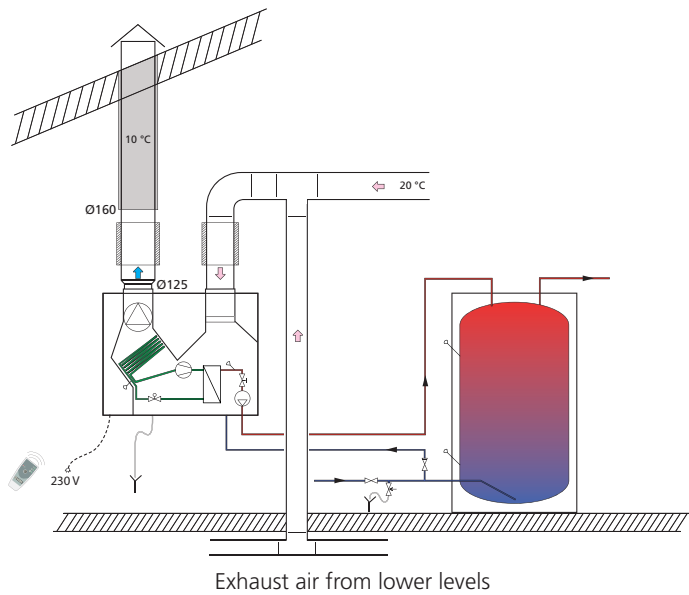
NIBE FIGHTER 120



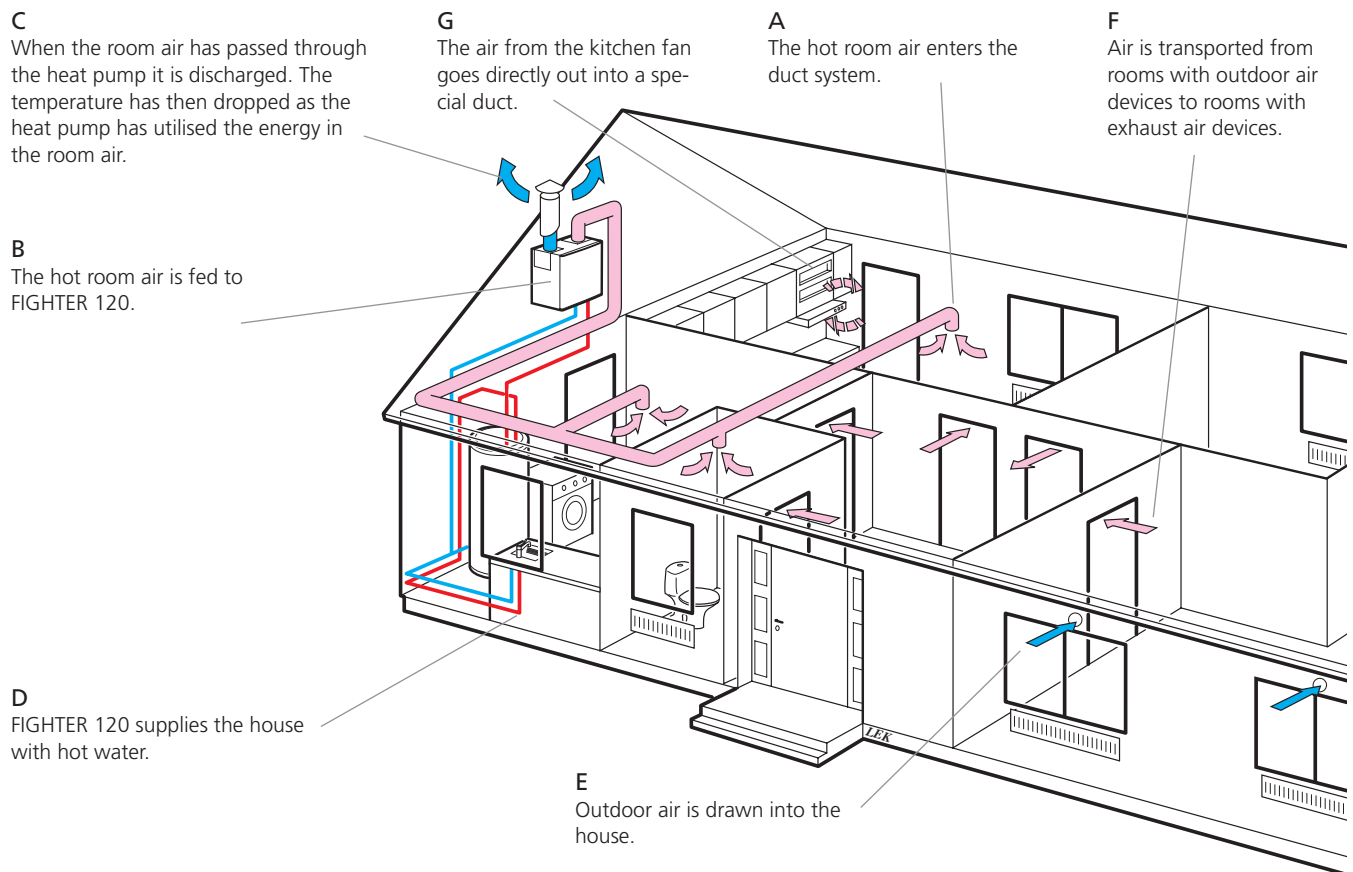
- High COP – provides great savings and shorter payback times
- DC-fan – means even greater savings
- DC-circulation pump – provides optimum hot water temperature
- Split versions – means great installation flexibility



FIGHTER 120 is a two piece heat pump that is supplied with an air treatment section and a stainless steel hot water heater. The heat pump recovers energy from the ventilation air. The recovered energy supplies hot water via a circuit with water circulating between the air treatment section and heater. The heat pump has an integrated DC fan and must be installed in a ventilation system intended for mechanical exhaust air.



System diagram



NIBE FIGHTER 200P



Mechanical ventilation system with local outside air post-flow using a heat pump, which heats domestic hot water and radiator water using exhaust air energy.



Technical description

In the FIGHTER 200P the controlled domestic ventilation system with heat recovery via a heat pump is combined with heating the domestic hot water and radiator water.

The FIGHTER 200P is a complete system to replace both the conventional gas condensing boiler, hot water tank and the separate heat recovery ventilation system.

The FIGHTER 200P is ideal for both low-temperature heating systems and underfloor and wall heating.

The FIGHTER 200P is to be controlled by a room thermostat. The FIGHTER 200P also has additional heating in the form of an integrated immersion heater of 3.0 kW. This only switches on automatically when required, as the basic heating function is provided by the heat pump.

The operator panel has all its switches and buttons arranged in a user-friendly manner, making it easy to operate.

Area of application

The FIGHTER 200P is designed for flats and single houses with small heating demand of about 2 – 4 kW (NE standard) with an average room height of 2.50 m.

Accessories

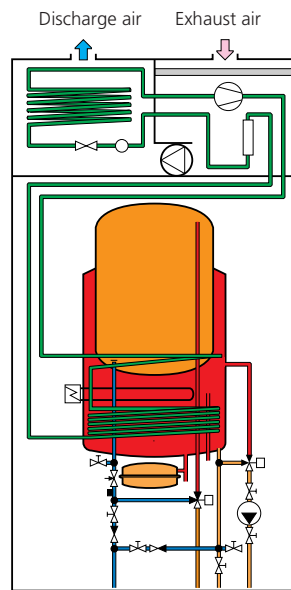
Room thermostat

Structural design

The FIGHTER 200P is a complete heat pump unit for recovering thermal energy from exhaust air. Warm inside air is channelled from the connected rooms through the ventilation unit built into the system via a heat exchanger located in the heat pump circuit.

The heat recovered in this way is transferred via an indirect heating surface to a double-jacket tank. The domestic hot water tank has excellent corrosion protection in the form of double-layer enamelling and a sacrificial anode.

The hot water tank's double-jacket system means that radiator water and domestic hot water can be heated at the same time.



System diagram

C When the inside air has passed through the heat pump the discharge air is released into the open air. Before this, the heat pump has extracted so much energy from the exhaust air to produce heat for the radiators and domestic hot water that the temperature of the discharge air is only about 0° C (depending on the system).

G Extractor hood

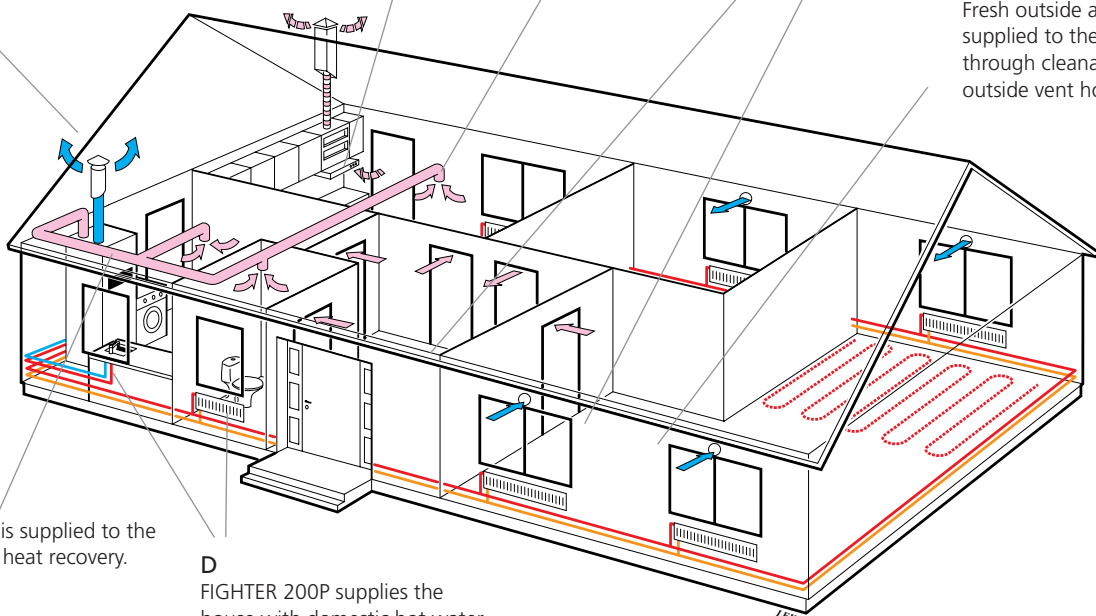
A The warm inside air (exhaust air) is drawn into the ventilation system.

F The air overflow occurs under the door or through the overflow vent holes.

E Fresh outside air is supplied to the house through cleanable outside vent holes.

B Warm exhaust air is supplied to the FIGHTER 200P for heat recovery.

D FIGHTER 200P supplies the house with domestic hot water and water for radiators.



NIBE FIGHTER 310P/315P



Mechanical ventilation system with local outside air post-flow using a heat pump, which heats domestic hot water and radiator water using exhaust air energy.



Technical description

In the FIGHTER 310P/ 315P the controlled domestic ventilation system with heat recovery via a heat pump is combined with heating the domestic hot water and radiator water.

The FIGHTER 310P/ 315P is a complete system to replace both the conventional gas condensing boiler, hot water tank and the separate heat recovery ventilation system.

The FIGHTER 310P/ 315P is ideal for both low-temperature heating systems and underfloor and wall heating.

The weather-controlled microprocessor continually ensures the system's efficient operation and guarantees a constant room temperature as part of this. The FIGHTER 310P/ 315P also has additional heating in the form of an integrated immersion heater, which is changeable between 3.0 and 13.5 kW. This only switches on automatically when required, as the basic heating function is provided by the heat pump.

The fan can be set to three levels just with the press of a key. It is also controlled by the microprocessor and for instance, it can be automatically reset to normal fan operation after six hours of high-power fan operation.

The operator panel has all its switches and buttons arranged in a user-friendly manner, making it easy to operate.

Area of application

The FIGHTER 310P/ 315P is designed for single and two-family houses and with heat demand of about 4 – 6 kW (NE standard) with an average room height of 2.50 m.

Accessories

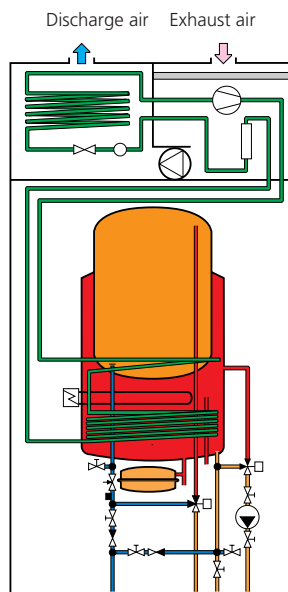
Docking kit
Room sensor

Structural design

The FIGHTER 315P is a complete heat pump unit for recovering thermal energy from exhaust air. Warm inside air is channelled from the connected rooms through the ventilation unit built into the system via a heat exchanger located in the heat pump circuit.

The heat recovered in this way is transferred via an indirect heating surface to a double-jacket tank. The domestic hot water tank has excellent corrosion protection in the form of double-layer enamelling and a sacrificial anode.

The hot water tank's double-jacket system means that radiator water and domestic hot water can be heated at the same time.



System diagram

C When the inside air has passed through the heat pump the discharge air is released into the open air. Before this, the heat pump has extracted so much energy from the exhaust air to produce heat for the radiators and domestic hot water that the temperature of the discharge air is only about 0° C (depending on the system).

G Extractor hood

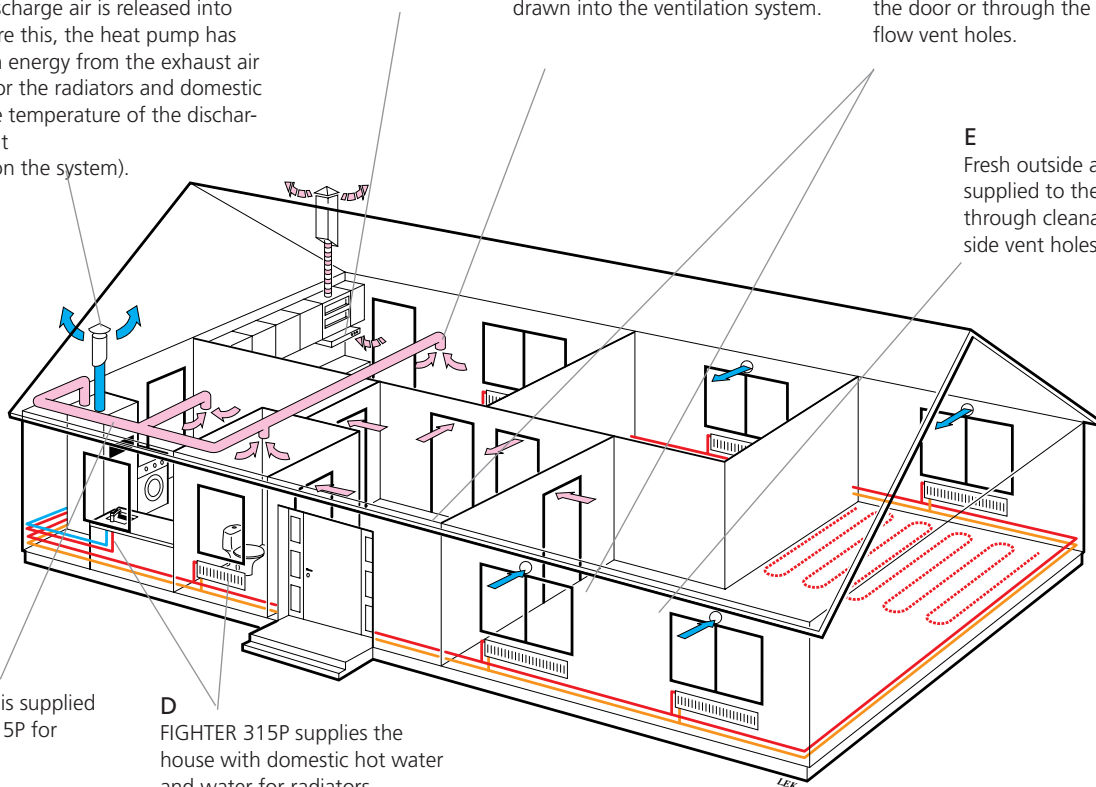
A The warm inside air (exhaust air) is drawn into the ventilation system.

F The air overflow occurs under the door or through the overflow vent holes.

E Fresh outside air is supplied to the house through cleanable outside vent holes.

B Warm exhaust air is supplied to the FIGHTER 315P for heat recovery.

D FIGHTER 315P supplies the house with domestic hot water and water for radiators.



NIBE FIGHTER 360P



Mechanical ventilation system with local outside air post-flow using a heat pump, which heats domestic hot water and radiator water using exhaust air energy.



Technical description

FIGHTER 360P is an exhaust air heat pump based on FIGHTER 310P. The pump has been enhanced and offers improved performance, communication and design. But still retains its simplicity and user-friendliness.

FIGHTER 360P consists of an electric boiler, a heat pump and a maintenance-free hot water heater.

Energy is recovered from the ventilation exhaust air and fed to the heating system and/or the water heater. FIGHTER 360P is designed for low temperature radiators and underfloor heating systems.

FIGHTER 360P has a well-arranged control panel with an informative display. Information about the operational conditions, set values etc. of the pump is clearly seen on the screen.

FIGHTER 360P has a newly developed control system prepared for communication with computers and central monitoring systems in the house or on the Internet.

The exhaust air pump is equipped with a 8.0 W electric heater and power guard. The new design of FIGHTER 360P gives a lower sound level and a higher ventilating capacity. The fan has ten output steps that are easily increased or reduced through the control panel or external signal.

The newly developed monitoring program in the compressor in FIGHTER 360P selects the most favourable temperature conditions at the time, which in turn improves the energy saving qualities of the heat pump.

Area of application

The FIGHTER 360P is designed for single and two-family houses and with heat demand of about 4 – 6 kW (NE standard) with an average room height of 2.50 m.

Accessories

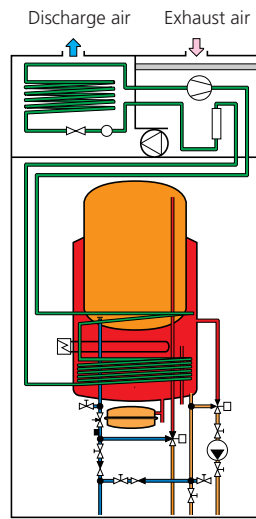
Room thermostat

Structural design

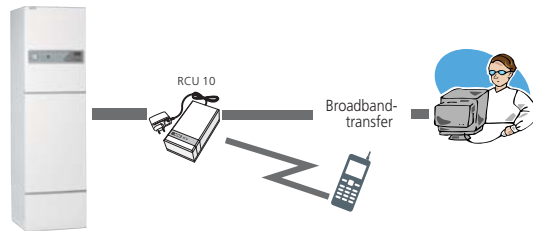
The FIGHTER 360P is a complete heat pump unit for recovering thermal energy from exhaust air. Warm inside air is channelled from the connected rooms through the ventilation unit built into the system via a heat exchanger located in the heat pump circuit.

The heat recovered in this way is transferred via an indirect heating surface to a double-jacket tank. The domestic hot water tank has excellent corrosion protection in copper.

The hot water tank's double-jacket system means that radiator water and domestic hot water can be heated at the same time.



Communication unit which enables control and supervision of the heat pump over a local network or via the internet.



System diagram

C When the inside air has passed through the heat pump the discharge air is released into the open air. Before this, the heat pump has extracted so much energy from the exhaust air to produce heat for the radiators and domestic hot water that the temperature of the discharge air is only about 0° C (depending on the system).

G Extractor hood

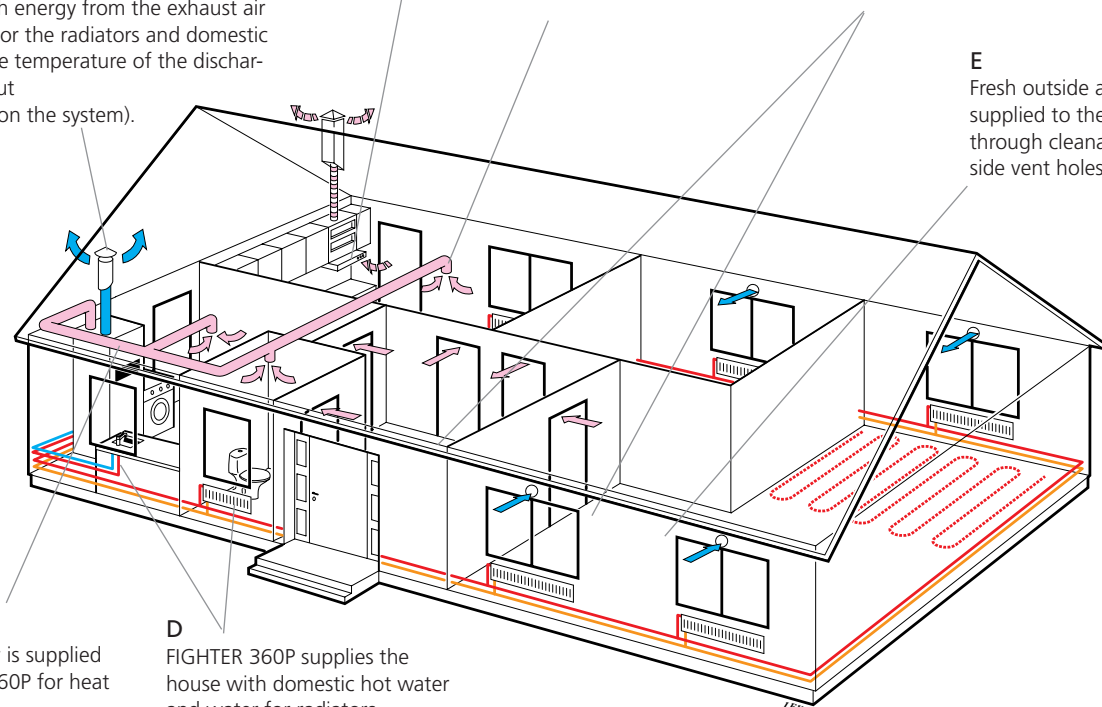
A The warm inside air (exhaust air) is drawn into the ventilation system.

F The air overflow occurs under the door or through the overflow vent holes.

E Fresh outside air is supplied to the house through cleanable outside vent holes.

B Warm exhaust air is supplied to the FIGHTER 360P for heat recovery.

D FIGHTER 360P supplies the house with domestic hot water and water for radiators.



NIBE FIGHTER 410P



Mechanical ventilation system (central supply air) combined with a heat pump, which heats the domestic hot water and radiator water using exhaust air energy and preheats the fresh supply air.



Technical description

In the FIGHTER 410P the controlled domestic ventilation with heat recovery via a heat pump is combined with heating the domestic hot water, supply air and providing heating.

The weather-controlled microprocessor continually ensures the system's efficient operation and guarantees a constant room temperature as part of this. This is set by adjusting the radiator thermostats. The FIGHTER 410P has additional heating in the form of an integrated immersion heater, which switches on automatically between 2x3.0 and 3x3.0 kW, only when required, as the basic heating function is provided by the heat pump.

The operator panel has all its switches and buttons arranged in a user-friendly manner, making it easy to operate.

The FIGHTER 410P is ideal both for low-temperature radiator systems and underfloor heating.

Area of application

The FIGHTER 410P is designed for single and two-family houses and with heat demand of about 4 – 6 kW (NE standard) with an average room height of 2.50 m.

If it were possible to switch off the heating circuit this system would operate as a supply air and hot water tank as a result of heat recovery.

Accessories

Docking kit

Room sensor

4.5 kW extra immersion heater kit

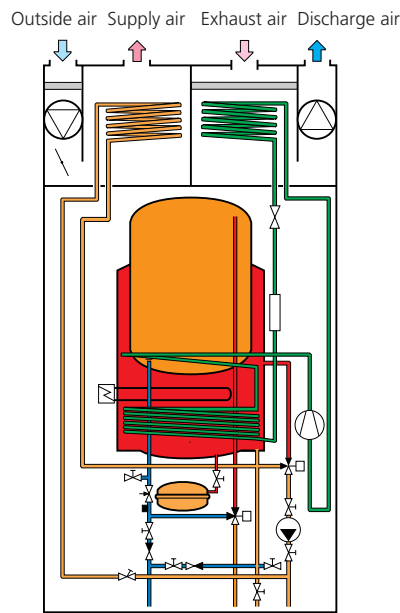
Structural design

The FIGHTER 410P is a complete heat pump unit for recovering thermal energy from exhaust air. Warm, oxygen-poor air is channelled from the connected rooms where the exhaust air is through the ventilation unit built into the system via a heat exchanger located in the heat pump circuit.

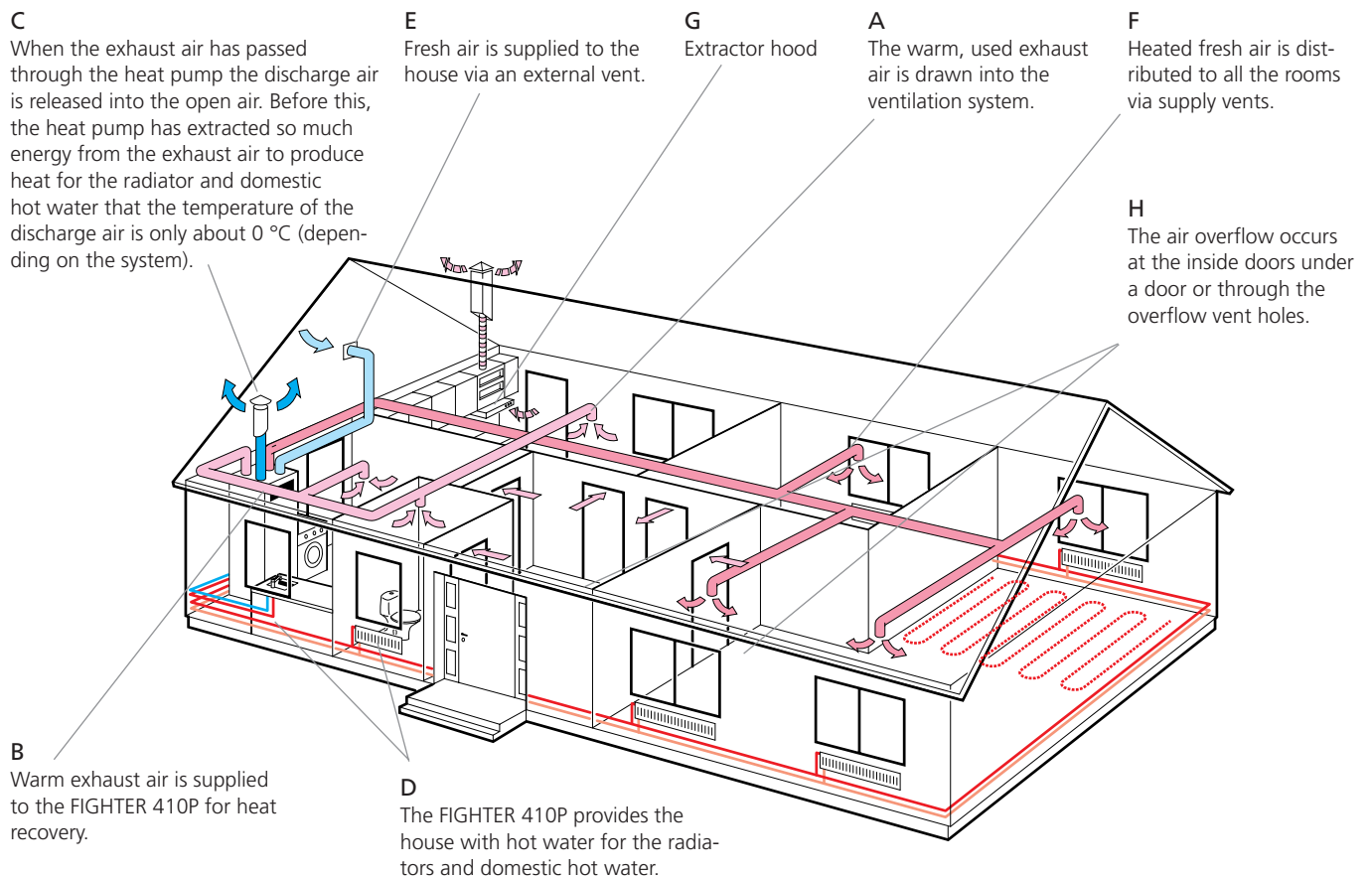
The heat recovered in this way is transferred via an indirect heating surface to a double-jacket tank. At the same time the recovered heat is channelled via another heat exchanger to both the supply air and the heating circuit.

A copper lining or stainless steel is used for the domestic hot water tank to prevent corrosion.

The hot water tank's double-jacket system not only helps to heat the radiator water and domestic hot water, it also heats the fresh supply air at the same time via the supply air heat exchanger.



System diagram



NIBE FIGHTER 600P



Mechanical ventilation system combined with a heat pump, which heats domestic hot water and radiator water using exhaust and outside air energy.



Technical description

In the FIGHTER 600P the controlled domestic ventilation system with heat recovery via an exhaust air and outside air heat pump is combined with heating domestic hot water and radiator water.

The FIGHTER 600P is a complete system which replaces the conventional heating boiler, hot water tank and a heat recovery ventilation system, while also using outside air energy up to -5°C . If the outside temperature drops below -5°C the FIGHTER 600P automatically switches over to exhaust air energy recovery only. The FIGHTER 600P is ideal for both low-temperature heating systems and underfloor heating.

The weather-controlled microprocessor continually ensures the system's efficient operation and guarantees a constant room temperature as part of this. This is set by adjusting the radiator thermostats. The FIGHTER 600P has additional heating in the form of an integrated 9 kW immersion heater. This only switches on automatically when required, as the basic heating function is provided by the heat pump.

The operator panel has all its switches and buttons arranged in a user-friendly manner, making it easy to operate.

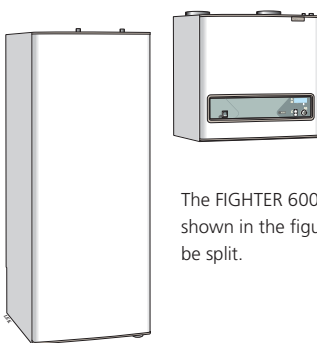
Area of application

The FIGHTER 600P is designed for single and two-family houses and with heat demand of about 4 – 6 kW (NE standard).

Given that it can also be split into a heat pump section and hot water tank, the FIGHTER 600P is especially ideal for rooms with minimal installation height.

Accessories

Splitting kit

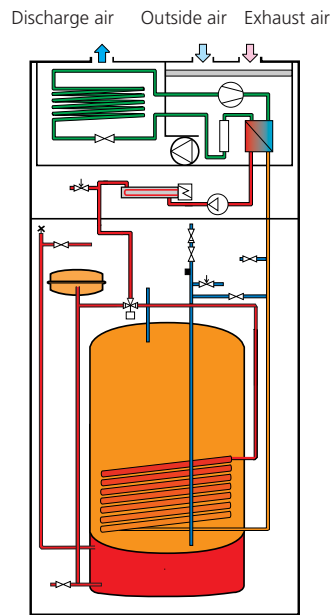


The FIGHTER 600P can, as shown in the figure, also be split.

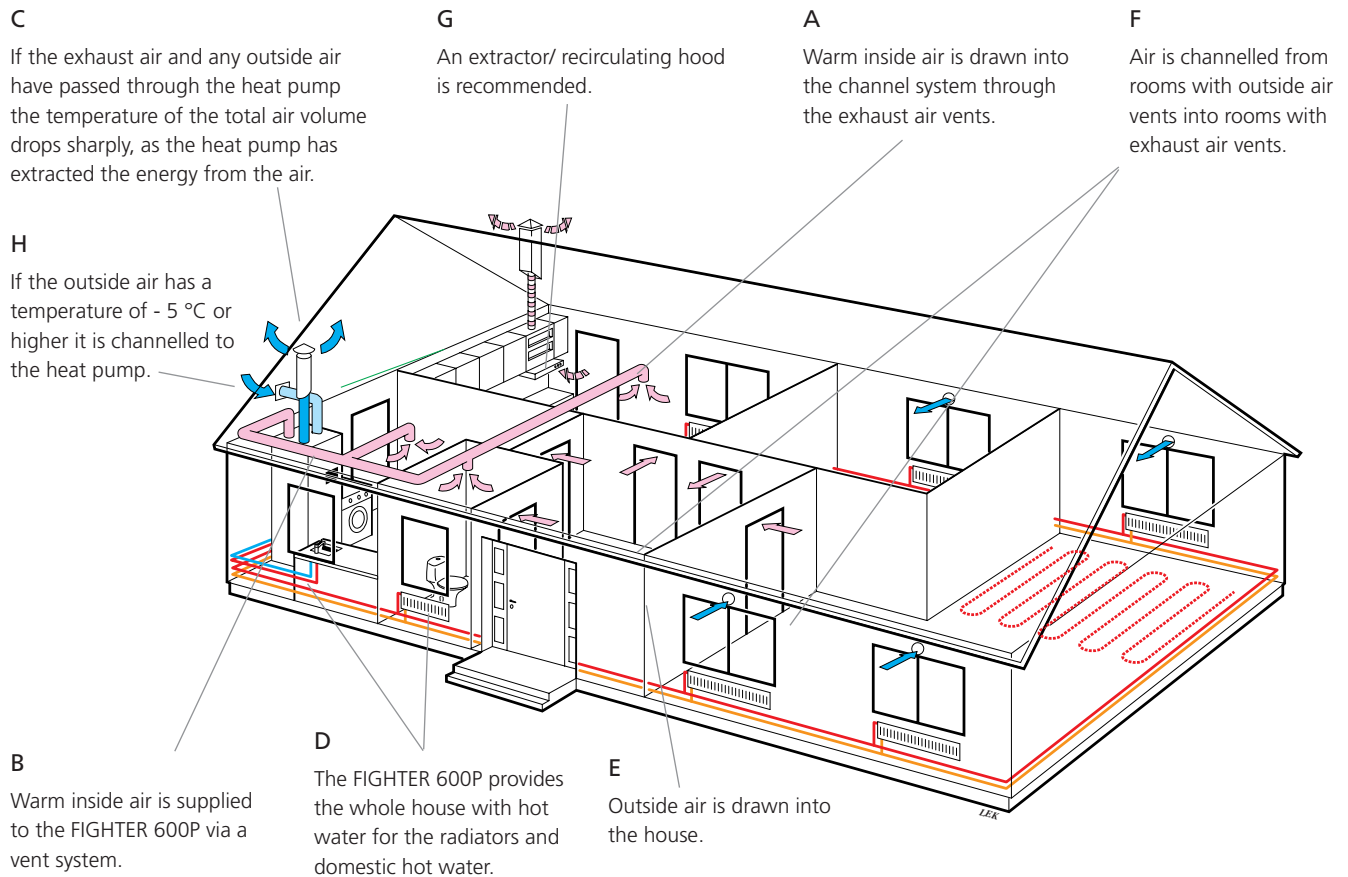
Structural design

The FIGHTER 600P is a complete heat pump unit for recovering the heat energy from exhaust air and generating outside air heat. Hot exhaust air is drawn from the connected rooms via a heat exchanger located in the active heat pump circuit through the fan unit integrated in the ventilation system. Both the recovered and newly generated energy is then transferred to the heating circuit, and from there to the domestic hot water.

This means that any risk is removed, in the event of a refrigerant leak, of the domestic hot water being contaminated by the refrigerant, which is mixed with oil. The hot water tank has excellent corrosion protection in the form of double-layer enamelling and a sacrificial anode.



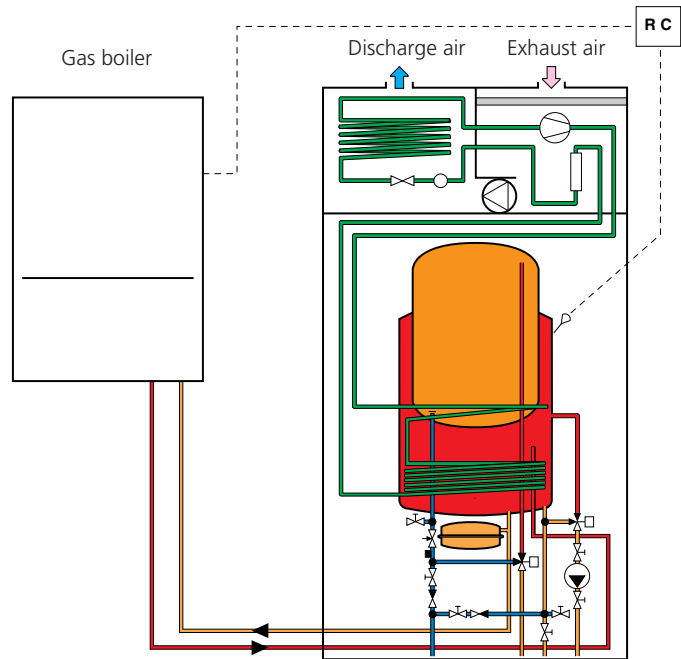
System diagram



Additional heating using a gas condensing boiler or similar heating systems.

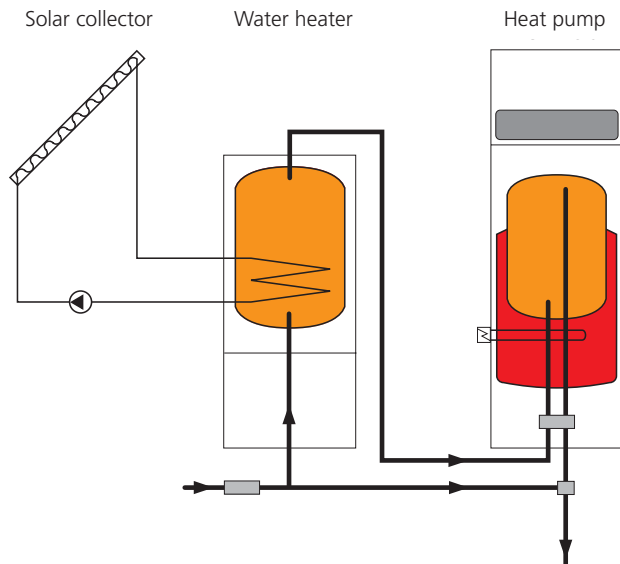
The FIGHTER 200P/ 310P/ 315P/ 360P/ 410P and 600P can be docked with gas condensing boilers. From an energy point of view, the gas condensing boiler should be chosen as additional heating when the required heating capacity is >6 kW. The capacity of the additional heating devices selected should not, however, exceed the maximum permissible capacity (13.5 kW). The chimney design must comply with the relevant local regulations.

The gas condensing boiler supplies the heating circuit with heated radiator water and is controlled by the FIGHTER's microprocessor.



Additional heating in conjunction with solar collectors

The FIGHTER 200P/ 310P/ 315P, FIGHTER 410P and 600P can also operate in conjunction with solar collectors. Solar energy can be used to heat up domestic hot water (as shown in the drawings). As the domestic hot water in the accumulator tank is preheated by the solar collectors, the FIGHTER's energy consumption decreases by the corresponding amount. During the transition period solar energy can also be used as a backup for the heating.



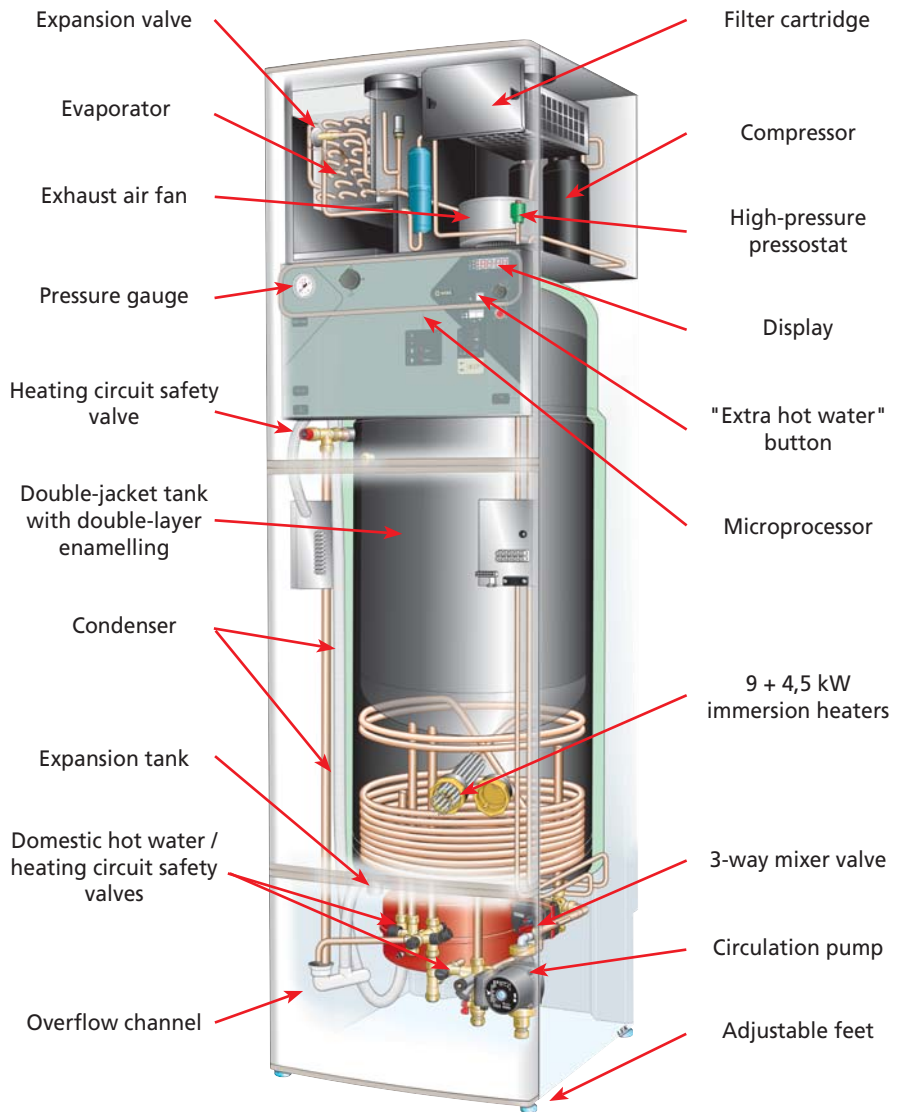
Operating principle for the FIGHTER 315P combined with solar collectors. This solution can be modified, as appropriate, if a gas condensing boiler is to be docked.

The double-walled heating boiler combined with a sophisticated microprocessor offers numerous connection options.



NIBE EXHAUST AIR HEAT PUMP

Mechanical ventilation system with local outside air post-flow using a heat pump, which heats domestic hot water and radiator water using exhaust air energy.



Accessories

ETS additional electrical system

for FIGHTER 410P only
A second immersion heater increases the heating capacity from 9 kW to 13.5 kW.

Splitting kit for FIGHTER 600P

In rooms with a restricted installation height the FIGHTER 600P is split into an upper and lower section.

Ventilation system

Any ventilation system should be designed and installed in accordance with the guidelines set out in DIN 1946. Only this will ensure hygienic room air and prevent any damage from dampness to the building structure.

Apart from in the case of the FIGHTER 410P, we have followed the principle based on handling exhaust air centrally and supply air locally. This has been done primarily for hygiene reasons, as individual filters are easier to maintain, compared with complicated ventilation systems. There were cost considerations as well because, unlike with centrally controlled supply air systems, our FIGHTER systems only require the minimum of equipment and installation.

To be able to ensure a high degree of efficiency and an extremely comfortable living environment, we recommend that the installation of any ventilation system should be planned and this plan must be strictly followed by the ventilation engineer.

Exhaust air is usually extracted via folded spiral seam pipes conducive to the flow from the bathroom, toilet, kitchen and utility room. At the same time, fresh air is coming via outside wall vents into the living room, bedrooms and children's rooms. Factors such as street noise, exhaust fumes, wind, general noise, cold and pollen can be taken into account when choosing the right outside air vents and can therefore ensure the controlled ventilation system with heat recovery offers a high degree of comfort.



Outside air device

Technical data

Product		Single phase FIGHTER 100P	Single phase FIGHTER 200P	Three phase FIGHTER 315P	Three phase FIGHTER 600P
Height	mm	1930	2095	2095	2110
Width	mm	600	600	600	600
Depth	mm	610	610	610	635
Net weight	kg	155	195	195	210
Water capacity, outer jacket	Liter	–	70	70	55
Water capacity, cylinder	Liter	225	170	170	189
Voltage		230(1-phase+N)	230(1-phase+N)	400(3-phase+N)	400(3-phase+N)
Refrigerant		R290 (Propan)	R290 (Propan)	R290 (Propan)	R290 (Propan)
Compressor rated output (Pel)	W	350	550	550	1000
Immersion heater rated output	kW	1,5	3,0	9,0	9,0
Savings/year*	kWh	1800 – 3500	4000 – 7500	6000 – 8500	7000 – 10000
Corrosion protection		Cu	Cu	E	E

Product		Single phase FIGHTER 310P	Three phase FIGHTER 310P	Single phase FIGHTER 360P	Three phase FIGHTER 360P	Single phase FIGHTER 410P	Three phase FIGHTER 410P
Height	mm	2095	2095	2095	2095	2095	2095
Width	mm	600	600	600	600	600	600
Depth	mm	610	610	615	615	610	610
Net weight	kg	195	195	205	205	200	200
Water capacity, outer jacket	Liter	70	70	70	70	70	70
Water capacity, cylinder	Liter	170	170	170	170	170	170
Voltage		230(1-phase+N)	400(3-phase+N)	230(1-phase+N)	400 (3-phase+N)	230 (1-phase+N)	400(3-phase+N)
Refrigerant		R290 (Propan)	R290 (Propan)	R290 (Propan)	R290 (Propan)	R290 (Propan)	R290 (Propan)
Compressor rated output (Pel)	W	550	550	550	650	650	650
Immersion heater rated output	kW	8,0	9,0	8,0	13,5	8,0	9,0
Savings/year*	kWh	4000 – 7500	4000 – 7500	6000 – 8500	6000 – 8500	6000 – 8500	6000 – 8500
Corrosion protection		Cu	Cu, Stainless steel	Cu	Cu	Cu	Cu, Stainless steel

* Value varies, as it is dependent on the energy extracted and exhaust air volume flow.

Technical data NIBE FIGHTER 120

Height	mm	600
Width	mm	600
Depth	mm	456
Net weight	kg	38
Supply voltage	V	230 (1-phase+N)
Rated output, compressor	W	245
Rated output circulation pump	W	10
Driving power fan (DC)	W	25 – 110 W
Enclosure class		Drip proof IP21
Max noise level at 260 m ³ h	dB(A)	45
Refrigerant volume	g	470
Break pressure high pressure pressostat	MPa	2,0
Max flow line temperature, compressor	°C	65
Connection, flow line	mm	15
Connection return line	mm	15

Water heater

Volume	l	150	300
Height	mm	840	1550
Diameter	mm	596	596
Net weight	kg	31	53
Connection, hot water	mm	22	22
Connection, cold water/ HP return	mm	28	28
Connection, HP front	mm	22	22
Corrosion protection		Stainless steel	

Commissioning and maintenance

Commissioning should be carried out by either an installation company as defective installation of the ventilation system may not only reduce the heat pump system's efficiency, but also result in damage to the building. In addition, this technical expert will be able to use his or her sensitive measurement devices to ensure that ventilation is effective and draught-free.

Maintenance involves cleaning the system or replacing the integrated filter. Safety valves should also be inspected regularly.

And finally...

This brochure has hopefully provided you with an overview of what domestic ventilation with heat recovery is all about, while also introducing you to our extensive FIGHTER range.

Did you know that there is a whole variety of public funding opportunities available for installing heat recovery systems? Information about this can be obtained from any relevant power supply company and please contact us if you would like more detailed documentation about this.



MADE IN SWEDEN

NIBE Heating, with its Head Office in Markaryd, Sweden, is one of Europe's leading companies in the domestic heating field. Products such as water heaters, heat pumps and several types of boiler are the basis of NIBE's current product range.

NIBE Heating is one of three business areas of NIBE Industrier AB, a company listed on the Swedish Stock Exchange.



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