

ISTRUZIONI PER L'ASSEMBLAGGIO

ASSEMBLY INSTRUCTIONS MONTAGEANLEITUNG INSTRUCTIONS POUR L'ASSEMBLAGE INSTRUCCIONES PARA EL ENSAMBLADO



CO₂NNEXT

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1. General information

1.1. General introduction

These assembly instructions are an integral part of the product CO₂NNEXT (identified, in this document, with the term partly-completed machine) produced by the company Rivacold s.r.l.; for this reason, they will need to be part of the technical dossier of the final machine onto which this partly-completed machine will be incorporated.

These instructions have been written to provide the technicians involved in the installation and maintenance of the partly-completed machine with the essential information and instructions to operate correctly and safely.



ATTENTION: Needing to be easily and immediately available, these instructions must be kept in a place that is known and accessible to all.



NOTE: The purchaser may request a copy of this document (for example, in case of damage to the original document) with a written request to the Manufacturer's Technical Office (see Section 1.7.1 "Request for Assistance"), engaging, in any case, to return the damaged copy.

1.2. Proprietary information

These assembly instructions contain confidential proprietary information. All rights reserved.

These instructions may not be reproduced or photocopied, in whole or in part, without the prior written consent of the Manufacturer. Only the purchaser may use this documentary material to whom the instructions have been provided as a kit of the partly-completed machine and only for the purposes of installation and maintenance of the partly-completed machine to which the instructions refer.

The Manufacturer declares that the information contained in these instructions is consistent with the technical and safety specifications of the partly-completed machine to which the instructions refer. The drawings, diagrams and technical data shown are updated at the date of publication of this document and are valid only for the partly-completed machine to which they have been attached.

The Manufacturer reserves the right to apply changes or improvements to this documentation without prior notification.

The Manufacturer assumes no responsibility for direct or indirect damage to persons, property or pets resulting from use of this documentary material or of the partly-completed machine in conditions other than those provided for.

1.3. Contents of the assembly instructions

These assembly instructions are intended for technicians in order to be able to understand and install the partly-completed machine correctly.

In fact, these instructions provide, in addition to a description of the partly-completed machine, instructions and indications for:

- correct transportation and installation of the partly-completed machine;
- performing of correct cleaning, adjustment and maintenance of the machine;
- drawing attention to the most important safety and accident-prevention rules.

It is necessary to carefully read all the chapters in order to understand the indications provided in these instructions and to operate with the partly-completed machine; for subsequent and easier searching through the contents, refer to Table 1, containing a description of the topics addressed in the chapters.

CHAPTER	CONTENT
Chapter 1 General information	<ul style="list-style-type: none"> • Description of the assembly instructions, of their structure and of the conventions used; • definition of the terms used; • definition of the relationship between the Manufacturer and the Purchaser/User (in terms of warranty and assistance conditions).
Chapter 2 Introduction on safety	<ul style="list-style-type: none"> • Presentation of general indications on the partly-completed machine, on the solutions adopted for the protection of operating personnel; • Presentation of the residual risks present
Chapter 3 Description of the partly-completed machine	<ul style="list-style-type: none"> • Description of the partly-completed machine • presentation of the main technical data concerning the partly-completed machine.
Chapter 4 Transport and Installation	<ul style="list-style-type: none"> • Description of the methods for lifting and handling of the partly-completed machine; • description of the installation methods, electrical connection and commissioning of the partly-completed machine; • description of the mode of storage of the partly-completed machine. • Description of the partly-completed machine uninstallation.
Chapter 5 Maintenance and demolition	<ul style="list-style-type: none"> • Description of the verification and control procedures of the parts and components of the partly-completed machine (in particular, of the parts most subject to wear); • description of the procedures that allow the designated personnel to clean the partly-completed machine; • presentation of the instructions for disassembling, demolishing and disposing of the partly-completed machine.
Chapter 6 Options	<ul style="list-style-type: none"> • Description of the options available for installation on the partly-completed machine.
Chapter 7 Troubleshooting	<ul style="list-style-type: none"> • List of possible malfunctions of the partly-completed machine and the related solutions.
Chapter 8 Annexes	<ul style="list-style-type: none"> • Indications on the: • Technical datasheets of the possible versions of the partly-completed machine; • refrigeration diagram; • documentation of components fitted to the partly-completed machine. • declaration of incorporation

Table 1 – Structure of the assembly instructions

1.4. Conventions and definitions

The assembly instructions for the partly-completed machine were divided into chapters to enable, for each life phase of the partly-completed machine (transportation, installation, maintenance and decommissioning) readily available information necessary for the user of the partly-completed machine.

The entire documentation relating to the partly-completed machine was prepared by developing the topics indicated by the Machinery Directive (2006/42/EC), by the PED Directive (2014/68 EU) and by the current safety regulations.

The configuration of certain elements or devices described or represented in the documents may differ from that composing the partly-completed machine in the specific set-up created according to particular requirements or safety regulations; in this case, certain descriptions, references or best practices may have a generic character while retaining their effectiveness.

Dimensional drawings and photographs are provided as an example as a reference for easier understanding of the text.

1.4.1. Definitions

PARTLY-COMPLETED MACHINE: it is the term used in these Assembly Instructions to indicate the CO₂NNEXT.

P.P.E.: it is the acronym for Personal Protective Equipment.

DANGEROUS ZONE: Any area inside or near the machine in which the presence of an exposed person is a risk to the health and safety of the person.

USER: Any person (entrepreneur/company) who adequately uses the partly-completed machine or who entrusts its related use or operations to instructed persons.

EXPOSED PERSON: Any person wholly or partially present in a dangerous zone or near such areas.

MECHANICAL MAINTENANCE TECHNICIAN: Qualified technician allowed to work on any mechanical component, to carry out the necessary adjustments, repairs and maintenance intervention.

The mechanical maintenance operator is not permitted to carry out interventions on powered electrical plants.

ELECTRICAL MAINTENANCE TECHNICIAN: a qualified technician in charge of electrical works (adjustment, maintenance, repairs) and, when necessary, works inside powered electric cabinets and the junction boxes.

HANDLING PERSONNEL: Qualified personnel who carry out the tasks of handling the partly-completed machine or the materials used if the operation requires the use of lifting devices.

MANUFACTURER'S TECHNICIAN: Qualified technician provided by the manufacturer of the partly-completed machine to carry out operations of a complex nature in particular situations or, in any case, when agreed with the user.

1.4.2. Personal protection equipment and rules of conduct

For each of the operations described in these instructions are indicated the means of protection that personnel are required to use and the rules of conduct that allow protection of the safety of the operators themselves.

1.4.3. Graphical conventions

The graphic layout of these Assembly Instructions is such as to allow easy recognition of the contents; in this context, for example, the instructions are associated with lists, as indicated below:

- This symbol identifies a generic bulleted list or list in points consisting of simple actions (the order in which the actions are presented is not mandatory but recommended);

1. In this way a numbered explanatory list of a complex procedure is identified (the order in which the actions are presented is mandatory to correctly and safely perform the intervention in question).

Italicised text is used, in particular, for:

italic text

- cross-references; the cross references used in these instructions are expressed in the following form: "Paragraph/Table" with the number and, in general, the specification "of the Chapter" with the number and the relative name (when it is not specified it is implied that the paragraph or the table belong to the current chapter);
- the technical and specialised terms, the first time they appear in the text;
- foreign terms which are not commonly used (normally, the first time they appear in the text).

bold text Bold text is used to highlight words, phrases or parts of the procedure.

Editorial pictograms

To ensure further knowledge of the partly-completed machine, the text of these assembly instructions is accompanied by indications that complete them, providing additional information, highlighting tasks that require essential attention and also particularly significant hazards to consider; in this regard, the following notation is used:



DANGER: It indicates situations or operations that must be performed or information to which particular attention must be paid to prevent causing injuries to persons.



WARNING: It indicates situations or operations in which there is the possibility of causing damage to the machine or to the equipment connected to it.



ENVIRONMENTAL NOTE: It indicates situations or operations in which there is the possibility of causing damage to the environment.



NOTE: it indicates the notes, warnings, suggestions and other points to which to draw the reader's attention or to complete the explanation with further information.

Personal Protective Equipment (PPE)

This paragraph indicates the graphic symbols used in these instructions to indicate the need to use certain PPE.

SYMBOL	DESCRIPTION
	It indicates the need to use suitable head protectors to perform the described operation.
	It indicates the necessity to use suitable protective gloves to perform the operation described (possibly of the dielectrics type for operations on the electrical system).
	It indicates the necessity to use suitable protective clothing to perform the operation described.
	It indicates the necessity to use suitable safety shoes to perform the operation described.
	It indicates the necessity to use protective goggles to perform the operation described.

Table 2 – Individual protection devices

1.5. Testing

The partly-completed machine is directly tested by the manufacturer during the production phases at the headquarters of Rivacold s.r.l.

1.6. Warranty

1.6.1. General conditions

The Manufacturer, Rivacold s.r.l., guarantees the partly-completed machine and the equipment produced by the Manufacturer itself as being free from material and processing defects for a period that is agreed upon when the contract for the sale of the same machine is concluded.

The parts subject to wear and all the tools and consumables supplied by the Manufacturer together with the machine are excluded from the warranty.

1.6.2. Operations that invalidate the Warranty

Any attempt to disassemble, modify or tamper with a component of the partly-completed machine by the user or by unauthorised personnel entails invalidating of the warranty and exempts the Manufacturer from any responsibility for any damage to persons or property. deriving from such tampering.

The Manufacturer is also deemed to be exempted from any liability with invalidation of the warranty relating to the partly-completed machine in the following cases:

- unforeseen uses of the partly-completed machine (see Section 2.5 "Proper and improper use of the partly-completed machine");
- use contrary to that required by the regulations in force in the country of use;
- installation of the partly-completed machine under conditions other than those specified in Chapter 4 - Transport and Installation;
- installation not compliant with the specifications provided in Chapter 4 - Transport and Installation;
- full or partial failure to comply with the instructions provided in this instruction manual;
- non- or incorrect maintenance;
- use of spare parts which are not original or not specified by the Manufacturer.

1.7. Assistance

Regarding the maximum exploitation of the services provided by the partly-completed machine and the extraordinary maintenance operations, this instruction manual does not replace the experience of trained and qualified installers, users and maintenance technicians.

In this case, the Technical Assistance Service of Rivacold s.r.l. provides:

- telephone support regarding the simplest features and interventions that can be performed on the PARTLY-COMPLETED MACHINE;
- sending of documentary material;



WARNING: If in any doubt about the correct interpretation of the instructions provided in these assembly instructions, contact the Technical Assistance Service (as indicated below) to obtain the NECESSARY clarifications.

1.7.1. Request for assistance

The Technical Assistance Service contact details are:

TECHNICAL OFFICE OF THE COMPANY RIVACOLD S.R.L.

Telephone: (+39) 0721 919911 - Telefax: (+39) 0721
490015

Via Sicilia, 7 - Fraz. Montecchio
61022 VALLEFOGLIA (PU) - ITALY

Provide the name, model and serial number of the partly-completed machine when asking for assistance.

2. Introduction on safety

2.1. Design criteria

In designing the partly-completed machine principles and concepts have been applied according to the paragraphs on the harmonised standards indicated in Table 3.

STANDA	NAME
EC Directive no. 2006/42	Machine Safety Directive
UNI EN ISO 12100: 2010	Machinery safety design principles for design - Fundamental concepts, main principles - Part 1: Main concepts, general
UNI EN ISO 12100: 2010	Machinery safety main design - Fundamental concepts, principles - Part 2: Technical principles
UNI EN ISO 13857: 2008	Safety of machinery – Safety distances to prevent hazard zones being reached by upper and lower limbs
UNI EN ISO 14120: 2015	Machinery safety – Guards - General requirements for the design and construction of fixed and mobile guards
UNI EN 378-1: 2017	Refrigeration systems and heat pumps – Safety and environmental requirements – Part 1: basic requirements, definitions, classification and selection criteria
UNI EN 378-2: 2017	Refrigeration systems and heat pumps – Safety and environmental requirements- Part 2: design, construction, testing, marking and documentation
IEC EN 60204-1: 2006	Safety of machinery - Electrical equipment of machines - Part 1: General rules

Table 3 - Main harmonized standards used to design the partly-completed machine

Compliance with the relevant paragraphs of the afore-mentioned harmonised standards has made it possible to eliminate or reduce risks in the best way possible, both during normal operation and during maintenance operations.

The components used have been carefully chosen from those available on the market; the materials the partly-completed machine is made of involve no risks to the health and integrity of persons. All parts supplied by third parties are CE-marked (when envisaged) and comply with the relevant directives of reference. All components have been strictly controlled in accordance with the quality standards prescribed by the current regulations.

For the partly-completed machine, the necessary warning and protection measures have been adopted in relation to the residual risks (see, in this regard, Section 2.3 "Residual Risks").

2.2. Devices and Solutions for protection

2.2.1. Passive safety devices

For the partly-completed machine the devices and constructive solutions described below were adopted:

- fixed guards close to the moving parts;
- external fairing with fixed access doors (if present);
- safety signs corresponding to the guards of the partly-completed machine.

2.2.2. Active safety devices

For the partly-completed machine, the active safety devices described below were adopted:

- Maximum safety pressure switch for each automatic reset compressor (PSH) or for specific versions with safety pressure switch for each manual reset compressor (PZH);
- Safety valve on the MT and LT circuit low pressure side (if present);
- Safety valve(s) on the intermediate receiver;
- Safety valve on the high pressure side, (if present).

The valve calibration is shown on the valves themselves and has been dimensioned on the basis of the indications of the EN 13136 standard.



ATTENTION: It is absolutely forbidden to modify the calibration of the safety pressure switch and/or to inhibit its operation.

2.2.3. Protection systems

The system is equipped with protections to safeguard anomalous situations acting on both the pressure and voltage circuits.

Excessive pressure inside the refrigeration circuit

The safeguard against excess pressure inside the refrigerating circuit during discharge, which beside compromising system operation, can also be dangerous to the personnel, has two intervention steps:

- When the pressure reaches values exceeding the acceptable conditions, values determined according to the characteristics of the refrigerant adopted, from the sizing of the system and from the characteristics of the compressor, the maximum pressure switches intervene which cause the associated compressor to stop. Resetting the system operation can occur automatically or through manual intervention, which should only be carried out after having removed the fault cause. The resetting differs on the basis of the machine characteristics.



ATTENTION: It is strictly forbidden to change calibration of the high pressure safety switches once testing has been carried out during initial start-up.

- Regarding all the safety valves on the low pressure and high pressure side; the calibration is shown on the valve itself and has been calculated on the basis of the indications of the EN 13136 standard. The intervention of these devices causes leakage and loss, in whole or in part, of the refrigerant loading into the system.

Refrigerant pressure defect

The causes that can cause lowering of the intake pressure beyond the values permitted in the project are:

- defect in the quality of refrigerant loaded;
- poor regulation of the thermostatic valves;
- gas leaks that reduce the load.

This entails a drastic reduction in the thermodynamic efficiency of the system and can cause compressor failure. If the reduction occurs at values lower than the calibration one, the protection from electronic control of minimum pressure comes into operation. This intervention blocks the compressor motor and reset is automatic. If the intake side pressure increases again, the system automatically restarts. This can of course be accepted if it were a transitory phenomenon while it requires maintenance if the phenomenon continues to be repeated.

Electronic control malfunction

In the event of malfunction of the electronic control acting on the compressors, electronic valves and on the gas-cooler, there may be limited functionality or system shutdown depending on the type of fault. The high pressure safety related to the pressure switches, independent of the electronic control, continues to be active. Probe reading failure or breakage of the probes, related to electronic control, may limit certain features or generate system shutdown. All malfunctions can be acquired by a supervisory system. Malfunction of the electronic control does not generate a risk for personal safety.

Insufficient lubrication of the compressor

In the oil circuit (if any) there is an oil separator, positioned on the general supply route, which redistributes the oil collected to the compressors themselves through appropriate logics and circuits.

Furthermore, the electronic control includes checking of the compressor speed in order to guarantee the correct oil return to the compressor.

2.2.4. Notifications

The partly-completed machine is equipped, in addition to the luminous signals and the instruments installed on the panel of the electrical panel, with indicator lights on the inside.

To access it, it may be necessary to remove one or more covering panels that close the structure.

For further information on the light signals and on the instruments of the electrical panel, refer to the wiring diagram and to the relative documentation attached to this manual.

ATTENTION: Operations with the panel removed should only be performed by authorised/qualified personnel.



Observe all foreseeable safety precautions and use the necessary PPE. At the end of the intervention, always carefully replace all the panels removed.

Liquid passage light

It is a transparent indicator that is installed along the liquid line which allows understanding of the load state. When the system is at full speed, the flow through the sight glass must be continuous and free from foams or gas bubbles. If there is considerable turbulence with the presence of gas, wait a few minutes before correcting the load; it could be a transitory phenomenon caused by rapid opening of a thermostatic valve.

Humidity reporting

On the liquid passage indicator it is possible to observe a coloured element that indicates if the refrigerant is dry or contains moisture. Based on the colour, it is possible to understand the status.

In the presence of moisture it is possible to replace the dehydrating filter. Should the problem persist it is necessary to stop the system, empty it and repeat the empty and load phases.

Oil level indicator light

It is installed on the oil separator (if present) and indicates the minimum level. Depending on the version of the partly-completed machine there may be a second indicator to identify the maximum level. The oil level check must be carried out when the system is fully operational for a few hours and for a few days after starting.

If it is necessary to top up, always use only the type of oil indicated on the plate of the machine and/or in the enclosed documentation.

Pressure reporting

The pressure reading at the different points of the circuit is possible by:

- electronic control;
- The installation of pressure gauges.

The pressure gauges must be connected to the service valves on the various points of the circuit. In case of faired units, to access the connection points, it is necessary to remove the covering panels.

Indication of presence of malfunctions and presence of alarms

The presence of alarms is signalled by a red light directly on the electronic control terminal located on the door of the partly-completed machine. The light can be flashing or fixed; in the first case, the light indicates the presence of active and unseen alarms, the second identifies that the alarm has been viewed.

A red light on the electronic control display in the panel area generally indicates the malfunction and/or alarms presence status. The specific cause can be identified by interrogation of the electronic control. These signals can be acquired by a supervisory system.

Some alarms can be of manual reset type and therefore the intervention of a technician on the partly-completed machine is required.



DANGER: Manual reset of the system or part of it following an anomaly involves the intervention of a specialist technician who only after having analysed the causes and having resolved the problem can restart the system.



DANGER: With R744 (CO₂) refrigerant all operations must be carried out only by specialist technicians trained to operate with this type of refrigerant.

2.3. Residual risks

To avoid any dangerous condition for persons or damage to the partly-completed machine caused by residual risks, i.e. those risks that persist despite all provisions implemented, or potential risks which were not obvious, the manufacturer recommends that maintenance personnel and all personnel in charge of operating the partly-completed machine strictly follow the warnings indicated in the following pages.



ATTENTION: Always comply with the signs and indications of the plates applied to the machine and operate exclusively according to the instructions provided in this instruction manual.



ATTENTION: All operations to be performed on the machine must be performed by qualified, trained, informed or properly equipped personnel.



Residual risk of intoxication

To avoid impacts or damage that could cause leaks of gases dangerous to human health, install the machine in a dry, protected and sufficiently ventilated place in compliance with the laws of the country of installation.



Residual risk of burns

Before carrying out any work on the machine, make sure that the hot surfaces have cooled down; wear protective gloves to avoid burns.

2.4. Safety Plates

The warning plates shown in Table 4 are present on the partly-completed machine.












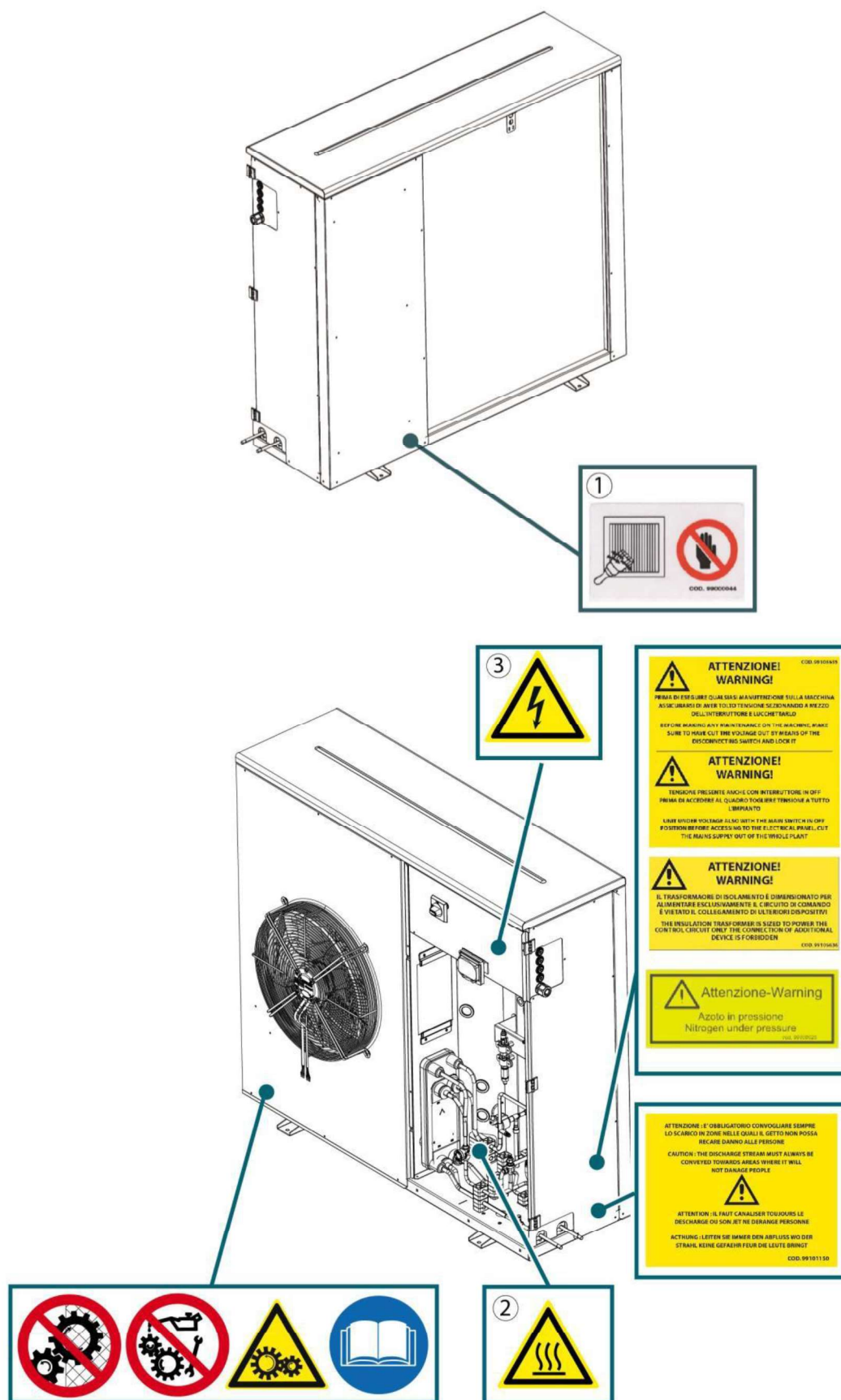
PLATE	DESCRIPTION
	It indicates the prohibition to remove the devices and the safety protections installed; it is typically also accompanied by an explanatory text: DO NOT REMOVE THE PROTECTIVE DEVICES.
	It indicates the prohibition to perform any intervention (including lubrication and cleaning) close to moving parts; typically, it is also accompanied by an explanatory text: DO NOT REPAIR OR ADJUST WITH PARTS IN MOTION.
	It signals the danger, due to the presence of mobile parts close to the zone of the partly-completed machine where it is located.
	It reports the danger of electrical voltage.
	It reports the danger of hot surfaces.
	It reports the obligation to read the assembly manual/instructions.
	Indicates it is forbidden to touch the zone where it is positioned
	Pressurised nitrogen.
	Remove the voltage from the disconnecter before carrying out maintenance on the machine. Remove power to the entire system before carrying out operations inside the panel.
	It is forbidden to connect other devices to the control transformer.
	Obligation to convey the discharge of the safety valves.

Table 4 - Description of the warning labels on the machine.

Position of the pictograms on the partly-completed machine



1. On all the air exchangers present in the machine
2. On each surface subject to high temperatures
3. On each energised part

2.5. Proper and improper use of the partly-completed machine

The partly-completed machine which is the subject of these assembly instructions has been designed and constructed **exclusively** for refrigeration. The partly-completed machine is configured to use **only** R744 (CO₂) refrigerant gas.

The manner in which each partly-completed machine is designed to use only the above refrigerant is specified. It is therefore important to use the partly-completed machine in compliance with the refrigerant fluid for which it was designed and built and as received from the Manufacturer.

The partly-completed machine has been designed and built to work in environments where **there is no potentially explosive atmosphere.**

The partly-completed machine must be adequately protected from atmospheric agents.

It is a good precautionary measure to have powder extinguishers in the vicinity of the partly-completed machine. To prevent the possibility of fire, keep the partly-completed machine clean of plastic pieces, oil, solvents, paper and rags.

Use of the partly-completed machine for different operations could cause harm to persons or damage to the machine itself and are therefore considered **improper use** for which the manufacturer is not responsible.



DANGER: The user MUST view the type of gas contained in the partly-completed machine and its quantity in order to operate properly.



ATTENTION: In case of different use, it is essential to consult in advance with the Manufacturer's Technical Office.



DANGER: With R744 (CO₂) refrigerant all operations must be carried out only by specialist technicians trained to operate with this type of refrigerant.

2.6. Incorporation statement

This document is accompanied by a Declaration of Incorporation which will be issued by the manufacturer at the time of purchase.

2.7. General Warnings and Rules of Conduct

In order to avoid any risk to persons or damage to the machine, it is advisable to strictly follow the warnings and general rules of conduct reported here.



DANGER WARNING: the Manufacturer disclaims any liability for any damage to property and/or persons arising from improper operations carried out by unqualified, untrained or unauthorized personnel.

- Operators in charge of operation of the partly-completed machine must be adequately trained to best use it, with no risk, and must work in a comfortable environment that guarantees the best possible safety and hygiene conditions.
- Prior to using the partly-completed machine ensure that any hazardous conditions for safety have been removed and no operators are present in the danger area near the partly-completed machine.
- After removing the packaging, make sure all machine parts are intact, otherwise contact your dealer.
- Before using the partly-completed machine, make sure all guards or other protections are fitted and that all safety devices are present and working.
- Carefully read the labels on the partly-completed machine, do not cover them and replace them immediately if damaged.
- Do not place containers of liquids on the partly-completed machine.
- Consult these instructions on the safety provisions in force and the specific PPE to implement for staff safety; in particular, the staff responsible for the partly-completed machine must wear suitable clothing, avoiding or paying due attention to:
 - loose clothing,
 - wide sleeves,
 - ties or draping scarves,
 - necklaces, bracelets and rings.
- Staff responsible for maintenance of the partly-completed machine must be aware of all the procedures outlined in Chapter 5 - Maintenance and Demolition and have adequate technical preparation to correctly interpret the instructions and diagrams attached to these instructions and to intervene on the partly-completed machine.

- The area where the maintenance operations are carried out must always be clean, dry and with the appropriate equipment always available and efficient.
- If it is necessary to perform interventions in the vicinity of electrical components, operate with dry hands and use dielectric gloves.
- If the machine is installed in a position not easily accessible to the operator, it is necessary to have suitable structures to allow access to the intervention areas.



DANGER: It is necessary to ensure that before starting any type of intervention on the machine or on its components or accessory equipment, the power supply is disconnected; if this is not possible, it is necessary to provide precautions that in any case allow operating in safety close to the partly-completed machine.



DANGER: The leaking of refrigerant gas following intervention of the safety valve can cause damage to property and/or to persons.



DANGER: Tampering with or unauthorised replacement of one or several parts of the partly-completed machine and the use of accessories, tools and consumables other than those indicated by the Manufacturer may result in an accident.



DANGER: The R744 (CO₂) refrigerant is colourless and odourless. Its presence in the environment can cause asphyxiation. All operations must be performed in the presence of gas presence detectors and in compliance with the safety regulations of the country of installation.



ATTENTION: With R744 (CO₂) refrigerant all operations must be carried out only by specialist technicians trained to operate with this type of refrigerant.



ATTENTION: With R744 (CO₂) refrigerant all operations must be carried out in the presence of gas presence detectors.



ATTENTION: All materials with an environmental impact that must be eliminated as a result of interventions or work on the machine must be disposed of according to the regulations in force. If necessary, use specialist facilities for their disposal.

3. Description of the partly-completed machine

The partly-completed machine models that are the subject of this document are faired condensing units for use in commercial refrigeration. The faired condensing units are systems for positive and negative refrigeration where the heat can be disposed of into the environment.

The faired condensing units are compact, low noise systems, suitable for working outdoors.

The partly-completed machine is designed and optimised to work with CO₂ (R744).

The operating modes can be transcritical or subcritical depending on the conditions of the external environment.

The electronic control, with appropriate logics, allows the partly-completed machine to always operate in conditions of maximum efficiency in different environmental conditions and cold demand. It also manages lubrication and any alarms signalling them on the electronic control terminal and on any type of supervision. Depending on the models, for the condensing unit, units can be provided with a single fan-motor, or with a double fan.

The various models are equipped with the following refrigerator accessories:

- BLDC compressor(s) driven by inverter;
- control valves;
- intermediate receiver;
- dehydrating filter and liquid indicator;
- on-board gas-cooler;
- electrical panel with relative electronic control;

For the negative refrigeration models there is also a desuperheater (intercooler) incorporated in the gas-cooler battery.

All models also have a casing heating element that prevents the accumulation of liquid in the lower area of the compressor during downturn periods. The unit is always enclosed in a self-supporting housing made of steel varnished with epoxy powder, and is equipped with electrical equipment with a main disconnecting switch (the power supply wire that must be connected to the switch is not supplied).

The following variants are possible:

- Only for TN/MT positive refrigeration;
- Only for BT/LT negative refrigeration;

The compressors are managed by a dedicated inverter, which allows modulation of the capacity from 25 to 100%.

The compressor(s) of the partly-completed machine can be provided with a by-pass solenoid to facilitate starting of the same. On the line, pressing each compressor, there is a non-return valve.

The machine is equipped with pressure switches and safety valves to address any malfunctions.

In addition there are: back-pressure valve (HPV) in general delivery after the gascooler, intermediate liquid and gas separation receiver, a gas flash valve (VFL) to keep the pressure constant at the receiver itself (only in certain configurations), a braze-weld liquid filter with relative indicator, liquid-intake heat exchanger (if any), insulation of all cold parts, shut-off valves and service valves for easy maintenance.

An electric power panel with magneto-thermal switches and electronic control allows the power supply and management of the entire gascooler system and intercooler (if any) included.

The partly-completed machine can communicate with the supervisory systems through Modbus RTU communication via RS485, and can also be provided with a system of remote communication with the owner.

The compact design allows installation even in small spaces. The structure is made of bent sheet metal with epoxy paint and suitable feet dampen the vibrations. Depending on the version, the partly-completed machine can be soundproofed.

The partly-completed machine, depending on the model, has two different voltages: 230/1/50 Hz and 400/3/50Hz. For refrigeration, electrical, management and operating logics, refer to the dedicated documentation and manuals.

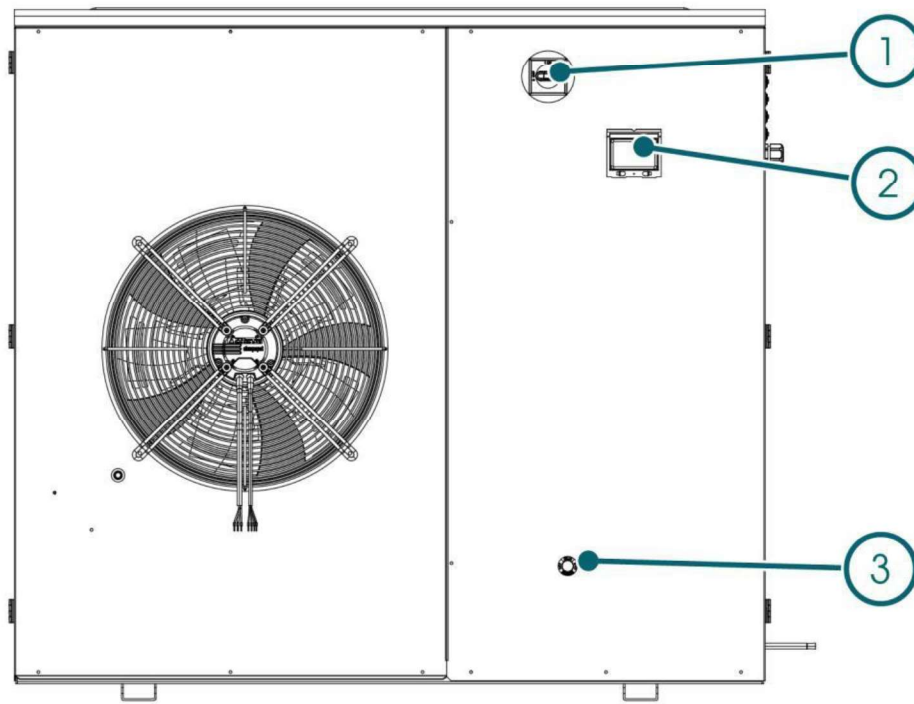
Regardless of the configuration, the partly-completed machine is always supplied without the air evaporators so it is not able to perform the function for which it is created without the evaporating unit. As a consequence, it is a partly-completed machine, as defined by Machinery Directive 2006/42/CE. In order to define the refrigeration cycle envisaged, the purchaser has to insert it in a complete refrigeration circuit.

It can however be placed on the market as it is, accompanied by the related declaration of incorporation of the manufacturer and the corresponding instructions for assembly, which enable its simple integration in the final machine (to be then CE marked, pursuant to the directives applicable to it, by whomever integrates it).

Regardless of the configuration, the partly-completed machine is always supplied without the air evaporators so it is not able to perform the function for which it is created without the evaporating unit. As a consequence, it is a partly-completed machine, as defined by Machinery Directive 2006/42/CE. In order to define the refrigeration cycle envisaged, the purchaser has to insert it in a complete refrigeration circuit. It can however be placed on the market as it is, accompanied by the related declaration of incorporation of the manufacturer and the corresponding instructions for assembly, which enable its simple integration in the final machine (which must then be CE-marked, pursuant to the directives applicable to it, by the integrating entity).

On the right front panel of the partly-completed machine is the electrical panel on which the main switch and the display are installed.

An example is shown below. For further information, refer to the wiring diagram and the enclosed documentation.



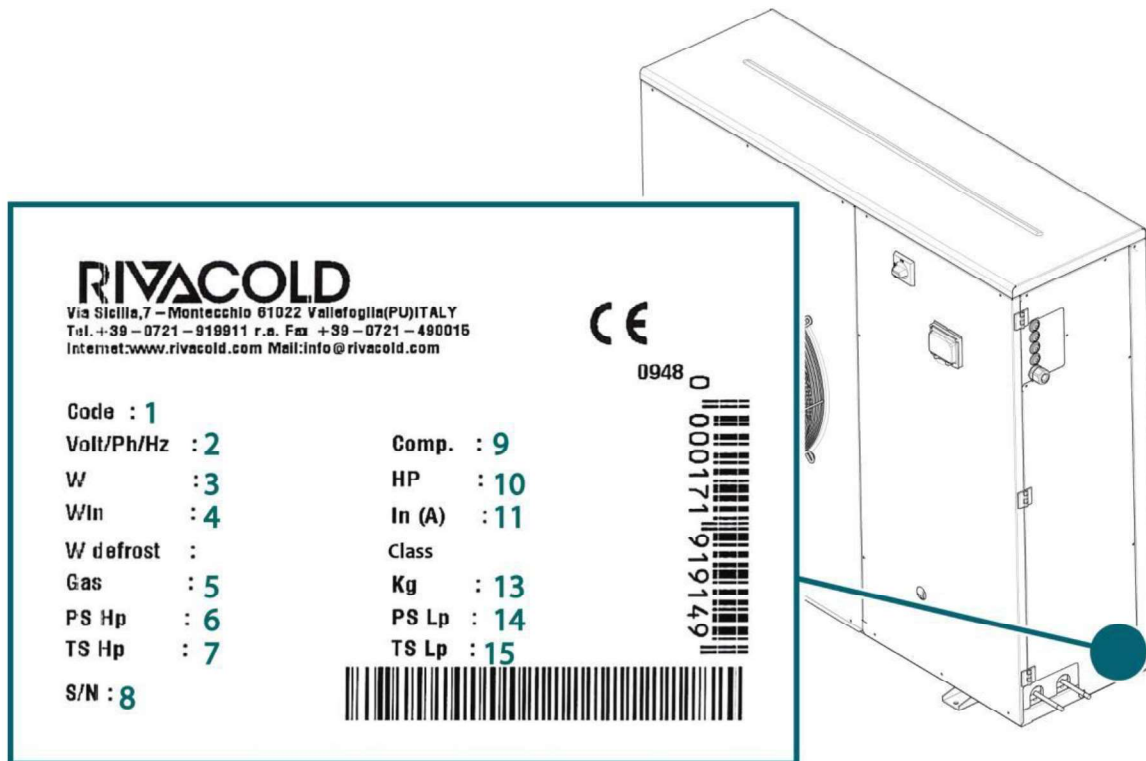
1. Main switch
2. Display*

3. Liquid indicator

* For the description of the display, see paragraph 4.5. "Preparation for start-up" in the dedicated section in this manual.

3.1. Identification plate

For identification of the partly-completed machine a specific CE identification plate has been affixed; the identification data shown on this plate must be reported to the Manufacturer's offices for each request for intervention or for the ordering of spare parts. The identification plate contains the following data:



- | | |
|---|---|
| 1. Partly-completed machine code | 9. Compressor |
| 2. Power supply voltage | 10. Horses |
| 3. Cooling capacity | 11. Absorption in amperes (A) |
| 4. Absorption in Watts | 12. - |
| 5. Type of coolant | 13. Refrigerant load |
| 6. Max. operating pressure (high pressure) | 14. Max. operating pressure (low pressure) |
| 7. Max. operating temperature (high pressure) | 15. Max. operating temperature (low pressure) |
| 8. Serial number | |

Example identification of serial number: Digit 1 and 2 =

Serial Number: 17033924

last two digits of the year of construction;

Digit 3 and 4 = week of the year in which the partly-completed machine was produced; Figures 5, 6, 7, 8 = progressive number.



NOTE: Additional plates may be available for partly-completed machine versions in which it is necessary to specify: positive and/or negative refrigeration powers; different models of compressors; pressures and operating temperatures.

3.1.1.Name

(A) (B) (C) (D) (E) (F) (G) (H) (I) (L) (M)
CN 045 M 1 45 X 0 2 1 1 00

A
B
C
D
E
F
G
H
I
L
M

Series: CO2NNext with BLDC motor

Size of compressor(s)

Type of application:

M = medium temperature
 (TN) L = low temperature

Number of fans:

1 = an electronic fan-motor 2 = two electronic fan-motors

Fan-motors diameter: 450 mm

Refrigerant type R744

Progressive no.

No. of gas cooler/capacitor rows

Expansion type: with thermostat valve

Supply voltage:

1 = 230/1/50 + neutral
 2 = 400/3/50 + neutral

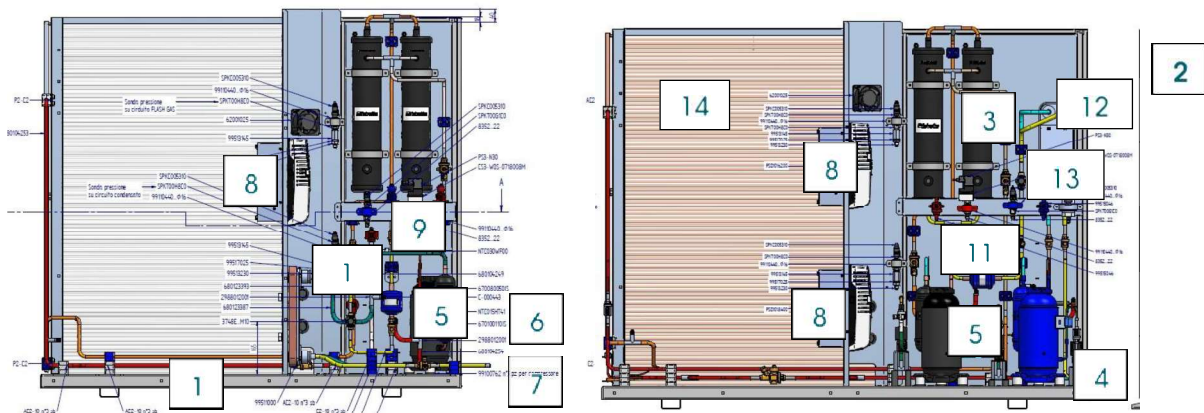
Optional *



***NOTE:** For further information, refer to UT.

3.1.2.Frame and components layout

The following shows the locations of the components and main connections of a type model.



- | | |
|-------------------------|-------------------------------|
| 1. Frame | 8. Inverter |
| 2. Electrical panel | 9. Flash gas valve |
| 3. Received liquid tank | 10. HPV or backpressure valve |
| 4. Solenoid valves | 11. Liquid filter |
| 5. MV-LV compressors | 12. ECO Subcooler |
| 6. Liquid line output | 13. Liquid indicator |
| 7. Suction line return | 14. Gascooler |

3.1.3. Technical data

In the documentation attached to this document, including a specific electric and refrigeration scheme, it is possible to find the following detailed technical information concerning the specific machine:

- R744 (CO₂) as the only usable refrigerant;
- Machine code;
- Number and model of TN/MT compressors;
- Number and model of BT/LT compressors (if any);
- Model of parallel compressor P (if present);
- Type and characteristics of the combined gas-cooler;
- Type and characteristics of the combined intercooler (if present);
- Rated and maximum electrical absorption data;
- Performance coefficient;
- Diameter and type of connections;
- Design pressures in the various sections of the circuit;
- Intermediate receiver volume;
- Type of oil used;
- PED category;
- Empty weight;
- Overall dimensions of the machine and packaging;
- Calculation conditions and set nominal values.

3.1.4. Noise

The noise level is shown in the attached documentation based on the model of the partly-completed machine. The value of the maximum and average noise level in the 24h is provided at a distance of 10m and depending on the variants of the partly-completed machine: without fairing, with fairing, with additional soundproofing.

The presence of several machines installed in a confined environment increases the overall noise level.



ATTENTION ! It is the PURCHASER's responsibility to carry out an assessment of the noise risk of their own activity as prescribed by the legislation in force in the place where the assembly is installed and to provide the operators with adequate Personal Protective Equipment (such as headphones for hearing protection).

4. Transport and Installation



DANGER: The operations indicated below must be carried out by qualified operators. The Manufacturer declines all responsibility for operations carried out without respecting the safety regulations, by unqualified operators and without compliance with the specifications of this manual.



ATTENTION! The user, having purchased the equipment, before use, becomes the person in charge of the component subject to Directive 2014/68/EU (PED) and must arrange for the legal checks to be performed according to the national legislation in force (Ministerial Decree 329 dated 1/12/2004 for Italy). For instance the start-up report, periodic checks, etc.



ATTENTION: With R744 (CO₂) refrigerant all operations must be carried out only by specialist technicians trained to operate with this type of refrigerant.

Prior to incorporating the partly-completed machine into the final equipment prepare the power supplies and the appliances necessary for correct operation of the system, following the instructions provided in this chapter and, if necessary, consulting the manufacturer's technical office beforehand.

4.1. Environmental requirements

Regarding the installation zone, the system does not have any particular restrictions from an environmental temperature viewpoint. The temperature can vary between -10°C ÷ +40°C.

The relative humidity must not exceed 50% with an ambient temperature of 40°C; higher relative humidity levels are permitted for lower temperatures (example RH 90% with an ambient temperature of 20°C).

The machine cannot be installed over 1000 m above sea level, unless otherwise specified.

The partly-completed machine has been engineered and manufactured to work in environments where no potentially explosive atmosphere is present.

4.2. Power Supplies and Utilities

The power supplies and utilities (responsibility of the purchaser) necessary for operation of the partly-completed machine consist exclusively of power supply.

Unless otherwise specified, the Purchaser must:

- prepare the means necessary to transport the partly-completed machine to the assembly or installation place;
- prearrange the tools necessary for assembly and installation;
- provide the auxiliary equipment and consumables (use only water and cleaning cloths).

4.3. Transport and handling

The indications contained in this paragraph must be respected during the phases of transportation and handling of the partly-completed machine and during its assembly on the final machine.



ATTENTION: During operations, the operator must use all the necessary Personal Protective Equipment (PPE).



DANGER: During transportation or handling of the partly-completed machine it is necessary to follow the warnings listed below.

- The means used for lifting and transportation must be sized and suitable to the load being moved.
- During the transportation phase, check that the load is correctly balanced and that there are no parts that are not correctly fixed or at risk of damage.
- The structure of the partly-completed machine must be intact and completely assembled.
- Check that the area intended for handling is clear and that there are no obstacles that could generate a dangerous situation.
- Transiting and remaining under suspended loads is prohibited. Always place the partly-completed machine on bearing surfaces suitable to support its weight.

4.3.1. Lifting



DANGER: the lifting operations must be performed under the direct supervision of a qualified mechanical maintenance operator.

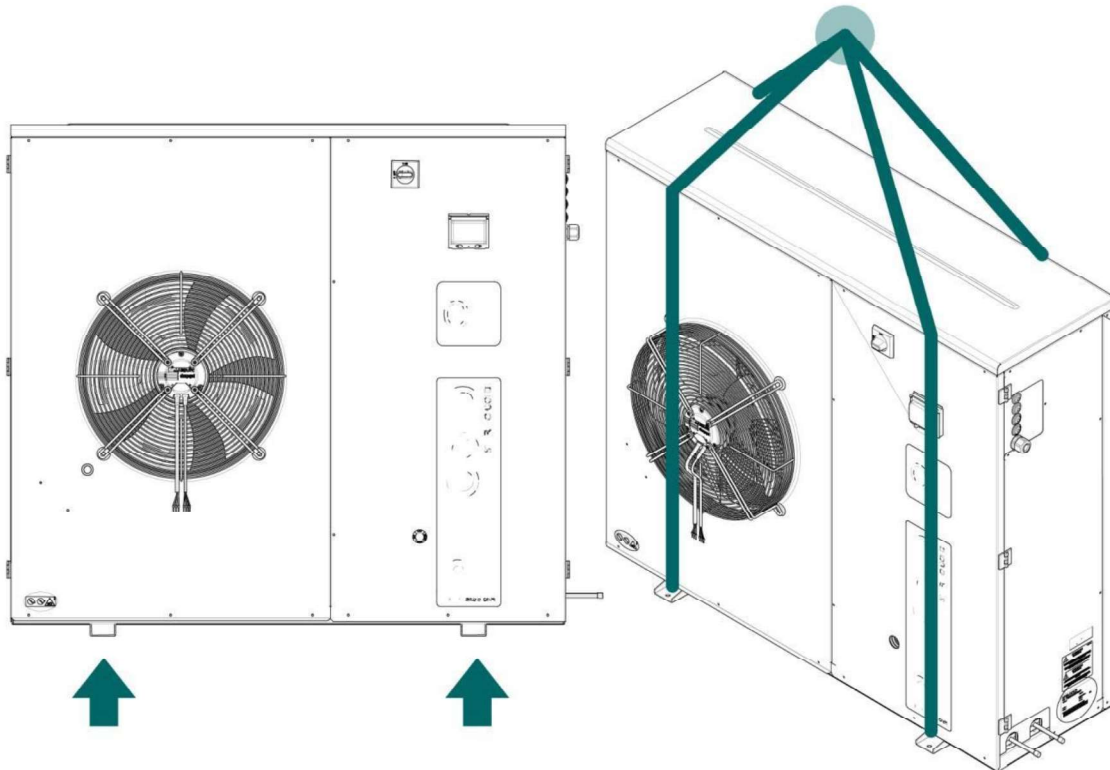


ATTENTION: during all these operations, exercise the necessary caution to avoid collisions and tipping over, handling the partly-completed machine in a manner that maintains conditions of balance.



DANGER: Make sure there are no unauthorised personnel near the area where the lifting, handling, and unloading operations are taking place. Such persons must always remain at a safety distance.

Lifting for handling and subsequent positioning of the machine must be performed using straps that must be inserted into the appropriate lifting pockets of the structure, as shown in the figure.



Follow the previous recommendations for correct handling operations.

- never use two lifting means simultaneously;
- never stand beneath the suspended loads;
- if steel ropes are used, fit always the loop on the end on the lifting hook;
- if steel ropes are used, pay attention not to create narrow bends, i.e. with a bending radius lower than the loops on the end of the rope;
- use ropes of suitable length so that the angle between ropes and the horizon is always greater than 45°.

4.4. Installation



ATTENTION: The partly-completed machine that is the object of this manual is part of a refrigeration system consisting of the condensing unit and components of a refrigeration system such as evaporator(s), pipes, safety components, etc.

The total volume of the evaporators associated with the partly-completed machine must NOT exceed 9 litres.



ATTENTION: During operations, the operator must wear all the necessary Personal Protective Equipment (PPE).



DANGER: If the partly-completed machine is installed in closed environments, correct air recirculation must be ensured and acoustic-visual detection and signalling systems must be installed that intervene in the event of a refrigerant gas leak. Furthermore, for this type of installation, the constraints imposed by the laws of the installation country must be complied with.



DANGER: The installation surface must permanently support the weight of the machine, persons and equipment necessary for safe maintenance. Overloads should be considered in compliance with the conditions of the installation site and respecting the restrictions imposed by the laws of the country of installation.



DANGER: Perform the required interventions using appropriate work tools and paying the utmost attention to elements that could cause accidents and in compliance with the legislation in force in the country of installation.



DANGER: There must be no access to rooms at a lower level and/or to wells close to the installation site of the partly-completed machine (this is to avoid any gas leak being channelled, such as heavy gas).

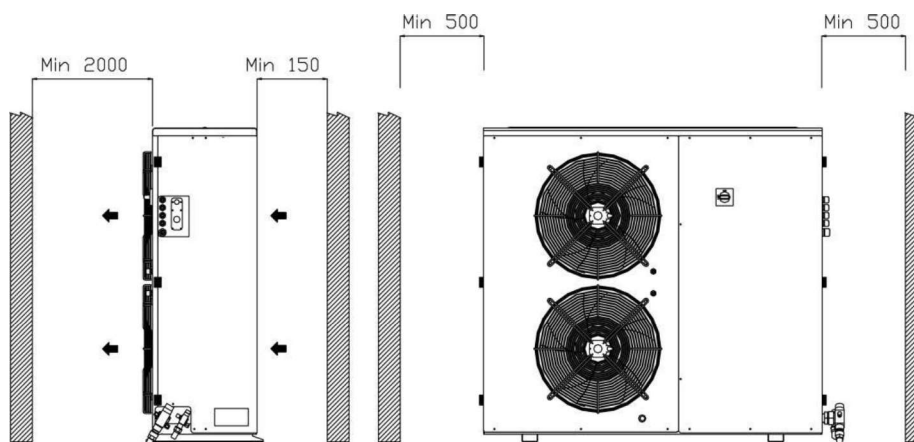


DANGER: The R744 (CO₂) refrigerant is colourless and odourless. Its presence in the environment can cause asphyxiation. All operations must be carried out using gas presence detectors and in compliance with the safety regulations of the country of installation.

Before proceeding with installation it is necessary to develop a refrigeration system housing project in which the following are defined:

- all components of the refrigeration system (e.g. condensing unit, evaporator, pipes, safety components, etc.);
- all the power, command and communication power lines;
- location of the system;
- piping route (lay-out).

The partly-completed machine must be installed on a horizontal plane to enable carrying out of the necessary maintenance safely. The following figure shows the minimum distances regarding the recommended safety distances. Secure the machine to the floor by using the holes on the anti-vibration supports.



4.4.1. Power and control electrical panel and electrical connection



DANGER: The electrical connection operations must be carried out by qualified personnel who meet the necessary technical requirements established by the country in which the machine is installed.



ATTENTION: The Manufacturer declines all responsibility deriving from non-observance of the indications below.



ATTENTION: It is mandatory, by law, to connect the machine to an efficient earthing system. No responsibility is accepted for failure to comply with this provision and if the electrical system to which connection is made is not built according to the regulations in force.



ATTENTION: Check the power supply phases to obtain correct rotation direction of the compressors. Incorrect rotation can irreparably damage the compressors themselves.

The power supply provided by the purchaser (voltage, phases and frequency) must be correct and sufficient to adequately power the partly-completed machine. Specifically, it is necessary to adopt the following indications:

- If envisaged by the type of configuration of the partly-completed machine, install a differential thermal magnetic circuit breaker between the power supply line and the door lock switch of the electrical equipment installed on the machine. This switch must be adequately sized to the application and to the laws in force in the country of installation. Make sure that the supply voltage is the same as that shown on the plate and wiring diagram of the partly-completed machine; the permissible tolerance is $\pm 10\%$ of the rated voltage. In case of presence on the machine of user devices that generate earth fault currents with high continuous and/or high frequency components (inverter, UPS, etc.), use a class differential thermal breaker suitable for use with such non-linear circuits.



ATTENTION: The differential thermal magnetic circuit breaker must be placed in the immediate vicinity of the partly-completed machine (but outside the safety area) so that it can be clearly visible and reachable by the technician in case of maintenance.

- The section of the power supply cable must be adequate for the power absorbed by the partly-completed machine. For further information on the total absorption of the partly-completed machine, refer to the wiring diagram attached to this manual.
- The power supply cable must have construction characteristics that are suitable to the conditions of the installation site of the machine.

The partly-completed machine is equipped with an electrical panel for power and control. In general it has the following functions:

- general switch with door lock;
- magnetothermal protection of all loads;
- electronic control terminal;
- compressors protected by magnetothermal switches;
- power transformer for control circuits;
- management of the maximum (and optional minimum) pressure switches each according to its functionality.

In the electrical panel there is a customized electronic controller with different functions:

- regulation with pressure or temperature probe;
- compressors operation management
- control of the work area of the compressors;
- alarms management;
- oil management;
- management of the low temperature system (if any.).

Wiring of the various components of the system

The first electrical operations to be performed on the machine, even before powering it, are those of wiring the various devices that compose it:

- supervision network (where present);
- other optional components.



ATTENTION: The sizing and laying of the cables that connect the machine to all its external components must be carried out in compliance with the laws in force in the country in which it is installed.



ATTENTION: Regarding the laying of cables, where possible, it is recommended to avoid a common path between the cables used to transport energy for powering the partly-completed machine, or in general for powering motors (fans, solenoid valves, etc.) and those dedicated to the transmission of signals (such as network cables, 0/10V, etc.). Failure to comply with this provision could jeopardise correct functionality of the system due to serious capacitive couplings that disturb the communication of very low power.

Supervision network

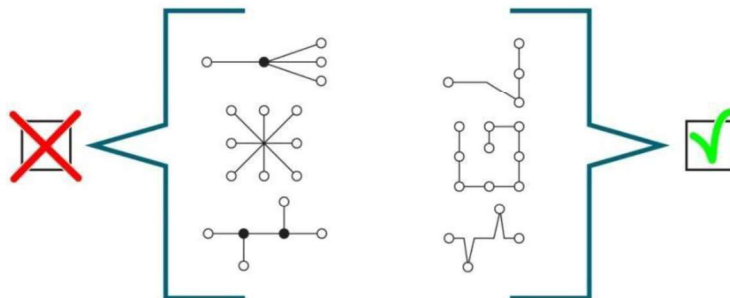


ATTENTION: Where possible, it is recommended to keep the partly-completed machine supervision network separate from that of the supermarket control devices (desks, cells, cabinets, etc.). This is to avoid accidental overwriting of parameters between devices with the same network addresses.

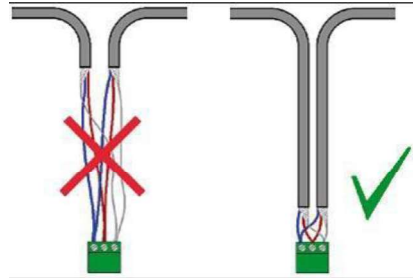
For the wiring of the RS485 serial line on which the supervision network will sit, the following are recommended:

- use BELDEN 8762 AWG20 type cable;
- minimise the length of the serial line (RS485 max 1000m).

Do not create bifurcations of the line or star connections, as shown:



- Avoid passing the serial cable near power cables; provide separate conduits for power and communication cables; furthermore, it is advisable to keep the cable away from devices that generate magnetic or electromagnetic fields, such as radio antennas, transformers, contactors, neon lights, etc.;
- Strictly respect the polarity of the + and - wires. Use the same colour for polarity; for example white wire for "+" and black for "-". The sheath must always only be connected to the dedicated terminal (usually called "GND" and near the "+" and "-" terminals). The two terminals must be connected to the GND terminal, that of the incoming cable and that of the outgoing cable;
- Avoid unsheathing the serial cable for an excessive length, as shown:



4.4.2. Refrigerating connection



ATTENTION: The pipes must be sized according to the type and extension of the system in full compliance with the safety restrictions imposed by the laws of the country of installation. The Manufacturer is not responsible for the incorrect selection and execution of the system pipes.



ATTENTION: The pipes may have different dimensions from that of the partly-completed machine connection. Use appropriate reduction to allow connection.

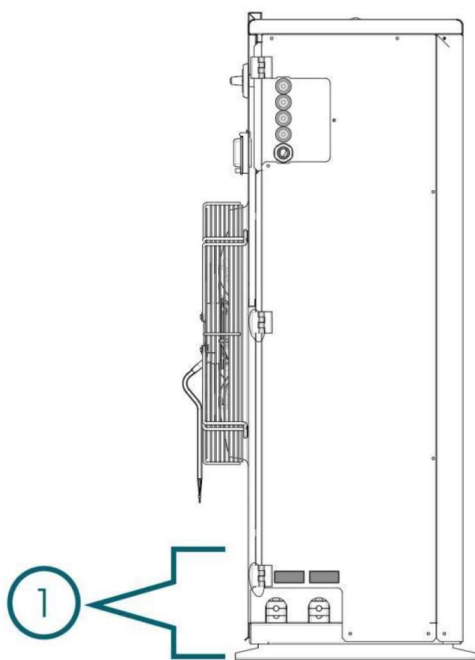
The partly-completed machine must be connected to the following components to complete the entire system:

- TN positive evaporators;
- LV negative evaporators (if any);

the connections are as follows:

- liquid
- MT suction
- LT suction (if any)

Near each connection is shown the relative label (1) with the type indicated, while the information regarding the diameter is shown in the refrigerator diagram attached to this manual.



The dimensions of the outlet pipes (intake line and liquid line) shown in the refrigeration diagram are calculated for a **MAXIMUM TUBING LENGTH** of 30 m.

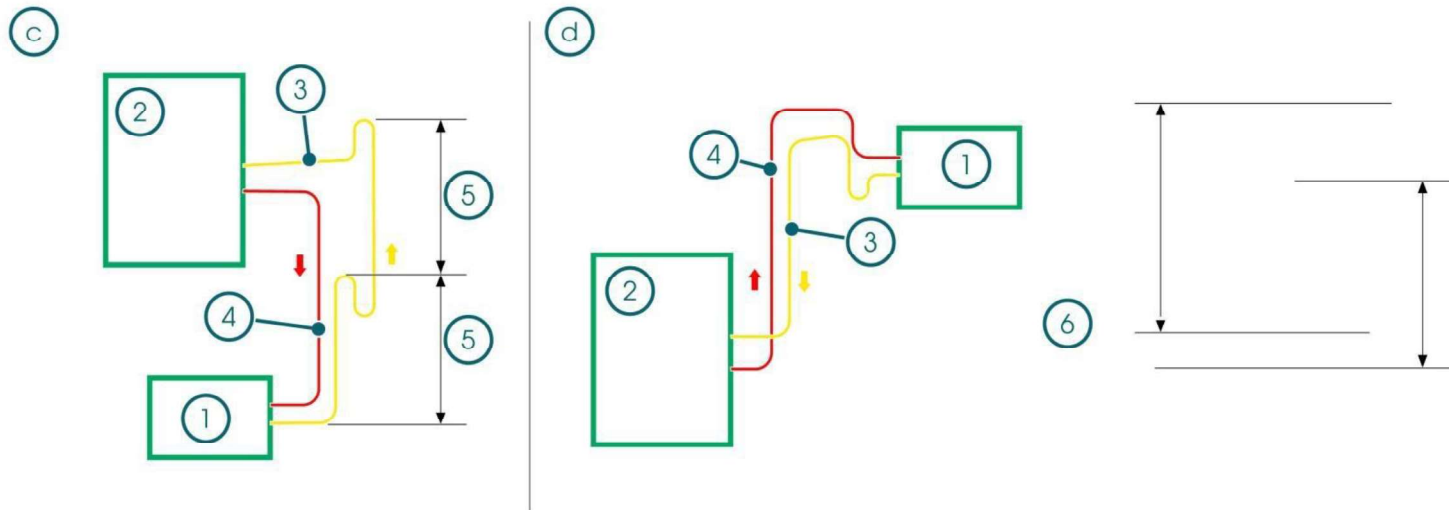
This maximum length, valid for each individual section of both intake and liquid, has been defined in order to obtain a pressure drop that does not compromise correct functioning of the evaporator.

Furthermore, the following functional requirements must be satisfied:

- the liquid line must be created in such a way that the refrigerant speed is between 0.6 and 1.2m/s and that the pressure drops are contained. It is advisable not to exceed 50kPa;
- the liquid line must be insulated with a suitable thickness and not less than 13 mm for medium temperature machines and 19mm for low temperature machines;
- the intake line from positive (if present) and/or negative (if present) users must be created in such a way that guarantees correct oil return to the partly-completed machine and to reduce pressure drops. It is advisable not to exceed 50kPa;
- the intake lines must be insulated with a suitable thickness and be not less than 19mm.

The following images show a number of explanatory notes for the installation of the described sections in order to guarantee a correct oil return by creating siphons and slopes.

- Evaporator positioned at a **lower** level with respect to the central point*
- Evaporator positioned at a **higher** level with respect to the central point*



- Evaporator
- Central point
- Supply
- Return
- Siphons minimum distance 2÷3
-

IMPORTANT

In the vertical section of the pipe **create siphons every 2÷3 metres**.

In the horizontal section, **create inclination of the piping of 2÷3%**, in the flow direction of the refrigerant.



ATTENTION: The outlet pipe of the safety valve must be sized in compliance with the laws of the country of installation.

The size of the output on the machine is valid for a linear conveyance with a maximum length of 10m. The conveyance is necessary where it is necessary to send the gas leaving the safety valves outside of a possible machines room.

The connections are performed in such a way that welding or brazing can be carried out according to the type of material of the pipe being used. In general, steel requires welding, while other materials such as K65 or copper require brazing.

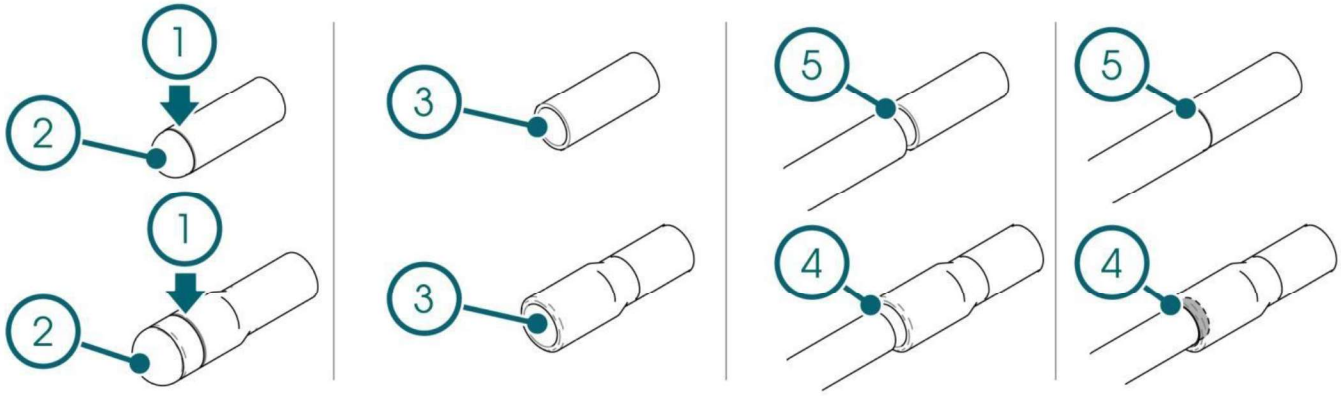


ATTENTION: Machine supplied under nitrogen pressure. Before working on the connections, remove the pressure by opening the appropriate service valves and acting on the pressure outlets in the circuit. If there is no pressure in the partly-completed machine circuit, do not install and instead contact the manufacturer.



ATTENTION: Perform preparation of the connections by making a clean cut using appropriate tools.

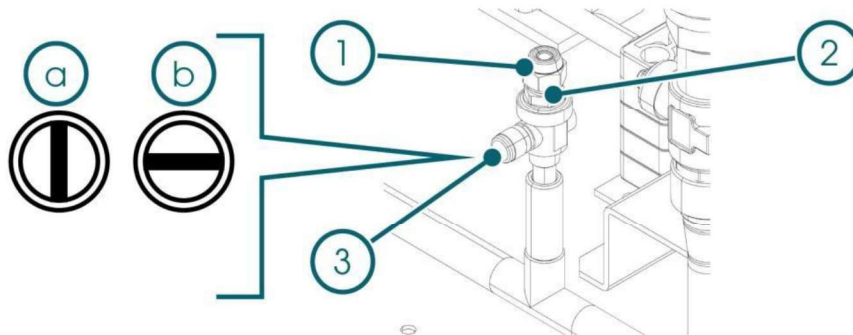
Connections with the possibility of welding or brazing or with the possibility only of brazing



Information on the type of connection possible can be found on the refrigerator diagram.

- | | |
|----------------------|--------------------------------------|
| 1. Pre-cut | 4. Connection with ODS brazing |
| 2. Closure cap | 5. Connection with head-head welding |
| 3. Connection points | |

RS service valve



- | | |
|----------------------------------|------------------------------|
| 1. Closure cap | a. Position – Passage open |
| 2. SAE 1/4 fitting | b. Position – Passage closed |
| 3. Closure screw – two positions | |

4.4.3. System drain

For the refrigerating machine and the compressors to work properly, it is essential to correctly vacuum the system to ensure a value of air and above all of humidity below the permissible values.

Introduction of the new gases required the use of polyester-based oils with characteristics of high hygroscopicity, necessitating greater attention in creating of the vacuum.

The duration of the draining phase is variable as it depends on several factors, but must nevertheless be at least 24 hours. In addition to reaching a vacuum level of at least 0.3 mbar it must remain constant over time.



The IND1 indicator of liquid passage **must** be green to indicate the absence of humidity.



ATTENTION: Before proceeding with the drain phase, check that all the valves on the machine and on the system are open.



ATTENTION: The drain phase can take place when the machine is not electrically powered.



ATTENTION: Any removal of coils from solenoid valves must take place when the machine is switched off. Only perform ignition after repositioning the coil on the solenoid valve.



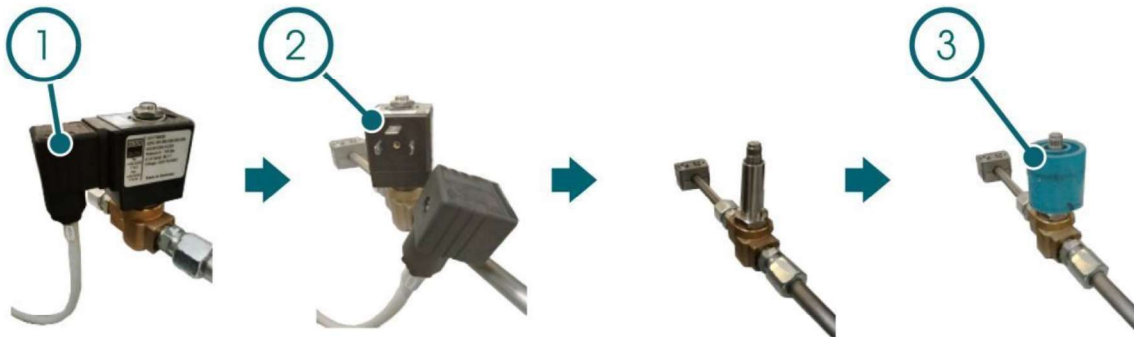
ATTENTION: Do not start the compressors in vacuum conditions and without gas loaded, to avoid irreparable damage.

The service valves to which the vacuum pump must be connected are the following:

- RS2 or RS2.P delivery (if present);
- RS3 liquid;
- positive intake RS1;
- negative intake RS1 (if present).

Furthermore, as shown in the following figures, when the machine is switched off, opening magnets must be inserted in the solenoid valves YVEq.LT and YVEq.P if present.

- remove the connector (1);
- remove the coil (2);
- insert the magnet (3).



NOTE: Refer to the procedure DRAIN PROCEDURE MANUAL MODE (par. 4.4.1)

4.4.4. Refrigerant load

After the drain operation, the system must be loaded with carbon dioxide –CO₂ – R744 Purity ≥ 99.99%) H₂O ≤ 10 ppm, O₂ ≤ 10 ppm, N₂ ≤ 50 ppm or higher.

R744 refrigerant (CO₂) is classified as safety class A1 according to EN 378-1 (non-flammable, non-toxic). ODP = 0 and GWP = 1. High CO₂ concentrations are dangerous. This refrigerant is odourless and colourless.



ATTENTION: The CO₂ refrigerant is heavier than air. The use of CO₂ detectors and a ventilation system is recommended if the machine is installed in a machines room or in areas where pockets of CO₂ might form (e.g. underground floors).



ATTENTION: The first phase of refrigerant load, or pre-load, must ONLY take place in the gaseous phase



For the refrigerant pre-load phase the following are necessary:

- that the partly-completed machine is electrically powered so that the YVEq.P YVEq.LT compressor bypass solenoid valves (if present) are energised);
- that the condensing unit and therefore the compressor and/or the compressors are in the OFF position from the electronic control keyboard;
- that the valves HPV and VFL are manually opened by electronic control to guarantee opening of the entire refrigeration circuit

During refrigerant pre-load it is necessary to insert CO₂ in the gaseous state at a pressure value well above the triple point (5.185 bar(a)) to avoid the formation of dry ice inside the system. A gaseous pre-filling of 10 bars is recommended throughout the circuit

The load points are RS1, RS2, RS3 and RS1.LT and RS2.P (if present).

The reading of the pressure on each section is possible from the main screen of the electronic control.



ATTENTION: Do not power the solenoid valve coils if they are not installed on the valve itself.

The next phase of loading consists of restoring the partly-completed machine, putting the condensing unit and/or the compressors in ON from electronic control and following the steps provided in the chapter on starting up.

Loading can then continue in liquid phase on RS3 tap, in vapour phase on RS1, RS1.LT (if present).

The utilities must be activated.



ATTENTION: The utilities must already be configured and programmed correctly for use with CO₂.



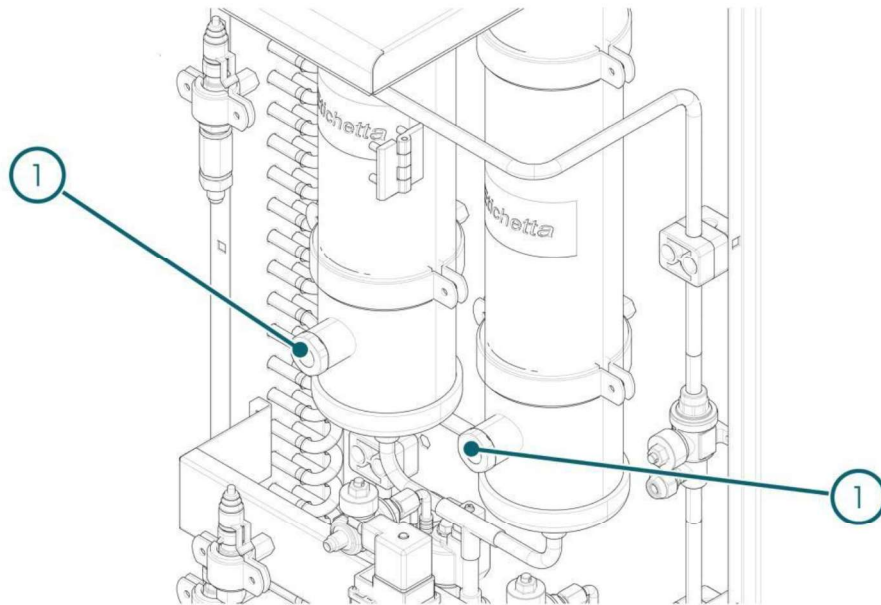
ATTENTION: Activate the utilities gradually during loading.



ATTENTION: During the loading phase the compressors will be activated and any alarms in the initial phase may be present.

Loading ends when the level of liquid inside the receivers exceeds at least half the indicator light of the visual indicator (1) present on them and there is no presence of bubbles on the IND1 indicator in stationary conditions.

The passage indicator also detects the presence of humidity, which must not be present. If any is found, the system must be stopped and the emptying and loading phases repeated.



DANGER: For refrigerant filling, recovery and verification operations, wear gloves for protection against low temperatures. The filling operations must be performed only by specialized technicians.



DANGER: The R744 (CO₂) refrigerant is colourless and odourless. Its presence in the environment can cause asphyxiation. All operations must be performed in the presence of gas presence detectors and in compliance with the safety regulations of the country of installation.

4.4.1.Oil fill

The oil must be added according to the refrigerant load as indicated in the table. If the refrigerant load is LOWER than 4kg, no oil must be added.

REFRIGERANT LOAD R744	UP TO 4kg	OVER 4kg
OIL LOAD PAG100	DO NOT ADD OIL	ADD 50g OIL FOR EACH kg of REFRIGERANT

The operation is carried out by following these steps:

- stop the utilities and wait for the compressors to stop;
- place the machine in OFF in the electronic control display;
- close the general intake valve R1;
- remove the internal pressure by acting on the RS1 and RS2 valves;
- using the RS1 valve, load oil and at the same time aspirate with an empty pump on the service valve RS2;
- once loading is complete, close the RS1 and continue with the drain phase to the value previously described;
- remove the vacuum pump and related pipes from the service valve;
- reopen the previously closed valves;
- reactivate the machine in the ON position;
- reactivate the utilities;
- wait for the system to stabilise and for no alarms to be present;



ATTENTION: DO NOT load more than 250 g of oil at a time. If the necessary oil is higher, repeat the above procedure.

The partly-completed machine does not include oil monitoring to check its presence inside the compressor and the refrigerant circuit.

However, the electronic controller includes a function that facilitates return of the oil to certain working conditions of the compressor by forcing the compressor to work at a fixed speed for a set time in order to recover the oil lost along the refrigerant circuit.

4.5. Preparation for start up



DANGER: The following operations must out be carried only by qualified and specifically trained technicians. The Manufacturer declines all responsibility for operations carried out without respecting the safety regulations, by unqualified operators and without compliance with the specifications of this manual.



ATTENTION: During operations, the operator must use all the necessary Personal Protective Equipment (PPE).



Before bringing the partly-completed machine to full capacity, a number of preliminary checks are necessary to be carried out at start-up.

Check valves

Make sure that all the valves on the partly-completed machine and on the system are open, that the service valves are closed and that they all are fitted with caps.

Check utilities thermostatic valves

Make sure that all the electronic thermostatic valves of the utilities are correctly programmed.



ATTENTION: The positive and negative utilities must have a minimum overheating of 5K and a correct MOP value on the expansion valve control to avoid increasing the intake pressure in the event of system shutdown. 35 bar - 1°C is recommended.

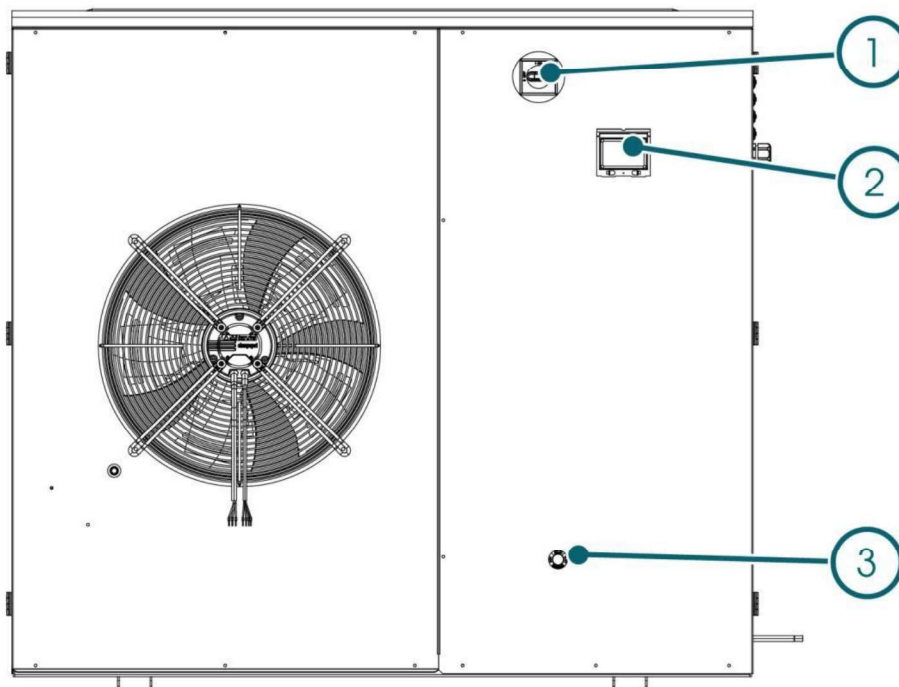
Pre-heating of the compressor casing (if present)

At least 12 hours before starting the compressors, the casing heater must be energised to eliminate the risk of diluting the lubricating oil with the refrigerating fluid.

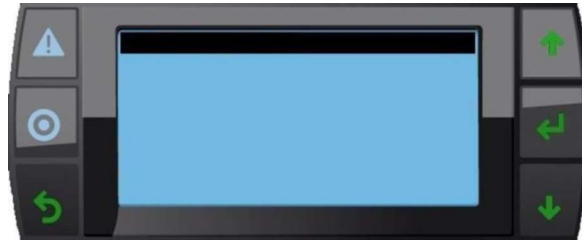
Electronic control

To start the system it is necessary to follow this sequence of operations:

- Set the disconnecter (1) of the electrical panel to ON to supply the entire system;
- Set the electronic control to ON via the display (2);
- Using the display (2) carry out the operations indicated .



Looking at the display on the door of the partly-completed machine electrical panel the following are evident:



BUTTONS		ASSOCIATED
	ALARM	It shows the list of active alarms and access to the alarm logs
	PRG.	It is used to enter the main menu
	BACK	Return to the previous page
	UP	To switch to the upper value in a list or to increase the value of a variable highlighted by the cursor.
	DOWN	To switch to the lower value in a list or to decrease the value of a variable highlighted by the cursor.
	ENTER	Enter the selected sub-menus or confirm the set values

MANAGEMENT OF LED SIGNALS

BUTTONS	ASSOCIATED	
Red		Flashing: Active alarms not seen Fixed: Alarms seen
Yellow		Control Hecu CO ₂ in state of ON
Green		Control Hecu CO ₂ powered

- Bring the application software that manages the compressors to ON;
Inside the electrical panel there are two electronic boards: one for the management of the high pressure part of the partly-completed machine (heat recovery, gas-cooler, back pressure valve, gas flash valve, etc.) and one for the management of BLDC rotary compressors.

Normally, the display on the electrical panel is connected (via a 6-pole telephone cable) to the management controller of the high-pressure part (pRack application). Therefore to turn the software of the second controller ON, it is necessary to disconnect the telephone cable connected to the display and to attach the second telephone cable located nearby. In this way accessibility is provided to the second controller.

- Turn the pRack CO₂ application ON;
The steps to be taken on the second application are the following:

MAIN PAGE



1 | Time and Date

2 | Main Values:

- Evaporation
- Parallel Aspiration
- Condensing
- BLDC compressor speed: LV and Parallel









3 | Unit Status:


- Compressor Status
- Gas cooler fan status
- HPV valve status

4 | Signal of active alarm and/or manual operation

5 | Access to additional information pages

INFORMATION PAGES

<pre> LT 10:33 04/07/18 Evaporating: -9.9-bar_g Par.suct.: -30.0bar_g Gas cooler: -30.0bar_g LT: 0.0rps P: 0.0rps Unit OFF by keyboard </pre>	Press the display key	
<pre> Main info Ha01 Suction info Pressure: ----bar_g Temperature: 0.0°_C Sat.temp.: ----°_C Superheat: 0.0K </pre>	Information on the variables of the intake side.	
<pre> Main info Ha03 Suction regulation Evap. demand -% Actual/req.: 0/ 0% Status: Stop Type: FIXED SETP. Setpoint: 25.5bar_g </pre>		
<pre> Main info Ha04 Compressors status C1: 0% 0s </pre>		
<pre> Main info Ha06 Suction info P+I ⇌ Pwr+ ⇌  0.0% 0.0% 0.0rps Low discharge Press. </pre>		
<pre> Main info Ha11 LT discharge: Pressure: -30.0bar_g LT Disch.Temp.: 0.0°_C Sat.temp.: 0.0°_C DSH: 0.0K </pre>		
<pre> Main info Ha31 Parallel info Pressure: -30.0bar_g Temperature: 0.0°_C Sat.temp.: 0.0°_C Superheat: 0.0K </pre>		

<pre> Main info Ha33 Parallel regulation Actual/req.: 0/ 0% Status: Stop Type: FIXED SETP. Setpoint: 37.0barg </pre>		↓
<pre> Main info Ha34 Parallel comp status C1: 0% 0s </pre>		↓
<pre> Main info Ha36 Parallel info P+I ⇌ Pwr+ ⇌  0.0% 0.0% 0.0rps Low discharge press. </pre>	<p>Parallel compressor information.</p>	↓
<pre> Main info Ha41 Parallel discharge Pressure: -99.9barg Par.disch.temp: 0.0°C Sat.temp.: 0.0°C DSH: 0.0K </pre>		↓
<pre> Main info Ha11 Gas cooler: Pressure: -99.9barg Disch.Temp.: 0.0°C Sat.temp.: 0.0°C DSH: 0.0K </pre>		↓
<pre> Main info Ha24 Gas cooler: Gas Cool.Temp: 0.0°C Subcooling: 0.0K External temp.: 0.0°C </pre>	<p>Information on the Gas Cooler.</p>	↓
<pre> Main info Ha60 Gas cooler: Temp.GC: 0.0°C Pressure: -99.9barg T ext. 0.0°C Act.setpoint: 20.0°C Differential: 4.0°C </pre>		↓
<pre> Main info Ha22 Gas cooler regulation Actual/req.: 0/ 0% Status: Stop Type: Proportional Setpoint: 20.0°C </pre>		↓

<pre>Main info Ha23 Fans status F1: 0%</pre>	<p>Information on the fans of the Gas Cooler.</p>	
<pre>Main info Ha57 HPV GC out.temp.: 0.0°C GC press.: -99.9barg Regulation zone: HPV closing zone Status: Safety low P.</pre>	<p>Information on the HPV valve.</p>	
<pre>Main info Ha58 HPV GC out.temp. 0.0°C GC press.: -99.9barg Act.setp.: 55.0barg Valve output: 0.0% Valve feedback: ---%</pre>		
<p>UNIT ON/OFF</p>		
<pre>LT 10:33 04/07/18 Evaporating: -9.9barg Par.suct: -30.0barg Gas cooler: -30.0barg LT: 0.0rps P: 0.0rps Unit OFF by keyboard</pre>	<p>Press the display key</p>	
<pre>Password management Insert password: 0000</pre>	<p>Press the key</p>	
<pre>Main menu 1/0 A.Unit Status I/O B.Inputs/Outputs C.Compressors</pre>	<p>Select the "A.Unit Status" item</p>	
<pre>Unit Status 3/3 a.Main info b.Setpoint c.On/Off</pre>	<p>Select the "c.On/Off" item</p>	
<pre>On/Off Ac01 Status:Off by keyboard OFF ON [ENTER] to switch unit</pre>	<p>Press the key</p>	

1.1. Manual mode for the drain procedure




Perform this procedure only during the vacuum phase and with the unit OFF.

UNIT ON/OFF

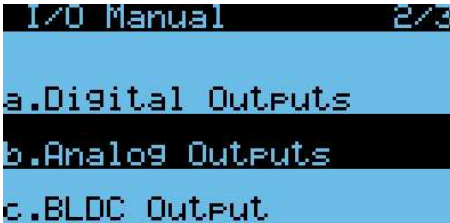

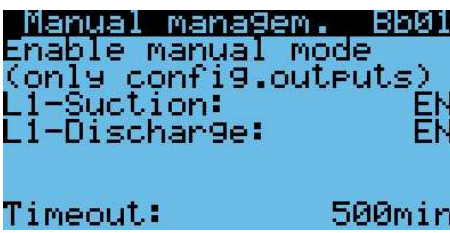

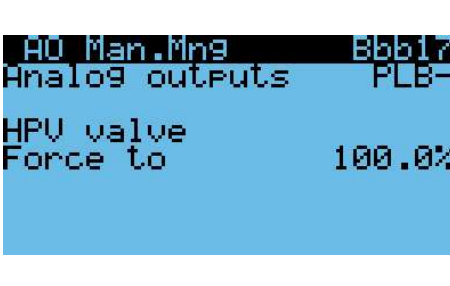

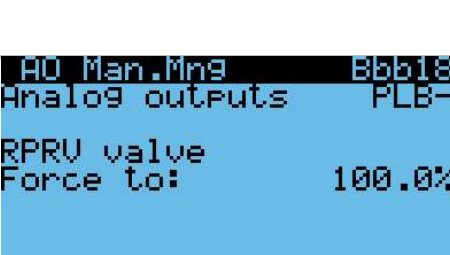







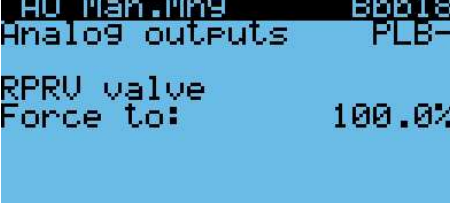



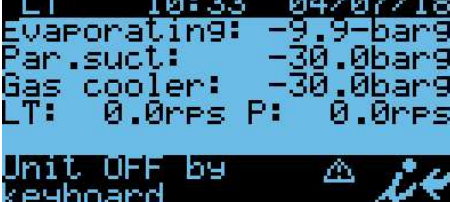

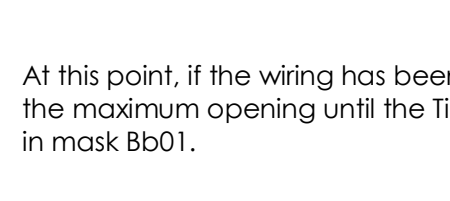

	<p>Press the display key</p>	
	<p>Press the key</p>	
	<p>The cursor will move onto the first figure of the password. Enter the password "0000". Then press the key</p>	
	<p>Select the "A.Unit Status" item</p>	
	<p>Press the key</p>	
	<p>Select the "c.On/Off" item</p>	
	<p>Press the key</p>	
	<p>Press the key</p>	

Starting from the main screen:

	<p>Press the display key</p>	
	<p>Press the key</p> <p>The cursor will move onto the first figure of the password. Enter the password "0000". Then press the key</p>	 
	<p>Move down with the key</p> <p>until "B. Inputs/Outputs" is highlighted, then press the key</p>	 
	<p>Move down with the key</p> <p>until "b. Manual Management" is highlighted, then press the key</p>	 
	<p>Move down with the key</p> <p>until "d. Vacuum" appears then press the key</p>	 
	<p>Press the key</p> <p>move to the mask in the figure. At that point, press one of the arrow keys to switch from NO to YES. Then select YES with the ENTER key.</p>	

<pre>Man.Mn9 Bbd02 HPV opening: 100.0% LT compressor Equalization valve: 0</pre>	<p>Press the key to reach the mask as shown in the figure. Make sure that the values are equal to 100% of opening for the valve and in position O=Open for the equalisation valves present.</p>	
<p>NOTE: In the <u>TN machines</u> the Bbd02 mask is as follows:</p> <pre>Man.Mn9 Bbd02 HPV opening: 100.0% RPRV opening: 100.0%</pre>	<p>NOTE: In the <u>TN machines</u> the Bbd02 mask is as follows:</p>	
<pre>Man.Mn9 Bbd03 Crankcase heater Mode: VACUUM ONLY Current: 24.0% 0.0A</pre>	<p>Confirm by pressing the key</p>	
	<p>Move down with the key</p>	
	<p>Check and retain the default values</p>	

N.B.: For softwares preceding the Hecu CO₂ r3.0.012 version and for machines manufactured before OCTOBER 2018, proceed as follows:

	Move down with the key	
	until "b. Manual Management" is highlighted, then press the key	
	Press the key	
	until the cursor is positioned on "L1 – Discharge:". At that point, press one of the arrow keys to switch from DIS to EN. Then again the ENTER key until the cursor is in the top left.	
	Pressing the key, until the cursor is positioned as shown in the figure.	
	Pressing the key. The percentage value is 100%.	
	Confirm by pressing the key	
Only perform this operation in the TN units.		
	Pressing the key, until the cursor is positioned as shown in the figure.	
	Pressing the key. The percentage value is 100%.	
	Confirm by pressing the key	
	Press the key until returning to the main page	

At this point, if the wiring has been carried out correctly, the HPV and VFL valves (if present) will move to the maximum opening until the Time-out time is reached or until the initial situation is restored placing DIS in mask Bb01.

If there is a cell control (MPX Pro or Ultracella) connected to the unit, it is also possible to force the electronic thermostatic valve.

Starting from the main screen:

	<p>Press the display key</p>	
	<p>Press the key</p> <p>The cursor will move onto the first figure of the password. Enter the password "0000". Then press the key</p>	
	<p>Move down with the key</p> <p>until "E. Evaporator" appears then press the key</p>	
	<p>Move down with the key</p> <p>until "d. Driver EVD" appears then press the key</p>	
	<p>Press the key</p> <p>Select YES</p> <p>Press again to confirm the selection</p> <p>Select the value to be inserted (100% = 600 step)</p> <p>Press again to confirm the selection</p>	
	<p>Press the key until returning to the main page</p>	

At this point, if the wiring has been carried out correctly, the EEV valve will move to the inserted opening until the initial situation is restored by setting NO at the "EEV Manual" parameter in mask Ead01.

Wait until the system is stable and perform the necessary optimisations, referring to the machine manual, software manual of the controls.

Check panels closure

Make sure that the panels of the machine are all correctly positioned, closed and correctly secured.

4.6. Storage

If it is necessary to keep the partly-completed machine for a certain period of time before installing it, it is recommended to protect it adequately and to store it in a suitable environment, with the following characteristics:

- external surfaces resistant to atmospheric agents;
- no access permitted to unauthorised persons;
- with the following environmental conditions:
 - well ventilated;
 - ambient temperature between -10 °C and +40 °C;
 - relative air humidity between 30% and 80%.



ATTENTION: Do not remove the packages possibly present for certain partly-completed machine components, or take appropriate precautions to protect the parts exposed.

4.7. Disassembling

If it is necessary to uninstall the partly-completed machine, proceed in the reverse order with respect to the installation sequence provided in Paragraph 4.4 "Installation". Gas removal must take place in the intake lines keeping at least one positive and negative utility active if present. The service valves on which to operate are RS1, RS1.LT (if present), RS2 and RS2.P (if present). Do not remove the gas from the liquid line for instantaneous ice formation for pressures below 5.6 bar.



DANGER WARNING: The following operations must only be performed by qualified and specifically trained technicians. The Manufacturer declines all responsibility for operations carried out without respecting the safety regulations, by unqualified operators and without compliance with the specifications of this manual.

5. Maintenance and dismantling

To guarantee maximum reliability on the machine and to avoid dangerous conditions, carefully follow the instructions and warnings on the following pages.

Periodic maintenance and correct use are essential factors to guarantee the full efficiency and safety of the machine.

The maintenance interventions and the prescribed operations help prevent problems due to deterioration of the safety measures or resulting from machine downtime.

This way information on any extraordinary operations that may be necessary can be provided.

DANGER: The following operations must out be carried only by qualified and specifically trained technicians. The Manufacturer declines all responsibility for operations carried out without respecting the safety regulations, by unqualified operators and without compliance with the specifications of this manual.



DANGER: Before carrying out any maintenance or cleaning operations described in this paragraph, it is necessary to section the PARTLY-COMPLETED MACHINE from the electric power supply by acting on the general disconnecting switch located on the panel that closes the electrical equipment. The disconnecter must be locked in the open position with a padlock.



ATTENTION: During operations, the operator must use all the necessary Personal Protective Equipment (PPE).



DANGER: During the maintenance and demolition of the partly-completed machine it is necessary to follow the warnings listed below.



DANGER: Before carrying out any type of intervention, it is necessary to check, with a specific gas detector, the absence of CO₂ leaks (R744).



- It is necessary to warn, using appropriate signs, of the intervention on the partly-completed machine to prevent any undesired operation on the same.
- During the interventions only authorised personnel may access the work area.
- Disassemble only the parts of the machine that are actually required to perform the specific maintenance operation.
- Moreover, before returning the machine to the operators, it is necessary to verify its integrity and functionality.
- Operate, as far as possible, on the partly-completed machine and on the pipes only after having emptied them and before proceeding with restart, ensure thorough cleaning of the system.
- Do not, for any reason, use petrol, solvents, corrosive products or flammable fluids to clean parts, but use neutral and approved non-flammable and non-toxic commercial detergents.
- Do not make changes, transformations or applications to the machine that could compromise safety without first obtaining written authorisation from the manufacturer.
- All environmental impact materials that need to be removed as a result of maintenance must be disposed of in accordance with current regulations.



ATTENTION: For the disposal of materials with high environmental impact, if necessary, use specialist facilities.

Checking the availability of the material

60 days prior to the date determined for interventions of maintenance, perform a detailed examination of the material necessary:

1. check if the material is on the stock,
2. if necessary, ask the manufacturer's Technical Office for the missing parts at least **30 days** in advance.

5.1. Maintenance and cleaning



DANGER: the Manufacturer cannot be held in any way liable for any damage caused to property or persons due to incorrect or incomplete maintenance.



DANGER: before carrying out any scheduled ordinary maintenance, ensure the partly-completed machine has been disconnected from the mains; wait for the hot surfaces to cool.



ATTENTION: in the event the machine parts require replacement, only use original spare parts.



ATTENTION: any brazing operations in the products must be carried out by qualified personnel.

5.1.1. Interventions and relative periodicity



ATTENTION: At the end of maintenance, replace all previously removed guards.

DESCRIPTION OF THE MAINTENANCE	FREQUENCY
Electrical terminals connection check	
Check the tightness of all the electrical terminals both inside the electrical panels and in the terminals of each electrical utility.	Monthly
Check for refrigerant and oil leaks	
Visually check the entire refrigerant circuit for refrigerant leaks, including inside the partly-completed machine. These leaks are also evident from traces of lubricating oil. Intervene promptly and investigate further in case of uncertainty.	Monthly
Check efficiency of the earthing	
Check the earthing terminal and its efficiency with appropriate instrumentation.	Monthly
Cleaning of gascooler and intercooler (if present)	
Periodically clean the gascooler and intercooler (if present) removing dust and grease. The surface of the finned pack must be perfectly free, the air flow must not be obstructed by dust or by other deposited material. For cleaning use a compressed air gun or, alternatively, an aspirator.	Monthly
Clean the air filters	
Check and if necessary clean the air filters (if present). During certain periods, especially in spring, it is necessary to perform the cleaning operation earlier due to the presence of increased impurities in the air.	Monthly
Check electrical cables status	
Check that the cables inside the machine compartment do not show any alterations of any kind (abrasion, burns, deterioration, etc.) Any possible variation in cable quality requires immediate replacement of the same.	Monthly
Check the tightness of the cable glands.	

DESCRIPTION OF THE MAINTENANCE	FREQUENCY
Controls and safety devices checks	
Proceed with verification of the operation of all the safety control devices by checking the anomalies signalled by the electronic control, which detects probe faults and anomalies of the same. Refer to the dedicated manual.	Monthly
Check for the presence of oil on the separators (if any)	
Check that there are no oil alarms on the electronic control and that the level on the separators is higher than the minimum as indicated by the sensor. In the event that the level is low before adding oil, wait a day and check for any alarms. In the presence of alarms, add oil to the minimum level and check over the following days.	Monthly
Check of non-return valves for compressors (if any)	
Check the tightness of the non-return valves on each compressor outlet.	Monthly
Cleaning of the compressor body	
Perform regular cleaning of the external surfaces of the electric motor of the compressor to prevent the accumulation of dust deposits.	Monthly
Air extraction fans (if present)	
Check correct operation of the air extraction fan.	Quarterly
Check the status of electrical contacts	
Clean the contacts, fixed and mobile, of all the contactors, replacing them if they show signs of deterioration.	Quarterly
Refrigerant humidity control	
Check the regular flow of the refrigerant in the sight glass on the IND1 liquid line and carefully examine the colour of the moisture-sensitive element through the sight glass. The green colour indicates dry, the yellow colour indicates humidity. In case of humidity indication, immediately stop the partly-completed machine replacing the gas only after having carried out the drain procedure again. It may also be necessary to replace the filter on liquid FL1, which is installed by brazing. Replacement is possible by closing the R4 and R5 valves upstream and downstream of the filter itself. The RS3 service valve will allow the refrigerant to be removed as well as the subsequent pressure test operations, gas drain and preload up to 10 bar.	Quarterly
Compressor noise check	
The control operations must be performed in the absence of unauthorised personnel and with instruments suitable for the type of operation. The instruments must be positioned with the machine switched off and, if inside the machine, all the protections removed must be repositioned. The presence of clicks or vibrations may be a sign of breakage or excessive mechanical clearance between moving parts.	Quarterly
Checking of HPV high pressure and VFL gas flash electronic valves	
Clean the internal filter (if present) and the internal mechanisms of the HPV and VFL electronic valves after having collected all the gas inside the liquid receivers using the shut-off valves in the machine and the service valves for the operations of discharge and of subsequent drainage.	Annual
Replacing HPV high pressure and VFL gas flash electronic valves	
Replace the internal mechanisms of the HPV and VFL electronic valves using the shut-off valves in the machine and using the service valves for the operations of discharge and subsequent draining.	Five-yearly
Periodically clean the gascooler/capacitor removing dust and grease. If the environment where the unit is installed is very dusty, it may be necessary to clean the machine more frequently. For cleaning use a compressed air gun or, alternatively, an aspirator.	Monthly

Table 6 - Maintenance frequency

5.2. Safety valve interventions

It is advisable to replace the safety valve if it has intervened as the point of intervention is no longer guaranteed and reclosing may not be perfect, thus generating loss of refrigerant. Check the safety valve (if any) **every three years** or according to different periods depending on the valve manufacturer.

Replacement of the valves is possible through the use of shut-off valves (if any) or through the use of valves in the system.



DANGER: Before replacing the valve, check that, in the intervention area, the system is neither pressurised or at a high temperature.



ATTENTION: No maintenance is required for the safety valves. Removal of the cap or tampering with the seal is considered unauthorised modification to the factory settings, which will cause the manufacturer's warranty to void. Inspection of the safety valves is only permitted to supervisory bodies and is governed by specific legislation in force, in the country of installation.

5.3. Disassembly and demolition

See the instructions provided at the beginning of Chapter 5 regarding the warnings and the Personal Protective Equipment to be used.

5.3.1. Disassembly

In case it is necessary to disassemble the PARTLY-COMPLETED MACHINE, follow the procedure indicated below.

1. Isolate the PARTLY-COMPLETED MACHINE from the power supply.
2. Referring to Paragraph 4.7. - Uninstalling Chapter 4 - Transport and Installation, proceed with uninstalling the PARTLY-COMPLETED MACHINE; in addition, contact the Manufacturer's Technical Offices to obtain the necessary assistance during this operation.
3. To proceed with handling of the PARTLY-COMPLETED MACHINE, operate according to the instructions given in Paragraph 4.3 - Transport and Handling of Chapter 4 - Transport and Installation.
4. Prepare the components appropriately according to the fact that they must be transported to another location (refer to Section 4.3 - Transport and Handling of Chapter 4 - Transport and Installation), which must be stored (refer to Section 4.6 - Storage of Chapter 4 - Transport and Installation) or which must be demolished (refer to Section 5.3.2 - Dismantling and Disposal).

5.3.2. Dismantling and disposal

When the machine has completed its life cycle, before proceeding with final dismantling, it is necessary to carry out a series of operations aimed at minimising the environmental impact related to disposal of the components of the partly-completed machine, as required by current regulations on the disposal of waste.

These operations are:

1. Separate and store the polluting parts:
 - a) separate the parts that could cause pollution;
 - b) select the materials so as to ease recycling; send them to differentiated waste disposal centres (in particular plastic or rubber parts).
2. The gas contained in the system **must not** be dispersed into the environment. It is advisable to dispose of the unit only at specialist collection centres and not as normal scrap iron, respecting the current regulations.
3. Dispose of the outer frames. Once the removal and storage of the pollutants have been completed, use specialist facilities for the disposal of the outer frames.

7.1.2. ATTENTION: At the time of demolition of the partly-completed machine, make the identification plate of the partly-completed machine itself and the related technical documentation unusable.

The Customer may return these items to the Technical Office of the Manufacturer, which will provide for their destruction.



These elements cannot be preserved in inaccessible places.

At the end of the interventions communicate to the Technical Office of the Manufacturer the fact of dismantling of the partly-completed machine.

6. Troubleshooting

	POSSIBLE CAUSE	SOLUTION
A	The compressor does not start and does not hum	
	<ul style="list-style-type: none"> Absence of voltage. Starter relay with contacts open. 	<ul style="list-style-type: none"> Check the line or replace the relay.
	<ul style="list-style-type: none"> The thermal protector intervenes. Loose electrical connections or incorrect electrical connections. 	<ul style="list-style-type: none"> Check the electrical connections. Tighten the connections or re-perform the connections according to the wiring diagram.
	<ul style="list-style-type: none"> Check inverter compressor 	<ul style="list-style-type: none"> Check the power and communication cables Check for the presence of alarms on the compressor
B	Compressor does not start (emits hum)	
	<ul style="list-style-type: none"> Incorrect electrical connections. Low voltage on the compressor. 	<ul style="list-style-type: none"> Check the connections. Identify the cause and eliminate it.
	<ul style="list-style-type: none"> Incorrect rotation of the compressor. 	<ul style="list-style-type: none"> Check the phase sequence Check the compressor-inverter wiring
	<ul style="list-style-type: none"> Check the inverter. 	<ul style="list-style-type: none"> Check the power cables between the inverter and compressor and communication cables Check for the presence of alarms on the compressor Replace compressor
C	Inverter alarm intervention	
	<ul style="list-style-type: none"> Low voltage to the compressor (unbalanced phases on three-phase motors). 	<ul style="list-style-type: none"> Identify the cause and eliminate it. Check its characteristics and replace it if necessary.
	<ul style="list-style-type: none"> Alarms presence. 	<ul style="list-style-type: none"> Check compressor rotation Check compressor working conditions Check the alarm type to identify and eliminate the cause Replace compressor
D	Compressor starts and runs, with short-lasting operating cycles	
	<ul style="list-style-type: none"> High pressure switch intervention. 	<ul style="list-style-type: none"> Check that the fan-motor is Check the correct operation of the HPV valve.
	<ul style="list-style-type: none"> Low pressure protection intervention. 	<ul style="list-style-type: none"> Check and repair any refrigerant leaks. Then reload the refrigerant. Verify correct operation of the expansion valves. Replace the component if necessary. Check and correct user control parameters. Insufficient gas load. Add refrigerant
	<ul style="list-style-type: none"> Inverter alarm intervention. 	<ul style="list-style-type: none"> Verify the type of alarms identifying and eliminating the causes. Replace the compressors
E	Compressor emits loud noise	
	<ul style="list-style-type: none"> Incorrect rotation. 	<ul style="list-style-type: none"> Incorrect rotation. Check the electrical connection.
	<ul style="list-style-type: none"> Insufficient oil. 	<ul style="list-style-type: none"> Add oil to the intake of the individual compressor, attempting to restart. Replace the compressor.

	POSSIBLE CAUSE	SOLUTION
	Compressor works continuously or for long periods	
F	<ul style="list-style-type: none"> System not sufficiently sized according to the load. 	<ul style="list-style-type: none"> Replace the system with a more powerful one.
	<ul style="list-style-type: none"> Excessive load to cool or insufficient insulation 	<ul style="list-style-type: none"> Reduce the load and improve insulation, if possible.
	<ul style="list-style-type: none"> Evaporator covered with ice. 	<ul style="list-style-type: none"> Defrost.
	<ul style="list-style-type: none"> Limited thermal exchange on clogged gas- 	<ul style="list-style-type: none"> Check function of the gas-cooler
	High pressure in main circuit supply	
G	<ul style="list-style-type: none"> Gas-cooler malfunction 	<ul style="list-style-type: none"> Clean and check the gas-cooler and the relative fans Check the temperature probes for the STH2 and STA gas cooler output
	<ul style="list-style-type: none"> HPV high pressure valve not working properly. 	<ul style="list-style-type: none"> Check valve check alarms and reset.
		<ul style="list-style-type: none"> Check the correct operation of the HPV valve.
		<ul style="list-style-type: none"> Check the minimum set-point.
		<ul style="list-style-type: none"> Clean entire mechanism and filter if provided for the HPV valve.
<ul style="list-style-type: none"> Replace the HPV valve. 		
	High pressure liquid receiver	
H	<ul style="list-style-type: none"> VFL gas flash valve not working properly. 	<ul style="list-style-type: none"> Check valve check alarms and reset. Check the correct operation of the VFL valve. Clean the entire mechanism and filter if required of the VFL valve. Replace the VFL valve.
	<ul style="list-style-type: none"> Parallel compressor (if present). 	<ul style="list-style-type: none"> Check set-point. Check correct compressor operation, related alarms and reset
	Frosted or wet drain pipes - low overheating	
I	<ul style="list-style-type: none"> Thermostatic valve functioning. 	<ul style="list-style-type: none"> Possible liquid return to the compressor. Check thermostatic valve overheating and related parameters.
	<ul style="list-style-type: none"> Expansion valve blocked in opening. 	<ul style="list-style-type: none"> Clean the valve from foreign substances or replace it if necessary.
	<ul style="list-style-type: none"> Incorrect parameters for management of utilities and/or related defrosts, utilities management and defrost management. 	<ul style="list-style-type: none"> Check the parameters and optimise them to achieve overheating of at least 15K.

7. Annexes

The specific characteristics of the partly-completed machine are reported in:

- Declaration of Incorporation;
- datasheet;
- refrigeration diagram;
- wiring diagram.