THERMO-TEC®
KLIMAGERÄTE

BEDIENHANDBUCH

Klimaschrank

TRF DX

Dear Customer,
Thanking you for choosing our products, we are pleased to provide you this manual for the correct use of equipment.
Please read carefully the recommendations mentioned in the following pages and instruct your technicians and dedicated personnel who will deal with the management and maintenance of the unit.
Our company will remain at your complete disposal for any questions e/o clarification you should need during the commissioning phases or its life cycle.

Each unit has an identification plate that is located on its frame and inside the electrical control panel, which shows all the data necessary for the installation, maintenance and traceability of the machine.

THE LABEL SHOWS THE FOLLOWING DATA:

- Manufacturer/Marketing body
- CE mark, possibly accompanied by a subscript that identifies the certifying body for the Pressure Equipment Directive 2014/68/EU (PED). The number of the certifying body must be indicated for units of a PED category equal to or greater than class 2.
- Series and size of the unit
- Date of manufacture
- Main technical data

Note the model, the serial number, the final refrigerant charge and the machine reference diagrams attached to this manual so that they can be easily found in case of data plate damaging and system maintenance.

ATTENTION

Never remove the label. This shows the serial number of the unit from which it is possible to obtain information about the technical features and the components installed, to then identify the unit correctly.

Modello - Model				
Matricola - Serial number				
Codice identificativo - ID code				
Data di produzione - Date of production				
Categoria PED/ 2014/68/EU - Category PED/ 2014/68/EU				
Procedura di valutazione conformità PED - PED conformity module				
Max pressione ammissibile (PS) lato alta pressione - Max allowable pressure (PS) high pressure side [bar-r]				
Max pressione esercizio (PS) lato bassa pressione - Max allowable pressure (PS) low pressure side [bar-r]				
Max/min temperatura di stoccaggio - Max/min storage temperature [°C]				
Max/min temperatura ambiente di funzionamento - Max/min ambient working temperature [°C]				
Potenza frigorifera* - Cooling capacity* [kW]				
EER*				
Potenza termica* - Heating capacity* [kW]				
COP*				
Refrigerante - Refrigerant [Ashrae 15/1992] / GWP				
Carica refrigerante - Refrigerant charge [kg]	C1	C2	C3	C4
Refrigerante aggiunto - Added refrigerant [kg]	C1	C2	C3	C4
Carica totale refrigerante - Total charge refrigerant [kg]				
CO2 equivalenti - CO2 equivalent [t]				
Taratura pressione lato alta - High pressure switch set [bar-r]				
Taratura pressione lato bassa - Low pressure switch set [bar-r]				
Taratura valvola sicurezza refrigerante lato alta/bassa pressione - Safety valve refrigerant high/low pressure side set [bar-r]				
Massima pressione esercizio circuito acqua - Max working pressure water circuit [bar-r]				
Taratura valvola sicurezza acqua - Safety valve water side set [bar-r]				
Alimentazione elettrica - Power supply				
Potenza massima assorbita - Max absorbed power [kW]				
Corrente massima - Full load ampere FLA [A]				
Corrente di spunto - Starting current LRA [A]				
Schema elettrico - Wiring diagram				
Schema frigorifero - Refrigeration diagram				
Peso a vuoto - Empty weight [kg]				
* EN14511-2 Contiene gas fluorurati ad effetto serra disciplinati dal protocollo di Kyoto/ Contains fluorinated greenhouse gases governed by the Kyoto protocol Ermeticamente sigillato/Hermetically sealed				

SAFETY SYMBOLS	
☞ WARNING	With reference to additions or recommendations for the correct use of the unit.
⚠ DANGER	With reference to dangerous situations that may occur with the use of the unit to guarantee personal safety.
⚠ ATTENTION	With reference to dangerous situations that may occur with the use of the unit to prevent damage to property and to the unit itself.

GENERAL CAUTIONARY NOTES

The operating rules contained in this manual are an integral part of the unit supply and are valid exclusively for the units covered by this manual. They contain all the useful and necessary information for safe operation and ideal, recommended use of the unit. The declaration of conformity is attached individually to the literature kept on the machine, usually inside the control cabinet.
Please follow the instructions given below:
• Read carefully the instruction manual which should be considered an integral part of the unit.
• Every operator and the personnel in charge of unit maintenance must read the manual throughout carefully and observe its prescriptions.
• The employer is requested to make sure that the operator has the necessary aptitude requirements for operating the unit and has carefully read the manual.
• The instruction manual must be easily available to the operation and maintenance personnel.
• Keep the manual for the entire working life of the unit.
• Make sure any updates that are received are integrated into the text.
• Hand over the manual to any other user or subsequent owner.
• Use the manual so that the contents are not damaged - entirely or in part.
• Do not remove, tear off or rewrite parts of the manual for any reason.
• Keep the manual with care; it must be available at the unit, stored in a special container, to protect it from moisture and heat, until final scrapping of the machine. The location where the manual is kept must be known to the user of the unit, to the managers, to the persons in charge of transportation, installation, use, maintenance, repairs, and end-of-life dismantling and scrapping. If the manual is lost or partially damaged, so that it is no longer possible to read all of its contents, it is advisable to request a new one from the manufacturer.
• Avoid hasty and incomplete preparation that lead to improvisation and cause many accidents.
Pay close attention to the safety symbols shown in the table on the previous page and to their meaning.
Before starting to work, read through and strictly observe the following suggestions:
• the operator must always have the instruction manual readily available at any time;
• plan each action carefully;
• before beginning to work, make sure that the safety devices work properly and you have no doubts about their operation; otherwise, do not under any circumstances start the unit;
• carefully observe the warnings relating to special hazards contained in this manual;
• preventive and thorough maintenance guarantees constantly high operating safety for the unit. Never delay repairs and always have them carried out solely by qualified personnel; only original spare parts are to be used.
THE MANUFACTURER shall not be liable for any accident to persons or property which may occur due to:
• failure to comply with the instructions in this manual regarding the operation, use and maintenance of the unit;
• violent actions or incorrect manoeuvres when performing maintenance on the unit;
• alterations made to the unit without prior written authorisation from the MANUFACTURER;
• events that are, in any case, unrelated to the normal and correct use of the unit;
• in any case, if the user attributes the incident to a defect in the unit, he must prove that the damage caused was a main and direct consequence of this “defect”.
This manual reflects the state of the art at the time of unit sale: The MANUFACTURER reserves the right to update its products and manuals without any obligation to update earlier products and manuals, except in special circumstances. These may not be considered inadequate only because they have been subsequently updated based on new experience.

⚠ ATTENTION

• The installer must provide adequate documentation that must comply with EN 378-3 if applicable in the country of installation; otherwise, reference should be made to the local regulations in force.
• When installing or servicing the unit, the rules stipulated in this manual must be complied with together with those on board the unit and in any case all necessary precautions must be taken.
• The fluids under pressure in the cooling circuit and the presence of electrical components may cause hazardous situations during installation and maintenance work.
• Any action on the unit must be carried out by qualified and authorised personnel. In the event of a fault, do not attempt repairs on your own and do not let unauthorised technicians carry out repairs, or the guarantee will no longer be valid.
• The initial start-up must be carried out exclusively by qualified personnel authorised by the marketing entity (see annex).
• Before performing any work on the unit, ensure it has been disconnected from the power supply.
• For maintenance service or repairs always and exclusively use original spare parts. THE MANUFACTURER declines all responsibility for damages that may occur due to non-compliance with the above.
• The unit is guaranteed according to the contractual agreements entered into upon its sale: however, failure to comply with the rules and instructions contained in this manual and any modification in the unit not previously authorised, will cause an immediate loss of guarantee validity.
• This manual describes the intended use of the unit and provides instructions for its handling, installation, assembly, adjustment and use. It supplies information on the maintenance schedule, how to order spare parts, the presence of residual risks, and staff training. Therefore, before handling, installing, using or carrying out any maintenance on the unit, read the manual very carefully.
• It is important to remember that the use and maintenance manual can never replace adequate user experience. This manual represents a reminder of the main operations to be performed by operators who have received specific training, for example by attending training courses held by the manufacturer, with reference to particular maintenance operations.
• Make sure all the users have thoroughly understood the operating instructions together with the meaning of any symbols on the unit.
• Possible accidents can be avoided by following these technical instructions drafted in accordance with the Machinery Directive 2006/42/EC and subsequent additions.
• In any case, always comply with national safety regulations.
• Do not remove or damage guards, decals, stickers and wording, especially any that are required by law.
• Adhesive labels intended for safer use are applied to the unit, therefore, it is very important to replace them if they become illegible.

☞ WARNING

• The electrical wiring, hydraulic and refrigeration diagrams and the technical data shown in this manual are supplied for guidance only and may be changed without prior notice for the purpose of improving the product range. For detailed information on specific models, refer to the specific documentation attached to the each product.
Any updates or additions to this use and maintenance manual are to be considered an integral part of the manual and may be requested via the contact phone numbers listed in this manual. Contact the MANUFACTURER for additional information and to share any feedback and recommendations aimed at improving the manual.
If the unit is transferred to a new owner, the MANUFACTURER expects you to please notify the address where to send any manual additions for the new user.

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1 SERIES

1.1 Scope of application

TRF units are specially designed for technological environments with very high thermal loads such as Data Centers, where high precision in climate control and a 24h/day operation are required.

☞ **WARNING**

Regarding the unit setting and its use, it is important to know that:

— All models belonging to the TRF series are designed and built for indoor installation:
— the units are designed and built to operate in the temperature ranges indicated in paragraph 5.2 Operating limits p. 22: applications outside the indicated limits may be authorised by the MANUFACTURER, subject to verification and subsequent written authorization.
— the storage temperature of the unit must be within the limits indicated in the paragraph 5.2 Operating limits p. 22;
— ventilation of the unit external finned heat exchanger and the clearance space around it must be guaranteed;
— the installation environment must be immediately suitable from first positioning of the unit and not just after installation completion (for example, do not install and operate the unit in premises and open work sites where completion works might damage the unit);
— the unit must only be used for housing, industrial and technological conditioning; any other use is considered not recommended.
— failure to comply with the aforementioned items and those contained in the manual will cause an immediate loss of guarantee validity; in this case, the manufacturer declines all responsibility for any damage to persons, property or the unit that may derive from it.

⚠ **DANGER**

— Install the unit in environments without any risks of explosion, corrosion or fire.
— Make sure that the unit is supplied an adequate volume of air at both intake and outlet ends.
— Any use that does not conform to the expected conditions could result in serious consequences for the unit.
— All ordinary and extraordinary maintenance operations must be carried out with the unit switched off, by disconnecting the power supply.
— Wait approximately 30 minutes after switching off the unit before carrying out any maintenance operations to avoid burns.

⚠ **ATTENTION**

— Before starting any work on the unit, each operator must be perfectly familiar with its operation and its controls, and have read and understood all the technical information contained in this manual.
— It is forbidden to use the unit in conditions or for uses other than what is indicated in this manual and the MANUFACTURER may not be held responsible for breakdowns, accidents or injuries due to failure to comply with this prohibition.
— Do not repair high pressure pipes with welds.
— It is forbidden to tamper with, alter or modify, even partially, the systems or equipment described in the instruction manual, and in particular, the guards and warning symbols required for personal safety.
— It is also forbidden to operate in manners different from those indicated or fail to perform operations necessary for safety reasons.
— Safety instructions are particularly important, as well as general information contained in this manual.

1.2 Product information

The TRF series precision chilled water air conditioners are specially designed for technological environments with very high thermal loads such as data centers, laboratories and in any case for applications where high precision in climate control and a 24h/day operation are required.
The TRF units, like all our products, represent the state of the art in terms of technology and aesthetics. Furthermore, the innovative design and the high tech colors used make the TRF units a valid complement to the latest generation racks.
The internal design of the units is first of all thought of efficiency and reliability without ever forgetting accessibility.
All components, including electrical heaters, fans, valves, etc. they can be subjected to maintenance by acting only from the front. The doors can be disassembled in a few minutes thanks to the use of innovative hinges that allow easy removal if necessary: a significant feature when the units are mounted in confined spaces.
The use of components from the best brands and an integrated development process (CAD + CAM, CAE) is a guarantee of the highest quality in terms of efficiency, reliability, maintenance times, pre- and post-sales assistance.
It is possible to order the TRF units with different air flow configurations, based on the needs and design of the datacenter. Downflow, upflow, displacement (D, U, X) versions are available.
All units are available in single circuit up to 52 kW and dual circuit up to 130 kW.

1.2.1 Structure

TRF units are designed with a self supporting frame and all components are produced using sophisticated computer driven machines and special tools.
All sheet metals are galvanized and all external panels are powder coated RAL 7016 giving to the units the image and the quality like last generation of IT devices.
Units are completely closed and only frontal access is requested.
Anyway it is also possible to have side access in order to reach the steam piping and the drain pan, or simply to substitute a damaged side panel.
All this problems are very rare, but with TRF units it is possible to solve them.

The shape of the units is characterized with the curved edges with variable radius and gives both a good aesthetic and advantages against injuries.
The compressor compartment is separated from the air flow. The special internal design allows the simple dismounting of the upper part of it ensuring an insuperable accessibility to all refrigerating components.
All fixing elements are made in stainless steel or in non corroding materials. The dray pan is made in stainless steel in order to ensure long time operation without damages.
All panels are thermally insulated with a polyurethane foam class 1 according UL 94 norms.
This material, thanks to the open cells, gives good performances in sound absorption. Possibility of sandwich paneling (optional).
Mineral fibres are closed between the panel and a second sheet of metal giving the maximum in terms of internal cleaning. Double skin panels are classified between non flammable materials class A1 according DIN 4102 norms.
The sound insulation is better than the standard solution, but the internal reflected sound power will increase the amount in delivery side (+2dB).

1.2.2 Cooling circuit

The entire refrigerating circuit is assembled in our production line including all pipe work and using only primary brand for components.
The workers involved in the welding and pipe work process are qualified by a third part according 2014/68/EU.
The DX unit (“A“, “W“, “F“, “D“, “Q“, “Z“ versions) are prechargerd with dry nitrogen for “A” and “D” or with refrigerant for “W”, “F”, “Q”, “Z” versions.

Compressors
On TRF units only primary brand Scroll compressors are installed.
Scroll compressor represent for CCAC units the best solution in terms of efficiency and reliability.
The internal compression ratio is very close to the typical operating condition of CCAC giving the maximum in terms of COPs and the perfect balanced pressures at start up gives big advantages to the e_motor in terms of reliability, mainly in this filed where frequent start up may be possible.
All motors are thermally protected with an internal sensors chain. In case of overload this sensor opens without giving contacts to the connection box.

Cooling components:
— Molecular mesh activated-alumina filter dryer
— Flow and humidity indicator. The key is shown directly on the indicator glass.
— Thermostatic valve with external equalisation and integrated MOP function.
— High and low pressure switch
— Schrader valves for checks and/or maintenance

Electric control board
The electric control board is constructed and wired in accordance with Directives 2014/35/EU and 2014/30/EU and related standards.
The board may be accessed through a door after the main switch has been turned off. All the remote controls are implemented with signals at 24 V, powered by an isolation transformer positioned inside the control board.

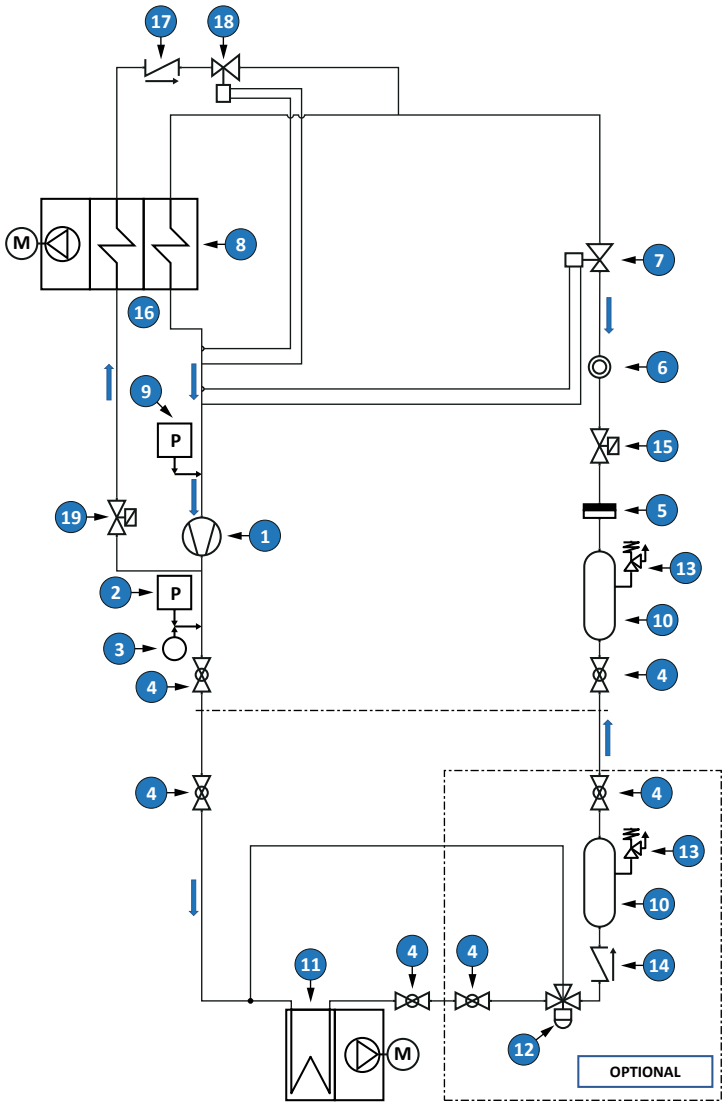
☞ **WARNING**

The mechanical safety devices such as the high-pressure switch are of the kind that trigger directly; their efficiency will not be affected by any faults occurring in the microprocessor control circuit. in compliance with 2014/68/UE PED.

Microprocessor controller
The microprocessor built into the unit allows the different operating parameters to be controlled from a set of pushbuttons situated on the electric control board:
— Switching On/Off of compressor(s) to maintain the temperature set point T inside the shelter;
— Alarm management: High/low pressure; clogged air filters, air flow alarm
— Alarm signalling
— Displaying of operating parameters
— Serial output management (optional) RS232, RS485
— Phase sequence error [not displayed by the mP, but prevents the compressor from starting up].
See microprocessor control manual, enclosed with the unit’s documentation, for further details, also in relation to particular customer specifications.

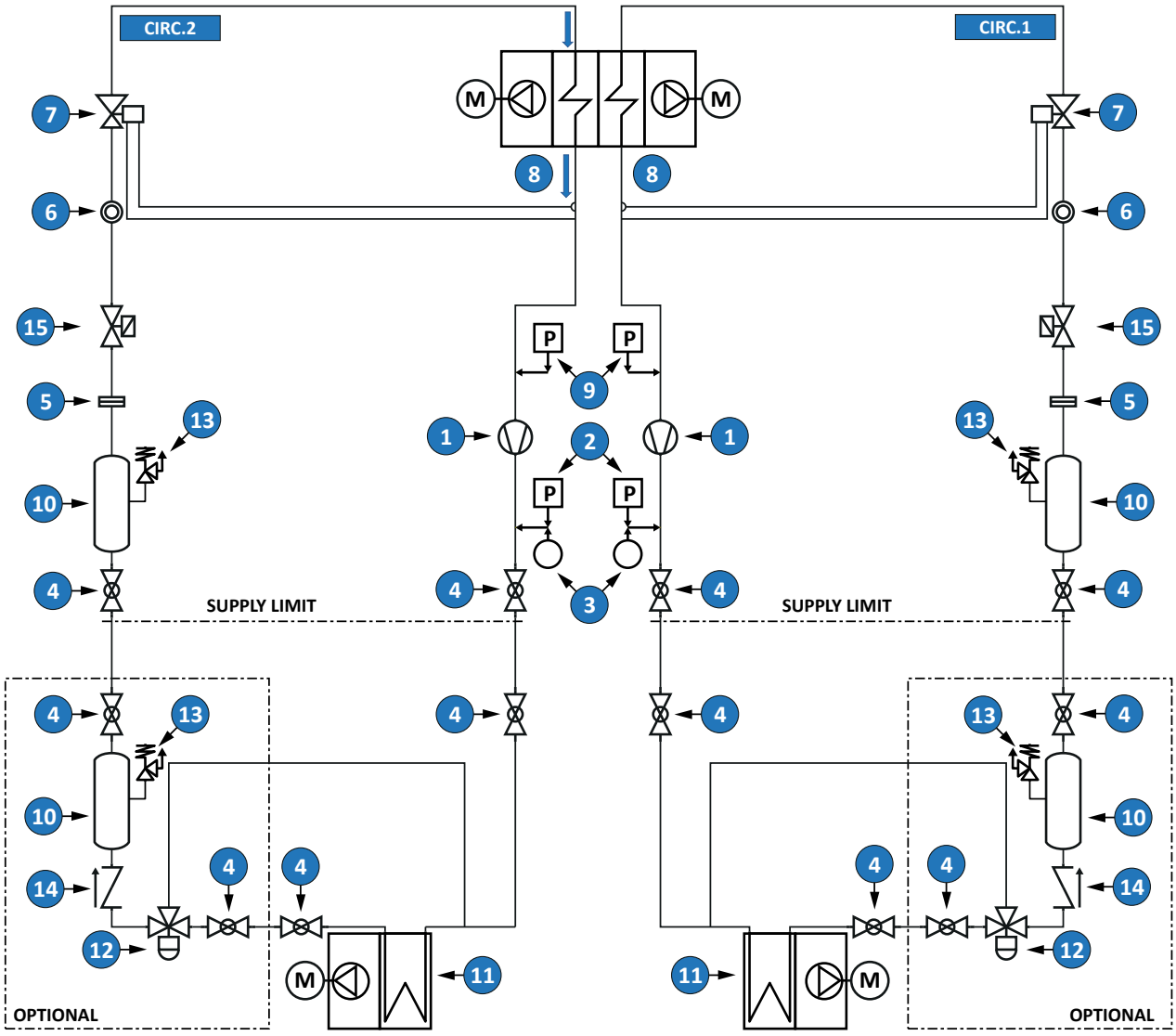
1.2.2.1 Cooling circuits

» Basic cooling circuit (DX version - 1 circuit)



1	Compressor	**11**	Condenser
2	High pressure switch	**12**	Flooding valve
3	Pressure probe (optional)	**13**	Safety valve
4	Ball valve	**14**	Check valve
5	Dehydrating filter	**15**	Solenoid valve
6	Sight glass	**16**	Hot gas coil (optional)
7	Thermostatic valve	**17**	Hot gas check valve (optional)
8	Evaporator	**18**	Hot gas thermostatic valve (optional)
9	Low pressure switch	**19**	Hot gas solenoid valve (optional)
10	Liquid receiver		

» Basic cooling circuit - DX version (2 circuits)

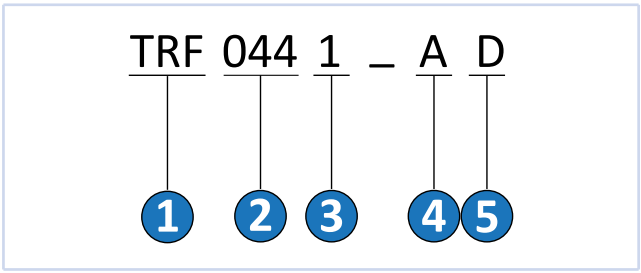


1 Compressor
2 High pressure switch
3 Pressure probe (optional)
4 Ball valve
5 Dehydrating filter
6 Sight glass
7 Thermostatic valve
8 Evaporator
9 Low pressure switch
10 Liquid receiver
11 Condenser
12 Flooding valve
13 Safety valve
14 Check valve
15 Solenoid valve

For different models and configurations see the cooling circuit attached to the unit.

1.3 Models and versions

The TRF units are direct expansion units equipped with Scroll on-off compressors and EC electronically commutated radial fans.
The naming methods and the unit configuration options are shown below.

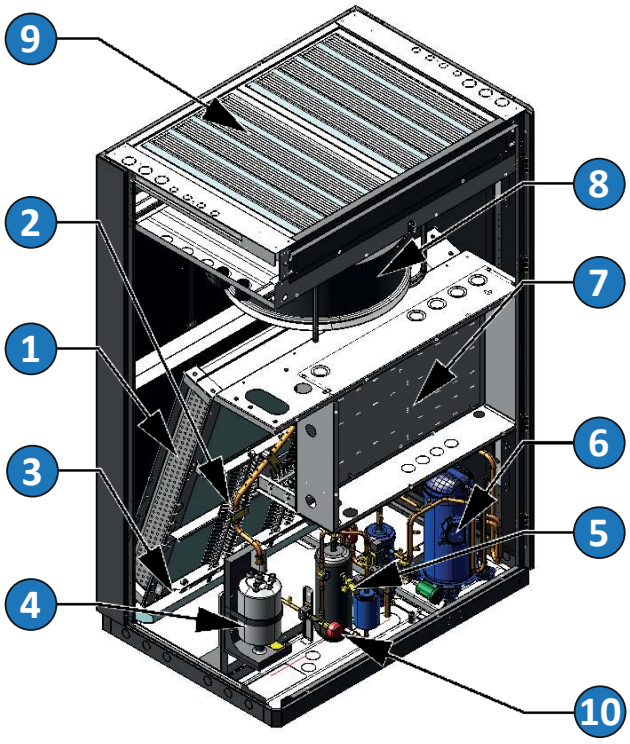


1 - Unit name	
Perimeter closet	TRF

2 - Size	
Nominal Cooling Capacity [kW]	024
	...
	130
3 - Configuration	
One cooling circuit - One on/off compressor	1
Two cooling circuits - Two on/off compressors	2
Two cooling circuits - Four on/off compressors	4
4 - Esecution	
Direct expansion - External air source	A
Direct expansion - External air source - Dual cooling	D
Direct expansion - Dry cooler air source	W
Direct expansion - Dry cooler air source - Dual cooling	K
Direct expansion - Groundwater source	Z
Direct expansion - Groundwater source - Dual cooling	Q
Direct expansion - Indirect free cooling	F
5 - Air flow	
Unit with downflow airflow	D
Unit with upflow airflow	U
Unit with displacement airflow	X

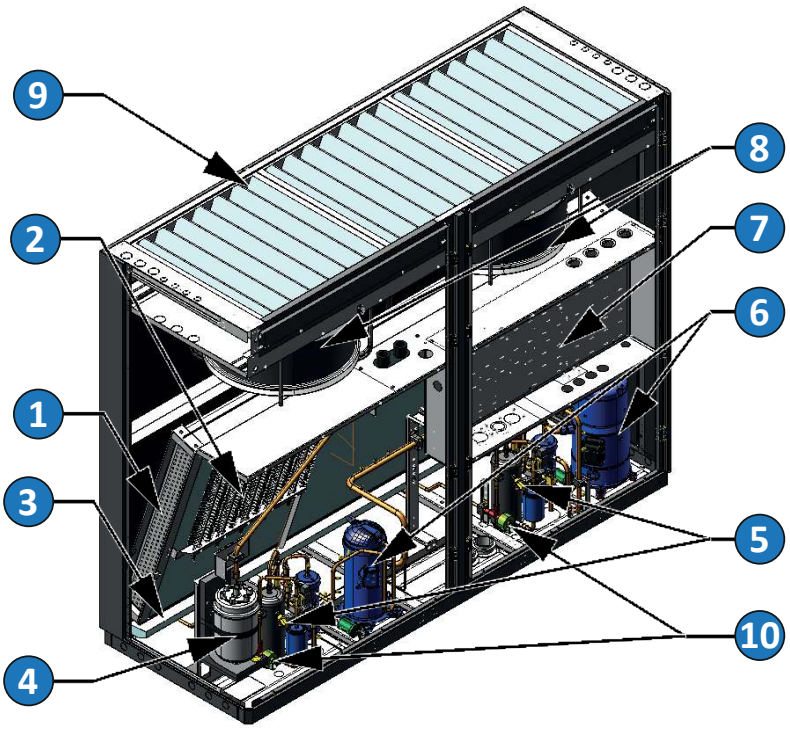
1.3.1 Main components

» Single circuit units



1 Evaporating coil
2 Electrical heating elements
3 Condensate collection tray
4 Humidifier
5 Thermostatic valve
6 Scroll compressor
7 Electric control board
8 Fan
9 Air filter
10 Thermostatic valve

» Double circuit



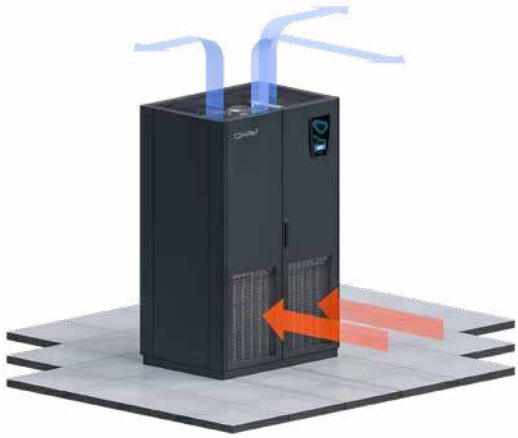
1	Evaporating coil	**6**	Scroll compressor
2	Electrical heating elements	**7**	Electric control board
3	Condensate collection tray	**8**	Fan
4	Humidifier	**9**	Air filter
5	Thermostatic valve	**10**	Thermostatic valve

The images shown are for illustrative purposes only. For the correct positioning of the components and accessories, refer to the dimensional drawing attached to the unit.

1.3.2 Operating Diagrams

» Downflow version

» Upflow version



» Displacement version

2 SAFETY PRESCRIPTIONS

The following are some general rules useful for ensuring the safety of people who are in contact with the unit.

⚠ **ATTENTION**

It is up to the installer and the owner of the installation site to define the safety and protection devices to be used for unit maintenance operations or in dangerous situations - as well as the emergency procedures to be adopted in the latter case. All this in accordance with current legislation and in conjunction with local rescue units.

2.1 General safety rules

2.1.1 Thoroughly know the unit

The unit must only be used by qualified personnel, who are expected to know the arrangement and function of all controls, instruments, indicators, indicator lights and various data plates.

2.1.2 Wear protective clothing

Each operator must use personal protective equipment such as gloves, headgear, safety goggles, safety shoes, and hearing protection.

⚠ **ATTENTION**

Please also refer to the relevant section in chapter 12 Refrigerant fluid safety sheet p. 44.

2.1.3 Use safety equipment

A first aid kit and a fire extinguisher must be placed near the unit.

⚠ **ATTENTION**

Please also refer to the relevant section in chapter 12 Refrigerant fluid safety sheet.

2.1.4 Fire extinguisher and a first aid kit

Check the presence and location of the fire extinguisher.
Regularly check that the fire extinguishers are charged and their operating instructions are clearly understood.
It is required to be aware of where the first aid box is kept.
Periodically check that the first aid kit is stocked with disinfectants, bandages, drugs, etc.
The personnel must know what to do in the event of a fire.
Make sure that emergency help phone numbers are readily available.
In the event of a fire, use a fire extinguisher in compliance with the regulations in force. Contact the fire department.

☞ **WARNING**

The owner of the building where the unit is installed must provide the required fire extinguisher.

2.2 General precautions

The Machinery Directive 2006/42/EC provides the following definitions (Annex 1.1.1.1):
DANGER ZONE: any area next to and/or inside a machine, where the presence of an exposed person constitutes a risk for the safety and health of said person.
EXPOSED PERSON: any person found entirely or partially within a danger zone.
OPERATOR: the person or persons installing, operating, adjusting, maintaining, cleaning, repairing or moving machinery.

☞ **WARNING**

— Before carrying out any operation or maintenance on the unit it is mandatory to read and follow the instructions given in the use and maintenance manual. During the

actual work, it would be too late: any not recommended or wrong operation could then cause serious damage to people or property.
— The employer must inform in detail all operators about the risks of accidents and particularly about risks related to noise, required personal protective devices and general accident prevention rules provided by laws or international standards and national standards in the Country of destination of the unit. All operators must comply with the international accident prevention standards and standards in force in the country of destination of the unit. Please be reminded that the European Union has issued some directives concerning the safety and health of workers, among which the directives 89/391/EEC, 89/686/EEC, 89/654/EEC, 2009/104/EC, 89/656/EEC, 2003/10/EC, 92/58/EEC and 92/57/EEC that each employer has an obligation to observe and to enforce. In the event that the unit is installed outside the European union, always refer to the regulations in force in the country of installation.
— Before starting any work on the unit, each operator must be perfectly familiar with its operation and its controls, and have read and understood all the information contained in this manual.

ATTENTION

It is forbidden to tamper with or replace parts of the unit unless this has been expressly authorised by the MANUFACTURER.
The use of accessories, tools, consumables or spare parts other than those recommended by the MANUFACTURER and/or specified in this manual may be a hazard to operators and/or damage the unit.
Any alteration of the unit not expressly authorised by the MANUFACTURER shall not imply any civil or criminal liability for the manufacturing company.

WARNING

— It is strictly forbidden to remove or tamper with any safety devices.
— Any installation, ordinary and extraordinary maintenance operations must be carried out with the unit stopped and without power supply.
— Once the unit has been cleaned, the operator must check that there are no worn or damaged parts or parts that are not safely fixed, or if this is the case, ask the maintenance staff to fix the problem. Special attention must be paid to the state of repair of the pressurised pipes or other parts exposed to wear. It must also be ensured that there are no leaks of fluid, or other dangerous substances. In these cases, it is forbidden for the operator to restart the unit before the situation has been remedied. If any of these occurrences are detected, the operator, before leaving the unit unattended, must display a warning sign indicating that maintenance is in progress and it is forbidden to start the unit.
— The use of flammable fluids in cleaning operations is prohibited.
— Periodically check the condition of the data plates and arrange, if necessary, for them to be restored.
— The operator work place must be kept clean, tidy and free from any objects that may limit unhindered movement.
— Operators should avoid operating the device from unsafe, uncomfortable positions that may affect their balance.
— Operators must be aware of possible risks of entrapment and entanglement of clothes and/or hair in moving parts; it is recommended to wear caps over long hair.
— Wearing chains, bracelets and rings can also be dangerous.
— The workplace must be adequately lit for the intended operations. Insufficient or excessively bright lighting can imply safety risks.
— The instructions, accident-prevention rules and warnings contained in this manual must be observed at all times.

2.2.1 Safety information

The units have been designed and built according to the current state of the art and the technical rules currently applicable to fluid chillers and heat pumps and/or fluid chillers with free-cooling exchange intended for cooling water or water and anti-freezing agent mixtures, for housing air conditioning and industrial cooling systems. Compliance with the laws, provisions, prescriptions, orders and directives in force for these machines has been ensured.
The materials and the equipment parts used, as well as the production, quality assurance and control processes meet the highest safety and reliability requirements.
By using them for the purposes specified in this user manual, by operating them with the required diligence and performing accurate maintenance and overhauling in a workmanlike manner, consistent performance and functionality and durability can be ensured.

2.2.2 Accident prevention

The MANUFACTURER will not be liable for accidents, during the use of the unit, due to failure by the user to comply with laws, provisions, prescriptions and regulations applicable to fluid chillers and heat pumps and/or fluid chillers with free-cooling exchange system.

2.2.3 Operational safety

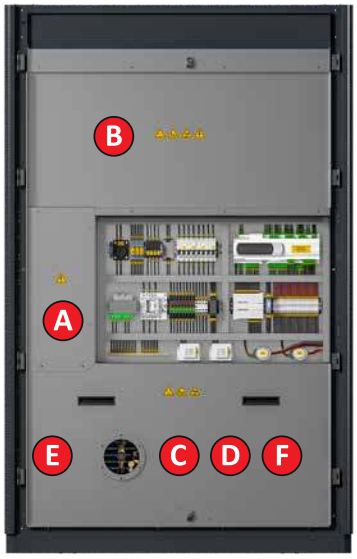
The MANUFACTURER will not be responsible in case of malfunctions and damage if the unit:
— it is used for purposes other than those for which it is intended;
— it is not operated and maintained according to the service standards specified further on in this manual;
— it does not regularly and consistently receive maintenance as prescribed or non-original spare parts are used;
— is modified or some components are replaced without the MANUFACTURER's written authorisation, especially when the effectiveness of the safety systems has been altered or minimised on purpose;
— it is used outside the permissible temperature range.

2.2.4 Residual risk areas

⚠ DANGER

In some areas of the unit there are some residual risks that could not be eliminated during the design phase nor isolated with guards due to the unit's operating characteristics. Each operator must be aware of the residual risks present in this unit in order to prevent any accidents.

» Residual risk areas



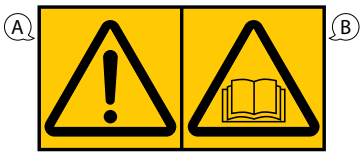
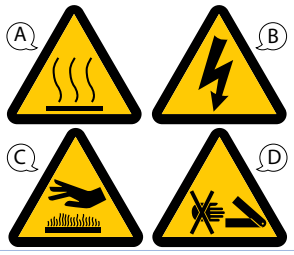
A Danger of fire
B Impact and abrasion hazard in fan area
C Danger of explosion due to the presence of pressurised circuits
D Danger of pollution due to the presence of refrigerant in the circuit
E Danger of cutting injuries near finned exchangers
F Danger of burns due to the presence of high temperature pipes

☞ WARNING

In order to avoid the risks listed above it is essentially important to:
— set the control panel according to the manufacturer's instructions;
— not place metal objects inside the electrical control panel;
— not store flammable materials near the machine;
— not alter any component of the refrigerant circuit;
— not let the machine work outside the limits indicated by the manufacturer;
— dispose of all the materials that make up the machine correctly, use suitable equipment for the recovery of the refrigerant gas (see chapter 11 Retiring the unit p. 42);
— not touch the internal components during operation without adequate protection.

2.3 Location of safety data plates

» Safety symbols

1 **A.** Warning: danger due to poor familiarity with all the functions of the unit and the resulting risks. **B.** Read the use and maintenance manual carefully before operating the unit.	
2 Electric power supply data plate	
3 **A.** Danger: hot parts. **B.** Danger: live parts. **C.** Danger of burns. **D.** Danger of cutting injuries in the finned exchangers area.	
4 Refrigerating liquid	

2.4 Maintenance precautions

2.4.1 Tools

Use only tools prescribed by the unit manufacturer; in order to avoid personal injury, do not use worn or damaged, low quality or makeshift tools.
If tools not recommended or modified without authorisation are used, the manufacturer will no longer be liable for damages caused.

2.4.2 Personnel

Ordinary maintenance prescribed in this manual must only be performed by authorised and trained personnel. For the maintenance or overhauling of components not specified in this manual, contact the MANUFACTURER.

2.4.3 Keep the unit clean

Oil and grease stains, misplaced tools or broken pieces are harmful to people as they can cause slipping or falls. Always keep the area where the unit is installed clean and tidy.
Do not use diesel fuel, oil or solvents to clean the unit as the first two leave an oily film that makes it easier for dust to stick, while solvents (even milder ones) damage the paint finish and cause rusting.
If a water jet hits the inside of electrical equipment, in addition to causing contact oxidation, it may cause the unit malfunction.
For this reason, do not use water or steam jets on sensors, connectors or any electrical parts.

2.4.4 Warning plates

Before starting any maintenance operation, turn off the unit. If other people start the unit and operate the control buttons while maintenance operations are being performed, serious injury or even death may result.
To avoid these dangers, before carrying out maintenance, hang caution signs around the unit.

2.4.5 Warnings for inspections and maintenance

Display a sign with the warning: “INSPECTION IN PROGRESS” on all sides of the unit.
Check the unit carefully following the list of operations contained in this manual.

2.4.6 Care and maintenance

The cause of damages and accidents is often attributable to wrong maintenance, such as:
— no water in the circuit;
— incorrect percentage of anti-freezing agent in the hydraulic circuit;
— inadequate refrigerant;
— poor cleaning in the unit setting;
— circuit inefficiency (damage to the exchangers, pipe connections, tightening of pipes, screws, etc.).

Carry out maintenance work as required: this is also critical for your own safety.
Never postpone scheduled repairs.
Only assign skilled or authorised personnel to repair tasks.
Always observe the following safety rules, even when you are thoroughly familiar with the operations involved:
— always keep the unit and the surrounding area clean;
— before beginning to work, check the perfect efficiency of protective devices;
— make sure that no unqualified or not specially appointed persons enter the unit operating area.

3 INSPECTION / TRANSPORT / POSITIONING

The following are recommended and necessary indications to correctly carry out transporting, handling and positioning of the unit. To this end, information is also provided regarding the distribution of weights, anti-vibration devices to be used and clearance space around the unit.

3.1 Transport

While the unit is being unloaded and positioned, utmost care must be taken to avoid abrupt or violent manoeuvres. The unit must be handled carefully and gently; avoid using machine components as anchorages or holds and always keep it in an upright position.

ATTENTION

The unit should be lifted using the pallet it is packed on; a transpallet or similar conveyance means should be used.
In all lifting operations make sure that the unit is securely anchored in order to prevent accidental falls or overturning.

3.2 Inspection

Upon receiving the unit, check its integrity: the machine has left the factory in perfect condition; any damage must be immediately reported to the forwarder and noted on the Delivery report before signing it.
The manufacturers or their agents must be informed as soon as possible about the extent of the damage. The Customer must submit a written report for any significant damage.
Check that the following items are present:
— commissioning report
— wiring diagram
Also check the integrity of the documents supplied on-board the machine and attached to this manual.

3.3 Conveyance

During handling, it is mandatory to check the dimensions, weights, centre of gravity and lifting points. Also check that the lifting and positioning equipment complies with the applicable safety regulations.

3.4 Unpacking

WARNING

The unit packaging must be carefully removed avoiding possible damage to the machine.

Different packing materials are used: wood, cardboard, nylon etc. It is recommended to keep them separately and deliver them to suitable waste disposal or recycling facilities in order to minimise their environmental impact.

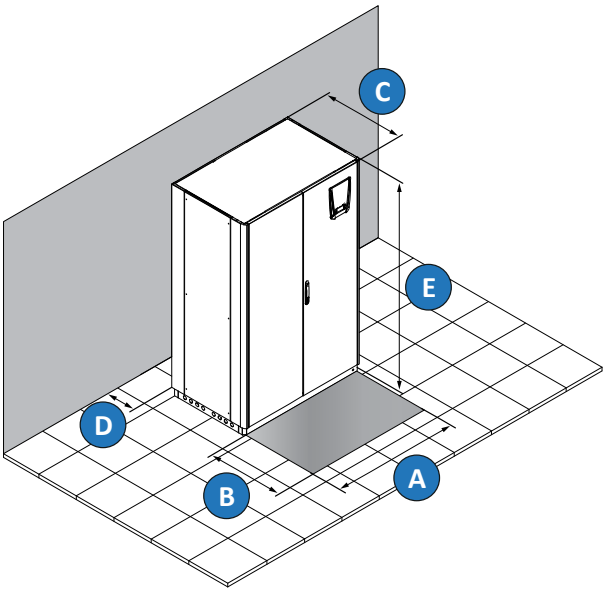
3.5 Siting

Check the following points to select the best installation setting for the unit and its connections:
— Size and origin of water pipes;
— power supply location;
— accessibility for maintenance or repairs;
— solidity of the supporting surface
— position of any obstacles to air flow;
It is recommended to first prepare the holes in the floor / wall to pass the electric cables and for the air supply (downward air supply). The dimensions of the air outlet and the positions of the holes for anchoring the screws and electrical cables are indicated in the dimensional drawings attached to the unit.
If the unit is to be installed in proximity to private offices or areas where noise levels must be kept down, it is advisable to conduct a thorough analysis of the sound field generated and verify its compatibility with the local laws in force.

3.6 Installation clearance requirements

The TRF air-conditioning unit is suitable for all environments except aggressive ones. Do not place any obstacles near the units and make sure that the air flow is not impeded by obstacles and/or situations causing back suction.
The spaces indicated in the dimensional drawings must be complied with for the units to function properly and routine maintenance to be performed.

» Installation clearance requirements



Model	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]
0241-0261-0291	1010	750	890	10	2000
0331-0361-0391-0441	1280	750	890	10	2000
0481-0521-0382-0432-0492-0532-0602	1760	750	890	10	2000
0632-0682-0762	2030	750	890	10	2000
0802-0872-0962	2510	750	890	10	2000
1102-1304	3160	750	890	10	2000

To ensure correct installation, follow the instructions below:
— Apply a anti-vibration rubber lining between the unit and the bottom;
— Position the unit on the floor/floorstand (base frame).
In case of installation of the accessories supplied, such as “plenum” and “base module”, it is necessary to apply a gasket between the unit and the accessory to ensure the seal.
Bear in mind the following aspects when choosing the best site for installing the unit and the relative connections:
— positioning and dimensions of the coupling flanges and refrigerant connections;
— power supply location;
— solidity of the supporting surface;

☞ **WARNING**

It is recommended to first prepare holes in the floor/wall for passing through the power cables and for the air outlet (down flow units).

The dimensions of the flanges (optional) and of the power cable holes are shown in the unit dimensions attached to the machine documentation.

4 PLUMBING AND ELECTRICAL CONNECTIONS

4.1 Hydraulic connections

4.1.1 Properties of the feed water (only dual cooling version)

The quality and chemical composition of the cooling and heat transfer substance has a great influence on the life of the system, on the heat transfer and therefore on the performance of the air conditioning unit.
Basically, all fluctuating substances in the cooling and heat transfer substance must be avoided since the suspended substance accumulates in the heat exchanger, affecting the heat exchange and the performance of the unit.
Below are the values of the dissolved substances and the water properties recommended.
The information refers to the use of copper exchangers.
If the concentration of some components will be out of range, the customer has to introduce a correction, otherwise the system will be out of warranty.

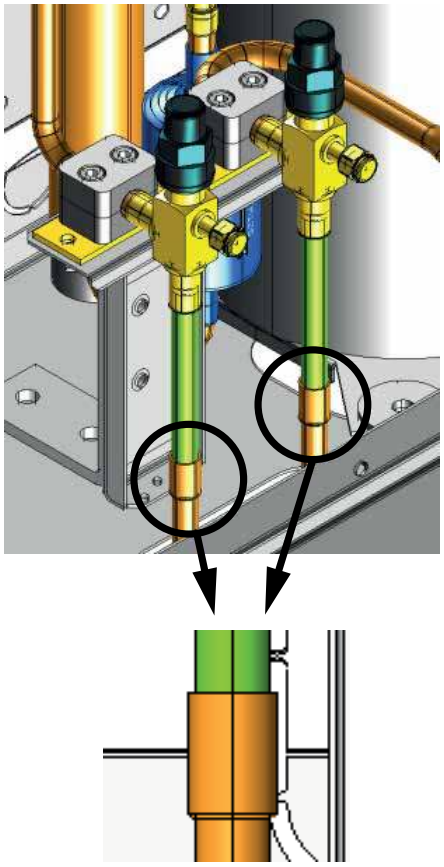
WATER CONTENT	CONCENTRATION
Alkalinity (HCO_3^-)	70 - 300 ppm
Sulphate (SO_4^{2-})	< 70 ppm
HCO_3^- / SO_4^{2-}	> 1.0 ppm
Electrical conductivity	10 - 500 µS/cm
pH*	7.5 - 9.0
Ammonium (NH_4^+)	< 2 ppm
Chloride (Cl^-)	< 30 ppm
Free chlorine (Cl_2)	< 0.5 ppm
Hydrogen sulphide (H_2S)	< 0.05 ppm
Carbon dioxide (CO_2)	< 5 ppm
Total hardness (°dH)	4.5 - 8.5
Nitrate (NO_3^-)	< 100 ppm
Iron (Fe)**	< 0.2 ppm
Aluminium (Al)	< 0.2 ppm
Manganese (Mn)**	< 0.05 ppm
Calcium carbonate ($CaCO_3$)	< 200 ppm
Phosphate (PO_4^{3-})	< 2 ppm
Ammonia (NH_3)	< 0.5 ppm
Temperature (°C)	< 65 °C
Oxygen content	< 0.1 ppm

*Generally a low pH value (less than 6) increases the risk of corrosion and a high pH (above 7.5) decreases the risk of corrosion
**Fe^{3+} and Mn^{4+} are powerful oxidants and may increase the risk of localized corrosion on stainless steel

4.1.2 Refrigerant connections

To connect angle valves with ODS connection to the piping, you must use pipe belling and brazing, with a maximum melting temperature of 750°C and a brazing alloy that is at least 5% silver.
Before installation, make sure the valve is in the open position and that plastic caps, if any, have been removed.
During soldering, protect the valve from being overheated by the flame with a wet cloth or guard.

» Pipe belling



Diameters used:
— ANGLE VALVE ODS 12 mm
— ANGLE VALVE ODS 16 mm
— ANGLE VALVE ODS 18 mm
— ANGLE VALVE ODS 22 mm
— ANGLE VALVE ODS 28 mm
Please refer to the unit's dimension drawings for connection dimensions.

4.2 Electrical connections

4.2.1 Main features

⚠ **ATTENTION**

Before carrying out any operation on electrical parts, make sure that there is no applied voltage.

Check that the mains electricity supply is compatible with the specifications (voltage, number of phases, frequency) shown on the unit rating plate.

The power connection for single-phase loads is to be made with a three-pole cable and “N” wire at the centre of the star [optional: power supply w/o neutral].

ATTENTION

The cable section and line protections must accordant with what is indicated in the wiring diagram (attaced to the unit’s documentation).

The supply voltage may not undergo fluctuations exceeding ±10% and the unbalance between phases must always be below 2%.

ATTENTION

The unit must operate within the above values, or the warranty will be invalidated.

The electrical connections must be made in accordance with the information shown in the wiring diagram provided with the unit and with current and local regulations.
An earth connection is mandatory. The installer must connect the earthing wire using the earthing terminal situated on the electric control board (yellow and green wire).
The power supply to the control circuit is shunted from the power line through an insulating transformer situated on the electric control board.
The control circuit is protected by suitable fuses or automatic breakers depending on the unit size.

ATTENTION

When the motor runs independently due to air flowing through or if it continues to run down after being turned off, dangerous voltages of over 50V can arise on the motor internal connections through operation of the generator. The absence of voltage must be ascertained by means of a bipolar voltage detector.

ATTENTION

Even after disconnecting the mains voltage, life-threating charges can appear between the protective ground “PE” and the mains connection. The protective earth is conducting high discharge currents (dependent on the switching frequency, current source voltage and motor capacity). Earthing in compliance with EN specifications shall therefore be observed even for testing and trial conditions (EN 50 178, Art.5.2.11).

Regarding the differential protection that needs to be installed upstream, it is necessary to use a type A switch that is sensitive to direct currents. It is mandatory for it to have the following features:

1. Adjustable operation threshold
2. Adjustable operation delay

5 START-UP

5.1 Preliminary checks

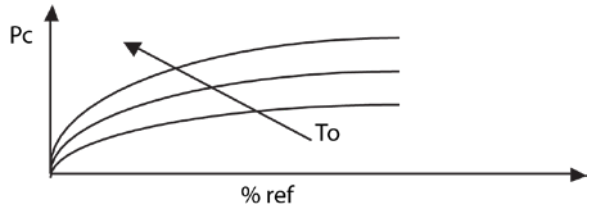
— Check that the electrical connections have been made properly and that all the terminals are securely tightened. This check should also be included in a periodic six-month inspection.
— Check that the voltage at the RST terminals is 400 V ± 10% and make sure the yellow indicator light of the phase sequence relay is on (only DX versions). The phase sequence relay is positioned on the electric control board; if the sequence is not duly observed, it will not enable the machine to start.
— Make sure there are no refrigerant leakage that may have been caused by accidental impacts during transport and/or installation (monobloc unit).
— Check the power supply to the crankcase heating elements, where present.

ATTENTION

The heating elements must be turned on at least 12 hours before the unit is started. This function is carried out automatically when the main switch is off. Their function is to raise the T of the oil in the sump and limit the quantity of refrigerant dissolved in it.

To ensure the correct operation of the heating elements, check that the lower part of the compressors is hot and in any case, that it is at a temperature 10 - 15°C higher than ambient temperature.

» Charles' law



- Pc: Pressure
- % ref: Percentage of refrigerant dissolved in oil
- To: Oil temperature

The diagram above illustrates a specific property [Charles' Law] of gases. which are more soluble in liquids as the pressure increases but less soluble as the temperature increases: if the oil in the sump is held at a constant pressure, an increase in oil temperature will significantly reduce the amount of refrigerant dissolved in it, thus ensuring that the lubricating function desired is maintained.

5.2 Operating limits

The units TRF must be used within the operating limits defined in this manual.

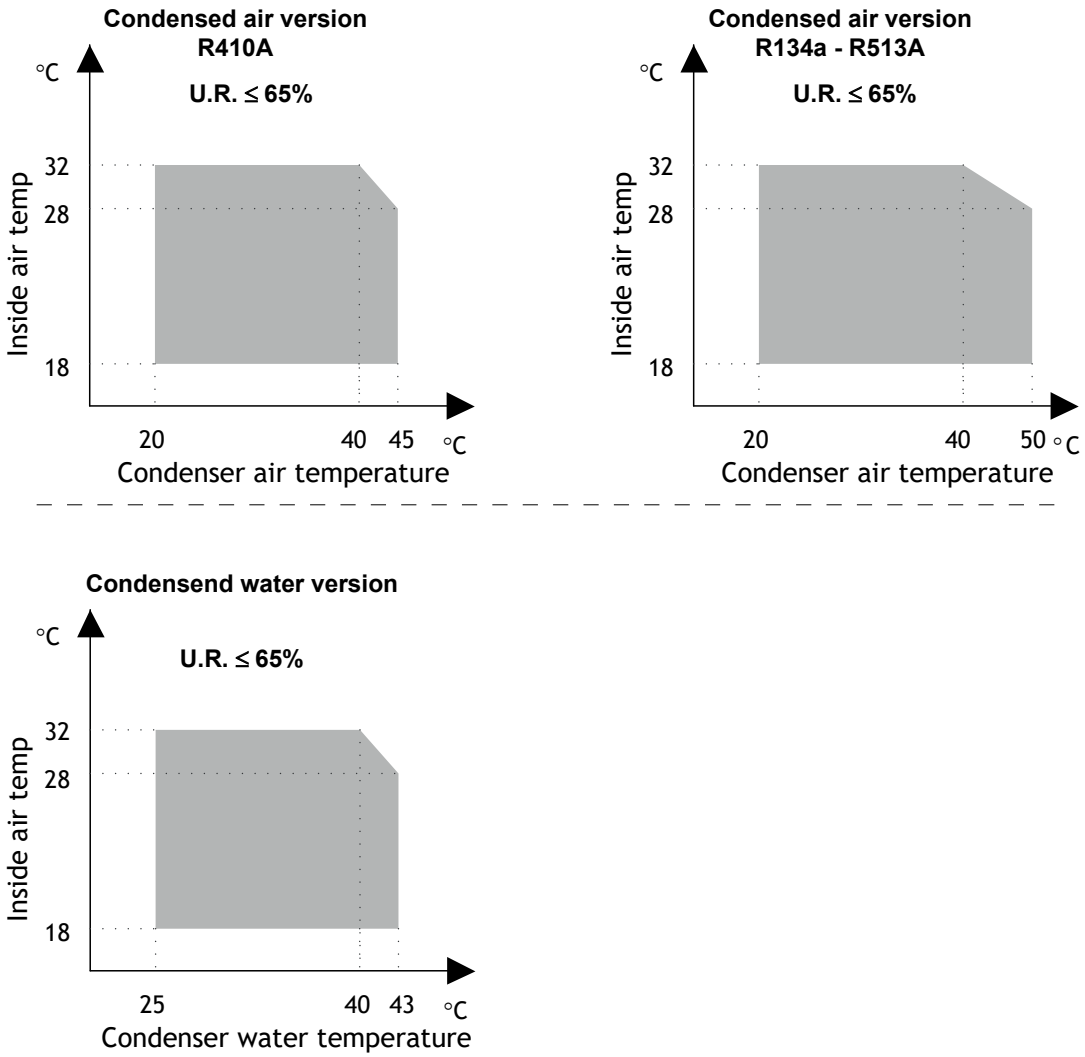
REQUIREMENTS

Non-compliance of these limits makes it null and void the stipulated warranty contract.

» Power supply limits and storage conditions

"DX" version			TRF
Power supply *			400 (±10%) / 3+N / 50
Storage conditions	Temperature	Min	-10°C
		Max	+55°C
	Relative Humidity	Max	90%
* For different power supplies, see the attached unit wiring diagram.			

» Application limits



For temperatures lower than 20 ° C the modulating condensation control must be combined and, for temperatures lower than -20 °C and up to a minimum of -40 °C it must be combined with the flooding device which, reducing the available exchange surface thermal, allows operating at extreme temperatures even in the presence of prevailing winds.
While the unit is operating, the heat load must not be less than 25% of the unit's nominal refrigeration output.
A lower thermal load can lead to loss of control of room temperature and humidity, and too frequent switching on and off of the compressors.

5.3 Thermal carrying fluid

The units belonging to the TRF series can operate with mixtures of water and up to 50% ethylene glycol.

% by weight of glycol	Freezing temperature of the mixture with ethylene glycol (°C)	Freezing temperature of the mixture with propylene glycol (°C)
0	0	0
10	-3	-3
15	-5	-5
20	-8	-7
25	-11	-10
30	-14	-13
40	-22	-21
50	-34	-33
60	-48	-51

ATTENTION

If there is a need to exceed 50% of glycol, or in any case conditions of use that are not contemplated in the following tables, please contact the technical department for the appropriate checks, otherwise the warranty coverage will be void.

⚠ **ATTENTION**

Using glycol is necessary in all cases in which the temperature of the heat transfer fluid drops below 5°C, i.e. even when the unit is switched off or only running in summer mode, should this temperature condition occur. This will prevent water freezing and the resulting internal damage to components.

The percentage of glycol must be selected according to the lowest expected temperature.
The use of glycol will determine a change in terms of heating capacity, water flow and pressure drop.

5.4 Start-up

Before starting the unit, turn the main switch on, select the operating mode desired from the control panel and press the "ON" button on the control panel.
If the unit fails to start up, check whether the service thermostat has been set at the rated calibration values.

⚠ **ATTENTION**

You should not disconnect the unit from the power supply during periods when it is idle but only when it is to be taken out of service for a prolonged period (e.g. at the end of the season).

☞ **WARNING**

In any case, please also refer to the document "First start up instructions", supplied with the unit.

☞ **WARNING**

It is mandatory to install a metal mesh filter on the inlet pipe with a recommended 1 mm mesh size, to protect the exchanger from residues or impurities in the pipes. If the machine works in combination with process cycles, it is advisable to install an inspectable uncoupling exchanger, in order to avoid possible lockups and/or breaks of the plate heat exchanger.

5.5 Inspections during operation

Check the relay on the control board to verify whether the phases occur in the correct sequence: if they do not, disconnect the unit from power supply and reverse two phases of the three-core cable at the unit input. **Never** attempt to modify internal electrical connections: any undue modifications will render the warranty null and void.

5.6 Refrigerant charge checks

— After a few hours of operation, check that the liquid indicator (a) has a green crown: a yellow colour indicates the presence of moisture in the circuit. In this case, the circuit must be drained by qualified personnel.
— Large quantities of bubbles should not appear through the liquid level indicator. A constant passage of numerous bubbles may indicate that the refrigerant level is low and needs to be topped up.
— Make sure the overheating of the cooling fluid is limited to between 5 and 8 °C. To this end:
    1. detect the temperature indicated by a contact thermometer placed on the compressor intake pipe;
    2. read the temperature indicated on the scale of a pressure gauge likewise connected to the intake side; refer to the pressure gauge scale for the refrigerant.
    3. The difference between the temperatures determined in this way indicates the overheating value.
— Make sure that the undercooling of the cooling fluid is limited to between 3 and 5°C. To this end:
    1. detect the temperature indicated by a contact thermometer placed on the compressor outlet pipe;
    2. read the temperature indicated on the scale of a pressure gauge connected to the liquid inlet at the condenser outlet; refer to the pressure gauge scale for the refrigerant;
    3. The difference between the temperatures determined in this way indicates the undercooling value.

⚠ **ATTENTION**

Any charge top-ups must be carried out with refrigerant of the same type as that indicated on the plate, by specialised personnel and exclusively in the liquid phase.

⚠ **ATTENTION**

The refrigerant requires "POE" polyolester oil of a type approved by the compressor manufacturer. For no reason should a mineral oil be introduced into the oil circuit.

⚠ **ATTENTION**

The air cooled units (TRF) are pre-charge with Nitrogen.

5.7 Group stop

The group is stopped by pressing the "OFF" key on the front panel or by acting on the main disconnector, or by acting on the special controls of the LCD user interface.

⚠ **ATTENTION**

It is recommended not to power off the unit via the mains power switch during regular shutdowns, but only in case of expected prolonged idle times (e.g. seasonal stops). The mains switch must be used to cut the unit off from the power supply when there is no current flow, i.e. when the unit is in the OFF state.

Additionally, by completely disconnecting voltage to the unit:

— any casing resistances would not be powered - which would damage the compressor upon its next start (only DX versions);
— the only antifreeze protection would be the presence of glycol.

6 EVACUATION AND CHARGING OPERATIONS

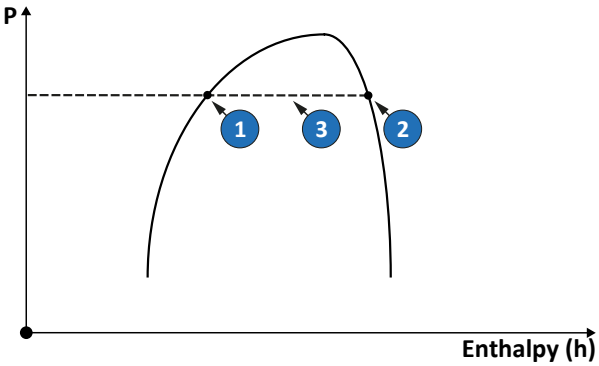
6.1 Introduction

ATTENTION

This type of work must be carried out by qualified personnel only trained to do their job in accordance with current laws and regulations.

The simultaneous presence of liquid and vapour requires that both are in saturated conditions [Gibbs' law], as shown in the following figure.

» Gibb's law diagram



1 Saturated liquid
2 Saturated gas
3 T tank/ambient

In thermal equilibrated conditions, the pressure in the tank corresponds to the ambient temperature. Withdrawal of refrigerant from the tank has following effects:

— Charge withdrawal pressure drop in the cylinder
— Pressure drop in the cylinder dop in temperature and change of state
— Drop in temperature and change of state evaporation of part of the liquid at the expense of cooling it
— Liquid cooling heat exchange with ambient air, further evaporation of residual liquid; the original pressure in the cylinder will be restored after a certain time

6.2 Full vacuum and charge of the unit

ATTENTION

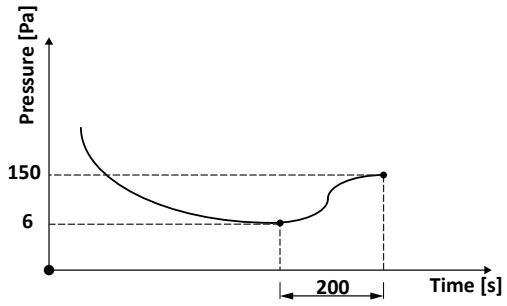
Air condensed units (TRF) are pre-charged with nitrogen.

Vacuum cycle

After the connection of the refrigerator line with the indoor unit with the outdoor unit, proceed with the vacuum cycle making sure to keep the connections of the indoor unit open (preloaded with nitrogen).

In order to obtain a satisfactory result, it is necessary to connect the vacuum pump to both pressure points of the connections of the indoor unit in order to perform the vacuum on the connection line of the indoor unit with the remote condenser and on the latter.
In general it is better to apply a "long" rather than a "hard" vacuum: reaching a low pressure too abruptly may in fact cause that any remaining humidity evaporates instantaneously, thus freezing part of it.

» Vacuum cycle

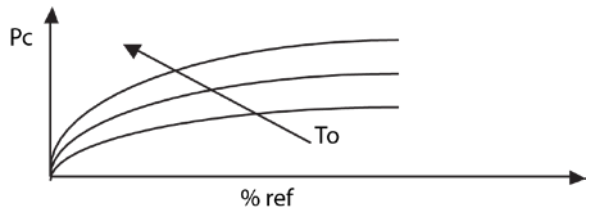


The picture represents a vacuum cycle and subsequent rising of the optimum pressure for refrigeration equipment such as those of our production.
In general, in the case of suspicion of strong hydration of the circuit or of very extensive systems, it is necessary to "break" the vacuum with anhydrous nitrogen.
Then repeat the vacuum operations as described above. This operation facilitates the removal of nested and / or frozen moisture during the vacuum process

6.3 Evacuating a circuit "contaminated" with refrigerant

The first step is to remove the refrigerant from the circuit. To do this a specific machine is necessary with a drying compressor in order to recover the refrigerant.
All refrigerants all tend to be dissolve the in oil in the compressor sump).
The next figure illustrates a specific property (Charles' Law) of gases, which are more soluble in liquids as the pressure increases but less soluble as the temperature increases.

» Charles' law



- Pc: Pressure
- % ref: Percentage of refrigerant dissolved in oil
- To: Oil temperature

If the oil in the sump is held at a constant pressure, an increase in temperature will significantly reduce the amount of refrigerant dissolved in it, thus ensuring that the lubricating function desired is maintained.
The problem of inadequate lubrication occurs if the crankcase is not duly heated, above all after seasonal interruptions.
Due to the suction effect of the compressor, there is an abrupt drop in pressure inside the sump, which results in considerable evaporation of the refrigerant previously dissolved in the oil.
If the heating elements are not installed, this phenomenon causes two problems:

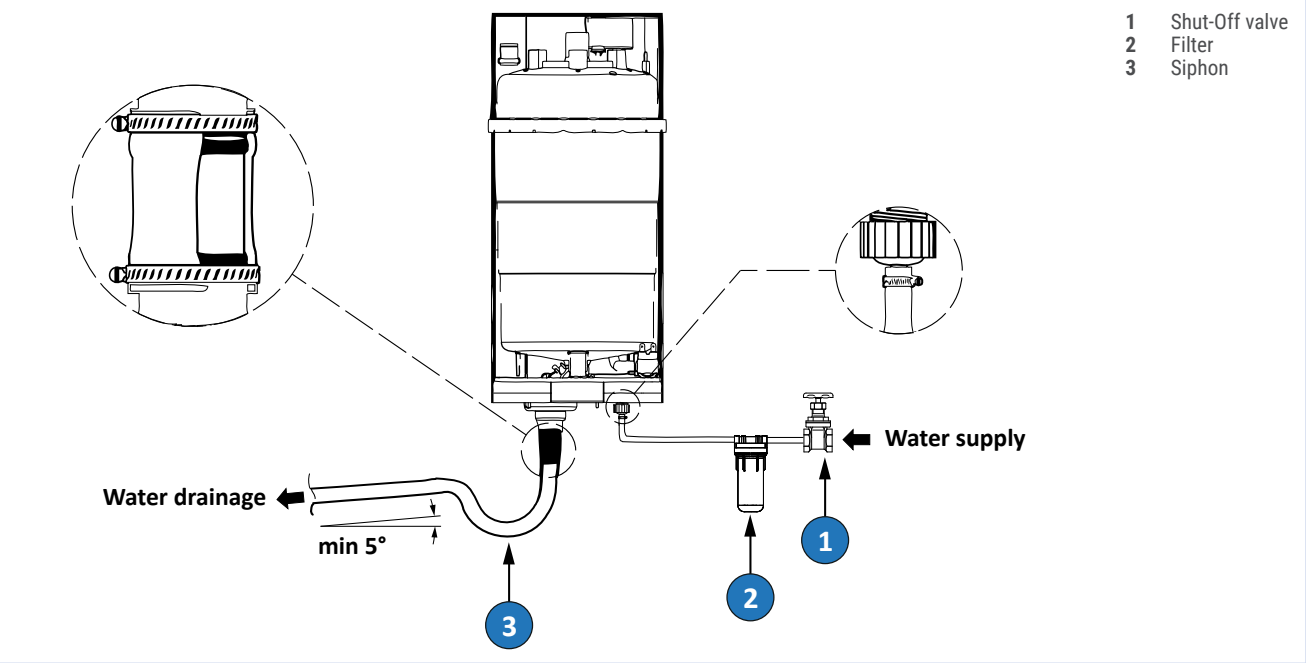
1. The release of refrigerant from the cooling circuit tends to cool down the oil and thus actually creates the opposite effect by keeping more refrigerant dissolved in the oil: for this reason, it is advisable to switch on the crankcase heater during the evacuation process.
2. If a high % of refrigerant gets in contact with the Pirani gauge (vacuum sensor), it may "mislead" this sensitive sensor and misinterpret the value for a certain period of time. For this reason (if no machine for recovering refrigerant is available) it is nonetheless advisable to switch on the crankcase heater and to avoid full vacuum before the circuit has been adequately purged of refrigerant. The refrigerant may in fact dissolve in the oil of the vacuum pump, reducing its performance for a long time (hours).

6.4 Charging positions (single point)

The best position to charge the unit is the section between the thermostatic valve and the evaporator. Take care to avoid the fixing of the thermostat bulb until the operation is completed: it is important to ensure that the valve orifice remains open in order to allow the passage of refrigerant also towards the condenser / liquid receiver.
If possible, avoid the charge of refrigerant into the suction line of the compressor as this may cause excessive dilution of the lubricant.
In case of air cooled units, in the attached "Piping Design Criteria" is described how to calculate the estimate refrigerant charge.

7 HUMIDIFIER

L'installazione di un umidificatore richiede l'allacciamento alle tubazioni d'alimentazione e di drenaggio dell'acqua.



To simplify installation, it is recommended to use flexible pipes with an internal diameter of 6 mm and an external diameter of 8 mm and the 3/4 "G straight or 90 ° swivel fitting.

☞ **WARNING**

È consigliata l'inserzione di un rubinetto di intercettazione e di un filtro meccanico per trattenere eventuali impurità solide.

The drainage water connection is made by means of rubber or plastic pipe resistant to 100 ° C, with a recommended internal diameter of 32 mm.
The drain fitting is suitable for hot blade welding with polypropylene drain pipes.

☞ **WARNING**

The drain pipe must be free, without back pressure and with a siphon immediately downstream of the connection to the humidifier.

The following conditions satisfy a correct hydraulic connection:
— interruption of the feed water line by means of a valve;
— presence of a mechanical filter on the feed water line;
— water temperature and pressure within the allowed values;
— drainage pipe resistant to a temperature of 100°C;
— minimum internal diameter of the drainage pipe of 25 mm;
— minimum slope of the drainage pipe greater than or equal to 5°;
— electrically non-conductive sleeve;
— presence of a siphon in the drainage pipe.

☞ **WARNING**

Ad installazione ultimata, spurgare la tubazione d'alimento per circa 30 minuti convogliando l'acqua direttamente nel lo scarico senza introdurla nell'umidificatore. Ciò per eliminare eventuali scorie e sostanze di lavorazione che potrebbero intasare la valvola di carico e provocare schiuma durante l'ebollizione.

7.1 Feed water

The humidifier must be supplied with mains water and with the following characteristics:
— pressure between 0.1 and 0.8 MPa (1-8 bar, 14.5-116 PSI);
— temperature between 1 and 40°C;
— instant flow rate not less than the nominal flow rate of the supply solenoid valve (0.6 l/min);
— The connection is 3/4"G Male type.

» Limit values for medium-high conductivity feed water of a humidifier with immersed electrodes.

	Symbol	Unit	Min	Max
Hydrogen ion activity	pH		7	8.5
Specific conductivity at 20°C	$\sigma_{R,\ 20°C}$	µS/cm	300	1250
Total dissolved solids	TDS	mg/l	(1)	(1)
Fixed residue at 180°C	R_{180}	mg/l	(1)	(1)
Total hardness	TH	mg/l $CaCO_3$	100(2)	400
Temporary hardness		mg/l $CaCO_3$	60(3)	300
Fe + Mn		mg/l Fe + Mn	0	0.2
Chlorides		ppm Cl	0	30
Silicon		mg/l SiO_2	0	20
Residual chlorine		mg/l Cl^-	0	0.2
Calcium sulphate		mg/l $CaSO_4$	0	100
Metallic impurities		mg/l	0	0
Solvents, thinners, soaps, lubricants		mg/l	0	0

(1) - Values dependent on specific conductivity; generally: TDS ≅ 0.93 * σ_{20}; R_{180} ≅ 0.65 * σ_{20}
(2) - Not less than 200% of the chloride content in mg/l di Cl^-
(3) - Not less than 300% of the chloride content in mg/l di Cl^-

» Limit values for the medium-low conductivity feed water of a humidifier with immersed electrodes

	Symbol	Unit	Min	Max
Hydrogen ion activity	pH		7	8,5
Specific conductivity at 20°C	$\sigma_{R,\ 20°C}$	µS/cm	125	500
Total dissolved solids	TDS	mg/l	(1)	(1)
Fixed residue at 180°C	R_{180}	mg/l	(1)	(1)
Total hardness	TH	mg/l $CaCO_3$	50(2)	250
Temporary hardness		mg/l $CaCO_3$	30(3)	150
Fe + Mn		mg/l Fe + Mn	0	0.2
Chlorides		ppm Cl	0	20
Silicon		mg/l SiO_2	0	20
Residual chlorine		mg/l Cl^-	0	0.2
Calcium sulphate		mg/l $CaSO_4$	0	60
Metallic impurities		mg/l	0	0
Solvents, thinners, soaps, lubricants		mg/l	0	0

(1) - Values dependent on specific conductivity; generally: TDS ≅ 0.93 * σ_{20}; R_{180} ≅ 0.65 * σ_{20}
(2) - Not less than 200% of the chloride content in mg/l di Cl^-
(3) - Not less than 300% of the chloride content in mg/l di Cl^-

☞ **WARNING**

There is no reliable relationship between water hardness and conductivity.

⚠ **ATTENTION**

There is no need to carry out water treatments with softeners! This can cause electrode corrosion and lead to foaming, potentially resulting in uneven service problems.

The following are not recommended:
— the use of well water, industrial water or water drawn from cooling circuits and, in general, potentially polluted water, chemically or bacteriologically;
— the addition of disinfectants or anticorrosive compounds to the water, as they are potentially irritating.

7.2 Drain water

Inside the humidifier, the water is boiled and transformed into steam, without adding any type of substance.
Therefore, the drainage water contains the same substances dissolved in the feed water but in greater quantities, depending on the concentration in the feed water and the set drainage cycles and **can reach a temperature of 100°C** .
As it is not toxic, it can be drained into the white water collection system.
The drain connection has an outside diameter of 32 mm.

8 CONTROL AND SAFETY DEVICES

All control equipment is calibrated and tested at the factory before shipping the machine. However, after the unit has been operating for a reasonable period of time, it is advisable to check the operating and safety devices.

⚠ DANGER

All service operations on the control equipment must be carried out EXCLUSIVELY BY QUALIFIED PERSONNEL: incorrect calibration valuescan cause serious personal injuries and damage the unit.

Many of the operating and calibration parameters of control systems are set by microprocessor control and are password protected.

8.1 Control devices

8.1.1 Control device settings

The calibration valuesof the control devices set by default for the specific unit are contained in the document “Parameter List”, made available to customers by the manufacturer.

8.2 Safety devices

On each refrigerant circuit, according to the volumetric capacity of the installed compressors, the PED (Pressure Equipment Directive 2014/68/EU) category of the machine and the refrigerant circuit configuration, there are safety devices for the refrigeration circuit as prescribed by the PED regulation. In particular, this regulation requires designing to be carried out by referring to the technical standard that is closest to the type of item produced; in the case of machines designed for air conditioning or cooling of liquids, the UNI EN 378-2 standard is referred to.
According to this standard, on a case by case basis, on the high and low pressure sides of each refrigerant circuit safety venting valves can be provided, connected to an exchange tap, to protect the pressurised parts and programmed to be activated when the maximum pressure setting is reached on the corresponding side (PS).
The high and low pressure sides have a maximum pressure PS defined by the pressure limit of the machine components; this pressure cannot be reached during normal machine operation. For more details, refer to the refrigerant circuit diagram of the unit.
During normal use, high pressure at the compressor outlet is limited by the high pressure switch, set to the maximum working pressure of the compressor itself, which depends on the unit model and is equal to the PS, in compliance with the UNI standard EN 378-2.
All the safety devices installed on the units are listed and described here below.

8.2.1 High pressure switch

The high pressure switch stops the compressor when the delivery pressure exceedsthe set value.

⚠ ATTENTION

Do not attempt to change the setting of the maximum pressure switch. Should the latter fail to trip in the event of a pressure increase, the pressure relief valve will open.

Any shutdown or alarm must be reported immediately to the service department.

⚠ ATTENTION

The high pressure switch must be manually reset; this is possible only when the pressure falls below the set differential.

8.2.2 Low pressure protections

The low pressure switch stops the compressor when the inlet pressure falls below the set value for more than 1 second at start up and in runnig.
The switch is automatically reset when the pressure rises above the set differential.

8.2.3 Flow switch (only Dual-Cooling and Free-Cooling versions)

The low pressure probe protects the exchanger from the risk of freezing due to low evaporation temperatures.

8.2.4 Compressors timing

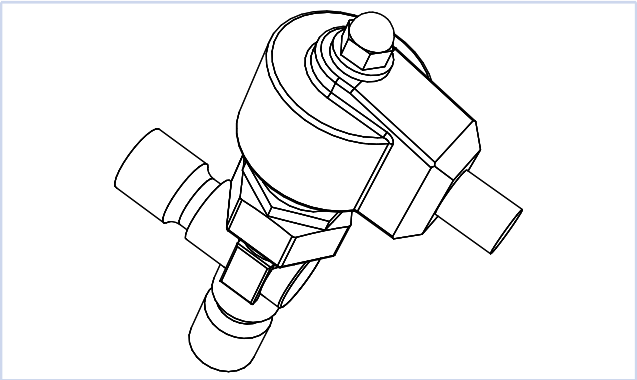
The compressor switching on and off timing schedules programmed by the manufacturer on the units guarantee correct operation of the compressors and an increased durability and stability of the system. They establish:
— the minimum activation time of a compressor, which must remain on for a time equal to the set time;
— the minimum shutdown time of a compressor, which is not powered back on unless the minimum selected time has not elapsed since the last power-off;
— the delay time between two power-on requests of different compressors, i.e. the minimum time that must elapse between two power-ons of the devices independently of the detected measurement and the setpoint;
— the delay time between two successive power-ons of the same compressor, the minimum time that must elapse between two power-ons of the device.
The purpose of the minimum time intervals is to stabilize the operation of the compressors, ensuring adequate circulation of the oil in the refrigerant circuit and preventing too frequent compressor stops and starts, limiting the maximum number of starts per hour.
For more information related to the operation, the calibration values and the set delays, please refer to the microprocessor manual and the document “Parameter List”, supplied with the unit.

⚠ ATTENTION

Never change the factory preset time interval: valuesother than the default ones may cause serious damage to the unit.

8.2.5 Expansion valve

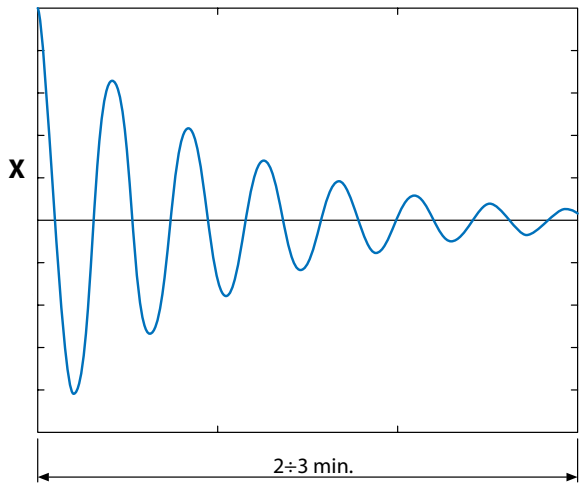
A controlled expansion valve is installed as a standard feature on all TRF units.



When a sudden change in the thermal load occurs, a traditional expansion valve is designed to be in a transient state for 2-3 minutes before reaching its equilibrium condition. E.g.:

— One compressor switches off
— Evaporation temperature increases
— Overheating decreases
— Valve closes
— Refrigerant flow decreases
— Refrigerating power decreases
— Evaporation temperature decreases

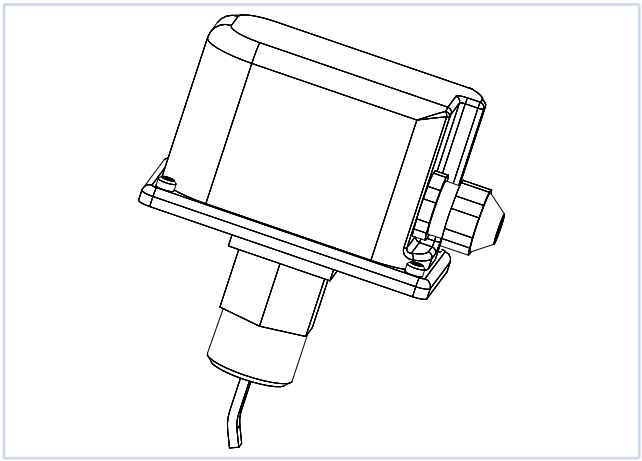
... and so on...



X valve opening (mm)

8.2.6 Water differential pressure switch (only Dual-Cooling version)

The paddle flow switch, supplied pre-mounted and wired or separately as part of the equipment, according to the different models, stops the unit in case of excessive reduction of the water flow.



8.2.7 Setting operating parameters

All the control devices are set and tested in the factory before the unit is dispatched. However, after the unit has been in service for a reasonable period of time you can perform a check on the operating and safety devices. The settings are shown in Tablee “8.1 Setting operating parameters p. 31“.

ATTENTION

All servicing of the equipment is to be considered extraordinary maintenance and may be carried out **BY QUALIFIED TECHNICIANS ONLY**.

ATTENTION

Incorrect calibration valuescan cause serious personal injuries and damage the unit.

WARNING

The operating parameters and control system settings configurable by means of the microprocessor control are password protected if they have a potential impact on the integrity of the unit.

» Setting operating parameters

Control device		Set point	Differential
Differential air pressure switch (air flow)	Pa	50	20
Differential air pressure switch (dirty filter)	Pa	350	20

» Control and safety devices settings

Control device (R410A refrigerant)		Start up	Differential	Re-activation
Maximum pressure switch cat.	Bar-g	45,0	0,7	Manual
Minimum pressure switch	Bar-g	1,5	0,4	Automatic
Modulating condensation control (DX version)	Bar-g	22,0	10,0	-

Time lapse between two starts of the same compressor	s	360	-	-

Control device (R410A and R513A refrigerant)		Start up	Differential	Re-activation
Maximum pressure switch cat.	Bar-g	28,0	1,0	Manual
Minimum pressure switch	Bar-g	0,7	0,4	Automatic
Modulating condensation control (DX version)	Bar-g	8,0	5,0	-
Time lapse between two starts of the same compressor	s	360	-	-

9 MAINTENANCE

9.1 Warnings

ATTENTION

When the motor runs independently due to air flowing through or if it continues to run down after being turned off, dangerous voltages of over 50V can arise on the motor internal connections through operation of the generator. The absence of voltage must be ascertained by means of a bipolar voltage detector.

ATTENTION

Even after disconnecting the mains voltage, life-threating charges can appear between the protective ground “PE” and the mains connection. The protective earth is conducting high discharge currents (dependent on the switching frequency, current source voltage and motor capacity). Earthing in compliance with EN specifications shall therefore be observed even for testing and trial conditions (EN 50 178, Art.5.2.11).

ATTENTION

All the operations described in this chapter **MUST ALWAYS BE PERFORMED BY QUALIFIED PERSONNEL ONLY**.

ATTENTION

Before carrying out any work on the unit or accessing internal parts, make sure you have disconnected it from the mains power supply.

ATTENTION

Be especially careful when working in proximity to finned coils of the units since the 0.11 mm-thick aluminium fins can cause superficial injuries due to cuts.

ATTENTION

After completing maintenance jobs, always replace the panels enclosing the units and secure them with the fastening screws provided.

ATTENTION

In case of extraordinary maintenance (e.g. replacement of components) contact the technical department for the correct tightening torques. If the compressor is replaced, the filter must also be replaced.

9.2 Main features

To guarantee a constantly satisfactory performance over time, it is advisable to carry out routine maintenance and checks as described below. The indications below are related to standard tear and wear.

ACTION		MAINTENANCE FREQUENCY			
		1 month	3 months	6 months	1 year
UNIT	Check that no unusual noise is emitted by the machine and in particular, that there are no vibrations and/or beating.			x	
	Check the efficiency of the differential air pressure switch			x	
FANS Caution: do not access the fan while the fan wheel is in operation	Check for dirt, damage, corrosion, wear and ensure correct fixing.	x			
	Check for any noise of the bearings and the balancing of the shaft.	x			
	Measure current and power consumption.			x	
	Check the electrical connections.		x		
	Clean to preserve smooth functioning.		x		
	Check the correct closing of the electrical box (if available).			x	
AIR FILTERS	Check for dirt, damage, corrosion, and wear.	x			
	Check the filter condition.	x			
	Clean or replace if necessary.			x	
	Perform checks more frequently in dusty environments.	x			
	Check the efficiency of the differential pressure switch for dirty filters.			x	
CONTROL SYSTEM	Check the correct installation and the wiring conditions.	x			
	Check the operation of the LEDs of the display control system and of the alarms.		x		
	Check the connections for electrical and mechanical operation.			x	
	Check the functional elements (e.g. operating controls and display devices).			x	
	Check electrical/electronic and pneumatic input signals (e.g. sensors, remote controllers, control variables) to conform to normal values.			x	
	Check the valuesin the parameter list (see the Microprocessor Manual).				x
	Adjust the control function and control signals. Check the software cycle running (see the Microprocessor Manual).			x	
SWITCH BOOTH POWER SUPPLY CIRCUITS Caution: the electric cables and electrical components of the air conditioner are live.	Check the power supply in all phases.			x	
	Check the electrical connections and the mechanical function. Restore if not properly tightened.			x	
	Check the power supply of all the terminals.			x	
	Measure power consumption at all connected devices.			x	
	Check, adjust and tighten the functional elements (e.g. operating controls and display devices).			x	
	Check the safety equipment, e.g. thermal switch. Replace every 2 years.				x
	Check the protective covers.				x
	Check the tightening of the electrical terminals both inside the electrical panel and in the compressor terminal blocks. The mobile and fixed contacts of the contactors must be periodically cleaned and, if they show signs of deterioration, they must be replaced.				x

ACTION		MAINTENANCE FREQUENCY			
		1 month	3 months	6 months	1 year
Condensing water (only water condensed units or free-cooling units)	Check the cooling water circuit, check for damage, leaks and ensure correct fixing.	x			
	Check the correct flow of water and clean the water filter.		x		
	Check for internal air: bleed air if present from water circuit.			x	
	Make sure that the system is filled with the prescribed amount of glycol and that there is no ice in the hydraulic circuit.			x	
REFRIGERATION CIRCUIT (only for direct expansion system) Fluoride based refrigerants increase the greenhouse effect and are expected to conform to restrictions and regulations, according to national and European standards.	Measure the pressures and working temperatures (to be performed by a refrigeration technician).			x	
	Check the energy consumption, measure the heat temperature and check for unusual noise during operation.			x	
	Make sure there is no frost formation in the evaporator and in the compressor.		x		
	Check the operation of all the adjustment devices (power regulators, valves, etc.).	x			
	Check the efficiency of the actuators.				x
	Check the operation of the safety devices.			x	
	Check the refrigerant charge, the liquid level indicator and the operating parameters (undercooling, overheating, high and low pressure, degree of valve opening). If the amount of refrigerant is not sufficient, it must be restored by refilling with fresh refrigerant.			x	
	Check the oil level through the appropriate viewing windows.		x		
	Perform a test to check the oil internal humidity level.				x
	Check the enclosure heater operation.			x	
	Check the humidity indicator on the liquid indicator (green = dry, yellow = wet); if the indicator is not green, as shown by the indicator sticker, replace the filter.			x	
FINNED PACK EXCHANGERS	Clean the finned pack with compressed air or brushes. If the unit is located in particularly dusty environments, perform the inspections more frequently.			x	
CHILLED WATER CIRCUIT (only dual cooling and free-cooling units)	Check the filling of the hydraulic circuit, by venting it from the valves placed at the highest points.			x	
	Make sure that there are no water leaks.			x	
	Check for any air in the circuit: bleed air from the cooling water circuit using the special valve in the top part of the circuit.			x	
	Check the water temperature and pressure at the inlet and outlet using thermometers and pressure gauges - if installed.			x	
	Check the correct operation of the 2- or 3-way valve.			x	
	Check the efficiency of the actuators.				x
	Make sure that the system is filled with the prescribed amount of glycol and that there is no ice in the hydraulic circuit.			x	
	In the event that there is a water leak and the circuit must be filled, make sure that the glycol concentration is correct.			x	
	Check that the water circulation is as required.			x	
	Clean the external metal filters in the hydraulic lines.			x	
	Check the efficient operation of the flow switch or differential pressure switch.			x	

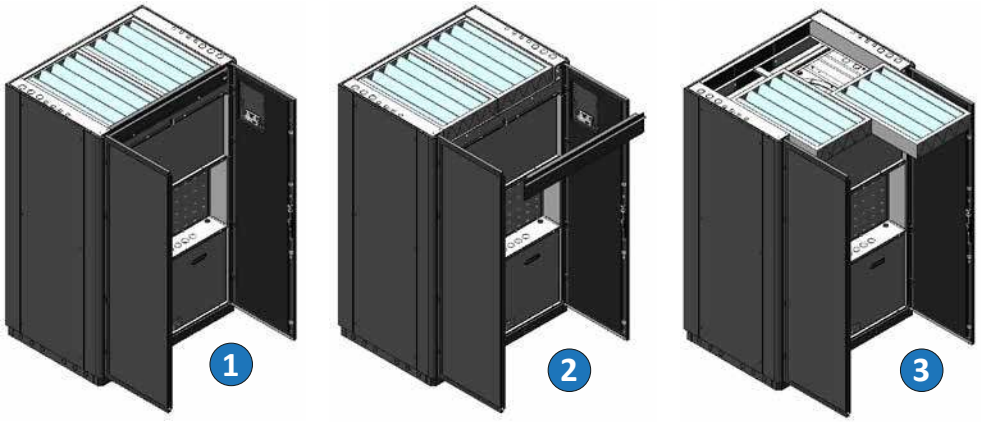
ACTION		MAINTENANCE FREQUENCY			
		1 month	3 months	6 months	1 year
HUMIDIFIER (if present)	Check operation, the absence of significant water leaks, the general conditions of the container. Verify that no arcing or sparking occurs between the electrodes during operation.	x (300 working hours)			
	Check operation, the absence of significant water leaks and replace the cylinder if necessary		x (1000 working hours)		
	Cylinder replacement				x (2500 working hours)

ATTENTION

If the unit is expected not to be in operation for a long time, drain the water from the pipes and the machine, including the water exchanger if it is a Free-Cooling unit (if no glycol-based solutions are used). This operation is mandatory if ambient temperatures are expected to fall below the freezing point of the fluid used, during the unit down time.

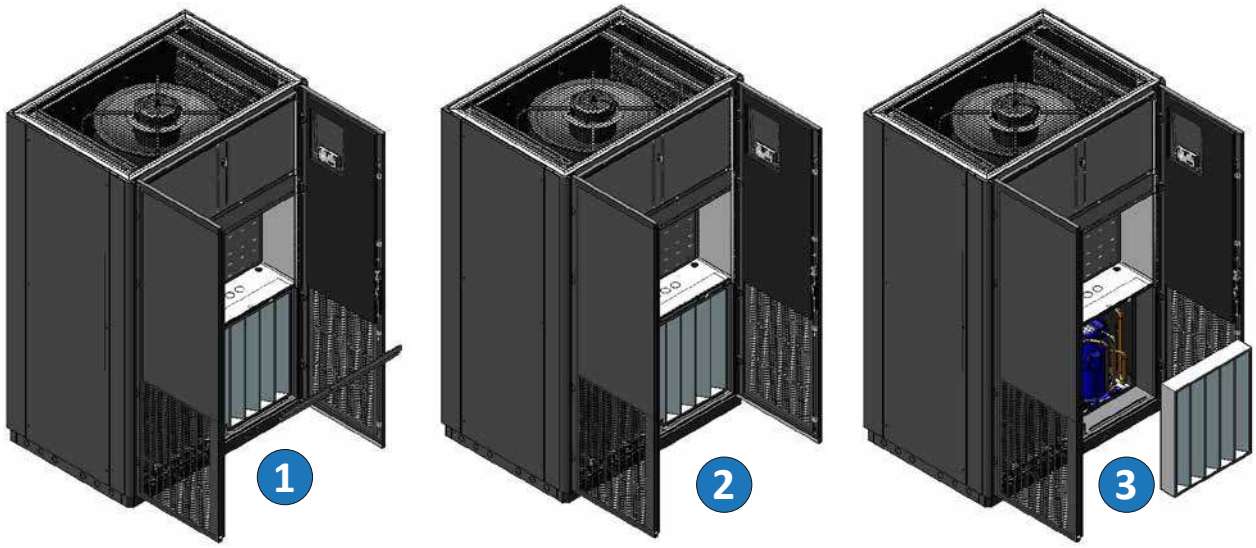
9.3 Air filters inspection

» Air filters inspection (Downflow and Displacement versions)



1 Open the front panel to access the filter section;
2 Locate the air filters in the upper part of the machine;
3 Remove the lower filters and check their condition and replace them if necessary.

» Air filters inspection (Upflow versions)

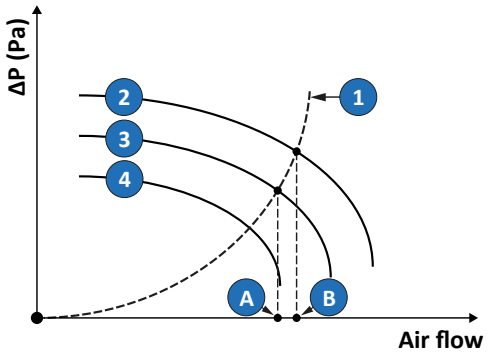


1 Open the front panel to access the filter section;
2 Locate the air filters in the central part of the machine;
3 Remove the screws and the metal support;
4 Remove the lower filters and check their condition and replace them if necessary.

9.4 Set the right fan speed

The adopted fans are of the backward curved blades type in combination with a 4 poles e-motor.
This kind of fan has very high performances so that it's speed has to be reduced in order to match to the nominal air flow with the real external pressure drops.
In case of wrong selection, the air flow may exceed the limits with possible water dragging out from the coils.
In case of DX units a not sufficient airflow can cause ice on the coil.

» Fan speed



1 External pressure drops
2 Unit performance @ full speed
3 Unit performance @ intermediate speed
4 Unit performance @ low speed

A Rated air flow
B Air flow over the limits

The fan speed has to be selected according to the enclosed table.
In the EC fans the rotation speeds are selected with different values of the control tension (0 - 10V).
If in the unit is present the ADVANCED control the right value of the control tension is set by the keyboard present in the advanced control.
With the BASIC control the control tension is set with a manual potential installed in the E-Panel.
To know the tension set with the potential it is necessary to use an external tool (Voltmeter).

9.5 Refrigeration circuit repairs

⚠ ATTENTION

During any repairs to the refrigeration circuit or compressor maintenance, minimise the opening time of the circuit. Even short exposure times of the ester oil to ambient air will cause the absorption of large amounts of moisture by the oil with the resulting formation of weak acids.

If the refrigeration circuit has been repaired, the following operations must be carried out:
— leak test;
— refrigeration circuit vacuum and drying cycle;
— refrigerant charge

☞ WARNING

If the system needs to be drained, always collect all the refrigerant present in the circuit using suitable equipment, by working exclusively in the liquid phase.

9.5.1 Leak test

As far as leak tests are concerned, the units will leave the factory after having been tested according to the procedures indicated in EN 378-2.
A leak test on the installation site is necessary whenever the refrigeration circuit has been repaired or if the cooling connection between modules of a split unit must be carried out.

⚠ ATTENTION

Leak tests on site must be carried out by specialised and authorised personnel, who must operate according to the methods indicated in EN 378-2, if applicable in the country of installation, or according to local regulations in force.

Fill the circuit with anhydrous nitrogen supplied from a tank with a pressure-reducing valve until the maximum pressure rises to 22 bars.

⚠ DANGER

During the pressurization phase, do not exceed a pressure of 22 bars on the compressor low pressure side.

The presence of any leaks must be determined using special leak detectors.
Should any leaks be detected during the test, empty out the circuit before repairing the leaks with suitable alloys.

⚠ DANGER

Do not use oxygen in the place of nitrogen as a test agent, since this would cause a risk of explosion.

9.5.2 High vacuum and refrigeration circuit drying

To obtain high vacuum in the refrigerant circuit, it is necessary to have a pump capable of generating a high degree of vacuum, at least 15 Pa of absolute pressure, with a capacity of 10 m³/h. If this pump is available, normally one draining only should be controlled to reach the absolute pressure of 15 Pa.
When a suitable vacuum pump is not available or when the circuit has been open for long periods of time, it is strongly recommended to follow the triple draining method. This method is also indicated when there is moisture in the circuit.
The vacuum pump must be connected to the charging points. The required procedure is as follows:
— Evacuate the circuit until you reach an absolute pressure of at least 350 Pa: at this point inject nitrogen into the circuit until you reach a relative pressure of about 1 bar.
— Repeat the operation described in the point here above.
— Repeat the operation described in the point here above for the third time, now trying to achieve the hardest possible vacuum condition.

With this procedure it is possible to easily remove up to 99% of the pollutants.

9.5.3 Refrigerant charge

DANGER

Before carrying out any operation with the refrigerant, it is recommended to read the special safety data sheet (MSDS).

DANGER

The area must be immediately evacuated if there is a constant leak of refrigerant gas. The gases concentrate near the floor, thereby restricting the availability of oxygen. Once evacuated, the area must be ventilated with fans or blowers in order to circulate the air at floor level.

For loading operations, follow the procedure described below:

— connect the refrigerant gas cylinder to the 1/4 SAE male filler outlet located on the liquid line, making sure that there are no impurities, moisture and/or incondensable gases in the inlet pipes;
— load liquid state charge until 75% of the total charge has been introduced;
— then connect to the intake on the suction line and complete liquid charge loading until no more bubbles appear on the liquid viewer and the operating values are reached that are indicated in the paragraph5.6 Refrigerant charge checks p. 24.

ATTENTION

These units are designed for the exclusive use of refrigerant indicated by the manufacturer and should not be charge with different refrigerants without the written permission of the manufacturer.

ATTENTION

Refer to paragraph 11.2 Environment protection p. 42 contained in this document.

10 TROUBLESHOOTING

For troubleshooting purposes, please refer to the list and to the complete description of the alarms related to the installed software version.

⚠ **DANGER**

As far as possible remedies are concerned, it is first of all essential to have read the chapter “2 Safety prescriptions p. 13”, to be able to adopt all the necessary precautions.
You should be extremely careful when attempting to implement any of the possible remedies suggested: overconfidence can result in injuries, even serious ones, to inexpert individuals.
In case of breakdowns, please contact a qualified and authorised technician or our customer care.

☞ **WARNING**

Do not reset the alarm until after an accurate analysis and subsequent removal of the causes of the alarm: continuous resetting operations could lead to compressor breakdowns.

Fault	Possible causes	Corrective action
The unit does not start	No electrical power supply	Check its presence both on the primary and auxiliary circuit
	The circuit board is powered	Check the fuses
	There are alarms present	Check the microprocessor panel for the presence of alarms, eliminate their cause and restart the unit
	The phase sequence is wrong	Invert two phases in the primary power line after disconnecting them upstream from the unit.
The compressor is noisy	The compressor is rotating in the wrong direction	Check the phase sequence relay. Invert the phases on the terminal board after disconnecting the unit and contact the manufacturer.
Presence of air in the hydraulic circuit	Air inlet occurred during the connection of the unit to the hydraulic system	Open the valves located on the top of the coil.
Faulty high pressure	Insufficient flow of air to the condenser	Check for the presence of obstructions in the condenser section ventilation circuit
		Check whether the condenser coil surface is obstructed
		Check the speed regulator of condensing fans
	Presence of air in the refrigerant circuit, as revealed by the presence of bubbles in the flow indicator also with undercooling values exceeding 5 °C	Drain and pressurise the circuit and check for leaks. Evacuate slowly (for more than 3 hours) until reaching a pressure of 0,1 Pa and then recharge in the liquid phase.
	Unit overcharged. As revealed by an undercooling of more than 8 °C.	Discharge the circuit
	Clogged thermostatic valve and /or filter. Such faults may occur in the presence of low pressure.	Check the temperature upstream and downstream the valve and filter and have them replaced, if necessary.
Low condensation pressure	Faulty transducers	Replace the trasducer
	Wrong sentting of the condensation control device	Check the setting of the condensation control device (optional).
Low evaporating pressure	Malfunctioning of thermostatic valve	Warming the bulb with your hand, check whether the valve opens and adjust it if necessary. If it does not respond, replace it.
	Dehydrating filter clogged	Pressure drops upstream and downstream from the filter should not exceed 2°C. If they do, replace the filter.
	Low condensing temperatures	Check the efficiency of the condensation control device (where present)
	Low level of refrigerant	Check the refrigerant level by measuring the degree of undercooling; if it is below 2°C replenish the charge.
The compressor does not start	The internal thermal protection device has tripped	Check the status of the thermal contact in models equipped with protection modules. Identify the causes after restarting.
	Tripping of circuit breakers or fuses in line after short circuit	Check the cause by measuring the resistance of the individual coils and the isolation towards the chassis before re-connecting the power.
	Intervention of HP or LP switches	Check on the microprocessor, eliminate the causes.
	The phases in the distribution cabin have been inverted.	Check the phase sequence relay, then invert the phases upstream from the main switch (only DX).
Water out from the unit	The drain pan hole is closed	Open the front panels, remove the sheet metal just below the electric control board (down flow units) and clean it.
	The siphon is missing	Checkand provide for a new one
	The air flow is too high	Reduce the fan speed up to reaching the nominal air flow.
	Condensate drain pan is not perfectly horizontal	Place correctly the unit.

11 RETIRING THE UNIT

When the unit has reached the end of its working life and needs to removed and replaced, a series of operations should be carried out:
— the refrigerant gas that it contains should be recovered by specialised personnel and sent to a waste collection facility;
— the lubricating oil in the compressor should be recovered and sent to a waste collection facility;
— if they cannot be reused, the framework and components should be scrapped and separated according to the type of material: this applies especially for the considerable quantities of copper, aluminium and steel present in the unit.

This should be done to facilitate work at the special collection, disposal and recycling centres and to minimise the environmental impact that this operation requires.

⚠ **ATTENTION**

If the unit, or part of it, has been decommissioned, any of its parts that are likely to cause dangers must be rendered harmless.
Please note that any replacement of unit parts subject to separate waste disposal must always be done by referring to the currently applicable legal provisions.

Please note that it is mandatory to record the loading and unloading of special and toxic-harmful waste.
Collection of special and toxic-harmful waste must be carried out by specially authorized companies.
Disposal of special and toxic or harmful waste must be carried out in compliance with the law provisions in force in the user's country.
For unit scrapping, follow the law prescriptions in force in the user's country. Before demolition ask the appointed organism to inspect the unit and write a report.
Finally, carry out scrapping according to the law in force in the country of use.

☞ **WARNING**

Dismantling, disposal and scrapping operations must be carried out by qualified personnel.

11.1 Waste electrical and electronic equipment management

This product falls within the application scope of the Directive 2012/19/EU concerning the management of waste electrical and electronic equipment (WEEE).
Equipment must not be disposed of with household waste as it is made of different materials that can be recycled at special facilities. Please inquire through your municipal authorities as to the location of the eco-friendly waste management sites where waste can be received for disposal and its subsequent recycling as recommended.
Furthermore, please note that, when an equivalent appliance is purchased, the seller is expected to collect free of charge the old product to be disposed of.

The product is not potentially dangerous for human health and the environment, as it does not contain any harmful substances according to the Directive 2011/65/EU (RoHS), but if disposed of freely in the environment, it might adversely affect the ecosystem.
Read the instructions carefully before using the equipment for the first time. It is strongly recommended not to use the product for any purpose other than that for which it was designed, to prevent the risk electric shock if the product is used incorrectly.

☞ **WARNING**

The crossed-out bin symbol, on the equipment label, indicates product compliance with the regulations on waste electrical and electronic equipment. Disposing of the equipment in the environment or illegal disposal of the equipment is punishable by law.

11.2 Environment protection

In general, the laws regulating the use of substances that damage the stratospheric ozone layer and the gases responsible for the greenhouse effect in force in the various countries provide that it is forbidden to disperse refrigerant gases in the environment and request their originators to recover them and return them, at the end of their service life, to the retailers or to special collection centres.
The refrigerants, although not harmful to the ozone layer, is listed among the substances responsible for the greenhouse effect and must therefore be used in compliance with the above obligations.

⚠ **ATTENTION**

Caution is therefore recommended during maintenance operations in order to minimise refrigerant leaks as much as possible. In any case, refer to the laws in force in the country of installation.

11.3 Packaging disposal

The QR Code below is shown on a label on the packaging of the machine, which allows the user to identify the nature of the packaging used in order to follow the correct disposal procedure.

ATTENTION

For disposal of packaging, always refer to local laws that implement Directives 2018/851/UE and 2018/852/UE.

12 REFRIGERANT FLUID SAFETY SHEET

For refrigerant fluid safety data sheet, please refer to the documents supplied with the unit.

Konformitätserklärung

Dieses Produkt trägt das CE-Kennzeichen. Dieses Produkt wurde in Übereinstimmung folgender Richtlinien und Normen gefertigt:

- Maschinenrichtlinie 2006/42/EG
- Sicherheit von Maschinen-Mindestabstände zur Vermeidung des Quetschens von Körperteilen EN 349-04
- Sicherheit von Maschinen - Sicherheitsabstände gegen das Erreichen von Gefährdungsbereichen mit den oberen und unteren Gliedmaßen EN ISO 13857
- Richtlinie Elektromagnetische Kompatibilität 2004/108/EG
- Sicherheit der Maschinen - Elektrische Ausrüstung für Maschinen EN 60204-1
- Niederspannrichtlinie 2006/95/EG
- Elektromagnetische Verträglichkeit - Anforderungen an Haushaltsgeräte, Elektrowerkzeuge und ähnliche Elektrogeräte EN 55014-1
- Sicherheit von Maschinen EN ISO 12100-1,2
- Sicherheit von Maschinen - Sicherheitsabstände gegen das Erreichen von Gefährdungsbereichen mit den oberen und unteren Gliedmaßen EN ISO 13857

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