redge

# ELEVATE

## Air cooled Heat Pump




R290

**45 – 60 kW**

# Installation, Operation and Maintenance

# AIR-COOLED HEAT PUMPS

# INSTALLATION, OPERATION, MAINTENANCE MANUAL

**Ref.:** MIL173E-0425 10-2025

**The present manual applies to the following air-cooled heat pump versions: ELEVATE range YBH 045-060.**

**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 air-cooled heat pumps are tested and rated in accordance with Eurovent certification program. | EUROVENT CERTIFIED PERFORMANCE www.eurovent-certification.com |
| 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 used (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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# 1. INTRODUCTION

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

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 used (except in operation of this product), reproduced, issued to, or made available to third parties without the prior written agreement of LFB Group.

You must read and be familiar with this manual before the commissioning of the air-cooled heat pump. Please closely follow the instructions. We would like to emphasise the importance of training in accordance with the correct handling of the air-cooled 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 air-cooled heat pump.

Please do not hesitate to contact one of our employees should you require further information on specific air-cooled heat pump subjects.
The data published in this manual are based on the most recent information available. These data are subject to later modifications.
We reserve the right to modify the construction and/or design of our air-cooled heat pumps, at any time, without prior notification or obligation to adapt
previous supplies accordingly.



Any work on the air-cooled 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 highly 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



**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.**

**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.**

# 2. GENERAL DESCRIPTION

**The Elevate range is an Air-cooled Heat Pump unit designed to heat/cool water for air conditioning and industrial processes.**

**As standard, the ELEVATE range is supplied with R290 refrigerant which is a flammable gas classified A3 (highly flammable).**

This section is based on the EN 378, EN 60079-10-1 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 persons involved in the product life cycle at risk.

| Flammability class | |
|---|---|
| **A1** | Non-flammable |
| **A2L** | Lightly flammable |
| **A2** | Flammable |
| **A3** | Highly flammable |



The pictogram on the nameplate indicates that the product contains a flammable refrigerant. 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.

# 3. COMPLIANCE FOR MARKET INTRODUCTION 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.

## 3.1. EMC DIRECTIVE COMPLIANCE

This equipment complies with the EMC directive, for industrial environments and light industry. In an industrial environment, this equipment may create radio noise.

In this case, the owner may be asked to take appropriate actions.

The units comply with environmental standards in accordance with the Product Declaration of Conformity:

The units comply with the following main standards:

- EN 61000-6-2: Immunity for industrial environments.
- EN 61000-6-4: Emissions for industrial environments.
- EN 61000-6-8: Emissions for commercial and light industrial environments

In conclusion, in view of the results obtained on the unit tested, the entire range defined complies with the essential requirements of the EMC Directive 2014/30/EU, for commercial, light industrial and industrial environments in accordance with the above standards.

This applies to all installed machines which have a rated current I<75A:

•The short-circuit ratio Rsce=66 is defined in standard EN61000-3-12 in relation to the harmonic values on the network. Equipment complying with the harmonic current limits equivalent to Rsce=66 may be connected to any connection point on the main power supply system.

•The machine is also compliant with EN 61000-3-11. Tests show no limits are exceeded and no specific Zmax is required for voltage variation, fluctuation, and flicker measurements. The connection to the supply is a conditional connection submitted to the preliminary agreement of the power supply local provider.

Differences between the various machines are linked to the power of the compressors and the equipment associated with them.
For conducted and radiated emissions, as well as for immunity, these differences are not such as to alter the results obtained.

## 3.2. F-Gas REGULATION (UE) 2024/2215

**PLEASE READ THE SAFETY DATA SHEET OF THE REFRIGERANT BEFORE ANY INTERVENTION OR INSTALLATION OF THE MACHINE.**

Operators of refrigeration equipments must comply with the obligations defined in

- Regulation on Fluorinated greenhouse gases (F Gas - III), please consider the following articles:
- Cf. art 2-1 b), c), 2 et art.3 a), b)

## 3.3. PED DIRECTIVE

**For units covered by the Pressure Equipment Directive (see EU Declaration of Conformity).**

1. All work on the unit must be performed by competent and qualified technical personnel. Non-compliance with the following instructions may result in injury or serious accidents.
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, lightning 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 378-2:2016 § 6.2.2.3). However, the designer may implement means to limit damage in case of fire. Our products, even when equipped with LFL sensor (for products loaded with A3 fluids) and damage limitation accessory in the event of an external fire, are not designed to withstand a fire. This fire risk must be considered 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.
5. In case of exposure to corrosive external or internal 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 enough 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 378-2:2016), 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 pipework 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.

### 3.3.1. PROTECTION: SAFETY ACCESSORY / DAMAGE LIMITATION ACCESSORY

This equipment is protected with calibrated safety pressure switches. This equipment contains damage limitation valves in the event of an external fire. Make sure that people are not exposed to refrigerant discharge

**The HP pressure switch is a PED safety accessory (see 2.11 Dir.2014/68/EU), and the 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 |
| **Valve(s)** | N/A | YES |

### 3.3.2. LIMITS VALUES

**MAXIMUM PERMISSIBLE VALUES FOR THE UNIT**

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

| R290 | PS (barg) | | TS (°C) | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| HP line | -1 | 32 | -30 | 150 |
| Liquid line | -1 | 32 | -30 | 83 |
| LP line | -1 | 19 | -30 | 55 |
| Water | | 3,5 | | |

**STORAGE LIMITS**

Refer to the nameplate for storage temperature limits.

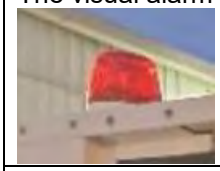
## 3.4. MACHINERY DIRECTIVE

### 3.4.1. PRESSURE SWITCH SAFETY CHAIN TEST

Test to check correct operation of the pressure switch safety chain, to be performed by a qualified technical personnel or servicing LFB Group technician.
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.
On the CE plate, clearly identify the "PS HP" value that must not be exceeded.
On the eClimatic 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, the compressors are running, ventilation is off, the high-pressure envelope safety program is desactivated, and the pressure switch status is being monitored. Once the test mode has started, follow the pressure on the display.
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. If the PS HP value is exceeded, switch off the compressor circuit breakers and contact LFB Group.

### 3.4.2. LEAK DETECTOR SAFETY CHAIN TESTING

Visual inspection to verify proper operation of the leak detector safety chain, which must be performed at a minimum once a year by servicing LFB Group technician.

| TEST | CHECK POINTS AND CRITERIA | VALIDATION |
|---|---|---|
| Leak detector safety chain | For this test, it needs to create a calibrated leak at 20% of LFL | ☐ |
| | Extraction fan **MB102** running? (visual) | ☐ |
| | The visual alarm **SLB1** is blinking? (visual)  | ☐ |
| | The acoustic alarm **SLB1** is horning? (Buzzer alarm)  | ☐ |
| | The contactor **KRD10** is desenergized? (visual) | ☐ |
| | Power supply of the unit is off except leak detector,extraction fans and alarm | ☐ |

FURTHER INFORMATION

Test to verify proper operation of the leak detector, which **must be performed annually by LFB Group technical personnel**.

- Conduct the test with a calibrated bottle.
- Follow the leak detector manufacturer's maintenance instructions.
- To complete the operation and calibration of the leak detector, the unit must be shut down.

NOTE: If a new calibration test is not performed after the maintenance period (1 year), the unit will shut down.

## 3.5. 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.**

**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. These units must not be installed in hazardous (ATEX) areas, including zones 0, 1, and 2.**

## 3.6. WEEE DIRECTIVE

The waste recovery sectors (e.g. eco-organizations) oversee collecting, cleaning up and recovering WEEE on the whole European market.

**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.**

## 3.7. NATIONAL REGULATIONS

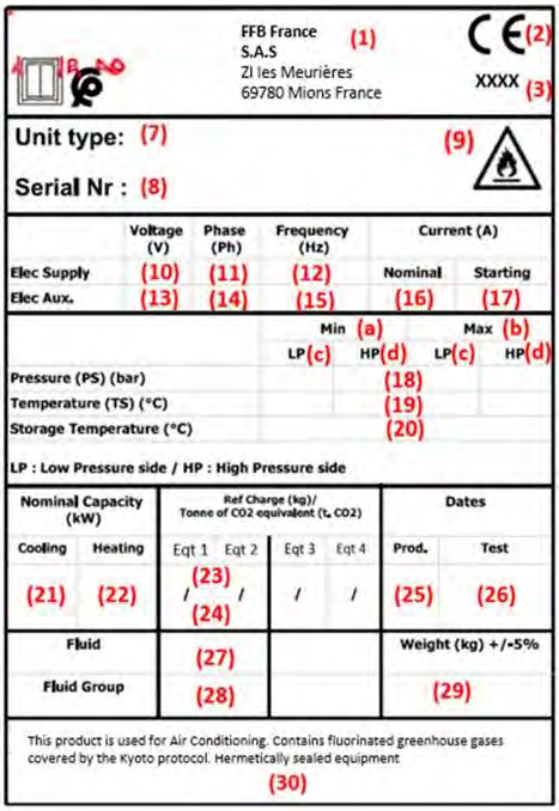
The unit must be installed in accordance with local safety codes and national regulations and may only be used in well ventilated area.

**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 made mandatory in certain countries.**

## 3.8. RATING PLATE

The rating plate is the identity card of the product and ensures that the unit corresponds to the model ordered. It contains several key pieces of information, such as:

- The unit's power consumption at start-up,
- The power rating,
- The power supply voltage (Note: it should not vary more than ±10%).
  **The customer must have a suitable power supply. It is therefore important to check that the power supply voltage indicated on the nameplate of the unit is compatible with the main supply.**




The rating plate also 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
(7) Unit type
(8) Serial number
(9) Flammable fluid type pictogram
(10) Power voltage
(11) Power phase
(12) Power phase frequency
(13) Control voltage
(14) Control phase
(15) Control 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 CO2 refrigerant per circuit
(25) Year of production
(26) Date of end of line test of the unit
(27) Type of refrigerant and GWP Global warming potential
(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".

# 4. WARRANTY

The warranty of the unit is subject to the warranty terms as agreed upon in the order. It is expected that the design and installation of the unit follow good engineering and workmanship 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 the prior written consent of LFB Group.
- Settings and protections have been modified without the prior written consent of 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 been 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 made during the warranty period shall be the extension of the warranty period for the affected material.
• 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 signing a contract including four inspections per year (every three months), before the start of each season, 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 air-cooled heat pumps with R290 as refrigerant. For the training to certification, please contact with our LFB GROUP ACADEMY**

**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.**

# 5. 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 cannot 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, and maintenance guide.

**Notwithstanding the fact that the units are equipped with extensive safety and protection features, utmost care and attention must be exercised when performing any operations on the machine. All operations on the cooling circuit or electrical equipment must be carried out by authorized personnel only.**



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 these criteria (kitchen, industry, ...) please contact your local sales representative.**

- Wearing appropriate Personal Protective Equipment (PPE)—including clothing, safety glasses, and gloves suitable for the ATEX zone—is mandatory. Avoid contact between the refrigerant and skin or eyes. In case of skin contact, wash the affected area immediately with soap and water. If liquid refrigerant enters the eyes, flush thoroughly with water and seek medical attention immediately.
- Sound pressure levels generated by the unit may pose a health risk. Refer to the acoustic data provided when selecting the unit. Suitable hearing protection (e.g., earplugs) must be worn when working in close proximity to the operating unit.
- The unit must be isolated from the electrical supply by disconnecting and locking out 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).
- If by chance any manipulation of the refrigerant circuit is required, this operation must be carried out by a qualified and authorized technician. These procedures must be carried out with the unit shutdown.
- 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 (grilles replacement …) ensure that the power is shut off to avoid automatic restart.

WORK ON THE REFRIGERATING 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 refrigerant and oil spray, the circuit shall first inertized (e.g. with dry nitrogen) and then depressurized to zero pressure before any disassembly or unsoldering of refrigerating components.
- Never leave a unit stopped with valves closed on the liquid line, 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.
- Brazing shall be carried out by a qualified brazer. Brazing shall comply with standard EN ISO 17672 AG130 (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’s 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 may 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

# 6. 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:

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.
- Consider the risk of an explosive atmosphere.
- Check with an explosimeter that the area is safe
- Eliminate the risk of ignition. Switch off the power of the unit
- Alert emergency services
- Prevent discharge into drains
- Evacuate and rescue

AFTER SECURING - RESUMPTION OF ACTIVITY

- Resolve the cause of the emergency stop before restarting the unit.

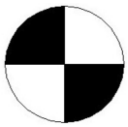
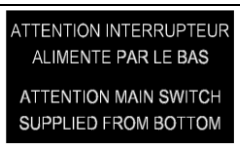
IN THE EVENT OF FIRE OR EXPLOSION

Alert emergency services and people in the building. In this case:

- Comply with site instructions
- Alert emergency services
- Evacuate and rescue
- If the fire is clearly identified and small, you may 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.

# 7. LABELS

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

| | | | |
|---|---|---|---|
|  |  |  |  |
| High temperatures | Low temperatures | Rotating parts | Sharp parts |
|  |  | | |
| Electrical voltage | Flammable | | |
|  |  |  |  |
| Don’t walk on it | Wear of antistatic PPE | Warning<br>Inflammable dusty filters | Don’t strap |
|  |  |  |  |
| Gravity center | Warning main switch supplied from bottom | EUROVENT certification | An environmentally friendly HVAC unit |
|  |  |  |  |
| 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 may loose during transport.<br>Please check them before start-up. | |
|  |  |  |  |
| CMIM marking (Morocco) | CE marking | Anti-spark tools | ATEX equipment (explosimeter, fan, transfer pump and vacuum pump) |

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

# 8. TRANSPORT

## 8.1. A FLAMMABLE GAS UNIT

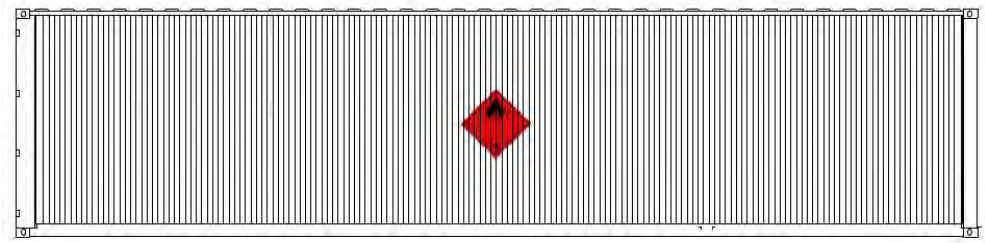
Machines loaded with A3 refrigerant must comply with the ADR rules (Accord for dangerous goods by road), in particular UN 3358. Please plan the route in accordance with this class. In the case of specific air transport requiring machines not charged with refrigerant, please contact your LFB Group contact.

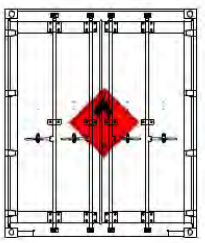
UN3358 transports are not allowed in Eurotunnel and tunnels of category D and E.

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




**UN 3358**





In the transport voucher, note: UN3358 Refrigerant units 2.1

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).

## 8.2. 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 300°C.

Likewise, If the product needs to be stored before installation, please keep it in a well-ventilated area, away from any potential sources of ignition, as described above.

## 8.3. TRANSPORT – HANDLING

- The unit is shipped to the customer charged with R290 refrigerant below 12 kg total load.
  If the customer so requests and as an option, the unit may be shipped empty of R290 refrigerant.
- 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 is also valid to reach other parts of the unit: filters, refrigerant circuit, etc…
- It is strictly forbidden to store or handle heavy equipment 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).
- All unloading operations must be carried out with suitable equipment (crane, forklift truck, etc.).
- When using a forklift truck, you must respect the positions, fork spacings, 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.

## 8.4. DELIVERY CHECK

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

- Before unloading: Inspect the unit with an A3 calibrated leak detector.
- Check that the external packaging has not been damaged in any way. Conduct a 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 in writing 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.

## 8.5. 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:

- Keep the heat exchanger protection if any.
- 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 in a suitable location (flat surface), in a ventilated area and away from any sources of ignition, at a minimum distance of 2 m.
- Storage temperature must be respected according to the information given on the rating plate.
- It is strongly recommended to store the units in a dry and sheltered outdoor location, respecting all applicable safety distances and ventilation requirements.

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

# 9. INSTALLATION OF A FLAMMABLE GAS UNIT

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

**• 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 (propane) and oil. Please take this into account in in the site-specific ATEX risk assessment (Refer to Directive 1999/92/EC).**

**• These units must not be installed in hazardous (ATEX) areas, including zones 0, 1, and 2.**

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

**In the immediate area of the unit (proximity distance ≤ to 2m in free field):**

- The presence, even temporary, of ignition sources is prohibited (as like as: Hot surfaces, flames and hot gases, friction, impact or abrasion processes, electric sparks, stray electric currents, cathodic corrosion protection, static electricity, lightning, electromagnetic waves, Ionizing radiation, ultrasonic waves, adiabatic compression and in shock waves and exothermic reactions)
- It is prohibited to install near fresh air intakes or exhaust vents of a building.

## 9.1. SAFETY REQUIREMENTS

Handling refrigerants may pose risks to your health:

- Dizziness, nausea, intoxication
- Breathing difficulties and asphyxiation
- Cold burns (frostbite)
- Explosion, fire
- Projection of equipment and fluids
- Falls due to other hazards
- Illnesses

People working on refrigeration systems using flammable fluids must have the necessary skills in accordance with NF EN ISO 22712 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.

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. Of course, all work 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 that could lead to an accidental leak during the life of the equipment.
    - Corrosion: do not use detergents. Do not use in an atmosphere corrosive to copper and aluminum without protecting the sensitive 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.
- A safety Integrity Level 2 chain is installed, please maintain the detection system and the associated control chain according to EN 60079-29-1, EN 61511 and EN 50495.

## 9.2. PRELIMINARY REQUIREMENTS

The following preparations are important for the installation of the air-cooled heat pump:

- Air-cooled heat pumps with helicoids fans such as ELEVATE are designed for outdoor installation. Install the unit in an open space, at least 2m from air intakes of the building. 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.
- 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 outdoor air-cooled heat pump, position the unit where it is less affected by wind. The units are designed to withstand winds up to 80 km/h. Above this limit, it's recommended to take appropriate actions to secure the installation. (install windbreaks where wind speeds > 80 km/h).
- 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.
- 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. Clearly marking the safety zone is recommended.
- Pressure relief valves must be installed facing an area free from ignition sources, windows, skylights, or parking spaces with electric vehicles.

**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 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 service and maintenance. As an air-cooled heat pump, the air rejected by the condenser must not encounter any obstacles to prevent air re-circulation. This could cause an increase in the temperature of the air used to cool the condensers. Obstruction of the air outlet could also impair air distribution across the entire heat exchanging surface of the condenser. Both conditions, which reduce the heat exchange capacity of the coils, will 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 from being 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's written approval.

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

## 9.3. UNPACKING

- Before unpacking the unit, check with a suitable leak detector that there are no leaks around the unit. Check the absence of sources of ignition close to the unit.
- 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.

**NOTE:** Unit is wrapped in packing foil with its transport stickers. It is recommended to not remove any packaging materials during any transport and lifting.

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.

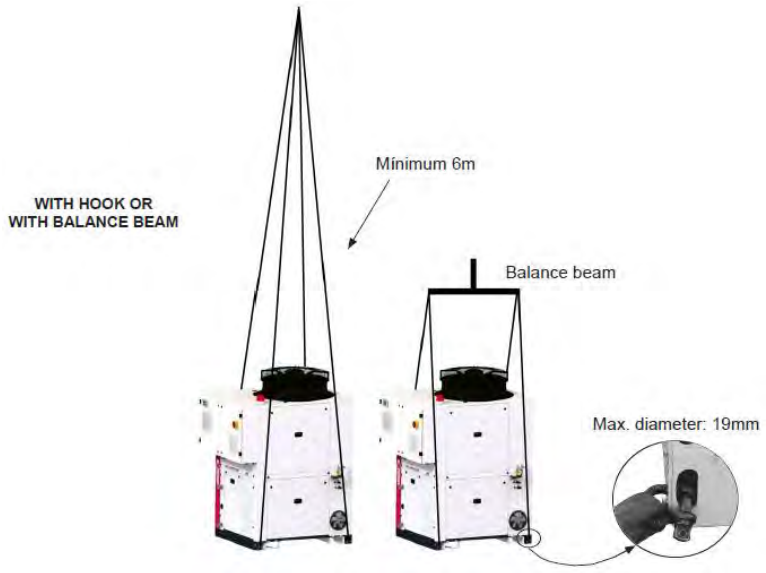
## 9.4. HANDLING

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.

Conduct a **leak test** with an approved and calibrated detector before handling.

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




**NOTE:** Use slingers of 6m with the hook to prevent excessive pressure on the top of the unit because it may be damaged. Whenever it is possible, use balance beams.

## 9.5. LOCATION OF THE UNIT

Installation, start up and adjustment of this equipment may be dangerous if certain system specific factors are ignored, such as operating pressures, electrical components, locations.
Only highly qualified contractors and technicians with solid knowledge of this type of equipment and aware of the safety requirements and recommendations for the installation of propane-powered units, are authorised to install, start up and service it.
During any service operation, 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
• Handle heavy or bulky equipment carefully during lifting and moving operations, and when setting it on the ground.

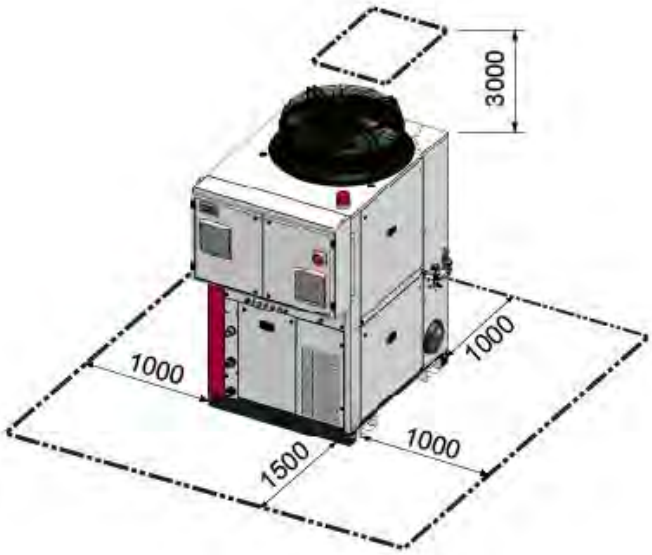
### 9.5.1. MINIMUM TECHNICAL CLEARANCE AROUND THE UNIT

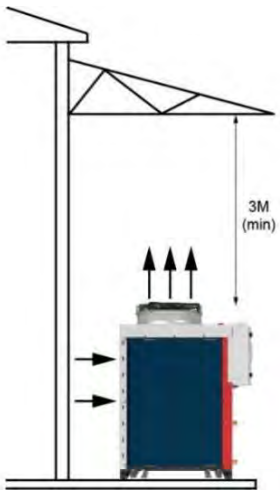
Clearance around the unit, for any unit version. Keep this space free around the unit for installation. Failure to install the unit as shown will impact performance and reliability.

- 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 3000 mm.**
- If you have any questions about the implementation, please contact us so that we may assist you.

**All dimensions shown on the drawings below are in millimetres.**

**The 3m awning is open on at least 3 sides. The valve discharge (see 9.5.3) must be offset above the canopy to prevent any risk of propane accumulation underneath.**



Nothing must obstruct the damage limitation valves manifold on the outlet clearance. If not, clear the outlet of the damage limitation valves manifold above the awning. (Cf. 9.5.4).

### 9.5.2. EXCLUSION ZONES

The exclusion zone must be clearly identified (for example: using marking on the ground, fencing, studs with chains,…)

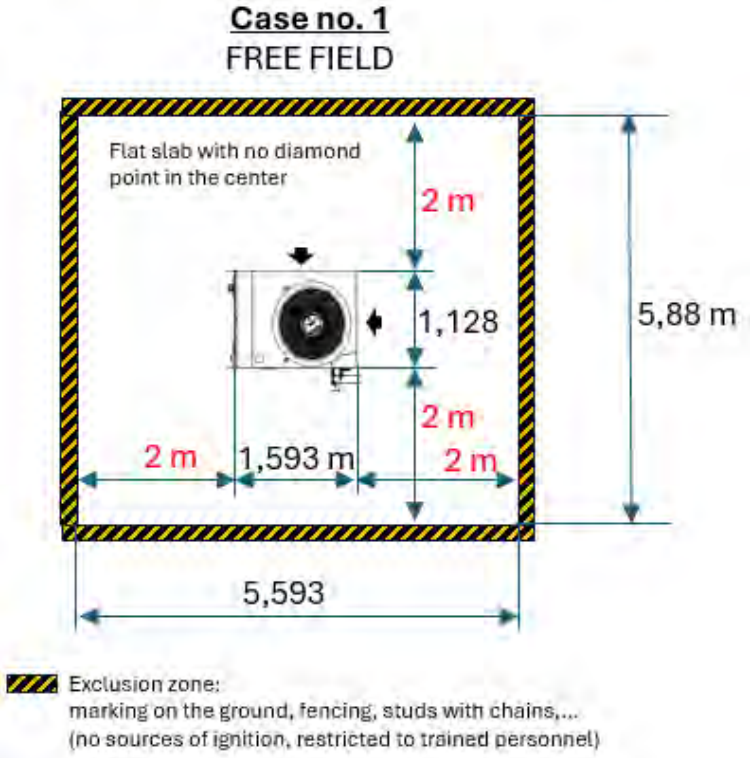
Case no. 1

(FREE FIELD)

Conditions considered to characterize exclusion zones:

- Natural ventilation speed of 0,5 m/s in an unobstructed environment
- Orographic variation in ground height of 1 meter, typical of an industrial zone
- HP pressure 32 barg
- Direction of discharge: Horizontal / Ground impact

*(It is the user's responsibility to check that these conditions are met, depending on the location. If not, a study will have to be carried out to assess the necessary corrective measures.)*

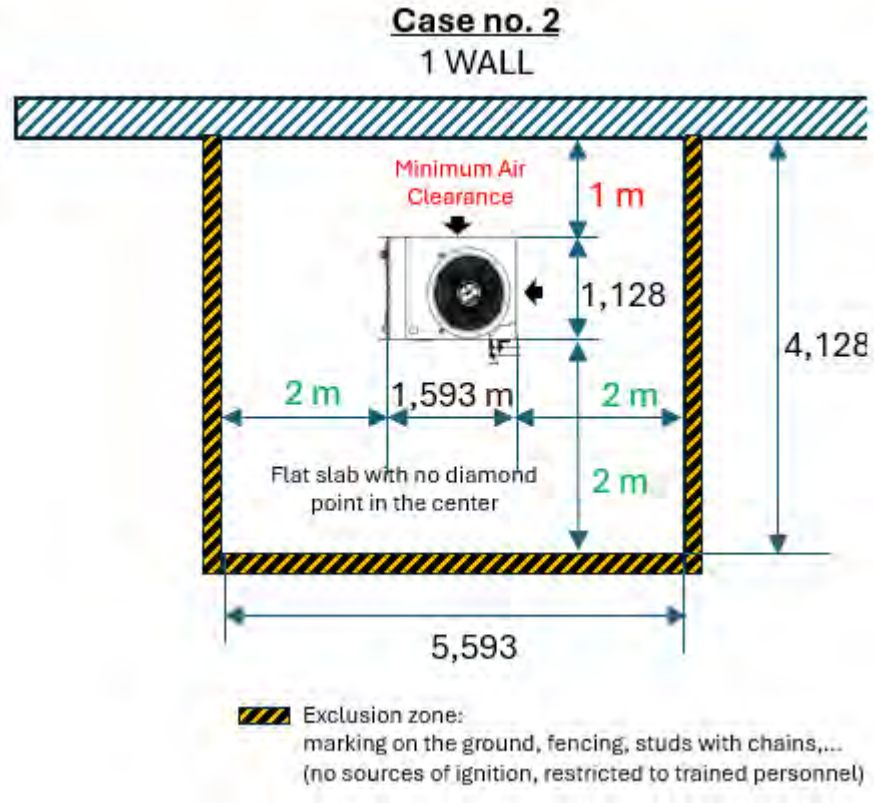





Case no. 2

(1 WALL)

Conditions considered to characterize exclusion zones are the same




Case no. 3

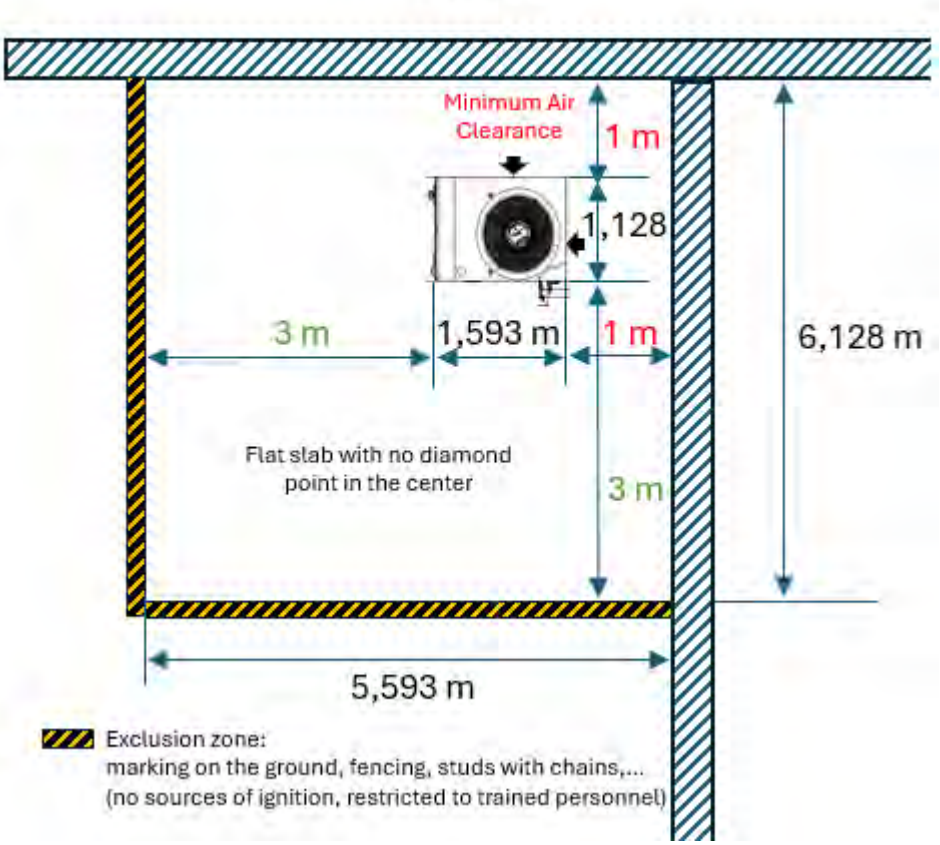
(2 WALLS)

Conditions considered to characterize exclusion zones are the same as those described above, except that:

- Natural ventilation speed of 0,3 m/s in an unobstructed environment

*(It is the user's responsibility to check that these conditions are met, depending on the location. If not, a study will have to be carried out to assess the necessary corrective measures.)*

**Case no. 3**
2 WALLS



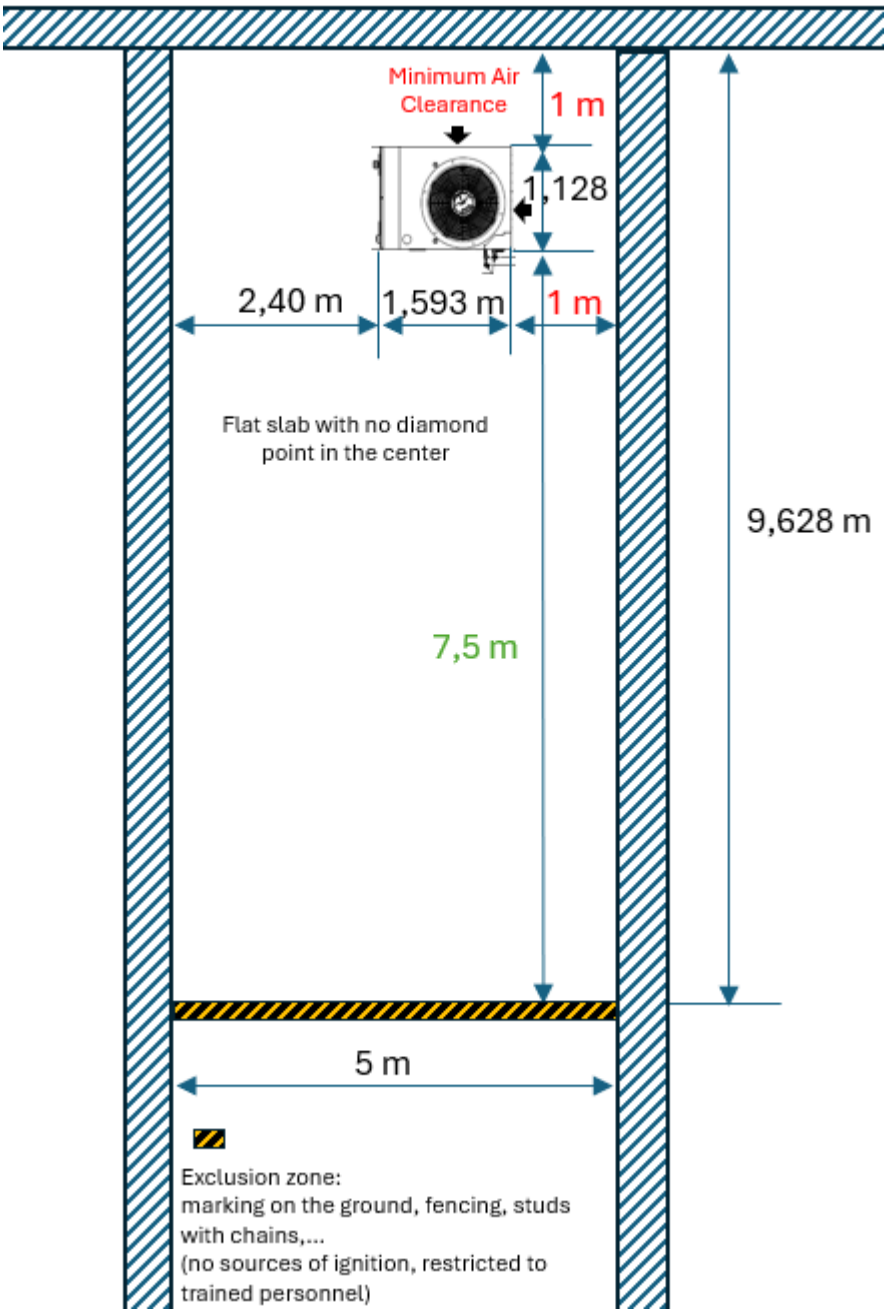

Case no. 4

(3 WALLS)

Conditions considered to characterize exclusion zones are the same as those described above, except that:

- Natural ventilation speed of 0,1 m/s in a heavily obstructed environment

*(It is the user's responsibility to check that these conditions are met, depending on the location. If not, a study will have to be carried out to assess the necessary corrective measures.)*




### 9.5.3. ATEX ZONES

A minimum ATEX Zone 2 of 1m is defined at the unbrazed connections of safety valves and service valves (assuming a leak on a 0,025 mm² connection at 32 barg). Subject to periodic leak tests of these screw connections, carried out on receipt on site, and then regularly: first at a frequency of one month, then three months, and finally every six months, the Zone becomes non-hazardous, i.e. a Zone 2 of negligible extent.

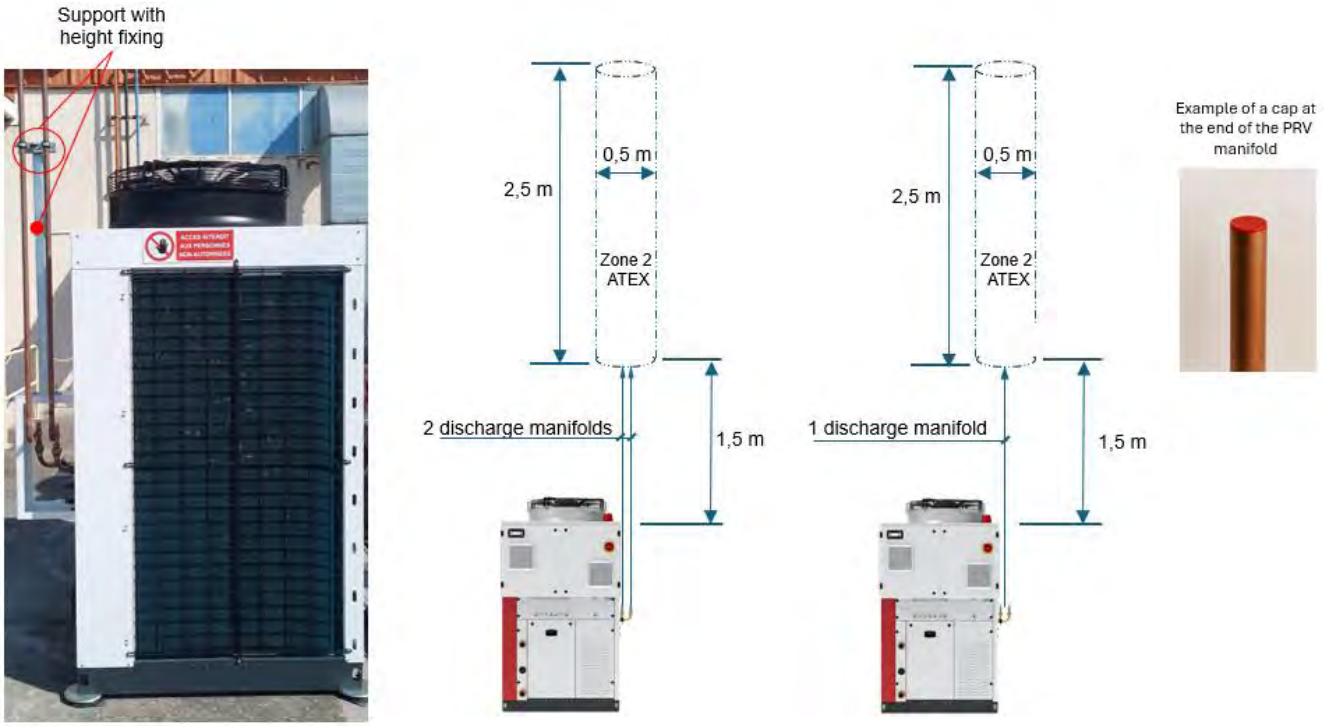
There is also an ATEX Zone 2 at the valve outlet. This zone must be collected at a distance and in a safe area.

### 9.5.4. REJECTION OF DAMAGE LIMITATION VALVES IN THE EVENT OF EXTERNAL FIRE

To properly duct the damage limitation valves (PRV), the following recommendations must be followed:

- The discharge from the damage limitation valves must be at least 1,5 meters vertically above the unit. It is the user's responsibility to check, depending on the location, that no source of ignition, fresh air intake or human intervention is planned in this ATEX Zone 2. If this is not the case, another discharge zone must be identified. The discharge at the end of the manifold will be vertical, with a plastic plug at its end, allowing visual checks on the integrity of the valves and that they have not been triggered.
- Discharge must be done in secure locations, away from pedestrian traffic, away from fresh air intakes, away from windows, skydomes.

- No ignition source should be present in the ATEX zone in the form of a cylinder 2.5 m high and 0.5 m in radius (see diagrams below).Each damage limitation valves includes a 3-piece connection system for brazing the discharge manifold. The discharge manifold must be secured at the top of the unit (see photo below). Before any brazing work, it is mandatory to check the tightness of the screw connections on the damage limitation valves and pressure taps using a leak detector before brazing work is carried out. Preparation for brazing work must be carried out as far away from the exclusion zone as possible.




- Below the following table indicates the required diameters of duct that must be provided for the manifolds according to the different configurations:

| | 3-piece fitting | 1 manifold per PRV | | 1 common manifold | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 2,5m | 1 elbow | 8m | 4 elbows | 16m | 8 elbows | 24m | 12 elbows |
| LP valve | 1/2‘ female BSP x 1/2’ ODS | 7/8” | | 1 3/8” | | 1 5/8” | | 1 5/8” | |
| HP valve | | 7/8” | | | | | | | |

*Compliant EN ISO 24664:2024*

### 9.5.5 MINIMUM INSTALLATION DISTANCES FOR THE UNIT

From a building's mechanical extraction unit ……5 m

Other equipment fitted with an extraction ventilation system ……5 m

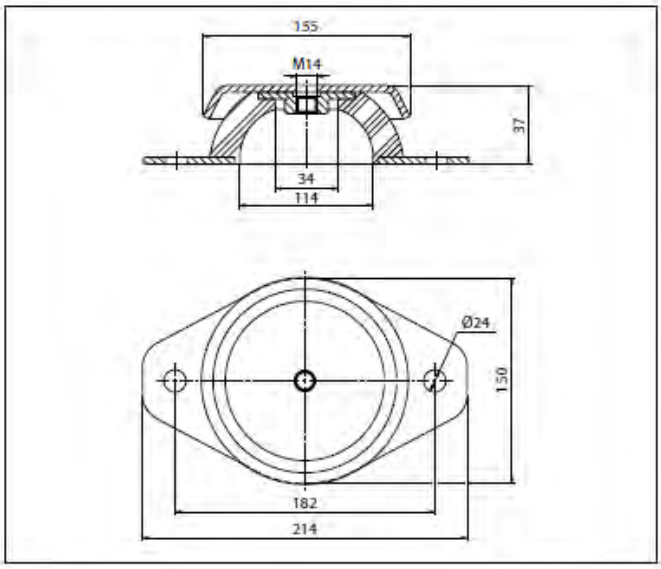
A road or property line ……..5 m

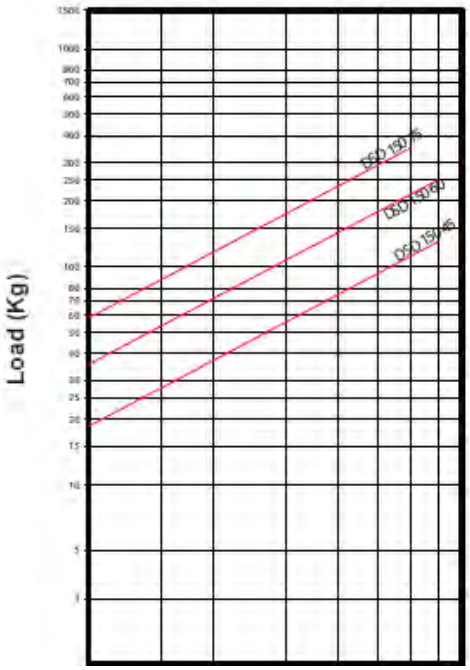


The unit is secure because it is equipped with its own SIL 2 leak detection safety system. In the event of a leak of more than 10% of the lower flammable limit (LFL) of propane, it emits a visual alarm and activates a fan to circulate fresh air. From 20%, the unit is shut down (power off pump and antifreeze heaters as well), in addition to the visual alarm, an audible alarm is activated and ventilation remain active. To restart the unit, deactivate the QSG1 interrupter. **In all cases, do not position the unit in a semi-buried area or on gutters, floor drains, jointed paving, etc. Position it on a flat surface.**

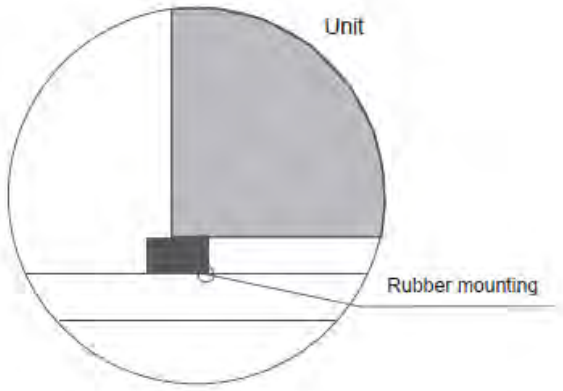
### 9.5.6 ANTIVIBRATION MOUNTING

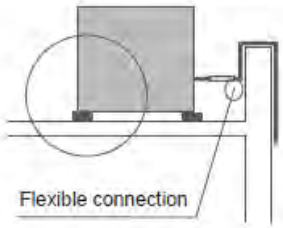
| | STD Unit | | With Dual Pump | | With Dual Pump & Water Tank | |
|---|---|---|---|---|---|---|
| | G1 / D1 | G2 / D2 | G1 / D1 | G2 / D2 | G1 / D1 | G2 / D2 |
| YBH045SY1M<br>YBH060SY1M | DSD150 A45 | | | | DSD150 B60 | |

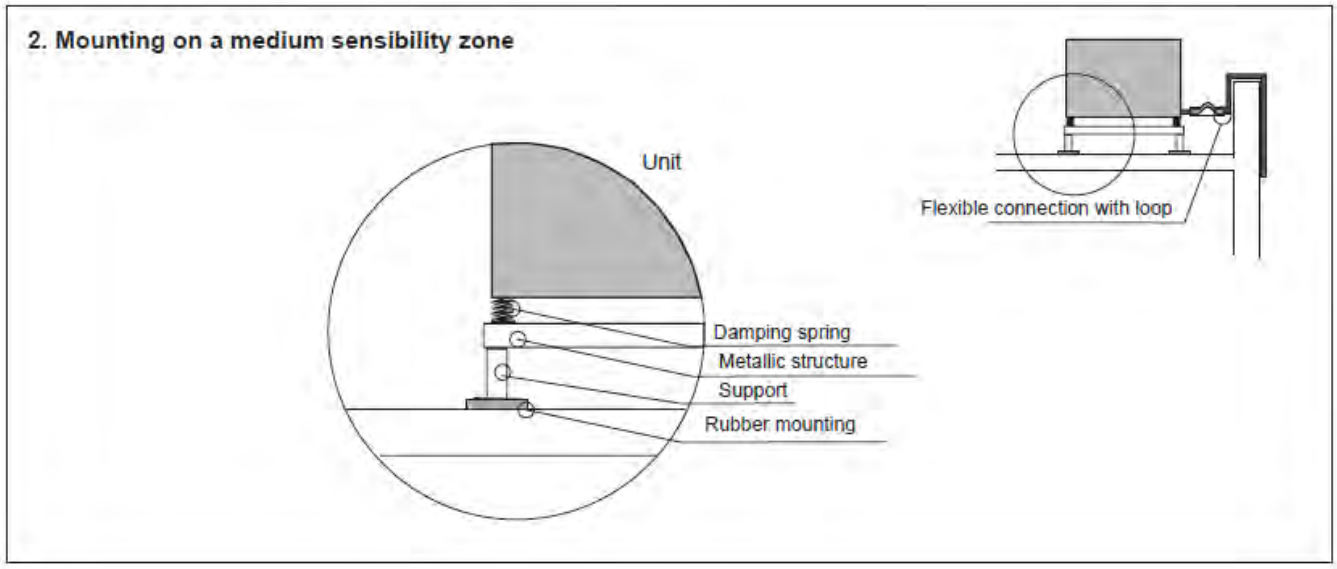


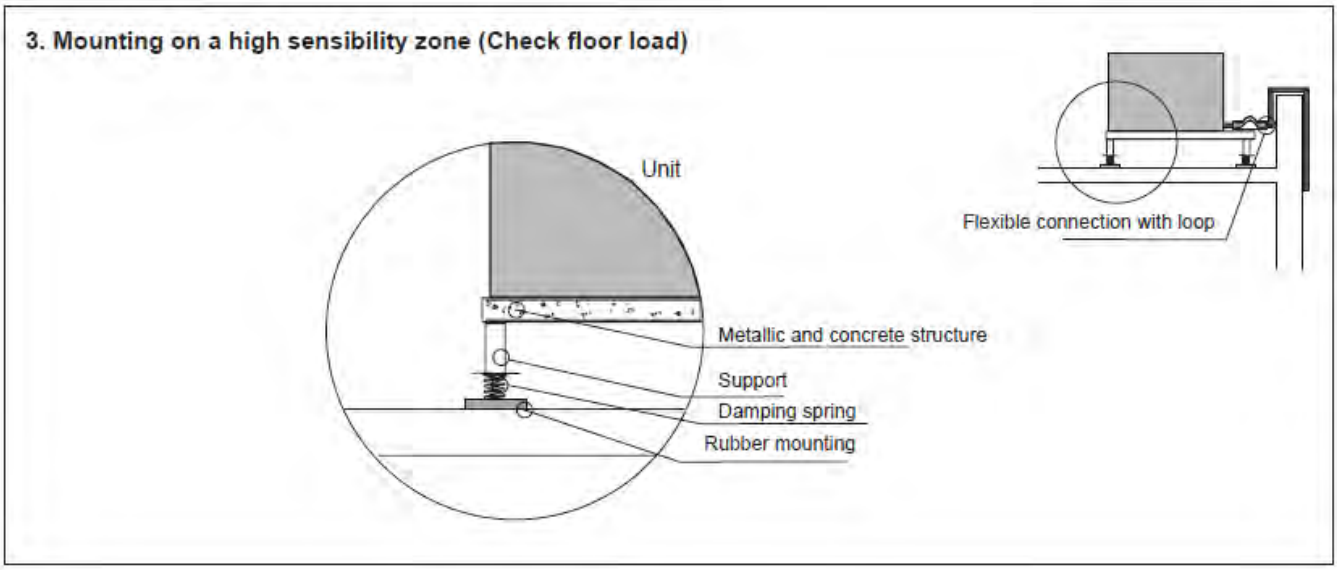




**1. Mounting on a low sensibility zone**






## 9.6 WATER/GLYCOL CONNECTIONS

### 9.6.1 EVAPORATOR

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.

An air vent fitted with a manual valve must be installed outside the unit before the water network enters the building and at high points in the network requiring it to ensure that in the event of a leak on the unit's water heat exchanger no flammable refrigerant may enter the building.

During the inspection of the piping system, an explosimeter will be positioned at the purge outlet to ensure that there are no leaks on the heat exchanger and no refrigerant in the circuit. Once this check has been carried out, the manual purge valves will be closed, and the circuit will be hermetically sealed to prevent any air entering and any risk of refrigerant being released into 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 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, insulate the piping and add an electric heater. Internal unit piping is insulated from factory.
- Ensure full earth 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 may cause problems with oxygenation, or operation with untreated ground water.**

### 9.6.2 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 may cause problems with oxygenation, or operation with untreated ground water.**
The use of untreated or improperly treated water may lead to scale, algae, sludge build-up, or corrosion. It is recommended to consult a qualified water treatment specialist to determine the appropriate treatment. The manufacturer cannot be held liable for any damage resulting from the use of untreated or improperly treated water, saline water, or seawater.
Here are our non exhaustive recommendations given as an indication:

- NH4+ ammonium ions in the water 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.
- 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 may also lead to corrosion risks. Content < 1mg/l.
- Water hardness: TH > 2.8 K. Values between 10 and 25 may be recommended. This will facilitate scale deposit that may limit corrosion of copper. Too high TH values may 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 may 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 drain the water circuit for a period of more than one month, the entire circuit must be put under a nitrogen charge, to avoid any risk of differential aeration corrosion.

### 9.6.3 ANTIFREEZE PROTECTION

**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 ELEVATE 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 the 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*

**DRAIN THE INSTALLATION**

**It is important to ensure that <u>manual air bleeders</u> 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.**

### 9.6.4 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.**

## 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 may only be ensured if the volume of water is sufficient. The theoretical volume of the water loop for a proper air conditioning operation may 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 → 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 YBH | | | | | | | |
|---|---|---|---|---|---|---|---|
| Size | Nominal cooling capacity | Nominal heating capacity | Minimum capacity step | | Minimum water content of the installation | | |
| | kW | kW | COMFORT | PROCESS | Maximum temperature deviation of 6ºC | Maximum temperature deviation of 4ºC | Maximum temperature deviation of 2ºC |
| | | | % | | | | |
| Standard compresor | | | | | | | |
| 045 | 38,9 | 42,3 | 21% | | 78 | 117 | 235 |
| 060 | 50,4 | 60,3 | 25% | | 121 | 181 | 362 |

**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.

| ELEVATE unit range | Expansion vessel volume | Pressure in the expansion vessel | Maximum clear water volume | | Maximum glycol water volume | |
|---|---|---|---|---|---|---|
| | | | Static pressure 5 m | Static pressure 10 m | Static pressure 5 m | Static pressure 10 m |
| YBH 045-060 | 25 l | 1,5 bar | 500 l | 350 l | 270 l | 180 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. This is responsibility of installer to adjust pressure before filling the hydraulic system.**

### 9.6.5 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 ELEVATE 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 may 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.**

A paddle flow switch is implemented in standard in the ELEVATE units.

### 9.6.6 BUFFER TANK OPTION

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

## 9.7 SOUND LEVELS

Air-cooled heat pump may be a significant source of noise in refrigeration and air conditioning systems. Considering 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 unit 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 soundproofing 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 contact an engineering office that specialises 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.**

## 9.8 ELECTRICAL CONNECTIONS

Ensure power supplies to the unit matches the nameplate values and wires are properly sized 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. Air-cooled heat pumps are supplied with a main isolator switch.



Unit working with highly flammable refrigerant. Before powering the unit, conduct a refrigerant detection with a dedicated device to ensure no possible presence around the unit.



**Wiring must conform to applicable regulations. The type and location of fused isolators must also conform to regulations. For safety, install them where they are visible and within easy reach of the unit. Units must have full earthing continuity.**

**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.**



**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 A3 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.**

## 9.9 ELECTRIC WIRING

When a cable passes through a panel, 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 if presence of a leak.

### 9.9.1 RECOMMENDED CABLE SELECTION

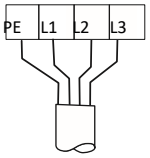
The sizing of the power cables is the responsibility of the installer. It must be done in accordance with the electrical values of each unit (noted at the time of ordering and on the electric diagram) and according to the regulations of each site.
The table below is given as an indication and does not 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** and check their cross-section

The cable sections have been calculated based on a distance of 50m and variation of -10V.

- XLPE insulation cupper cable over perforated cable tray.
- Max temperature: 50ºC.
- Type of cable in Cu RV-K.

Do not start the unit if the drop is greater than this.
Ground wires must be properly connected and have a greater length than the phase wires

**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.**

| POWER SUPPLY | UNIT MODEL YBH | NUMBER OF WIRE PER SECTION | |
|---|---|---|---|
| | | CUPPER CU | ALUMINIUM AL |
|  3 ~ 400V-50Hz + PE | **045SY1M** | 4G x 6mm² | 4G x 10mm² |
| | **060SY1M** | 4G x 10mm² | 4G x 16mm² |

### 9.9.2 VOLTAGE OPERATION LIMITS

| MODELS | VOLTAGE | LIMITS |
|---|---|---|
| **YBH 045-060** | 3~400V-50Hz ±5% | 3~360-440V-50Hz |

Main switch pad dimension



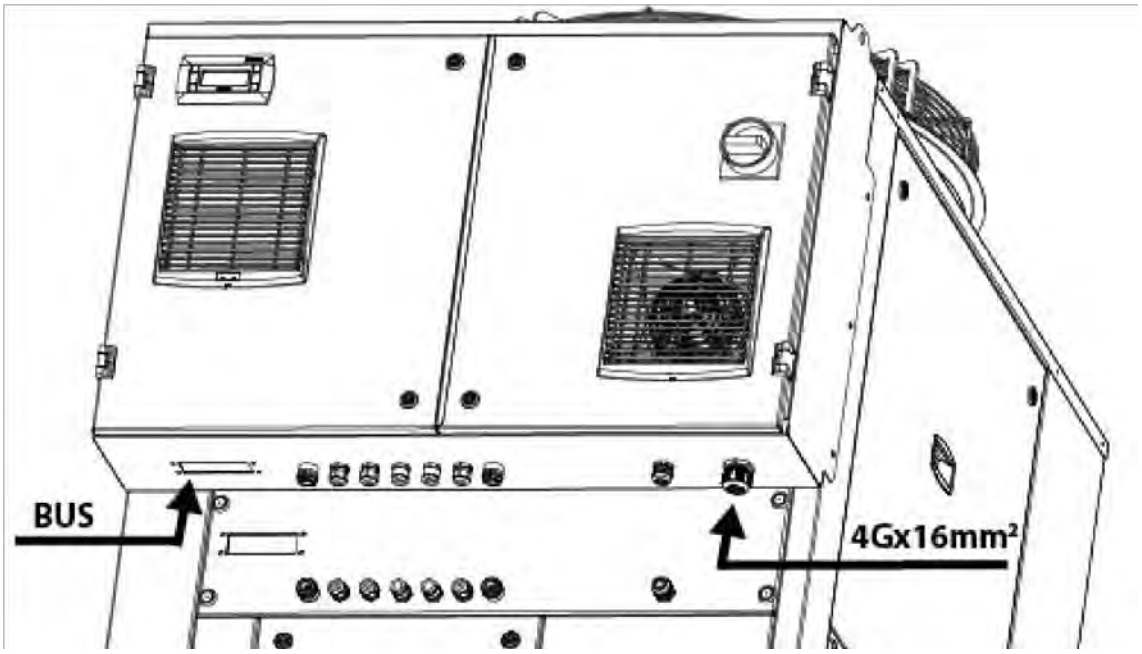

SCHNEIDER




| VARIO_V4 | S (mm²) | d (mm) |
|---|---|---|
| 57 A | 4-25 | 15 |

### 9.9.3 MAIN SUPPLY CABLE ROOTING TO MAIN SWITCH

**Example of unit power supply rooting with one cable 4G 16mm².**




When a cable passes through a panel, 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.

### 9.9.4 CUSTOMER PROTECTION INFORMATION

To protect our unit, LFB Group recommends the implementation of upstream circuit breaker protection.
For this circuit breaker protection, the customer must consider the “maximum peak” withstand voltage of our breaker (see table below)

| Protection by circuit breaker | | | |
|---|---|---|---|
| Main switch set in the unit | | | Customer protection requested |
| **Supplier** | **Reference** | **Ipeak max.** | **Reference** |
| **SCHNEIDER** | **VARIO_V4 - 57A** | 10kA | To be determined by the customer |

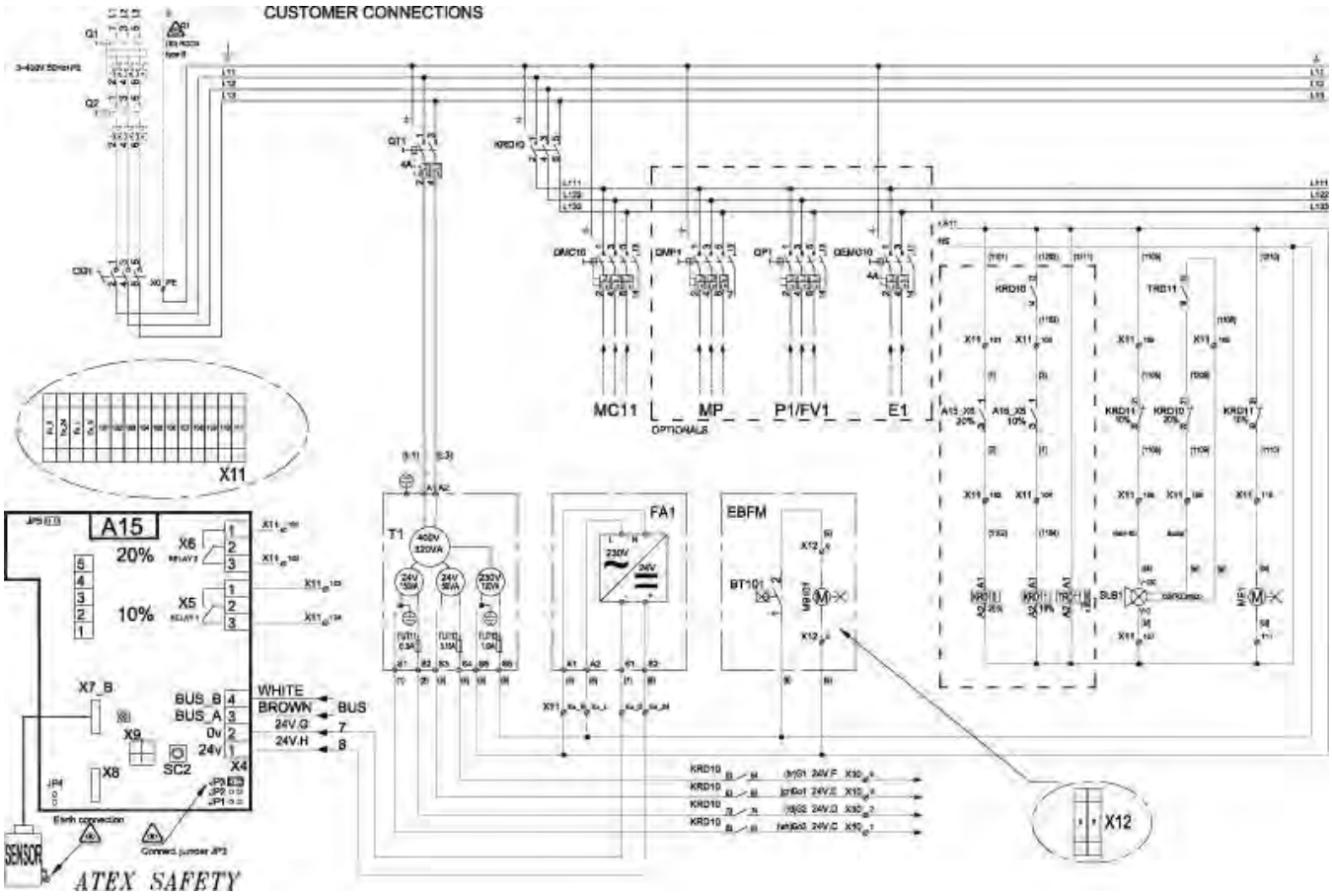
The customer must provide the necessary equipment in his installation to protect the power line that supplies the unit.

As the unit is equipped with variable condenser fans or variable speed pumps or compressor, a 300mA Type B super-immune residual current device (RCD) is recommended for industrial use.

### 9.9.5 ELECTRICAL SAFETY

When the ATEX leak detector detects an R290 refrigerant leak, the unit performs the following steps:

- Only ATEX leak detector, ATEX extraction fan and alarm are active via KRD11.
- Other components are shut off via KRD10.




Ignition source in a potentially flammable atmosphere: Fire hazard. Any work on the energized terminals in the unit terminal box could create an igntion. Do not touch the energized terminals wit a tool or cable when the unit is energized. Circuits operating with flammable refrigerants shall use only the qualified terminal box supplied by the LFB Group.

### 9.9.6 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 |
|---|---|---|---|
| pLan | 500m | Screw | 2 wire 2x0.5mm² LiYCY (Shielded) |
| DM | 500m | Screw | 2 pair 2x0.5mm² LiYCY (Shielded, twisted) |
| DS | 50m | Phone cable | 3 pair 0.25mm² (Not shielded) |
| DC | 200m | Screw | 2 pair 2x0.5mm² LiYCY (Shielded, twisted) |

# 10 COMMISSIONING

- **This work must only be carried out by LFB Group personnel or technical partners trained and authorized by LFB Group.**
- Do not forget to check that the check valve on the suction line is opened before starting the unit (ball valve on the frigorific circuit schematics).
- Check the presence of a water / refrigerant separator in the water/glycol circuit (see ❶ the drawing below). This equipment must be installed outside the electrical box. Please ensure that the separator is placed in the water outlet connections (check stickers and hydraulic connections).
- Check the installation respects safety requirements:
  - 2m exclusion zone around the unit.
  - Mandatory to duct the damage limitation valves discharges, otherwise the unit cannot be commissioned. (see clause POSITION OF DAMAGE LIMITATION VALVES IN THE EVENT OF EXTERNAL FIRE)
  - Keep a minimum distance of 1,5m (minimum height position 1,5 m) between the damage limitation valves discharge and the unit.
- 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.




## 10.1 INTERVENTION ON THE UNIT

Prior to any operation about refrigeration circuit, hydraulic system, please check the operation limits of the unit given in the «APPENDIX» at the end of the IOM, these tables will give you all necessary information concerning the operating envelop of the unit.

**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..**

### 10.1.1 CHECK BEFORE START-UP

**Before working on the unit, use an appropriate leak detector to ensure the absence of refrigerant around it.**
When working on a machine with flammable fluid A3, do not create sources of ignition in the area near the air-cooled heat pump (see above). For example: do not smoke, make phone calls, do not use connected equipment (watches, car keys, etc.).

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 even leading to break internal parts:

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.
2. 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.
3. 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.
4. 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
5. Ensure that the water circuits mentioned in 1 are completely filled with water or brine as the case may be; with the manual air bled out of all high points, including the evaporator ensuring they are perfectly clean and leak tight.
6. Open power circuits to all components: compressors, fans, etc
7. Power up the unit with the main disconnect switch.

**Power up the unit 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 bottom of the compressor shell.**

8. 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 x √(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.

9. Check correct operation of the fans and that the protective grilles are in good condition.

10. 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.

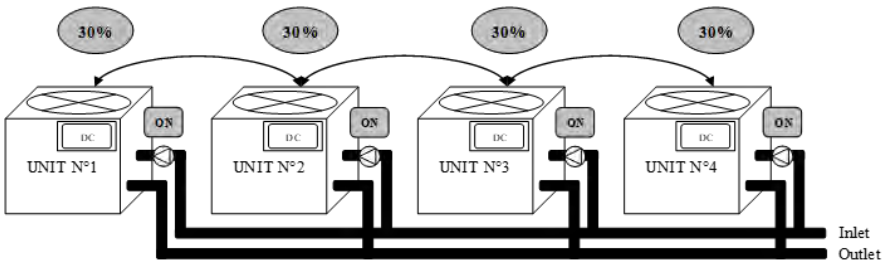
**Do not start any motor whose insulation resistance is lower than 2 megaohms.**
**Never start any motor while the system is under a vacuum.**

### 10.1.2 MASTER - SLAVE CONFIGURATION (UP TO 8 UNITS)

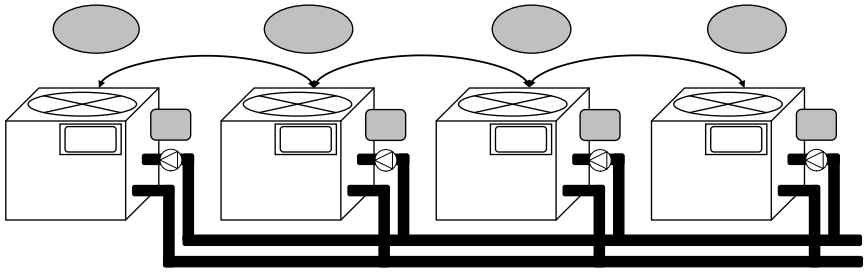
In case of two units or more that shall operate together, the controller allows several configurations: please consult the controller manual to enter the right parameters.

**Cascade mode:**

- Parallel: All units work together in parallel. The master unit controls the slave units to equalize the compressor stages number



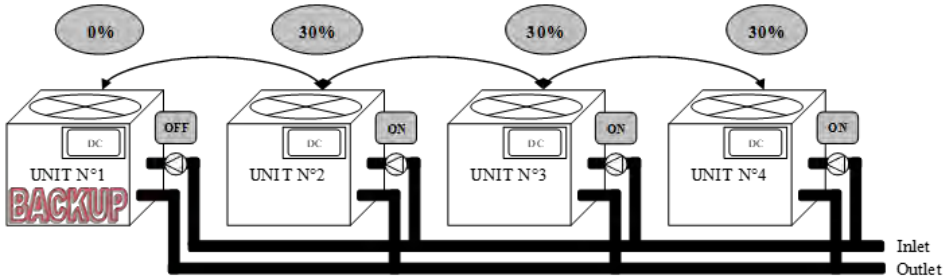

- Serial: In this mode, units start one after the other. The next unit starts only when the previous one reach full capacity (100%).



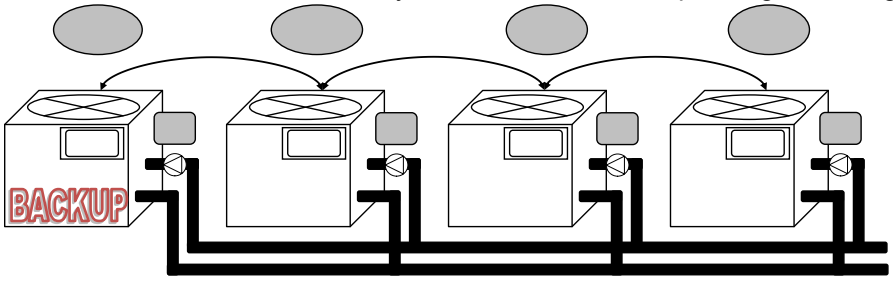
**Backup mode:**

In this mode, one of the units is set in standby. The backup unit starts only if an alarm is detected on the others operating units.

- Parallel: One of the units is forced in standby and the others are in operating according to the Cascade parallel method.




- Serial: One of the units is forced in standby and the others are in operating according to the Cascade serial



### 10.1.3 CHECK DURING START UP

**During the works on the unit, use an appropriate leak detector to ensure the absence of refrigerant around it.** Before switching on the power supply, conduct a refrigerant leak detection test using an appropriate device to ensure the absence of refrigerant around the unit.

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 may 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.

- Mandatory commissioning must be performed by LFB Group personnel or technical partners trained and authorized by LFB Group to ensure the guarantee.
- Check the presence of a water / refrigerant separator in the water / glycol circuit.
- Check that the installation complies with the requirements of the exclusion zone around the unit (Cf.9.5.2) according to the configuration of the site and the ATEX risk assessment. As there must be no source of ignition in this zone, the damage limitation valves must be evacuated to a location that is safe for people, property and the environment (see 9.5.3 & 9.5.4). Nothing must obstruct the damage limitation valves manifold on the outlet clearance.
- 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 the presence of the safety high pressure switch.
- Run evaporator pump prior to start the unit.
- 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).

### 10.1.4 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.
- The best practice recommends checking the sub cooling after the condenser.
- Check the subcooling after the condenser.
- 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.

### 10.1.5 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.

The nominal flows at design conditions and the delta T at design conditions must be used. Now, during start-up, the ambient conditions will often be different from the ambient design conditions, and therefore, the cooling capacity (and the heat rejection) of the unit will be different from those at design conditions. Use the unit performance charts of the AGU to find the right ΔT on the evaporator (and condenser side). For a unit selected at design conditions, this will give the nominal delta T on the evaporator side (ΔTen), 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 (ΔTesu) should be ΔTesu= ΔTen*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 may 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 table 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 |

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.

### 10.1.6 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 (tube & fin or Microchanels): 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.
6. Damage limitation 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 powered up when the compressor is not running.
9. Leak detection safety chain: it is a Safety Integreted Level 2 leak detection safety system. It triggers a visual alarm at 10% of the LFL and shuts down the unit at 20% of the LFL while keeping the detector, fresh air fan, visual alarm, and audible alarm active.

# Propane heat pump unit ELEVATE (R290)

## Commissioning checklist / technicians

***This checklist is intended for technicians responsible for installing and commissioning the unit. It must be completed each time the unit is commissioned to ensure compliance with the safety conditions for the use of propane (R290 fluid). The technicians must follow the instructions in the instruction operation manual.***

| Control point (commissioning) | Yes/ No | Observations / measures taken |
|---|---|---|
| The personnel working on the site have the necessary skills for handling flammable fluids (training to NF EN ISO 22712 or equivalent, employer's certificate) and the appropriate personal protective equipment. | | |
| Before any intervention, check for gas leaks around the unit using an ATEX explosimeter and check for leaks on screw connections, valves and service valves using an ATEX propane detector. | | |
| The confirmed location complies with minimum distances (≥ 2 m from ignition sources, ≥ 5 m from buildings, roads, property boundaries, other mechanical ventilation systems/units). | | |
| The site benefits from sufficient natural ventilation and no accumulation of gas is possible; there is a clearly marked exclusion zone. | | |
| Electrical lockout and power supply isolation procedures are followed before any work is carried out, if necessary. The unit is properly earthed | | |
| The unit's safety components (SIL 2 safety chain, pressure switches) have been tested and are working correctly. | | |
| The screwed connections have been checked and tightened correctly; the tightness check on delivery has been carried out and periodic tests are planned to maintain the negligible extended ATEX zone 2 around the non-brazed connections. | | |
| The safety valve discharge pipe is installed in accordance with the recommendations: it opens vertically at least 1.5 m above the unit, in an area with no sources of ignition, with no openings nearby, with a fresh air intake, and it is securely fastened. Where this is not possible, an exhaust manifold is installed at a distance with a vertical discharge; in all cases, the end is sealed with a protective plastic plug to prevent the entry of water or impurities. | | |
| The unit is installed level on anti-vibration supports, using hydraulic hoses and observing assembly procedures (to avoid transmitting vibrations). | | |
| The water/glycol connections are correctly made (respect for inlets/outlets, upstream filters, manual drain, leak test, no propagation of fluid in the building). | | |
| Maintenance and leakage monitoring plans (initial, monthly, quarterly and then half-yearly inspections) are put in place and recorded. | | |
| An explosion protection document is available on site and includes a description of the risks, technical and organisational measures, and responsibilities (see EPD Checklist). | | |

*This document certifies that the unit has been delivered in accordance with the technical and regulatory specifications in force. The end user's signature validates acceptance and releases the manufacturer from any further liability. It is understood that the instructions in the installation, use and maintenance manual must be strictly complied with.*

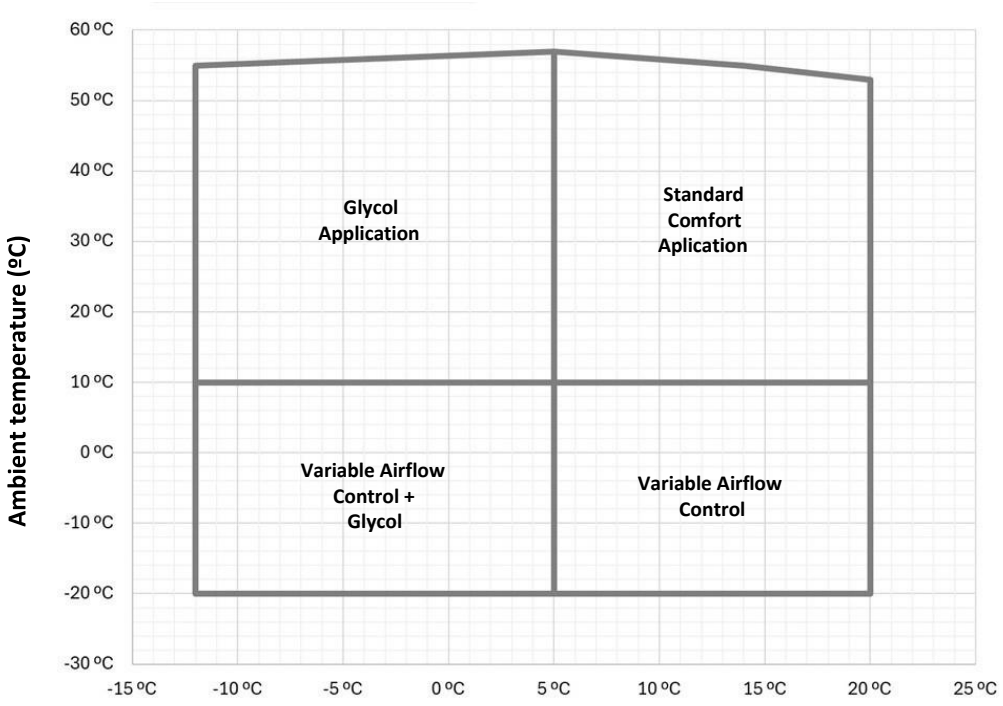
| Done at [Place], on [date] | |
|---|---|
| End user [Name] / [signature] | LFB technician [Name] / [signature] |

# 11 OPERATION

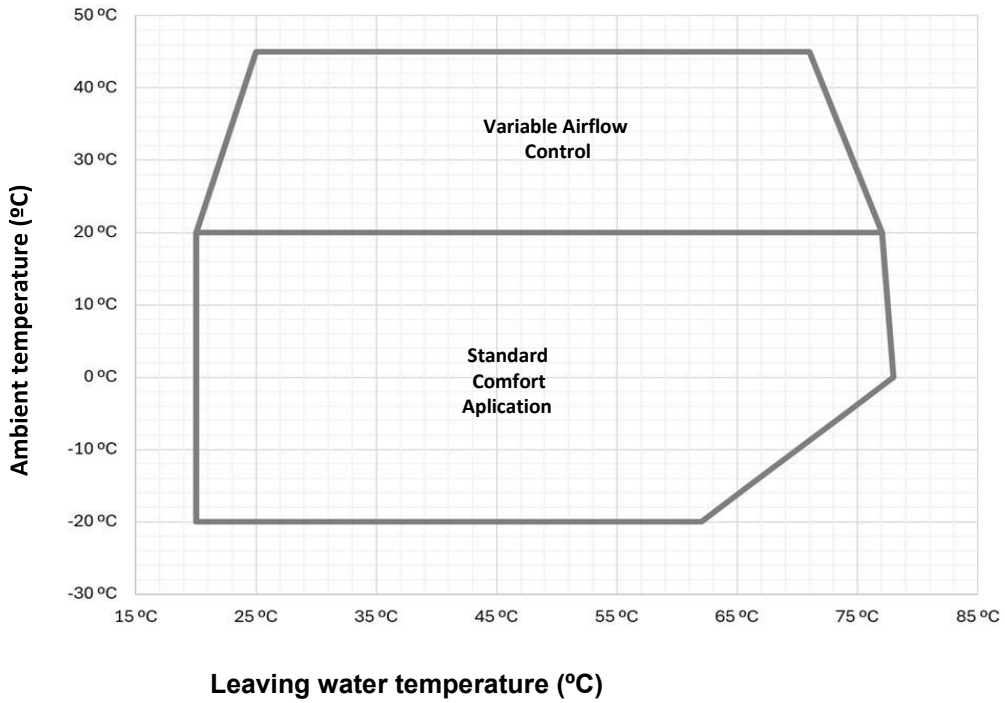
## 11.1 OPERATING LIMITS

**It is very important to ensure that the units operate well inside these envelopes**

Operating limits YBH - Cooling mode




Operating limits YBH - Heating mode



### 11.1.1 REFRIGERATION CIRCUIT

**Oil charge**

All units are delivered with a complete oil charge, and there is no need to add any oil before starting up the unit or afterwards. When a compressor is replaced, use only spare official parts approved by LFB Group. Overcharging the circuit with oil may cause serious problems in an installation, particularly in the compressors. In case of doubt please contact LFB Group.

| OIL RECOMENDATION FOR ELEVATE | | | |
|---|---|---|---|
| **Refrigerant** | **Compressor type** | **Brand** | **Oil type** |
| R290 | Scroll (Variable Speed) | Copeland | POE Emkarate 3MAF |

**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 monitors 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.

## 11.2 ELECTRICAL AND CONTROL FEATURES

See the specific «Basic CLIMATIC controller» manual. In case of doubt, please contact LFB Group.

1. **Fan over current protection:**

Circuit breaker is 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 is designed to protect each motor winding against accidental over current.

3. **Chilled liquid pump interlock:**

This interlock is made only if the the pump is supplied with the air-cooled 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 may 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.

### 11.2.1 CLIMATIC CONTROL

See the specific «Basic CLIMATIC controller» manual. In case of doubt, please contact LFB Group.

# 12 MAINTENANCE

## 12.1 SAFETY REMINDER

Our air-cooled heat pump products are hermetically sealed and carry the CE mark. They are designed to contain highly flammable A3 refrigerants. As such they are not considered as a source of release as defined by the ATEX 60079-10-1 directive in normal operation.

A formalized periodic inspection of the hermeticity of the product 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, LFB Group has conducted studies in accordance with EN IEC 60079-10-1 and EN 378. Thus, a unit that is installed in accordance with our recommendations and properly maintained does not create 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 with an explosimeter, 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 R290, a 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 flammable gases on site and the implementation of appropriate staff training on safe handling practices and preventive measures.

## 12.2 SCHEDULE

**Unit working with highly flammable refrigerant. Before, during and after any intervention on the unit, use an explosimeter to ensure the absence of refrigerant around the unit.**

**During the lifetime 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 EN ISO 5149:2025 may be used if no similar criteria exist in the national regulations. With regard to damage limitation valves, the manufacturer's instructions take precedence over the standard and state that: an external visual inspection is required at around 36 - 48 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 servicing of the unit. The following maintenance instructions form a part of the operations required for this type of equipment.

However, it is not possible to provide a fixed or precise schedule for permanent maintenance procedures that can keep all units in perfect operating condition, as this depends on numerous factors specific to the installation, the way the machine is operated, its frequency of operation, climatic conditions, atmospheric pollution, and other variables. Only trained experienced personnel may establish strict maintenance procedures adapted to the conditions listed above.

Nonetheless, we recommend a regular maintenance schedule as follows:

- 4 times a year for air-cooled heat pumps operating all year long.
- 2 times a year for air-cooled heat pumps that only operate during the cooling 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», with 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 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 dealer.
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 may be carried out by on-site maintenance technicians trained and legally capable of performing operations in R290 units.**

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

## 12.3 MAINTENANCE PLAN

| N° | MAINTENANCE PLAN | | Monthly | Quarterly | Half yearly | Per year |
|---|---|---|---|---|---|---|
| | Task | Operating mode | | | | |
| 1 | Inspection of the microchannel coils aluminum-copper connexions for corrosion. | Proper care should be taken when cleaning the coils. If corrosion is detected, preventive treatment should be carried out in accordance with our recommendations. | \| | | | |
| 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.<br>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.<br>(WARNING: Fins and copper tubes are very fragile. Any damage will reduce the performances of the unit). | \| | \| | \| | |
| 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:<br>**Monthly:** If the unit is used all over the year.<br>**Half Year:** If seasonal use. | \| | \| | \| | |
| 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.<br>Check the filter fouling rate, clean or replace it when needed by an original filter. | • | • | • | |
| 5 | Inspection of the condenser fans. | Check the rotation of the fan (free rotation, detection of vibrations or bearing noises).<br>Check for the Amps consumed on all three phases; compare it with the nominal value given in the electrical wiring diagram.<br>Check the status of the fan blades and its protections. | | \| | | |
| 6 | Inspection of the oil level and check the oil for traces of acidity in the refrigerant circuits. | Check the oil level in the compressor. Test the oil every 3 years and/or after each intervention on the refrigerant circuit. | | \| | | |
| 7 | Check the 4-way valve. | During cooling mode, reverse to Heat Pump mode. Reset the control. | | \| | | |
| 8 | 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. | | \| | | |
| 9 | If possible, check for water pressure in the circuit. | Check the water pressure in the circuit and the efficiency of the expansion vessels. | | • | | |
| 10 | 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. | | \| | | |
| 11 | Check the circulation pumps. | Check the absorbed electrical power and the correct rotation of the pumps.<br>Check if there is no leakage of water at pump seal and if needed follow the manufacturer maintenance plan. | | \| | | |
| 12 | Check water flow. | Measure the water flow rate and compare to the selected value from the technical datasheet. | | \| | | |

| N° | MAINTENANCE PLAN | | Monthly | Quarterly | Half yearly | Per year |
|---|---|---|---|---|---|---|
| | Task | Operating mode | | | | |
| 13 | 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 | | |
| 14 | Check for water leakage in the unit and its accessories. | Verify the gaskets If cracked or ripped, repair them or replace them. Check for water leaks and repair if its needed. | | | I | |
| 15 | Check CLIMATIC™ control, set points and variables. | Refer to the commissioning sheet; Check all set points are set according to this document. | | | I | |
| 16 | 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 | |
| 17 | Check the position and tightness of refrigeration components. | Check systematically all connections and fixings 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.<br>(Specifically for screw connections, to be carried out upon receipt on site, then regularly: initially once a month, then every three months, and finally every six months) | (I) | (I) | I | |
| 18 | Check the position and tightness of refrigeration components. | Check systematically all connections and fixings 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.<br>(Specifically for screw connections, to be carried out upon receipt on site, then regularly: initially once a month, then every three months, and finally every six months) | (I) | (I) | I | |
| 19 | Leak detector | Test to verify proper operation of the leak detector, which must be performed annually by LFB Group technical personnel.<br>If a new calibration test is not performed after the maintenance period (1 year), the unit will shut down | | | | I |
| 20 | Check antifreeze protection. | Test antifreeze function (leakage rate, frost protection thermostat) | | | I | |
| 21 | Check water 3-way valve. | Check the proper functioning of the system. | | | I | |
| 22 | 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 it's power. | | | I | |

| N° | MAINTENANCE PLAN | | Monthly | Quarterly | Half yearly | Per year |
|---|---|---|---|---|---|---|
| | Task | Operating mode | | | | |
| 23 | Check HP safety switch safety chain. | Install a pressure gauge high pressure and check if the safety switches work properly. | | | | I |
| 24 | Check Safety chain leak detector | With a leak calibrated at 20% of the LFL of the propane, ensure that the audible and visual alarms are operating, that the fan is working and that the unit is switched off. | | | | I |
| 25 | Check damage limitation valves | Every 36 - 48 months according to national regulations in force or choose the most restrictive | | | | |
| 26 | Check the position of all sensors. | Check the position and the fixation of all sensors. | | | • | |
| 27 | Check anti-vibration mountings, for wear and tear. | Visually check anti-vibration mountings on compressors and centrifugal fan. If damaged, replace them. | | | • | |
| 28 | 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 | |
| 29 | Check casing and equipment corrosion. | To treat and neutralize rust spots. | | | • | |
| 30 | 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 | |
| 31 | Plate exchanger. | Verify the general insulation state, the tightness of the water connection and the freeze protection. | | | I | |
| 32 | Check the expansion vessel (if applicable). | Measure the pressure under the different water modes (from +7°C to +45°C). | | | I | |
| 33 | Check the software version. | Contact the manufacturer for updates. | | | I | |

## 12.4 PREVENTIVE MAINTENANCE

LFB Group recommends performing the following operations on the unit periodically.

NOTE: If the unit is close to the sea, maintenance intervals should be more restrictive — halve the time.

| N° | PREVENTIVE MAINTENANCE<br>Task | Half yearly | Per year |
|---|---|---|---|
| 1 | Check the condition of the fan (corrosion, screws fixation...) in other to prevent blades detachment. | I | |
| 2 | Check no ice in the circuit, coils, heat exchanger... | I | |
| 3 | Check of the glycol pH. | | I |
| 4 | Perform a R290 refrigerant leak test on the screw connections of 3 way valves, damage limitation valves. | I | |
| 5 | Check the condition of the coils to prevent any possible leaks (impacts, corrosion...) and possible failing components (corrosion, wear). | | I |

## 12.5 CLEANING THE CONDENSER

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 warranry**

## 12.6 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.

## 12.7 CORRECTIVE MAINTENANCE

### 12.7.1 SAFETY MEASURES

**Unit working with highly flammable refrigerant. Before, during and after any intervention on the unit, use an explosimeter. 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 the refrigeration circuit.**

The following precautions, specific to this gas, must be taken when using the R290 refrigerant:

- Always use original replacement parts.
- The ATEX vacuum pump must be fitted with a non-return valve or a solenoid valve and comply with R290 (A3).
- 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.
- Refrigerant must be added in liquid phase.
- Always use a scale to charge the refrigerant.
- Use an ATEX leak detector suitable for R290 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.
- 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 AG130 (minimum 30% silver).
- 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

**The refrigerant must be removed from the circuit before cutting or removing any piping, using an ATEX transfer pump suitable for use with R290 (A3).**

**We recommend the following protocol before any piping work:**

- To prevent the risk of explosion due to refrigerant and oil spray, the circuit shall first be inertized (e.g. with dry nitrogen) and then depressurized to zero pressure before any disassembly or unsoldering of refrigeration components.
- ATEX Vacuum with A3 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.



### 12.7.2 VACUUM 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!**

## 12.8 UNIT INTERVENTION WORKS

- Training and awareness: Ensure that personnel are properly trained and qualified in the risks associated with using propane (dir. 1999/92/EC, national labour code). Technical documentation: Read our technical manual carefully before handling.
- Securing the area: Mark out the work area and install temporary ATEX signage while the work is underway.
- Use of certified equipment: when working on the gas circuit, no non-ATEX devices are allowed (telephones, car keys, watches, connected tablets, etc. are prohibited). Use only ATEX-certified spark-proof and electrical equipment.
- 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. If it is necessary to work with the unit powered up, it is compulsory to conduct a leak test to ensure that there is no refrigerant leak, keeping the explosimeter always switched on and positioned at the bottom, on the floor near the unit.
- Fire-fighting equipment: Keep a fire extinguisher (minimum 2 kg - class C powder) on hand to protect the immediate environment around the unit.
- 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.
- Monitoring for the presence of gas: Use an explosimeter. It must remain active before, during and after work.
- Ventilation: If leaks are detected, use an ATEX fan to supply fresh air. The portable extraction fan must be supplied with electricity at more than 2 m from the appliance. Provide a 5 m non-removable cable.
- Checking equipment: Check that the explosimeter and ATEX fan are working properly before starting work.
- Specific equipment: Prepare equipment adapted to A3 fluids, such as equipotential connections (unit, cylinder) and PPE adapted for ATEX zones (antistatic shoes and overalls).
- Setting the explosimeter: The explosimeter for propane should be calibrated to the LEL of the fluid. the explosimeter should be switched on outside the gas zone (the explosimeter calibrates against ambient air when switched on)
- Position of explosimeter: To be placed at the bottom, on the floor near the unit, preferably on the ankle or belt.
- Procedure in the event of gas detection: If the explosimeter detects a concentration greater than 10% of the LEL, evacuate the area and wait for the gas to dissipate. The LEL of propane is between 2.2% and 9.5%.
- No leaks: Check that there are no leaks by positioning the explosimeter at the lower ventilation outlet.
- For the refrigerant charge: Ensure adequate ventilation using an ATEX fan placed on the floor throughout the work.
- If the intervention is not carried out by the LFB Group personnel: The customer is responsible for training the people present with LFB Group before intervening on the unit.
- 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 or ATEX 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:
    - Only ATEX-approved personnel.
    - Equip themselves with antistatic PPE.

- Mark out the work area and install temporary ATEX signs for the duration of the work.
- Keep the explosimeter running throughout the operation.
- Have a fire extinguisher to hand.

## 12.9 REMOVING THE REFRIGERANT

- Open the expansion valve via the control system before disconnecting the power supply of the unit.
- Lock the unit
- Ground the refrigerant recovery bottle before removing the refrigerant.
- Ventilate the work area
- Start recovery with a suitable recovery unit. Keep the circuit under vacuum for 30 minutes
- If the circuit is not leaktight, stop recovery at 0 bar and close the valves.
- Seal and inertize the circuit by alternating dry nitrogen pressure and vacuum.

## 12.10 REPLACING A CIRCUIT COMPONENT

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

## 12.11 REFRIGERANT RECHARGING:

- Make vacuum to the installation.
- Ventilate the area.
- Grounding the propane cylinder
- Fill the circuit with the specified refrigerant charge (see nameplate of the unit).
- Conduct a leak test with an appropriate leak detector.
- Start the unit safely.
- Fill in the worksheet.

## 12.12 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. 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 followed during the transportation of these refrigerant containers.
- All equipment used for these procedures (gauges, hoses, ATEX 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 LFB Group guidelines.

## 12.13 COMPRESSOR MAINTENANCE

### 12.13.1 COMPRESSOR REPLACEMENT

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 make this operation in complete safety.
- After a mechanical failure in the compressor, clean the circuit once the compressor is removed. Then replace both the compressor and the liquid line filter before starting the unit again.

**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.**

### 12.13.2 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 may 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. Changes in this configuration could cause a inadequate oil return to the compressors.**

### 12.13.3 REFRIGERANT CIRCUIT OPENING TIME

These units use POE oil, which will absorb humidity when exposed to air. It is recommended to minimize the exposure time of the refrigerant circuit, applying the following recommendations:

- In accordance with good practice, the refrigeration circuit should only be opened when necessary, and for as short a time as possible.
- 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.

### 12.13.4 COMPRESSOR ELECTRICAL CONNECTIONS

To ensure the correct rotation of the compressor, they must be perfectly wired. Check the rotation using a rotation meter. If compressor rotates in the wrong direction, this could cause internal damages in the bearings and other internal components of the compressor. 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 make 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 may 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 boxesline filter drier.

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

**Compressor crankcase heaters:**

Since it is necessary to heat the oil refrigerant before starting the compressors, the internal crankcase heaters must be energized at least eight hours prior to starting the unit (unit must be powered on).

### 12.13.5 OIL LEVEL

Unit is filled with the correct amount of oil. To correctly verify the oil level, the compressors must be switched off and wait a few minutes before carrying out some reading operation.

### 12.13.6 OIL TESTS

If it is necessary, it is recommended to make 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.

# 13 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 ISO 5149:2025.

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 ISO 5149:2025). No material may be disposed of in the environment.

**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.**

# 14 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. It is recommended not to make 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 consider the correct segregation of the waste generated. No Hazardous like: Painted metallic parts, plastic elements, copper pipes, batteries, exchangers, liquid receivers, water pumps, fans. Hazardous materials such as batteries, electrical and electronic components, compressors, dehydrating filters, valves, refrigerant, etc. must be managed by an authorized company.

# 15 TROUBLESHOOTING – REPAIRS

## 15.1 LIST OF THE MOST COMMON PROBLEMS

**A.- THE COMPRESSOR DOES NOT START**

| PROBLEMS - SYMPTOMS | PROBABLE CAUSE | RECOMMENDED ACTION |
|---|---|---|
| • The compressor does not run | • No power supply | • Check main power supply and switches |
| | • Compressor motor burnt out. | • Replace |
| • Low voltage reading on voltmeter | • Voltage too low. | • Contact electrical company |
| • Unit does not start | • Breaker tripped or fuses blown. | • Check voltage and current of the equipment. |
| | | • Check condition of fuses |
| | • No water flow in the evaporator or condenser. | • Measure water flow. Check the water pump and water circuitry and filters |
| | • Flow switch contacts open. | • Find the cause of the trip. |
| | | • 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 and 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 stops due to low pressure alarm.<br>• Normal compressor operation, but the low pressure alarm trips out and resets frequently | • Low refrigerant charge | • Check the charge through subcooling value. Conduct a leak test. Refill the unit with refrigerant if required. |
| • 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 |
|---|---|---|
| • Compressor runs in 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 fans are operating correctly. Check the cleanliness of the coils. |
| | • Incondensable substances in the refrigeration circuit | • Evacuate the circuit, make vaccuum and load the unit.<br>• Note: it is not permitted to discharge refrigerant to the atmosphere |

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

| PROBLEMS - SYMPTOMS | PROBABLE CAUSE | RECOMMENDED ACTION |
|---|---|---|
| • Compressor running not stopping. | • 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 and re-fill if necessary. |
| | • Filter-drier partly obstructed | • Replace it. |
| | • Expansion valve partly closed. | • Check expansion valve bulb and capillary. Measure superheat. |
| | • Liquid line valve does not open enough. | • Check expansion valve operation. |
| • Noisy compressor, or abnormally high suction pressure or low discharge pressure. | • Internal leak in compressor valves/seals.<br>• Low oil level | • Contact LFB Group, compressor may have to be changed.<br>• Add oil |

### D.- THE COMPRESSOR CUTS OUT BECAUSE OF OIL ISSUES

| PROBLEMS - SYMPTOMS | PROBABLE CAUSE | RECOMMENDED ACTION |
|---|---|---|
| • Visible oil leak | • 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 | • 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. |
| | • Frozen evaporator. | • 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. | • Measure superheat at the expansion valve, check that the valve sensors are tightly attached. |
| | • Poor heat exchange in the evaporator. | • Check water flow and inspect for fouling by measuring the pressure drop across the evaporator. In case of excessive oil migration in the circuit, measure the 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. Check expansion valve operation. |
| | • 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. |

## 15.2 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.

**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.**

## 15.3 REGULAR CHECKS TO BE MADE: AIR-COOLED HEAT PUMP UNIT 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.

## 15.4 MANUFACTURER'S RECOMMENDED INSPECTIONS

**AIR-COOLED HEAT PUMPS WITH SCROLL COMPRESSOR(S)**

**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.

**DESCRIPTION OF INSPECTION DUTIES**

| | |
|---|---|
| **START UP:**<br>• Check unit installation<br>• Check water flow and water circuit auxilliaries<br>• Check safety devices<br>• Check leak tightness<br>• Configuration of the microprocessor-based management system<br>• Verification of operating parameters and unit performance<br>Transmission of the machine service log | **INSPECTION VISIT:**<br>• Leak test.<br>Operating test with record of measurements taken and functional analysis |
| **500 h / 1000 h VISITS:**<br>• Post wear in inspection<br>• Oil acidity test, leak test<br>• Replacement of the filter-drier cartridges depending on the results of the test above.<br>Monitor unit performance and any eventual variations linked to use of the installation | **MAJOR TECHNICAL INSPECTION:**<br>• Inspection visit.<br>• Acid test.<br>• Oil change if necessary.<br>• Replacement of filter-drier cartridges.<br>• Check up on the microprocessor-based management system.<br>• Adjustment of safety devices.<br>• Verification of unit interlocks.<br>• 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.**

# APPENDIX 1

**CHECK LIST**

| | | | |
|---|---|---|---|
| **Machine model:** | | **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:** | | | |
| **Remarks:** | | | |

| | | **C1** | | | **C2** | | | **C3** | **C4** |
|---|---|---|---|---|---|---|---|---|---|
| | | Cp1 | Cp2 | Cp3 | Cp1 | Cp2 | Cp3 | Cp1 | Cp1 |
| 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:** |

# APPENDIX 2

**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.

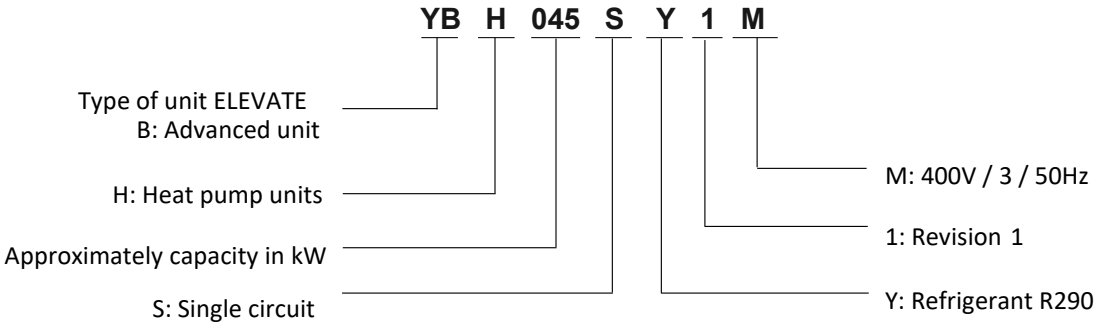
**GENERAL:**

- Ensure cooling load is available, (minimum 50 %).
- Coordination between different professions on site required for final commissioning.
- Switch on the unit 48 hours before commissioning date.

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

# APPENDIX 3

## TECHNICAL DATA




| OPTIONS: | |
|---|---|
| **HIFP** | Variable air flow control with high pressure EC fans |
| **ACTR** | LenGuard anti-corrosion condenser coil treatment |
| **LLWT** | Low leaving water temperature down to -12°C |
| **RLKD** | Refrigerant leak detection |
| **UDWR** | Unit without refrigerant |
| **TWPR** | 3 Way valve for pressure relief valve |
| **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) |
| **WFIF** | Water filter (supplied loose) |
| **ARSP** | Water / Refrigerant separator |
| **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** | Cloud connectivity Ethernet communication |
| **CGSM** | Cloud connectivity GSM communication |
| **APEP** | Antifreeze protection on exchangers and pipings down to -20°C |
| **APPP** | Antifreeze protection on exchangers, pump(s), piping down to -20°C |
| **ELME** | Electric energy meter |
| **PHCT** | Phase reversal protection |
| **AVUB** | Anti-vibration mounts rubber type (supplied loose) |
| **SLCR** | Wooden crate for long distance |
| **LNCJ** | Low noise : Accoustic compressor jacket |
| **CPGR** | Coils protection: metallic grille |

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

# APPENDIX 4

## TECHNICAL DATA

### AIR-COOLED HEAT PUMP

This unit is an advanced heat pump. It includes a variable speed compressor and EC fan, and as an option it may include variable speed pumps.

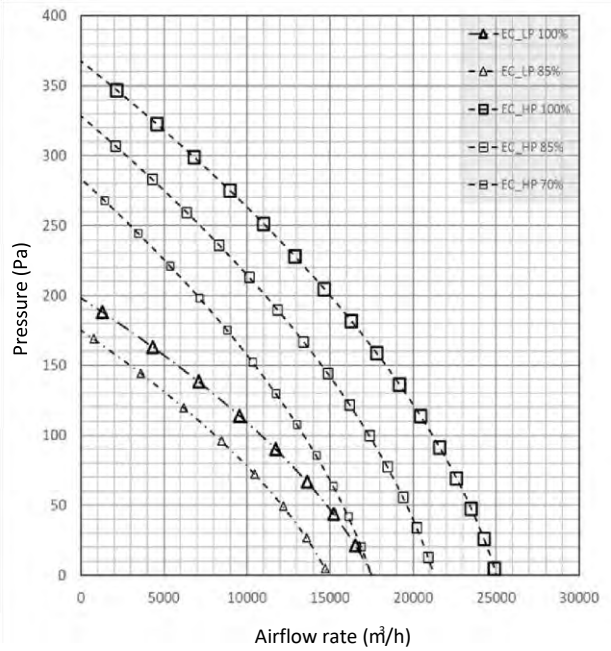
| YBH MODELS | | 045S | 060S |
|---|---|---|---|
| **Nominal cooling capacity (*)** | Kw | 38,9 | 50,4 |
| **Maximum cooling capacity (*) (***)** | Kw | 38,9 | 52,3 |
| **Minimum cooling capacity (*) (***)** | Kw | 8 | 13,4 |
| **Nominal heating capacity (**)** | Kw | 42,3 | 60,3 |
| **Maximum heating capacity (**) (***)** | Kw | 42,3 | 62,5 |
| **Minimum heating capacity (**) (***)** | Kw | 9,8 | 17,3 |
| **Number of compressors** | | 1 / Scroll variable | |
| **Hydraulic connections** | | 2” | |
| **Nominal water rate** | $m^3/h$ | 6,7 | 8,7 |
| **Net weight** | Kg | 411 | 500 |

(*) Cooling capacity: Outside temperature: 35ºC / Inlet / Outlet water temperature: 12 / 7ºC.
(**) Heating capacity: Outside temperature: 7ºC DB / 6ºC WB / Inlet / Outlet water temperature: 40 / 45ºC.
(***) Maximum / minimum cooling / heating capacity depending on the minimum / maximum speed of the compressor.

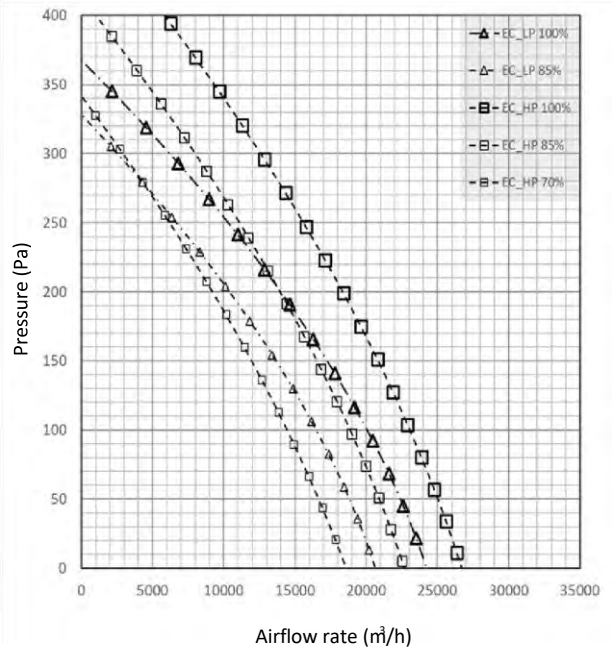
**To know the R290 refrigerant charge, see the unit rating plate.**

## FAN DATA

### YBH045SY1M



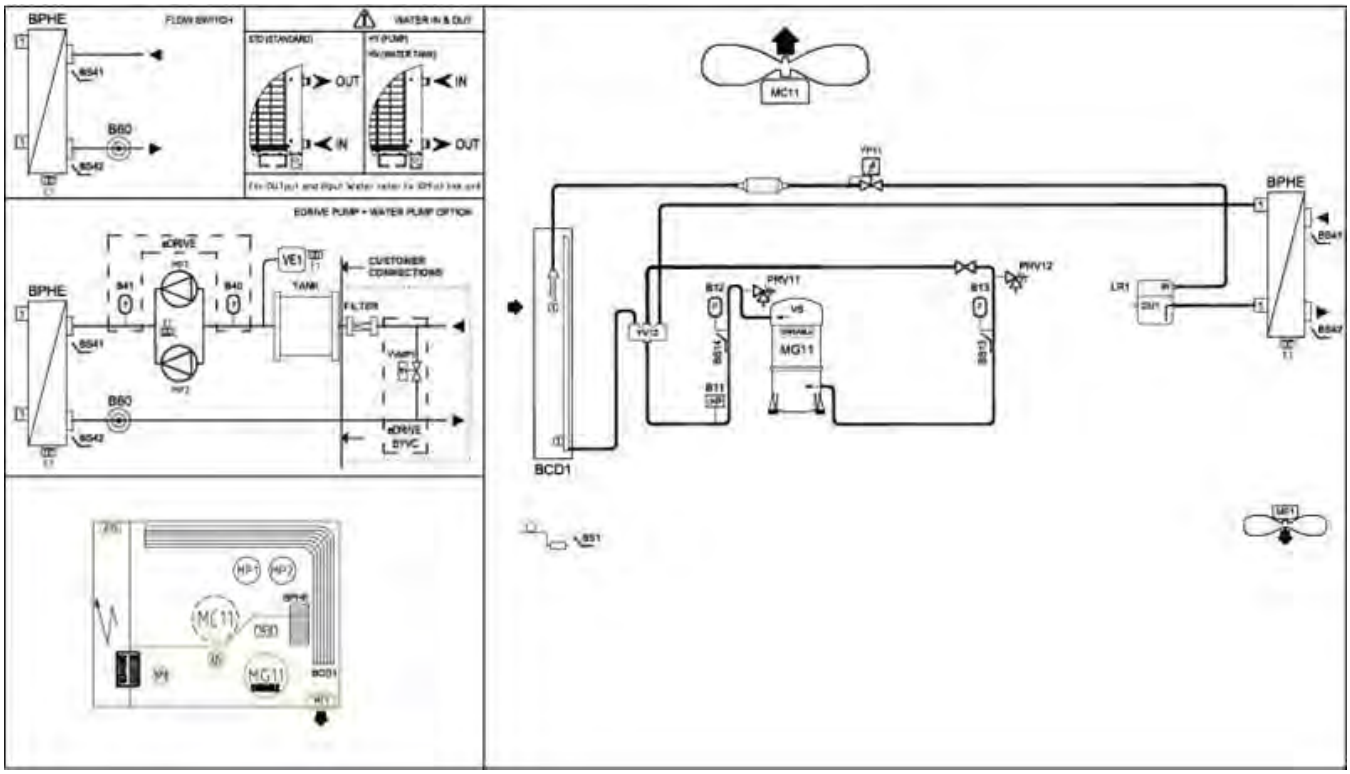

### YBH060SY1M



# APPENDIX 5

**GENERAL REFRIGERATION CIRCUIT: ELEVATE HEAT PUMP YBH 045 / 060**

Service valves are available to load / unload the unit

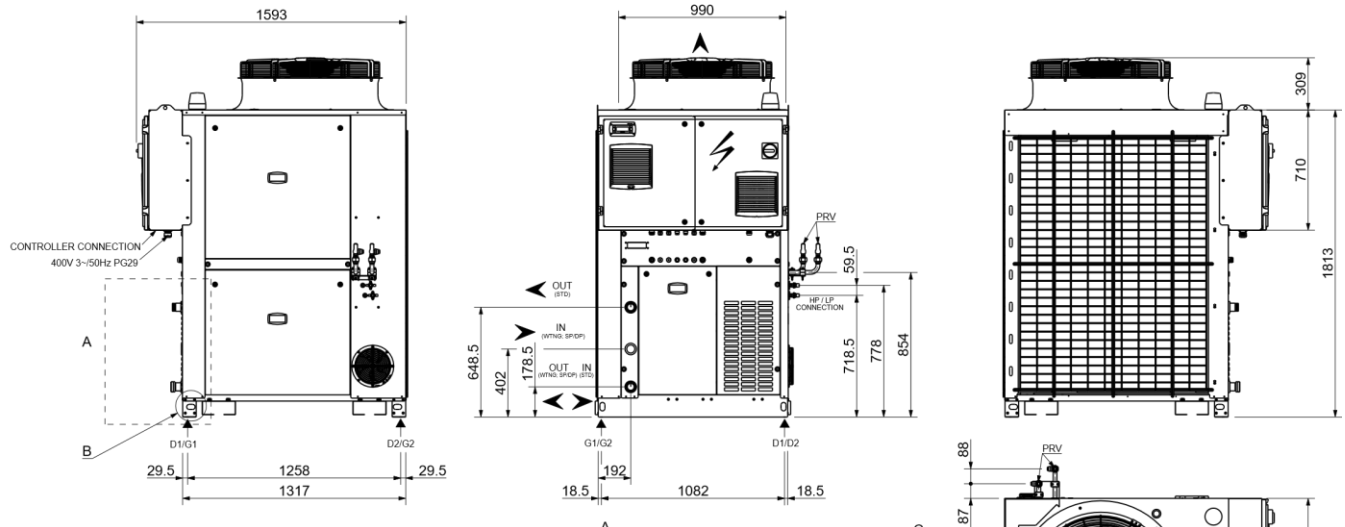



| | | | | | |
|---|---|---|---|---|---|
| **MG11 (VS)** | Scroll compressor (variable speed) | **BCD1** | Air-cooled condenser | **YP11** | Electronic expansion valve |
| **B11** | High pressure safety pressure switch | **MC11** | Condenser motor fan | **BPHE** | Evaporator heat exchanger |
| **B12 / B13** | Pressure transducers HP & BP | **B40 / B41** | Inlet / Outlet water pressure | **BS13 / BS14** | Suction / Discharge temperature sensors |
| **B60** | Water flow switch | **BS41 / BS42** | Inlet / Outlet water temperature sensors | **BS1** | External temperature sensor |
| **YV12** | 4 way valve | **MP1 / MP2** | Water pumps (OPTION) | **VE1** | Expansion vessel (OPTION) |
| **YVMP1** | By-pass valve (OPTION) | **A15** | Leak detector (ATEX) | **ME1** | Extraction fan (ATEX) |
| **PRV11 / PRV12** | Pressure relief valves | **LR1** | Liquid receiver | | Heating resistance (OPTION) |

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

# APPENDIX 6

## GENERAL MECHANICAL DRAWING - YBH 045 / 060 (STANDARD UNIT)




**LEGEND:**

| | |
|---|---|
| **IN (STD):** | Water inlet - 2" Threaded male |
| **IN (WFIF):** | Water inlet - 2" Threaded female |
| **OUT (STD):** | Water outlet - 2" Threaded male |

## LOAD DISTRIBUTION

| Nr. Position | STD Unit | | With Dual Pump | | With Dual Pump & Water Tank | |
|---|---|---|---|---|---|---|
| | G1 / D1 | G2 / D2 | G1 / D1 | G2 / D2 | G1 / D1 | G2 / D2 |
| **YBH045SY1M** | 86 / 109 | 95 / 121 | 104 / 111 | 117 / 125 | 163 / 129 | 173 / 136 |
| **YBH060SY1M** | 105 / 132 | 116 / 147 | 125 / 133 | 139 / 149 | 187 / 148 | 198 / 157 |

# APPENDIX 7

## HYDRAULIC VERSION ELEMENTS (HY) / HYDRONIC VERSION ELEMENTS (HN)

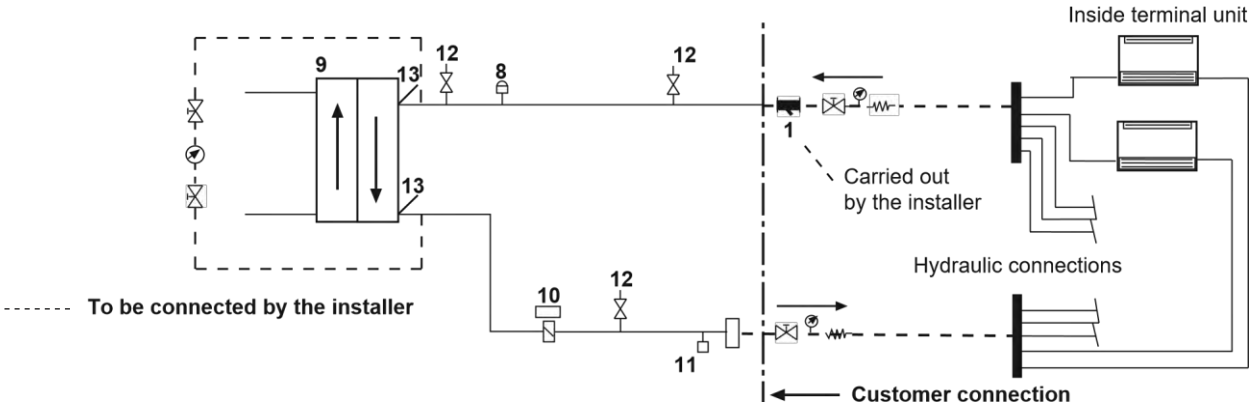
| YBH MODELS | | 045S | 060S |
|---|---|---|---|
| Low pressure pump | Type | Stainless steel threaded centrifugal pumps | |
| High pressure pump | | | |
| Expansion vessel | Type | Fixed membrane expansion vessel | |
| | Max. pressure (bar) | 4 | |
| | Capacity ($dm^3$) | 25 | |
| Buffer tank (***) | Type | Isolated steel tank | |
| | Safety valve set (bar) | 3 | |
| | Volume ($dm^3$) | 100 | |

## COMPONENTS

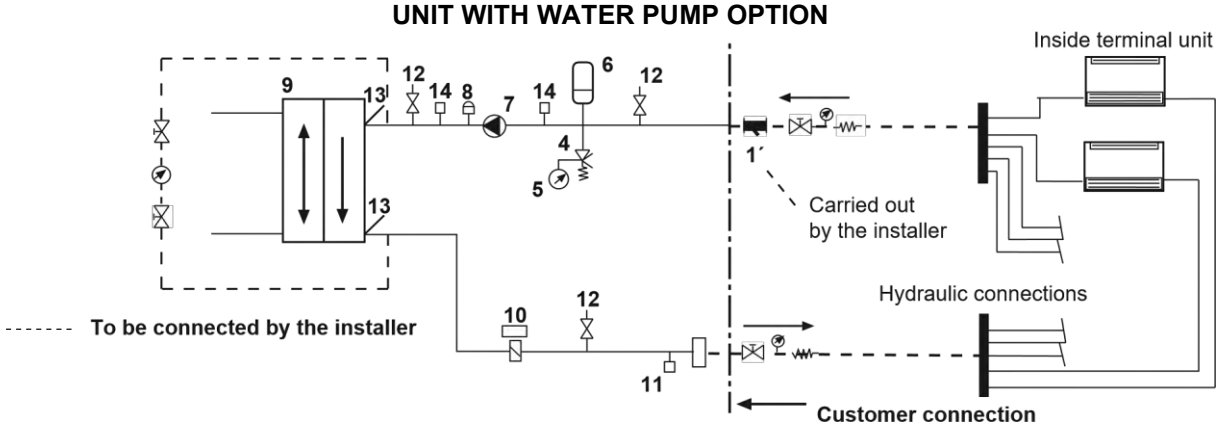
The ELEVATE system comprises an air to water heatpump combined with a series of hydraulic accessories

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

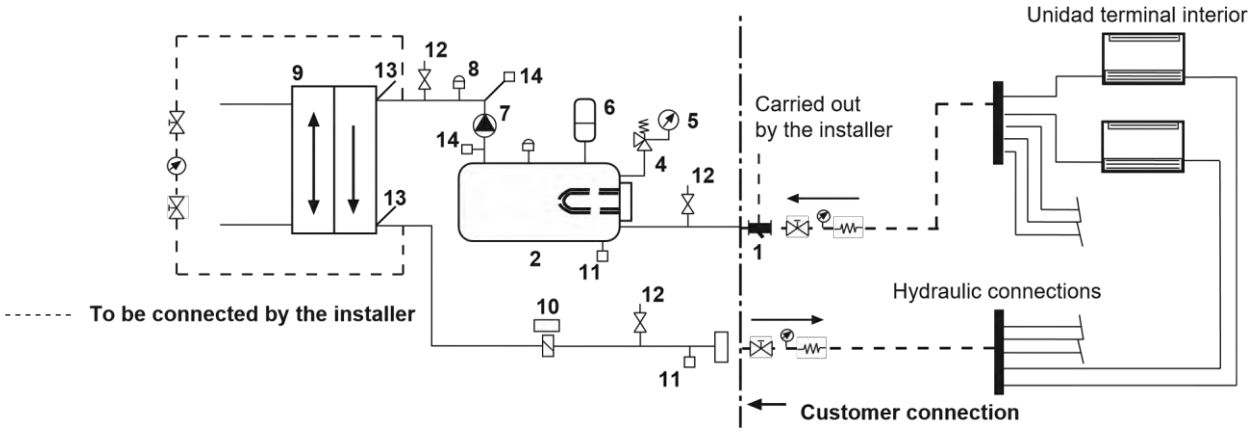
**STANDARD UNIT**




**UNIT WITH WATER PUMP OPTION**



## UNIT WITH WATER TANK OPTION

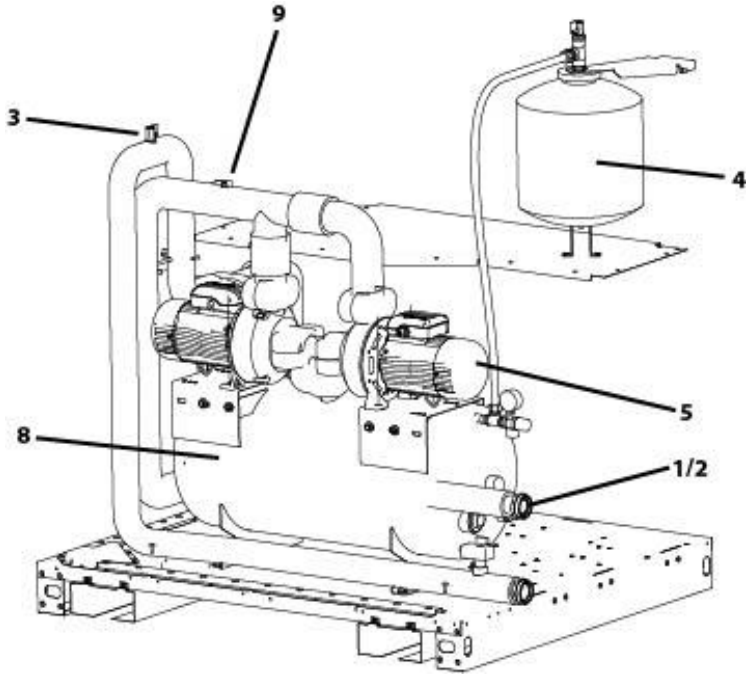



**COMPONENTS**

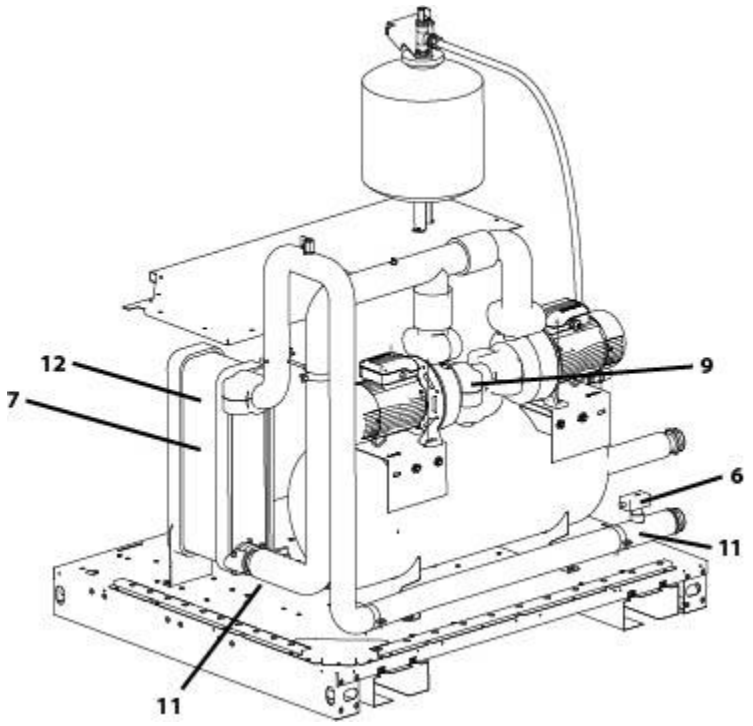
| STANDARD VERSION (STD) | | UNIT WITH WATER PUMP OPTION (HY) | | UNIT WITH WATER TANK OPTION (HN) | |
|---|---|---|---|---|---|
| 8, 9, 10, 11, 12, 13 | | 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14 | | 2, 3, 4, 5, 6, 7, 8, 9, 10, 11,12, 13, 14 | |
| **1** | Water filter (additional option, supplied loose) | **6** | Expansion vessel | **11** | Drain valve |
| **2** | Water tank | **7** | Water pump | **12** | Pressure tap |
| **3** | Water tank heater (option) | **8** | Air purge valve | **13** | Water temperature sensor |
| **4** | Safety valve | **9** | Plate exchanger | **14** | Pressure transducer (when variable water flow option is selected) |
| **5** | Pressure gauge | **10** | Flow switch | | |

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 1mm and must be positioned within 1m of the inlet of the exchanger. They may be supplied as an option by the manufacturer

## HYDRAULIC DATA

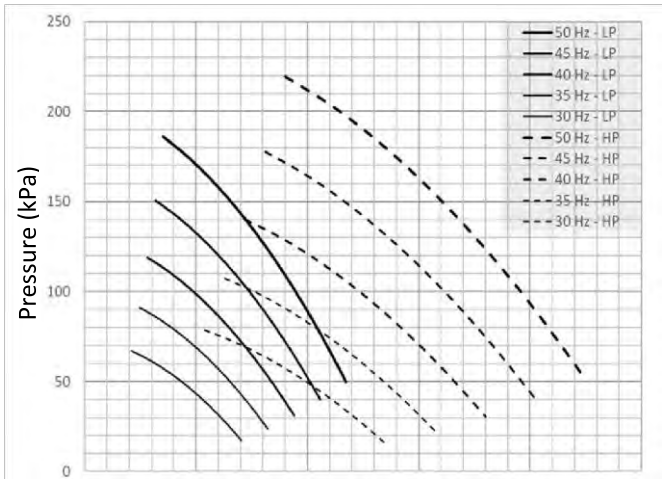



| | |
|---|---|
| 1.- Threaded adaptor. | 7.- High performance stainless steel evaporator. |
| 2.- Water inlet filter (Supplied loose). | 8.- Water tank |
| 3.- Manual air bleeder. | 9.- Pressure tap or water pressure sensor (with eDrive optional). |
| 4.- Expansion vessel | 10.- Water pump inverter → Electrical panel (Option). |
| 5.- Single or dual pump, high or low pressure (option). | 11.- Drain valves. |
| 6.- Flow switch. | 12.- Temperature sensor. |



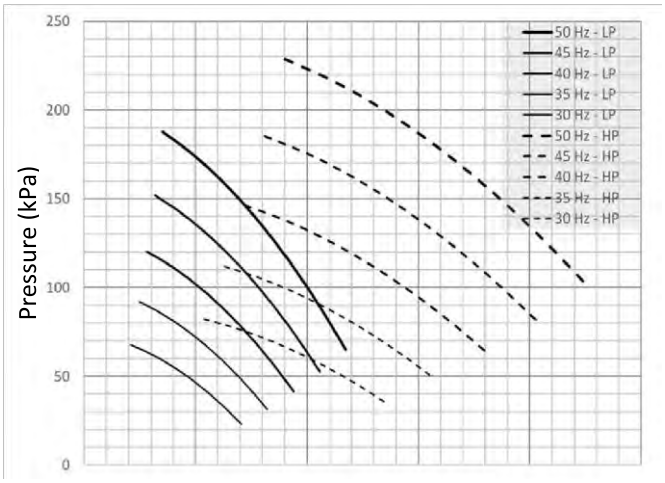
## WATER FLOW AND AVAILABLE STATIC PRESSURE OF WATER PUMP

**YBH045SY1M**




Water flow rate ($m^3/h$)

**YBH060SY1M**



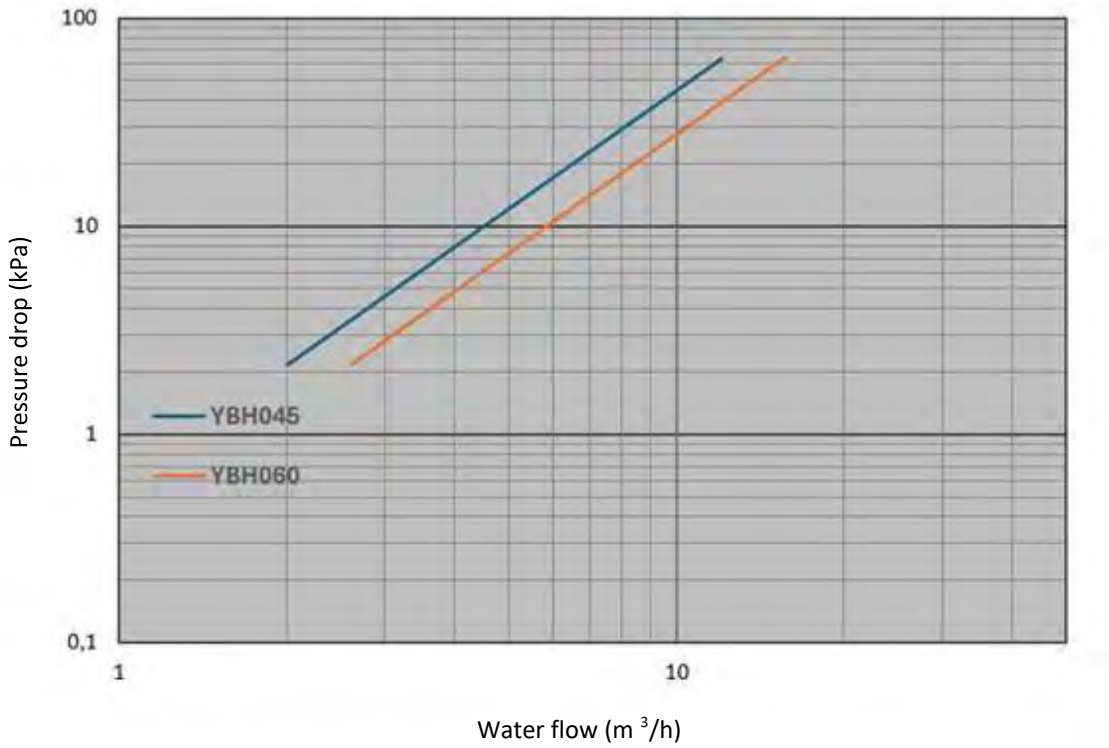

Water flow rate ($m^3/h$)

| UNIT MODEL | WATER FLOW RATE ($m^3/h$) | | | WATER CONTENT ($dm^3$) | |
|---|---|---|---|---|---|
| | MINIMUM | NOMINAL | MAXIMUM | UNIT WITHOUT BUFFER TANK | BUFFER TANK |
| YBH 045 | 2,01 | 6,70 | 12,05 | 5,27 | 100 |
| YBH 060 | 2,61 | 8,70 | 15,65 | 6,86 | 100 |

# APPENDIX 8

## PRESSURE DROPS

### EVAPORATOR AND CONDENSER CURVES - ELEVATE HEAT PUMP

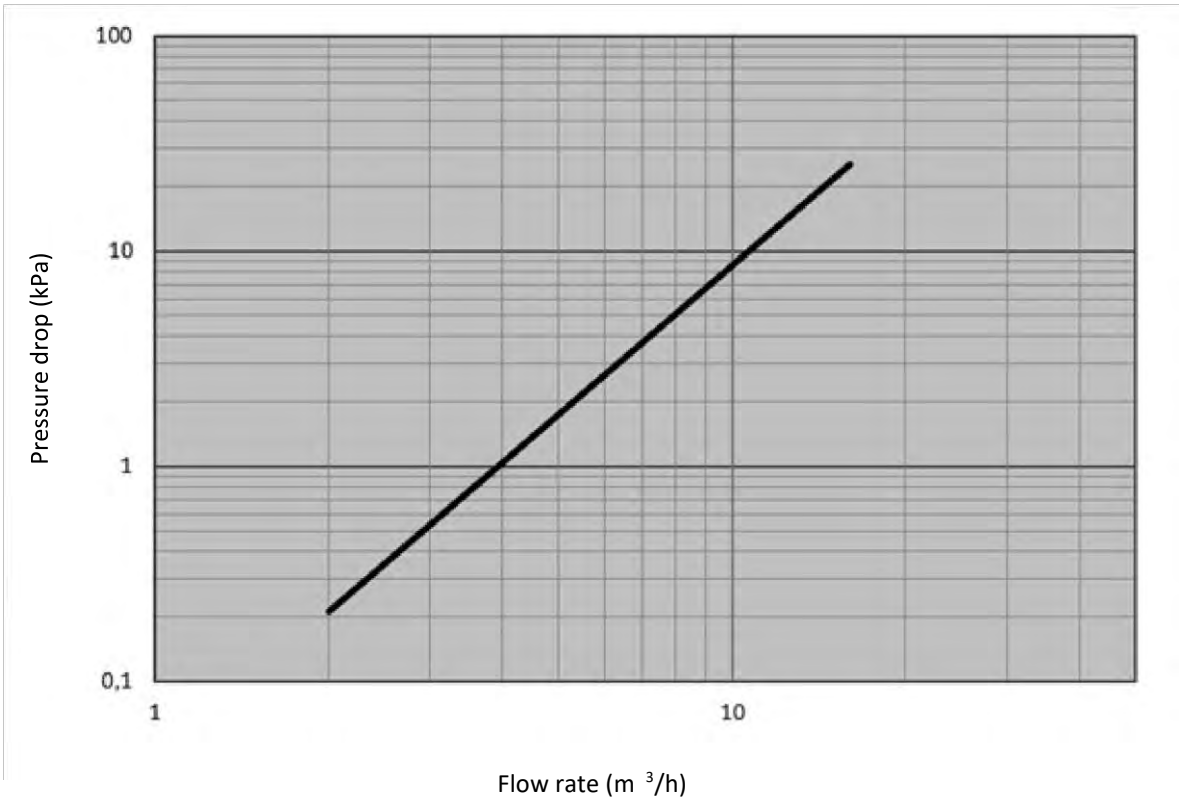



| YBH | $\Delta P = a X^b$ | |
|---|---|---|
| | a | b |
| **045** | 0,576 | 1,890 |
| **060** | 0,347 | 1,902 |

*The pressure drop values are given for reference purposes only. A tolerance of +/- 20 kPa must be considered when selecting water pumps.*

## PRESSURE DROPS

### FILTER CURVE - ELEVATE COOLING ONLY / HEAT PUMP




*Size of the filter mesh: 1 mm*

| YBH | $\Delta P = a X^b$ | |
|---|---|---|
| | a | b |
| 045 | 0,043 | 2,307 |
| 060 | | |

# APPENDIX 9

**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.