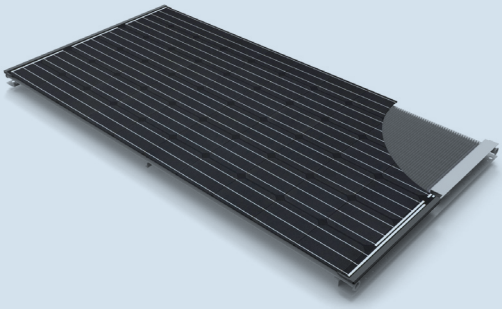
# NIBE PV-T

## The collector system for NIBE Multi-source heat pumps



**Photovoltaic-Thermal panels are an excellent collector source for a NIBE heat pump. The installation of a PV-T array can be utilised as a direct alternative or supplement to a traditional borehole or surface collector.**

**This new, innovative, approach transforms a NIBE "Ground" source heat pump product into a "Multi-source" heat pump product.**

PV-T panels are equipped with PV cells at the front that convert sunlight into electricity. The rear consists of a thermal heat exchanger that extracts energy from the ambient air that is heated under the panels by daylight and sunlight. The operation of the heat exchanger is therefore comparable to that of an air/water heat pump, without the requirement of a mechanical fan. A PV-T system therefore works 100% silently!

Even on cloudy days and at night – without direct heating of sunlight and even at temperatures below freezing, the heat exchanger provides sufficient heat supply for the heat pump.

In warmer months the heat extracted by the collector helps cool the PV aperture surface, improving generation efficiency.

- Totally silent air collector for NIBE Multi-source heat pumps.
- The ideal solution as an alternative or supplement to a borehole or surface soil collector system.
- Unique, elegant, all-black panels with double production of energy, thermal and electricity.
- Improved PV generation efficiency.
- Connects to a NIBE heat pump for maximum energy efficiency.

# Design

The PV-T system should be sized in relation to the output capacity of the heat pump product being installed. As a rule-of-thumb the surface area of the array is proportionate to the output capacity, which can be calculated as follows:

PV-T Panel Area($m^2$) = 2.7 x Heat Pump Capacity ($kW_{Thermal}$)

There are two PV-T panel sizes, both of which must be installed in the landscape orientation.

| | | M3 450 XL | M3 375 L |
|---|---|---|---|
| Overall Dimensions | mm | 2131 x 1055 x 65 | 1791 x 1055 x 65 |
| Surface Area | $m^2$ | 2.25 | 1.89 |
| Nominal PV Power | Wp | 450 | 375 |
| HP Thermal Output | kW | 0.8 | 0.7 |

## M3 450 XL Sizing Sample

**Start a new PVT row on a new line**

| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Field Length |
|---|---|---|---|---|---|---|---|---|---|
| **no. of rows** | 1 | PVT 450 Wp | PVT 450 Wp | PVT 450 Wp | | | | | 6.5 m |
| | 2 | PVT 450 Wp | PVT 450 Wp | PVT 450 Wp | | | | | |
| | 3 | PVT 450 Wp | PVT 450 Wp | PVT 450 Wp | | | | | |
| | 4 | | | | | | | | |
| | 5 | | | | | | | | |
| | 6 | | | | | | | | |
| | 7 | | | | | | | | |
| | 8 | | | | | | | | |
| | 9 | | | | | | | | |
| | 10 | | | | | | | | |

Height of field (no. of rows) 3.3 m

| | 450 Wp | 375 Wp |
|---|---|---|
| **no. of PVT panels:** | 9 | 0 |
| **no. of PV panels:** | 0 | 0 |

| | | |
|---|---|---|
| **m2 PVT source** | 19.9 | **m2 PVT** |
| **Thermal (T):** | 7.4 | **kW** |
| **Electrical (PV):** | 4.1 | **kWp** |

## M3 375 L Sizing Sample

**Start a new PVT row on a new line**

| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Field Length |
|---|---|---|---|---|---|---|---|---|---|
| **no. of rows** | 1 | PVT 375 Wp | PVT 375 Wp | PVT 375 Wp | | | | | 5.5 m |
| | 2 | PVT 375 Wp | PVT 375 Wp | PVT 375 Wp | | | | | |
| | 3 | PVT 375 Wp | PVT 375 Wp | PVT 375 Wp | | | | | |
| | 4 | | | | | | | | |
| | 5 | | | | | | | | |
| | 6 | | | | | | | | |
| | 7 | | | | | | | | |
| | 8 | | | | | | | | |
| | 9 | | | | | | | | |
| | 10 | | | | | | | | |

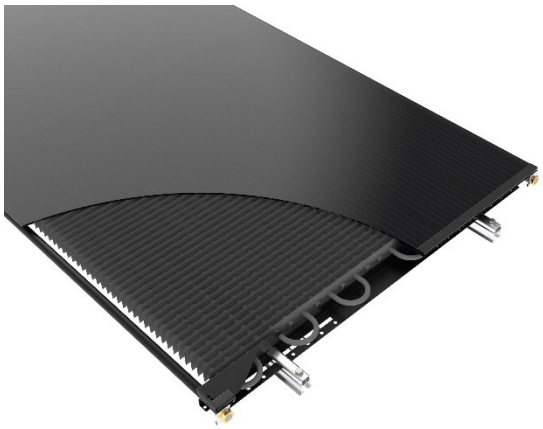
Height of field (no. of rows) 3.3 m

| | 450 Wp | 375 Wp |
|---|---|---|
| **no. of PVT panels:** | 0 | 9 |
| **no. of PV panels:** | 0 | 0 |

| | | |
|---|---|---|
| **m2 PVT source** | 16.7 | **m2 PVT** |
| **Thermal (T):** | 6.2 | **kW** |
| **Electrical (PV):** | 3.4 | **kWp** |

# Supplied components

## PV-T Panel



| Art No. | Description |
|---|---|
| 101150 | PV-T M3-450XL heat pump panel landscpae 450Wp 2.21m$^2$ |
| 101250 | PV-T M3-375L heat pump panel landscpae 375Wp 1.87m$^2$ |

## Mounting Rails

2 pieces of mounting rail per PV-T panel with pre-mounted panel clamps and connectors. Mounting rail supplied will depend on the PV-T array size and configuration.

| Art No. | Description |
|---|---|
| 325010 | Mounting Rail 2209mm for first panel in row, M3-450XL, pre-mounted clamps |
| 325020 | Mounting Rail 2169mm for supplementary panel in row, M3-450XL, pre-mounted clamps |
| 325030 | Mounting Rail 1869mm for first panel in row, M3-375L, pre-mounted clamps |
| 325040 | Mounting Rail 1829mm for supplementary panel in row, M3-375L, pre-mounted clamps |

## Hydraulic Packages


| Art No. | Description |
|---|---|
| 012013 | PV-T Basic Kit 1-s, First Panel Press Fit |
| Contents : | |
| 311120 | Locking Pin x 2 |
| 424010 | Ribbed hose plug/press 20-40mm. DN20, with 22mm SS press fit. |
| 424015 | Ribbed hose plug/press 110-210mm. DN20, with 22mm SS press fit. |
| 410200 | End plug with air vent x 2 |
| 410500 | Locking Clip x 4 |
| 615000 | PV cable clamp |


| Art No. | Description |
|---|---|
| 012023 | PV-T Basic Kit 3, Supplementary Panel |
| Contents : | |
| 311120 | Locking Pin x 2 |
| 411000 | Intermediate hose x 2 |
| 615000 | PV cable clamp x 1 |

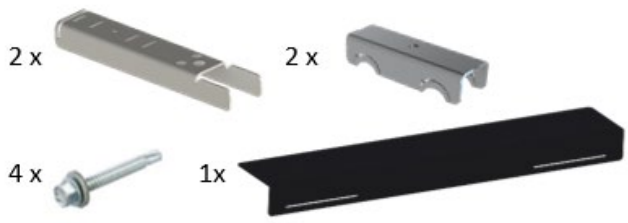
# Supplied components

## Roof penetration kits


| Art No. | Description |
|---|---|
| 014011 | Sloped roof gland, including flexible piping (SS press) and insulation. Antracite |
| 014021 | Sloped roof gland, including flexible piping (SS press) and insulation. Natural Red |
| Contents: | |
| 890020890010 | Roof Pentration Kit (Antracite or natural red) |
| 890005 | Sealing Collar (EPS, diam. 42-55mm x 2 |
| 425080 | Ribbed hose SS press. DN25, 1000-2000mm x 2 |
| 430252 | Pipe insulation vapour tight 2m length, (19x28mm) x 2 |

## Cover Plate

For pitched roof insulations a mounting cover plate accessory can be installed to conceal the header pipework connections.



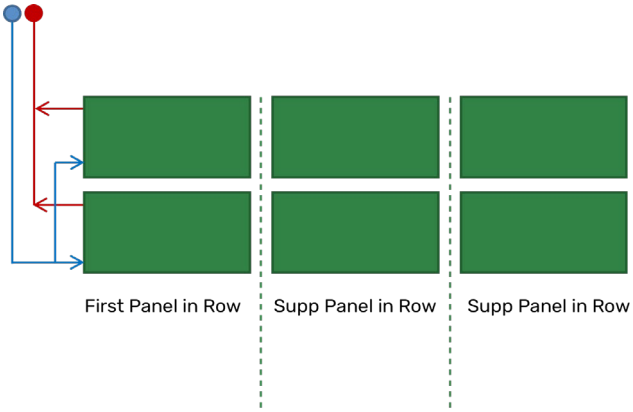

| Art No. | Description |
|---|---|
| 013022 | Sloped roof mountign cover plate, per PV-T row. |

# Configuration

Mounting and hydraulic components for the PV-T system are provided in packages, depending on the configuration of the installation.

1 hydraulic package and 2 mounting packages are required per panel, dependent on the configuration of the installation. Separate packages are available for “first panel in row” and “supplementary panel in row” arrangements.

Mounting packages should be selected to reflect the size of the PV-T panel being installed, choosing between the M3 450 XL and M3 375 L variants.

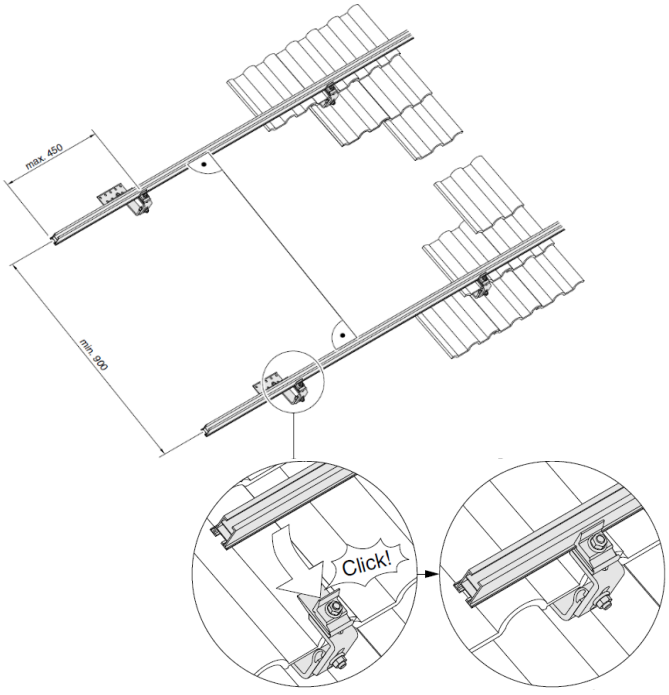


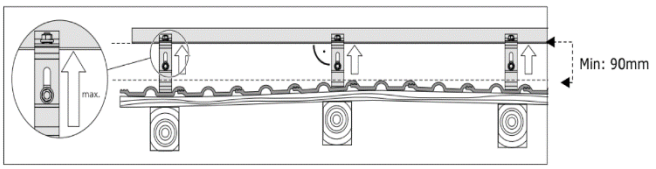

# Mounting

The PV-T system can be installed using ground, flat roof and pitched-roof mounting systems to suit a projects requirements. The mounting rails and clamps supplied with the PV-T system package is part of the Wagner TRIC mounting system and is compatible with many standard PV systems.

Wind loading calculations for static loading and/or ballast configuration is the responsibility of the installer.

Each PV-T panel must be supported by 4 anchors, 2 per mounting rail. Full instruction for the mounting system can be found within the main products installer handbook




> **NOTE**
>
> There is a minimum distance between the roof and the bottom of the heat pump panel of 90mm. The height of the roof anchors should be adjusted to meet this.

# Hydraulics

## General

Consideration should be made to limit the pressure drop through the PV-T system, in accordance to the minimum pipework recommendations and flow rates provided opposite.

Various pipework specifications can be used for the connections between the PV-T panel array and the heat pump. Stainless Steel pipe, copper pipe, PEX, or plastic PP-R pipe can be used.

Plastic pipes that are exposed to the sun must always be protected against UV light by means of a UV-resistant sheath or UV-resistant paint. The plastic pipes must be suitable for the source fluid.

Any pipework from the roof flange, within the insulated envelope of the building, should be installed with vapor sealed insulation to prevent the risk of condensation.

Because the temperature of the brine system can fall below 0°C, it must be protected against freezing down to -15°C. Anti-freeze must be mixed according to manufacturer's instructions to ensure frost protection and should be checked using a refractometer.

## Minimum Primary Pipework Specification

| Heat Pump Capacity (kW) | Minimum Primary Pipework Specification (Ø mm) |
|---|---|
| 6 to 8 kW | 28mm |
| 8 to 15 kW | 35mm |
| 15 to 28 kW | 42mm |
| 29 to 50 kW | 54mm |

## Collector Flow Rates

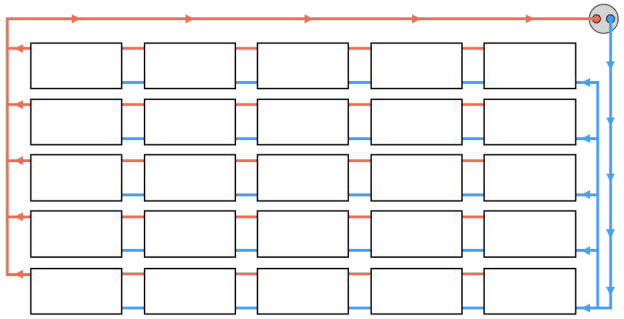
| No. of Panels | Flow Rate per row (l/s) | Pressure Drop (kPa) |
|---|---|---|
| 1 | 0.028 | 14 |
| 2 | 0.056 | 15 |
| 3 | 0.083 | 15 |
| 4 | 0.111 | 16 |
| 5 | 0.139 | 16 |
| 6 | 0.167 | 17 |
| 7 | 0.194 | 18 |

## Pitched Roof Hydraulic Set-Up

When connecting several PV-T panels in a row, consideration must be given to limiting the pressure drop. We recommend a connection set-up according to the reverse return Tichelmann principle.

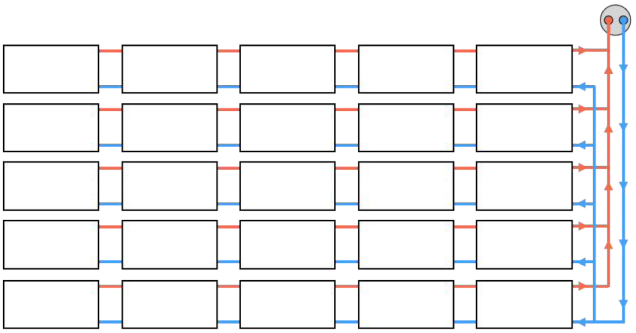
For pitched roof installations a reverse return pipework configuration is mandatory for system containing 4 or more panels in a row.

## Double-sided Tichelmann connection



If a double sided Tichelmann connection is not an option, it is possible to do a single-sided Tichelmann connections. A double-sided connection will always have better flow characteristics.

## Single-sided Tichelmann connection



### Note

For either Tichelmann connection:

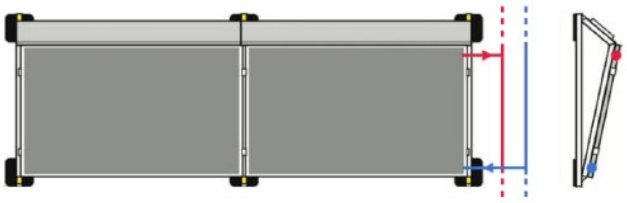
- The **cold** pipe is connected at the bottom of the panels
- The **warm** return line is connected at the top.
- Ensure that all system air vents are accessible

# Hydraulics

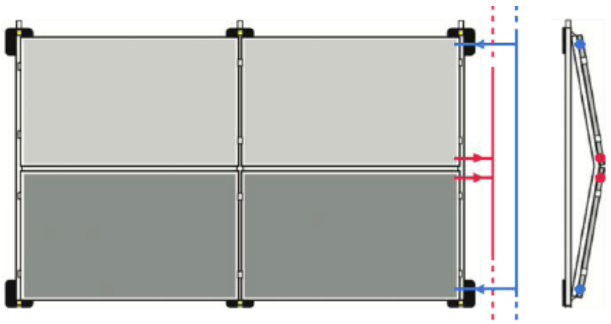
### Flat Roof Hydraulic Set-Up

For flat roof installations, the return (warm) pipe should always be at the highest point of the panels.

### Flat roof – Connection with South Elevation



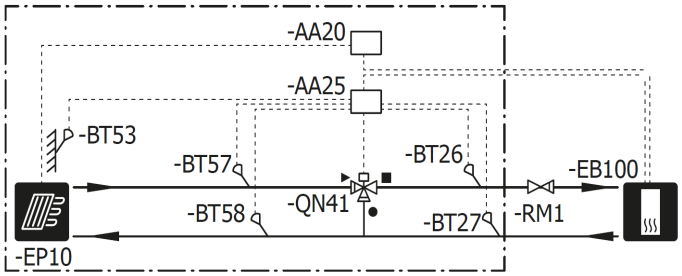
### Flat roof – Connection with East/West split configuration



### Shunt Controlled Brine AXC 50 / PV-T 40 Accessory

The PV-T accessory or AXC 50 accessory is required to connect the heat pump to the PV-T system, to activate the shunt-controlled brine function. Using a shunt valve (QN14) and brine sensor (BT26), the heat pump regulates the temperature of the incoming brine in the summer, limiting the incoming brine temperature to a maximum of 30°C.

The PV-T 40 manual or AXC 50 installer handbook should be consulted for full installation instructions. The PV-T 40 accessory is suitable for installations up to 40kW. Installations exceeding 40kW should use the NIBE AXC 50 accessory.




### Connecting the brine side

- Insulate all indoor brine pipes against condensation
- The system must be fitted with an expansion vessel (CM3), pressure gauge (BP6) and safety valve (FL3).
- Install a shut off valve for outgoing brine as close to the heat pump as possible.
- Fit the enclosed filter ball on the incoming brine, before the QN41 shunt-valve.

# Solar Communication

The NIBE heat pump product is capable of connecting and communicating to solar PV inverters, to optimize how generated electricity is being consumed.

### NIBE EME 20

For NIBE F-series and S-series heat pumps the EME 20 accessory can be used to allow for solar communication. Successful connectivity requires the solar PV inverter to be registered on the Sunspec alliance database with Modbus RTU communication protocol, with an RS 485 connectivity type. For full installation instructions on the EME 20 please consult the accessory installer handbook.

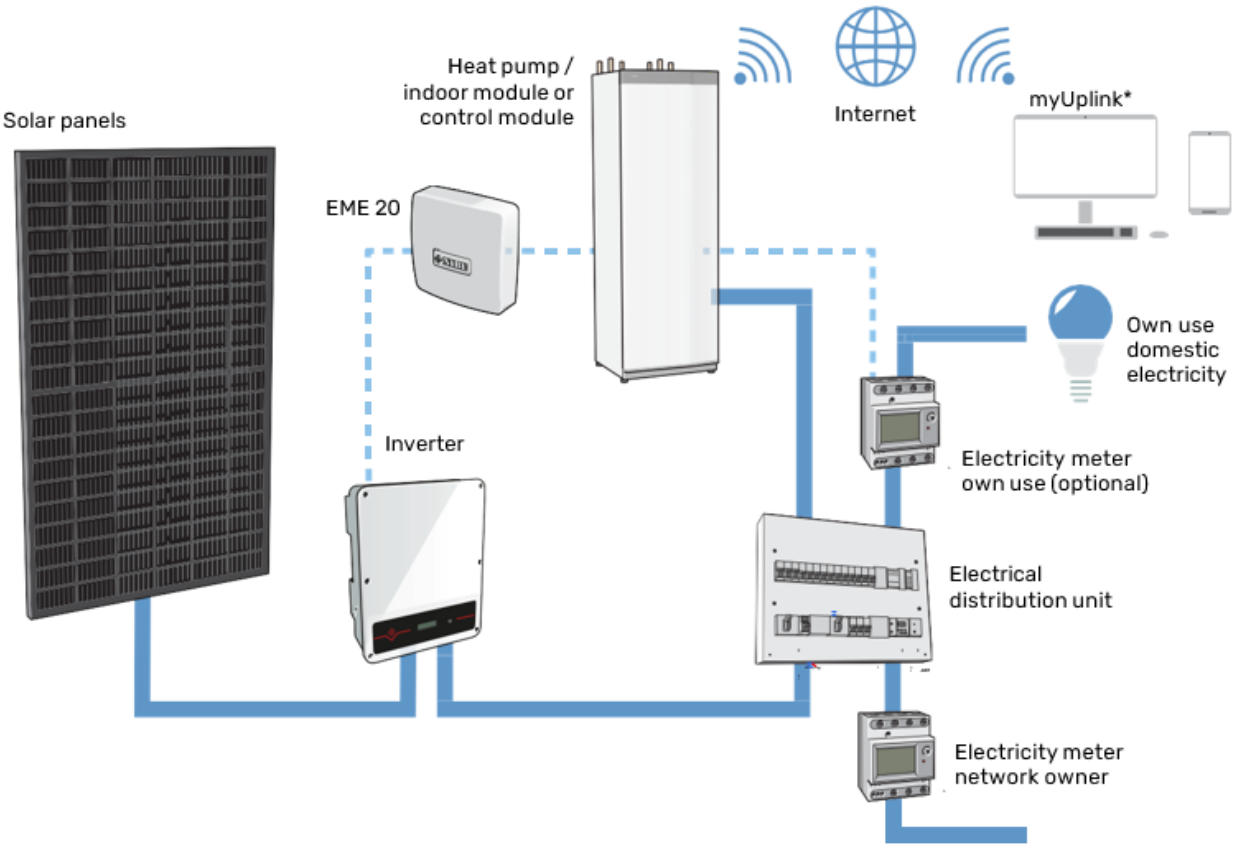
### Modbus TCP Connectivity

For NIBE S-series heat pumps it is possible to connect to the solar PV inverter using the heat pumps in-built Modbus TCP connectivity.

PV inverters must be compatible with the Modbus TCP communication protocol to be suitable for this style of connection.

**Caution**

Connectivity via Modbus TCP requires an active internet subscription.



# Technical Specification

| PV-T Panels | Unit | M3-375L | M3-450XL |
|---|---|---|---|
| Overall Dimensions | mm | 1791 x 1055 x 65 | 2131 x 1055 x 65 |
| Aperture Dimensions | mm | 1778 x 1043 | 2118 x 1043 |
| Weight | kg | 27 | 32 |
| Overall Surface | $m^2$ | 1.85 | 2.21 |
| Materials | | | |
| PV Panel | - | Glass | |
| Heat Exchanger Tube | - | Copper | |
| Heat Exchanger Fin | - | Aluminum | |
| Surface Treatment | - | Black Power Coating | |
| **PV Panel** | | **M3-375L** | **M3-450XL** |
| Type | - | Monocrystalline half cut cell duplex | |
| Nominal Power | $W_p$ | 375 | 450 |
| Short Circuit Current | A | 11.40 | 11.35 |
| Short Circuit Voltage | V | 41.9 | 50.2 |
| MPP Current | A | 10.75 | 10.75 |
| MPP Voltage | V | 34.9 | 41.9 |
| Solar Cell Efficiency | % | 21.7 | 21.6 |
| Module Efficiency | % | 20.2 | 20.3 |
| Power Output Tolerance | W | 0/+5W | |
| Maximum Reverse Current | A | 20 | |
| Max System Voltage | V | 1500 (class A) | |
| Current Temperature Coefficient | %/K | 0.06 | |
| Voltage Temperature Coefficient | %/K | -0.27 | |
| Power Temperature Coefficient | %/K | -0.35 | |
| NOCT | °C | 44 | |
| Temperature Range | °C | -40 to +95 | |
| **Heat Exchanger** | | **M3-357L** | **M3-450XL** |
| Meander Tube | mm | 12 x 0.3 | |
| Header Tube | mm | 22 x 1.0 | |
| Volume Fluid | Litres | 3.0 | 3.4 |
| Heat Exchanger Tube | - | Copper | |
| Heat Exchanger Fin | - | Aluminum | |
| Surface Heat Exchanger | mm | 0.18 | |
| Surface Heat Exchanger | $m^2$ | ca. 18 | |
| Connectors | - | Plug in with double O-ring | |
| Length Compensation | - | Flexible Connectors | |
| Maximum Pressure | bar | 6 | |
| Pressure loss water-glycol mixture 40% [1)] | mbar | 140 | |
| Specific Flow | l/min | Ca. 2-4 per panel | |
| Heat exchange capacity Air to liquid, U value [2] | | 62 with parallel roof mounting | |
| Optical Efficiency [2)] | % | 47 | |
| Heat Capacity [2)] | kJ/($m^2$K) | 77 | |
| Stagnation Temperature | °C | 62°C at 1000W/$m^2$ irradiation with an ambient temperature of 30°C | |

# Read more about our sustainable energy solutions at www.nibe.co.uk

### Ground source heat pumps

Ground source heat is stored solar energy harvested from deep within the ground, the bottom of lakes or just a few metres below your lawn. With a ground source heat system, you can create a pleasant indoor climate, and not only supply your home with heating and hot water but also cool it down on warm summer days. This kind of renewable energy means that you can lower your energy bills AND help the planet at the same time.

### Air source heat pumps

With the help of an air source heat pump, you can keep your home warm in winter and cool in summer, while lowering your energy bills at the same time. By harnessing one of nature's free and renewable energy sources, you can create a pleasant indoor climate with a low environmental impact.

### Exhaust air heat pumps

By installing an exhaust air heat pump, you can easily and effectively supply your home with heating, hot water and ventilation. Create a pleasant indoor climate by reusing the energy from the warm air as it passes through your ventilation system.

### Solar panels

Start generating your own energy with solar products from NIBE. Plus, connecting the system to your intelligent heat pump will multiply the energy you harvest. By integrating the products in one system, you can reduce your energy bills and use renewable energy effectively.

### Water heater

NIBE has been creating water solutions for over 60 years. Our complete range of hot water solutions complements our selection of heat pumps.

# Sustainable energy solutions since 1952

For 70 years, NIBE has been manufacturing energy-efficient and sustainable climate solutions for your home. It all started in Markaryd in Sweden and we value our Nordic heritage by harnessing the power of nature. We combine renewable energy with smart technology in order to offer effective solutions so that together we can build a more sustainable future.

Whether it's a chilly winter's day or a hot summer's afternoon, we need a well-balanced indoor climate for a comfortable everyday life, whatever the weather. Our wide range of products supplies your home with cooling, heating, ventilation and hot water, so that you can create a pleasant indoor climate with a low impact on nature.

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