
Operation and Maintenance

ThermoCooler HP 100-980



Order number:
Project:



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1 General

1.1 Intended use

The ThermoCooler HP cooling/heating pump is intended to be used to cool and heat supply air in properties. The reversible heat pump is designed to be installed together with IV Produkt AB air handling units.

The cooling/heating pump should not be used as a standalone unit.

When installed indoors, the air handling unit must be installed in an area that maintains a temperature between +7 and +30°C, and with a moisture content of <3.5 g/kg in the fan room in winter. The unit can also be equipped for outdoor installation.

Any other use and installation in other environments is prohibited unless specifically permitted by IV Produkt AB.

1.2 Safety regulations

For safety regulations relating to the reversible heat pump installed together with the Envistar Flex air handling unit, see Operation and Maintenance for Envistar Flex, under order-specific documentation at docs.ivprodukt.com.

1.3 Manufacturer



The ThermoCooler HP cooling/heating pump is manufactured by:

IV Produkt AB
 Sjöuddevägen 7
 SE-350 43 VÄXJÖ

1.4 Designations

The reversible heat pump comes with a model rating plate placed on the front.

The model type plate shows the series number and the requisite designations to identify the unit.

		Reversible heat pump	
		ThermoCooler HP	
Ordernumber	<input type="text"/>		
Code Key	<input type="text"/>		
Model	<input type="text"/>		
Name of project	<input type="text"/>		
Date of manufacture	<input type="text"/>		
PS Max allowable press.	<input type="text"/>	bar (e)	
PT Test pressure	<input type="text"/>	bar (e)	
TS Temperature range	<input type="text"/>	°C	
Protection level - low	<input type="text"/>	bar (e)	
Protection level - high	<input type="text"/>	bar (e)	
Refrigerant, Fluid group	<input type="text"/>		
GWP	<input type="text"/>		
Code	<input type="text"/>		
Refrigerant charge	Circuit 1	<input type="text"/> kg	<input type="text"/> CO ₂ e
	Circuit 2	<input type="text"/> kg	<input type="text"/> CO ₂ e
	Circuit 3	<input type="text"/> kg	<input type="text"/> CO ₂ e
		 0409 IV Produkt AB VÄXJÖ, SWEDEN <small>Art. Nr. 19121-0009_00 EN</small>	
<small>Contains fluorinated greenhouse gases covered by the Kyoto protocol.</small>			

Typical model identification label

1.5 CE marking and EU Declaration of Conformity

The reversible heat pump is CE-marked, which means that upon delivery, it conforms to applicable provisions in EU Machinery Directive 2006/42/EC as well as to the EU Directives applicable to the type of unit, e.g. Pressure Equipment Directive (PED) 2014/68/EU.

As certification confirming that the requirements have been met, we provide an EU Declaration of Conformity, which is available under Documentation at ivprodukt.docfactory.com, or under Order Unique Documentation at docs.ivprodukt.com.



Typical CE label for air handling units

1.6 Maintenance

Regular maintenance of the reversible heat pump should be performed by a certified refrigeration technician.

1.7 Handling of refrigerant

The following information summarises the requirements and guidelines for handling the refrigerant used in cooling units. For further information, see the F-gas Regulations (517/2014). The purpose of the regulations is to contribute to achieving EU goals for reduced climate impact in accordance with the Kyoto Protocol.

Operator responsibilities

Generally speaking, the unit operator must:

- Minimise and prevent leakage
- Take corrective action to repair any leakage that arises
- Ensure that the service and repair of the refrigerant circuit is carried out by a certified refrigeration technician
- Ensure that refrigerant is handled in an environmentally secure manner and in accordance with national regulations.

By operator, we refer to the European Parliament's definition: "...the natural or legal person exercising actual power over the technical functioning of the equipment and systems...".

The levels for the various actions to be taken for a system are calculated using carbon dioxide equivalents, CO₂ e(ton). This figure is calculated by multiplying the refrigerant's GWP value (Global Warming Potential) by the charge in kilos. GWP for R410a is 2088. A charge of 5.0 kg R410a therefore corresponds to $(5.0 \times 2088) / 1000 = 10.44$ CO₂ e(tons).

The unit is marked with refrigerant quantity and carbon dioxide equivalent.

Leakage inspection and registration

- **Leakage inspection** must be carried out by a certified refrigeration technician:
 - when installing/commissioning the unit, size 190-980
 - periodically at least once every 12 months,
i.e. no more than 12 months between inspections, size 190-980
 - within one month of any work being performed (e.g. sealing a leak, replacing a component), size 190-980
- The operator must **record** events, such as the volume and type of refrigerant topped up, recovered refrigerant, results of inspections and work done, person and company who carried out service and maintenance, size 190-980.

If a unit has been assembled on site, the rules for recording, installing and periodic leakage inspection are applicable to size 100-150 as well.



1.8 Extended warranty

In cases in which the equipment delivered falls under a 5-year warranty, in accordance with ABM 07 with supplement ABM-V 07 or in accordance with NL 09 with supplement VU13, the IV Produkt Service and Warranty Manual is supplied with the product.

In order to lay claim to an extended warranty, a complete, documented and signed IV Produkt Service and Warranty Manual must be presented.

1.9 Spare parts

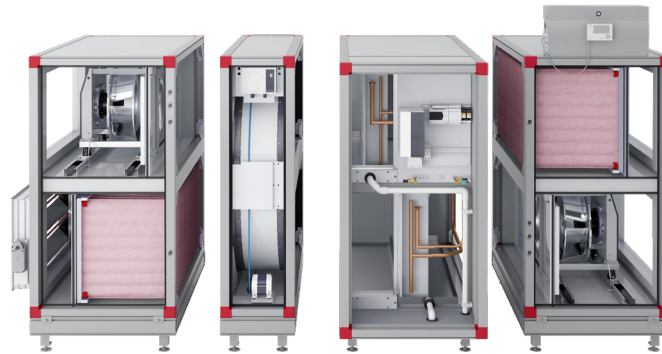
Spare parts and accessories for this unit are ordered from your nearest IV Produkt sales representative. When ordering, state the order number and designation. These are stated on a model type plate, affixed to each component. There is a separate spare parts list for the unit, refer to Order Unique Documentation at docs.ivprodukt.com.

1.10 Dismantling and decommissioning

When an air handling unit is to be dismantled, separate instructions must be followed, see [Dismantling and decommissioning the AHU](#) under Documentation at ivprodukt.docfactory.com.

2 Technical description

2.1 Cooling/heating pump ThermoCooler HP



Fan and filter section (extract air fan) Rotor ThermoCooler HP cooling/heating pump Fan and filter section (supply air fan)

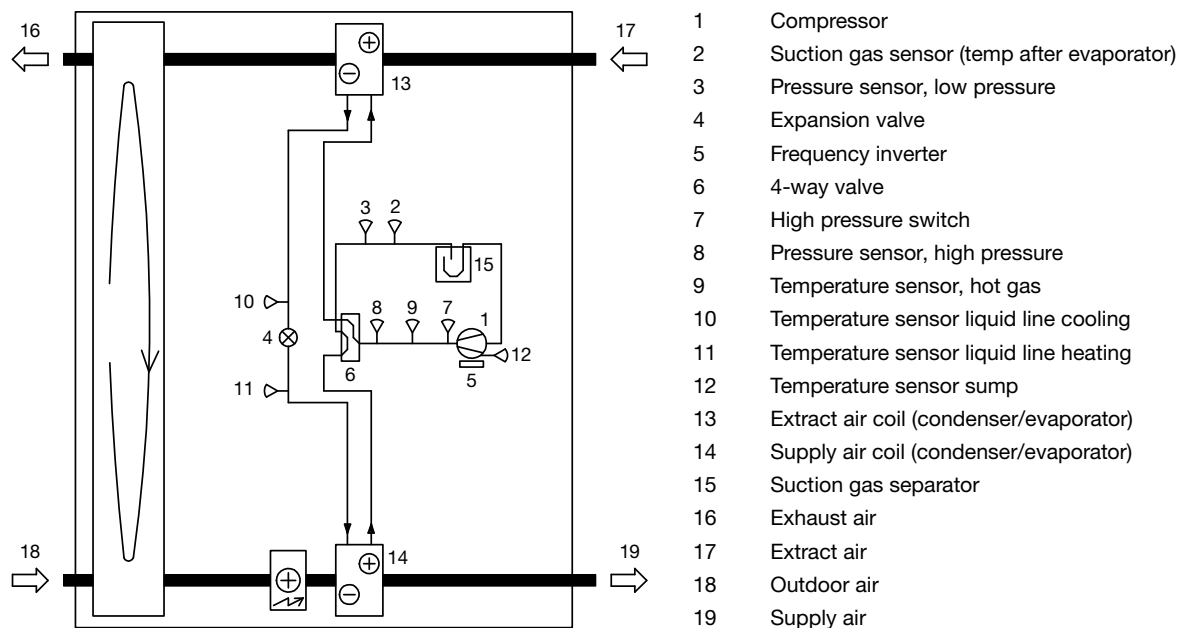
ThermoCooler HP is a series of integrated, speed controlled reversible heat pumps with stepless cooling and heating power.

Cooling circuit function

The reversible heat pump has four basic components: evaporator, condenser, expansion valve and compressor.

A 4-way valve is used to shift between cooling and heating.

For cooling, the 4-way valve is in cooling mode. For heating, the 4-way valve is in heating mode. This means that the coil, which was a condenser in cooling mode, becomes an evaporator in heating mode. Conversely, the evaporator becomes a condenser.



Flowchart for cooling mode, reversible heat pump (size 100-240)

Cooling mode

The compressor carries out the work required to run the cooling process. The evaporator is located in the supply air for the unit. The heat from the outdoor air is taken up in this coil, thereby cooling the supply air.

The energy supplied to the cooling system from the evaporator and the compressor leaves the unit via the condenser in the extract air.

It is important to ensure that the air volumes are above the specified minimum flow on both the outdoor air and extract air side. The process cannot work if these air volumes are not available.

Heating mode

The heating pump function takes the heat content of the extract air and reuses it, supplying the same heat to the air handling unit's supply air.

The extract air is the heat pump's energy source. When the extract air meets the extract air coil, it is cooled since the coil functions as an evaporator. From the evaporator, the refrigerant moves to the compressor, where it is compressed. The refrigerant then moves to the supply air coil, where the energy from the extract air and the compressor is released. The energy remaining in the extract air downstream of the heat pump is then recovered in the rotor.

These two recovery systems give a very high degree of efficiency. Since the rotor requires less energy to run than the compressor system, this will be in the first instance. The compressor will only start when the rotor's energy recovery is insufficient to heat the supply air.

Compressor

The reversible heat pump is equipped with a speed-controlled PM scroll compressor.

Depending on its size, the reversible heat pump may be equipped with another fixed compressor that is step-linked to the speed-controlled compressor. In the event of an increased power requirement, the frequency inverter will increase the speed of the compressor.

If the reversible heat pump is equipped with two compressors, the fixed compressor will engage in when the speed-controlled compressor has reached its maximum speed. The speed-controlled compressor returns to its minimum speed and can then adjust back up to maximum speed. This achieves infinitely adjustable cooling power.

The function is reversed where less cooling is needed.

Compressor protection

In the event of an alarm initiated by the control equipment or the safety circuit, the compressor stops and an alarm indication is given. The alarm can be read on the Climatix display or the Carel unit on the unit's circuit board.

In the event of an alarm, correct the fault and then reset the alarm. If alarm trips repeatedly, an authorised refrigeration service company must be called in.

The cooling/heating pump will primarily trip alarms for the following errors:

- High pressure in the system, manual reset on pressure control HP1
- Low pressure in the system
- Alarm from frequency inverter
- Incorrect phase sequence (size 600-980).

Function

The reversible heat pump is interlocked across the air handling unit. If any of the fans stop, the cooling/heating pump will also stop. The reversible heat pump is not permitted to start unless the minimum air flow has been achieved. The same applies if a heater is fitted.

The interlock and demand signal is sent via Modbus.

Circuit board

The circuit board for the unit contains:

- Main switch
- Fuses
- Control unit
- Any control unit for expansion valve next to fixed compressor.

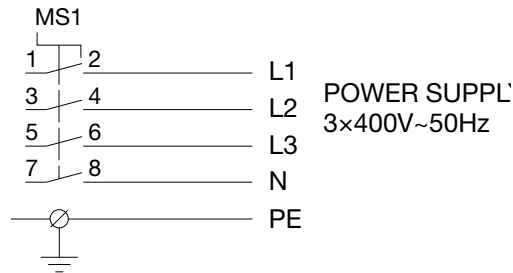
The circuit board is installed inside the unit and is internally prewired and tested at the factory.



3 Wiring instructions

3.1 Power supply

The reversible heat pump is powered separately as shown in the diagram below. For the recommended fuse protection, see "7 Technical data" page 19.



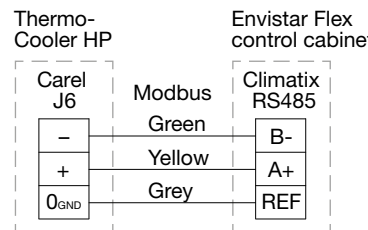
NB!
A residual current circuit breaker should not be used since the unit has a built-in frequency inverter.

In the event that the decision is nevertheless made to use a residual current circuit breaker, we recommend a 300 mA, type B residual current circuit breaker specially adapted for the frequency converter.

A 300 mA, type B residual current circuit breaker offers fire protection – not personal protection.

3.2 Communication with Climatix

Communication with the air handling unit's (Envistar Flex) Climatix control system takes place via Modbus. The connection between Carel and Climatix is made using a pre-installed quick connector.

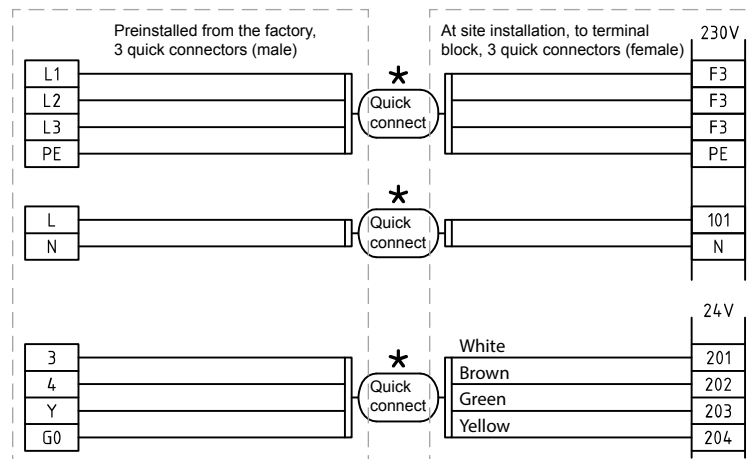


Basic diagram showing communication between Carel and Climatix via Modbus

3.3 Heater (optional)

A heater is optional and supplied integrated and fully connected with quick connectors if they have been selected when ordering the reversible heat pump.

The following wiring instructions apply if the heater is retrofitted. All connections are made internally in the reversible heat pump.



For maintenance instructions, see the section entitled “Air heater electric” in Operation and Maintenance for Envistar Flex, under order-specific documentation at docs.ivprodukt.com.



3.4 Envistar Flex unit parts

Quick connectors

Connection between unit parts in the air handling unit is carried out by connecting the pre-installed quick connectors using the markings on the cables for guidance.

Setting Climatix

The following settings for Climatix are made at the factory.

Main menu / Configuration / Configuration 1

Heat recovery	Rotor
Heating	TCHP
Electric heater	TCHP
Cooling	TCHP

Main menu / Configuration / Configuration 2

Cooling recovery	No
Support operation	No
Support operation/Osstp block	No
Freezing monitor	No
Pump heating	No
Pump alarm heating	No

Main menu / Configuration / Integration

Type of cooling, Modbus	Carel
No. of compressors	1 or 2
High pressure sensor	Yes
Increased MB communication	Yes

Main menu / Configuration / Basic data

Electric heater electrical power	value dependent on output variant
----------------------------------	-----------------------------------

4 Operation

4.1 Commissioning

Commissioning of the unit must be carried out by competent personnel according to the commissioning procedure, see [ThermoCooler HP, Commissioning record](#), which is available to download from ivprodukt.docfactory.com.

The validity of the product warranty is conditional on the system having been commissioned correctly. Working on the unit during the warranty period without the approval of IV Produkt shall render the warranty void.

The unit was designed and manufactured based on given operation cases that must comply with the unit's use for optimal function and a good operating economy.

External circumstances should not be changed without checking that such changes are within the unit's intended area of operation.

NB!

It is important that the oil is warm inside the speed controlled compressor crankcase before starting the cooling unit. The crankcase heating must be switched on long enough before the unit begins operating so that the oil maintains a temperature of at least 30 °C. The maximum warm-up time is approximately 2–3 hours. The temperature can be measured externally at the bottom of the compressor.

NB!

For units in size 600-980 (2-circuit), the compressor for the second circuit is dependent on the correct phase sequence. Compressor 2 starts briefly 30 seconds after powering up the unit in order to check the phase sequence. Check whether the alarm is displayed. If necessary, switch two of the incoming phases.

Prior to commissioning, the contractor must:

NB!

Wiring of connections and other electrical work may only be carried out by a qualified electrician or by service personnel recommended by IV Produkt.

1. Connect the unit to the power supply via a lockable safety switch.
2. Connect all ducts.

**WARNING!**

Rotating fan impeller. The unit must not be energised until all ducts have been connected.

Follow the troubleshooting instructions in the troubleshooting chart before contacting a service representative for servicing a unit under warranty. This will prevent any unnecessary service calls.



4.2 Cooling status

Status information is read on the Climatix display.

Information	Value	Explanation
Cooling unit status	UnitOn	Status of cooling unit
Heating	x%	Heating requirement from Climatix cooling regulator
Cooling	x%	Cooling requirement from Climatix cooling regulator
Freq. inv. output	x.x%	Frequency to the compressor
Compr. no	Comp1	
Compr. Sum alarm	Normal	
Alarm management	>	The alarm is displayed if there is a fault with the inverter or compressor. In the event of an alarm, see "6.2 Alarm information for inverter and compressor" page 17.

Compressor C1	On/Off	Compressor operating mode
Suction gas temp C1	x.x°C	Measured suction gas temp
Evaporation temp C1	x.x°C	Calculated evaporating temp based on low pressure
Low pressure C1	x.x bar	Relative pressure from low pressure sensor
Overheating C1	x.x K	Measured superheating
High pressure C1	x.x bar	Relative pressure from high pressure sensor
Expansion valve 1	x.x%	Expansion valve position
Condensation temp C	x.x°C	
Hot gas temperature	x.x°C	Temperature of output from compressor
Liquid line temperature	x.x°C	Temperature downstream of condenser
Supercooling	x.x°C	Measured supercooling

5 Maintenance instructions

5.1 Service schedule

For a service schedule, see Operation and Maintenance for Envistar Flex, under order-specific documentation at docs.ivprodukt.com.

5.2 Periodic inspection

The operation parameters for the reversible heat pump must not be changed unless a check is first made to ascertain that the changes will be within the unit's operating range.

Leakage inspection and registration

For information on the operator's responsibility with regards to leakage inspection and registration, see "1.7 Handling of refrigerant" page 5.

Visual check

Check:

1. The fins on the condenser/evaporator to detect mechanical deformations
2. The drip tray and drain with water trap (clean if necessary)
3. That the water trap (without non-return valve) is filled with water.

Cleaning

If the fins are fouled, they should be vacuumed from the inlet side. Alternatively, you can blow them clean with compressed air from the outlet side. If they are severely fouled, you can clean them with warm water mixed with dishwashing detergent that will not corrode aluminium.

For more information, refer to [Cooling coil, cleaning](#) under Documentation at ivprodukt.docfactory.com.

Check function

Check that the reversible heat pump in the air handling unit is operating as it should by temporarily lowering/increasing the temperature setting (setpoint).

6 Alarm management and troubleshooting

For units with control equipment (code MX), alarm information can be read on the Climatix display.

For units without control equipment (code UC, MK, US), alarm information can be read on the Carel display.

Press the alarm symbol to view alarms.

6.1 Troubleshooting in the event of an alarm

Inspection	Possible cause	Corrective action
Has the high pressure switch tripped?	YES ⇒ No or too low air flow across the condenser	Check the air flow across the condenser. Rest the pressure switch manually.
	Defective high pressure switch	Check/replace
NO ↓		
Is the alarm “118 Compr 1, Low evaporation pressure” or “176 Compr 2, LowEvap-Pressure” displayed?	YES ⇒ Insufficient refrigerant volume	Look for leakage, seal the leak and top up with refrigerant
	No or too low air flow across evaporator	Check/adjust the flow
	Defective expansion valve	Check/replace
NO ↓		
Is the LED flashing red on the frequency inverter?	YES ⇒ Phase failure/voltage failure	Check the 3-phase supply, measure the incoming voltage. Reset the frequency inverter by switching off the voltage for 1 minute or more. Check that the compressor is running without dissonance.
	Overload/defective stepless compressor	Reset the frequency inverter by switching off the voltage for 1 minute or more. Check that the compressor is running without dissonance.
NO ↓		
Is the alarm “189 Phase Rotation order” displayed?	YES ⇒ Incorrect phase sequence for supply voltage on compressor 2	Shut off voltage and switch two of the incoming phases
NO ↓		
Is the alarm “94 Drive offline” displayed?	YES ⇒ ThermoCooler HP does not have supply voltage 3×400V	Connect supply voltage

6.2 Alarm information for inverter and compressor

Alarm Climatix	Explanation and corrective action
Cooling unit	
Sum alarm	Sum alarm, check alarm in Carel, see table below.
Alarm C1 R. pressure switch	High pressure switch tripped or alarm for frequency inverter.
Alarm C1 EEV motor fault	Fault on electrical connection to expansion valve.
Alarm C1 low pressure sensor	Power cut or short circuit to low pressure sensor. Check EVD, cabling and sensor.
Alarm C1 suction gas sensor	Power cut or short circuit to suction gas sensor. Check EVD, cabling and sensor.
Alarm C1 high pressure sensor	Power cut or short circuit to high pressure sensor. Check EVD, cabling and sensor.
Alarm C1 low overheating	Compressor stoppage caused by low overheating.
Alarm C1 LOP	Compressor stoppage caused by low evaporation temperature.
Alarm C1 MOP	Compressor stoppage caused by high evaporation temperature.
Alarm C1 communication EVD	Fault on communication to EVD (expansion valve control).
Alarm C1 low suction gas temp	Low suction gas temperature.

Alarm Carel	Explanation and corrective action
76 Drive MainsPhaseLoss	Check that all three phases are connected to the frequency inverter.
81 Drive U_phaseLoss	
82 Drive V_phaseLoss	
83 Drive W_phaseLoss	
94 Drive offline	No communication with the frequency inverter. Check that the frequency inverter is energised with 3-phase 400V.
118 Compr 1, Low evaporation pressure	Circuit 1, low evaporation temp/pressure. Check leakage in cooling circuit.
121 Compr 1, High pressure switch	Circuit 1, high pressure switch tripped. Check air flow and fire damper.
172 Compr 2, Motor protector	Circuit 2, motor protection alarm
174 Compr 2, High pressure switch	Circuit 2, high pressure switch tripped. Check air flow and fire damper.
176 Compr 2, LowEvapPressure	Circuit 2, low evaporation temp/pressure. Check leakage in cooling circuit.
180 Compr 1, High pressure switch	Circuit 1, high pressure switch tripped. Check air flow and fire damper.
189 Phase rotation order	Incorrect phase sequence gives incorrect rotation direction. Switch two of the incoming phases.



6.3 Troubleshooting via symptoms

Symptom	Possible cause	Corrective action
Low cooling power - too high temperature in the cooled object	The power supply has been interrupted	Check the control/safety switches and fuses.
	Separate supply not connected	Connect supply
	None or too low air flow across evaporator	Check that nothing inhibits the air flow
	The control equipment is incorrectly preset/defective	Adjust the settings or replace the equipment
Compressor is not operating	The power supply has been interrupted.	Check the control/safety switches and fuses
	Incorrect phase sequence (compressor 2)	Switch two of the incoming phases
	Compressor has opened a safety circuit	Check and reset, if needed
	Defective compressor	Check/replace
Frost on the evaporator (heating application)	Expansion valve is defective	Check/replace
	Insufficient refrigerant volume	Look for leakage, seal the leak and top up with refrigerant
	Low return air flow	Adjust the flow

6.4 Alarm reset

In the event of an alarm initiated by the frequency inverter or the safety circuit, the compressor stops and the sum alarm relay is energised. The alarm is displayed in the control unit menus “Operating information, compressors” and “Status: Alarm”.

In the event of an alarm, take corrective action to correct the fault, and then press the “Alarm reset” button on the control unit for at least 3 seconds. If the safety circuit alarm trips repeatedly, an authorised refrigeration service company must be called in.

7 Technical data

	Size	100	150	190	240	300	360	400	480	600	740	850	980
Air flow min ^(a)	m ³ /s	0.25	0.38	0.50	0.58	0.68	0.85	0.92	1.07	1.34	1.71	1.98	2.38
Air flow max ^(a)	m ³ /s	0.95	1.61	2.12	2.48	2.91	3.64	3.93	4.61	5.75	7.34	8.47	9,95
Max cooling power ^(b)	kW	13.2	21.3	27.1	29.1	40.1	48.3	51.0	65.1	81.7	99.5	113.3	129.1
No. of compressors	units	1	1	1	1	1	1	1	1	2	2	2	2
Max operating current	A	7.6	11	15	15	21	24	26	33	44	52	63	65
External fuse protection ^(c)	A	10	16	20	20	25	32	32	40	50	63	80	80
Refrigerant R410a	kg	2.8	4.6	5.8	7.0	8.2	10.1	10.7	13.2	10.4 + 5.8	14.0 + 6.0	14.0 + 9.0	17.4 + 12.6

a) For units with dampers, ePM1-50% (F7) filter supply air, ePM10-60% (M5) filter extract air, SFPv values with NP rotor, supply air temp 20°C and duct pressure 200 Pa (170+30 Pa). Max. air flow calculated with a minimum 10% spare capacity for fans.

b) With outdoor temp 26°C, 50% RH and extract air temp 22°C.

c) Regarding cooling/heating pump at 3×400V+N 50 Hz. Fuses with type C characteristics. The air handling unit is fused separately and the fuse protection size varies depending on selection of fan variants.



Air handling with focus on LCC

You are welcome to contact us

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