61AF

High-temperature heat pumps

Nominal heating capacity 22-105 kW

50 Hz

PRO-DIALOG

Installation, operation and maintenance instructions

ISO9001 · ISO14001

Quality and Environment Management Systems Approval

CONTENTS

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

1 - INTRODUCTION

Prior to the initial start-up of the 61AF units, the people involved should be thoroughly familiar with these instructions and the specific project data for the installation site.

The 61AF heat pumps are designed to provide a very high level of safety and reliability making installation, start-up, operation and maintenance easier and more secure. They will provide safe and reliable service when operated within their application range.

The procedures in this manual are arranged in the sequence required for machine installation, start-up, operation and maintenance.

Be sure you understand and follow the procedures and safety precautions contained in the instructions supplied with the machine, as well as those listed in this guide, such as: protective clothing such as gloves, safety glasses, safety shoes and appropriate tools, and suitable qualifications (electrical, air conditioning, local legislation).

To find out, if these products comply with European directives (machine safety, low voltage, electromagnetic compatibility, equipment under pressure, etc.) check the declarations of conformity for these products.

1.1 - Check equipment received

- Inspect the unit for damage or missing parts. If damage is detected, or if shipment is incomplete, immediately file a claim with the shipping company.
- Confirm that the unit received is the one ordered. Compare the name plate data with the order.
- The name plate is attached to the unit in two locations:
  - on the outside on one of the unit sides
  - on the control box door on the inside

  This shows the following information:
  - Model number - size
  - CE marking
  - Serial number
  - Year of manufacture and pressure and leak tightness test date
  - Refrigerant used
  - Refrigerant charge per circuit
  - PS: Min./max. allowable pressure (high and low pressure side)
  - TS: Min./max. allowable temperature (high and low pressure side)
  - Pressure switch cut-out pressure
  - Unit leak test pressure
  - Voltage, frequency, number of phases
  - Maximum current drawn
  - Maximum power input
  - Unit net weight
- Confirm that all accessories ordered for on-site installation have been supplied, are complete and undamaged.

The unit must be checked periodically, if necessary removing the insulation (thermal, acoustic), during its whole operating life to ensure that no shocks (handling accessories, tools, etc.) have damaged it. If necessary, the damaged parts must be repaired or replaced. See also chapter "Maintenance".

1.2 - Installation safety considerations

After the unit has been received, when it is ready to be installed or reinstalled, and before it is started up, it must be inspected for damage. Check that the refrigerant circuits are intact, especially that no components or pipes have shifted or been damaged (e.g. following a shock). If in doubt, carry out a leak tightness check. If damage is detected upon receipt, immediately file a claim with the shipping company.

This machine must be installed in a location that is not accessible to the public and protected against access by non-authorised people.

Do not remove the skid or the packaging until the unit is in its final position. These units can be moved with a fork lift truck, as long as the forks are positioned in the right place and direction on the unit.

The units can also be lifted with slings, using only the designated lifting points marked on the unit (labels on the chassis and a label with all unit handling instructions are attached to the unit tank - refer to chapter 2.4).

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

Safety is only guaranteed, if these instructions are carefully followed. If this is not the case, there is a risk of material deterioration and injuries to personnel.

These units are not designed to be lifted from above.

DO NOT COVER ANY PROTECTION DEVICES.

This applies to fuse plugs and safety valves (if used) in the refrigerant or heat transfer medium circuits. Check if the original protection plugs are still present at the valve outlets. These plugs are generally made of plastic and should not be used. If they are still present, please remove them. Install devices at the valve outlets or drain piping that prevent the penetration of foreign bodies (dust, building debris, etc.) and atmospheric agents (water can form rust or ice). These devices, as well as the drain piping, must not impair operation and not lead to a pressure drop that is higher than 10% of the control pressure.

Ensure that the valves are correctly installed, before operating the unit.

Classification and control
In accordance with the Pressure Equipment Directive and national usage monitoring regulations in the European Union the protection devices for these machines are classified as follows:

	Safety accessory*	Damage limitation accessory** in case of an external fire
Refrigerant side		
High-pressure switch	x	
External relief valve***		x
Rupture disk		x
Fuse plug		x
Heat transfer fluid side		
External relief valve****	x	x

* Classified for protection in normal service situations.
** Classified for protection in abnormal service situations.
*** The instantaneous over-pressure limited to 10% of the operating pressure does not apply to this abnormal service situation. The control pressure can be higher than the service pressure. In this case either the design temperature or the high-pressure switch ensures that the service pressure is not exceeded in normal service situations.
**** The classification of these safety valves must be made by the personnel that completes the whole hydronic installation.

Do not remove these valves and fuses, even if the fire risk is under control for a particular installation. There is no guarantee that the accessories are re-installed if the installation is changed or for transport with a gas charge.

All factory-installed safety valves are lead-sealed to prevent any calibration change.

The external safety valves must always be connected to drain pipes for units installed in a closed room. Refer to the installation regulations, for example those of European standard EN 378 and EN 13136.

These pipes must be installed in a way that ensures that people and property are not exposed to refrigerant leaks. As the fluids can be diffused in the air, ensure that the outlet is far away from any building air intake, or that they are discharged in a quantity that is appropriate for a suitably absorbing environment. Safety valves must be checked periodically. See paragraph "Repair safety considerations".

If the safety relief valves are installed on a reversing valve (changeover), this is equipped with a safety relief valve on each of the two outlets. Only one of the two safety relief valves is in operation, the other one is isolated. Never leave the reversing valve in the intermediate position, i.e. with both ways open (locate the control element in the stop position). If a safety valve is removed for checking or replacement please ensure that there is always an active safety valve on each of the reversing valves installed in the unit.

Provide a drain in the drain pipe, close to each safety valve, to avoid an accumulation of condensate or rain water.

All precautions concerning handling of refrigerant must be observed in accordance with local regulations.

Accumulation of refrigerant in an enclosed space can displace oxygen and cause asphyxiation or explosions.

Inhalation of high concentrations of vapour is harmful and may cause heart irregularities, unconsciousness, or death. Vapour is heavier than air and reduces the amount of oxygen available for breathing. These products cause eye and skin irritation. Decomposition products can be hazardous.

1.3 - Equipment and components under pressure

These products incorporate equipment or components under pressure, manufactured by Carrier or other manufacturers. We recommend that you consult your appropriate national trade association or the owner of the equipment or components under pressure (declaration, re-qualification, retesting, etc.). The characteristics of this equipment/these components are given on the nameplate or in the required documentation, supplied with the products.

Do not introduce high static and dynamic pressure compared with the existing operating pressures - either service or test pressures in the refrigerant circuit or in the heat transfer circuit, especially:

- limiting the elevation of the condensers or evaporators
- taking the circulating pumps into consideration.

1.4 - Maintenance safety considerations

Engineers working on the electric or refrigeration components must be authorized, trained and fully qualified to do so (e.g. electricians trained and qualified in accordance with IEC 60364 Classification BA4).

All refrigerant circuit work must be carried out by a trained person, fully qualified to work on these units. He must have been trained and be familiar with the equipment and the installation. All welding operations must be carried out by qualified specialists.
61AF units use refrigerant R-407C. Special equipment must be used when working on the refrigerant circuit (pressure gauge, charge transfer, etc.).

Any manipulation (opening or closing) of a shut-off valve must be carried out by a qualified and authorised engineer, observing applicable standards (e.g. during draining operations). The unit must be switched off while this is done.

During any handling, maintenance and service operations the engineers working on the unit must be equipped with safety gloves, glasses, shoes and protective clothing.

Never work on a unit that is still energized. Never work on any of the electrical components, until the general power supply to the unit has been cut.

If any maintenance operations are carried out on the unit, lock the power supply circuit in the open position and secure the machine upstream with a padlock.

If the work is interrupted, always ensure that all circuits are still deenergized before resuming the work.

ATTENTION: Even if the unit has been switched off, the power circuit remains energized, unless the unit or circuit disconnect switch is open, and remote start-up is still possible.

Refer to the wiring diagram for further details. Attach appropriate safety labels.

If any work is carried out in the fan area, specifically if the grilles or casings have to be removed, cut the power supply to the fans to prevent their operation. It is also rcommended to block the rotation of the blades during the work.

It is recommended to install an indicating device to show if part of the refrigerant has leaked from the valve. The presence of oil at the outlet orifice is a useful indicator that refrigerant has leaked. Keep this orifice clean to ensure that any leaks are obvious. The calibration of a valve that has leaked is generally lower than its original calibration. The new calibration may affect the operating range. To avoid nuisance tripping or leaks, replace or re-calibrate the valve.

OPERATING CHECKS:

- ***IMPORTANT INFORMATION REGARDING THE REFRIGERANT USED:***
  This product contains fluorinated greenhouse gas covered by the Kyoto protocol.
  Refrigerant type: R-407C
  Global Warming Potential (GWP): 1653
  Periodic inspections for refrigerant leaks may be required depending on European or local legislation.
  Please contact your local dealer for more information.
- ***During the life-time of the system, inspection and tests must be carried out in accordance with national regulations.***

Protection device checks:

- ***If no national regulations exist, check the protection devices on site in accordance with standard EN378: once a year for the high-pressure switches, every five years for external safety valves.***

If the machine operates in a corrosive environment, inspect the protection devices more frequently.

Regularly carry out leak tests and immediately repair any leaks.

Ensure regularly that the vibration levels remain acceptable and close to those at the initial unit start-up.

Before opening a refrigerant circuit, transfer the refrigerant to bottles specifically provided for this purpose and consult the pressure gauges.

Change the refrigerant after an equipment failure, following a procedure such as the one described in NF E29-795 or carry out a refrigerant analysis in a specialist laboratory.

If the refrigerant circuit remains open for longer than a day after an intervention (such as a component replacement), the openings must be plugged and the circuit must be charged with nitrogen (inertia principle). The objective is to prevent penetration of atmospheric humidity and the corrosion on the unprotected internal steel walls.

1.5 - Repair safety considerations

All installation parts must be maintained by the personnel in charge, in order to avoid deterioration and injury. Faults and leaks must be repaired immediately. The authorized technician must have the responsibility to repair the fault immediately. After each repair of the unit, check the operation of the protection devices and create a report of the parameter operation at 100%.

Comply with the regulations and recommendations in unit and HVAC installation safety standards, such as: EN 378 and ISO 5149.

Never use air or a gas containing oxygen during leak tests to purge lines or to pressurise a machine. Pressurised air mixtures or gases containing oxygen can be the cause of an explosion. Oxygen reacts violently with oil and grease.

Only use dry nitrogen for leak tests, possibly with an appropriate tracer gas.

If the recommendations above are not observed, this can have serious or even fatal consequences and damage the installation.

Never exceed the specified maximum operating pressures. Verify the allowable maximum high- and low-side test pressures by checking the instructions in this manual and the pressures given on the unit name plate.

Do not unweld or flamecut the refrigerant lines or any refrigerant circuit component until all refrigerant (liquid and vapour)as well as the oil have been been transferred from the heat pump. Traces of vapour should be displaced with dry air nitrogen. Refrigerant in contact with an open flame can produce toxic gases.

The necessary protection equipment must be available, and appropriate fire extinguishers for the system and the refrigerant type used must be within easy reach.

Do not siphon refrigerant.

Avoid spilling liquid refrigerant on skin or splashing it into the eyes. Use safety goggles and safety gloves. Wash any spills from the skin with soap and water. If liquid refrigerant enters the eyes, immediately and abundantly flush the eyes with water and consult a doctor.

Never apply an open flame (blowlamp) or overheated steam (high-pressure cleaner) to the refrigerant circuit. Dangerous overpressure can result.

During refrigerant removal and storage operations follow applicable regulations. These regulations, permitting condi-tioning and recovery of halogenated hydrocarbons under optimum quality conditions for the products and optimum safety conditions for people, property and the environment are described in standard NF E29-795.

Refer to the certified dimensional drawings for the units.

It is dangerous and illegal to re-use disposable (non-returnable) reclaim cylinders or attempt to refill them. When reclaim cylinders are empty, evacuate the remaining gas pressure, and move them to a designated place for recovery. Do not incinerate.

Do not attempt to remove refrigerant circuit components or fittings, while the machine is under pressure or while it is running. Be sure pressure is at 0 kPa and that the unit has been shut-down and de-energised before removing components or opening a circuit.

Do not attempt to repair or recondition any safety devices when corrosion or build-up of foreign material (rust, dirt, scale, etc.) is found within the valve body or mechanism. If necessary, replace the device. Do not install safety valves in series or backwards.

ATTENTION: No part of the unit must be used as a walkway, rack or support. Periodically check and repair or if necessary replace any component or piping that shows signs of damage.

Do not step on refrigerant lines. The lines can break under the weight and release refrigerant, causing personal injury. Do not climb on a machine. Use a platform, or staging to work at higher levels.

Use mechanical lifting equipment (crane, hoist, winch, etc.) to lift or move heavy components. For lighter components, use lifting equipment when there is a risk of slipping or losing your balance.

Use only original replacement parts for any repair or component replacement. Consult the list of replacement parts for the specification of the original equipment.

Do not drain water circuits containing industrial brines, without informing the technical service department at the installation site or a competent body first.

Close the entering and leaving water shut-off valves and purge the unit hydronic circuit, before working on the components installed on the circuit (screen filter, pump, water flow switch, etc.).

Periodically inspect all valves, fittings and pipes of the refrigerant and hydronic circuits to ensure that they do not show any corrosion or any signs of leaks.

It is recommended to wear ear defenders, when working near the unit and the unit is in operation.

Always ensure you are using the correct refrigerant type before recharging the unit.

Charging any refrigerant other than the original charge type (R-407C) will impair machine operation and can even lead to a destruction of the compressors. The compressors operate with R-407C and are charged with a synthetic polyol-ester oil.

Before any intervention on the refrigerant circuit, the complete refrigerant charge must be recovered.

2 - MOVING AND SITING THE UNIT

2.1 - Moving

See chapter 1.2 - "Installation safety considerations".

2.2 - Siting the unit

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

In case of extra-high units the machine environment must permit easy access for maintenance operations.

Always refer to the chapter "Dimensions and clearances" to confirm that there is adequate space for all connections and service operations. For the centre of gravity coordinates, the position of the unit mounting holes, and the weight distribution points, refer to the certified dimensional drawing supplied with the unit.

Typical applications of these units do not require earthquake resistance. Earthquake resistance has not been verified and the units are not explosion-proof.

CAUTION: Only use slings at the designated lifting points which are marked on the unit.

Before siting the unit check that:

- the permitted loading at the site is adequate or that appropriate strenghtening measures have been taken.
- if the heat pump is required to operate in temperatures below 0°C it must be raised at least 300 mm from the ground. This is necessary to avoid ice build-up on the unit chassis and also to permit correct unit operation in locations where the snow level may reach this height.
- the unit is installed level on an even surface (maximum tolerance is 5 mm in both axes).
- there is adequate space above the unit for air flow and to ensure 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.
- Baffles may be necessary to deflect strong winds. They must not restrict air flow into the unit.

CAUTION: Before lifting the unit, check that all casing panels 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.

If 61AF units are hoisted with rigging, 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 a unit more than 15°.

WARNING: Never push or lever on any of the enclosure panels of the unit. Only the base of the unit frame is designed to withstand such stresses.

2.3 - Checks before system start-up

Before the start-up of the refrigeration system, the complete installation, including the refrigeration system must be verified against the installation drawings, dimensional drawings, system piping and instrumentation diagrams and the wiring diagrams.

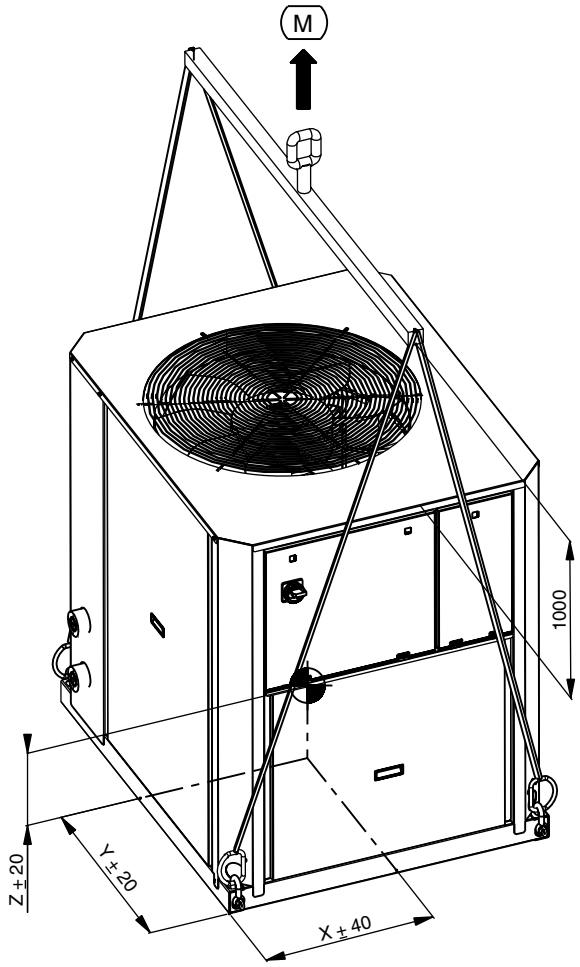
For these checks national regulations must be followed. If the national regulation does not specify any details, refer to standard EN 378-2 as follows:

External visual installation checks:

- Compare the complete installation with the refrigeration system and power circuit diagrams.
- Check that all components comply with the design specifications.
- Check that all protection documents and equipment provided by the manufacturer (dimensional drawings, P&ID, declarations etc.) to comply with the regulations are present.
- Verify that the environmental safety and protection and devices and arrangements provided by the manufacturer to comply with the regulations are in place.
- Verify that all documents for pressure containers, certificates, name plates, files, instruction manuals provided by the manufacturer to comply with the regulations are present.
- Verify the free passage of access and safety routes.
- Verify the instructions and directives to prevent the deliberate removal of refrigerant gases.
- 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 and of the vapour barriers.
- Ensure that the ventilation in the machine room is sufficient.
- Check the refrigerant detectors.

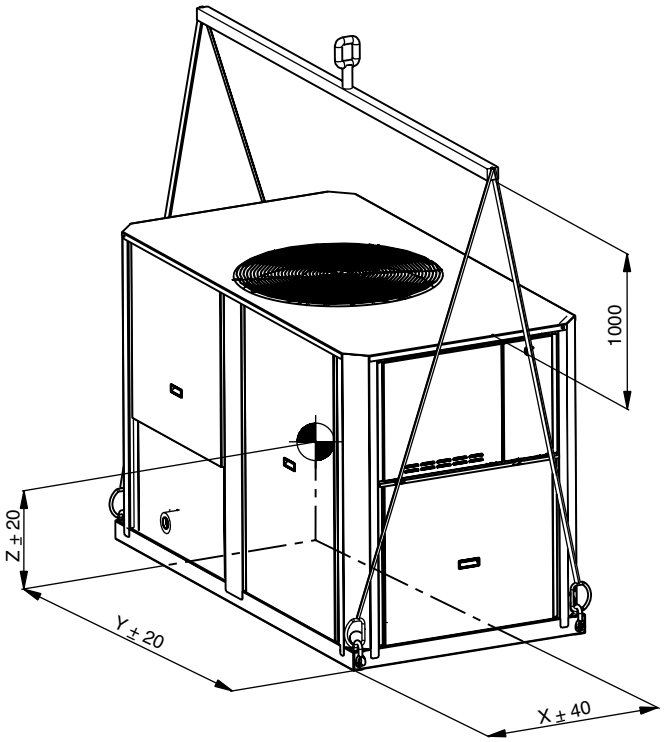
2.4 - Lifting labels

61AF 022 to 035



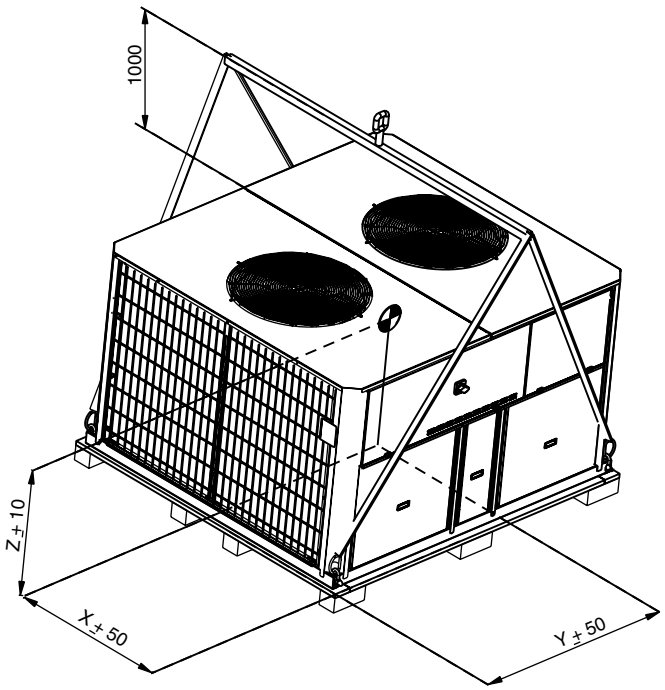
61AF	Dimensions in mm		
	X	Y	Z
022	551	584	575
030	522	546	543
035	527	550	567

61AF 045 to 055



61AF	Dimensions in mm		
	X	Y	Z
045	546	846	540
055	537	810	595

61AF 075 to 105



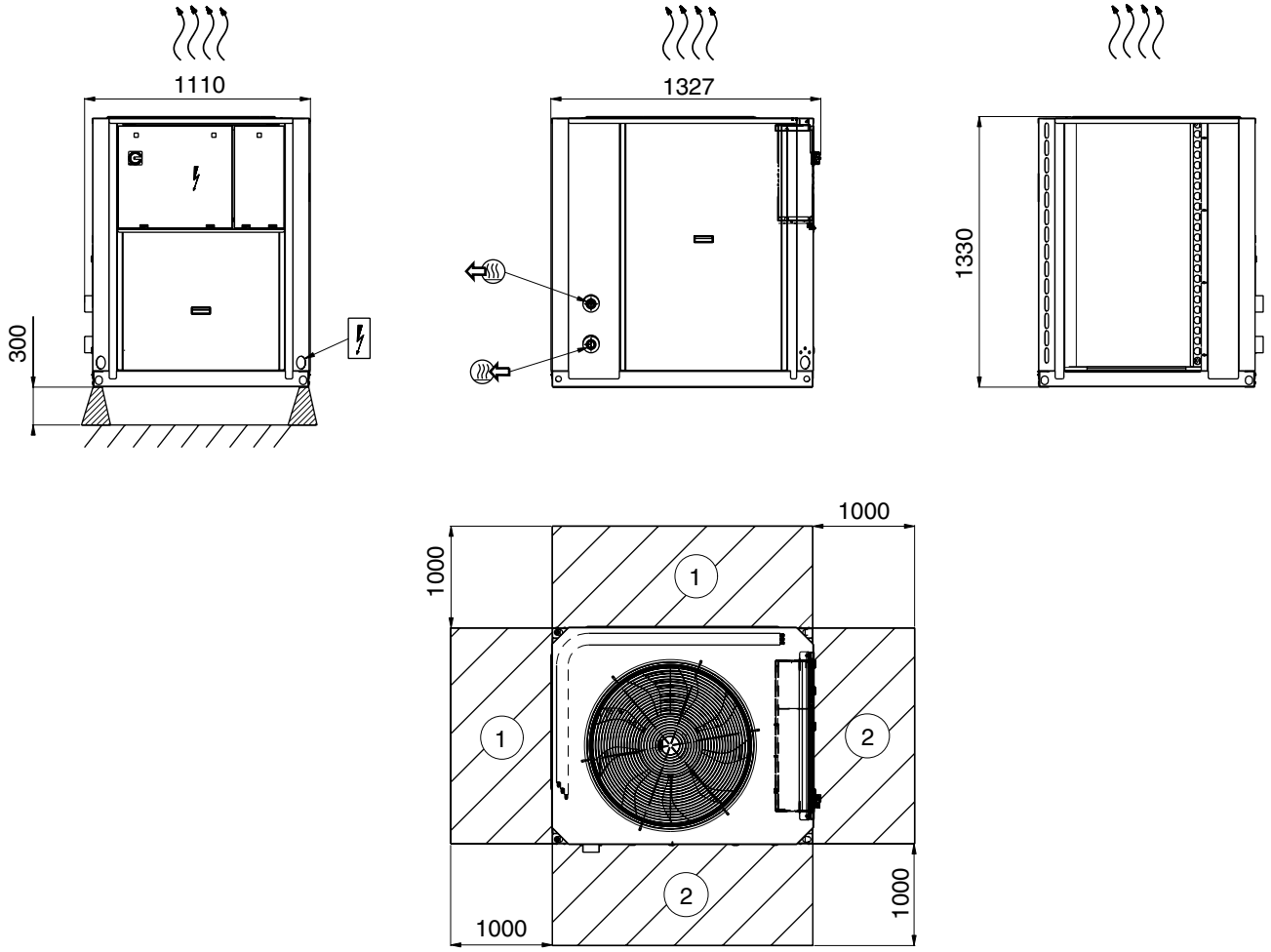
61AF	Dimensions in mm		
	X	Y	Z
075	1303	1150	545
105	1291	1147	590

NOTES:

1. ***Material: self-adhesive vinyl 9800***
2. ***The symbols must be centred.***
3. ***The symbols are black on a red background.***

3 - DIMENSIONS, CLEARANCES

3.1 - 61AF 022-035, units with and without hydronic module



Legend:
All dimensions are given in mm

- Control box
- Water inlet
- Water outlet
- (1) Required clearances for air flow
- (2) Recommended clearances for maintenance
- Air outlet, do not obstruct
- Power cable entry

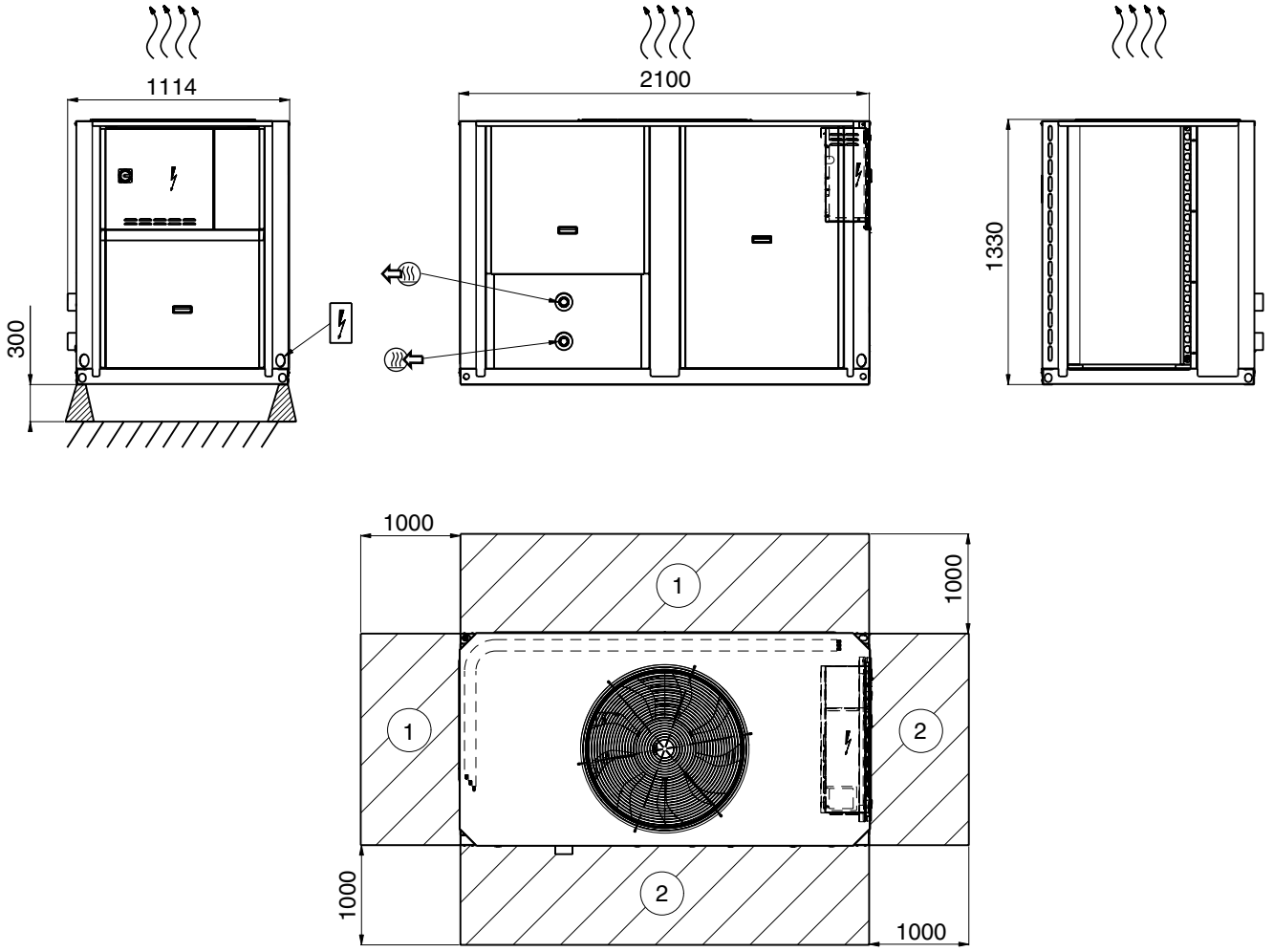
NOTES:

A Non-certified drawings.
Refer to the certified dimensional drawings supplied with the unit or available on request, when designing an installation. For the location of fixing points, weight distribution and coordinates of the centre of gravity refer to the certified dimensional drawings.

B In multiple-unit installations (maximum four units), the side clearance between the units should be increased from 1000 to 2000 mm.

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

3.2 - 61AF 045-055, units with and without hydronic module



Legend:
All dimensions are given in mm

- Control box
- Water inlet
- Water outlet
- (1) Required clearances for air flow
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- Air outlet, do not obstruct
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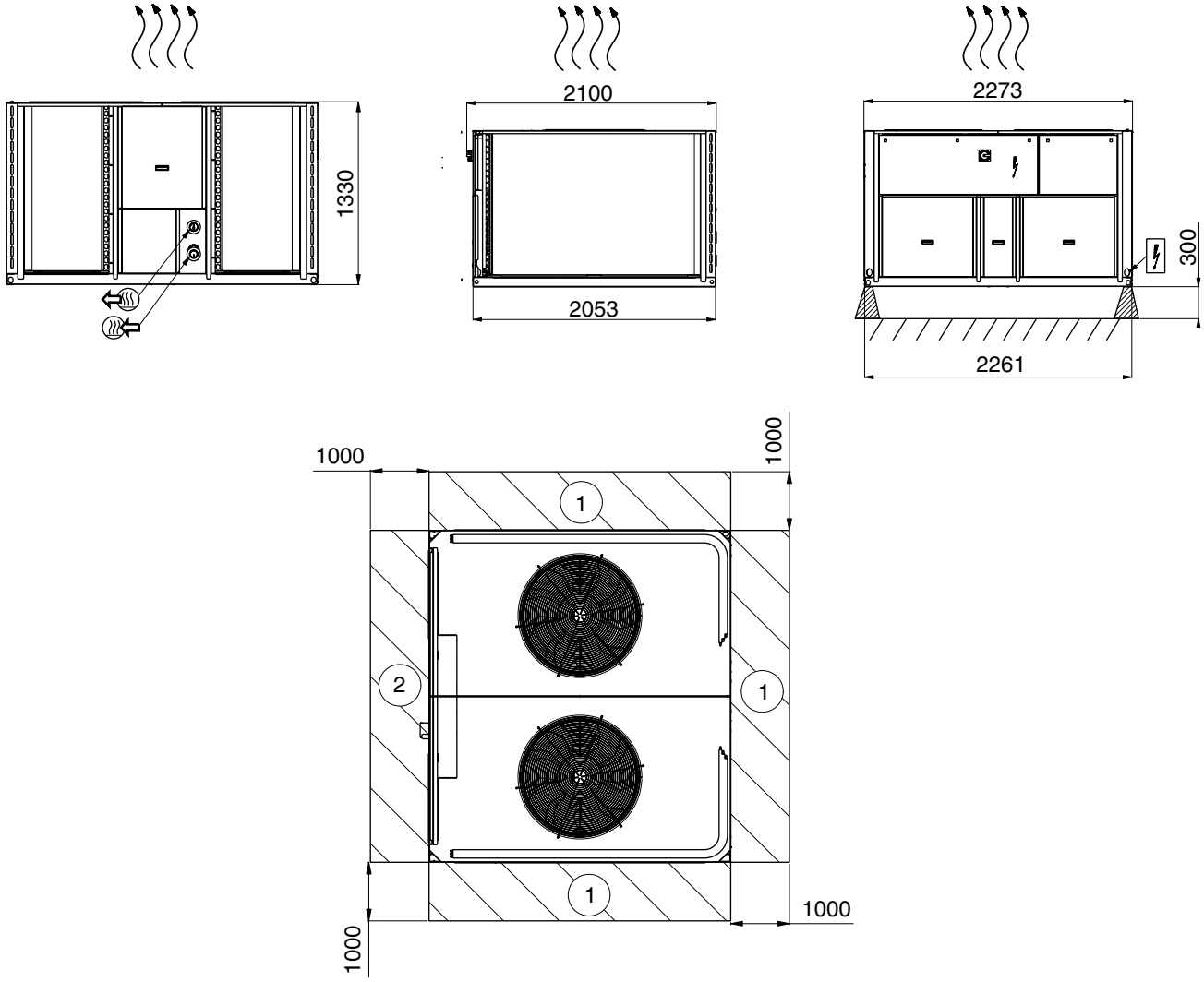
B In multiple-unit installations (maximum four units), the side clearance between the units should be increased from 1000 to 2000 mm.

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

3.3 - 61AF 075-105, units with and without hydronic module



Legend:
All dimensions are given in mm

- Control box
- Water inlet
- Water outlet
- (1) Required clearances for air flow
- (2) Recommended clearances for maintenance
- Air outlet, do not obstruct
- Power cable entry

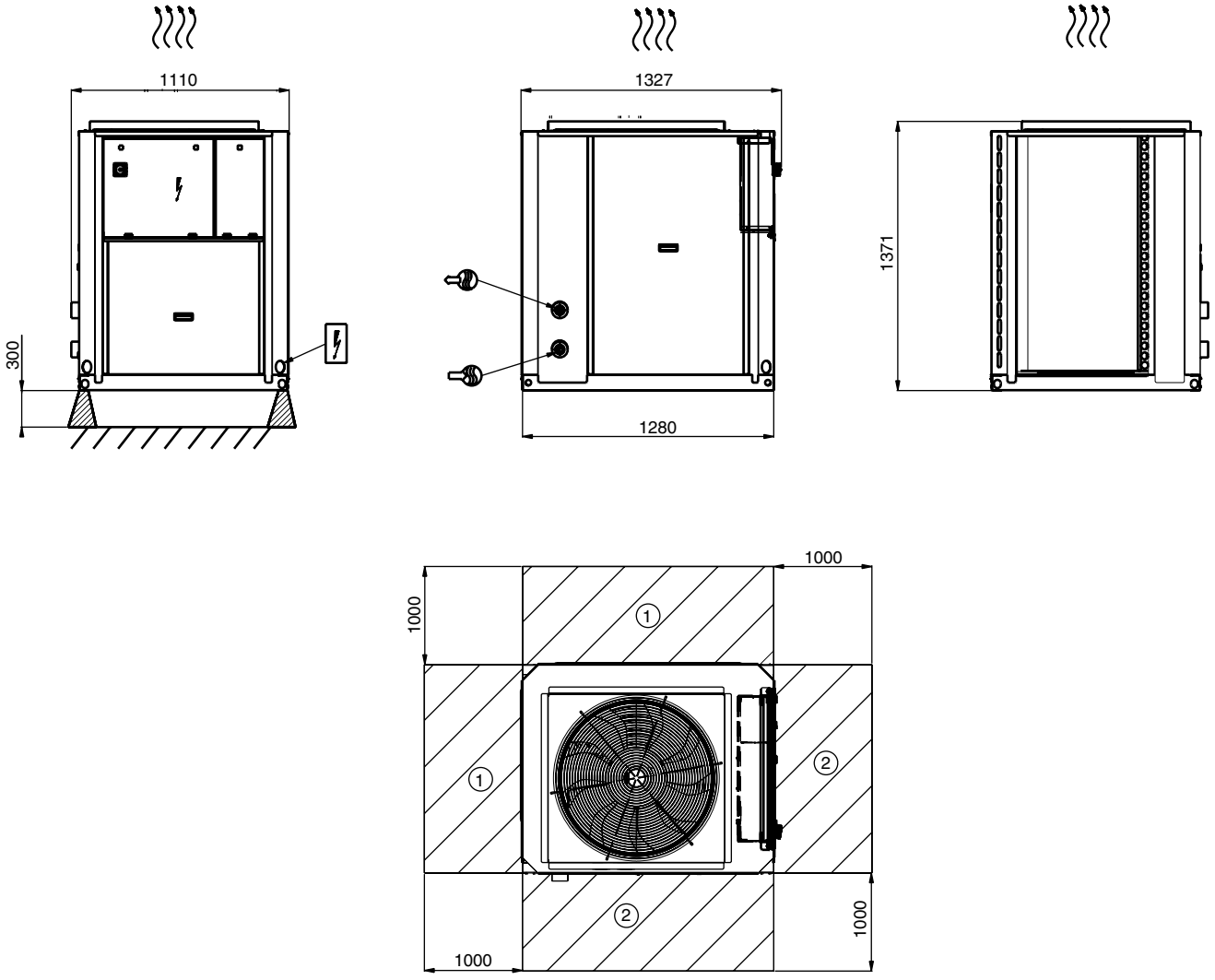
NOTES:

A ***Non-certified drawings.***
Refer to the certified dimensional drawings supplied with the unit or available on request, when designing an installation. For the location of fixing points, weight distribution and coordinates of the centre of gravity refer to the certified dimensional drawings.

B ***In multiple-unit installations (maximum four units), the side clearance between the units should be increased from 1000 to 2000 mm.***

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

3.4 - 61AF 022-035 option 11, units with and without hydronic module



Legend:
All dimensions are given in mm

- Control box
- Water inlet
- Water outlet
- (1) Required clearances for air flow
- (2) Recommended clearances for maintenance
- Air outlet, do not obstruct
- Power cable entry

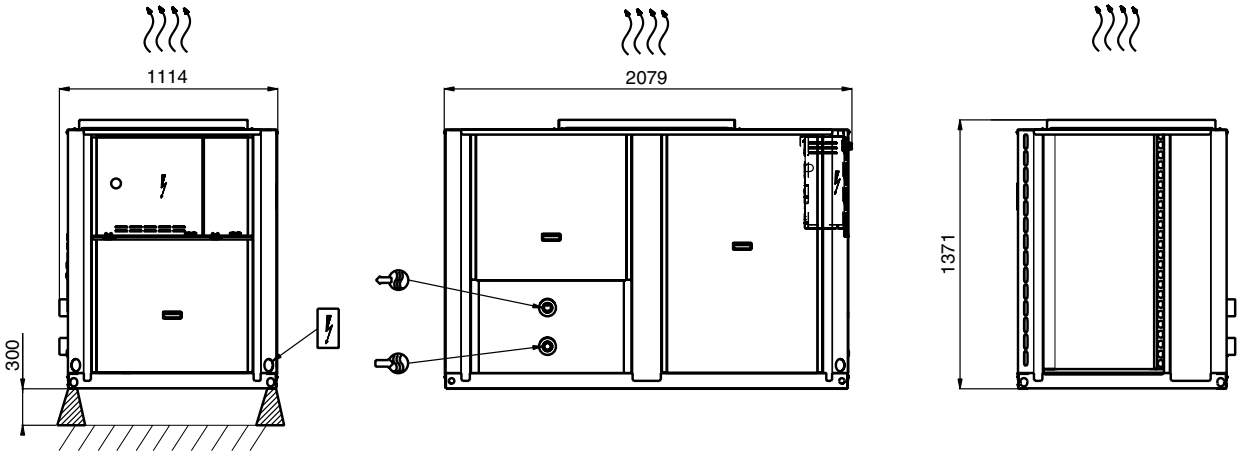
NOTES:

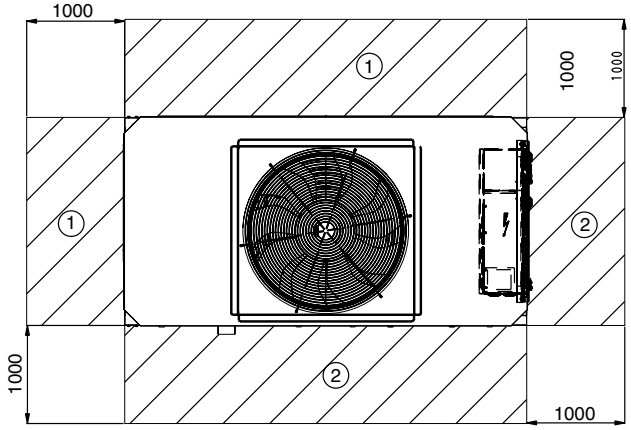
A ***Non-certified drawings.***
Refer to the certified dimensional drawings supplied with the unit or available on request, when designing an installation. For the location of fixing points, weight distribution and coordinates of the centre of gravity refer to the certified dimensional drawings.

B ***In multiple-unit installations (maximum four units), the side clearance between the units should be increased from 1000 to 2000 mm.***

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

3.5 - 61AF 045-055 option 11, units with and without hydronic module





Legend:
All dimensions are given in mm

- Control box
- Water inlet
- Water outlet
- (1) Required clearances for air flow
- (2) Recommended clearances for maintenance
- Air outlet, do not obstruct
- Power cable entry

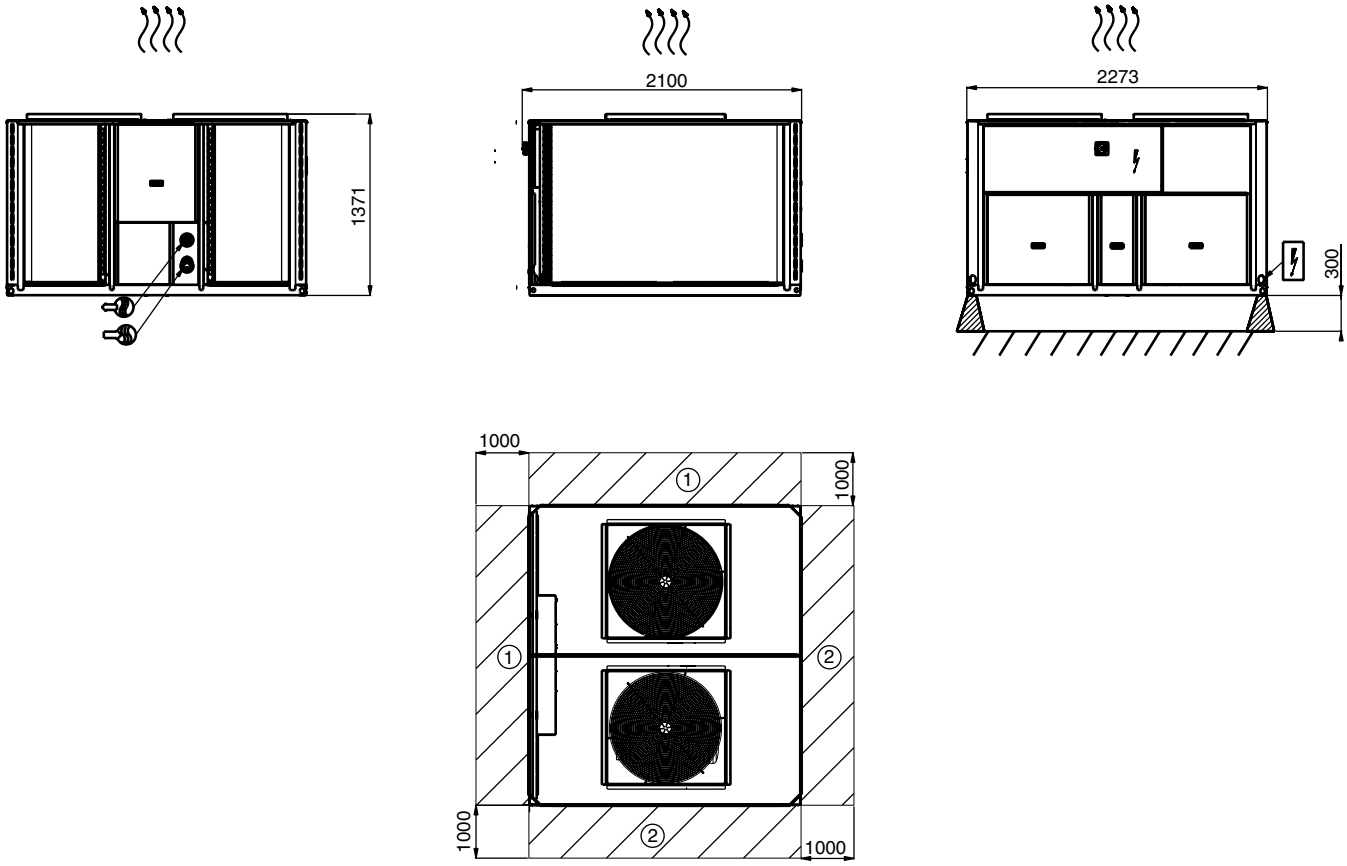
NOTES:

A Non-certified drawings.
Refer to the certified dimensional drawings supplied with the unit or available on request, when designing an installation. For the location of fixing points, weight distribution and coordinates of the centre of gravity refer to the certified dimensional drawings.

B In multiple-unit installations (maximum four units), the side clearance between the units should be increased from 1000 to 2000 mm.

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

3.6 - 61AF 075-105 option 11, units with and without hydronic module



Legend:
All dimensions are given in mm

- Control box
- Water inlet
- Water outlet
- (1) Required clearances for air flow
- (2) Recommended clearances for maintenance
- Air outlet, do not obstruct
- Power cable entry

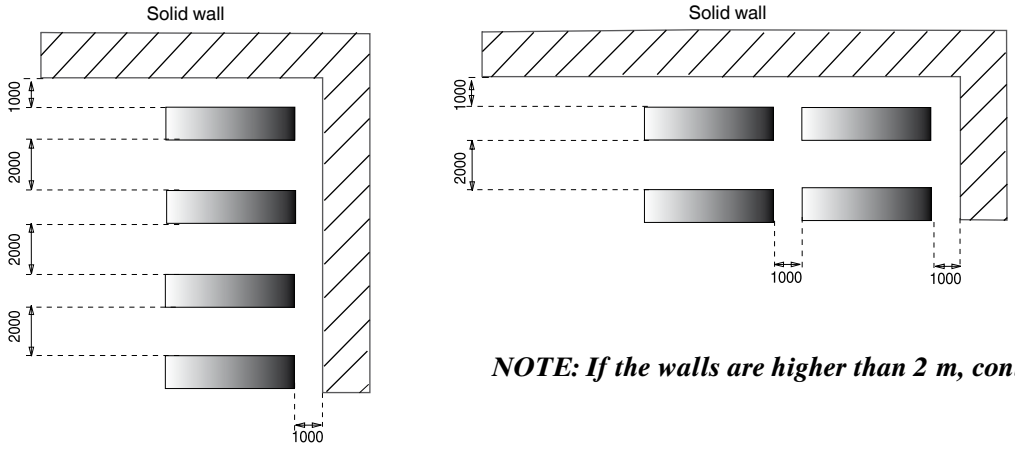
NOTES:

A Non-certified drawings.
Refer to the certified dimensional drawings supplied with the unit or available on request, when designing an installation. For the location of fixing points, weight distribution and coordinates of the centre of gravity refer to the certified dimensional drawings.

B In multiple-unit installations (maximum four units), the side clearance between the units should be increased from 1000 to 2000 mm.

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

3.7 - Multiple-unit installation



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

4 - PHYSICAL DATA

61AF		022	030	035	045	055	075	105
Operating weight*								
Standard unit without hydronic module	kg	343	396	421	509	533	900	1018
Standard unit + optional hydronic module	kg	349	403	436	524	549	926	1044
Sound levels								
Sound power level 10^{-12} W**	dB(A)	81	82	83	83	84	84	85
Sound pressure level at 10 m***	dB(A)	50	51	51	51	53	53	53
Compressors		Hermetic scroll compressor 48.3 r/s						
Circuit A		1	1	1	1	1	2	2
No. of capacity steps		1	1	1	1	1	2	2
Refrigerant charge		R-407C						
Circuit A	kg	8.0	8.8	9.7	10.0	13.2	22.0	26.5
Capacity control		Pro-Dialog+						
Minimum capacity	%	100	100	100	100	100	50	50
Condensers		Direct-expansion welded plate heat exchanger						
Water volume	l	4.9	6.4	8.2	9.6	12.1	16.4	22.7
Max. water-side operating pressure without hydronic module	kPa	1000	1000	1000	1000	1000	1000	1000
Max. water-side operating pressure with hydronic module	kPa	400	400	400	400	400	400	400
Fans		Axial Flying Bird 4 fans with rotating shroud						
Quantity		1	1	1	1	1	2	2
Total air flow (high speed)	l/s	3770	3748	3736	4035	4036	7479	8072
Speed, standard unit	r/s	12	12	12	12	12	12	12
Speed, unit with option 11	r/s	16	16	16	16	16	16	16
Evaporator		Grooved copper tubes, aluminium fins						
Hydronic module (option)								
Three-speed single pump		Pump, Victaulic screen filter, safety valve, water + air purge valves, cavitation pressure sensors						
Water connections (with and without hydronic module)		Victaulic						
Connections****	inch	1-1/4	1-1/4	1-1/2	1-1/2	1-1/2	2	2
Outside tube diameter	mm	42.4	42.4	48.3	48.3	48.3	60.3	60.3
Chassis paint colour		Colour code RAL 7035						

* Weight shown is a guideline only. To find out the unit refrigerant charge, please refer to the unit nameplate.
** In accordance with ISO 9614-1, for information only.
*** For information, calculated from the sound power level Lw(A).
**** Units 61AF 022 and 61AF 030 include two adapter sleeves for 1-1/4" Victaulic to 1-1/4" screw connections as standard.

5 - ELECTRICAL DATA

61AF - Standard unit (without hydronic module)		022	030	035	045	055	075	105
Power circuit								
Nominal power supply	V-ph-Hz	400-3-50						
Voltage range	V	360-440						
Control circuit supply		24 V, via internal transformer						
Maximum start-up current (Un)*								
Standard unit	A	104.6	102.6	131.0	171.0	191.0	1545	221.5
Unit with electronic starter option	A	56.1	55.1	70.0	90.8	101.2	101.5	142.5
Unit power factor at maximum capacity**		0.82	0.82	0.82	0.82	0.82	0.82	0.82
Maximum unit power input**	kW	8.7	11.6	12.9	14.6	16.8	25.8	33.7
Nominal unit current draw***	A	14.3	16.9	20.2	23.2	27.9	39.7	55.1
Maximum unit current draw (Un)****	A	16.1	21.3	24.1	27.1	31.1	47.5	61.5
Maximum unit current draw (Un-10%)†	A	21.1	28.4	32.2	36.4	42.0	63.7	83.3
Customer-side unit power reserve		Customer reserve at the 24 V control power circuit						
Short-circuit stability and protection		See table on the next page						

* Maximum instantaneous start-up current (maximum operating current of the smallest compressor(s) + fan current + locked rotor current of the largest compressor).
** Power input, compressors and fans, at the unit operating limits (saturated suction temperature 10°C, saturated condensing temperature 65°C) and nominal voltage of 400 V (data given on the unit nameplate).
*** Standardised Eurovent conditions: condenser entering/leaving water temperature 40°C/45°C, outside air temperature 7°C db/6°C wb.
**** Maximum unit operating current at maximum unit power input and 400 V (values given on the unit nameplate).
† Maximum unit operating current at maximum unit power input and 360 V.

5.1 - Compressor usage and electrical data for standard units

Compressor	I Nom	I Max (Un)	I Max (Un-10%)	LRA* A	LRA** A	Cosine Phi max.	022	030	035	045	055	075	105
ZH18KVE	10.7	12.5	17.5	101	53	0.8	1	-	-	-	-	-	-
ZH24KVE	13.3	17.7	24.8	99	51	0.8	-	1	-	-	-	-	-
ZH33KVE	16.2	20.1	28.2	127	66	0.8	-	-	1	-	-	2	-
ZH40KVE	19.2	23.1	32.4	167	87	0.8	-	-	-	1	-	-	-
ZH48KVE	23.9	27.1	38.0	187	97	0.8	-	-	-	-	1	-	2

Legend
I Nom Nominal current draw at Eurovent conditions (see definition of conditions under nominal unit current draw), A
I Max Maximum operating current at 360 V, A
* Locked rotor current at nominal voltage, A
** Locked rotor current at nominal voltage, electronic starter

5.2 - Short-circuit stability current (TN system*) - standard unit (with main disconnect without fuse)

61AF	022	030	035	045	055	075	105
Value without upstream protection							
Short-term current at 1 s - Icw - kA rms	0.6	0.6	0.6	1.26	1.26	1.26	2
Admissible peak current - Ipk - kA pk	4.5	4.5	4.5	6	6	6	10
Value with upstream protection (circuit breaker)							
Conditional short-circuit current Icc - kA rms	5.4	7	7	7.7	7.7	6.1	10
Siemens circuit breaker - Compact series	32	40	40	50	63	80	100
Reference number**	5SY6332-7	5SY6340-7	5SY6340-7	5SY4350-7	5SY4363-8	5SP4380-7	5SP4391-7
Value with upstream protection (fuses)							
Conditional short-circuit current Icc - kA rms	17	50	50	50	50	14.5	22
Siemens fuse (gL/gG)	40	40	40	63	63	80	125

* Earthing system type
** If another current limitation protection system is used, its time-current and thermal constraint (I^2t) trip characteristics must be at least equivalent to those of the recommended Siemens circuit breaker. Contact your nearest Carrier office.
The short-circuit stability current values above are in accordance with the TN system.

Electrical data and operating conditions notes:
- 61AF 022-105 units have a single power connection point located immediately upstream of the main disconnect switch.
- The control box includes the following standard features:
  - a main disconnect switch,
  - starter and motor protection devices for each compressor, the fans and the pump,
  - the control devices.
- **Field connections:**
  All connections to the system and the electrical installations must be in full accordance with all applicable local codes.
- The Carrier 61AF units are designed and built to ensure conformance with these codes. The recommendations of European standard EN 60204-1 (machine safety - electrical machine components - part 1: general regulations - corresponds to IEC 60204-1) 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 directives. Conformance with EN 60204-1 is the best means of ensuring compliance with the Machines Directive § 1.5.1.
- Annex B of EN 60204-1 describes the electrical characteristics used for the operation of the machines.
- The operating environment for the 61AF units is specified below:

1. Environment* - Environment as classified in EN 60721 (corresponds to IEC 60721):
   - outdoor installation*
   - ambient temperature range: -20°C to +40°C, class 4K4H
   - altitude: ≤ 2000 m
   - presence of hard solids, class 4S2 (no significant dust present)
   - presence of corrosive and polluting substances, class 4C2 (negligible)
2. Power supply frequency variation: ± 2 Hz.
3. The neutral (N) conductor 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 is of a type suitable for power interruption in accordance with EN 60947.
6. The units are designed for connection to TN networks (IEC 60364). For IT networks the earth connection must not be at the network earth. Provide a local earth, consult competent local organisations to complete the electrical installation.

Caution: 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.

* The required protection level for this class is IP43BW (according to reference document IEC 60529). All 61AF units are protected to IP44CW and fulfil this protection condition.

6 - APPLICATION DATA

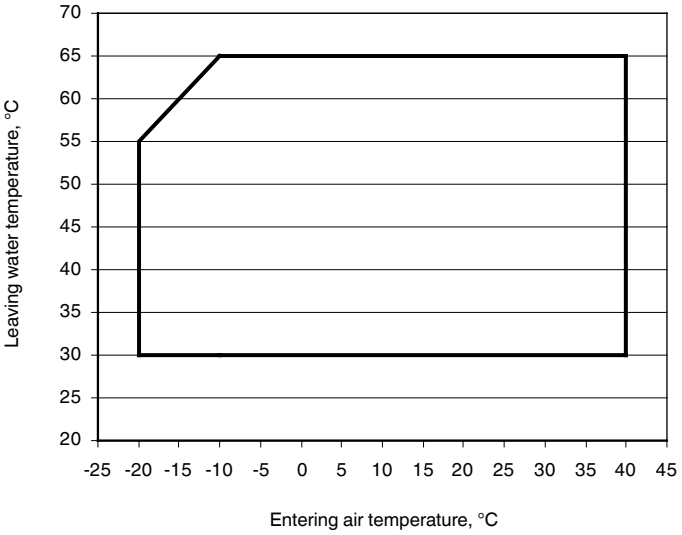
6.1 - Unit operating range

Condenser		Minimum	Maximum
Entering water temperature at start-up	°C	8	57
Leaving water temperature during operation	°C	30	65
Entering/leaving water temperature difference	K	3	**
Evaporator		**Minimum**	**Maximum**
Entering air temperature, standard unit*	°C	-20	40
Entering air temperature, unit with option 11	°C	-15	40

Note: Do not exceed the maximum operating temperature.

* Outside temperature: For transport and storage of the 61AF units the minimum and maximum allowable temperatures are -20°C and +50°C. It is recommended that these temperatures are used for transport by container.

** Refer to the minimum water flow rate for each machine (see chapter 6.2).



Full load

6.2 - Plate heat exchanger water flow

61AF	Minimum flow rate, l/s	Maximum flow rate with hydronic module, l/s*	Maximum flow rate without hydronic module, l/s**
022	0.4	1.6	1.8
030	0.5	1.7	2.4
035	0.7	3.3	3.1
045	0.8	3.3	3.8
055	0.9	3.2	4.6
075	1.2	5.9	6.4
105	1.6	6.1	8.5

* Maximum flow rate at an available pressure of 15 kPa.

** Maximum flow rate at a water temperature difference of 3 K in the plate heat exchanger.

Note: For a domestic hot water application (leaving water temperature = 65°C), the water temperature difference must be 8 K minimum.

6.3 - Minimum water flow rate

If the installation flow rate is below the minimum flow rate, there is a risk of excessive fouling of the condenser.

6.4 - Maximum plate heat exchanger water flow rate

This is limited by the permitted plate heat exchanger pressure drop. Also, a minimum condenser ΔT of 3 K must be guaranteed, which corresponds to a water flow rate of 0.09 l/s per kW.

6.5 - Water loop volume

6.5.1 - Minimum water loop volume

The heat pump is used in a domestic hot water application and must heat an intermediate loop that supplies domestic hot water via a heat exchanger. The primary loop is charged with softened water. Regular checks must be carried out on the water system to detect possible scale formation. The heat pump in this type of application must never supply domestic hot water directly.

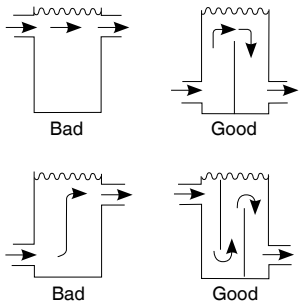
The minimum water loop volume, in litres, is given by the following formula:

Volume (l) = CAP (kW) x N, where CAP is the nominal heating capacity at nominal operating conditions.

Heating or domestic hot water application	N
61AF 022-055	5,0 l
61AF 075-105	3.0 l

This volume is required to obtain temperature stability and precision.

To achieve this volume, it may be necessary to add a storage tank to the circuit. This tank should be equipped with baffles to allow mixing of the fluid (water or brine). Please refer to the examples below.



6.5.2 - Expansion tank volume

Units with hydronic module do not incorporate an expansion tank. This must be included in the water loop.

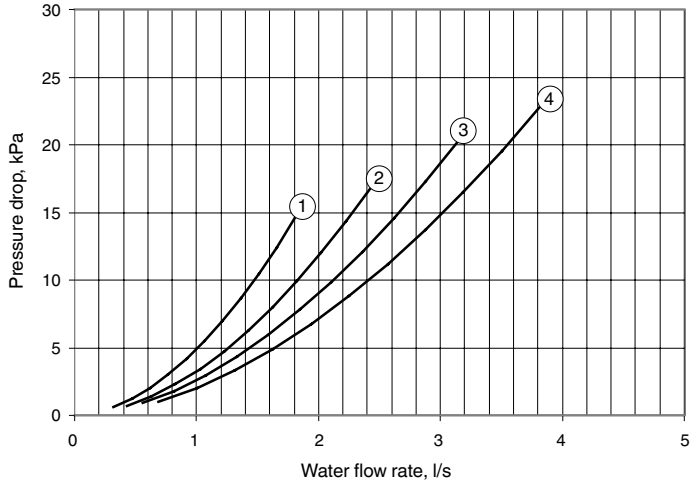
The table below gives the buffer tank volume that must be provided, based on the water loop volume, the fluid used and its concentration.

Expansion tank volume required	% of water loop volume*
Pure water	3.0
10% ethylene glycol	3.0
20% ethylene glycol	3.5
30% ethylene glycol	3.8
40% ethylene glycol	4.2

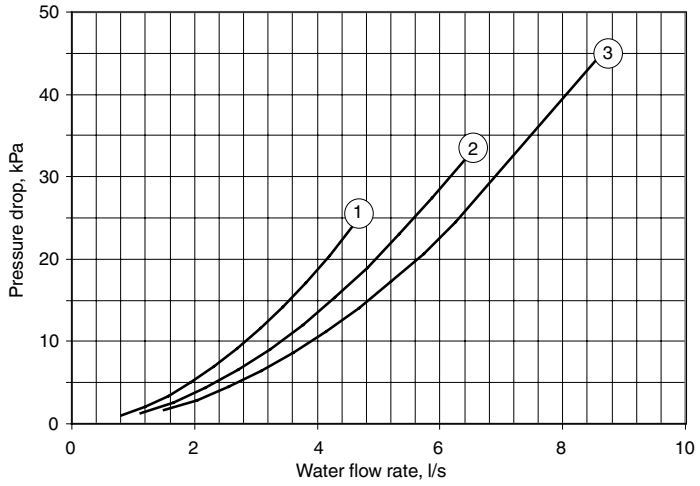
* Calculation based on a charge temperature of 10°C.

6.6 - Plate heat exchanger pressure drop curves

For pure water at 20°C



1 61AF 022 2 61AF 030 3 61AF 035 4 61AF 045



1 61AF 055 2 61AF 075 3 61AF 105

7 - ELECTRICAL CONNECTION

Please refer to the certified dimensional drawings, supplied with the unit (also available on the internet).

7.1 - Power supply

The power supply must conform to the specification on the heat pump nameplate. The supply voltage must be within the range specified in the electrical data table. For connections refer to the wiring diagrams and the certified dimensional drawings.

WARNING: Operation of the unit with an improper supply voltage or excessive phase imbalance constitutes abuse which will invalidate the Carrier warranty. If the phase imbalance exceeds 2% for voltage, or 10% for current, contact your local electricity supply at once and ensure that the heat pump is not switched on until corrective measures have been taken.

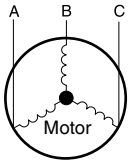
7.2 - Voltage phase imbalance (%)

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

Example:
On a 400 V - 3 ph - 50 Hz supply, the individual phase voltages were measured to be:
AB = 406 V; BC = 399 V; AC = 394 V

Average voltage = (406 + 399 + 394)/3 = 1199/3
= 399.7 say 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.

7.3 - Recommended wire 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 guide-line, and does not make Carrier in any way liable.** After wire sizing has been completed, using the certified dimensional drawing, the installer must ensure easy connection and define any modifications necessary on site.

The connections provided as standard for the field-supplied power entry cables to the general disconnect/isolator switch are designed for the number and type of wires, listed in the table below.

Table of minimum and maximum wire sections for connection to 61AF units

	Disconnect switch	Connectable wire					
	Max. connectable section	Min. wire section			Max. wire section		
61AF	Section (mm²)	Section (mm²)	Max. length (m)	Wire type	Section (mm²)	Max. length (m)	Wire type
022	1 x 10	1 x 6	100	XLPE Cu	1 x 10	210	PVC Cu
030	1 x 10	1 x 6	100	XLPE Cu	1 x 10	245	PVC Cu
035	1 x 10	1 x 10	130	XLPE Cu	1 x 10	245	PVC Cu
045	1 x 16	1 x 10	130	XLPE Cu	1 x 16	245	PVC Cu
055	1 x 16	1 x 10	130	XLPE Cu	1 x 16	245	PVC Cu
075	1 x 16	1 x 16	220	XLPE Cu	1 x 16	245	PVC Cu
105	1 x 35	1 x 35	220	XLPE Cu	1 x 35	220	PVC Cu

Note: Power supply cable section (see the diagram in the chapter “Electrical connection”).

The calculations are based on the maximum machine cur-rent (see electrical data tables). Standard installation practises for units installed outside have been applied in accordance with IEC 60364, table 52C:
- No. 17: suspended aerial lines,
- No. 61: buried conduit with a derating coefficient of 20.

The calculation is based on PVC or XLPE insulated cables with copper core. A maximum ambient temperature of 40°C has been taken into consideration for 61AF units. The given wire length limits the voltage drop to < 5%.

IMPORTANT: Before connection of the main power cables (L1 - L2 - L3) on the terminal block, it is imperative to check the correct order of the 3 phases before proceeding to the connection on the main disconnect/isolator switch.

7.3.1 - Power cable entry

The power cables can enter the 61AF control box from below or from the side of the unit, at the bottom of the angle iron. Pre-punched holes facilitate the entry. Refer to the certified dimensional drawing for the unit. An opening below the control box allows introduction of the cables.

7.4 - Field control wiring

Refer to the 61AF Pro-Dialog+ Control IOM and the certified wiring diagram supplied with the unit for the field control wiring of the following features:
- Condenser pump interlock (mandatory)
- Remote on/off switch
- Demand limit external switch
- Remote dual setpoint switch
- Alarm, alert and operation report

7.5 - Power supply

After the unit has been commissioned, 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 and stored the power supply must be maintained to ensure supply to the heaters (unit frost protection).

7.6 - 24 V user power reserve

After all possible options have been connected, the trans-former ensures the availability of a usable 24 VA or 1 A power reserve for the control circuit on site.

8 - WATER CONNECTIONS

For size and position of the unit water inlet and outlet con-nections refer to the certified dimensional drawings supplied with the unit. The water pipes must not transmit any radial or axial force to the heat exchangers nor any vibration.

The water supply must be analysed and appropriate desilting, filtering, treatment, control devices, shut-off and bleed valves built in, to prevent corrosion (example: damage to the protection of the tube surface if the fluid is polluted), fouling and deterioration of the water circuit.

Before any start-up verify that the heat exchange fluid is compatible with the materials and the water circuit coating.

In case additives or other fluids than those recommended by Carrier are used, ensure that the fluids are not considered as a gas, and that they belong to class 2, as defined in direc-tive 97/23/EC.

Carrier recommendations on heat exchange fluids:
- No NH^{4+} ammonium ions in the water, they are very detrimental for copper. This is one of the most important factors for the operating life of copper piping. A content of several tenths of mg/l will badly corrode the copper over time.
- Cl^- Chloride ions are detrimental for copper with a risk of perforations by corrosion by puncture. If possible keep 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 < 1mg/l.
- Water hardness: >0.5 mmol/l. Values between 0.5 and 1.5 mmol/l are recommended. This will facilitate scale deposit that can limit corrosion of copper. Values that are too high can cause piping blockage over time. A total alkalimetric titre (TAC) below 100 is desirable in primary domestic hot water loops and for heating applications.
- Dissolved oxygen: Any sudden change in water oxygenation conditions must be avoided. 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.
- Specific resistance - electric conductivity: the higher the specific resistance, the slower the corrosion tendency. Values above 30 Ohm·m are desirable. A neutral environment favours maximum specific resistance values. For electric conductivity values in the order of 20-60 mS/m can be recommended.
- pH: Ideal case pH neutral at 20-25°C (7 < pH < 8).

ATTENTION: Charging, adding or draining fluid from the water circuit must be done by qualified personnel, using air vents and materials suitable for the products. The water circuit charging devices are field-supplied.

Charging and removing heat exchange fluids should be done with devices that must be included on the water circuit by the installer.

8.1 - Operating precautions and recommendations

The water circuit should be designed to have the least number of elbows and horizontal pipe runs at different levels. Below the main points to be checked for the connection:
- 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.

- Use a pressure reducer to maintain pressure in the system and install a safety valve and an expansion tank.
- Units with a hydronic module include a safety valve.
- Install thermometers in both the entering and leaving water connections.
- Install drain connections at all low points to allow the whole circuit to be drained.
- Install stop valves, close to the entering and leaving water connections.
- Use flexible connections to reduce vibration transmission.
- Insulate all pipework, after testing for leaks, to prevent heat loss.
- Wrap the insulations with a demisting screen.
- If the external unit water pipes are in an area where the ambient temperature is likely to fall below 0°C, they must be protected against frost (frost protection solution or electric heaters).

NOTE: For units not equipped with a hydronic module a screen filter must be installed. This must be installed on the water entering pipes upstream of the pressure gauge at the unit inlet. It must be located in a position that is easily accessible for removal and cleaning. The mesh size of the filter must be 1.2 mm.

The plate heat exchanger can foul up quickly at the initial unit start-up, as it complements the filter function, and the unit operation will be impaired (reduced water flow rate due to increased pressure drop). Units with hydronic module are equipped with this type of filter.

Do not introduce any significant static or dynamic pressure into the heat exchange circuit (with regard to the design operating pressures).

The products that may be added for thermal insulation of the containers during the water piping connection procedure must be chemically neutral in relation to the materials and coatings to which they are applied. This is also the case for the products originally supplied by Carrier.

8.2 - Hydronic connections

The diagram on the following page shows a typical hydronic installation. When charging the water circuit use air vents to evacuate any residual air pockets.

8.3 - Frost protection

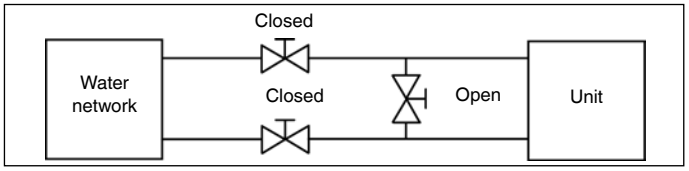
The plate heat exchangers, the piping and the hydronic module pump can be damaged by frost, despite the built-in anti-freeze protection of the units. Frost protection of the plate heat exchanger and all hydronic circuit components is guaranteed:

- Down to -20°C by electric heaters (heat exchanger and internal piping) that have an automatic supply (units without hydronic module),
- Down to -10°C by an electric heater on the heat exchanger that has an automatic supply and by pump cycling (standard for units with hydronic module),
- Down to -20°C by electric heaters (heat exchanger and internal piping) that have an automatic supply and by pump cycling (units with hydronic module and "Reinforced frost protection" option).

Never switch off the plate heat exchanger and hydronic circuit heaters or the pump, otherwise frost protection cannot be guaranteed. The main unit disconnect switch as well as the heater auxiliary protection switch must always be left closed (for the location of these components see the wiring diagram).

To ensure frost protection of the units with hydronic module water circulation in the water circuit must be maintained by periodically switching on the pump. If a shut-off valve is installed, a bypass must be included as shown below.

Winter position



IMPORTANT: Depending on the climate conditions in your area do the following when switching the unit off in winter:

- ***Add ethylene glycol or propylene glycol with an adequate concentration to protect the installation up to a temperature of 10 K below the lowest temperature likely to occur at the installation site. If ethylene glycol or propylene glycol is added, ensure that the unit pump is not used to add pure glycol and to apportion the fluid amount (possible pump damage). Always add a mixture that is measured in advance.***
- ***If the unit is not used for an extended period, it should be drained, and as a safety precaution ethylene glycol or propylene glycol introduced in the heat exchanger, using the water entering purge valve connection.***
- ***At the start of the next season, refill the unit with water and add an inhibitor.***
- ***For the installation of auxiliary equipment, the installer must comply with basic regulations, especially for minimum and maximum flow rates, that must be between the values listed in the operating limit table (application data).***
- ***To prevent corrosion by differential aeration, the complete drained heat transfer circuit must be charged with nitrogen for a period of one month. If the heat transfer fluid does not comply with the Carrier regulations, the nitrogen charge must be added immediately.***

8.4 - Protection against cavitation (option 116)

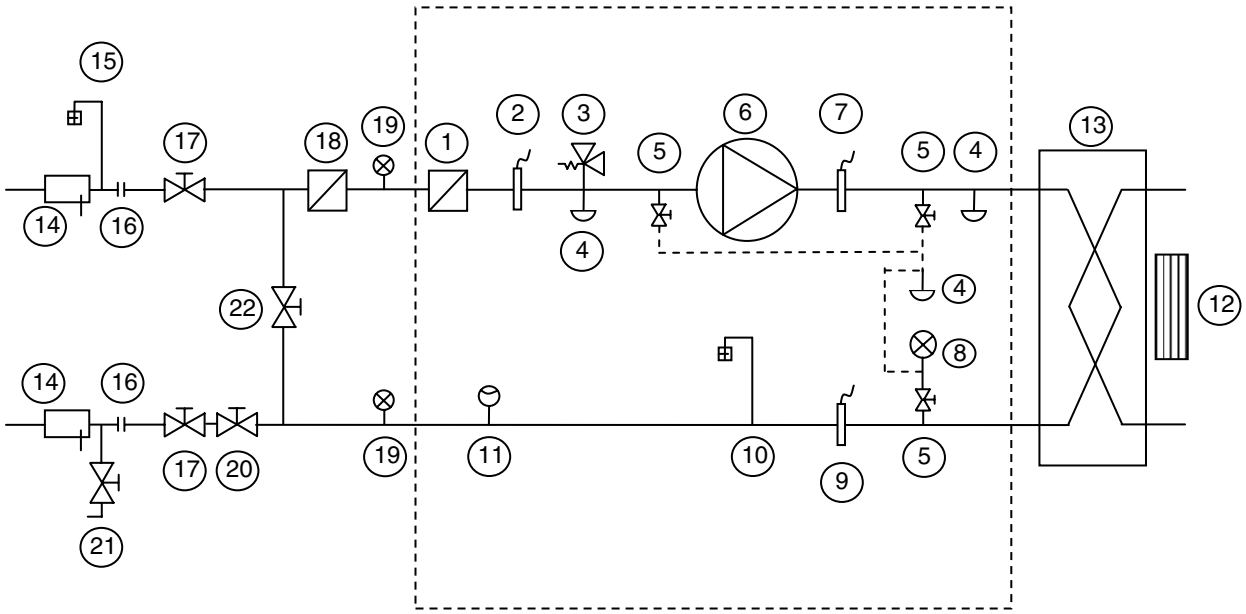
To ensure the durability of the pumps in the integreated hydronic modules (options 116), the control algorithm of the 61AF units incorporates anti-cavitation protection.

It is therefore necessary to ensure a minimum pump entering pressure of 40 kPa (0.4 bar) during operation and at shut-down. A pressure below 40 kPa will prohibit unit start-up or cause an alarm with the unit shutting down. In order to obtain sufficient pressure, it is recommended:

- to pressurise the hydronic circuit between 1 and 4 bar (maximum),
- to clean the hydronic circuit before charging water (see chapters 9.2 and 9.3),
- to regularly clean the screen filter,

ATTENTION: The use of integrated hydronic kits in the open loop is not permitted.

Typical hydronic circuit diagram



Legend

Components of the unit and hydronic module

1 Victaulic screen filter
2 Pressure sensor
Note: Gives pump suction pressure information (see installation manual)
3 Safety valve
4 Water drain valve
Note: A second valve is located on the heat exchanger leaving piping
5 Shut-off valve
6 Available pressure pump
7 Temperature probe, BPHE inlet
Note: Gives heat exchanger entering temperature information (see installation manual)
8 Pressure gauge
Note: Allows measuring of the pump suction pressure, the pump leaving pressure and the heat exchanger leaving pressure
9 Temperature probe, BPHE outlet
Note: Gives heat exchanger leaving temperature information (see installation manual)
10 Automatic air vent
11 Flow switch
12 Plate heat exchanger frost protection heater
13 Plate heat exchanger

Installation components

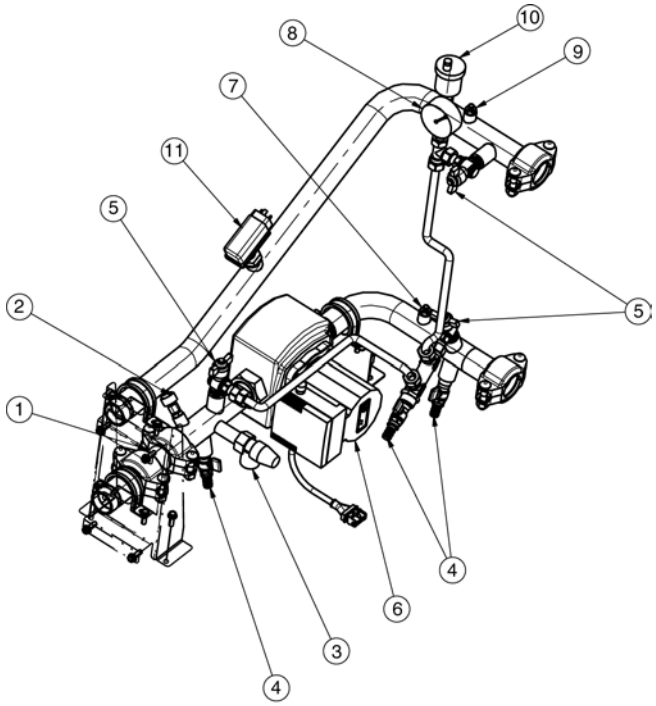
14 Temperature probe well
15 Air vent
16 Flexible connection
17 Shut-off valve
18 Screen filter (obligatory for a unit without hydronic module)
19 Pressure gauge
20 Water flow control valve
21 Charge valve
22 Frost protection bypass valve (when shut-off valves [17] are closed during winter)

--- Hydronic module (unit with hydronic module)

Notes:

- Units without hydronic module (standard units) are equipped with a flow switch and two temperature sensors (7 and 9).
- For units equipped with hydronic module, the pressure sensor located upstream of the pump to prevent cavitation is installed on a connection without Schraeder valves. Depressurise and drain the system before any intervention.

Hydronic module - 61AF



Legend

Components of the unit and hydronic module

1 Victaulic screen filter
2 Pressure sensor
Note: Gives pump suction pressure information (see installation manual)
3 Safety valve
4 Water drain valve
Note: A second valve is located on the heat exchanger leaving piping
5 Shut-off valve
6 Available pressure pump
7 Temperature probe, BPHE inlet
Note: Gives heat exchanger entering temperature information (see installation manual)
8 Pressure gauge
Note: Allows measuring of the pump suction pressure, the pump leaving pressure and the heat exchanger leaving pressure
9 Temperature probe, BPHE outlet
Note: Gives heat exchanger leaving temperature information (see installation manual)
10 Automatic air vent
11 Flow switch

9 - NOMINAL SYSTEM WATER FLOW CONTROL

The optional water circulation pumps of the 61AF units have been sized to allow the hydronic modules to cover all possible configurations based on the specific installation conditions, i.e. for various temperature differences between the entering and the leaving water (ΔT) at full load, which can vary between 3 and 10 K. This required difference between the entering and leaving water temperature determines the nominal system flow rate.

It is essential to know the nominal system flow rate to be able to control it, using a manual valve that must be on the water leaving piping of the system (item 20 in the typical hydronic circuit diagram).

Due to the pressure drop it generates in the hydronic system this flow control valve permits adjustment of the pressure/ system flow rate curve in accordance with the pump pressure/ flow rate curve to obtain the nominal flow rate at the required operating point (see example for unit size 61AF 035). The pressure drop reading in the plate heat exchanger is used as means of control and adjustment of the nominal system flow rate. This reading can be taken with a differential pressure gauge that must be installed at the heat exchanger inlet and outlet.

Use the specifications used for the unit connection to find out the system operating conditions and to work out the nominal flow rate and the plate heat exchanger pressure drop at the specified conditions. If this information is not available at the system start-up, contact the technical service department responsible for the installation to get it.

These characteristics can be obtained from the technical literature using the unit performance tables for a ΔT of 5 K at the condenser or with the Electronic Catalogue selection program for all ΔT conditions other than 5 K in the range of 3 to 10 K.

For domestic hot water applications (leaving water temperatures above 60°C) the control cannot be made at a ΔT below 8 K at the condenser.

9.1 - Water flow control procedure

Hydronic circuit cleaning procedure

- Open the valve fully (item 20).
- Start-up the system or unit pump (by quick test), if the unit is equipped with a hydronic module with a pump.
- Read the plate heat exchanger pressure drop by taking the difference of the readings of the pressure gauge connected to the unit inlet and outlet (item 19).
- Let the pump run for two consecutive hours to clean the system hydronic circuit (presence of solid contaminants).
- Take another reading.
- Compare this value to the initial value.
- If the pressure drop has decreased, this indicates that the screen filter must be removed and cleaned, as the hydronic circuit contains solid particles. In this case close the shut-off valves at the water inlet and outlet (item 17) and remove the screen filter (item 18 or 1 for a unit with hydronic module) after emptying the hydronic section of the unit (item 4).
- Purge the air from the circuit (items 10 and 15).
- Renew, if necessary, to ensure that the filter is not contaminated.

Water flow control procedure

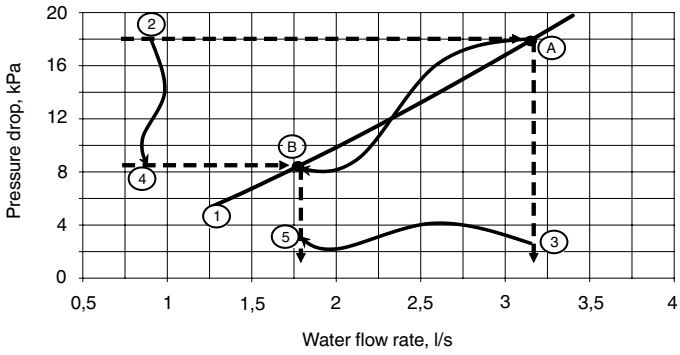
- When the circuit is cleaned, read the pressures at the differential pressure gauge (BPHE leaving water pressure - BPHE entering water pressure), to find out the pressure drop for the plate heat exchanger and the internal piping.
- Compare the value obtained with the theoretical selection value.
- If the pressure drop measured is higher than the value specified this means that the unit flow rate (and thus system flow rate) is too high. The pump supplies an excessive flow rate based on the global pressure drop of the application. In this case close the control valve and read the new pressure difference.
- Proceed by successively closing the control valve until you obtain the specific pressure drop that corresponds to the nominal flow rate at the required unit operating point.

NOTE: If the system has an excessive pressure drop in relation to the available static pressure provided by the system pump the nominal water flow rate cannot be obtained (the resulting flow rate is lower) and the temperature difference between the condenser entering and leaving water will increase.

To reduce the pressure drops of the hydronic system, it is necessary:

- to reduce the individual pressure drops as much as possible (bends, level changes, accessories, etc.).
- to use a correctly sized piping diameter.
- to avoid hydronic system extensions, wherever possible.

Example: 61AF 035 at Eurovent conditions of 1.76 l/s



Legend

1 'BPHE pressure drop/flow rate'' curve
2 With the valve open the pressure drop read (18 kPa) gives point A on the curve.
A Operating point reached with the valve open.
3 With the valve open the flow rate achieved is 3.4 l/s: this is too high, and the valve must be closed again.
4 If the valve is partially closed, the pressure drop read (6 kPa) gives point B on the curve.
B Operating point reached with the valve partially closed.
5 With the valve partially closed the flow rate achieved is 1.76 l/s: this is the required flow rate and the valve is in an adequate position.

9.2 - Pump pressure/flow rate curve for units with hydronic module

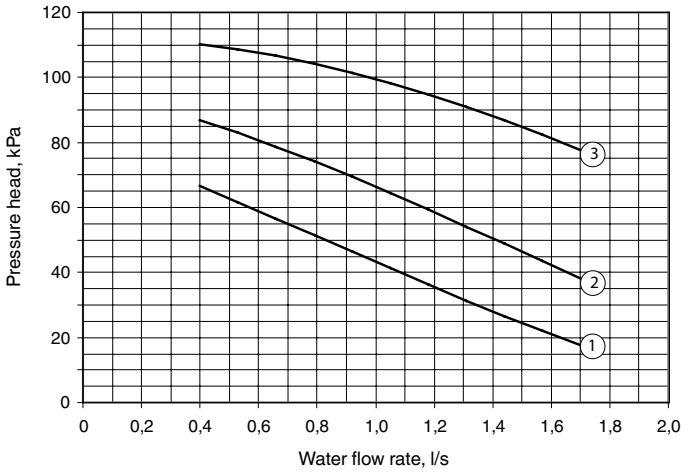
The 61AF units are equipped with fixed-speed pumps with three different speeds.

These speeds can be manually adjusted by changing the speed terminal board inside the terminal box (this operation can only be carried out by approved personnel). The speed initially selected corresponds to standard use for heating water loops. If this speed needs to be changed, the pressure/flow curves for the three speeds are shown below.

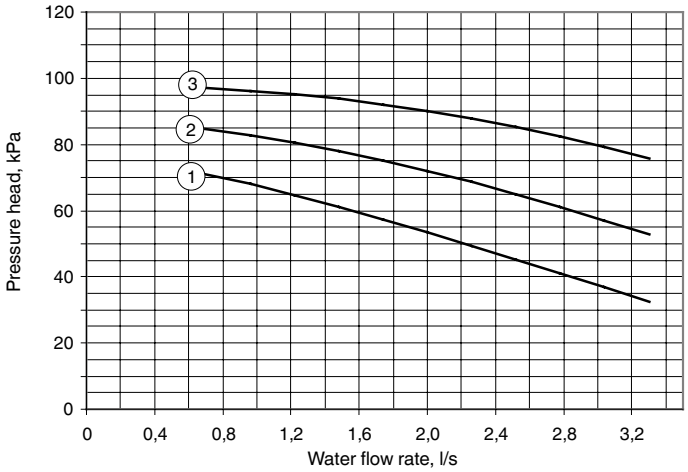
For pure water at 20°C

	Evaporator water flow rate, l/s	
61AF	**Minimum**	**Maximum***
022	0.4	1.8
030	0.5	2.4
035	0.7	3.1
045	0.8	3.8
055	0.9	4.6
075	1.1	6.4
105	1.5	8.5

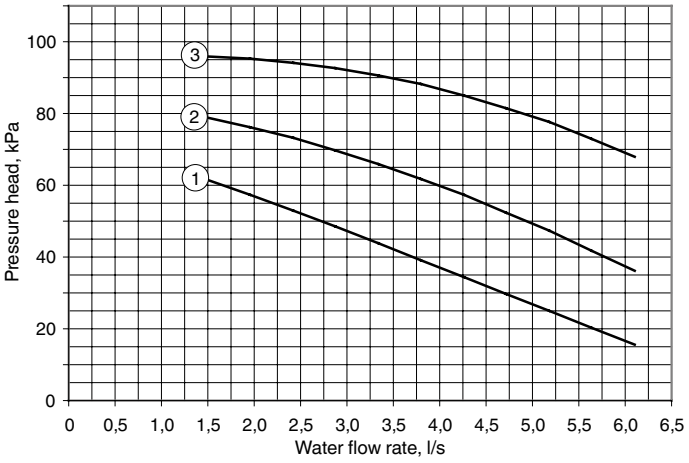
* Maximum flow rate, corresponding to a water temperature difference of 8 K in the plate heat exchanger (unit without hydronic module).



Legend
1 61AF 022-030 (speed 1)
2 61AF 022-030 (speed 2): selected
3 61AF 022-030 (speed 3)



Legend
1 61AF 035-055 (speed 1)
2 61AF 035-055 (speed 2): selected
3 61AF 035-055 (speed 3)



Legend
1 61AF 075-105 (speed 1)
2 61AF 075-105 (speed 2)
3 61AF 075-105 (speed 3): selected

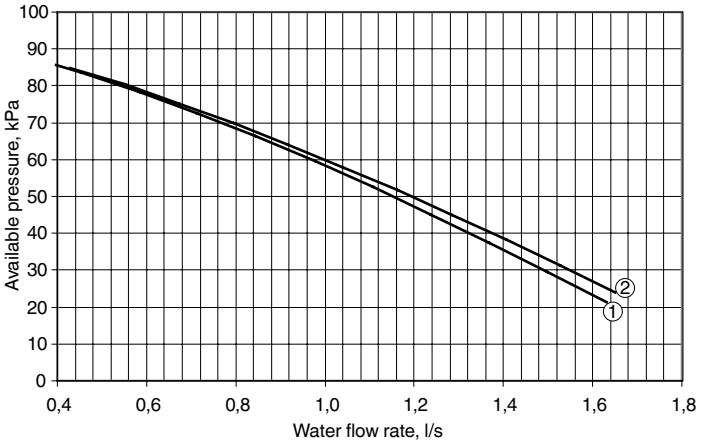
9.3 - Available system pressure for units with hydronic module

The available pressure curves for the 61AF units are given for the speed initially selected (see chapter 9.2). If the speed is changed by the user, the curves below do not apply.

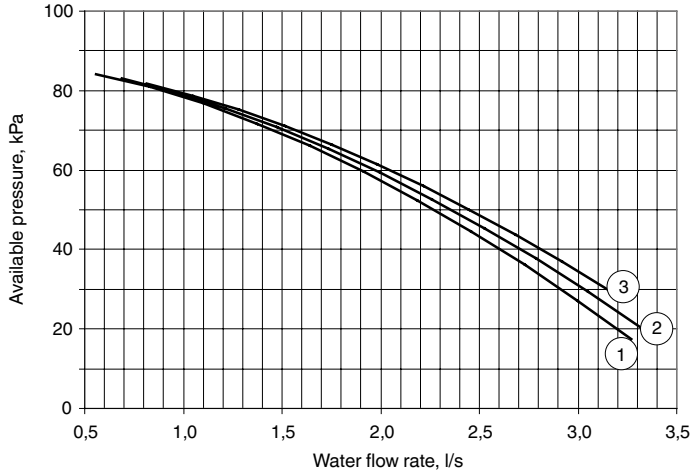
For pure water at 20°C

	Evaporator water flow rate, l/s	
61AF	**Minimum**	**Maximum***
022	0.4	1.6
030	0.5	1.7
035	0.7	3.3
045	0.8	3.3
055	0.9	3.2
075	1.1	5.9
105	1.5	8.5

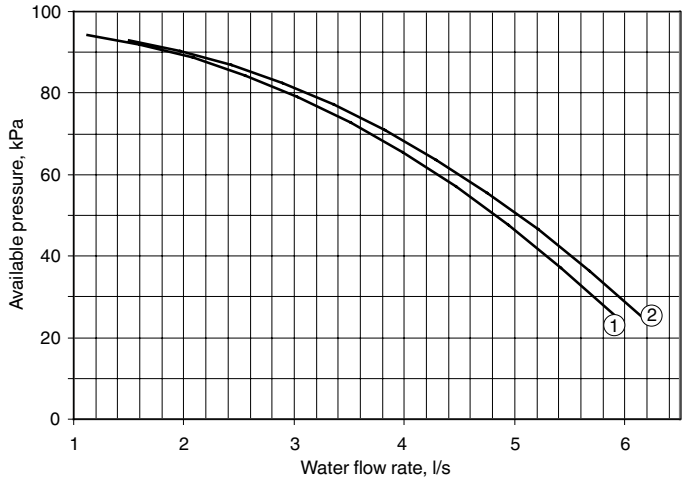
* Maximum flow rate, corresponding to an available pressure of 15 kPa (units with hydronic module).



Legend
1 61AF 022
2 61AF 030



Legend
1 61AF 035
2 61AF 045
3 61AF 055



Legend
1 61AF 075
2 61AF 105

10 - START-UP

10.1 - Preliminary checks

Never be tempted to start the heat pump without reading fully, and understanding, the operating instructions and without having carried out the following pre-start checks:

- Check the water circulation pumps, air handling units and all other equipment connected to the condenser.
- Refer to the manufacturer's instructions.
- Refer to the wiring diagram supplied with the unit.
- Ensure that there are no refrigerant leaks.
- Confirm that all pipe securing bands are tight.
- Confirm the the electrical connections are secure.

10.2 - Actual start-up

IMPORTANT:

- ***Commissioning and start-up of the chiller must be supervised by a qualified refrigeration engineer.***
- ***Start-up and operating tests must be carried out with a thermal load applied and water circulating in the condenser.***
- ***All setpoint adjustments and control tests must be carried out before the unit is started up.***
- ***Please refer to the 61AF Pro-Dialog+ control manual.***

The unit should be started up in Local ON mode. Ensure that all safety devices are satisfied, especially the high pressure switches.

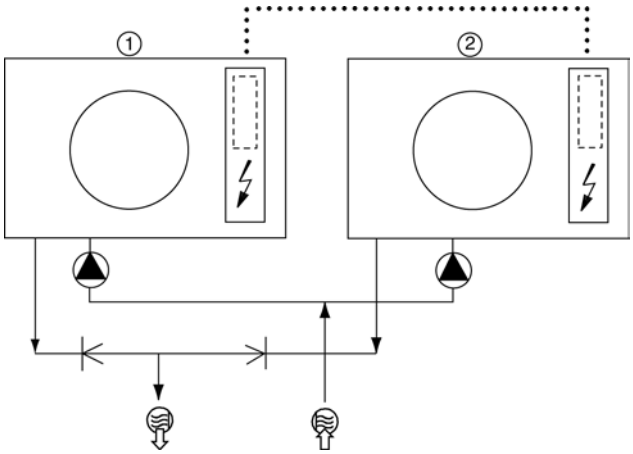
10.3 - Operation of two units in master/slave mode

The control of a master/slave assembly is in the entering water and does not require any additional sensors (standard configuration). It can also be located in the leaving water. In this case two additional sensors must be added on the common piping.

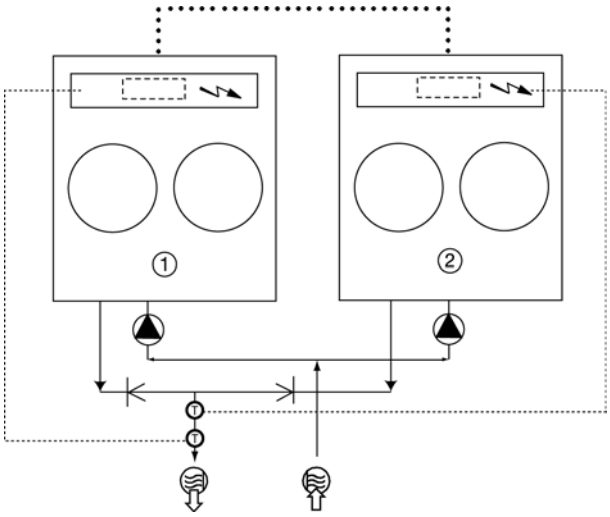
All parameters, required for the master/slave function must be configured using the Service Configuration menu. All remote controls of the master/slave assembly (start/stop, setpoint, load shedding, etc.) are controlled by the unit con-figured as master and must only be applied to the master unit.

Depending on the installation and control type, each unit can control its own water pump. Please install check valves in the leaving water piping of each unit, as shown in the following diagrams. If there is only one common pump for the two units, the master unit can control this. In this case shut-off valves must be installed on each unit. They will be activated at the opening and closing by the control of each unit (and the valves will be controlled using the dedicated water pump outputs).

Standard configuration: return water control



Configuration: leaving water control



Legend

1	Master unit
2	Slave unit
	Additional CCN board (one per unit, with connection via communication bus)
	Control boxes of the master and slave units
	Water inlet
	Water outlet
	Water pumps for each unit (included for units with hydronic module)
T	Additional sensors for leaving water control, to be connected to channel 1 of the slave boards of each master and slave unit
••••	CCN communication bus
·····	Connection of two additional sensors
	Check valve

10.4 - Supplementary electric resistance heaters

To permit staging of the capacity reduction of the heat pump at low ambient temperatures, as shown in the diagram below, it is possible to install supplementary electric heaters in the leaving water line. Their capacity can compensate for the capacity drop of the heat pump.

These heaters can be controlled via an integrated electronic board.

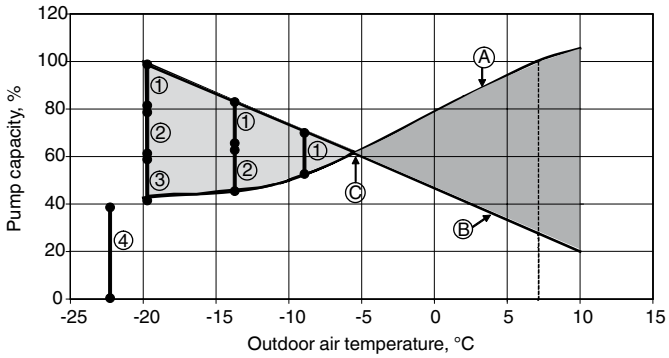
Four outputs are available to control the heater contactors, permitting gradual compensation of the heat pump capacity reduction.

These outputs are configurable to obtain a choice of two, three or four stages. The last stage will only be activated after a shut-down of the heat pump following a fault condition (safety device).

This requires only a 400 V-3 ph-50 Hz power supply source.

For the required configuration of the stages consult the 61AF Pro-Dialog+ control manual.

Example of additional electric heaters



Operating range, in which the heat pump capacity is lower than the building thermal load

Operating range, in which the heat pump capacity is higher than the building thermal load

Legend

1	Stage 1
2	Stage 2
3	Stage 3
4	Stage 4
A	Heat pump capacity variation as a function of the air temperature
B	Building thermal load
C	Balance point between the capacity supplied by the heat pump and the thermal load of the building

11 - MAJOR SYSTEM COMPONENTS

11.1 - Compressors

61AF units use hermetic scroll compressors with vapour injection. Each compressor is equipped with a crankcase oil heater, as standard.

Each compressor function is equipped with:
- Anti-vibration mountings between the unit chassis and the compressor(s).
- A single pressure safety switch at the discharge.

11.2 - Lubricant

The compressors installed in these units have a specific oil charge, indicated on the name plate of each compressor.

The oil level check must be done with the unit switched off, when then suction and discharge pressures are equalised. The oil level must be visible and above the middle of the sight-glass in the oil equalisation line. If this is not the case, there may be an oil leak in the circuit. Search and repair the leak, then recharge oil, so that it reaches a level between the middle and three quarters of the sight-glass (unit in vacuum).

ATTENTION: Too much oil in the circuit can cause a unit defect.

Use only oils which have been approved for the compressors. Never use oils which have been exposed to air.

R-22 oils are absolutely not compatible with R-407C oils and vice versa.

11.3 - Air evaporators

The 61AF coils are air evaporators with internally grooved copper tubes with aluminium fins.

11.4 - Fans

The fans are axial Flying Bird fans equipped with rotating shroud and made of composite recyclable material. The motors are three-phase, with permanently lubricated bearings and insulation class F.

11.5 - Electronic expansion valve (EXV) of the main circuit

The EXV is equipped with a stepper motor that is controlled via the EXV board.

11.6 - Electronic expansion valve (EXV) of the economised circuit

The EXV is equipped with a stepper motor that is controlled via the EXV board.

11.7 - Four-way valve

The four-way valve allows the reversal of the refrigerant cycle, required during the unit defrost phases.

11.8 - Moisture indicator

Located on the liquid line, permits control of the unit charge and indicates 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.

11.9 - Filter drier

This is a one-piece, brazed filter drier, located in the liquid line. The role of the filter drier is to keep the circuit clean and moisture-free. The moisture indicator shows when it is necessary to change the filter drier. A difference in temperature between the filter inlet and outlet shows that the element is dirty.

11.10 - Condenser

The condenser is a plate heat exchanger. The water connection of the heat exchanger is a Victaulic connection.

The condenser has a thermal insulation of 19 mm thick polyurethane foam.

As standard the condenser is equipped with frost protection.

11.11 - Economiser

The economiser is a plate-type economiser.

11.12 - Refrigerant

61AF units are charged with liquid HFC-407C refrigerant. This non-azeotropic refrigerant blend consists of 23% R-32, 25% of R-125 and 52% R-134a, and is characterised by the fact that at the time of the change in state the temperature of the liquid/vapour mixture is not constant, as with azeotropic refrigerants.

All checks must be pressure tests, and the appropriate pressure/temperature ratio table must be used to determine the corresponding saturated temperatures (saturated bubble point curve or saturated dew point curve).

Leak detection is especially important for units charged with refrigerant R-407C. Depending on whether the leak occurs in the liquid or in the vapour phase, the proportion of the different components in the remaining liquid is not the same.

NOTE: Regularly carry out leak checks and immediately repair any leak found. If there is a leak in the plate heat exchanger, this part must be replaced.

The refrigerant must always be recharged in the liquid phase into the liquid line.

The refrigerant cylinder must always contain at least 10% of its initial charge.

For the refrigerant quantity per circuit, refer to the data on the unit name plate.

11.13 - High-pressure safety switch

61AF units are equipped with automatically reset high-pressure safety switches, calibrated to 3130 kPa relative pressure (soft alarm is manually reset).

NOTES: Monitoring during operation:

- ***Follow the regulations on monitoring pressurised equipment.***
- ***It is normally required that the user or operator sets up and maintains a monitoring and maintenance file.***
- ***Follow the control programmes of EN378-2, annex D.***
- ***If they exist follow local professional recommendations.***
- ***Regularly inspect the condition of the coating (paint) to detect blistering resulting from corrosion.***
- ***Regularly check for possible presence of impurities (e.g. silicon grains) in the heat exchange fluids. These impurities maybe the cause of the wear or corrosion by puncture.***
- ***Filter the heat exchange fluid check and carry out internal inspections as described in EN378-2, annex C.***
- ***The reports of periodical checks by the user or operator must be included in the supervision and maintenance file.***

REPAIR

Any repair or modification, including the replacement of moving parts:

- ***must follow local regulations and be made by qualified operators and in accordance with qualified procedures,***
- ***must be made in accordance with the instructions of the original manufacturer. Repair and modification that necessitate permanent assembly (soldering, welding, expanding etc.) must be made using the correct procedures and by qualified operators.***

An indication of any modification or repair must be shown in the monitoring and maintenance file.

12 - OPTIONS AND ACCESSORIES

Options	No.	Description	Advantages	Use
Anti-corrosion protection, traditional coils	3A	Fins made of pre-treated aluminium (polyurethane and epoxy)	Improved corrosion resistance, recommended for marine environments	61AF 022-105
Unit with discharge air ducts	11	Fans with available pressure - max. 100 Pa	Enhances unit adjustment during installation (e.g. under a roof)	61AF 022-105
Low noise level	15	Acoustic compressor enclosure	Noise emission reduction	61AF 022-105
Very low noise level	15LS	Acoustic compressor enclosure and fan speed reduction, when ambient air temperature is above 20°C.	Noise emission reduction	61AF 022-105
Soft starter	25	Electronic compressor starter	Reduced compressor start-up current	61AF 022-105
Frost protection down to -20°C	42	Electric heater on the hydronic module (option 116F)	Hydronic module frost protection at low outside temperatures	61AF 022-105 (with option 116F)
Low-pressure single-pump hydronic module	116F	See hydronic module chapter	Easy and fast installation	61AF 022-105
JBus gateway	148B	Two-directional communications board, complies with JBus protocol	Easy connection by communication bus to a building management system	61AF 022-105
Bacnet gateway	148C	Two-directional communications board, complies with Bacnet protocol	Easy connection by communication bus to a building management system	61AF 022-105
LonTalk gateway	148D	Two-directional communications board, complies with LonTalk protocol	Easy connection by communication bus to a building management system	61AF 022-105
Heating system control*	157	Additional control box for remote installation to control the various heating system components	Allows control of pre-configured heating systems	61AF 022-105
Screw water connection between the customer's condenser and the unit	265	Victaulic screw connection at the condenser (standard on sizes 022-030)	Permits customer connections to be screwed to the unit	61AF 035-105
Welded water connection between the customer's condenser and the unit	267	Welded Victaulic connection (standard on sizes 022-030)	Permits customer connections to be welded to the unit	61AF 035-105
Accessories		**Description**	**Advantages**	**Use**
Remote user interface		Remotely installed user interface (communication bus)	Remote heat pump control up to 300 m	61AF 022-105
JBus gateway		Two-directional communications board, complies with JBus protocol	Easy connection by communication bus to a building management system	61AF 022-105
Bacnet gateway		Two-directional communications board, complies with Bacnet protocol	Easy connection by communication bus to a building management system	61AF 022-105
LonTalk gateway		Two-directional communications board, complies with LonTalk protocol	Easy connection by communication bus to a building management system	61AF 022-105
Anti-vibration mounts		Anti-vibration mounts to reduce vibration	Reduced vibration transmission through the floor	61AF 022-105
Hydronic pump		Low-pressure single pump with filter, water and air purge and pressure gauge	Main kit for installation on site	61AF 022-105
Twinning (lead/lag kit)		Unit equipped with an additional field-installed leaving water temperature sensor, allowing master/slave operation of two units connected in parallel	Operation of two units connected in parallel with operating time equalisation	61AF 022-105

* Option available in 2012.

13 - UNITS WITH FANS WITH AVAILABLE PRESSURE FOR INDOOR INSTALLATION (OPTION 11)

This option applies to 61AF units installed inside the building in a plant room. For this type of installation the cold air leaving the air-cooled evaporators is discharged by the fans to the outside of the building, using a duct system.

The installation of a duct system at the air evaporator discharge line causes a pressure drop due to the resistance caused by the air flow.

Therefore more powerful fan motors than those used for the standard units are installed in the units with this option. For each installation of a unit installed inside a plant room the duct pressure drops differ, depending on the duct length, duct section and direction changes.

61AF units equipped with fans with available pressure are designed to operate with air discharge ducts with maximum pressure drops of 100 Pa.

13.1 - Fan discharge connection

A square flange is supplied mounted on the unit. An available standard round flange can easily be installed at the fan discharge, if the installer prefers the use of a round connection duct.

The unit is supplied with a grille on the discharge side. This grille has to be removed before connection to the duct system.

It is advisable to make the connection to the duct system with a flexible sleeve. If this recommendation is not observed, a lot of vibration and noise may be transmitted to the building structure.

13.2 - Applicable rules for units incorporated into an air duct system

Ensure that the suction or discharge inlets are not accidentally obstructed by the panel positioning (e.g. low return or open doors etc.).

13.3 - Electrical data for 61AF units with option 11

61AF - units with option 11 (without hydronic kit)		022	030	035	045	055	075	105
Power circuit								
Nominal power supply	V-ph-Hz	400-3-50						
Voltage range	V	360-440						
Control circuit supply		24 V, via internal transformer						
Maximum start-up current (Un)*								
Standard unit	A	107,1	105,1	133,5	173,5	193,5	159,5	226,5
Unit with electronic starter option	A	58,6	57,6	72,5	93,3	103,7	106,5	147,5
Unit power factor at maximum capacity**		0,82	0,82	0,82	0,82	0,82	0,82	0,82
Maximum unit power input**	kW	9,8	12,7	14	15,7	17,9	28	35,9
Nominal unit current draw***	A	16,4	19	22,3	25,3	30	43,9	59,3
Maximum unit current draw (Un)****	A	18,5	23,7	26,5	29,5	33,5	52,3	66,3
Maximum unit current draw (Un-10%)†	A	23,2	30,5	34,3	38,5	44,1	67,9	87,5
Customer-side unit power reserve		Customer reserve at the 24 V control power circuit						
Short-circuit stability and protection		See table on page 13						

* Maximum instantaneous start-up current (maximum operating current of the compressor + fan current + locked rotor current of the compressor).

** Power input, compressor and fan, at the unit operating limits (saturated suction temperature 10°C, saturated condensing temperature 65°C) and nominal voltage of 400 V (data given on the unit nameplate).

*** Standardised Eurovent conditions: condenser entering/leaving water temperature = 40°C/45°C, outside air temperature db/wb = 7°C/6°C.

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

† Maximum unit operating current at maximum unit power input and 360 V.

14 - STANDARD MAINTENANCE

The heat pumps must be maintained by professional technicians, whilst routine checks can be carried out locally by specialised technicians.

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

WARNING: Before doing any work on the machine ensure that the power is switched off. If a refrigerant circuit is opened, it must be evacuated, recharged and tested for leaks. Before any operation on a refrigerant circuit, it is necessary to remove the complete refrigerant charge from the unit with a refrigerant charge recovery group.

Simple preventive maintenance will allow you to get the best performance from your heat pump unit:
- improved heating performance
- reduced power consumption
- prevention of accidental component failure
- prevention of major time-consuming and costly interventions
- protection of the environment

There are five maintenance levels for the heat pump units, as defined by the AFNOR X60-010 standard.

14.1 - Level 1 maintenance

Simple procedures, can be carried out by the user on a weekly basis:
- Visual inspection for oil traces (sign of a refrigerant leak),
- Air heat exchanger (evaporator) cleaning - see chapter 'Evaporator coil - level 1',
- Check for removed protection devices, and badly closed doors/covers,
- Check the unit alarm report when the unit does not work (see 61AF Pro-Dialog+ control manual),
- General visual inspection for any signs of deterioration,
- Verify the charge in the sight-glass,
- Check that the temperature difference between the heat exchanger inlet and outlet is correct.

14.2 - Level 2 maintenance

This level requires specific know-how in the electrical, hydronic and mechanical fields. It is possible that these skills are available locally: existence of a maintenance service, industrial site, specialised subcontractor.

The frequency of this maintenance level can be monthly or annually depending on the verification type.

In these conditions, the following maintenance operations are recommended.

Carry out all level 1 operations, then:

Electrical checks
- At least once a year tighten the power circuit electrical screw connections (see table with tightening torques).
- Check and retighten all control/command screw connections, if required (see table with tightening torques).
- Remove the dust and clean the interior of the control boxes, if required.
- Check the status of the contactors and disconnect switches.
- Check the presence and the condition of the electrical protection devices.
- Check the correct operation of all heaters.
- Replace the fuses every 3 years or every 15000 hours (age-hardening).
- Check that no water has penetrated into the control box.

Mechanical checks
- Check the tightening of the fan tower, fan, compressor and control box fixing bolts.

Water circuit checks
- Check the water connections.
- Purge the water circuit (see chapter 'Water flow control procedure').
- Clean the water filter (see chapter 'Water flow control procedure').
- Check the operation of the flow switch.
- Check the status of the thermal piping insulation.
- Check the concentration of the anti-freeze protection solution (ethylene glycol or polyethylene glycol).

Refrigerant circuit
- Fully clean the air evaporators with a low-pressure jet and a bio-degradable cleaner (counter-current cleaning - see chapter 'Evaporator coil - level 2).
- Check the unit operating parameters and compare them with previous values.
- Carry out an oil contamination test. Replace the oil, if necessary.
- 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 necessary.
- Keep and maintain a maintenance sheet, attached to the unit.

All these operations require strict observation of adequate safety measures: individual protection garments, compliance with all industry regulations, compliance with applicable local regulations and using common sense.

14.3 - Level 3 (or higher) maintenance

The maintenance at this level requires specific skills/approval/ tools and know-how and only the manufacturer, his representative or authorised agent are permitted to carry out these operations. These maintenance operations concern for example:

- a major component replacement (compressor, condenser),
- any intervention on the refrigerant circuit (handling refrigerant),
- changing of parameters set at the factory (application change),
- removal or dismantling of the unit,
- any intervention due to a missed established maintenance operation,
- any intervention covered by the warranty.

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 detected leaks must be repaired immediately.

The compressor oil that is recovered during maintenance contains refrigerant and must be treated accordingly.

Refrigerant under pressure must not be purged to the open air.

If a refrigerant circuit is opened, plug all openings, if the operation takes up to one day, or for longer periods charge the circuit with nitrogen.

NOTE: Any deviation or non-observation of these maintenance criteria will render the guarantee conditions for the unit nul and void, and the manufacturer, Carrier SCS, will no longer be held responsible.

14.4 - Tightening torques for the main electrical screw connections

Screw type	Designation in the unit	Torque (N·m)
Soldered screw (PE) customer connection		
M8	PE	80
Screw on switch inlet zones		
Switch 3LD2114-0TK51	QS_	2-2.5
Switch 3LD2214-0TK51		2-2.5
Switch 3LD2514-0TK51		2.5-3
Switch 3LD2714-0TK51		2.5-3
Tunnel terminal screw, compressor protection		
Fuse 3NW6120-1	QM*	1.2
Tunnel terminal screw, compressor contactor		
Contactor 3RT1034-2AB00	KM*	3-4.5
Tunnel terminal screw, fan, heater, pump protection		
Disconnect switch 3RV1011-1BA10	QM*	0.8-1.2
Tunnel terminal screw, heater relay		
Relay 3RH1122-2AB00	KM*	0.8-1.2
Tunnel terminal screw, auxiliary contact		
Auxiliary terminal block 3RH1911-2FA11 Auxiliary terminal block 3RH1921-2FA22	-	0.8-1.2
Tunnel terminal screw, control power transformer		
Transformer 4AM3496-0FS30-0EN1	TC	0.8-1.2
Compressor earth terminal		
M8	Gnd	12

* The spring-loaded terminal connections are designed to ensure permanent affixture on the conductor.

14.5 - Tightening torques for the main bolts and screws

Screw type	Used for	Torque (N·m)
Compressor strut	Compressor support	30
M8 nut	BPHE* fixing	15
M10 nut	Compressor mounting	30
M16 nut	Compressor fixing	30
Oil nut	Oil equalisation line	75
Taptite screw M6	Fan support	7
Taptite screw M8	Fan motor fixing	13
H M8 screw	Fan scroll fixing	18
Metal screw	Sheet metal plates	4.2
H M6 screw	Stauff clamps	10
Earth screw	Compressor	2.8

* BPHE = Brazed plate heat exchanger

14.6 - Evaporator coil

We recommend, that finned coils are inspected regularly to check the degree of fouling. This depends on the environment where the unit is installed, and will be worse in urban and industrial installations and near trees that shed their leaves.

For coil cleaning, two maintenance levels are used, based on the AFNOR X60-010 standard:

Level 1

- If the evaporator coils are fouled, clean them gently in a vertical direction, using a brush.
- Only work on air evaporators with the fans switched off.
- For this type of operation switch off the heat pump if service considerations allow this.
- Clean evaporators guarantee optimal operation of your unit. Cleaning is necessary when the evaporators begin to become fouled. The frequency of cleaning depends on the season and location of the unit (ventilated, wooded, dusty area, etc.).

Level 2

The two cleaning products can be used for any Cu/Al coil with protection.

Clean the coil, using appropriate products.
We recommend TOTALINE products for coil cleaning:
Part No. P902 DT 05EE: traditional cleaning method
Part No. P902 CL 05EE: cleaning and degreasing.

These products have a neutral pH value, do not contain phosphates, are not harmful to the human body, and can be disposed of through the public drainage system.

Depending on the degree of fouling both products can be used diluted or undiluted.

For normal maintenance routines we recommend using 1 kg of the concentrated product, diluted to 10%, to treat a coil surface of 2 m^2. This process can either be carried out using a high-pressure spray gun in the low-pressure position.

With pressurised cleaning methods care should be taken not to damage the coil fins. The spraying of the coil must be done:

- in the direction of the fins
- in the opposite direction of the air flow direction
- with a large diffuser (25-30°)
- at a minimum distance of 300 mm from the coil.

It is not necessary to rinse the coil, as the products used are pH neutral. To ensure that the coil is perfectly clean, we recommend rinsing with a low water flow rate. The pH value of the water used should be between 7 and 8.

WARNING: Never use pressurised water without a large diffuser. Do not use high-pressure cleaners for Cu/Al coils.

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 2/3 of the corrosion problems.

Protect the control box during cleaning operations.

14.7 - Condenser maintenance

Check that:

- the insulating foam is intact and securely in place.
- the cooler heaters are operating, secure and correctly positioned.
- the water-side connections are clean and show no sign of leakage.

14.8 - Characteristics of R-407C

Bar (relative)	Saturated bubble point temp. , °C	Saturated dew point temp., °C	Bar (relative)	Saturated bubble point temp., °C	Saturated dew point temp., °C	Bar (relative)	Saturated bubble point temp., °C	Saturated dew point temp., °C
1	-28.55	-21.72	10.5	23.74	29.35	20	47.81	52.55
1.25	-25.66	-18.88	10.75	24.54	30.12	20.25	48.32	53.04
1.5	-23.01	-16.29	11	25.32	30.87	20.5	48.83	53.53
1.75	-20.57	-13.88	11.25	26.09	31.62	20.75	49.34	54.01
2	-18.28	-11.65	11.5	26.85	32.35	21	49.84	54.49
2.25	-16.14	-9.55	11.75	27.6	33.08	21.25	50.34	54.96
2.5	-14.12	-7.57	12	28.34	33.79	21.5	50.83	55.43
2.75	-12.21	-5.7	12.25	29.06	34.5	21.75	51.32	55.9
3	-10.4	-3.93	12.5	29.78	35.19	22	51.8	56.36
3.25	-8.67	-2.23	12.75	30.49	35.87	22.25	52.28	56.82
3.5	-7.01	-0.61	13	31.18	36.55	22.5	52.76	57.28
3.75	-5.43	0.93	13.25	31.87	37.21	22.75	53.24	57.73
4	-3.9	2.42	13.5	32.55	37.87	23	53.71	58.18
4.25	-2.44	3.85	13.75	33.22	38.51	23.25	54.17	58.62
4.5	-1.02	5.23	14	33.89	39.16	23.5	54.64	59.07
4.75	0.34	6.57	14.25	34.54	39.79	23.75	55.1	59.5
5	1.66	7.86	14.5	35.19	40.41	24	55.55	59.94
5.25	2.94	9.11	14.75	35.83	41.03	24.25	56.01	60.37
5.5	4.19	10.33	15	36.46	41.64	24.5	56.46	60.8
5.75	5.4	11.5	15.25	37.08	42.24	24.75	56.9	61.22
6	6.57	12.65	15.5	37.7	42.84	25	57.35	61.65
6.25	7.71	13.76	15.75	38.31	43.42	25.25	57.79	62.07
6.5	8.83	14.85	16	38.92	44.01	25.5	58.23	62.48
6.75	9.92	15.91	16.25	39.52	44.58	25.75	58.66	62.9
7	10.98	16.94	16.5	40.11	45.15	26	59.09	63.31
7.25	12.02	17.95	16.75	40.69	45.71	26.25	59.52	63.71
7.5	13.03	18.94	17	41.27	46.27	26.5	59.95	64.12
7.75	14.02	19.9	17.25	41.85	46.82	26.75	60.37	64.52
8	14.99	20.85	17.5	42.41	47.37	27	60.79	64.92
8.25	15.94	21.77	17.75	42.98	47.91	27.25	61.21	65.31
8.5	16.88	22.68	18	43.53	48.44	27.5	61.63	65.71
8.75	17.79	23.57	18.25	44.09	48.97	27.75	62.04	66.1
9	18.69	24.44	18.5	44.63	49.5	28	62.45	66.49
9.25	19.57	25.29	18.75	45.17	50.02	28.25	62.86	66.87
9.5	20.43	26.13	19	45.71	50.53	28.5	63.27	67.26
9.75	21.28	26.96	19.25	46.24	51.04	28.75	63.67	67.64
10	22.12	27.77	19.5	46.77	51.55	29	64.07	68.02
10.25	22.94	28.56	19.75	47.29	52.05	29.25	64.47	68.39

61AF units use R-407C refrigerant. Special equipment must be used when working on the refrigerant circuit (pressure gauge, charge transfer, etc.).

15 - START-UP CHECKLIST FOR 61AF HEAT PUMPS (USE FOR JOB FILE)

Preliminary information
Job name: .....
Location: .....
Installing contractor: .....
Distributor: .....
Start-up preformed by: ..... Date: .....

Equipment
Model 61AF: ..... S/N .....

Compressors
1. Model No. ..... 2. Model No. .....
Serial No. ..... Serial No. .....

Air handling equipment
Manufacturer .....
Model No. ..... Serial No. .....

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

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

☐ Unit is level in its installation
☐ Power supply agrees with the unit name plate
☐ 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 handlers are operating
☐ All water valves are open
☐ All fluid piping is connected properly
☐ All air has been vented from the system
☐ Hot-water pump is operating with the correct rotation. CWP amperage: Rated: ..... Actual .....

Unit start-up
☐ Hot-water pump control has been properly interlocked with the heat pump
☐ Oil level is correct
☐ Compressor crankcase heaters have been energised for 12 hours
☐ Unit has been leak checked (including fittings)
☐ 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 heat pump if voltage imbalance is greater than 2%. Contact local power company for assistance.

☐ All incoming power voltage is within rated voltage range

Check condenser water loop
Water loop volume = ... (litres)
Calculated volume = ... (litres)

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

Check pressure drop across the unit condenser (without hydronic module) or the external static pressure (with hydronic module)
Entering condenser = ... (kPa)
Leaving condenser = ... (kPa)
Pressure drop (entering - leaving) = ... (kPa)

WARNING (unit without hydronic module): Plot the pressure drop on the condenser flow/pressure drop curve to determine the flow rate in l/s at the nominal operating conditions for the installation. For units with hydronic module, a flow rate indication is displayed by the unit control (consult the 61AF Pro-Dialog+ control manual).

☐ 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)

Carry out the QUICK TEST function (see 61AF Pro-Dialog+ control manual):

Check and log on to the user menu configuration
Load sequence selection.....
Capacity ramp loading selection.....
Start-up delay.....
Burner section.....
Pump control.....
Setpoint reset mode.....
Night-time capacity setback .....

Re-enter the setpoints (see controls section)

To start up the heat pump

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, start the unit in the "LOCAL ON" position.

Unit starts and operates properly

Temperatures and pressures

WARNING: Once the machine has been operating for a while and the temperatures and pressures have stabilized, record the following:

BPHE entering water.....
BPHE leaving water.....
Outside air temperature .....
Suction pressure.....
Discharge pressure .....
Suction temperature .....
Discharge temperature .....
Liquid line temperature.....

NOTES: .....
.....
.....

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