Epsilon Echos series

EN

Installation, use and maintenance manual

26-10-2016

BlueBox

THANK YOU

Thank you for choosing our product.

It is the result of many years' experience and careful design and has been built with first-class quality materials and advanced technologies.

The CE marking also guarantees that the equipment meets the requirements of the European Machinery Safety Directive.

The quality level is constantly monitored, and therefore our products are synonymous with Safety, Quality and Reliability.

Changes considered necessary for product improvement may be made to the stated data at any time without any obligation to give prior notice.

Thank you again

Read this manual carefully before installing, testing or starting this unit.

Give this manual and all complementary documentation to the operator of the system who will be responsible for keeping them so they are always available if needed.

The images and drawings contained herein are examples only.

Contents

1 INTRODUCTION

1.1 Conformity

With regard to relevant regulations and directives, see the declaration of conformity that is an integral part of the manual.

1.2 Description

1.2.1 Symbols

A description of the main symbols used in this manual and on the labels affixed to the unit is given below.

Danger symbol; take extreme care.

Danger symbol; moving mechanical parts.

Danger symbol; live parts.

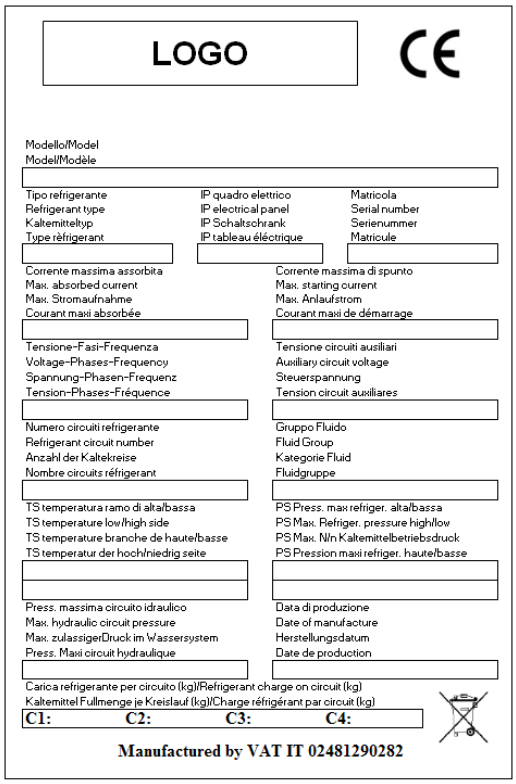
Warning symbol; important information

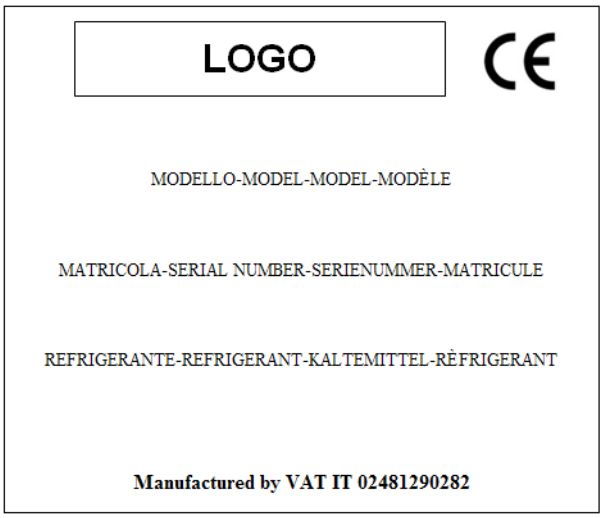
Note symbol; suggestions and advice

1.2.2 Labels

For the constructional features, available models and technical data, please refer to the Technical Booklet.

The model, serial number, features, power supply voltage and so on are shown on the labels affixed to the unit (the following illustrations are shown only as an example).





The Manufacturer adopts a continuous development policy and, in this perspective, reserves the right to make changes and improvements to the documentation and to the units without prior notice.

The technical booklet, the labels placed directly on the unit and the various diagrams referred to below, must be considered an integral part of this manual.

Do not remove or alter the labels placed on the unit.

2 SAFETY

2.1 General safety precautions

The equipment operator is responsible for complying with regulatory obligations.

The equipment operator is the person who has actual control over the technical operation and free access, which means the possibility of monitoring its components and their operation and the possibility of granting access to third parties.

The equipment operator has the power (including financial power) to decide on technical modifications, checks and repairs.

The equipment operator may give instructions to employees or to external companies for carrying out maintenance and repair operations.

Only an authorised operator should be able to access the unit.

Installation and maintenance or repair of the unit must be carried out by personnel and companies holding a certificate issued by a certification body designated by a member state that certifies the requirements contained in Commission Regulation (EC) No. 517/2014.

The internal danger zone can be accessed by removing the protective devices and entering the unit.

On no account must unqualified personnel be allowed to enter the unit and no one should be allowed to enter before the power to it has been turned off.

The user can interact with the unit only through the control and external OK signals.

Only authorised knowledgeable personnel may access the unit in compliance with safety in the workplace regulations. Council Directive 89/391/EEC, of 12 June 1989, on the introduction of measures to encourage improvements in the health and safety of workers at work.

Also, knowledge and understanding of the manual are indispensable for reducing risks and for improving the health and safety of workers.

The operator who enters the unit must have sufficient knowledge to perform the various activities throughout the technical life of the machine.

The operator must know what to do when faced with possible anomalies, malfunctions or conditions of danger to himself or others, and in any case, he must comply with the following instructions:

Do not do anything that goes beyond your duties and technical knowledge.

Inform the manager immediately and do not take personal initiatives.

Before carrying out any work on the unit, make sure you have turned off the power supply to it. Refer to the section on maintenance work.

In units with capacitors and/or inverters, certain components can remain live for several minutes even after having turned off the main switch.

Wait 10 minutes before working on the electrical parts of the unit.

Circuits supplied from external sources (made with orange cable) can remain live even after the power supply to the unit has been turned off.

Work on the unit only if there is sufficient lighting for the type of work to be carried out.

Failure to comply with the instructions in this manual and any modifications made to the unit without prior written consent, will immediately void the warranty.

The law regulating the use of stratospheric ozone depleting substances prohibits the release of refrigerant gases into the environment and obliges owners to recover and return them to the dealer or take them to special collection centres at the end of their operational life.

The refrigerant contained in the refrigerant circuit is included among the substances subject to special control regulations provided for by law and must therefore be disposed of as indicated above.

Particular care should be taken during maintenance operations in order to reduce refrigerant leaks as much as possible.

2.1.1 Discharge of the safety valves

If present on the refrigerant circuit, installation requirements and/or national regulations lay down that the discharge of the safety valves must be routed to the outside.

The conveying must be done with a pipe whose diameter must be at least that of the valve outlet, and the weight of the pipe must not be borne by the valve.

Always direct the discharge to areas where the jet cannot cause harm to anyone.

Risk of burns following contact with hot and cold parts.

2.2 Basic rules

All the units are designed and built in compliance with Directive 2014/68/EU of the European Parliament and of the Council of 15 May 2014 on the approximation of the laws of the Member States relating to pressure equipment.

To ensure maximum safety, in order to prevent possible risks, follow the instructions below:

- this product contains pressurised vessels, live components, moving mechanical parts and very hot and cold surfaces that, in certain situations, can pose a risk: all maintenance work must be carried out by skilled personnel equipped with the necessary qualifications in accordance with current regulations. Before carrying out any operation, make sure that the personnel in charge has full knowledge of the documentation supplied with the unit.
- always have a copy of the documentation near the unit.
- The operations indicated in this manual must be integrated with the procedures indicated in the user instruction manuals of the other systems and devices incorporated in the unit. The manuals contain all the necessary information for safely managing the devices and the possible operating modes.
- use suitable protection (gloves, hard hat, protective glasses, safety shoes, etc.) for all maintenance or control operations carried out on the unit.
- Do not wear loose clothing, ties, chains, watches, etc., which can get caught in the moving parts of the unit.
- always use tools and protective equipment in excellent condition.
- The compressors and delivery gas pipes are at high temperature. Therefore, when working in the immediate vicinity, be careful to avoid touching any components of the unit without suitable protection.
- do not work in the discharge trajectory of the safety valves.
- if the units are positioned in unprotected places which can easily be reached by unqualified persons, suitable protection devices must be installed.
- the user must consult the installation and use system manuals, incorporated and attached to this manual.
- there may be potential risks that are not obvious. Warnings and signals are therefore displayed on the unit.
- Do not remove the warnings.

It is expressly forbidden to:

- remove or disable the safety guards;
- tamper with and/or modify, even partially, the safety devices installed on the unit.

If there are alarm warnings and consequent tripping of the safety devices, the user must call in skilled maintenance technicians to fix the problem immediately.

An accident can lead to serious injury or death.

The safety devices must be tested according to the guidelines in this manual.

The manufacturer does not assume any liability for damage/injury to persons, pets or objects arising from the re-use of individual parts of the unit for functions or assembly situations different from the original ones. Tampering with/unauthorised replacement of one or more parts of the unit is prohibited.

The use of accessories, tools or consumables other than those recommended by the Manufacturer relieves the latter from civil and criminal liability.

Deactivation and scrapping of the unit must be carried out only by suitably trained and equipped personnel.

The units do not fall within the scope of Directive 2014/34/EU of the European Parliament and of the Council, of 26 February 2014, on the approximation of the laws of the Member States relating to equipment and protective systems intended for use in potentially explosive atmospheres.

2.2.1 Water flow rate at the heat exchangers

It is necessary to ensure that the water flow rate during operation is no higher than 1.5 times and no lower than 0.5 times the nominal flow rate of the unit stated in the Technical Booklet.

In any case, refer to the specific Technical Booklet for the allowed conditions for water flow in and out of the exchangers.

2.2.2 Water composition

Dissolved substances in the water can cause corrosion in the heat exchangers.

It is mandatory to make sure the parameters of the water comply with the following table:

Description	Values
Total hardness	2,0 ÷ 6,0 °f
Langelier index	- 0,4 ÷ 0,4
pH	7,5 ÷ 8,5
Electrical conductivity	10÷500 µS/cm
Organic elements	-
Hydrogen carbonate (HCO3-)	70 ÷ 300 ppm
Sulphates (SO42-)	< 50 ppm
Hydrogen carbonate / Sulphates (HCO3-/SO42-)	> 1
Chlorides (Cl-)	< 50 ppm
Nitrates (NO3-)	< 50 ppm
Hydrogen sulphide (H2S)	< 0,05 ppm
Ammonia (NH3)	< 0,05 ppm
Sulphites (SO3), free chlorine (Cl2)	< 1 ppm
Carbon dioxide (CO2)	< 5 ppm
Metal cations	< 0,2 ppm
Manganese ions (Mn++)	< 0,2 ppm
Iron ions (Fe2+, Fe3+)	< 0,2 ppm
Iron + Manganese	< 0,4 ppm
Phosphates (PO43-)	< 2 ppm
Oxygen	< 0,1 ppm

ppm = mg/l

The use of water with values above the limits stated in the table will immediately void the warranty.

It is mandatory to include a system for eliminating possible organic substances in the water that could pass through the filter and settle in the heat exchangers, which would lead to malfunctioning and/or breakage over time.

The use of water containing organic substances will immediately void the warranty.

2.2.3 Minimum water content in the system

For correct operation of the unit, it is necessary to ensure a buffering on the system such as to comply with the minimum operating time considering the greater between the minimum OFF time and the minimum ON time.

In short, these contribute to limiting the number of times the compressors are switched on per hour and to preventing undesired deviations from the set point of the delivered water temperature.

Larger amounts of water are in any case always preferable, because they allow a smaller number of starts and switch-offs of the compressors, less wear of them and an increase in the efficiency of the system as a consequence of a reduction in the number of transients. It should also be pointed out that, for air-water units working in heat pump mode, the minimum amount of water must consider the need of the unit to carry out defrosting. Having an adequate buffering volume will allow prevention of too high drifts of the delivered water temperature at the end of the defrost cycle.

The following experimental formula allows the minimum cold-side and hot-side water volume of the system to be calculated:

$$v = \frac{P_{tot}}{N} \cdot 1000 \cdot \frac{\Delta\tau}{\Delta T \cdot \rho \cdot Cp} \cdot Fm + P_{tot} \cdot K_1$$

where

v = Minimum water content of the system [l]

Ptot = Total refrigeration capacity [kW]

N = N° of capacity reduction steps

Δτ = Time interval – the greater between minimum OFF time and minimum ON time [s]

ΔT = Allowed differential on the water temperature [°C](unless specified, this is 2.5°C)

ρ = Water density 1000 [kg / m3]

Cp = Specific heat of water 4.186 [kJ / (kg°C)]

Fm = Q factor: experimental factor, different from 1 for some types of unit

K1 = Experimental multiplying constant depending on the type of compressor

With some terms grouped together, the formula can be rewritten as follows:

$$v = \frac{P_{tot}}{N} \cdot K \cdot Fm + P_{tot} \cdot K_1$$

If the carrying fluid consists of mixtures of water-glycol (ethylene or propylene), the density and specific heat values must consequently be adjusted.

For units with scroll compressor, the constants used in the formula assume the following values:

K [l/kW]	17,2
N	For units with compressor without inverter = 1
	For units with compressor with inverter = 3
Fm	1
K1	0,25

The constant K considers that the maximum between the minimum ON and OFF time is Δτ=180s.

2.2.4 Installing the flow switch

The units are sent from the factory with paddle flow switch supplied with them.

In addition to the flow switch, the "kit" supplied with the unit includes a “T” joint with female connections of the same diameter as that of the exchanger, as shown on the dimensional drawing of the unit. Installation of the flow switch is mandatory and is to be carried out by the installer.

The flow switch is complete with cable for the electrical connection and the paddle that detects water flow is already fitted.

The "T" joint must be inserted on the water pipe leaving the unit in a straight and horizontal part of the pipe away from filters, valves etc. at a distance of at least 5 times the diameter of the pipe both upstream and downstream.

The arrow on the switch must be aligned with the water flow.

The flow switch is factory calibrated for installation on a horizontal pipe.

The push rod must be in the vertical position.

The electrical connection of the flow switch should be made in the terminal board of the electrical control panel using the prepared terminals as shown in the wiring diagram.

Lock the cable in place with cable ties in the section between the flow switch and the inlet to the electrical control panel.

2.2.5 Unit operating in heat pump mode

The performance of units in heat pump operation goes down as the external air temperature falls.

The units can be equipped with anti-freeze heater for heating the exchanger.

This heater starts working with the unit off, when the temperature of the water leaving the evaporator drops below the anti-freeze calibration temperature.

2.2.6 Operation with water to the evaporator at low temperature

With temperatures below 5°C, it is mandatory to work with water and anti-freeze mixtures, and also change the safety devices (anti-freeze, etc.), which must be carried out by qualified authorised personnel or by the manufacturer.

The glycol percentage by weight is determined based on the desired temperature of the chilled water (see table).

Minimum ambient temperature or liquid outlet temperature (°C)	**0**	**-5**	**-10**	**-15**	**-20**	**-25**	**-30**	**-35**	**-40**
Freezing point (°C)	-5	-10	-15	-20	-25	-30	-35	-40	-45
Antifreeze	% by weight								
Ethylene glycol	6	22	30	36	41	46	50	53	56
Propylene glycol	15	25	33	39	44	48	51	54	57

If ambient temperatures are expected to be lower than the freezing point of water, it is essential to use anti-freeze mixtures in the above-mentioned percentages.

In the case of units with pump units applied in systems with glycol percentages above 30%, when ordering, a request must be made for a technical check for compatibility of the pumps and, if necessary, the best solution identified, which could require the use of a specific hydraulic module or the application of pumps with special electric motors.

2.2.7 Operation with water to the condenser at low temperature

The standard units are not designed to operate with water to the condenser at too low a temperature (refer to the technical booklet for the limits).

In order to operate below this limit, the unit could require structural modifications.

If required, please contact our company.

2.2.8 Condensate drain (only for heat pump units)

Some heat pump version units are equipped, at the base of each condensing/evaporating coil, with a condensate collection tank with drain holes.

If the holes are used to direct the water with pipes, they must be prevented from freezing.

Fig. 1 Position of condensate drain

2.2.9 Hydraulic connection to the heat recuperator (DC option)

The heat recuperator must be connected to a closed hydraulic circuit.

Constant renewal of water causes limescale to build up in the exchanger, which reduces its efficiency in a short time and makes it unserviceable.

All units equipped with heat recuperator have water temperature control probe on the return from the system.

The microprocessor control enables recovery when necessary, by switching the fans off and starting them again when the water has reached the desired temperature.

If an anomaly occurs at the recovery condenser, the microprocessor control will restart the fans.

It is essential for the water to come in at the connection indicated in the dimensional diagram and with the relevant plate on the unit.

A modulating three-way valve that will ensure an incoming water temperature within the operating limits stated in the technical booklet must be installed for correct operation of the unit.

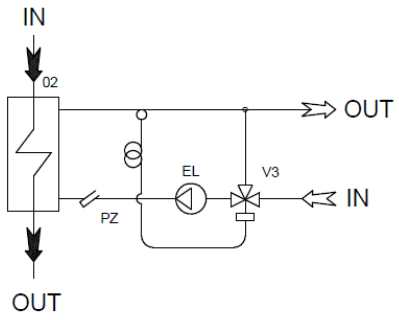


Fig. 2 3-way valve installation layout

02	Heat recuperator
EL	Motor-driven pump
V3	Thermostatic three-way valve

As an alternative to the 3-way modulating valve, it is possible to use a pressure switch valve for each refrigerant circuit that will ensure an average condensing temperature of at least 40°C.

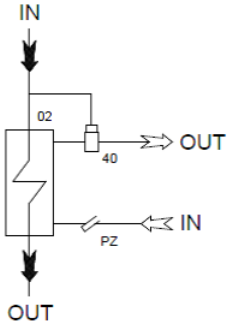


Fig. 3 Pressure switch valve installation layout

02	Heat recuperator
40	Pressure switch valve
PZ	Well for water temperature probe

To prevent malfunctioning of the unit, the temperature of the water entering the desuperheater must not be lower than the design temperature and the flow rate must not be lower than the design flow rate with reference to the values given in the Technical Booklet.

It is essential for the water to come in at the connection indicated in the dimensional diagram and with the relevant plate on the unit.

2.3 Noise

The starting of the unit, with activation of its components, emits a noise whose intensity varies depending on the operating level.

The correct location choice and the correct installation prevent the unit causing annoying noise due to resonances, reflections and vibrations.

2.4 Residual risks

The unit uses technical means suitable for protecting people, animals and things against hazards that cannot reasonably be eliminated or sufficiently reduced through design.

The presence of an operator is not required for normal operation of the unit. The change from the "OFF" state to the "ON" state, and vice versa, of the unit can be carried out remotely or through the display, without having to enter areas at risk.

Access restriction is part of correct installation to eliminate residual risks during normal operation.

Removal of the restrictions gives access to cold parts, hot parts and sharp edges.

When the electrical boxes and the electrical control panel are open, live parts can be accessed.

Do not:

- remove or disable the safety guards;
- tamper with and/or modify, even partially, the safety devices installed on the unit.

In heat pump operation, during defrost cycles, the water drips onto the ground when the frost melts off the coils.

If the water is not properly drained, when the ambient temperatures are sub-zero, dangerous sheets of ice are formed.

Limit access to the area to prevent accidents.

2.5 Safety information on the refrigerant fluid

This product contains fluorinated greenhouse gases included in the Kyoto protocol. Do not release these gases into the atmosphere.

Type of refrigerant: R410A

GWP value: 2088.

GWP is the global warming potential.

The quantity of refrigerant fluid is indicated in the unit's data label. Periodic inspections are necessary to check for refrigerant fluid leaks in accordance with local and/or European regulations.

2.5.1 Hazards and health consequences

If accidentally released, rapid evaporation of the liquid can cause freezing.

In case of contact with the liquid:

- defrost the various part with water;
- remove clothing carefully;
- rinse thoroughly with water.

Contaminated clothing and shoes should be washed before reuse.

High vapour concentrations can cause headaches, dizziness, drowsiness and nausea, and may lead to unconsciousness and cardiac arrhythmia.

If inhaled move the victim to fresh air. Artificial respiration and/or oxygen may be necessary. Call a doctor immediately.

In case of contact with eyes, remove contact lenses. Rinse immediately with plenty of water, holding the eyelids open, for at least 15 minutes.

The safety data sheet drawn up by the producer of the refrigerant can be obtained from the manufacturer of the unit.

3 RECEIVING THE PRODUCT AND STORAGE

3.1 Reception

On receiving the unit, check that it is undamaged, bearing in mind that it left the factory in perfect condition.

Report any signs of damage immediately to the transporter and make a note of these on the Delivery Sheet before signing it.

The relevant sales department or the manufacturer should be informed of the extent of the damage as soon as possible.

The Customer must draw up a written and photographic report concerning any and all significant damage.

Disposal of the packing material is the responsibility of the consignee and must be carried out in compliance with the regulations in force in the country in which it is carried out.

3.2 Transport

The unit is sent from the factory using suitable vehicles, with correct locking in order to prevent any possibility of movement whilst in transit by road that may damage it or cause accidents.

If there is to be trans-shipment to other vehicles to continue the journey, it is essential to adopt all necessary measures for ensuring the correct safety conditions, with regard to the vehicles used and the anchorage, in order to prevent damage.

If the unit is to be transported over uneven roads, the manufacturer must be informed beforehand so that suitable measures can be taken in order to prevent damage to the unit.

If it is to be transported by container, make sure it is correctly anchored.

3.3 Handling

Before each unit handling operation, check that the lifting capacity of the machinery used is compatible with the weight of the unit.

Handling must be carried out by adequately equipped qualified personnel.

In all lifting operations, make sure the unit is firmly secured in order to prevent accidental falls or overturning.

Lifting must be carried out by qualified and authorised personnel taking the necessary precautions; if carried out incorrectly, lifting can cause serious damage and physical injury.

Do not, under any circumstances, stand or pass under or near the unit when it is lifted off the ground. Use only the lifting system designed and prepared for the unit.

During unloading and positioning of the unit, great care must be taken to prevent sudden or violent manoeuvres, and the components of the unit must not be used as lifting points.

Make sure the machinery and lifting ropes are of suitable size and capacity and strictly follow their operating instructions. Use only equipment that is in excellent working order.

All work on the unit, including unpacking and connections, must be carried out with the unit resting on the ground.

Refer, in any case, to the lifting instructions provided with the unit.

The units are dispatched screwed onto pallets having anti-overturning boards. To unload them from the vehicle, use a forklift truck or a crane.

If a forklift truck is used, insert the forks under the unit on the side where the anti-overturning boards are fixed, with the forks as far apart as possible, until they protrude from the back of the base, and keep the centre of gravity of the unit centred between the forks.

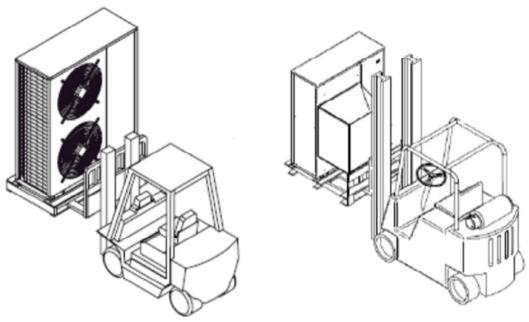


Fig. 4 Lifting with forklift truck

If you are using a crane, sling the unit with slings using suitable lifting tubes (not supplied with the unit) inserted in the slots on the base of the unit.

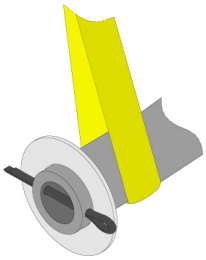


Fig. 5 Detail of hooking the sling to the lifting tube

It is mandatory to use a lifting beam adjusted to the width of the unit in order to ensure lifting stability. Also, suitable protective devices must be placed on the upper edges to prevent the slings from coming into contact with the unit. If the unit is shipped in rigid packaging, this precaution is not necessary.

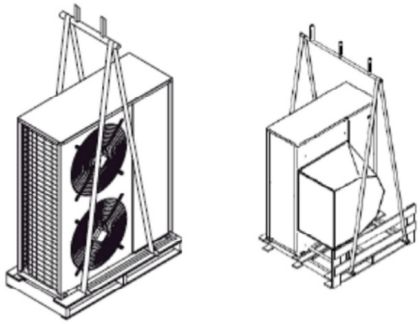


Fig. 6 Lifting with crane

If anti-vibration mounts are installed under the base of the unit, this must be done with the unit raised by no more than 200 mm from the ground and without putting any parts of the body under it.

Before sliding out the pallet, remove the screws fixing it to the unit. Use a 10 mm socket wrench to unscrew them.

Depending on the unit, the screws fixing the pallet are in different positions.

For units without tank, they are in the fixing bracket or are visible through the holes of the base.

Fig. 7 Details of positions of screws fixing to the pallet for units without tank

For units with tank, the side fasteners must be removed to reach the screws that fix the unit to the pallet.

Fig. 8 Details of positions of screws fixing to the pallet for units with tank

3.4 Storage

There are no special requirements if the unit has to be stored temporarily before installation.

Since these units are intended for outdoor installation, they withstand normal atmospheric conditions without problem.

The unit must be placed on a flat surface that is suitable for bearing its weight, in order to avoid deformation of the structure with consequent possible breakage.

4 PRODUCT DESCRIPTION

4.1 Intended use

These units are intended for cooling (unit in cooling only version) or for cooling/heating (heat pump version) of heat-carrying fluid; they are generally used in applications in the air-conditioning and refrigeration field.

Their use is recommended within the operating limits indicated in the Technical Booklet.

Use outside the operating limits stated in the Technical Booklet will cause the unit to stop.

4.2 Unintended use

The unit must not be used:

- in an explosive atmosphere;
- in a flammable atmosphere;
- in extremely dusty environments;
- in an environment that is not compatible with the stated IP protection rating;
- by untrained personnel;
- in a way that does not comply with the regulations in force;
- with incorrect installation;
- with power supply defects;
- with total or partial failure to comply with the instructions;
- with lack of maintenance and/or use of non-original spare parts;
- with inefficient safety components;
- with modifications or other work not authorised by the Manufacturer.

4.3 Control and safety devices

The unit is integrally managed by an electronic microprocessor control that, through the various temperature and pressure sensors installed in the unit, keeps its operation within the safety limits.

All the parameters involved with control of the unit are shown in the “Control Manual” that is an integral part of the documentation of the unit.

The manual fully describes the logic with which the checks of the unit take place during the various operating stages.

The devices are shown in the technical booklet.

4.4 Principles of operation

The principle of these units is based on using the characteristics of the compression refrigeration cycle (compression, condensation, throttling and evaporation).

This cycle produces the transfer of heat from a fluid at lower temperature to a fluid at higher temperature, which is the opposite of what happens naturally.

In our specific case, these units consist of a refrigerant circuit that cools the water of a hydraulic circuit inside a heat exchanger (“evaporator”) and rejects the heat through an air heat exchanger (“condenser”). This happens in units intended for operation in cooling mode.

In units in heat pump operation, where hot water is produced, there is cycle reversal that reverses the function of the two heat exchangers so that the water heat exchanger becomes the condenser and the air heat exchanger becomes the evaporator.

4.5 Structure

The structure is made of galvanized sheet-iron coated with polyester powder, which makes it highly resistant to weather conditions. All screws and bolts are stainless steel.

The panels can be removed easily to allow full access to internal components.

4.6 Specifications

Air-condensed water chiller unit with “scroll” o “rotary” compressors, directly coupled axial or radial fans and dry-expansion plate evaporators.

4.7 Control panels

This line of units can be managed with two electronic microprocessor controls: one parametric and the other programmable.

The next sections describe the basic operations for both controls, such as starting and stopping the unit, changing the operating mode from cooling to heating and vice versa (in units with heat pump), and changing the set point.

For the other operations, refer to the manual of the control that is an integral part of the documentation of the unit.

4.7.1 Parametric control

The following instructions are for the main screen of the control, which is displayed in normal operating conditions.

Fig. 9 Display of the parametric control

4.7.1.1 Switching the unit on/off

Normally, the units are shipped with standard programming for switching on and off from the keypad. The following instructions refer to this configuration.

To start the unit in cooling mode from the keypad, press and hold down the following button for 5 seconds: .

Units that can also operate in heating mode may be started in cooling mode as described above, or in heating mode by pressing and holding down the following button for 5 seconds: .

To switch off the unit from the keypad, press the button with the same symbol present on the display and hold it down for 5 seconds.

If you want to use the digital input for switching the unit on/off, the function must be enabled on the controller.

For management of unit switch on/off from digital input, a potential free contact must be used and connected between the terminals indicated in the wiring diagram with "IE" or "IE1".

With the input closed, the unit is switched on, and with the input open, it is stopped.

To enable the switch on/off function from digital input on the controller:

press, for 5 seconds, button **Sel** ;

select the "H" parameters using buttons or ;

confirm with button **Sel** ;

select the "H07" parameters using buttons or ;

confirm with button **Sel** ;

change the set value from "00" to "01" with buttons or ;

confirm with button **Sel** ;

return to the main screen by pressing, three times, button Prg mute .

When switching on and off from digital input is enabled, buttons e remain operational but allow the unit to be started and stopped in the respective operating mode only when the digital input is closed.

4.7.1.2 Changing the operating mode from cooling to heating and vice versa

It is possible to change the operating mode from cooling to heating and vice versa only in units that have this feature. The change can be made using the display keypad or from digital input.

Unless a specific request is made, the units are shipped programmed for changing from cooling to heating and vice versa from the keypad.

In units where the change of operation is from the keypad, the required operation is activated using the same buttons ▲ or ▼ used for switching on and switching off as described above.

If the ON/OFF function is enabled from digital input, you still use buttons ▲ e ▼ to activate or deactivate the two functionalities. In any case, to change functionality, the active one must be deactivated, going through switching off of the unit.

The change of operation from heating to cooling and vice versa from digital input, in units that have this function, is enabled from the factory only when requested.

In units where the change of operation is from digital input, when the input is closed, the unit can be started in heating mode only, or when it is open, the unit can be started in cooling mode only.

In this condition too, it is possible to use buttons ▲ e ▼ only to enable or disable the unit in the function envisaged by the digital input.

4.7.1.3 Displaying and changing the set point

With the parametric control with a single access, the set temperature set point values can be displayed and changed within factory-set limits. The sequence of operations to carry out is as follows:

- press, for 5 seconds, button **Sel** to access the parameter loop for programming;
- with pressing twice on button ▼ to reach the group of parameters "r";
- confirm with button **Sel** in order to read the current value of the set temperature set point;
- to decrease the value, use button ▼ ; to increase it, use button ▲ ;
- confirm the value by again pressing button **Sel** ;
- repeatedly press button Prg/mute to exit the group of parameters "r" and the programming loop.

For units that also provide heating, it is possible to access and change the relevant operating set point. The sequence of operations to carry out is as follows:

- repeat the procedure described for accessing and changing the cooling mode operation set point until parameter "r1" appears;
- press twice on button ▼ to make parameter "r3" appear, which corresponds to the set point for heating mode operation;
- press button **Sel** and with ▲ e ▼ to access and change it;
- to confirm the set value and exit the parameter loop, the sequence of operations to carry out is the same as the one described above regarding the cooling mode operation set point.

4.7.2 Programmable control

For some configurations and functionalities, a programmable control is used.

The figure shows the main screen.

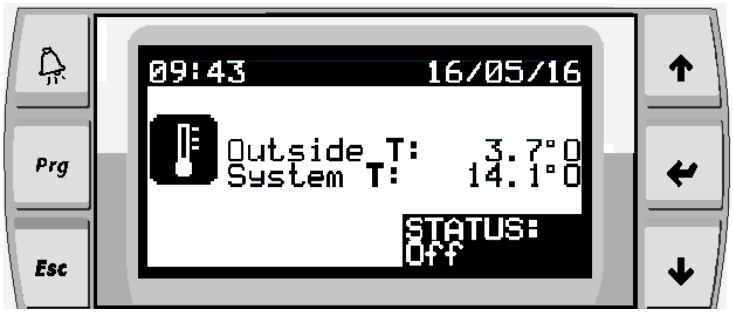


Fig. 10 Main screen

From the main screen, when you press on button Prg you will access the "Main Menu" screen.

The various branches are accessed from the "Main Menu" screen.

4.7.2.1 Switching the unit on/off

In the “Main Menu”, scroll with buttons ↑ e ↓ through the various choices until the "On/Off Unit" branch appears in "reverse video".

On confirming with button ↵ you will access the “A01” screen where the type of unit and the operating status are shown.

If the unit is switched off from digital input, the input needs to be closed to start the unit.

If the digital input is closed, when you press on button ↵ you will access the field for switching on/off.

With button ↑ or ↓ the operating status is changed.

The available choices are:

- "ON";
- “OFF”;
- “AUTO”;
- “ENERGY SAVE”.

When “ON” is selected, the unit starts;

When “OFF” is selected, the unit switches off;

When “AUTO” is selected, the controller goes automatically to “ON”;

When “ENERGY SAVE” is selected, the unit starts with the set point set for energy saving.

For further information regarding the “ENERGY SAVE” function, see the controller manual.

Pressing twice on the button Esc returns to the main screen.

4.7.2.2 Changing from cooling to heating and vice versa

It is possible to change operation from cooling to heating and vice versa only in units that have this function.

The change of operation can be done only when the unit is in “OFF” state.

The change can take place in two ways according to the request and the envisaged setting:

- from keypad and via serial;
- from digital input.

In units that have the change of operation from keypad and via serial, in the “Main Menu”, scroll with buttons ↑ or ↓ through the various choices until the "On/Off Unit" branch appears in "reverse video".

On confirming with button ↵ you will access the “A01” screen where the type of unit and the operating status are shown.

Only when the unit is in “OFF” state, when you press on button ↵ you can access the field for the change of operation.

With button ↑ or ↓ the operating status is changed.

Pressing twice on the button Esc returns to the main screen.

In units that have the change of operation from digital input, with the input closed, the unit operates in cooling mode, with the input open, the unit operates in heating mode.

If the unit is running, the change of state of the digital input causes the change of operation only after it is switched off.

4.7.2.3 Displaying and changing the operating set points

Displaying and changing the operating set point from the keypad is possible only in units that have this feature.

In units that feature the change of set point from keypad, in the “Main Menu”, scroll with buttons ↑ or ↓ through the various choices until the "Setpoint" branch appears in "reverse video".

On confirming with button ↵ you will access the “B01” screen that shows the set point for operation in cooling mode for chiller only units or both set points for heat pump units.

With the first press on button ↵ you will access the field for changing the set point regarding operation in cooling mode.

With buttons ↑ e ↓ the value of the set point can be changed within the set limits.

The change must be confirmed by pressing again on button ↵ .

For heat pump units, with a second press on button ↵ you will access the field for changing the set point regarding operation in heating mode.

As for the cooling mode set point, with buttons ↑ e ↓ you can change the value of the heating mode set point, within the set limits.

The change must be confirmed by pressing again on button ↵ .

Pressing twice on the button Esc returns to the main screen.

4.7.3 Remote terminal

The remote terminal is available as accessory.

In the case of parametric control, the remote terminal is physically different from the one on the unit but the same symbols are present on its buttons and therefore it is used in the same way as the terminal on the unit for the described functions.

In the case of programmable control, the remote terminal is the same as the one on the unit and its use is also the same.

For the connections of the remote terminal, see the wiring diagram.

4.8 Wiring diagram

The wiring diagram is an essential part of the documentation and is present inside each unit.

It is essential to refer to this document if you are unsure about anything or need further explanations regarding the auxiliary electrical connections and power connections as well as for the electrical specifications.

In particular, refer to the wiring diagram as regards the possibility of remotely managing the functionalities that contemplate this.

5 INSTALLATION

During installation or whenever work must be carried out on the unit, it is essential to strictly follow the instructions in this manual, comply with the directions on the unit and in any case take all necessary precautions.

The pressures in the refrigerant circuit and the electrical components can create risky situations during installation and maintenance work.

5.1 Dimensions and weight

In order to correctly position the unit, please refer to the dimensional drawing supplied with the order confirmation for its size and weight.

5.2 Installation site

The following should be taken into account to establish the best place to install the unit and the relevant connections:

- size and origin of the hydraulic piping;
- location of the power supply;
- accessibility for maintenance or repair operations;
- load-bearing capacity of the support surface;
- ventilation of the air-cooled condenser;
- orientation and exposure to solar radiation. Keep the condensing coil out of direct sunlight as far as possible;
- direction of prevailing winds. Do not position the unit in a such way that prevailing winds can cause air recirculation at the condensing coil;
- type of surface. Do not position the unit on dark coloured surfaces (e.g. tarred surfaces) so as to avoid overtemperatures during use;
- possible reflections, resonances and acoustic interactions with elements outside the unit.

It is obligatory to observe the clearances specified in the dimensional diagram of the unit.

If the unit is installed in particularly windy areas, windbreaks must be installed to prevent malfunctioning of the unit.

During the defrost cycle, units in heat pump operation allow water to flow out that freezes with sub-zero temperatures. Although the unit is installed perfectly horizontal, make slopes in the support surface to direct the defrost water into drains, wells or in any case to places where there is no danger of accident.

In areas where there are heavy snowfalls, the place of installation must be chosen so that the snow cannot in any way interfere with the operation of the unit:

- build a wide canopy;
- build a base;
- install the unit in a fairly high position off the ground so that it will not be covered with snow.

To make installation easier, the "Snow cover kit" accessory and the "Base frame (H=500 mm) with rubber anti-vibration mounts" accessory are available in the catalogue.

The “Snow cover kit” accessory is not available for all sizes. Contact our sales department about availability of the accessory for the size you are interested in.

5.3 Installation

The units are sent from the factory already tested and they need only the electrical and hydraulic connections for installation, except the "LE" (motocondensing) versions and the "LE/HP" (reversible motocondensing) versions for which the refrigerant connections with the remote exchanger must also be made.

5.3.1 External positioning

A solid base on which to position the unit must be created.

This base must be perfectly flat and horizontal. Its dimensions must be adequate for those of the unit.

The slab must be:

- made in a suitable foundation about 15-20 cm higher than the surrounding ground;
- flat, horizontal and able to bear at least 4 times the operating weight of the unit;
- at least 30 cm longer and wider than the unit.

Although the units transmit low levels of vibration to the ground, it is advisable to lay a strip of hard rubber between the base frame and the support surface.

If better isolation is required, it is advisable to use the anti-vibration mounts that are available as accessories.

In the event of installation on roofs or intermediate floors, the unit and pipes must be isolated from the walls and ceilings. The units should not be positioned near private offices, bedrooms or areas where low sound emissions are required.

It is also advisable not to install the units in narrow passages or small spaces, in order to avoid reverberations, reflections, resonances and acoustic interactions with elements outside the unit.

Units equipped with standard coils (copper-aluminium) should not be installed in an environment where there is an aggressive chemical atmosphere, in order to avoid the risk of corrosion.

Particular attention should be given to atmospheres containing sodium chloride, which worsen corrosion due to galvanic currents; a unit with untreated coils must absolutely not be installed in a marine environment.

For installations in marine environments, in the vicinity of animal farms or in heavily polluting industrial areas, it is necessary to order coils with anticorrosive surface treatments.

In any case, please contact our sales department to define the most suitable solution.

It is mandatory to anchor the unit to the ground.

5.3.2 Positioning of unit with radial fans

After anchoring the unit to the ground, remove the fan shroud support used for transport.

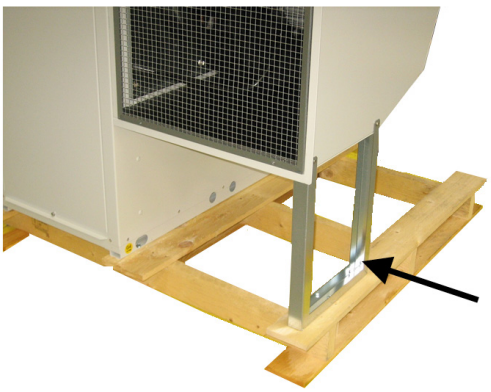


Fig. 11 Support to be removed after anchoring

5.3.3 Anti-vibration mounts

In order to reduce vibrations transmitted to the structure, it is advisable to install the unit on rubber or spring anti-vibration mounts, supplied as an accessory and to be requested when placing the order.

The dimensional diagram with footprint shows the position and load of each anti-vibration mount.

The anti-vibration mounts must be fixed on before positioning the unit on the ground.

When fixing the anti-vibration mounts, the unit should be lifted off the ground by no more than 200 mm and no parts of the body should be placed under the unit.

5.3.3.1 Rubber anti-vibration mounts

The anti-vibration mount consists of an upper metal bell in which there is a screw for fixing it to the base of the unit. The anti-vibration mount is fixed to the base through the two holes on the flange. The flange of the anti-vibration mount bears a number (45,60,70 ShA) that identifies the hardness of the rubber support.

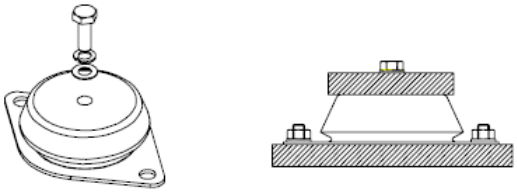


Fig. 12 Rubber/metal anti-vibration mounts

5.3.4 Noise attenuation

The units are designed and built paying particular attention to keeping down noise emission during operation.

In addition to the standard versions, there are “LN” (Low Noise) and “SLN” (Super Low Noise) versions for which further devices are used for lower noise emission.

Correct installation for both the place and the components, as shown in the relevant chapter, prevents resonances, reflections and vibrations that can be particularly bothersome.

If, after following the instructions above, further attenuation is required, the use of acoustic barriers is a valid solution.

It is essential to be careful that any work done to soundproof the unit does not affect its correct installation or its correct operation.

That is why it is necessary to avoid restricting the service spaces and installing covers that create recirculation between air supply and exhaust.

5.3.5 Minimum distances

The service spaces to comply with are shown on the dimensional drawings attached to the documentation of the unit.

It is essential to ensure an adequate volume of air on the suction side and on the delivery side of the condensing coil.

It is very important to avoid recirculation between suction and delivery, as this would lower the performance of the unit or even stop its normal operation.

The presence of very high walls near the unit will impair its correct operation.

Units should be installed a minimum of three metres apart.

It is, in any case, advisable to leave sufficient space between the units to allow removal, if necessary, of their larger components such as the exchangers, compressors or pumps.

5.4 Aeraulic connections

5.4.1 Overview

For ductable units, both the suction and the delivery of the finned coil exchanger can be ducted.

The ducting must be suitably sized so as not to generate unforeseen concentrated and/or distributed head losses that can cause drops in the handled air flow rate below the design flow rate. The head losses in the ducting must not exceed the available pressure provided by the fans (for particular applications, consult our Technical Department).

5.4.2 Ducting of high-pressure axial fans

Units equipped with high-pressure axial fans can be ducted. Check the available pressure in the technical log.

If ducting is installed, use the support present in the unit.

Fig. 13 Exploded view of the support for ducting on suction side

There is a support on the suction side and on the delivery side.

Use only the supports present on the suction side and on the delivery side.

The unit must not be drilled to connect the ducting.

5.4.3 Ducting of the radial fans and dynamic pressure

To optimize the air flow rate, which is necessary for good operation of the finned coil exchanger, it is important that, on the delivery outlet of the fan, there is ducting of the size of the fan opening and twice as long as the fan impeller.

In this way, part of the dynamic pressure generated by the fan is converted into static pressure, which is therefore made available to overcome pressure losses; otherwise this would be dissipated and effectively reduce the available pressure.

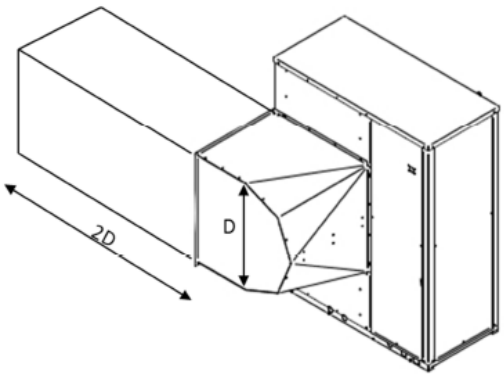


Fig. 14 Minimum ducting

Correct installation of the channels should comply with the following recommendations:

- the size of the ducting must be at least the size of the supply outlet and suction inlet on the unit. It is preferable to enlarge the ducts near the machine made in accordance with the rules of good practice;
- the ducting must be connected to the unit by interposition of an anti-vibration coupling in order to reduce transmission of vibrations from the unit to the ducting;
- always seal the joints so as to prevent air escaping from the channels;
- if the noise transmitted by the machine through the channels needs to be considerably reduced, these must be fitted with special silencers. Allow for the head losses along them when calculating the required available discharge head.

5.4.4 Changing the air flow direction

The standard direction of the air flow is horizontal. On units from size 14 to size 41, it can be changed to vertical.

This operation should be carried out by qualified and authorised personnel.

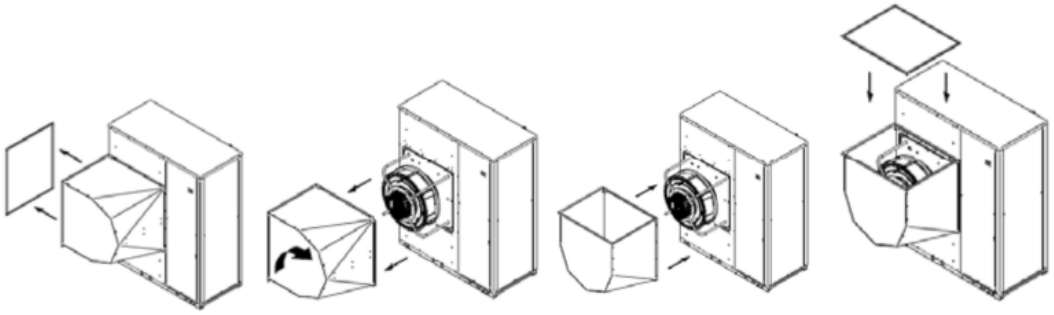


Fig. 15 Changing the air flow direction

5.5 Hydraulic connections

When preparing to connect the hydraulic circuit for the evaporator (refer to the diagrams included in the manual), it is good practice to comply with the following instructions and in any case to follow national or local regulations.

Fit the pipes to the unit using flexible couplings in order to prevent transmission of vibrations and compensate thermal expansion. (Proceed on the pumps unit in the same way).

Install the following components on the pipes:

- Temperature and pressure indicators for normal maintenance and control of the unit.
- Wells on the inlet and outlet pipes for temperature measurements, if temperature indicators are not present.
- Shut-off valves (ball gate valves) to isolate the unit from the hydraulic circuit.
- metal mesh filter with a mesh size no larger than 1 mm, situated on the exchanger inlet pipe, to protect the exchanger from slag or impurities in the pipes.
- Air valves, to be placed in the highest parts of the hydraulic circuit, to allow the non-condensable gases to be bled off.
- Expansion vessel and automatic charging valve for maintaining system pressure and to compensate thermal expansion.
- Drain valves, so that the system can be emptied for maintenance operations or seasonal stops.

It is mandatory to comply with the above requirements to facilitate the hydraulic connection operations and the maintenance operations.

The installation of a safety valve on the hydraulic circuit is strongly recommended. In the event of serious anomalies in the system or exceptional events (e.g. a fire breaks out), this will allow the system to be drained to prevent possible bursting.

If supplied with the unit, it is mandatory to install the flow switch at the chilled water outlet connection. If the flow switch is not installed, the warranty is voided immediately.

It is mandatory to fit the metal mesh filter on the water inlet pipe. If the metal filter is not fitted, the warranty is voided immediately.

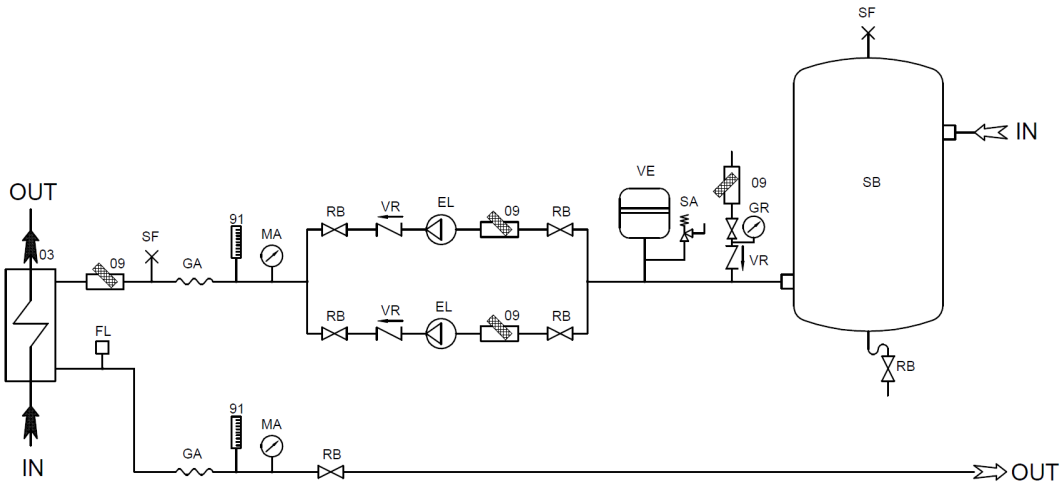


Fig. 16 Recommended hydraulic circuit

03	Evaporator
09	Water filter
91	Thermometer
EL	Motor-driven pump
FL	Flow switch
GA	Flexible coupling
GR	System filling unit
MA	Water pressure gauge
RB	Valve
SA	Safety valve
SB	Storage tank
SF	Air valve
VE	Expansion vessel
VR	Check valve

It is essential for the water to come in at the connection indicated in the dimensional diagram and with the relevant plate on the unit.

If it does not, there would be a risk of the evaporator being frozen since the antifreeze probe control would be thwarted.

The hydraulic circuit must be made in such a way as to ensure a constant flow of water to the exchanger in all operating conditions.

If this is not done, there will be a risk of refrigerant returning to the liquid state at the compressor inlet, with the danger of it breaking.

Operation with a variable water flow rate at the user-side exchanger is allowed only if the inverter pump is integrated in the unit (and therefore supplied by the manufacturer) and if the hydraulic circuit is made in accordance with the manufacturer's specific instructions.

5.6 Electrical connections

All electrical operations must be carried out by personnel having the necessary legal requirements, and trained and informed on the risks connected with these operations.

The sizing and characteristics of the power lines and relevant components must be determined by staff qualified to design electrical systems, following the international and national regulations of the place of installation of the units in conformity with the regulations in force at the time of installation.

To install components outside the unit, you must refer to the wiring diagram supplied with the unit.

The wiring diagram, along with the manuals, must be kept carefully and made available for future work on the unit.

Overview:

- The electrical connections must comply with the information shown in the wiring diagram attached to the unit and the regulations in force in the place of installation.
- grounding is required by law;
- The installer must connect the earth cable to the PE terminal on the earth bar situated in the electrical control panel.
- Make sure the power supply voltage corresponds to the rated data of the unit (voltage, number of phases, frequency) stated on the plate on the unit.
- the standard power supply voltage (see specific wiring diagram) must not fluctuate by more than ±10% and the unbalance between phases must always be less than 2%. If this does not occur, contact our technical department to choose suitable protection devices.
- Make sure the power line is correctly connected with a clockwise phase sequence.
- The control circuit power supply is taken from the power line via a transformer situated in the electrical control panel; the control circuit is protected by fuses.

To fix the power cable, use power cable fixing systems that resist tensile and torsional stresses.

The weight of the cables must not be borne by the electrical connection system.

Make sure no voltage is present before carrying out any operation on electrical parts.

The cross-section of the cable and the line protection devices must correspond to those indicated in the wiring diagram.

The connections to the electrical control panel must be made maintaining the stated IP protection rating.

If you use a residual current device to protect the power line, in units with inverter, use type "B" residual current devices.

If the circulation pump is not installed on the unit, potential free contacts are available as accessory for controlling the external pump.

If the potential free contacts for controlling the circulation pump are present, connect the pump as shown in the wiring diagram.

5.7 Refrigeration connections

For the "LE" (motocondensing) versions and the "LE/HP" (reversible motocondensing) versions, the refrigerant connections must be made between the unit and the remote exchanger.

Pay attention to the notes that differentiate the operations to be carried out between the ranges with and without the inverter-controlled compressor.

The "LE" and "LE/HP" version units are "dry run" tested, and the refrigerant circuit is charged at the factory with a mixture of nitrogen and helium at a pressure of about 10 bar.

Check that the unit is pressurised as this will confirm that the refrigerant circuit has not been damaged in transit.

Units of the range equipped with inverter-controlled compressor are supplied with refrigerant charge in the refrigerant circuit.

The following operations require pressurised pipes and brazed connections to be made, and these must be carried out by skilled staff with the necessary qualifications in accordance with current regulations.

5.7.1 Piping implementation

In order to lay the pipes, use copper pipes, of a size suitable for the cooling capacity and the distance to be covered and of an adequate thickness for the maximum design pressure and the type of refrigerant used.

The route of the pipes must be as short and straight as possible, making sure the following basic rules are complied with:

- use the fewest number of bends possible, preferably as wide as possible;
- make a slight slope in the suction line (1%) in the horizontal sections so that the oil is carried more easily in the installations of cold only units "LE". For the installation of reversible units "LE/HP", the horizontal sections of the suction/delivery line must not slope at all;
- fit suitable syphons every 4 metres, in the vertical riser sections of the suction pipe (suction/delivery for reversible units "LE/HP");
- support the horizontal and vertical lines with suitable vibration dampers;
- insulate the suction line (suction/delivery for reversible units "LE/HP") with insulating material that is at least 9 mm thick;
- solder the joints, avoiding butt welds by using sleeves or enlarging the tubes;
- adequately protect the various components such as valves or taps fitted nearby, e.g. by wrapping them with wet rags, during braze-welding;
- once the junctions have been completed, blow-clean the tubes to remove any dirt;
- press the plant to search for any leaks.

The maximum height difference between the unit and the remote exchanger is 15 equivalent metres for any type of installation.

The recommended diameters for equivalent lengths up to 30 m are given below.

Recommended diameters for R410A - The thickness of the pipe must be compatible with the refrigerant used and with current regulations.

Model	Equivalent length 10 m		Equivalent length 20 m		Equivalent length 30 m	
	Gas	Liquid	Gas	Liquid	Gas	Liquid
6	18	12	18	12	18	12
8	18	12	18	12	18	16
10	18	12	22	16	22	16
14	22	16	22	16	28	16
16	22	16	28	16	28	18
18	28	16	28	18	28	18
21	28	16	28	18	28	22
25	28	18	28	18	35	22
28	28	18	35	22	35	22
31	35	18	35	22	35	22
37	35	22	35	22	35	28
41	35	22	35	22	35	28

For units of the range equipped with inverter-controlled compressor

Model	Equivalent length 10 m		Equivalent length 20 m		Equivalent length 30 m	
	Gas	Flash/Liquid	Gas	Flash/Liquid	Gas	Flash/Liquid
9	12	10	12	10	-	-
15	16	12	16	12	-	-
20	22	16	22	16	22	16
26	22	16	22	16	22	16
30	28	16	28	16	28	16

The above mentioned diameters were chosen in order to optimise the performance of the units, contemporaneously ensuring the proper operation at the permissible conditions and to contain the refrigerant charge within reasonable limits.

The diameters refer to motocondensing units and to reversible motocondensing units.

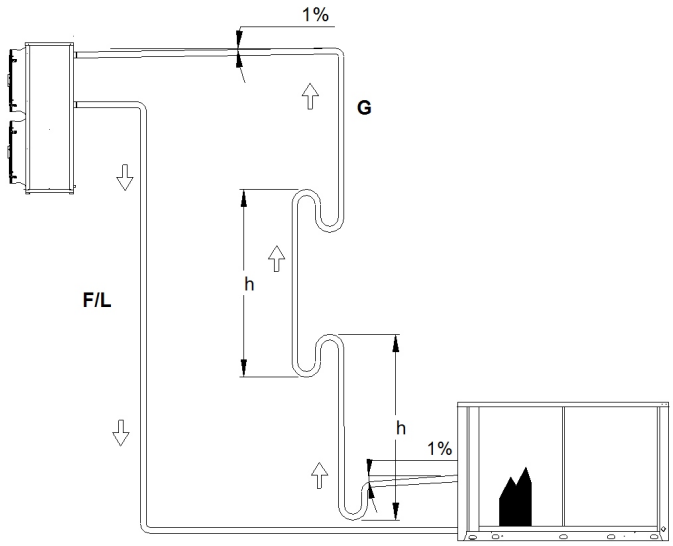
For units of the range equipped with an inverter-controlled compressor, the maximum length of the pipes is 20 metres for sizes 9 and 15, and 30 metres for sizes 20, 26 and 30.

5.7.2 LE version: unit installed at a higher level than the remote exchanger

A summary is given below of the measures to be taken if the unit is installed at a higher level than the evaporator.

There must be syphons in the vertical sections of the suction line "G" to facilitate oil return to the compressor. The height "h" must be less than 4 metres.

In the horizontal sections of the suction line "G", make a slope of at least 1% to facilitate oil return to the compressor.

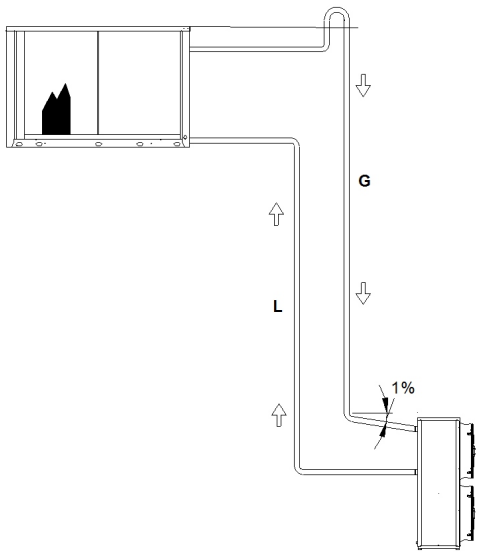


These precautions also apply to the units of the range equipped with inverter-controlled compressor.

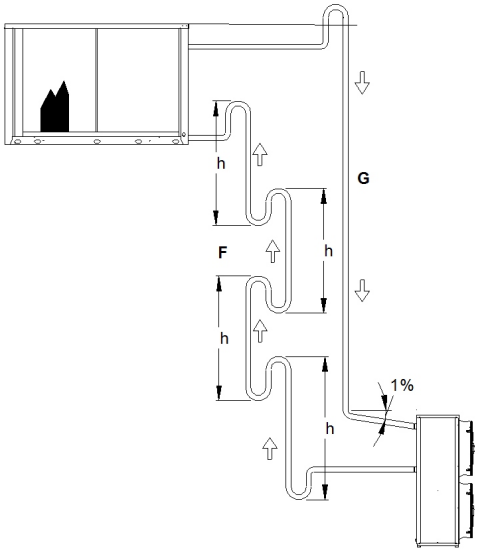
5.7.3 LE version: unit installed at a lower level than the remote exchanger

Fit a syphon on the highest suction line "G" of the evaporator in order to prevent liquid refrigerant from going towards the compressor when the unit is not running.

In the horizontal sections of the suction line "G", it is advisable to have a slope of at least 1% to facilitate oil return to the compressor.



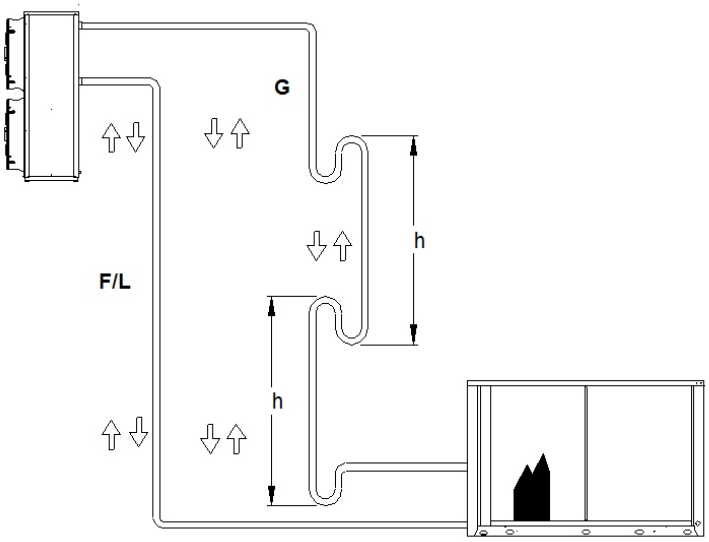
For units of the range equipped with inverter-controlled compressor
In addition to the precautions already described, there must be syphons on the vertical sections of the gas flash line "F" to facilitate oil return to the compressor. The height "h" must be less than 4 metres.



5.7.4 LE/HP version: unit installed at a higher level than the remote exchanger

There must be syphons in the vertical sections of the suction/delivery line "G" to facilitate oil return to the compressor. The height "h" must be less than 4 metres.

The horizontal sections of the suction/delivery line "G" must not slope at all.



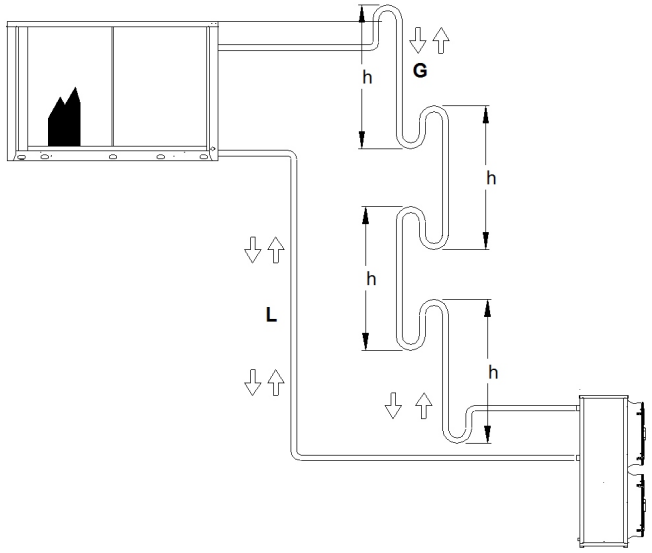
These precautions also apply to the units of the range equipped with inverter-controlled compressor.

5.7.5 LE/HP version: unit installed at a lower level than the remote exchanger

Fit a syphon on the highest suction/delivery line "G" of the evaporator in order to prevent liquid refrigerant from going towards the compressor when the unit is not running.

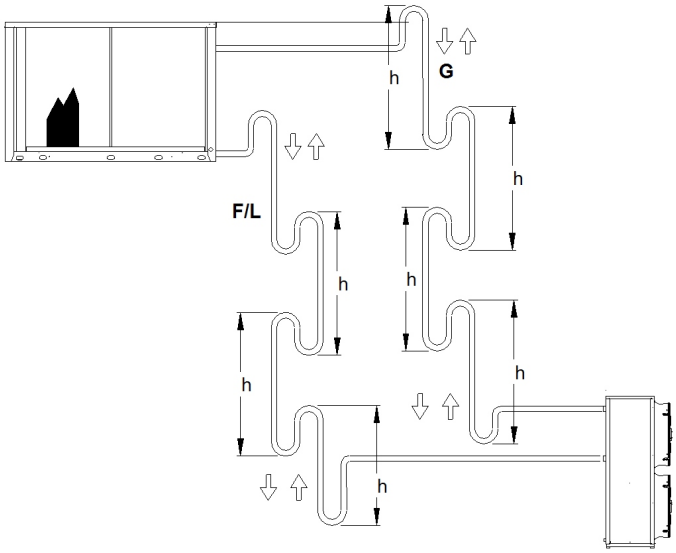
There must be syphons in the vertical sections of the suction/delivery line "G" to facilitate oil return to the compressor. The height "h" must be less than 4 metres.

The horizontal sections of the suction/delivery line "G" must not slope at all.



For units of the range equipped with inverter-controlled compressor

In addition to the precautions already described, there must be syphons on the vertical sections of the gas and liquid flash line "F/L" to facilitate oil return to the compressor. The height "h" must be less than 4 metres.



5.8 Expansion valve

The “LE“ and “LE/HP” units can have an expansion valve as accessory, to be installed by the installer, on the remote exchanger.

The supplied expansion valve is sized with reference to the envisaged operating conditions for the unit.

Carry out the installation following the documentation attached to the valve.

For units of the range equipped with inverter-controlled compressor

In units of the range equipped with inverter-controlled compressor, the electronic expansion valve is always installed on the unit at the factory.

5.9 Refrigerant connections on the remote exchanger

For motocondensing units, it is sufficient to connect the pipe of the liquid leaving the unit to the distributor of the remote exchanger and the suction pipe of the unit to the relevant manifold on the remote exchanger.

For reversible motocondensing units, the refrigerant connections differ in the number of connections of the remote exchanger and the position in which the expansion valve is installed.

For more detailed information, also refer to the refrigerant diagram of the unit.

5.9.1 Remote exchanger with two connections with expansion valve on the reversible motocondensing unit

In this case, it is sufficient to connect the pipe of the liquid leaving the unit to the distributor of the remote exchanger and the suction pipe of the unit to the relevant manifold on the remote exchanger.

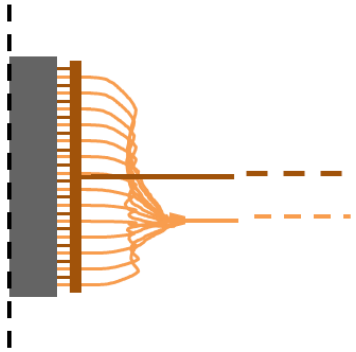


Fig. 17 Diagram of connections of remote exchanger with two connections with expansion valve on the reversible motocondensing unit

5.9.2 Remote exchanger with three connections with expansion valve on the reversible motocondensing unit

In this case, it is necessary to install a non-return valve on the exchanger liquid manifold in parallel to the distributor and join it with a “T” joint to the distributor to connect both to the liquid line coming from the unit.

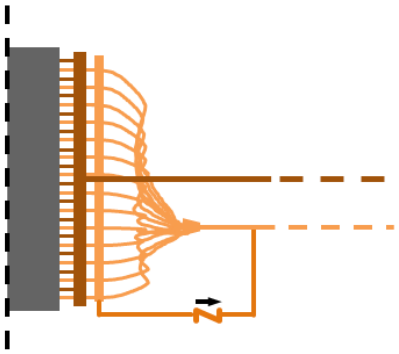


Fig. 18 Diagram of connections of remote exchanger with three connections and with expansion valve on the reversible motocondensing unit

5.9.3 Remote exchanger with two connections with expansion valve on the remote exchanger

In this case, it is necessary to install a non-return valve in parallel to the expansion valve and connect both valves with a “T” joint to the liquid line coming from the unit.

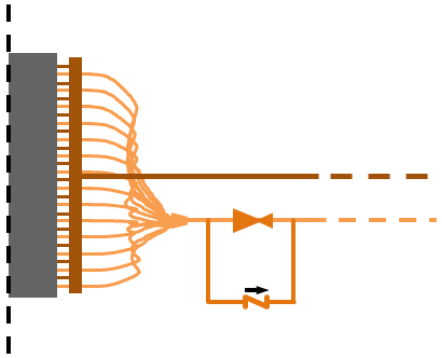


Fig. 19 Diagram of connections of remote exchanger with two connections with expansion valve on the remote exchanger

5.9.4 Remote exchanger with three connections with expansion valve on the remote exchanger

In this case, it is necessary to install a non-return valve on the exchanger liquid manifold in parallel to the distributor and to the expansion valve and join them with a “T” joint to the liquid line coming from the unit.

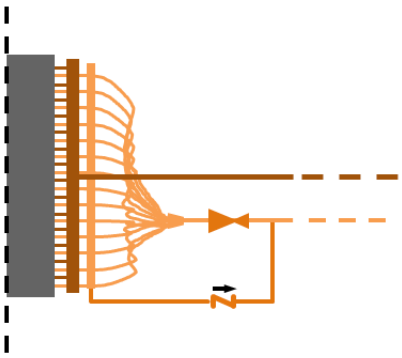


Fig. 20 Diagram of connections of remote exchanger with three connections with expansion valve on the remote exchanger

5.10 Vacuum and refrigerant charge

The emptying and charging operations are different between unit ranges charged at the factory with nitrogen and helium and the unit equipped with refrigerant charge.

Units of the range equipped with inverter-controlled compressor are supplied with refrigerant charge in the refrigerant circuit.

5.10.1 For units charged at the factory with nitrogen and helium mixture

Where present, open the valves of the unit and evacuate the pre-charge of nitrogen and helium before completing the refrigerant connections. To evacuate the pre-charge in units that do not have these valves, use the dedicated charging ports.

Do not leave the refrigerant circuit open for more than 15-30 min as the high hygroscopic nature of the oil can cause it to absorb moisture that would be detrimental to the circuit.

Carry out the vacuum of the entire system with a high vacuum pump, able to reach 0.1 mbar of residual pressure. Connect the vacuum pump to several points of the refrigerant circuit in order to ensure better evacuation.

Never use the compressor as a vacuum pump, doing so will invalidate the warranty.

Once the vacuum has been obtained, charge the system through the charging port 5/16" SAE placed on the liquid line. Perform charging in liquid form. The tables below show the estimated refrigerant charges for the units and for the connecting pipes to which will be added the charge contained in the remote exchanger.

As an indication, the charge regarding the remote exchanger can be considered by multiplying its volume by 0.15-0.20.

The final charge may differ slightly according to the necessary adjustments (see next chapters).

Estimated refrigerant charges for the unit* excluding remote exchanger and pipes

Model	Unit LE	Unit LE/HP	Unit DK-LE	Unit DK-LE/HP
	Charge (kg)	Charge (kg)	Charge (kg)	Charge (kg)
6	1,5	2,4	1,9	2,9
8	1,5	2,4	1,9	2,9
10	1,9	2,9	1,9	3,7
14	2,9	3,9	3,4	5,9
16	2,9	4,6	3,9	5,9
18	3,6	4,6	4,3	6,0
21	3,5	6,9	4,4	6,9
25	4,0	6,4	4,3	6,9
28	4,8	7,3	4,8	9,3
31	5,1	8,4	4,8	8,8
37	5,4	8,7	6,3	8,7
41	6,7	10,2	7,2	13,2

* The table shows the charges for cooling only operation (LE) with evaporation at 7.5°C and air at 35°C for reversible operation (LE/HP), under the same conditions as regards operation in cooling mode and with condensation at 40°C and air at 7°C for operation in heat pump mode.

Additional refrigerant charges R410A per linear metre of pipe

Diameter (mm)	Gas (kg/m)	Liquid (kg/m)
12	0,007	0,074
16	0,014	0,139
18	0,019	0,182
22	0,029	0,285
28	0,045	0,445
35	0,074	0,729

5.10.2 For units supplied with refrigerant charge in the refrigerant circuit

Before evacuating any refrigerant present in the pipe nipples of the connections, make sure the valves are closed.

To evacuate the refrigerant, use the charging ports present.

After removing the fasteners and making the connections of the pipes, make the vacuum of the remote exchanger and of the refrigerant connections with a high vacuum pump, capable of reaching 0.1 mbar of residual pressure. Connect the vacuum pump to several points of the refrigerant circuit in order to ensure better evacuation.

Once the vacuum has been made, open the valves and, if necessary, complete the charging of the system through the charging port 5/16” SAE situated on the liquid line. Perform charging in liquid form. The table below shows the estimated refrigerant charges for the connecting pipes to which will be added the charge contained in the remote exchanger.

The units of the range equipped with compressor with inverter are pre-charged at the factory with an R-410A refrigerant charge; this charge is calculated theoretically for a length of refrigerant lines of 10 m.

The factory charge must be adjusted during the first start-up based on the volume of the connected evaporating coil or evaporating/condensing coil and the length of the connecting lines.

The factory charge does not consider the volume of the remote exchanger because the combination is not known beforehand.

As an indication, the charge regarding the remote exchanger can be considered by multiplying its volume by 0.15.

The final charge may differ slightly according to the necessary adjustments (see next chapters).

Additional refrigerant charges R410A per linear metre of pipe

Diameter (mm)	Gas (kg/m)	Liquid (kg/m)
12	0,007	0,074
16	0,014	0,139
18	0,019	0,182
22	0,029	0,285
28	0,045	0,445
35	0,074	0,729

6 COMMISSIONING

6.1 Preliminary operations

Make sure the main disconnect switch is in the OFF position.

Before filling the hydraulic system, check that the drain valve is closed and that all the air valves are open.

Open the shut-off devices of the system and start to fill it by slowly opening the water filling valve.

When water begins to come out through the air valves, close them and continue filling until the pressure value envisaged for the system is reached.

The unit should only be started up by qualified personnel authorised by the manufacturer.

All the units are pre-charged with refrigerant gas, so the refrigerant circuit is pressurised.

Check:

- that the electrical connection has been made correctly and that all the terminals are properly tightened;
- **non tradotto**
- that the gas pressure in the refrigerant circuits is shown on the pressure gauges (if present) or on the display of the control.
- that there are no refrigerant fluid leaks, using a leak detector if necessary (the presence of oil stains may be a sign of refrigerant leaks).

Be careful with the electrical checks and use only suitable tools.

Position the master switch of the unit to ON and check on the display of the control that the unit is OFF in order to prevent it from starting.

Check that the crankcase heaters are powered correctly.

The crankcase heaters are switched on when the main disconnect switch is closed and this must be done at least 12 hours before starting the unit.

To check that the heaters are working correctly, check that the lower part of the compressors is hot and in any case at a temperature of 10 - 15 °C above ambient temperature.

Check:

- that the hydraulic connections have been made properly, according to the instructions given on the inlet / output plates and that a mechanical filter has been installed at the unit's inlet (a mandatory component, whose absence will invalidate the warranty);
- that the hydraulic system has been vented, eliminating any excess air, loading it gradually and opening the venting devices on the top;
- that the installer has organised a storage tank with the appropriate capacity for the volume of the system's water.

To avoid damage to the mechanical seals, do not start the circulation pump before completely filling the system with water.

If a pump has to be replaced, after replacing it, make sure the valves are open and the pump is full of water before enabling its operation.

6.1.1 Checking the pre-charge of the expansion vessel

The values of the pre-charge pressure and the maximum pressure at which it can operate are stated on the label present on the expansion vessel.

The pre-charge pressure of the expansion vessel must be adjusted to the hydraulic pressure at the point of installation. At the time of installing the unit, make sure the pre-charge value is equal to the hydrostatic pressure value at the point of installation increased by a precautionary pressure value (at least 0.3 bar), to ensure there are no areas under vacuum in the system.

$$pVE = 0{,}3 + \frac{Hmax}{9.81}$$

where

- pVE: new pre-charge pressure of the expansion vessel [barg]
- Hmax: difference in level between the highest point of use and the installation level of the unit [m]

If the calibration value obtained from the calculation is lower than the pre-charge value stated on the label, keep the existing pre-charge value.

The maximum value of the pre-charge pressure corresponds to the calibration pressure of the safety valve.

The checking of the pre-charge must be done for each installed vessel

6.1.2 Checking the volume of the expansion vessel

As the pre-charge pressure increases, the maximum volume of the system supported by the expansion vessel supplied as standard, decreases.

$$VI = VVE\ /Ce \cdot \left[1 - \frac{1 + pVE}{1 + pVS}\right]$$

where

- VI: volume of the system supported by the expansion vessel [l]
- VVE: volume of the expansion vessel [l]
- Ce: expansion coefficient of water
- pVE: pre-charge pressure of the expansion vessel [barg]
- pVS: calibration pressure of the safety valve [barg]

If the actual volume of the system is higher than this maximum value, an additional expansion vessel of adequate volume must be installed.

After filling the hydraulic circuit, the pressure at the expansion vessel must be just a little higher than the pre-charge pressure.

If there are points of use placed at levels lower than the level at which the unit is installed, check that the point of use is able to withstand the maximum pressure that can be generated.

6.1.3 Preliminary instructions for units with remote exchanger

In addition to the previous general checks, the units with remote exchanger require further investigation:

- check the correct connection of the environment control to the terminals as in the wiring diagram;
- make sure there is an air flow control switch in the remote exchanger (in the case of units with several remote exchangers, a flow control switch must be installed for each one);
- make sure the fans are turning the right way;
- follow the instructions given in the documentation for the remote exchanger.

6.2 First starting

When the unit is started for the first time, some important tests and checks must be done.

6.2.1 Hydraulic tests

So that the unit can operate, the external OK signal device must be closed (refer to the wiring diagram provided with the unit).

The external OK signal device must be short-circuited if not needed for system requirements.

Water circulation can be managed by the control of the unit or by a control outside the unit.

If water circulation is controlled by an external control, the pump must be started before the unit starts and stopped after the unit stops.

We advise an advance on starting and a delay on stopping of at least 5 minutes.

Start the unit by acting on the user interface of the control.

Check that the water flow switch/differential pressure switch is working correctly by closing the shut-off valve at the outlet of the unit; this should cause the alarm to be displayed on the user interface of the unit.

If not, restore correct operation.

Reopen the valve, reset the alarm and restart the unit.

For units equipped with pump, if the pump is noisy and it is not possible to adjust the pressure by acting on its control, close the delivery valve until normal operation has been restored. This can occur when the head loss of the system differs considerably from the discharge head of the pump.

For pumps/circulators that include delivery pressure adjustment, work on the adjustment as described in the next chapters.

If there is a water leak on first start-up, it could be a problem with bedding in of the mechanical seal. We therefore advise pressurizing the pump body 2 or 3 times by closing and opening the delivery valve so as to correctly bed in the seal.

If this operation does not solve the problem, contact the technical support department.

6.2.2 Functional tests

With the starting of the unit, a few seconds after the starting of the pump, if managed by the controller, the compressor will start according to the request of the thermoregulation.

After a few hours of compressor operation, check that the liquid sight glass has a green ring: if it is yellow, there is moisture in the circuit. In this case, the circuit must be dried by qualified authorised personnel.

Check that bubbles do not appear at the liquid sight glass. The continuous passage of bubbles can indicate there is insufficient refrigerant and it needs to be topped up. In this case, check that the subcooling value is at least 5°C. But the presence of a few bubbles is allowed during transients.

The end user is required to keep a register of the unit (not supplied), which will allow a record to be kept of the work carried out on the unit. This will make it easier to appropriately organize the work to facilitate the checks and the prevention of malfunctions.

State the following in the register: the type of refrigerant, the date and type of work done (routine maintenance or repair), description of the work with any parts replaced, measures implemented, the operator who carried out the work and his qualification.

6.2.3 Adjustment of the inverter of the user-side pump

Some sizes and set-ups include the presence of a circulator or pump with variable flow rate.

In both cases, the adjustment is carried out with constant head as the flow rate changes.

The head adjustment done on the circulators or pumps present on the unit is suitable only for adapting it to the actual request of the system as more efficient alternative to the adjustment done by means of valves.

This solution is not suitable for correct operation of the unit on systems with variable flow rate.

The circulator or the pump is set at the factory to the maximum head.

The head setting operation should be carried out only by authorised personnel.

The setting of an incorrect head value can cause malfunctioning and breakage of the unit and the system.

6.2.3.1 Adjustment of the head of the circulator

The circulator with variable flow rate regulates the head so as to keep it constant at the set value as the flow rate changes, within the operating limits of the circulator.

Two sets of circulators will be used that differ basically due to the presence of a LED indicator.

For both, the head can be set by operating the control situated on the electric motor of the circulator.

Circulator without LED indicator

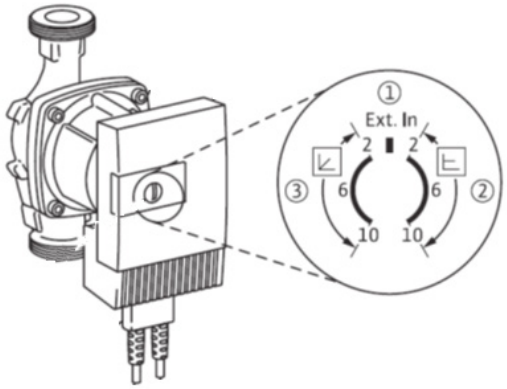


Fig. 21 Adjustment of the circulator without LED indicator

To adjust the head, with a flat screwdriver, turn the red wheel to set the required head in just the right-side section, indicated in area "2" of the figure.

The adjustment can range from the minimum value corresponding to 2 in the scale to the maximum value corresponding to 10 in the scale.

The setting of an incorrect head value can cause malfunctioning and breakage of the machine and the system.

The central position corresponding to area 1 of the image stops the circulator.

The left-side section indicated in area 3 of the image adjusts the circulator with variable head based on the flow rate. Do not use this adjustment because it could cause malfunctioning of the unit.

Circulator with LED indicator

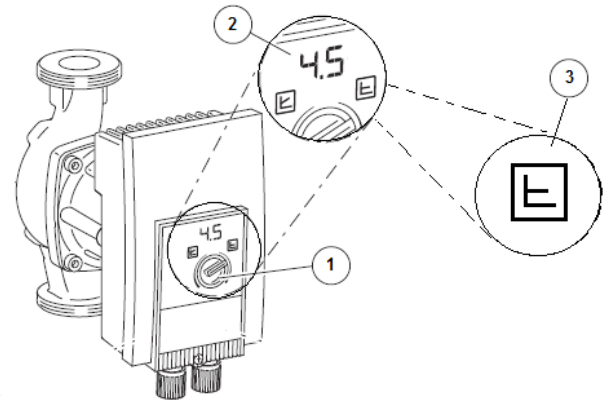


Fig. 22 Adjustment of the circulator with LED indicator

With reference to the figure, to adjust the head, turn the control button "1", in the right-side section indicated by the symbol "3", until the value of the required head is obtained in the LED indicator "2".

The LED indicator shows the head value set for the circulator, expressed in metres.

The adjustment can range from the minimum value to the maximum value with increments of 0.5 m (up to the rated head of 10 m) or in increments of 1 m (> 10 m of rated head). Intermediate increment values are possible but these are not displayed.

The left-side section of the control button adjusts the circulator with variable head based on the flow rate whereas the central part adjusts the circulator with 3 constant speeds. Do not use these adjustments because they could cause malfunctioning of the unit.

6.2.3.2 Adjustment of the head of the pump

The pump with variable flow rate regulates the head so as to keep it constant at the set value as the flow rate changes, within the operating limits of the pump.

The head can be set by turning, with a screwdriver, the regulating screw situated on the electric motor of the pump.

The adjusting screw has a limited travel, less than one turn, between the minimum value (0 bar) and the maximum value (10 bar).

Do not force the adjusting screw beyond the limits because this could damage it.

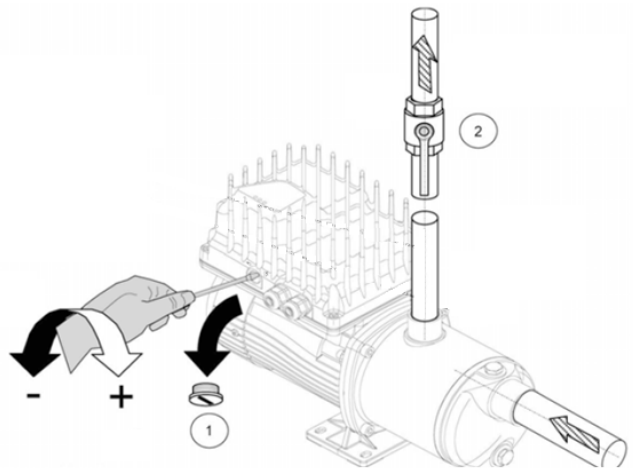


Fig. 23 Adjustment of the pump

To reduce the factory-set head value:

- check that the system is under pressure, and close the valve downstream of the unit;
- supply power to the pump making sure the compressor does not start. After starting, the pump will stop at the set pressure value;
- remove the protective cap indicated with "1" in the image;
- slightly open the valve downstream of the pump until the pump starts;
- using a screwdriver, turn the adjusting screw anticlockwise slowly while reading the pressure value upstream of the valve until the pressure gauge needle reaches the required value;
- make sure the pressure has stabilized at the required value;
- if necessary, carry out slight changes by turning the adjusting screw to the right or left.

Make sure the chosen pressure value is within the head range indicated in the rated data of the system.

6.2.4 Calibration of radial fans

The radial fans of this unit have integrated electronics that allows a wide range of pressures to be covered, by changing the number of revolutions, and allows them to be made suitable for systems with different characteristics.

The number of revolutions is adjusted, through a 0-10V signal, between a minimum and a maximum value according to the pressure of the refrigerant in the coil.

If these parameters are not set properly with regard to the head losses present in the installation, there can be excessive flow rates in the channels with consequent noise and vibration problems, especially in heat pump mode where adjustment takes place due to external air temperatures higher than a preset threshold.

To avoid these problems, we advise you to consider, together with the customer support centre, the best set point for the parameter that determines the maximum speed of the fans.

This operation should be carried out by qualified and authorised personnel.

6.2.5 Unit with remote exchanger

In addition to the general guidelines given in the previous chapter, for the first start-up of the unit with remote air heat exchanger, it is necessary to check the refrigerant charge and the oil level in the compressor.

These checks must be made with the compressor running (in the case of compressor with inverter, the capacity must be 100%), and at conditions near the design conditions.

Check that bubbles do not appear at the liquid sight glass. The continuous passage of bubbles can indicate there is insufficient refrigerant and it needs to be topped up. In this case, check that the subcooling value is at least 5°C. But the presence of a few bubbles is allowed during transients.

For LE/HP units, since the dehydrator filter installed on the unit is passed through only in chiller operating mode, it is advisable to do the first start-up in chiller operating mode.

After the unit has started and been operating for about ten minutes, check the oil level in the compressors; a top up may be necessary.

Refer to the type of oil indicated on the compressor label.

If needed, be careful to top up with the correct type of oil. Always use the oil recommended by the Manufacturer and shown on the compressor label or an exactly equivalent oil. The use of an incorrect type of oil can cause serious damage to the compressor and will immediately void any guarantee.

When topping up the oil, do not add more than 10% of the weight of the refrigerant gas present in the circuit.

If after topping up, the oil level in the compressors is still not correct, it is likely that there are oil return problems in the refrigerant circuit.

6.3 Calibration of safety components

Any work on the unit must be carried out by qualified authorised personnel. Incorrect calibration values can cause serious damage to the unit and harm people.

The control and safety equipment is calibrated and tested in the factory before the unit is shipped.

However, after the unit has been started, the safety devices must be checked (only the high and low pressure switches).

The checks must be carried out as described in the "Periodic checks" chapter.

The calibration values are shown in the table

Unit control	**Parametric**		**Programmable**		**-**
Control and safety components	Activation set point	Differential	Activation set point	Differential	Reset
High-pressure switch	37,8 barg	10,8 barg	40.5 barg	10,8 barg	Manual
Low-pressure switch	2,5 barg	1,0 barg	-	-	Automatic
High pressure safety valve (where present)	42 barg	-	45 barg	-	-

6.4 Checks during operation

With the circuit operating at 100% and stable at working conditions near the nominal ones, check:

- that the electrical absorption of the unit is close to the data shown in the wiring diagram. Considerably different values may be due to the reduced capacity operation of the unit, at working conditions very different from nominal ones, or to the malfunctioning of one or more components.
- that the difference in water temperature seen between the inlet and outlet of the unit falls within the allowed range given in the technical booklet.
- Higher values indicate that there is a reduced flow rate of water through the unit. In this case, it is necessary to check for closed or partially closed shut-off devices in the hydraulic circuit and check the characteristics of the pumps and that they are working correctly.
- Lower values indicate that the water flow rate through the unit is too high. In this case, the water flow rate through the system must be reduced by acting on the control switch (if any) of the pumps or by partially closing the shut-off device placed at the outlet of the unit.
- that the difference between the condensing temperature and the air temperature is less than 25°C;
- If it is higher, check that all the fans are turning correctly and that there are no parts obstructing the condensing coil.
- the superheating value of the suction gas. The optimal value must be between 4 and 7°C;
- the subcooling value of the liquid leaving the condenser. The optimal value must be between 5 and 10 °C.

6.5 Alarms and malfunctions

Possible malfunctions will trigger the protective devices and safety devices of the unit before serious faults occur.

All the “warnings” and “alarms” are recorded in the memory of the control and displayed on the display of the unit.

Before resetting an alarm, the cause that triggered it must be found and eliminated.

An alarm going off repeatedly quickly leads to serious damage to the unit.

Refer to the manual of the control for the alarms and warnings that appear on the display of the unit.

In case of anomalies not handled by the control panel, refer to the following troubleshooting section.

This troubleshooting section does not include causes due to deliberate work or tampering or particularly serious malfunctions, for which a thorough analysis is necessary.

SYMPTOM	LIKELY CAUSE	POSSIBLE SOLUTION
The unit does not start, the display is off.	No mains voltage.	Check that the main disconnect switch is in the “ON” position.
		Check for voltage in the power supply line.
	No voltage to the auxiliary circuit.	Check that the protective devices upline and downline of the transformer of the auxiliary circuit are undamaged.
		Reset the triggered protective device after eliminating the cause that triggered it
The unit does not start, the display is off, the control is powered correctly.	The unit is switched off from the display and the display is disconnected or not working.	Restore the connection of the display or replace it.
The unit does not start, the display is off, the control is powered correctly but the LEDs are not flashing.	The control is not working.	Replace the control.
The unit is operating normally, the display is off.	The connection of the display to the control is disconnected.	Restore the connection between the display and the control.
	The display is not working.	Replace the display.
Abnormal noises from the unit due to vibrations.	The weight of the unit is not distributed evenly on the base.	Correct the weight distribution of the unit by adjusting the height of the anti-vibration mounts.
Abnormal noises on the hydraulic pipes.	Operation of the system pump outside its performance curve with excessive water flow rate.	If it is not possible to work on the control of the pump, partially close the shut-off device on the delivery side of the unit until the nominal flow rate is restored.
	Presence of air in the system.	Check that the air valves are not shut off by valves.
		Vent the system.
Presence of oil on the discharge of the safety valve.	Opening of the valve due to failure of the protective devices to operate.	Check that the high pressure switches are working and, if necessary, replace them.
		The valve must be replaced.
	Opening of the valve due to overtemperature.	Replace the valve and restore the charge.
Water leaks from the pump on first start-up	Bedding in the mechanical seal	Pressurize the pump body 2 or 3 times by closing and opening the delivery valve so as to correctly bed in the seal.

6.6 Temporary stop

The stopping of the unit for a few hours in the day “during non-working hours” or for a few days “over the weekend” is considered temporary.

The unit must be stopped using the display of the control, the external OK signal or via serial if included.

During the temporary stop, the unit must be powered correctly.

When the circulation pump is managed by the control of the unit, if the temporary stop takes place within sub-zero air temperature and the system does not have glycol fluid, make sure water circulation is guaranteed and that no taps or valves are preventing it.

If, in the previous conditions, the circulation pump is not managed by the control, the pump must always be kept running.

When the temporary stop is carried out in this way, all that needs to be done to restart the unit is to set the control to “ON”.

6.7 Stop for long periods of time

If the unit is to remain stopped for a season or for long periods of time, it is necessary to:

- turn the unit off by means of the control switch;
- disconnect the power supply using the switch / general switch of the unit;
- drain the hydraulic system (unless it contains glycol water).

This case record can in fact be traced back to the storage condition; therefore, refer to the relevant set limits.

Repeat the start-up procedure at the next restart.

If the hydraulic system is discharged during a stop of the unit, turn off the power to prevent the pump from starting, in antifreeze function, without water being present.

7 MAINTENANCE

All the operations described in this chapter must always be carried out by qualified and authorised personnel.

Before carrying out any work on the unit or accessing internal parts, make sure you have turned off the power supply to it.

The compressors and delivery pipes are very hot. Be particularly careful when working near them.

Be particularly careful when working near the finned coils as the aluminium fins are very sharp.

Do not access moving parts without guards.

In units with capacitors and/or inverters, certain components can remain live for several minutes even after having turned off the main switch.

Wait 10 minutes before working on the electrical parts of the unit.

Circuits supplied from external sources (made with orange cable) can remain live even after the power supply to the unit has been turned off.

Work on the unit only if there is sufficient lighting for the type of work to be carried out.

7.1 Adjustments

All the parameters that control the operation of the unit can be set through the user interface of the control.

Refer to the control manual should modifications be necessary, but contact the manufacturer first.

Calibrations regarding the safety of the unit cannot be modified (safety valves, high pressure switches, fuses, etc.) or are in any case protected from tampering (calibration of thermal overload protection devices, timers, etc.).

If in any case replacement becomes necessary, it is essential to use components supplied by the manufacturer (in the case of adjustable parts) or with the same sizes and characteristics (in the case of fuses).

7.2 External cleaning

The component of the unit that needs most care is the finned pack heat exchanger.

It is essential to keep it clean and free of dirt and/or deposits that can hinder or prevent air flow.

Regular cleaning of the surface of the coil is essential for the unit to work correctly and also increases the operating life of the exchanger and the unit.

Frequent and correct cleaning of the coils contributes to considerably reducing corrosion problems.

While cleaning the finned pack heat exchanger, the electrical control panel must be closed and the main disconnect switch must be locked in the "OFF" position.

Using a jet of water on the coil while it is still dirty will cause deposits and pollutants to remain inside the exchanger, which will make cleaning even more difficult. All the dirt and deposits must therefore be removed from the surface before rinsing.

For units installed in coastal or industrial areas or in areas where there are aggressive chemicals in the air, periodic rinsing with clean water is considerably beneficial and helps counter corrosive effects.

Never clean the coils with chemicals, water containing bleach or acid or basic detergents. These detergents can be difficult to rinse off and could accelerate corrosion on the joint between pipe and fin and in areas where different materials come into contact (Cu and Al).

7.2.1 Cleaning traditional finned coils in Cu/Al

Conventional pipe-fin coils can be cleaned with a vacuum cleaner or a brush with soft, non-metallic bristles.

Always clean in the direction of the fins and never perpendicularly to them. They can easily be bent and damaged.

Clean in the opposite direction to the normal air flow.

The coil can then be rinsed using only drinking water at low pressure (3-5 barg).

Rinsing must be carried out with a low pressure jet of water to avoid damaging the fins.

Never use jets of water or high-pressure compressed air to clean the coil. The force of the jet of air or water could bend the fins, with a consequent increase in aeraulic head losses on the exchanger and lowering of the performance of the unit.

7.3 Internal cleaning

It is essential to keep the installation site clean and tidy for correct maintenance of the unit and to keep it in good working order.

7.3.1 Cleaning the unit

Keep the inside of the electrical control panel and (where present) the compressor compartment clean.

After working on the unit, always clean the electrical control panel of any work remnants and extraneous components.

Restore the safety devices and protective devices that had to be removed in order to carry out the work.

Use a vacuum cleaner to eliminate small objects, work remnants and/or any dust.

Do not use compressed air

If you have to carry out work on compressors inside the compartment, before closing it again, check that the electrical box of the compressor is closed correctly and that any refrigerant circuit valves are in the correct state, and make sure you do not leave any materials inside the compartment.

7.3.2 Cleaning the plate heat exchangers

Thanks to the generally very high level of turbulence, in plate heat exchangers, a self-cleaning effect takes place in the channels.

However, in some applications the tendency to scaling and/or the formation of deposits in the heat exchanger can be very high (e.g. use of very hard water at high temperatures).

An increase in head losses on the hydraulic circuit and a decrease in temperature difference between water inlet and outlet, are a sign that the exchanger is becoming fouled.

In such cases, the heat exchanger can always be cleaned by circulating an in-situ cleaning fluid (CIP).

When carrying out the operations described here, adopt all the technical and organisational measures provided for by workplace safety laws and regulations; use the personal protective equipment in accordance with the instructions in the safety data sheets for the chemical products used.

Also, all technical and organisational measures for waste water treatment must be applied in accordance with current environmental laws and regulations.

To reduce the extent of scaling and residues, use a 5% solution of oxalic acid $(COOH)^2$ at 20°C as washing fluid: cleaning with acid solution must be carried out for no longer than 15 minutes.

After finishing cleaning with acid detergent solutions, use a 2% solution of sodium bicarbonate ($NaHCO^3$) at 20°C to neutralise the acid solution.

The flow rate of the acid and basic solution must be at least 1.5 times the operating flow rate with reverse circulation mode. Then wash with plenty of clean soft water until all traces of acid and basic solution have been removed from the heat exchanger. Any traces of acid or basic fluids left inside the heat exchanger can cause serious damage to property and people.

If it is thought that the exchangers will need to be washed regularly, installing CIP valves in the hydraulic circuits will make this operation easier.

7.4 Periodic checks

Carry out periodic checks to make sure the unit is working correctly:

OPERATION	RECOMMENDED FREQUENCY
Check the operation of all the control and safety equipment as described previously.	Monthly
Check the tightness of the electrical terminals in the electrical control panel and in the terminal boards of the compressors. The moving and fixed contacts of the contactors must be cleaned periodically and should be replaced whenever they show signs of deterioration.	Monthly
Check the refrigerant charge through the liquid sight glass.	Monthly
Make sure there are no oil leaks from the compressor.	Monthly
Make sure there are no water or water/glycol mixture leaks in the hydraulic circuit.	Monthly
If the unit is to remain out of service for a long time, drain the water from the pipes and the heat exchanger. This operation is necessary if ambient temperatures lower than the freezing point of the fluid used are expected during the time it is to remain stopped.	Seasonal
Check the filling of the water circuit.	Monthly
Check that the differential water pressure switch, or the flow switch (where present), is working correctly.	Monthly
Check the crankcase heaters of the compressors.	Monthly
Clean the metal filters in the hydraulic pipes.	Monthly
Clean the finned coil by following the instructions in the section entitled “Recommendations for carrying out maintenance and cleaning of finned coils” according to the type of coil installed.	Monthly
If the unit also has metal filters, clean them with compressed air blown in the opposite direction to that of the air flow during operation. Use a jet of water if they are completely clogged.	Monthly
Clean the air filters	Monthly
Clean the ventilation filters of the electrical control panel.	Monthly
Carry out the defrosting test (only for heat pump units).	Monthly
Check the moisture indicator on the liquid sight glass (green = dry, yellow = wet). If the indicator is not green, as indicated on the sight glass sticker, replace the filter.	4 months
Check the condition, fixing and balance of the fans.	4 months
In units with belt and pulley driven fans, check the drive belts for wear and correct tension. To check the tension of the belts, press down perpendicularly on the belt at the central point with a force of about 5 kg. The central point of the belt should move by 10 to 12 mm; as regards wear, replace the belts if they are cracked, frayed or scuffed or have any other obvious damage.	4 months
Check that the noise emitted by the unit is normal.	4 months

This planning refers to an average installation; there could be installations in which it may be necessary to increase the frequency of some checks.

Current legislation may require considerably longer intervals on periodic checks than the recommended ones, also in reference to the safety devices installed and to the refrigerant charge present, without causing the warranty on the unit to be voided.

7.5 Unscheduled maintenance

After correctly starting-up and carrying out the relevant checks, the units normally do not need any intervention by the customer service in order to check the charge of the refrigerant gas.

7.5.1 Special work

With use of the unit, particular situations may occur that require work to be carried out promptly.

Even in an emergency, work on the unit must be carried out by skilled personnel in safe conditions.

The presence of oil on the unit, on the pipes or on parts of the unit can be a sign of gas leaks.

Repair the leakage point and restore the charge of refrigerant gas.

In the case of small oil leaks, clean the dirty parts with absorbent cloths, otherwise recover the leaked oil with absorbent sheets. In any case, the material used must be disposed of in accordance with current rules and regulations.

Check whether it is necessary to restore the oil charge.

In the case of spillage of the water and glycol mixture of the system, stop the operation of the unit and immediately stop the supply by closing the valves to isolate the leaking part.

Prepare suitable means for containing the spillage (absorbent rolls, cloths, sheets).

As far as possible, recover the liquid with a wet vacuum cleaner.

In the event of environmental damage that will require reclamation work, inform the relevant authorities.

The recovered liquid and the material used must be disposed of in accordance with current rules and regulations.

8 DECOMMISSIONING

This unit contains greenhouse refrigerant gas.

It is prohibited to release it into the air, and it is mandatory to recover it and return it to the dealer or take it to special collection centres.

The law regulating the use of greenhouse substances prohibits the release of refrigerant gases into the environment and obliges owners to recover and return them to the dealer or take them to special collection centres at the end of their operational life.

The refrigerant gas present in the unit is included among the substances subject to special control regulations provided for by law and must therefore be disposed of as indicated above.

In the compressors and in the refrigerant circuit, there is lubricating oil that should be recovered and sent to special collection centres.

Disposal of the unit should be carried out by sending it to an authorised centre in compliance with the regulations in force in the country of installation.

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Blue Box Group S.r.l.

Via Valletta, 5 - 30010
Cantarana di Cona, (VE) Italy - T. +39 0426 921111 - F. +39 0426 302222
www.blueboxcooling.com - info@swegon.it
Blue Box Group S.r.l. a socio unico - P.IVA 02481290282
Company directed and coordinated by Investment Latour (Sweden)

BlueBox
A Swegon Group company