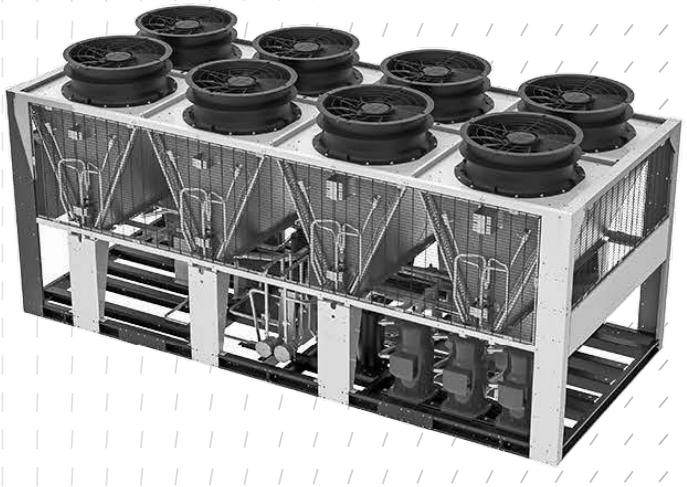
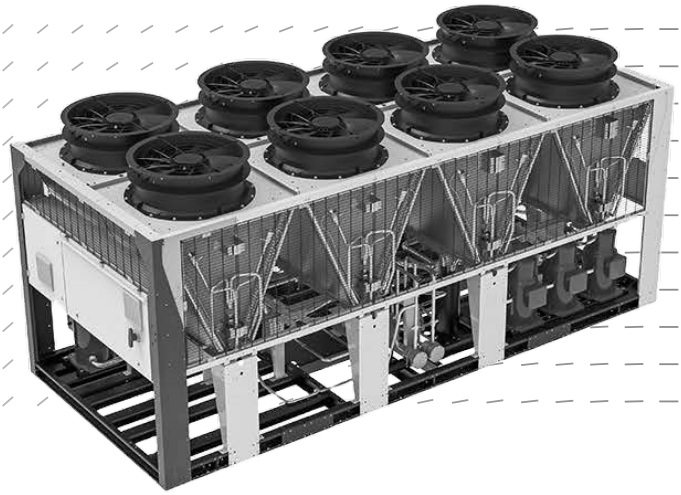
redge

R32

ECOMFORT THERMA

Air cooled heat pump





EUROVENT CERTIFIED PERFORMANCE
www.eurovent-certification.com

Installation, Operation and Maintenance Manual

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AIR COOLED UNITS

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

Ref.: MIL174E-0625 03-2026

The present manual applies to the following heat pump versions:
ECOMFORT THERMA range GHS 220-500.

INSPECTIONS AND REQUALIFICATION ACCORDING PRESSURE EQUIPMENT DIRECTIVE MUST FOLLOW THE LOCAL REGULATIONS WHERE THE UNIT IS INSTALLED.

Our company is a member of the Eurovent Certification Program, all heat pumps are tested and rated in accordance with Eurovent certification program.	EUROVENT CERTIFIED PERFORMANCE
Our products comply with the European standards.	CE

Original version is the English one. Other versions are translations.

All the technical and technological information contained in this manual, including any drawing and technical descriptions provided by us, remain the property of LFB GROUP and must not be utilised (except in operation of this product), reproduced, issued to or made available to third parties without the prior written agreement of LFB GROUP.

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IMPORTANT NOTICE:
This document forms part of the sale contract. The instructions contained herein are binding. Failure to comply with them may result in warranty cancellation and transfer of liability to the installer or end-user.

INTRODUCTION

We remind you that these instructions must be followed for operation, maintenance, repair and decommissioning of the product. Failure to follow these instructions will result in the offender assuming the manufacturer's responsibilities.

You must read and be familiar with this operating manual prior to commission the heat pump.
Please closely follow the instructions.
We would like to remark the importance of training in accordance with the correct use of the heat pump.
Please consult LFB GROUP on the options available in this field.
It is important that this manual is stored in a permanent location in the vicinity of the heat pump.



IMPORTANT GENERAL INSTRUCTIONS

This manual contains important instructions regarding the commissioning of the heat pump. It also includes important instructions to prevent personal injury and damage to the machine during operation. Furthermore, in order to promote fault-free operation of the heat pump, maintenance information has been included.
Please do not hesitate to contact one of our employees should you require further information on specific heat pump subjects. Order related documentation will be forwarded under separate cover.
This documentation consists of:

- ***EU declaration.***
- ***Operating manual for control system.***
- ***Installation operating manual.***
- ***Wiring diagram.***
- ***Refrigerant flow diagram.***
- ***Unit details are given in the nameplate.***

The data published in this manual are based on the most recent information available and are subject to later modifications. We reserve the right to modify the construction and/or design of our heat pumps at any time without prior notification or obligation to adapt previous supplies accordingly.



Any work on the heat pump should be carried out by trained and licensed competent technician. The following risks are present on the unit:

- ***Risk of electrical shock.***
- ***Risk of injury from rotating parts.***
- ***Risk of injury from sharp edges and heavy weight.***
- ***Risk of injury from high pressure gas.***
- ***Risk of injury from slightly flammable refrigerant.***
- ***Risk of injury from high and low temperatures components.***

It is expected that all works on equipment be carried out in accordance with all local standards and norms. It is expected that all works are carried out with good working practices.

Inspections and requalification according to Pressure Equipment Directive (PED) must follow the local regulations where the unit is installed.

The refrigerating system is designed for a working life of 12 years if the safety and maintenance instructions are strictly respected.

The equipment may be renewed in its lifespan of the periodic requalification certificate is validated by the expert (Authorized body or according to current local regulations).

Failure to follow the procedures and limitations outlined in this manual, especially in connection with installation, refrigerant handling or maintenance, shall release the manufacturer from all liability. The installer or operator shall assume full responsibility for resulting damages or incidents.

COMPLIANCE WITH REGULATIONS AND DIRECTIVES

The units comply with the directives and regulations which apply at the time of their placing on the market.
For more information, please see the Declaration of Conformity of the product.

The unit is designed for outdoor installation only. The unit must be installed in accordance with local safety codes and regulations and can only be used in well ventilated areas.

Periodic inspections must comply with current regulations. Obligations such as the list of equipment subject to inspection, the creation of an operating file, initial verification, planning, commissioning, periodic inspections and operational monitoring may be mandatory in certain countries.

DIRECTIVE ATEX 1999/92/EC: Risk from explosive atmospheres.
Users must conduct an Explosion Risk Assessment (ERA) and prepare an Explosion Protection Document (EPD).
Contact us to set it up, as it is mandatory in Europe.

Users and installers must read this user manual before setting up the equipment and commissioning the unit. Follow the instructions precisely. We highlight the importance of training for the correct management of the unit. Please consult LFB GROUP on the options available in this field.
It is important that this manual is stored in a permanent location in the vicinity of the unit.

SAFETY DEVICES:
This equipment is protected with calibrated safety pressure switches.

PRESSURE RELIEF VALVES:
This equipment contains pressure relief valves to limit damage in the event of an external fire. Make sure that people are not exposed to refrigerant discharge.

EMC DIRECTIVE COMPLIANCE:
WARNING:

This equipment is compliant with the essential requirements of the EMC2014/30/EU directive for residential and industrial environment.

The units meet the following hardest environments standards, according to the Declaration of Conformity of the product:
- EN 61000-6-2: Immunity for industrial applications.
- EN 61000-6-3: Emissions for residential, commercial and light industry applications.

Differences between the various machines are only related to the power of the compressors and equipment associated. For conducted and radiated emission and immunity, these differences do not alter the results.

CAUTION:
In the event of fire, refrigerating circuits may cause an explosion and spray refrigerant and oil.

F-GAS REGULATION:
PLEASE READ THE SAFETY DATA SHEET OF THE REFRIGERANT BEFORE ANY INTERVENTION OR INSTALLATION OF THE UNIT.

Users and installers must comply with the obligations defined in:
- **Regulation on Fluorinated Greenhouse Gases (F Gas).**
- **Regulation on substances which may deplete the ozone layer.**

	Non compliance with these requirements is an offence and may be liable of financial penalties.
	Moreover, in case of problem it is mandatory to prove to the insurance company that the equipment complies with the F gas Regulation, as well as all measures have been taken to safeguard people, environment and property.

MAIN SAFETY RECOMMENDATIONS

IMPORTANT NOTICE:
All work on the unit must be carried out by a qualified and authorized personnel.
Non-compliance with the following instructions may result in injury or serious accidents.

Protection: Safety accessory / Damage limitation accessory:

- In the heat pumps, the HP pressure switch is a PED safety accessory (see 2.11 Dir.2014/68/EU) and the pressure relief valves are accessories to limit damage in the event of an external fire (see 2.12).

	PED safety accessory (see 2.11)	**Damage limitation accessory in the event of an external fire (see 2.12)**
HP pressure switch	YES	N/A
Pressure relief valves	N/A	YES

Maximum permissible values for the unit:

- The unit is able to operate with outside air between -30°C and +57ºC and according to the limits indicated on the nameplate as well as the limits mentioned below:

R32	**Operating pressure (bar)**		**Operating temperature (ºC)**	
	min	**max**	**min**	**max**
HP	-1	45	-30	150
HP Liquid	-1	45	-30	70
LP	-1	31	-30	51
Water	-	3,5	-	-

Storage limits:

- Refer to the nameplate for storage temperature limits of the unit.

Pressure switch safety chain test:

- Test to check correct operation of the safety pressure switch chain, to be carried out every year by LFB GROUP technical personnel:

1. Before starting the test, install an HP pressure gauge to check overall operation of the safety pressure switch. Perform a visual check and a preliminary leak test.
2. On the rating plate, clearly identify the “PS HP” value that must not be exceeded.
3. On the CLIMATIC in expert mode, from the DS Service remote display, use the TEST command to force the HP cut-off test. A password must be entered (contact LFB GROUP service). Next, for the pressure build-up in the refrigerant circuit, we have (compressors running, ventilation off, HP envelope safety programme deactivated, pressure switch status taken into account).
4. Once the test mode has started, follow the pressure on the display.
5. At the “PS HP” cut-off value, a HP cut-off alarm is displayed on the screen, confirming that the safety chain is operating correctly.
6. If the “PS HP” value is exceeded, switch off the compressor circuit breakers and contact the LFB GROUP department.

MAIN SAFETY RECOMMENDATIONS

Works on the unit:
The risk analyses of our machines are carried out considering operation in a standard environment with unpolluted air. For other applications, which do not meet this criteria (kitchens, industry, ...) please contact your local sales representative.

- The unit shall be isolated from the electrical supply by disconnecting and locking out the main isolating switch.
- Workers shall wear the appropriate personal protective equipment (helmet, gloves, glasses, etc.).

Works on the electrical system:
- Work on electric components shall be performed with the power off by employees having valid electrical qualification and authorization.

Work on the refrigerant circuit(s):
- Monitoring of the pressures, draining and filling of the system under pressure shall be carried out using equipment designed for this purpose and suitable for the refrigerant contained.
- To prevent the risk of explosion due to spraying of coolant and oil, the relevant circuit shall be drained and at zero pressure before any disassembly or unbracing of the refrigerating parts takes place.
- There is a residual risk of pressure build-up by degassing the oil or by heating the exchangers after the circuit has been drained. Zero pressure shall be maintained by venting the drain connection to the atmosphere on the low-pressure side.
- The brazing shall be carried out by a qualified brazier. The brazing shall comply with standard EN ISO 17672:2010 (minimum 30% silver).

Replacing components, equipment and piping:
- Replacement shall be carried out using spare parts, or using parts approved by LFB GROUP.
- Only the refrigerant shown on the manufacturer’s nameplate shall be used, excluding the rest of the products (mixture of refrigerants, hydrocarbons, etc.).

Parametering and control:
- For any intervention related to component parameterization, controls and unit operation management, refer to “eClimatic” user manual.

Recommend refrigerant speeds:
- Liquid line: Max. pressure loss: 1 - 1,5°C. Max. speed: 1 - 1,5m/s.
- Suction line: Max. pressure loss: 1,5 - 2°C. Vmax: 15m/s, Vmin horizontal: 3,5m/s, Vmin vertical: 8m/s.
- Disharge line: Max. pressure loss: 1°C. Vmax: 15m/s, Vmin horizontal: 3,5m/s, Vmin vertical: 8m/s

Transport - Handling:
- The unit is shipped to the customer charged with R32 refrigerant, whose charge is recorded on the nameplate of the unit.
- Never lift the unit without forklift protections.
- Remove the forklift protection before installation.
- If access to the installation is difficult, provide guard rail. This recommendation is valid for installations in general. It’s also valid to reach other parts of the unit: refrigerant circuit, etc.
- Installation of the unit and accessibility must be compliant with the local regulations. Ensure that all access equipment allow maintenance operation in safety (electrical cabinet, main switch, panels, refrigerant circuit, etc).
- It is strictly forbidden to walk or store equipment or material on top of the unit.
- Equipment designed to withstand transport and handling according to the established protocol (for the handling protocol, please refer to the installation instructions for the relevant product range).

MAIN SAFETY RECOMMENDATIONS

- All unloading operations must be carried out with suitable equipment (crane, forklift truck, etc.).
- When using a forklift truck, you must respect the positions and the direction of handling indicated on the products.
- The equipment must be handled with care to avoid damage to the bodywork, pipework, condenser, etc.

Unit installation in heavy wind locations:

- The units are designed to withstand winds up to 80km/h. Above this limit, it's recommended to take appropriate actions to secure the installation.

Commissioning:

- This work should only be performed by personnel competent in the field of refrigeration equipment.
- Before starting the unit, check the position of the suction valve, which must be open.
- Check that glycol is used when required by the application.
- Check the unit is properly grounded.
- Check that the installation respects requirements in case of storm.

WARNING: The units are not designed to resist fire. The installation site must comply with national and European fire safety standards.

- In case of installation of the units in an area recognized as being potentially at risk for natural phenomena (tornado, earthquake, tidal wave, lightning...), please follow the standards and regulations, and provide the necessary devices to prevent from these risks.
- In the event of fire, the refrigerant circuit may experience a pressure rise beyond the maximum allowable pressure, potentially resulting in the release of flammable refrigerant and oil. Please take this into account in in the site-specific risk assessment (Refer to Directive 1999/92/EC).
- These units must not be installed in hazardous (ATEX) areas, including zones 0, 1, and 2.

WARNING: It is forbidden to store and install the machine in an ATEX area.

MAIN SAFETY RECOMMENDATIONS

Delivery check:
On receipt of a new equipment please check the following points. It is the customer's responsibility to ensure that the products are in good working order:

- The exterior has not been damaged in any way. Carry out a leak detector leak test before handling.
- The lifting and handling equipment are suitable for the equipment and comply with the specifications of the handling instructions enclosed here-in.
- Accessories ordered for on-site installation have been delivered and are in good working order.
- The equipment supplied corresponds to the order and matches the delivery note.

If the product is damaged, exact details must be confirmed, written down and sent by registered post to the shipping company within 48 hours of delivery (working days). A copy of the letter must be addressed to LFB GROUP and the supplier or distributor for information purposes. Failure to comply will invalidate any claim against the shipping company.

Storage:
When units are delivered on site they are not always required immediately and are sometimes put into storage. In the event of medium to long-term storage, we recommend the following procedures:

- Ensure that there is no water in the hydraulic systems.
- Keep protective plastic film in position.
- Ensure the electrical panels are closed.
- Keep all items and options supplied in a dry and clean place for future assembly before using the equipment.
- Store the unit on an appropriate place (flat surface).
- Storage temperature must be respected according to the information given on the rating plate.

Others:
- R32 refrigerant can be diluted in oil.



Indoor storage is strictly prohibited, unless the building is specifically designed and certified for the safe storage of equipment containing flammable refrigerants.

WARRANTY

The warranty of the unit is subject to the warranty definitions as agreed upon in the order.
It is expected that the design and installation of the unit utilises good working practices.
The warranty will be legally null and void if:

- ***Service and maintenance have not been executed in accordance with the regulations; repairs have not been carried out by LFB GROUP personnel or have been implemented without prior written permission by LFB GROUP.***
- ***Modifications have been made to the equipment without prior written permission by LFB GROUP.***
- ***Settings and protections have been modified without prior written permission by LFB GROUP.***
- ***Non-original or other than the prescribed refrigerants or lubricants are used.***
- ***The equipment has not been installed and/or connected in accordance with the installation instructions.***
- ***The equipment has being used improperly, incorrectly, negligently or not in accordance with its nature and/or purpose.***
- ***A flow protection device is not fitted.***
- ***The unit maintenance booklet is not complete or not available.***

Under these circumstances LFB GROUP is indemnified from any product liability claims from third parties.
In the event of a warranty claim the machine serial number and LFB GROUP order number must be quoted.

The technical information and specifications contained in this manual are for reference only. The manufacturer reserves the right to modify these without warning and without obligation to modify equipment already sold.



DO NOT CONFUSE WARRANTY WITH MAINTENANCE.

In the absence of any other written agreement (e.g. local regulations), the guarantee shall only apply to design faults which occur within the warranty period.

- The warranty will only apply if a maintenance contract has been signed, starting from the date of commissioning, and if the maintenance contract has actually been performed.
- The maintenance contract must be made with a specialist, competent company.
- The sole effect of any repair, modification or replacement of an item during the warranty period must be to extend the material's warranty period.
- Maintenance must be carried out in accordance with regulations.
- In addition to annual checks, safety accessories for non-toxic fluids must be requalified (calibrated or replaced) every 12 months, according to the current regulations.
- If a spare part is supplied after the expiry of the warranty period, it shall be guaranteed for a period equal to the initial warranty period and will be subject to the same conditions.
- We recommend to sign a contract including four inspections per year (every three months), before the start of each season, in order to check the operation of the equipment.



During the warranty period, the maintenance is required to be done by LFB GROUP technician or a certified company in LFB GROUP heat pumps with R32 refrigerant.
For the training to certi ication, please contact with our Redge ACADEMY.

WARRANTY

SAFETY INFORMATION:

The safety information contained in this manual is provided as a guide for the safe handling of this installation. LFB GROUP does not vouch for the completeness of this information and can therefore not accept liability for any possible omissions.

Everyone involved in the product life cycle must perform a risk analysis. This applies to manufacturers, installers, maintainers and end-users. If risks are not eliminated or remain at unacceptable levels of occurrence or severity, they must be communicated to the next party (the customer in general) through the drafting of an installation, use, maintenance guide.

In heat pumps, heat is transported by a pressurised refrigerant, which changes in pressure and temperature. In air-cooled heat pumps, fans are included to discharge heat into the environment. The protection of operating and maintenance personnel has been a priority when designing the heat pump. Safety measures have been included to prevent excessive system pressure. Sheet metal parts have been fitted to prevent accidental contact with (hot) pipes. In case of air-cooled heat pumps, the fans are fitted with protection grids and the electrical panel is fully protected against contact. Excluded are some parts which operate with a safe voltage (< 24 volts). In order to prevent unauthorised access, the service panels can only be opened with a special tool.

Not with standing that the heat pumps are equipped with extensive safety and protection features, the utmost care and attention is needed when carrying out operations on the machine. Furthermore, ear protection should be worn when working on or in the vicinity of the heat pumps. Operations on the cooling circuit or electrical equipment should be carried out by authorised personnel.

It is essential to follow the recommendations hereunder (non exhaustive list):

Before working on the unit:

The risk analyses of our machines are carried out considering operation in a standard environment with unpolluted air. For other applications, which do not meet this criteria (kitchens, industry,...) please contact your local sales representative.

- Wearing PPE is mandatory (glasses, cuffs, gloves, masks,...). Avoid splashing refrigerant on the skin or in the eyes. Wash any spills from the skin with soap and water. If liquid refrigerant enters the eyes, immediately and abundantly flush the eyes with water and consult a doctor.
- Sound pressure levels may present a health hazard. Refer to the data supplied when selecting the unit. Appropriate PPE (e.g. earplugs) must be worn to work safely close to the operating unit.
- The unit shall be isolated from the electrical supply by disconnecting and locking using the main isolating switch.

Work on the electrical system:

- Never work on a unit that is still energized. Wait 15 minutes before working on the machine after a power outage (discharge of the capacitors).
- Any manipulation (opening or closing) of a shut-off valve must be carried out by a qualified and authorized engineer. These procedures must be carried out with the unit shut-down.
- Never work on an electrical component until the general power supply to the unit has been switched off. During any maintenance operations on the unit, lock the power supply circuit in the open position ahead of the machine. If the work is interrupted, check the lock before resuming the work.
- WARNING: Even if the unit has been switched off, the power circuit remains energized, unless the unit or circuit disconnect switch is open. Refer to the wiring diagram for further details.
- In case of maintenance operations on fans (grills replacement,…) ensure that the power is shut off to avoid automatic restart.

Work on the refrigerant circuits:

- Monitoring of the pressures, draining and filling of the system under pressure shall be carried out using equipment designed for this purpose and suitable for the refrigerant contained in the air-cooled heat pump.
- Before the opening of the refrigerant circuit, check the pressure with manometers or pressure sensors, and purge the circuit in accordance with current environmental directives.
- To prevent the risk of explosion due to spraying of refrigerant and oil, the relevant circuit shall be drained at zero pressure before any disassembly or unbracing of the refrigerating parts takes place.
- Never leave a unit stopped with valves closed, refrigerant could be trapped, and the pressure would rise.
- All installation parts must be maintained by the personnel in charge, to avoid material deterioration and injuries to people. Faults and leaks must be repaired immediately. The authorized technician is responsible for repairing the fault immediately. Each time repairs have been carried out in the unit, operation of the safety devices must be re-checked.

WARRANTY

- Brazing shall be carried out by a qualified brazer. Brazing shall comply with standard EN ISO 177672:2010 (minimum 30% silver). Always braze under nitrogen flow (inerting) to prevent any ignition.
- Do not use oxygen to purge lines or to pressurize a machine for any purpose. Oxygen gas reacts violently with oil, grease, and other common substances.
- Never exceed the specified maximum allowable pressures.
- Verify the allowable maximum high- and low-side pressures by checking the instructions in this manual and the pressures given on the unit name plate.
- Do not use air for leak testing. Use only nidron or dry nitrogen.
- There is a residual risk of pressure build-up by degassing the oil or by heating the exchangers after the circuit has been drained. Zero pressure shall be maintained by venting the drain connection to the atmosphere on the low-pressure side.
- Do not cut the refrigerant pipes or any other component in the refrigerant circuit until all the refrigerant has been removed from the unit. Lock the unit, connect the transfer bottle to earth, ventilate the work area, start recovery, keep the circuit under vacuum for 30 minutes. Inert the circuit, alternating nitrogen pushes and vacuum pulls. Refrigerant in contact with an open flame can create an explosion risk.

Replacing components, equipment and piping:
- Replacement shall be carried out using spare parts, or using parts approved by LFB GROUP.
- Only the refrigerant shown on the manufacturer's nameplate shall be used.

Parametering and control:
- For any intervention related to component parameterization, controls and unit operation management refer to "eClimatic" user manual.

EMERGENCY PROCEDURE:

One or more competent authorized persons must be designated who are familiar with the procedures below and have the authority to act accordingly.

In the event of a gas leak:

1. Monitoring site instructions and risk management:
Alert emergency services and people in the building, in this case:
- Follow the site instructions.
- Equip yourself with the necessary PPE.
- Eliminate the risk of ignition. Switch off the power of the unit.
- Prevent discharge into drains.
- Take action in the event of a fire.

2. After securing - resumption of activity:
Resolve the cause of the emergency stop before restarting the unit.

3. In the event of fire:
Alert emergency services and people in the building, in this case:
- Comply with site instructions.
- If the fire is clearly identified and small, you can control it with an extinguisher appropriate to the type of fire and refrigerant. Wear the appropriate PPE during this operation.
- If the smoke is too heavy or uncontrollable, evacuate the premises as quickly as possible, following the evacuation plan.

Any unauthorised intervention or modification, including the use of non-original parts or non-certified technicians, shall void the warranty and exempt LFB GROUP from any liability vis-à-vis third parties.

WARNING

Warning labels

The heat pump may be marked with the following warning labels to alert to potential hazards (on or near the potentially hazardous part).
The heat pump may include the following labels:

			
High temperatures	Low temperatures	Rotating parts	Sharp parts
			
Electrical voltage	Flammable	Warning Inflammable dusty filters	
			
Don’t walk on it	Wear of PPE (Personal protective equipment)	Don’t strap	Pressurized gas
			
Gravity center	Warning main switch supplied from bottom	EUROVENT certification	
			
Protection by water filter mandatory	Protection by strainer filter mandatory	Electronic and connected devices prohibited	Earthing terminal
			
OK to send document	Mandatory to read the instructions	Electrical connections can loosen during transport Please check them before start-up	
			
CMIM marking (Morocco)	CE marking	CA marking (UK)	EAC marking (Russia)

Regularly check that the warning labels are still in the correct positions on the machine and replace them if necessary.

WARNING

PED DIRECTIVE:
All units are compliant with the Pressure Equipment Directive (see EU Declaration of Conformity).



WARNING:

1. All work on the unit must be performed by competent and qualified personnel. Failure to comply with the following instructions could result in serious injury or accident.
2. **Warning:** High pressure safety switches are safety accessories that keep the system within its permissible operating limits.
3. In case of installation in an earthquake zone or in an area that may be affected by severe natural events such as storms, tornadoes, floods, tidal waves, etc., the installer and/or operator shall refer to the applicable standards and regulations to ensure that the required devices are available, as our units are not designed to operate under such conditions without prior precautions.
4. The pressure increase in case of external fire is not considered as an operating condition (EN 378-2 § 6.2 .2.3). However, the designer may implement means to limit damage in case of fire: Our products, even when equipped with LFL sensors (for products loaded with A2L fluids) are not designed to withstand a fire. This fire risk must be taken into account by the integrator/installer in the risk analysis of the location where our products are installed. The installation site must implement all necessary fire protection measures and comply with applicable regulations. The installation of means as described in EN 378-3+A1:2020 for refrigeration systems in a separate room for refrigeration machines fulfills the requirement for damage limitation. A damage limitation accessory may be present if necessary.
5. In case of exposure to corrosive external atmospheres or corrosive products, the installer and/or operator shall take the necessary precautions to avoid damage to the equipment and shall ensure that the equipment supplied has the necessary and sufficient corrosion protection.
6. To respect a sufficient number of supports for the piping according to their size and weight under operating conditions and to design the piping to avoid a water hammer phenomenon.
7. For factory hermetically sealed refrigeration systems charged with refrigerant, a safety chain test is performed at the end of the test to ensure proper operation of the factory pressure switch. As hydrostatic tests cannot be carried out on all our units for prejudicial reasons, a visual examination, a pressure resistance test at 1.1 x PS and a tightness test are planned. (The whole circuit is checked with a leak detector).
8. If a valve for damage limitation in the event of an external fire is present, the refrigerant emissions must be directed to the outside, to a place free of ignition sources, fresh air intake and human presence. The valve shall be sized and connected in accordance with EN ISO 24664:2024.
9. When carrying out any work, comply with all applicable safety regulations and standards (e.g., EN 378-2), and follow the recommendations on the labels or in the instructions accompanying the equipment. All necessary measures must be taken to prevent access to not competent persons.
10. It is essential that any piping or other components of the refrigeration circuit hazardous to people because of their surface temperature are insulated or identified.
11. Ensure that the installation zone (room or area) of the machine has restricted access and ensure the good condition of the covering.

FLAMMABLES GASES

As standard, the ECOMFORT THERMA range is supplied with R32 refrigerant which is a flammable gas classified A2L (slightly flammable).

A2L / A2 / A3 flammable gases are subject to more important safety regulations than gases classified A1. This section summarizes the standard and provides specific LFB GROUP recommendations. This section is based on the standards as well as numerical simulations and tests related to the flammability risk carried out on these products. It provides the recommendations to be considered so that the product is installed, used, maintained and destroyed at the end of its life cycle without putting the actors in the product life cycle at risk.

FLAMMABILITY CLASS	
A1	Non-flammable
A2L	Slightly flammable
A2	Low flammable
A3	Highly flammable

LABELS OF FLAMMABLE GAS UNIT:



The A2L logo on the nameplate indicates that the product contains refrigerant of the slightly flammable category. It is also positioned on schraders where refrigeration components may be connected for maintenance. This label tells you that there is a potential risk of a flammable gas leak and that this should be taken into account in the operational risk analysis.

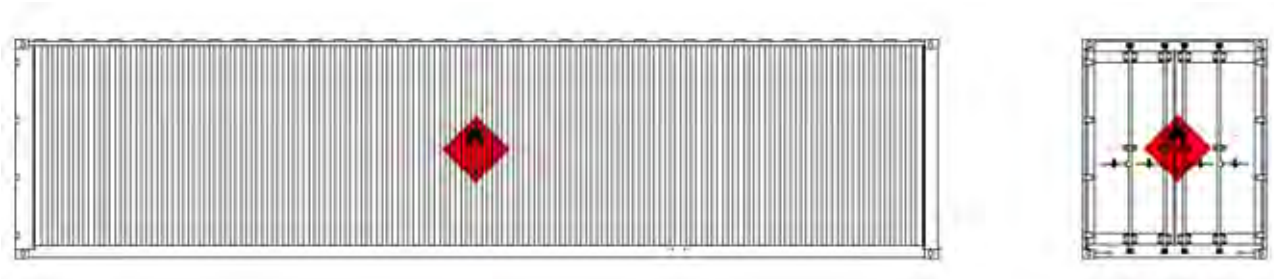
TRANSPORT OF FLAMMABLE GAS UNIT:



Machines loaded with A2L refrigerant must comply with the ADR rules (Accord for dangerous goods by road). Please plan the route in accordance with this class. In the case of specific air transport requiring machines not charged with refrigerant, please contact your LFB GROUP contact.

UN3358 transports are not allowed in Eurotunnel and tunnels of category D and E.

Containers must be fitted with stickers according to the plan below:



In the transport voucher, note: Refrigerant units.

In case the machine contains more than 12kg of refrigerant, please also note the total amount of refrigerant on the transport voucher.

In the case of maritime transport, the IMDG (International Maritime Dangerous Goods Code) is based on the same rules as the ADR. Some specific local rules may apply (especially in Asia).

FLAMMABLES GASES

RECEPTION CONTROLS FOR A FLAMMABLE GAS UNIT:

Please do not approach the container or truck in the presence of an open flame, an electric power source, a cell phone, or any other heat source whose temperature would exceed 500°C.
Likewise, if the product had to be stored prior to installation, please store it in a place free from potential sources of ignition as described above.

SAFETY:

People working on refrigeration systems using flammable fluids must have the necessary skills in accordance with EN 13313:2011 for the safe handling of these flammable fluids:

- Knowledge of the legislation, regulations and standards concerning flammable refrigerants.
- Knowledge of fluids and their handling.

These skills must be supported by appropriate training according to legislation.

Only equipment designed for use with flammable refrigerants should be used and all work performed on the equipment should be in accordance with local regulations and standards. All works must be carried out in a professional manner.

To ensure the absence of a secondary ATEX zone, maintainers should:
- Set up a periodic leakage inspection plan to ensure that the product's leakage level is maintained.
- Set up an inspection and maintenance plan to avoid deterioration of the product which could lead to an accidental leak during the lifetime of the equipment.
  Corrosion: Do not use detergents. Do not use in an atmosphere corrosive to copper and aluminum without protecting the sen sitive elements of the exchanger.
  Freezing of the heat exchanger coil: Check regularly that the coil is not frozen. Check that the defrosting system is working properly and that it is effective.
  Abnormal vibrations: Check that the pipes are properly maintained.
- If a safety chain is installed, please maintain the detection system and the associated control chain according to standards.

SAFETY AREA:

Our products (rooftops, heat pumps,...) and quasi-machines (evaporators, air-cooled condensers,...) are hermetically sealed and carry the CE mark. They are designed to contain slightly flammable A2L refrigerants. As such, they are not considered as a source of release as defined by the directive in normal operation. In France, they are exempt from the measures described in the regulation governing the safety of buildings open to the public (ERP).

A formalized periodic inspection of the product's hermeticity will guarantee the preservation of this high level of hermeticity. Nevertheless, in abnormal operating conditions, leaks may occur (poor maintenance, maintenance with opening of the refrigeration circuit). For these cases, prior to placing these products on the market, we carried out studies in accordance with standards. Thus, the unit installed according to our recommendations and well maintained does not generate an ATEX zone.

Please maintain the detection system and the associated control chain according to standards. In case of maintenance we recommend that the operators to be equipped with an explosimeter, switch off the power supply of the unit and do not approach any potential source of ignition without first checking the absence of a potentially flammable area due to an undetected leak.

The end user must update the Risk Analysis, indicating the presence on his site of products charged with R32 fluid, and train his personnel on the good practices to be adopted for a safe use.

INSTALLATION ON A FLAMMABLE GAS UNIT:

It is forbidden to store and install the machine in an ATEX area.

In the immediate area of the unit (within a distance of 2 meters or less):
- The presence, even temporary, of ignition sources is prohibited (electrical or heat sources according to EN378).
- Installation of building fresh air vents or extraction outlets is prohibited.

For units ducting the discharge of the fans, ensure that no sources of ignition as defined in the standards (e.g. electrical and heat) are installed in or near the ducts.

The manufacturer shall not be held liable for any risks arising from the specific installation environment, including but not limited to the presence of ignition sources, confined spaces or insufficient ventilation. ATEX zoning and risk analysis remain the sole responsibility of the end user.

FLAMMABLES GASES

POWERING UP A UNIT CONTAINING FLAMMABLE GAS:

Before switching on the power supply, please carry out a refrigerant leak detection using an appropriate device to ensure that there is no refrigerant around the machine. . Please perform a refrigerant detection with a suitable and calibrated detector to ensure that there is no gas around the unit.

ELECTRIC WIRING ON A UNIT CONTAINING FLAMMABLE GAS:

When a cable passes through a wall, be sure to use a cable gland to ensure that the cable is sealed and insulated. This insulation prevents any electric arcs that could ignite the refrigerant in presence of a leak.

INTERVENTION ON A UNIT CONTAINING FLAMMABLE GAS:

Before any intervention on a machine with A2L / A2 / A3 flammable fluid, please carry out a refrigerant leak detection using an appropriate device to ensure that there is no refrigerant around the machine.

When working on a machine with flammable fluid A2L / A2 / A3, do not cause sources of flammability in the area near the unit (see above). For example: do not smoke, make phone calls, do not use walkie-talkies.

CORRECTIVE MAINTENANCE ON R32 GAS UNIT:

The following precautions, specific to this gas, must be taken when using the R32 refrigerant;

- The vacuum pump must be fitted with a non-return valve or a solenoid valve and comply with R32 (A2L).
- The pressure control, draining and filling operations of the pressurized system must be carried out using the fittings specified for this purpose and the appropriate equipment.
- Use only pipe cutters and no torches to open the pipes.
- The load must be applied in the liquid phase.
- Always use a scale to charge the refrigerant.
- Use the leak detector suitable for R32 refrigerant.
- Do not use mineral oil, only synthetic oil for boring, expanding or making connections.
- Keep the pipes closed before using them and pay close attention to any traces of humidity and dirt (dust, filings, burrs, etc.).
- Brazing must always be carried out in a nitrogen atmosphere.
- Drill bits must always be sharp.
- The refrigerant bottle must contain at least 2% of the total amount.
- Brazing operation must be performed by a professional.

WARNING:
Care must be taken to remove refrigerant from the system before cutting or unbrazing any piping with a tool suitable for use with A2L fluids.

We recommend the following protocol before any piping work:

- To avoid any risk of explosion due to the spraying of refrigerant liquid and oil, the circuit must be drained and display a relative pressure of zero during the disassembling or debrasing of parts of the refrigerant circuit.
- Make vacuum with a compatible equipment and recharge with dry nitrogen to allow the refrigerant dissolved in the oil to degas.
- Repeat these operations twice.
- Once the circuit has been drained, there is a residual risk of pressure build-up by degassing the oil or due to the heat from the exchangers. To keep the pressure at zero, the pipe connection must be evacuted from the low pressure side.

Vacuum procedure:

- Connect the vacuum pump to the HP line and to the BP line.
- Make vacuum (P = 1Pa). Break the vacuum with dry nitrogen. Make vacuum again (P = 1Pa), the residual moisture content must be less than 50ppm.
- Perform a vacuum test (15 minutes at maximum 70Pa).

The compressors must be switched off during the vacuum test.

INSTALLATION

1.- TRANSPORT - HANDLING

Equipment is designed to withstand transport and handling according to the established protocol (for the handling protocol, please refer to the installation instructions for the relevant product range).

All unloading operations will be carried out with suitable equipment (crane, forklift, etc.).

Optional removable rigging shackles are available for certain products.

When using a forklift, respect the positions and handling direction indicated on the products.

The equipment must be handled with care to avoid damage to the structure, piping, condenser, etc.

1.1.- Controls and delivery checks

After the unit has been received, it must be inspected to check possible damages. On receipt of a new equipment please check the following points. It is the customer's responsibility to ensure that the products are in good working order:

- The exterior has not been damaged in any way.
- The lifting and handling equipment are suitable for the equipment and comply with the specifications of the handling instructions enclosed here-in.
- Accessories ordered for on site installation have been delivered and are in good working order.
- If the unit is delivered loaded with refrigerant, verify the absence of leaks with an appropiate leak detector.
- The equipment supplied corresponds to the order and matches the delivery note.

If the product is damaged, exact details must be confirmed, written down, and sent by registered post to the shipping company within 48 hours of delivery (working days).

A copy of the letter must be addressed to LFB GROUP and the supplier or distributor for information purposes. Failure to comply will invalidate any claim against the shipping company.
Please be reminded that LFB GROUP is not responsible for off-loading and positioning.

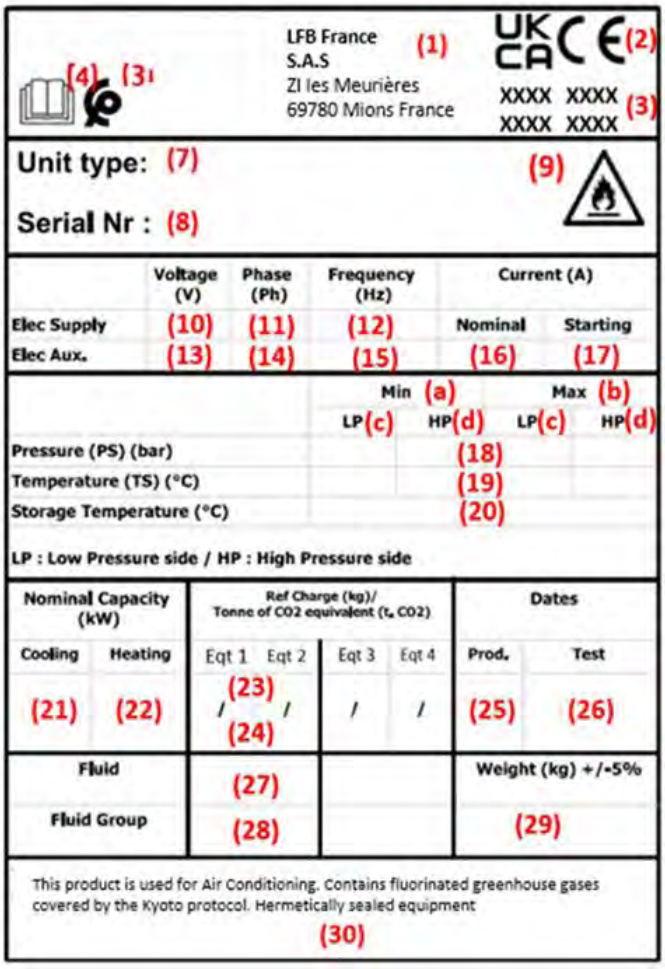
UNIT RATING PLATE:

The rating plate provides a complete reference for the model and ensures that the unit corresponds to the model ordered. It states the electrical power consumption of the unit on start-up, its rated power and its supply voltage.

The supply voltage must not deviate beyond +5 / -5 %.

The start-up power is the maximum value likely to be achieved for the specified operational voltage. The customer must have a suitable electrical supply. It is therefore important to check whether the supply voltage stated on the unit's rating plate is compatible with that of the mains electrical supply.

When positioning the unit, be sure that the nameplate is always visible since these data will be necessary to ensure proper maintenance.



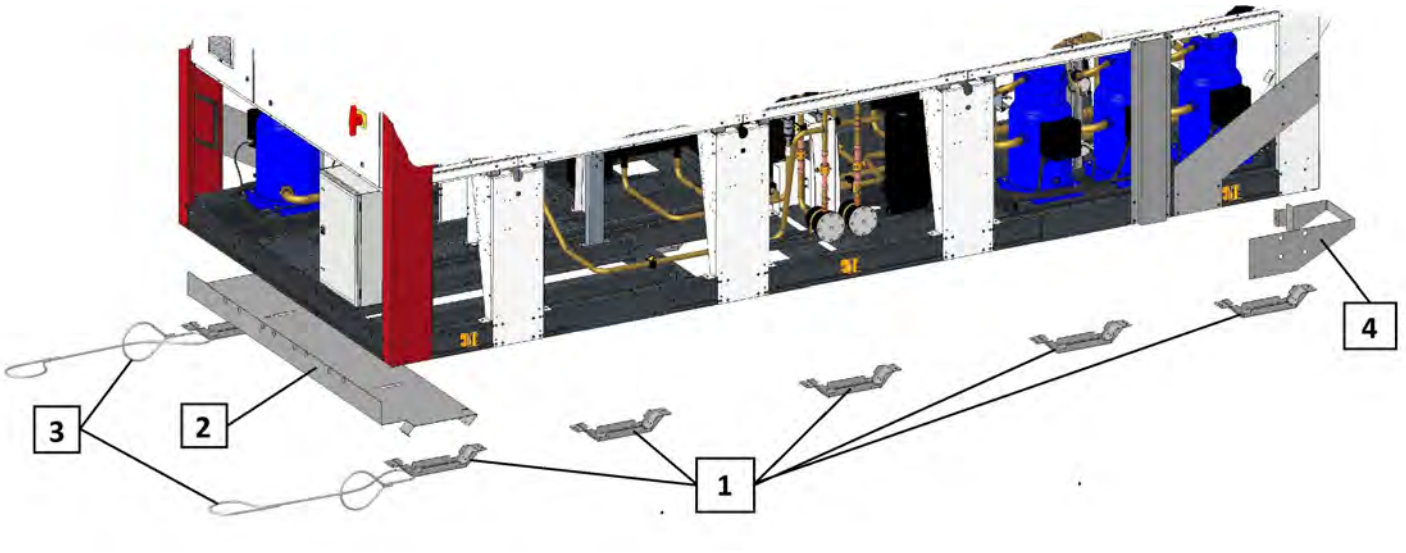
The rating plate indicates:

(1) Address.
(2) Regulatory marking.
(3) Identification number of the notified body only if the product is subject to the Pressure Equipment Directive (2014/68/EU).
(4) «To be read» pictogram.
(5) Regulatory marking.
(6) QR code, unit documentation link.
(7) Unit type.
(8) Serial number.
(9) Flammable fluid type pictogram.
(10) Power part voltage.
(11) Power part phase.
(12) Power part phase frequency.
(13) Control part voltage.
(14) Control part phase.
(15) Control part frequency.
(16) Nominal current.
(17) Start-up current.
(18) Minimum (a) / maximum (b) operating pressure low (c) / high (d) pressure side.
(19) Minimum (a) / maximum (b) operating temperature low (c) / high (d) pressure side.
(20) Minimum (a) / maximum (b) storage temperature low (c) / high (d) pressure side.
(21) Nominal capacity in cooling mode.
(22) Nominal capacity in heating mode.
(23) Refrigerant charge per circuit.
(24) Equivalent ton of CO_2 refrigerant per circuit.
(25) Year of production.
(26) Date of end of line test of the unit.
(27) Type of refrigerant and global warming potential (GWP).
(28) Refrigerant group.
(29) Unit weight.
(30) Message: “This product is used for Air Conditioning. Contains fluorinated greenhouse gases covered by the Kyoto Protocol. Hermetically sealed equipment”.

1.2.- Container loading kit

Taking into account the height of the unit, a standard container cannot be used. A «High Cube» with a minimum internal height of 2.5m is mandatory.

A dedicated kit has been designed for this purpose:
1. Sliders.
2. Fork lifter stiffener and stop.
3. Pulling cable.
4. Bumpers.
5. Wooden parts on each slider side (non represented).



Note: Numbers of components can vary depending on unit configuration.

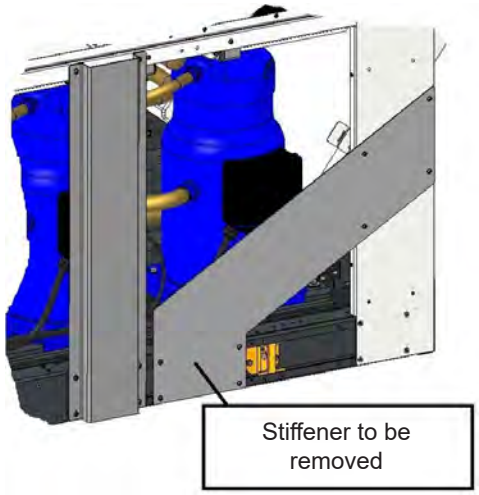
All these parts are designed to be removed prior to place the unit on its final location.

Unit working with slightly flammable refrigerant. Before any operation on the unit, carry out a refrigerant detection with a dedicated device in order to ensure the absence of refrigerant around the unit.

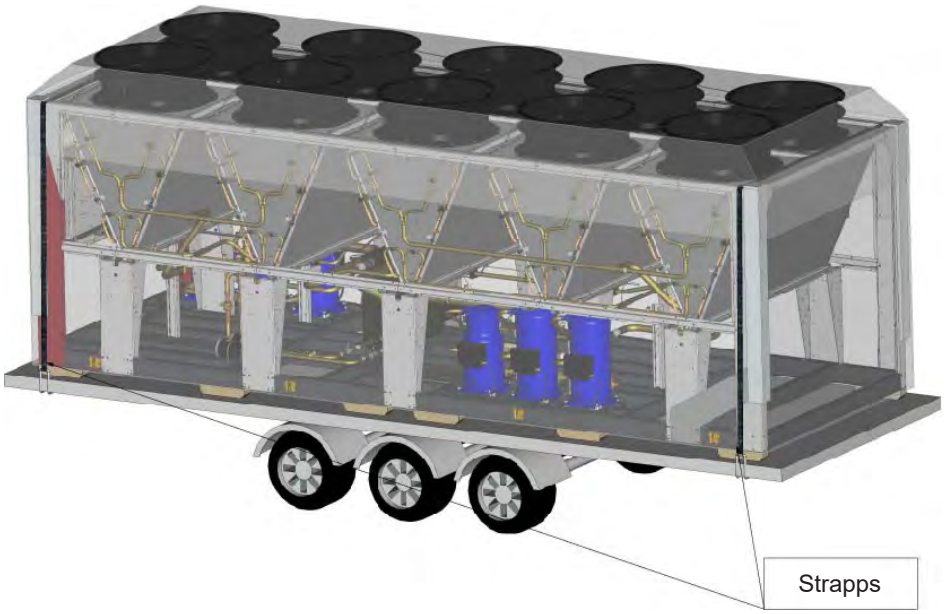
Possible risk when opening container.

1.3.- Transportation

In some units, stiffeners on lower corners are present to secure the lifting.
These parts are designed to be removed once the unit is installed on its final location.



During transportation, the unit must be secured by two strapps.



1.4.- Site guidance

When the unit is received, it should be checked to ensure that there are no bumps or other damage, following the instructions on the packaging. If there is damage, the unit may be rejected by notifying the LFB GROUP Distribution Deparent and reporting why the machine is unacceptable on the transport agent's delivery notice. Any later complaint or claim made to the LFB GROUP Distribution Deparent, for this type of anomaly, cannot be considered under the Warranty.

Sufficient space must be allowed to facilitate placement of the unit.

Unit may be installed outdoors. There should be adequate drainage around the unit.

The installation location must be able to support the weight of the unit during operation.

In heat pump units during defrost cycle, the units produce a great amount of water melting the ice off coils. If you wish to drain the water, adequate drainage should be installed to evacuate the water where desired.

When positioning the unit, be sure that the Rating Plate will always be visible since this data will be necessary to assure proper maintenance.

1.5.- Storage

When units are delivered on site they are not always required immediately and are sometimes put into storage. In the event of medium to long-term storage, we recommend the following procedures:

- Ensure that there is no water in the hydraulic systems.
- Keep the heat exchanger covers in position.
- Keep protective plastic film in position.
- Ensure the electrical panels are closed.
- Keep all items and options supplied in a dry and clean place for future assembly before using the equipment.

It is strongly recommended to store units in a dry, sheltered place.

Unit working with slightly flammable refrigerant. Before any operation on the unit, carry out a refrigerant detection with a dedicated device in order to ensure no possible presence around the unit.

The unit maximum storage temperature is 51°C. Above this limit risk of too high pressure or refrigerant losses through safety relief valves if any.

2.- LIFTING THE UNIT

2.1.- Safety instructions

Installation, start up and adjustment of this equipment can be dangerous if certain system specific factors are ignored, such as operating pressures, electrical components, locations (roofs, terraces and other structures located well above ground level).

Only highly qualified contractors and technicians with knowledge on this type of equipment, are authorised to install, start up and service it.

During any service operations, observe the recommendations given on labels or instructions sent with the equipment, as well as any other applicable safety procedures.

- Follow all safety rules and regulations
- Wear protective glasses and work gloves
- Handle heavy or bulky equipment carefully during lifting and moving operations, and when setting it on the ground.



BEFORE EACH SERVICE OPERATION MAKE SURE THAT THE UNIT POWER SUPPLY IS PROPERLY ISOLATED AND LOCKED OUT.

2.2.- Handling

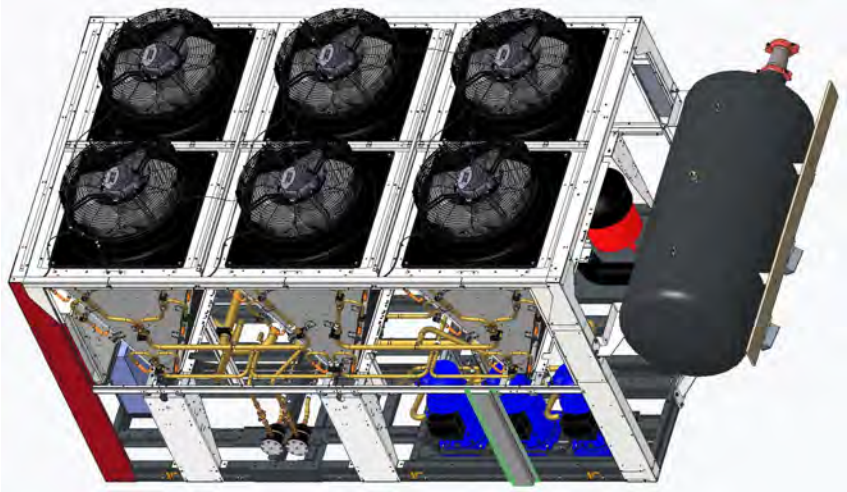
Handling operations must be carried out by qualified personnel. Comply strictly with the lifting instructions as well as with any other applicable safety procedures. Wear protective glasses and work gloves. Unit handling operations must be carried out carefully to avoid jolting the frame, the panels, the electrical box, etc.

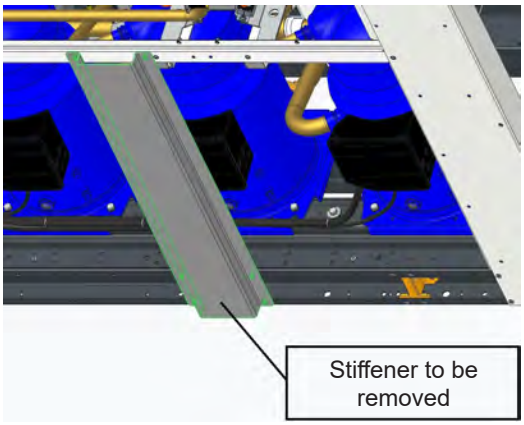
The unit must always be transported in the same horizontal position in which it will be installed. Transporting it in any other position may result in serious damage to the equipment.

NOTE: The heat exchangers of the condensers could be protected from damage during transport by plastic plates. The machine is also wrapped in packing foil. It is recommended to leave this protection in place during any transport and lifting operations, and not to remove the plastic plates until commissioning (take care that the protecting foil wrapping is not blown away).
Rubber anti-vibrations mountings (AVM) & factory accessories may be found in the control panel or in an extra box for shipping. If the unit is mounted on anti-vibration mountings, these should be fitted to the unit before final positioning.

CAUTION: IN CASE OF REINSTALLATION OF THE UNIT, MAKE SURE THAT THE UNIT POWER SUPPLY IS PROPERLY ISOLATED AND LOCKED OUT.

In some units with water tank, we have added some stiffener on the side closest to the water tank of the unit in the compressors area to ensure its lifting. These parts are designed to be removed once the unit is installed on its final location.

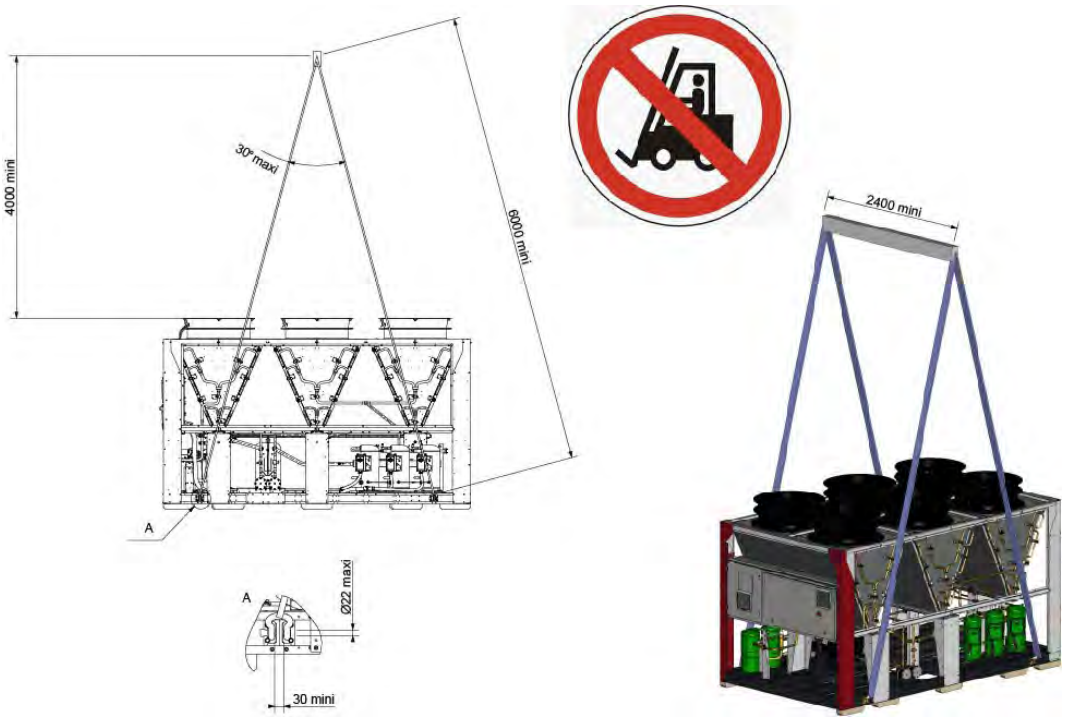




For unloading and placement, a crane is required, secure the suspension cables as shown in the figure.
The unit can only be lifted and moved by its base.

LIFTING DRAWING WITH CRANE (F-G-BOX): 2 Lifting Points.

- **Units GHS 220 / 250 / 280 & GHS 320 / 360 / 370 / 380.**
- **Units GHS 220 / 250 / 280 + Water tank.**

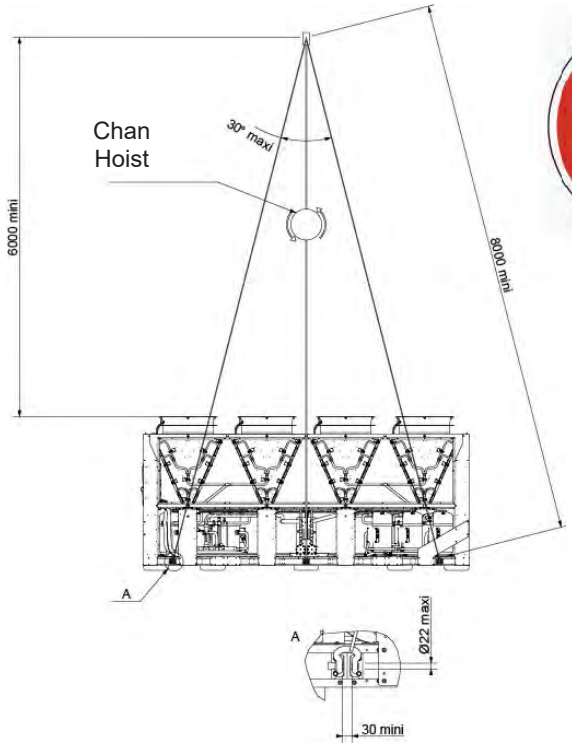


INSTALLATION

For unloading and placement, a crane is required, secure the suspension cables as shown in the figure.
The unit can only be lifted and moved by its base.

LIFTING DRAWING WITH CRANE (G-H-BOX): 3 Lifting Points.

- **Units GHS 320 / 360 / 370 / 380 + Water tank.**
- **Units GHS 410 / 450 / 500.**
- **Units GHS 410 / 450 / 500 + Water tank.**







2.3.- Unpacking

After unpacking the machine, non-hazardous waste from packaging shall be properly disposed. For example, plastic film or other plastic elements, metal strips, wood, pallets, shall be disposed through authorized dealers, or separated into their respective waste containers.

Follow the installation instructions established in this manual to avoid disturbing noise caused by movement or vibration due to improper installation of the unit.

It is advisable to unpack the unit at the place where the unit will be installed, to avoid damages during handling.

3.- LAY-OUT AND INSTALLATION REQUIREMENTS

Before proceeding with the installation of the heat pump, it is important to consider the following points:

- Air-cooled heat pumps with helicoids fans such as ECOMFORT THERMA are designed for outdoor installation. Install the unit in an open space, at least 2m from the building's air intakes. Avoid low points that could retain refrigerant (gutters, manholes,...). Do not place ignition sources in this zone.
- Please consult LFB GROUP prior to implementing other types of installation. A risk analysis study is recommended before installing the unit in any other location than the one described above.
- Installation of the unit and accessibility must be compliant with the local regulations. Ensure that all access equipment allow maintenance operation in safety (electrical cabinet, main switch, panels, filter, refrigerant circuit,…).
- For these air-cooled heat pumps, position the unit where it is less affected by wind. The units are designed to withstand winds up to 80km/h. Above this limit, it is recommended to take appropriate actions to secure the installation, e.g. install windbreaks.
- The ground beneath the unit must be flat, leveled and of sufficient strength to support the weight of the unit with its full liquid charge, and the occasional presence of the usual service equipment.
- Uneven surfaces are prohibited. The surface must be flat and respect a maximal flatness of 0.5mm per linear meter (in both directions length and width).
- In locations exposed to frost, the supporting surface, if the unit is installed on the ground, must be built on concrete stakes extending downwards beyond the normal depth of frost. It is always advisable to build a supporting surface detached from the general building structure to avoid transmission of vibrations.
- On normal applications, unit rigidity and point load positions enable installation to minimise vibrations. Vibration isolators may be used by contractors on installations requiring particularly low vibration levels.
- Sufficient space must be allowed to facilitate placement of the unit. There should be adequate drainage around the unit.
- Within the site security boundary and especially within the safety zone, do not install any gutters, siphons, ventilation ducts, doors, trapdoors, or openings that could allow the refrigerant to spread in the event of a leak.
- Make sure that the pressure relief valves are oriented within a perimeter of 2m towards an area without sources of ignition, away from windows, skydomes, air intakes or car parks with electric cars.

Use of vibration isolators MUST be accompanied by installation of flexible connections in the unit water piping. Vibration isolators must also be secured to the unit BEFORE being attached to the ground. Selection of vibration absorbing isolator capacity is not LFB GROUP's responsibility.

- The unit must be bolted to the vibration isolators and the latter solidly secured into the concrete slab. Check that vibration isolator contact surfaces are flush to the floor. If necessary, use spacers or re-surface the flooring, but in all events, make sure that the isolators seat flatly on the supporting surface.
- Units should be installed with sufficient free space around them to provide easy access to all unit components for servicing and maintenance. As an air-cooled heat pump, the air rejected by the condenser must not encounter any obstacles to prevent air recirculation. This could cause an increase in the temperature of the air used to cool the condensers. Obstruction of the air outlet will also impair air distribution across the entire heat exchanging surface of the condenser. Both of these conditions, which reduce the heat exchange capacity of the coils, could cause an increase in the condensing pressure. This will lead to a loss of capacity and an increase in compressor power input. (See clearance drawings).
- To prevent air flow to be reversed due to prevailing winds, units cannot be completely shrouded with a higher, uninterrupted wind shield. If such a configuration cannot be avoided, an air ejection duct could be installed at the same height as the surrounding shield after LFB GROUP representative written approval.

INSTALLATION

Failure to comply with the installation rules set out above will result in the suspension of the warranty conditions for the equipment.

Once the unit is charged with R32 refrigerant and before proceeding with its installation, the following recommendations should be followed:

- If the unit must be stored before installation, it must be done in a safe area free of ignition sources (minimum distance of 2m around the unit). It is also recommended to protect the unit against impacts from engines and / or people.
- Conduct a **preliminary inspection** to ensure the unit is not damaged.
- Conduct a **leak test** with an approved and calibrated detector before handling.
- **Pressure relief valves** must be installed make sure them faces an area free of ignition sources, windows, skydomes or an open parking without electric cars.
- **Unit location:**

1. Install the unit in an open space (outdoors), at least 2m from the building's air intakes.
2. Avoid low points that could retain gas (gutters, manholes,...).
3. Do not place ignition sources in this zone.
4. The end user should update the EPD (Explosion Protection Document) indicating the presence on his site of products charged with R32 fluid and train his personnel on the good practices to be adopted for safe use.

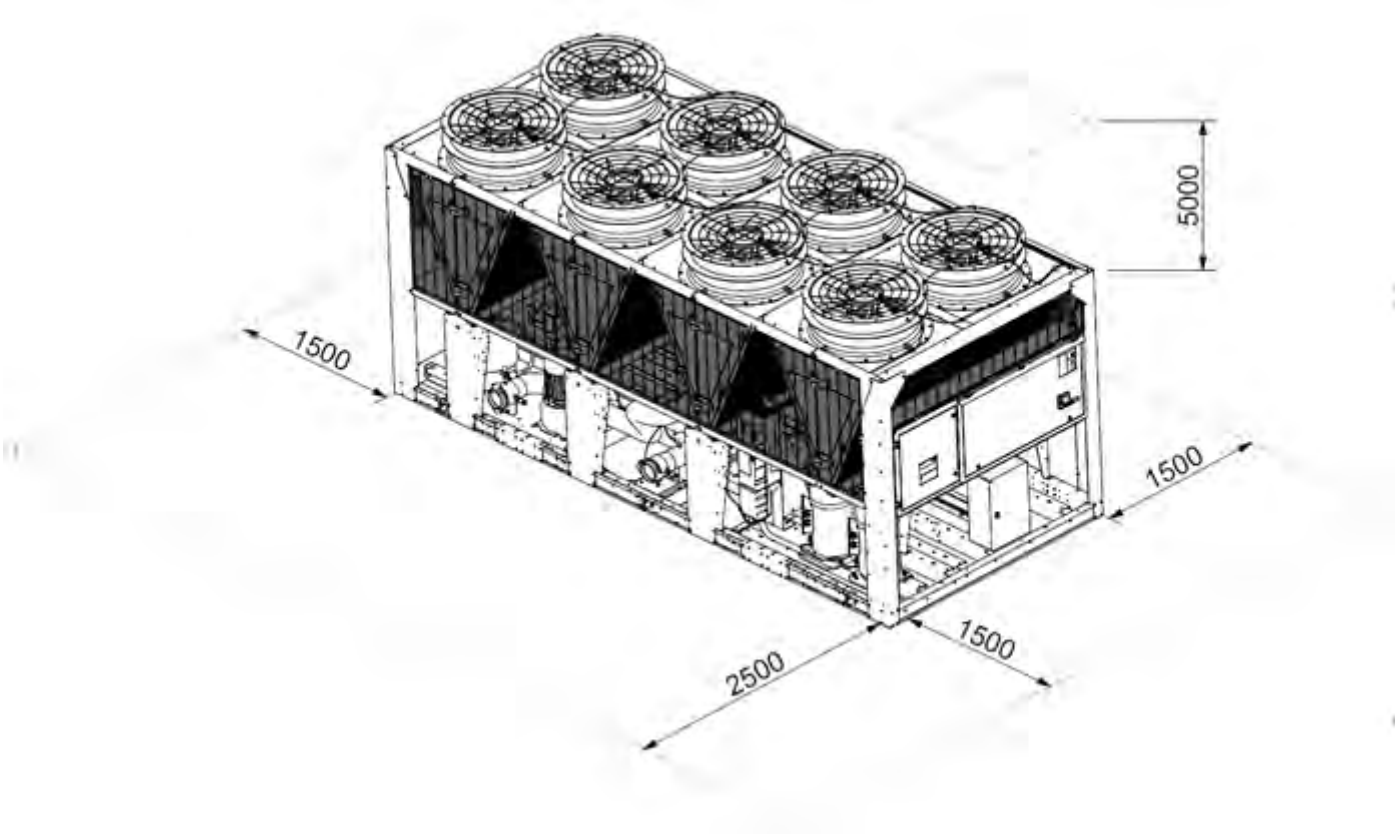
- **Risk of freezing:** For applications with outlet water temperature under 5°C or if the ambient temperature can go down to 0°C or less, an appropriate glycol concentration must be used in order to avoid water freezing in the circuit. In order to avoid the use of glycol with low ambient temperature, the customer must ensure permanent water circulation, even when the unit is stopped in order to avoid water freezing. Water freezing would result in piping breakage and a possible refrigerant leak.
- In the event of a **storm**, organizational measures to be put in place at the customer's premises as paralighting and protection against hail sould be checked.
- It is important to ensure that people or engines that could hit and damage the unit cannot operate around by using, for example, anti-impact blocks.

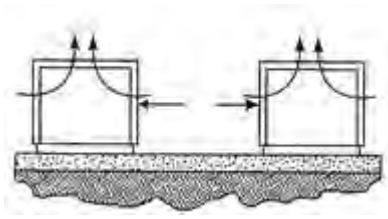
3.1.- Minimum clearance around the unit

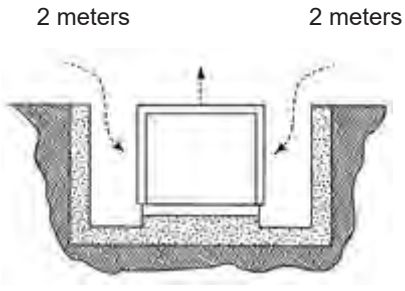
Clearance around the unit, for any unit version. Keep this space free around the unit for installation. Failure to install the unit as shown will impact performance and reliability.

- In general, the air inlet and outlet should not be obstructed.
- It is also important that there are no obstructions above the fans of the unit.
  The recommended minimum clearance above the unit is 5000mm.
- If you have any questions about the implementation, please contact us so that we can assist you.

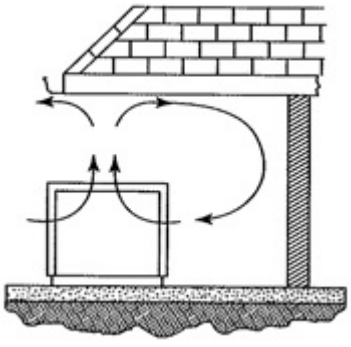
All dimensions shown on the drawings below are in millimetres.







Not recommended



Not allowed

With R32 heavier than air, it will not evacuate in case of leak. Consider to place some refrigerant detector and exhaust system.

In all cases, do not place the unit in a semi-buried area or on gutters, floor drains,... Place it on a flat surface.

4.- WATER CONNECTIONS

4.1.- Evaporator / Desuperheater

Before the system start-up check that the water circuits are connected to the right heat exchangers (e.g. no reversal between water in and outlets). The water circulating pump will be preferably installed upstream so that the evaporator will be subjected to positive pressure. Entering and leaving water connections are indicated on the certified drawing sent with the unit or shown in the sales brochure. The use of a water filter in the water circuit upstream of the heat exchanger is mandatory. These filters must remove all particles with a diameter greater than 1 mm, and must be positioned within 1 meter of the inlet of the unit. They may be supplied as an option by the manufacturer.

LACK OF FILTER AT THE INLET OF A PLATE HEAT EXCHANGER WILL MAKE WARRANTY VOID.
Hydraulic drawings in Appendices or supplied with the unit.

Automatic air bleeder must be installed at all outdoor high points of the water circuits without ignition source around to ensure that in case of leak on the water heat exchanger of the unit, no flammable refrigerant can go inside the building.
Ideally, we recommend installation with primary and secondary loop to avoid refrigerant going inside the building.

It is essential to follow the recommendations hereunder (non exhaustive list):

- Water pipes must not transmit any radial or axial force to the heat exchangers nor any vibration. (Use flexible connections to reduce the transmission of vibrations).
- Manual or automatic air bleeders must be installed at all high points in the circuit(s).
- Drain connections must be installed at all low points to allow the whole circuit to be drained.
- An expansion device must be installed to maintain pressure in the circuit(s) as well as a safety device.
- Comply with the water inlet and outlet connections shown on the unit.
- Install thermometers in both the entering and leaving water connections.
- Install ball valves, close to the entering and leaving water connections.
- After testing for leaks, insulate all pipe work, to reduce thermal leaks and to prevent condensation.
- If the external water pipes are in an area, where the ambient temperature is likely to fall below 0°C, they must be insulated and electric heaters must be added. Like standard, the internal water pipes of the unit are insulated.
- Ensure full earthling continuity.
- Connection pipes must under no circumstances generate strain on the piping system of our units. To do this, appropriate means of support and fastening must be used.
- The unit must not be used for supporting the piping of the installation.
- Respect a sufficient number of supports for the piping according to their size and weight under operating conditions and to design the piping to avoid a water hammer phenomenon.

CHARGING AND REMOVING HEAT EXCHANGE FLUIDS SHOULD BE DONE BY QUALIFIED TECHNICIANS WITH DEVICES THAT MUST BE INCLUDED ON THE WATER CIRCUIT BY THE INSTALLER. NEVER USE THE UNIT HEAT EXCHANGERS TO ADD HEAT EXCHANGE FLUID.

We do not support operation of the units with open loops which can cause problems with oxygenation, or operation with untreated ground water.

4.2.- Water analysis

The water must be analyzed. According to the results of the analysis, the installed hydraulic network must include all the necessary elements for the water treatment: filters, additives, intermediate exchangers, purge valves, vents, isolation valves, etc,...

We do not advise operation of the units with open loops which can cause problems with oxygenation, or operation with untreated ground water.

The use of untreated, or improperly treated, water can lead to scale, algae and sludge build-up, or corrosion. It is advisable to consult a qualified water treatment specialist to determine the type of treatment required. The manufacturer cannot be held responsible for damage caused by the use of untreated or improperly treated water, salt water or seawater.

Here are our non exhaustive recommendations given as an indication:

- No NH4+ ammonium ions in the water, they are very detrimental for copper <10mg/l.
- Cl- Chloride ions are detrimental for copper with a risk of perforations by corrosion by puncture. < 10 mg/l.
- SO42- sulphate ions may cause perforating corrosion.< 30 mg/l.
- No fluoride ions (<0.1 mg/l).
- No Fe2+ and Fe3+ ions with dissolved oxygen. Dissolved iron < 5 mg/l with dissolved oxygen < 5 mg/l. Over those values, it means a corrosion of steel which may generate a corrosion of copper parts under deposite of Fe – this is mainly the case with shell and tube heat exchangers.
- Dissolved silicon: silicon is an acid element of water and can also lead to corrosion risks. Content < 1mg/l.
- Water hardness: TH > 2.8 K. Values between 10 and 25 can be recommended. This will facilitate scale deposit that can limit corrosion of copper. TH values that are too high can cause piping blockage over time.
- TAC < 100.
- Dissolved oxygen: Any sudden change in water oxygenation conditions must be avoided. It is as detrimental to deoxygenate the water by mixing it with inert gas as it is to over-oxygenate it by mixing it with pure oxygen. The disturbance of the oxygenation conditions encourages destabilisation of copper hydroxides and enlargement of particles.
- Specific resistance - Electric conductivity: The higher the specific resistance, the slower the corrosion tendency. Values above 3000 Ohm/cm are desirable. A neutral environment favours maximum specific resistance values. For electric conductivity values in the order of 200-6000 S/cm can be recommended.
- pH (hydrogen potential): neutral pH at 20°C, according to the values in the glycol safety data sheet.

If it is necessary to empty the water circuit for a period of more than one month, the entire circuit must be placed under a nitrogen charge, to avoid any risk of differential aeration corrosion.

4.3.- Antifreeze protection

4.3.1.- Use glycol / water solution

IMPORTANT

FREEZING OF A HEAT EXCHANGER DUE TO COLD WEATHER CONDITIONS IS NOT COVERED BY LFB GROUP WARRANTY.

If the outside temperature in the area where the ECOMFORT THERMA unit is to be installed is likely to drop below 5°C, it is very important to take the following precautions to avoid that water in the circuit freezing, that may produce damage to the components.
If unit has to work under low outside temperatures:

- Do not disconnect power supply in order that water pump starts when detects water temperature below +5°C (only with hydraulic module).
- If the outside temperature where the system is to be installed or the water outlet temperature is likely to drop below 5°C, it is very important to use glycol anti-freeze.
- The amount of anti freeze required will vary depending on the minimum ambient temperature or the water outlet temperature.
- When the percentage of glycol increases, the standard pump flow decreases, the pressure drop increases and the cooling and thermal capacities drop. As a result the minimum flow must be multiplied by the coefficient shown in the table below.
- It is also advisable to use the option «Evaporator anti freeze protection».
- Long term stoppage period: It is recommended to drain the water loop and maintain it under dry nitrogen pressure to avoid corrosion.

Minimum ambient temperature or water outlet temperature	% glycol	Pressure drop	Water flow	Absorbed power	Capacities	
					Cooling	Heating
+5ºC -> 0ºC	10%	1,05	1,02	0,997	0,995	0,994
0ºC -> -5ºC	20%	1,10	1,05	0,996	0,985	0,993
-5ºC -> -10ºC	30%	1,15	1,08	0,995	0,975	0,990
-10ºC -> -15ºC	35%	1,18	1,10	0,994	0,965	0,987

Example: 20% glycol instead of water -->: water flow x 1,05; Pressure drop x 1,1; Cooling capacity x 0,98

4.3.2.- Drain the installation

It is important to make sure that manual or automatic air bleeders are installed at all the high points of the water circuit. To enable drainage of the circuit, make sure that drain cocks are installed at all the low points of the circuit. To drain the circuit, the drain cocks must be opened and an air inlet ensured.
Note: Air bleeders are not designed to admit air.

Automatic air bleeder can release some refrigerant in the case of puncture in heat exchanger between refrigerant and water. Take into account possible ignition source when placing bleeder into water loop.

4.4.- Electrolytic corrosion

We would like to draw your attention to the problems of corrosion due to electrolytic corrosion caused by an imbalance between earthing points.

AN EXCHANGER THAT IS PUNCTURED BY ELECTROLYTIC CORROSION IS NOT COVERED BY THE UNIT WARRANTY.

4.5.- Minimum water capacity

The minimum volume of the chilled water circuit must be calculated with the formula here under. If necessary, install a buffer tank. Proper operation of regulating and safety devices can only be ensured if the volume of water is sufficient. The theoretical volume of the water loop for a proper air conditioning operation can be calculated using the formula hereafter:

$$V_t = \frac{(Q \times N) \times T_{min} \times 1000}{W_d \times C_p \times D_t}$$

Vt → Minimum water content of the installation.
Q → Heat pump cooling capacity in kW.
Tmin → Minimum working time (180s).
Wd → Water density (1000kg/m^3).
Cp → Heat capacity of the water (4,18 kJ/kg.°C).
N → Minimum capacity step.
Dt → Maximum acceptable temperature deviation.

The water volume is a value which allows the chilled water temperature to be maintained and avoids the operating of the compressors from operating in short cycles.

The main factors which have influence on the stability of water temperature are:
- The number of capacity stages.
- The volume of the water circuit.
- The rotation of the compressors.
- The minimum time between two starts of a compressor.
- Load fluctuation.
- The dead band, which must be adjusted through the controller.

For comfort applications (standard units), water temperature fluctuation may be allowed at part load. The value which must be considered is the minimum operating time of the compressor.
To avoid lubrication problems in the compressor, it must run for a minimum time before stopping.

To estimate the biggest step, it is recommended to select at a lower ambient temperature, where efficiency is higher and compressors have bigger steps.

For process applications (units with the low temperature option: glycol), operating limitations may exist with a single compressor. These applications need great water volume to minimize water temperature fluctuation at part load.

STANDARD UNITS GHS							
Size	Nominal cooling capacity	Nominal heating capacity	Minimum capacity step		Minimum water content of the installation		
	kW	kW	COMFORT	PROCESS	Maximum temperature desviation of 6ºC	Maximum temperature desviation of 4ºC	Maximum temperature desviation of 2ºC
			%				
Standard compresor							
220	201	217	21%		303	454	909
250	238	252	25%		427	641	1281
280	256	273	23%	27%	423	634	1268
320	288	314	20%		413	620	1240
360	328	354	18%		424	636	1271
370	337	365	17%		411	617	1234
380	352	381	16%	20%	404	606	1213
410	385	412	15%	30%	414	622	1243
450	423	452	17%	33%	516	774	1548
500	455	484	25%		816	1225	2449

4.6.- ECOMFORT THERMA range with expansion vessel in hydraulic module - maximum water content

The maximum water content of the installation is determined by the capacity of the expansion vessel.
On units fitted with an optional expansion vessel it is possible to determine the maximum water content of the installation.

ECOMFORT THERMA unit range	Expansion vessel volume	Pressure in the expansion vessel	Maximum clear water volume (l)		Maximum glycol water volume (l)	
			Static pressure 5 m	Static pressure 10 m	Static pressure 5 m	Static pressure 10 m
GHS220-250-280 GHS320-360-370-380 GHS410-450-500	50 l	1,5 bar	5230 l	4180 l	4020 l	3210 l

Pressure in the expansion vessel depends on the location of the installed unit compared to hydraulic system (with or without static pressure) and needs to be adjust. The value of 1.5 bar is given as an example.
Installer is responsible for adjusting the pressure before filling the hydraulic system.

4.7.- Flow switch

A flow switch must be installed on the evaporator water inlet or outlet, to enable detection of water flow through the heat exchanger before the unit is started up. This will protect the compressors against any eventual liquid slugging during the starting phase and prevent accidental ice formation in the evaporator, if the flow of water is interrupted.

Flow switches are available as standard on ECOMFORT THERMA units. The normally open contact of the flow switch is connected to the terminals provided to that effect in the unit electrical box. (See the wiring diagram supplied with the unit). The normally closed contact can be used as an indication of a lack of flow condition.
Warranty is void if a flow detection device is not fitted and connected to the unit's control panel.

PADDLE FLOW SWITCH
A paddle flow switch is implemented in standard in the ECOMFORT THERMA units.

4.8.- Buffer tank option

Buffer tank filling process is a specific process at commissioning. Heaters or compressors must not work during this process.

5.- ELECTRICAL CONNECTIONS

Ensure power supplies to the unit matches the nameplate values and wire are properly size to handle start up and running currents. Check tightness of all electrical connections. A mains isolator switch must be installed between the incoming power supply and the unit to enable total isolation of the latter when necessary. Heat pumps are supplied with a mains isolator switch.

Unit working with slightly flammable refrigerant. Before powering the unit, realize a refrigerant detection with a dedicated device in order to ensure no possible presence around the unit.

WARNING
Wiring must conform to applicable regulations. The type and location of fused isolators must also conform to regulations. For the sake of safety, install them where they can be seen and in easy reach of the unit. Units must have full earthing continuity.

IMPORTANT
Operation of a unit with the wrong power supply or with excessive phase unbalance constitutes abuse and is not covered by the LFB GROUP warranty. If phase unbalance exceeds 2% for voltage and 1% for current, contact your local electricity company immediately before powering up the unit.
Be also careful with power factor correction. Central excessive correction (>0.95) may generate transitory phenomena which could damage motors and contactors during starts and stops. Check the instantaneous voltage during those sequences. In case of doubt, contact LFB GROUP technical support for any power factor correction.

The main electrical box supply connection is designed with a removable plate to give an easy access to connection point on the main switch.
This plate is an important part of the safety protection against fire risk with A2L refrigerant. You must use it by installing appropriate cable gland on it and place it back to ensure the right tightness of the electrical box.

The tightness of electrical box is compulsory for the safety of the electrical box. Before to start the unit, check following points:
- **Door gaskets are in place with no sign of disassembling.**
- **All holes on the back of electrical panel for cable rooting are used or closed.**
- **All cables and harnesses are fitted with appropriate cable gland and connector.**

INSTALLATION

Recommended cable selection

The sizing of the power cables is the responsibility of the installer. It must be done in accordance with the electrical values of each unit (noted at the time of ordering and on the electric diagram) and according to the regulations of each site.

The table below is given as an indication and does not engage the responsibility of LFB GROUP.
Once the selection is made, the installer must make the adaptations if necessary.
The connections on the main switch of the unit are to be realized with lugs or bars. In case of use of aluminum wires, the customer must use bi-metal terminals.
The table below gives the dimensions of the fixing points on the main switch with the hole diameter and center distance.
The below chart gives the number and size for customer power cable end sections for each machine.

Calculations have been made using the maximum possible current on each unit (see table of electrical characteristics).In the accessories study, the following standardized installation methods, according to IEC 60364 table 52C, were retained:
- No. 13: Suspended overhead lines.
- No. 61: Buried conduit with land transfer coefficient of 20ºC.

The study took into account cables with PVC or XLPE insulation and copper or aluminum core at maximum temperature of 55°C.
The cable length mentioned limits the voltage drop < to 5%.

Before connecting the electric power cables (L1 - L2 - L3), it is imperative to check the correct order of the 3 phases before connecting to the main disconnect switch.
Use proper wire terminal material that is compatible to the type of wire (Copper or Aluminum) being used.
Use proper procedures and coatings when using aluminum wires to avoid galvanic corrosion which may lead to a short circuit event.

The currents considered are given for a machine equipped with a hydraulic kit operating at maximum current.

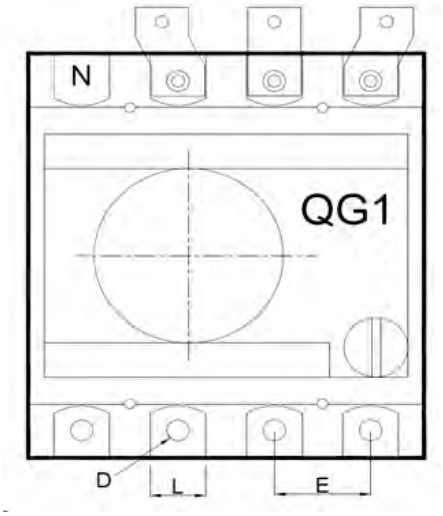
		temp.: 55ºC	temp.: 20ºC	temp.: 55ºC	temp.: 20ºC	temp.: 55ºC	temp.: 20ºC	temp.: 55ºC	temp.: 20ºC
GHS	**I nominal for basic unit with HP water single pump**	**1 cable per phase HO7RNF-F TITANEX PREMIUMCOPPER**		**2 cables per phase HO7RNF-F TITANEX PREMIUMCOPPER**		**1 cableper phase U-1000 AR2V - XLPE ALUMINIUM**		**2 cables per phase U-1000 AR2V - XLPE ALUMINIUM**	
220	169,41 A	4G70	4G70	2x 25mm²	2x 35mm²	4G95	4G95	2x 35mm²	2x 50mm²
250	191,89 A	4G70	4G70	2x 35mm²	2x 35mm²	4G120	4G95	2x 50mm²	2x 70mm²
280	212,97 A	4G95	4G95	2x 35mm²	2x 50mm²	4G150	4G120	2x 70mm²	2x 70mm²
320	232,45 A	4G95	4G95	2x 50mm²	2x 50mm²	4G150	4G150	2x 70mm²	2x 95mm²
360	271,27 A	4G150	4G120	2x 50mm²	2x 70mm²	4G185	4G185	2x 70mm²	2x 95mm²
370	280,01 A	4G150	4G120	2x 50mm²	2x 70mm²	4G240	4G240	2x 95mm²	2x 120mm²
380	291,09 A	4G150	4G120	2x 50mm²	2x 70mm²	4G240	4G240	2x 95mm²	2x 120mm²
410	308,23 A	4G150	4G150	2x 70mm²	2x 95mm²	4G240	4G240	2x 95mm²	2x 120mm²
450	350,15 A	N/A	N/A	2x 70mm²	2x 95mm²	N/A	N/A	2x 120mm²	2x 150mm²
500	375,31 A	N/A	N/A	2x 95mm²	2x 120mm²	N/A	N/A	2x 120mm²	2x 185mm²

According to CEI 60364 table 52C - Based on EASYCAL software from Nexans:
- Temp. 55°C: Perforated cable tray (ref: 13).
- Temp. 20°C: Buried in ducts or sleeves (ref: 61).

Main switch pad dimension

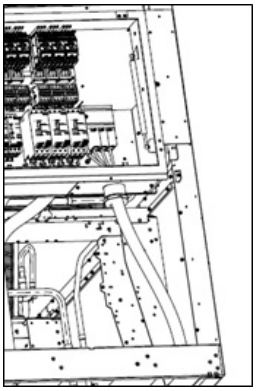
Products	L Pad with (mm)	E Distance (mm)	D Hole (mm)
160A - 250A	25	35	8
320A - 630A	32	45	10

SCHNEIDER

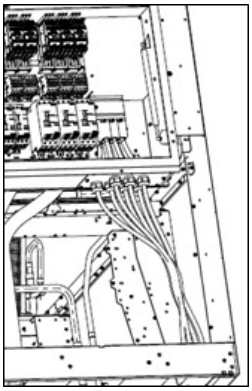


Main supply cable rooting to main switch

Example of unit power supply rooting with one cable 4G 150mm².



Example of power supply rooting with 2x 70mm² wire per phase.



Customer protection information

In order to protect our unit, LFB GROUP recommends the implementation of this type of protection upstream. There are two options available, either circuit breaker protection or fuse protection.

When protecting by circuit breaker, the customer must take into consideration the “Ipeak Max.” admissible by our switch (see table below).

Protection by circuit breaker			
Main switch set in the unit			Customer protection requested
Supplier	Reference	Ipeak max.	Reference
SCHNEIDER	INS - 200A	30kA	XT4S 250 Ekip LS/I 250A
	INS - 250A	30kA	
	INS - 320A	50kA	T5S 400 PR221DS-LS/I 400A
	INS - 400A	50kA	
	INS - 500A	50kA	T5S 630 PR221DS-LS/I 630A
	INS - 630A	50kA	

Protection by Fuses			
Main switch set in the unit		Customer protection requested	
Supplier	Reference	Fuses gG	Fuses aM
SCHNEIDER	INS - 200A	315A	315A
	INS - 250A		
	INS - 320A	500A	450A
	INS - 400A		
	INS - 500A		
	INS - 630A	800A	1000A

The customer must provide the necessary equipment in his installation to protect the power line that supplies the unit. A differential of 300mA is recommended.

If the unit is equipped with variable condenser fans or variable speed pumps or compressor, a type B differential is recommended.

Wiring of remote elements

- Avoid electromagnetic interference around the cables of remote elements.
- Do not run power or lighting cables and control cables in the same cable tray (minimum 50cm separation).
- Keep cables apart when they cross.
- The lengths given below are indicative and depend on the environment in which it is located:

REFERENCE	LENGTH MAX.	CONNECTION TYPE	CABLE TYPE
AD0	50m	Phone cable (RJ12)	Flat phone cable 0,25mm² (Shielded)
AD2	500m		Li-2YCY 1x2x0,5 ou Li-2YCY 1x2x0,34 (Shielded, twisted)
AD3	50m	Phone cable (RJ12)	Flat phone cable 0,25mm² (Shielded)
pLan, Bus	500m		Li-2YCY 1x2x0,5 ou Li-2YCY 1x2x0,34 (Shielded, twisted)
BS0, BH10, BH15	200m		Li-YCY 2x0,75 ou Li-YCY 2x1 (Shielded)

6.- SOUND LEVELS

Heat pumps can be a significant source of noise in refrigeration and air conditioning systems. Taking into account technical constraints in both design and manufacturing, sound levels cannot be significantly improved beyond the specified limits. Sound levels must therefore be accepted for what they are, and the area surrounding the heat pumps should be treated as necessary. The quality of installation may either improve or decrease initial sound characteristics: it may be necessary to provide further treatment such as sound-proofing or installation of screens around units installed externally.

The choice of the location for the installation may be of great importance: reflection, absorption, transmission of vibrations.

The type of unit support is also very important: inertia of the room and the structure of the surrounding walls, interfere with the installation and its behaviour.

Before taking any further steps, first determine whether the sound level is compatible with the environment, whether it is fully justifiable, and whether the proposed measures will not result in unreasonable costs.

Determine what level of sound proofing is necessary on the equipment, the installation (silencer, vibration isolators, and screens) and on the building (reinforcement of flooring, false ceilings, and wall coverings).

It may be necessary to consult an engineering firm that specializes in sound abatement.

After the unit has been installed in its final location and prior to start-up, check all bolts and fasteners for any loose connections. Critical components include the compressor bolts, outdoor fan bolts, BPHE (Brazed Plate Heat Exchanger), outdoor coil mounts, and water pumps.
Additionally, all electrical connections must be inspected to ensure they are properly secured.

PRELIMINARY CHECKS

IMPORTANT:
- **Start up and commissioning must be conducted by LFB GROUP authorised technician.**
- **Never switch off the crankcase heaters except for long service operations or seasonal shutdown.**

Check that all drain and purge plugs are in place and well tightened prior to fill the installation with water.

1.- LIMITS

Prior to any operation, please check the operation limits of the unit given in the «APPENDIX». These tables will give you all necessary information concerning the operating envelop of the unit.

2.- REFRIGERATION CIRCUIT CHECKS AND RECOMMENDATIONS

The unit refrigeration circuit sketch is given in the «APPENDIX» or supplied with the unit.

3.- HYDRAULIC SYSTEM INSTALLATION CHECKS

The unit hydraulic sketch is given in the «APPENDIX».

Components which are located inside the units or in a separate box and must be installed by a qualified technician.
Note: In case of plate heat exchangers it is mandatory that a filter is installed at exchanger unit entrance. These filters must remove all particles with a diameter greater than 1mm.

4.- CHECK LIST BEFORE START-UP

4.1.- Check list of standard unit

Check that all drain and purge plugs are in place and properly tightened before filling the system with water or brine. Before proceeding with start-up (even for a short test) verify the following points, ensuring that all valves in the refrigeration circuit (discharge and liquid valves) are fully open.

Starting up a compressor with the discharge valve closed will either trip the HP safety switch, or blow the cylinder head gasket or the internal pressure safety disc.

1. Ensure that the liquid pump(s) and any other equipment interlocked with the unit (such as coils, air handling units, dry coolers, cooling towers, and terminal units like fan coil units) are functioning properly, in accordance with the system design and their specific operational requirements. Set all water and refrigerant valves to their correct operating positions and start the water circulation pumps. Before performing any work, make sure the main power supply is isolated. Also ensure that the unit is properly earthed and that earth continuity is correctly established. Verify that all anti-vibration mountings are properly installed and adjusted.

2. Check the cleanliness and the tightness of all electrical connections, both the connections made at the factory and the connections made on site. Also make sure that all temperature probes are correctly attached or tightened in their wells, if necessary add heat conducting paste to improve contact. Make sure all sensors are correctly fitted.
   The technical data printed at the top of the wiring diagram should correspond with those indicated on the unit nameplate.

PRELIMINARY CHECKS

3. Make sure that the power supplied to the unit corresponds to its operating voltage and that phase rotation corresponds to the direction of rotation of the compressors.

4. Ensure that the water circuits mentioned in 1 are completely filled with water or brine as the case may be; with the air bled out of all high points, including the evaporator ensuring they are perfectly clean and leak tight.

5. Reset all manually resetting safety devices (where necessary). Open power circuits to all components: compressors, fans, etc.

6. Power up the unit with the main disconnect switch. Visually check the oil level in the compressor crankcases (sight glasses). This level may vary from one compressor to another, but should never be higher than the first third of the way up the sight glasses.

Power up the compressor crankcase heaters at least 24 hours before starting the unit. This will enable the refrigerant in the crankcases to evaporate off, and prevents damage to compressors through lack of lubrication during start up.
Check the good working by touching the compressor shell close to the crankcase heater.

7. Start the pump(s) check the flow of liquid to be cooled through the heat exchangers: note the inlet and outlet water pressures, and, using the pressure drop curves, calculate liquid flow by applying the following formula:

Actual flow
$Q = Q1 \times \sqrt{(P2/P1)}$

Where:
P1 = pressure drop published by LFB GROUP for a liquid flow of Q1.
P2 = pressure drop measured on site.
Q1 = nominal flow.
Q = real flow.

Adjust the evaporator circuit water flows (via regulating valves, pump speed position, etc.) to the design conditions (LFB GROUP software) as close as possible..

8. Check the correct operation of the fans and that the protective grilles are in good condition. Make sure that rotation is in the right direction (if AC fans optional was requested).

9. Before making any electrical connections, check that insulation resistance between power supply connection terminals is in accordance with applicable regulations. Check the insulation of all electrical motors using a DC 500V megohmmeter, following the manufacturer's instructions.

Do not start any motor whose insulation resistance is lower than 2 megaohms.
Never start any motor while the system is under a vacuum.

5.- MASTER - SLAVE CONFIGURATION (2 UNITS OR MORE)

In case of two units or more that shall operate together, the controller allows several configurations: please consult the controller manual to enter the right parameters.

COMMISSIONING OF THE UNIT

1.- CHECKS DURING COMMISSIONING



Unit working with slightly flammable refrigerant. Before startup of the unit, conduct a refrigerant detection with a dedicated device in order to ensure the absence of refrigerant around the unit.



REMEMBER THAT THE COMPRESSOR IS A SCROLL TYPE COMPRESSOR.

Before starting the unit, the right rotation of the compressor should be checked, through a three phase protection. Scroll type compressors only compress in one direction of the rotation. Therefore, it is essential that the phase connection for scroll-type three-phase compressors is carried out correctly (the correct direction of rotation can be checked when the pressure on the suction side decreases and the pressure on the discharge side increases when the compressor is activated). If the connection is wrong, the rotation will be reversed causing a high noise level and a reduction in the amount of current consumed. The solution is to disconnect, switch the wires between two of the phases and connect the three again).

SE-B2 protection is included with the unit compressors: This device protects the compressor against high motor temperatures. When the temperature reaches critical values, protection opens a safety dry contact of the circuit and cuts power supply to compressor.

Before starting the unit, fill in the check list sheet of this manual and follow the instructions below to be sure that the unit is correctly installed and ready to operate.

- This work must only be carried out by LFB GROUP personnel or technical partners trained and authorized by LFB GROUP.
- Don’t forget to open the insulation valve on the suction line before starting the unit (Ball valve on the frigorific circuit schematics).
- Check installation respects safety requirements, according to applicable regulations.
- Minimum clearance around the unit, according the installation drawings.
- Check that glycol is used when required by the application.
- Check the unit is properly grounded.
- Check that installation respects requirements in case of storm.
- Thermometers and pressure switches installed in the chilled water circuit.
  Check these safety devices in this order: high pressure switch.
- Run evaporator pump prior to start the heat pump.
- Flow switch installed and wired into the control box operates properly.
- Check that there is sufficient cooling load on the day the start up is conducted (at least 50 % of the nominal load).

COMMISSIONING OF THE UNIT

PROCEDURE TO FOLLOW WHEN STARTING THE UNIT:

- Check immediately the proper rotation of the compressor. Evaporating pressure drops steadily, the evaporator empties itself of the liquid refrigerant accumulated in it during storage.
- Check in the sight glass (upstream of the expansion valve if available) that the bubbles disappear progressively, indicating a correct refrigerant charge and without non condensable gas. If the humidity indicator changes colour, indicating the presence of humidity, replace the filter-drier cartridge if the latter is of the replaceable type.
- Check the subcooling after the condenser.
- Check that, when the cooling load has been balanced by the capacity of the unit, the chilled liquid is at design temperature.
- Check the current values per phase on each compressor motor.
- Check the current values per phase on each fan motor (If available).
- Check compressor discharge temperature.
- Check suction and discharge pressures and compressor suction and discharge temperatures.
- Check chilled liquid entering and leaving temperatures.
- Check condenser leaving air temperatures.
- Check liquid refrigerant temperature at the condenser outlet.

These verifications should be made as quickly as possible with a stable cooling load, i.e. the cooling load of the installation should be the same as the capacity developed by the unit. Measurements taken without heeding this condition will result in off-design operating values.

These verifications may only be made once the proper operation of all safety devices and unit controls has been established.

COMMISSIONING OF THE UNIT

2.- WATER FLOW CHECKS

The unit control system displays the inlet and water outlet temperature. It is very important that the unit operates at the correct water flow rate. Unit operating at a low flow rate may damage critical components such as the water exchanger (on the evaporator side, the flow switch will stop the unit at too low water flows). If the unit operates at too high a flow rate, this will also hinder optimum performance. The second way of determining the operating flow rates is to measure the temperature difference between the water in and outlet at full or partial loads.

Nominal flows at design conditions and the Delta T at design conditions must be used. Now, during the commissioning, the ambient conditions will often be different from the ambient design conditions, and therefore, the cooling capacity (and the heat rejection) of the heat pump will be different from those at design conditions. Use the heat pump performance charts of the AGU to find the right ∆T on the evaporator (and condenser side). For a unit selected at design conditions, this will give the nominal delta T on the evaporator side (∆Ten), and the nominal flows (den). At ambient start-up conditions, the charts will give start-up flows on the evaporator side (desu). If the water flows are correct, for this start-up conditions, the delta T on the evaporator (∆Tesu) should be ∆Tesu= ∆Ten*desu/den.

Checking the water flow rate (it is vital to measure the thermal peak) (Standard unit)

For nominal and minimum water flow the difference between the inlet and water outlet temperature should be 5ºC (cooling and heating pump units in cooling cycle only) for an inlet temperature of 12°C, an outlet temperature of 7°C and an outside temperature of 35°C. If these conditions change, the unit capacity will also change and as a result for nominal flow the difference between the inlet and water outlet temperature will vary slightly from 5ºC as can be seen in the following table, based on nominal flow rate.

	∆T (Water inlet temperature - Water outlet temperature)						
	Outside temperature (ºC)						
Water outlet (ºC)	**15**	**20**	**25**	**30**	**35**	**40**	**45**
7	6,1	5,8	5,5	5,3	5,0	4,7	4,4
9	6,5	6,2	5,9	5,6	5,3	5,0	4,7
11	7,0	6,7	6,4	6,0	5,7	5,4	5,0

If the unit must be started in the heating cycle and it is required to operate at nominal cooling rate, the following shows the approximate differences between the inlet and water outlet temperatures for the various conditions.

	∆T (Water inlet temperature - Water outlet temperature)				
	Outside Temperature (ºC BH)				
Water outlet (ºC)	**-6**	**0**	**6**	**12**	**18**
35	4,5	5,5	6,5	7,5	8,5
50	4	5	6	7	8

COMMISSIONING OF THE UNIT

NOTES:

- The unit control system displays the inlet and water outlet temperature.
- Check that the correct water pump has been selected, taking into account the loss of pressure in the hydraulic system. It is dangerous to let the unit run at a low rate and any faults which may result will not be covered under warranty.
- Do not start up the air conditioning units or the fan coils until the water temperature reaches the set temperature or use an automatic control device which cancels the air conditioning unit operation if the installation is not properly set.
- When everything is operating normally, take a reading of all the data and **fill out the Commissioning Sheet.**

3.- FUNCTIONS AND MAIN REFRIGERANT COMPONENTS

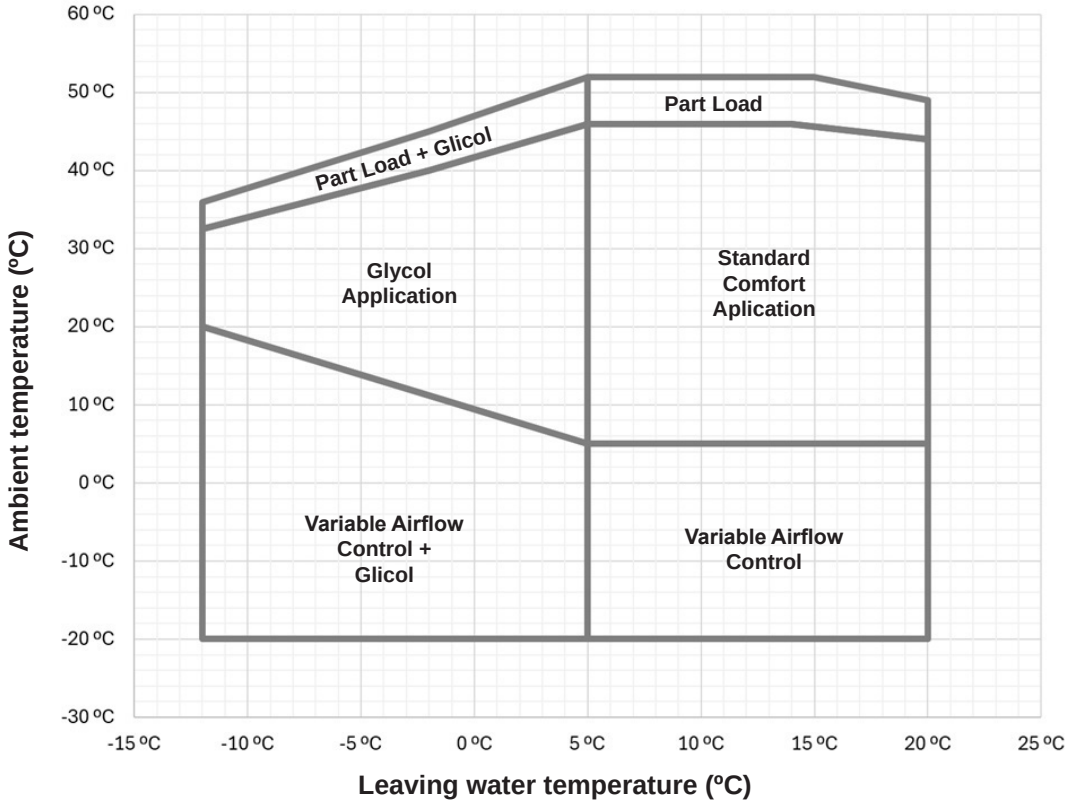
1. Compressor (scroll type): A compressor is a device driven by a motor to bring a refrigerant gas from a low pressure, low temperature phase to a high pressure, high temperature phase.
2. Evaporator (brazed plate type): A heat exchanger in which on one side the refrigerant evaporates, thus extracting heat from the water or brine on the other side.
3. Condenser (tubes and fins): A heat exchanger in which on one side the refrigerant condensates, thus releasing heat on the air cooled other side.
4. Electronic Expansion Valve : A device that regulates the refrigerant flow to the evaporator.
   Very important:
   The expansion valve fitted on each circuit of the unit has been selected for a given operating range; it must be replaced with a model with the same reference from the same manufacturer.
5. High pressure switch: This pressure switch initiates unconditional stoppage of the unit if compressor discharge pressure exceeds the operating limits. Reset is manual.
6. Pressure relief valve: Device for limiting damages in the event of external fire.
7. Filter dryer: This is designed to keep the circuit clean and to remove all traces of humidity from within the refrigeration circuit, since this may impair operation of the unit, by acidification of the oil, which causes slow disintegration of the varnish protecting of the compressor motor windings.
8. Crankcase heater: Every compressor is fitted with a single phase crankcase heater that is activated when the compressor stops to ensure separation of the refrigerant and the compressor oil. It is therefore powered up when the compressor is not running.

OPERATION

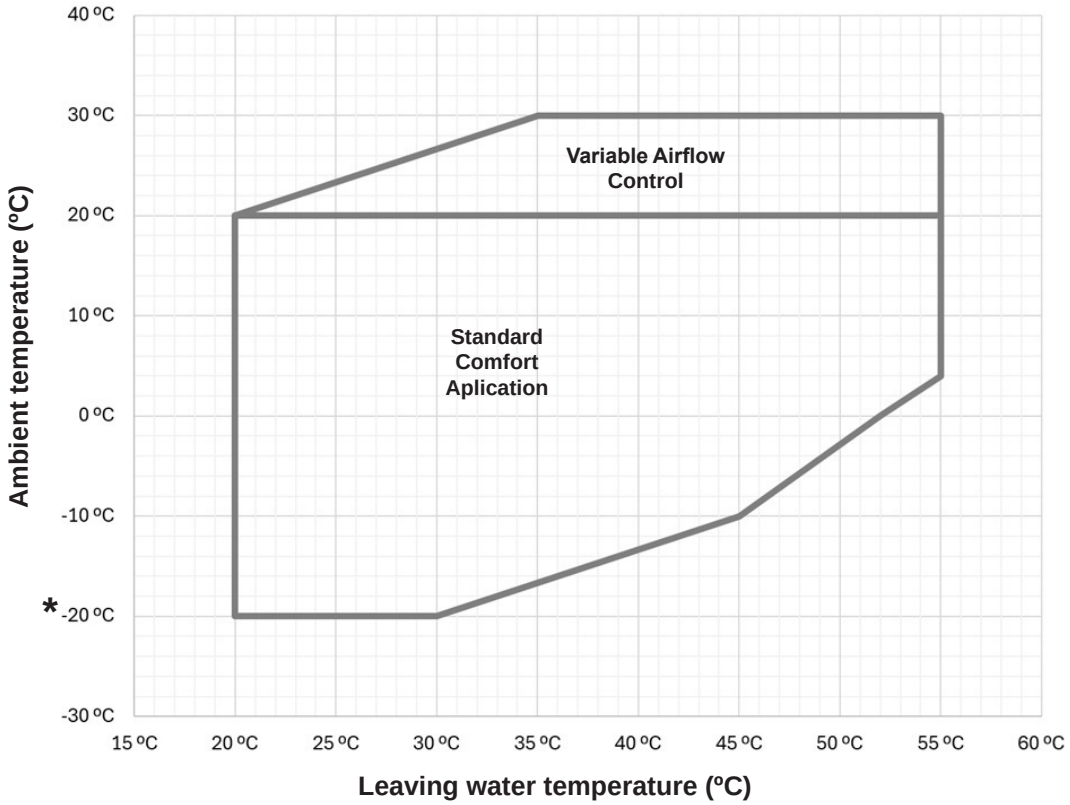
1.- OPERATING LIMITS

WARNING:
It is very important to ensure that the units operate well inside these envelopes.

1.1.- Operating limits GHS - Cooling mode



1.2.- Operating limits GHS - Heating mode



*** This limit only possible with heat exchanger clean and with unloading compressors. Restriction for maximum leaving water temperature. Recommended electrical heaters in the tank when it is possible.**

2.- UNIT OPERATION: REFRIGERATION CIRCUIT

2.1.- Tandem and Trios scroll assemblies

Compressor are generally fitted with sight glass to check oil level in the compressor assembly. In case of oil equlazing line, a sight glass is fitted on equalizing line. It is mandatory to stop both compressors to get a good reading of the oil level in the crankcase of the compressors.

- There can be three types of assemblies:
- EVEN TANDEM when both compressors are the same models.
- UNEVEN TANDEM when compressors are different models.
- TRIO with three compressors of the same models.

Contact LFB GROUP after sales offices for additional informations.

2.2.- Oil charge

All units are delivered with a complete oil charge, and there is no need to add any oil before start up or afterwards. When a compressor is replaced, it may be necessary to add a certain amount of oil. Oil level must be between one third and two third of the sight glass of compressor when unit is idle for 30 min. Overcharging with oil can cause serious problems on an installation, particularly for the compressors.

OIL RECOMENDATION FOR ECOMFORT THERMA			
Refrigerant	**Compressor type**	**Brand**	**Oil type**
R32	Scroll	Danfoss	POE lubricant 185 SL

2.3.- Antifreeze function

Whatever type of device is used (see case 1 and 2), cut-out by the antifreeze function causes immediate unit stoppage.

CASE 1: Antifreeze temperature.
The control monitor chilled liquid temperature at the evaporator outlet. It triggers when the temperature goes below the minimum value (+3°C for pure water)..

CASE 2: Antifreeze pressure transducer:
This monitors evaporating pressure of the refrigerant. It triggers when the temperature goes below the preset minimum value.

Note: See the «CLIMATIC» user manual for more specific details.

3.- UNIT OPERATION: ELECTRICAL AND CONTROL FEATURES

See the specific «Basic CLIMATIC controller» manual.

1. Fan over current protection:
Circuit breaker designed to stop the fan motors in the event of phase over current in relation to the permitted value.

2. Compressor motor over current protection:
Circuit breaker designed to protect each motor winding against accidental over current.

3. Chilled liquid pump interlock:
This interlock is only available if the the pump is supplied with the heat pump. As soon as the unit is powered up and the remote on / off for the unit is validated, the pump starts running. Prior operation of the pumps is mandatory for compressor operation.
Note: on units with «CLIMATIC» control, control of 1 or 2 water pumps is catered for by the control program.

4. Flow switch for the chilled liquid:
This control device initiates unconditional unit stoppage as soon as the flow of chilled liquid (water, brine, etc...) ensured by the pump becomes insufficient, since this could cause rapid evaporator freeze up. When the contact opens due to a lack of flow the unit must stop immediately.
If the purchaser installs a flow switch himself, electrical connections should be made to the two remote interlock terminals (dry contact).

5. Antifreeze protection (standard):
This feature is provided as standard by the climatic controller: and can be adjusted for brine or glycol/water chilling for which the freezing temperature depends on the concentration of the solution.
The antifreeze protection causes an immediate shut down of the unit.
The controller monitors the chilled water outlet temperature. It then triggers the fault if the temperature goes below the set point value (+3°C for water).

6. Loss of power supply:
There are no problems restarting the machine after a loss of power supply of short duration (up to about one hour). If loss of power supply lasts longer than this, when power supply is resumed set the unit to «OFF» with the compressor crankcase heaters activated for as long as it takes to bring sump oil back up to temperature, then restart the unit.

4.- CLIMATIC CONTROL

See the specific «Basic CLIMATIC controller» manual.

MAINTENANCE

1.- MAINTENANCE SCHEDULE



Unit working with slightly flammable refrigerant.
Before, during and after any intervention on the unit, we recommend use an explosimeter in order to ensure no possible presence of refrigerant around the unit.



During the life-time of the system, inspection and tests must be carried out in accordance with national regulations. The information on operating inspections given in annex D of standard EN378-4 may be used if no similar criteria exist in the national regulations.
With regard to pressure relief valves, the manufacturer's instructions take precedence over the standard and state that: an external visual inspection is required at around 36 months to check the condition of the valve and extend its average service life by a similar period until the next inspection.

We recommend regular and thorough maintenance of the unit. The following maintenance instructions are part of the operations required for this type of equipment.

However, it is not possible to give fixed and precise schedule for permanent maintenance procedures capable of keeping all units in perfect operating condition since too many factors depending on local conditions specific to the installation, the way the machine is operated, the frequency of operation, climatic conditions, atmospheric pollution, etc. Only trained experienced personnel may establish strict maintenance procedures adapted to the conditions listed above.

Nonetheless, we recommend a regular maintenance schedule:
- 4 times a year for heat pumps operating all year long.
- 2 times a year for heat pumps operating only the cool season.

All operations must be performed in conformity with the maintenance plan; this will extend the service life of the unit and reduce the number of serious and costly breakdowns.

It is essential to keep a «service log», for weekly records of operating conditions of the machine. This log will serve as an excellent diagnostic tool for maintenance personnel ; likewise, the machine operator, by noting down changes in machine operating conditions, will often be able to anticipate and avoid problems before they actually occur or worsen.

The manufacturer cannot be held responsible for any malfunctioning of any equipment it provides if it is caused by a lack of maintenance or by operating conditions beyond those recommended in this manual.

For service and maintenance work, the operator must recover the refrigerant in order to depressurize the refrigerant circuit before carrying out the work.

It is therefore advisable to ask your dealer about maintenance contracts. Local legislation must be respected.

When carrying out maintenance work on these units, correctly separate the non-hazardous waste that is generated - insulation, air filters, plastic or metal elements, packaging, etc. - from the waste considered dangerous: oil filters and oil-impregnated rags, welding elements such as filler material, strippers, electrical and electronic waste, batteries, lamps, etc. They must be treated by an authorized company.

The refrigerant gas may be reused or collected in a bottle to be treated as hazardous waste by an authorized company.

Symbols and legends:

● Operation which can be carried out by on-site maintenance technicians.

▌Operation which must be carried out by qualified refrigeration personnel, trained to operate on this type of equipment.

MAINTENANCE

N°	MAINTENANCE PLAN		Monthly	Quarterly	Half Yearly
	Task	Operating mode			
1	Inspection of the coils aluminium / copper connexions for corrosion.	Proper care to be given when cleaning the coils. If corrosion is detected, a preventive treatment needs to be done following our recommendations.	I		
2	Cleanning the coils (In accordance with local regulations).	It is mandatory to clean the external coils, according to the environment where the unit is located, the frequency of the cleaning varies from once in a month to minimum twice in a year. The performance and the sustainability of the machine is based on the perfect heat exchange.The use of a neutral pH cleaning product is mandatory. (WARNING: Fins and copper tubes are very fragile. Any damage will reduce the performances of the unit).	I	I	I
3	Inspection of compressor's electrical current.	Check the electrical current of each compressor on the 3 phases of partial load and at 100% - with a certain frequency, according to the utilization of the machine. Example: **Monthly:** If the unit is used all over the year. **Half Year:** If seasonal use.	I	I	I
4	Electrical cabinets air-filters cleanning.	It is mandatory to clean the filters at least once a month according to environment where the unit is located to avoid overheating the electrical components. Check the filter fouling rate, clean or replace it when needed by an original filter.	•	•	•
5	Inspection of the condensors fans.	Check the rotation of the fan (free rotation, detection of vibrations or bearing noises). Check for the Amps consumed on all three phases; compare it with the nominal value given in the electrical wiring diagram. Check the status of the fan blades and its protections.		I	
6	Visual inspection of the oil level and check the oil for traces of acidity in the refrigerant circuits.	Visually check the oil level through the sight glass on the side of the compressor casing. Test the oil every 3 years and/or after each intervention on the refrigerant circuit.		I	
7	Check the 4-way valve.	During cooling mode, reverse to Heat Pump mode. Reset the control.		I	
8	Check the position of the crankcase heaters (around the compressor) and it's proper functioning.	Ensure crankcase heaters is well fitted and secured.Verify the operation of the crankcase heaters.		I	
9	Verification of the defrost cycle with 4-way valve inversion.	Switch the unit to heat pump mode. Change the set point to obtain the standard defrost mode and reduce the cycle time to the min value. Check the operation of the defrost cycle.		I	
10	If possible, check for water pressure in the circuit.	Check the water pressure in the circuit and the efficiency of the expansion vessels.		•	
11	Check overall working of the flow controller.	Cut-off the compressors, stop the water circulation. Then start the unit and wait for the water flow fault signal in the controller.		I	
12	Check the circulation pumps.	Check the absorbed electrical power and the correct rotation of the pumps. Check if there is no leakage of water at pump seal and if needed follow the manufacturer maintenance plan.		I	

MAINTENANCE

N°	MAINTENANCE PLAN		Monthly	Quarterly	Half Yearly
	Task	Operating mode			
13	Check water flow.	Measure the water flow rate and compare to the selected value from the technical datasheet.		I	
14	Inspection and cleanning the water filter.	ATTENTION: The water circuit may be under pressure. Follow the usual precautions when depressurizing the circuit before opening. Ignoring these rules may lead to accidents and cause injury to the personal.		I	
15	Check for water leakage in the unit and it's accessories.	Verify the gaskets, if cracked or ripped, repair them or replace them. Check for water leaks and repair if it's needed.			I
16	Check CLIMATIC™ control, set-points and variables.	Refer to the commissioning sheet; Check all set points are set according to this document.			I
17	Check refrigeration system for proper functioning (Thermal expansion valve).	Retrieve/Check the values for superheating and subcooling. Resume the expansion valve settings when needed, verify the behavior in partial loads and at 100%. Resume settings to obtain superheat between 5K and 10K.			I
18	Check refrigeration system for proper functioning (Electronic expansion valve).	Retrieve/Check the values of the pressure and temperature sensors. Check also for the good behavior of the expansion valve (Open/closed) in full load and partial load conditions. The superheat must be between 5K an 8K.			I
19	Check the position and tightness of refrigeration components.	Check systematically all connections and fittings on the refrigeration circuit. Check for oil traces, eventually a leak test should be conducted. Check operating pressures correspond to the ones indicated on the commissioning sheet.			I
20	Sight glass (when applicable).	The liquid refrigerant flow through the sight glass should be steady and without bubbles. Bubbles are a sign of a low charge, a possible leak, or of a restriction in the liquid line. Each sight glass is fitted with a humidity indicator. The color of the element changes according to the level of humidity in the refrigerant, but also according to temperature. It should indicate «dry refrigerant. If it shows «wet» or «CAUTION», contact a qualified refrigeration technician. **CAUTION:** when starting up the unit, run the compressor for at least 2 hours before taking a humidity reading. The humidity detector is also sensitive to temperature, and as a consequence, the system must be at normal operating temperature to give a meaningful reading.			I
21	Check antifreeze protection.	Test antifreeze function (leakage rate, frost protection thermostat).			I
22	Check refrigeration 3-way valve.	Check the proper functionning of the system.			I
23	Check tightness of all electrical connections.	Power down the unit and check and tighten all the screws, terminal and electric connections (including the terminal boxes). When turning on the unit, check for the deterioration of the electrical components with a thermal camera while the unit is working at 100% of its power.			I

MAINTENANCE

N°	MAINTENANCE PLAN		Monthly	Quarterly	Half Yearly
	Task	Operating mode			
24	Check HP / LP safety switches.	Install a pressure gauge high / low pressure and check if the safety switches work properly.			I
25	Check the position of all sensors.	Check the position and the fixation of all sensors.			•
26	Check anti-vibration mountings, for wear and tear.	Visually check anti-vibration mountings on compressors and centrifugal fan. If damaged, replace them.			•
27	Check glycol concentration in the water circuit.	Check the glycol concentration in the pressurized water circuit (a concentration of 30% gives a protection down to approx. -15°C). Check the circuit pressure.			I
28	Check casing and equipment corrosion.	To treat and neutralize rust spots.			•
29	Check the water pump.	When the unit is operated with glycol up to 20% and the water temperature below -5°C, even if you use a specific thermal protection for the pump, it is advisable to clean the body of the pump every 18 months in order to avoid leaks by crystallization. (see supplier catalogue).			I
30	Plate exchanger.	Verify the general insulation state, the tightness of the water connection and the freeze protection.			I
31	Check the expansion vessel (if applicable).	Measure the pressure under the different water modes (from +7°C to +45°C).			I
32	Check the software version.	Contact the manufacturer for updates.			I

MAINTENANCE

Safety reminder

Heat pumps are hermetically sealed and carry the CE mark. They are designed to contain slightly flammable A2 refrigerants. As such they are not considered as a source of release as defined by the ATEX 60079-10-1 directive in normal operation. In France, they are exempt from the measures described in § 3 of the CH35 of the regulation governing the safety of buildings open to the public (ERP).

A formalized periodic inspection of the product's hermeticity will guarantee the preservation of this high level of hermeticity. Nevertheless, in abnormal operating conditions, leaks may occur (poor maintenance, maintenance with opening of the refrigeration circuit). For these cases, prior to placing these products on the market, we carried out studies in accordance with standards EN IEC 60079-10-1 and EN 378. Thus, the unit installed according to our recommendations and well maintained does not generate an ATEX zone.

Moreover, the product is equipped with safety devices. (see § PROTECTION: SAFETY ACCESSORY / DAMAGE LIMITATION ACCESSORY).

Please maintain the detection system and the associated control chain according to EN 60079-29-1 , EN 61511 and EN 50495. In case of maintenance we recommend that the operators be equipped, switch off the power supply to the unit and do not approach any potential source of ignition without first checking the absence of a potentially flammable area due to an undetected leak.

The units are charged with R32, a slightly flammable refrigerant. In accordance with Directive 1999/92/EC, employer must conduct an Explosion Risk Assessment (ERA) and prepare an Explosion Protection Document (EPD) to reflect the presence of equipment containing slightly flammable gases on site and the implementation of appropriate staff training on safe handling practices and preventive measures.

2.- CLEANING THE CONDENSER

2.1.- Tube and fins air cooled condensers

Clean the coils either with a vacuum cleaner, cold water, compressed air, or with a soft brush (non metallic). For units installed in a corrosive atmosphere, coil cleaning should be part of the regular maintenance program. For such installation, all dust gathered on the coils should be quickly removed by regular cleaning.
Do not use high pressure cleaners that could cause permanent damage to the aluminium coil fins.

A LEAKAGE BY CORROSION DUE TO A LACK OF CONDENSER MAINTENANCE IS NOT COVERED BY UNIT WARRANTY.

MAINTENANCE

3.- COMPRESSORS / OIL DRAINAGE

Oil for refrigeration equipment is clear and transparent. It keeps its colour over a long period of operation.
Given that a correctly designed and installed refrigeration system will operate without any problems, there is no need to replace the compressor oil even after a very long period of operation.

Oil that has become dark in colour has been exposed to impurities in the refrigeration piping system or to excessive temperatures on the discharge side of the compressor, and this inevitably impairs the quality of the oil. Darkening of the colour of the oil or degradation of its qualities may also be caused by the presence of humidity in the system. When the oil has changed colour or has been degraded, it must be changed.

In this event, before putting the unit back into service, the compressor and the refrigeration circuit will have to be evacuated.

4.- CORRECTIVE MAINTENANCE

MAKE SURE THAT THE UNIT IS COMPLETELY DISCONNECTED FROM THE POWER SUPPLY BEFORE CARRYING OUT ANY TYPE OF WORK ON THE UNIT.

REMEMBER THAT ONLY TRAINED AND QUALIFIED PERSONNEL ARE AUTHORIZED TO OPERATE ON A REFRIGERATION CIRCUIT.

SAFETY MEASURES:

The following precautions, specific to this gas, must be taken when using the R32 refrigerant:

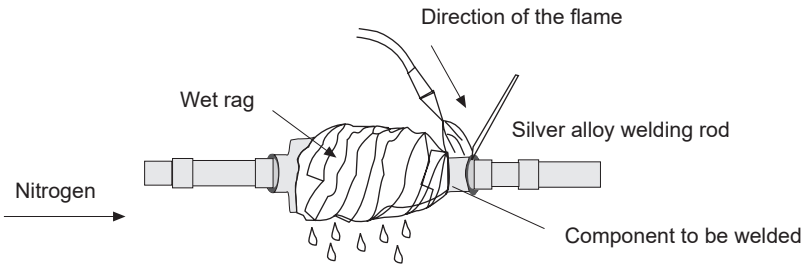
- Always use original replacement parts.
- The vacuum pump must be fitted with a non-return valve or a solenoid valve and suitable for R32 (A2L).
- The pressure control, draining and filling operations of the pressurized system must be carried out using the fittings specified for this purpose and the appropriate equipment.
- Use only pipe cutters and no torches to open the pipes.
- The load must be applied in the liquid phase.
- Always use a scale to charge the refrigerant.
- Use the leak detector suitable for R32 refrigerant.
- Do not use mineral oil, only synthetic oil for boring, expanding or making connections.
- Keep the pipes closed before using them and pay close attention to any traces of humidity and dirt (dust, filings, burrs,...).
- Brazing must always be carried out in a nitrogen atmosphere.
- The refrigerant bottle must contain at least 2% of the total amount.
- The brazing operation must be performed by suitable personnel, using qualified brazers in accordance with EN ISO 13585 and with qualified operating procedures according to EN 14276-1 and 2.
- Use silver alloy brazing rod.
- If a compressor must be replaced, disconnect it electrically and un-braze the suction and discharge lines. Remove the securing screws and replace the old compressor with the new one. Check that the new compressor has the correct oil charge, screw it to the base and connect the lines and electrical connections.
- Inspect the circuit to ensure that it is perfectly clean (filter-drier) and leak tight.

MAINTENANCE

WARNING:
The refrigerant must be removed from the circuit before cutting or removing any piping, using a transfer pump suitable for use with R32 (A2L).

We recommend the following protocol before any piping work:

- To avoid any risk of explosion due to the spraying of refrigerant liquid and oil, the circuit must be drained and display a relative pressure of zero during the disassembling or unbrazing of parts of the refrigerant circuit.
- Vacuum with A2L compatible equipment and recharge with dry nitrogen to allow the refrigerant dissolved in the oil to degas.
- Repeat these operations three times.
- Once the circuit has been drained, there is a residual risk of pressure build-up by degassing the oil or due to the heat from the exchangers. To keep the pressure at zero, the pipe connection must be evacuated from the low pressure side.



VACCUUM PROCEDURE:

- Connect the vacuum pump to the HP line and to the BP line.
- Draw vacuum (P=1 Pa). Break the vacuum with dry nitrogen. Draw vacuum again (P=1 Pa), the residual moisture content must be less than 50 ppm.
- Perform a vacuum test (15 minutes at maximum 70 Pa). Once this level of vacuum has been reached, keep the pump in operation for at least one hour. DO NOT USE THE COMPRESSOR AS A VACUUM PUMP. If the compressor runs in vacuum it will fail.

The compressors must be switched off during the vacuum test.

5.- UNIT INTERVENTION WORKS

Before performing any work on a unit using R32 refrigerant, the following recommendations must be followed:

- **Training and awareness:** Ensure that technical personnel are properly qualified and aware of the risks associated with the use of R32 refrigerant (Directive 1999/92/EC, National Labor Code).
- **Technical documentation:** Carefully read our technical manual before handling.
- **Securing the area:** Mark out the work area and install temporary signage throughout the work.
- **Electrical equipment:** Do not bring electrical equipment or sources of ignition into the work area.
- **Electrical isolation:** Switch off the unit and isolate the electrical connections before opening the circuit.
- **Safety reminder:** Trying to extinguish a gas flame may be dangerous. The first thing to do is to stop the flow of gas at source.
- **Specific equipment:** Prepare equipment and PPE's suitable for the unit refrigerant.
- **For the refrigerant charge:** Ensure adequate ventilation druing the operation.
- **Brazing:** A fire permit may be required. In most EU Member States, a fire permit or written risk assessment is required before carrying out hot-spot work, particularly in industrial zones.

  To ensure compliance, it is always advisable to check the current national regulations in each country.

  The following procedure must be followed to eliminate any risk of explosion during this operation:

1. Approved personnel in accordance with applicable regulations.
2. Equip themselves with suitable PPE in accordance with applicable regulations.
3. Mark out the work area and install temporary signs for the duration of the work.

- **Replacing a circuit component:** The following procedure must be followed to eliminate any risk of explosion during this operation.

1. Open the pressure reducer to circulate the nitrogen (low flow rate 5 to 10 l/min).
2. Braze under nitrogen flow (inerting) to prevent any ignition.
3. Pressurise the circuit with nitrogen to 1,1 x PS.

<u>NOTE:</u> If the test is not carryed out by LFB GROUP equipment, customer is responsible for training the personnel with LFB GROUP before working on the unit.

6.- REMOVAL / RECHARGE OF REFRIGERANT

If it is necessary to remove the refrigerant from the unit, the following recommendations should be followed:

- Open the expansion valve via the control system before switching off the power.
- Lock the unit.
- Earth the transfer cylinder.
- Ventilate the work area.
- Start recovery, keep the circuit under vacuum for 30 minutes.
- If the circuit is not leaktight, stop recovery at 0 bar and close the valves.
- Seal the circuit by alternating nitrogen pressure and vacuum.

In the event that the unit is received without R32 refrigerant charge and recharging is carried out, the following recommendations should be followed:

- Vacuum the installation.
- Ventilate the area.
- Load the unit to the specified weight.
- Check for leaks.
- Run the unit to start pumping down and empty the pressure gauges.
- Fill in the work sheet.

7.- REFRIGERANT EMISSION CONTROL

It is recommended to reduce refrigerant emissions to a minimum following the corresponding operation, maintenance and service procedures recommended by LFB GROUP:

- The refrigerant recycling procedure must be established before starting the intervention.
- The used refrigerant must always be recovered for its later reuse or recycling. The refrigerant should never be released into the atmosphere.
- Recycling equipment must guarantee the lowest possible vacuum while the refrigerant is recovered.
- It is advisable to use cleaning methods for the refrigerant circuit using filters and dryers. Solvents which are not environmentally friendly should never be used. The materials used during these processes must be recycled correctly.
- Storage containers which comply with current legislation should always be used. Also, current regulations must be applied during the transportation of these refrigerant containers.
- All equipment used for these procedures (gauges, hoses, vacuum pumps,...) must be maintained in perfect condition, following the established calibration periods.
- To improve the performance of the equipment and reduce energy consumption, it must be considered to perform adequate preventive maintenance periodically.
- It is advisable to check the manufacturer's recommendations from time to time to reduce refrigerant emissions and increase the efficiency of the units. These improvements of the units could be through conversion refrigerants and/or compatible parts which must follow specific guidelines.

8.- COMPRESSOR MAINTENANCE

Compressors replacement: Mechanical and/or electrical failures.

If in the unit happens a failure in the compressor, it is recommended to follow these procedures to replace it:

- To lift a compressor, you must always use the two lifting eyes which each compressor has. LFB GROUP recommends using lifting techniques approved in accordance with current applicable regulations to carry out this operation in complete safety.
- After a mechanical failure in a compressor, the oil must always be changed in all compressors corresponding to the set (TRIO / TANDEM) and it is recommended to replace the liquid line filter drier.
- After an electrical failure in a compressor, the oil must always be changed in all compressors corresponding to the set (TRIO / TANDEM), replace the liquid line filter drier and add a suction filter drier with clean-up cores.

A compressor should NEVER be lifted using a single lifting eye.
The refrigerant piping should NEVER be modified because this action could affect the lubrication of the compressor.

MAINTENANCE

Refrigerant piping:

To facilitate welding and avoid possible leaks in the refrigerant piping, the connections and compressor suction and discharge piping are made of copper.

During maintenance and service works, the refrigerant piping can be reused. In cases where they cannot be reused, it is recommended that the customer request these replacement parts from LFB GROUP technical service to avoid altering the configuration of the refrigerant piping and possible incorrect operation of the unit.

If it is necessary to cut the tubes of the refrigerant installation should be done using a tubing cutter and it is recommended to clean these areas using a suitable suction system to prevent copper shavings from entering the system.

The compressor suction line configuration should NEVER be modified.
Changing this configuration could cause a inadequate oil return to the compressors.

Refrigerant circuit opening time:

According to previously indicated in this manual, these units use POE oil, so it is recommended to minimize the exposure time of the refrigerant circuit, applying the following recommendations:

- The maximum opening time of the refrigerant circuit should never exceed one hour but depending on the environmental conditions this time should be reduced.
- It is recommended to evacuate the circuit to 500 microns or less.
- The compressor should always be re-sealed until it is installed again in the unit.
- Always keep POE oil containers closed to avoid exposure to the atmosphere.
- To minimize humidity absorption in the system, it is recommended to seal the refrigerant circuit and change the liquid line filter drier.

Compressor electrical connections:

For the rotation of the compressors used in these units to be correct, they must be perfectly wired, and their correct rotation must be verified using a rotation meter.
Although the reverse rotation of these compressors is not a terrible mistake for these models, it must be corrected as soon as possible because a negative impact on the bearings will be avoided.

The proper rotation of these compressors is following phases: L1 -L2 - L3. If these compressors are connected incorrectly, they carry out an excessive noise, do not pump and consume approximately half the normal current. If they stop operating for a long period of time, the compressors can become overheated.

When brazing works are carried out on the connections of the refrigerant circuit piping with the compressors, it is recommended to protect their electrical boxes.

To verify the correct rotation of a compressor you should never hit it, as incorrect rotation may cause motor failure within seconds.

Compressor crankcase heaters:

- It is necessary to heat the oil refrigerant before starting the compressors, the crankcase heaters must be energized at least eight hours before starting the unit.
- Due to the crankcase heaters must always be energized before starting the compressors, the ambient temperature is not considered an important factor to consider.

MAINTENANCE

Oil level:

To correctly verify the oil level, the compressors must be switch off and wait a few minutes before carrying out some reading operation. In TANDEM and/or TRIO compressor configurations, the oil level equalizes after switching off.

The oil level in the compressors should never be lower than the bottom of the sight glass or higher than the full sight glass. When these compressors are operating in a TANDEM and/or TRIO configuration, each compressor could have a different oil level. The oil level could be at the bottom of the sight glass but should always be visible.

Oil equalization line:

To facilitate the extraction of the oil equalization line, this piping is equipped with a rotolock connections. Before separating the oil equalization line from the compressors, oil must be drained to a level below the connector of this piping. This operation must be carried out in all compressors using the oil drain valve which each compressor has. Consider that if the oil drains below the level of the sight glass will be below the level of the oil equalization line. To drain the oil correctly, it is recommended to pressurize the low side of the compressor using nitrogen.

Oil filling, extraction and capacity:

To add or remove oil from compressors, it is recommended to use oil charging valves which have a dip tube that is extended to the bottom of each compressor.

To avoid that the humidity enters the refrigerant circuit when oil is added, this operation must be carried out following the manufacturer's guidelines, due to the POE oil used in these units easily absorbs and retains humidity. A vacuum pump can be used to remove the humidity from the oil, considering that is a difficult process. Also, it is recommended that once a POE oil container is opened, it must always be used.

In these units, only the oil specified by LFB GROUP in this manual should be used and under no circumstances should any other POE oil with similar characteristics be used.

WARNING: Oil should NEVER be reused once extracted from the compressors.

Suction restrictors for TANDEM and/or TRIO compressors:

Due to different size compressors are used in these units for TANDEM and/or TRIO configurations, these compressor combinations could require the use of a restrictor in the suction line of one or more compressors to avoid an imbalance in the oil level between the compressors when are in operation.

Oil tests:

If it is necessary, it is recommended to carry out an oil analysis in a laboratory specialized in oil analysis for these units. This analysis must provide a vision of the compressor and the refrigerant circuit conditions: presence of water, wear elements, viscosity, acidity, dielectric data,...

If once this analysis has been carried out, unacceptable wear conditions are shown, a change in the characteristics of the oil is evident, so its replacement is recommended to avoid further problems.

MAINTENANCE

9.- DISPOSAL OF EQUIPMENT

The shutdown of the equipment, the recovery of fluids (oil, refrigerant, water and its mixtures with glycols) must be carried out by qualified personnel in accordance with the recommendations of EN 378-4:2016+A1:2019.

All components of the refrigeration system, such as refrigerants, oil, coolants, filters, dehydrators and insulating materials shall be recovered, reused and/or disposed of properly (see EN 378-4:2016+A1:2019). No material may be disposed of in the environment.

WEEE DIRECTIVE:
The waste recovery sectors (e.g. eco-organizations,...) are in charge of collecting, cleaning up and recovering WEEE on the whole European market.



Legislation does not allow refrigerant gas emissions to the atmosphere, so the refrigerant have to be recycled to avoid being released to the atmosphere.

Those recycled refrigerants shall be processed afterwards by an authorized waste manager.
Those components derived from the recycling of the unit have to be managed by authorized waste manager or be left in local waste facilities according the local normative in each country.

It is the sole responsibility of the end user to ensure that all components, fluids and materials are disposed of in full compliance with applicable environmental and waste regulations.

10.- PRESSURE RELIEF VALVES

It is recommended to check pressure relief valves every 36 months according to the manufacturer's instructions. This operation is entrusted to qualified and trained personnel in compliance with the regulation in force in the country where the maintenance is performed.

LIFETIME OF THE EQUIPMENT

The refrigerating system is designed for a working life of at least 12 years if the safety and maintenance instructions are strictly respected. In particular, it is recommended not to carry out more than 25 circuits draining per year.

The equipment may be renewed in its lifespan of the periodic requalification certificate is validated by the expert (Authorized body or according to current local regulations).

At the end of the useful life of the units, please take into account the correct segregation of the waste generated. No Hazardous like: Painted metallic parts, plastic elements, copper pipes, batteries, exchangers, liquid receivers, water pumps, fans.. And Hazardous Materials such as batteries, electrical and electronic elements, compressors, dehydrating filters, valves or refrigerant gas, etc. to be managed with an authorized dealer.

TROUBLESHOOTING – REPAIRS

1.- LIST OF THE MOST COMMON PROBLEMS

A.- THE COMPRESSOR DOES NOT START

PROBLEMS - SYMPTOMS	PROBABLE CAUSE	RECOMMENDED ACTION
• Motor control circuits established, the compressor does not run	• No power supply	• Check main power supply and switch positions
	• Compressor motor burnt out	• Replace
• Low voltage reading on voltmeter	• Voltage too low	• Contact power company
• The system does not start	• Breaker tripped or fuses blown	• Determine the cause. If the system is in running order, close the disconnect
		• Check condition of fuses
	• No water flow in the evaporator or condenser	• Measure flow, check the water pump and water circuitry and filters
	• Flow switch contacts open	• Find the cause of the trip out
		• Check circulation of liquid in the evaporator, and the condition of the flow switch
	• Anti short cycle relay action	• Wait until the anti short cycle time delay has expired
	• Faulty control thermostat	• Check for proper operation, set points, contacts
	• Antifreeze thermostat tripped	• Check evaporating pressure and the condition of the antifreeze thermostat
	• Compressor thermal protection relay tripped	• Check for proper operation of the relay
	• High pressure safety switch tripped	• Check the condensing pressure, and the condition of the high pressure safety switch
• Normal operation with too frequent starts and stoppages due to low pressure alarm. • Or, normal compressor operation, but the low pressure alarm trips out and resets frequently	• Low refrigerant charge	• Check the charge through sub-cooling value, carry out a leak test, then top up the refrigerant charge
• Suction pressure too low, Filter drier frozen up	• Filter-drier obstructed	• Check the state of the drier and replace the filter
	• Expansion valve closed	• Check operation of the valve

B.- THE COMPRESSOR SHORT CYCLES ON HIGH PRESSURE SAFETY SWITCH TRIP OUT

PROBLEMS - SYMPTOMS	PROBABLE CAUSE	RECOMMENDED ACTION
• The compressor short cycles on high pressure safety switch trip out	• High pressure safety switch trip out	• Check high pressure safety switch differential
	• Low air flow in condenser or dirty condenser coil (poor heat exchange)	• Check that fans are operating correctly or the state of cleanliness of the coils
	• Incondensable substances in the refrigeration circuit	• Bleed from circuit and top up the refrigerant charge. • Note : it is not permitted to discharge refrigerant to atmosphere

C.- THE COMPRESSOR RUNS IN LONG CYCLES OR RUNS CONTINOUSLY

PROBLEMS - SYMPTOMS	PROBABLE CAUSE	RECOMMENDED ACTION
	• Faulty control thermostat	• Check operation
• Temperature too low in the conditioned space	• Chilled water thermostat set too low	• Adjust it
• No sub-cooling in the system at full load	• Low refrigerant charge	• Check the refrigerant charge in the sight glass and top up if necessary
	• Filter-drier partly obstructed	• Check the drier and replace as required, change the filter cartridge
	• Expansion valve partly closed	• Check expansion valve bulb and capillary, measure superheat
	• Liquid line valve not open far enough	• Open the valve completely
• Noisy compressor, or abnormally high suction pressure or low discharge pressure	• Leaky internal compressor valves/seals • Low oil level	• Contact LFB GROUP, compressor may have to be changed • Add oil

D.- THE COMPRESSOR CUTS OUT BECAUSE OF OIL ISSUES

PROBLEMS - SYMPTOMS	PROBABLE CAUSE	RECOMMENDED ACTION
• Oil level in sight glass is too low -	• Oil level is too low	• Check the oil level in the sight glass on the crankcase
• Visible oil leak / Oil level too low	• Low oil charge	• Check that there is no leakage and add oil
	• Leaky oil sump	• Repair and add oil
• Suction line unusually cold, compressor noisy	• Liquid refrigerant present in the compressor crankcase	• Check appearance of the oil in the sight glass. Measure superheat at the expansion valve
	• Poor heat exchange in the evaporator	• Check water flow. Check fouling by measuring the water pressure drop. Excessive oil migration in the circuit: measure evaporating pressure and superheat

E.- THE COMPRESSOR CUTS OUT ON ANTIFREEZE ALARMS

PROBLEMS - SYMPTOMS	PROBABLE CAUSE	RECOMMENDED ACTION
	• Antifreeze alarm tripped	• Check that the low pressure side sensor is operating properly
	• Low water flow in the evaporator	• Check the water pump
	• Evaporator obstructed	• Determine the degree of fouling by measuring water pressure drop
	• Evaporator frozen up	• Measure pressure drop in water circuit, keep water circulating until evaporator has thawed completely
	• Low refrigerant charge	• Check the refrigerant charge and add refrigerant if necessary
	• Liquid refrigerant in the compressor crankcase	• Check appearance of the oil in the sight glass. Measure superheat at the expansion valve, check that the valve sensors are tightly attached
	• Poor heat exchange in the evaporator	• Check water flow. Check fouling by measuring the evaporator pressure drop. Excessive oil migration in the circuit : measure evaporating pressure and superheat

F.- THE COMPRESSOR CUTS OUT ON ITS MOTOR PROTECTION THERMAL RELAY

PROBLEMS - SYMPTOMS	PROBABLE CAUSE	RECOMMENDED ACTION
	• Thermal protection tripped	• Check operation of thermal protection, change it if necessary
	• Motor windings are not being sufficiently cooled	• Measure superheat in the evaporator, adjust it if necessary
	• Compressor operating out of its application range	• Check operating conditions

G.- THE COMPRESSOR STARTS WITH DIFFICULTY

PROBLEMS - SYMPTOMS	PROBABLE CAUSE	RECOMMENDED ACTION
	• Faulty windings	• Replace the compressor
	• Mechanical problem	• Replace the compressor

H.- THE COMPRESSOR IS NOISY

PROBLEMS - SYMPTOMS	PROBABLE CAUSE	RECOMMENDED ACTION
• Compressor knocking	• Broken mechanical parts inside compressor	• Replace the compressor
• Suction line is unusually cold	• Liquid slugging	• Check superheat and that the expansion valve sensors are correctly installed
	• Expansion valve blocked in open position	• Repair or replace

I.- DISCHARGE PRESSURE TOO HIGH

PROBLEMS - SYMPTOMS	PROBABLE CAUSE	RECOMMENDED ACTION
• Condenser abnormally hot	• Excessive refrigerant charge	• Recover excess refrigerant
• Chilled water leaving temperature too high	• Excessive cooling load	• Reduce load, reduce water flow if necessary

J.- DISCHARGE PRESSURE IS TOO LOW

PROBLEMS - SYMPTOMS	PROBABLE CAUSE	RECOMMENDED ACTION
• No sub-cooling when operating at full load.	• Low refrigerant charge	• Repair the leak and add refrigerant

K.- SUCTION PRESSURE IS TOO HIGH

PROBLEMS - SYMPTOMS	PROBABLE CAUSE	RECOMMENDED ACTION
• The compressor runs continuously	• Too much cooling demand on the evaporator	• Check the system
• Suction line unusually cold. Liquid refrigerant returns to compressor	• Expansion valve opened to far	• Adjust superheat and check that the expansion valve sensors are correctly fitted. Check parameters for electronic expansion valve.
	• Expansion valve blocked in open position	• Repair or replace

L.- SUCTION PRESSURE IS TOO LOW

PROBLEMS - SYMPTOMS	PROBABLE CAUSE	RECOMMENDED ACTION
• No sub-cooling when operating at full load	• Low refrigerant charge	• Repair the leak and add refrigerant
• Excessive pressure drop across the filter-drier	• Filter-drier obstructed	• Replace the cartridge
• Loss of capacity	• Expansion valve obstructed	• Clean or replace
• Conditioned space too cold	• Control thermostat contacts stuck in closed position	• Repair or replace
• Compressor short-cycling	• Capacity modulation setting too low	• Adjust
• Low pressure drop in the evaporator	• Low water flow	• Check water flow. Check the condition of the filters, look for obstructions in the chilled water circuit piping

2.- CONTROL DEVICES

Operation

By reacting to compressor discharge pressure, the high pressure switch monitors efficiency of the condenser. Poor efficiency, the result of an excessive condensing pressure, is usually caused by:

- A dirty condenser.
- Low air flow.

The low pressure transducer monitors the pressure at which the refrigerant evaporates in the evaporator tubes. Low evaporating pressure is usually caused by:

- Low refrigerant charge.
- A faulty expansion valve.
- An obstructed liquid line filter-drier.

The control thermostat monitors chilled water temperature at the evaporator inlet. The most common causes of abnormal temperatures in this zone are:

- Low water flow.
- Thermostat setting too low.

A defective crankcase heater, causes condensation of refrigerant in the oil sump.

The above information does not represent a complete analysis of the refrigeration system. It is intended to familiarise the operator with unit operation and to provide him with the technical data required to enable him to recognise, correct or report a fault.

Only trained and qualified personnel is authorised to service and maintain this equipment.

3.- REGULAR CHECKS: HEAT PUMP ENVIRONMENT

CHILLED WATER CIRCUIT VALUE:

Inlet / Outlet pressure gauges for pressure drop ..... kPa

Evaporator inlet temperature ..... °C

Evaporator outlet temperature ..... °C

Glycol concentration (1) ..... %

Flow switch operational at .....flow %

Chilled water pump interlock ..... [ ]

Filter on water circuit ..... [ ]

CONDENSER WATER CIRCUIT:

Inlet / Outlet pressure gauges for pressure drop ..... kPa

Condenser inlet temperature ..... °C

Condenser outlet temperature ..... °C

Regulation on condenser water inlet ..... [ ]

Condenser pump interlock ..... [ ]

Filter on water circuit ..... [ ]

Unrestricted air flow on condenser coils (2) ..... [ ]

ELECTRICAL POWER SUPPLY:

Control circuit voltage V

Power circuit power supply voltage L1/L2 V

Power circuit power supply voltage L2/L3 V

Power circuit power supply voltage L3/L1 V

(1) Depending on the application.
(2) According to the type of unit.

4.- MANUFACTURER'S RECOMMENDED INSPECTIONS

4.1.- Heat pumps with scroll compressors

4.1.1.- Number of recommended preventive maintenance visits

NUMBER OF RECOMMENDED PREVENTIVE MAINTENANCE VISITS

Year visit	Start up Tube analysis	500 / 1000h visit	Major technical inspection	Inspection
1	1	1		2
2			1	3
3			1	3
4				3
5			1	3
6			1	3
7				3
8			1	3
9			1	3
10				3
+10			Every year	3 times a year

This table is published for units operating under normal conditions with an average annual runtime of 4000 hours. In hostile industrial environments, a specific maintenance visit schedule must be planned.

(1) Depending on the quality of the water.

4.1.2.- Description of inspection duties

START UP:
- Check unit installation.
- Check water flow and water circuit auxilliaries.
- Check safety devices.
- Check leak tightness.
- Configuration of the microprocessor based management system.
- Verification of operating parameters and unit performance.
- Transmission of the machine service log.

500h / 1000h VISITS:
- Post wear in inspection.
- Oil acidity test, leak test.
- Replacement of the filter-drier cartridges depending on the results of the test above.
- Monitor unit performance and any eventual variations linked to use of the installation.

INSPECTION VISIT:
- **L**eak test.
- Operating test with record of measurements taken and functional analysis.

MAJOR TECHNICAL INSPECTION:
- Inspection visit.
- Acid test.
- Oil change if necessary.
- Replacement of filter-drier cartridges.
- Check up on the microprocessor based management system.
- Adjustment of safety devices.
- Verification of unit interlocks.
- Lubrication of bearings / dampers if necessary.

In case of a positive acidity test result, we advice to replace the oil.
In a case of high acidity level a circuit clean up is recommended.

CHECK LIST

Machine identifications:	**Affair number:**	
Year of manufacture:		
NORMAL CONDITIONS OF USE		
Leaving chilled water temperature:		**°C**
Outdoor air temperature:	**Max:** **ºC**	**Min:** **ºC**
Power supply voltage:		**V/Ph/Hz**
Refrigerant type:		
Date and time measurements were taken:		
Outdoor air temperature:		**°C**
Company responsible for measurements:		
Name of technician:		
Reamrks:		

		Circuit 1			**Circuit 2**			**Circuit 3**	**Circuit 4**
		Compr. 1	Compr. 2	Compr. 3	Compr. 1	Compr. 2	Compr. 3	Compr. 1	Compr. 1
Number of hours of operation									
Compressors in service per circuit									
Evaporating pressure	Bar								
Suction piping temperature	ºC								
Condensing pressure	Bar								
Discharge piping temperature	ºC								
Oil pump temperature	ºC								
Oil pressure	Bar								
Oil level									
Current on phase 1 per compressor	A								
Current on phase 2 per compressor	A								
Current on phase 3 per compressor	A								
Liquid line temperature	ºC								
Evaporator pressure drop	Bar								
Chilled water temperature	ºC								
Leaving chilled water temperature	ºC								
Condenser pressure drop	Bar								
Condenser lentering water temperature	ºC								
Condenser leaving water temperature	ºC								
H.P. pressure switch cut-out	Bar								
H.P. pressure switch cut-in	Bar								
Low pressure switch cut-in	Bar								
Oil pressure switch cut-out	Bar								
Antifreeze pressure switch cut-out	Bar								

Fan pressure switch 1: (cut-out / bar)	**Fan 2:**	**Fan 3:**	**Fan 4:**

CHECK LIST

This check list should be filled in by the contractor to make sure that unit installation takes place according to appropriate industry practices.
WARNING: Disconnect the power supply before carrying out any inspections on the unit. If the unit must be left powered up, proceed with precaution to avoid risk of electrocution.

RECEPTION:
- Check absence of transport damage. If the product is damaged, exact details must be reported directly to LFB GROUP.
- Check for missing items.
- Availability of suitable lifting gear, slings and spacers.

UNIT INSTALLATION:
- Remove shipping crate.
- Confirm unit installation clearances.
- Mount vibration isolators.
- Set unit in permanent place.
- Level unit if necessary.

CHILLED WATER CIRCUIT:
- Check all piping for leakage.
- Install thermometers.
- Install water pressure regulator.
- Install balancing valves.
- Install flow switch.
- Clean, rinse, and fill water piping before connecting to the unit. Check presence of filter on unit inlet and state of cleanliness of the filter.
- Check operation of the pump and evaporator pressure drop.
- Check minimum volume of installation of hydraulic system.
- Expansion vessel is at correct pressure (before water is filled).
- If pump is external, flow rate is measured and within range.

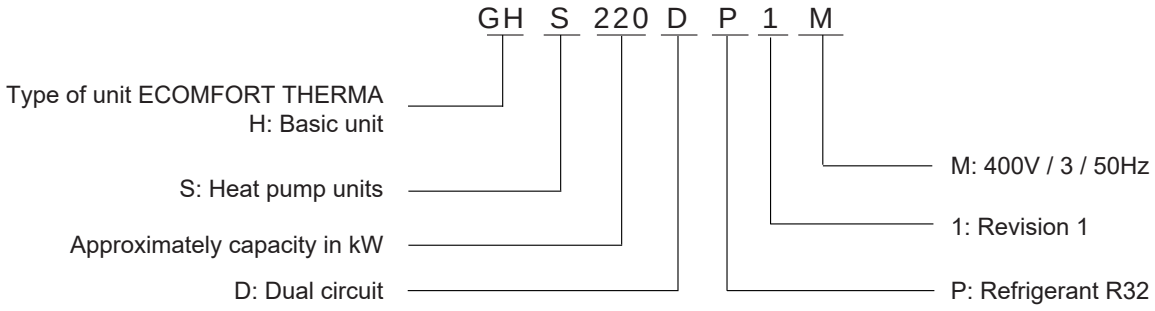
ELECTRICAL EQUIPMENT:
- Check the main power supply matches the unit data plate.
- Check that the unit is correctly earthed.
- Check order of power supply phases for scroll compressor units.
- Check correct direction of rotation of fan motors and proper operation of the latter.
- Verify direction of rotation of pump correct.
- Ensure control cabinet wired up.
- Ensure power supply conforms with unit nameplate indications.
- Ensure pump starter and flow switch circuits complete and in working order.
- Install pipe heaters on all piping exposed to freezing temperatures.
- Tighten all connections with a torque wrench.

GENERAL:
- Ensure cooling load is available, (minimum 50%).
- Coordination between different professions on site required for final commissioning.
- Power on carter heater 48 hour before commissioning date.

CUSTOMER ORDER NUMBER: ..... LFB GROUP REFERENCE: .....
DESIGNATION: .....
COMMENTS: .....
.....
NAME: ..... SIGNATURE: .....

APPENDIX 1

TECHNICAL DATA



OPTIONS:	
ACTR	LenGuard anti-corrosion condenser coil treatment
SFAC	Fixed speed standard AC fans *(Only available for basic units)*
LLWT	Low leaving water temperature down to -12°C
RLKD	Refrigerant leak detection
SYRP	Insulation of refrigeration suction piping
SPLP	Hydraulic module with low-pressure single pump *(Only available for basic units)*
SPEL	Hydraulic module with eDrive low-pressure single pump
SPHP	Hydraulic module with high-pressure single pump *(Only available for basic units)*
SPEH	Hydraulic module with eDrive high-pressure single pump
DPLP	Hydraulic module with low-pressure twin pump *(Only available for basic units)*
DPEL	Hydraulic module with eDrive low-pressure twin pump
DPHP	Hydraulic module with high-pressure twin pump *(Only available for basic units)*
DPEH	Hydraulic module with eDrive high-pressure twin pump
WTNG	Water tank
BYVC	Bypass Valve for delta P control with eDrive pump (supplied loose)
WTHS	Water tank electrical heater Standard
WTHH	Water tank electrical heater High
WFIF	Water filter (supplied loose)
KGRL	Flange connection (supplied loose)
EXTA	Expanssion vessel
BNET	BACnet® interface MSTP
MBUS	ModBus interface RS485
MBIP	ModBus and BACnet® interface TCP/IP
DCBO	Remote control: customer drive contact input/output
DM60	Remote advanced display (supplied loose)
DS60	Service display (supplied loose)
CETH	Redge Cloud connectivity Ethernet communication
CGSM	Redge Cloud connectivity GSM communication

NOTE: When it is possible options supplied loose should be included in a carton box inside the unit.

APPENDIX 1

TECHNICAL DATA

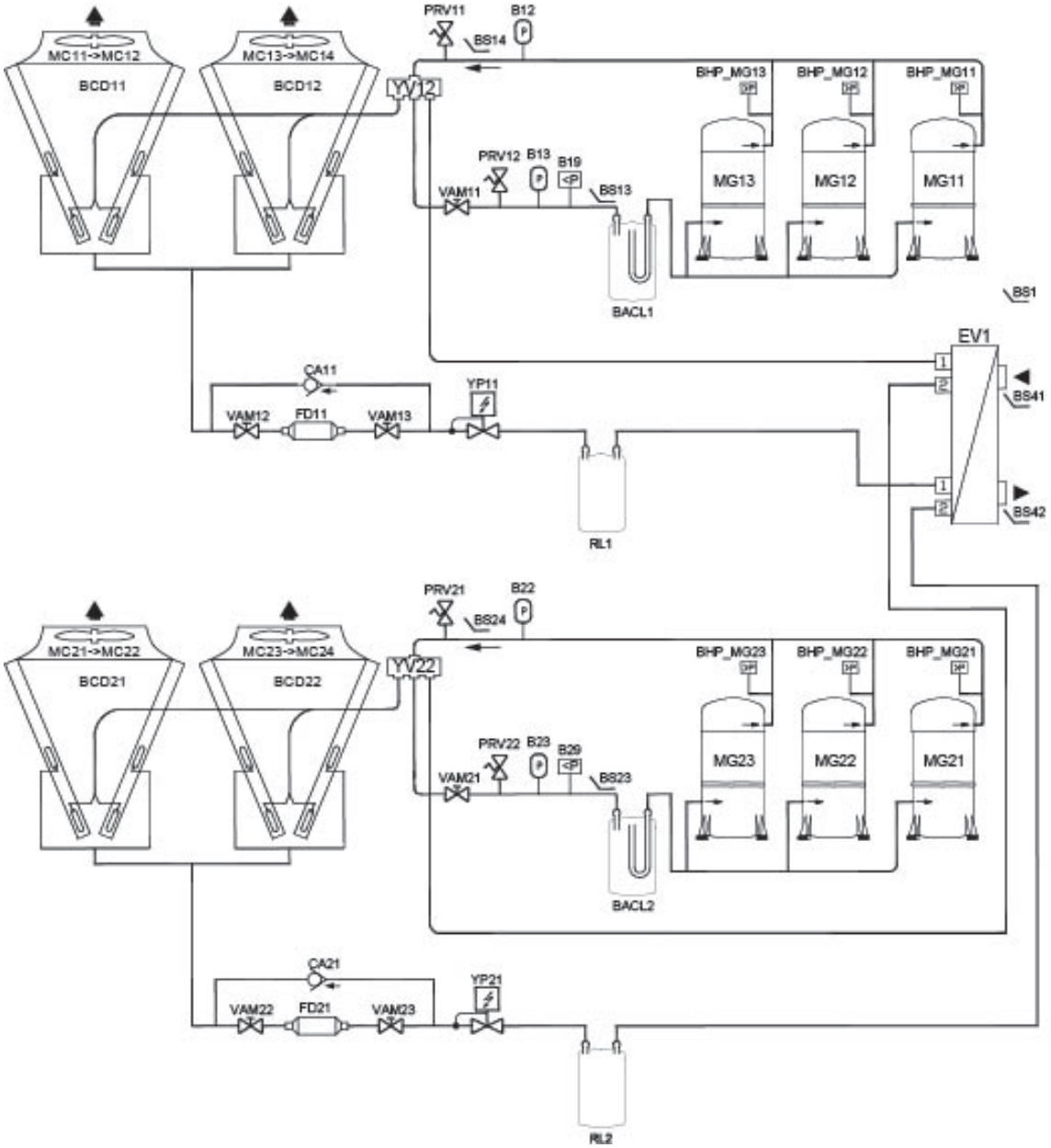
OPTIONS:	
APEP	Antifreeze protection on exchangers and pipings down to -20°C
APPP	Antifreeze protection on exchangers, pump(s), piping down to -20°C
APPW	Antifreeze protection on exchangers, pump(s),piping and water tank down to -20°C
ELME	Electric energy meter
PHCT	Phase reversal protection
SOFT	Soft starter
POWF	Power factor correction
CTBK	Circuit breaker
EEEM	Efficiency energy meter
AVUB	Anti-vibration mounts rubber type (supplied loose)
SLCR	Wooden crate for long distance
LNCJ	Low noise : Accoustic compressor jacket
CPGR	Upper metallic grille: Coil protection
FCPG	Full metallic grille pack
VGUA	Aesthetic protection
CLOAD	Container loading

NOTE: When it is possible options supplied loose should be included in a carton box inside the unit.

APPENDIX 2

GENERAL REFRIGERATION CIRCUIT: ECOMFORT THERMA HEAT PUMP GHS

Service valves (Schrader type) are available to load / unload the circuit.

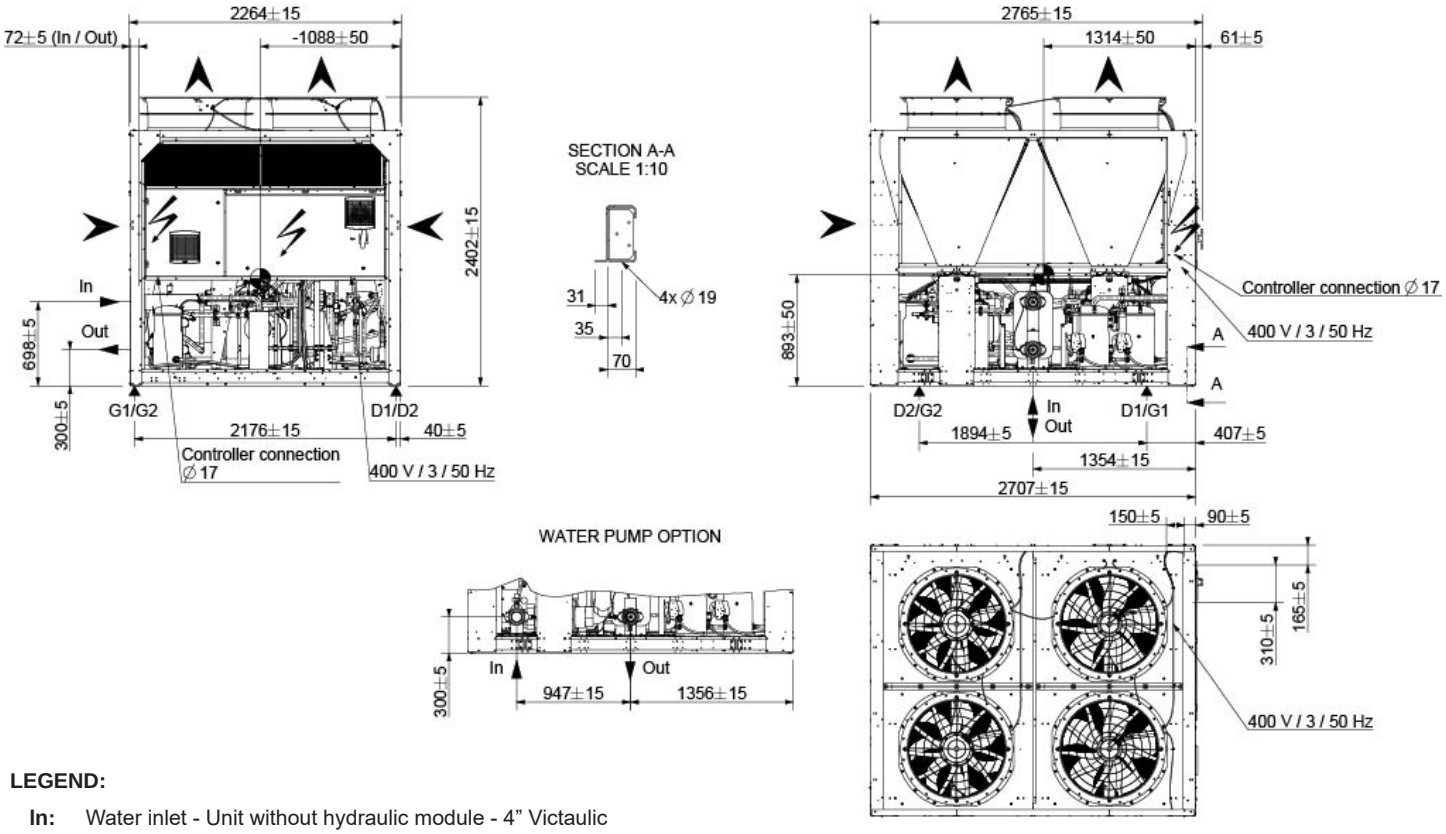


MG11 / MG12 MG21 / MG22 MG13 / MG23	Scroll compressors	**BCD11 BCD12 BCD21 BCD22**	Air cooled condensers	**YP11 YP21**	Electronic expansion valves
BHP_MG11 BHP_MG12 BHP_MG13 BHP_MG21 BHP_MG22 BHP_MG23	High pressure safety pressure switches	**MC11 / MC12 MC13 / MC14 MC21 / MC22 MC23 / MC24**	Condenser motor fans	**EV1**	Evaporator heat exchanger
B12 / B13 B22 / B23	Pressure transducers HP & BP	**VAM11 / VAM12 / VAM13 VAM21 / VAM22 / VAM23**	Manual isolating valves	**BS13 / BS14 BS23 / BS24 BS41 / BS42**	Suction / Discharge temperature sensors
B19 B29	Low pressure safety switches	**FD11 FD21**	Cartridge filter driers	**BS1**	External temperature sensor
YV12 YV22	4 way valves	**BACL1 BACL2**	Suction accumulators	**CA11 CA21**	Check valves
PRV11 / PRV12 PRV21 / PRV22	Pressure relief valves	**RL1 RL2**	Liquid receivers		Heating resistance (OPTION)

WARNING:
Check the inlet and outlet position of the water piping on the dimension drawings.
See indications on unit.

APPENDIX 3

GENERAL MECHANICAL DRAWING - GHS 220 / 250 / 280 (UNIT WITHOUT HYDRAULIC MODULE)



LEGEND:

In:	Water inlet - Unit without hydraulic module - 4” Victaulic
Out:	Water outlet - 4” Victaulic

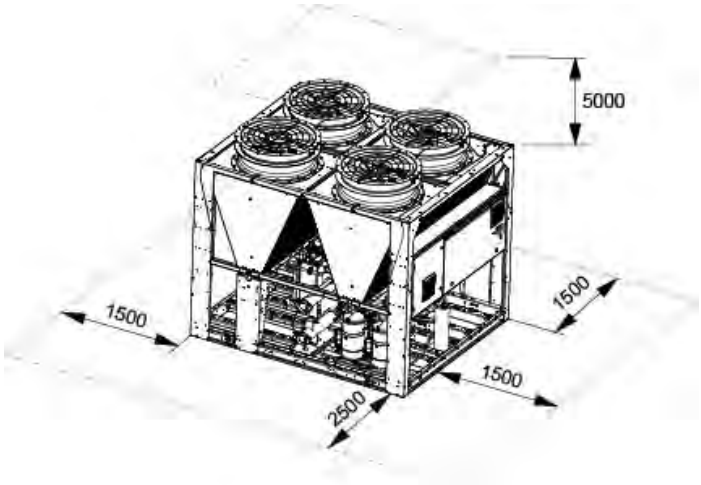
LOAD DISTRIBUTION

(kg - Operating weights dual pump without hydraulic module)

	G1 / D1	G2 / D2
GHS 220	451 / 431	546 / 522
GHS 250	534 / 462	581 / 503
GHS 280	537 / 464	583 / 506

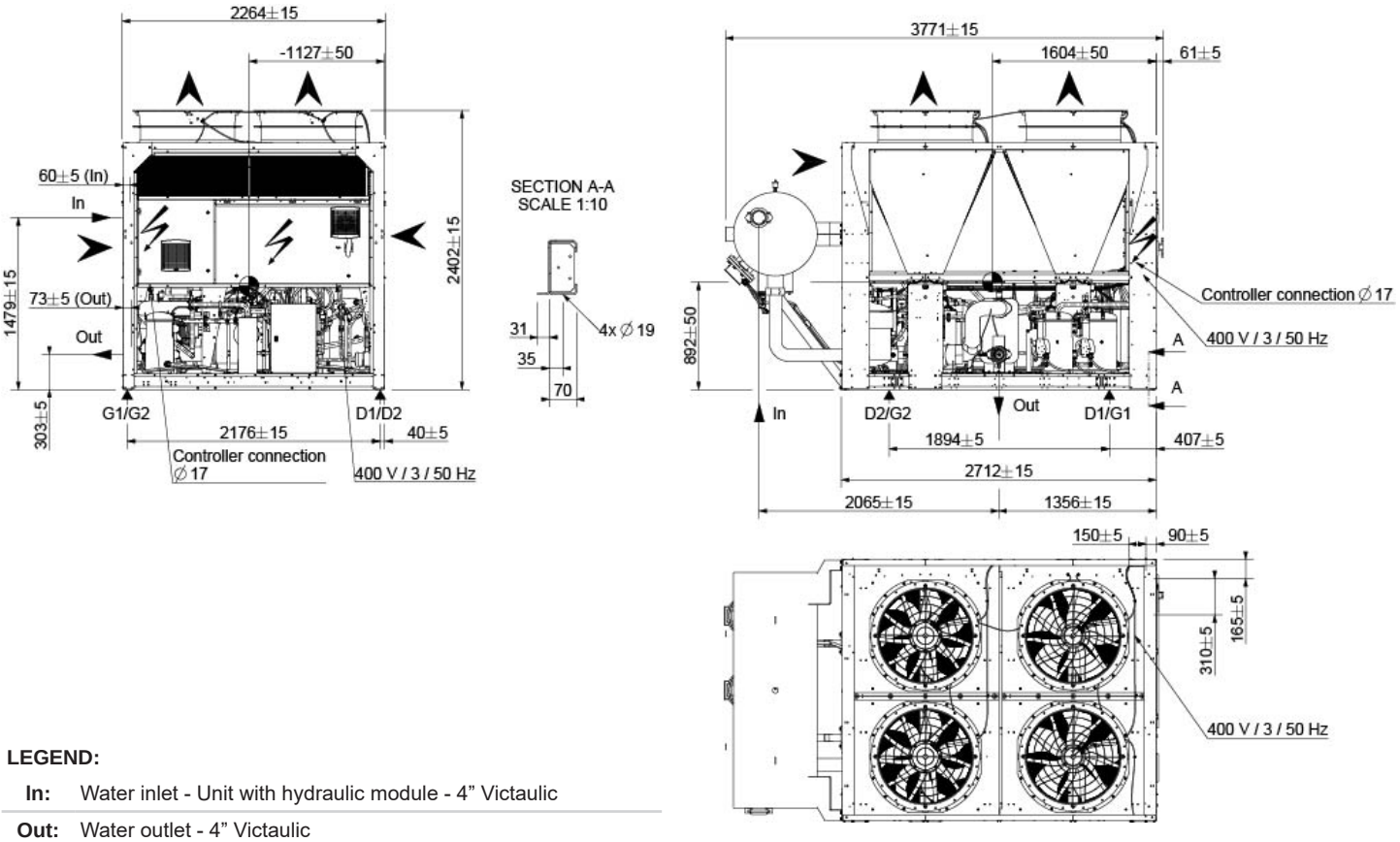
CLEARANCES

Overhead obstructions are not permitted.



APPENDIX 3

GENERAL MECHANICAL DRAWING - GHS 220 / 250 / 280 (UNIT WITH HYDRAULIC MODULE)



LEGEND:

In:	Water inlet - Unit with hydraulic module - 4” Victaulic
Out:	Water outlet - 4” Victaulic

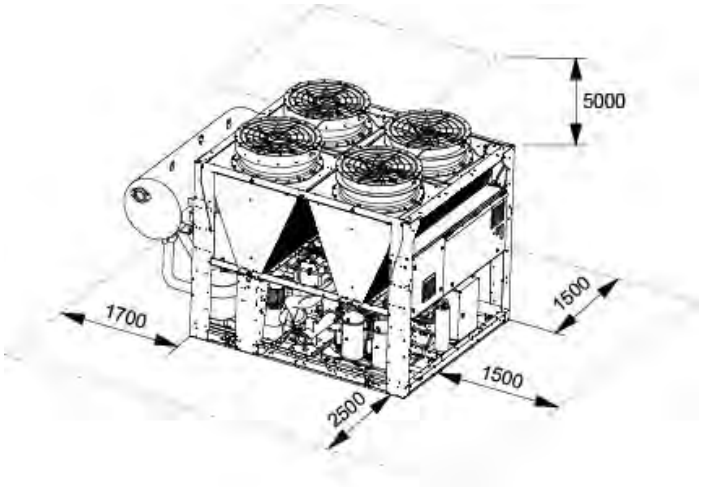
LOAD DISTRIBUTION

(kg - Operating weights with dual pump with hydraulic module)

	G1 / D1	G2 / D2
GHS 220	669 / 640	811 / 774
GHS 250	776 / 674	842 / 732
GHS 280	792 / 688	860 / 747

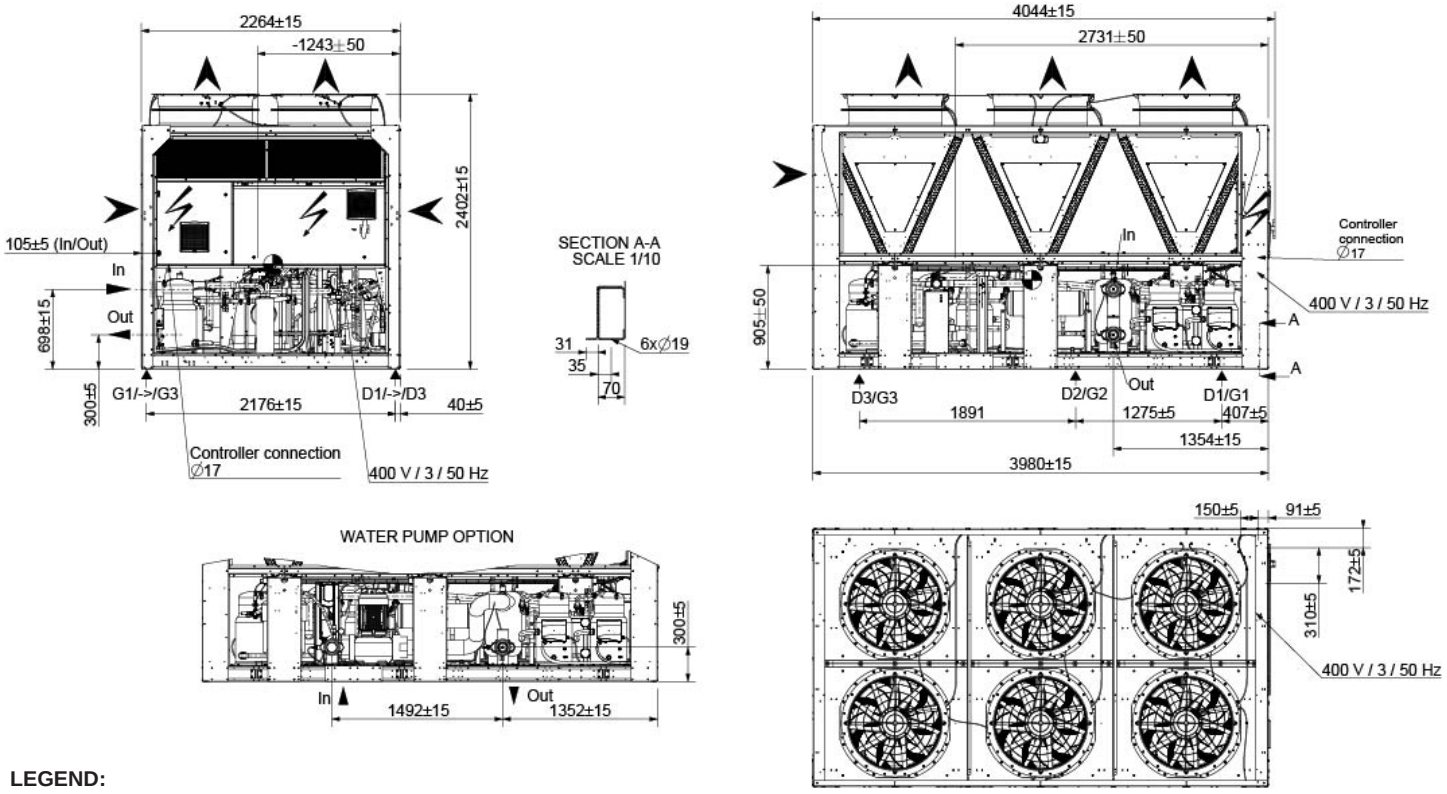
CLEARANCES

Overhead obstructions are not permitted.



APPENDIX 3

GENERAL MECHANICAL DRAWING - GHS 320 / 360 / 370 / 380 (UNIT WITHOUT HYDRAULIC MODULE)



LEGEND:

In:	Water inlet - Unit without hydraulic module - 4” Victaulic
Out:	Water outlet - 4” Victaulic

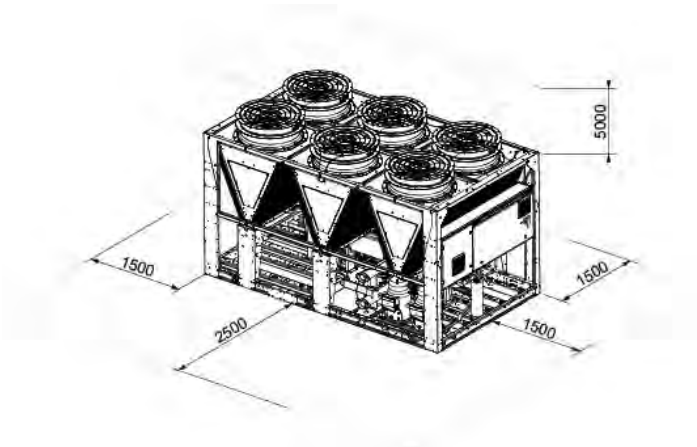
LOAD DISTRIBUTION

(kg - Operating weights dual pump without hydraulic module)

	G1 / D1	G2 / D2	G3 / D3
GHS 320	295 / 394	406 / 549	583 / 493
GHS 360	300 / 396	407 / 553	589 / 502
GHS 370	302 / 399	410 / 557	593 / 506
GHS 380	305 / 403	414 / 563	599 / 511

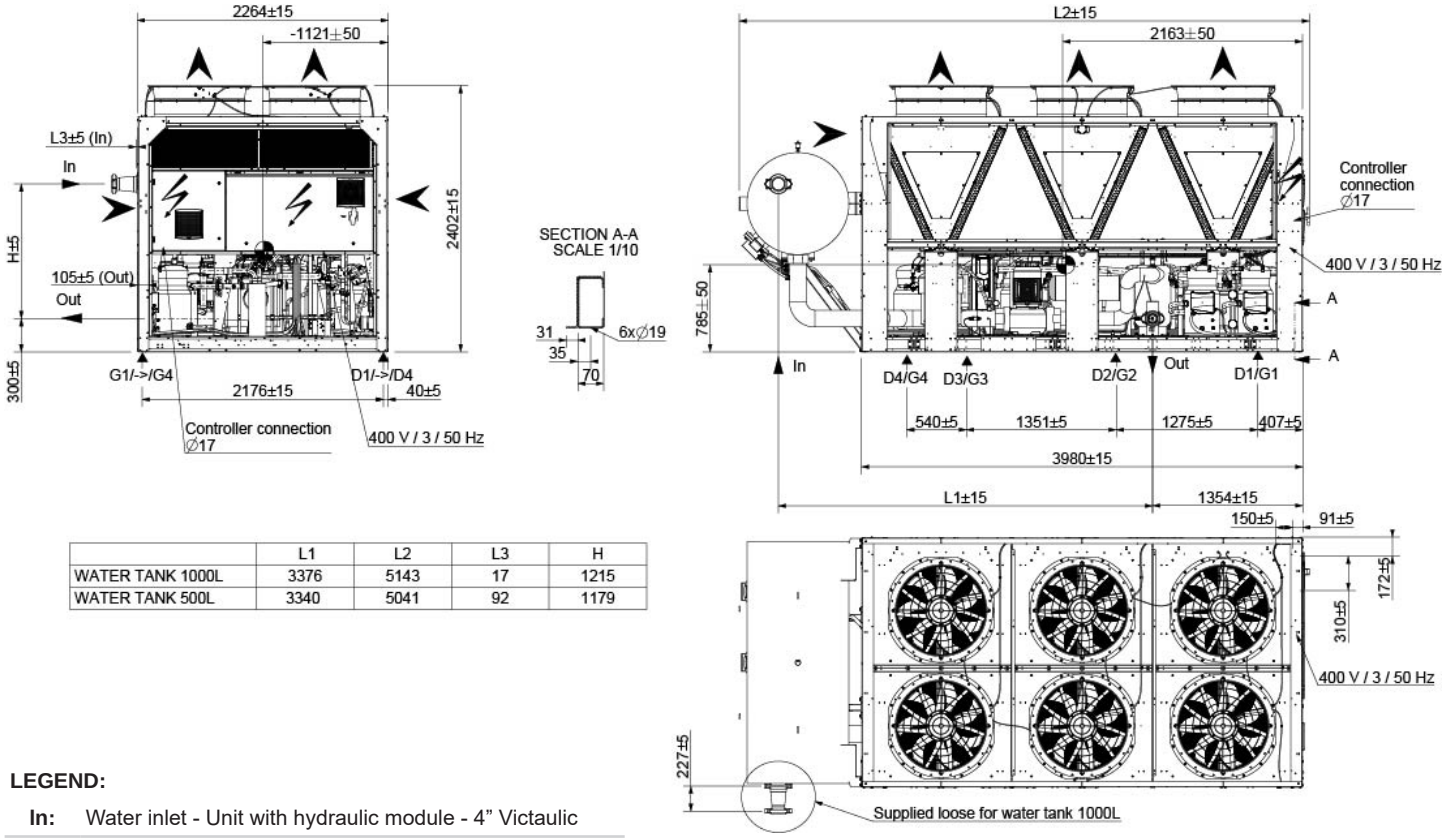
CLEARANCES

Overhead obstructions are not permitted.



APPENDIX 3

GENERAL MECHANICAL DRAWING - GHS 320 / 360 / 370 / 380 (UNIT WITH HYDRAULIC MODULE)



	L1	L2	L3	H
WATER TANK 1000L	3376	5143	17	1215
WATER TANK 500L	3340	5041	92	1179

LEGEND:

In:	Water inlet - Unit with hydraulic module - 4” Victaulic
Out:	Water outlet - 4” Victaulic

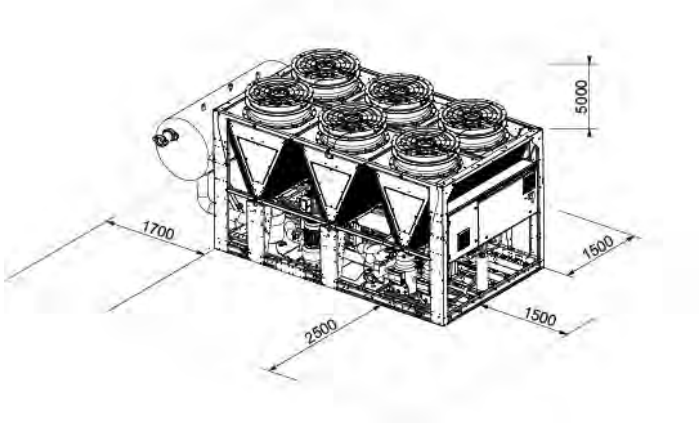
LOAD DISTRIBUTION

(kg - Operating weights dual pump with hydraulic module)

	G1 / D1	G2 / D2	G3 / D3	G4 / D4
GHS 320	424 / 232	523 / 502	139 / 539	941 / 1037
GHS 360	426 / 232	527 / 505	137 / 544	951 / 1041
GHS 370	428 / 233	529 / 507	137 / 546	956 / 1046
GHS 380	431 / 234	533 / 511	138 / 550	962 / 1053

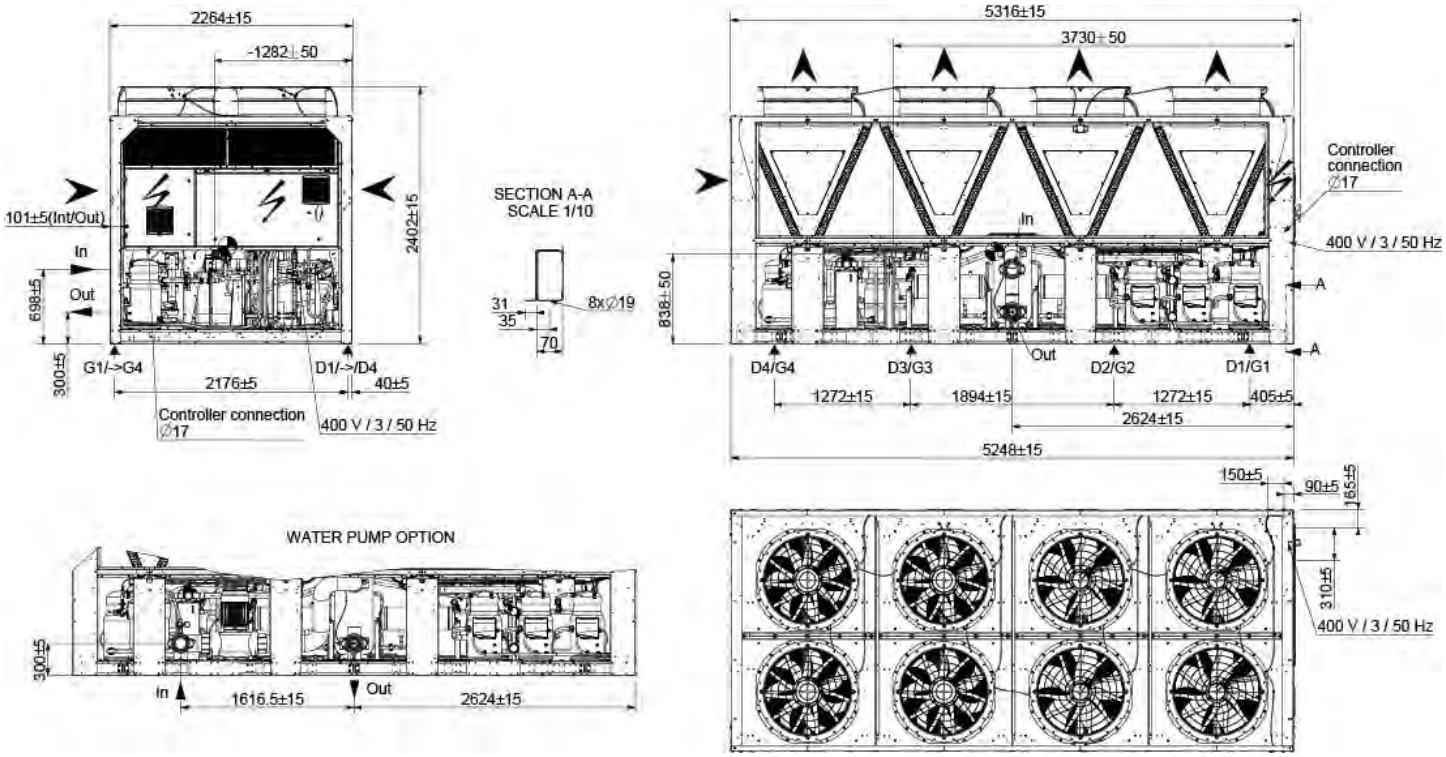
CLEARANCES

Overhead obstructions are not permitted.



APPENDIX 3

GENERAL MECHANICAL DRAWING - GHS 410 / 450 / 500 (UNIT WITHOUT HYDRAULIC MODULE)



LEGEND:

In:	Water inlet - Unit without hydraulic module - 5” Victaulic
Out:	Water outlet - 5” Victaulic

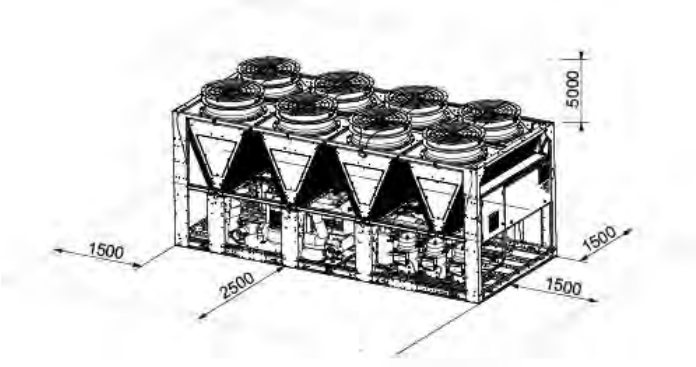
LOAD DISTRIBUTION

(kg - Operating weights dual pump without hydraulic module)

	G1 / D1	G2 / D2	G3 / D3	G4 / D4
GHS 410	383 / 546	368 / 400	357 / 394	536 / 428
GHS 450	391 / 560	378 / 410	366 / 405	549 / 439
GHS 500	395 / 565	381 / 413	370 / 408	554 / 443

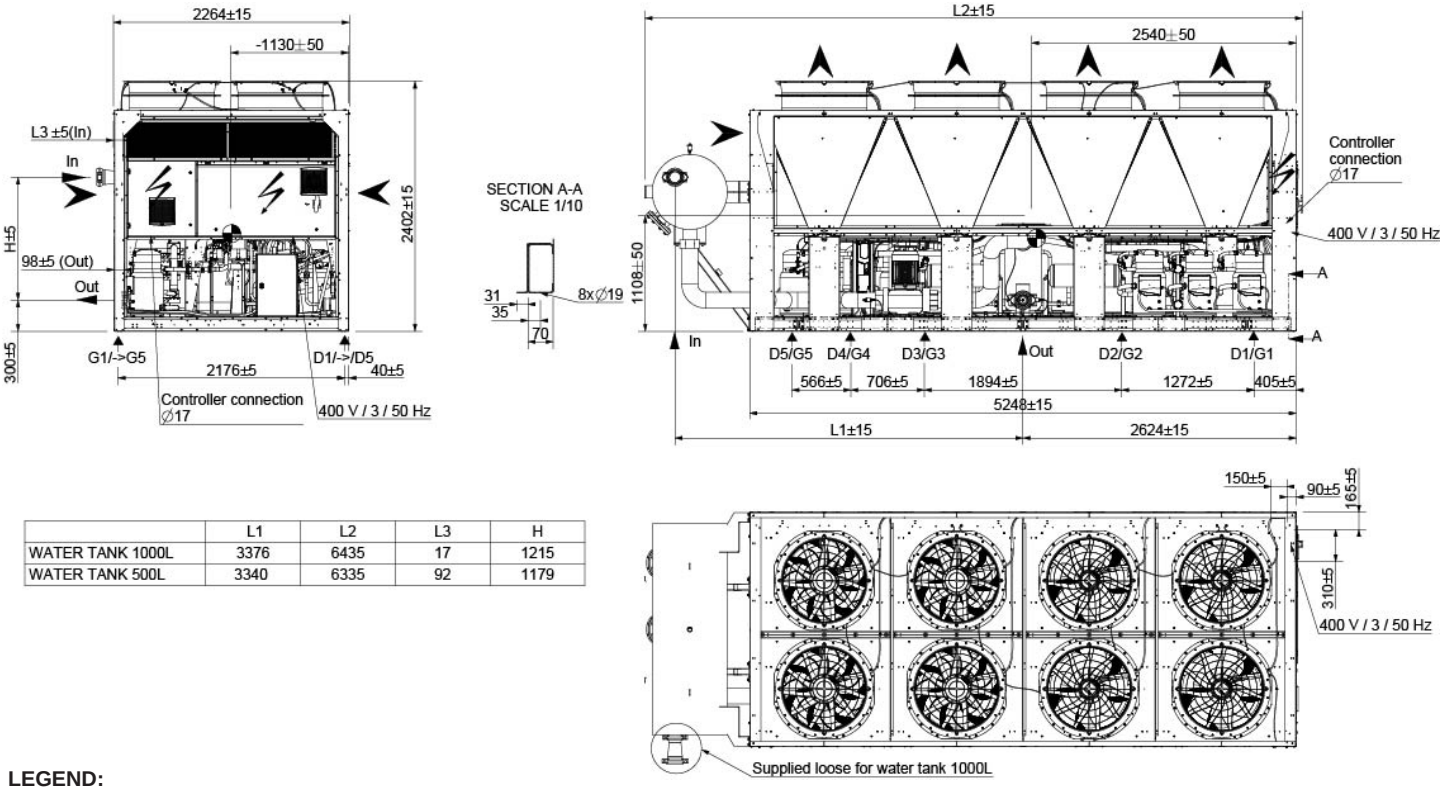
CLEARANCES

Overhead obstructions are not permitted.



APPENDIX 3

GENERAL MECHANICAL DRAWING - GHS 410 / 450 / 500 (UNIT WITH HYDRAULIC MODULE)



	L1	L2	L3	H
WATER TANK 1000L	3376	6435	17	1215
WATER TANK 500L	3340	6335	92	1179

LEGEND:

In:	Water inlet - Unit with hydraulic module - 5” Victaulic
Out:	Water outlet - 5” Victaulic

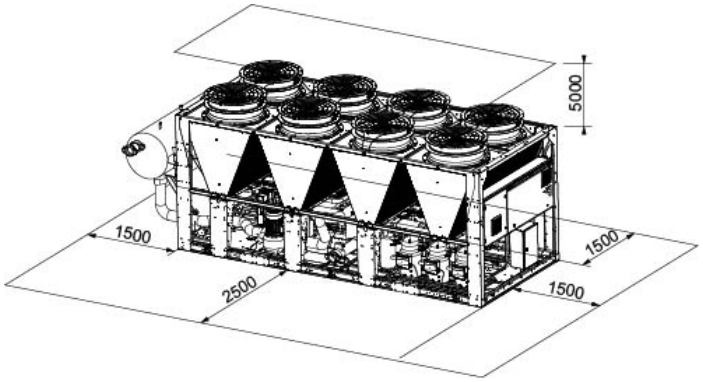
LOAD DISTRIBUTION

(kg - Operating weights dual pump with hydraulic module)

	G1 / D1	G2 / D2	G3 / D3	G4 / D4	G5 / D5
GHS 410	419 / 212	455 / 388	498 / 431	159 / 456	919 / 1091
GHS 450	426 / 217	463 / 395	506 / 438	163 / 465	934 / 1109
GHS 500	430 / 218	467 / 398	510 / 442	164 / 469	942 / 1117

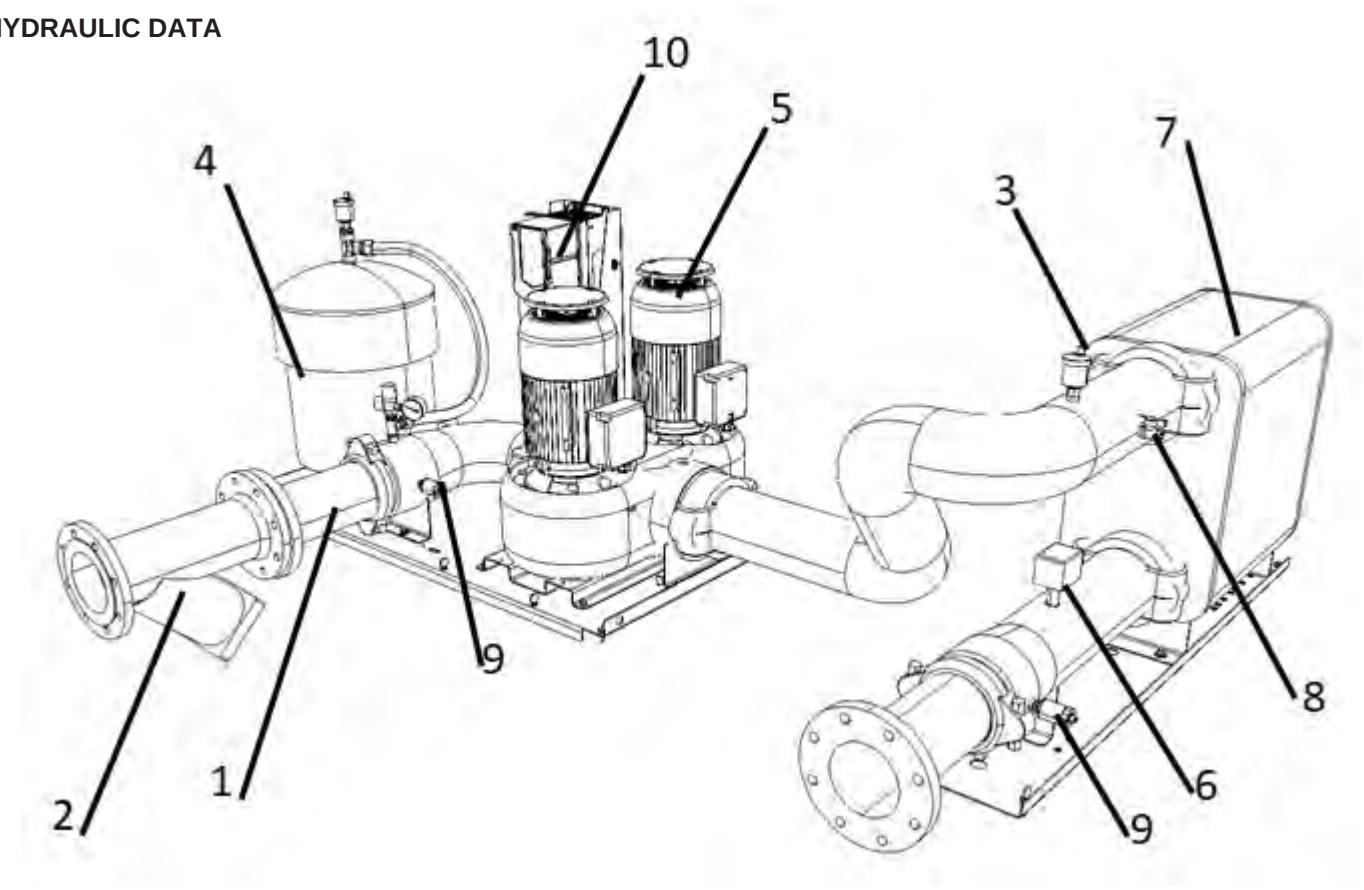
CLEARANCES

Overhead obstructions are not permitted.

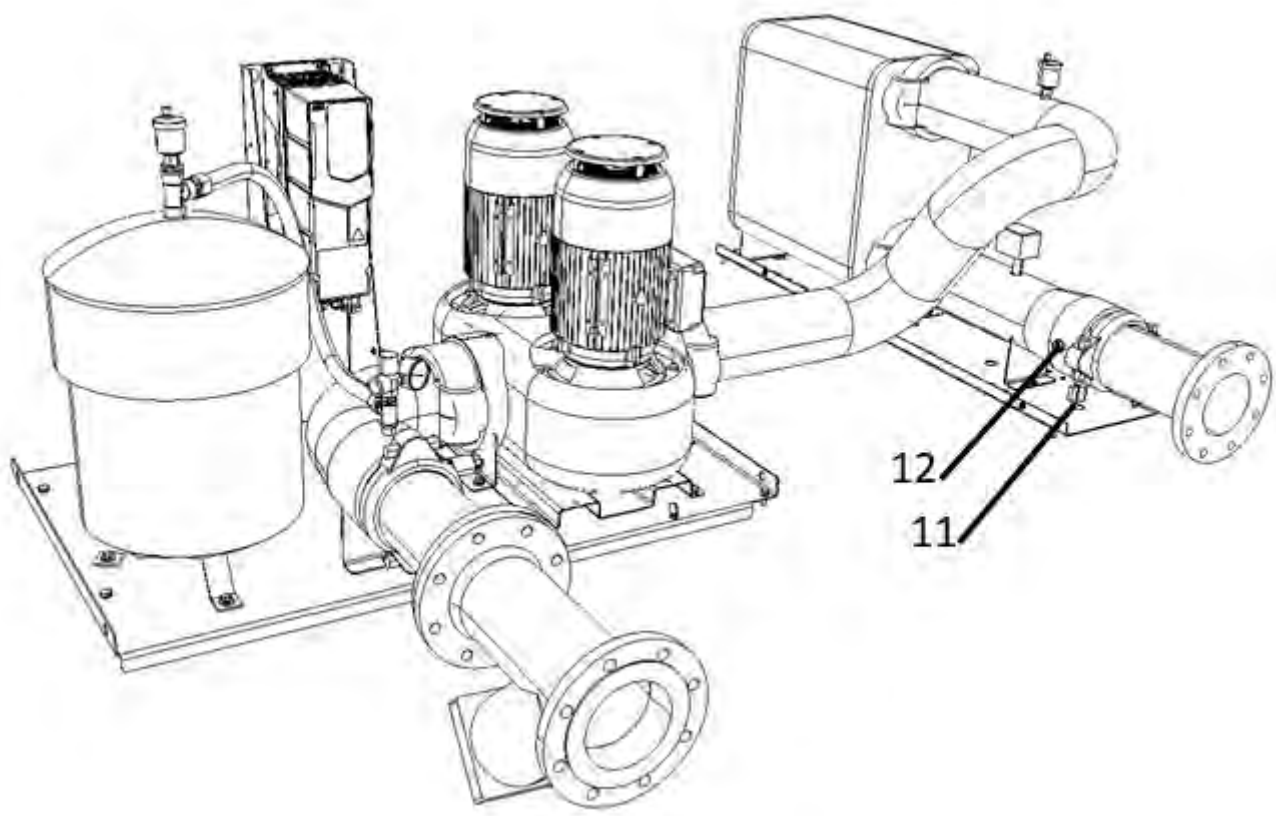


APPENDIX 4

HYDRAULIC DATA



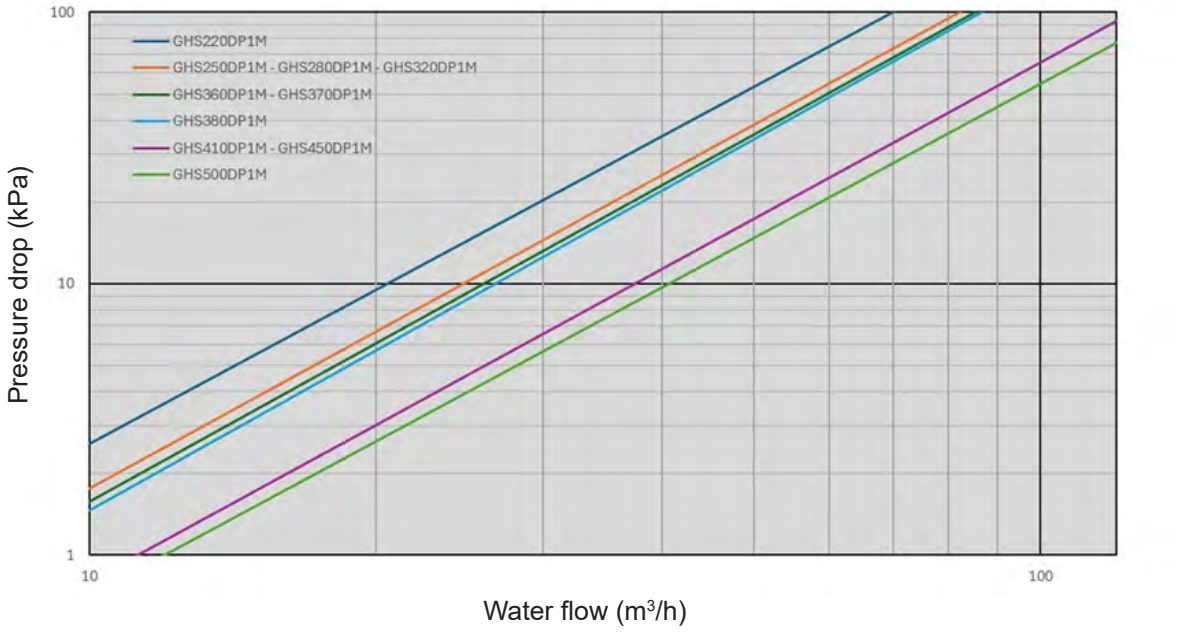
1. Victaulic / Flange adaptor.
2. Inlet filter (supplied loose).
3. Automatic air bleed.
4. Expansion vessel, bleeder, safety relief valve & manometer (Option).
5. Single or dual pump, high or low pressure.
6. Flow switch.
7. High performance stainless steel evaporator.
8. Pressure taps.
9. Pressure tap or water pressure sensor with edrive option.
10. Water pump inverter (Option).
11. Drain valve.
12. Temperature sensor.



APPENDIX 5

PRESSURE DROPS

EVAPORATOR AND CONDENSER CURVES - ECOMFORT THERMA HEAT PUMP



GHS	$\Delta P = a X^b$	
	a	b
220	0,0337	1,8819
250	0,0211	1,9206
280		
320		
360	0,0182	1,9370
370		
380	0,0162	1,9572
400	0,0098	1,9126
450		
500	0,0092	1,8858

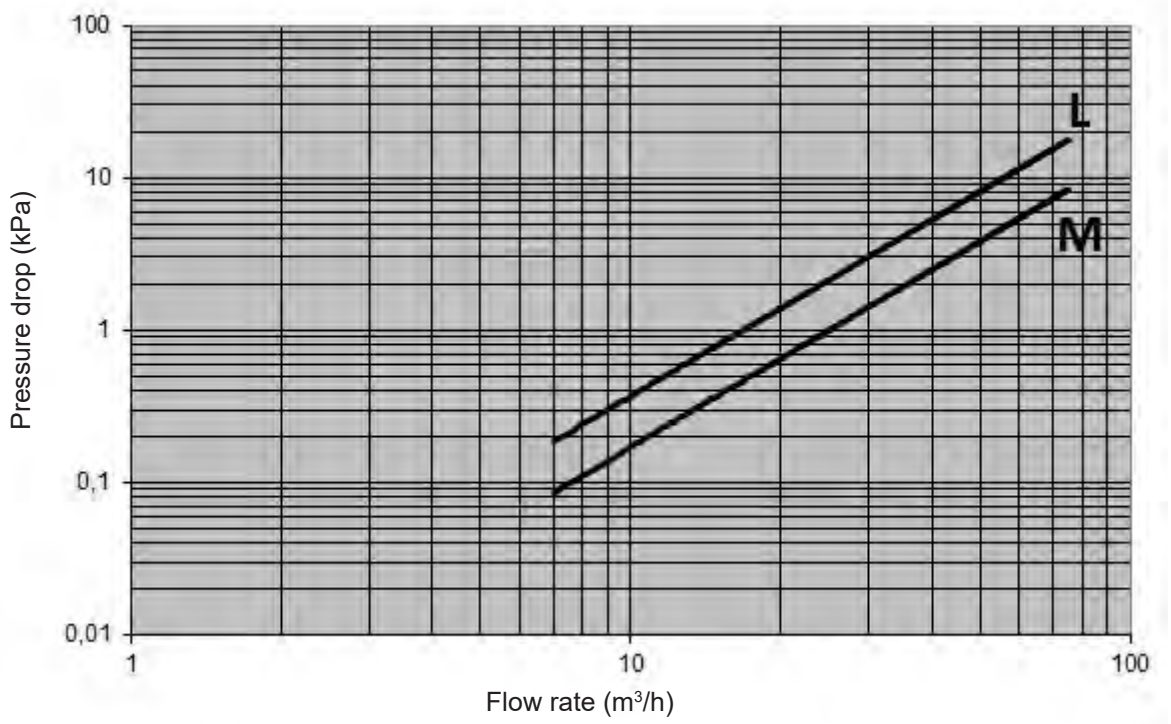
Pressure drops are given for information only. A tolerance of +/- 20 kPa must be considered when selecting water pumps.

APPENDIX 5

PRESSURE DROPS

FILTER CURVE - ECOMFORT THERMA HEAT PUMP

GHS	Curve
220	L
250	
280	
320	
360	
370	
380	
410	M
450	
500	



Size of the filter mesh: 1 mm

GHS	$\Delta P = a X^b$	
	a	b
220	0,0044	1,9207
250		
280		
320		
360		
370		
380		
410	0,002	1,9305
450		
500		

NOTES

CE

Due to REDGE ongoing commitment to quality, the specifications, ratings and dimensions are subject to change without notice and without incurring liability.
Improper installation, adjustment, alteration, service or maintenance can cause property damage or personal injury.
Installation and service must be performed by a qualified installer and servicing agency.