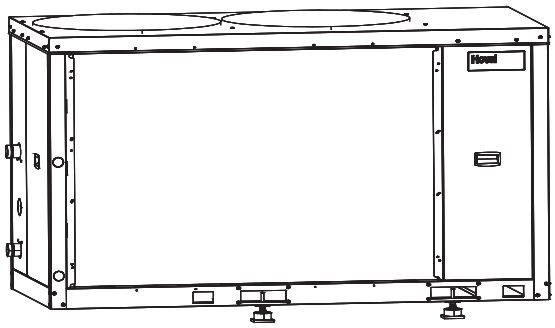
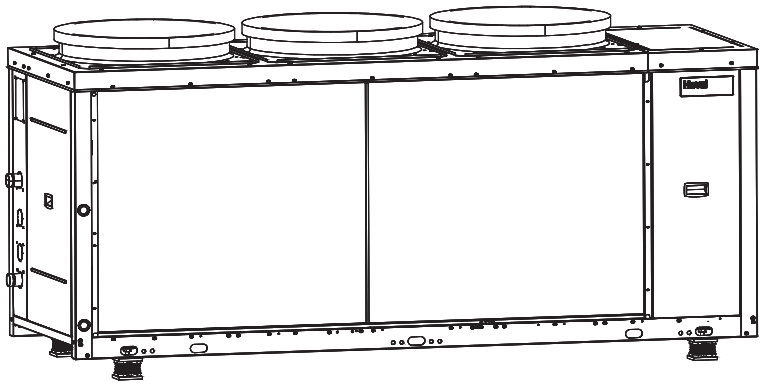
# Technical information
# Installation/operating instructions

Hoval

## Belaria® fit (53,85)
Air/water heat pump



Belaria® fit (53)



Belaria® fit (85)

These instructions are applicable to the following types:
1-Belaria® fit (53,85)

Hoval products are only allowed to be installed and commissioned by specialists.
These instructions are intended for service engineers.
Electrical installations are only allowed to be carried out by an electrician.

Hoval

# 1. Safety Considerations

**Safety**
Operate in compliance with safety regulations in force. To carry out the operations use protection devices:
gloves, goggles, helmet, headphones, protective knee pads.
All work must be carried out by personnel who have been instructed in the possible dangers of a general or electrical nature, as well as in working on pressurised equipment.
Only qualified personnel can operate on the unit, as required by the regulation in force.

**Manual**
The manual provides important information on the correct installation, use and maintenance of the unit.
It is advisable to read it carefully so you will save time during operations.
Follow the written indications so you will not cause damages to things and injuries people.

**Risk situations**
The unit has been designed and created to prevent injures to people.
During designing it is not possible to plane and operate on all risk situation.
Read the “Residual risks” section, which refers to situations that may cause hazards to property or persons.
Installation, starting, maintenance and repair required specific knowledge; if they are carried out by inexperienced personnel, they may cause damages to things and injuries people.

**Intended use**
The unit is only suitable for cooling and heating with water or water mixed with glycol. The technical data and limit values specified in the manual must be observed.
The manufacturer accepts no responsibility if the equipment is used for any purpose other than the intended use.

**Installation**
Outdoor installation
The positioning, hydraulic system, refrigerating, electrics and the ducting of the air must be determined by the system designer in accordance with local regulations in force.
Verify that the electrical line characteristics are in compliance with data quotes on the unit serial number label.

**Maintenance**
Plan periodic inspection and maintenance in order to avoid or reduce repairing costs.
Turn the unit off before any operation.

**Before any work read:**
- Read “Safety instructions - R32” on page 45

**Pay particular attention to:**
- warnings / prohibitions / danger
  They indicate particularly important work processes or information, they point out manipulations which must not be carried out, those which can endanger the functionality of the machine or cause damage to property or personal injury.

**Modification**
All unit modifications will end the warranty coverage and the manufacturer responsibility.

**Breakdown/Malfunction**
Immediately switch off the unit in case of damage or malfunction, and contact an authorised customer service centre.
Using the unit in case of breakdown or malfunction:
- voids the warranty
- it may compromise the safety of the unit
- it may increase time and repair costs

**User training**
In particular, the installer must inform the user of the following:
- start-up/shutdown
- set points change
- standby mode
- maintenance
- what to do / what not to do in case of breakdown.

**Other instructions**
All instructions relevant to your system can be found in the Hoval system manual.
Please retain all instructions.
In exceptional cases, the instructions can be found with the components.
Further sources of information:
- Hoval catalogue
- Standards, regulations

**Indications for the User**
Keep this manual with the wiring diagram in an accessible place for the operator.
Note the unit data label so you can provide them to the assistance centre in case of intervention (see “Unit identification” section).
Provide a unit notebook that allows any interventions carried out on the unit to be noted and tracked making it easier to suitably note the various interventions and aids the search for any breakdowns.

**The installer must train the user, particularly on:**
- Start-up/shutdown
- Set points change
- Standby mode
- Maintenance
- What to do / what not to do in case of breakdown

**Unit identification**
The serial number label is positioned on the unit and allows to indentify all the unit features.
The matriculation plate shows the indications foreseen by the standards, in particular:

- unit type
- serial number (12 characters)
- year of manufacture
- wiring diagram number
- electrical data
- type of refrigerant
- refrigerant charge
- manufacturer logo and address

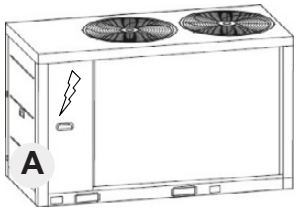
**Serial number**
It identifies uniquely each unit.
The matriculation plate must never be removed.
Must be quoted when ordering spare parts.

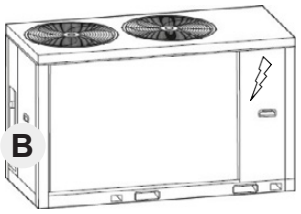
**Assistance request**
Note data from the serial number label and write them in the chart on side, so you will find them easily when needed.

| |
|---|
| Series |
| Size |
| Serial number |
| Year of manufacture |
| Number of electrical wiring diagram |

**Accessories supplied**

| | | |
|---|---|---|
| T5 - DHW storage temperature probe | 1 | A |
| Taf1 - DHW storage antifreeze probe | 1 | A |
| TW – flow sensor (pre-installed on the outlet pipe of the unit) | 1 | B |
| Sensor mounting bracket TW | 1 | A |
| - Victaulic couplings for hydraulic pipe connections<br>- Mains adapter of the control module | 2 | B |



## 2. Information on Refrigerant Gas

This product contains fluorinated greenhouse gases covered by the Kyoto protocol. Do not discharge gas into air.

Refrigerant type: R32
The refrigerant quantity is indicated on the unit plate.

Quantity factory-loaded refrigerant and equivalent $CO_2$ tons:

| Typ | Refrigerant (Kg) | Equivalent $CO_2$ tons |
|---|---|---|
| Belaria® fit (53) | 14 | 9.45 |
| Belaria® fit (85) | 17.5 | 11.8 |

| Physical characteristics of the R32 refrigerant | | |
|---|---|---|
| Safety class (ISO 817) | A2L | |
| Global warming potential | 675 | |
| LFL lower flammability limit | 0.307 | kg/m³ @ 60 °C |
| BV Burning velocity | 6.7 | cm/s |
| Punto di ebollizione | -52 | °C |
| Global warming potential | 675 | 100 yr ITH |
| Global warming potential | 677 | ARS 100 yr ITH |
| Self-ignition temperature | 648 | °C |

# 3. Before Installation

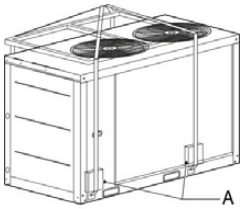
**Reception**
On delivery:
- Carry out a visual inspection immediately on receiving the heat pump.
- If any damage is found, take the necessary steps as defined in the delivery contract.
- The respective risk carrier bears the cost of repairs.

**Storage**
Respect the indications on the outside of the pack.
In particolar:
- minimum ambient temperature –20 °C (possible components damages)
- maximum ambient temperature +48 °C (possible safety valve opening)
- maximum relative humidity 95 % (possible damages to electrical components)

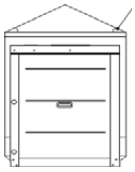
**NOTE**
- The unit may not be tilted more than 15° during transport.

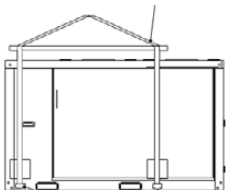
**Removal of packaging**
Be careful not to damage the unit.
Recycle and dispose of the packaging material in compliance with local regulations.

**Suitably protect the unit to prevent damage.**

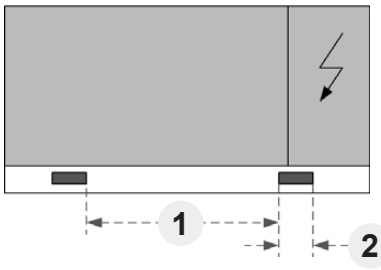


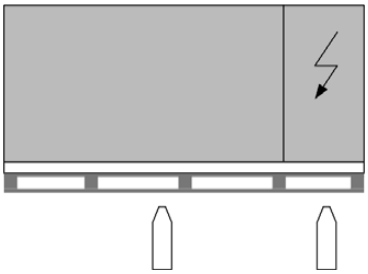

**spacer bar**





| | Belaria® fit (53) | Belaria® fit (85) |
|---|---|---|
| 1 | 640 | Unit on pallet |
| 2 | 200 | |



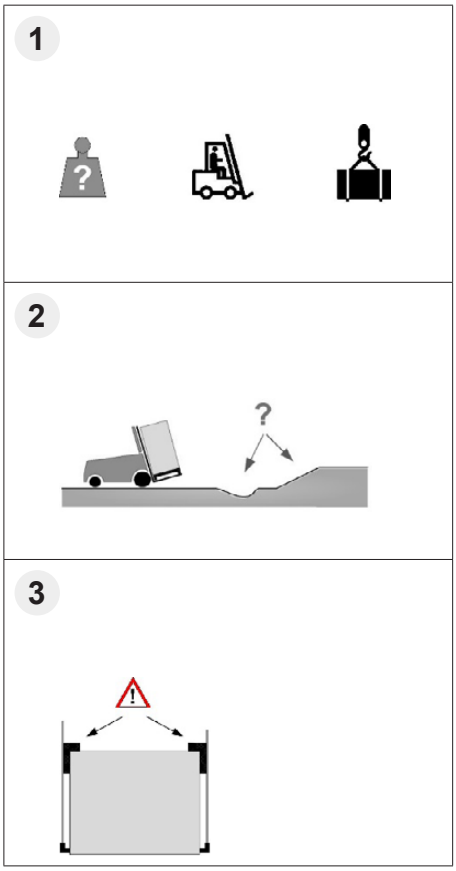
**Handling**

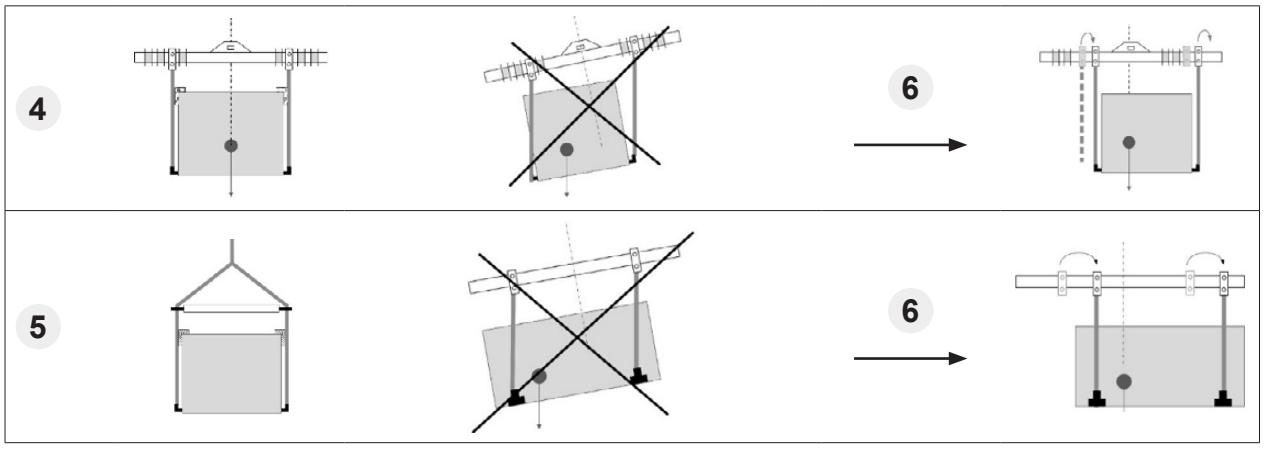
- Check that all handling equipment complies with local safety regulations (cran, forklifts, ropes, hooks, etc.).
- Provide personnel with personal protective equipment suitable for the situation, such as helmet, gloves, accident-prevention shoes, etc.
- Observe all safety procedures in order to guarantee the safety of the personnel present and the of material.

**Lifting**

1. Check the weight of the units and the load-bearing capacity of the hoist.
2. Identify critical points during handling (disconnected routes, flights, steps, doors).
3. Suitably protect the unit to prevent damage.
4. Lifting with balance
5. Lifting with spacer bar
6. Align the barycenter to the lifting point

- Tighten the slings slowly, checking that they are correctly aligned.
- Before lifting, make sure that the unit is in a stable, balanced position.



# 4. Selecting the Installation Site

**General informations**

- *Installation must be in accordance with local regulations. If they do not exist, follow EN378 .*

During positioning consider these elements:

- customer approval
- unit weight and bearing point capacity
- safe accessible position
- functional spaces
- spaces for the air intake/exhaust
- electrical connections
- max. distance allowed by the electrical connections
- water connections

**Functional spaces**

Functional spaces are designed to:

- guarantee good unit operation
- carry out maintenance operations
- protect authorized operators and exposed people
  - *Observe the space specifications/distances given in the DIMENSIONS chapter on pages 71, 73.*

**Positioning**

Units are designed to be installed:

- EXTERNAL
- in fixed positions
  - *Place the unit in such a way that any escaping gas cannot enter the building or accumulate in the near vicinity. In the latter case, observe the rules for machinery rooms (ventilation, leak detection, etc.).*

Installation standards:

- install the unit raised from the ground
- bearing points aligned and leveled
- discharged condensation water must not cause harm/ danger to people and property
- The fin evaporator must not be covered by snow.
- avoid installations in places subject to flooding

Limit vibration transmission:

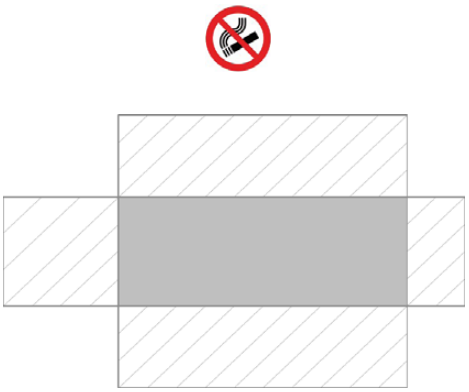
- use anti-vibration devices or neoprene strips on the unitsupport points
- install flexible joints on the hydraulic connections

Protect the unit with suitable fence in order to avoid access to unauthorised personnel (children, vandals, etc.)
A correct circulation of the air is mandatory to guarantee the good unit operating

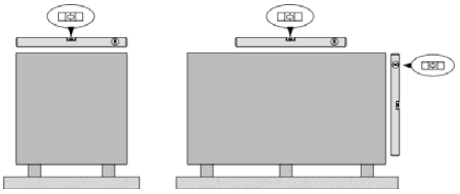
**Functional spaces Safety Zone**

See page 73

**Do not smoke or use open flames within this area**



The unit must be level.



Do not go up to the surface

Avoid therefore:
- obstacles to the airflow
- Inadequate exchange of air
- leaves or other foreign bodies that can obstruct the exchange batteries
- winds that hinder or favour the airflow
- heat or pollution sources close to the unit (chimneys, extractors etc)
- stratification (cold air that stagnates at the bottom)
- recirculation (expelled air that is sucked in again)
- positioning below the level of the threshold, close to very high walls, attics or in angles that could give rise to stratification or recirculation phenomenons.

Ignoring the previous indications could:
- energy efficiency decrease
- alarm lockout due to High Pressure (in summer) or Low Pressure (in winter)

**Prevent the accumulation of snow.**
The fin evaporator and the fans must always be free of obstructions, accumulations of leaves and snow, etc.
If the unit is installed where it might snow:
- do not install the unit under trees or roofs that may accumulate snow
- envisage a base of a suitable height for a possible accumulation of snow.

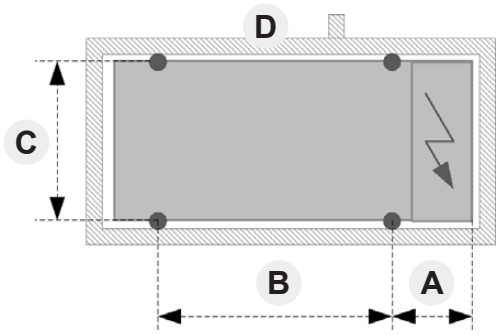
Otherwise the accumulated snow will block the airflow and may cause problems to the equipment.

**Condensate**
A considerable amount of water can be produced during the operation of the heat pump, which comes from the defrost cycles of the evaporator.
The condensate must be drained in such a way that personal injury and damage to property are avoided.

**Pressure relief valve gas side**
The installer must assess whether and how to install the blow-off pipe in accordance with the provisions of the applicable local regulations (EN 378).
If ducted, the valves must be sized according to EN13136.

**Installation of the antivibration mounts**
Place the antivibration mounts between the unit and the base. Use the holes on the unit frame (15 mm diameter). Slings are required to lift the unit for mounting the vibration damping feet.

**NOTE**
- *If spring antivibration units are also installed, the total height of the unit increases.*




| | Belaria® fit (53) | Belaria® fit (85) |
|---|---|---|
| A | 425 | 253 |
| B | 840 | 2715 |
| C | 995 | 1029 |
| D | Ensure that condensate can seep away on site. | |

# 5. Hydraulic connection

**Hydraulic system**
The pipes must be designed and manufactured to limit pressure drops as much as possible, i.e. optimise performance of the system. Keep the following to a minimum:
- overall length
- Number of bends
- changes of direction

**Water quality**
The quality of the water must be checked by qualified personnel.
Water with inadequate characteristics can cause:
- pressure drop increase
- energy efficiency decrease
- corrosive symptom increase

Water features:
- If the values are outside the specified limits, treat the water accordingly

**Cleanliness**
Before connecting the water to the unit, clean the system thoroughly with specific products effective to remove residues or impurities that may affect functioning.
Existing systems must be free from sludge and contaminants and protected against build-ups.

**New systems**
For new installations, the entire plant must be completely cleaned before commissioning. This removes residues of the installation process (welding, waste, joint products...). The system must then be filled with clean high-quality tap water.

**Existing systems**
If a new unit is installed on an existing system, the system must be rinsed to avoid the presence of particles, sludge and waste. The system must be drained before installing the new unit.
Dirt can be removed only with a suitable water flow.
Each section must then be washed separately.
Particular attention must also be paid to “blind spots” where a lot of dirt can accumulate due to the reduced water flow.
The system must then be filled with clean high-quality tap water. If, after rinsing, the quality of the water is still unsuitable, a few measures must be taken to avoid problems.
An option to remove pollutants is to install a filter.

**The warranty does not cover damage caused by lime deposits, other deposits, impurities in the water supply and/or failure to clean the system.**

| **Water content for corrosion limit for copper** | |
|---|---|
| PH (25 °C) | 7.5 ÷ 9.0 |
| SO4-- | < 100 |
| HCO3- / SO4-- | > 1 |
| Total Hardness | 8 ÷ 15 °f |
| Cl- | < 50 ppm |
| PO4 3- | < 2.0 ppm |
| NH3 | < 0.5 ppm |
| Free Chlorine | < 0.5 ppm |
| Fe3 + | < 0.5 ppm |
| Mn++ | < 0.05 ppm |
| $CO_2$ | < 50 |
| H2S | < 50 ppb |
| Oxygen content | < 0.1 ppm |
| Sand | 10 mg/L |
| Magnetit Fe304 | Dose ( / amount) < 7.5 mg/L<br>50 % of the mass diameter < 10 µm |
| Iron oxide Fe2O3 (red) | Dose ( / amount) < 7.5 mg/L<br>diameter < 1 µm |
| Electrical conductivity (µS/cm) | <500 |
| Sodium nitrate (mgNaNo3/l) | <100 |
| Alkalinity (mgCaCo3/l) | <100 |
| Copper (mgCu/l) | <1.0 |
| Sulphide ion (S-/l) | None |
| Ammonium ion (mgNH4 /L) | <1.0 |
| Silica (mgSiO2/l) | 50 |
| Max Ethylene, Propylene glycol | 50% |
| Nitrates | <100 |
| Free&aggressive Carbonic Acid | <5 |

**Risk of freeze**
If the unit or the water pipes are subject to temperatures close to 0 °C:
- Mix water with ethylene glycol, or
- Safeguard the pipes with heating cables placed under the insulation, or
- Empty the system in cases of long non-use

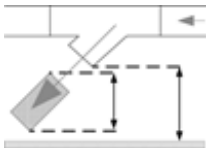
The unit must always be protected from freeze. Otherwise irreversible damage may occur.

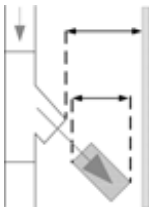
**Anti-freeze solutions**
Consider that the use of anti-freeze solution determines an increase in a pressure drop.
Make sure that the glycol type utilized is inhibited (not corrosive) and compatible with the hydraulic circuit components.
Do not use different glicol mixture (i.e. ethylic with propylene).

**Water filter**
- A water filter must be installed directly at the water inlet of the machine, in a place that can be easily reached for cleaning.
- The filter never should be removed, this operation invalidates the guaranty

The filter must have an adequate mesh to prevent the entry of particles greater than:
**0.5 mm**

**OK**





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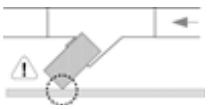
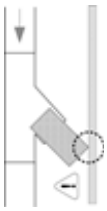




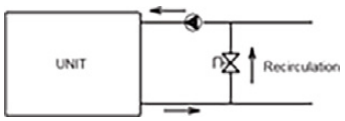
**Water flow rate**
The water flow rate must meet the following conditions:
- inside the exchanger operating limits (see the Technical Data chapter)
- It must be guaranteed even under changing plant conditions (e.g. plants with zones that are switched off in certain situations)

If the flow rate of the system is lower than the minimum flow rate, the system must be bypassed as shown in the “Minimum flow rate” figure.
If the flow rate of the system is higher than the maximum flow rate, the heat exchanger must be bypassed as shown in the “Maximum flow rate” figure.

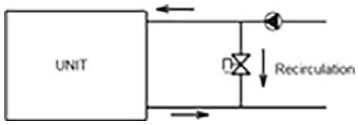
**Non-return valve**
Provide for the installation of non-return valves (A) in the case of several units connected in parallel.

**Domestic hot water**
See „Electrical Connections“ chapter.

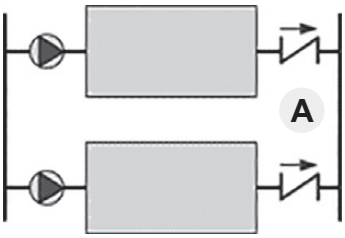
**Minimum water flow**

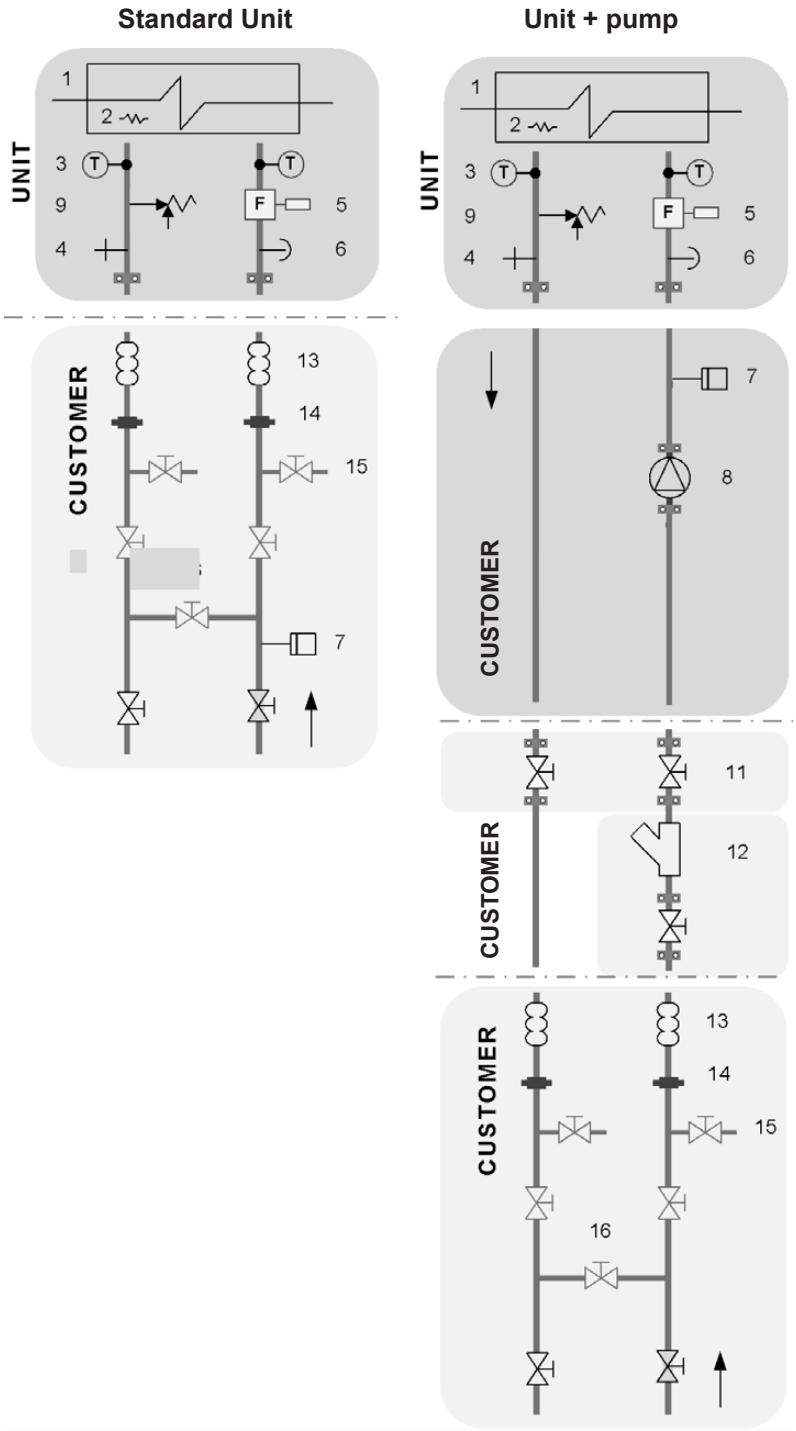



**Maximum water flow**




**Non-return valve**






1. exchanger
2. antifreeze heater
3. water temperature probe
4. drain
5. water flow switch
6. vent
7. system loading safety pressure switch
8. pump
9. safety valve
10. N.D.
11. shut-off valves
12. filter
13. flexible couplings
14. piping supports
15. exchanger chemical cleaning bypass
16. system cleaning bypass

**Hydraulic connections**

1. take away the supplied connection union by acting on the connection joint.
2. Weld the connection nozzles to the hydraulic line (supply and return) of the plant.
3. perform the connection between the installation pipe and the evaporator, using the joint.

**NOTE**

- *Do not weld on the pipe of the plant with the Victaulic coupling connected. The rubber seals could be irrevocably damaged.*

**Operations sequence**

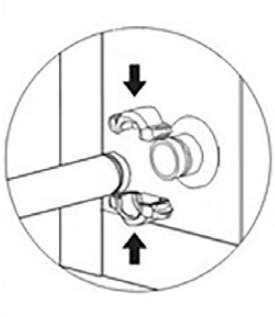
Before starting the unit pump:

1. Close all vents.
2. Close all drain taps:
   - Exchangers
   - Pumps
   - collectors
   - storage tanks
3. Flush the system thoroughly with clean water: Use the bypass to exclude the heat exchanger from the flow (diagram on the previous page). Fill and drain the system several times.
4. Apply additives to prevent corrosion, fouling, formation of mud and algae.
5. Fill the system do not use the unit pump
6. Conduct a leak test.
7. Isolate the pipes to avoid heat dispersions and formation of condensate.
   - Maintenance points such as drains, air vents, etc. must not be insulated.

**NOTE**

- If flushing of the system is neglected, the filter must be cleaned much more frequently. In the worst case, the heat exchanger and other components could be damaged.

**Victaulic**



# 6. Electrical Connections

The characteristics of the electrical lines must be determined by specialized personnel able to design electrical installations; moreover, the lines must be in conformity with regulations in force.
The protection devices of the unit power line must be able to stop the presumed short circuit current, whose value must be determined in function of system features.
The power cables and the protection cable section must be defined in accordance with the characteristics of the protections adopted.
All electrical operations should be performed by trained personnel having the necessary requirements by the regulations in force and being informed about the risks relevant to these activities.
Operate in compliance with safety regulations in force.

**Electrical data**
The nameplate indicates the specific electrical data of the unit.
The electrical data indicated in the technical bulletin and in the manual refer to the standard unit, accessories excluded.
Refer to the electrical data report on the serial number label:
- Tensione
- F.L.A.: full load ampere, absorbed current at maximum admitted conditions
- F.L.I.: full load input, full load power input at max. admissible condition
- Electrical wiring diagram Nr

**Connections**
1. Refer to the unit electrical diagram (the number of the diagram is shown on the serial number label).
2. verify that the network has characteristics conforming to the data shown on the serial number label.
3. Before starting work, verify that the sectioning device at the start of the unit power line is open, blocked and equipped with cartel warning.
4. Primarily you have to realize the earthing connection.
5. Shelter the cables using adequate measure fairleads.
6. Prevent dust, insects or rodents from entering the electrical panel as they can damage components and cables.
7. Prevent noise from escaping from the compressor compartment; seal any openings made.
8. Secure the cables: if left unattached they can be stripped.
9. The cables must not touch the compressors or the refrigerant piping (they reach high temperatures).
10. Do not drill holes in the electrical panel.
    Alternatively, restore the IP rating with watertight systems.
11. Before power the unit, make sure that all the protections that were removed during the electrical connection work have been restored.

**Opening for electrical power supply**

**Signals-/data lines**

Do not overpass the maximum power allowed, which varies, according to the type of signal.
Do not lay the cables near power lines that have a different voltage or emit electromagnetic interference.
Do not lay the cable near devices which can generate electromagnetic interferences.
Do not lay the cables parallel to other cables; cable crossings are possible, only if laid at 90°.
In case of parallel power supply and signal cables, use separate metal ducts. Minimum distance between power supply and signal cables:

- 300 mm for absorption up to 10A.
- 500 mm for absorption up to 50A.

Connect the screen to the ground, only if there aren't disturbances.
Guarantee the continuity of the screen during the entire extension of the cable. Respect impendency, capacity and attenuation indications.

**Power supply cables section**

| | Belaria® fit (53) | Belaria® fit (85) |
|---|---|---|
| Max. cable section Cu (mm²) | 25 | 25 |

**Power supply network requirements**

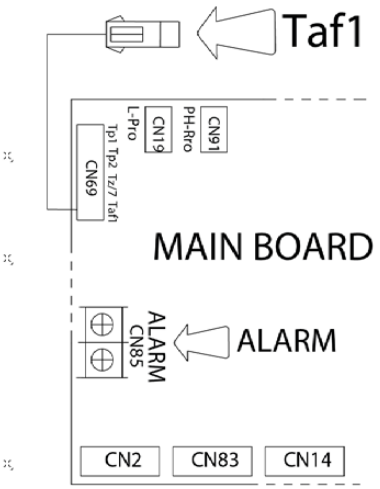
1. The short circuit capacity of the line must be less than 15 kA
2. The units can only be connected to TN, TT distribution systems
3. Voltage 400-3-50 +/-10 %
4. Phase unbalance < 2 %
5. Harmonic distortion less than 12% (THDv<12 %)
6. Voltage interruptions lasting no longer than 3 ms and with at least 1 s between each one
7. Voltage dips not exceeding 20 % of the RMS value, lasting no longer than a single period (50 Hz) and with at least 1 s between each dip.
8. Earth cable as specified in the table:

| Cross-section of the line conductors (mm²) | Minimum cross-section of the protective conductor (PE) (mm²) |
|---|---|
| $S \leq 16$ | S |
| $16 < S \leq 35$ | 16 |
| $S > 35$ | S/2 |

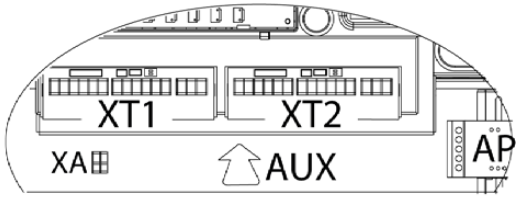
**EMC filter**

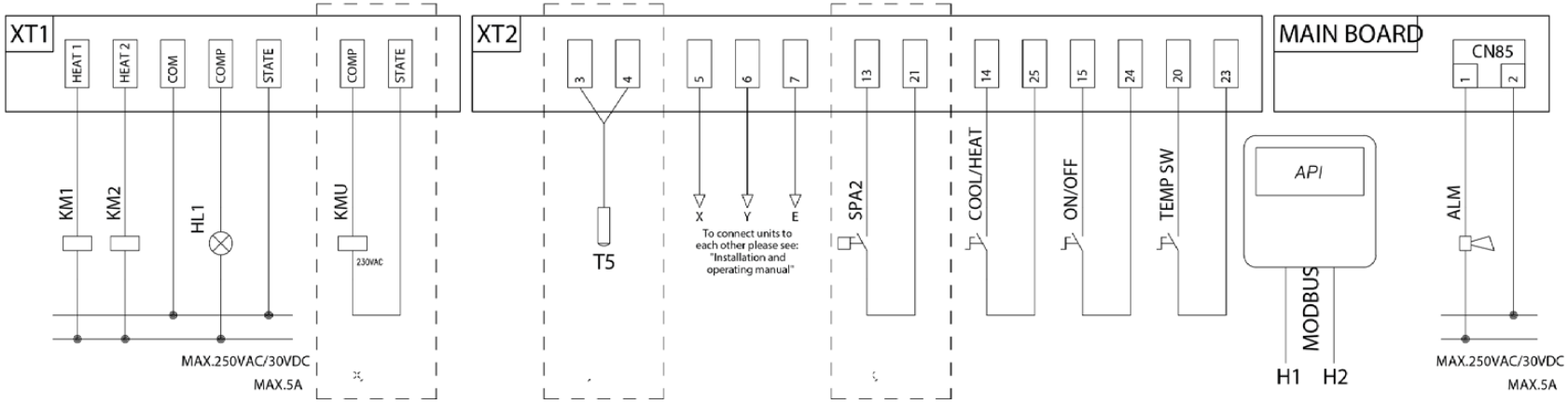
Option available for installation in residential, commercial and light industrial environments for conducted emissions (direct connection to the public grid).
The Belaria® fit (85) has an EMC filter built in, it allows the unit to be installed in residential, commercial or light industrial environments, and reduces electromagnetic interference.

| | | | |
|---|---|---|---|
| ALM | Segnalazione blocco cumulativo<br>Cumulative fault signal<br>Signalisation alarme<br>Sammelstörmeldung<br>Señalización bloqueo cumulativo | ON/OFF | Selettore ON/OFF remoto<br>Remote ON/OFF selector<br>Selector de ON/OFF remoto<br>Remote ON/OFF Wahlschalter<br>Selector de ON/OFF remoto |
| COOL/HEAT | Selettore remoto "estate/inverno"<br>Remote winter/summer selector<br>Sélecteur déporté "été/hiver"<br>Fernwahlschalter Winter/Sommer<br>Selector remoto "verano/invierno" | SPA2 | Pressostato controllo carico impianto<br>System charge control pressure switch<br>Selector de ON/OFF remoto<br>Remote ON/OFF Wahlschalter<br>Selector de ON/OFF remoto |
| HL1 | Lampada di segnalazione stato compressore<br>Compressor status signal lamp<br>Lampe de signalisation état compresseur<br>Signallampe Verdichterzustand<br>Lámpara de señalización estado compresor | TAF1 | Sensore antigelo su acqua lato ACS<br>Anti-freeze sensor on water on DHW side<br>Sonda anticongelante lado ACS<br>Frostschutzsensor auf der Warmwasserseite<br>Sonda anticongelante lado ACS |
| KA-H1 | Relè' di comando resistenza ausiliaria tubatura acqua<br>Control Relay for pipeline Auxiliary Heater<br>Relais de commande de chauffage auxiliaire de conduite d'eau<br>Steuerrelais für Zusatzheizung der Wasserleitung<br>Relé de control del calentador auxiliar de la tubería de agua | TEMP SW | Selettore remoto per cambio set-point<br>Remote selector for set-point change<br>Sélecteur à distance pour le changement de point de consigne<br>Fernwahlschalter für Sollwertänderung<br>Selector remoto para cambio de punto de ajuste |
| KA-H2 | Rele' di comando resistenza ausiliaria accumulo acqua sanitaria<br>Control relay for sanytary water storage tank auxiliary heater<br>Relais de contrôle de résistance auxiliaire pour stockage d'eau chaude sanitaire<br>Hilfswiderstandsregelrelais für die Warmwasserspeicherung<br>Relé de control de calefacción auxiliar para almacenamiento de agua caliente sanitaria | T5 | Sonda di temperatura accumulo acqua calda sanitaria<br>Domestic hot water storage temperature probe<br>Sonde de température de stockage d'eau chaude sanitaire<br>Brauchwasserspeicher-Temperaturfühler<br>Sonda de temperatura de almacenamiento de agua caliente sanitaria |
| KMU | Contattore di comando pompa a carico cliente<br>Pump control contactor provided by the costumer<br>Contacteur commande pompe à la charge du client<br>Kundeseitiger Schaltgeber Pumpensteuerung<br>Contactor de accionamiento bomba a cargo del cliente | | |




Collegamenti a cura del cliente
Connections performed by customer
Raccordements à la charge du client
Kundenseitige Anschlüsse
Conexiones a cargo del cliente



**Remote control of the unit**
(without PEND00017 Remote interface module for REMAUX auxiliary controls)

With S5_3 ON, the unit is controlled remotely.


Wired controller disabled.
ON/OFF state:
controlled by the On/Off input input
ON = unit ON
Heat/Cool mode:
controlled by the Heat/Cool input
On = heating, Off = Cooling
In the case of modular units (cascade), the remote control must be set to the master unit, which forwards it to the slaves. After setting S5_3, disconnect and reconnect the power supply to apply the change.

**Remote control of the unit**
(with PEND00017 Remote interface module for REMAUX auxiliary controls)
With S5_3 in OFF, for operation see the instructions of the accessory supplied separately.

**Alarm signal - ALARM**
The door is closed with alarmed unit.

**Functioning compressor signal - HL 1**
Connect the signal lamp as shown in the diagram.

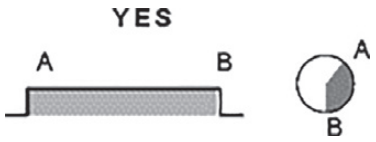
**External pump control - PUMP-N**
In case of a unit supplied with no circulation pump, control the external pump as shown in the diagram.
Use a contactor.

**Auxiliary heater control - KA-H2**
Control the auxiliary heater as shown in the diagram. Us a contactor.

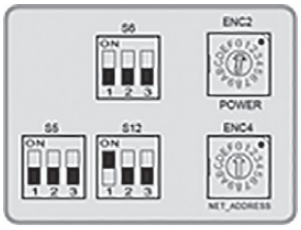
**Anti-freeze heater control - KA-H1**
Control the heater as shown in the diagram Use a contactor.

**Modbus**
Connect on the back of the controller.
Modular unit: connect the modbus to the Master unit port.

**ON-OFF**



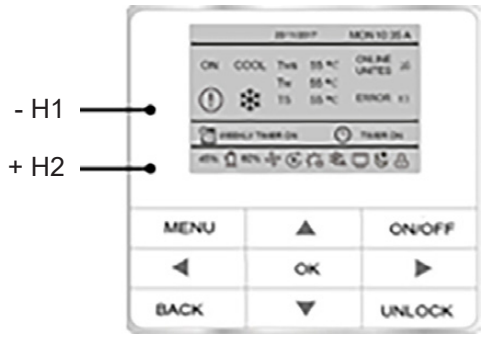





**S6-3**

ON = anti-snow function enabled
OFF = disable (factory setting)

**MODBUS**

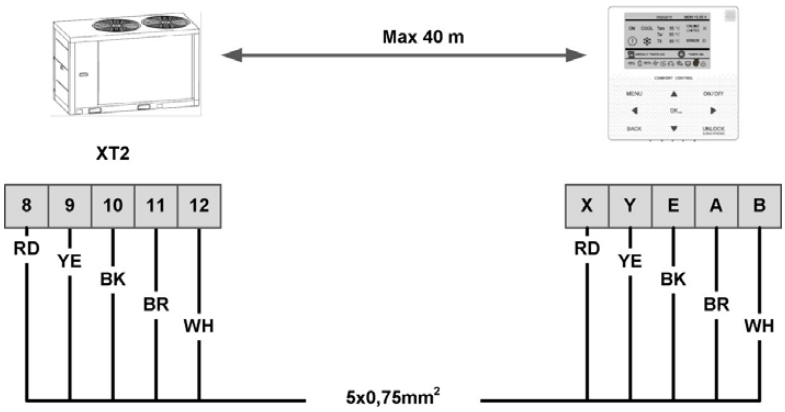
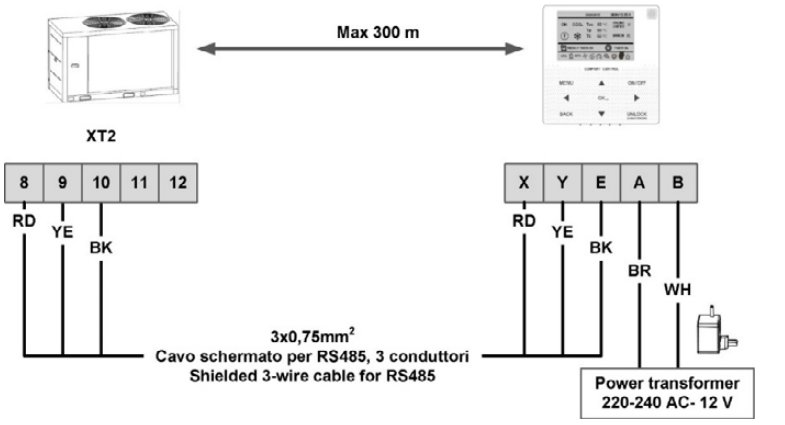


**TW Probe**
The sensor for checking the water temperature in the flow of the plant is installed on the flow line in the heat pump. If units have been configured in cascade, the TW sensor of the master unit must be installed at the greatest possible distance in the common flow of the plant.
Use the additional sensor holder in the control panel.
Do not remove the sensor from the terminals in the control panel. Only remove the sensor from the mounted sensor holder in the flow and place it in the common flow of the plant.

**Taf 1 Probe**
The frost protection sensor for domestic hot water is located in the control panel in a plastic bag with a 10 m cable.
To remotely control the Taf1 sensor, electrically disconnect the sensor in the control panel (only 3 meters long) and connect the sensor included in the bag with the Taf1 label to the same connector.

**T5 Probe**
The temperature sensor for switching the hot water system is located in the control panel in a plastic bag with a 10 m cable. Connect it to the free connection “T5” in the control panel.

**Installing the control module in a different location**
The control module is connected to the unit with a cable.
The control module can be installed in a remote location.

| | |
|---|---|
| **Maximum distance 40 m.**<br>**Power supplied by the unit.** |  |
| **Maximum distance 300 m.**<br>**Separate power supply Power supply provided with the unit.** |  |

**Domestic hot water**

Option.

Domestic hot water management is of priority compared to the system.

In DHW production mode, the compressors start only if the DHW storage temperature is above a minimum threshold (see chart).

The maximum variable flow temperature of the plant depends on the outdoor temperature.

To prevent it from falling below the minimum temperature, it is advisable to install a backup electric heater on the DHW storage.

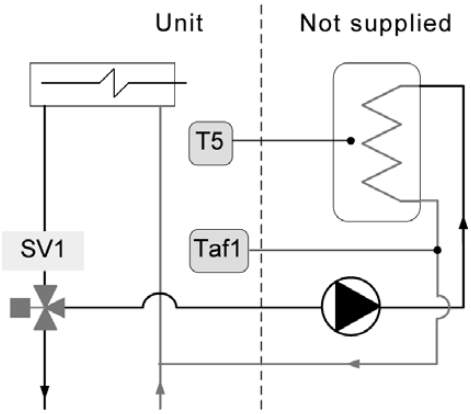
The following components are required:

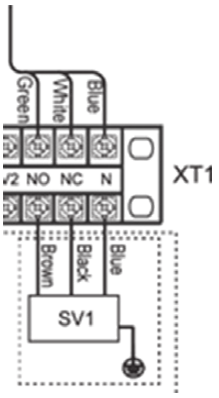
- 3-way valve SV1 (connection to XT1)
- temperature probe Taf1
  antifreeze protection for domestic hot water
- temperature probe T5
  regulation and switching between system and DHW production

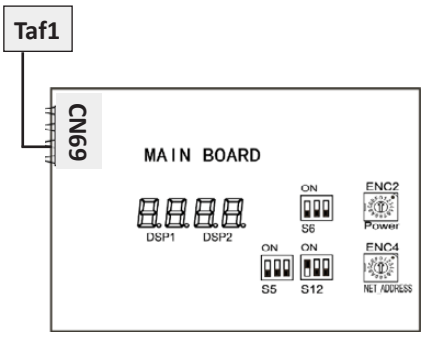
Operations sequence:

1. Disconnect the Taf1 sensor connected to the unit as standard (main board-CN69)
2. Connect the Taf1 sensor supplied as a spare part with the 10 m cable (main board-CN69)
3. After connecting the cable, attach the sensor to the domestic hot water pipe
4. Connect the T5 sensor electrically and insert the T5 sensor into the domestic hot water tank

**Domestic hot water management**




| T outdoor | T5 DHW storage tanks | Compressor | backup heater |
|---|---|---|---|
| 24 °C < t.o ≤ 30 °C | < 15 °C | OFF | ON |
| 24 °C < t.o ≤ 30 °C | ≥ 15 °C | ON | OFF |
| t.o > 30 °C | < 20 °C | OFF | ON |
| t.o > 30 °C | ≥ 20 °C | ON | OFF |

# 7. Commissioning

**General**

Commissioning may only be performed by Hoval service or a trained specialist authorised by Hoval.

The following persons are required at the start of commissioning:

Installation engineer/planner/electrician

The system operator must be present at the end of commissioning so that the operation and maintenance of the heat generator can be explained to him, as well as the safety instructions relating to the heat pump.

Upon request, the service centres performing the start-up. Agree upon in advance the start-up data with the service centre. For details, refer to the various chapters in the manual.

Before checking, please verify the following:

- the unit should be installed properly and in conformity with this manual
- the electrical power supply line should be sectioned at the beginning.
- The line sectionalizing device is open, locked and equipped with the suitable warning
- make sure no tension is present

**WARNING**

- After switching off the unit, wait at least 10 minutes before working on the control panel or other electrical components.
- Before touching, use a tester to check that there are no residual voltages.
- Do not power the unit with empty water side exchangers. The frost protection heaters could be damaged.

**Preliminary checks**
**Unit power supply OFF**

| | | Yes / No |
|---|---|---|
| 1 | safe access | |
| 2 | suitable frame to withstand unit weight + people weight | |
| 3 | functional clearances | |
| 4 | air flow: correct return and supply (no bypass, no stratification) | |
| 5 | condensation drain | |
| 6 | considered level to be reachable by snow | |
| 7 | considered main winds | |
| 8 | lack of chimneys/corrosive atmospheres/pollutants | |
| 9 | structure integrity | |
| 10 | fans run freely | |
| 11 | unit on vibration isolators | |
| 12 | unit levelled | |
| 13 | unit input water filter + shut-off valves for cleaning | |
| 14 | vibration dampeners on hydraulic connections | |
| 15 | expansion tank (recommended volume = 10% system content) | |
| 16 | minimum system water content | |
| 17 | clean system | |
| 18 | loaded system + possible glycol solution + corrosion inhibitor | |
| 19 | system under pressure + vented | |
| 20 | refrigerant circuit visual check | |
| 21 | earthing connection | |
| 22 | Electrical connections according to instructions | |
| 23 | connections performed by Customer: electrical connected, configuration | |
| 24 | Only modular units (cascade):<br>Bus connection, addressing of units, addressing of controller, sensor TW to master | |
| 25 | Temperature probe TW: installed, hydraulically connected | |

**Start-up sequence**
**Unit power supply ON**

| | | Yes / No |
|---|---|---|
| 1 | Oil sump heater in operation for at least 8 hours | |
| 2 | off-load voltage measure | |
| 3 | phase sequence check | |
| 4 | pump manual start-up and flow check | |
| 5 | refrigeration circuit shut-off valves opening (if applicable) | |
| 6 | unit ON | |
| 7 | load voltage measure | |
| 8 | if remote On-Off:<br>set dip-switch S5-3 on ON | |
| 9 | if units in modular configuration (cascade)<br>set dip-switch S12-2 on ON<br>set unit address via ENC4 | |
| 10 | Make sure that the refrigerant is free of bubbles by means of the sight glass (if present). | |
| 11 | check of all fan operating | |
| 12 | measure of return and supply water temperature | |
| 13 | super-heating and sub-cooling measure | |
| 14 | check no anomalous vibrations are present | |
| 15 | set-point personalization | |
| 16 | scheduling customisation | |
| 17 | complete and available unit documentation | |

**Cooling circuit**

1. Visually inspect the refrigerating circuit: the presence of oil stains can by a symptom of leakage (caused e.g. by transportation, handling or other).
2. Verify that the refrigerating circuit is in pressure: Using the unit manometers, if present, or service manometers.
3. Make sure that all the service outlets are closed with proper caps; if caps are not present a leak of refrigerant can be possible.
4. Open all of the refrigeration circuit shut-off valves (if applicable).

**Hydraulic circuit**

1. Before connecting the unit to the hydraulic system, make sure that the hydraulic system has been washed and that the water has been drained
2. Check that the hydraulic circuit has been filled and pressurized-
3. Check that the shut-off valves in the circuit are in the “OPEN” position.
4. Make sure that there is no air in the water circuit. If necessary, vent the water circuit via the existing air valves.
5. When using antifreeze solutions, make sure the glycol percentage is suitable for the type of use envisaged.

**NOTE**

- *Neglecting the washing will lead to several filter cleaning interventions and at worst cases can cause damages to the exchangers and the other parts.*

**Electric circuit**

Check if the unit is earthed.
Check the connections of the electrical cables:

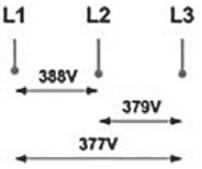
- Vibrations caused by handling and transport may cause loosening.

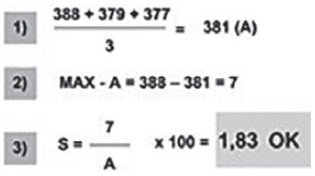
Connect the unit to the supply by closing the disconnector, but do not start the unit yet.
Check the network frequency and voltage values, which must be within the limits: 380-415 V 3N~ 50 Hz +/-6 %

Check and adjust the phase balance as necessary: it must be lower than 2 %
Example:
400 - 6 % = 376
400 + 6 % = 424

**NOTE**

- *Working outside of these limits can cause irreversible damages and voids the warranty.*



**Compressor oil sump heater**
Connect the compressor oil heating resistances at least 8 hours before the compressor is to be started:
- at the first unit start-up
- after each prolonged period of inactivity

1. Power the heaters: isolator switch on 1 / ON.
2. Check the heating elements are drawing electricity, to ensure proper function.
3. Start-up the compressor only if the crank-case temperature on the lower side is be higher than the outside temperature by at least 10 °C .
4. Do not start the compressor until the oil in the crank-case is at the correct temperature.

**Voltage**
Check that the air and water temperatures are within in the operating limits.
Start-up the unit.
While the unit is operative, i.e. in stable conditions nearing operating ones, check:
- Power supply voltage
- Total absorption of the unit
- Absorption of the single electric loads

**Remote controls**
Check that the remote controls (ON-OFF etc) are connected and, if necessary, enabled with the respective parameters as indicated in the “electrical connections” section.
Check that optional sensors or components are enabled with the appropriate parameters as specified in the “Electrical connection” section and following pages.

**Scroll compressors (only Belaria® fit (85))**
The scroll compressors have only one sense of rotation. Reversing the sense of rotation will not damage the compressor, but it will increase the noise and affect the capacity.
After a few minutes, the compressor shuts down due to the thermal protection trip.
In this case, disconnect the power supply and invert 2 phases on the machine power supply.

**NOTE**

- *Avoid prolonged running times of the compressor in the reverse sense of rotation. Several starts with the wrong sense of rotation can damage the compressor.*

To ensure the rotation direction is correct, measure the condensation and suction pressure.
The pressures must differ significantly: upon start-up, the suction pressure decreases while the condensation one increases.

**Start-up report**
To detect the objective operational conditions is useful to control the unit over time.
With unit at steady state, i.e. in stable and close-to-work conditions, identify the following data:
- total voltages and absorptions with unit at full load
- absorptions of the different electric loads (compressors, fans, pumps etc)
- Temperatures and flow rates of the various liquids (water, air) both at the inlet and outlet of the unit
- Temperatures and pressures at characteristic points of the refrigeration circuit (discharge side of the compressor, liquid, suction side)

The detections must be kept and made available during maintenance interventions.

**Directive 2014/68EU PED**
Directive 2014/68EU PED also sets out the regulations for unit installers, users and maintenance operators.
Refer to local regulations; briefly and as an example, see the following:
Compulsory verification of the first installation:
- only for units assembled on the installer’s building site (for ex. condensing circuit + direct expansion unit)

Commissioning declaration:
- for all units

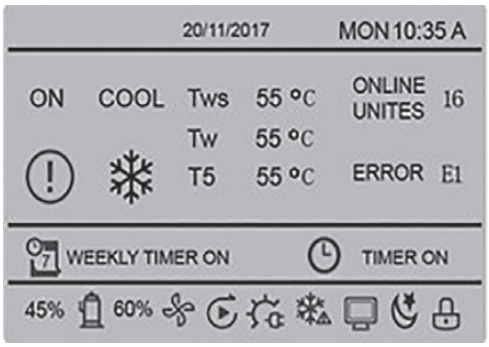
Periodical checks:
- to be executed with the frequency indicated by the Manufacturer (see the “maintenance inspections” paragraph)

# 8. Control


| | |
|---|---|
| **UNLOCK (RELEASE)** | Press for 3 sec. to unlock. |
| ▲ ▼ | To modify current setpoint |
| MENU | To open the various menus from the HOME screen. |
| ▲ ▼ ◀ ▶ | To move the cursor, change the selection or change the set value. The parameter can be quickly changed with a long press. |
| **OK** | To confirm an operation. |
| **ON/OFF** | To switch the heat pump on or off |
| **BACK** | To return to the previous level.<br>Press to exit the current page and return to the previous page. Long press to return straight to the home screen. |

**Unit in modular configuration (cascade)**

On the slave controllers, only the password-protected SERVICE menu can be opened.




| | |
|---|---|
| | Mode : indicate respectively heating, cooling, domestic hot water |
| OFF | Heat pump switched off |
| | Weekly timer active |
| 45% | Compressor output |
| | Compressor in operation |
| 60% | Fan power |
| | Fan in operation |
| | Pump in operation |
| | Auxiliary electric heater in operation. |
| | Manual antifreeze or defrosting in operation |
| | Remote control: the unit is set from the keypad to be controlled by a remote terminal or by a remote switch |
| | Silent mode. |
| | Key lock |
| | Timer on |
| | Alarm: The display lights up when a fault occurs or a protective device is active |

**Unit in modular configuration (cascade)**

The information displayed on all controllers refers to the master unit.

**MODE**
- **HEAT**
- **COOL**
- **DHW**

**USER MENU**
- **QUERY**
  - STATE QUERY
  - TEMP QUERY
  - HISTORY ERRORS QUERY
- **TIMER**
  - DAILY TIMER
  - WEEKLY SCHEDULE
- **GENERAL SETTING**
- **DOUBLE SETPOINT**
- **SNOW-BLOWING SWITCH**
- **SILENT SWITCH**
- **DHW SWITCH**

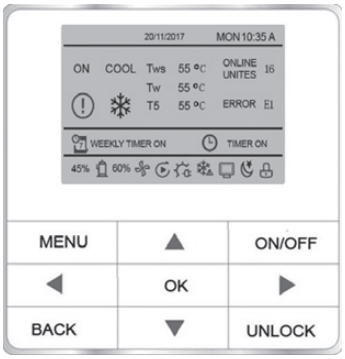
**SERVICE MENU***
- **STATE QUERY**
- **CLEAR HISTORY ERRORS**
  - CLEAR UNIT HISTORY ERRORS
  - CLEAR ALL HISTORY ERRORS
  - CLEAR LOCK ERROR
  - CLEAR RUN TIME
- **SETTING ADRESS**
- **HEAT CONTROL**
  - HEAT 1
  - HEAT 2
  - FORCED HEAT2 OPEN
- **TEMPERATURE COMPENSATION**
- **PUMP CONTROL**
  - FORCED PUMP OPEN
  - INV PUMP SETTING
  - PUMP ON/OFF TIME
- **MANUAL DEFROST**
- **LOW OUTLETWATER CONTROL**
- **VACUUM SWITCH**
- **ENERGY SAVING SWITCH**
- **DHW ENABLE**
- **FACTORY DATA RESET**

**PROJECT MENU***
- **SET UNIT AIRCONDITIONING**
- **SET PARALLEL UNIT**
- **SET DHW TIME** (Only if DIP switch 12-2 is ON)
- **INV PUMP RATIO**
- **CHECK PARTS**

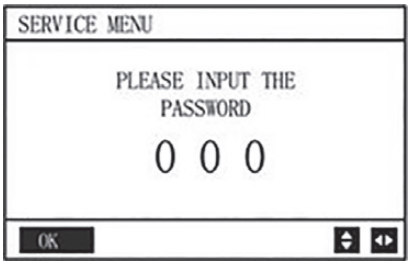
* Access via password entry is reserved for specialist personnel. Changes to the parameters can lead to malfunctions in operation.

**Unlock/lock**
To lockout the screen, press UNLOCK for 3 sec.

**Switch-on/off**
Press ON/OFF to switch-on/off



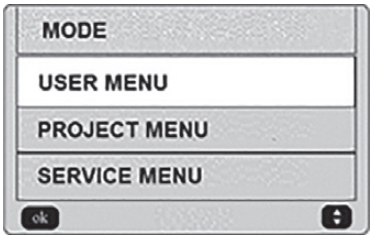

**Unit in modular configuration (cascade)**
On the slave controllers, only the password-protected SERVICE menu can be opened.

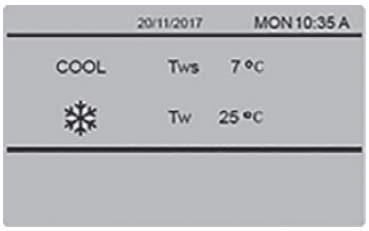


**Set MODE and TEMPERATURE**
Press MENU
Press ▲ or ▼ to select MODE Press OK
Press ◄ or ► to select the mode or the temperature
Press ▲ or ▼ to adjust the mode and temperature.
Press OK to confirm.

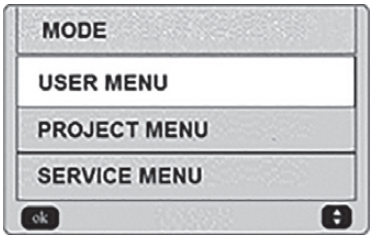
If no operations are performed for more than 60 seconds, the system automatically saves the settings and returns to the home page.

**Note**
**During cooling with T ext < 15 °C, the setpoint is forced to 10 °C (ref. Functioning limits)**

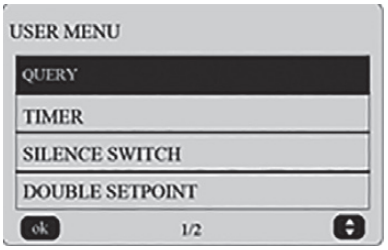


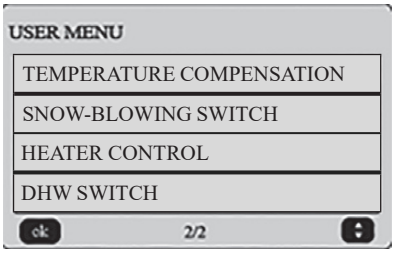




**DOMESTIC HOT WATER**
Domestic hot water if available and activated:
Press MENU
Press ▲ or ▼ to select MODE
Press OK
Press ◄ or ► to select the DHW mode
Press On-Off
Press OK to confirm.

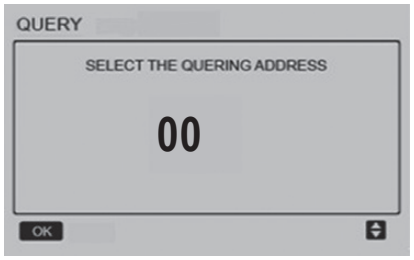


**USER MENU**
Press MENU

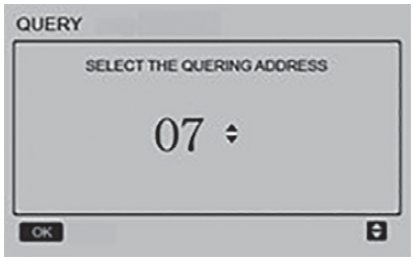


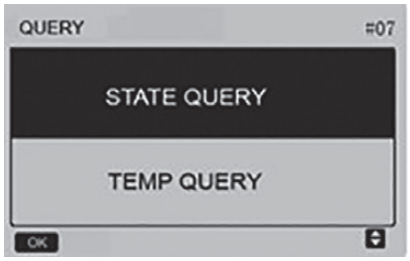

**USER MENU - QUERY**

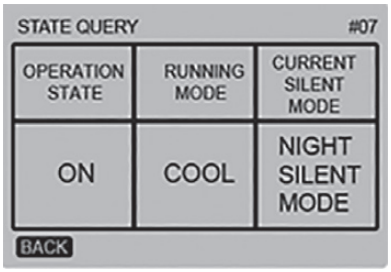



**Only if multiple units are connected to the network**
To display data for the units in the network:
Press MENU
Press ▲ or ▼ to select QUERY
Press ◄ or ► to select the unit's address
Press OK

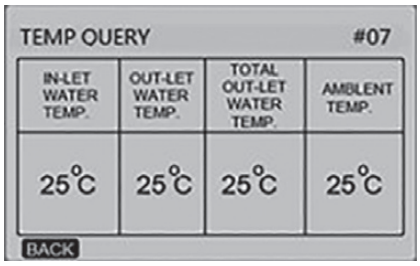



If STATE QUERY is selected:
the address of the unit is displayed in the top right corner (only for units in modular configuration (cascade)).

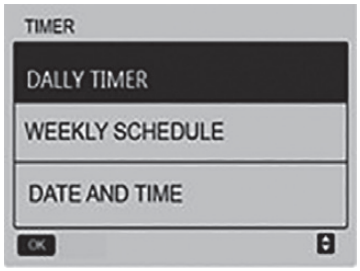



If TEMP QUERY is selected:

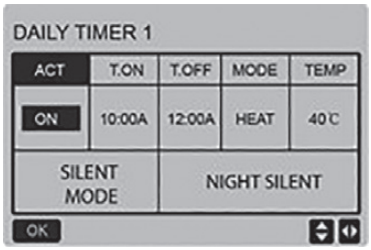


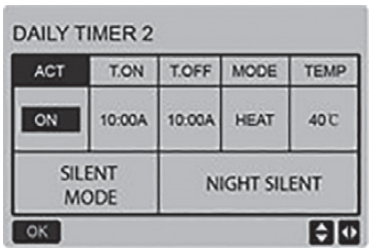
**USER MENU - TIMER**
Press MENU Press TIMER
Select one of the 3 categories proposed
If " DAILY TIMER" is selected, the "WEEKLY SHEDULE" cannot be activated and vice versa.
If the unit is controlled via a remote On-Off or Modbus, DAILY and WEEKLY timers are disabled.



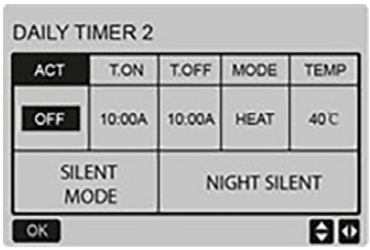

**TIMER menu - DAILY TIMER**
Press ▲ or ▼ to select timer 1 or timer 2
Press ON/OFF when the cursor is over the word ACT
Press ◀ or ▶ to select the starting time, the end time and the mode
Press ▲ or ▼ to select the time, mode, temperature, silent mode
Press ◀ or ▶ to set the silent, standard, night silent or super silent modes

Press OK to confirm
The "Timer on" symbol appears on the main screen

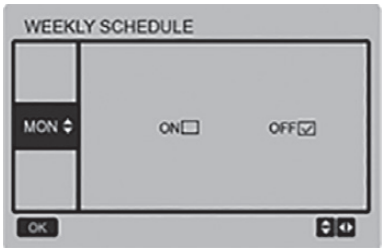


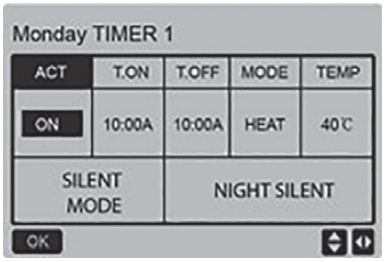

If two time ranges overlap by mistake, the last one in the list is activated (see figure OFF).

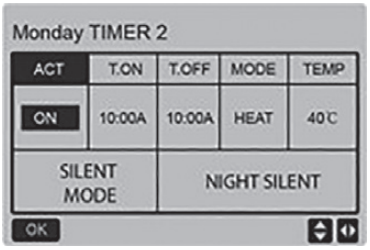


**TIMER menu - WEEKLY TIMER**
Select WEEKLY SCHEDULE
Press ▲ or ▼ to select the day
Set ON or OFF
Press OK to confirm



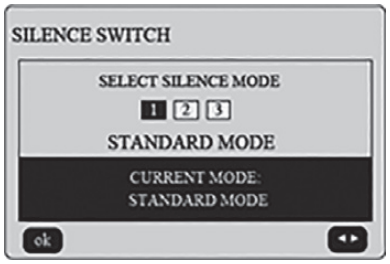

Press ◄ or ► to select timer 1 or timer 2
Press ON/OFF when the cursor is over the word ACT
Press ◄ or ► to select the starting time, the end time and the mode
Press ▲ or ▼ to select the time, mode, temperature, silent mode
Press ◄ or ► to set the silent, standard, night silent or super silent modes
Press OK to confirm
The “ Weekly timer on” symbol appears on the main screen




**TIMER menu - DATE and TIME**
Select DATE AND TIME
Select DATE to change the date
Select TIME to change the time

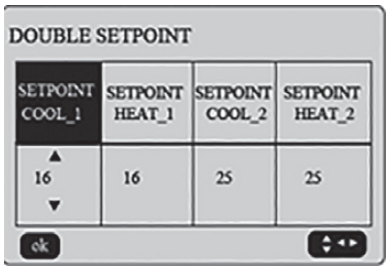
**USER menu - SILENT MODE SWITCH**
Press ◄ or ► to select the mode:
Standard, Silent, Supersilent
Press OK to save the settings.



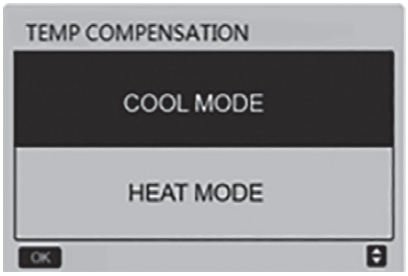

**USER menu - DOUBLE SETPOINT**
Press ◄ or ► to ENABLE or DISABLE .


**Enable the double setpoint**
Press ◄ or ► to select the setpoint mode
Press ▲ or ▼ to adjust the parameters

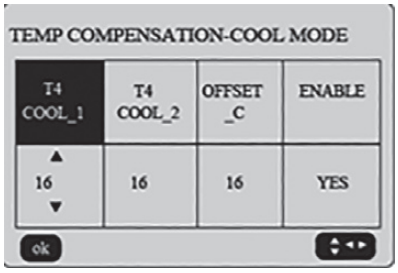
The 2nd setpoint is activated only if the “ temp-switch” input on the terminal block XT 2 is closed



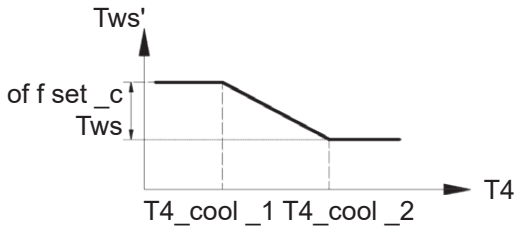
**SERVICE - TEMPERATURE COMPENSATION**
Press ▲ or ▼ to select:
COOL MODE
HEAT MODE



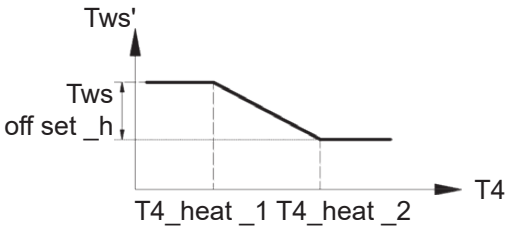

The water temperature is adjusted based on the outdoor temperature T4.



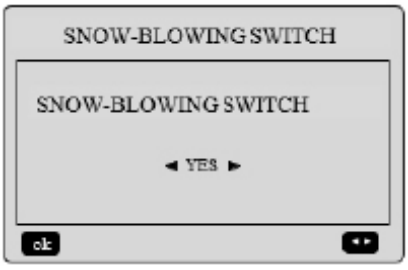

**COOLING**
The following parameters can be adjusted:
- T4_cool_1 (15~30 ºC)
- T4_cool_2 (35~45 ºC)
- offset_c (0~15 ºC)

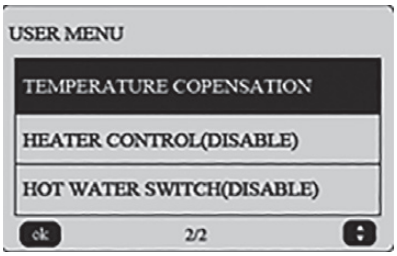
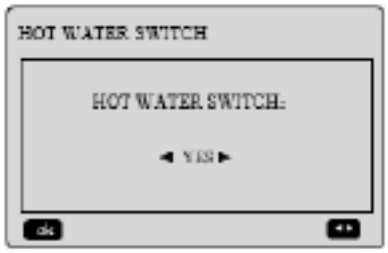
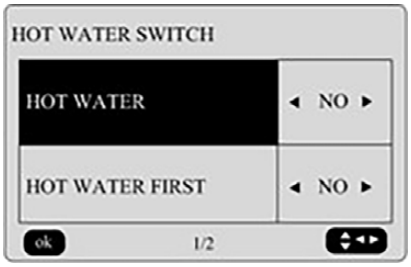
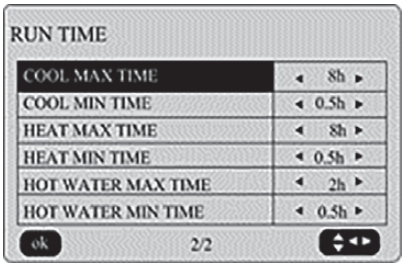


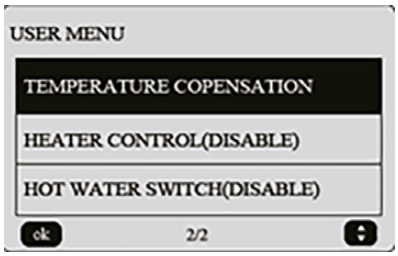
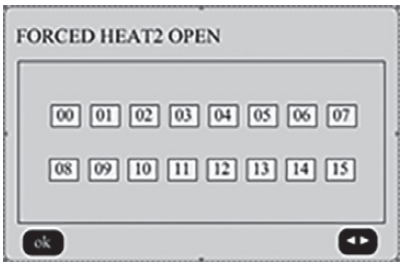

**HEATING**
The following parameters can be adjusted:
- T4_heat_1 (-10~10 ºC)
- T4_heat_2 (15~30 ºC)
- offset_h (0~30 ºC)




**menu USER - SNOW- BLOWING SWITCH**
If enabled, the function activates the fans in order to avoid the accumulation of snow.
The fans start for 2 minutes every 30 minutes. With T air < 3 °C and unit stopped.

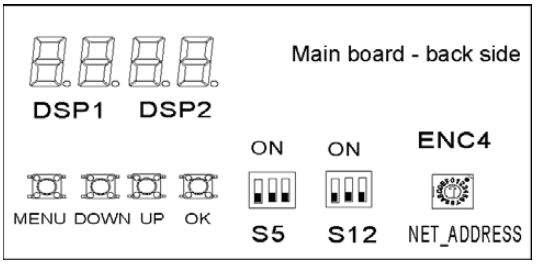


| | |
|---|---|
| **USER MENU - DOMESTIC HOT WATER**<br>Select HOT WATER |  |
| **single unit** |  |
| **Unit in modular configuration (cascade)**<br>select address |  |
| enable domestic hot water, if applicable<br>activate priority of domestic hot water, if applicable |  |
| minimum and maximum operating times of the unit once it has entered the corresponding mode |  |

| | |
|---|---|
| **USER MENU - AUXILIARY HEATER**<br>domestic hot water storage ( wiring diagram: KA -H2)<br>select heater control |  |
| |  |
| single unit |  |
| Unit in modular configuration (cascade)<br>select address |  |

# 9. Troubleshooting

**STATUSES DISPLAY**
If the keyboard is remote, it is possible to read the unit statuses also from the display on the main board.
Press UP on the main board.




| | |
|---|---|
| | Standby: unit address (88 to the left) + online number (88 to the right)<br>On: frequency<br>defrosting: dFdF |
| 0.xx | unit address |
| 1.xx | High pressure |
| 2.xx | number of units |
| 3.xx | T4 correction |
| 4.xx | Mode (8: Off; 0: Standby; 1: Cooling; 2: Heating) |
| 5.xx | fan speed 1 |
| 6.xx | fan speed 2 |
| 7.xx | T3: Evaporator temperature |
| 8.xx | T4: outside temperature |
| 9.xx | T5: DHW temperature: |
| 10.xx | Outlet temperature heat exchanger, frost protection DHW line – Taf1 |
| 11.xx | Taf2: Outlet temperature heat exchanger, freezing protection |
| 12.xx | Tw: Water temperature common outlet, after last unit |
| t.xx | Twi Inlet temperature heating water |
| 14.xx | Two Outlet temperature heating water |
| 15.xx | Tz Outlet temperature heating water |
| 16.xx | THeatR recovery |
| 17.xx | supply 1 |
| 18.xx | supply 2 |
| 19.xx | Temperature 1 of the evaporator fins |
| 20.xx | Temperature 2 of the evaporator fins |
| 21.xx | saturated drain temperature (+25) |
| 22.xx | Compressor current A |
| 23.xx | Compressor current B |
| 24.xx | Pump current |
| 25.xx | Opening the electronic expansion valve A (/20) |

| | |
|---|---|
| 26.xx | Opening the electronic expansion valve B (/20) |
| 27.xx | Opening the electronic expansion valve C (/4) |
| 28.xx | High pressure |
| L.xx | Low pressure |
| 30.xx | overheating |
| 31.xx | intake temperature |
| 32.xx | silent |
| 33.xx | static pressure |
| 34.xx | DC voltage A (reserved) |
| 35.xx | DC voltage B (reserved) |
| 36.xx | frequency limit<br>0 = None; 1 = T4;<br>2 = pressure;<br>3 = drain;<br>4 = low pressure ratio;<br>5 = Real-time;<br>6 = Current frequency;<br>7 = voltage;<br>8 = Adjustment of energy requirement of pressure ratio;<br>9 = low pressure in cooling |
| 37.xx | defrosting status (1st digit: T4 selection solution; 2nd digit: at intervals ; 3rd and 4th digit defrosting on timer) |
| 38.xx | EPROM error: 1: Error; 0: No error |
| 39.xx | defrosting |
| 40.xx | initial frequency |
| 41.xx | Tc: Saturation temperature corresponding to high pressure in heating mode |
| 42.xx | Te: Saturation temperature corresponding to low pressure in cooling mode |
| 43.xx | T6a: exchanger inlet temperature |
| 44.xx | T6b: exchanger outlet temperature |
| 45.xx | software version |
| 46.xx | last error |
| 47.xx | ---- |

Alarm reset: turn the unit off and on again.

**NOTE**

- *Before resetting an alarm, identify and remove the cause generating that.*
- *Repeated resets can cause irreversible damage.*

**Master unit**

If the Master unit's power supply is disconnected, all of the group's units stop.
The unit is in protection in the following conditions:

- High pressure or outlet temperature protection
- low voltage
- compressor current protection
- Frequency protection of the compressor
- High condenser temperature
- High temperature difference between flow and return
- Frost protection
- Malfunction of the outlet temperature sensor
- Low evaporator temperature
- frequency protection by voltage
- compressor inverter malfunction
- fan motor protection
- water return high temperature, in cooling
- Low pressure with frost protection
- high temperature of inverter compressor module

When the unit fails or is in protection, the water pump continues working (except for water flow alarm, voltage protection, phase sequence protection).
When the master unit is in protection, only the master unit stops and the other units carry on working.
When a slave unit is in protection, this unit stops and the other units are not involved.
If the master unit fails, the slave units also stop working.

**Temperature sensors**

All temperature sensors are classed as faulty when the voltage on the corresponding input is lower than 0.05 V or higher than 4.95 V.
After an error has been signalled, all units stop. The error is cleared after the sensor is replaced.

| Error code | Description |
|---|---|
| 1E0 | EEPROM error - main board |
| 2E0 | EEPROM error - inverter A module |
| 3E0 | EEPROM error - inverter B module |
| E1 | phases sequence - control from main board |
| E2 | communication error between main board and keypad |
| E3 | “Total” outlet water temperature probe Tw fault (only for master unit) |
| E4 | outlet water temperature probe Two fault |
| 1E5 | condenser temperature probe T3A fault |
| 2E5 | condenser temperature probe T3B fault |
| E6 | storage temperature probe T5 fault |
| E7 | room temperature probe T4 fault |
| E8 | phases sequence |
| E9 | no flow (manual reset) Ddained system |
| 1Eb | antifreeze probe Taf1 fault |
| 2Eb | antifreeze probe Taf2 fault |
| EC | Slave unit module reduction |
| 1Ed | Sensor outlet temperature compressor A |
| 2Ed | Sensor outlet temperature compressor B |
| 1EE | refrigerant temperature probe T6A |
| 2EE | refrigerant temperature probe T6B |
| EF | return water temperature probe |
| EH | autotest error |
| EP | Outlet temperature sensor |
| EU | condenser total temperature probe Tz |
| P0 | High pressure/high temperature at outlet |
| P1 | low pressure |
| P2 | High temperature outlet condenser total Tz |
| P4 | compressor A in protection |
| P6 | module error |
| P7 | condenser high temperature |
| P8 | Reserved |

| | |
|---|---|
| P9 | Inlet / outlet water temperature difference |
| PA | Reserved |
| Pb | winter antifreeze |
| PC | evaporator low pressure in cooling |
| PE | antifreeze protection evaporator low temperature in cooling |
| PF | circuit board lock - controller lock/unlock error |
| pH | high room temperature probe T4 |
| PL | Inverter module excess temperature |
| 1PP | IPM module error, circuit A |
| 2PP | IPM module error, circuit B |
| 1PU | fan A module |
| 2PU | fan B module |
| 3PU | fan C module |
| 1H9 | compressor driver A - configuration error |
| 2H9 | compressor driver B - configuration error |
| H5 | High / low voltage |
| 1HE | valve A error |
| 2HE | valve B error |
| 3HE | valve C error |
| 1F0 | IPM module transmission error |
| 2F0 | IPM module transmission error |
| F2 | insufficient overheating |
| 1F3 | Fan A transmission error |
| 2F3 | Fan B transmission error |
| 3F3 | Fan C transmission error |
| 1F4 | protection L0 or L1 intervention 3 times in 60 minutes |
| 2F4 | protection L0 or L1 intervention 3 times in 60 minutes |
| 1F6 | circuit A bus voltage (PTC) |
| 2F6 | circuit B bus voltage (PTC) |
| F7 | Reserved |
| 1F9 | radiator temperature sensor Tfin1 |

| | |
|---|---|
| 2F9 | radiator temperature sensor Tfin2 |
| 1FA | Reserved |
| 2FA | Reserved |
| Fb | pressure sensor |
| Fd | return air temperature sensor |
| FE | recovery temperature sensor |
| 1FF | fan A |
| 2FF | fan B |
| 3FF | fan C |
| FP | Configuration error DIP switch for modular unit (cascade) |
| C7 | Error PL occurred 3 x in 100 minutes, manual restart needed |
| L0 | module protection |
| L1 | low voltage |
| L2 | high voltage |
| L4 | MCE error |
| L5 | speed 0 |
| L7 | no phase |
| L8 | variation of frequency higher than 15Hz |
| L9 | difference of phase frequency higher than 15Hz |
| d0 | Gate error (d0 and address alternatively displayed every 10 sec) |
| dF | defrosting |

# 10. Safety instructions - R32

**Area checks**
Before working on systems containing flammable refrigerants, perform safety checks to reduce the risk of combustion to the minimum. Before performing
any reparation operations on the cooling system, comply with the following warnings.

**Work procedures**
Operations must be performed following a controlled procedure so as to reduce the risk of flammable gases or vapours developing.

**General work area**
All the personnel in charge with maintenance
operations and other operators working in the local area must be instructed and monitored as regards the nature of the intervention.
Avoid working in tight spaces. The area surrounding the working space must be cordoned off. Make sure the area is secured by monitoring the flammable material.

**Checking for the presence of refrigerant**
Both before and during operations, the area must be monitored with a dedicated refrigerant detector to make sure the technician is aware of the presence of potentially-flammable environments.
Make sure the leak detection equipment is suitable for use with flammable refrigerants and therefore without sparks, suitably sealed or intrinsically safe.

**Presence of the f ire extinguisher**
If hot interventions are not performed on cooling equipment or connected components, suitable fire fighting equipment must be kept at hand.
Keep a dry-powder or $CO_2$ extinguisher near the loading area.

**No ignition source**
It is absolutely forbidden to use ignition sources that may lead to fire or explosion during operations on the cooling system or on pipes that contain or have contained flammable refrigerant.
All possible ignition sources, including cigarettes, must be kept sufficiently away from the installation, reparation, removal and disposal site as flammable refrigerant may be released in the surrounding area.
Before starting operations, the area surrounding the equipment must be inspected to guarantee the
absence of flammables or combustion risks. “SMOKING IS FORBIDDEN” signs must be affixed.

**Ventilated area**
Before intervening on the system or performing any hot intervention, make sure to be in an outdoor or suitably ventilated area.
Ventilation must be maintained during operations.
Ventilation must disperse the released refrigerant safely, preferably outdoors in the atmosphere.

**Cooling equipment checks**
Should a replacement be necessary, the new components installed must be suitable for the
purpose envisaged and compliant with specifications.
Always follow the manufacturer guidelines on maintenance and assistance. In case of doubt, contact the manufacturer technical office for assistance.
The following checks must be preformed on systems containing flammable refrigerants:
- the quantity of the charge must comply with the size of the room where the parts containing refrigerant are installed;
- the machine and ventilation intake function correctly and are not obstructed;
- If an indirect cooling circuit is used, the secondary circuits must be checked to verify the presence of refrigerants; the marking on the equipment remains visible and readable;
- Make sure markings and symbols are always readable; cooling pipes or components must be
- installed in a position that makes improbable their exposure to substances that may corrode the components containing refrigerant, unless they are manufactured with material intrinsically resistant to corrosion or suitably protected against corrosion.

**Electrical device checks**
The reparation and maintenance of electric components must include initial safety checks and component inspection procedures.
In case of a fault that compromises safety, do not perform any electrical connection to the circuit until said fault is suitably resolved.
If it is not possible to repair the fault immediately and electrical components need to remain functioning, a temporary solution must be adopted. This must be reported to the owner of the equipment so as to keep all parties informed.
Initial safety checks must include:
- that condensers are emptied. This operation must be performed safely to avoid any sparks:
- that electrical components and wiring are not exposed during the charging, recovering or venting phases;
- That the earth conductor is continuous.

**Repairing sealed components**

- During the reparation operations of sealed components, disconnect all the equipment before removing sealed casings etc. If, during operations, it is absolutely necessary for the equipment to remain connected, a leak detection device must be placed in the most critical point so as to report any potentially-dangerous situation.
- Pay particular attention to what follows to guarantee that, while intervening on electrical components, the housing is not altered in a way so as to affect the level of protection. This includes damage to cables, an excessive number of connections, terminals not compliance with the original specifications, damage to gaskets, an unsuitable installation of gaskets, etc.
- Make sure the device is installed safely.
- Check that the seals or sealing materials are not altered in such a way that they no longer the impede the entry of flammable environments. Spare parts must comply with manufacturer specifications.

**NOTE:**

- *Using silicone sealants may inhibit the effectiveness of a few types of leak detection equipment. It is not necessary to isolate intrinsically safe components before performing operations on them.*

**Reparation of intrinsically safe components**

Do not apply permanent inductive or capacitive loads to the circuit without making sure that they do not exceed the admissible voltage and current allowed for equipment in use.

Intrinsically safe components are the only component type on which operations can be performed in a flammable atmosphere. The testing device must show a correct value. Replace components only with the parts specified by the manufacturer.

Following a leak, other parts could lead to the combustion of the refrigerant in the atmosphere.

**Wires**

Make sure wires are not subjected to wear, corrosion, excessive pressure or vibration, that there are no sharp edges and that they do not produce other negative effects on the environment. The inspection must also keep into consideration the effects of tine or the continuous vibration caused e.g. by compressors or fans.

**Detection of flammable refrigerants**

When searching for refrigerant leaks or if one is detected, never use potential ignition sources (e.g. halogen search lamp or other implement with an open flame).

**Leak detection methods**

The following leak detection methods are considered acceptable for systems containing flammable refrigerants.

Electric leak detectors must always be used to identify flammable refrigerants, although they do not present a suitable sensitivity level or require recalibration (detection equipment must be calibrated in an area free from refrigerants).

Check that the detector is not a possible source of ignition and that it is suitable for the refrigerant. Leak detection equipment must always be set to an LFL percentage and calibrated depending on the refrigerant used, so the correct gas percentage (25 % max) must be verified.

Leak detection fluids are suitable for most refrigerants, although using detergents containing chlorine should be avoided as this substance may react with the refrigerant and corrode copper pipes.

If a leak is suspected, all open flames must be removed or switched off.

If a refrigerant leak is detected that requires brazing, all refrigerant must be extracted from the system. Oxygen-Free-Nitrogen (OFN) is then purged through the system both before and during the brazing procedure.

**Removal and evacuation**

When intervening on the cooling circuit to perform repair work or any other type of work, always follow the normal procedure. However, considering the risk of flammability, we recommend following the best practices. Comply with the following procedure:

- Extract the refrigerant;
- purge the circuit with inert gas;
- evacuate;
- Purge again with inert gas;
- Interrupt the circuit with interruption or brazing.

The refrigerant charge must be directed to the correct recycling bottles. To make the unit safe, flushing with Oxygen-free -Nitrogen must be performed. This procedure may have to be repeated multiple times. Do not use compressed air or oxygen for this operation.

For flushing, break the vacuum in the system with oxygen-free nitrogen and continue filling until the operating pressure is reached. Then release into the atmosphere and re-establish the vacuum. This process must be repeated until there is no trace of refrigerant in the system.

When using the final OFN charge, the system must be vented to the atmospheric pressure to allow the intervention. This step is essential to perform brazing operations on the pipes.

Make sure that the vacuum pump intake is not near ignition sources and that there is suitable ventilation.

**Charging operations**

In addition to conventional charging operations, the following requirements must be complied with:

- When using charging equipment, make sure that the various refrigerants are not contaminated. Flexible tubes or conduits must be as short as possible to reduce to the minimum the quantity of refrigerant contained.
- Bottles must be positioned upright.
- Before loading the system with refrigerant, check that the cooling system is earthed.

- Label the system when fully charged (unless already labelled).
- Make sure not to fill the cooling system excessively.
- Before recharging the system, the pressure must be tested with OFN. A leak test must be performed after the charging operations but before commissioning. Before leaving the site, perform an additional leak test.

**Dismantling**

Before performing this procedure, it is essential that the technician has become familiar with the equipment and the relative details.

It is generally recommended that all refrigerants be extracted in a safe manner.

Before performing the operation, take a sample of oil and refrigerant should an analysis be necessary before reusing the regenerated refrigerant. Before performing the operation, check the availability of electricity.

- Become familiar with the equipment and how it functions.
- Electrically isolate the system.

Before attempting the procedure, check that:

- The mechanical manipulation equipment is available, if necessary, to handle refrigerant tanks;
- All the personal protection equipment is available and employed correctly;
- The recovery procedure is monitored at all times by skilled personnel;
- The equipment for recovery and recycling bottles meet the relevant standards.
- If possible, pump the cooling system.
- If it is not possible to obtain a vacuum, make sure that a collector removes the refrigerant from various parts of the system.
- Before recovery, make sure that the recycling bottle is on the scale.
- Start up the recovery machine and use it following the instructions by the manufacturer.
- Do not overfill the recycling bottles. (Not more than 80% by volume of liquid filling.)
- Do not exceed the maximum operating pressure of the recycling bottles – even temporarily.
- After the recycling bottles have been filled correctly and the operation has been completed, ensure that the recycling bottles and equipment are removed from the place of use immediately, and that all shut-off valves on the equipment are closed.
- The extracted refrigerant is only allowed to be filled into another refrigeration system if it has been cleaned and checked.

**Labelling**

Equipment must be labelled reporting the dismantling and emptying of the refrigerant.

Labels must be dated and signed.

Make sure all the equipment is labelled and reporting the presence of flammable refrigerant.

**Recovery**

When removing the refrigerant from the system, please adopt good practices to remove all refrigerants safely in case of both assistance or decommissioning operations.

When extracting refrigerant in bottles, make sure to use only suitable recycling bottles.

Ensure that the correct number of bottles for the total filling quantity is available in the system.

All recycling bottles to be used are designed for the recovered refrigerant and are labelled accordingly (i.e. as special recycling bottles for the extraction of refrigerant).

The bottles must be equipped with a safety valve and associated shut-off valves in proper condition.

Empty recycling bottles must be evacuated and, if possible, cooled prior to recovery.

Recovery equipment must be perfectly functioning with the respective instruction booklets at hand and they must be suitable to recover flammable refrigerants. A series of perfectly-functioning calibrates scales must also be available.

- Flexible tubes must be equipped with leak-proof disconnection fittings in good condition. Before using the recovery machine, make sure it is in good condition, maintained and that all associated electrical components are sealed to avoid combustion in case of a refrigerant leak

Please contact the manufacturer in case of doubt.

The recovered refrigerant must be returned to the refrigerant supplier in proper recycling bottles and associated proof of disposal.

Never mix different refrigerants in the recovery equipment and especially in the recycling bottles. If it is necessary to remove compressors or compressor oils, make sure they are evacuated to an acceptable level to make sure no trace is left of the flammable refrigerant inside the lubricant. The evacuation process must be performed before taking the compressors back to the suppliers.

The electric resistance must be used with the compressor body only to accelerate this process.

Operations to discharge the oil from the system must be performed in full safety.

**Transport, mark and storage**

1. Transport of equipment containing flammable refrigerants. Compliance with transport regulations
2. Marking of equipment with symbols. Compliance with local regulations.
3. Disposal of equipment employing flammable refrigerants. Compliance with national regulations.
4. Storage of equipment/devices. The equipment must be stored in compliance with the instructions provided by the manufacturer.
5. Storing packed (unsold) equipment. The protective function of the packaging must be such that in the event of mechanical damage to the equipment contained in the packaging, the refrigerant charge cannot escape. The maximum number of elements that can be stored together is determined by local regulations.

# 11. Maintenance

**Safety**

Operate in compliance with safety regulations in force. To carry out the operations use protection devices:
gloves, goggles, helmet, headphones, protective knee pads.
All work must be carried out by personnel who have been instructed in the possible dangers of a general or electrical nature, as well as in working on pressurised equipment.
Only qualified personnel can operate on the unit, as required by the regulation in force.

**General**

Maintenance must be performed by authorized centres or by qualified personnel.
The maintenance allows to:

- to maintain the efficiency of the unit
- reduce the deterioration speed all the equipment is subject to over time
- collect information and data to understand the status of the units and prevent possible failures

**WARNING**

Before checking, please verify the following:

- The power supply for the unit has been interrupted.
- The disconnector of the power supply is open and blocked, and the appropriate information sign is attached to it.
- make sure no tension is present
- After switching the power off, wait at least 10 minutes before accessing to the electrical panel or any other electrical component.
- Before accessing check with a multimeter that there are no residual stresses.

**Frequency of interventions**

Perform an inspection every 6 months.
However, frequency depends on the type of use. Pan inspections at close intervals in the event of:

- frequent use (continuous or very intermittent use, near the operating limits, etc)
- critical use (service necessary)

**WARNING**

- *Read “Safety instructions - R32” on page* 45

**Do not go up to the surface**

| | Frequency of the intervention (months) | 1 | 6 | 12 |
|---|---|---|---|---|
| 1 | Presence of corrosions | | | X |
| 2 | Panel fixing | | | X |
| 3 | Fan fixing | | X | |
| 4 | Cleaning the evaporators | | X | |
| 5 | Water filter cleaning | | X | |
| 6 | water: quality, pH, glycol concentration | | X | |
| 7 | check exchanger efficiency | | | X |
| 8 | circulation pump | | X | |
| 9 | Check of the fixing and the insulation of the power lead | | | X |
| 10 | earth cable check | | | X |
| 11 | Cleaning the control panel | | | X |
| 12 | Status of the power contactor | | | X |
| 13 | clamp closure, cable isolation integrity | | | X |
| 14 | Voltage and phase unbalancing (no load and on-load) | | X | |
| 15 | Absorptions of the single electrical loads | | X | |
| 16 | compressor casing heaters test | | X | |
| 17 | Checking for leaks * | | | * |
| 18 | cooling circuit work parameter detection | | X | |
| 19 | safety valve * | | | * |
| 20 | protective device test: pressure switches, thermostats, flow switches etc.. | | | X |
| 21 | control system test: setpoint, climatic compensations, capacity stepping, air flow-rate variations | | | X |
| 22 | Control device test: alarm signalling, thermometers, probes, pressure gauges etc | | | X |

**NOTE**

- Refer to the local regulations. Companies and technicians performing installation, maintenance/repair, leak control and recovery operations must be Certified as set out by the local regulations.

**Unit booklet**
Foresee a unit schedule to keep trace of the interventions made on the unit.
In this way, it will be easier to adequately schedule the various interventions and facilitate any troubleshooting.
On the schedule note:
- date
- intervention description
- carried out measures etc.

**Standby mode**
If foreseen a long period of inactivity:
- turn off the power
- Prevent the risk of freezing (use glycol or empty the system)

disconnect voltage to avoid electric risks or damages following lightning.
With lower temperatures keep heaters turned on in of the electrical panel (option).
It is recommended to have a qualified technician start the system after a period of inactivity, especially after seasonal stops or for seasonal switch-overs.
Proceed as described in the “Startup” section for startup (7).
Plan the technician’s deployment in advance to avoid breakdowns and to be able to use the system again when needed.

**System drain**
The system must be drained only if necessary.
Avoid draining the system periodically; corrosive phenomena can be generated.
1. empty the system
2. Drain heat exchanger, use all existing valves and threaded pins
3. blow the exchanger with compressed air
4. dry the exchanger with hot air; for greater safety, fill the exchanger with glycol solution
5. Protect heat exchanger from air inlet
6. Remove drain plugs from the pumps

Any anti-freeze liquid contained in the system should not be discharged freely as it is a pollutant. It must be collected and reused.
Before start-up, wash the system.
It is recommended to have a qualified technician start the system after a period of inactivity, especially after seasonal stops or for seasonal switch-overs.
Proceed as described in the “Startup” section for startup.
Plan the technician’s deployment in advance to avoid breakdowns and to be able to use the system again when needed.

**Water side heat exchanger**
The heat exchanger must allow maximum heat transfer, so the internal surfaces must be clean and free of scale deposits.
Periodically check the difference between the temperature of the supply water and the condensation temperature: if the difference is greater than 8 °C–10 °C it is advisable to clean the exchanger.
The clearing must be effected:
- with circulation opposite to the usual one
- with a speed at least 1.5 times higher than the nominal one
- with an appropriate product moderately acid (95 % water + 5 % phosphoric acid)
- after cleaning, rinse with water to prevent cleaning agent residues from remaining.

**Water filter**
Check that no impurities prevent the correct passage of water.

**Flow switch**
- controls the operations
- remove incrustations from the palette

**Circulation pumps**
Check:
- no leaks
- Bearing status (anomalies are highlighted by abnormal noise and vibration)
- The closing of terminal covers and the correct positioning of the cable glands.

**Insulations**
Check the condition of the insulations: if necessary, apply glue and renew the seals.

**Safety valve**
The pressure relief valve must be replaced:
- if it has intervened
- if there is oxidation
- based on the date of manufacture, in compliance with local regulations.

**Heat exchanger air side (evaporator)**

- *Accidental contact with the exchanger fins can cause cuts: wear protective gloves.*

The evaporator should ensure maximum heat exchange, so the surface must be free of dirt build-up and contamination.
It is recommended a quarterly cleaning of the coils, as the minimum.
The cleaning frequency should be increased depending on the level of dirt/dust accumulation and the environment (e.g., coastal areas with chlorides and salts) or industrial areas with aggressive substances.

**Shut down periods**

At times when the unit is not used for more than a week, the evaporator should be completely cleaned in accordance with the procedure for cleaning.

**Cleaning procedure**

Compared to tube and fin heat exchangers, these evaporators tend to accumulate more dirt on the outside and less on the inside, making them easier to clean.
Follow the steps below for proper cleaning.

**Remove surface debris**

Remove surface dirt, leaves, fibres, etc. with a vacuum cleaner (preferably with a brush or other soft accessory instead of a metal tube), compressed air blown from the inside, and/or a soft bristle brush. Do not bump or scratch the evaporator.

**Rinse**

Rinse only with water. Do not use chemical agents to clean the evaporators, as this could lead to corrosion.
Hose off gently, preferably from the inside-out and top to bottom, running the water through every fin passage until it comes out clean.
The fins are stronger than athers coil fins but still need to be handled with care. Do not hit the coil with the hose.
We do not recommend using a pressure washer to clean the coil due to the possibility of damage. Warranty claims in connection with cleaning damage, in particular caused by high-pressure cleaners or corrosion caused by chemical cleaning agents for evaporators, will be rejected.

**WARNING**

- Coatings applied on site are not recommended for heat exchangers.

# 12. Decommissioning

**Disconnection**

**WARNING**

- *Before performing any operation, read the warnings found in the Maintenance chapter.*

Avoid leak or spills into the environment.
Before switching off the unit, extract the following substances (if present):

- refrigerant gas
- Anti-freeze solutions in the hydraulic circuit

Awaiting decommissioning and disposal, the unit can also be stored outdoors, as bad weather and rapid changes in temperature do not harm the environment provided that the electric, cooling and hydraulic circuits of the unit are intact and closed.

**WEEE-Information**

The manufacturer is registered in accordance with the implementation of Directive 2012/19/EU and the relevant national regulations for waste electrical and electronic equipment.

This Directive requires electrical and electronic equipment to be disposed of properly.
Equipment bearing the crossed-out wheelie bin mark must be disposed of separately at the end of its life cycle to prevent damage to human health and to the environment.
Electrical and electronic equipment must be disposed of together with all of its parts.
To dispose of “household” electrical and electronic equipment, the manufacturer recommends you contact an authorised dealer or an authorised ecological area.
“Professional” electrical and electronic equipment must be disposed of by authorised personnel through established waste disposal authorities around the country.
In this regard, here is the definition of household WEEE and professional WEEE:
WEEE from private households: WEEE originating from private households and WEEE which comes from commercial, industrial, institutional and other sources which, because of its nature and quantity, is similar to that from private households. Subject to the nature and quantity, where the waste from EEE was likely to have been by both a private household and users of other than private households, it will be classed as private household WEEE;
Professional WEEE: all WEEE which comes from users other than private households.
This equipment may contain:
Refrigerant that must be completely removed by qualified personnel and collected in suitable containers that meet the necessary requirements.

- lubrication oil contained in compressors and in the cooling circuit to be collected;
- mixtures with antifreeze in the water circuit, the contents of which are to be collected;
- mechanical and electrical parts to be separated and disposed of as authorised.

When machine components to be replaced for maintenance purposes are removed or when the entire unit reaches the end of its life and needs to be removed from the installation, waste should be separated by its nature and disposed of by authorised personnel at existing collection centres.

# 13. Residual Risks

**General**
In this section the most common situations are indicated,as these cannot be controlled by the manufacturer and could be a source of risk situations for people or things.

**Danger zone**
This is an area in which only an authorised operator may work. The danger area is the area inside the unit that becomes accessible only by deliberate removal of the cladding or parts of it.

**Handling**
The handling operations, if implemented without all of the protection necesssary and without due caution, may cause the drop or the tipping of the unit with the consequent damage, even serious, to persons, things or the unit itself.
Handle the unit following the instructions provided in the present manual regarding the packaging and in compliance with the local regulations in force.
In case of refrigerant leakage, see the “Safety data sheet” for the refrigerant.

**Installation**
The incorrect installation of the unit could cause water leaks, condensate accumulation, leaking of the refrigerant, electric shock, poor operation or damage to the unit itself.
Check that the installation has been implemented by qualified technical personnel only and that the instructions contained in the present manual and the local regulations in force have been adhered to.
The installation of the unit in a place where even infrequent leaks of inflam-mable gas and the accumulation of this gas in the area surrounding the area occur could cause explosions or fires.
Carefully check the positioning of the unit.
The installation of the unit in a place unsuited to support its weight and/ or guarantee adequate anchorage may result in consequent damage to things, people or the unit itself.
Carefully check the positioning and the anchoring of the unit.
Easy access to the unit by children, unauthorised persons or animals may be the source of accidents, some serious.
Install the unit in areas which are only accessible to authorised person and/or provide protection against intrusion into the danger zone.

**General risks**
Smell of burning, smoke or other signals of serious anomalies may indicate a situation which could cause damage to people, things or the unit itself.
Electrically isolate the unit (yellow-red isolator).
Contact the authorised service centre to identify and resolve the problem at the source of the anomaly.
Accidental contact with heat exchangers, compressors, water pipes or other components can result in injury and/ or burns. Always wear suitable clothing including protective gloves when working in the danger area.
Maintenance and repair operations carried out by non-qualified personnel may cause damage to persons, things or the unit itself.
Always contact the qualified assistance centre.
Failing to close the unit panels or failure to check the correct tightening of all of the panelling fixing screws may cause damage to persons, things or the unit itself.
Periodically check that all of the panels are correctly closed and fixed.
If there is a fire the temperature of the refrigerant could reach values that in-crease the pressure to beyond the safety valve with the consequent possible projection of the refrigerant itself or explosion of the circuit parts that remain isolated by the closure of the tap.
Do not remain in the vicinity of the safety valve and never leave the refrigerating system taps closed.

**Electric parts**
Cables not connected to the mains and/or improperly configured cables and/or cables with inadequate protective devices can cause electric shocks, poisoning, damage to the equipment or fires. Carry out all of the work on the electric system referring to the electric layout and the present manual ensuring the use of a system thereto dedicated.
An incorrect fixing of the electric components cover may lead to the entry of dust, water etc inside and may consequently electric shocks, damage to the unit or fires.
Always fix the unit cover properly.
When the metallic mass of the unit is under voltage and is not correctly connected to the earthing system it may be as source of electric shock and electrocution.
Always pay particular attention to the implementation of the earthing system connections.
Contact with parts under voltage accessible inside the unit after the removal of the guards can cause electric shocks, burns and electrocution.
Open and padlock the general isolator prior to removing the guards and signal work in progress with the appropriate sign.
Contact with parts that could be under voltage due to the start up of the unit may cause electric shocks, burns and electrocution.
When voltage is necessary for the circuit open the isolator on the attachment line of the unit itself, padlock it and display the appropriate warning sign.

**Moving parts**
Touching the drives or the fans can cause injuries.
Before entering the interior of the unit, open and lock the disconnecting switch on the connecting line of the unit and set up an appropriate sign.
Contact with the fans can cause injury.
Prior to removing the protective grill or the fans, open the isolator on the attachment line of the unit itself, padlock it and display the appropriate warning sign.

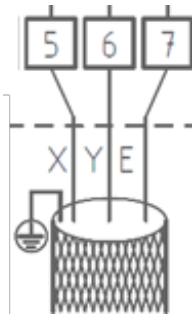
**Refrigerant**
The intervention of the safety valve and the consequent expulsion of the gas refrigerant may cause injuries and intoxication.
Always wear suitable clothing including protective gloves and eyeglasses for operations inside the danger zone.
Should the refrigerant leak please refer to the refrigerant “Safety sheet”.
The taps which are before the safety valves must remain in the open position and with the seal intact.
After any maintenance interventions, the valves must be sealed in the open position; failure to comply with these instructions can cause the refrigerant circuit to explode, causing injury to persons and damage to property.
Contact between open flames or heat sources with the refrigerant or the heating of the gas circuit under pressure (e.g. during welding operations) may cause explosions or fires.
Do not place any heat source inside the danger zone.
The maintenance or repair interventions which include welding must be carried out with the system off.

**Hydraulic parts**
Defects in tubing, the attachments or the removal parts may cause a leak or water projection with the consequent damages to people, things or shortcircuit the unit.
Therefore, make the water connections with the utmost care according to the instructions in this manual.

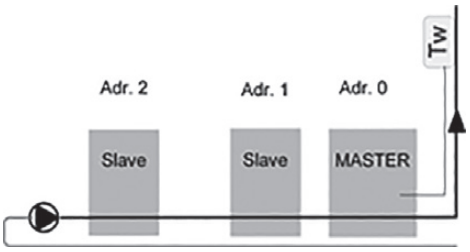
# 14. Units in modular configuration (cascade)

A maximum of 16 units can be connected in cascade.
The modular system is controlled by the so-called master unit (address = 0).
Each module is identified by a specific address (0 to 15).
The sensor for regulating the TW water outlet temperature, the flow monitor and the electric auxiliary heater must be controlled/regulated by the master unit.
All units must be electrically connected to one another via the X-Y-E bus (see Electrical connection chapter, page 16).
Each module can be equipped with an inertial system storage tank.
Each unit with DHW option must have its own DHW storage.
An external pumping unit sized for the entire capacity of the modular system must be provided (by the Customer). The pumping unit will be managed by the Master unit through a potential-free contact and 0-10 V signal.
The flow temperature sensor TW must be installed on the common flow line of the system.

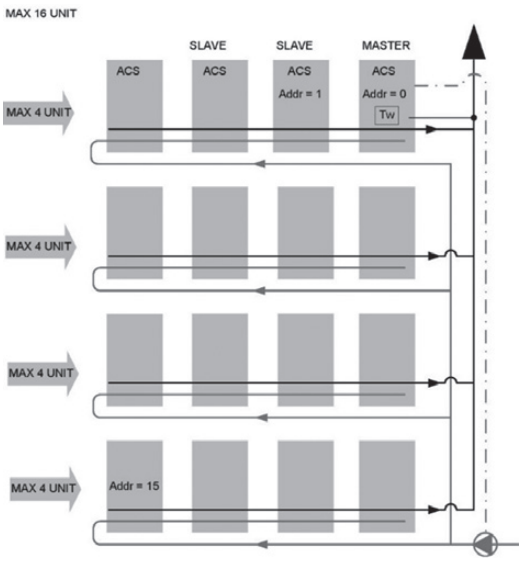
**Bus comunicazione unità modulare**




**TW probe**




**Plant diagram inverted return (Tichelmann)**




**Inlet and outlet collectors**

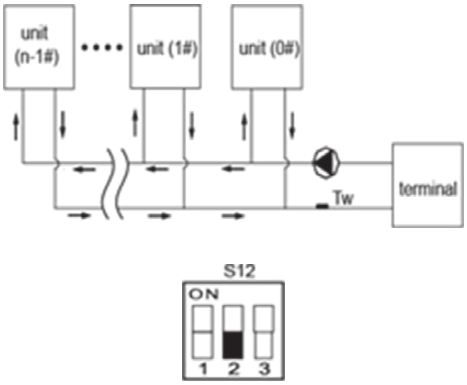
| Cooling (kW) Min | Max | Water pipe IN-OUT |
|---|---|---|
| 15 | 30 | DN40 |
| 30 | 90 | DN50 |
| 90 | 130 | DN65 |
| 130 | 210 | DN80 |
| 210 | 325 | DN100 |
| 325 | 510 | DN125 |
| 510 | 740 | DN150 |
| 740 | 1300 | DN200 |
| 1300 | 2080 | DN250 |

**Single/multiple pump system**
Set up the DIP S12-2 according to the type of system.

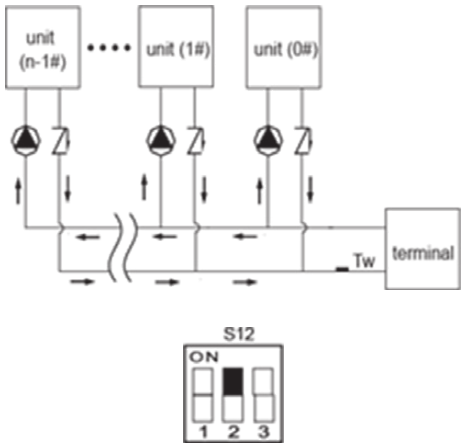
**Single water pump**
The retaining valve is not necessary with this configuration. The pump control is only activated on the master unit.

**Multiple water pumps.**
A retaining valve for each unit is necessary with this configuration.
Pump control is activated on each unit.

**Single water pumps.**
DIP S12-2 = OFF




**Multiple water pumps.**
DIP S12-2 = ON



**Addressing**

Set the correct date and time on each unit before connecting them to the network.
Set multiple configuration on each unit.
SW12-2 :
ON unit on modular configuration (or enabling DHW menu)
OFF single unit
The modular configuration (cascade) consists of 2 networks: the network of controllers and the network of units (main boards).
Each network can have max 16 addresses (0 to 15) and must be addressed separately.
Each network has its own master, which must have address = 0.
If some of the slave units do not have the DHW option:

- configure a unit without a DHW option as the master
- assign the higher addresses to the slave units equipped with DHW option

**Unit addressing**

Addressing is carried out through encoder ENC4 on the back of the keypad.
The address corresponds to the number on the encoder
The address is shown on the display DSP1.
E.g.:

MASTER: address = 0 encoder = 0

SLAVE 1: address = 1 encoder = 1

SLAVE 15: address = 15 encoder = F

The address of the unit is shown on display “DSP1” on the main keypad.

**Addressing controls**

A maximum of 16 controls can be addressed, with address from 0 to 15; so for example :

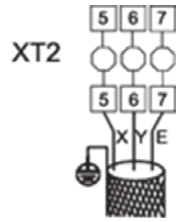
- 16 units with relative controller on board, il master con indirizzo 0, gli slave, the master with address 0, the slave, in read-only mode, with subsequent ones
- 15 units with relative controller on board + a remote controller as the master

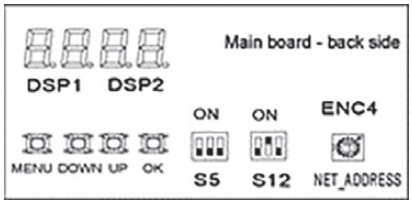
Press MENU + ▶ for 3 seconds
Press ▲ ▼ to select the address

**Remote ON-OFF**

In the case of units in a modular configuration (cascade), the remote control must act on the master unit, which in turn controls the slaves.

**Modular unit communication bus**




**START-UP**

Complete system management is carried out by the master unit, identified by address 0.
Thermoregulation takes place on the supply temperature of the entire system (Tw).
At switch-on, when a load is requested, the units are switched on in sequence based on their address, in numerical order.
When the load decreases, the units are switched off following the same sequence.

**Example in cooling:**

If Tw >= set point + 10 °C

- the control activates 50 % of the resources in sequence based on the set address.
- after a time interval (default: 240 seconds)
- if the load increases, additional resources are activated
- if the load decreases, the units are switched off following the same sequence (first start, first stop).

If Tw < set point + 10 °C (in cooling)

- the control activates only the master unit.
- after a time interval (default: 240 seconds)
- if the load increases, additional resources are activated based on the set address
- if the load decreases, the master unit switches off.

# 15. General technical data

**Belaria® fit (53,85)**

| Type | | (53) | (85) |
|---|---|---|---|
| • Energy efficiency class of the compound system with control | 35 °C | A++ | A++ |
| • Room heating energy efficiency “moderate climate” 35 °C ηS [1] | % | 152 | 159 |
| • Seasonal coefficient of performance moderate climate 35 °C | SCOP | 3.87 | 4.04 |
| **Max. performance data heating and cooling in acc. with EN 14511** | | | |
| • Heat output A2W35 | kW | 53.3 | 84.8 |
| • Coefficient of performance A2W35 | COP | 3.5 | 3.4 |
| • Heat output A-7W35 | kW | 40.6 | 65.9 |
| • Coefficient of performance A-7W35 | COP | 2.8 | 2.7 |
| • Cooling capacity A35W18 | kW | 75.6 | 119 |
| • Energy efficiency ratio A35W18 | EER | 3.3 | 3.3 |
| • Cooling capacity A35W7 | kW | 55 | 88.4 |
| • Energy efficiency ratio A35W7 | EER | 2.6 | 2.7 |
| **Sound data** | | | |
| • Sound power level “Standard” | dB(A) | 82 | 83 |
| • Sound power level “Silent” [2] | dB(A) | 74 | 75 |
| • Sound power level “Supersilent” [2] | dB(A) | 71 | 73 |
| **Hydraulic data** | | | |
| • Maximum flow temperature | °C | 54 | 55 |
| • Nominal heating water quantity heating ΔT 5 K (A7W35) | $m^3/h$ | 10.66 | 16.53 |
| • Nominal heating water quantity heating ΔT 8 K (A7W35) | $m^3/h$ | 6.6 | 10.3 |
| • Nominal heating water quantity cooling ΔT 4 K (A35W7) | $m^3/h$ | 11.8 | 19 |
| • Nominal heating water quantity cooling ΔT 4 K (A35W18) | $m^3/h$ | 16.2 | 25.6 |
| • Max. operating pressure on the heating side | bar | 6 | 6 |
| • Flow/return connection heating | R (ext. thread) | 2″ | 2″ |
| • Built-in fan | | 2 axial fans | 3 axial fans |
| • Nominal air quantity | $m^3/h$ | 24000 | 36000 |
| **Cooling technical data** | | | |
| • Refrigerant | | R32 | R32 |
| • Refrigeration circuits | | 1 | 1 |
| • Compressor stages | | modulating | modulating |
| • Refrigerant filling quantity | kg | 14 | 17.5 |
| • Compressor oil filling quantity | l | 4.6 | 6 |
| **Electrical data** | | | |
| • Connections | V/Hz | 3~400/50 | 3~400/50 |
| • Starting current (compressor and fan) | A | 40.5 | 60.2 |
| • Main current fuse | A | 50 | 80 |
| **Dimensions/Weight** | | | |
| • Dimensions (H x W x D) | mm | 1320 x 2280 x 1060 | 1510 x 3300 x 1100 |
| • Weight | kg | 530 | 830 |

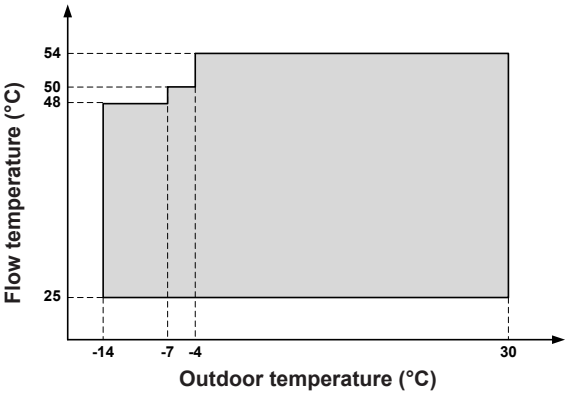
[1] 2 % can be added for class II heat pump incl. control.

[2] Reduced heat outputs according to heating performance data

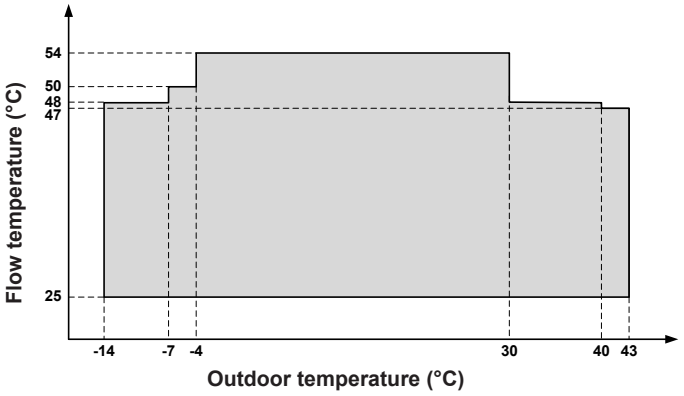
[3] Country-specific regulations must be observed. Selection of the fuse size by the electrician.

## Diagrams of areas of application

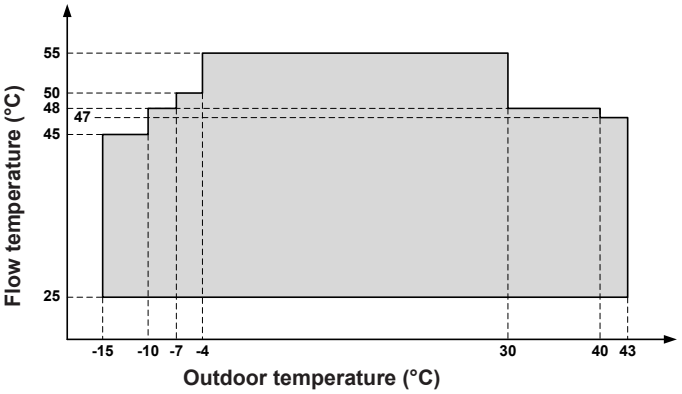
### Heating Belaria® fit (53)



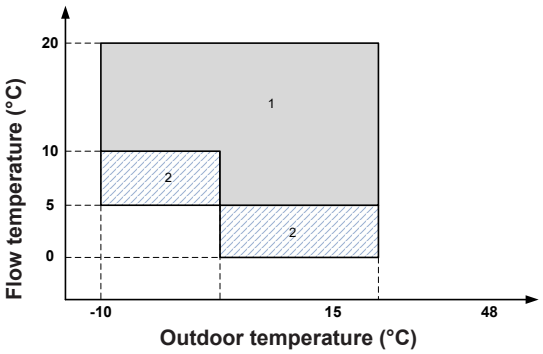

### Hot water Belaria® fit (53)




### Heating and hot water Belaria® fit (85)




### Cooling Belaria® fit (53,85)




1 Normal operating range

2 Operating range in which the use of ethylene glycol is mandatory

## Sound pressure level

**Standard**

| Type | Sound pressure level frequency band [Hz] | | | | | | | | Sound pressure level | Sound power level |
|---|---|---|---|---|---|---|---|---|---|---|
| | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | dB(A) | dB(A) |
| Belaria® fit (53) | 66 | 73 | 76 | 78 | 78 | 74 | 66 | 56 | 65 | 82 |
| Belaria® fit (85) | 88 | 89 | 82 | 76 | 80 | 75 | 69 | 59 | 66 | 83 |

**Silent (low-noise)**

| Type | Sound pressure level frequency band [Hz] | | | | | | | | Sound pressure level | Sound power level |
|---|---|---|---|---|---|---|---|---|---|---|
| | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | dB(A) | dB(A) |
| Belaria® fit (53) | 58 | 67 | 67 | 69 | 70 | 68 | 60 | 52 | 57 | 74 |
| Belaria® fit (85) | 63 | 68 | 71 | 71 | 71 | 68 | 56 | 58 | 58 | 75 |

In Silent mode, the maximum outputs must be reduced by the correction factor 0.9.

**Supersilent (whisper mode)**

| Type | Sound pressure level frequency band [Hz] | | | | | | | | Sound pressure level | Sound power level |
|---|---|---|---|---|---|---|---|---|---|---|
| | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | dB(A) | dB(A) |
| Belaria® fit (53) | 54 | 67 | 63 | 66 | 66 | 65 | 58 | 51 | 54 | 71 |
| Belaria® fit (85) | 55 | 74 | 71 | 68 | 66 | 66 | 64 | 55 | 55 | 73 |

In Supersilent mode, the maximum outputs must be reduced by the correction factor 0.85.

The sound levels refer to devices with maximum test conditions.
The sound pressure level refers to a distance of 1 meter from the outer surface of the unit during operation in the open.
The noise levels are determined according to the tensiometric method (EN ISO 9614-2).
The data refers to the following conditions in heating mode:
- Water in the internal heat exchanger = 30/35 °C
- Ambient temperature 7 °C

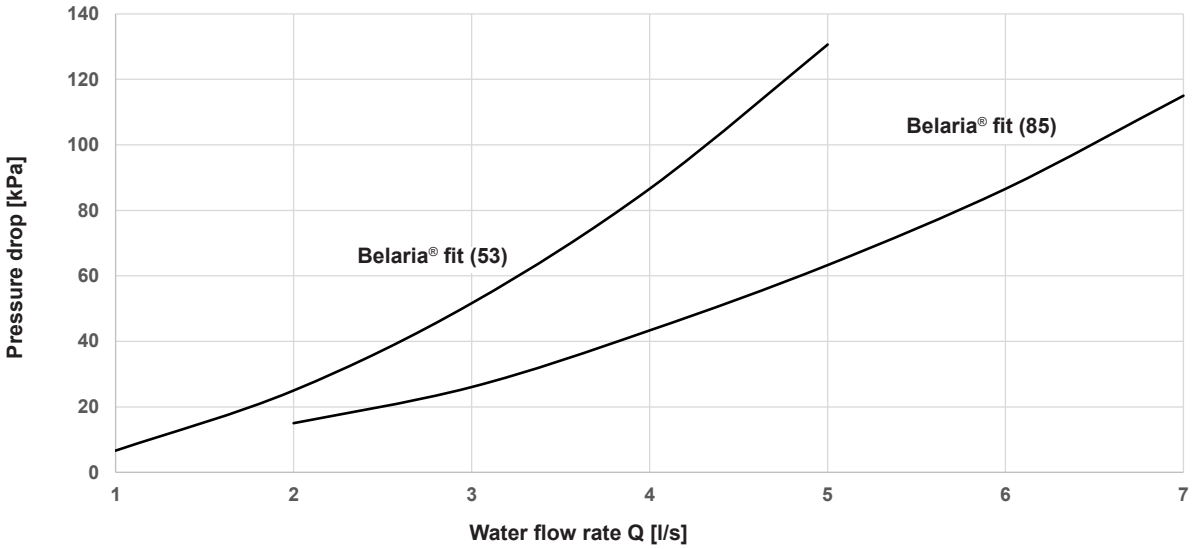
The data refers to the following conditions in cooling mode:
- Water in the internal heat exchanger = 12/7 °C
- Ambient temperature 35 °C

**Sound values under maximum conditions**

| Type | Sound pressure level frequency band [Hz] | | | | | | | | Sound pressure level | Sound power level |
|---|---|---|---|---|---|---|---|---|---|---|
| | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | dB(A) | dB(A) |
| Belaria® fit (53) | 68 | 74 | 79 | 79 | 81 | 76 | 69 | 59 | 67 | 84 |
| Belaria® fit (85) | 88 | 89 | 82 | 76 | 80 | 75 | 69 | 59 | 66 | 84 |

The sound levels refer to devices with maximum test conditions.
The sound pressure level refers to a distance of 1 meter from the outer surface of the unit during operation in the open.
The noise levels are determined according to the tensiometric method (EN ISO 9614-2).

### Pressure drop of the internal heat exchanger




The water pressure drops are calculated assuming an average water temperature of 7 °C.

### Permitted water flow rates

| | | Belaria® fit (53) | Belaria® fit (85) |
|---|---|---|---|
| Minimum flow rate | l/s | 1.8 | 2.9 |
| Maximum flow rate | l/s | 5.0 | 6.4 |

### Correction factors when using glycol

| Ethylene glycol percentage by weight % | 10 | 20 | 30 | 40 | 50 |
|---|---|---|---|---|---|
| Freezing point °C | -4 | -9 | -16 | -23 | -37 |
| Correction factor for the refrigerating capacity/heat output of the unit | 0.984 | 0.973 | 0.965 | 0.960 | 0.950 |
| Correction factor for the flow rate | 1.019 | 1.051 | 1.092 | 1.145 | 1.200 |
| Correction factor for the pressure drop in the system | 1.118 | 1.268 | 4.482 | 1.791 | 2.100 |

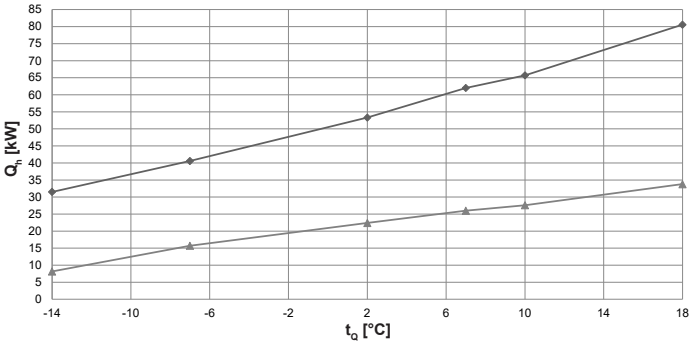
For the exact specifications of the frost protection agent used, refer to the respective manufacturer’s data sheet!

## Performance data – heating

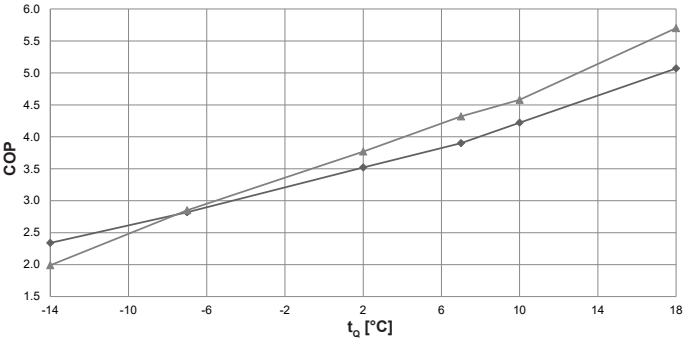
Maximum heat output allowing for defrosting losses

### Belaria® fit (53)

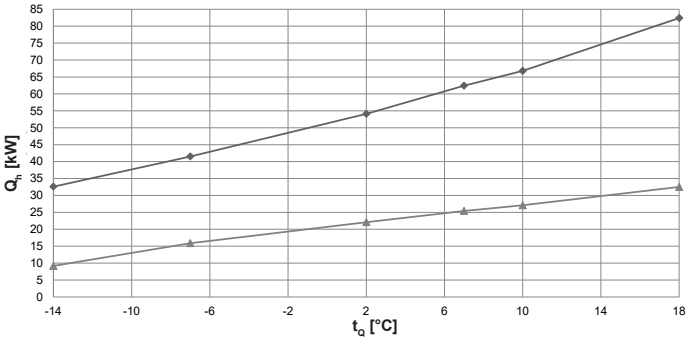
**Heat output - $t_{VL}$ 35 °C**



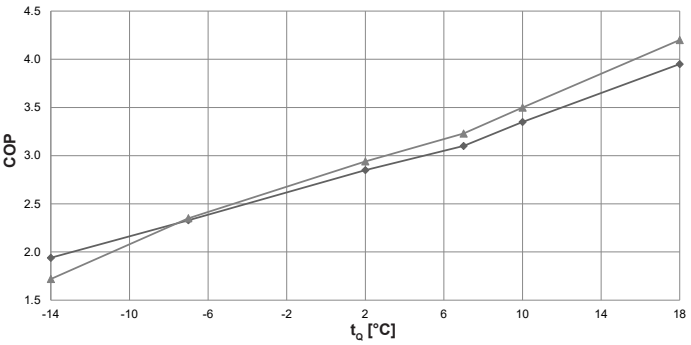

**Coefficient of performance - $t_{VL}$ 35 °C**



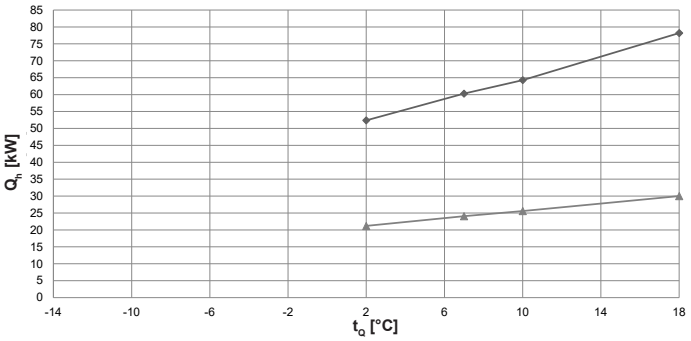

**Heat output - $t_{VL}$ 45 °C**



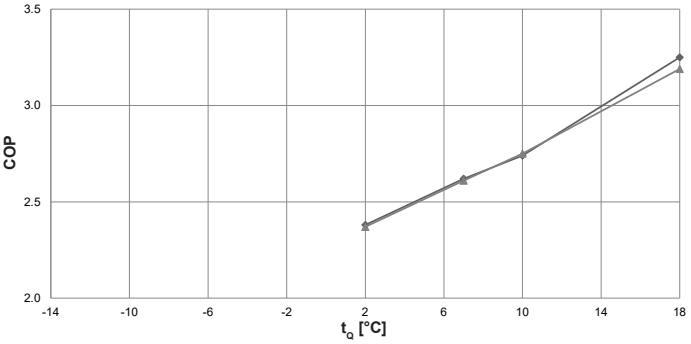

**Coefficient of performance - $t_{VL}$ 45 °C**




**Heat output - $t_{VL}$ 54 °C**




**Coefficient of performance - $t_{VL}$ 54 °C**




$t_{VL}$ = heating flow temperature (°C)
$t_Q$ = source temperature (°C)
$Q_h$ = heat output at full load (kW), measured in accordance with standard EN 14511
COP = Coefficient of performance for the overall unit in accordance with standard EN 14511

35 °C
45 °C
54 °C

Output correction factors in silenced mode

| | Silent | Supersilent |
|---|---|---|
| Heat output factor | 0.92 | 0.87 |
| Power consumption factor | 0.92 | 0.87 |
| COP factor | 1.00 | 1.00 |

## Performance data – heating

### Belaria® fit (53)

Data according to EN 14511

| Type | | Maximum output | | | Minimum output | | |
|---|---|---|---|---|---|---|---|
| $t_{VL}$ °C | $t_Q$ °C | $Q_h$ kW | P kW | COP | $Q_h$ kW | P kW | COP |
| 25 | -14 | 34.0 | 11.9 | 2.9 | 7.9 | 3.3 | 2.4 |
| | -7 | 42.6 | 12.3 | 3.5 | 16.3 | 4.6 | 3.5 |
| | 2 | 55.1 | 12.5 | 4.4 | 23.7 | 4.9 | 4.8 |
| | 7 | 63.5 | 12.5 | 5.1 | 27.6 | 4.9 | 5.6 |
| | 10 | 67.8 | 12.5 | 5.4 | 29.5 | 4.9 | 6.0 |
| | 18 | 83.9 | 12.3 | 6.8 | 36.2 | 4.7 | 7.7 |
| 30 | -14 | 32.6 | 12.6 | 2.6 | 8.0 | 3.7 | 2.2 |
| | -7 | 41.5 | 13.3 | 3.1 | 16.0 | 5.1 | 3.2 |
| | 2 | 54.1 | 13.8 | 3.9 | 23.1 | 5.4 | 4.3 |
| | 7 | 62.4 | 13.9 | 4.5 | 26.8 | 5.4 | 4.9 |
| | 10 | 66.8 | 14.0 | 4.8 | 28.5 | 5.4 | 5.2 |
| | 18 | 82.4 | 14.1 | 5.9 | 35.0 | 5.3 | 6.6 |
| 35 | -14 | 31.5 | 13.5 | 2.3 | 8.2 | 4.1 | 2.0 |
| | -7 | 40.6 | 14.4 | 2.8 | 15.7 | 5.5 | 2.9 |
| | 2 | 53.3 | 15.1 | 3.5 | 22.4 | 5.9 | 3.8 |
| | 7 | 62.0 | 15.9 | 3.9 | 26.0 | 6.0 | 4.3 |
| | 10 | 65.7 | 15.6 | 4.2 | 27.6 | 6.0 | 4.6 |
| | 18 | 80.6 | 15.9 | 5.1 | 33.8 | 5.9 | 5.7 |
| 40 | -14 | 30.5 | 14.3 | 2.1 | 8.4 | 4.6 | 1.8 |
| | -7 | 39.8 | 15.5 | 2.6 | 15.4 | 6.0 | 2.6 |
| | 2 | 52.5 | 16.6 | 3.2 | 21.9 | 6.6 | 3.3 |
| | 7 | 60.0 | 16.9 | 3.6 | 25.3 | 6.7 | 3.8 |
| | 10 | 64.8 | 17.2 | 3.8 | 26.9 | 6.7 | 4.0 |
| | 18 | 79.1 | 17.7 | 4.5 | 32.6 | 6.6 | 4.9 |
| 45 | -14 | 30.8 | 15.9 | 1.9 | 9.2 | 5.3 | 1.7 |
| | -7 | 40.6 | 17.4 | 2.3 | 15.9 | 6.8 | 2.4 |
| | 2 | 53.7 | 18.8 | 2.9 | 22.1 | 7.5 | 2.9 |
| | 7 | 62.0 | 20.0 | 3.1 | 25.4 | 7.9 | 3.2 |
| | 10 | 66.2 | 19.8 | 3.4 | 27.1 | 7.7 | 3.5 |
| | 18 | 80.7 | 20.4 | 4.0 | 32.5 | 7.7 | 4.2 |
| 50 | -7 | 40.0 | 18.9 | 2.1 | 15.9 | 7.4 | 2.1 |
| | 2 | 53.0 | 20.6 | 2.6 | 21.6 | 8.3 | 2.6 |
| | 7 | 61.1 | 21.4 | 2.9 | 24.7 | 8.5 | 2.9 |
| | 10 | 65.1 | 21.8 | 3.0 | 26.2 | 8.6 | 3.1 |
| | 18 | 79.3 | 22.5 | 3.5 | 31.1 | 8.6 | 3.6 |
| 54 | 2 | 52.4 | 22.0 | 2.4 | 21.2 | 8.9 | 2.4 |
| | 7 | 60.3 | 23.0 | 2.6 | 24.1 | 9.2 | 2.6 |
| | 10 | 64.3 | 23.5 | 2.7 | 25.6 | 9.3 | 2.8 |
| | 18 | 78.2 | 24.1 | 3.3 | 30.0 | 9.4 | 3.2 |

$t_{VL}$ = heating flow temperature (°C)
$t_Q$ = source temperature (°C)
$Q_h$ = heat output at full load (kW), measured in accordance with standard EN 14511
P = power consumption for the overall unit (kW)
COP = Coefficient of performance for the overall unit in accordance with standard EN 14511

Output correction factors in silenced mode

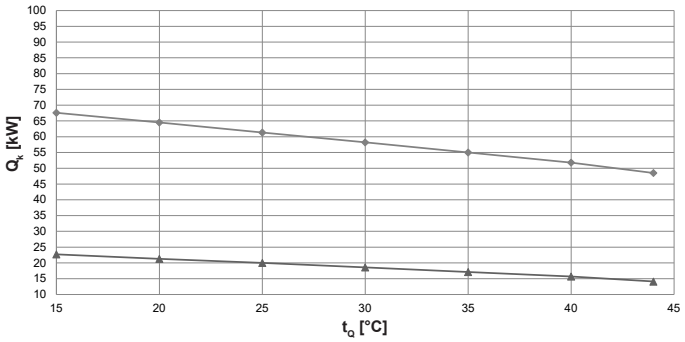
| | Silent | Supersilent |
|---|---|---|
| Heat output factor | 0.92 | 0.87 |
| Power consumption factor | 0.92 | 0.87 |
| COP factor | 1.00 | 1.00 |

## Performance data - cooling

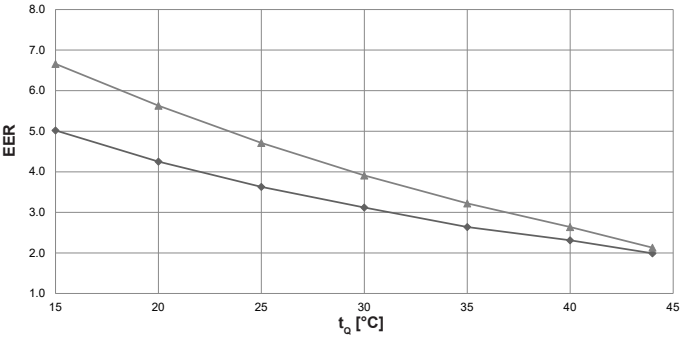
Maximum cooling capacity

### Belaria® fit (53)

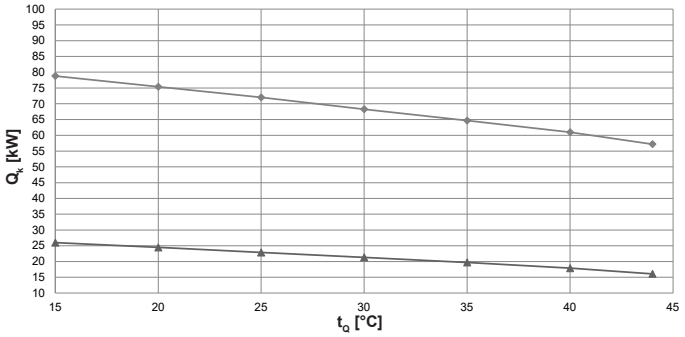
**Cooling capacity - $t_{VL}$ 7 °C**



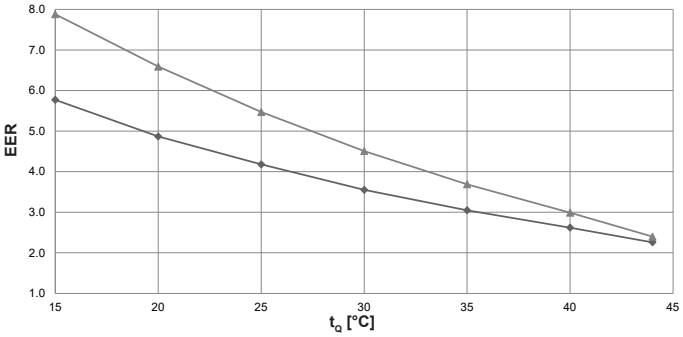

**Energy efficiency ratio - $t_{VL}$ 7 °C**



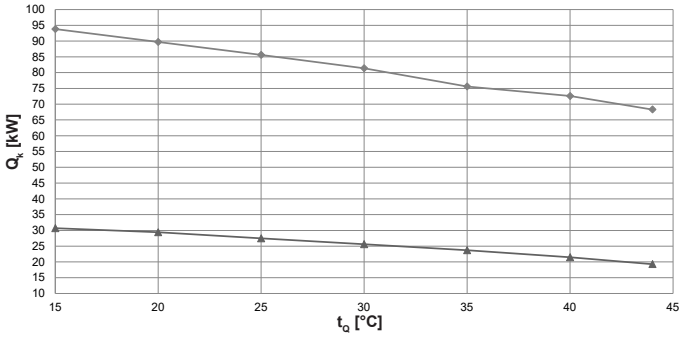

**Cooling capacity - $t_{VL}$ 12 °C**



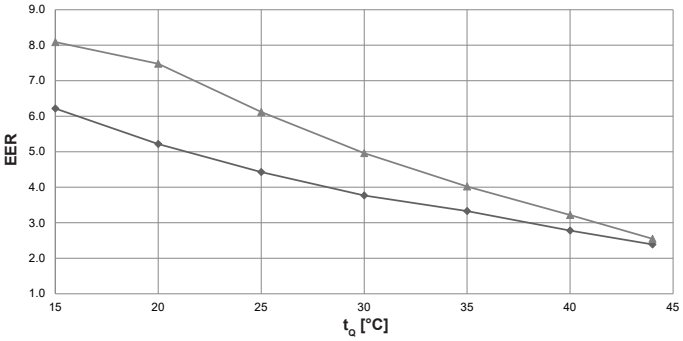

**Energy efficiency ratio - $t_{VL}$ 12 °C**



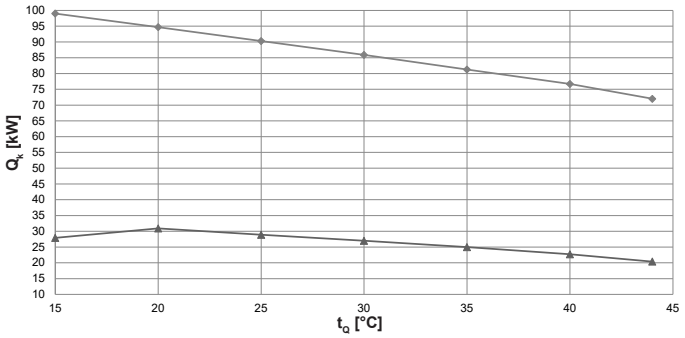

**Cooling capacity - $t_{VL}$ 18 °C**



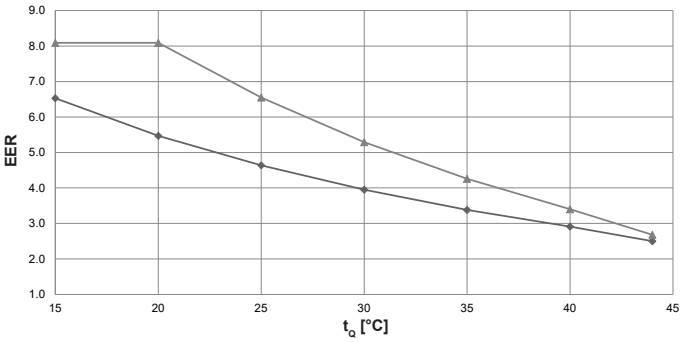

**Energy efficiency ratio - $t_{VL}$ 18 °C**




**Cooling capacity - $t_{VL}$ 20 °C**




**Energy efficiency ratio - $t_{VL}$ 20 °C**




$t_{VL}$ = cooling water flow temperature (°C)
$t_Q$ = source temperature (°C)
$Q_k$ = cooling capacity at full load (kW), measured in accordance with standard EN 14511
EER = Energy Efficiency Ratio for the overall unit in accordance with standard EN 14511

7 °C
12 °C
18 °C
20 °C

Output correction factors in silenced mode

| | Silent | Supersilent |
|---|---|---|
| Cooling capacity factor | 0.90 | 0.85 |
| Power consumption factor | 1.00 | 1.00 |
| EER factor | 0.90 | 0.85 |

## Performance data – cooling

### Belaria® fit (53)

Data according to EN 14511

| Type | | Maximum output | | | Minimum output | | |
|---|---|---|---|---|---|---|---|
| $t_{VL}$ °C | $t_Q$ °C | $Q_k$ kW | P kW | EER | $Q_k$ kW | P kW | EER |
| 7 | 15 | 67.6 | 13.5 | 5.0 | 22.7 | 3.4 | 6.7 |
| | 20 | 64.5 | 15.2 | 4.3 | 21.3 | 3.8 | 5.6 |
| | 25 | 61.3 | 16.9 | 3.6 | 20.0 | 4.2 | 4.7 |
| | 30 | 58.2 | 18.7 | 3.1 | 18.6 | 4.8 | 3.9 |
| | 35 | 55.0 | 20.8 | 2.6 | 17.1 | 5.3 | 3.2 |
| | 40 | 51.8 | 22.4 | 2.3 | 15.7 | 5.9 | 2.6 |
| | 44 | 48.5 | 24.4 | 2.0 | 14.1 | 6.6 | 2.1 |
| 10 | 15 | 74.2 | 13.6 | 5.5 | 24.6 | 3.4 | 7.3 |
| | 20 | 70.9 | 15.3 | 4.6 | 23.2 | 3.7 | 6.2 |
| | 25 | 67.6 | 17.2 | 3.9 | 21.7 | 4.2 | 5.2 |
| | 30 | 64.2 | 19.0 | 3.4 | 20.2 | 4.7 | 4.3 |
| | 35 | 60.7 | 20.9 | 2.9 | 18.6 | 5.3 | 3.5 |
| | 40 | 57.2 | 22.9 | 2.5 | 17.0 | 6.0 | 2.9 |
| | 44 | 53.7 | 25.0 | 2.2 | 15.3 | 6.7 | 2.3 |
| 12 | 15 | 78.8 | 13.7 | 5.8 | 26.0 | 3.3 | 7.9 |
| | 20 | 75.4 | 15.5 | 4.9 | 24.5 | 3.7 | 6.6 |
| | 25 | 72.0 | 17.2 | 4.2 | 22.9 | 4.2 | 5.5 |
| | 30 | 68.3 | 19.2 | 3.6 | 21.3 | 4.7 | 4.5 |
| | 35 | 64.7 | 21.2 | 3.1 | 19.7 | 5.3 | 3.7 |
| | 40 | 61.0 | 23.3 | 2.6 | 17.9 | 6.0 | 3.0 |
| | 44 | 57.2 | 25.3 | 2.3 | 16.1 | 6.7 | 2.4 |
| 15 | 15 | 86.2 | 13.8 | 6.3 | 28.0 | 3.2 | 8.8 |
| | 20 | 82.4 | 15.7 | 5.3 | 26.4 | 3.6 | 7.3 |
| | 25 | 78.6 | 17.5 | 4.5 | 24.7 | 4.1 | 6.0 |
| | 30 | 74.7 | 19.6 | 3.8 | 23.0 | 4.7 | 4.9 |
| | 35 | 70.7 | 21.6 | 3.3 | 21.2 | 5.3 | 4.0 |
| | 40 | 66.8 | 23.7 | 2.8 | 19.3 | 6.0 | 3.2 |
| | 44 | 62.7 | 25.8 | 2.4 | 17.3 | 6.7 | 2.6 |
| 18 | 15 | 93.8 | 15.1 | 6.2 | 30.7 | 3.8 | 8.1 |
| | 20 | 89.7 | 17.2 | 5.2 | 29.4 | 3.9 | 7.5 |
| | 25 | 85.6 | 19.3 | 4.4 | 27.5 | 4.5 | 6.1 |
| | 30 | 81.4 | 21.6 | 3.8 | 25.6 | 5.2 | 5.0 |
| | 35 | 75.6 | 22.7 | 3.3 | 23.7 | 5.9 | 4.0 |
| | 40 | 72.6 | 26.1 | 2.8 | 21.5 | 6.7 | 3.2 |
| | 44 | 68.3 | 28.6 | 2.4 | 19.3 | 7.6 | 2.6 |
| 20 | 15 | 99.0 | 15.2 | 6.5 | 27.9 | 3.4 | 8.1 |
| | 20 | 94.7 | 17.3 | 5.5 | 30.9 | 3.8 | 8.1 |
| | 25 | 90.3 | 19.5 | 4.6 | 28.9 | 4.4 | 6.6 |
| | 30 | 85.9 | 21.7 | 4.0 | 27.0 | 5.1 | 5.3 |
| | 35 | 81.3 | 24.1 | 3.4 | 25.0 | 5.9 | 4.3 |
| | 40 | 76.7 | 26.4 | 2.9 | 22.7 | 6.7 | 3.4 |
| | 44 | 72.0 | 28.8 | 2.5 | 20.4 | 7.6 | 2.7 |

$t_{VL}$ = cooling water flow temperature (°C)
$t_Q$ = source temperature (°C)
$Q_k$ = cooling capacity at full load (kW), measured in accordance with standard EN 14511
P = power consumption for the overall unit (kW)
EER = Energy Efficiency Ratio for the overall unit in accordance with standard EN 14511

Output correction factors in silenced mode

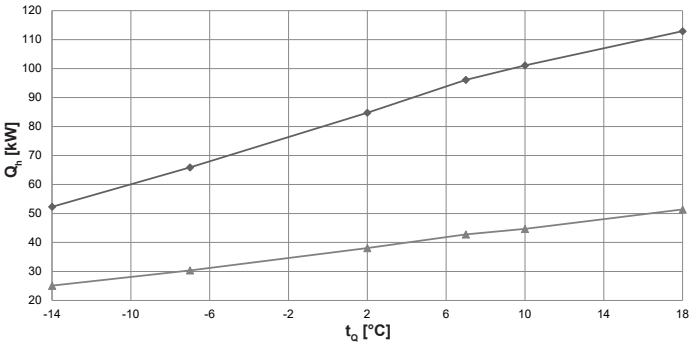
| | Silent | Supersilent |
|---|---|---|
| Cooling capacity factor | 0.90 | 0.85 |
| Power consumption factor | 1.00 | 1.00 |
| EER factor | 0.90 | 0.85 |

## Performance data – heating

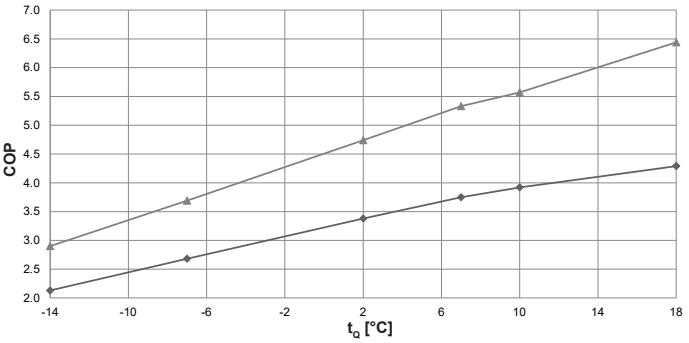
Maximum heat output allowing for defrosting losses

### Belaria® fit (85)

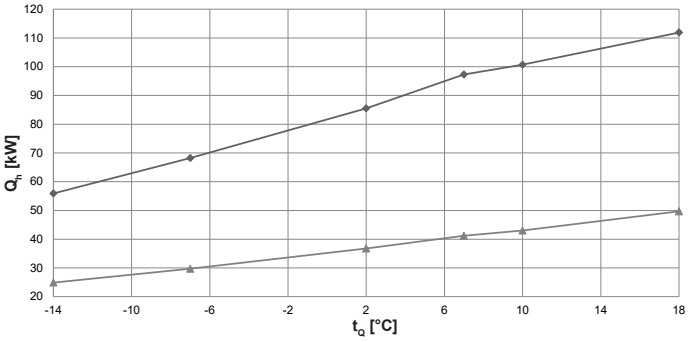
**Heat output - $t_{VL}$ 35 °C**



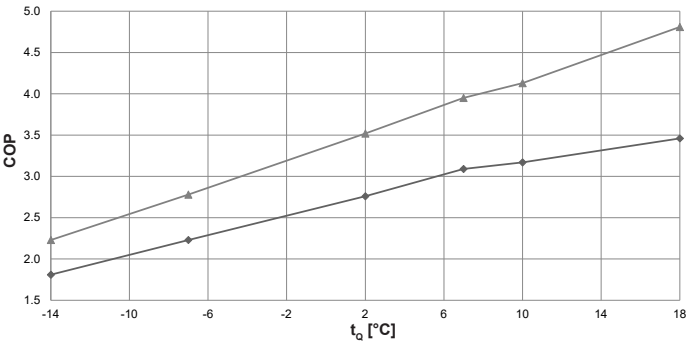

**Coefficient of performance - $t_{VL}$ 35 °C**



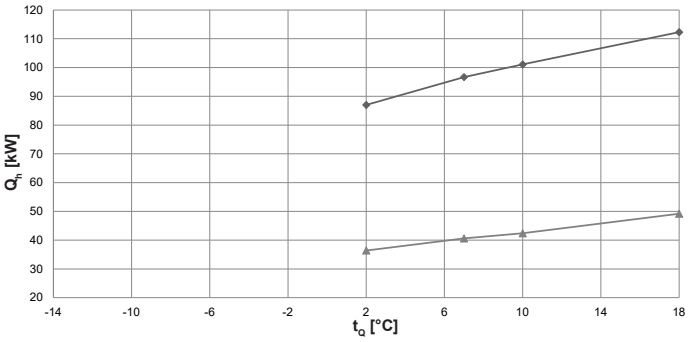

**Heat output - $t_{VL}$ 45 °C**



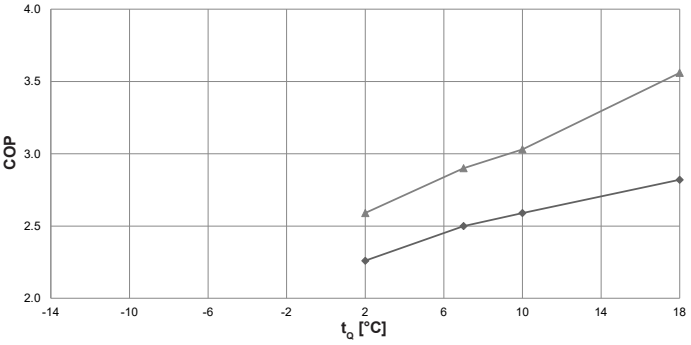

**Coefficient of performance - $t_{VL}$ 45 °C**




**Heat output - $t_{VL}$ 54 °C**




**Coefficient of performance - $t_{VL}$ 54 °C**




$t_{VL}$ = heating flow temperature (°C)
$t_Q$ = source temperature (°C)
$Q_h$ = heat output at full load (kW), measured in accordance with standard EN 14511
COP = Coefficient of performance for the overall unit in accordance with standard EN 14511

max. output
min. output

Output correction factors in silenced mode

| | Silent | Supersilent |
|---|---|---|
| Heat output factor | 0.95 | 0.90 |
| Power consumption factor | 0.95 | 0.90 |
| COP factor | 1.00 | 1.00 |

## Performance data – heating

### Belaria® fit (85)

Data according to EN 14511

| Type | | Maximum output | | | Minimum output | | |
|---|---|---|---|---|---|---|---|
| $t_{VL}$ °C | $t_Q$ °C | $Q_h$ kW | P kW | COP | $Q_h$ kW | P kW | COP |
| 25 | -14 | 49.1 | 19.3 | 2.6 | 25.8 | 7.3 | 3.6 |
| | -7 | 64.2 | 19.8 | 3.3 | 31.7 | 6.9 | 4.6 |
| | 2 | 84.7 | 20.5 | 4.1 | 40.2 | 6.7 | 6.0 |
| | 7 | 96.9 | 20.9 | 4.6 | 45.3 | 6.8 | 6.7 |
| | 10 | 102.2 | 21.1 | 4.8 | 47.4 | 6.8 | 7.0 |
| | 18 | 114.9 | 21.6 | 5.3 | 54.2 | 6.7 | 8.1 |
| 30 | -14 | 50.6 | 21.7 | 2.3 | 29.8 | 9.2 | 3.2 |
| | -7 | 65.0 | 22.0 | 3.0 | 36.9 | 8.8 | 4.2 |
| | 2 | 84.7 | 22.6 | 3.7 | 47.4 | 8.8 | 5.4 |
| | 7 | 96.4 | 23.1 | 4.2 | 53.6 | 8.8 | 6.1 |
| | 10 | 101.5 | 23.3 | 4.4 | 56.2 | 8.9 | 6.3 |
| | 18 | 113.8 | 23.8 | 4.8 | 63.6 | 8.7 | 7.3 |
| 35 | -14 | 52.3 | 24.6 | 2.1 | 25.1 | 8.7 | 2.9 |
| | -7 | 65.9 | 24.6 | 2.7 | 30.4 | 8.2 | 3.7 |
| | 2 | 84.8 | 25.1 | 3.4 | 38.1 | 8.0 | 4.7 |
| | 7 | 96.1 | 25.6 | 3.8 | 42.8 | 8.0 | 5.3 |
| | 10 | 101.1 | 25.8 | 3.9 | 44.7 | 8.0 | 5.6 |
| | 18 | 112.9 | 26.3 | 4.3 | 51.4 | 8.0 | 6.4 |
| 40 | -14 | 54.0 | 27.6 | 2.0 | 25.0 | 9.8 | 2.6 |
| | -7 | 67.0 | 27.5 | 2.4 | 30.0 | 9.3 | 3.2 |
| | 2 | 85.0 | 27.8 | 3.1 | 37.3 | 9.1 | 4.1 |
| | 7 | 96.0 | 28.3 | 3.4 | 41.9 | 9.1 | 4.6 |
| | 10 | 100.8 | 28.6 | 3.5 | 43.8 | 9.1 | 4.8 |
| | 18 | 112.4 | 29.0 | 3.9 | 50.4 | 9.0 | 5.6 |
| 45 | -14 | 55.9 | 30.9 | 1.8 | 24.9 | 11.2 | 2.2 |
| | -7 | 68.2 | 30.6 | 2.2 | 29.7 | 10.7 | 2.8 |
| | 2 | 85.5 | 31.0 | 2.8 | 36.8 | 10.5 | 3.5 |
| | 7 | 97.3 | 31.5 | 3.1 | 41.2 | 10.4 | 4.0 |
| | 10 | 100.7 | 31.8 | 3.2 | 43.0 | 10.4 | 4.1 |
| | 18 | 111.9 | 32.3 | 3.5 | 49.7 | 10.3 | 4.8 |
| 50 | -7 | 69.5 | 34.1 | 2.0 | 29.6 | 12.3 | 2.4 |
| | 2 | 86.2 | 34.5 | 2.5 | 36.5 | 12.1 | 3.0 |
| | 7 | 96.4 | 35.1 | 2.8 | 40.8 | 12.1 | 3.4 |
| | 10 | 100.9 | 35.4 | 2.9 | 42.6 | 12.1 | 3.5 |
| | 18 | 112.1 | 36.0 | 3.1 | 49.3 | 11.9 | 4.1 |
| 54 | 2 | 87.0 | 38.5 | 2.3 | 36.4 | 14.1 | 2.6 |
| | 7 | 96.7 | 38.7 | 2.5 | 40.6 | 14.0 | 2.9 |
| | 10 | 101.1 | 39.0 | 2.6 | 42.4 | 14.0 | 3.0 |
| | 18 | 112.3 | 39.8 | 2.8 | 49.2 | 13.8 | 3.6 |

$t_{VL}$ = heating flow temperature (°C)
$t_Q$ = source temperature (°C)
$Q_h$ = heat output at full load (kW), measured in accordance with standard EN 14511
P = power consumption for the overall unit (kW)
COP = Coefficient of performance for the overall unit in accordance with standard EN 14511

Output correction factors in silenced mode

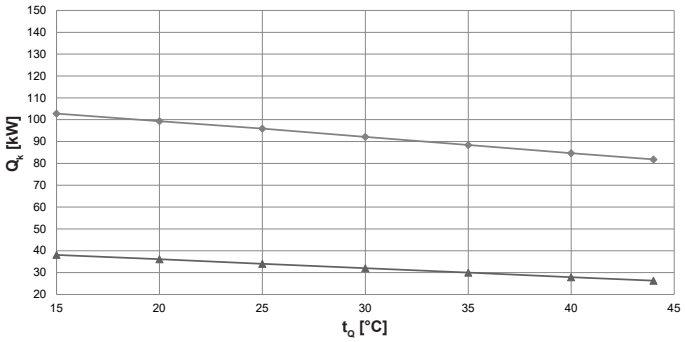
| | Silent | Supersilent |
|---|---|---|
| Heat output factor | 0.95 | 0.90 |
| Power consumption factor | 0.95 | 0.90 |
| COP factor | 1.00 | 1.00 |

## Performance data - cooling

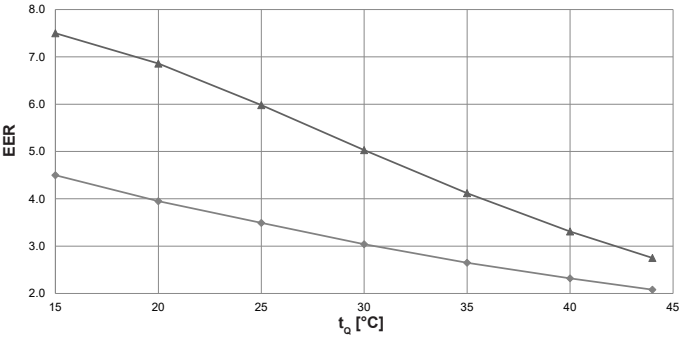
Maximum cooling capacity

### Belaria® fit (85)

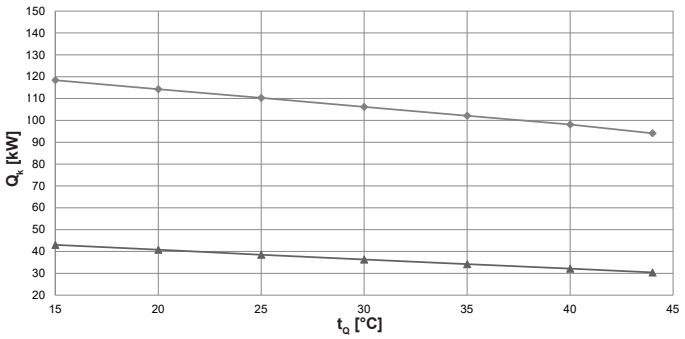
**Cooling capacity - $t_{VL}$ 7 °C**



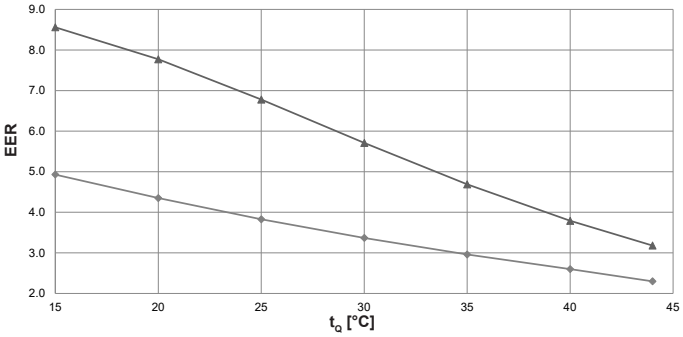

**Energy efficiency ratio - $t_{VL}$ 7 °C**



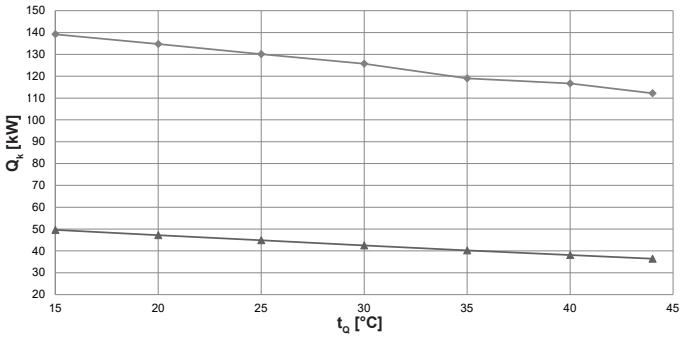

**Cooling capacity - $t_{VL}$ 12 °C**



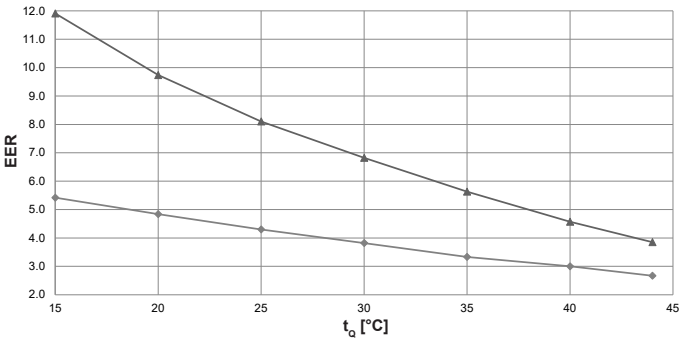

**Energy efficiency ratio - $t_{VL}$ 12 °C**



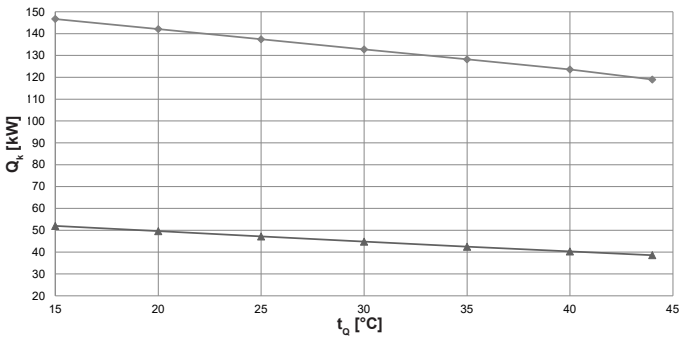

**Cooling capacity - $t_{VL}$ 18 °C**



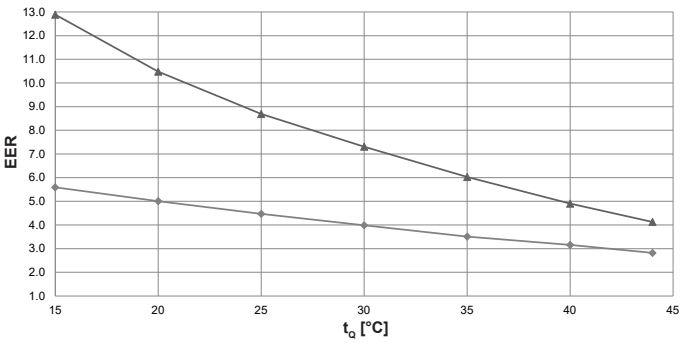

**Energy efficiency ratio - $t_{VL}$ 18 °C**




**Cooling capacity - $t_{VL}$ 20 °C**




**Energy efficiency ratio - $t_{VL}$ 20 °C**




$t_{VL}$ = cooling water flow temperature (°C)
$t_Q$ = source temperature (°C)
$Q_k$ = cooling capacity at full load (kW), measured in accordance with standard EN 14511
EER = Energy Efficiency Ratio for the overall unit in accordance with standard EN 14511

max. output
min. output

Output correction factors in silenced mode

| | Silent | Supersilent |
|---|---|---|
| Cooling capacity factor | 0.93 | 0.88 |
| Power consumption factor | 1.02 | 1.02 |
| EER factor | 0.93 | 0.86 |

## Performance data – cooling

### Belaria® fit (85)

Data according to EN 14511

| Type | | Maximum output | | | Minimum output | | |
|---|---|---|---|---|---|---|---|
| $t_{VL}$ °C | $t_Q$ °C | $Q_k$ kW | P kW | EER | $Q_k$ kW | P kW | EER |
| 7 | 15 | 102.8 | 22.8 | 4.5 | 38.1 | 5.1 | 7.5 |
| | 20 | 99.3 | 25.1 | 4.0 | 36.1 | 5.3 | 6.9 |
| | 25 | 95.9 | 27.5 | 3.5 | 34.0 | 5.7 | 6.0 |
| | 30 | 92.1 | 30.3 | 3.0 | 32.0 | 6.4 | 5.0 |
| | 35 | 88.4 | 33.4 | 2.7 | 30.0 | 7.3 | 4.1 |
| | 40 | 84.7 | 36.5 | 2.3 | 27.9 | 8.4 | 3.3 |
| | 44 | 81.8 | 39.3 | 2.1 | 26.3 | 9.6 | 2.8 |
| 10 | 15 | 112.0 | 23.5 | 4.8 | 41.0 | 5.1 | 8.1 |
| | 20 | 108.1 | 25.8 | 4.2 | 38.8 | 5.3 | 7.4 |
| | 25 | 104.3 | 28.3 | 3.7 | 36.7 | 5.7 | 6.4 |
| | 30 | 100.4 | 31.1 | 3.2 | 34.5 | 6.4 | 5.4 |
| | 35 | 96.5 | 34.1 | 2.8 | 32.4 | 7.3 | 4.5 |
| | 40 | 92.6 | 37.3 | 2.5 | 30.3 | 8.5 | 3.6 |
| | 44 | 89.4 | 44.2 | 2.0 | 28.7 | 9.6 | 3.0 |
| 12 | 15 | 118.4 | 24.0 | 4.9 | 43.0 | 5.0 | 8.6 |
| | 20 | 114.3 | 26.3 | 4.4 | 40.8 | 5.3 | 7.8 |
| | 25 | 110.3 | 28.8 | 3.8 | 38.5 | 5.7 | 6.8 |
| | 30 | 106.2 | 31.5 | 3.4 | 36.3 | 6.4 | 5.7 |
| | 35 | 102.1 | 34.5 | 3.0 | 34.2 | 7.3 | 4.7 |
| | 40 | 98.1 | 37.7 | 2.6 | 32.1 | 8.5 | 3.8 |
| | 44 | 94.1 | 40.9 | 2.3 | 30.4 | 9.6 | 3.2 |
| 15 | 15 | 128.5 | 24.8 | 5.2 | 46.2 | 4.7 | 9.8 |
| | 20 | 124.2 | 27.1 | 4.6 | 43.9 | 5.2 | 8.5 |
| | 25 | 119.9 | 29.5 | 4.1 | 41.6 | 5.6 | 7.4 |
| | 30 | 115.6 | 32.3 | 3.6 | 39.3 | 6.3 | 6.2 |
| | 35 | 111.3 | 35.2 | 3.2 | 37.1 | 7.2 | 5.1 |
| | 40 | 106.9 | 38.3 | 2.8 | 34.9 | 8.4 | 4.1 |
| | 44 | 102.6 | 41.5 | 2.5 | 33.3 | 9.6 | 3.5 |
| 18 | 15 | 139.2 | 25.7 | 5.4 | 49.6 | 4.2 | 11.9 |
| | 20 | 134.7 | 27.8 | 4.8 | 47.2 | 4.8 | 9.7 |
| | 25 | 130.1 | 30.3 | 4.3 | 44.9 | 5.5 | 8.1 |
| | 30 | 125.7 | 32.9 | 3.8 | 42.5 | 6.2 | 6.8 |
| | 35 | 119.0 | 35.7 | 3.3 | 40.2 | 7.1 | 5.6 |
| | 40 | 116.7 | 38.9 | 3.0 | 38.1 | 8.3 | 4.6 |
| | 44 | 112.2 | 42.0 | 2.7 | 36.4 | 9.5 | 3.9 |
| 20 | 15 | 146.7 | 26.2 | 5.6 | 52.0 | 4.0 | 12.9 |
| | 20 | 142.1 | 28.4 | 5.0 | 49.6 | 4.7 | 10.5 |
| | 25 | 137.4 | 30.7 | 4.5 | 47.2 | 5.4 | 8.7 |
| | 30 | 132.8 | 33.3 | 4.0 | 44.8 | 6.1 | 7.3 |
| | 35 | 128.2 | 36.5 | 3.5 | 42.5 | 7.0 | 6.0 |
| | 40 | 123.6 | 39.1 | 3.2 | 40.3 | 8.2 | 4.9 |
| | 44 | 119.0 | 42.2 | 2.8 | 38.6 | 9.3 | 4.1 |

$t_{VL}$ = cooling water flow temperature (°C)
$t_Q$ = source temperature (°C)
$Q_k$ = cooling capacity at full load (kW), measured in accordance with standard EN 14511
P = power consumption for the overall unit (kW)
EER = Energy Efficiency Ratio for the overall unit in accordance with standard EN 14511

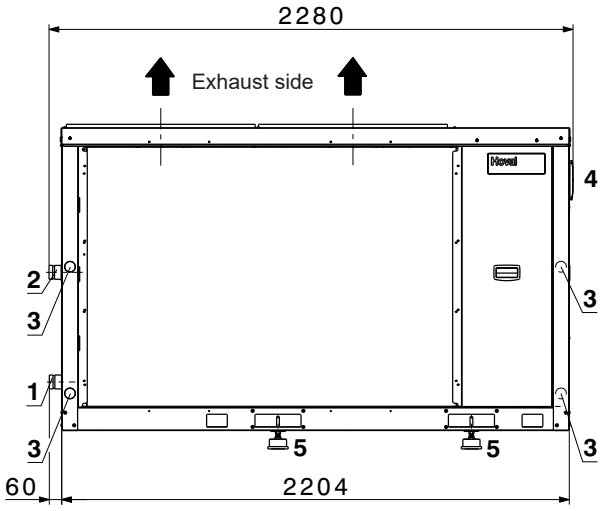
Output correction factors in silenced mode

| | Silent | Supersilent |
|---|---|---|
| Cooling capacity factor | 0.93 | 0.88 |
| Power consumption factor | 1.02 | 1.02 |
| EER factor | 0.93 | 0.86 |

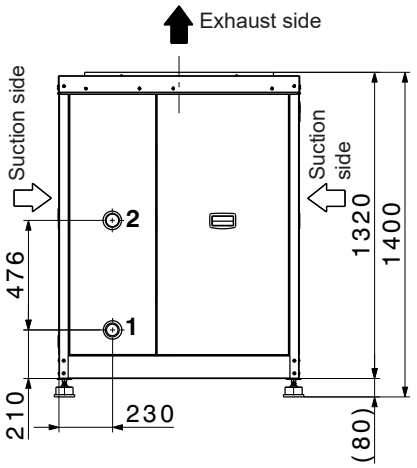
## Dimensions Belaria® fit (53)

(Dimensions in mm)

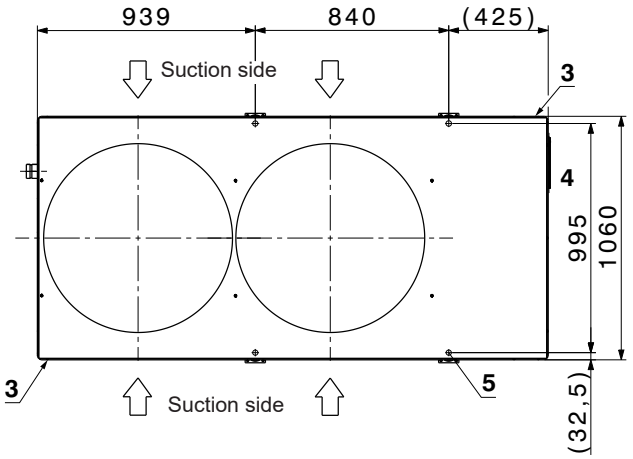
Front view (exhaust side)




Side view




Rear (suction side)

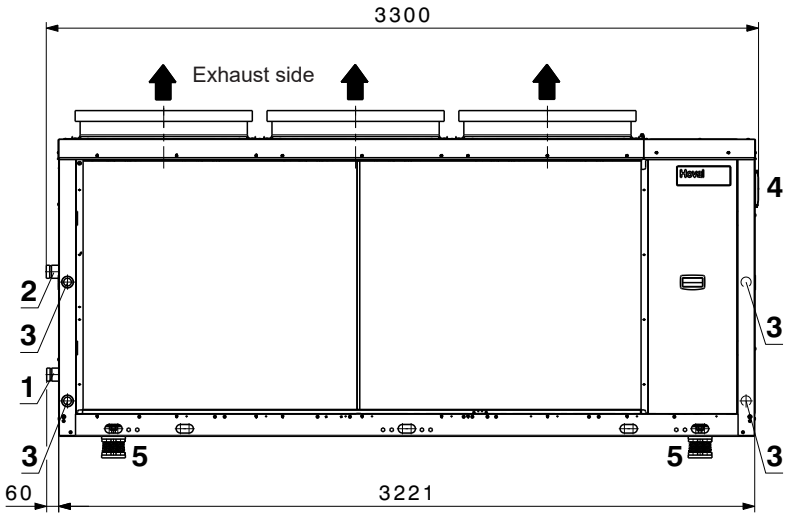



1 Flow heating DN 50
2 Return heating DN 50
3 Electrical connection
4 Control module bracket
5 Vibration dampers

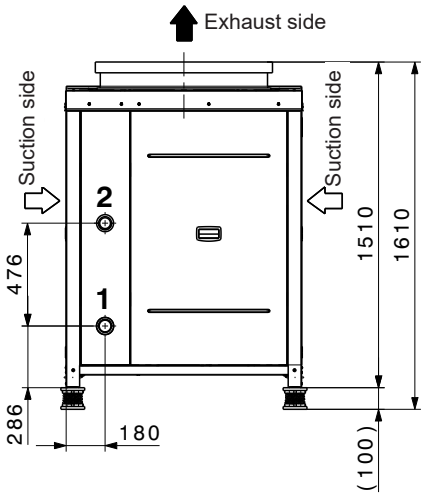
## Dimensions Belaria® fit (85)

(Dimensions in mm)

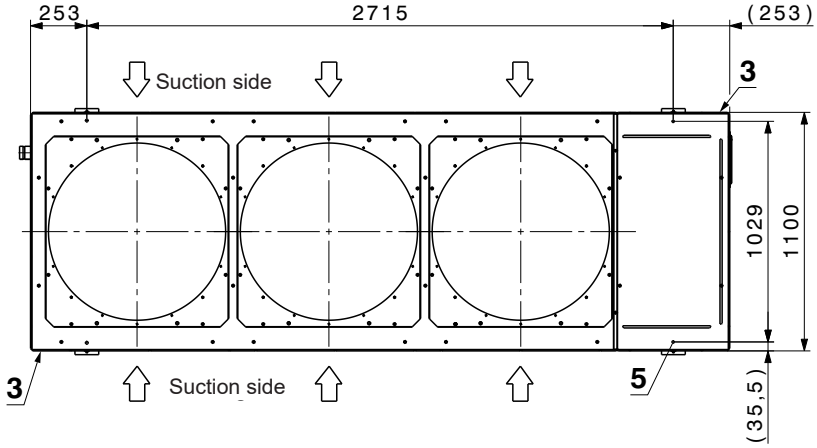
Front view (exhaust side)




Side view




Rear (suction side)



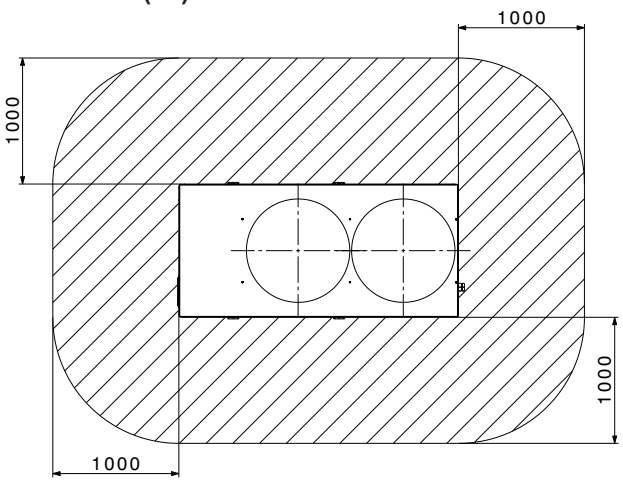

1 Flow heating DN 50
2 Return heating DN 50
3 Electrical connection
4 Control module bracket
5 Vibration dampers

### Functional spaces Safety Zone

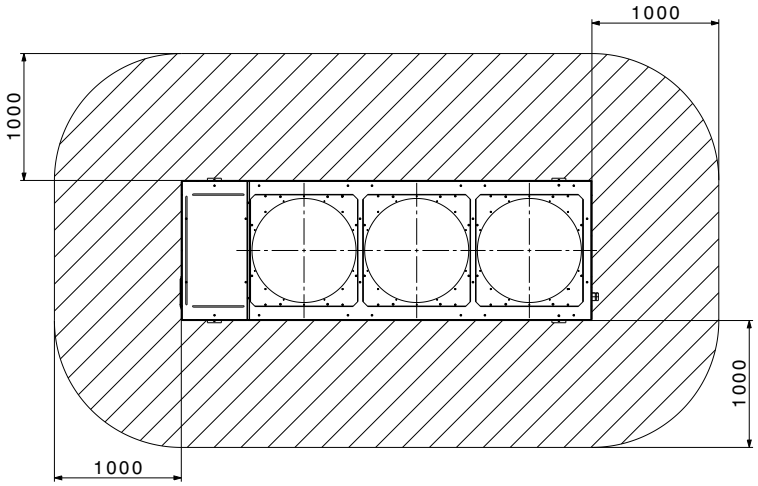
**WARNING**

- *A protection area of at least 1 m must be maintained on all sides of the heat pump.*
- *The following must be excluded within this area:*
  - Ignition sources (e.g. naked flames, cigarettes), surfaces with high temperatures
  - Openings (e.g. windows, doors, ventilation pipes)
  - Sinks (e.g. air shafts, drains)
  - The protected area must not extend into the area of stairs and traffic routes, and also it must not extend beyond the boundary of the property
- *The extent of the protected area is to be assessed depending on the local conditions, the existing degree of ventilation and the on-site situation.*

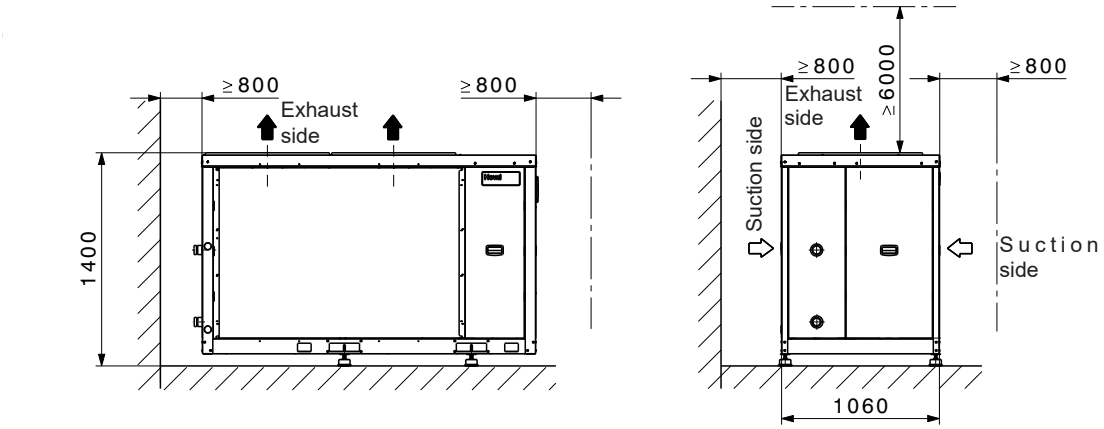
**Belaria® fit (53)**



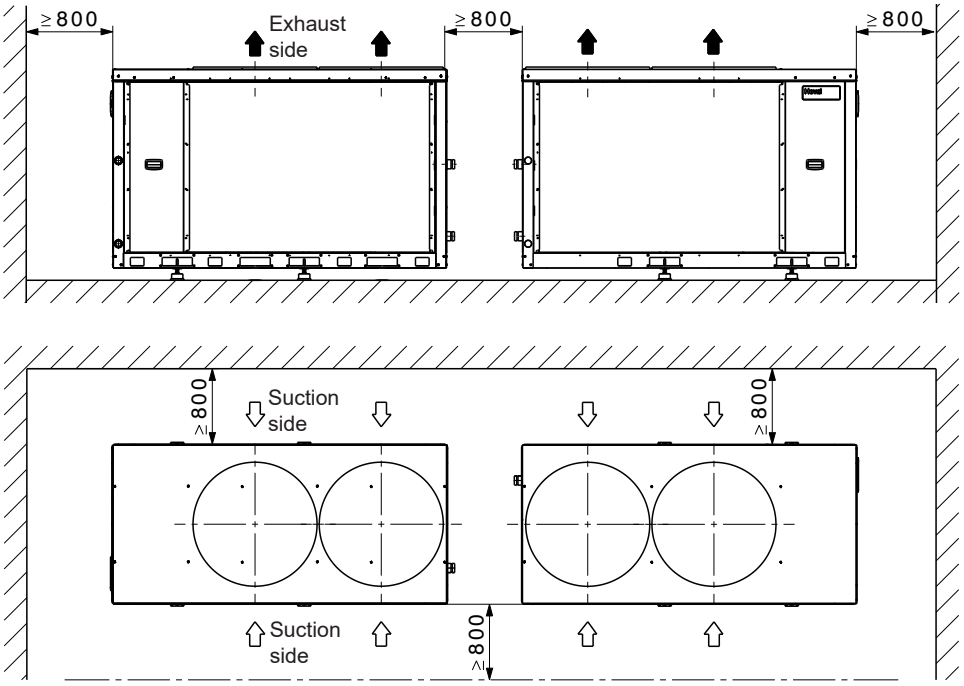

**Belaria® fit (85)**

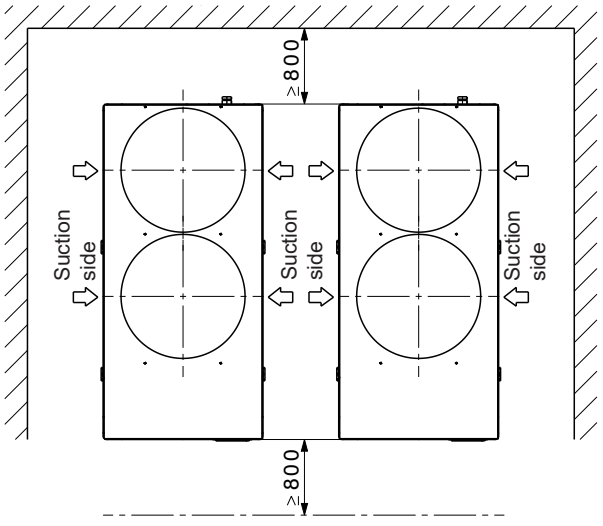


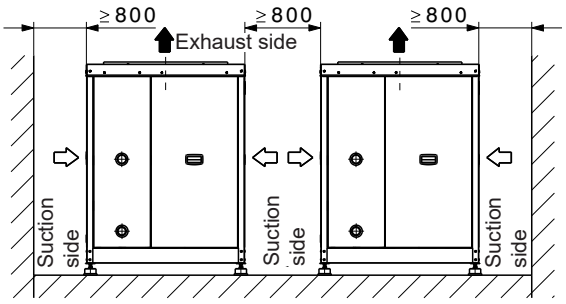
**Space requirement Belaria® fit (53)**
(Dimensions in mm)



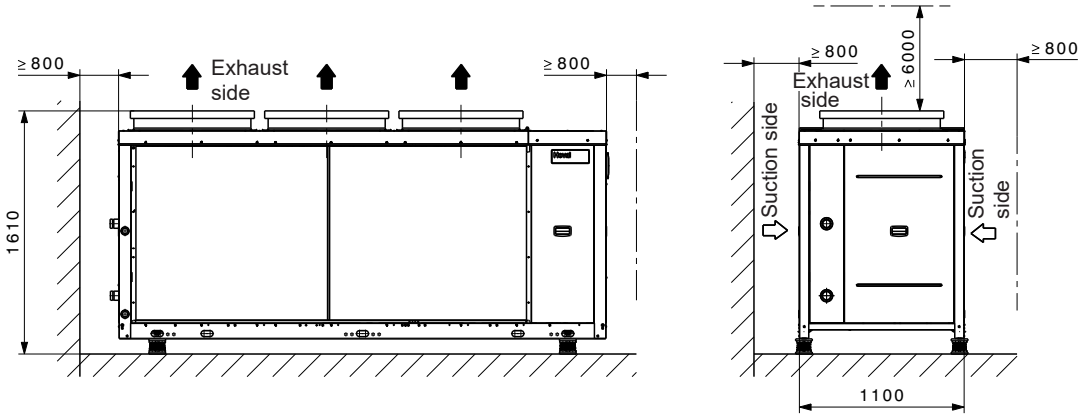

**Minimum distances for cascade systems Belaria® fit (53)**
(Dimensions in mm)



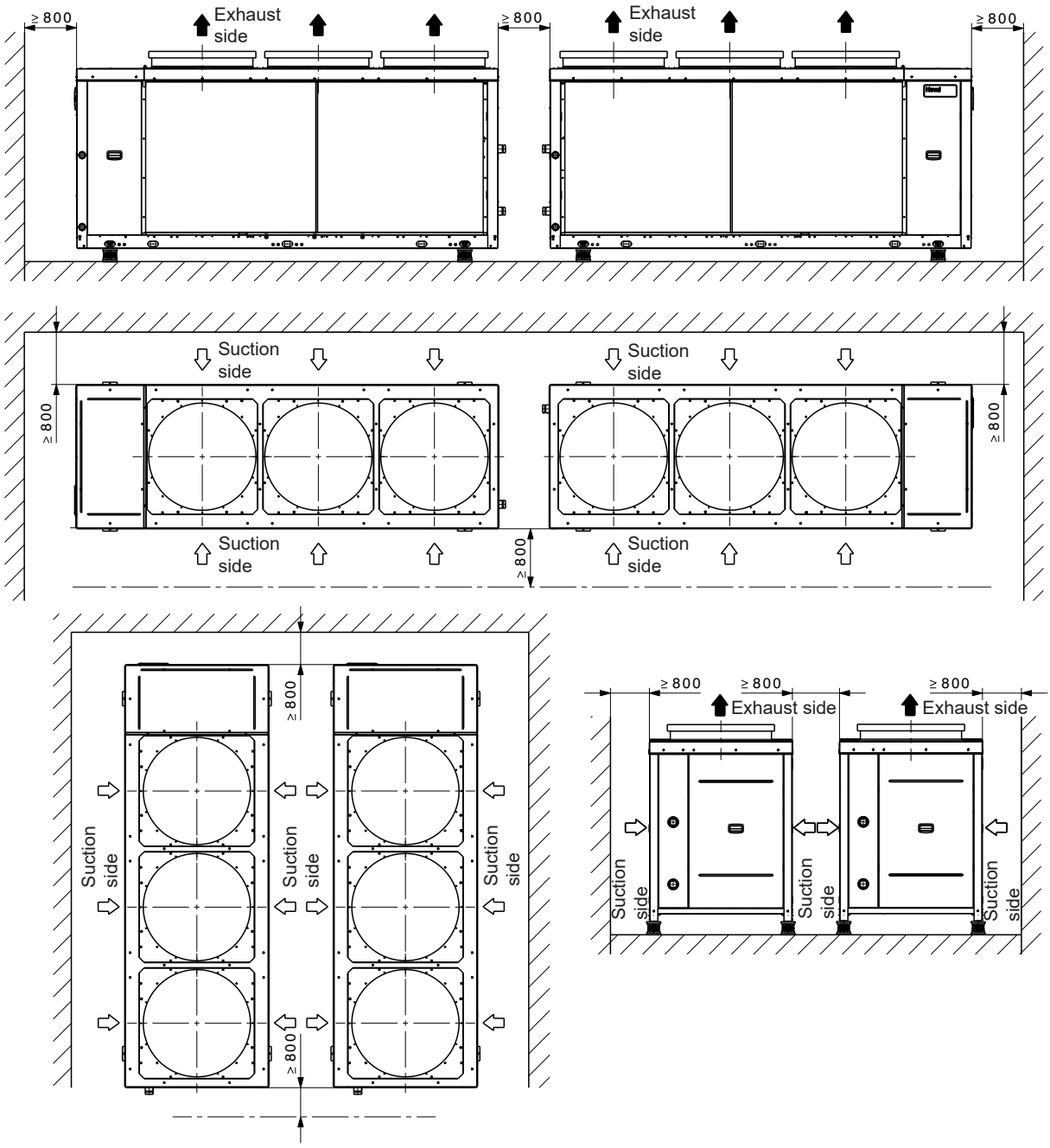



**Space requirement Belaria® fit (85)**



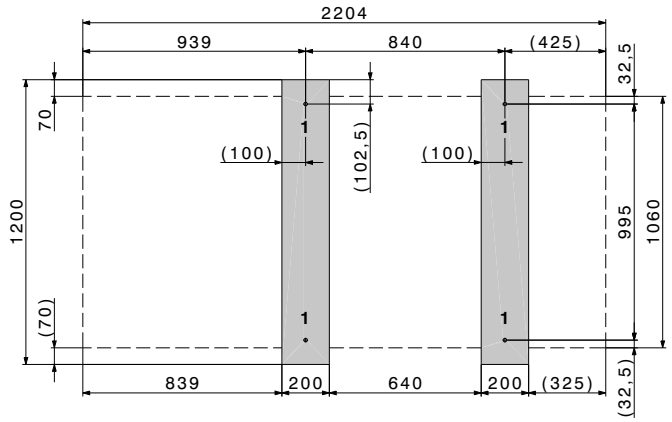

**Minimum distances for cascade systems Belaria® fit (85)**
(Dimensions in mm)



## Base design Belaria® fit (53)

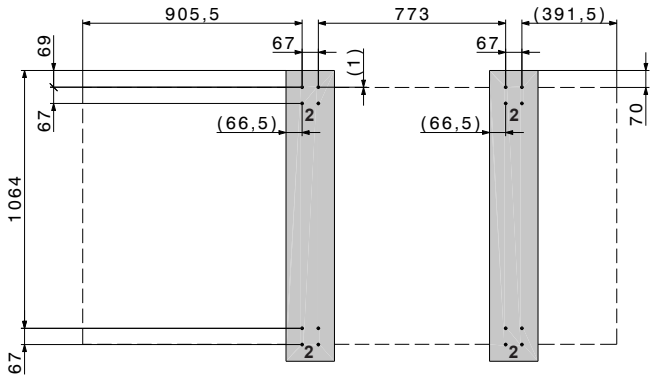
(Dimensions in mm)

Base plan feet



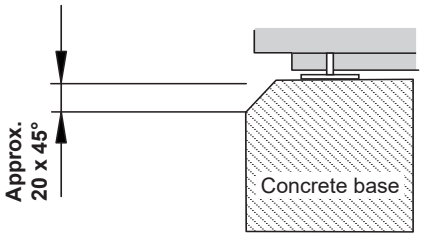

1 Hole for attachment of the heat pump M12

Base plan set of vibration-damping feet




2 Holes for vibration-damping adjustable feet

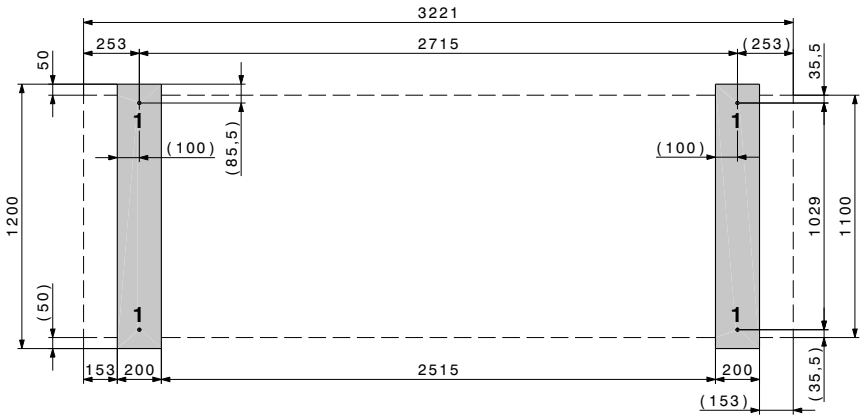
The concrete base must have a level surface the size of the Belaria® fit. The base should have chamfered edges.



## Base design Belaria® fit (85)

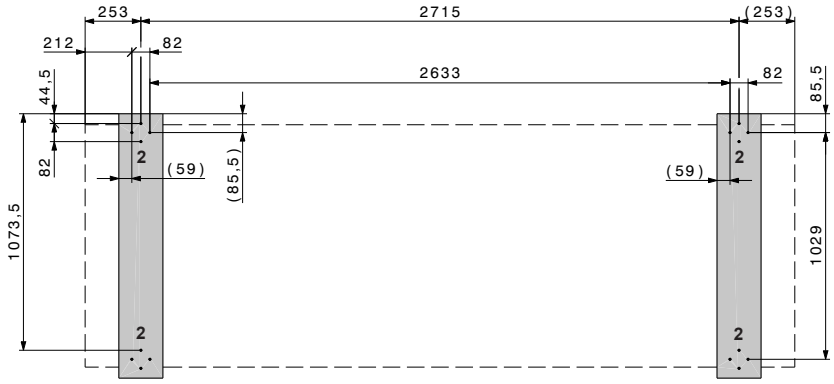
(Dimensions in mm)

Base plan feet



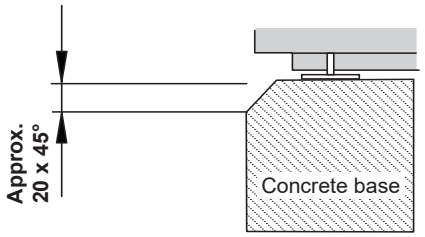

1 Hole for attachment of the heat pump M16

Base plan set of vibration-damping feet

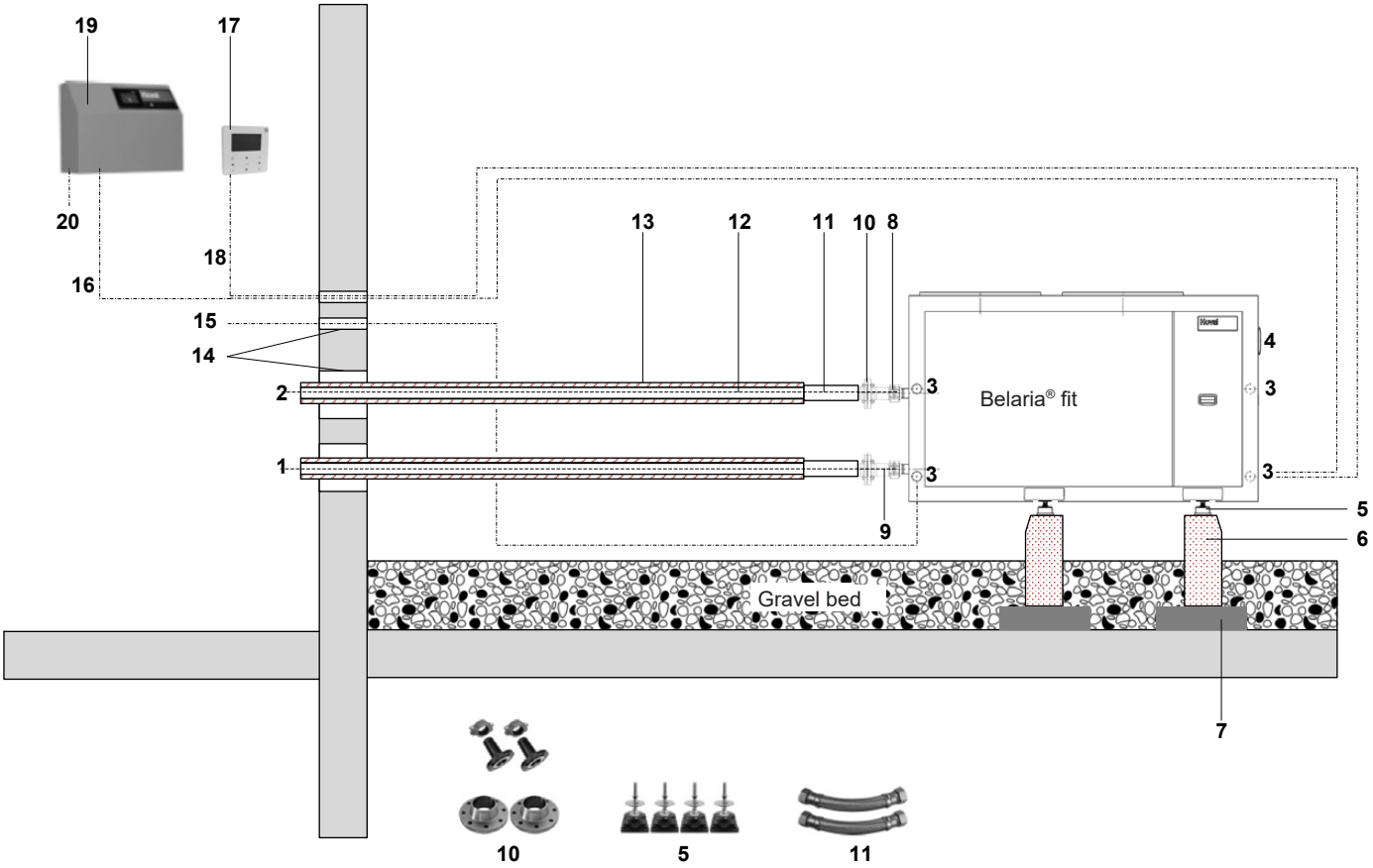



2 Holes for vibration-damping adjustable feet

The concrete base must have a level surface the size of the Belaria® fit. The base should have chamfered edges.



## Configuration and connection diagram for the Belaria® fit




| | | |
|---|---|---|
| 1 | Heating flow DN 50 | |
| 2 | Heating return DN 50 | |
| 3 | Electrical system feed-through | |
| 4 | Control module bracket (installation possible on site) | |
| 5 | Vibration dampers (option) | |
| 6 | Concrete base (on site) | |
| 7 | Vibration decouplers (on site) | |
| 8 | Victaulic coupling (included in the scope of delivery) | |
| 9 | Victaulic connection pipe (included in the scope of delivery) | |
| 10 | Set of welded-on flanges (option) | |
| 11 | Vibration decouplers (option) | |
| 12 | Hydraulic line (on site) | |
| 13 | Insulation (on site) | |
| 14 | Feed-throughs (on site) | |
| 15 | Main current | 400 V/5-pin (configuration of cross-section on site) |
| 16 | Connection to heat pump | |
| | Request On/Off | 230 V/2-pin (see wiring diagram) |
| | Cooling mode On/Off | 230 V/2-pin (see wiring diagram) |
| | Alarm | 230 V/2-pin (see wiring diagram) |
| 17 | Operator terminal | |
| 18 | Connection of heat pump operator terminal (on-site line length < 40 m: 5 x 0.75 mm² shielded line length < 300 m: 3 x 0.75 mm² shielded) | |
| 19 | Electrical box | |
| 20 | Control current | 230 V/13 A/3-pin (see wiring diagram) |

The piping from the boiler room to the heat pump must be configured by the installer. Connecting pipes are not included.