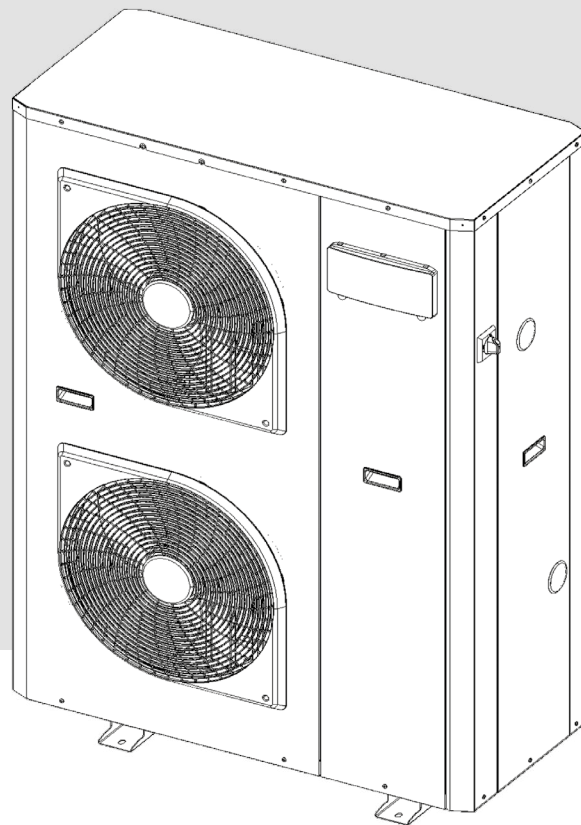




United Technologies

INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS



High-temperature heat pumps

61AF-B

Nominal heating capacity 14 - 20 kW / 50 Hz

AQUASNAP[®]

Original document

61 AF

High temperature Heat Pumps with integrated hydronic module

For the use of the control system, refer to the Pro-Dialog + control manual.

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Start-up check list

Equipment sold by: _____ Start up date _____
Installed by: _____ Contract No: _____
Site address _____ Contract No: _____
Equipment type and serial No: 61AF _____

ELECTRICAL DATA:

Supply voltage Ph 1: _____ V Ph 2: _____ V Ph 3: _____ V
Nominal voltage: _____ V % network voltage _____
Current draw Ph 1: _____ A Ph 2: _____ A Ph 3: _____ A
Control circuit voltage: _____ V Control circuit fuse _____ A
Main circuit breaker rating _____

PHYSICAL DATA

Coil:

Entering air temp.: _____ °C
Leaving air temp.: _____ °C

Plate heat exchanger:

Entering water temp.: _____ °C
Leaving water temp.: _____ °C
Pressure drop (water): _____ kPa

SAFETY DEVICE SETTING:

High pressure switch: cut-out: _____ kPa cut-in: _____ kPa

Oil level _____

OPTIONS:

Commissioning engineer (name) _____
Customer agreement

Name: _____ Date: _____

Note: Complete this start-up list at the time of installation.

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Physical data and electrical data

Table I: Physical data

61AF		014-7	014-9	019-9
Operating weight⁽¹⁾				
Standard unit (without hydronic kit)	kg	159	159	206
Standard unit (plus hydronic module option)	kg	169	169	216
Sound levels				
Sound power level ⁽²⁾	dB(A)	71	71	72
Sound pressure level at 10 m ⁽³⁾	dB(A)	43	43	44
Compressor		Hermetic scroll 48.3 r/s		
Quantity		1	1	1
Number of capacity stages		1	1	1
Refrigerant		R-407C	R-407C	R-407C
Charge	kg	4,0	4,0	8,0
	teqCO2	7.1	7.1	14.2
Capacity control		Pro-Dialog+		
Minimum capacity	%	100	100	100
Condenser		Direct-expansion plate heat exchanger		
Water volume	l	3,7	3,7	3,9
Max. water-side operating pressure without hydronic module	kPa	300	300	400
Max. water-side operating pressure with hydronic module	kPa	300	300	400
Fan		Axial twin-speed fans		
Quantity		2	2	2
Total air flow (high speed)	l/s	2050	2050	2000
Speed	r/s	11.7	11.7	14.5
Evaporator		Grooved copper tubes and aluminium fins		
Pump		Variable speed pump		
Water connections with/without hydronic module				
Connection Type (M male/ F female)		F	F	M, M
Connections	inch	1	1	1 IN, 1 1/4 OUT
Nominal diameter	mm	25	25	25 IN, 32 OUT

⁽¹⁾ Weight shown is a guideline only. Please refer to the unit nameplate

⁽²⁾ In dB ref=10-12 W, (A) weighting. Declared dualnumber noise emission values in accordance with ISO 4871 (with an associated uncertainty of +/-3dB(A)). Measured in accordance with ISO 9614-1 and certified by Eurovent.

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

Table II: Electrical data

61AF - standard unit			Without PUMP		With PUMP		
		014X7	014X9	019X9	014H7	014H9	019H9
Power circuit							
Nominal power supply	V-ph-Hz	230-1-50	400-3-50	400-3-50	230-1-50	400-3-50	400-3-50
Voltage range	V	207-253	360-440	360-440	207-253	360-440	360-440
Control circuit supply		24 V, via internal transformer			24 V, via internal transformer		
Maximum start-up current (Un)*							
Standard unit	A	-	66	102	-	67	103
Unit with electronic starter option	A	47	-	-	48	-	-
Unit power factor at maximum capacity**		0.82	0.82	0.82	0.82	0.82	0.82
Maximum unit power input**	kW	6.4	5.9	8.8	6.5	6.0	8.9
Nominal unit current draw***	A	22.9	7.9	12.4	24.0	9.0	13.5
Maximum unit current draw (Un)****	A	30.7	10.8	16.0	31.8	11.9	17.1
Maximum unit current draw (Un-10%)†	A	36.4	11.9	16.6	37.5	13.0	17.7

* Maximum instantaneous start-up current (maximum operating current of the pump + 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.

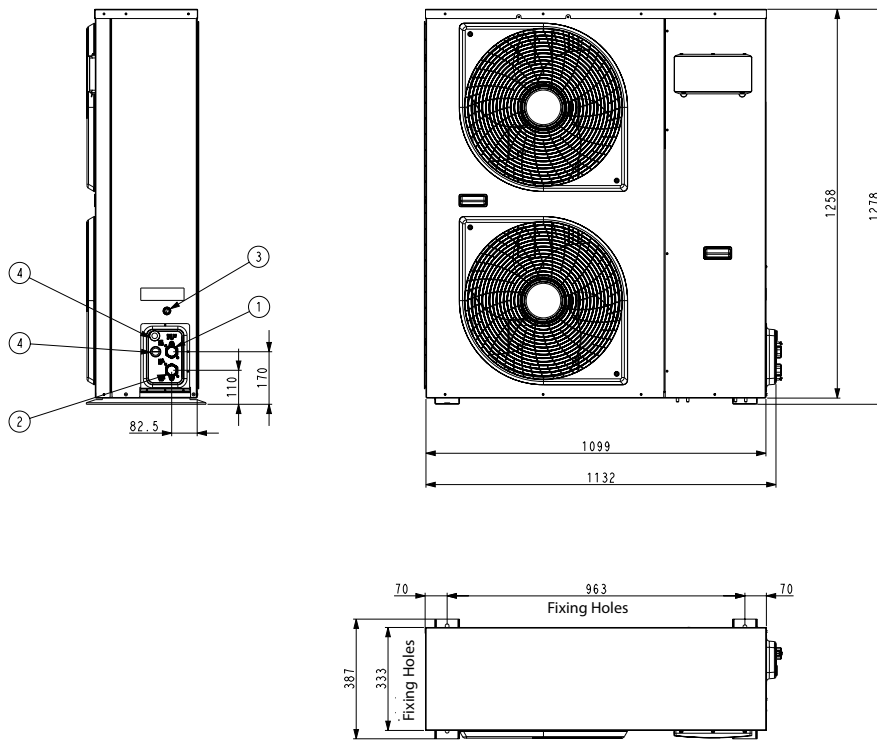
**** Maximum unit operating current at maximum unit power input and 400 V (values given on the unit nameplate) for tri phase and 230V for mono phase.

† Maximum unit operating current at maximum unit power input and 360 V for tri phase and 207 V for mono phase.

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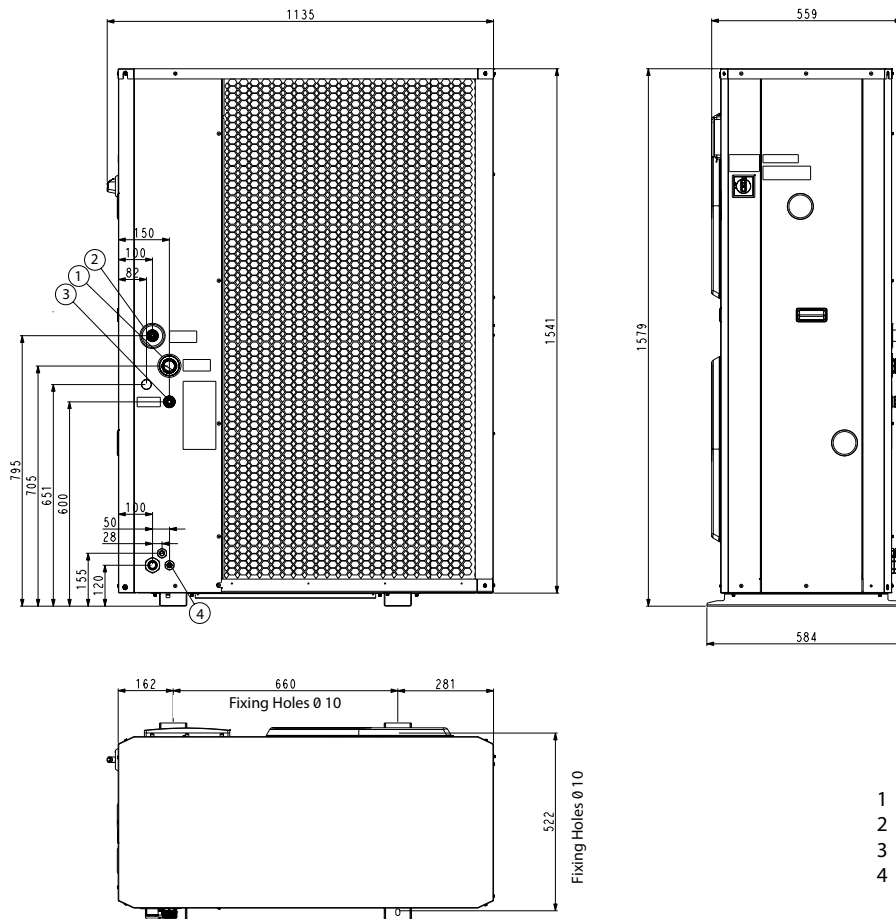
Dimensions and location of connections (mm)

61AF014



- 1 water outlet
- 2 water inlet
- 3 relief valve outlet
- 4 electrical connections

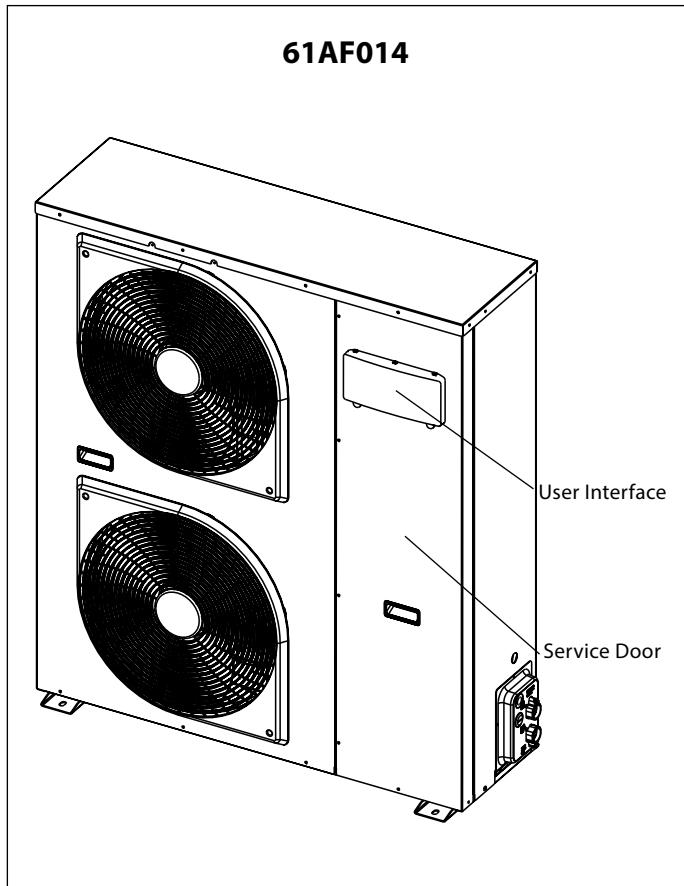
61AF019



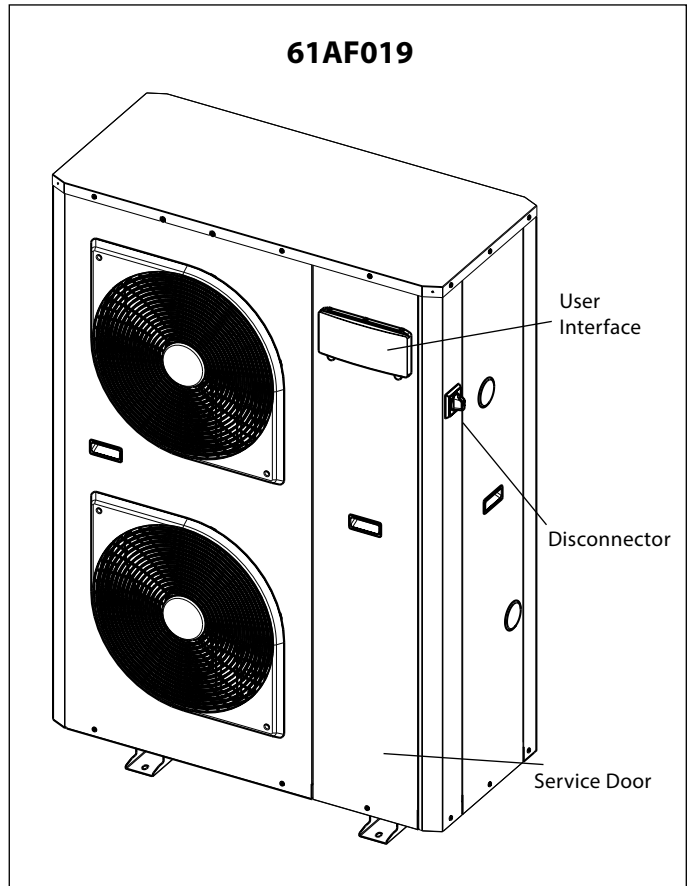
- 1 water outlet
- 2 water inlet
- 3 relief valve outlet
- 4 electrical connections

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User interface and main switch



* Check that the user interface is protected as described in section "Electronic control".



Minimum Clearances (mm)

The diagrams illustrate the required clearances for the units. Diagrams on the left show side and top views of the units with clearances labeled A, B, C, D, and E. Diagrams on the right show top and side views of the units with clearances labeled A, B, C, F, and G.

61AF	014	019
A	100	300
B	250	200
C	500	400
D	100	200
E	670	700
F	400	500
G	670	1000

Unit installation

Read this manual thoroughly before starting machine installation. The device complies with the low voltage directives, Machinery Directive and EMC Directive.

- **Check that the impedance of the mains power supply is in conformance with the unit power input indicated in the electrical data table II on page 4 (EN 61000-3-11).**
- The installation must be carried out by a qualified installer.
- Follow all current national safety code requirements. In particular ensure that a properly sized and connected ground wire is in place.
- Check that voltage and frequency of the mains power supply are those required; the available power must be adequate to operate any other possible appliances connected to the same line. Also ensure that national safety code requirements have been followed for the mains supply circuit.
- After installation thoroughly test the system operation and explain all system functions to the owner.
- Leave this manual with the owner for consultation during future periodic maintenance.
- Be sure the unit and its components are checked periodically to look for loosen, damaged or broken components
In case of persisting defects, the unit may cause personal injury or property damage.

IMPORTANT:

During the unit installation make first the hydronic connections and then electrical connections. If unit is uninstalled first disconnect electrical cables, then the hydronic connections.

WARNING:

Disconnect the mains power supply switch before servicing the system or handling any internal parts of the unit. All mains supply circuits must be disconnected.

- The manufacturer declines any liability for damage resulting from modifications or errors in the electrical or hydronic connections.
- Failure to observe the installation instructions or use of the unit under conditions other than those indicated in Tables "Operating limits", will immediately void the unit warranty.
- Failure to observe electric safety codes may cause a fire hazard in case of short circuits.
- Inspect equipment for damage due to improper transportation or handling: file an immediate claim with the shipping company. Do not install or use damaged units.
- During unit operation, some of the refrigerant circuit elements could reach a temperature in excess of 70°C so only trained and qualified personnel should access areas protected by access panels.
- In case of any malfunctioning turn the unit off, disconnect the mains power supply and contact a qualified service engineer.
- **All of the manufacturing and packaging materials used for your new appliance are compatible with the environment and can be recycled.**
- Dispose of the packaging material in accordance with local requirements.
- This equipment contains refrigerant R-407C that must be disposed of in a proper manner. When disposing of the unit after its operational life, remove it carefully. The unit must then be delivered to an appropriate disposal center or to the original equipment dealer.
- Carefully recover refrigerant within this unit before final disposal or when servicing. Never vent refrigerant to atmosphere.

Choosing the installation site

- This unit should not be installed in an explosive atmosphere.
- The unit can operate in normal radioelectric atmospheres in residential, commercial and light industrial installations. For other applications, please consult Carrier.
- In the case of heat pump operation with an outdoor temperature of less than 0 °C the unit must be installed at least 300 mm above ground level. This is necessary to prevent ice from accumulating on the frame and to permit correct operation also in the event of heavy snowfalls.
- The unit must be levelled on both axes (the tolerance is less than 2 mm per metre).
- In some cases it may be necessary to fit deflectors against strong winds and to stop snow from hitting the coil directly. These deflectors must be installed so that the normal air circulation is not obstructed.

Siting the unit

Check that:

- The location is able to support unit operating weight (Table I).
- There is sufficient space for servicing and air flow around the unit (see "Clearances" figure).
- The selected site is without dust or foreign material which could obstruct the coil.
- When installing the unit on the ground, the selected site is not subject to flooding.
- The installation is in accordance with local rules and standards governing the installation of air conditioning equipment.
- Vibration absorbers have been provided throughout the installation to prevent noise from being transmitted.
- To avoid possible damages fix the vibration absorbers under a feet-supporting frame of the unit.

Transport

1. Use spreader bars to lift the unit to avoid damage to the panels. Avoid violent movements.
2. Never roll or swing the unit more than 15°.

IMPORTANT:

Ensure that all unit panels are fixed in place before moving the unit. Raise and set down the unit carefully.

IMPORTANT:

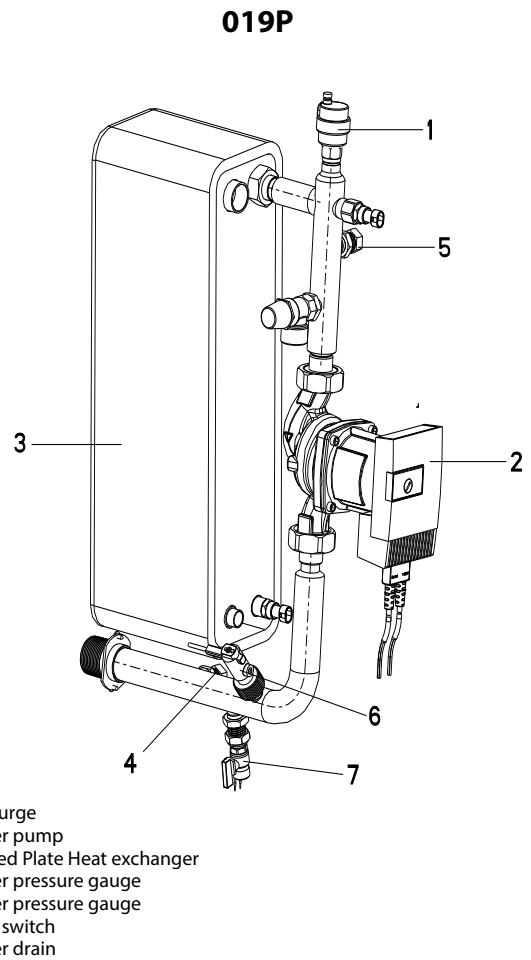
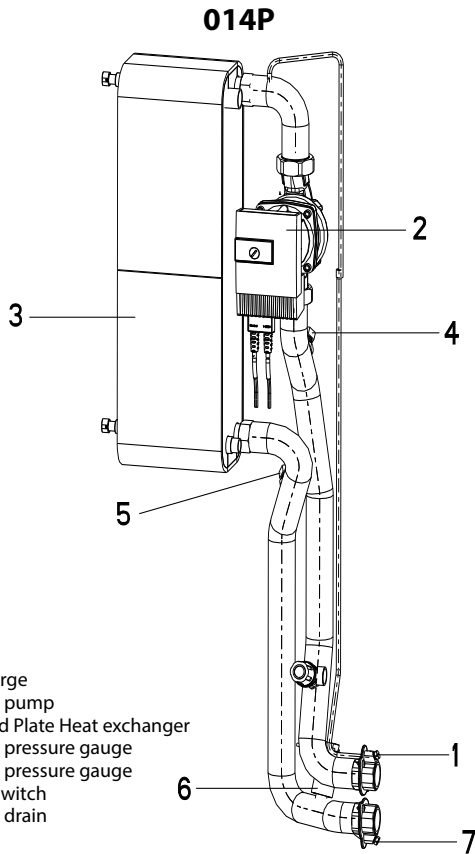
Always ensure that the unit is levelled correctly.

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General information and hydronic module

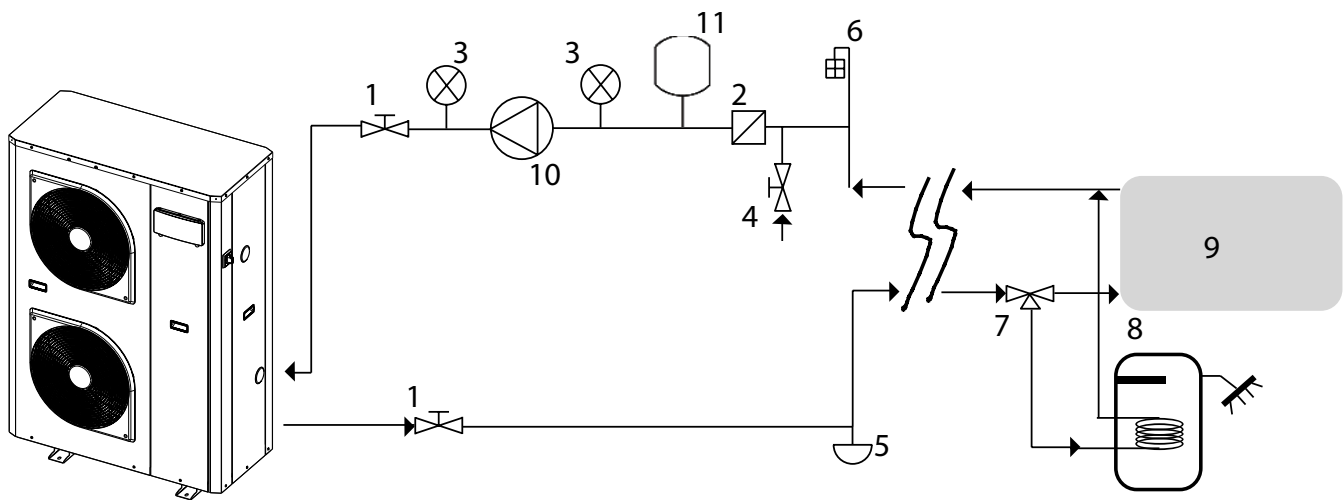
Hydronic module

The hydronic module is factory-installed. This eliminates the need to install the necessary components onsite, making the unit more compact and easy to install.



Water connections

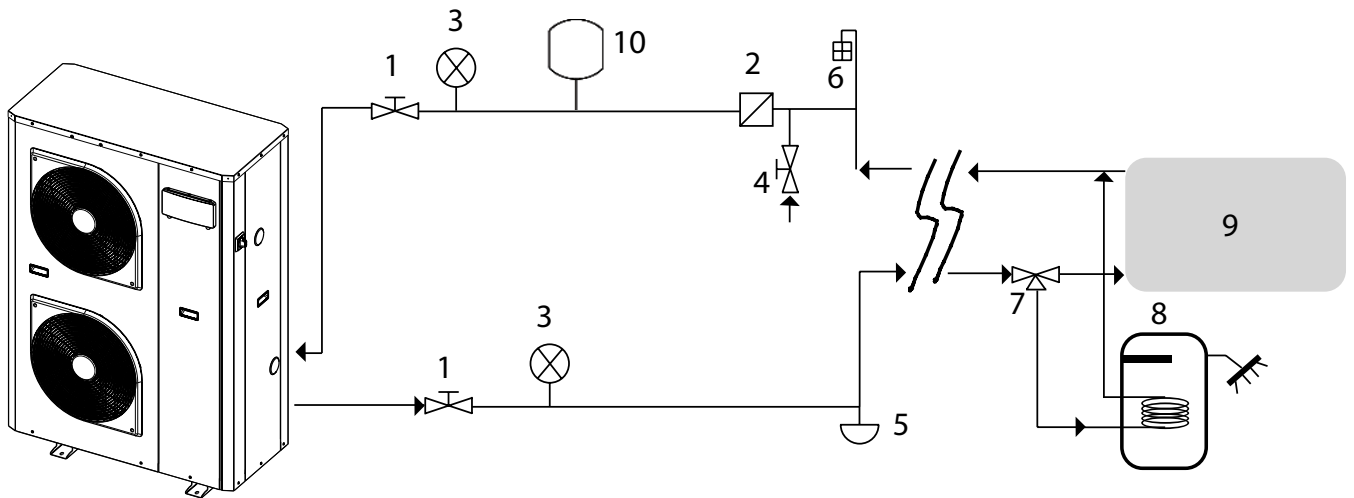
Typical water circuit diagram for units without hydronic module



- 1 shut off valve
- 2 line filter for water (10 mesh/cm²)
- 3 pressure gauges
- 4 filling valve
- 5 system drain valve (at the lowest points of the circuit)
- 6 air flushing valve (in the highest parts of the circuit)

- 7 3-way valve
- 8 sanitary water accumulation tank
- 9 inside system
- 10 water circulation pump
- 11 expansion vessel

Typical water circuit diagram for units with hydronic module



1. shut off valve
2. line filter for water (10 mesh/cm²)
3. pressure gauges
4. filling valve
5. system drain valve (at the lowest points of the circuit)

6. air flushing valve (in the highest parts of the circuit)
7. 3-way valve
8. sanitary water accumulation tank
9. inside system
10. expansion vessel

Make the plate heat exchanger hydraulic connections with the necessary components, using material which will guarantee that the screwed joints are leakproof.

The typical hydraulic circuit diagram shows a typical water circuit installation in an air conditioning system.

For an application with a water circuit, the following recommendations must be taken into account.

1. The pump must be fitted immediately before of the heat exchanger and after the connection to the system return (unit without hydronic module).
2. It is advisable to install shut-off valves to allow isolation of the most important circuit components, as well as the heat exchanger itself. These valves (ball, globe or butterfly valves) should produce a minimum loss of charge when they are open.
3. Provide unit and system drains and vents at the lowest system point.
4. Install purges in the higher sections of the installation.
5. Pressure ports and pressure gauges should be installed upstream and downstream of the water pump (unit without hydronic module).
6. Thermometers should be installed in the unit water inlet and outlet.
7. All piping must be adequately insulated and supported.

Installation of the following components is obligatory:

1. The presence of particles in the water can lead to obstructions in the heat exchanger.
It is therefore necessary to protect the heat exchanger inlet with an extractable mesh filter. The filter mesh gauge must be at least 10 mesh/cm².
The equipment standard version with hydronic module is equipped with mesh filter, included in the supply and installed.
2. After assembling the system, or repairing the circuit, the whole system must be thoroughly cleaned with special attention paid to the state of the filters.
3. Pump flow rate control is made through a flow control valve supplied with the unit with hydronic module, which must be installed on the delivery pipe during installation.

4. When water has to reach temperatures below 5°C, or the equipment is installed in areas subject to temperatures below 0°C, it is necessary to mix water with glycol in suitable quantity. The maximum allowable quantity of ethylene and propylene glycol is 40 % (higher concentrations depend on the mix viscosity and the operating conditions address to Carrier for further details).

Frost protection

The plate heat exchanger and the water connections of the hydronic module pump may be damaged in spite of the anti-freeze protection system these units are fitted with.

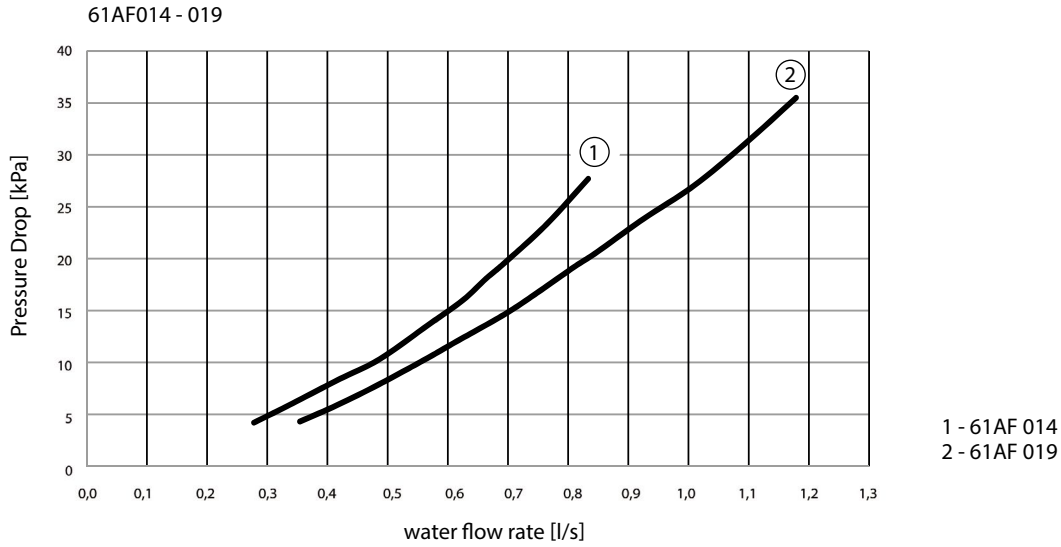
Frost protection of the plate heat exchanger and of the circuit inside the hydronic module is always guaranteed down to -10°C by the electric heaters that are automatically activated if needed.

The power supply to the electric heaters of the plate heat exchanger and to the internal circuit of the hydronic module must never be interrupted.

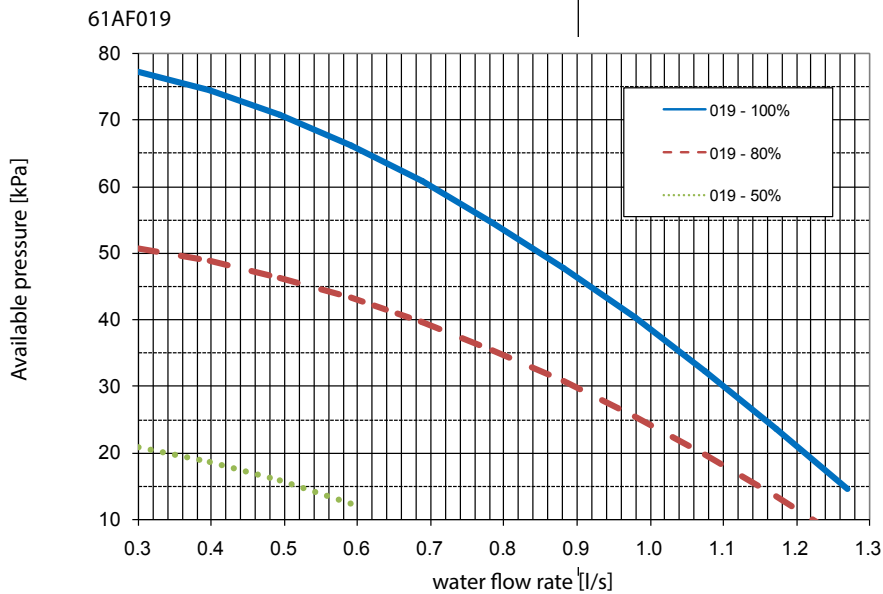
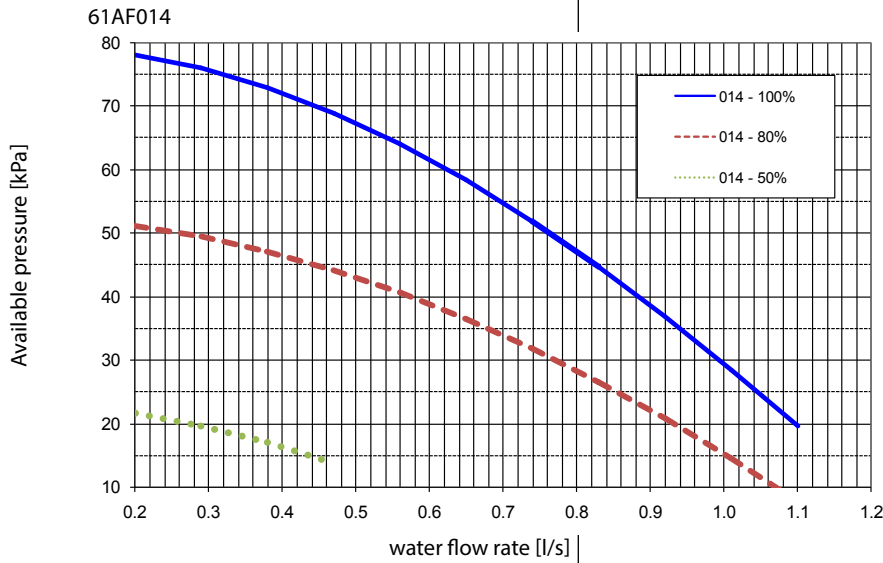
61 AF

Water connections

Water pressure drop of the unit without hydronic module



Outlet available static pressure of the unit with hydronic module



General

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.

The pump of the hydronic module is a variable speed pump. Two different water flow controls can be selected:

- Fixed speed control
- Variable speed control based on constant temperature difference.

The default factory setting is fixed speed and the default speed is 100%. Settings change need to be done by a Carrier Service representative.

For both flow control and for energy saving, the speed of the pump will be reduced to its minimum when unit capacity is 0%.

It is essential to know the nominal system flow rate to be able to control it, using the variable pump speed or a manual valve that must be on the water leaving piping of the system (item 21 in the typical hydronic circuit diagram).

The flow control with the pump speed or with the 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. A differential pressure gauge must be installed at the unit inlet and outlet or using pressure gauge (item 4 and 5) on the hydronic module.

Use the specification of the unit selection to know the system operating conditions and to deduce 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 with the technical literature using the unit performance tables for a ΔT of 5 K at the water heat exchanger or with the Electronic Catalogue selection program for all ΔT conditions in the range of 3 to 10 K.

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

It is therefore necessary to ensure a minimum pump entering pressure of 40 kPa (0.4 bar) during operation and at shut-down. In order to obtain sufficient pressure, it is recommended:

- to pressurise the hydronic circuit between 1 and 3 bars (maximum),
- to clean the hydronic circuit before charging water (see chapter after),
- to regularly clean the screen filter,

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

Water flow control procedure (fixed speed)

Hydronic circuit cleaning procedure

- Open the valve fully (item 21) if present.
- Start-up the system or unit pump (by quick test), if the unit is equipped with a hydronic module with a pump.
- Read the difference of pressure between the pressure gauge connected to the unit inlet and outlet (item 3).
- 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 difference of pressure 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 1) and remove the screen filter (item 2) after emptying the hydronic section of the unit (item 5).
- Purge the air from the circuit (item 6).
- Renew, if necessary, to ensure that the filter is not contaminated.

Water flow control procedure

- When the circuit is cleaned, run the pump at speed 100% and read the differential pressure of the unit (items 3)
- Find the flow rate with the pump curve 100%
- If the flow rate is higher than the value specified close the control valve or reduce the pump speed.
- Verify the minimum speed pump (when unit capacity is 0%) is compatible with the flow switch protection (no flow switch alarm for minimum speed).

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.

Water flow control procedure (variable speed)

61AF units with variable-speed hydronic module include a water pump that automatically adjusts the flow to maintain a constant temperature difference.

No control is required at start-up, but the control mode must be selected in the unit control by a Carrier service representant.

Verify the minimum speed pump (when unit capacity is 0%) is compatible with the flow switch protection (no flow switch alarm for minimum speed).

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Electrical connections and refrigerant charge

Electrical connections

WARNING:

To prevent electrical shock or equipment damage, make sure disconnects are open before electrical connections are made. If this action is not taken, personal injury may occur.

Power supply cable size and external connection must be made by the installer according to the unit installation characteristics and the applicable standards. The power supply and earth multicore cable of the device has to be connected to the general disconnecter by routing the cable through the grommet installed in the device, after removing the access panel/s. The maximum section allowable for flexible copper cable is 25 mm². Before connection, check that phase sequence L1 – L2 – L3 is correct.

The table below should be considered as a reference and does not involve Carrier responsibility.

	Min Wire section [mm ²]	Max Length [m]	Wire Type	Fuse (type gG) [A]	Max Wire section [mm ²]	Max Length [m]	Wire Type	Fuse (type gG) [A]
14-7	5x6	100	H07 RN - F	63	5x10	210	H07 RN - F	63
14-9	5x2,5	100	H07 RN - F	25	5x4	210	H07 RN - F	25
19-9	5x4	100	H07 RN - F	32	5x6	210	H07 RN - F	32

Take special care when making the earth connection.

The maximum permitted voltage and current imbalance is 10% of the values indicated in Table II.

Contact your local power company for correction of an incorrect line voltage.

IMPORTANT: For size 014, an external main switch must be positioned next to the unit. On size 019, the main switch is already included on the unit.

WARNING:

Operation of the unit on improper line voltage constitutes abuse and is not covered by the Carrier warranty.

IMPORTANT:

To ensure the correct unit power supply (cable entry, conductor cross section, protection devices etc.), consult the electrical data table, the wiring diagram supplied with the unit and the applicable standards concerning the installation of air conditioning equipment.

Never operate a unit if the voltage imbalance exceeds 2%.

The following formula must be used to determine the percentage of voltage imbalance.

$$\text{Voltage imbalance (\%)} = \frac{(\text{Largest deviation from average voltage} \times 100)}{\text{Average voltage}}$$

Example:

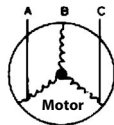
Nominal supply: 400-3-50

AB = 404 V

BC = 399 V

AC = 394 V

$$\text{Average voltage} = \frac{404 + 399 + 394}{3} = 399 \approx 400 \text{ V}$$



Determine maximum deviation from average voltage

AB = 404 - 400 = 4

BC = 400 - 399 = 1

AC = 400 - 394 = 6

Largest deviation is 6 volts. Percentage voltage imbalance is therefore.

$$\frac{6}{400} \times 100 = 1,5 \%$$

CAUTION:

The installer must install protection devices, as required by the applicable legislation.

For sizes 19 kW, the power supply cable must be routed through the grommet of the electric control panel. To connect the power supply cable to the main disconnecter remove the metal protection box (by removing the two fixing screws). After completing all connections, re-install the protection box by fixing the two screws which were previously removed.

Liquid refrigerant charge

Checking the charge

WARNING:

When adjusting the refrigerant charge always ensure that water is circulating in the heat exchanger to prevent any possibility of freezing up. Damage caused by freezing is not covered by the product warranty.

61AF units are shipped with a full operating charge of refrigerant. Refer to Table I.

61AF units use a R-407C refrigerant charge. For your information, we are reproducing here some extracts from the official publication dealing with the design, installation, operation and maintenance of air conditioning and refrigeration systems and the training of people involved in these activities, agreed by the air conditioning and refrigeration industry.

Refrigerant guidelines

61 AF contains fluorinated greenhouse gas covered by the Kyoto protocol. Refrigerant type: R-407C Global Warming Potential (GWP): 1653. Refrigeration installations must be inspected and maintained regularly and rigorously by specialists. Their activities must be overseen and checked by properly trained people. To minimise discharge to the atmosphere, refrigerants and lubricating oil must be transferred using methods which reduce leaks and losses to a minimum

- Leaks must be repaired immediately.
- Service valves fitted to the flow and return lines permit charge transfer to a suitably arranged external container.
- It is indispensable to use a dedicated transfer station.
- Compressor lubricating oil contains refrigerant. Any oil drained from a system during maintenance must therefore be handled and stored accordingly.
- Refrigerant under pressure must never be discharged to the atmosphere.

Unit R-407C should be charged with liquid refrigerant. Apply a common flow regulator available on the market to the hose pipe to vaporize the liquid refrigerant before it enters the unit. R-407C, like other HFCs, is only compatible with the oils selected by the manufacturer of compressors (POE).

NOTE:

Regularly carry out leak checks and immediately repair any leak found.

WARNING:

If brazing is to be done, the refrigerant circuit must be filled with nitrogen. Combustion of refrigerant produces toxic phosgene gas.

IMPORTANT:

Never use the compressor as a vacuum pump. Always add refrigerant via the suction line. Refrigerant must be added very slowly. Do not overcharge the system with refrigerant.

Electronic control

Operation and control of all units is carried out via the electronic control. The instructions supplied with the control include comprehensive descriptions.

After use, check the user interface is properly inserted into its housing and the cover is closed by means of the screw supplied. This way, the electronic control and the unit are protected against any impacts and atmospheric agents.

PRO-Dialog + electronic control

PRO-DIALOG + is an advanced numeric control system that combines complex intelligence with great operating simplicity.

PRO-DIALOG + constantly monitors all machine parameters and safety devices, and precisely manages the operation of compressor and fans for optimum energy efficiency.

It also controls the operation of the water pump.

A powerful control system

The PID control algorithm with permanent compensation for the difference between entering and leaving water temperature and anticipation of load variations regulates compressor operation for intelligent leaving water temperature control.

To optimise power absorption, the PRO-DIALOG + automatically re-calibrates the set point of the entering water temperature based on the outside air temperature to one of the two pre-set values (occupied building and of an unoccupied building for example).

PRO-DIALOG + control is auto-adaptive for full compressor protection. The system permanently optimises compressor run times according to the application characteristics (water loop inertia), preventing excessive

cycling. In most comfort air conditioning applications this feature makes a buffer tank unnecessary.

Clear and easy-to-use control system

The operator interface is clear and user-friendly: two LEDs and digital displays allow the immediate control of the device operating data.

The menus offer direct access to all machine controls, including a history of possible faults, for rapid and complete chiller fault diagnosis.

Extended communications capabilities

PRO-DIALOG + allows remote control and monitoring of the unit through a wired connection: 7-8 x 0.5 mm² multiple cables. The cable should be screened of the FROH2R or BELTEN 9842 type.

The screening should be grounded only on the electric unit panel board. Functions available are start/stop, power demand limit or dual set-point and customer safety lock.

The system permits remote signalling of any general anomaly for each refrigerant circuit.

Three independent time schedules permit definition of: chiller start/stop, operation at the second set-point (e.g. unoccupied mode), and operation at low fan speed (e.g. during the night).

This option also permits cascade operation of two units and remote control via communication bus (RS 485 serial port).

Start-up

Unit start-up is done by the electronic control described above, and must always be carried out under the supervision of a qualified air conditioning engineer.

This appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety.

Children should be supervised to ensure that they do not play with the appliance.

Necessary checks/precautions before start-up

- Ensure that all electrical connections are properly tightened.
- Ensure that the unit is level and well-supported.
- Check that the hydraulic circuit has sufficient water flow and that the pipe connections correspond to the installation diagram.
- Ensure that there are no water losses. Check the correct operation of the valves installed.
- All panels should be fitted and firmly secured with the corresponding screws.
- Make sure that there is sufficient space for servicing and maintenance purposes.
- Ensure that there are no refrigerant leaks.
- Confirm that the electrical power source agrees with the unit nameplate rating, wiring diagram and other documentation for the unit.
- Ensure that the power supply corresponds to the applicable standards.
- Make sure that compressors float freely on the mounting springs. ±

Description of unit protection devices

The unit includes the following protection devices.

- Internal compressor protection.
- Fan motor internal thermal protection.
- Main switch. (Only for size 019)
- Anti-short-cycle protection.
- Thermomagnetic control switch
- Fan circuit breaker, heaters and compressor.
- Defrost thermostat.
- Fault detector for the temperature and pressure sensors.
- High pressurestat: this protects the unit against excessive condensing pressure.
The high pressurestat has factory-fixed non-adjustable settings. The appliance stops due to the intervention of the high pressure alarm threshold, before the high pressurestat intervenes.
This function is performed by the electronic control device via a pressure transducer.
- Low pressurestat: this function is performed by the electronic control device via a pressure transducer.

Table III: Pressure switch settings

	Cut Out [bar]	Reset
High Pressure state	31.3 ± 0.7	Manual

WARNING: Alteration of factory settings other than the design set-point, without manufacturer's authorisation, may void the warranty. In case of use other than the manufacturer configuration, Carrier Service must be asked for permission to change the Pro-Dialog + system configuration.

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Operating limits

These units have been designed to operate within the following limits:

61AF		Minimum	Maximum
Plate heat Exchanger			
Entering water temperature at start-up	°C	8	57
Leaving water temperature during operation	°C	30	65
Entering/leaving water temperature difference	K	3	10
Coil			
Entering air temperature*	°C	-20	40

* 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

Note: Do not exceed the maximum operating temperature.

Minimum and maximum water flow rates in the plate heat exchangers

Plate heat exchanger water flow rate

61AF	Flow rate, [l/s]	
	Minimum	Maximum*
014-7	0,2	1,1
014-9	0,2	1,1
019-9	0,3	1,6

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

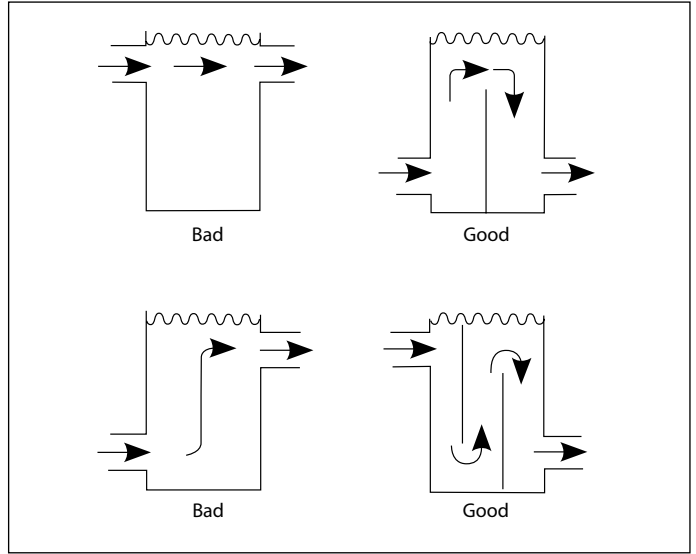
Note: For a domestic hot water application (leaving water temperature = 65°C), the water temperature difference must be at least 8 K.

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. N=5. 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.



It is often necessary to add a buffer water tank to the circuit in order to achieve the required volume.

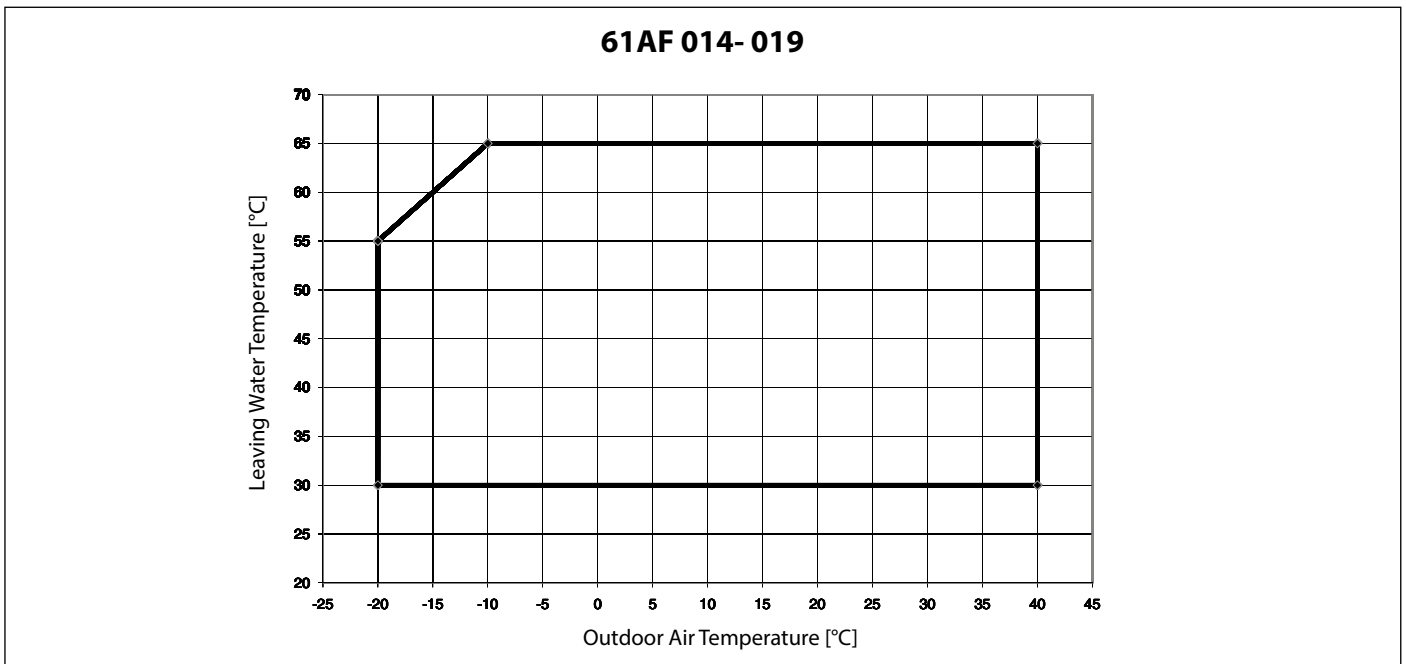
Expansion tank volume

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

The table below gives the Expansion 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
10% ethylene glycol	3
20% ethylene glycol	3,5
30% ethylene glycol	3,8
40% ethylene glycol	4,2

Operating range



General maintenance

ATTENTION: Before starting any servicing or maintenance operation on the unit, make sure that the power supply has been disconnected. A current discharge could cause personal injury.

In order to obtain maximum performance from the unit special attention should be paid to the following points.

- Electrical connections:

The supply voltage should be within the limits indicated in Table II. Ensure that no faulty contacts exist in the terminal blocks, contactor boards, etc.

Make sure that all the electrical connections are properly tightened, and that all the electrical components (contactors, relays, etc) are firmly secured to the corresponding rails. Pay special attention to the condition of the connecting cables between the control elements and the electrical box, and to that of the unit power supply cable. They should not be twisted and there should be no slits or notches in the insulation. Check that the starting and running consumptions are within the limits specified in Table II.

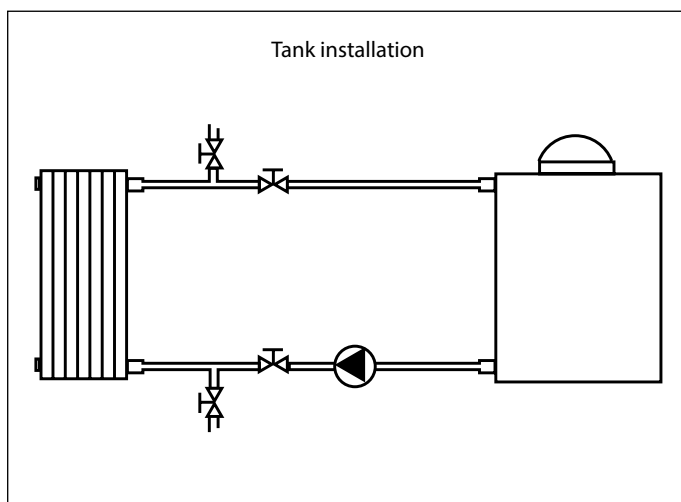
- Water connections:

Make sure there are no water leaks from the system. Should the unit be shutdown for long periods, open the drain valve installed on the hydronic module and partially drain the pump and the water pipes as well as the drain valve on the plate-type exchanger, which must be installed on the hydraulic circuit. This operation is essential if temperatures are expected to drop below freezing. If the unit is not drained, the main switch should remain connected so that the defrost thermostat can operate. Carefully clean the system water filter.

- Plate heat exchanger cleaning:

In some applications, for example when very hard water is used, there is an increased tendency for fouling. In these cases the installation of a descaling filter is recommended. The heat exchanger can always be cleaned by circulating a cleaning fluid.

A weak acid solution should be used (5% phosphoric acid or, if frequently cleaned 5% oxalic acid), and the cleaning fluid should be pumped through the exchanger. The tank installation can be permanent or, alternatively, the connections can be prepared and, at any given time, a portable cleaning device can be connected. To achieve optimum cleaning the acid solution should be circulated at a minimum of 1.5 times the normal operational flow speed, and preferably in reverse direction. The installation should then be flushed with large amounts of water to totally remove the acid before the system is started up.



Cleaning should be done at regular intervals and should never be left until the unit has become blocked. The time intervals between cleaning depend on the quality of the water used, but as a general rule it is advisable to clean it at least once a year.

- Refrigerant circuit:

Ensure that there is no leakage of refrigerant or oil from the compressor. Check that the high and low side operating pressures are normal. Check the cleanliness of the refrigerant-water heat exchangers by checking the pressure drop across them.

- Controls:

Check the operation of all the electrical components, the high pressurestat and of the high and low pressure transducers and the water, air and defrost temperature detector.

Maintenance

Servicing recommendations

- Maintenance of the unit must be carried out by skilled personnel only. Nevertheless, the easiest operations, such as cleaning of the battery and the unit external parts can be carried out by non-skilled personnel.
- For any operation on the unit follow thoroughly the instructions shown in the manual and on the unit labels as well as the Safety Standards. Always wear the protective gloves and safety glasses. Pay attention to burns when brazing.
- Use only Carrier Original Spare Parts when repair is required. Always make sure the spare parts are installed correctly. Always install the spare parts in the original position.
- Before replacing any of the elements in the refrigerating circuit, ensure that the entire refrigerant charge is removed from both the high and low pressure sides of the unit.
- The control elements of the refrigerating system are highly sensitive. If they need to be replaced, care should be taken not to overheat them with blowlamps whilst soldering. A damp cloth should be wrapped around the component to be soldered, and the flame directed away from the component body.
- Silver alloy soldering rods should always be used.
- If the total unit gas charge has to be replaced, the quantity should be as given on the nameplate and the unit should be properly evacuated beforehand.
- During unit operation all panels should be in place, including the electrical box access panel.
- If it is necessary to cut the lines of the refrigerant circuit, tube cutters should always be used and never tools which produce burrs. All refrigerant circuit tubing should be of copper, specially made for refrigeration purposes.

Final recommendations

The unit you have purchased has undergone strict quality control procedures before leaving the factory. All components, including the control systems and electrical equipment, etc., are certified by our Quality Control Department, and tested under the harshest possible operating conditions in our laboratories. However, after leaving the factory, it is possible that one or more of these elements may be damaged due to causes beyond our control. In such an event, **the user should not work on any of the internal components, or subject the unit to operating conditions which are not specified in this manual**, since serious damage may result and the guarantee would be invalidated. Repair and maintenance work should always be left to the installer. All recommendations concerning unit installation are intended as a guideline. The installer should carry out the installation according to the design conditions and should comply with all applicable regulations for air conditioning and refrigeration installations.

NOTE: The manufacturer does not accept responsibility for any malfunctions resulting from misuse of the equipment.

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Troubleshooting

A list of possible faults, as well as the probable cause and suggested solutions is shown as follows. In the event of a unit malfunction it is recommended to disconnect the power supply and ascertain the cause.

SYMPTOMS	CAUSE	REMEDY
Unit does not start:	No power supply;	CONNECT POWER SUPPLY.
	Main switch open;	CLOSE SWITCH.
	Low line voltage;	CHECK VOLTAGE AND REMEDY THE DEFICIENCY.
	A protection has tripped;	RESET.
	Contactors stuck open;	CHECK AND IF NECESSARY REPLACE CONTACTOR.
	Loose electrical connections;	CHECK CONNECTIONS.
Unit runs continuously or starts and stops frequently:	Defective compressor contactor;	CHECK AND IF NECESSARY REPLACE CONTACTOR.
	Refrigerant losses;	CHECK AND ADD THE NECESSARY QUANTITY.
	Total water flow too low;	CHECK FOR PRESSURE DROP IN THE HYDRAULIC CIRCUIT.
	Static pressure in the hydraulic circuit too low;	CHECK IT ON THE PRESSURE GAUGE AND RESTORE IT IF NECESSARY.
Unit continuously cuts out at low pressure:	Refrigerant losses;	CHECK AND ADD THE NECESSARY QUANTITY.
	Low water flow in the exchanger;	CHECK WATER PUMP.
	Unit start-up delay;	WAIT UNTIL THE SYSTEM HAS STABILISED
Unit continuously cuts out at high pressure:	Defective high pressurestat;	CHECK AND IF NECESSARY REPLACE PRESSURESTAT
	Blocked expansion valve;	CHECK AND REPLACE IF NECESSARY
	Blocked filter drier;	CHECK AND IF NECESSARY REPLACE FILTER
	The outdoor fan/s does/do not work;	CHECK THE CONDITION OF THE FAN MOTOR/S AND ITS/ THEIR ELECTRICAL CONNECTIONS
	Obstructed or dirty battery;	REMOVE THE OBSTRUCTION OR CLEAN THE BATTERY
Abnormal system noise:	Piping vibration;	SUPPORT PIPING
	Noisy compressor;	CHECK AND CHANGE IF NECESSARY
	Hissing expansion valve;	CHECK AND ADD REFRIGERANT IF NECESSARY
	Badly fitting panels;	INSTALL CORRECTLY.
Compressor loses oil:	Leaking refrigeration circuit;	REPAIR LEAK.
Water loss:	Defective entering or leaving connections;	CHECK AND TIGHTEN IF NECESSARY
The unit does not defrost:	Four-way reversing valve faulty;	CHECK AND REPLACE THE VALVE IF NECESSARY.
	Defrost sensor broken;	CHECK AND REPLACE THE SENSOR IF NECESSARY.



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