



# Energy Genius 5-21

Reversible air/water  
Heat Pump with inverter  
technology

TECHNICAL MANUAL

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## Introduction

The new Sabiana Energy Genius reversible heat pumps, designed for residential and commercial applications, are air-water units suitable for air conditioning, cooling and domestic hot water production.

The units incorporate the latest technological innovations: DC inverter compressors, variable speed fans with low noise levels and microprocessor control.

To guarantee greater flexibility and simplicity of installation, the Energy Genius units are fitted with a built-in hydronic module. This limits the number of operations to be carried out during installation, which are reduced to the power supply connection and the water supply and return connection.

The units have excellent energy efficiency levels and can be used in combination with the wide range of hydronic terminals by Sabiana.

## The Energy Genius range

Model	Description	Power supply (V/ph/Hz)	Code
ENGY 5M	Energy Genius 5M	230/1/50	0033001
ENGY 7M	Energy Genius 7M	230/1/50	0033002
ENGY 11M	Energy Genius 11M	230/1/50	0033003
ENGY 11T	Energy Genius 11T	400/3+N/50	0033010
ENGY 15T	Energy Genius 15T	400/3+N/50	0033011
ENGY 17T	Energy Genius 17T	400/3+N/50	0033012
ENGY 21T	Energy Genius 21T	400/3+N/50	0033013

# Energy Genius

## Main Features

- Twin rotary compressors with direct current hybrid inverter drive, combination of PAM (Pulse Amplitude Modulation) and PWM (Pulse Width Modulation) that optimises compressor operation under all operating conditions, minimizing temperature variations and ensuring perfect comfort, with a significant reduction in power consumption.
- Variable speed fans with impellers fitted with blades with a profile designed to ensure better air distribution on the coil and at the same time exceptionally low sound levels.
- Simple installation and commissioning thanks to the hydronic module built into the unit and a WUI user interface supplied with the unit.
- Possibility to produce hot water with a temperature up to 60 °C (57 °C for the 21T size), which means these appliances can be used not only in fan coil systems and underfloor panels, but also for radiator systems and for the production of domestic hot water. By means input and output connections, the unit controls the three-way valve and the tank temperature probe for domestic hot water.
- High energy efficiency thanks to the thermodynamic characteristics of the R410A refrigerant and the choice and the sizing of the components. Energy Genius units are heat pumps optimised for heating, but with excellent performance also in cooling mode.
- Wide operating range in both cooling and heating mode, designed to offer the highest performance levels in a wide temperature range.
- Leaving water temperature control with a fixed setpoint or through the preset or customised selection of the climatic curve to guarantee, for every weather condition, a stable capacity that is always equivalent to the real load of capacity required by the utilities.
- The unit can be integrated into systems with existing heat sources. Defining the switching parameters to the alternative heat source guarantees continuous operation with higher savings and optimal comfort in all climatic conditions.
- Possibility to install the units in a master/slave configuration, up to a maximum of 4 units of the same size.
- Built-in Modbus interface.
- Lower maintenance costs thanks to maintenance-free twin rotary compressors, the quick failure diagnosis and access to the fault history by means of WUI user interface.

## Construction features

The advanced technology that characterizes the refrigerant circuit, together with the selection of the components, allowed to develop a compact unit with exceptionally small overall dimensions, this makes transport easy even through narrow doors.

Transport is made even easier also thanks to the reduced operating weight and the handle applied on the unit's panelling.

The unit cladding is comprised of easily removable panels that cover all the components (except for the air coil and the fans).

The neutral colour (RAL 7035) makes it fit in better in residential areas.

# Energy Genius

**Silenced twin rotary compressor** fitted with low vibration INVERTER.

Advanced technology that ensures maximum energy efficiency by providing high potential at maximum load conditions and optimized performance under medium and low speed conditions. The DC inverter of the Energy Genius heat pump uses the Intelligent Power Drive Unit (IPDU) hybrid inverter technology, which combines two electronic control logics: Pulse Amplitude Modulation (PAM) and Pulse Width Modulation (PWM). These optimise compressor operation under any condition, minimising temperature variations and guaranteeing perfect individual comfort, as well as a significant reduction in energy consumption:

- *PAM logic*: the amplitude modulation of the direct current pulse allows for control over the compressor under maximum load conditions (i.e. during start-up and under peak conditions) by increasing the voltage at a constant frequency. Accordingly, the compressor operates at high speed in order to ensure the system quickly reaches the desired temperature.

- *PWM logic*: the width modulation of the direct current pulse allows for the control of the compressor under partial load conditions by varying the frequency at a constant voltage. This way, the compressor speed is accurately adjusted to guarantee the highest level of comfort in the absence of temperature variations.

During start-up, the compressor frequency increases constantly until it reaches the maximum value. This avoids absorption peaks during start-up and the safety of the connections to single phase power supply is guaranteed even in large capacity systems. Thanks to the inverter, the gradual increase in the compressor speed makes it possible to avoid the use of softstarter systems and to guarantee the immediate supply of maximum power.

The two rotary compression cylinders, offset from each other by 180°, and the brushless motor with the shaft in perfect balance ensure reduced vibration and noise, even at very low operating speed.

This results in an extremely wide range between minimum and maximum capacity with continuous operation, guaranteeing that the system is always optimised and provides maximum comfort at exceptionally high efficiency level.

The low level of vibration and load on their shaft guarantees maximum reliability and a very long working life for these compressors without any inconvenience. The standard equipment of these twin rotary compressors with a brushless motor includes the crankcase heater.

The double acoustic shielding of the compressor further reduces the sound level of these units.

## **Pulse modulating thermostatic valve.**

Bi-flow expansion device that optimises the refrigerant amount in the circuit and the superheat, preventing the liquid refrigerant returns to the compressor. This kind of device further increases the already high performance and reliability of the system.

**Air circulation system**, consisting of **axial fans**, as well as an inlet and a air discharge grille, both designed and manufactured to minimise the sound level of the unit. There is a large and high-efficiency **air heat exchanger** with grooved copper pipes and aluminium fins.

## **NHC control**

The NHC control, associated with the variable frequency driver of the compressor and the fan, creates an excellent combination: smart and simple operation. The control constantly monitors all the heat pump parameters and accurately manages the operation of the compressor, the expansion device, the fans and the circulator to guarantee optimal energy efficiency.

# Energy Genius

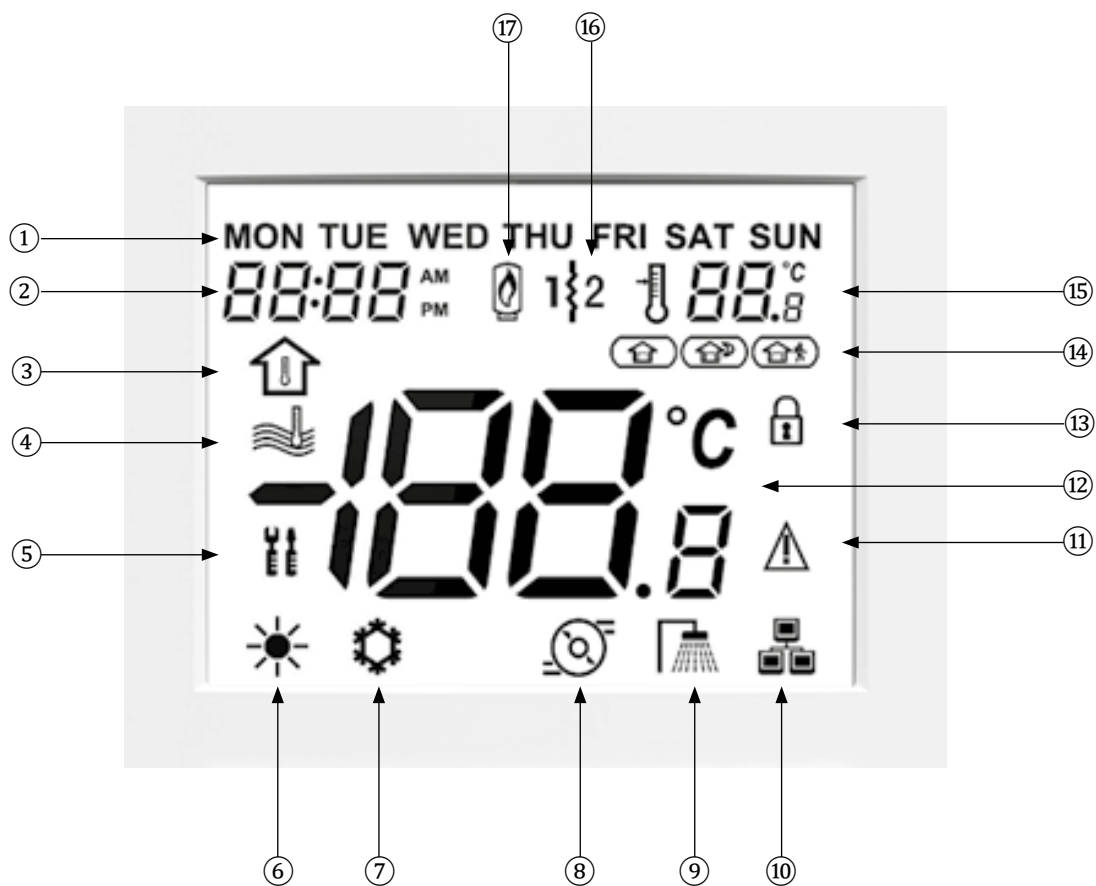
## Unit control

The Energy Genius unit can be operated and controlled via the WUI interface supplied with the unit or with a Modbus protocol or via the available digital inputs or outputs.

- **WUI user interface**

The user interface is very intuitive to use: it allows to easily read and select the operating mode and to easily access the configuration parameters (compressor frequency, refrigerant circuit temperature, setpoint, air temperature, inlet water temperature, alarm report, etc.).

All the features are represented by icons on the backlit LCD screen.



**Legend:**

- |                       |  |                         |
|-----------------------|--|-------------------------|
| ① Days of the week    | ⑦ Cooling mode                         | ⑬ Occupancy lock        |
| ② Clock               | ⑧ Pump in operation                    | ⑭ Occupancy Status      |
| ③ Ambient temperature | ⑨ Domestic Hot Water Mode (DHW)        | ⑮ Setpoint              |
| ④ Water temperature   | ⑩ Master / Slave control               | ⑯ Electric Heater Stage |
| ⑤ Advanced settings   | ⑪ Alarm                                | ⑰ Boiler                |
| ⑥ Heating mode        | ⑫ Temp. display / Alarm Code / Message |                         |

## Overview of the icons

<b>FRI</b>	<b>Days of the week:</b> Monday – Sunday		<b>Temperature display:</b> Ambient temperature	
	<b>Clock:</b> 12- or 24-hour display		Water temperature	
	<b>Ambient temperature:</b> System control is based on the room temperature		<b>Occupancy lock:</b> Occupancy is set manually by the user (schedule control is disabled)	
	<b>Water temperature:</b> System control is based on the water temperature		<b>Occupancy:</b> The HOME mode is active	
	<b>Advanced settings:</b> The icon is blinking when the password is required		<b>Occupancy:</b> SLEEP mode is active	
	<b>Heating mode:</b> HEATING mode is active		<b>Occupancy:</b> AWAY mode is active	
	<b>Cooling mode:</b> COOLING mode is active		<b>Setpoint:</b> Temperature to be reached (ambient or water temperature)	
	<b>Pump status:</b> Pump is running		<b>Active Electric Heater Stage:</b> Used in the event of a heat pump failure or low outdoor air temperature	
	<b>Domestic Hot Water Mode (DHW):</b> DHW mode is active		<b>Boiler on:</b> Used in the event of a heat pump failure or low outdoor air temperature	
	<b>Master / Slave:</b> <u>Steady icon:</u> This interface is connected to the master unit and it is used to control all the units in the same master/slave unit		<b>Alarm:</b> <u>Steady icon:</u> Alarm condition detected; the unit is stopped	
	<u>Fast flashing icon:</u> This interface is connected to the slave unit and it is controlled by commands sent from the Master unit		<u>Steady icon:</u> Alarm condition detected; the unit is running	
	<u>Slowly flashing icon:</u> Master/Slave communication failure			

**Note** When the user interface backlight is switched off, press any key to turn on the display.

# Energy Genius

To make the interface easier to use, there are 3 access levels: end user, installer and factory.

Main features and characteristics:

- Heating / Cooling mode management.
- Control with predefined or customised climatic curves.
- Unit control with water temperature setpoint.
- Unit control with air temperature setpoint.
- Hourly programming of the operating mode: for each day of the week it is possible to set up to 8 different time slots to be associated with one of the 3 different ways of occupying the environment "at house" (HOME), "away from house" (AWAY) and "night-time" (SLEEP). Each of these occupancy modes is associated with a different operating set point, which is set by default but is still modifiable and customisable.
- Night mode or low-noise level control.
- Home anti-freeze mode control: to prevent the ambient temperature from falling below a set minimum value.
- Water anti-freeze control mode: to protect the water pipes from freezing when the outdoor ambient temperature is low and the unit is not running.
- Control of an additional heat source on the heating circuit: up to 3 electric heating elements (or a heating element with 3 heating stages) or a boiler.
- Control of an additional circulator.
- Domestic hot water control: anti-legionella mode, electric back-up on DHW production, electric back-up on DHW production + booster via 1 or 2 electric heating stages.
- Master/slave control up to 4 units operating in parallel.
- Modbus Protocol.



The WUI interface can be installed up to a maximum distance of 50 m from the unit and must be connected to the NHC board by using 4 cables (H07RN-F 0.75 mm<sup>2</sup>).

The WUI has an internal sensor to measure the room temperature, which can be used to adjust the heat pump based on air temperature.

- **Modbus Protocol:**

Direct access to the ModBus connection to set up, configure and monitor the unit.

# Energy Genius

- **Digital inputs:**

There are 8 digital inputs: 4 inputs (Pin4 - Pin7) with default function and 4 inputs (Pin9 - Pin12) that can be configured with a suitable value assigned to parameters from 502 to 505, respectively.

The digital inputs with default function are:

- Remote Contact On/Off (Pin4).
- Heating/Cooling remote contact: this switch is used to select the Cooling Mode (open contact) or the Heating Mode (closed contact) (Pin5).
- Savings remote contact: this switch is used to select the normal HOME mode (at home) when the contact is open or the most economical operating mode AWAY (away from home) when the contact is closed (Pin6).
- Safety Input Contact: this switch is normally closed type. According to configuration, it is used to turn off the unit, to exclude the Heating Mode or to exclude the Cooling Mode when the contact is open (Pin7).

For the other 4 configurable digital inputs, the following features are available instead to customise the system:

- Power limitation/Night mode: this switch is used to reduce the maximum frequency of the compressor in order to limit sound emissions.
- Off-Peak period: if the general purpose contact, set to "Off-Peak period", is closed then, the stages of the electric heating elements cannot be activated.
- Load distribution request (Loadshed): if the general purpose contact, set to "Load distribution request (Loadshed)", is closed, the unit must be switched off as soon as possible. This contact is requested by the electricity provider of some countries, such as Germany, to control the consumption and production of "clean" electricity (solar, wind energy).
- Solar energy input: if the general purpose contact, configured on "Solar energy input", is closed, the unit's operation in Heating or DHW mode is inhibited, as the production of hot water is carried out via a solar energy source.
- DHW request switch from the tank: when this input is closed, the production of domestic hot water is requested (the DHW probe supplied as an accessory is required).
- DHW priority: When this input is closed, the unit switches to the Domestic Hot Water Production mode regardless of the space heating demand and the current DHW schedule (the DHW probe supplied as an accessory must be integrated).
- Anti-legionella cycle request: when this input is open, it means that the production of domestic hot water is requested with the anti-legionella setpoint.
- Summer Switch: this switch is used to select Winter mode (open contact) or Summer mode (closed contact).
- Energy meter input: this input is used to count the number of pulses received by an external energy meter (not supplied)
- External Alarm Indication input: when this input is open, the presence of an alarm outside the unit is reported (e.g. blocked boiler). However, this is an alarm for information purposes only, which does not affect the operation of the unit.

- **Digital outputs**

Two output contacts can be chosen on the NHC board, which can be configured for the following functions: warning, alarm, standby, operation (Cooling, Heating, DHW or Defrosting mode), indoor air temperature (IAT) reached, 2<sup>nd</sup> stage electrical heating element, 3<sup>rd</sup> stage electrical heating element.

# Energy Genius

## Built-in hydronic module

All Energy Genius units are fitted with a hydronic module that allows for considerable savings in terms of space and installation time.

Indeed, the unit features the factory-installation of the main hydraulic circuit components: the variable speed water pump, the expansion vessel and the safety valve (3 bar).

Units 17 and 21 are fitted with an electric antifreeze heating element (protection down to -20 °C), while units 5-15 are protected from frost down to -10 °C by starting the circulator.

However, MPG (mono-propylene glycol) is able to effectively protect the system even in case of pump failure.

**The water filter is a mandatory component to be installed in order to protect the plate heat exchanger. The water filter is supplied as standard on units 17 and 21, while it needs to be purchased separately for units 5-15.**

The minimum volume of water required in the hydraulic circuit, expressed in litres, is obtained by applying the following formula:

$$\text{Volume (l)} = \text{CAP (kW)} \times \text{N}$$

With:

CAP the cooling capacity under rated operating conditions

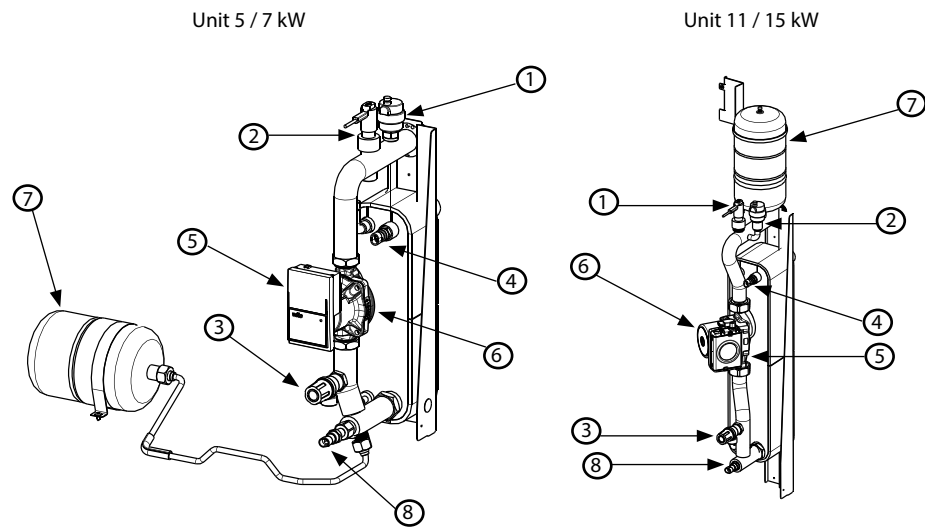
N = 3.5 in cooling mode

N = 6 in heating or DHW production mode

The units work with a low water content, so in most applications there is no need for an inertial tank.

In any case, the minimum recommended volume is used to obtain stable and accurate temperatures, so install a storage tank if required.

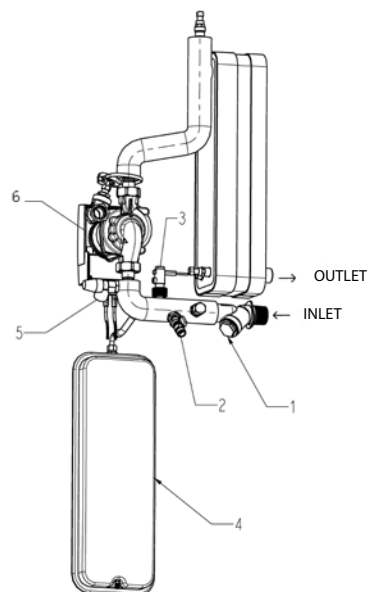
## Hydronic module of Unit 5 / 7 kW and Unit 11 / 15 kW



### Legend

- 1 - Automatic drain valve
- 2 - Flow switch
- 3 - Safety valve outlet
- 4 - Leaving water temperature probe
- 5 - Circulation pump
- 6 - Plug to unlock seized pump
- 7 - Expansion vessel
- 8 - Entering water temperature probe

## Hydronic module of Unit 17 / 21 kW



### Legend

- 1 - Mesh filter
- 2 - Water drain valve
- 3 - Paddle flow switch
- 4 - Expansion vessel
- 5 - Safety valve
- 6 - Pump

# Energy Genius

## Energy Genius technical data

ENGY				5M	7M	11M	11T	15T	17T	21T
<b>Heating</b>										
*Full load performance	air 7 °C db (6 °C wb) water 30/35 °C (**)	Nominal Capacity	kW	5.10	7.15	11.25	11.20	15.00	17.10	21.10
		COP		4.40	4.10	4.70	4.60	4.35	4.10	4.10
	air 7 °C db (6 °C wb) water 40/45 °C (**)	Nominal Capacity	kW	4.85	6.80	11.30	10.40	13.50	16.20	20.00
		COP		3.40	3.20	3.60	3.60	3.50	3.40	3.30
	air 7 °C db (6 °C wb) water 47/55 °C (**)	Nominal Capacity	kW	4.45	6.75	11.20	10.25	11.80	15.30	19.10
		COP		2.80	2.70	2.95	3.00	3.00	2.70	2.70
<b>Cooling</b>										
*Full load performance	air 35 °C water 12/7 °C (**)	Nominal Capacity	kW	4.00	5.55	11.20	10.65	13.00	14.90	18.60
		EER	kW/kW	3.10	3.10	3.40	3.40	3.20	3.00	3.10
		Energy class in cooling mode		A	A	A	A	A	B	A
	air 35 °C water 23/18 °C (**)	Nominal Capacity	kW	4.85	8.00	13.70	13.75	17.00	19.80	25.80
		EER	kW/kW	4.35	4.00	4.60	4.65	4.15	3.90	3.80
		Energy class in cooling mode		A	A	A	A	A	A	A
Seasonal efficiency	SEER 12/7 °C		kWh/kWh	4.85	5.75	5.15	5.40	5.25	4.60	4.51
	ESEER		kWh/kWh	5.30	5.60	5.40	5.40	5.25	4.01	3.85
<b>Sound level</b>										
Sound power <sup>(2)</sup>			dB(A)	64	65	68	69	69	71	74
Sound pressure at 10 m <sup>(3)</sup>			dB(A)	33	34	37	38	38	40	43
<b>Dimensions</b>										
Length			mm	908	908	908	908	908	1141	1141
Width			mm	350	350	350	350	350	584	584
Height			mm	821	821	1363	1363	1363	1579	1579
<b>Operating weight <sup>(1)</sup></b>										
Standard unit			kg	57	69	107	121	121	191	199
<b>Compressors</b>			Rotary	1	1	1	1	1	1	1
<b>Refrigerant</b>				R410A						
Charge <sup>(1)</sup>			kg	1.2	1.8	3	3	3	6.25	6.25
<b>Capacity control</b>										
Minimum capacity			%	23%	20%	20%	20%	17%	33%	41%
<b>Air coil</b>				Grooved copper tubes, aluminium fins						
<b>Fans</b>				Axial flow fan						
Quantity				1	1	2	2	2	2	2
Total maximum air flow rate			l/s	800	800	1800	1800	1800	2000	2400
Maximum rotation speed			rpm	560	660	820	820	820	840	960
<b>Water heat exchanger</b>				Brazen plates						
Water volume			l	1.7	2.3	4.4	4.4	4.4	2	2
<b>Hydronic module</b>				Circulator, drain valve, flow switch, expansion vessel						
Circulator				Centrifugal with variable speed						
Expansion vessel volume			l	2	2	3	3	3	8	8
Maximum operating pressure on the water side <sup>(4)</sup>			kPa	300	300	300	300	300	300	300
<b>Hydraulic connections</b>										
Inlet diameter (BSP GAS)			inches	1	1	1	1	1	1 1/4	1 1/4
Outlet diameter (BSP GAS)			inches	1	1	1	1	1	1	1
<b>Unit colour</b>				RAL 7035						

\* In compliance with EN 14511

\*\* The fouling factor of the evaporator is 0m<sup>2</sup> K/W

(1) The values are only meant as a guide. Refer to the unit rating plate.

(2) In dB ref.=10<sup>-12</sup>W, Weighting curve (A). Declared sound emission values expressed in dual numbers, according to ISO 4871 (with a tolerance of +/-3dB(A)). Measured in compliance with standard ISO 9614-1.

(3) In dB ref. 20 µPa, Weighting curve (A). Declared sound emission values expressed in dual numbers, according to ISO 4871 (with a tolerance of +/-3dB(A)). For information purposes, calculated according to the sound power level L<sub>w</sub> (A).

(4) The minimum pressure on the water side is 40 kPa with a variable speed hydronic module.

<b>Seasonal performance for the different climatic areas (in compliance with EU regulations No. 811/2013 and 813/2013)</b>								
<b>Average climatic area – Application temperature (30/35 °C)</b>								
ENGY model		5M	7M	11M	11T	15T	17T	21T
Rated thermal capacity kW	Prated	3.93	5.06	9.34	9.17	10.05	9.25	16.64
Seasonal energy efficiency	$\eta_{sn}$ %	185	184	153	155	166	144	139
Seasonal coefficient of performance	SCOP	4.72	4.68	3.90	3.96	4.22	3.68	3.56
Energy Class		A+++	A+++	A++	A++	A++	A+	A+
Annual energy consumption kWh	$Q_{HE}$	1747	2273	5037	4874	5002	5169	9625
Sound power	dB(A)	64	65	68	69	69	71	74
<b>Average climatic area – Application temperature (47/55 °C)</b>								
ENGY model		5M	7M	11M	11T	15T	17T	21T
Rated thermal capacity kW	Prated	3.43	4.24	8.52	8.61	10.87	9.11	15.07
Seasonal energy efficiency	$\eta_{sn}$ %	130	132	131	129	133	118	111
Seasonal coefficient of performance	SCOP	3.3	3.37	3.41	3.31	3.4	3.03	2.85
Energy Class		A++	A++	A++	A++	A++	A+	A+
Annual energy consumption kWh	$Q_{HE}$	2170	2650	5347	5357	6743	6189	10889
Sound power	dB(A)	64	65	68	69	69	71	74
<b>Cold climatic area – Application temperature (30/35 °C)</b>								
ENGY model		5M	7M	11M	11T	15T	17T	21T
Rated thermal capacity kW	Prated	6.03	9.2	13.91	14.29	15.41	13.65	24.47
Seasonal energy efficiency	$\eta_{sn}$ %	148	153	138	141	141	121	117
Seasonal coefficient of performance	SCOP	3.77	3.89	3.52	3.59	3.6	3.09	3.01
Annual energy consumption kWh	$Q_{HE}$	3769	5566	9306	9372	11079	10390	19152
<b>Cold climatic area – Application temperature (47/55 °C)</b>								
ENGY model		5M	7M	11M	11T	15T	17T	21T
Rated thermal capacity kW	Prated	5.53	8.36	12.97	13.32	14.06	16.41	22.77
Seasonal energy efficiency	$\eta_{sn}$ %	98	111	109	112	108	108	92
Seasonal coefficient of performance	SCOP	2.52	2.84	2.8	2.86	2.78	2.78	2.37
Annual energy consumption kWh	$Q_{HE}$	5166	6930	10922	10951	11924	13894	22602
<b>Warm climatic area – Application temperature (30/35 °C)</b>								
ENGY model		5M	7M	11M	11T	15T	17T	21T
Rated thermal capacity kW	Prated	3.64	6	9.61	9.89	11.21	14.67	21.06
Seasonal energy efficiency	$\eta_{sn}$ %	230	259	229	232	227	225	192
Seasonal coefficient of performance	SCOP	5.83	6.55	5.81	5.88	5.74	5.71	4.87
Annual energy consumption kWh	$Q_{HE}$	828	1215	2201	2235	2596	3425	5764
<b>Warm climatic area – Application temperature (47/55 °C)</b>								
ENGY model		5M	7M	11M	11T	15T	17T	21T
Rated thermal capacity kW	Prated	3.3	5.17	4.63	8.25	9.82	12.5	16.37
Seasonal energy efficiency	$\eta_{sn}$ %	160	156	154	173	160	149	143
Seasonal coefficient of performance	SCOP	4.07	3.97	3.91	4.41	4.09	3.8	3.65
Annual energy consumption kWh	$Q_{HE}$	1076	1732	1571	2488	3198	4383	5983

# Energy Genius

## Energy Genius electrical data

ENGY		5M	7M	11M	11T	15T
Electric power supply circuit						
Nominal power supply	V-ph-Hz	230/1+N/50	230/1+N/50	230/1+N/50	400/3+N/50	400/3+N/50
Voltage range	V	220-240	220-240	220-240	380-415	380-415
Control circuit power supply		24V AC via an internal transformer				
Maximum unit power input (Un) (1)	kW	1.8	3.38	4.73	10.32	10.32
Cos Phi unit at maximum power (1)		0.98	0.98	0.98	0.98	0.98
Maximum unit current drawn (Un-10%) (2)	A	8.9	16.7	23.3	16.8	16.8
Maximum unit current drawn (Un) (3)	A	8	15	21	15.2	15.2
Maximum unit start-up current (Un) (4)	A	Not applicable (lower than the operating current)				

- (1) Power absorbed by the compressors and the fans under limit operating conditions (i.e. with saturated intake temperature of 15 °C and condensation temperature of 68.3 °C) with a rated supply voltage of 400V (data reported on the identification plate of the unit).
- (2) Maximum operating current of the unit at maximum unit power input and at 360V.
- (3) Maximum operating current of the unit at maximum unit power input of the unit and at 400V (values indicated on the unit nameplate).
- (4) Max instantaneous start current within operating limits (maximum operating current of the smallest compressors + fan current + locked rotor current of the largest compressor).

ENGY		17 T	21T
Power circuit			
Nominal power supply	V-ph-Hz	400-3+N-50	400-3+N-50
Voltage range	V	360-440	360-440
Control circuit power supply		24V AC via an internal transformer	
Nominal unit current drawn(Un) *	A	12.5	14.3
Maximum unit power input (Un) *	kW	10.8	12.4
Cos phi unit at maximum power **		0.93	0.93
Maximum unit current drawn (Un-10%)***	A	18.5	21.2
Maximum unit current drawn (Un) ***	A	16.7	19.1
Maximum unit start-up current (Un) †	A	Not applicable (lower than the operating current)	

\* Conditions equivalent to standardised Eurovent conditions (evaporator water temperature at inlet/outlet = 12 °C/7 °C, outdoor ambient temperature = 35 °C).

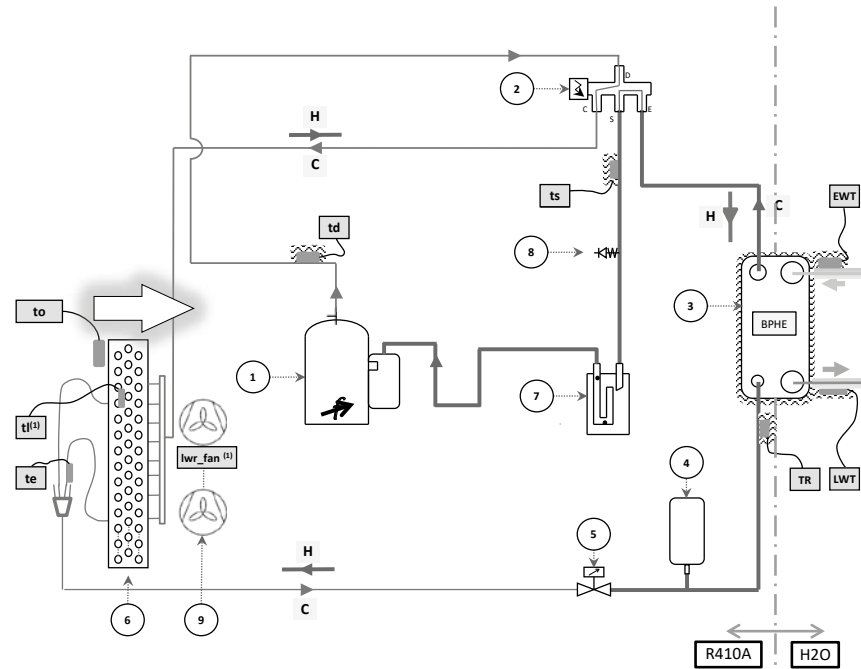
\*\* Power absorbed by the compressors and the fans, within the operation limits of the unit (saturated intake temperature of 15 °C, saturated condensing temperature of 68.3 °C) with a nominal voltage of 400 V (data shown on the unit nameplate).

\*\*\* Maximum operating current of the unit at maximum unit power unit and at 360 V.

\*\*\* Maximum operating current of the unit at maximum unit power input and at 400 V (values indicated on the unit nameplate).

† Maximum instantaneous start-up current within the operating limits (maximum operating current of the smallest compressor(s) + fan current + current with locked rotor current of the largest compressor).

## Unit 5-15 refrigerant section diagram



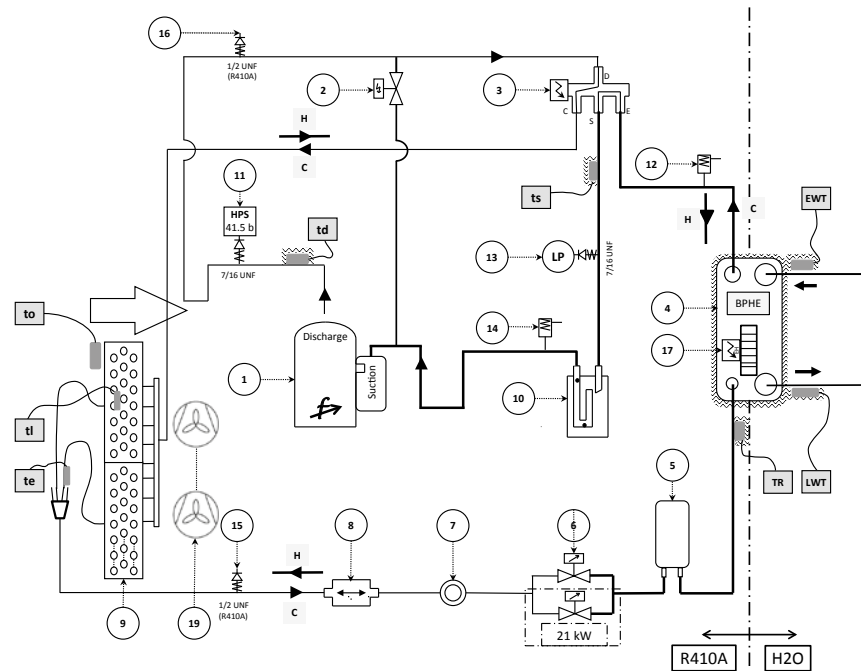
**Legend:**

- 1 Variable speed rotary compressor
- 2 4-way valve for cycle reversal (energised when in Heating Mode)
- 3 Water heat exchanger – BPHE
- 4 Receiver
- 5 Expansion valve
- 6 Air-cooled coil
- 7 Accumulator
- 8 Service valve (Schrader valve)
- 9 Lower and upper fans

**Probe Legend:**

- ts suction temperature
- td discharge temperature
- tl lower coil area temperature
- te upper coil area temperature
- to outdoor air temperature
- TR refrigerant temperature
- EWT entering water temperature
- LWT leaving water temperature

## Unit 17-21 refrigerant section diagram



**Legend:**

- 1 Variable speed rotary compressor
- 2 2 way solenoid valve – Compressor heating at start-up
- 3 4-way valve for cycle reversal (energised when in Heating Mode)
- 4 Water heat exchanger – BPHE
- 5 Receiver
- 6 Expansion valve – pulse modulating valve (2x expansion valves, size 21)
- 7 Sight glass
- 8 Dryer filter
- 9 Air-cooled coil
- 10 Accumulator
- 11 High pressure switch (4150 kPa ~ 41.5 b)
- 12 Safety discharge valve in case of high pressure @ suction on the BPHE
- 13 Low Pressure Transducer (mounted on the Schrader valve)
- 14 Safety discharge valve in case of high pressure @ suction
- 15 Service pressure Automatic port (Schrader) on the LP side

- 16 Service pressure Automatic port (Schrader) on the HP side
- 17 Electric heater on BPHE: water anti-freeze protection
- 18 Electric heater on the BPHE inlet pipe: water anti-freeze protection
- 19 Fans

**Probe Legend:**

- ts suction temperature
- td discharge temperature
- tl lower coil area temperature
- te upper coil area temperature
- to outdoor air temperature
- TR refrigerant temperature
- EWT entering water temperature
- LWT leaving water temperature

# Energy Genius

## Operating limits

Energy Genius heat pumps can operate very efficiently in a wide range of outdoor temperatures. Indeed, the new Energy Genius units can operate in cooling mode between +46 °C and 0 °C (air), while in heating mode they can operate with outdoor air temperatures down to -20 °C, always guaranteeing the necessary comfort for the user. In summer, they can also produce hot water up to 60 °C with outdoor air temperatures up to 35 °C (30 °C for units 17 and 21), ensuring the production of domestic hot water required for utilities

## Energy Genius 5-15

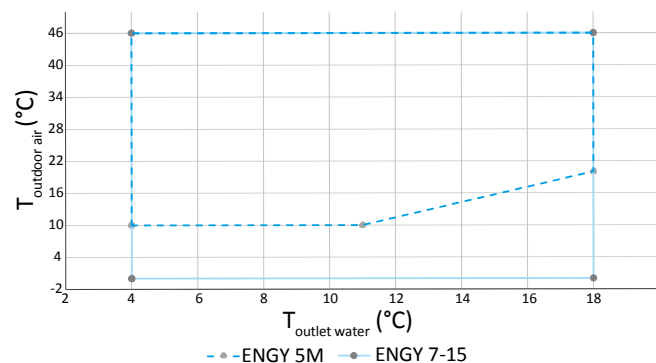
COOLING		
Water temperature °C	Minimum	Maximum
Entering water temperature upon start-up	6	30
Leaving water temperature during operation	4	18
Air temperature °C	Minimum	Maximum
Standard unit	0 / 10 <sup>(1)</sup>	46
HEATING		
Water temperature °C	Minimum	Maximum
Entering water temperature upon start-up	15	52/59 <sup>(2)</sup>
Leaving water temperature during operation	20	60
Air temperature °C	Minimum	Maximum
Standard unit	-20 <sup>(3)</sup>	30

(1) 0 °C for Engy 7-15 and 10 °C for Engy 5

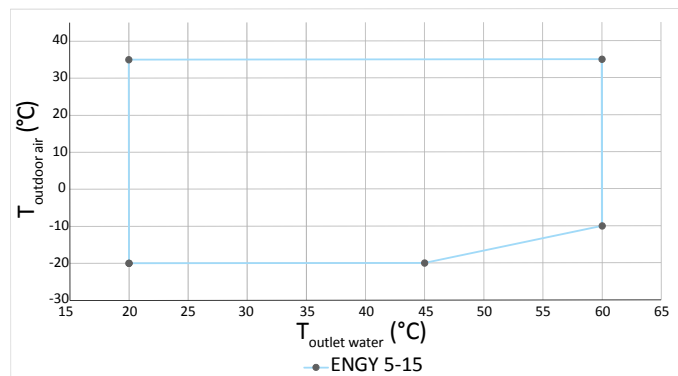
(2) 52 °C with unit stopped at the entering water temperature threshold (EWT), 59 °C with the unit running at the entering water temperature threshold (EWT)

(3) In case of operation with an outside temperature lower than 0 °C, the antifreeze protection of the water must be available and/or the water circuit can be protected from freezing thanks to the intervention of the installer, who will use an antifreeze solution

### Operating limits in Cooling mode



### Operating limits in Heating mode



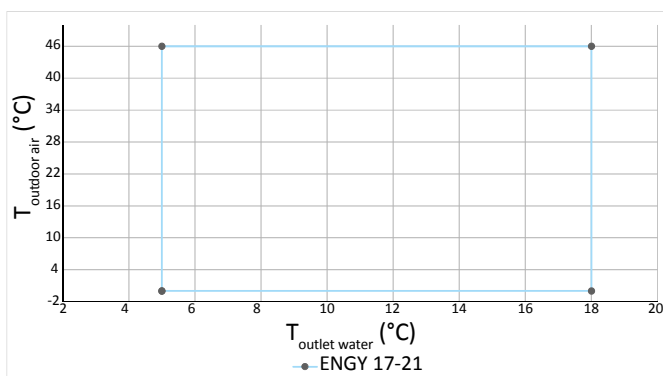
## Energy Genius 17-21

COOLING		
Water temperature °C	Minimum	Maximum
Entering water temperature upon start-up	6	30
Leaving water temperature during operation	5	18
Air temperature °C	Minimum	Maximum
Standard unit	0	46
HEATING		
Water temperature °C	Minimum	Maximum
Entering water temperature upon start-up	10	45
Leaving water temperature during operation	20	60 / 57 <sup>(1)</sup>
Air temperature °C	Minimum	Maximum
Standard unit	-20 <sup>(2)</sup>	30

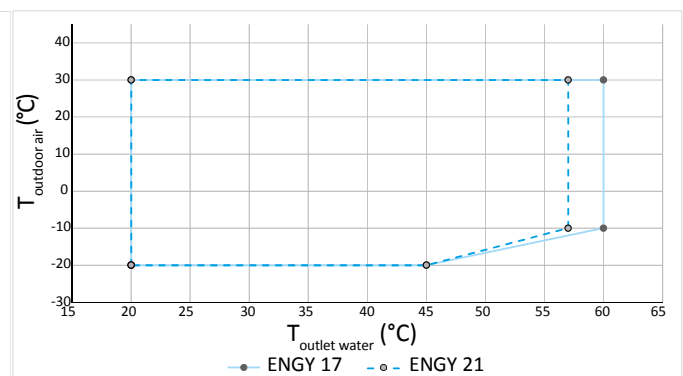
(1) 60 °C for Engy 17 and 57 °C for Engy 21

(2) In case of operation with an outside temperature lower than 0 °C, the antifreeze protection of the water must be available and/or the water circuit can be protected against freezing thanks to the intervention of the installer, who will use an anti-freeze solution.

Operating limits in Cooling mode



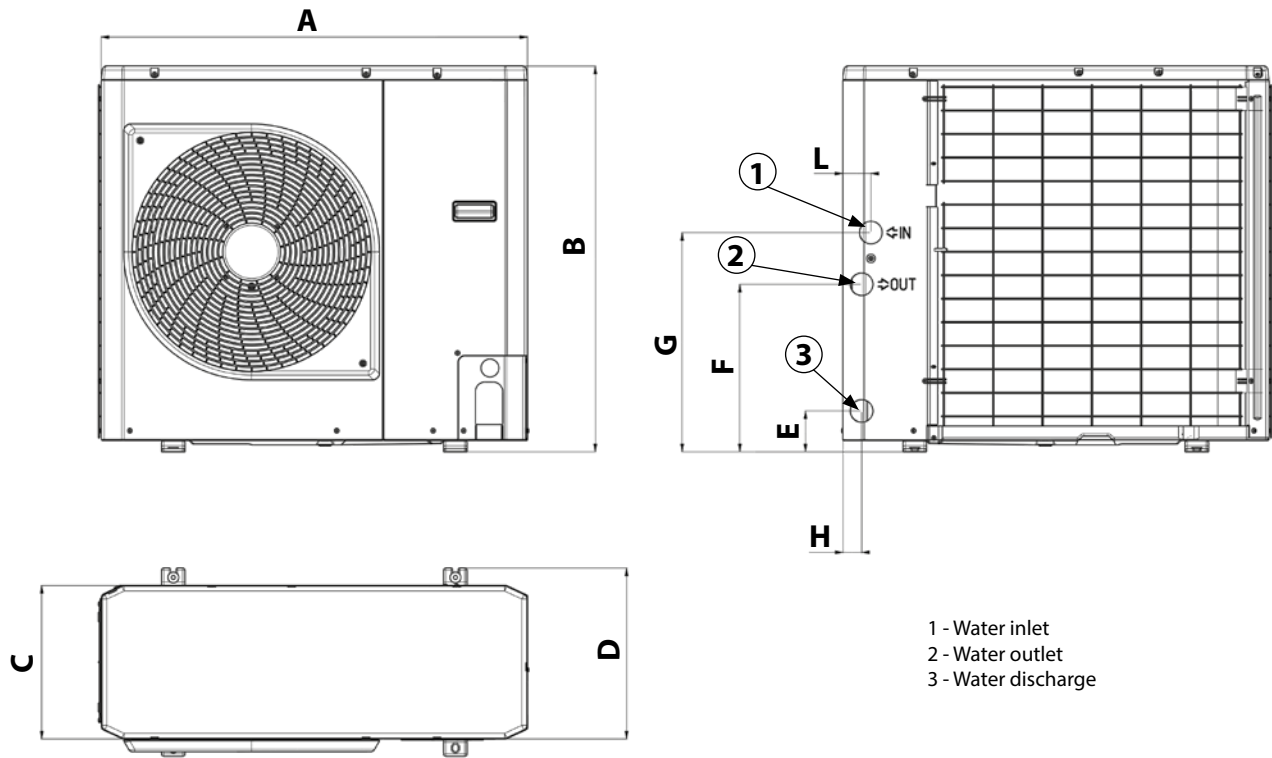
Operating limits in Heating mode



# Energy Genius

## Dimensions and clearances

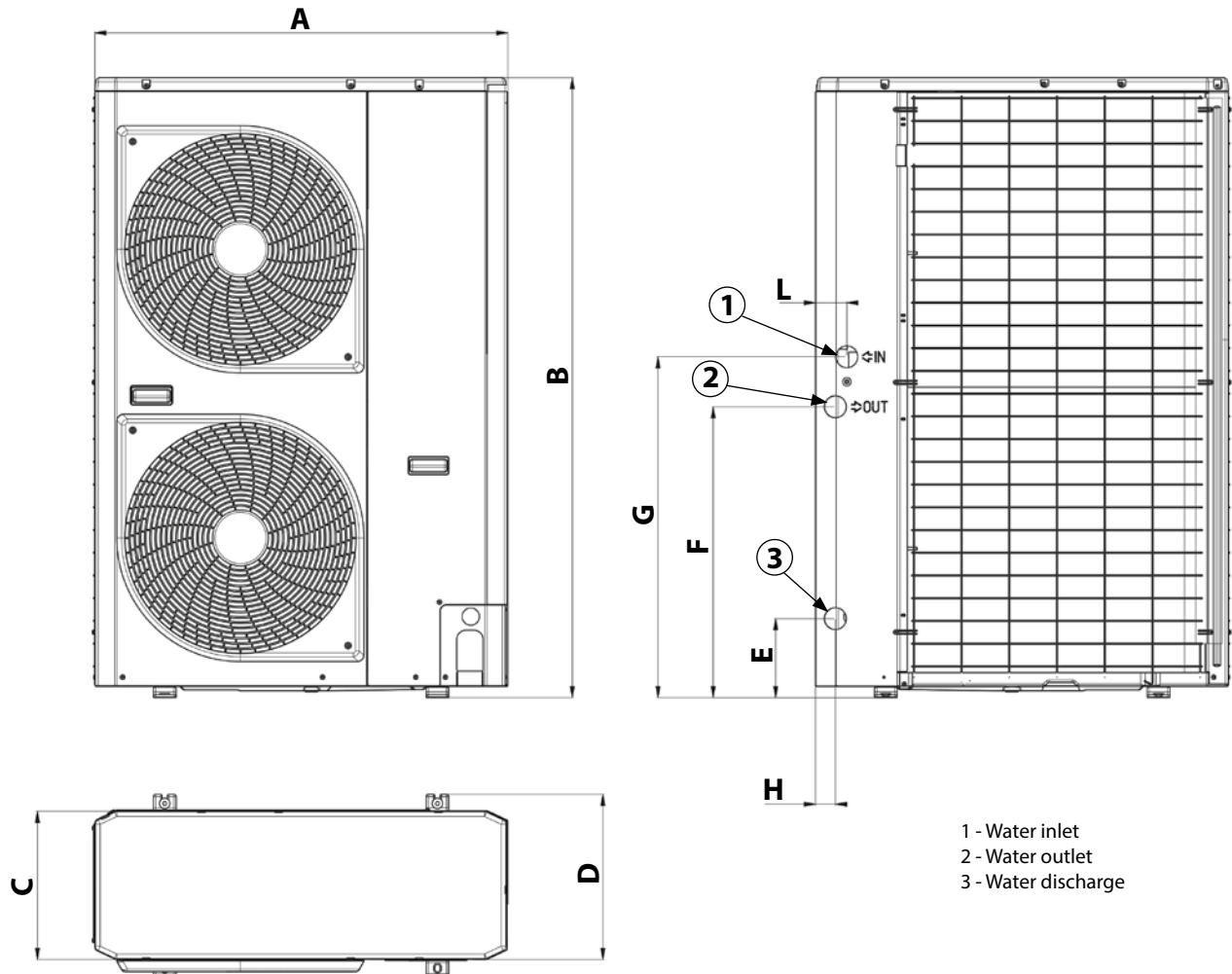
### Energy Genius 5M – 7M



- 1 - Water inlet
- 2 - Water outlet
- 3 - Water discharge

ENGY	A	B	C	D	E	F	G	H	L	weight (kg)
5M	908	821	326	350	87	356	466	40	60	57
7M	908	821	326	350	87	356	466	40	60	69

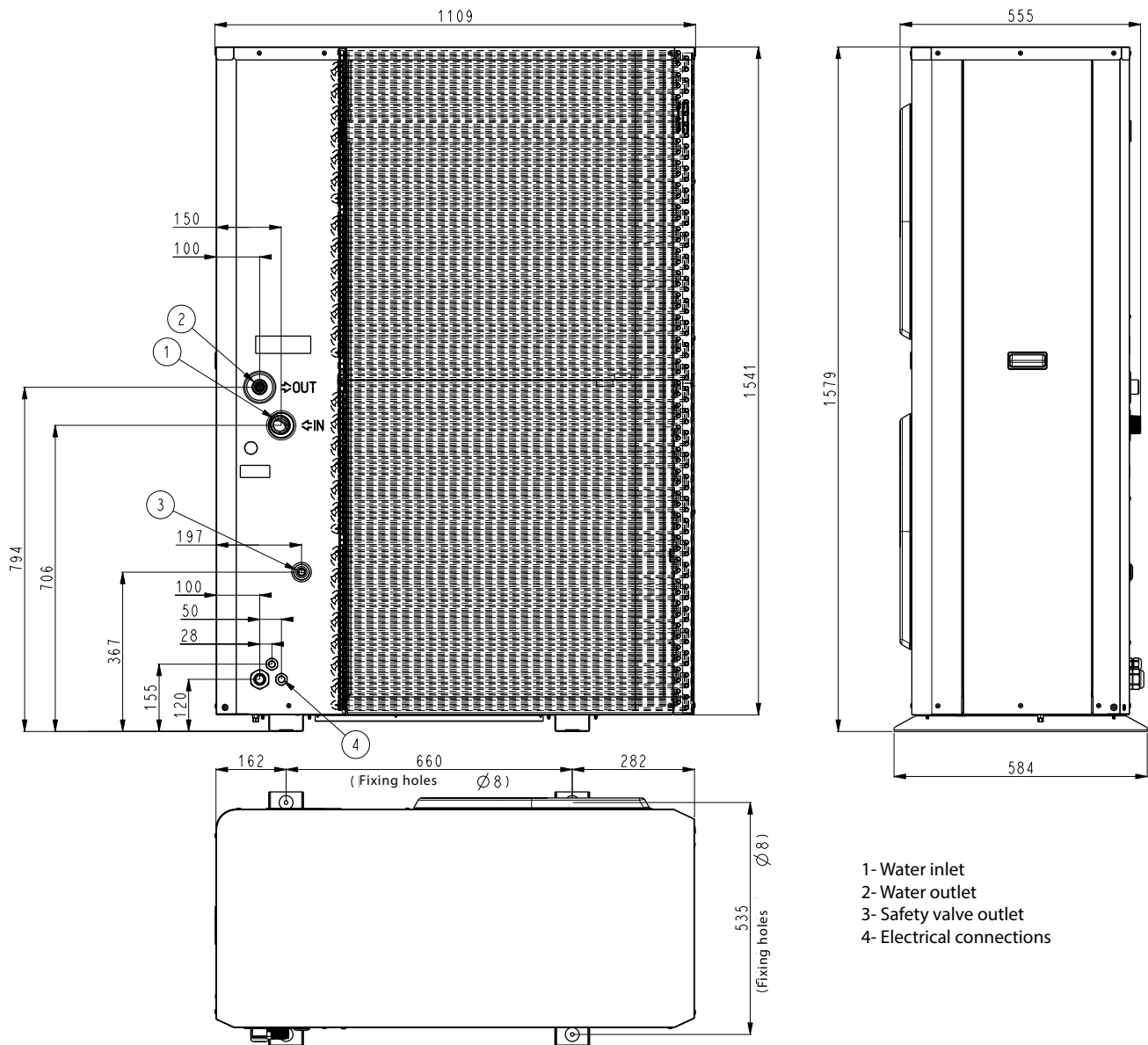
## Energy Genius 11 – 15 (Single phase and Three phase)



ENGY	A	B	C	D	E	F	G	H	L	weight (kg)
11M	908	1363	326	350	169	645	744	43	73	115
11T	908	1363	326	350	169	645	744	43	73	121
15T	908	1363	326	350	169	645	744	43	73	121

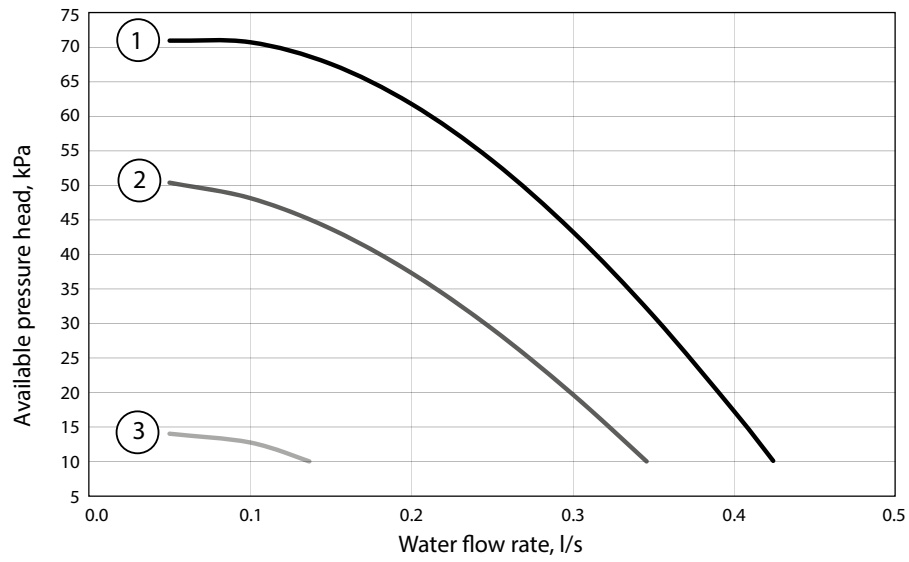
# Energy Genius

## Energy Genius 17T – 21T

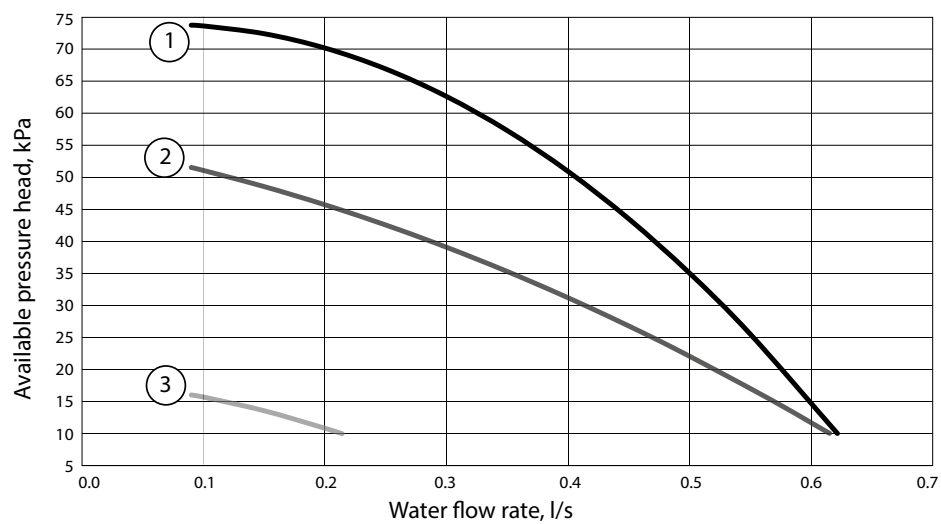


## System pressure head

### Energy Genius 5M

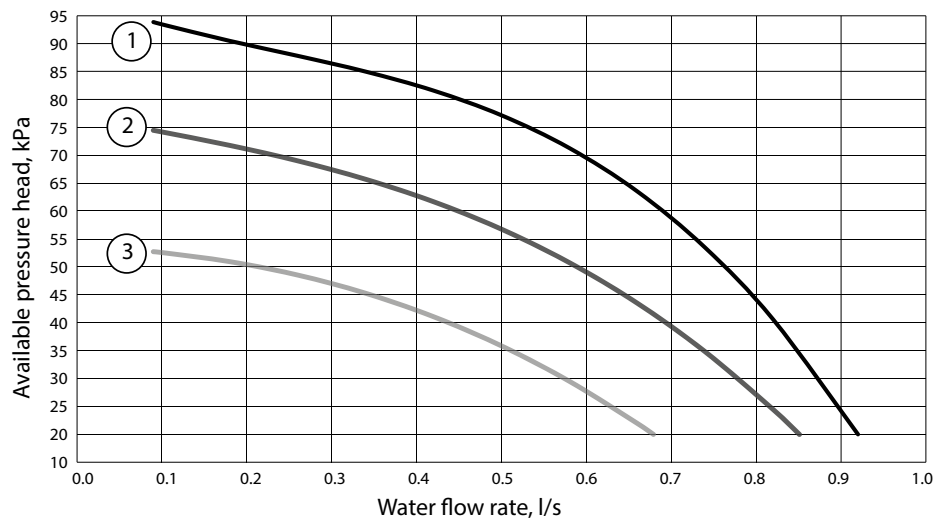


### Energy Genius 7M

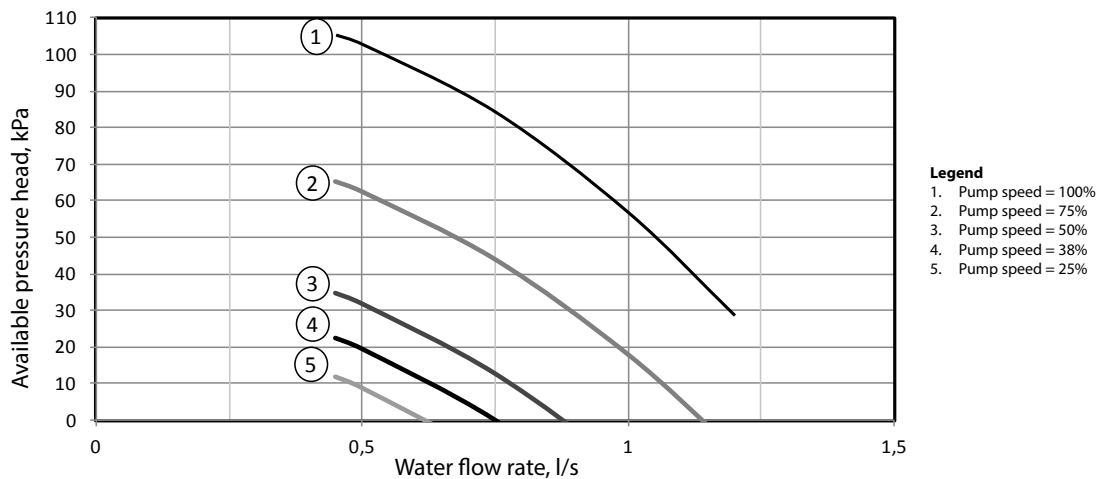


# Energy Genius

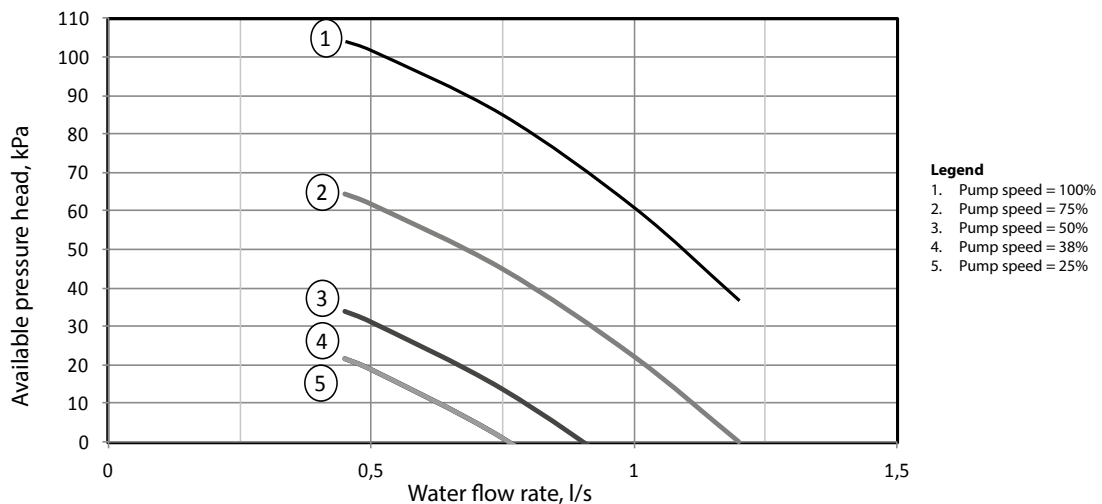
## Energy Genius 11 – 15 (Single phase and three phase)



## Energy Genius 17T



## Energy Genius 21T



## Operating modes

The user can normally choose one of the three operating modes available: Cooling, heating or domestic hot water production.

### • **Heating or Cooling**

The system can be operated by controlling the air or water setpoint.

To optimise comfort, you can adjust the ambient temperature setpoint or water temperature setpoint according to your needs. Every mode of use has its own range of values within which this adjustment can be carried out.

If the user interface has been installed in the room as a thermostat or if you have a room temperature sensor, the check can be performed according to the desired air temperature.

For each operating mode of the heat pump: heating or cooling, and for each mode of use: at home (HOME), away from home (AWAY) and night-time (SLEEP), the air setpoint values are defined by selecting a temperature value in the range of possible values or simply by leaving the default value unchanged.

The type of use (home, away, sleep) can be set manually by the user or automatically according to the type of programming carried out (see the user manual).

Based on the defined air setpoint value, the value of the leaving water temperature is calculated by the unit in order to maintain the selected air setpoint value. This calculation can be performed based on the following factors:

1. **Predefined climate curves:** depending on the outdoor air temperature. The control logic provides, as a factory configuration, 2 predefined climatic curves in cooling mode and 12 predefined climatic curves in Heating mode.
2. **Customised climate curve:** depending on the outdoor air temperature. Customised climatic curves can be defined according to the application.
3. **Fixed water setpoint:** by using a fixed value for each operating mode.

If, instead, the user interface is installed in a technical room, where the measured temperature is not representative for adjustment purposes and there is no connected room temperature sensor, then the check must be carried out based on the leaving water temperature (LWT), i.e. by working with a "fixed point".

### • **Production of domestic hot water**

Energy Genius units are also suitable for the production of domestic hot water. The heat pumps can control a 3-way valve (2-wire control, 230 Vac) for the management of a DHW storage tank (cylinder). According to the operating logic, in case of a request for domestic water from the storage tank (cylinder), the system controls a 3-way valve to direct the hot water only to the tank and to operate at maximum capacity to supply water at 60 °C (if compatible with the operation limits).

For the purposes of managing domestic hot water production, a temperature sensor, available as an accessory, must be installed in the DHW storage tank.

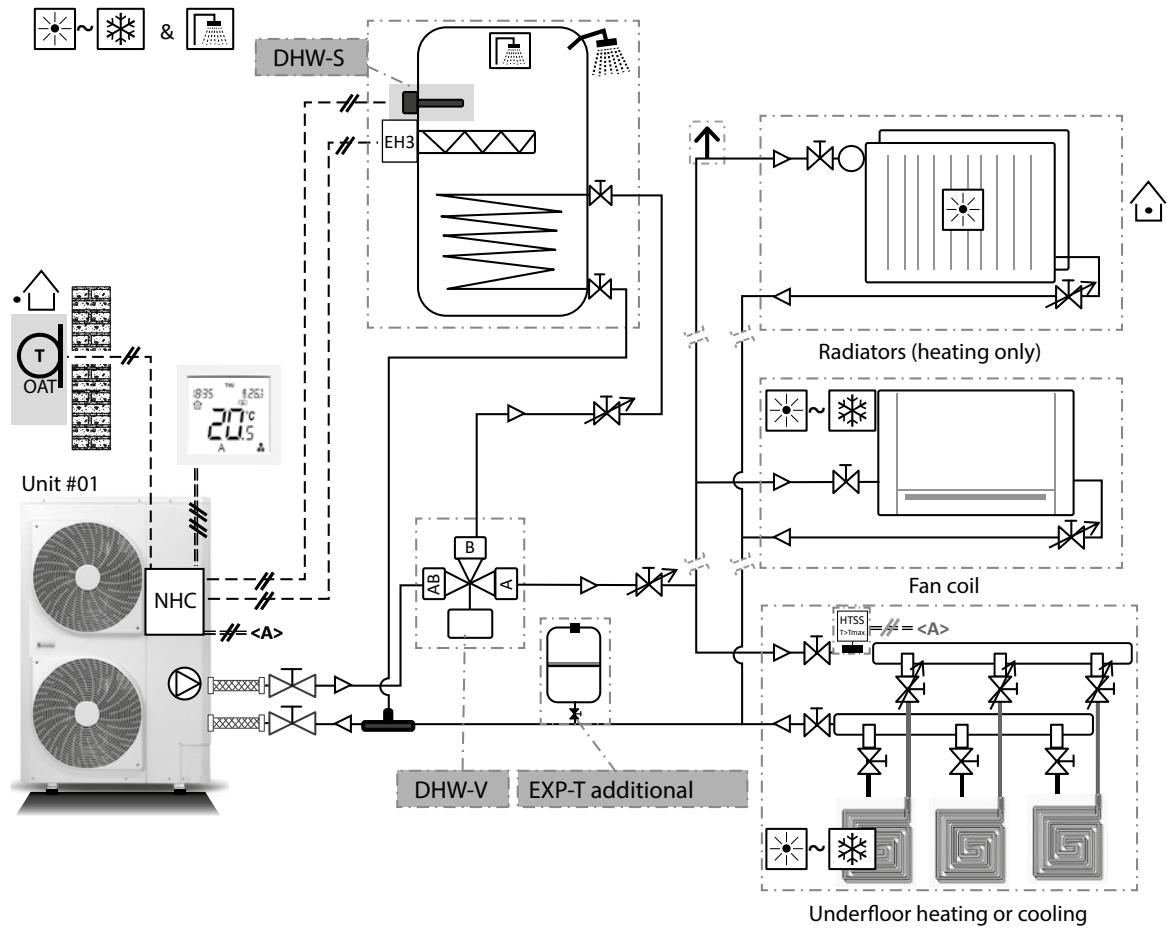
The production of domestic hot water can be controlled according to the request of the tank temperature sensor alone or with hourly programming on the various days of the week.

The water in the domestic water tank must be constantly monitored in order to minimise any risk of contamination, even by legionella bacteria. The heat pump control manages the operating mode of the anti-legionella feature. The day of the week and start time of this mode must be set during installation.

Energy Genius can produce DHW also with the help of an electric heating element installed in the tank. This electrical integration can be managed in place of the heat pump when there is a request for domestic hot water production and the heat pump is not able to meet the demand, because it is defrosting or the operating conditions are outside the permitted limits in terms of outdoor air temperature for operation in heating mode or if the unit is faulty.

# Energy Genius

## Standard installation with DHW production



## • Additional source of heat control

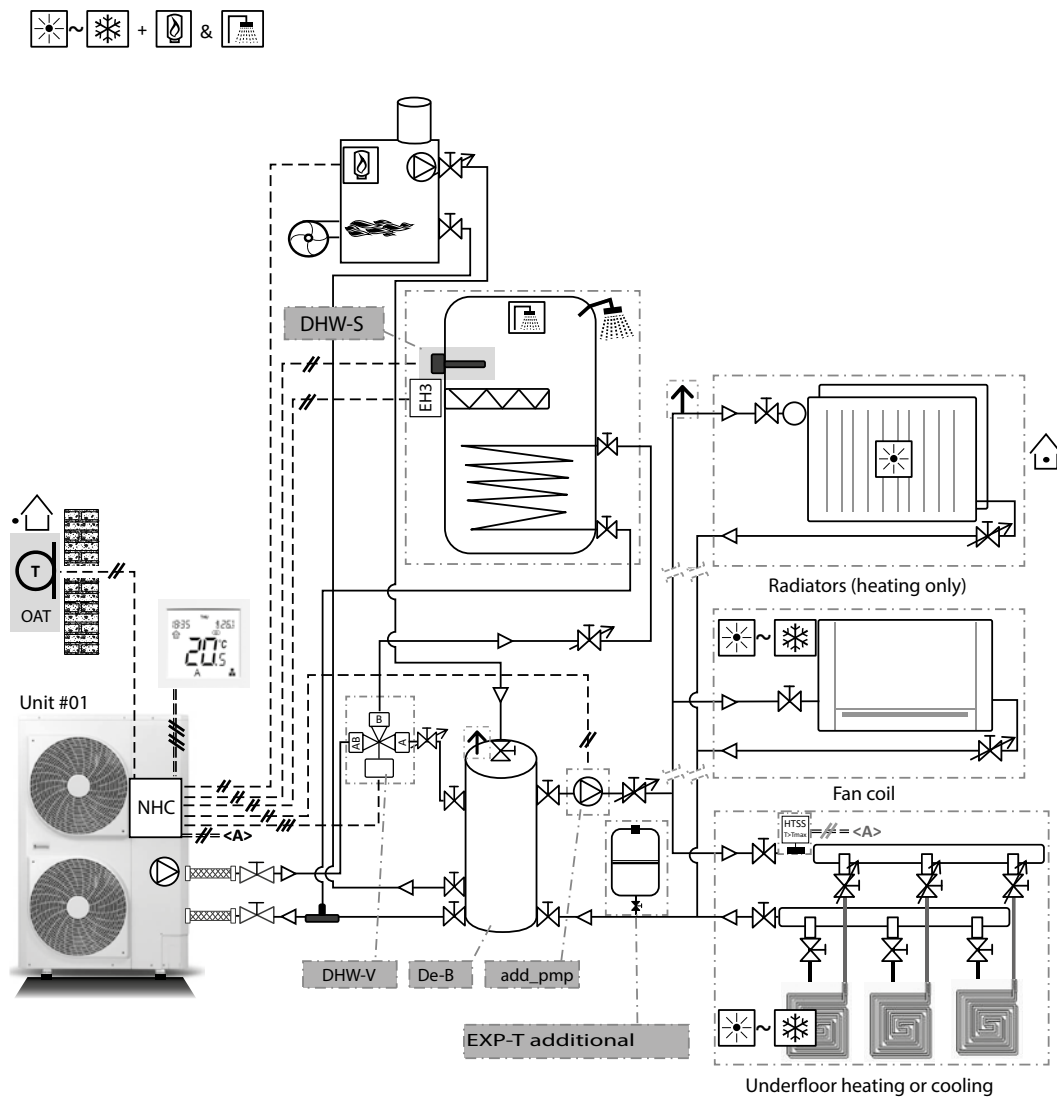
To meet the need for heating in periods with very low ambient temperature values, an additional heat source can be installed in the system.

Depending on the type of system configuration, it is possible to control up to a maximum of three electrical heating elements or a three-stage electrical heating element or a boiler.

The electric heating elements fitted with an auxiliary device can work both as an integration, running simultaneously with the heat pump, or as a replacement, when the outdoor air temperature is not favourable for the use of the heat pump or when the latter is faulty or is defrosting.

Instead, the boiler, connected to the same water circuit of the heat pump, is regarded as a replacement support, i.e. when it is activated, the heat pump cannot operate at the same time. The boiler turns on when the outdoor air temperature is below the minimum heating value allowed (settable parameter) or in case of a heat pump failure.

## Standard installation with DHW production and boiler



# Energy Genius

- Master /Slave configuration**

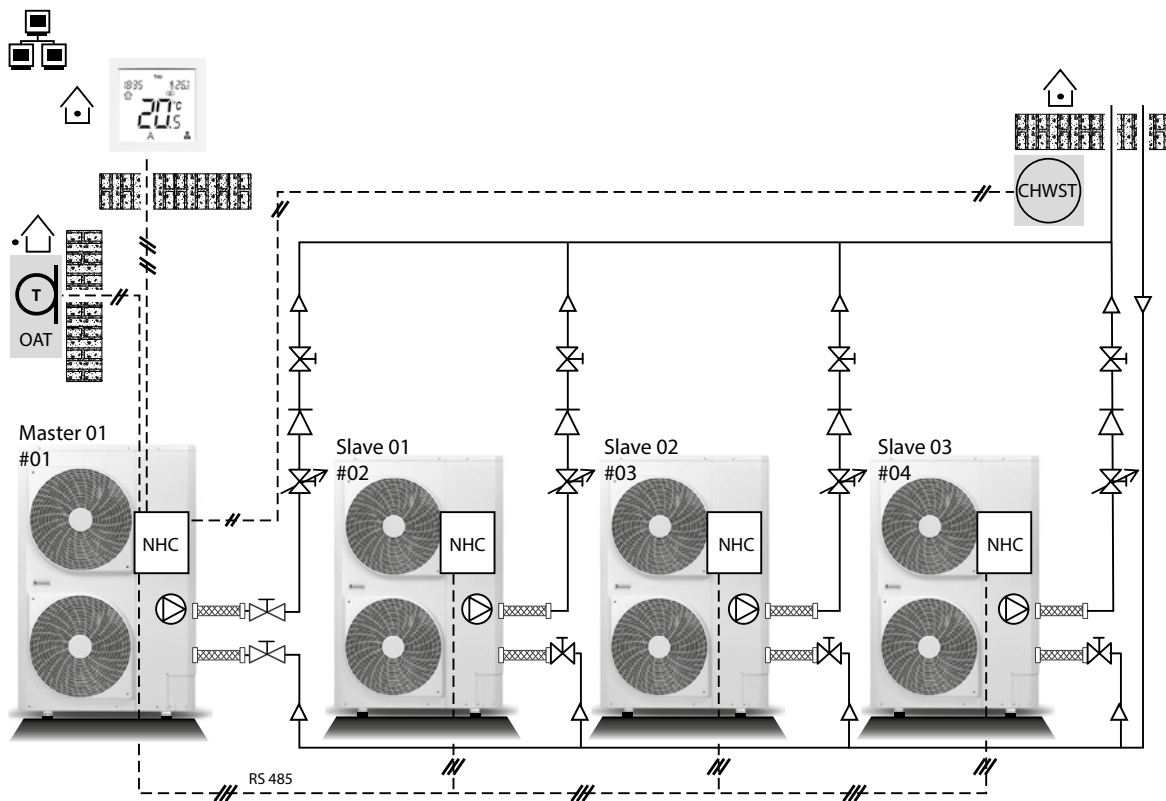
Energy Genius heat pumps can be connected in Master and Slave mode by installing up to a maximum of 4 units in parallel. According to this type of installation, the units connected to each other by an RS485 cable (not supplied) must be all the same size. The units can be controlled by the Master unit user interface alone, the other interfaces must be disconnected. The "Master" user interface is decisive for all the other units of the same master/slave unit. This means that the operating mode (Cooling / Heating) and the water set point defined by the Master unit will be transmitted to the other "slave" units. All the units installed in the same master/slave unit share the same operating mode and the same setpoint. The temperature sensor for Master/ Slave installation (5kΩ – 15 metres long), supplied as an accessory, must be installed on the common leaving water temperature manifold.

The water pumps of the units must be controlled by a constant speed logic (no  $\Delta T$  logic). Moreover, master / slave operation is not compatible with the production of domestic hot water.

By configuring at least two units in Master/Slave mode, it is possible to define the start mode of the compressors according to 3 different control modes:

- 1 Based on the configuration of the address :** The Master unit starts first, then the Slave units start sequentially. During the stopping stage, the last Slave unit stops first, while the Master unit stops last.
- 2 Based on wear factor:** The units start sequentially based on wear factor. When the request from the system increases in capacity, the unit with the lowest wear factor starts first. When the request from the system decreases, the unit with the highest wear factor stops first.
- 3 Simultaneously:** All units start and stop at the same time. The frequency of the compressors is reduced or increased simultaneously for all units.

In the event of a Master/Slave communication error, the Master unit will operate in stand-alone mode or will keep on operating with the Slave units that communicate regularly. The faulty Slave unit will interrupt all the operations it was performing.



## Accessories:

- **Outdoor air temperature sensor**

The Energy Genius heat pump is fitted with a outdoor air temperature sensor installed on the coil. If the unit is installed in a position that induces the probe to read a value that is not representative of the external temperature, it is possible to install an additional remote temperature sensor (NTC 2 cables from 3k $\Omega$  @ 25 °C).

This accessory is particularly important to implement water setpoint control based on climatic curves.

Once the terminals of the additional outdoor air sensor have been connected between PIN 17 and 18 of the terminal board and parameter 511 is adequately set (see installation manual), the probe on the coil will be inhibited entirely.

- **Domestic hot water temperature sensor**

For the purposes of managing domestic hot water production, install the temperature sensor available in the DHW storage tank. The ends of the domestic hot water temperature sensor must be connected between PINs 14 and 18 of the terminal board. Refer to the installation manual for the modes designed to control the production of domestic hot water.

- **Temperature sensor for Master/Slave installation**

To install the units in parallel according to a Master/Slave configuration, the temperature sensor (5k $\Omega$  – 15 metres long) must be installed on the common leaving water temperature manifold.

Refer to the installation manual for more details on the configuration and operation setting mode.

# Energy Genius

## Performance data – Cooling Mode – in accordance with EN 14511

Engy	LWT °C	Outdoor air temperature, °C (dry bulb)													
		15							25						
		Cooling capacity			EER			Flow rate	Cooling capacity			EER			Flow rate
		kW			kW/kW			l/s	kW			kW/kW			l/s
		Nom	Min	Max	Nom	Min	Max	Nom	Nom	Min	Max	Nom	Min	Max	Nom
5M	5	1.07	1.07	1.07	6.72	6.72	6.72	0.05	2.14	0.91	2.14	4.01	6.07	4.01	0.10
7M		5.37	0.76	5.37	5.57	7.57	5.57	0.25	5.60	0.59	6.45	3.85	4.25	3.76	0.26
11M		12.39	3.57	13.24	5.48	7.78	5.18	0.59	11.51	3.05	13.27	4.30	4.73	3.88	0.55
11T		12.52	3.61	13.37	5.54	7.86	5.23	0.60	11.62	3.09	13.40	4.35	4.78	3.91	0.56
15T		13.37	3.61	13.37	5.23	7.86	5.23	0.63	13.40	3.09	13.40	3.91	4.78	3.91	0.63
17T		15.06	9.65	15.06	4.26	5.48	4.26	0.72	14.16	8.78	14.16	3.67	4.18	3.67	0.68
21T		20.02	12.50	24.01	4.38	3.12	3.69	0.96	19.50	13.50	23.31	3.87	4.06	3.30	0.93
5M	7	1.34	1.34	1.34	7.50	7.50	7.50	0.06	2.42	1.01	2.42	4.59	6.49	4.59	0.12
7M		5.59	0.95	5.59	6.15	9.55	6.15	0.27	6.14	0.77	6.78	4.31	5.62	4.16	0.29
11M		13.19	3.88	14.09	5.64	8.25	5.33	0.63	12.25	3.38	14.12	4.44	5.18	4.00	0.59
11T		13.32	3.92	14.23	5.70	8.33	5.39	0.64	12.37	3.41	14.26	4.48	5.23	4.04	0.59
15T		14.37	3.92	14.37	5.39	8.33	5.39	0.67	14.40	3.41	14.26	4.04	5.23	4.04	0.68
17T		15.97	10.30	15.98	4.43	6.07	4.43	0.76	15.31	9.40	15.31	3.93	4.47	3.93	0.73
21T		21.12	13.20	25.69	4.49	3.26	3.93	1.01	20.65	14.40	24.63	4.02	4.27	3.40	0.99
5M	10	1.49	1.49	1.49	8.47	8.47	8.47	0.07	2.71	1.17	2.71	5.21	7.31	5.21	0.13
7M		6.04	1.06	6.04	6.43	12.38	6.43	0.30	6.79	0.87	6.84	4.71	7.54	4.54	0.32
11M		14.48	4.43	15.93	5.95	9.56	5.47	0.69	13.45	3.95	15.47	4.69	6.19	4.22	0.65
11T		14.62	4.47	16.09	6.01	9.66	5.53	0.70	13.59	3.99	15.63	4.74	6.26	4.26	0.65
15T		16.25	4.47	16.25	5.53	9.66	5.53	0.76	15.78	3.99	15.63	4.26	6.26	4.26	0.74
17T		17.39	6.06	17.39	4.67	8.92	4.66	0.83	16.74	5.14	16.74	4.20	4.34	4.20	0.80
21T		22.83	7.91	28.12	4.64	4.60	4.19	1.09	22.45	8.23	26.69	4.23	4.22	3.53	1.07
5M	15	-	-	-	-	-	-	-	3.48	1.41	3.48	6.54	8.46	6.54	0.17
7M		6.93	1.25	6.93	7.16	14.51	7.16	0.35	7.87	1.05	8.69	5.34	10.71	5.12	0.37
11M		16.65	5.37	18.58	6.61	14.09	5.96	0.79	15.49	4.94	18.96	5.21	9.06	4.37	0.74
11T		16.82	5.42	18.76	6.68	14.23	6.02	0.81	15.64	4.99	19.15	5.26	9.15	4.41	0.75
15T		18.76	5.42	18.76	6.02	14.23	6.02	0.89	18.30	4.99	19.15	4.70	9.15	4.41	0.86
17T		19.94	6.81	19.94	5.05	8.84	5.05	0.95	19.37	6.00	19.37	4.66	5.19	4.66	0.93
21T		26.75	9.30	32.59	5.40	5.76	4.65	1.28	25.65	9.60	30.32	4.59	4.99	3.74	1.23
5M	18	-	-	-	-	-	-	-	5.30	1.56	5.30	6.73	9.63	6.73	0.25
7M		7.74	1.67	7.74	7.80	16.07	7.80	0.38	9.05	1.46	9.71	5.73	12.82	5.48	0.43
11M		17.83	5.81	19.90	7.06	16.22	6.34	0.85	16.59	5.41	20.30	5.55	12.18	4.61	0.79
11T		18.01	5.87	20.10	7.13	16.38	6.40	0.86	16.75	5.46	20.50	5.60	12.31	4.66	0.80
15T		20.10	5.87	20.10	6.40	18.43	6.40	0.96	19.59	5.46	20.50	4.96	12.31	4.66	0.92
17T		21.54	6.94	21.55	5.26	8.88	5.26	1.03	21.04	6.84	21.46	4.94	7.45	4.93	1.01
21T		29.16	9.71	35.50	5.79	5.30	4.92	1.40	27.70	10.50	32.63	4.79	5.57	3.85	1.33

LWT: Water temperature at heat exchanger outlet

Operating conditions:

- Water thermal gradient through the refrigerant/water heat exchanger: 5 K (10 K for LWT = 60 °C)
- Fouling factor: 0.18 x 10<sup>-4</sup> (m<sup>2</sup> K)/W

## Performance data – Cooling Mode – in accordance with EN 14511

Engy	LWT °C	Outdoor air temperature, °C (dry bulb)													
		35							45						
		Cooling capacity			EER			Flow rate	Cooling capacity			EER			Flow rate
		kW			kW/kW			l/s	kW			kW/kW			l/s
		Nom	Min	Max	Nom	Min	Max	Nom	Nom	Min	Max	Nom	Min	Max	Nom
5M	5	3.69	0.80	3.75	2.81	4.56	2.77	0.18	1.87	0.66	1.87	2.00	3.45	2.00	0.09
7M		4.86	0.42	5.39	2.93	3.41	2.77	0.23	1.96	0.36	1.96	2.00	2.44	2.00	0.09
11M		9.52	2.27	12.88	2.95	3.00	2.89	0.46	6.80	3.05	6.80	2.23	2.30	2.23	0.33
11T		9.61	2.29	13.01	2.98	3.03	2.92	0.46	6.87	3.08	6.87	2.26	2.32	2.26	0.33
15T		12.14	2.29	13.01	2.94	3.03	2.92	0.57	6.87	3.08	6.87	2.26	2.32	2.26	0.32
17T		13.97	2.91	14.52	2.89	2.19	2.82	0.67	11.99	3.87	12.01	2.25	1.38	2.25	0.57
21T		17.70	8.14	21.82	2.96	3.14	2.57	0.84	14.86	6.37	16.08	2.25	2.21	2.22	0.71
5M	7	4.00	0.89	4.09	3.10	4.92	2.95	0.19	2.13	0.75	2.13	2.14	3.70	2.38	0.10
7M		5.55	0.50	5.95	3.10	3.85	2.94	0.27	2.23	0.44	2.23	2.28	2.77	2.28	0.11
11M		11.20	2.61	13.70	3.40	3.45	2.98	0.54	7.93	3.53	7.93	2.50	2.64	2.50	0.38
11T		10.65	2.64	13.84	3.40	3.48	3.01	0.54	8.00	3.57	8.00	2.52	2.67	2.52	0.38
15T		13.00	2.64	13.84	3.20	3.48	3.01	0.61	8.00	3.57	8.00	2.52	2.67	2.52	0.38
17T		14.88	3.13	15.45	3.00	2.36	2.93	0.71	12.80	4.14	12.82	2.35	1.45	2.35	0.61
21T		18.58	8.67	23.08	3.10	3.33	2.65	0.89	15.79	6.79	17.07	2.34	2.33	2.30	0.75
5M	10	4.27	1.03	4.39	3.35	5.46	3.25	0.21	2.20	0.87	2.20	2.64	4.06	2.64	0.11
7M		5.98	0.63	6.70	3.35	4.50	3.18	0.28	2.46	0.55	2.46	2.53	3.28	2.53	0.12
11M		12.15	3.21	15.02	3.53	3.62	3.15	0.58	8.47	4.00	8.47	2.74	2.75	2.74	0.41
11T		12.28	3.25	15.17	3.57	3.66	3.18	0.59	8.55	4.04	8.55	2.77	2.77	2.77	0.41
15T		14.32	3.25	15.17	3.38	3.66	3.18	0.67	8.55	4.04	8.55	2.77	2.77	2.77	0.41
17T		16.26	3.48	16.88	3.20	2.64	3.10	0.78	14.03	4.55	14.05	2.50	1.57	2.50	0.67
21T		20.43	9.50	25.03	3.09	3.42	2.77	0.98	17.21	7.45	18.60	2.47	2.51	2.43	0.82
5M	15	4.48	1.26	5.31	3.89	6.36	3.73	0.22	2.59	1.08	2.59	3.12	4.67	3.12	0.12
7M		6.99	0.84	7.75	3.77	5.58	3.60	0.33	2.96	0.74	2.96	3.10	4.12	3.10	0.14
11M		14.05	4.25	17.24	3.94	5.42	3.46	0.67	9.75	4.82	9.75	3.19	3.15	3.19	0.47
11T		14.19	4.29	17.42	3.98	5.47	3.50	0.68	9.85	4.87	9.85	3.22	3.18	3.22	0.47
15T		16.63	4.29	17.42	3.76	5.47	3.50	0.78	9.85	4.87	9.85	3.22	3.18	3.22	0.47
17T		18.82	4.11	19.51	3.51	3.23	3.39	0.90	16.30	5.30	16.33	2.75	1.80	2.75	0.78
21T		23.40	11.00	28.49	3.36	3.91	2.95	1.12	19.76	8.62	21.34	2.70	2.83	2.65	0.95
5M	18	4.85	1.40	5.50	4.35	6.89	4.01	0.23	2.85	1.20	2.85	3.33	5.04	3.33	0.14
7M		8.00	0.97	8.72	4.00	6.24	3.84	0.38	2.31	2.31	2.31	3.53	3.53	3.53	0.10
11M		13.70	4.74	18.46	4.60	7.02	3.65	0.66	10.58	5.42	10.58	3.45	3.75	3.45	0.51
11T		13.75	4.79	18.64	4.65	7.09	3.68	0.67	10.68	5.47	10.68	3.48	3.79	3.48	0.51
15T		17.00	4.79	18.64	4.15	7.09	3.68	0.79	10.68	5.47	10.68	3.48	3.79	3.48	0.51
17T		19.83	4.52	21.17	3.87	3.67	3.65	0.95	18.10	5.79	18.13	2.99	1.95	2.99	0.87
21T		25.81	11.97	30.67	3.80	4.24	3.05	1.24	21.38	9.38	23.08	2.83	3.03	2.77	1.02

LWT: Water temperature at heat exchanger outlet

Operating conditions:

- Water thermal gradient through the refrigerant/water heat exchanger: 5 K (10 K for LWT = 60 °C)
- Fouling factor:  $0.18 \times 10^{-4} \text{ (m}^2 \text{ K)/W}$

# Energy Genius

## Performance data – Heating Mode – in accordance with EN 14511

Engy	L W T °C	Outdoor air temperature (wet bulb), °C														
		-20 (-21)							-15 (-16)							
		Thermal capacity			COP			Flow rate	Thermal capacity			COP			Flow rate	
		kW			kW/kW			l/s	kW			kW/kW			l/s	
		Nom	Min	Max	Nom	Min	Max	Nom	Nom	Min	Max	Nom	Min	Max	Nom	
5M	35	1.00	0.42	1.00	1.90	1.91	1.86	0.05	2.26	0.49	2.34	2.14	2.23	2.11	0.11	
		7M	1.81	0.68	1.81	1.31	1.87	1.31	0.12	3.89	0.76	3.89	2.29	2.52	2.29	0.19
		11M	2.60	1.74	2.60	1.52	1.54	1.52	0.17	2.88	1.92	2.88	1.82	1.91	1.82	0.17
		11T	2.65	1.86	2.65	1.55	1.60	1.55	0.17	2.91	1.96	2.91	1.87	1.95	1.87	0.17
		15T	2.65	1.86	2.65	1.55	1.61	1.55	0.17	2.91	1.96	2.91	1.87	1.95	1.87	0.17
		17T	4.41	2.20	4.44	1.84	2.04	1.84	0.45	5.18	2.62	5.15	2.05	2.29	2.03	0.45
		21T	6.32	4.11	6.40	1.93	1.98	1.92	0.58	7.57	4.94	7.58	2.15	2.25	2.15	0.58
5M	45	0.78	0.39	0.78	1.98	1.87	1.71	0.05	2.05	0.45	2.10	2.09	2.14	1.94	0.10	
		7M	1.69	0.66	1.69	1.66	2.12	1.66	0.12	3.84	0.73	3.84	1.90	2.19	1.90	0.18
		11M	2.34	1.60	2.34	1.28	1.29	1.28	0.17	2.73	1.79	2.73	1.52	1.57	1.52	0.17
		11T	2.39	1.71	2.39	1.30	1.35	1.30	0.17	2.76	1.83	2.76	1.56	1.60	1.56	0.17
		15T	2.39	1.71	2.39	1.30	1.35	1.30	0.17	2.76	1.83	2.76	1.56	1.60	1.56	0.17
		17T	4.23	2.13	4.26	1.57	1.73	1.57	0.45	4.90	2.46	4.93	1.71	1.88	1.71	0.45
		21T	5.84	4.75	5.85	1.54	1.49	1.54	0.58	7.00	5.80	7.01	1.71	1.68	1.71	0.58
5M	55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
7M		-	-	-	-	-	-	-	-	-	-	-	-	-	-	
11M		-	-	-	-	-	-	-	-	-	-	-	-	-	-	
11T		-	-	-	-	-	-	-	-	-	-	-	-	-	-	
15T		-	-	-	-	-	-	-	-	-	-	-	-	-	-	
17T		-	-	-	-	-	-	-	-	-	-	-	-	-	-	
21T		-	-	-	-	-	-	-	-	-	-	-	-	-	-	
5M	60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
7M		-	-	-	-	-	-	-	-	-	-	-	-	-	-	
11M		-	-	-	-	-	-	-	-	-	-	-	-	-	-	
11T		-	-	-	-	-	-	-	-	-	-	-	-	-	-	
15T		-	-	-	-	-	-	-	-	-	-	-	-	-	-	
17T		-	-	-	-	-	-	-	-	-	-	-	-	-	-	
21T		-	-	-	-	-	-	-	-	-	-	-	-	-	-	

LWT: Water temperature at heat exchanger outlet

Operating conditions:

- Water thermal gradient through the refrigerant/water heat exchanger: 5 K (10 K for LWT = 60 °C)
- Fouling factor: 0.18 x 10<sup>-4</sup> (m<sup>2</sup> K)/W

## Performance data – Heating Mode – in accordance with EN 14511

Engy	L W T °C	Outdoor air temperature (wet bulb), °C													
		-10(-11)							-7 (-8)						
		Thermal capacity			COP			Flow rate	Thermal capacity			COP			Flow rate
		kW			kW/kW			l/s	kW			kW/kW			l/s
		Nom	Min	Max	Nom	Min	Max	Nom	Nom	Min	Max	Nom	Min	Max	Nom
5M	35	2.58	0.56	2.80	2.41	2.61	2.39	0.12	3.35	0.64	3.55	3.01	3.19	3.00	0.16
7M		3.90	0.84	4.66	2.81	2.89	2.34	0.19	4.10	0.94	4.95	3.00	3.21	2.48	0.20
11M		6.16	2.13	7.65	2.40	2.89	2.24	0.35	6.81	2.52	8.50	2.93	2.99	2.80	0.38
11T		6.32	2.24	7.95	2.50	2.95	2.18	0.30	6.98	2.57	8.20	3.00	3.05	2.85	0.34
15T		7.78	2.24	8.51	2.44	2.95	2.15	0.42	8.72	2.57	9.15	2.90	3.05	2.75	0.46
17T		6.70	2.42	6.83	2.22	2.53	2.19	0.52	7.27	2.41	10.50	2.34	2.71	2.06	0.57
21T		9.56	5.82	10.30	2.37	2.55	2.35	0.64	10.39	6.50	15.31	2.51	2.74	2.22	0.69
5M	45	2.47	0.52	2.67	2.21	2.39	2.20	0.12	3.17	0.60	3.40	2.65	2.81	2.60	0.15
7M		3.68	0.81	3.84	2.21	2.26	1.94	0.18	3.83	0.90	4.58	2.33	2.51	2.06	0.18
11M		3.44	1.92	3.44	1.89	1.93	1.89	0.19	6.48	2.37	7.95	2.42	2.44	2.29	0.36
11T		3.53	1.96	3.53	1.94	1.97	1.94	0.17	6.63	2.42	8.13	2.47	2.49	2.34	0.32
15T		3.53	1.96	3.53	1.94	1.97	1.94	0.19	8.06	2.42	8.60	2.34	2.49	2.24	0.43
17T		6.42	2.86	6.60	1.87	2.08	1.85	0.50	6.91	2.29	10.10	1.96	2.20	1.71	0.54
21T		8.94	6.88	9.66	1.89	1.89	1.87	0.61	9.74	7.56	14.70	1.99	2.02	1.80	0.66
5M	55	2.39	0.49	2.58	1.91	2.06	1.88	0.12	2.90	0.56	2.96	1.99	2.10	1.95	0.14
7M		3.05	0.74	3.35	1.80	2.07	1.75	0.15	3.17	0.85	3.17	1.90	2.30	1.86	0.15
11M		2.97	1.85	2.97	1.30	1.29	1.30	0.17	5.70	2.29	7.06	1.82	1.88	1.76	0.32
11T		3.03	1.89	3.03	1.32	1.34	1.32	0.17	5.81	2.34	7.20	1.85	1.92	1.79	0.28
15T		3.03	1.89	3.03	1.32	1.34	1.32	0.17	7.07	2.34	7.55	1.76	1.92	1.70	0.38
17T		6.62	2.90	6.80	1.78	1.72	1.77	0.48	7.15	2.17	8.45	1.87	1.82	1.79	0.52
21T		8.24	6.38	8.98	1.52	1.50	1.52	0.58	9.03	7.07	11.28	1.60	1.60	1.55	0.62
5M	60	2.33	0.46	2.50	1.86	2.01	1.83	0.11	2.56	0.52	2.82	1.93	2.04	1.89	0.12
7M		2.68	0.69	2.68	1.54	1.84	1.54	0.13	2.79	0.81	2.79	1.62	2.05	1.62	0.13
11M		2.44	1.69	2.44	1.10	1.11	1.10	0.17	4.99	2.15	6.30	1.46	1.45	1.45	0.28
11T		2.47	1.72	2.47	1.12	1.13	1.12	0.17	5.06	2.20	6.39	1.46	1.47	1.45	0.24
15T		2.48	1.72	2.48	1.12	1.13	1.12	0.17	6.37	2.20	6.82	1.44	1.47	1.40	0.34
17T		6.45	2.93	6.58	1.65	1.63	1.63	0.47	6.95	2.15	7.06	1.72	1.70	1.69	0.50
21T		-	-	-	-	-	-	-	-	-	-	-	-	-	-

LWT: Water temperature at heat exchanger outlet

Operating conditions:

- Water thermal gradient through the refrigerant/water heat exchanger: 5 K (10 K for LWT = 60 °C)
- Fouling factor:  $0.18 \times 10^{-4}$  (m<sup>2</sup> K)/W

## Performance data – Heating Mode – in accordance with EN 14511

Engy	L W T °C	Outdoor air temperature (wet bulb), °C													
		2 (1)							7 (6)						
		Thermal capacity			COP			Flow rate	Thermal capacity			COP			Flow rate
		kW			kW/kW			l/s	kW			kW/kW			l/s
		Nom	Min	Max	Nom	Min	Max	Nom	Nom	Min	Max	Nom	Min	Max	Nom
5M	35	3.53	0.73	3.64	3.37	3.46	3.31	0.17	5.10	0.82	5.27	4.40	4.58	4.34	0.25
7M		5.12	1.04	6.11	3.32	3.54	2.92	0.25	7.15	1.36	8.77	4.10	4.46	3.31	0.34
11M		8.25	2.81	9.80	3.39	3.40	3.24	0.49	11.25	3.73	13.67	4.70	4.90	4.21	0.54
11T		8.42	2.86	10.09	3.42	3.47	3.27	0.40	11.20	3.80	14.19	4.60	4.99	4.32	0.56
15T		10.79	2.86	11.44	3.27	3.47	3.22	0.61	15.00	3.80	16.52	4.35	4.99	4.27	0.69
17T		12.72	5.50	18.77	3.05	3.22	2.48	0.72	17.14	3.35	21.77	4.10	3.93	3.08	0.83
21T		15.62	7.27	19.91	2.90	3.08	2.47	0.90	21.10	7.56	22.17	4.10	4.37	2.94	1.01
5M	45	3.46	0.69	3.51	2.49	2.56	2.41	0.17	4.85	0.74	4.99	3.40	3.52	3.34	0.23
7M		4.78	1.00	5.73	2.56	2.71	2.13	0.23	6.80	1.31	7.96	3.20	3.42	2.83	0.33
11M		7.77	2.77	9.12	2.75	2.81	2.53	0.46	11.30	3.58	12.64	3.60	3.73	3.31	0.56
11T		7.93	2.82	9.48	2.80	2.87	2.58	0.38	10.40	3.65	13.12	3.60	3.80	3.35	0.57
15T		10.26	2.82	10.88	2.75	2.87	2.53	0.58	13.50	3.65	15.88	3.50	3.80	3.32	0.65
17T		12.03	5.17	18.01	2.50	3.02	2.04	0.58	16.16	4.47	20.44	3.40	2.87	2.51	0.78
21T		14.83	6.84	18.93	2.34	2.41	2.03	0.86	19.97	6.78	21.55	3.30	3.37	2.45	0.97
5M	55	3.28	0.64	3.28	2.28	2.39	2.28	0.16	4.41	0.68	4.41	2.79	2.95	2.79	0.21
7M		4.44	0.97	4.44	2.20	2.44	2.20	0.21	6.51	1.27	7.35	2.59	2.80	2.43	0.31
11M		6.99	2.74	8.02	2.20	2.23	2.18	0.40	9.46	3.22	11.08	2.69	2.73	2.46	0.45
11T		7.34	2.79	8.42	2.24	2.27	2.20	0.35	9.93	3.28	11.63	2.72	2.76	2.48	0.48
15T		9.53	2.79	10.02	2.19	2.27	2.10	0.53	13.61	3.28	14.90	2.56	2.76	2.45	0.62
17T		11.43	4.30	13.20	2.10	2.41	1.95	0.65	15.27	4.21	18.10	2.69	2.17	2.68	0.74
21T		13.70	6.37	17.02	1.90	1.91	1.83	0.79	19.07	6.31	23.24	2.69	2.63	2.53	0.92
5M	60	2.78	0.59	2.78	2.15	2.32	2.15	0.13	3.88	0.65	3.88	2.44	2.66	2.44	0.19
7M		3.38	0.96	3.38	1.85	2.13	1.85	0.16	5.16	1.25	5.16	2.15	2.32	2.15	0.25
11M		6.30	2.57	7.18	1.85	1.88	1.83	0.36	8.48	3.10	9.94	2.10	2.12	2.03	0.41
11T		6.93	2.62	7.54	1.88	1.94	1.84	0.33	8.90	3.16	10.44	2.21	2.23	2.13	0.43
15T		9.03	2.62	9.42	1.85	1.94	1.81	0.50	12.90	3.16	14.17	2.10	2.14	2.06	0.58
17T		11.07	4.16	11.37	1.92	2.17	1.90	0.63	14.74	3.87	15.30	2.58	1.80	2.57	0.72
21T		-	-	-	-	-	-	-	-	-	-	-	-	-	-

LWT: Water temperature at heat exchanger outlet

Operating conditions:

- Water thermal gradient through the refrigerant/water heat exchanger: 5 K (10 K for LWT = 60 °C)
- Fouling factor:  $0.18 \times 10^{-4}$  (m<sup>2</sup> K)/W

## Performance data – Heating Mode – in accordance with EN 14511

Engy	LWT °C	Outdoor air temperature (wet bulb), °C							
		10 (9)							
		Thermal capacity			COP			Flow rate	
		kW			kW/kW			l/s	
		Nom	Min	Max	Nom	Min	Max	Nom	
5M	35	5.54	0.92	5.88	4.66	4.86	4.51	0.27	
		7M	7.38	1.44	8.65	4.35	4.69	3.94	0.35
		11M	12.14	3.87	14.51	4.94	5.30	4.44	0.58
		11T	12.44	4.03	15.24	5.04	5.41	4.57	0.60
		15T	15.75	4.03	17.15	4.54	5.41	4.44	0.74
		17T	17.27	3.73	25.82	4.13	5.50	3.40	0.87
		21T	22.88	8.78	32.72	4.48	3.80	3.62	1.09
5M	45	5.05	0.83	5.36	3.69	3.85	3.60	0.24	
		7M	7.04	1.36	8.36	3.13	3.37	3.21	0.34
		11M	11.37	3.84	13.37	3.85	4.27	3.45	0.54
		11T	11.65	3.92	14.04	3.93	4.36	3.52	0.56
		15T	15.20	3.92	16.58	3.76	4.36	3.48	0.71
		17T	16.25	4.95	25.47	3.33	3.88	2.83	0.82
		21T	21.71	7.78	31.49	3.59	2.86	2.99	1.04
5M	55	4.61	0.76	4.61	2.88	3.01	2.88	0.22	
		7M	6.53	1.30	7.58	2.73	3.01	2.68	0.31
		11M	10.07	3.47	11.70	2.83	2.85	2.43	0.48
		11T	10.36	3.61	12.29	2.88	2.91	2.55	0.50
		15T	14.33	3.61	15.64	2.87	2.91	2.82	0.67
		17T	15.35	4.67	18.64	2.75	2.89	2.75	0.78
		21T	20.47	7.24	24.92	2.92	2.21	2.73	0.99
5M	60	4.14	0.73	4.14	2.58	2.74	2.58	0.20	
		7M	5.96	1.22	5.96	2.26	2.49	2.26	0.29
		11M	8.20	2.89	8.20	2.31	2.33	2.31	0.39
		11T	8.61	3.01	8.61	2.37	2.43	2.37	0.41
		15T	8.61	3.01	8.61	2.37	2.43	2.37	0.39
		17T	14.69	4.65	15.66	2.49	2.60	2.44	0.74
		21T	-	-	-	-	-	-	-

LWT: Water temperature at heat exchanger outlet

Operating conditions:

- Water thermal gradient through the refrigerant/water heat exchanger: 5 K (10 K for LWT = 60 °C)
- Fouling factor:  $0.18 \times 10^{-4}$  (m<sup>2</sup> K)/W
- Performance in accordance with Standard EN 14511







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