Carrier

INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

Reversible heat pumps

61AQ 040P-560P

Rated Heating capacity 40-140 kW
Modular capability up to 4 units (560kW)

INVERTER R-290 Natural greenspeed AQUASNAP®

* The availability of sizes and options depends on the country. Please contact your local commercial dealer for more information.

Original document

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CONTENTS

This manual applies to the following units:

- 61AQ, standard reversible heat pump, R-290 refrigerant (A3 fluid)

For operation of the control, please refer to the 61AQ control manual.

Most of the table of the documment are related to the base unit.

For modular system, need to consider the value of the differents unit of the system.

Combinaison

Monobloc unit		**Base unit**							
AquaSnap 61AQ	**Sizes**	**040P**	**050P**	**060P**	**070P**	**080P**	**100P**	**120P**	**140P**

Modular system		**Modular / 2 units**						**Modular / 3 units**					**Modular / 4 units**				
AquaSnap 61AQ	**Sizes**	**160P**	**180P**	**200P**	**240P**	**260P**	**280P**	**300P**	**320P**	**350P**	**380P**	**420P**	**440P**	**470P**	**490P**	**520P**	**560P**
Base unit																	
060P		1	1	1				1	1				1				
070P										1				1	1		
100P		1															
120P			1		2	1		2	1		2		2	1		2	
140P				1		1	2		1	2	1	3	1	2	3	2	4

The cover photograph is for illustrative purposes only and is not part of any offer for sale or contract.

1 - INTRODUCTION AND SAFETY INSTRUCTIONS

The units are designed to heat water (heating mode) and cool water (cooling mode) for the air conditioning / heating of buildings and industrial processes.

They are designed to provide a very high level of safety and reliability, making installation, start-up, operation and maintenance easier and safer.

They will provide safe and reliable service if used within their application ranges.

For all safety instructions, please refer to the EH&S instructions. A paper version is delivered with the machine, the digital version is available in the same place as the IOM, (contact your local distributor).

In addition to this EH&S instructions, the manufacturer states that the unit is designed for a maximum number of 120,000 start-ups.

These units contain natural refrigerant governed by the Kyoto protocol (1997) and subject to European regulation (EU) 2024/573:

- Refrigerant type: R-290 A3
- Global Warming Potential (GWP): 0,02 (AR6)

2 - RECEIPT OF GOODS

2.1 - Checking the equipment received

Check that the unit and the accessories have not been damaged during transport and that no parts are missing. If the unit and the accessories have been damaged or the shipment is incomplete, send a claim to the shipping company.

Compare the name plate data with the order.

The name plate is attached in two places to the unit:

- On one side of the unit exterior,
- On the inside of the electrical panel door.

Check that the IOM corresponds to the unit indicated on the nameplate. If the reference is not the same, contact your distributor.

3 - HANDLING AND POSITIONING

3.1 - Handling

Carrier strongly recommends employing a specialised company to unload the machine.

Do not remove the packaging until the unit is in its final position.

These units can be safely moved by trained personnel with a fork lift truck with the correct capacity for the dimensions and weight of the unit, as long as the forks are positioned in the location and direction shown on the unit.

The units can also be lifted with slings, using only the designated lifting points marked on the unit (labels on upper frame and a label with all unit handling instructions, attached to the unit).

Use slings with the correct capacity, and follow the lifting instructions on the certified dimensional drawings supplied.

IMPORTANT: Only attach slings to the designated lifting points which are marked on the unit.

There units are not design to be lifted by helicopter. For such operation, add a subbase and connect sling to the subbase, in any case to the unit lifting points.

It is advisable to protect coils against crushing while a unit is being moved. Use struts or a lifting beam to spread the slings above the unit. Do not tilt the unit more than 15°.

Safety when lifting can only be guaranteed if all these instructions are followed. Otherwise, there is a risk of equipment damage or injury to personnel.

3.2 - Positioning

The machine must be installed in a place that is not accessible to the public and is protected against access by non-authorised persons.

The machine is designed to be installed outdoor.

For more details on the different installation cases, see the A3 refrigerant installation guide.

For extra-high units, the unit environment must permit easy access for maintenance operations.

For the centre of gravity coordinates, the position of the unit mounting holes, and the weight distribution points, refer to the certified dimensional drawings. Ensure the free space shown in the dimensional drawings is respected to facilitate maintenance and connection.

The typical applications of these units are cooling and heating, which do not require earthquake resistance. Earthquake resistance has not been verified.

Before positioning the device, check that:

- The chosen location can support the weight of the unit, or that the appropriate reinforcement measures have been taken.
- The unit is installed level on an even surface (maximum tolerance is 5 mm along both axes).
- If the support structure is sensitive to vibration and/or noise transmission it is advisable to insert anti-vibration mounts (elastomer mounts option 308 or metal springs) between the unit and the structure. Selection of these devices is based on the system characteristics and the comfort level required and should be made by technical specialists.
- It's recommended to instal flexible water connection (option 309A) in order to avoid vibration and noise transmission to the water loop and the building.
- There is adequate space above and around the unit for air to circulate and for access to the components (see dimensional drawings).
- The number of support points is adequate and that they are in the right places.
- The location is not subject to flooding.
- Wind can affect the operation and performance of machines.
- Avoid installing the unit where snow is likely to accumulate (in areas subject to long periods of sub-zero temperatures, the unit should be raised, see the figure opposite).
- The unit is designed with a drain pan outlet to be connected to an evacuation system for 100% condensate recovery. Alternatively, it can be installed on a plinth designed to collect then drain the water produced by the reversible units during the defrost cycles. If there is some remaining water on the floor and if temperature is negative, this water could turn into ice and cause falls.
- Baffles may be necessary to deflect strong winds. These must not restrict the unit's air flow.

IMPORTANT: Before lifting the unit, check that all enclosure panels and grilles are securely fixed in place. Lift and set down the unit with great care. Tilting and jarring can damage the unit and impair unit operation.

Never apply pressure or leverage to any of the unit's panels or uprights; only the base of the unit frame is designed to withstand such stresses. No force or effort must be applied to pressurised parts, especially via pipes connected to the water type heat exchanger (with or without the hydraulic module if the unit is equipped with this). The hydraulic module pipes must be fitted so that the pump does not support the weight of the pipes.

3.2.1 - Free spaces and installing several units

61AQ units are especially designed to be mounted side-by-side in lead/lag operation (up to 4 x 61AQ units).

In that case, except for the space to access the screws, no specific clearance is required between units.

In the case of installation next to other type of products, the free space between the sides of the units should be increased to 1500mm minimum.

The height of the solid surface must not exceed 2 m.

NOTE: If the walls are higher than 2 m, contact the factory.

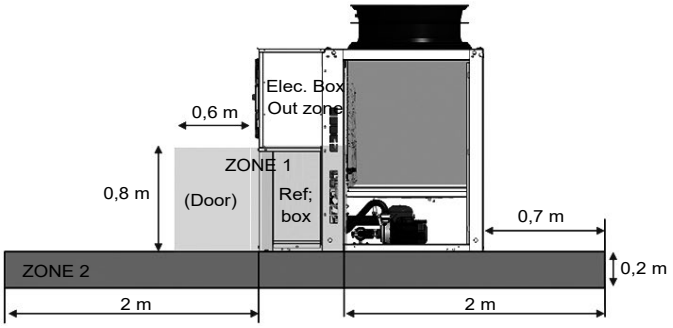
3.2.2 - Positioning of potentially flammable zones around the unit

The full unit, including all options & accessories that are delivered by CARRIER, has been qualified for the use with R290 refrigerant.

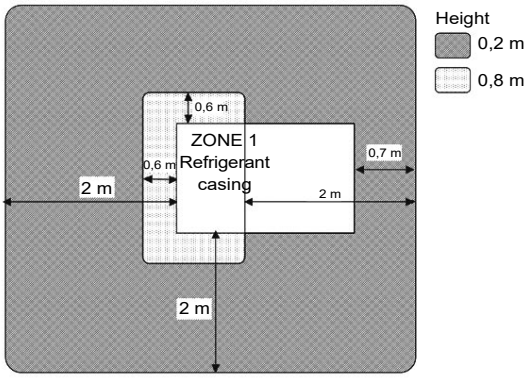
For that purpose, CARRIER is compliant with EN 378-2 §6.2.14 and has defined potentially flammable zone using EN 60079-10-1 in order to identify where ignition sources must not be present. Then CARRIER has designed the machine in order that, if the unit is used the way it was designed for, there is no internal ignition source in the internal potentially flammable zone.

Thus, the only residual risk is to have an ignition source introduced in the potentially flammable zone by the user. For that purpose, CARRIER has decided to represent the external potentially flammable zone where the user must not introduce ignition source.

Side view



Top view



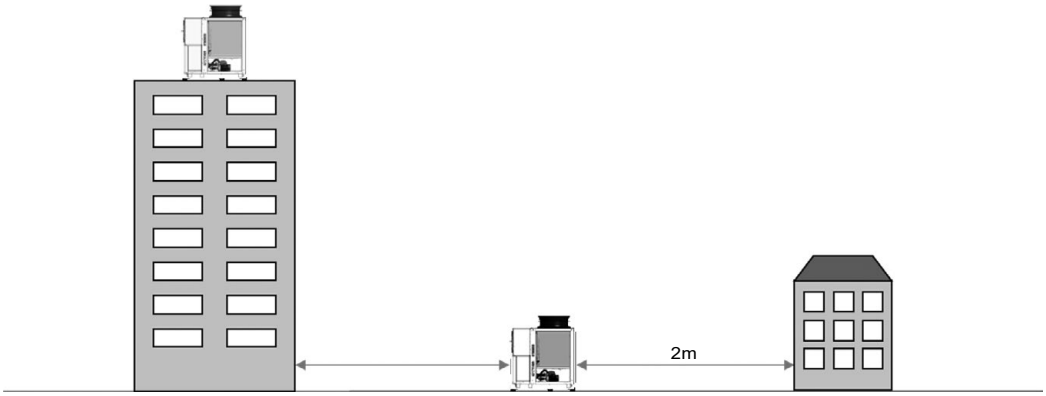
3.3 - Installation cases

Units are developped and qualified to be installed in free field area. However other installation cases could be required depending on site conditions. The below typical installation cases are provided with guidance to better consider the safety aspect linked to the flammability and/or explosion risk linked to the fluid used in the machine. It can not be considered as representative of the customer installation. The risk assessment of the installation of the equipment always remains under the responsibility of the customer. The manufacturer recommend to use EN378-3 standard to manage potential risks. Eventually national laws and guidelines must be consulted and adhered to under all circumstances.

Although this information is believed to be accurate, it is presented without warranty of any kind, either express or implied. These are general recommendations and do not replace the installer's individual advice and instructions for each specific site. Carrier shall not be liable if the information provided is not appropriate for a specific site and/or does not comply with applicable regulations. The manufacturer assumes no liability for actions taken by readers or users of this document that may cause unintentional damage or injury due to recommendations or inferences made from this document. The customer and the installer remain solely responsible for the obligation to train and inform themselves, as well as for compliance with all applicable regulations (European, national, local). The customer and/or the installer must carry out their own risk assessment related to the installation of the equipment and remain solely responsible for this risk assessment.

3.3.1 - Free field installation

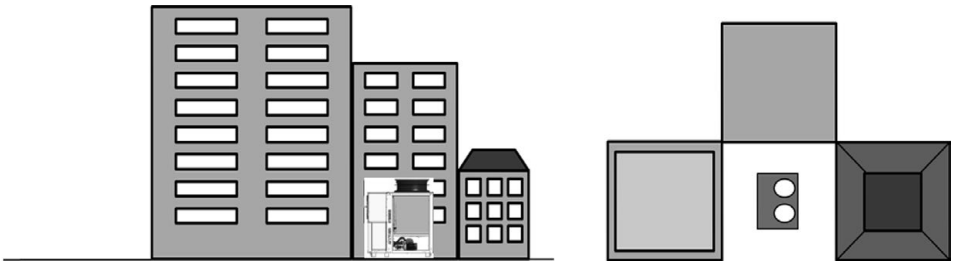
Unit is installed without obstacles around, avoiding accumulation of refrigerant fluid in case of leak.



The minimum distance with building or walls is given to allow circulation of thecnician around the unit during maintenance.

3.3.2 - Outdoor confined space installation

Small spaces



In that case, natural ventilation might be reduced, and refrigerant accumulated within the restricted space in case of leak event.

Customer must ensure no accumulation of refrigerant will be possible.

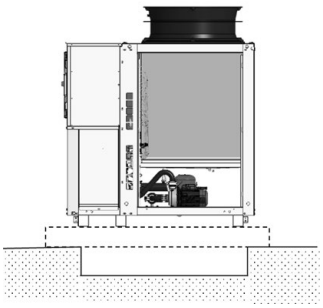
Commonly used solutions (non-exhaustive list) are:

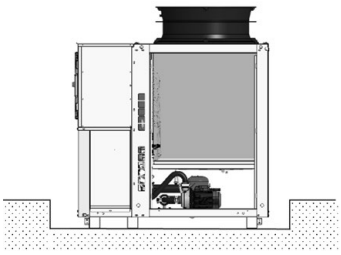
- Risk analysis demonstrating no accumulation risk
- Additional ventilation system for identified accumulation areas + leak detector
- Opening in wall at the position of the accumulation area

Choice of the used solution is under responsibility of customer, depending on site specificities.

3 - HANDLING AND POSITIONING

Installation over a pit





R290 has a density higher than air. In case of leak, the main risk is stagnation in the lowest point.

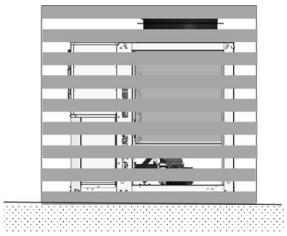
If unit is mounted in or over a pit, customer must ensure evacuation of gas is possible.

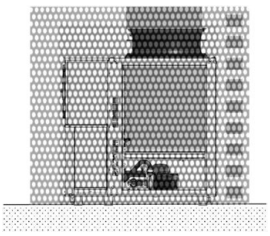
Commonly used solutions (non-exhaustive list) are:

- Vent duct
- Ventilation system + leak detector

Choice of the used solution is under responsibility of customer, depending on site specificities.

Acoustic package





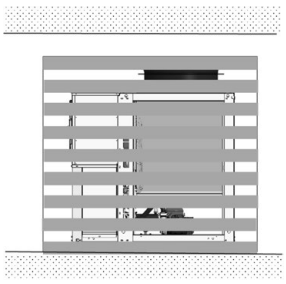
Some noise reduction systems have an impact on air circulation (packages, louvered panels, etc.).

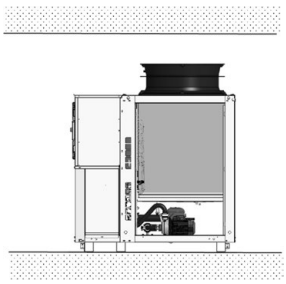
The customer must ensure that the acoustic system in place doesn't allow refrigerant fluid accumulation, especially in low part.

An alternative solution is to equip the system with a leak detector that ensures cuttingthe power and stopping unit operations.

Choice of used solution is under responsibility of customer, depending on site specificities.

Under shelter or covered area





Is considered under shelter an area or local that has at least one wall with opening rate > 75% with outdoor. This type of installation can be considered as an outdoor installation.

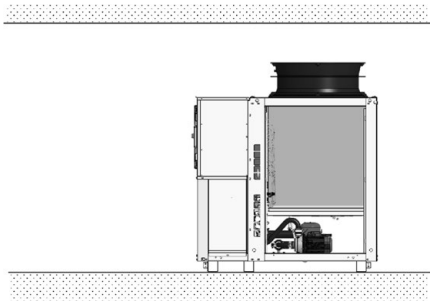
Customer must ensure accumulation of refrigerant is not possible.

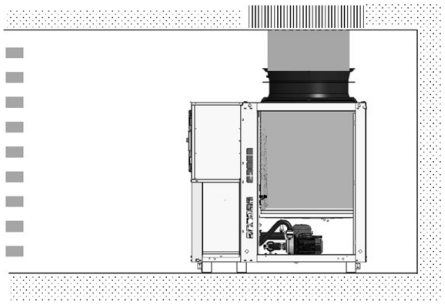
Commonly used solutions (non-exhaustive list) are:

- Risk analysis demonstrating no accumulation risk
- Permanent ventilation system avoiding gas accumulation
- Additional ventilation system for identified accumulation areas"

Choice of used solution is under responsibility of customer, depending on sitespecificities.

3.3.3 - Indoor installation





In case unit is installed in an indoor space, installation requirements provided by EN378-3 standard must be applied.

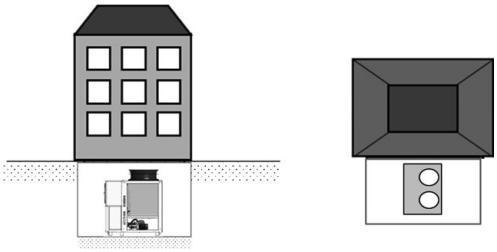
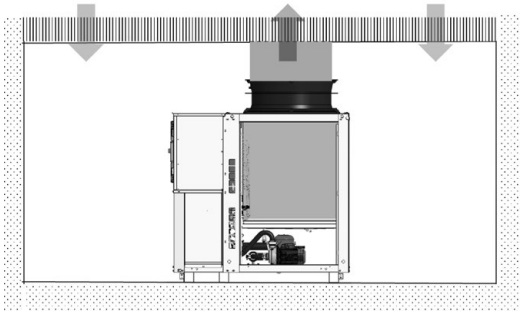
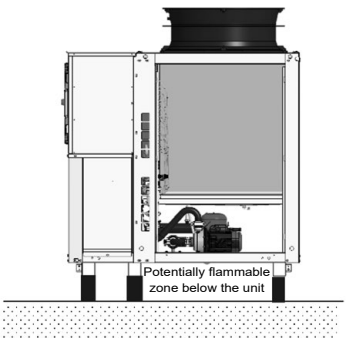
In that case, the potentially flammable zone generated by the unit is enlarged vs standard potentially flammable zone that is defined for outdoor use.

All necessary protection required must be employed (detection and ventilation).

Choice of used solution is under responsibility of customer, depending on site specificities.

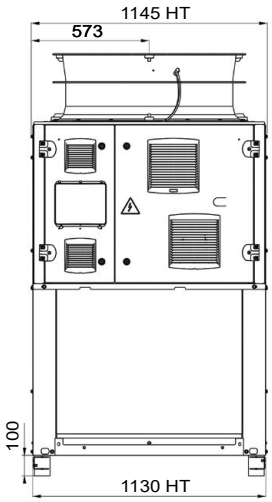
3.3.4 - Variants and corresponding installation

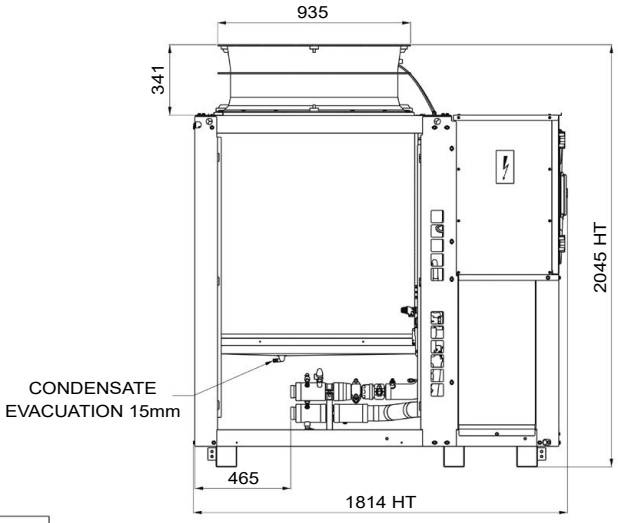
A high number of installation is possible. Here is a list of existing cases and the corresponding installation cases to report above.

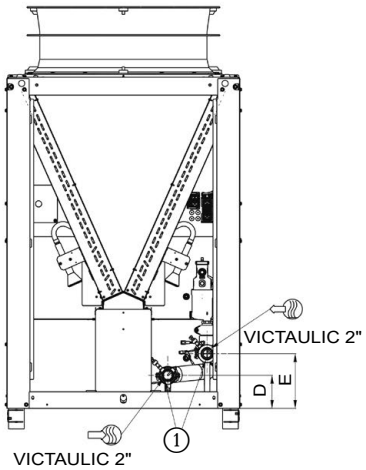
Variant	Installation case to report to
Sunken courtyard 	Depending on the courtyard dimensions and clearance around the unit: - Free field installation or - Installation over/in a pit
Room with inlet/outlet from the ceiling 	Shoud be considered as: - Indoor unit
Unit mounted on platform 	Flammable risk area below the unit depends on ventilation: - Good ventilation: can be considered as free field installation --> potentially flammable zone dimension is the same than on unit side - Lack of ventilation: should be considered as installation over/in a pit --> Flammable risk area extends down to the floor

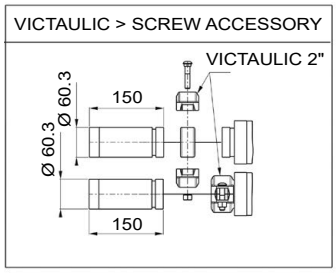
4 - DIMENSIONS, CLEARANCES, MINIMUM INSTALLATION DISTANCES

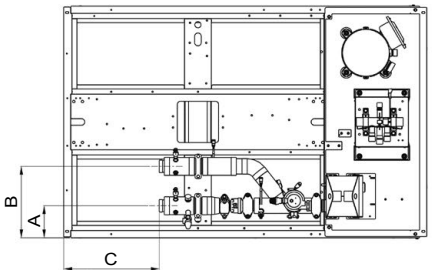
4.1 - 61AQ 040P-070P, units without hydraulic module











UNITS	A	B	C	D	E
Standard	155	346	462	160	264
Pump 116V	155	303	462	160	264

Key:
All dimensions are given in mm.

① Unit water inlet and outlet

Inlet water

Outlet water

Electrical supply entry

NOTE: Non-contractual drawings.

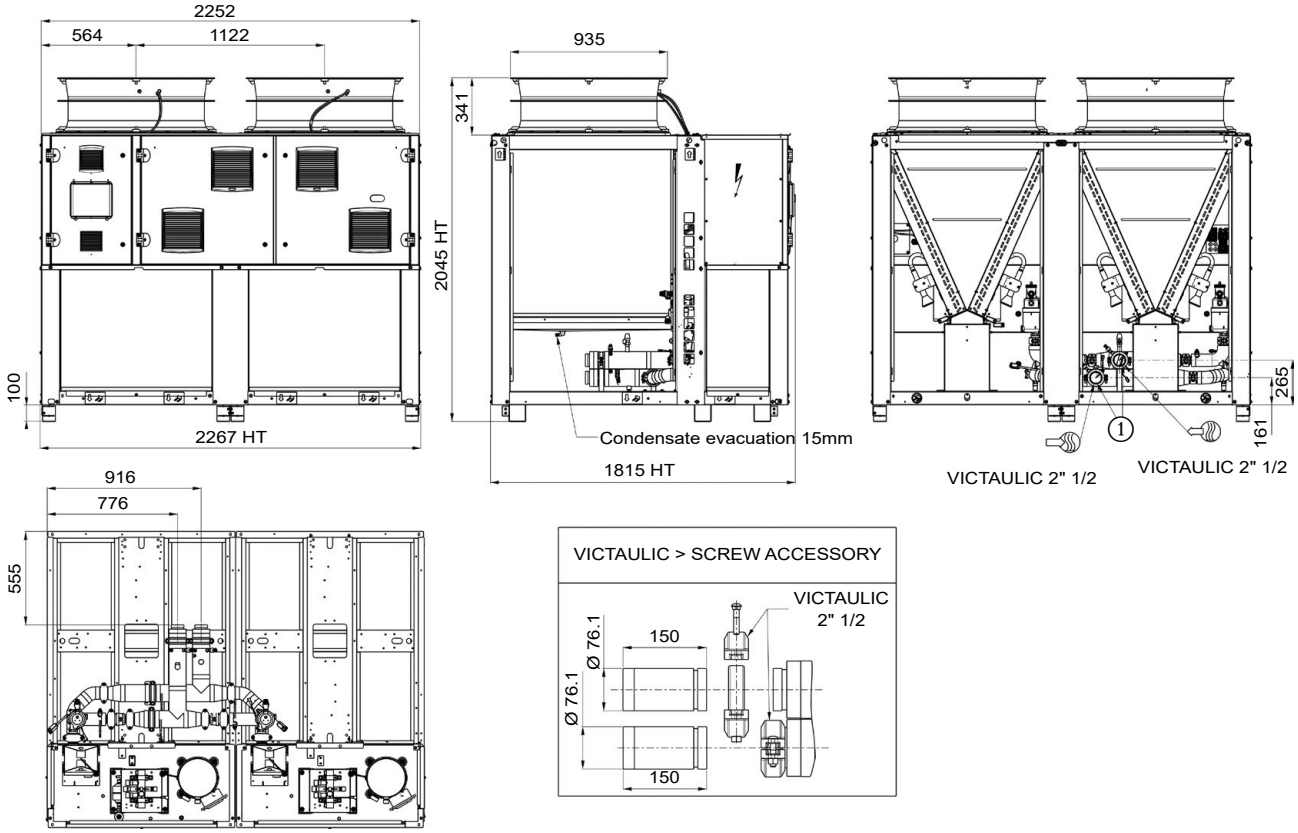
When designing a system, refer to the certified dimensional drawings provided with the unit or available on request.

Refer to the nameplate for the machine weight.

Refer to the certified dimensional drawings for:

- **The location of the fixing points,**
- **The weight distribution,**
- **The coordinates of the centre of gravity, hydraulic and electrical connections.**

4.2 - 61AQ 080P-140P, units without hydraulic module



Key:
All dimensions are given in mm.

① Unit water inlet and outlet

Inlet water

Outlet water

Electrical supply entry

NOTE: Non-contractual drawings.

When designing a system, refer to the certified dimensional drawings provided with the unit or available on request.

Refer to the nameplate for the machine weight.

Refer to the certified dimensional drawings for:

- **The location of the fixing points,**
- **The weight distribution,**
- **The coordinates of the centre of gravity, hydraulic and electrical connections.**

The complete unit, including all the options and accessories which are provided by the manufacturer, have been certified for use with an A3 refrigerant.

To ensure this, the manufacturer complies with EN 378-2 §6.2.14 and has defined a potentially flammable zone using EN 60079-10-1 in order to identify where no sources of ignition must be present.

The manufacturer has then designed the machine so that, if the unit is used in the manner for which it has been designed, there are no internal sources of ignition in the potentially flammable zone inside the machine.

Therefore, the only residual risk is that a source of ignition is introduced into the potentially flammable zone by the user. This is why the manufacturer has decided to show the potentially flammable zone around the machine (see the diagram above) into which the user must not introduce any sources of ignition. This indication is only provided to help our customers to identify the limits of the flammability risk.

However, the machine itself does not present any risk of explosion connected to the use of A3 refrigerant.

Note (the following information is provided by the manufacturer for guidance only. The application of the following directives is the sole responsibility of the user):

In compliance with the directives 2009/104/EC and 1999/92/EC, these zones may be qualified as ATEX Zone by the user on the basis of their own risk analysis, for which they alone remain responsible. In accordance with the definition given by Annex I of the directive 1999/92/EC, this zone may be classified as zone 2 since it may consist of a location where an explosive atmosphere consisting of a mixture of air and flammable substances in the form of a gas is not liable to occur during normal operation or, if it does occur, it only occurs for a short period of time.

If additional equipment is required (motorised valve, pump, etc.), it must be:

- Installed outside of the defined potentially flammable zone
- Certified as not being a source of ignition for the refrigerant used

5 - PHYSICAL DATA FOR THE UNITS

5.1 - Physical properties: 61AQ 040P-140P

AquaSnap 61AQ		MONOBLOC UNIT							
		040P	050P	060P	070P	080P	100P	120P	140P
Sound levels - Standard unit									
Sound power in heating mode(1)	dB(A)	75,0	77,0	78,0	0,0	78,0	80,0	81,0	0,0
Sound pressure in heating mode at 10 m(2)	dB(A)	43,0	45,5	46,5	0,0	46,0	48,5	49,5	0,0
Ecodesign Sound power SCOP C conditions	dB(A)	60,0	61,5	62,5	0,0	63,0	64,5	65,5	0,0
Dimensions - Standard unit									
Length	mm	1815	1815	1815	1815	1815	1815	1815	1815
Width	mm	1145	1145	1145	1145	2267	2267	2267	2267
Height	mm	2045	2045	2045	2045	2045	2045	2045	2045
Operating weight(3)									
Standard Unit	kg	527	536	580	596	1001	1020	1107	1138
Unit + option variable-speed single high pressure pump	kg	555	564	608	623	1059	1078	1165	1196
Compressors		Scroll inverter							
Circuit A		1	1	1	1	1	1	1	1
Circuit B		-	-	-	-	1	1	1	1
System PED Category		III	III	III	III	III	III	III	III
Refrigerant(3)		R-290 Natural / A3 / GWP=0,02 following AR6							
Circuit A	kg	3,0	3,0	3,9	3,9	3,0	3,0	3,9	3,9
	$teqCO_2$	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001
Circuit B	kg	-	-	-	-	3,0	3,0	3,9	3,9
	$teqCO_2$	-	-	-	-	0,0001	0,0001	0,0001	0,0001
Oil		Oil type							
Circuit A	l	3,3	3,3	3,3	4,4	3,3	3,3	3,3	4,4
Circuit B	l	-	-	-	-	3,3	3,3	3,3	4,4
Capacity control		Smart Vu™							
Number of control stages		Continuous control / Inverter							
Minimum capacity	%	21	21	21	21	21	21	21	21
Air heat exchanger		Grooved copper tubes and aluminium fins							
Fans		Axial fan with rotating impeller							
Standard unit									
Quantity		1	1	1	1	2	2	2	2
Maximum total air flow	l/s	5600	5600	5600	5600	11200	11200	11200	11200
Maximum rotation speed	rpm	950	950	950	950	950	950	950	950
Available static pressure	Pa	100	100	100	-	100	100	100	-

(1) In dB ref=10^{-12} W, 'A' weighted. Declared dual-number noise emission values in accordance with ISO 4871 with an associated uncertainty of +/-3dB(A). Measured in accordance with ISO 9614-1 (HA1 full load running conditions).

(2) In dB ref 20µPa, 'A' weighted. Declared dual-number noise emission values in accordance with ISO 4871 with an associated uncertainty of +/-3dB(A). For information, calculated from the sound power Lw(A).

(3) Values are guidelines only. Refer to the unit name plate.

For modular size 61AQ 160P to 560P apply value of above table on each module

EUROVENT CERTIFIED PERFORMANCE www.eurovent-certification.com

Eurovent certified values

CARRIER participates in the ECP programme for LCP-HP. Check ongoing validity of certificate: www.eurovent-certification.com

5 - PHYSICAL DATA FOR THE UNITS

AquaSnap 61AQ		MONOBLOC UNIT							
		040P	050P	060P	070P	080P	100P	120P	140P
Water heat exchanger		Direct-expansion welded plate heat exchanger							
Quantity		1	1	1	1	2	2	2	2
Water volume	l	5,33	5,33	8,13	8,13	10,66	10,66	16,26	16,26
Max. water-side operating pressure without hydraulic module	kPa	400	400	400	400	400	400	400	400
Module hydraulique (option)		Pump, cleanable screen filter, relief valve, water and air drain valve, pressure sensors, expansion vessel.							
Pompe		Centrifugal variable speed pump, monocell,high pressure.							
Expansion vessel volume	l	8	8	8	8	8	8	8	8
Buffer tank volume (Accessory)	l	400	400	400	400	400	400	400	400
Max. water-side operating pressure with hydraulic module	kPa	400	400	400	400	400	400	400	400
Water connections with or without hydraulic module		Screw type connections							
Connections	pouces	2	2	2	2	2"1/2	2"1/2	2"1/2	2"1/2
External diameter	mm	60,3	60,3	60,3	60,3	76,1	76,1	76,1	76,1
Casing paint		Colour code RAL 7035							

For modular size 61AQ 160P to 560P apply value of above table on each module

6 - ELECTRICAL DATA FOR THE UNITS

6.1 - Electrical data: 61AQ 040P-140P

AquaSnap 61AQ		040P	050P	060P	070P	080P	100P	120P	140P
Power circuit supply									
Nominal voltage	V-ph-Hz	400-3-50							
Voltage range	V	360-440							
Control circuit supply		24 V via internal transformer							
Maximum operating input power(1) or (2)									
Standard unit	kW	23	29	34		43	56	68	
Unit + option variable-speed single high pressure pump	kW	25	31	37		47	60	71	
Power factor at maximum power(1) or (2)									
Cosine phi		0,93	0,93	0,93		0,93	0,93	0,93	
Total harmonic distortion	%	35	35	35		35	35	35	
Nominal operating current draw(4)									
Standard unit	A	15	21	24		30	41	47	
Unit + option variable-speed single high pressure pump	A	16	22	26		32	44	52	
Maximum operating current draw (Un)(1) or (2)									
Standard unit	A	34	44	52	72	66	85	103	141
Unit + option variable-speed single high pressure pump	A	37	47	56	75	72	92	109	147
Maximum current (Un-10%)(1) or (2)									
Standard unit	A	37,4	48,4	57,2		72,6	93,5	113,3	
Unit + option variable-speed single high pressure pump	A	40,7	51,7	61,6		79,2	101,2	119,9	
Maximum start-up current(Un)(2) + (3)									
Standard unit	A	38,63	48,63	58,63		74,53	94,53	114,53	
Unit + option variable-speed single high pressure pump	A	42,05	51,78	61,78		80,83	100,83	120,83	

(1) Values obtained at unit continuous maximum operating conditions (data given on the unit nameplate)
(2) Values obtained at operation with maximum operating power input (data given on the unit nameplate)
(3) Operating current of the compressor(s) + fan current + locked rotor current or reduced start-up current of the compressor.
(4) Standardised EUROVENT conditions, water-cooled exchanger water inlet/outlet = 12°C/7°C, outdoor air temperature = 35°C.
For modular size 61AQ 160P to 560P apply value of above table on each module.

6.2 - Short circuit current withstand capability

Short circuit current withstand capability (TN system(1))

AquaSnap 61AQ		040P	050P	060P	070P	080P	100P	120P	140P
Rated short-circuit withstand currents									
Rated short time (1s) current – Icw	kA eff	8	8	8		8	8	8	
Rated peak current - Ipk	kA pk	30	30	30		30	30	30	
Value with upstream electrical protection(1)									
Rated conditional short circuit current - Icc	kA eff	25	25	25		25	25	25	
Associated protection - type / supplier		Fuse (gL/gG) / ABB							
Associated protection - rating / part number		315	315	315		315	315	315	

(1) If another current limitation protection device is used, its time-current and thermal constraint (I^2t) trip characteristics must be at least equivalent to those of the recommended protection.
Note: The short-circuit current resistance values given above are established for the TN diagram.
For modular size 61AQ 160P to 560P apply value of above table on each module.

IT system: The short circuit holding current values given above for the TN system are not valid for IT; modifications are required.

6.3 - Electrical data for the hydraulic module

The pumps that are factory-installed in these units have motors with efficiency class IE3 for > 0.75 kW motors. The additional electrical data required(1) is as follows:

Motors for unit high-pressure pumps (option 116V)

No.(2)	Description(3)		040P	050P	060P	070P	080P	100P	120P	140P
1	Nominal efficiency at full load and nominal voltage	%	85,9	85,9	85,9	85,9	85,9	85,9	85,9	85,9
1	Nominal efficiency at 75% full load and nominal voltage	%	86,0	86,0	86,0	86,0	86,0	86,0	86,0	86,0
1	Nominal efficiency at 50% full load and nominal voltage	%	84,0	84,0	84,0	84,0	84,0	84,0	84,0	84,0
2	Efficiency level	-	IE3							
3	Year of manufacture	-	This information varies depending on the manufacturer and model at the time of incorporation. Please refer to the motor nameplates.							
4	Company name or trademark, commercial registration number and head office of manufacturer	-	Same as above							
5	Product model number	-	Same as above							
6	Number of motor poles	-	2	2	2	2	2	2	2	2
7-1	Nominal shaft power output at full load and nominal voltage (400V)	kW	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5
7-2	Maximum input power (400V)(4)	kW	1,73	1,73	1,73	1,73	1,73	1,73	1,73	1,73
8	Nominal input frequency	Hz	50	50	50	50	50	50	50	50
9-1	Nominal voltage	V	400							
9-2	Maximum current drawn (400V)(5)	A	5,49	5,49	5,49	5,49	5,49	5,49	5,49	5,49
10	Nominal speed	tr/s - tr/min	2885							
11	product disassembly, recycling or disposal at end of life	-	Disassembly using standard tools. Disposal and recycling using an appropriate company.							
12	Operating conditions for which the motor is specifically designed									
	I - Altitudes above sea level	m	< 1000(6)							
	II - Ambient air temperature	°C	< 40							
	III - Maximum operating temperature	°C	Please refer to the operating conditions given in this manual or in the specific conditions given in the selection programs.							
	IV - Potentially explosive atmospheres	-	Non ATEX environment							

(1) Required by regulation No. 640/2009 concerning the application of directive 2009/125/EC on the eco-design requirements for electric motors.
(2) Item number imposed by regulation No. 640/2009, annex I2b.
(3) Description given by regulation No. 640/2009, annex I2b.
(4) To obtain the maximum input power for a unit with hydraulic module, add the maximum unit input power from the electrical data table to the pump power input.
(5) To obtain the maximum unit operating current draw for a unit with hydraulic module, add the maximum unit current draw from the electrical data table to the pump current draw.
(6) Above 1000 m, a degradation of 3% for each 500 m should be taken into consideration.

For modular size 61AQ 160P to 560P apply value of above table on each module

6.4 - Electrical data for the compressors

Compressor	I Nom(1)	I Max (Un)(2)	I Max (Un - 10%)(3)	LRA A(4)	Cos Phi nom.(5)	Cos Phi Max.(6)
00PSG004189700A	14A	32A	35A	80A	0,93	>0,98
00PSG004189800A	18A	42A	46A	95A	0,93	>0,98
00PSG004189900A	23A	52A	57A	120A	0,93	>0,98
00PSG004190000A						

(1) Nominal current draw at standard Eurovent conditions (see definition of conditions under nominal unit current draw)
(2) Maximum operating current
(3) Maximum compressor operating current, limited by the unit (current given for maximum capacity at 360 V)
(4) Locked rotor current at nominal voltage, corresponding to direct online starting current
(5) Value at standard Eurovent conditions: evaporator entering/leaving water temperature 12°C/7°C, condenser entering/leaving water temperature 30°C/35°C, upstream of VFD.
(6) Value at maximum capacity and nominal voltage

6.5 - Distribution of compressors per circuit

AquaSnap 61AQ		040P	050P	060P	070P	080P	100P	120P	140P
Ref. compressor 1	A	1				1			
	B	-	-	-	-	1			
Ref. compressor 2	A		1				1		
	B	-	-	-	-		1		
Ref. compressor 3	A			1				1	
	B	-	-	-	-			1	
Ref. compressor 4	A				1				1
	B	-	-	-	-				1

For modular size 61AQ 160P to 560P apply value of above table on each module

6.6 - Electrical notes

Electrical data example

- 61AQ units have a single power connection point located immediately upstream of the main switch.
- **Control box includes:**
  - Main disconnect switch,
  - Start-up and motor protection devices for each compressor, fans and pumps,
  - Control devices.
- **Field connections:**
  All connections to the system and the electrical installations must be in accordance with all applicable codes.
  61AQ units are designed and built to ensure conformance with these codes. The recommendations of European standard EN 60204-1 (corresponds to IEC 60204-1) (machine safety - electrical machine components - part 1:general regulations) are specifically taken into account, when designing the electrical equipment.

Notes

- Generally the recommendations of IEC 60364 are accepted as compliance with the requirements of the installation regulation.
- Conformance with EN 60204-1 is the best means of ensuring compliance (§1.5.1) with the Machinery Directive.
- Annex B of standard EN 60204-1 specifies the electrical features used for the operation of the units.
- Operating conditions of 61AQ units are described below:

1. Physical environment(1)
   The classification of environment is specified in standard EN 60364:
   - Outdoor installation(1),
   - Ambient temperature range: minimum temperature -25°C to +50°C,
   - Altitude: AC1 of 2000 m or less (for the hydraulic module, see the paragraph Electrical data for the hydraulic module),
   - Presence of hard solid: Class AE3 (no significant dust present)(1),
   - Presence of corrosive and polluting substances, class AF1 (negligible),
   - Competence of persons: BA4 (Persons wise).
2. Compatibility for low-frequency conducted disturbances according to class 2 levels per IEC61000-2-4 standard:
   - Power supply frequency variation: +- 2Hz
   - Phase imbalance : 2%
   - Total Voltage Harmonic Distortion (THDV): 8%
3. The neutral (N) line must not be connected directly to the unit (if necessary use a transformer).
4. Overcurrent protection of the power supply conductors is not provided with the unit.
5. The factory-installed disconnect switch(es)/circuit breaker(s) are of a type suitable for power interruption in accordance with EN 60947-3 (corresponds to IEC 60947-3).
6. The units are designed for connection to TN networks (IEC 60364). In IT networks,if noise filters are integrated into the variable frequency drive(s), this will render the units unsuitable for their intended purpose. In addition, the equipment characteristics in case of insulation failure are modified. Provide a local earth; consult competent local organisations to complete the electrical installation.
   61AQ units are designed to use for domestic / residential and industrial environments:
   Machines that are not equipped with variable speed drives comply with the standard regulations.
   - EN 61000-6-3: General standards - Standard emission for residential, commercial and light industry,
   - EN 61000-6-2: General standards - Immunity for industrial environments

   Units equipped with variable frequency drive(s) 61AQ, options 116V) are in accordance with standard EN61800 - 3 electric power variable speed drives - part 3: EMC requirements and specific test methods for the following:Use in the first and second environments(2).
   - Category C2 applicable in the first environment, to stationary devices designed to be installed and commissioned by a professional.

Warning: In a residential environment, this product may cause radio interference in which case additional mitigation measures could be required.

- Leakage currents: If protection by monitoring the leakage currents is necessary to ensure the safety of the installation, the presence of additional leakage currents introduced by the use of variable frequency drive(s) in the unit must be considered. In particular, the reinforced immunity protection types and a control value not lower than 150 mA are recommended when selecting differential protective devices.

Note: If particular aspects of an actual installation do not conform to the conditions described above, or if there are other conditions which should be considered, always contact your local Carrier representative.

(1) The required protection level for this class is IP43BW (according to reference document IEC 60529). All 61AQ units are IP54CW and fulfil this protection condition.

(2) - Example of installations of the first environment: Commercial and residential buildings.
- Example of installations of the second environment: industrial zones, technical rooms powered from a dedicated transformer.

6.7 - Electrical connection

Please refer to the certified dimensional drawings, supplied with the unit.

6.7.1 - Power supply

The power supply must meet the specification on the unit's nameplate.

The supply voltage must be within the range specified in the electrical data table.

For connections, refer to the wiring diagrams and certified dimensional drawings.

WARNING:

Operation of the unit with an incorrect supply voltage or excessive phase imbalance constitutes misuse which will invalidate the manufacturer's warranty. If the phase imbalance exceeds 2% for voltage, or 10% for current, contact your local electricity supplier at once and ensure that the unit is not switched on until corrective measures have been taken.

After the unit has been started up, the power supply must only be disconnected for quick maintenance operations (one day maximum). For longer maintenance operations or when the unit is taken out of service, the power supply of the unit must be maintained permanently (the heaters must be powered on).

6.7.2 - Voltage phase imbalance (%)

$$\frac{\text{100 x max. deviation from average voltage}}{\text{Average voltage}}$$

Example:

On a 400 V - 3 ph - 50 Hz supply, the individual phase voltages were measured with the following values:

AB = 406 V; BC = 399 V; AC = 394 V

Average voltage = (406 + 399 + 394)/3

= 1199/3

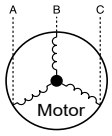
= 399.7 (rounded up to 400 V)

Calculate the maximum deviation from the 400 V average:

(AB) = 406 - 400 = 6

(BC) = 400 - 399 = 1

(CA) = 400 - 394 = 6



The maximum deviation from the average is 6 V. The greatest percentage deviation is: 100 x 6/400 = 1.5%

This is less than the permissible 2% and is therefore acceptable.

6.7.3 - Power connection/disconnect switch

The power connection of the unit is carried out at a single point upstream of the unit's disconnect switch.

Connection electrique Modular system = One lectrical supply per module.

6.7.4 - Recommended cable sections

Wire sizing is the responsibility of the installer, and depends on the characteristics and regulations applicable to each installation site. The following is only to be used as a guideline, and does not make the manufacturer in any way liable.

After wire sizing has been completed, using the certified dimensional drawing, the installer must verify the appropriate means of connection and define any modifications necessary on site.

The connections provided as standard for the customer-supplied power supply cables are designed for the number and type of cables listed in the table below.

The calculations of favourable and unfavourable cases are performed by using the maximum current possible for each unit fitted with a hydraulic module (see the tables of electrical data for the unit and the hydraulic module).

The study includes the standardised installation cases according to IEC 60364: Cables with PVC (70°C) or XLPE (90°C) insulation with copper core; routing in accordance with table 52C of the standard.

The maximum length mentioned is calculated to limit the voltage drop to 5%.

IMPORTANT:

Before connecting the main power cables (L1 - L2 - L3), always check 3 phases are in the correct order (clockwise) before proceeding to the connection on the main disconnect switch.

6 - ELECTRICAL DATA FOR THE UNITS

Table of minimum and maximum cable sections (per phase) for connection to the units

61AQ	Cas 1	Cas 2	Calculation of favourable case: - Multi-conductor cable wires in the open air (routing modes 34 and 35, method E) - Cable insulated to 90°C - opper conductor (Cu)			Calculation of unfavourable case: - Conductors in ducts or multi-conductor cables in closed conduits (Standardised routing modes 50, method B1) - Cable insulated to 70°C where possible - Copper conductor (Cu)		
	Max. connectable section(1)							
	Section(2)	Standard lug	Section(2)	Max. lenght for a voltage drop <5%	Cable type(3)	Section(2)	Max. lenght for a voltage drop <5%	Cable type(3)
	qt x mm² (per phase)	qt x mm² (per phase)	qt x mm² (per phase)	m	-	qty x mm² (per phase)	m	-
Standard unit								
040P	10	95	10	25	90°C	16	25	70°C
050P	10	95	10	25	90°C	25	25	70°C
060P	16	95	16	25	90°C	35	25	70°C
070P	16	95	25	25	90°C	50	25	70°C
080P	25	120	25	25	90°C	50	25	70°C
100P	25	120	35	25	90°C	70	25	70°C
120P	35	120	50	25	90°C	95	25	70°C
140P	50	120	70	25	90°C	150	25	70°C
Unit + option High Pressure Pump (116V)								
040P	10	95	10	25	90°C	25	25	70°C
050P	10	95	10	25	90°C	25	25	70°C
060P	16	95	16	25	90°C	35	25	70°C
070P	16	95	25	25	90°C	70	25	70°C
080P	25	120	25	25	90°C	70	25	70°C
100P	25	120	35	25	90°C	70	25	70°C
120P	35	120	50	25	90°C	95	25	70°C
140P	50	120	70	25	90°C	150	25	70°C

(1) Connection capacities actually available for each machine. These are defined according to the connection terminal size, the electrical box access opening dimensions and the available space inside the electrical box.
(2) Selection simulation result considering the hypotheses indicated.
(3) If the maximum calculated section is for an 90°C cable type, this means that a selection based on a 70°C cable type can exceed the connection capacity actually available. Special attention must be given to selection.
The protection against direct contact at the electrical connection point is compatible with the addition of terminals extension. The installer must determine whether these are necessary based on the cable sizing calculation.

Note: The currents considered are given for a machine equipped with an hydraulic module operating at maximum current.
For larger section power cables (e.g. aluminum cable) a specific connecting box can be offered as accessories.

6.7.5 - Power cable access routing

The power cable access can be routed in the electrical box by the back of it. A plate with cable glands is design for standard cable sizing as per table above.

In case a larger cable diameter is used, reaplce the cable glands. The plate must be used so that the electrical box remains hermetical in case refrigerant leak.

It is alos mandatory to avoid contact between power cable and copper pipe. For that purpose, holes are design in the post to fix the cable.

Refer to the certified dimensional drawing for the unit.

6.7.6 - Field-installed control wiring

Important: Field connection of interface circuits may lead to safety risks: Any modification to the electrics box must ensure the equipment remains compliant with local regulations. Precautions must be taken to prevent accidental electrical contact between circuits supplied by different sources:

- ***The routing selection and/or conductor insulation characteristics must ensure dual electric insulation.***
- ***In case of accidental disconnection, conductor fixing between different conductors and/or in the control box prevents any contact between the conductor ends and an active energised part.***

Refer to the 61AQ SmartVu™ control manual and the certified wiring diagram supplied with the unit for the field control wiring of the following features:

- Evaporator pump interlock (mandatory)
- Remote on/off switch
- Demand limit external switch
- Remote dual setpoint
- Alarm, alert and operation report,
- Heating/cooling selection.

6.8 - Electrical power reserve for the user

Control circuit power reserve:

After all possible options have been connected, the CT transformer ensures the availability of 1 A of power for the control cabling on-site on 24 V, 50 Hz.

7 - APPLICATION DATA

7.1 - Operating range

7.1.1 - 61AQ 040P-560P units

PED admissible essential limits

Refrigerant	VAR53 - AWHP004			
R-290 (Group 1)	Low Pressure (LP)	High Pressure (HP) High Temperature	High Pressure (HP) Liquid	Water
PS (barg)	32	32	32	4
TS MAX (°C)	82,8	150	82,8	85
TS MIN (°C)	-30	-30	-30	-15

7 - APPLICATION DATA

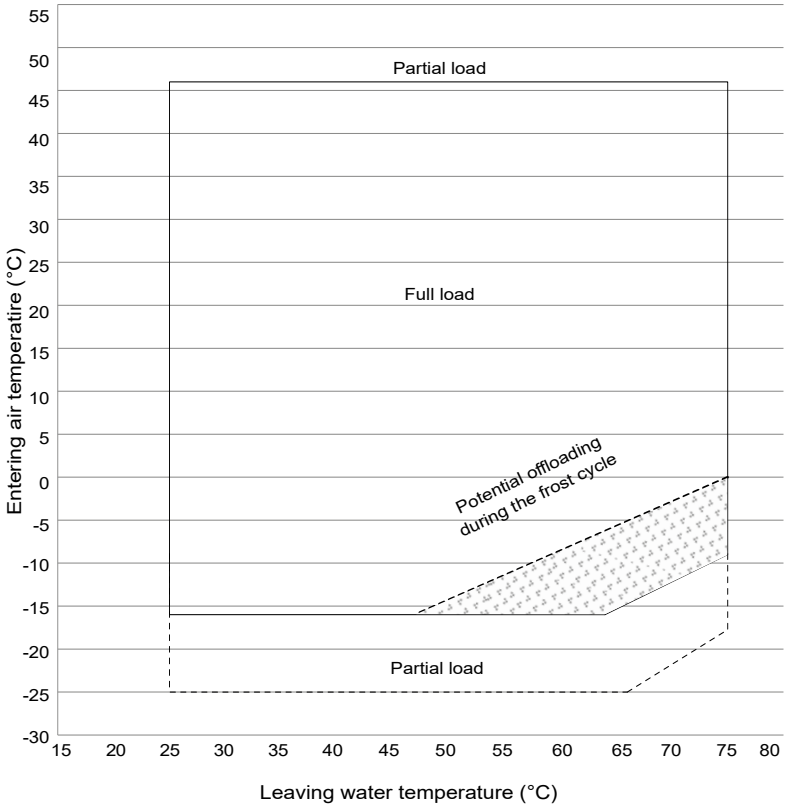
Heating mode / Cooling mode

		Heating mode		Cooling mode	
Water heat exchanger		**Minimum**	**Maximum**	**Minimum**	**Maximum**
Entering temperature at start-up	°C	8(1)	70	8(1)	40
Leaving temperature during operation	°C	20	75	6,5(2)	20(3)
Air heat exchanger		**Minimum**	**Maximum**	**Minimum**	**Maximum**
Outdoor ambient operating temperature					
Outdoor ambient temperature at start-up	°C	-25(4)(5)	46	-20(4)	50(5)
Available static pressure					
Standard units	Pa	0	100	0	100

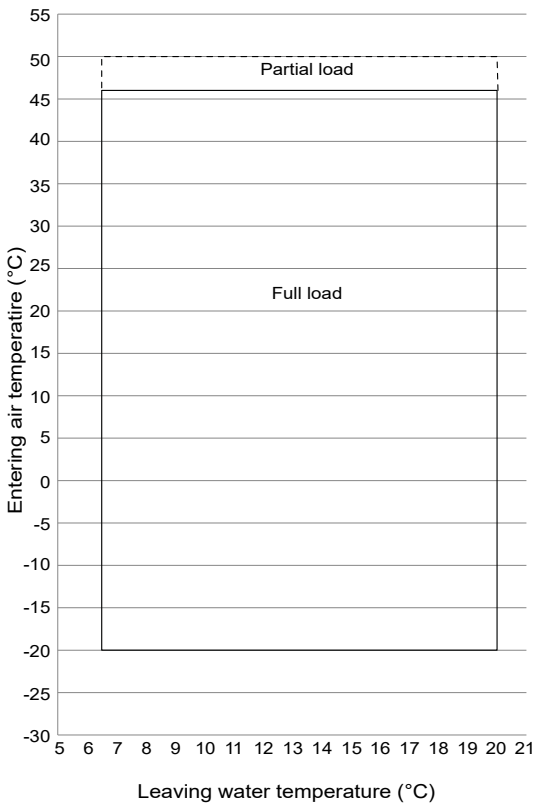
(1) For an application requiring start-up at less than 8°C, contact your representative to select a unit using the electronic catalog.
(2) The use of anti-freeze protection is required if the water outlet temperature is below 6.5°C
(3) For application requiring operation above a water outlet temperature of 20°C, contact your representative to select a unit using the electronic catalog.
(4) Units are equipped by default by heaters protecting the unit internal hydraulic circuit for operation at an ambient temperature below 0°C. It is mandatory for the installer to protect the rest of the installation with additonal heater or using an anti-freeze solution.
(5) Partial load operation authorized under -16°C and above 46°C.
Contact your representative to select a unit using the electronic catalog.

Temperatures in case of non-operating unit (storage and transport) : minimum and maximum ambient temperatures to respect are -20°C and +70°C. These temperature limits shall be considered in case of container shipment.

Operating map - heating mode
Standard unit 61AQ



Operating map - cooling mode
Standard unit 61AQ



Notes:
1. Water heat exchanger ΔT = 5K.
4. Operating ranges are guidelines only. The operating range must be checked with the selection software.

Key:

Operating range at full load

Potential offloading during the frost cycle, depending on the humidity conditions. Refer to the selection software.

Operating range at partial load

NOTE:

Units equipped with speed regulators (61AQ option 116V).

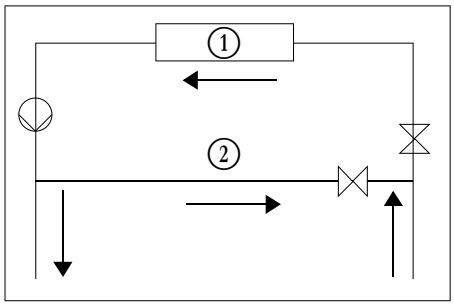
If the air temperature is below -10°C and the unit has been de-energised for more than 4 hours, it is necessary to wait two hours after the unit has been switched on again to allow the regulator to warm up.

7.2 - Minimum heat transfer fluid flow rate (units without factory-fitted hydraulic module)

The minimum heat transfer fluid flow rate for different unit sizes is given in the tables in paragraph “Water type heat exchanger flow rate”.

It is determined in order to allow sufficient exchange and prevent the risk of excessive fouling.

If the system flow rate is less than the unit’s minimum flow rate, the exchanger flow can be recirculated, as shown in the diagram.



Key

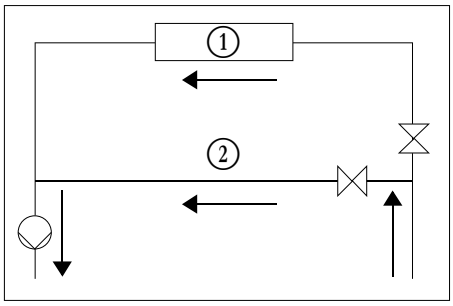
1. Water type heat exchanger
2. Recirculation

7.3 - Maximum heat-transfer fluid flow rate (units without factory-fitted hydraulic module)

The maximum heat transfer fluid flow rate for different unit sizes is given in the tables in paragraph “Water type heat exchanger flow rate”.

This is limited by the permitted exchanger pressure drop. In addition, there must be a minimum Delta T of 5 K, which correspond to the maximum flow rate acceptable.

If the system flow rate exceeds the unit’s maximum value, it can be bypassed as shown in the diagram.



Key

1. Water type heat exchanger
2. By-pass

7.4 - Variable flow water type heat exchanger (units without factory-fitted hydraulic module)

A variable water heat exchanger flow can be used in standard units. The flow rate must be higher than the minimum flow given in the table of permissible flow rates and must not vary by more than 10% per minute.

If the flow rate changes more rapidly, the system’s water volume should be increased and reach a value of at least 6.5 litres of water per kW.

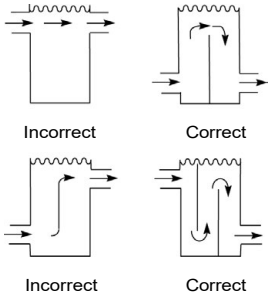
7.5 - Minimum system water volume

Whichever system, water volume for the water loop (to be provided between the unit and any customer valves outside the machine) is given by the table below

AquaSnap 61AQ		040P	050P	060P	070P	080P	100P	120P	140P
Minimum system water volume, air conditionning applications - cooling	l	160	200	250	290	320	400	500	580
Minimum system water volume, air conditionning applications - heating	l	190	250	300	350	380	500	600	700
Minimum system water volume, industrial process applications	l	320	410	510	590	640	820	1020	1180

NOTE: In the case of the Buffer tank Module option, take into account the volume of the tank: 400 Litres

Connection to a buffer tank



7.6 - Maximum system water volume

Units supplied with a hydraulic module include an expansion tank which limits the volume in the water loop.

The table below gives the maximum loop volume compatible with the expansion vessel (for pure water or ethylene glycol depending on the system's various concentrations and static pressures). If this volume is less than the volume of the loop installed, then an additional expansion vessel must be added to the installation.

AquaSnap 61AQ		35°C			55°C			75°C		
Static pressure	bar	1	2	3	1	2	3	1	2	3
Pure water	l	780	520	260	329	219	110	183	122	61
10% EG	l	516	344	172	270	180	90	165	110	55
20% EG	l	384	256	128	229	152	76	149	99	50
30% EG	l	327	218	109	207	138	69	139	93	46
40% EG	l	254	169	85	175	117	58	124	83	41

EG: Ethylene Glycol

7.7 - Water flow rate

Data applicable for pure water at 20°C.

Unit without hydraulic modul

AquaSnap 61AQ	Minimum flow rate(1) (l/s)	Maximum flow rate(2) (l/s)
040P	0,7	2,2
050P	0,7	2,7
060P	0,7	3,2
070P	0,7	3,3
080P	1,4	4,4
100P	1,4	5,4
120P	1,4	6,3
140P	1,4	6,6

(1) Minimum flow rate at the minimum reliable waterflow to secure unit operation.
(2) Maximum flow rate at a water temperature difference of 4.5 K up to a maximum of 3.3l/s per circuit.

Unit with high pressure hydraulic modul

AquaSnap 61AQ	Minimum flow rate(1) (l/s)	Maximum flow rate(2) (l/s)
	Single pump	Single pump
040P	0,7	2,2
050P	0,7	2,7
060P	0,7	3,2
070P	0,7	3,3
080P	1,4	4,4
100P	1,4	5,4
120P	1,4	6,3
140P	1,4	6,6

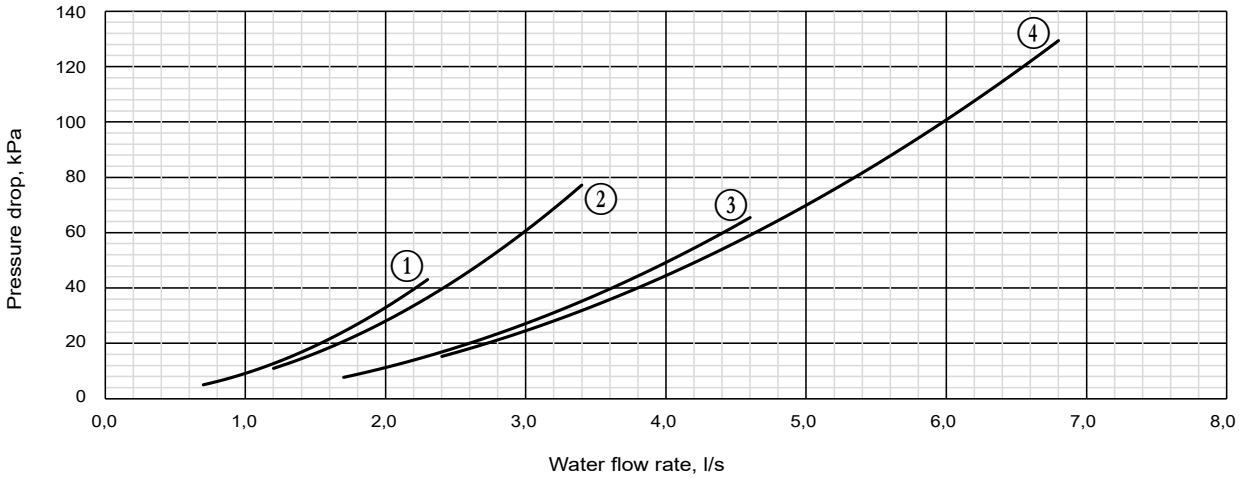
(1) Minimum flow rate at the minimum frequency of the pump and/or minimum reliable waterflow to secure unit operation.
(2) Maximum flow rate at a water temperature difference of 4.5 K up to a maximum of 3.3l/s per circuit.

7.8 - Pressure drop curves for the water exchanger and standard water inlet/outlet piping

Data applicable for pure water at 20°C.

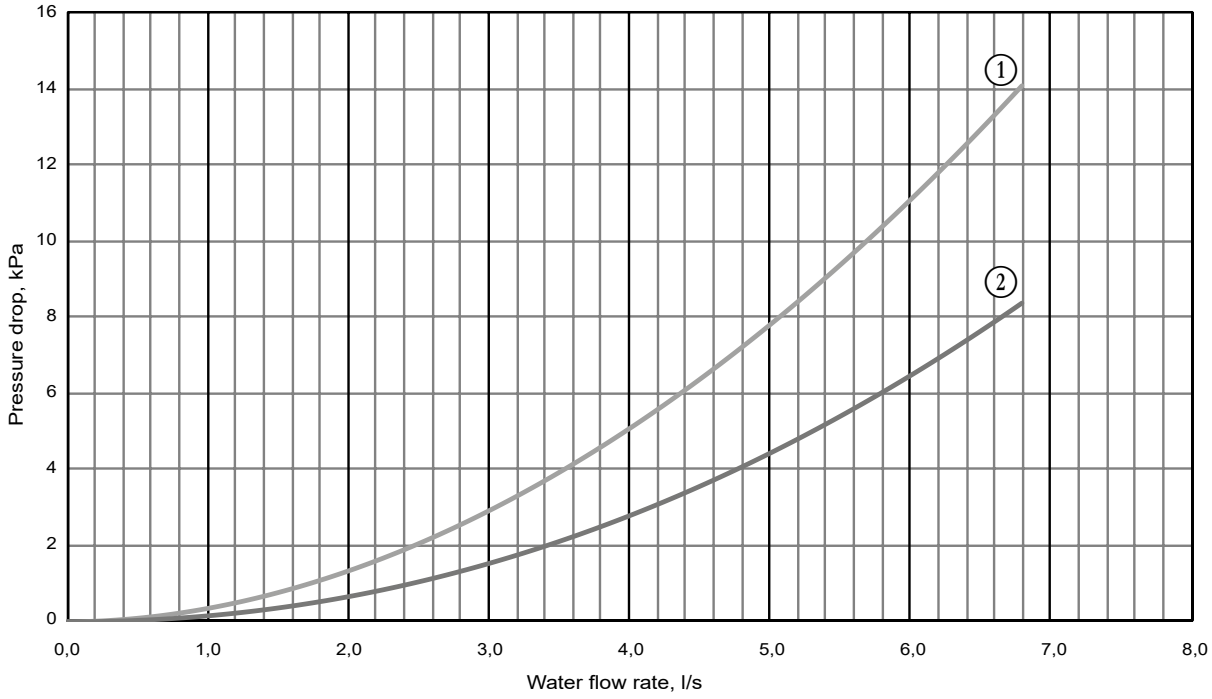
61AQ 040P-140P units

Water pressure drop in the unit



① 61AQ 040P-050P
② 61AQ 060P-070P
③ 61AQ 080P-100P
④ 61AQ 120P-140P

Water pressure drop in the filter



① 61AQ 040P-070P
② 61AQ 080P-140P

8 - WATER CONNECTIONS

When connecting units to the water distribution pipe work, refer to the certified dimensional drawings supplied with the unit for the dimensions and position of the water inlet and outlet connections.

The piping must not transmit any axial or radial force to the exchangers, or any vibrations.

The water must be analysed and the circuit must include provision of any necessary water treatment: Filters, additives, intermediate exchangers, bleed valves, vents, shut-off valves, etc. depending on the results, in order to prevent corrosion (e.g. damage to the surface of the tubes due to impurities in the fluid), fouling and deterioration of the pump lining.

Before any start-up, make sure the heat-transfer fluid is compatible with the water circuit materials and coating. Where additives or fluids other than those recommended by the manufacturer are used, ensure that these are not considered gases, and that they are class 2, as defined in directive 2014/68/EU.

Manufacturer's recommendations concerning heat transfer fluids:

- Cl^- Chloride ions are also harmful to copper with a risk of perforating corrosion. Keep at a level below 25 mg/l. Regarding the desuperheater options, the level of chloride ions (Cl-) must be kept below 10 mg/l.
- SO_4^{2-} sulphate ions can cause perforating corrosion, if their content is above 30 mg/l.
- No fluoride ions (< 0.1 mg/l).
- No Fe^{2+} and Fe^{3+} ions with non negligible levels of dissolved oxygen must be present. Dissolved iron < 5 mg/l with dissolved oxygen < 5 mg/l.
- Dissolved silicon: Silicon is an acid element of water and can also lead to corrosion risks. Content < 1 mg/l.
- Water hardness: > 0.5 mmol/l. Values between 1 and 2.5 are recommended. This will facilitate scale deposits that can limit the corrosion of copper. Values that are too high can cause piping blockage over time. A total alkalimetric titre (TAC) below 100 mg/l is desirable.
- Dissolved oxygen: Avoid any sudden change in water oxygenation conditions. It is as detrimental to deoxygenate the water by mixing it with inert gas as it is to over-oxygenate it by mixing it with pure oxygen. The disturbance of the oxygenation conditions encourages destabilisation of copper hydroxides and enlargement of particles.
- Electric conductivity 10-600 µS/cm.
- pH: Ideal case pH neutral at 20-25°C (7.5 < pH < 9).

IMPORTANT: Filling, topping up or emptying of the water circuit must be carried out by qualified personnel using the air bleed devices and tools and equipment suitable for the products.

The heat-transfer fluid should be filled and drained using devices fitted to the water circuit by the installer. Never use the unit heat exchangers to add heat-transfer fluid.

8.1 - Operating precautions and recommendations

Before commissioning, make sure the hydraulic circuits are connected to the appropriate heat exchangers.

The water circuit must have as few bends and horizontal sections at different levels as possible,

Main points to be checked for the connection:

- Make sure that the stainless steel water filter is in the screen filter.
- Comply with the water inlet and outlet connections shown on the unit.
- Install manual or automatic air purge valves at all high points in the circuit.
- Maintain the pressure of the circuit(s) with a pressure-reducing valve and install a relief valve and an expansion vessel. Units supplied with a hydraulic module include a valve. The expansion vessel is supplied as an option.
- Install thermometers in both the water inlet and outlet pipes.
- Install drain connections at all low points to allow the whole circuit to be drained.
- Install shut-off valves close to the water inlet and outlet connections.
- Use flexible connections (accessory 309A) to reduce the transmission of vibrations.
- Insulate the cold water pipework, after testing for leaks, to prevent heat transmission and condensation.
- Cover the insulation with a vapour barrier. If the water pipes outside the unit pass through an area where the ambient temperature is likely to fall below 0°C, it must be protected against frost (antifreeze solution or electric heaters) In case antifreeze solution is used, replace the antifreeze relief valve by a plug.
- Do not introduce any static or dynamic pressure into the heat exchange circuit which significantly deviates from the design operating pressures.
- The use of different metals in the hydraulic system may create galvanic couples and lead to corrosion. Verify the need to install sacrificial anodes.
- Products used for thermal insulation of recipients during hydraulic connection must be chemically neutral to the surfaces on which they are applied. All original materials supplied by the manufacturer comply with this requirement.

Note:

All units are delivered with a visitable filter with a mesh size of 0.8mm as an accessory.

This filter must be installed on the water inlet pipe, upstream of the pressure differential gauge and close to the unit. It must be located somewhere easily accessible to enable disassembly and cleaning.

In case another filter is used, the mesh size must not exceed 1.2mm.

If the filter is missing, the plate heat exchanger can quickly become fouled during the first start-up, as it will trap any debris in the system, and correct unit operation will be affected (reduced water flow rate due to the increased pressure drop).

Protection against cavitation (option 116V):

To ensure the durability of the pumps in the integrated hydraulic modules, the control algorithm of the unit incorporates anti-cavitation protection.

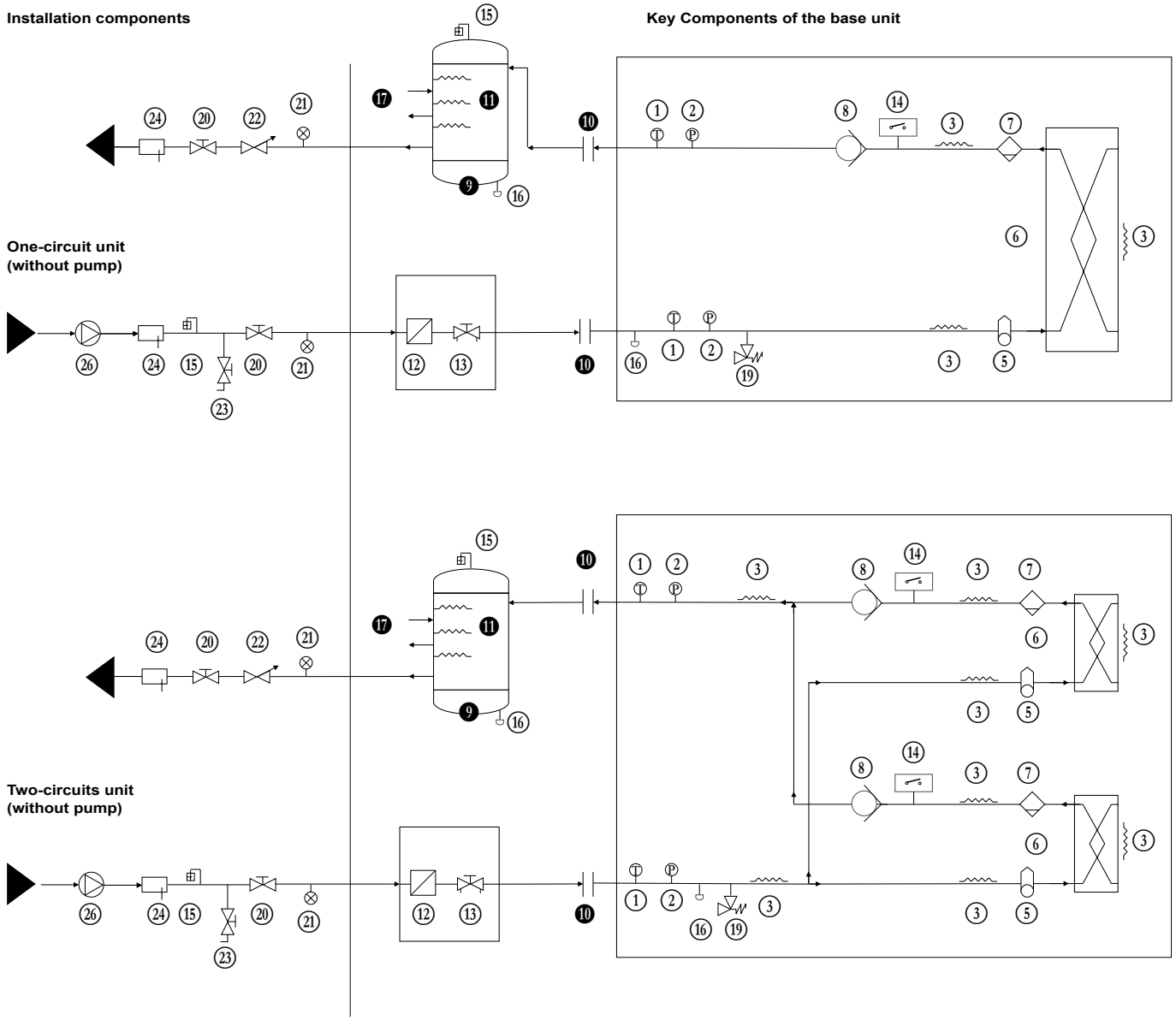
It is therefore necessary to ensure a minimum pump entering pressure of 60 kPa (0.6 bar) during operation and at shut-down.

A pressure below 60 kPa will prohibit unit start-up or cause an alarm with the unit shutting down.

8.2 - Water connections

The hydraulic module options are only compatible with closed loops.
The use of the hydraulic module on open systems is prohibited.

Schematic diagram of the hydraulic circuit without the hydraulic module

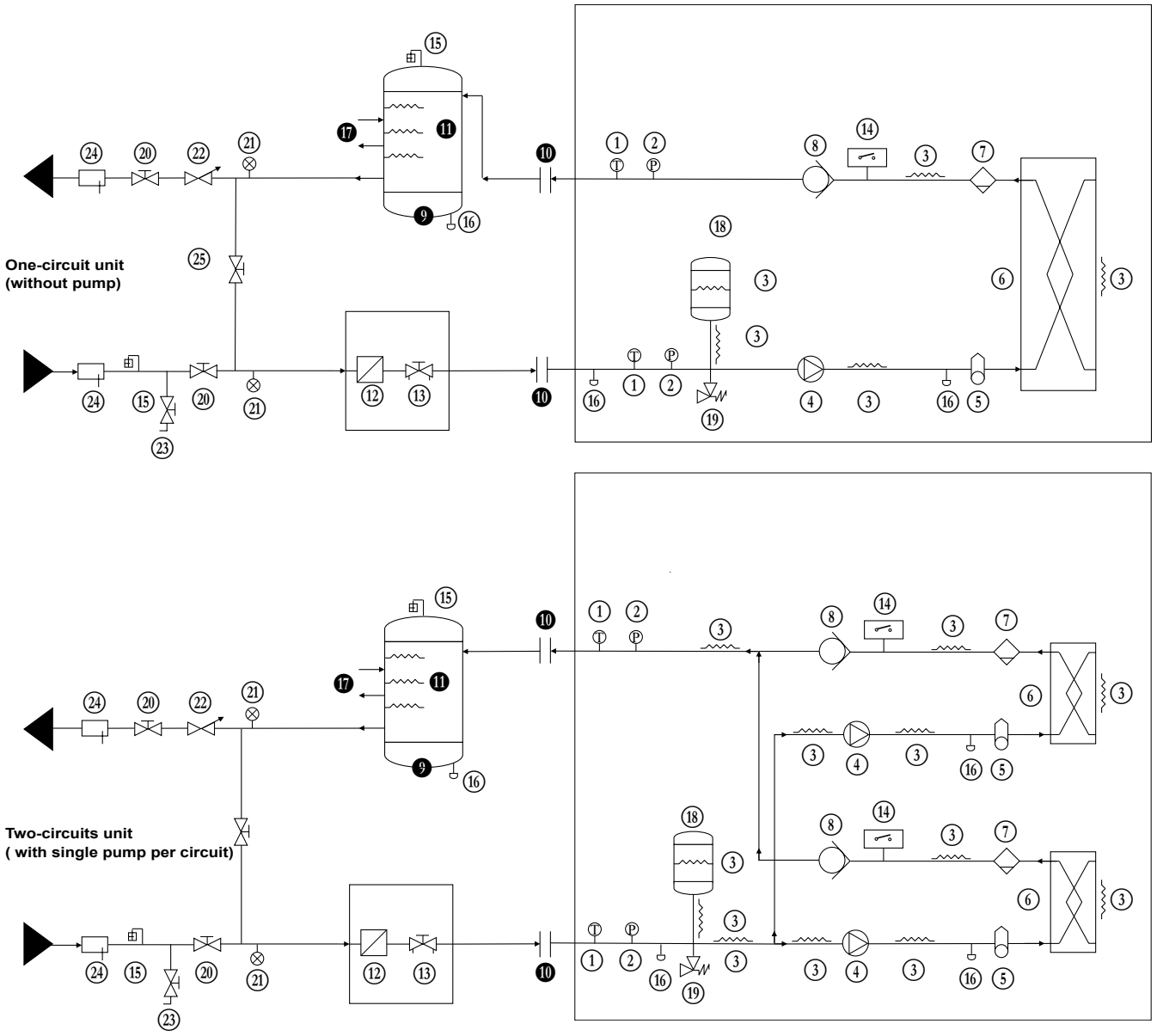


1. Temperature sensor
2. Pressure sensor
3. Heater
4. Pump
5. Antifreeze valve + Vacuum breaker
6. Heat exchanger (BPHE)
7. Gas separator + Relief valve
8. Check valve
9. Buffer tank (option)
10. Flexible connection (option)
11. Additional heaters (option)
12. Water filter
13. Isolation valve
14. Flow rate sensor (flow switch)
15. Air vent
16. Water drain tap
17. Secondary inlet/outlet
18. Expansion vessel
19. Relief valve
20. Stop valve
21. Pressure gage
22. Water flow control valve
23. Charge valve
24. Pocket
25. Bypass valve
26. Pump (client)

Standard scope of delivery

Schematic diagram of the hydraulic circuit with the hydraulic module

Installation components **Key Components of the unit with hydraulic module**

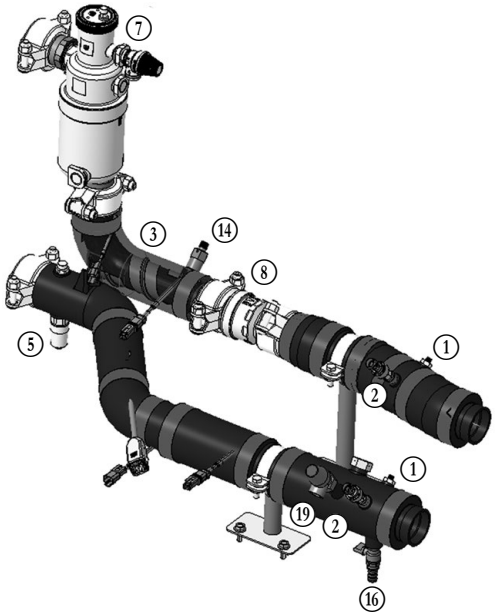


1. Temperature sensor
2. Pressure sensor
3. Heater
4. Pump
5. Antifreeze valve + Vacuum breaker
6. Heat exchanger (BPHE)
7. Gas separator + Relief valve
8. Check valve
9. Buffer tank (option)
10. Flexible connection (option)
11. Additional heaters (option)
12. Water filter
13. Isolation valve
14. Flow rate sensor (flow switch)
15. Air vent
16. Water drain tap
17. Secondary inlet/outlet
18. Expansion vessel
19. Relief valve
20. Stop valve
21. Pressure gage
22. Water flow control valve
23. Charge valve
24. Pocket
25. Bypass valve
26. Pump (client)

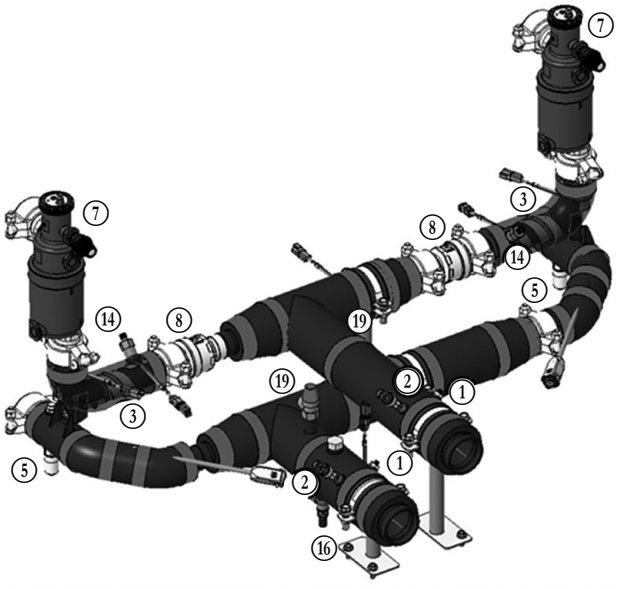
Standard scope of delivery

8 - WATER CONNECTIONS

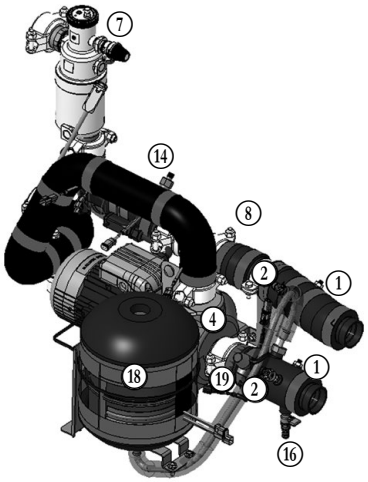
One-circuit unit (without pump)



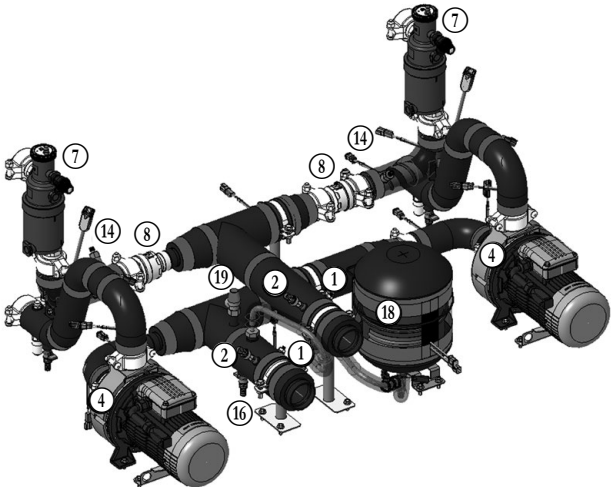
Two-circuits unit (without pump)



One-circuit unit (with single pump)



Two-circuits unit (with single pump per circuit)



1. Temperature sensor
2. Pressure sensor
3. Heater
4. Pump
5. Antifreeze valve + Vacuum breaker
7. Gas separator + Relief valve
8. Check valve
12. Water filter
13. Isolation valve
14. Flow rate sensor (flow switch)
15. Air vent
16. Water drain tap
18. Expansion vessel
19. Relief valve

Refer to the diagram in the "Hydraulic connections" section for all references points mentioned in this chapter.

The water circulation pumps for the units in the range have been sized to allow the hydraulic modules to operate in all possible configurations based on the operating conditions specific to the system, i.e. at a range of temperature differences between the water inlet and outlet (Delta T) at full load which may vary from 5 to 15 K.

This temperature difference required between the water inlet and outlet determines the nominal flow rate of the system. Use the specification provided when selecting the unit to determine the system's operating conditions.

In particular, collect the data to be used for the control of the system flow rate:

- Units without hydraulic module: The rated unit pressure drop. This is measured with pressure gauges that must be installed at the inlet and outlet of the unit (items 21).
- Units with variable speed pumps: Regulation of the constant pressure differential based on readings at the hydraulic module inlet and outlet. The water buffer tank module option is not taken into account.
- Units with variable speed pumps: Regulation of the temperature difference measured at the heat exchanger inlet and outlet.

If this information is not available when the system is commissioned, contact the engineering and design department responsible for the system to obtain it.

This data can be obtained either from the performance tables included in the technical documentation (for cases where the evaporator temperature delta is 5 K) or from the "Electronic Catalogue" selection program for all other applicable temperature delta in the range of 5 to 15 K.

8.3 - Units without hydraulic module

8.3.1 - General information

The nominal flow of the unit will be set using a manual valve that should be installed on the outlet of the unit (item 22 on the schematic hydraulic circuit). Changing the pressure drop of the valve allows adjustment of the system flow rate to achieve the design flow rate.

As the exact total system pressure drop is not known upon commissioning, it is necessary to adjust the water flow rate with the control valve to obtain the installation's specific flow rate.

8.3.2 - Hydraulic circuit cleaning procedure

- Open the valve completely (item 22).
- Start up the system pump.
- Read the pressure drop of the plate heat exchanger using the pressure differential gauge to find the difference between the unit inlet and outlet (items 21).
- Let the pump run for 2 hours continuously to flush the system's hydraulic circuit (presence of contaminating solids).
- Perform another reading.
- Compare this value to the initial value. A decrease in the pressure drop value indicates that the filters in the system need to be removed and cleaned. In this case, close the Shut-off valves on the water inlet and outlet (items 13 and 20) and remove then clean the filters (item 12) after draining the hydraulic part of the unit (item 16).
- Remove the air from the circuit (items 15).
- Repeat until all fouling is removed from the filter.

8.3.3 - Procedure for controlling the water flow

Once the circuit has been decontaminated, read the pressures on the pressure gauges (water inlet pressure - outlet pressure) to determine the pressure drop across the unit terminals (plate heat exchanger + internal pipework).

Compare the value obtained with the theoretical selection value.

If the pressure drop reading is above the specified value, this indicates that the flow rate at the terminals of the unit (and hence in the system) is too high. In this case, close the control valve and read the new difference in pressure. Repeat as necessary until a specific pressure drop corresponding to the unit's nominal flow rate at the operation point is achieved.

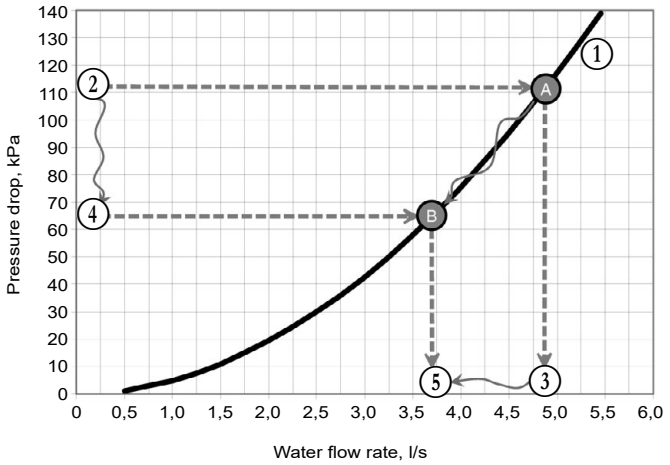
NOTE: If the network has an excessive pressure drop in relation to the available static pressure delivered by the system pump, the nominal water flow rate cannot be obtained (resulting flow rate is lower) and the difference in temperature between the water inlet and outlet of the evaporator will be increased.

To reduce the installation's hydraulic system pressure drop:

- Reduce the pressure drops of individual components (bends, level changes, valves etc.) as much as possible
- Use the correct pipe diameter;

- Avoid extending the hydraulic systems when possible.

Example: Unit with specific nominal flow 3.7 l/s



Key

1. "Unit pressure drop (including internal water circuits)/flow rate" curve
2. With the valve open the pressure drop read (111 kPa) gives point **A** on the curve.
   Operating point **A** reached with the valve open.
3. With the valve open, the flow rate achieved is 4.8 l/s: This is too high, and the valve must be closed again.
4. If the valve is partially closed, the pressure drop read (65 kPa) gives point **B** on the curve.
   Operating point **B** reached with the valve partially closed.
5. With the valve partially closed, the flow rate achieved is 3.7 l/s: This is the required flow rate and the valve is in the correct position.

8.4 - Units with hydraulic module and variable-speed pump - pressure differential control

The system flow rate has not been set to a rated value. The flow rate will be adjusted, by varying the pump speed, to maintain a constant operating pressure differential value defined by the user. The pressure sensor at the unit outlet (item 2 in the typical hydraulic circuit diagram) is used as the means of control.

The system calculates the measured pressure differential value, compares it with the setpoint value selected by the user and modulates the pump speed accordingly. The result is:

- An increased flow rate, if a lower value than the setpoint is measured,
- An decreased flow rate, if a higher value than the setpoint is measured.

This flow rate variation is realised, observing the minimum and maximum admissible unit flow rates as well as the minimum and maximum pump supply frequency values.

The pressure differential value maintained can in certain cases be different from the set point value:

- If the set point value is too high (achieved for a higher flow rate than the maximum value or a higher frequency than the maximum value), the system settles at the maximum flow rate or maximum frequency and this results in a lower pressure differential than the set point.
- If the set point value is too low (achieved for a lower flow rate that the minimum value or a lower frequency than the minimum value), the system settles at the minimum flow rate or minimum frequency and this results in a higher pressure differential than the set point.

Contact Carrier Service to discuss the implementation of the procedures set out below.

8.4.1 - Hydraulic circuit cleaning procedure

Before proceeding, it is advisable to remove any possible contamination from the hydraulic circuit.

- Start up the unit pump using the override command.
- Set the frequency to the maximum value to generate a high flow rate.
- If there is a "Maximum flow exceeded" alarm, reduce the frequency until an acceptable value is reached.
- Read the value of the flow on the user interface.
- Let the pump run for 2 hours continuously to flush the system's hydraulic circuit (presence of contaminating solids).
- Perform another reading of the flow and compare this value with the initial value. A reducing value of the flow indicates that the filters on the system need to be removed and cleaned. In this case, close the shut-off valves on the water inlet and outlet (items 13 and 20) and remove the filters (item 12) after draining the hydraulic part of the unit (item 16).
- Remove the air from the circuit (item 15).
- Repeat until all fouling is removed from the filter.

8.4.2 - Procedure for controlling the pressure differential

Setpoint

Once the circuit is cleaned, place the hydraulic circuit in the configuration for which the unit selection was performed generally (all valves open and all cooling coils active). Read the value of the !ow on the user interface and compare it with the theoretical value of the range:

- If the value of the flow is greater than the specified value, reduce the pressure differential setpoint on the user interface to reduce the value of the flow.
- If the value of the flow is lower to the specified value, increase the pressure differential setpoint on the user interface to increase the value of the flow.

Repeat until the design pressure drop / flow rate is achieved.

Stop the forced operation of the pump and proceed to the configuration of the unit for the required control mode.

Modify the control parameters:

- Set water flow control to 'pressure differential'
- Set the value of the required differential pressure

By default, the unit is factory configured at the minimum speed (frequency: 50 Hz).

NOTES:

If during controlling, the low or high frequency limits are reached before reaching the specified flow, keep the pressure differential value to its lower or higher limit to enter in the control parameters.

If the user already knows the pressure differential value to be maintained at the unit outlet, this may be entered directly as a parameter. However, the hydraulic circuit cleaning sequence must not be omitted.

8.5 - Units with hydraulic module and variable-speed pump - temperature difference control

The temperature sensors at the heat exchanger inlet and outlet (items 1 in the typical hydraulic circuit diagram) are used as means of control.

The system reads the measured temperature values, calculates the corresponding temperature difference, compares it with the user-selected setpoint value and modulates the pump speed as necessary:

- If a higher Delta T value than the setpoint is measured, the flow rate is increased;
- If a lower Delta T value than the setpoint is measured, the flow rate is decreased.

This flow rate variation is realised, observing the minimum and maximum admissible unit flow rates as well as the minimum and maximum pump supply frequency values.

The Delta T value maintained can in certain cases be different from the set point value:

- If the set point value is too high (achieved for a lower flow rate than the minimum value or a lower frequency than the minimum value), the system settles at the minimum flow rate or minimum frequency and this results in a lower Delta T value than the set point.
- If the set point value is too low (achieved for a higher flow rate that the maximum value or a higher frequency than the maximum value), the system settles at the maximum flow rate or maximum frequency and this results in a higher Delta T value than the set point.

Contact Carrier Service to discuss the implementation of the procedures set out below.

8.5.1 - Hydraulic circuit cleaning procedure

Refer to the procedure for cleaning the hydraulic circuit from chapter 8.3.1

8.5.2 - Procedure for adjusting the Delta T setpoint

Once the circuit is cleaned, stop the forced start of the pump and proceed to the configuration of the unit for the required control mode.

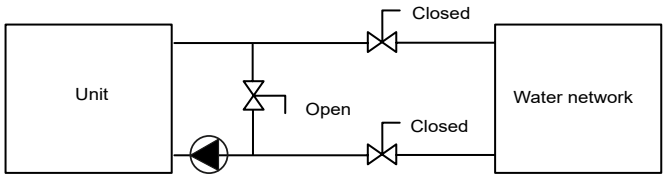
Modify the control parameters:

- Water flow rate control method (temperature differential)
- Set the value of the required differential temperature.

By default, the unit is factory configured at the minimum speed (frequency: 50 Hz).

If the system is isolated by a valve, it is imperative to install a bypass as indicated below.

Winter position



8 - WATER CONNECTIONS

IMPORTANT REMINDERS:

Depending on the atmospheric conditions in your region, you need to:

- ***Add an appropriate antifreeze solution agreed by the manufacturer (maximum of 45%) to protect the system down to a temperature of 10 K below the lowest temperature likely to occur locally.***
- ***For extended shut-downs, drain and add an anti-freeze solution to the heat exchanger (use the drain valve located at the water inlet).***
- ***To prevent corrosion due to differential aeration, if the system is to be empty for more than 1 month, the heat transfer fluid circuit should be protected with a blanket of neutral gas (0.5 bar maximum). If the heat transfer fluid does not meet the manufacturer's recommendations, a nitrogen blanket must be applied immediately.***
- ***In case of prolonged non-usage, the hydraulic circuits must be protected by circulating a passivating solution (consult a specialist).***
- ***At the start of the next season, refill the unit with water and add an inhibitor.***
- ***If auxiliary equipment is installed in the system, the installer must ensure that the resultant flow rates are still within the minimum and maximum values indicated in the operating limits table (application data). If frost protection is dependent on electric heaters, never de-energize the unit when frost protection is required. To ensure protection, the main unit disconnect switch and the auxiliary heater protection circuit breaker must be closed (see wiring diagram to locate these components). If it is not to be used in freezing conditions, or during a prolonged power failure (planned or unplanned), the water type heat exchanger and external pipes must be drained without delay. Damage caused by frost is not covered by the warranty.***
- ***The heat exchanger temperature sensors are an essential frost protection element: If piping trace heaters are used, ensure the external heaters do not affect the measurements provided by these sensors.***
- ***If there is a Water Type Heat Exchanger Connection sleeves option, it is necessary to install a heater on each extension in order to protect the water pipes down to an outdoor temperature of -25°C. The anti-freeze and heater solutions can be combined.***

9 - NOMINAL SYSTEM WATER FLOW RATE CONTROL

9.1 - Available static pressure for the installation

Units with hydraulic module (fixed-speed pump or variable-speed pump at 50 Hz)

Data applicable for:

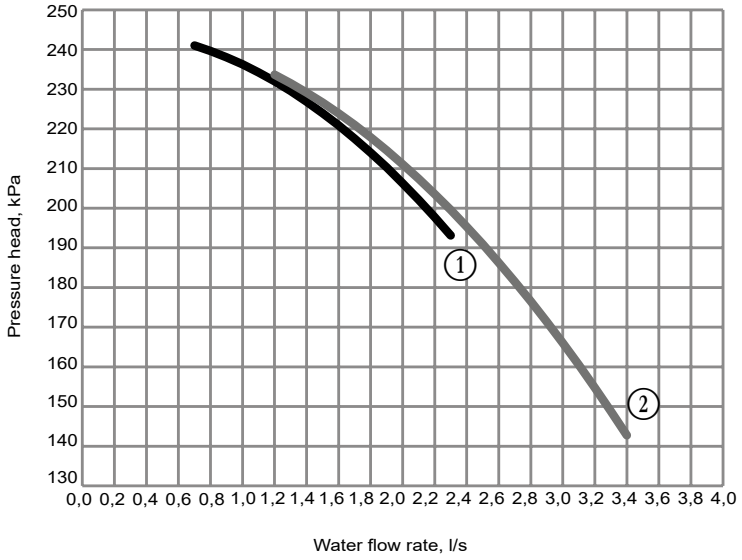
- Pure water at 20°C.
- Refer to the “Water exchanger water flow” section for the maximum water flow values.
- If ethylene glycol is used, the maximum flow rate is reduced.

9.1.1 - Units 61AQ 040P-140P

High pressure pumps

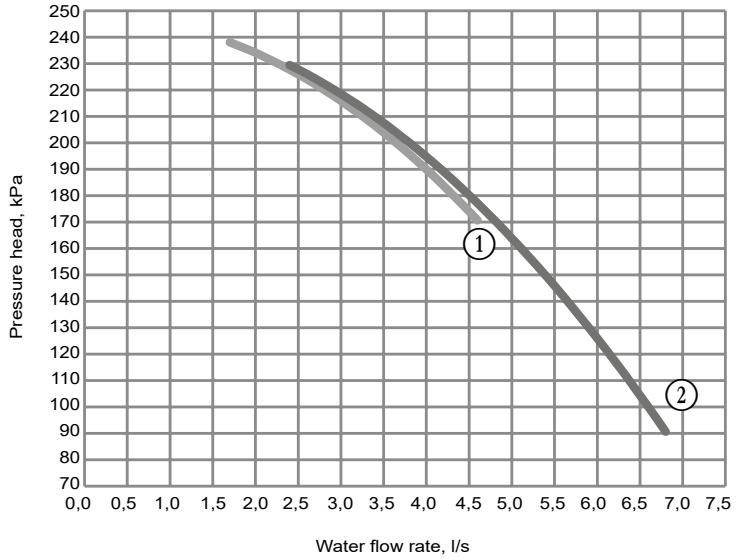
Single pumps

61AQ 040P-070P



① 61AQ 040P-050P
② 61AQ 060P-070P

61AQ 080P-140P



① 61AQ 080P-100P
② 61AQ 120P-140P

10 - SYSTEM START-UP

10.1 - Checks before system start-up

Before starting up the thermodynamic system, the complete system, including the thermodynamic system, must be verified against the installation drawings, dimensional drawings, system piping and instrumentation diagrams and the wiring diagrams.

All measures must be taken to ensure that the pressure and temperature limits, specifically those listed on the unit nameplates, are not exceeded during operation, maintenance and recycling.

Heat exchange fluid temperatures above the maximum recommended can lead to an increase in the refrigerant pressure and can cause a loss of refrigerant due to the relief valve discharge.

National regulations must be followed during these checks. If the national regulation does not specify any details, refer to standard EN 378 as follows:

External visual installation checks:

- Ensure that the machine is charged with refrigerant. Verify on the unit name plate that the 'fluid transported' is that recommended for operation, and is not nitrogen.
- Compare the complete installation with the refrigeration system and power circuit diagrams.
- Check that all documents provided by the manufacturer (dimensional drawings, pipe and instrument diagram (PID), declarations, etc.) to comply with the regulations are present. If any documentation is missing, order a replacement.
- Make sure the environmental safety and protection devices and arrangements provided by the manufacturer to comply with the regulations are in place.
- Make sure all declarations of conformity for the pressure containers, identification plates and documentation required to comply with local regulations are present.
- Verify the free passage of access and safety routes.
- Comply with the instructions and directives to prevent the deliberate release of refrigerant fluids.
- Verify the installation of connections.
- Verify the supports and fixing elements (materials, routing and connection).
- Verify the quality of welds and other joints.
- Check the protection against mechanical damage.
- Check the protection against heat.
- Check the protection of moving parts.
- Verify the accessibility for maintenance or repair and to check the piping.
- Verify the status of the valves.
- Verify the quality of the thermal insulation.
- Check the condition of 400 V cable insulation.

10.2 - Commissioning

Always ensure you have read and fully understood the operating instructions for the units before starting up the unit, and ensure the following precautions have been taken:

- Check the heat-transfer fluid circulation pumps, the air handling equipment, and any other equipment connected to the heat exchangers.
- Refer to the manufacturer's instructions.
- Refer to the electrical diagram delivered with the unit.
- Ensure there are no refrigerant leaks. Check the tightening of the fastening clips on all the pipes.
- Check the power supply at the main connection point and the order of phases.
- For units without the factory-fitted hydraulic module option, the installer is responsible for heat protection and the connections relating to the system pump.
- Check that the compressor crankcase heaters, and the compressor head heaters if applicable, have been energised for 6 hours before starting up the system.
- Open the suction shut-off valves on each circuit for the corresponding units.

IMPORTANT:

Commissioning and start-up must be supervised by a qualified engineer.

- ***The system must have a heat load and water flowing in the exchangers when it is started up and tested.***
- ***All setpoint adjustments and control tests must be carried out before the unit is started up.***
- ***Refer to the Service guide.***

Proceed with the unit commissioning.

Make sure all safety devices are operational, and especially that the high pressure switches are engaged and that any alarms have been cleared.

NOTE:

If the manufacturer's recommendations (system, water and power connections) are not observed, no claims made under the warranty will be accepted.

10.3 - Essential points to check

Compressors

Ensure that each compressor is rotating in the correct direction, checking that the discharge temperature rises quickly, the high pressure increases and the low pressure drops. If it is rotating in the wrong direction, the electric power supply is incorrectly wired (reversed phases). To ensure rotation in the correct direction, swap two power supply phases.

- Check the compressor discharge temperature using a contact sensor
- Check the input current; it should be normal
- Check all safety devices to make sure they operate correctly

Hydraulics

As the exact total system pressure drop is not known at start-up, adjust the water flow rate with the control valve until the desired nominal rate is obtained.

Please refer to the chapter “Nominal system water flow rate control - Procedure for adjusting the flow rate” for the steps to follow.

In any case, the hydraulic circuit must be free from pollution (removal of any solid particles in the circuit) before start-up: Please refer to the chapter “Nominal system water flow rate control - Procedure for cleaning the hydraulic circuit” for the steps to follow.

The antifreeze relief valves open when outside air temperature decrease below 3°C. If an antifreeze solution is used for freeze protection, replace the antifreeze relief valve by a plug.

Refrigerant charge

Each unit is shipped with an exact charge of refrigerant and oil.

Check that there are no visible refrigerant or oil leaks:

- No apparent damage on the refrigerant circuit pipes (no trauma, cracks, deformation)
- No traces of grease on the connections and refrigerant circuit sensors

In case of doubt, use a refrigerant leak detection device suited to the fluid in the unit.

10.4 - UNIT START-UP CHECKLIST FOR INSTALLERS PRIOR TO CONTACTING THE MANUFACTURER

Preliminary information

Job name:.....
Location:.....
Installing contractor: .....
Distributor: .....
Start-up performed by..... On .....

Equipment

Model..... Serial number .....

Compressors

Circuit A	**Circuit B**
1. Model	1. Model .....
Serial number	Serial number .....
2. Model	2. Model .....
Serial number	Serial number .....
3. Model	3. Model .....
Serial number	Serial number .....
4. Model	4. Model .....
Serial number	Serial number .....

Air handling equipment

Manufacturer: .....
Model ..... Serial number .....

Additional air handling units and accessories.....
.....

Preliminary equipment check

Is there any shipping damage? ..... If so, where? .....
.....
Will this damage prevent unit start-up? .....

☐ The unit is installed level
☐ The power supply corresponds to the unit nameplate
☐ Electrical circuit wiring has been sized and installed properly
☐ Unit ground wire has been connected
☐ Electrical circuit protection has been sized and installed properly
☐ All terminals are tight
☐ All cables and thermistors have been inspected for crossed wires
☐ All plug assemblies are tight

Check air handling systems

☐ All air handling units are operating
☐ All chilled water valves are open
☐ All fluid piping is connected properly
☐ All air has been vented from the system
☐ Chilled water pump is operating with the correct rotation. CWP current: Assigned:..... Actual.....

10 - SYSTEM START-UP

Unit start-up

☐ Chilled water pump contactor has been correctly cabled with the chiller
☐ Oil level is correct
☐ The unit has been checked for leaks (including couplings)
☐ Locate, repair, and report any refrigerant leaks

.....
.....
.....

Check voltage imbalance: AB..... AC..... BC.....
Average voltage = ... (See installation instructions)
Maximum deviation = ... (See installation instructions)
Voltage imbalance = ... (See installation instructions)

☐ Voltage imbalance is less than 2%

WARNING

Do not start the chiller if the voltage imbalance is greater than 2%. Contact your local power company for assistance.

☐ All incoming power voltage is within the nominal voltage range
☐ The compressor crankcase heaters have been running for 6 hours

Evaporator water loop check

Water loop volume ..... = ... (litres)
Calculated volume ..... = ... (litres)

☐ Correct loop volume established
☐ Correct loop corrosion inhibitor included ..... litres of
☐ Correct loop frost protection included (if required) ..... litres of
☐ Water piping includes electric tape heater up to the evaporator
☐ Return water piping is equipped with a screen filter with a mesh size of 1.2 mm

Checking the pressure drop across the evaporator (without hydraulic module) or ESP(1) (with hydraulic module)

Evaporator inlet = ... (kPa)
Evaporator outlet = ... (kPa)
Pressure drop (Inlet - Outlet) = ... (kPa)

(1) ESP: External Static Pressure

WARNING

Plot the pressure drop on the evaporator flow rate/pressure drop curve to determine the flow rate in l/s at the nominal operating conditions for the system. For units with hydraulic module, an indication of the flow rate is displayed by the unit control device (see the 61AQ control manual).

If necessary, use the control valve to adjust the flow rate to the rated value.

☐ Flow rate from the pressure drop curve, l/s = ...
☐ Nominal flow rate, l/s = ...
☐ The flow rate in l/s is higher than the minimum unit flow rate
☐ The flow rate in l/s corresponds to the specification of ..... (l/s)

10 - SYSTEM START-UP

Carry out the QUICK TEST function (Consult the manufacturer's Service):

Check and log on to the user menu configuration

Load sequence selection.....
Capacity ramp loading selection.....
Start-up delay .....
Pump control .....
Setpoint reset mode .....
Night-time capacity setback.....

Re-enter the setpoints

To start the chiller

WARNING

Be sure that all service valves are open, and that the pump is on before attempting to start this machine. Once all checks have been made, try to start the unit.

The unit starts and operates properly

Temperatures and pressures

WARNING

Once the unit has been operating for a while and the temperatures and pressures have stabilised, record the following:

Evaporator water inlet.....
Evaporator water outlet .....
Ambient temperature .....
Circuit A suction pressure .....
Circuit B suction pressure.....
Circuit A discharge pressure.....
Circuit B discharge pressure .....
Circuit A suction temperature .....
Circuit B suction temperature .....
Circuit A discharge temperature .....
Circuit B discharge temperature.....
Circuit A liquid line temperature .....
Circuit B liquid line temperature.....

NOTES:

.....
.....
.....

11 - MAIN COMPONENTS OF THE UNIT AND OPERATING CHARACTERISTICS

11.1 - Compressors

The units use hermetically sealed scroll compressors.

Each compressor sub-function is equipped with:

- Anti-vibration mountings between the unit chassis and the compressor,
- A safety pressure switch on the discharge line of each circuit,
- Pressure and temperature sensors at the common suction line and a pressure sensor at the common discharge line.

11.2 - Lubricant

The compressors installed on the units have an oil charge, ensuring good lubrication under all operating conditions.

The oil level check can be done:

- On the system: The oil levels must be greater than or equal to half of the sight glass.
- A few minutes after the sub-function has come to a complete stop: The oil levels must be visible in the sight glasses.

If this is not the case, there might be a leak or an oil trap in the circuit.

If there is an oil leak, find and repair it, then refill with refrigerant and oil.

See the Service Guide for the oil removal and refill procedures.

IMPORTANT: Too much oil in the circuit can cause the unit to malfunction.

NOTE :

Only use oils which have been approved for the compressors.

Never use oils which have been exposed to air.

IMPORTANT: Polyolester oils are completely incompatible with mineral oils.

Only use the oils specified by the manufacturer.

11.3 - Air-cooled exchanger

61AQ units are equipped with round tube plate fin coils (RTPF).

11.4 - Fans

Each fan motor assembly is equipped with a high-performance impeller made from recyclable composite material.

The motors are three-phase, with lifetime lubricated bearings and class F insulation (IP55 level).

According to regulation No. 327/2011 implementing directive 2009/125/EC with regard to eco-design requirements for fans driven by motors with an electric input power between 125 W and 500 kW.

AquaSnap 61AQ		Standard EC Fans
Overall efficiency	%	57,4
Measurement category		A
Efficiency category		Static
Target effciency level ERP2015		N(2015) 40
Effciency level at optimum efficiency point		62,1
Variable speed drive		Yes
year of manufacture		See label on the unit
Motorized fan manufacturer		Ziehl-Abegg
Motorized fan PN		00PSG004250800
Nominal power of the motor	kW	1,85
Flow rate	m³/s	4,31
Pressure at optimum energy efficiency	Pa	221
Nominal speed	rpm	950
Specific ratio		1,002
Relevant information to facilitate the disassembly, recycling or removal of the product at the end of life		See the maintenance manual
Relevant information to minimise the impact on the environment		See the maintenance manual

According to regulation No. 640/2009 and amendment 4/2014 implementing directive 2009/125/EC with regard to ecodesign requirements for electric motors.

AquaSnap 61AQ		Standard EC Fans
Motor type		Synchronous
Nominal input frequency	Hz	50
Nominal voltage	V	400
number of phases		3
Motor included in the application domain of the regulation 2019/1781 and amendment 4/2014		No
Rationale for exemption		Article 2(2)(b)
Ambient air temperature for which the motor is specifically designed	°C	70

The data above for the fans and motors are compulsory as part of the ecodesign regulations, and are provided for a self-contained component (not included in the cooling system).

11.5 - Electronic expansion valve (EXV)

The EXV has a stepper motor and an external sight glass is mounted on the same line to check the presence of the liquid gasket.

11.6 - Moisture indicator

This is used to check the unit charge and the presence of moisture in the circuit.

The presence of bubbles in the sight-glass indicates an insufficient charge or non-condensables in the system.

The presence of moisture changes the colour of the indicator paper in the sight-glass (from green to yellow).

11.7 - Filter drier

The role of the filter drier is to keep the circuit clean and moisture free.

The moisture indicator shows when the filter drier needs to be changed.

A difference in temperature between the filter inlet and outlet shows that the element is dirty.

11.8 - Water type heat exchanger

The exchanger is a brazed plate heat exchanger.

The hydraulic connections of the heat exchanger are screwed connections.

The water heat exchanger is thermally insulated with 19 mm of foam rubber.

It is protected in standard against frost by electric heaters.

Any products used for thermal insulation of recipients during hydraulic connection must be chemically neutral to the surfaces on which they are applied. All original materials supplied by the manufacturer comply with this requirement.

NOTE - Monitoring during operation

- **Follow local regulations on the monitoring of pressure equipment**
- **The user or operator is usually requested to create and maintain a monitoring and maintenance log.**
- **In the absence of any regulations, or in addition to the regulations, follow the guidance in the EN 378 standard.**
- **Follow the local professional recommendations, whenever they exist.**
- **Regularly check for the presence of any impurities (e.g. sand, grit) in the heat-transfer fluids. These impurities can cause wear and/or pitting corrosion.**
- **The reports of the periodical checks by the user or the operator must be included in the monitoring and maintenance log.**

11.9 - Refrigerant

Units operating with R-290 (A3 fluid).

Potentially flammable zones have been identified on the edge of the unit: Please refer to chapter “4.6 - Positioning of Potentially flammable zones around the unit”.

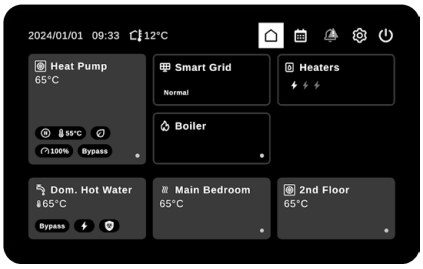
Please comply with applicable recommendations in the Potentially flammable zones.

11.10 - High-pressure safety pressostat

The units are equipped with high-pressure safety pressostats with automatic reset.

These pressure switches are located at the discharge of each circuit.

11.11 - SmartVu™ control



The interface for the SmartVu™ control has the following characteristics:

- It has a 7-inch colour screen.
- It is intuitive and user-friendly. Clear and concise information is presented in the local language (choice of 8 languages).
- The complete menu can be adapted to the various users (end customer, maintenance personnel, manufacturer engineers).
- Unit setting and use are secure. Password protection prevents unauthorised access to advanced parameters.
- No password is required to access the most important operating parameters.

12 - OPTIONS & ACCESSORIES

12.1 - Table of options & accessories

Options	No.	Description	Advantages	Aquasnap 61AQ
Corrosion protection, traditional coils	3A	Fins made of pre-treated aluminum by chemical conversion	Improved corrosion resistance, recommended for moderate marine and urban environments	040P-560P
Sensor for Lead / Lag operation (Accessory)	58	Unit equipped with supplementary water outlet temperature sensor kit (to be field installed) allowing Lead / Lag operation of four units connected in parallel	Optimized operation of four units connected in parallel operation with operating time equalization	040P-560P
Remote electrical connection (Accessory)	81B	Remote electrical junction box	Remote electrical connection box easily allows the connection of different types of electrical cables (Ex/ aluminum cable)	040P-560P
HP VSD single-pump (variable speed)	116V	Single high-pressure water pump with variable speed drive (VSD), electronic water flow control, pressure transducers. Multiple possibilities of water flow control. (expansion tank included)	Easy and fast installation (plug & play), significant pumping energy cost savings (up to two-thirds), tighter water flow control, improved system reliability	040P-560P
System Management Module (SMM) (Accessory)	156D	Electrical box to place on the technical room to connect heating accessories (DHW & Heating zones 3WV, boiler,...) Connected to the Heat Pump via a single bus, need 230V Suply.	Easy connection of the accessories of the Heating system	040P-560P
Refrigerant leak detector (Accessory)	159C	Unit equipped with refrigerant leak detector	Quick notification to the customer of refrigerant losses to the atmosphere, allowing timely corrective actions. Enlarge time between leak detection test according to F-Gas regulation and/or local regulation	040P-560P
System Management Sequencer 4 units (SMS) (Accessory)	275ABC	User Interface (10" display panel) for remote installation up to 2/3/4 units with SMM (System Management Module) included.	Remote control and sequencer for up to 2/3/ 4 units s as well as easy management of the heating system accessories	040P-560P
EMC class. C1, as per EN 61000-6-3 (Accessory)	282C	Additional RFI filters on the unit power line	Reduces electromagnetic interferences for compliance with emission level category C1 in order to allow the units to operate in the first environment (so called, residential environment)	040P-560P
EMC class. C1, as per EN 61600-6-3 + Energy meter (Accessory)	282D	Additional RFI filters on the unit power line + Electric energy metering	Reduces electromagnetic interferences for compliance with emission level category C1 in order to allow the units to operate in the first environment (so called, residential environment) Permits the acquisition, (remote) monitoring of energy used.	040P-560P
Electric energy meter (Accessory)	294	Display of energy consumption, instantaneous (U, V, I) and cumulated (kWh) on the unit user interface datas available on communication bus	Permits the acquisition, (remote) monitoring of energy used.	040P-560P
ABOUND HVAC Performance (CS Box Accessory)	298C	Box included : 4G modem + antenna system with GPS location to transmit the machine's (up to 5) operating data in real time	Enable ABOUND HVAC Performance service offer	040P-560P
Water buffer tank module (Accessory)	307	Integrate water buffer tank	Avoid short cycle on compressors and ensure a stable water in the loop	040P-140P
Water buffer tank module with heaters (Accessory)	307D/E	Integrate water buffer tank with electrical heater of D=12 kW (2 stages 2x6kW) / E= 18 kW (3 stages 3x6kW)	The water tank avoid short cycle on compressors and ensure a stable water in the loop. The electric heaters ensures a complement or a security in heating mode.	040P-140P
Anti-vibration mounts (Accessory)	308	Elastomer antivibratils mounts to be place under the unit(Material classified B2 fire class according to DIN 4102).	Isolate unit from the building, avoid transmission of vibration and associate noise to the buiding. Must be associate with flexible connection on water side	040P-560P
Exchangers flexibles connection (Accessory)	309A	Flexibles connections on the exchanger water side	Easy installation. Limit transmission of vibrations on the water network	040P-560P
External temperature sensor (Accessory)	312	Remote External temperature sensor	Better value of the external temperature according to the site configuration	040P-560P
Domestic Hot Water sensor (Accessory)	312A	Temperature sensor designed to measure and control the temperature of the Domestic Hot Water tank	Optimization of the production of domestic hot water	040P-560P
Domestic Hot Water 3WV & Management (Accessory)	347A	3WV furniture & management for domestic hot water production (3WV supplied)	Easy management of Domestic Hot Water. Directing the hot water produced by the Heat Pump to the heating circuit or the domestic hot water tank.	040P-140P

Features defined as accessories are not factory mounted on the unit. An action is required during installation to plug it to the unit. A dedicated instruction for each accessory is available with technical description, installation procedure and required information.

Other features are options factory mounted on the unit. No action is required during installation.

12.2 - Description

12.2.1 - Hydraulic module with variable speed (Options 116V)

The composition of the hydraulic module with variable speed is similar to that of the hydraulic module without variable speed.

In this case, the pump is controlled by a variable frequency drive that allows the pump's nominal flow rate to be adjusted according to the chosen control mode (constant pressure or temperature differential, or fixed speed) and the system operating conditions.

IMPORTANT: The use of the hydraulic module on open systems is prohibited.

12.2.2 - Operation of four units as a Lead/Lag pair (option 58)

The customer must connect both units with a communication bus in 0.75 mm² twisted, shielded cable (contact the manufacturer's Service for the installation).

All parameters required for Lead/Lag operation must be configured by the Service configuration menu.

All remote controls of the Lead/Lag assembly (start/stop, setpoint, load shedding, etc.) are managed by the unit configured as the lead and must only be applied to the lead unit.

Units supplied with hydraulic module

Lead/Lag operation is possible only when the units are installed in parallel:

- The Lead/Lag assembly is controlled on the water inlet without any additional sensors (system return) (Example 1).
- This can also be done on the water outlet with the addition of two additional sensors on the common pipe (see Example 2).

Each unit controls its own water pump.

Units supplied without hydraulic module

In the case of units installed in parallel, and if there is only one common pump installed by the installer, isolating valves must be installed on each unit. These should be controlled (opened and closed) using the control for the relevant unit (valves for each unit can be controlled using the unit water pump control outputs). Refer to the control manual for the connections.

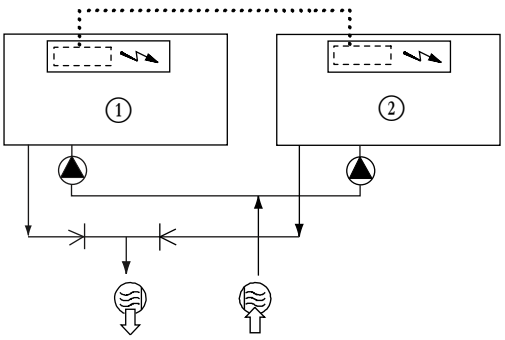
In this case, a variable-speed pump must be controlled by the unit via the 0-10 V dedicated output of the lead unit (control on Delta T only).

IMPORTANT:

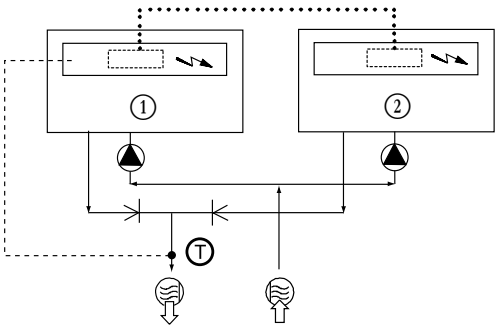
Both of the units must be equipped with an option to allow Lead/Lag operation.

If one or both units is equipped with the variable-speed pump option, it is strongly recommended not to set the control mode on the pressure differential. The same setpoint is recommended for configuring the temperature differential mode.

Example 1: Operation in parallel - control on water inlet for a hydraulic module



Example 2: Operation in parallel - control on water outlet for a hydraulic module



Key:
All dimensions are given in mm.

- (1) Lead unit
- (2) Lag unit
- Water inlet
- Water outlet
- Control boxes of the lead and lag units
- Water pumps for each unit (normally included in the units with hydraulic module)
- (T) Additional sensor for water outlet control, to be connected to channel X1-108 on the customer terminal block of lead unit
- •••• CCN communication bus
- ..... Connection of the additional sensor
- Non-return valve

13 - STANDARD MAINTENANCE

To ensure optimal efficiency and reliability of the equipment and all its functions, we recommend taking out a maintenance contract with the local organisation set up by your manufacturer. This contract will include regular inspections by the manufacturer's Service specialists so that any malfunction is detected and corrected quickly, ensuring that no serious damage can occur. The manufacturer's service maintenance contract is the best way to ensure the maximum operating life for your equipment and, through the expertise of manufacturer's qualified personnel, provides the ideal way to manage your system energy consumption effectively.

The refrigeration equipment must be serviced by professionals; however, routine checks may be carried out locally by specially-trained technicians. See standard EN 378-4.

All refrigerant charging, removal and draining operations must be carried out by a qualified technician and with the correct equipment for the unit. Any inappropriate handling can lead to uncontrolled fluid or pressure leaks.

IMPORTANT:

Before performing any work on the unit ensure it is de-energized. If a refrigerant circuit is opened, it must be evacuated, recharged and tested for leaks. Before any operation on a refrigerating circuit, it is necessary to evacuate the refrigerant charge from the device using a load transfer unit.

Simple preventive maintenance will allow you to get the best performance from your HVAC unit:

- Optimisation of energy performance,
- Reduced electricity consumption,
- Prevention of accidental component failure,
- Prevention of major time-consuming and costly work,
- Protection of the environment.

13.1 - Maintenance levels

- Level 1 maintenance must be performed by the operator,
- Level 2 maintenance must be performed by the maintenance service,
- Level 3 maintenance must be performed by a maintenance service authorised to work on refrigerant circuits.

NOTE: Any deviation from or failure to comply with these maintenance criteria will render the guarantee conditions for the refrigeration unit null and void, and will release the manufacturer from its liability.

13.2 - Level 1 maintenance

These simple procedures can be carried out by the user:

- Visual inspection for oil traces (sign of a refrigerant leak),
- Check for leaks in the circuit (monthly),
- Clean the air-cooled exchangers (see the dedicated chapter),
- Check that the protective grilles are present and in good condition, and that the doors and covers are properly closed,
- Check the unit's alarm report (see the control manual),
- Verify the refrigerant charge in the liquid line sight glass,
- Verify the temperature difference at the heat exchanger inlet and outlet is correct,
- Check for any general signs of deterioration,
- Check the anti-corrosion coatings.
- Check that the nameplates are always affixed to the unit
- Check that there are no flammable materials around the unit
- Check the cleanliness of the condensate tray and the drainage of condensate

13.3 - Level 2 maintenance

This level requires specific expertise in electrical, hydraulic and mechanical systems. it is possible that this expertise may be available locally; there may be a maintenance service, industrial site or specialist subcontractor in the area.

The frequency of this maintenance level may be monthly or annual, depending on the verification type.

In these cases, the following maintenance operations are recommended:

Carry out all level 1 operations, then:

Electrical checks (annual checks):

- At least once a year tighten the electrical connections for the power supply circuits (see tightening torques table),
- Check and tighten all control connections, if required,
- Check the labelling of the system and instruments, re-apply the missing labels if required,
- Remove the dust and clean the interior of the electrical boxes. Be careful not to blow dust or debris into components; use a brush and vacuum wherever possible,
- Clean the insulators and bus bar supports (dust combined with moisture reduces the insulation gaps and increases current leakage between phases and from phase to ground),
- Check the presence, condition and operation of electrical protective devices,
- Check the presence, condition and operation of control components,

- Check that all heaters are operating correctly,
- Replace the fuses every 3 years or every 15000 hours (ageing),
- Check that no water has penetrated into the electrical box,
- On the main electrical box and for units equipped with offset electrical boxes, regularly check the cleanliness of the filter media to maintain the correct air flow.
- Check that the circuit breaker works correctly (Power factor correction option).

Mechanical checks:

- Check that the mounting bolts for the ventilation sub-assemblies, fans, compressors and electrics box are securely tightened

Hydraulic checks:

- When working on the water circuit, take care not to damage the adjacent air heat exchanger,
- Check the water connections,
- Check the condition of the expansion tank (presence of corrosion or loss of gas pressure) and replace it if required,
- Drain the water circuit (see chapter “Water flow control procedure”),
- Clean the water filter and replace if damaged (see chapter “Water flow rate control procedure”),
- Replace the gland packing of the pump after 20000 hours of operation and the bearings after 17500 hours,
- Check gas separator every year,
- Replace the gas separator every 5 years,
- Check the operation of the low water flow safety device,
- Check the condition of pipe thermal insulation,
- Check the concentration of the anti-freeze protection solution (ethylene glycol or propylene glycol),
- Check the water flow via the heat exchanger pressure difference,
- Check the condition of the heat-transfer fluid or the water quality,
- Check for corrosion of the steel pipe work.

Refrigerant circuit checks:

- The unit is subject to F-gas tight regulatory checks. Please refer to the table in the introduction.
- Check the unit operating parameters and compare them with the previous values,
- Check the operation of the high-pressure switches. Replace them if there is a fault,
- Check the fouling of the filter drier. Replace it if required,
- Keep an up-to-date service booklet specific to the refrigeration unit in question.

IMPORTANT: Ensure all adequate safety measures are taken for all these operations: Use appropriate PPE (personal protective equipment), comply with all applicable industry and local regulations, and use common sense.

13.4 - Level 3 maintenance

Maintenance at this level requires specific skills, qualifications, tools and expertise. Only the manufacturer, his representative or authorised agent are permitted to carry out this work.

This maintenance work relates to the following:

- Replacement of major components (compressor, water heat exchanger), Replace relief valve every 5 years,
- Operations on the refrigerant circuit (handling refrigerant),
- Modification of factory-set parameters (change of application),
- Movement or disassembly of the refrigeration unit,
- Any operation due to proven lack of maintenance,
- Any operation covered by the warranty,
- One or two leak detection operations per year performed by qualified personnel using a certified leak detector.
- To reduce waste, the refrigerant and the oil must be transferred in accordance with applicable regulations, using methods that limit refrigerant leaks and pressure drops and with materials that are suitable for the products.
- Any leaks detected must be repaired immediately
- The compressor oil that is recovered during maintenance contains refrigerant and must be treated accordingly.
- Pressurised refrigerant must not be vented to the open air.
- If the refrigerating circuit must be opened, cap all openings for a period of up to one day. If open for longer, blanket the circuit with a dry, inert gas (e.g. nitrogen).

13.5 - Tightening of the electrical connections

Screw type	Use	Value (N.m)
Soldered screw (PE) customer connection		
M8	PE	24
Tunnel terminal screw switch		
Main Switch	QS100	15-22
Tunnel terminal screw, compressor contactor		
Compressur cable	W1-W2	2
Compressor motor		Max 3
Tunnel terminal screw variable speed drive compressor		
Compressor variable speed drive (power)	GSA-GSB	2
Compressor variable speed drive (control)	GSA-GSB	0,5
Tunnel terminal screw, control power transformer		
Transformer	TC	0,6
Ground terminal in the power wiring control box		
Ground connection compressor VFD	Gnd	9,8
Ground connection pump VFD	Gnd	5,7
Shield continuity compressor cable	Gnd	5,7
Shield continuity pump cable	Gnd	2,9
Tunnel terminal screw, disconnect switch		
Compressor circuit breaker	QMA-QMB	3,5
Fan circuit breaker	QM11-QM13	0,8-1,2
Pump circuit breaker	QM91-QM92	0,8-1,2
Transformer circuit breaker	QF	3,5
400V heaters circuit breaker	QF1	3,5
Control box fan circuit breaker	QF2	1,2
Control circuit breaker	QF3-6	1,2
24V heaters circuit breaker	QF7-9	1,2
Tunnel terminal screw, EMC filter (fan, pump)		
EMC filter	ZGS11-ZGS13	1,0-1,2
EMC filter	ZGS91-ZGS92	0,7-0,8
Tunnel terminal screw control relay		
Pipipng heater relay	K1-K2	0,78-1,18
Electrical box fan cut off relay	K3	0,78-1,18
BPHE heater	KM1-KM2	1
Coil heater	KM3-KM4	1
Compressor heater	KM6-KM7	1

13.6 - Tightening torques for the main fastenings

Component	Designation in the unit	Value (N.m)
Screw type	**Used for**	**Torque (N.m)**
Metal screw	Sheet metal plates	4,2
M6 screw	BPHE(1) fixing	7
Taptite screw M6	Sheet metal plates	7
H M6 screw	Stauff clamps	10
M8 nut	Compressor mounting	17
Taptite screw M8	Sheet metal plates	17
Taptite screw M10	Motor + Fan frame	30

(1) BPHE = Brazed Plate Heat Exchanger

13.7 - Air-cooled exchanger

We recommend that coils are inspected regularly to check the degree of fouling. This depends on the environment where the unit is installed, in particular urban and industrial sites, and for units installed near trees that shed their leaves.

Recommendations for maintenance and cleaning of air heat exchangers:

- Regularly cleaning the coil surface is essential for correct unit operation.
- Eliminating contamination and removal of harmful residue will increase the operating life of the coils and the unit.
- The maintenance and cleaning procedures below are part of the regular maintenance to increase the operating life of coils.
- Specific recommendation in case of snow: For long term storage, regularly check that no snow has accumulated on the coil.

Level 1 cleaning:

- Remove all foreign objects or debris attached to the surface of the coil or wedged between the casing and the supports
- Use a low pressure dry air jet to remove all traces of dust from the coil.

Level 2 cleaning:

- Carry out the level 1 cleaning operations.
- Clean the coil using suitable products.

Use appropriate PPE including safety glasses and/or mask, waterproof clothes and safety gloves. It is recommended to wear clothing that covers the whole body.

Specific products approved by the manufacturer for cleaning coils are available from the manufacturer's spare parts network. The use of any other product is strictly prohibited. After the cleaning product is applied, rinsing with water is mandatory (see manufacturer's standard RW01-25).

IMPORTANT:

Never use a pressure water spray without a large diffuser.

Concentrated and/or rotating water jets are strictly forbidden.

Never use a fluid with a temperature above 45°C to clean the air heat exchangers.

Correct and frequent cleaning (approximately every three months) will prevent two thirds of corrosion problems. Protect the electrics box during cleaning operations.

13.8 - Water type heat exchanger

Check that:

- The insulation has not been detached or torn during operations,
- The heaters and probes are operating and correctly positioned in their support,
- The water-side connections are clean and show no sign of leakage,
- The period inspections required by the local regulations have been carried out.

13.9 - Frequency inverter

IMPORTANT: Before any work on the variable frequency drive, ensure that the circuit is isolated and there is no voltage present (reminder: The capacitors take approximately 5 minutes to discharge once the circuit breaker has been opened). Only appropriately qualified personnel are authorised to work on the variable frequency drive.

In case of any alarm or persistent problem related to the variable frequency drive, contact the manufacturer's service department.

The variable frequency drives fitted on the units do not require a dielectric test, even if being replaced: They are systematically checked before delivery. Moreover, the filtering components installed in the variable frequency drive can falsify the measurement and may even be damaged. If there is a need to test the insulation of the unit components (fan motors and pumps, cables, etc.), the variable frequency drive must be disconnected from the power circuit.

13.10 - Refrigerant volume

It is essential to run the unit in cooling mode to find out whether the charge is correct; this is done by checking the actual subcooling.

Following a slight leak, it will be possible to detect a drop in the refrigerant charge from the initial charge, and this will affect the subcooling value obtained at the air-cooled exchanger outlet; it cannot, however, be detected in heating mode.

13.11 - Refrigerant properties

R-290 properties

Saturated temperatures based on the gauge pressure (in kPag)							
Saturated Temp.	**Pressure gauge**	**Saturated Temp.**	**Pressure gauge**	**Saturated Temp.**	**Pressure gauge**	**Saturated Temp.**	**Pressure gauge**
-20	245	4	535	28	1027	52	1789
-19	253	5	551	29	1053	53	1828
-18	263	6	567	30	1079	54	1867
-17	272	7	584	31	1106	55	1907
-16	282	8	601	32	1133	56	1948
-15	292	9	619	33	1161	57	1989
-14	302	10	637	34	1189	58	2031
-13	312	11	655	35	1218	59	2074
-12	323	12	673	36	1247	60	2117
-11	334	13	692	37	1277	61	2161
-10	345	14	712	38	1307	62	2205
-9	357	15	732	39	1338	63	2250
-8	369	16	752	40	1369	64	2296
-7	381	17	772	41	1401	65	2343
-6	393	18	793	42	1434	66	2390
-5	406	19	815	43	1467	67	2438
-4	419	20	836	44	1500	68	2487
-3	432	21	859	45	1534	69	2537
-2	446	22	881	46	1569	70	2587
-1	460	23	905	47	1604	-	-
0	474	24	928	48	1640	-	-
1	489	26	952	49	1676	-	-
2	504	25	977	50	1713	-	-
3	519	27	1001	51	1751	-	-

14 - FINAL SHUTDOWN

14.1 - Shutting down

Separate the units from their energy sources, allow them to cool then drain them completely.

14.2 - Recommendations for disassembly

Read information relating to the presence of potentially dangerous substances in the product and their precautions for use (REACH, Regulation no. 1907/2006). This information is available on the Manufacturer's website.

Use the original lifting equipment.

Sort the components according to their material for recycling or disposal, in accordance with regulations in force.

Check whether any part of the unit can be recycled for another purpose.

14.3 - Fluids to be recovered for treatment

- Refrigerant (In compliance with regulation F-GAS no. (EU) 2024/573) and local regulation.
- Heat-transfer fluid: Depending on the installation, water, brine solution, etc.
- Compressor oil

14.4 - Materials to be recovered for recycling

- Steel
- Copper
- Aluminium
- Plastics
- Polyurethane foam (insulation)

The proportions of materials for each unit are listed in the Product Environmental Profile (PEP) available at the following website: http://www.pep-ecopassport.org/fr/consulter-les-pep/

14.5 - Waste Electrical and Electronic Equipment (WEEE)

At the end of its life, this equipment must be disassembled and contaminated fluids removed by professionals and processed via approved channels for electrical and electronic equipment (WEEE).

CARRIER participates in the ECP programme for LCP-HP
Check ongoing validity of certificate:
www.eurovent-certification.com

The quality management system of this product's assembly site has been certified in accordance with the requirements of the ISO 9001 standard (latest current version) after an assessment conducted by an authorized independent third party.
The environmental management system of this product's assembly site has been certified in accordance with the requirements of the ISO 14001 standard (latest current version) after an assessment conducted by an authorized independent third party.
The occupational health and safety management system of this product's assembly site has been certified in accordance with the requirements of the ISO 45001 standard (latest current version) after an assessment conducted by an authorized independent third party.
Please contact your sales representative for more information.

Order No.: 10839, 02.2025 - Supersedes order No.: 10839, 12.2024.
The manufacturer reserves the right to change the product specifications without notice.

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