



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.

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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).

LOGO		CE
Modello/Model Modell/Modèle		
Tipo refrigerante Refrigerant type Kältemitteltyp Type réfrigérant	IP quadro elettrico IP electrical panel IP Schaltschrank IP tableau électrique	Matricola Serial number Seriennummer Maticule
Corrente massima assorbita Max. absorbed current Max. Stromaufnahme Courant maxi absorbée		Corrente massima di spunto Max. starting current Max. Anlaufstrom Courant maxi de démarrage
Tensione-Fasi-Frequenza Voltage-Phases-Frequency Spannung-Phasen-Frequenz Tension-Phases-Fréquence		Tensione circuiti ausiliari Auxiliary circuit voltage Steuerspannung Tension circuit auxiliaires
Numero circuiti refrigerante Refrigerant circuit number Anzahl der Kältekreise Nombre circuits réfrigérant		Gruppo Fluido Fluid Group Kategorie Fluid Fluidgruppe
TS temperatura ramo di alta/bassa TS temperature low/high side TS temperature branche de haute/basse TS temperatur der hoch/niedrig seite		PS Press. max refriger. alta/bassa PS Max. Refriger. pressure high/low PS Max. N/n Kältemittelbetriebsdruck PS Pression maxi réfriger. haute/basse
Press. massima circuito idraulico Max. hydraulic circuit pressure Max. zulässiger Druck im Wasser system Press. Maxi circuit hydraulique		Data di produzione Date of manufacture Herstellungsdatum Date de production
Carica refrigerante per circuito (kg) Refrigerant charge on circuit (kg) Kältemittel Füllmenge je Kreislauf (kg) Charge réfrigérant par circuit (kg)		
C1:	C2:	C3:
Manufactured by VAT IT 02481290282		

LOGO	CE
MODELLO-MODEL-MODEL-MODÈLE	
MATICOLA-SERIAL NUMBER-SERIENNUMMER-MATRICULE	
REFRIGERANTE-REFRIGERANT-KÄLTEMITTEL-RÉFRIGÉRANT	
Manufactured by VAT IT 02481290282	



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 94/9/EC of the European Parliament and of the Council, of 23 March 1994, 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 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 (HCO ₃ ⁻)	70 ÷ 300 ppm
Sulphates (SO ₄ ²⁻)	< 50 ppm
Hydrogen carbonate / Sulphates (HCO ₃ ⁻ /SO ₄ ²⁻)	> 1
Chlorides (Cl ⁻)	< 50 ppm
Nitrates (NO ₃ ⁻)	< 50 ppm
Hydrogen sulphide (H ₂ S)	< 0,05 ppm
Ammonia (NH ₃)	< 0,05 ppm
Sulphites (SO ₃ ⁻), free chlorine (Cl ₂)	< 1 ppm
Carbon dioxide (CO ₂)	< 5 ppm
Metal cations	< 0,2 ppm
Manganese ions (Mn ⁺⁺)	< 0,2 ppm
Iron ions (Fe ²⁺ , Fe ³⁺)	< 0,2 ppm
Iron + Manganese	< 0,4 ppm
Phosphates (PO ₄ ³⁻)	< 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.

2.3 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.

2.5 Safety information on the refrigerant fluid



This chapter only applies to units equipped with a cooling circuit; It does not apply to those where there are only one or two water coils.

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.



The handling operations must be carried out slowly and sudden manoeuvres and knocks must be avoided.



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.



Be careful when handling. The centre of gravity of the unit is high.

3.3.1 Monobloc 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.

If a crane is used, employ synthetic slings to secure the pallet, or suitable lifting equipment. 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.

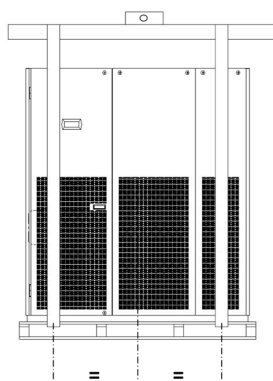


Fig. 1 Position of the slings

Pallet trucks or forklift trucks with short forks can be used (e.g. piano lifts) for handling inside buildings.



The unit should be lifted as little as possible when handling in order to avoid overturning risks.

If forklift trucks with short forks are used, position some protective material between the unit and the forklift trucks and the clamping belts.



Fig. 2 Pallet trucks and forklift trucks with short forks



At least two people must be present while the unit is being handled with forklift trucks with short forks.

Before sliding out the pallet, remove the screws fixing it to the unit. Use a 13 mm spanner to unscrew them.

The screws which fix the pallet to the unit are located in correspondence with the holes on the pallet's bottom axis.



Fig. 3 Position of fixing screws

To remove the fork lift trucks:

- lowering the forklift trucks as much as possible;
- remove the belts securing the trucks to the unit;
- Use a crowbar or a similar device to lift the unit enough to allow the removal of the trucks from each side;
- Remove the protective devices from the unit.

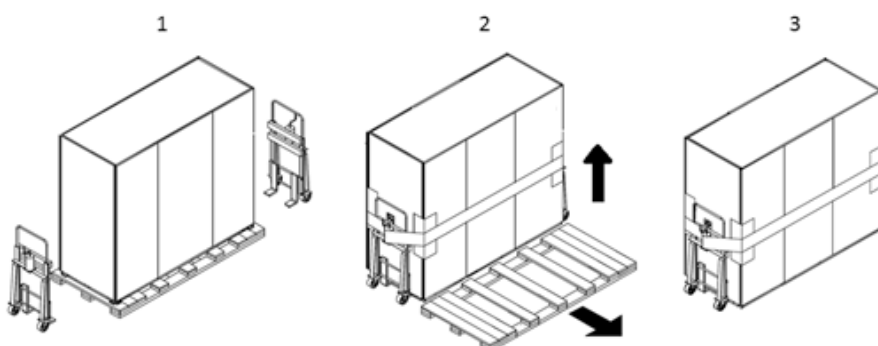


Fig. 4 Sequence of operations to remove the pallet

3.3.2 Units with separate ventilation section

The same means used for the unit can be employed to handle the fan section.

3.4 Storage

The units are built to be installed in indoor environments.

Storage outdoors is not allowed. Upon receipt they must be put in locations protected from weather agents.

Since the remote condensing unit is designed to be installed outdoors, it can withstand outdoor atmospheric conditions.

For the condensing unit, must be pay attention to the place where it is placed, which must be on the flat, in order to avoid deformation of the structure with consequent possible breakage.

4 PRODUCT DESCRIPTION

4.1 Intended use

The units are designed to control the air temperature and humidity, in "close control" applications and in technological ones in general.

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

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

These units are precision air conditioners that provide safe working conditions for Data Centres, computer rooms and other technological applications where a highly sensitive heat discharge and a precise temperature and humidity check are required. The parameters controlled are temperature, humidity and air quality according to the degree of filtration. Moreover, these units are used in installations where an uninterrupted service must be guaranteed and are therefore equipped with redundancy features.

4.5 Structure

The cabinet is made with sandwich panels of galvanized steel sheet and coated with epoxy. The panels are internally insulated with glass wool, to obtain fire insulation class A1 in accordance with EN13501. This type of panel allows good thermal and acoustic insulation.

Air tightness is achieved with adhesive sealing strips placed all around the edges of the panels.

The uprights and infills are made of galvanized steel sheet.

The front panel closing the electrical control panel can be opened by a handle for an easy inspection of the inside. Access to all refrigerant and electrical components of the unit is from the front of the machine only; this solution makes it unnecessary to carry out any work from the side and eliminates the obligation to consider “technical spaces” around the air conditioning units. All the materials forming the body are recyclable and CFC-free.

4.6 Specifications

Direct expansion precision air conditioner with hermetic compressor and evaporator coil, and / or chilled water coil, radial fans.

The direct expansion versions can be equipped with a water condenser integrated in the unit or connected to remote air condensers.

4.7 Air system

4.7.1 Unit fans

The units of the series are equipped with radial fans with reverse blades, with external rotor motor directly coupled to the impeller. These fans do not need any special maintenance as they do not have any couplings (belts, pulleys).

The fans can be integrated in the unit or supplied in a separate section.

The fans are of two different types, referred to as "AC" and "EC":

- AC: alternating current motor, adjustable speed by means of autotransformer on board the machine. The autotransformer has different output voltages and can, by changing the wiring, power the motor at different voltages in order to achieve the required airflow and static pressure performances. The units have a standard default connection which, nevertheless, may need to be checked and adapted to the specific installation.
- EC: electronically commutated "brushless" motor. The fan is powered by mains AC voltage, speed control is obtained via control signal DC 0-10V coming from the microprocessor mounted on board the unit. It is thus possible to set the required speed directly through the parameter being displayed.

Both motors are equipped with an alarm signal, which in the AC version is in fact equal to the thermal protection, whilst in the EC version it includes thermal protection, overcurrent, under-voltage, the lack of one or more phases, rotor blockage.



The EC fan is not equipped with a remote control switch and is constantly under tension as soon as the main switch of the unit is closed.

4.7.2 Air flow sensor / differential fan pressure

The units may be equipped, depending on the options or configurations, with a differential pressure transducer which detects the pressure difference between the inside and the outside (upstream) of the suction nozzle. The pressure difference is proportional, for each fan/nozzle pair, to the square root of the pressure difference according to the equation:

$$Q = n \cdot k \cdot \sqrt{\Delta P}$$

where

Q = total air flow [m³ / h]

n = number of fans in the unit

k = constant according to the fan nozzle

ΔP = pressure difference measured on the nozzle [Pa]

the differential pressure value or air flow rate can be seen directly on the microprocessor's display. If the unit is equipped with EC-type fans, the microprocessor will also automatically adjust the air flow.

Size	SXS	XS	S	S-M	M	M-L	L	XL	XXL
"K" for units with integrated fans	138	217	350	-	350	-	350	350	350
"K" for units with fans on separate section	-	-	515	260	350	515	-	515	515

4.7.3 Air flow sensor

This device prevents the unit operating in the absence of air flow. The control is effected by a differential pressure switch which measures the pressure difference upstream and downstream of the evaporator coil and the air filter, or by a differential pressure transducer in units where EC fans with control of the air flow are present. The going-off of the microprocessor alarm is delayed by the intervention of the sensor.

To test its operation:

- With AC fans: open the circuit breakers of the fan section and the compressors (QMV and QMC on the wiring diagram), and then turn on the unit. The microprocessor alarm should appear within a few tens of seconds.
- With EC fans: open the automatic compressor switches (QMC on the wiring diagram), remove the terminal with the control signal for the EC fan (terminal J4) from the microprocessor card, turn on the unit as above and wait for the alarm.

4.7.4 Dirty filter sensor (optional)

The check of the level of air filter clogging is carried out by means of a differential pressure switch which measures the upstream and downstream pressure drop of the filter.

The control panel will signal, via an alarm on the display, the need to replace or clean the filter. The machine will continue to work in any case.



The fouling of the filter may cause a decrease in the flow rate and therefore of the machine's performance; restoring the filter as quickly as possible from the time of reporting is recommended.

4.7.5 Discharge air pressure sensor (optional)

For units with air delivery pressure switch under the raised floor (accessory), once the unit is installed, the installer must connect the PVC tubes to the air differential pressure transmitter.

The small tubes supplied in coils inside the unit, must be positioned as follows:

- the tube connected to the negative inlet of the air differential pressure transducer should be positioned in the suction unit, preferably in an intake plenum or in any case in such a position that the air pressure measurement is not influenced by the dynamic component;
- the tube connected to the positive inlet of the air differential pressure transducer should be positioned under the floor, at a sufficient distance from the supply unit in order that the air pressure measurement is not influenced by the dynamic component;



The tubes must be positioned taking care not to make any small radius curves and not to choke the tubes with clamps; incorrect positioning of the ends of the tubes, sharp bends or kinks may cause false air pressure readings.

4.7.6 Air filters

The units are equipped with air filters on the recirculation line with varying degrees of efficiency. The filter change must always take place from the front of the unit.

The filters of the direct expansion units have the same overall size of the evaporator coils, whether they are UNDER or OVER.

In water chilled units the filters are located on the top (UNDER unit) or behind the front panels (OVER units). In any case refer to the dimensional drawings.

The drawings below show the way to extract the air filters according to the type of unit.

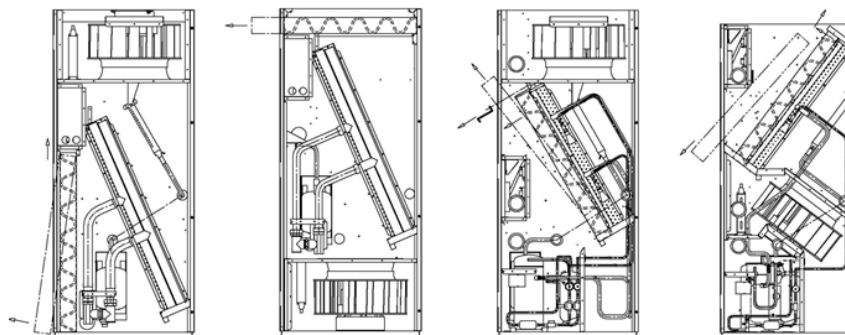


Fig. 5 Extracting the air filters

4.7.7 Humidifier

The units can be equipped with an immersed electrode humidifier according to the model version. Before use, make sure all electrical and hydraulic connections have been made.

The humidifier is automatically controlled by the microprocessor, which regulates the amount of water present inside the boiler, according to specific algorithms and according to the request for moisture production. For further details concerning the operation of the humidifier, refer to the humidifier and microprocessor manuals.

Should it be necessary to carry out maintenance or replace the humidifier components, first empty the water contained in the cylinder.

In order to ensure a correct operation and life of the humidifier cylinders, the characteristics of the feed water should be within the limits provided. The limits are reported in the specific manual.



Do not treat with softeners.

The use of well, industrial water or drawn from cooling circuits, potentially chemically or bacteriologically polluted, is forbidden. We do not recommend the addition of disinfectants or anticorrosive compounds, as they are potential irritants.

Any particular characteristics of the water supply, such as very low or very high conductivity, may require specific humidifier cylinders which differ from the standard, to be agreed upon with the manufacturer.

4.8 Control panel

The unit is integrally managed by an electronic system with microprocessor, having a graphic display as interface.

By using the display, you can access all the unit's functions, such as visualising the operating parameters, setting the parameters, managing and analysing any problems.

Control of these units is possible by using two software. The operations described below are the same, regardless of the software used for the control.



Fig. 6 Main screens of the two software used.

Basic operations such as starting and stopping the unit, changing the set point and the status check of the operation, can be carried out easily.

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

The reference for the following instructions is the main screen that is accessed from any other screen by pressing the Esc button repeatedly

4.8.1 Switching the unit on/off

For units with on / off compressors:

- from the main screen, by pressing the Esc key, you will see the power unit's start-up window;
- press Enter to turn the unit on.

For units with inverter-controlled compressor:

- you can access the list of control menus by pressing Prg from any screen;
- select the unit 's ON / OFF menu with the arrow keys;
- press Enter to access the menu;
- press Enter again to move the cursor to the parameter to be modified;
- use the arrow keys to change the status from OFF to ON;
- then press Enter to confirm.

To turn off the unit, repeat the same operation.

4.8.2 Change of set points

To change the set points:

- you can access the list of control menus by pressing Prg from any screen;
- select the Set point menu with the arrow keys;
- press Enter to access the menu;
- press Enter again to move the cursor to the set point field to be modified;
- select the desired Set points with the arrow keys;
- then press Enter to confirm.

4.9 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 Place of installation

The following should be taken into account when establishing 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;
- possible glare, resonance, acoustic interactions with elements outside the unit;
- ventilation of the remote air condenser (when required): for this purpose, please consult the documentation.

As for the installation of the remote air condenser, please also take into consideration:

- positioning and exposure to solar radiation of the air condenser. Keep the condensing coil out of direct sunlight as far as possible;
- direction of prevailing winds: Do not position the unit in a such a way that prevailing winds could cause air recirculation to the condensing coil;
- type of ground: Avoid placing the condensing unit on dark coloured ground (for example tarred surfaces), in order to avoid overheating during operation.

All models in the series are designed and built for indoor installation; it is therefore absolutely necessary to avoid positioning and even storage in outdoor environments even if protected against weather conditions.

The remote air condensers are designed for outdoor installation (terraces, gardens); it is therefore necessary to avoid placing them under any roofing or positioning them near trees (even if they should only partially cover the unit), in order to avoid air recirculation potential.

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



If the condenser is installed in particularly windy areas, it is necessary to provide windbreaks in order to prevent malfunction of the unit.

5.3 Installation

Upon installation, these units require different stages of assembly, depending on their operation and type.

The cases can be:

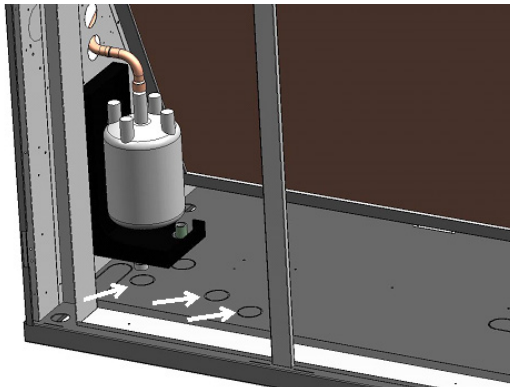
- Units consisting of water coil only; the units are shipped from the factory already tested and only need electrical and hydraulic connections for installation.
- Units which use the refrigeration cycle and are equipped with water condenser; in this case also the units are shipped from the factory already tested and only need electrical and hydraulic connections for installation.
- Units which use the refrigeration cycle and are pre-set for a remote condenser; as regards their operation, these units are shipped from the factory as "off-load" tested. The refrigerant circuit is charged with nitrogen and the oil charge is inside the compressor. In addition to the electrical and possibly the hydraulic connections, a refrigerant one is also required.
- units which use both the refrigerant circuit and water coils; for these units there is the same combination as in the previous cases with water coil and water cooled or remote condenser.

5.3.1 Positioning the units

Access to the refrigeration, plumbing and electrical connections is from the bottom of the unit. Should a raised floor not be available, a base in order to access the bottom of the unit and make the connections must be provided. The base may be provided as an accessory.

Make sure that the floor can support the weight of the unit (refer to the documentation attached to the unit).

Since all connections are on the bottom of the unit, the holes and / or predispositions for the various passages of the refrigerant /hydraulic pipes are also located on the base. Once any pre-cut piece is open and all connections have been made, the appropriate measures in order to prevent unwanted air leakage (for example, by sealing the unused spaces or covering unused holes) must be implemented.



The "fresh air intake" accessory must obviously have adequate lateral space from the unit for connecting the sleeve and removing the filter.

When installing multiple units in the same room, it is necessary to take all precautions in order to optimise air distribution and prevent its recirculation.

Given the high specific airflow, a proper study must be carried out if the units are installed in areas permanently occupied by people.



a suitable safety protection on the air discharge side of the unit itself must be provided for all units with vertical flow, should a connection to a duct or to a discharge plenum not have been provided.



Make sure that the unit is installed in a perfectly horizontal position.

5.3.2 The base frame (Versions UNDER)

The units with downward air flow require an adequate support system, as they are usually installed in rooms with a raised floor. For this purpose, the base frame with adjustable feet is available, if required can also be supplied with an air conveyor.



Fig. 7 The base frame

The unit must be fastened to the frame with M8 screws with an appropriate length, using the pre-set holes and threaded inserts.

It is advisable to install a thin draught-excluding gasket (not supplied) between the contact surfaces to avoid air leakage.

5.3.3 Separate fan section

the fan section must be installed first, under the floor or on the floor depending on the type of assembly planned; afterwards, the unit must be installed on top of the fan unit.

The two sections must be connected with M8 screws with an appropriate length, using the pre-set holes and threaded inserts on the unit's base and on the top ring of the fan unit.

If not all of the fastening points are accessible due to the position of installation, simply fasten the unit to the fan section at 4 of the 6 points provided.

It is advisable to install a thin draught-excluding gasket (not supplied) between the contact surfaces to avoid air leakage.

The electrical connections between the two sections are made by means of quick screw connectors; the male and female parts of each connector must be tightened to a torque of 5 Nm. Refer to the wiring diagram to make the connections.

After tightening the connectors, secure the cables and said connectors with clamps or another mechanical system in order to prevent them from moving or interfering with the moving parts.

5.3.4 Positioning the air condenser

To position the remote condenser see the appropriate manual.

5.3.5 Minimum distances

These units require (as the minimum necessary) only a clear space in front of the unit, in order to allow opening the panels and the electric box and normal maintenance operations. In particular, refrigeration, plumbing and electrical connections must be accessed from the bottom of the unit. In case a raised floor is not available, provide a base in order to make the connections. The base can be provided as an accessory.

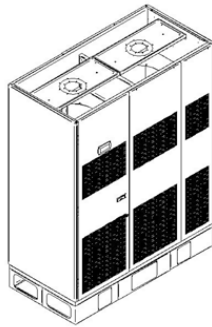


Fig. 8 Units with base

Refer to dimensional drawings for details of the diameters of the couplings.

Concerning the distances to be respected regarding the installation of the remote condenser, refer to the information in the corresponding manual.

5.4 Hydraulic connections

5.4.1 Connections to the plate condenser

Should the unit be equipped with integrated plate condensers, these must be connected to the heat dissipation system (cooling tower, dry cooler, ring). The dimensional drawings show the position of the water connections to the exchangers in their various configurations.



There is always a condenser for each refrigeration circuit, therefore in the dual-circuit units two condensation water inlets/outlet are required which can be connected to a single circuit by means of two manifolds placed outside of the unit.

Please observe the following guidelines:

- use copper or steel pipes;
- use hoses and three piece joints for the connections to the exchangers;
- install shut-off ball valves next to the heat exchangers;
- install drain taps at the lowest points of the circuit;
- display relief valves at highest points.



It is obligatory to install a mesh filter with a mesh size not exceeding 1 mm on the capacitors' inlet, in order to avoid clogging due to dirt.



Respect the direction of the capacitors' inlet / output otherwise there will be loss of performance.



The use of silty water or with a high limestone content can cause the rapid decrease in the performance of the exchanger.



Use an appropriate percentage of antifreeze should the hydraulic circuit be at a room temperatures near or below zero degrees centigrade.

Should the unit have two-way pressure regulating valves for controlling condensation, it is necessary to install them outside the unit.

For Free Cooling units, it is necessary to complete the hydraulic connection between the Free Cooling coils and the capacitor/s. The connection must be carried out outside the unit, according to the attached diagrams. The water flow three-way control valve in the condenser is supplied by the Manufacturer.

5.4.2 Connections to the water chiller coils

The water chiller coil is fitted as standard with a two or three-way modulating valve, with an electric three-point or 0-10V servo-control (depending on the version or configuration).

For the hydraulic connections (whether the coil is the main or the additional one) observe the following guidelines:

- use copper or steel pipes;
- adequately insulate the pipes;
- install shut-off valves in/out of the unit;
- install a thermometer and a pressure gauge at the input and output of the unit.

The diameters and types of connection required are indicated in the dimensional drawings.



Should the fluid contained in the hydraulic system be able to fall to near or below zero Celsius, add an appropriate percentage of antifreeze.

5.4.3 Connection to the condensate drain

All units are equipped with a condensate drip tray underneath the coil.

A rubber siphon is connected to the condensate drip tray which is joined to the base in all the units except for the vertical upward air flow water chillers in sizes "S", "M", "L" and when there is a separate fan section.

The connection to the condensation drip tray with relative syphon must be carried out under the unit by the installer in all vertical upward air flow water chillers in sizes "S", "M", "L" and when there is a separate fan section.



Fig. 9 Condensate drain

Connector for the condensate drip tray in "SXS", "XS", "S", "M" and "L" sizes is envisaged for a rubber pipe with an outer diameter of 20 mm. The one for "XL" and "XXL" sizes for a rubber pipe with an outer diameter of 25 mm.

In all cases it is better to arrange a slight slope of the discharge pipe to help the water flow.

5.4.4 Connection to the hot water coil

Refer to the dimensional drawings for the position and size of the water connections.

Please observe the following guidelines:

- use copper or steel pipes;
- adequately insulate the pipes;
- install shut-off valves in/out of the unit;
- install a thermometer and a pressure gauge at the input and output of the unit.



Should the fluid contained in the hydraulic system be able to fall to near or below zero Celsius, add an appropriate percentage of antifreeze.

5.4.5 Connection to the humidifier

Where present, the humidifier must be supplied with untreated mains water, preferably filtered from impurities and / or waste. The diameters of the couplings are reported in the dimensional drawings.

We recommend that the drain duct should consist of a non-electrically conductive material.



The water discharged from the humidifier can reach 100 ° C.



It is compulsory to implement a syphon in order to drain the water from the humidifier.



Absolutely do not fill the humidifier with demineralised or softened water.

Further information concerning installation may be found in the "Humidifier" chapter and in the humidifier manual enclosed with the unit's documentation.

5.5 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 $\pm 10\%$ 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.



Units with a separate fan section envisage electrical connections between the two parts with quick connectors.

Always refer to the wiring diagram of the unit in order to make the connections.



Once the quick connectors have been sufficiently tightened, the electric cables must be fastened to the unit by means of clamps, so as to ensure that they cannot come into contact with the fans or the electric heaters (if installed).

5.6 Refrigeration connections

The units using the refrigeration cycle often require a remote installation of the capacitor.

The cooling circuits equipped with shut-off valve, are charged in the factory with anhydrous nitrogen at a pressure of 12 bar.



Warning: the following operations require pressurised pipes and brazed connections to be made, and these must be carried out by specialised staff in possession of the necessary qualifications in accordance with current regulations.

5.6.1 Piping implementation

In order to lay the pipes, use hard or soft copper pipes, of a size suitable for the cooling capacity and the distance to be covered and of an adequate thickness for the maximum designed pressure and the type of refrigerant used. Table 1 shows the recommended diameters for equivalent lengths up to 50 m.

For greater distances, contact the manufacturer.

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;
- provide a slight slope of the flow line (1% downwards) in the horizontal sections in order to facilitate the passage of the oil;
- provide suitable syphons every 6 metres (5 metres for circuits with inverter-controlled compressor), in the vertical stretches of the gas discharge pipe to the condenser, placing the first one immediately at the outlet of the unit;
- maintain the gas discharge lines separate from the liquid back-flow one, if not isolated;
- support the horizontal and vertical lines with suitable vibration dampers;
- should the capacitor be placed in a higher position compared with the unit, install a non-return valve on the discharge line near the input of the condenser; should the capacitor be placed in a lower position compared with the unit, install a non-return valve on the liquid line near the output of the condenser;
- 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.

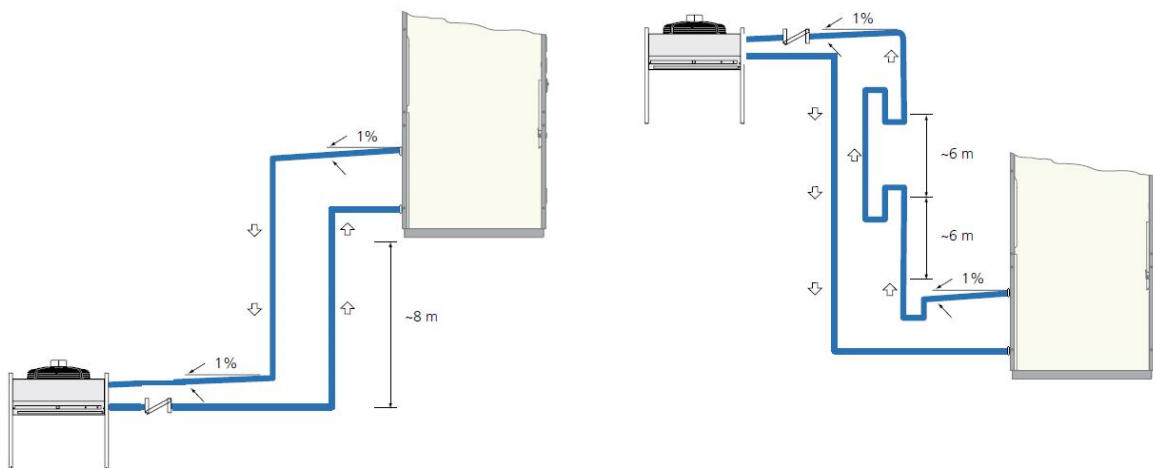


Fig. 10 Separate section refrigerant connections

Table 1A - R410A Recommended diameters - The thickness of the tube must be compatible with the refrigerant used and with current regulations

Model	Number of circuits	Equivalent length 10 m		Equivalent length 20 m		Equivalent length 30 m		Equivalent length 40 m		Equivalent length 50 m	
		Gas	Liquid	Gas	Liquid	Gas	Liquid	Gas	Liquid	Gas	Liquid
6.1	1	12	10	12	10	12	10	12	10	12	12
8.1	1	12	10	12	10	12	12	12	12	12	12
11.1	1	12	10	14	12	14	12	14	12	14	14
15.1	1	14	12	14	12	16	14	16	14	16	14
18.1	1	16	12	16	14	16	14	18	16	18	16
17.1	1	16	12	16	14	16	14	16	16	18	16
22.1	1	16	12	16	14	18	16	18	16	18	16
26.1	1	18	14	18	16	18	16	18	16	22	18
30.2	2	14	12	14	12	16	14	16	14	16	16
32.1	1	18	14	18	16	22	16	22	18	22	18
36.1	1	18	16	18	16	22	18	22	18	22	18
34.2	2	16	12	16	14	16	14	16	14	16	16
38.1	1	18	16	18	16	22	18	22	18	22	22
38.2	2	16	12	16	14	16	14	18	16	18	16
46.2	2	16	14	16	14	18	16	18	16	18	16
49.1	1	22	18	22	18	22	18	28	22	28	22
56.2	2	18	14	18	16	18	16	22	16	22	18
66.2	2	18	14	18	16	22	18	22	18	22	18
72.2	2	18	16	18	16	22	18	22	18	22	22
85.2	2	22	16	22	18	22	18	22	22	22	22
95.2	2	22	18	22	18	22	22	28	22	28	22
104.2	2	22	18	22	18	22	22	28	22	28	22



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.

Table 1B - R410A Recommended diameters for units with inverter controlled compressors - The thickness of the tube must be compatible with the refrigerant used and with current regulations

Model	Circuit	Equivalent length 10 m		Equivalent length 20 m		Equivalent length 30 m		Equivalent length 40 m		Equivalent length 50 m	
		Gas	Liquid	Gas	Liquid	Gas	Liquid	Gas	Liquid	Gas	Liquid
7.1	1	10	10	10	10	-	-	-	-	-	-
12.1	1	12	12	12	12	-	-	-	-	-	-
16.1	1	16	16	16	16	18	16	18	16	18	16
23.1	1	16	16	16	16	18	16	18	16	18	16
27.1	1	18	16	18	16	22	16	22	16	22	16
33.1	1	18	18	18	18	22	18	22	18	22	18
35.2	1	18	18	18	18	22	18	22	18	22	18
36.2	1	16	16	16	16	16	16	18	16	18	16
	2	16	16	16	16	16	16	16	16	16	16
45.2	1	22	18	22	18	22	18	22	18	22	18
44.2	1	16	16	16	16	18	16	18	16	18	16
	2	16	16	16	16	16	16	16	16	16	16
58.2	1	18	16	18	16	22	18	22	18	22	18
	2	18	16	18	16	22	16	22	16	22	16
66.3	1	16	16	16	16	18	16	18	16	18	16
	2	18	18	18	18	22	18	22	18	22	18
82.3	1	16	16	16	16	18	16	18	16	18	16
	2	22	18	22	18	22	22	22	22	22	22
100.4	1	22	18	22	18	22	18	22	18	22	18
	2	22	18	22	18	22	18	22	18	22	18

Should the length of the cooling lines envisage an increase of the diameters compared with those required for a length of 10 m, we recommend implementing the horizontal sections of the cooling line with the diameters prescribed for the total length, while the vertical sections must be implemented maintaining the prescribed diameters for a length equal to 10 m.



For example, consider the 33.1 size with a total length of cooling lines of 40 m, of which 30 m of horizontal sections and 10 m of vertical risers; the diameters of the horizontal lines will be respectively 22 mm for the discharge and 18 mm for the liquid, while the diameters of the vertical lines will be 18 mm for the delivery and 18 mm for the liquid.



For the units of the series equipped with an inverter-controlled compressor, the maximum length of the pipes is 20 metres for sizes 7.1 and 12.1, and 50 metres for the rest.

Table 2A - Refrigerant charge * for units with separate section circuits, excluding pipelines (compressors on / off)

Model	Refrigerant charge	Refrigerant charge	Refrigerant charge	Refrigerant charge	Refrigerant charge
	without condenser [kg]	with condenser standard [kg]	with condenser High-performance [kg]	with condenser LN [kg]	with condenser High-performance LN [kg]
6.1	1,1	1,7	1,7	1,7	1,7
8.1	1,2	1,8	2,1	1,8	2,3
11.1	1,5	2,1	2,4	2,6	2,6
15.1	1,7	2,6	2,8	2,8	3,2
18.1	2	3,1	3,5	3,1	3,5
17.1	2,9	4	4	4	4,4
22.1	2,9	4	4,4	4,4	5,2
26.1	3,6	5,1	5,5	5,5	5,9
30.2	2,6	3,5	3,7	3,7	4,1
32.1	3,6	5,5	5,6	5,8	6,6
36.1	4,1	6,1	6,3	6,3	7,1
34.2	2,8	3,9	3,9	3,9	4,3
38.1	4	6	6,1	6,1	7
38.2	2,8	3,9	4,3	4,3	4,7
46.2	3	4,1	4,5	4,5	4,9
49.1	4,7	6,9	7,7	8,6	8,6
56.2	3,5	5	5,4	5,8	5,7
66.2	4	5,9	6	6,2	7
72.2	4,6	6,6	6,8	6,8	7,6
85.2	4,9	7	7,9	7,9	8,7
95.2	4,9	7,1	7,9	7,9	8,7
104.2	7,1	10,2	10,2	11	11

Table 2B - Refrigerant charges * for units with separate section circuits, excluding pipelines (inverter-controlled compressors)

Model	Refrigerant charge	Refrigerant charge	Refrigerant charge	Refrigerant charge	Refrigerant charge
	without condenser [kg]	with condenser standard [kg]	with condenser High-performance [kg]	with condenser LN [kg]	with condenser High-performance LN [kg]
7.1	1	1,6	1,6	1,6	1,6
12.1	1,2	1,8	2,1	2,3	2,3
16.1	2,1	3,2	3,2	3,2	3,6
23.1	2,6	3,7	4,1	4,1	4,9
27.1	2,8	4,3	4,8	5,2	5
33.1	3,4	5,4	5,6	5,6	6,4
35.2	2,6	4,6	4,8	4,8	5,6
36.2	1,7	2,8	2,8	2,8	3,2
45.2	2,8	5	5	5,8	6,7
44.2	2,8	3,8	4,3	4,3	5,1
58.2	3,2	4,7	5,1	5,4	5,4
66.3	3,7	4,8	5,7	5,2	6,1
82.3	3,7	5,2	5,6	5,6	5,9
100.4	5,9	8,1	9,7	8,9	9,7

* The amount of refrigerant is indicative and has been calculated theoretically. The actual charge may differ from the calculation

Table 3 – Additional R410A refrigerant charges per metre of linear pipe

Outer Diameter [mm]	Gas [kg]	Liquid [kg]
10	0.0045	0.0474
12	0.007	0.074
14	0.01	0.1
16	0.014	0.145
18	0.018	0.19
22	0.028	0.3
28	0.048	0.5

* Discharge saturation temperature 45 ° C, liquid temperature 40 ° C



Suggested additional oil charge: over 20 metres of linear development of the pipes, add a quantity of oil equal to 2% in weight of the total refrigerant present in the circuit. Refer to the type of oil indicated on the compressor's label.

For two-circuit units featuring at least one inverter-controlled BLDC compressor pay attention to the type of oil loaded into each cooling circuit.

- Circuits fitted with a BLDC compressor (in single or twin configuration with ON/OFF compressor) use IDEMITSU FV50S oil.
- the circuit featuring ON/OFF compressors only uses EMKARARE RL 32 H oil.



If needed, do not forget to top up the level with the correct type of oil without mixing the two different oils, as they are not compatible. Always use the oil recommended by the Manufacturer of the compressor or a perfectly equivalent oil. The use of an incorrect type of oil may cause serious damage to the compressors and immediately void any guarantee.

Table 4 - Configurations

Relative position of the condensing unit	Syphons on the gas line	Liquid line insulation	Gas line insulation	Maximum height difference between the sections	Non-return valve to the condenser
Higher level condensing unit	Every 6 m of vertical risers (5 m for circuits with inverter-controlled compressor)	Only in the case of long stretches exposed to sunlight or to high room temperatures	Necessary	30 m (15 m 7.1 - 12.1)	Recommended on input
Lower level condensing unit	-	Only in the case of long stretches exposed to sunlight or to high room temperatures	Necessary inside the building	8 m	Recommended on output

5.6.2 Changes in temperature and speed in the cooling lines

Below are the diagrams for calculating the temperature variations in the delivery pipes and the liquid speed in the cooling line pipes.

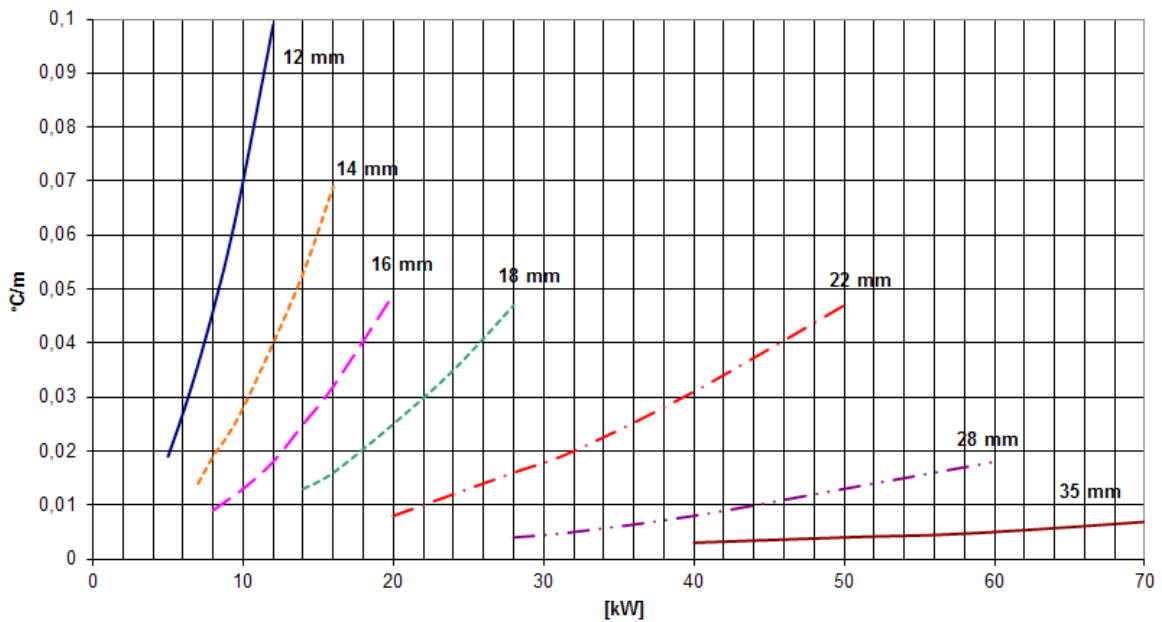


Fig. 11 Change of saturation temperature in the discharge lines

This diagram is useful in order to approximately determine the variation in saturation temperature, per equivalent linear metre of pipe, on the basis of the cooling capacity and the diameter of the discharge line.

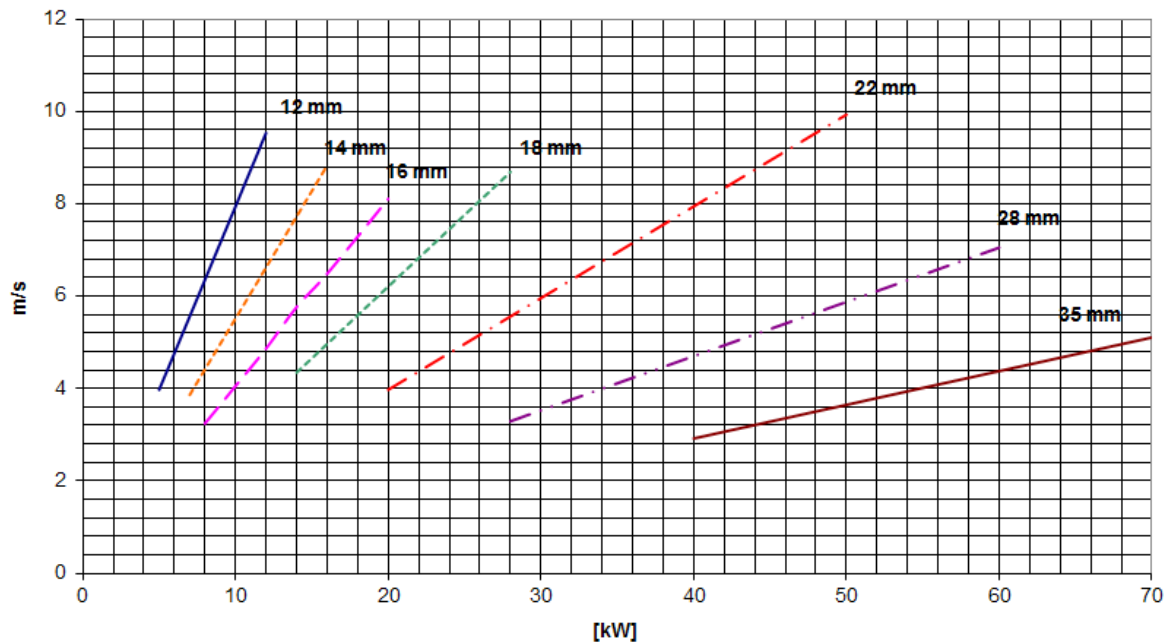


Fig. 12 Speed in the discharge lines

This diagram is useful in order to determine the approximate speed of the refrigerant, in metres per second, on the basis of the cooling capacity and the diameter of the discharge line.

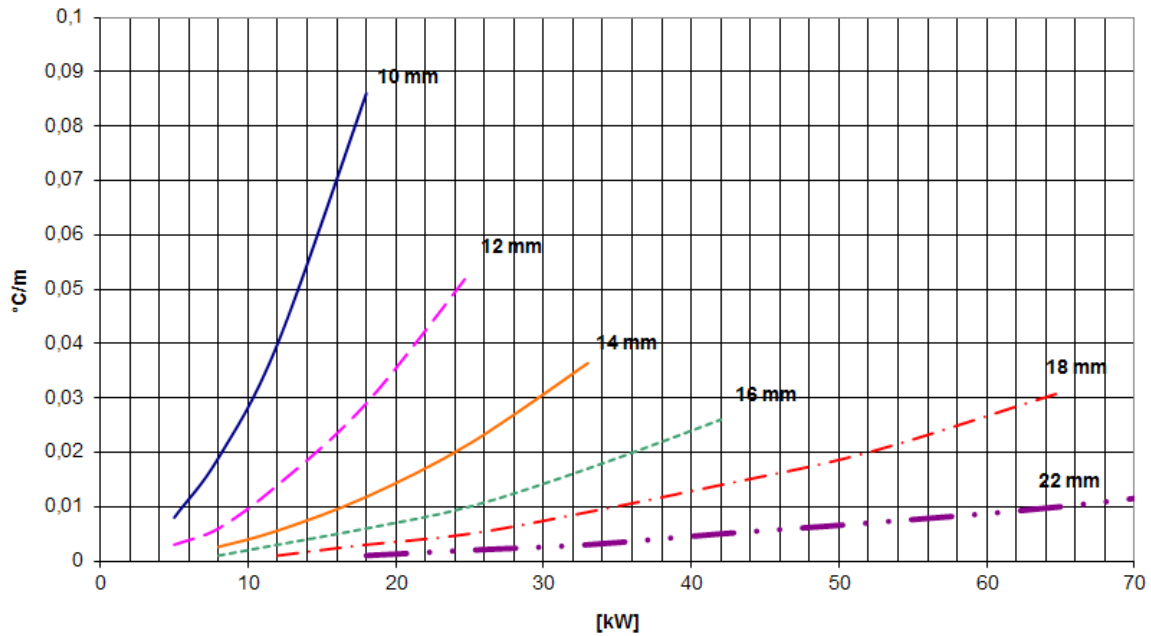


Fig. 13 Change of saturation temperature in the liquid lines

This diagram is useful in order to determine the approximate variation in saturation temperature, per equivalent linear metre of pipe, on the basis of the cooling capacity and the diameter of the liquid line.

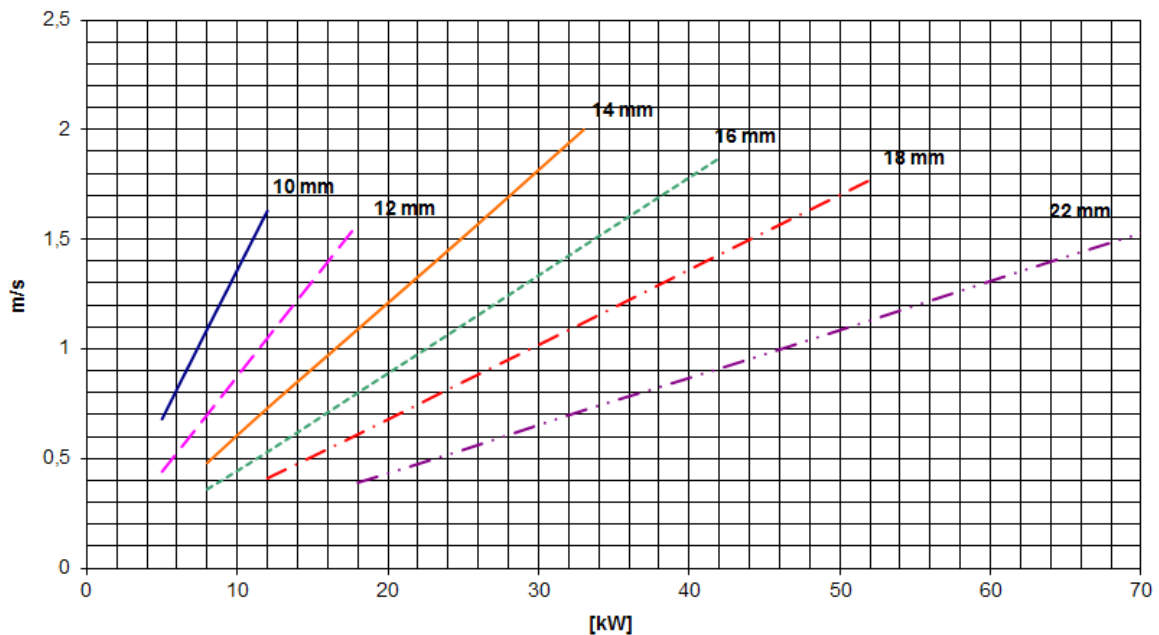


Fig. 14 Speed in the liquid lines

This diagram is useful in order to determine the approximate speed of the refrigerant, in metres per second, on the basis of the cooling capacity and the diameter of the liquid line.

These diagrams, and those of the previous page, are valid for the following conditions:

- saturation evaporation temperature equal to 8° C;
- superheating equal to 5° C;
- saturation condensing temperature equal to 50° C;
- sub cooling equal to 5° C;

5.6.3 Change in performance

In order to calculate the actual pressure drop and the consequent performance reduction coefficient, use the graph "Change in the saturation temperature in the flow lines".

Given the cooling capacity specifications for each refrigerant circuit:

- find the pressure drop per metre of length according to the diameters actually used;
- multiply them by the actual equivalent length for each diameter;
- if various diameters have been used, sum the result obtained in order to obtain the total pressure drop per refrigerant circuit (expressed in ° C);
- Based on the total pressure loss, verify the yield loss percentage and the increase of power consumption in the graph below.



Pay attention to size 66.3 and 82.3 whose circuits are divided according to 1/3 - 2/3.

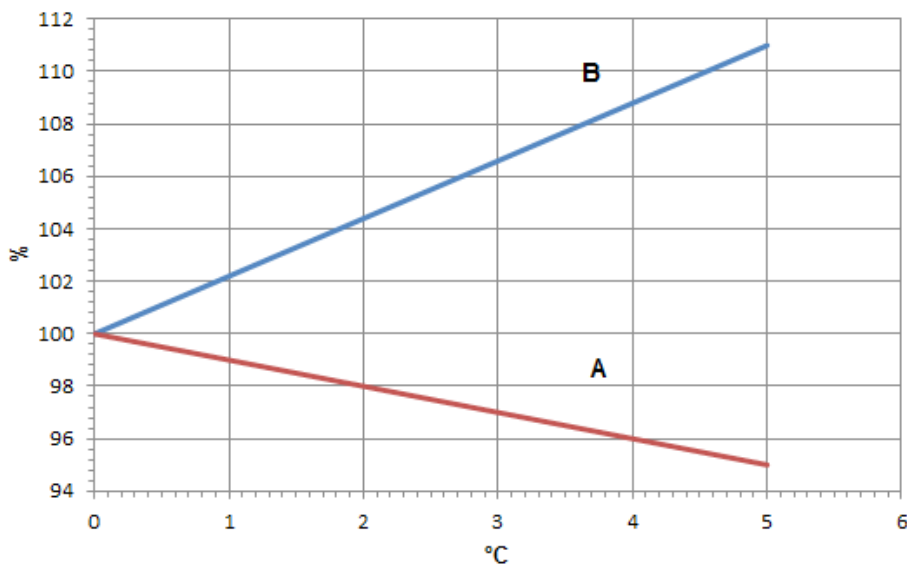


Fig. 15 Loss of yield (curve A) and increase of power absorbed (Curve B) based on the increase of the saturated condensing temperature



If the loss exceeds 3 to 4 °C, we recommend that the remote condenser be increased by one size in order to prevent undesired shut-downs due to the tripping of the high pressure switch in high outdoor temperature conditions (evaluate the operating limit decrease).

5.7 Vacuum and refrigerant charge

Open the taps of the indoor unit and evacuate the pre-charged nitrogen before completing the refrigerant connections. Do not leave the refrigerant circuit open for more than 15-30 min as the high hygroscopic capacity of the oil may cause the absorption of moisture 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, load the system from the charging socket 5/16 "SAE placed on the liquid line. Perform charging in liquid form. Table 2 shows the estimated refrigerating charges for indoor units and capacitors, to which it is necessary to add the charge contained in the connecting lines. The final charge could differ slightly according to the necessary adjustments (see subsequent chapters).

6 COMMISSIONING

6.1 Preliminary operations

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



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

Check:

- that the electrical connection has been made correctly and that all terminals are properly tightened.
- that the voltage on the RST terminals is $400\text{ V} \pm 10\%$ for the three-phase units or on FN terminals is $230\text{ V} \pm 10\%$ for single phase units (or the one reported on the plate of the unit in case of special voltages). If the voltage fluctuates frequently, contact our technical department in order to choose suitable protective devices;
- that the phase sequence is correct for the three phase units;
- that the gas pressure in the refrigerant circuits is shown on the pressure gauges (if present) or on the control display;
- that there are no refrigerant fluid leaks, using a leak detector if necessary (the presence of oil stains is a sign of refrigerant leaks).



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

Move the main switch of the unit to the ON position and verify on the user interface that the unit is OFF.

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 $10 - 15\text{ }^{\circ}\text{C}$ above ambient temperature.

Check:

- that any hydraulic connections have been correctly made, following the indications on the inlet / outlet plate on board the machine and / or on the diagrams supplied;
- that a mechanical filter on the unit's inlet (a mandatory component; non-compliance will invalidate the warranty) has been installed in the hydraulic circuit;
- 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 prepared an expansion vessel of suitable capacity for the water volume of the system;
- that all the taps in the refrigerating circuit are open;
- that all the infill and closing panels of the unit have been secured.

6.2 First starting



In all the units pre-set for a remote condenser, make sure the correct electrical connection has been made and that the switch is in the "ON" position.



In all units pre-set for a water connection, make sure there is water and that it can circulate properly.

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.

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

The first device to start up is either the single air supply fan or all of them. Subsequently, in relation to the temperature and humidity of the return air, the compressors and / or heating elements and the humidifier (if present) may start up.

After a few hours of operation of the compressors, 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. However, the presence of a few bubbles is allowed.

It is mandatory to keep a register for the unit (not supplied), which allows you to keep track 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.

6.3 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

Control and safety components	Activation set point	Differential	Reset
High-pressure switch	37,8 barg	10,8 barg	Manual
Low pressure switch (if any)	4,5 barg	1,5 barg	Automatic
High pressure safety valve	42 barg	-	-

6.4 Checks during operation

After a few minutes from the compressor start-up, check that:

- the condensation temperature is approximately 15 ° C higher than the outside air temperature (for units equipped with remote condenser) or 5°C higher than the temperature of the output water from the plate integrated condensers, but in any case not below 35°C of saturation temperature corresponding to the condensation pressure;
- the operating variables (temperature, pressure) measured by the probes on the machine and displayed by the micro-processor control switch must correspond to real values;

After a few hours from starting the compressors, when the air temperature is approaching the set point values set, check that:

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.

- the liquid sight glass must be green;
- that no bubbles appear on the sight glass placed in the liquid pipe. The continuous presence of bubbles may indicate a lack of refrigerant charge; the occasional or sporadic presence of bubbles is allowed;
- the superheating of the refrigerant fluid in inlet must be approximately between 5-7 ° C;
- the sub cooling of the refrigerant in the liquid line, when leaving the condenser, should be in the range of 2-5 ° C. Too high a sub cooling value may indicate that the refrigerant charge is too high or that there are non-condensable elements in the cooling circuit;
- that the coolant filter is not blocked or clogged. To this end, it is sufficient to detect the temperature of the liquid pipe immediately before and immediately after the filter, checking that there are no significant differences (up to a couple of degrees ° C are allowed).

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 shutdown of the unit for a few days is considered as 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 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

When the unit is not used for months this is considered a long period shutdown.

Should the unit be expected to stop for long periods, 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;
- empty and clean the condensation drip tray;
- empty the humidifier cylinder if any.

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.

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

When there is a remote condenser, the finned heat exchanger is the component of the unit which requires greatest attention. 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.

Please refer to the manual for the timing and modes of operation.

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.

7.4 Periodic checks

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

OPERATION	RECOMMEN- DED FREQUEN- CY
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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