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Installation, use and maintenance manual

24-02-2020

WESTERN™ AIRCONDITIONING WARMTEPOMPEN

BlueBox by Swegon

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.

Declaration or certificate of conformity 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

We reserve the right to make changes without any prior notice.

We reserve the right to make changes without any prior notice. Translation from original instructions

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.

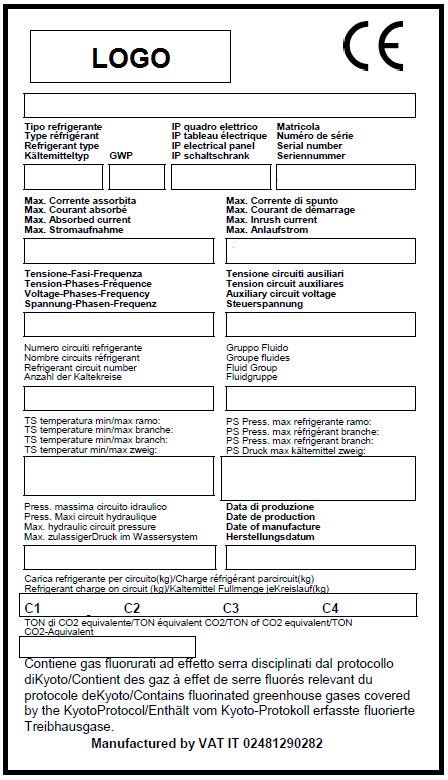
Warning symbol; important information

Note symbol; suggestions and advice

1.2.2 Labels

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

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 Catalogue, 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.

We reserve the right to make changes without any prior notice.

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 Catalogue.

In any case, refer to the specific Technical Catalogue 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 stops and starts 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.

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

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 / ³]

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	1
	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.

We reserve the right to make changes without any prior notice.

2.2.4 Installing the flow switch

The units are shipped from the factory without the flow switch installed.

The flow switch is supplied with the unit and must be connected 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 flow switch must be inserted on the water pipe at the outlet of the unit in a straight and horizontal section of the pipe well away from filters, valves etc. at a distance of at least 5 times the pipe diameter 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 Hydraulic components for reversible heat pump units

For the source-side heat exchanger, the hydraulic circuit of the reversible heat pump units requires a pressure switch valve, a by-pass solenoid valve and a second paddle flow switch.

For some models, these components are already installed in the unit whereas for others, they are assembled in kits and supplied loose with the unit.

If the kit is supplied loose with the unit, it is mandatory to install it and this must be done by the installer.

The flow switch in the source hydraulic circuit should be installed on the heat exchanger outlet, with the same measures used for the flow switch of the user circuit.

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 Catalogue 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 Condensation control at the source hydraulic circuit

The temperature and flow rate of the source circuit water must be maintained within the operating limits stated in the Technical Catalogue.

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 Catalogue must be installed for correct operation of the unit.

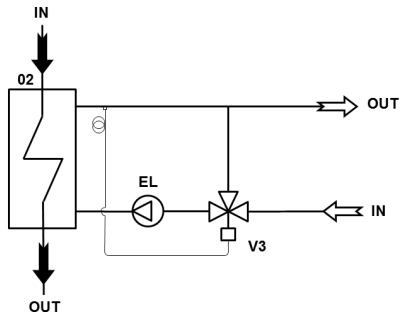


Fig. 1 3-way valve installation layout

02	Condenser
EL	Motor-driven pump
V3	Thermostatic three-way valve

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

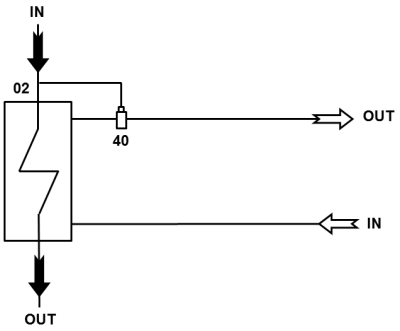


Fig. 2 Pressure switch valve installation layout

02	Condenser
40	Pressure switch valve

We reserve the right to make changes without any prior notice.

2.2.9 Condensation control at the source hydraulic circuit for HP units

For the source-side heat exchanger, the hydraulic circuit of the reversible heat pump units requires a pressure switch valve, a by-pass solenoid valve and a second paddle flow switch.

For some models, these components are already installed in the unit whereas for others, they are assembled in kits and supplied loose with the unit.

If the kit is supplied loose with the unit, it is mandatory to install it and this must be done by the installer.

The flow switch in the source hydraulic circuit should be installed on the heat exchanger outlet, with the same measures used for the flow switch of the user circuit.

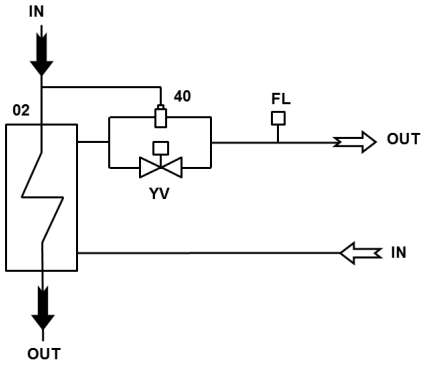


Fig. 3 Connection of pressure switch valve, solenoid valve and flow switch

02	Condenser
40	Pressure switch valve
YV	Solenoid valve
FL	Flow switch

2.2.10 Refrigerant leak detector

A refrigerant leak detector with semiconductor sensor can be installed on the units.

This device allows immediate detection of refrigerant leaks, with a warning or with stopping of the unit in pump down, depending on how it is managed.

The installation of the device is in line with European F-GAS regulations and USA ASHRAE regulations.

By default, the device is set at 100 ppm with a one minute delay.

Local regulations may require different calibration values with specific sensor checking and calibration procedures.

The main regulations require a check with tests at least once a year.

Check your local regulations on calibration and the testing requirements.

The detector must be tested and/or calibrated by a qualified technician.

To test and calibrate the device, qualified operators must know the rules and regulations laid down by the industrial sector and/or by the country of installation.

In the event of a significant refrigerant leak with prolonged exposure, check the sensor and, if necessary, replace the sensing element.

In any case, the sensing element of the device has a lifetime after which it must be replaced.

As regards the device testing and calibration method and procedures, refer to the “+0300035EN” manual available on the site www.Carel.com in the “Services” section of the “Documentation” folder.

For replacement of the sensing device and for other accessories needed for calibration, refer to your customer service centre.

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 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.

We reserve the right to make changes without any prior notice.

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.

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.

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.

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.

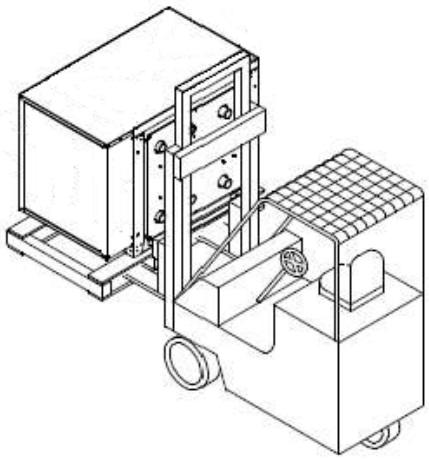


Fig. 4 Lifting with forklift truck

If 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.

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, if present, 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 ECODESIGN CONFORMITY

4.1 Documentation supplied with the product

Listed below are the documents supplied with the machine according to its type, with particular reference to conformity with Directive 2009/125/EC of the European Parliament and of the Council, of 21 October 2009, regarding the establishment of a framework for drafting specifications for the eco-friendly design of energy-related products, and relevant Regulations (hereinafter "Ecodesign").

These documents may or may not be binding depending on the country of installation.

Conformity of the units with the directives and standards in force in the European Union is broken down into the following cases, with regard to applicability of Ecodesign:

1. Units conforming to all EC requirements including the Ecodesign Directive;
2. Units exempt from the Ecodesign Directive and in general conforming to all EC requirements;
3. Partly completed machine;
4. Units conforming to all EC requirements except for the Ecodesign Directive.

4.1.1 Units conforming to all EC requirements including the Ecodesign Directive

Application of the Ecodesign Directive depends on the type of unit.

The CE marking is present.

The units can be put on the market in any country.

More specifically, they are allowed to be put on the market in member countries of the European Union (hereinafter "EU").

Putting the units on the market in the EU entails installation and running of the unit within this scope.

Putting the units on the market in the EU is bound by the effective dates required by each Regulation.

The EC Declaration of Conformity (hereinafter "EC Declaration") is supplied with the unit:

- irrespective of the destination country;
- according to the relevant Regulation, the EC Declaration is supplemented by one or more attached documents, also called product fiches (hereinafter "Attached Document");
- where envisaged, the Attached Document is always supplied irrespective of the destination country.

Units involved:

- chillers (with or without free-cooling mode);
- reversible heat pumps (cooling / heating), including multifunction units;
- non-reversible heat pumps (heating only) where applicable.

4.1.2 Units exempt from the Ecodesign Directive and in general conforming to all EC requirements

Units for which conformity with the Ecodesign Directive is not necessary.

All the points described in the first paragraph apply, with the exceptions stated below.

The EC Declaration is not accompanied by Attached Documents.

Units involved:

- non-reversible heat pumps (heating only) where applicable with Pdesign>400kW.
- chillers in general used for “Process” applications with water delivery temperature > 12°C or between -8°C and +2°C (extremes excluded).

4.1.3 Partly completed machine

Units for which conformity with the Ecodesign Directive must be related to a 'partly completed machine plus remote heat exchanger' system. Otherwise, the unit conforms to all EC requirements.

All the points described in the first paragraph apply, with the exceptions stated below.

The EC Declaration is not accompanied by Attached Documents

Conformity with the Ecodesign Directive depends on the combination of partly completed machine plus remote heat exchanger and is therefore the responsibility of the person who makes the selection and combination at the installation stage.

Units involved:

- chillers or reversible units with remote source heat exchanger;
- chillers or reversible units with remote user heat exchanger.

4.1.4 Attached Documents envisaged with regard to the type of unit

A table summarising the attached documents with regard to the type of unit is shown below.

Table (a)

Type of unit	Regulation	Supplied Attached Documents, reference parameter	
CE unit	2016/2281	SEER/ηsc LT	
CE unit	2016/2281	SEER/ηsc MT	
CE unit	2016/2281	SEER/ηsc LT	SEPR HT
CE unit	2016/2281	SEER/ηsc MT	SEPR HT
CE unit	2013/813	SCOP/ηsh (1)	Eco-label (2)
CE unit/exempt from Ecodesign	not applicable	none	
CE partly completed machine	2016/2281 or 2013/813	none	

(1) SCOP/ηsh LT or MT as required by Regulation 2013/813.

(2) Where provided for by Regulation 2013/811, applies to heat pumps with Pdesign <70kW.

4.1.5 Efficiency parameters required for conformity

To avoid ambiguity, this chapter identifies efficiency parameters with the acronyms indicated below.

Regulation 2016/2281 envisages conformity according to the following efficiency parameters:

- ηsc low temperature: user-side inlet/outlet temperatures 12/7°C; identified in this document as SEER/ηsc LT;
- ηsc medium temperature: user-side inlet/outlet temperatures 23/18°C; identified in this document as SEER/ηsc MT;
- SEPR HT.

Regulation 2013/813 envisages conformity according to the following efficiency parameters:

- ηsh low temperature: user-side inlet/outlet temperatures 30/35°C, average climate design conditions; identified in this document as SCOP/ηsh LT;
- ηsh medium temperature: user-side inlet/outlet temperatures 47/55°C, Average climate design conditions; identified in this document as SCOP/ηsh MT; this applies as regards models that can operate with delivery temperature ≥ 52°C at a source temperature of -7°C db/-8°C wb (air-water unit) (10°C inlet for water unit) in the aforesaid climate profile.

For each unit, the composition of the Attached Document(s) is predefined and comes under one of the cases in table (a); therefore, more specifically:

- if the type of unit and/or the expected operating condition are exempt from conformity, the EC Declaration will in any case be accompanied by Attached Document(s) according to table (a);
- in any case, the operating temperatures specified when ordering do NOT determine the type of Attached Document supplied.

4.2 Conformity of the application

The applications allowed as regards the documentation supplied with the unit are indicated below. This applies only in the case of units intended for installation and operation in the European Union.

The customer is required to select the unit with regard to the expected operating condition and the Ecodesign conformity required for that condition.

The documentation available during pre-sale enables the unit to be selected, ordered and purchased correctly for this purpose.

Table (b) indicates the type of conformity required according to the operating condition.

Conformity is to be verified during selection/pre-sale and will be certified by the Attached Document supplied with the unit.

The applications are defined by the Regulations as follows:

1. "Comfort" = application intended for the thermal comfort of people;
2. "Process" = application intended for cooling an appliance or a refrigeration system, whose aim is not to ensure cooling of a room for the thermal comfort of people.

A table summarising the Ecodesign Conformity required with regard to operating condition is shown below.

Table (b)

Operation / Water delivery temperature (LWT cooling), °C		Conformity	Notes
1) Comfort, cooling-only	< 18	SEER/ηsc LT	--
2) Comfort, cooling-only	≥ 18	SEER/ηsc MT	(1)
3) Process, cooling-only	+2 ≤ LWT ≤ 12	SEPR HT	--
4) Process, cooling-only	> 12	none	--
5) Process, cooling-only	-8 < LWT < 2	none	--

(1) - All the more so, SEER/ηsc LT conformity is also valid.

In the "Process, cooling only" case with delivery temperature between -8°C and +2°C (point 5 of table (b)), no type of conformity is required if the unit can operate only at delivery temperatures strictly higher than -8°C.

Operation / Unit: type and Pdesign, kW		Conformity
6) Comfort, heating + cooling	≤ 400kW	SCOP/ηsh
7) Comfort, heating + cooling	> 400kW	see point 1 or 2
8) Heating	heating-only unit ≤ 400kW	SCOP/ηsh
9) Heating	heating-only unit > 400kW	none

Operating conditions other than those indicated are not allowed because they may be in conflict with the issued Ecodesign conformity.

As regards the pre-sale stage, the Manufacturer reserves the right to consider and, if necessary, implement devices for specific operating conditions.

The customer (or the installer or the system operator) is responsible for the adopted operating condition and its consistency with the Ecodesign conformity issued by the Manufacturer.

The Manufacturer refuses all liability arising from improper use of the machine and more specifically from operation in temperature conditions not allowed by the technical documentation.

See also the "Intended use" and "Unintended use" paragraphs of the "Product description" chapter.

5 PRODUCT DESCRIPTION

5.1 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 Catalogue.

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

5.2 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.

5.3 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 Catalogue.

5.4 Principles of operation

The principle of these units is based on using the vapour compression refrigeration cycle, characterized by 4 phases (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 this 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 another water 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 refrigeration cycle reversal that reverses the function of the two heat exchangers, so that the evaporator becomes a condenser and vice versa.

In "LC" version units, the same functionalities made by the heat exchanger connected to the source hydraulic circuit are made by a remote air heat exchanger.

In "LE" version units, the same functionalities done by the heat exchanger connected to the user hydraulic circuit are done by a remote air heat exchanger.

5.5 Structure

The structure is made of epoxy polyester powder coated sheet metal, with removable panelling lined with sound absorbing material.

For sizes 6, 8 and 11 of units in LN set-up, standard sound absorbing material is replaced with multilayer acoustic insulation that is sound absorbing and soundproofing.

For sizes 16 to 48, this set-up includes insertion of a soundproof casing on the compressor. This set-up can be combined with all the aforesaid versions of the unit.

Sizes 6, 8 and 11 are prepared for wall mounting, sizes 16 to 48 are prepared for floor mounting.

5.6 Specifications

Water-condensed water chiller unit with hermetic scroll compressor, condenser and dry-expansion plate evaporator.

We reserve the right to make changes without any prior notice.

5.7 Control panel

This line of units is managed with a parametric electronic microprocessor controller.

The next sections describe the basic operations, 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.

5.7.1 Parametric control

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

Fig. 5 Display of the parametric control

5.7.1.1 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 and remain operational but allow the unit to be started and stopped in the respective operating mode only when the digital input is closed.

We reserve the right to make changes without any prior notice.

5.7.1.2 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 and 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 and only to enable or disable the unit in the function envisaged by the digital input.

5.7.1.3 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 and 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.

5.7.2 Remote terminal

The remote terminal is available as accessory.

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.

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

5.8 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.

We reserve the right to make changes without any prior notice.

6 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.

6.1 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.

6.2 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;
- 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.

During the defrost cycle, the remote heat exchanger of units in heat pump operation LC/HP allows water to flow out that freezes with sub-zero temperatures. Although the remote heat exchanger 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.

To install the remote heat exchanger of the LE and LE/HP units, consult the relevant documentation.

6.3 Installation

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

6.3.1 Positioning the units

The units must be positioned in covered areas where temperatures are kept above 4°C.

Make sure the support can bear the weight of the unit (refer to the documentation supplied with the unit).

Units installed on the ground transmit a low level of vibration. It is in any case advisable to lay a strip of hard rubber between the base and the support surface (floor or concrete slab).

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

6.3.2 Positioning the remote heat exchanger

To position the remote heat exchanger, see the relevant manual.

6.3.3 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) 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, avoids 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 limiting the service spaces.

6.3.4 Minimum distances

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

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.

As for a possible remote heat exchanger, see the relevant documentation.

We reserve the right to make changes without any prior notice. Translation from original instructions

6.4 Hydraulic connections

When preparing to make the hydraulic circuits, it is good practice to comply with the following instructions and in any case follow the national and local regulations (refer to the layouts included in the manual).

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.

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.

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

The basic unit has a relay for management of a user-side pump and a relay for management of a source-side pump.

6.4.0 User hydraulic circuit

Reference hydraulic diagram for connecting the unit to the user circuit.

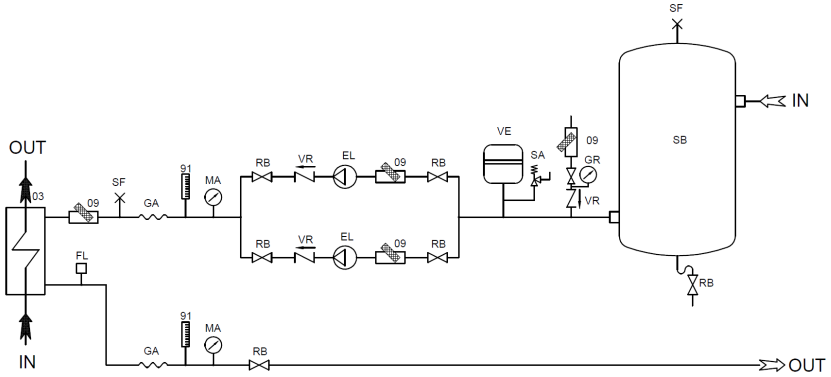


Fig. 6 Recommended hydraulic circuit

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.

6.4.1 Source hydraulic circuit

Reference hydraulic diagram for connecting the unit to the source circuit.

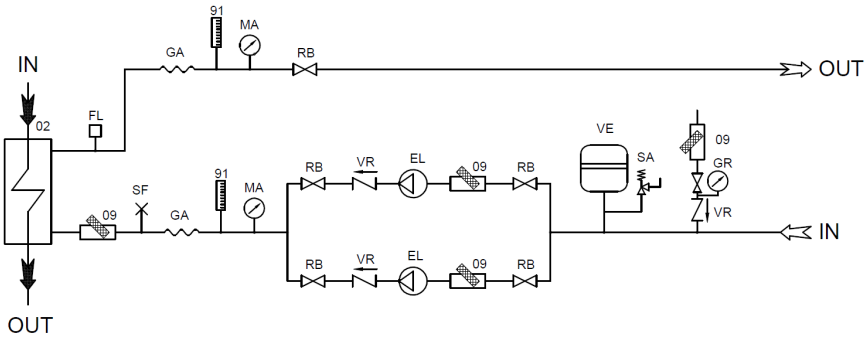


Fig. 7 Recommended hydraulic circuit

02	Condenser
09	Water filter
91	Thermometer
EL	Motor-driven pump
FL	Flow switch (mandatory in "HP" versions)
GA	Flexible coupling
GR	System filling unit
MA	Water pressure gauge
RB	Valve
SA	Safety valve
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.

Failing this, there would be a decline in the operating efficiency of the heat exchanger and, in "HP" units, there would be a risk of it being frozen since control by the antifreeze probe would be thwarted.

The hydraulic circuit must be made so as to guarantee the water flow rate to the heat exchanger for correct operation within the set limits (see the Technical Catalogue).

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

6.5 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 ±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 the potential free contacts for controlling the pumps are present, connect the pumps as shown in the wiring diagram.

Units with remote heat exchanger (LC, LC/HP, LE and LE/HP) require electrical connections between the two parts.

To carry out the connections, refer to the wiring diagram of the unit and to the documentation supplied with the remote heat exchanger.

The electrical connections to potential-free contacts, which are powered by external sources, must be suitably protected against overcurrent and earth faults.

The circuit of the potential-free contacts inside the electrical control panel is made using orange cable.

We reserve the right to make changes without any prior notice.

6.6 Refrigeration connections

For the "LE" (motocondensing),"LE/HP" (reversible motocondensing), "LC" (condenserless) and "LC/HP" (reversible condenserless) versions, refrigerant connections between the unit and the remote heat exchanger are necessary.

The "LE", "LE/HP", "LC" and "LC/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.

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.

6.6.1 Piping implementation

To lay the pipes, use copper pipes, of a suitable diameter 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 cooling only units "LE" and "LC". For the installation of reversible units "LE/HP" and "LC/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 pipe for reversible units "LE/HP" and "LC/HP");
- support the horizontal and vertical lines with suitable vibration dampers;
- insulate the suction line (suction/delivery line for reversible units "LE/HP" and "LC/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.

6.6.2 Sizing of lines for "LE" and "LE/HP" units

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	16	10	16	10	16	12
8	16	10	18	12	22	12
11	18	10	18	12	22	16
16	22	12	22	16	22	16
19	22	12	28	16	28	16
22	22	16	28	16	28	16
24	22	16	28	16	28	16
28	28	16	28	16	35	18
32	28	16	35	18	35	18
35	28	16	35	18	35	18
42	28	16	35	18	35	22
48	35	16	35	22	35	22

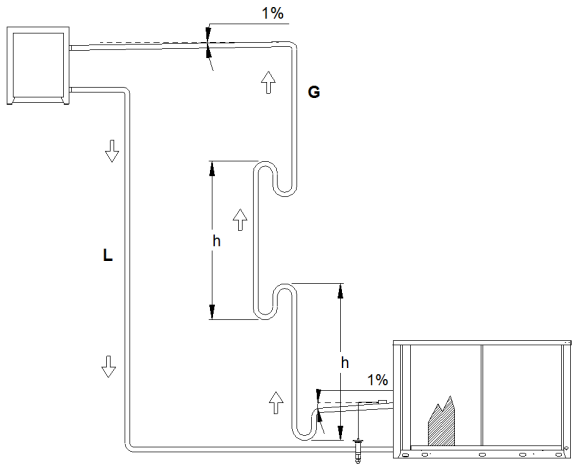
The above mentioned diameters were chosen in order to optimise the performance of the units, contemporaneously ensuring the proper operation at the permissible conditions and to contain the refrigerant charge within reasonable limits.

6.6.3 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 on 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.

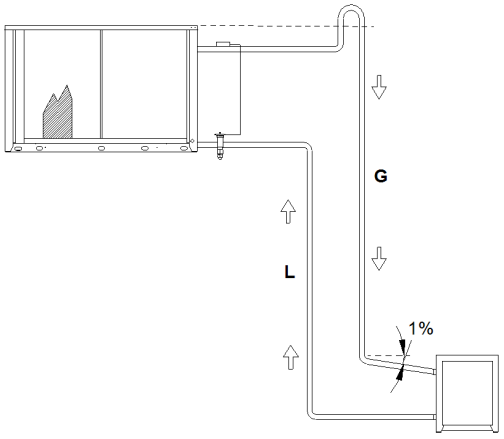


We reserve the right to make changes without any prior notice.

6.6.4 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.

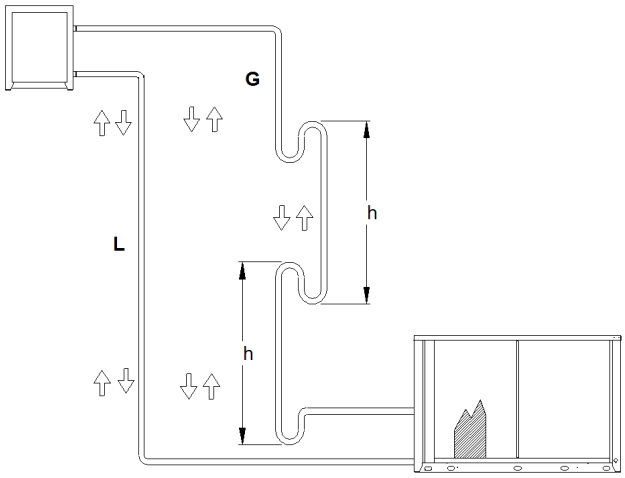
In the horizontal sections of the suction line "G", it is advisable to have a slope of at least 1% to facilitate oil return to the compressor.



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

There must be syphons on 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.

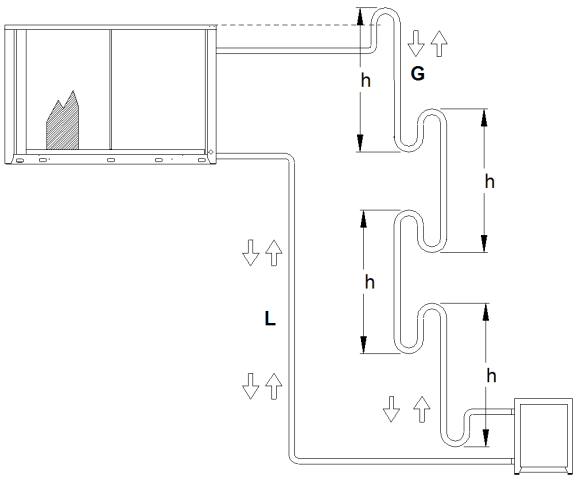


6.6.6 LE/HP version: unit installed at a lower level than the remote exchanger

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 on 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.



We reserve the right to make changes without any prior notice.

6.6.7 Sizing of lines for "LC" and "LC/HP" units

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

Recommended diameters for R410A for "LC" units - 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	12	10	12	10	12	12
8	12	10	12	12	12	12
11	16	10	16	12	16	16
16	16	12	16	16	16	16
19	16	12	16	16	16	16
22	18	16	18	16	18	16
24	18	16	18	16	18	16
28	18	16	18	16	18	18
32	18	16	18	18	22	18
35	18	16	22	18	22	18
42	22	16	22	18	22	22
48	22	16	22	22	22	22

Recommended diameters for R410A for "LC/HP" units - 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	16	10	16	10	16	12
8	16	10	18	12	22	12
11	18	10	18	12	22	16
16	22	12	22	16	22	16
19	22	12	28	16	28	16
22	22	16	28	16	28	16
24	22	16	28	16	28	16
28	28	16	28	16	35	18
32	28	16	35	18	35	18
35	28	16	35	18	35	18
42	28	16	35	18	35	22
48	35	16	35	22	35	22

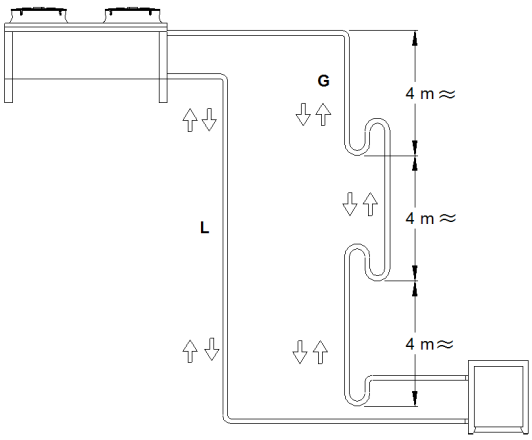
The above mentioned diameters were chosen in order to optimise the performance of the units, contemporaneously ensuring the proper operation at the permissible conditions and to contain the refrigerant charge within reasonable limits.

6.6.8 LC version: unit installed at a lower level than the remote exchanger

A summary is given below of the measures to be taken if the unit is installed at a lower level than the condenser:

make a well on the delivery line just downline of the compressor to collect the liquid refrigerant that can form during the stops of the unit and can irreparably damage the compressor;

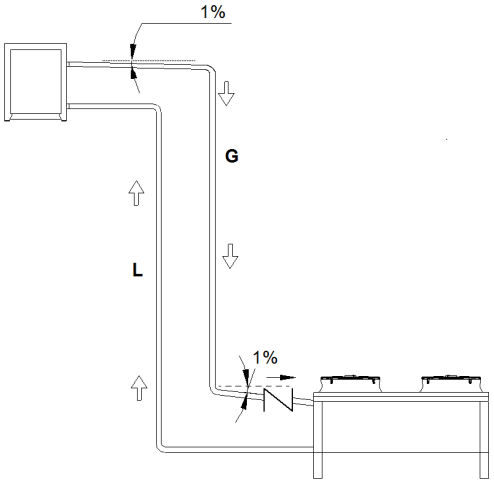
- there must be syphons on the vertical sections of the delivery line "G" to facilitate oil return to the compressor. The height "h" must be less than 4 metres;
- in the horizontal sections of the delivery line "G", make a slope of at least 1% to facilitate oil return to the compressor;
- install a non-return valve near the condenser inlet in order to prevent liquid refrigerant from returning to the compressor when the unit is not running.



6.6.9 LC 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 condenser:

- install a non-return valve near the condenser inlet in order to prevent liquid refrigerant from returning to the compressor when the unit is not running if the condenser is situated in an environment that may be at a higher temperature than the compressor;
- in the horizontal sections of the delivery line "G", it is advisable to have a slope of at least 1% in the direction of refrigerant gas outflow to aid oil return.

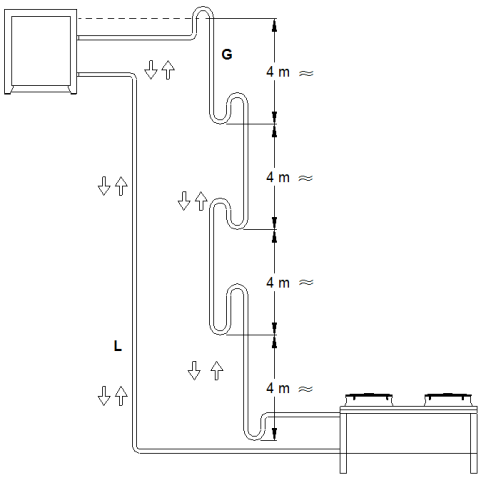


We reserve the right to make changes without any prior notice.

6.6.10 LC/HP version: unit installed at a higher level than the remote exchanger

There must be syphons on 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.

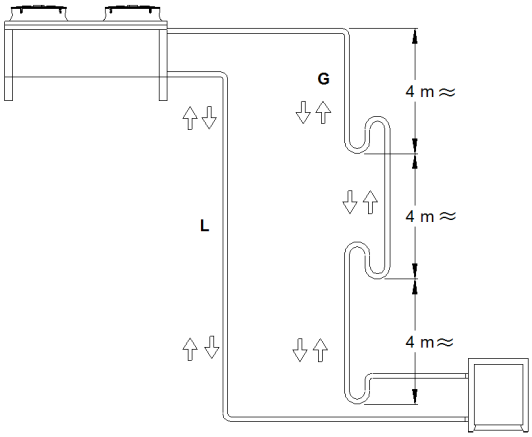
The horizontal sections of the suction/delivery line "G" must not slope at all.



6.6.11 LC/HP version: unit installed at a lower level than the remote exchanger

There must be syphons on 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.



6.7 Refrigerant connections on the remote exchanger

For the "LE" motocondensing units, connect the liquid pipe that comes out of the unit to the expansion valve installed on the distributor of the remote heat exchanger and the suction pipe of the unit to the relevant manifold on the remote heat exchanger.

For the "LC" condenserless units, just connect the liquid pipe and the delivery pipe that come out of the unit to the relevant ones of the remote heat exchanger.

For the reversible motocondensing and condenserless units ("LE/HP" and "LC/HP"), the refrigerant connections differ in the number of connections of the remote heat exchanger.

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

6.7.1 Expansion valve

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

6.7.2 Remote heat exchanger with two connections

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.

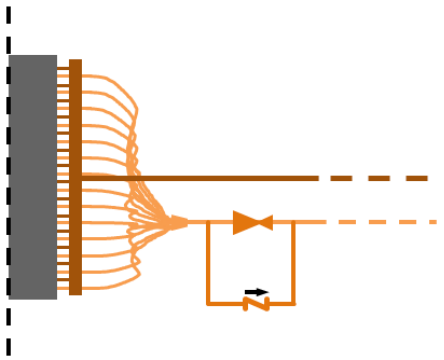


Fig. 8 Diagram of expansion valve connection with remote heat exchanger with two connections

6.7.3 Remote heat exchanger with three connections

In this case, it is necessary to install a non-return valve on the heat 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.

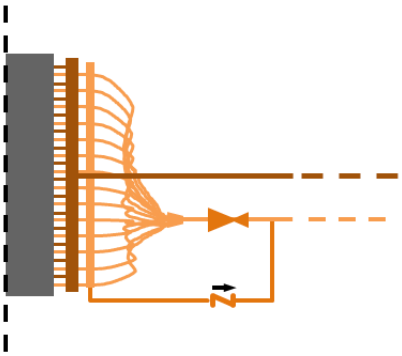


Fig. 9 Diagram of expansion valve connection with remote heat exchanger with three connections

6.8 Vacuum of the system

Open the taps of the unit and evacuate the pre-charge of nitrogen and helium before completing the refrigerant connections. 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.

We reserve the right to make changes without any prior notice.

7 COMMISSIONING

7.1 Preliminary operations

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

In units with pumps, their power supply is mechanically locked.

Restore functional conditions only on starting.

If the pumps of the unit are not locked, electrically isolate them by operating the protective devices, to prevent automatic starting, in the event of antifreeze function activation, during the preliminary operations.

Restore functional conditions only on starting.

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.

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 terminals are properly tightened;
- that the voltage on the RST terminals is 400 V ± 10% (or the rated voltage of the unit if there are special voltages). If the voltage fluctuates frequently, contact our technical department to choose suitable protective devices;
- 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 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.

If present, 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 pump has been bled properly;
- that the installer has organised a storage tank with the appropriate capacity for the volume of the system's water.

To bleed the pump, use the fill plug on the volute, as shown in the image.

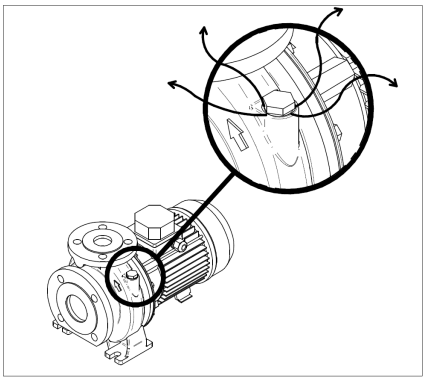


Fig. 10 Bleeding the pump

7.1.1 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

7.1.2 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.

The volume of the expansion vessel must be checked for each hydraulic circuit

We reserve the right to make changes without any prior notice.

7.1.3 Preliminary operations for LE and LE/HP units

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.

7.1.4 Preliminary operations for LC and LC/HP units

In addition to the previous general checks, further checks are needed for units with remote condenser exchanger:

- make sure the fans are turning the right way;
- connect the signals of the thermal safety devices of the fans to the terminals arranged inside the electrical control panel of the unit, as shown in the wiring diagram;

We reserve the right to make changes without any prior notice.

7.2 First starting

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

7.2.1 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 input 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.

Before starting the unit, make sure the system has been bled correctly.

For units equipped with pump unit, check that the pumps controlled with direct starting are rotating in the correct direction.

If the control for water circulation in the source system is present in the electrical control panel of the unit, the starting of the pump takes place with the starting of the first compressor.

If the control for water circulation in the source system is not present in the electrical control panel of the unit, make sure there is water circulation in the source system with the starting of the first compressor.

Check the pumps are rotating in the correct direction.

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 unit, if the pump is noisy, 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.

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.

We reserve the right to make changes without any prior notice.

7.2.2 Functional tests

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

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. 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.

We reserve the right to make changes without any prior notice.

7.3 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

7.4 Checks during operation

With the circuits 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 in the user circuit, read between the inlet and outlet of the unit falls within the allowed range given in the Technical Catalogue.
- higher values indicate that there is a reduced water flow rate 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.
- 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.
- that the water temperature at the outlet of the source circuit falls within the allowed range given in the Technical Catalogue;
- lower values indicate condensation control problems associated with water flow rate;
- that the difference between the condensing temperature of each circuit and the water temperature read at the outlet of the source-side heat exchanger is within 6°C.

For units with remote condenser, also check that the difference between the condensing temperature of each circuit and that of the air is less than 25°C. If it is greater, check that all the fans involved are turning correctly and that no parts are obstructing the condensing coil.

We reserve the right to make changes without any prior notice.

7.5 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.

7.5.1 General troubleshooting

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.
The unit does not start, the display is on.	There is no 230V auxiliary power supply.	Check that the secondary circuit of the 230V transformer is intact.
		Check that the protective devices downline of the 230V transformer are intact.
		Check that the phase sequence is correct and that the phase sequence relay is intact.
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.

We reserve the right to make changes without any prior notice.

SYMPTOM	LIKELY CAUSE	POSSIBLE SOLUTION
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 overtem-perature.	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.

7.6 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”.

7.7 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.

We reserve the right to make changes without any prior notice.

8 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.

8.1 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).

8.2 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.

8.2.1 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.

8.2.2 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.

We reserve the right to make changes without any prior notice.

8.3 Cleaning the remote exchanger

When present, the remote heat exchanger is the component that needs looking after the most.

8.3.1 LE and LE/HP motocondensing units

For the "LE" and "LE/HP" motocondensing and reversible motocondensing units, the component that needs looking after the most is the remote finned pack heat exchanger installed in the room.

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

8.3.2 LC and LC/HP condenserless units

For the "LC" and "LC/HP" condenserless and reversible condenserless units, the component that needs looking after the most 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.

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

We reserve the right to make changes without any prior notice.

8.4 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
If present, check the crankcase heaters of the compressors.	Monthly
Clean the air filters	Monthly
Clean the ventilation filters of the electrical control panel.	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 that the noise emitted by the unit is normal.	4 months
Refrigerant leak detector sensor checking test	Yearly
Calibration of the refrigerant leak detector sensor	Every 3 years
Replacement of the refrigerant leak detector sensor	Every 5/6 years

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.

8.5 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.

8.5.1 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.

9 DECOMMISSIONING

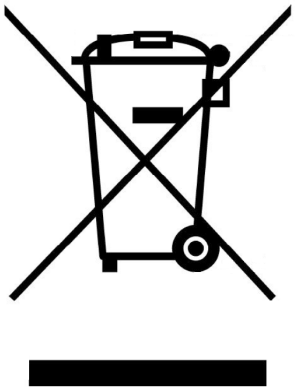
With reference to the European waste management directive, we inform you of the following:

- The owner of electrical and electronic equipment (EEE) is obliged not to dispose of it as non-separated municipal waste, and must dispose of it via separate collection through public or private waste collection systems as required by local regulations.
- The owner can return EEE to the dealer at the end of its life when purchasing equivalent new equipment.

This EEE may contain hazardous substances such as refrigerant gases, lubricating oils and accumulators or other materials, and improper or incorrect disposal of them may have adverse effects on human health and the environment.

Incorrect disposal of them also entails penalties as provided for by local regulations.

The symbol shown on the equipment, which indicates separate collection of EEE, is a crossed out wheelie bin accompanied by a solid horizontal bar and identifies that it was put on the market after 13 August 2005.



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