# INSTALLATION, OPERATING AND MAINTENANCE


Air cooled chillers

# eCOMFORT

170 - 400 kW

**eComfort MC-IOM-1910-E**

www,Lennoxemea.com

# AIR COOLED UNITS

# INSTALLATION OPERATION MAINTENANCE MANUAL

**Ref :** eCOMFORT-MC-IOM-1910-E

**The present manual applies to the following chiller versions:**
**eComfort range: GAC-GAH 170-400**

**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 LENNOX chillers are tested and rated in accordance with Eurovent certification program | EUROVENT CERTIFIED PERFORMANCE |
| Our products comply with the European standards | CE |

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

**You must read and be familiar with this operating manual prior to commission the chiller.**
**Please closely follow the instructions.**
We would like to stress the importance of training with respect to the correct handling of the chiller.
Please consult LENNOX on the options available in this field.
It is important that this manual is stored in a permanent location in the vicinity of the chiller.

## IMPORTANT GENERAL INSTRUCTION

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

- ***EU declaration.***
- ***Operating manual for control system.***
- ***Installation Operating manual***
- ***Wiring diagram***
- ***Refrigerant flow diagram***
- ***Unit detail are given on unit nameplate.***

The data published in this manual is based on the most recent information available. It is supplied conditional to later modifications. We reserve the right to modify the construction and/or design of our chillers, at any time, without prior notification or obligation to adapt previous supplies accordingly.

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

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

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

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

The refrigerating system is designed for a working life of at least 10 years if the safety and maintenance instructions are strictly respected.
The equipment can be renewed in its lifespan if the periodic requalification certificate is validated by the expert (Authorized body or DREAL for France)

**All units are compliant with the following Directives, Norms and Standards:**

- 2014/68/EU Pressure Equipment Directive
- 2006/42/CE Machinery Directive
- 2014/35/EU Low Voltage Directive
- 2014/30/EU Electro Magnetic Compatibility Directive
- EN378-2016 - Refrigerating systems and heat pumps - Safety and environmental requirements
- 2011/65/EU The European Restriction of the Use of Certain Hazardous Substances (RoHS)
- « WEEE », 2012/19/EU –Directive on waste electrical and electronic equipment
- 2009/125/EC Ecodesign (UE2016/2281 and UE2015/1095 for cooling only and UE 813/2013 for heating)
- EN-60204-1.

And is provided with CE markings (on the condition that the necessary options are present, for further information see EU declaration).

## SAFETY RELIEF (Optional)

This equipment is protected with safety pressure relief calibrated at 45 barg as an option and safety pressure switch calibrated at 44 barg. Do not exceed this operating pressure.

## IMPORTANT NOTICE

***All work on the unit must be carried out by a qualified and authorized personnel.***

Non-compliance with the following instructions may result in injury or serious accidents.

***Work on the unit:***

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

***Work on the electrical system:***

- Work on electrical components shall be performed with the power off by suitably trained and qualified personnel.

### EMC DIRECTIVE COMPLIANCE

***WARNING:***

This equipment is designated as “class A“ in accordance with the EMC Directive. Equipment may generate radio frequency emissions which may cause interference with other connected equipment. It is the responsibility of the designated installer to take proper steps assuring Electromagnetic Compatibility between equipment and the installation.

***Work on the refrigerating circuit(s):***

- Monitoring of the pressures, draining and filling of the system under pressure shall be carried out using connections provided for this purpose and suitable equipment.
- To prevent the risk of explosion due to release of refrigerant and oil, the relevant circuit shall be drained and at zero pressure before any disassembly or unbrazing of the refrigerating parts takes place.
- To Vacuum the unit with appropriate vacuum device for R32 (A2L) and to charge the unit with dry nitrogen to enable possible remaining R32 to be removed from oil. Repeat these operations twice
- There is a residual risk of pressure build-up by degassing the oil or by heating the exchangers after the circuit has been drained. Zero pressure shall be maintained by venting the drain connection to the atmosphere on the low pressure side.
- The brazing shall be carried out by a qualified brazer. The brazing shall comply with the standard NF EN1044 (Minimum 30% silver).

***Replacing components:***

- In order to maintain CE marking compliance, replacement of components shall be carried out using approved parts by LENNOX.
- Only the coolant shown on the manufacturer’s nameplate shall be used, to the exclusion of all other products (mix of coolants, hydrocarbons, etc.).

***CAUTION:***

In the event of fire, refrigerating circuits can cause an explosion and spray coolant gas and oil.

***Operators of refrigeration equipment’s must comply with the obligations defined in:***

- ***EU Regulation No 517/2014 on fluorinated greenhouse gases***
- ***EC 1005/2009 on substances that deplete the ozone layer***

| | |
|---|---|
|  | Non compliance with these requirements is an offence and 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. |

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

- ***Service and maintenance have not been executed in accordance with the regulations; repairs have not been carried out by LENNOX personnel or have been implemented without prior written permission by LENNOX.***
- ***Modifications have been made to the equipment without prior written permission by LENNOX.***
- ***Settings and protections have been modified without prior written permission by LENNOX.***
- ***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 is being used improperly, incorrectly, negligently or not in accordance with its nature and/or purpose.***
- ***A flow protection device is not fitted.***

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

## 1 - SAFETY

**The safety information contained in this manual is provided as a guide for the safe handling of this installation. LENNOX does not vouch for the completeness of this information and can therefore not accept liability for any possible omissions.**
In the chillers, heat is being transported by a pressurised refrigerant, with changes in pressure and temperature. For air cooled chillers, fans have been provided to discharge heat into the environment. The protection of operating and maintenance personnel was central in the design of the chiller. Safety features have been included to prevent excessive pressure in the system. Sheet metal parts have been fitted to prevent inadvertent contact with (hot) pipes. For air cooled chillers, the fans are equipped with protective grids and the electrical control panel is completely touch-proof. This excludes some parts operating at a safe voltage (< 24 Volt). The service panels can only be opened with a special tool to prevent unauthorized access.

***Notwithstanding that the chillers are equipped with extensive safety and protection features, the utmost care and attention is needed when carrying out operations on the machine. Furthermore, ear protection should be worn when working on or in the vicinity of the chillers. Operations on the cooling circuit or electrical equipment should be carried out by authorised personnel.***

It is essential to follow non exhaustive recommendations hereunder:

- Never work on a unit that is still energized.
- Any manipulation (opening or closing) of a shut-off valve must be carried out by a qualified and authorised engineer. These procedures must be carried out with the unit shut-down.
- Never work on any of the electrical components, until the general power supply to the unit has been cut. During any maintenance operations on the unit, lock the power supply circuit in the open position ahead of the machine. If the work is interrupted, check the lock before resuming the work.
  WARNING: Even if the unit has been switched off, the power circuit remains energized, unless the unit or circuit disconnect switch is open. Refer to the wiring diagram for further details.
- In case of maintenance operations on fans (grills replacement, etc) ensure that the power is shut off to avoid automatic restart.
- Before the opening of the refrigerant circuit, check the pressure with manometers or pressure sensors.
- 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, in order to avoid material deterioration and injuries to people. Faults and leaks must be repaired immediately. The authorized technician must have the responsibility to repair the fault immediately. Each time repairs have been carried out to the unit, the operation of the safety devices must be re-checked.
- Follow guidance and recommendations given in safety and machine standards such as EN378, ISO5149, etc
- 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 operating pressures. Verify the allowable maximum high- and low-side test pressures by checking the instructions in this manual and the pressures given on the unit name plate.
- Do not use air for leak testing. Use only dry nitrogen.
- Do not unweld or flame cut the refrigerant lines or any refrigerant circuit component until all refrigerant (liquid and vapour) has been removed from chiller. Traces of vapour should be displaced with dry air nitrogen. Refrigerant in contact with an open flame can ignite and produce toxic gases.
- Do not siphon refrigerant
- Avoid spilling liquid refrigerant on skin or splashing it into the eyes. Use safety goggles. Wash any spills from the skin with soap and water. If liquid refrigerant enters the eyes, immediately and abundantly flush the eyes with water and consult a doctor.

### 1.1 Warning Labels

The chiller is marked with the following warning labels to alert to potential hazards (on or near the potentially hazardous part).

| | | | | |
|---|---|---|---|---|
|  |  |  |  |  |
| High temperatures | Electrical Voltage | Slightly flammable | Rotating parts | Sharp parts |

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

## Warning:

1. **Caution**: The high-pressure safety switches are essential elements which guarantee the system remains within the admissible operating limits. Before switching on the installation, always ensure all electrical connections are correct on these elements which are used to isolate the electrical power supply to the compressor(s) they protect. Carry out a test to ensure the electrical power supply is effectively isolated when the pressure switch attains its set value.
2. In case of installation in a seismic zone or in a zone which may be effected by violent natural occurrences such as storms, tornados, floods, tidal waves, etc, the installer and/or operator will refer to valid standards and regulations in order to ensure the devices required are available as our units are not designed to operate under such conditions without prior precautions.
3. The equipment is not designed to resist fire. The installation site will therefore have to respect valid standards with regard to protection against fire (emergency instructions, map…).
4. In case of exposure to corrosive external atmospheres or products, the installer and/or operator shall take the necessary precautions to avoid damage to the equipment and will make sure the equipment provided has the necessary and sufficient anti-corrosion protection. This product has been designed to resist a C3H corrosive atmosphere according to ISO 9223.
5. To respect a sufficient number of supports for the piping according to their size and weight under operating conditions and to design the piping to avoid a water hammer phenomenon
6. All our units carry out a hydrostatic tests and leak test. (The entire circuit is checked using leak detectors). At the end of the test, an HP test is carried out in the factory to make sure the pressure switch is working properly.
7. All our units are delivered with refrigerant from factory. Then all the refrigerant circuit will be pressurized.
8. The emissions of refrigerant via the safety relief valves if selected must be channeled to safe area. The outlet relief valve will have to be sized in compliance with EN13136.
9. Installation and maintenance of these machines must be carried out by personnel qualified to work on refrigeration equipment.
10. All interventions must be carried out in conformity with valid safety regulations (e. g.: NF EN 378), as well as the recommendations indicated on the labels and handbooks provided with the machine. All actions shall be taken to avoid access of unauthorized persons.
11. 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.
12. Ensure that the installation zone (room or area) of the machine has restricted access and ensure the good condition of the covering.

## 1 - TRANSPORT - HANDLING

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 crane.
The equipment must be handled with care to avoid damage to the bodywork, pipework, condenser, etc.

### 1.1 - Controls and delivery checks

After the unit has been received, when it is ready to be installed or reinstalled, and before it is started up, it must be inspected for damage. On receipt of a new equipment please check the following points. It is the customer's responsibility to ensure that the products are in good working order:

- The exterior has not been damaged in any way.
- The lifting and handling equipment are suitable for the equipment and comply with the specifications of the handling instructions enclosed here-in.
- Accessories ordered for on site installation have been delivered and are in good working order.
- If the unit is delivered with its operating charge of refrigerant, that there has been no leakage (use an electronic detector).
- 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 LENNOX and the supplier or distributor for information purposes. Failure to comply will invalidate any claim against the shipping company.**
**Please be reminded that LENNOX is not responsible for off-loading and positioning.**

***Unit Nameplate***

The rating plate provides a complete reference for the model and ensures that the unit corresponds to the model ordered. It states the electrical power consumption of the unit on start-up, its rated power and its supply voltage.
**The supply voltage must not deviate beyond +5/-5 %.**
The start-up power is the maximum value likely to be achieved for the specified operational voltage. The customer must have a suitable electrical supply. It is therefore important to check whether the supply voltage stated on the unit's rating plate is compatible with that of the mains electrical supply.

The rating plate also states :
- Year of manufacture
- Weight of the unit
- Type of refrigerant used
- Required charge for each compressor circuit.
- Operating Pressure max/min
- Operating Temperature max/min

LENNOX EUROPE MIDDLE-EAST AFRICA
Lennox Refac, S.A.
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09001 Burgos España
CE 1767

**Unit type: GAC400DP1M**

**Serial Nr: 999999_1 1/1**

| | Voltage (V) | Phase (Ph) | Frequency (Hz) | Current (A) | |
|---|---|---|---|---|---|
| Elec | 400 | 3 | 50 | Nominal | Starting |
| Elec Aux. | 24 | 1 | 50 | 300.8 | 475 |

| | Min | | Max | |
|---|---|---|---|---|
| | LP | HP | LP | HP |
| Pressure (PS) (bar) | -1 | -1 | 31 | 45 |
| Temperature (TS) (°C) | -30 | -30 | 51 | 125 |
| Storage temperature (°C) | -30 | | 51 | |

LP: Low Pressure side / HP: High Pressure

| Capacities (kW) | | Ref Charge (kg) | | | | Dates | |
|---|---|---|---|---|---|---|---|
| Cooling | Heating | C1 | C2 | C3 | C4 | Prod. | Test |
| 400 | - | 20 | 20 | 0 | 0 | 2019 | 25/01/2019 |
| Fluid | | Fluid groupe | | | | Weight (kg) +/-5% | |
| R32 GWP 675* | | 1 | | | | 2905 | |

This product is used for Air Conditioning. Contains fluorinated greenhouse gases covered by the Kyoto protocol. Hermetically sealed.

*GWP : Global warming potential

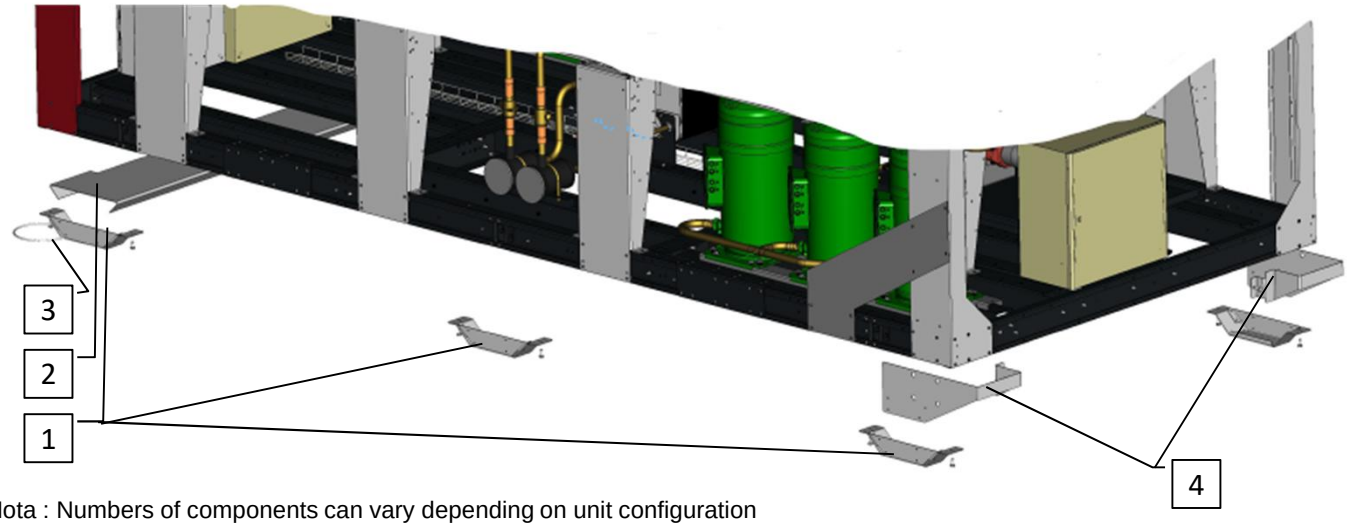
***When positioning the unit, be sure that the Rating plate will always be visible since this data will be necessary to assure proper maintenance.***

### 1.2 – Container loading kit

Taking into account the height of the unit, we can't use a standard container. A « High Cube » with a minimum internal height of 2.5m is mandatory.

A dedicated kit has been designed for this purpose :

1. Sliders
2. Fork lifter stiffener and stop
3. Pulling cable
4. Bumpers
5. Wooden parts on each slider side (Non represented)



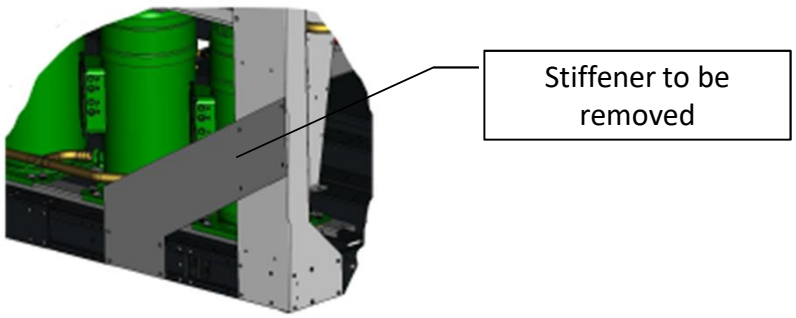

Nota : Numbers of components can vary depending on unit configuration

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

**Unit working with slightly flammable refrigerant. Before any operation on the unit, realize a refrigerant detection with a dedicated device in order to ensure no possible presence around the unit.**
**Possible risk when opening container.**

### 1.3 – Transportation

On some units we have added some stiffener on lower corner of unit to secure the lifting phases.
These parts are to be removed once the unit is installed on its final location.



### 1.3 - Storage

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

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

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

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

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

## 2 - LIFTING THE UNIT

### 2.1 - Safety instructions

Installation, start up and adjustment of this equipment can be dangerous if certain system specific factors are ignored, such as operating pressures, electrical components, locations (roofs, terraces and other structures located well above ground level).
Only highly qualified contractors and technicians with sound knowledge of this type of equipment, are authorised to install, start up and service it.
During any service operations, observe the recommendations given on labels or instructions sent with the equipment, as well as any other applicable safety procedures.

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

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

### 2.2 - Handling

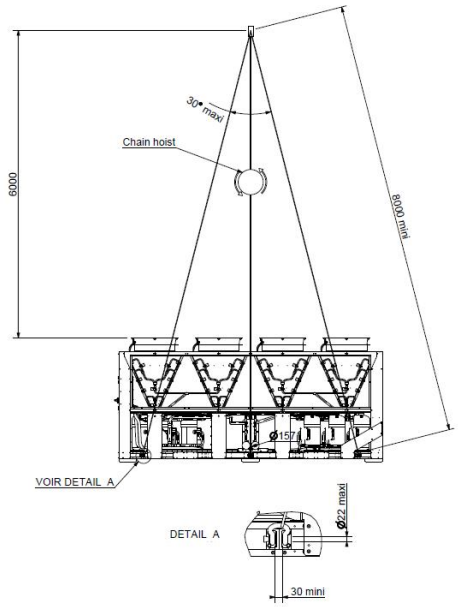
Handling operations must be carried out by qualified personnel. Comply strictly with the lifting instructions as well as with any other applicable safety procedures. Wear protective glasses and work gloves. Unit handling operations must be carried out carefully to avoid jolting the frame, the panels,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

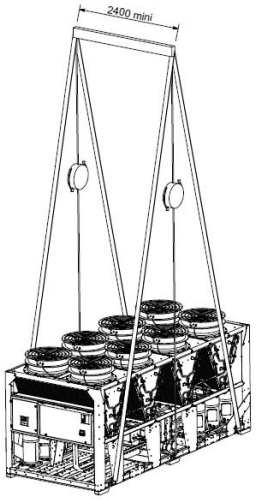
The unit must be transported in horizontal position. Any other position may cause serious damage to the machine.

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

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

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




### 2.3 - Unpacking

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

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

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

## 3 - LAY-OUT AND INSTALLATION REQUIREMENTS

The following preparations are important for the installation of the chiller:

- Air-cooled chillers with helicoids fans such as eComfort are designed for outdoor installation. Please consult LENNOX prior to implementing other types of installation.
- For outdoor air cooled chiller, position the chiller where it is less affected by wind (install windbreaks where wind speeds > 2.2 m/s).
- The ground beneath the unit must be flat, level 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.
- In locations exposed to frost, the supporting surface, if the unit is installed on the ground, must be built on concrete stakes extending downwards beyond the normal depth of frost. It is always advisable to build a supporting surface detached from the general building structure to avoid transmission of vibrations.
- On normal applications, unit rigidity and point load positions enable installation to minimise vibrations. Vibration isolators may be used by contractors on installations requiring particularly low vibration levels.
- Sufficient space must be allowed to facilitate placement of the unit. There should be adequate drainage around the unit.

***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 LENNOX's responsibility.***

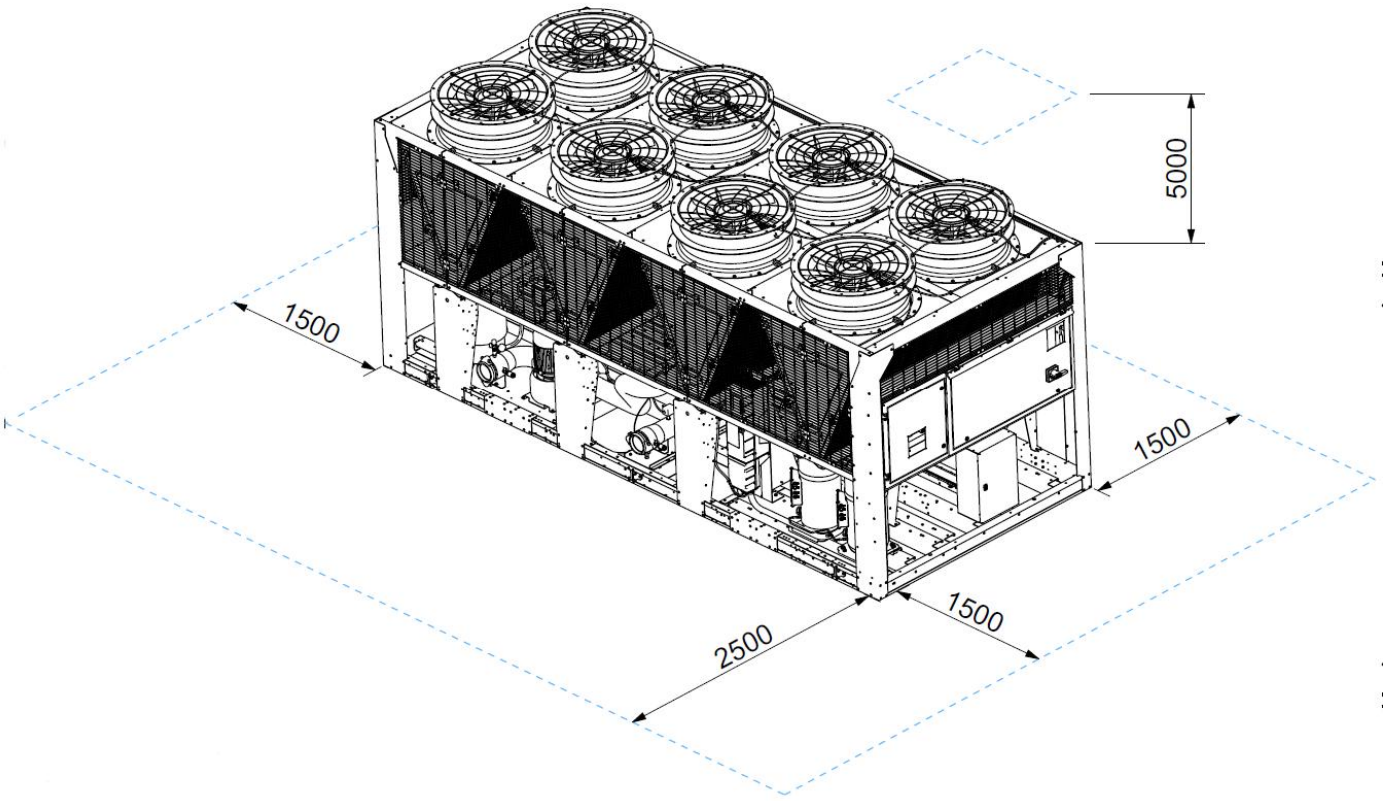
- The unit must be bolted to the vibration isolators and the latter solidly secured into the concrete slab.
  Check that vibration isolator contact surfaces are flush to the floor. If necessary, use spacers or re-surface the flooring, but in all events, make sure that the isolators seat flatly on the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

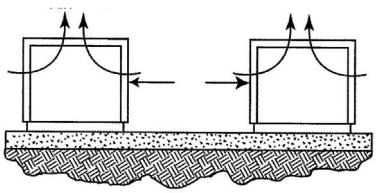
***It is important that units must be levelled. Failure to install unit correctly will void warranty.***

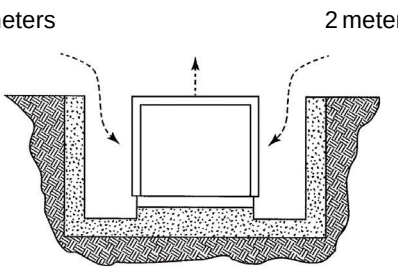
2.6 : CLEARANCES DRAWINGS

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.

For more details, please consult our Application Guides or the drawings supplied with the unit.

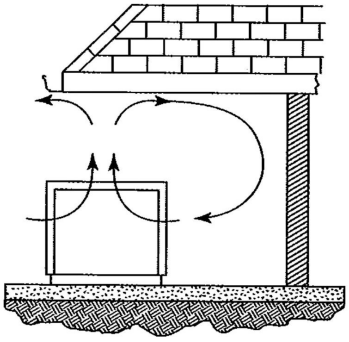



Not recommended

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



Not allowed

## 4 - WATER CONNECTIONS

### 4.1 - Water connections - Evaporator / Desuperheater

Before the system start-up check that the water circuits are connected to the right heat exchangers (e.g. no reversal between water in and outlets). The water circulating pump will be preferably installed upstream so that the evaporator will be subjected to positive pressure. Entering and leaving water connections are indicated on the certified drawing sent with the unit or shown in the sales brochure.

The use of a water filter in the water circuit upstream of the heat exchanger is mandatory. These filters must remove all particles with a diameter greater than 1 mm, and must be positioned within 1 meter of the inlet of the unit. They may be supplied as an option by the manufacturer.

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

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

It is important to follow non exhaustive recommendations hereunder:

- The water pipes must not transmit any radial or axial force to the heat exchangers nor any vibration. (Use flexible connections to reduce the transmission of vibrations.)
- Manual or automatic air bleeders must be installed at all high points in the circuit(s).
- Drain connections must be installed at all low points to allow the whole circuit to be drained.
- An expansion device must be installed to maintain pressure in the circuit(s) as well as a safety device
- Comply with the water inlet and outlet connections shown on the unit.
- Install thermometers in both the entering and leaving water connections.
- Install stop 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. As an option, the internal unit piping is protected.
- Ensure full earthling continuity
- Connection pipes must under no circumstances generate strain on the piping system of our units. To do this, appropriate means of support and fastening must be used.
- The unit mustn't be used for supporting the piping of the installation.
- Respect a sufficient number of supports for the piping according to their size and weight under operating conditions and to design the piping to avoid a water hammer phenomenon

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

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

### 4.2 - Water analysis

The water must be analysed; the water circuit installed must include all items necessary for treatment of the water: filters, additives, intermediate exchangers, bleed valves, vents, isolating valves etc... depending on the results of the water analysis.

Use of untreated or improperly treated water can cause deposits of scale, algae and sludge or cause corrosion and erosion. It is advisable to call in a qualified water treatment specialist to determine what kind of treatment will be necessary. The manufacturer cannot accept liability for damage caused by the use of untreated or improperly treated water, salt water or brine.

Here are our non exhaustive recommendations given as an indication:

- No NH4+ ammonium ions in the water, they are very detrimental for copper. <10mg/l
- Cl- Chloride ions are detrimental for copper with a risk of perforations by corrosion by puncture. < 10 mg/l.
- SO42- sulphate ions can cause perforating corrosion.< 30 mg/l.
- No fluoride ions (<0.1 mg/l).
- No Fe2+ and Fe3+ ions with dissolved oxygen. Dissolved iron < 5 mg/l with dissolved oxygen < 5 mg/l. Over those values, it means a corrosion of steel which may generate a corrosion of copper parts under deposite of Fe – this is mainly the case with shell and tube heat exchangers.
- Dissolved silicon: silicon is an acid element of water and can also lead to corrosion risks. Content < 1mg/l.
- Water hardness: TH >2.8 K. Values between 10 and 25 can be recommended. This will facilitate scale deposit that can limit corrosion of copper. TH values that are too high can cause piping blockage over time.

- TAC< 100.
- Dissolved oxygen: Any sudden change in water oxygenation conditions must be avoided. It is as detrimental to deoxygenate the water by mixing it with inert gas as it is to over-oxygenate it by mixing it with pure oxygen. The disturbance of the oxygenation conditions encourages destabilisation of copper hydroxides and enlargement of particles.
- Specific resistance – electric conductivity: the higher the specific resistance, the slower the corrosion tendency. Values above 3000 Ohm/cm are desirable. A neutral environment favours maximum specific resistance values. For electric conductivity values in the order of 200-6000 S/cm can be recommended.
- pH: pH neutral at 20°C (7 < pH < 8)

If the water circuit must be emptied for longer than one month, the complete circuit must be placed under nitrogen charge to avoid any risk of corrosion by differential aeration.

## 4.3 - Antifreeze protection

### *4.3.1: Use glycol/water solution*

**IMPORTANT**

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

If the outside temperature in the area where the eComfort unit is to be installed is likely to drop below 5°C, it is very important to take the following precautions to avoid that water in the circuit freezing, that may produce damage to the components.

If unit has to work under low outside temperatures:

- Do not disconnect power supply in order that water pump starts when detects water temperature below +5°C (only with hydraulic module)
- If the outside temperature where the system is to be installed or the water outlet temperature is likely to drop below 5°C, it is very important to use glycol anti-freeze.
  The amount of anti freeze required will vary depending on the minimum ambient temperature or the water outlet temperature.
  When the percentage of glycol increases, the standard pump flow decreases, the pressure drop increases and the cooling and thermal capacities drop. As a result the minimum flow must be multiplied by the coefficient shown in the table below.
- It's 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 | Ethylene glycol % | Pressure drop | Water flow | Absorbed Power | CAPACITIES | |
|---|---|---|---|---|---|---|
| | | | | | Cooling | Heating |
| +5 --> 0°C | 10% | 1,05 | 1,02 | 0.997 | 0,995 | 0,994 |
| 0 --> -5°C | 20% | 1,1 | 1,05 | 0.996 | 0,985 | 0,993 |
| -5 --> -10°C | 30% | 1,15 | 1,08 | 0.995 | 0,975 | 0,99 |
| -10 --> -15°C | 35% | 1,18 | 1,1 | 0.994 | 0,965 | 0,987 |

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

### *4.3.2: Drain the installation*

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

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

### 4.4 - Electrolytic corrosion

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

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

### 4.5 - Minimum water capacity

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

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

Vt → Minimum water content of the installation
Q → Chiller cooling capacity in kW
Tmin → Minimum working time (180 s)
Wd → Water density (1000 kg/m3)
Cp → Heat capacity of the water (4.18 kJ/kg.°C)
N → Minimum capacity step
Dt → Maximum acceptable temperature deviation

| Size | Nominal cooling capacity | Minimum capacity step | Minimum water content of the installation (liters) | | |
|---|---|---|---|---|---|
| | kW | % | Max. temperature deviation of 6°C | Max. temperature deviation of 4°C | Max. temperature deviationof 2°C |
| Standard compressor | | | | | |
| 170 | 178 | 25% | 319 | 478 | 957 |
| 200 | 200 | 25% | 359 | 538 | 1076 |
| 230 | 213 | 17% | 260 | 390 | 780 |
| 270 | 265 | 20% | 379 | 569 | 1138 |
| 300 | 298 | 20% | 428 | 642 | 1284 |
| 330 | 332 | 17% | 405 | 607 | 1215 |
| 370 | 368 | 17% | 448 | 672 | 1345 |
| 400 | 402 | 17% | 490 | 735 | 1470 |
| Variable speed compressor | | | | | |
| 170 | 186 | 17% | 227 | 340 | 680 |
| 200 | 205 | 15% | 220 | 331 | 661 |
| 230 | 225 | 14% | 226 | 339 | 677 |
| 270 | 278 | 11% | 219 | 328 | 657 |
| 300 | 309 | 10% | 221 | 332 | 664 |
| 330 | 347 | 14% | 348 | 522 | 1043 |
| 370 | 375 | 16% | 430 | 645 | 1291 |
| 400 | 405 | 14% | 407 | 610 | 1220 |

In heat pump operation, the minimum volume of the condenser water loop must be calculated based on the heating capacity using the same formula.

### 4.6 - eComfort range with expansion vessel in hydraulic module - maximum water content

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

| eComfort unit range | Expansion vessel volume | Pressure in the expansion vessel | Maximum clear water volume (l) | | Maximum glycol water volume (l) | |
|---|---|---|---|---|---|---|
| | | | Static pressure 5m | Static pressure 10 m | Static pressure 5m | Static pressure 10 m |
| 170-200-230<br>270-300<br>330-370-400 | 50 l | 1,5 bar | 5230 l | 4180 l | 4020 l | 3210 l |

**Pressure in the expansion vessel depends on position of installing 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.**

### 4.7 - Desuperheater option

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

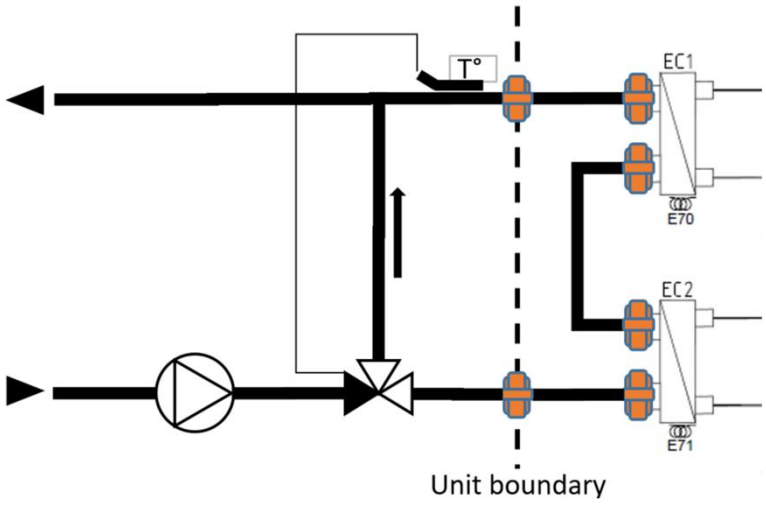
The aim of the desuperheater is to recover high temperature heat from the compressor discharge gases by means of a heat exchanger without condensing. This point is important as no refrigerant receiver to compensate the volume difference between the gas and liquid phase is then required. Therefore, we recommend mounting a regulating device on the water outlet temperature of the desuperheaters to avoid condensing in the heat exchangers. The heat recovery capacity depends on the operating conditions (the compressor discharge temperature comes from the HP/LP ratio), on the number of compressor running, on the water flow and on the water inlet temperature.

The unit will always be driven by the air conditioning load. In any case, if there is no load on the cooling side, the unit will not be able to generate heat. The heat capacity will always be in accordance with the cooling capacity and the absorbed power of the unit.

The recommend regulation on the scheme beside is done with a 3-way valve regulating on the Desuperheater Water Outlet Temperature (DWOT).
For a determined setpoint, the 3 way valve regulate as follow:
- if DWOT>setpoint, nominal flow is applied through the desuperheater.
- If DWOT = setpoint, 3 way valves regulate the flow through the desuperheater to maintain this.
- If DWOT<setpoint, applied a minimum flow below roughly 1/5th of the nominal flow.

A better regulation can be achieved by using an inverter driven pump that adjusts the flow to maintain the desired DWOT.

All regulation is to be managed by the customer.




| GAC with desuperheater option | | GAC170 | GAC200 | GAC230 | GAC270 | GAC300 | GAC330 | GAC370 | GAC400 |
|---|---|---|---|---|---|---|---|---|---|
| Cooling capacity (at 12/7°C with 35°C ambient) | kW | 178 | 200.2 | 213.5 | 264.6 | 298.4 | 332.2 | 367.8 | 402.2 |
| Heat recovery capacity (at 50/60°C) | kW | 43.5 | 54.8 | 59.9 | 64.5 | 83.3 | 80.9 | 89.8 | 111.6 |
| Water flow | $m^3/h$ | 3.76 | 4.72 | 5.17 | 5.56 | 7.19 | 6.98 | 7.74 | 9.63 |
| Exchanger pressure drop | kPa | 11.5 | 17.8 | 21.2 | 17.8 | 28.9 | 17.9 | 21.9 | 33 |
| Water volume | $dm^3$ | 4.2 | 4.2 | 4.2 | 5.25 | 5.25 | 6.3 | 6.3 | 6.3 |
| Connection diameters | inch | 2''1/2 / 2''1/2 | | | | | | | |

Note: there are 2 desuperheaters in serial, so the flow per desuperheater is the total flow from the table

### 4.7 - Flow switch

A flow switch must be installed on the evaporator water inlet or outlet, so as to enable detection of water flow through the heat exchanger before the unit is started up. This will protect the compressors against any eventual liquid slugging during the starting phase and prevent accidental ice formation in the evaporator, if the flow of water is interrupted.
Flow switches are available as standard on eComfort units. The normally open contact of the flow switch is connected to the terminals provided to that effect in the unit electrical box. (See the wiring diagram supplied with the unit). The normally closed contact can be used as an indication of a lack of flow condition.
**Warranty is void if a flow detection device is not fitted and connected to the LENNOX control panel.**

**PADDLE FLOW SWITCH**
A paddle flow switch is implemented in standard in the eComfort units.

## 5 - ELECTRICAL CONNECTIONS

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

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

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

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

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

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

## 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, the firm plate 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 LENNOX.
Once the selection is made, the installer must make the adaptations if necessary.
The connections on the main switch of the unit are to be realized with lugs or bars. In case of use of aluminum wires, the customer must use **bi-metal terminals**.

The table below gives the dimensions of the fixing points on the main switch with the hole diameter and center distance.
The below chart gives the number and size for customer power cable end sections for each machine.

Calculations have been made using the maximum possible current on each unit (see table of electrical characteristics).For this study, the following cases according to IEC 60364 Table 52C were used:
- No. 17: Suspended overhead lines
- No. 61: Buried conduit with land transfer coefficient of 20.

The study took into account cables with PVC or XLPE insulation and copper or aluminum core at maximum temperature of 48 ° C.
The cable length mentioned limits the voltage drop <to 5%.

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

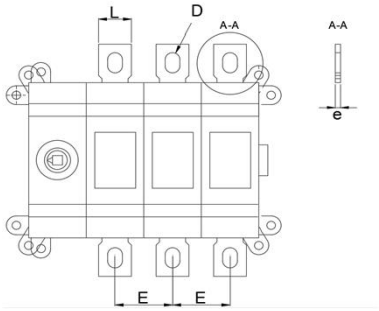
The currents considered are given for a machine equipped with a hydraulic kit operating at maximum current.

| | | temp: 45°C | temp 20°c | temp: 45°C | temp 20°c | temp: 45°C | temp 20°c | temp: 45°C | temp 20°c |
|---|---|---|---|---|---|---|---|---|---|
| GAC/GAH | I nominal for basic unit with HP water single pump | 1 Cable per phase HO7RNF-F TITANEX PREMIUM COPPER | | 2 Cables per phase HO7RNF-F TITANEX PREMIUM COPPER | | 1 Cable per phase U-1000 AR2V - XLPE ALUMINIUM | | 2 Cables per phase U-1000 AR2V - XLPE ALUMINIUM | |
| 170 | 131.65 A | 4G50 | 4G35 | 2x 16mm² | 2x 25mm² | 4G70 | 4G50 | 2x 35mm² | 2x 50mm² |
| 200 | 152.05 A | 4G70 | 4G50 | 2x 25mm² | 2x 35mm² | 4G95 | 4G70 | 2x 35mm² | 2x 70mm² |
| 230 | 161.45 A | 4G70 | 4G50 | 2x 25mm² | 2x 35mm² | 4G95 | 4G70 | 2x 50mm² | 2x 70mm² |
| 270 | 207.55 A | 4G95 | 4G70 | 2x 35mm² | 2x 70mm² | 4G150 | 4G120 | 2x 70mm² | 2x 95mm² |
| 300 | 233.95 A | 4G120 | 4G95 | 2x 50mm² | 2x 70mm² | 4G150 | 4G150 | 2x 95mm² | 2x 120mm² |
| 330 | 259.45 A | 4G120 | 4G95 | 2x 50mm² | 2x 95mm² | 4G185 | 4G185 | 2x 95mm² | 2x 150mm² |
| 370 | 285.85 A | 4G150 | 4G120 | 2x 70mm² | 2x 120mm² | 4G240 | 4G240 | 2x 120mm² | 2x 185mm² |
| 400 | 312.25 A | NA | 4G150 | 2x 70mm² | 2x 120mm² | 4G240 | 4G240 | 2x 150mm² | 2x 185mm² |

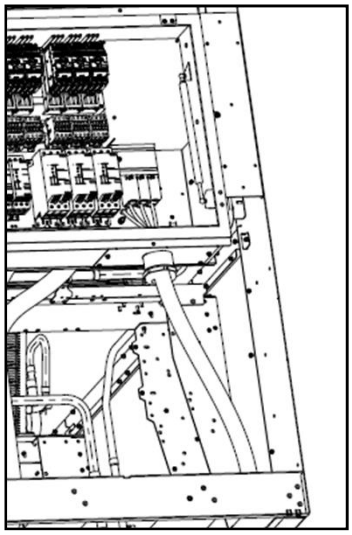
According to CEI 60364 table 52C - Based on EASYCAL software from Nexans :
- Temp 45°C :Perforated cable tray (ref: 13)
- Temp 20°C : Buried in ducts or sleeves (ref: 61)

## Main switch pad dimension

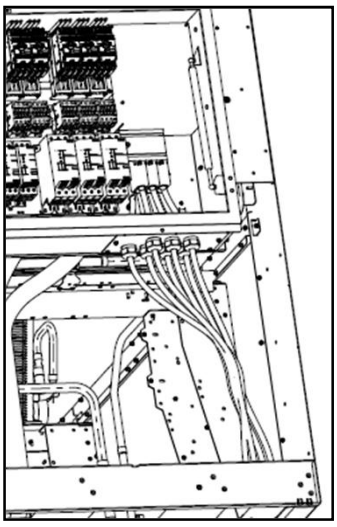
| Products | L<br>Pad Width (mm) | e<br>Pad Thickness (mm) | E<br>Distance (mm) | D<br>Hole (mm) |
|---|---|---|---|---|
| 160A --> 250 | 20 | 3 | 35 | 9 |
| 315A --> 500A | 25 | 4 | 44 | 11 |
| 630A --> 800A | 39 | 5 | 65 | 13,5 |



## Main supply cable rooting to main switch



**Example of unit power supply rooting with one cable 4G150mm².**



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

## Customer protection information

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

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

| Protection by circuit breaker | | |
|---|---|---|
| Main switch set in the unit | | Customer protection requested |
| Reference | Ipeak Max | Référence |
| OT200 | 30KA | XT4S 250 Kkip LS/I 250A |
| OT250 | 30KA | XT4S 250 Kkip LS/I 250A |
| OT315 | 65KA | T5S 400 PR221DS-LS/I 400A |
| OT400 | 65KA | T5S 400 PR221DS-LS/I 400A |
| OT500 | 65KA | T5S 630 PR221DS-LS/I 630A |
| OT630 | 80KA | T6S 630 PR221DS-LS/I 630A |

| Protection by Fuses | | |
|---|---|---|
| Main switch set in the unit | Customer protection requested | |
| Reference | Fuses gG | Fuses aM |
| OT200 | 315A | 315A |
| OT250 | 315A | 315A |
| OT315 | 500A | 450A |
| OT400 | 500A | 450A |
| OT500 | 500A | 450A |
| OT630 | 800A | 1000A |

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

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

## 6 - SOUND LEVELS

Liquid chillers can be a significant source of noise in refrigeration and air conditioning systems. Account is taken of technical constraints, both in design and manufacturing, sound levels cannot be improved much further than specified. Sound levels must therefore be accepted for what they are, and the area surrounding the chillers should be treated as necessary. The quality of installation can either improve or decrease initial sound characteristics: it may be necessary to provide further treatment such as sound-proofing or installation of screens around units installed externally.
The choice of the location for the installation can 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 walling, interfere with the installation and its behaviour.
Before taking any other steps, first determine whether the sound level is compatible or not with the environment, what it is perfectly justifiable and that these measures envisaged will not cause unreasonable cost.
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 unit installation in its final location and prior to start up the unit. Please check of all the bolt and fasteners for any loose connections. The critical are bolts of compressors, outdoor fans, BPHE, outdoor coils and water pumps. In addition all electrical connections must be checked for loose connections.**

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

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

**IMPORTANT**
- **Start up and commissioning must be conducted by LENNOX authorised engineer.**
- **Never shut off power to the crankcase heaters except for long service operations or seasonal shutdown**

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

## 1 - LIMITS

Prior to any operation, please checks 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.

## 2 - REFRIGERATION CIRCUIT CHECKS AND RECOMMENDATIONS

The unit refrigeration circuit sketch is given in the «APPENDICES» at the end of the IOM or supplied with the unit.

## 3 - HYDRAULIC SYSTEM INSTALLATION CHECKS

The unit hydraulic sketch is given in the «APPENDICES» at the end of the IOM.

**The components are located inside the units or in a separate box and must be installed by a qualified engineer. 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 1 mm.**

## 4 - CHECK LIST BEFORE START-UP

### 4.1 - Check list of standard unit

Check that all drain and purge plugs are in place and well tightened prior to fill the installation with water or brine. Before proceeding with start-up, even for a test of short duration, check the following points, after having made sure that all the valves on the refrigeration circuit are fully open (discharge valves and liquid valves).
Starting up a compressor with the discharge valve closed will either trip the HP safety switch, or blow the cylinder head gasket or the internal pressure safety disc.

1. The liquid pump(s) and other apparatus interlocked with the unit (coils, air handling units, dry coolers, cooling towers, terminals such as fan coil units, etc.) are in working order as required by the installation and according to their own specific requirements. Place all water valves and refrigerant valves in their operating positions and start the water circulating pumps. Ensure main power supply is isolated before any work is started. Ensure unit is correctly earthed and that earth continuity is correctly done. Check that anti-vibration mountings are correctly installed and set.

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

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

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

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

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

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

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

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

Where
P1 = pressure drop published by LENNOX 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 (LENNOX software) as close as possible.

8. Check for correct operation of the fans and that the protective grilles are in good condition. Make sure that rotation is in the right direction.

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

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

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

In case of 2 units or more that shall operate together, the controller allows several configurations: please consult the controller manual to enter the right parameters.

## 1 – Checks to be made during start up

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

**REMEMBER THAT THE COMPRESSOR IS A SCROLL TYPE COMPRESSOR**

**Before starting the unit, the compressor should be checked that rotation is in the correct direction, 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 be carried out correctly (the correct direction of rotation can be checked when the pressure on the suction side decreases and the pressure on the discharge side increases when the compressor is activated). If the connection is wrong, the rotation will be reversed causing a high noise level and a reduction in the amount of current consumed. The solution is to disconnect, switch the wires between two of the phases and connect the three again).**
**SE-B2 protection** is included with the unit compressors: This device protects the compressor against high motor temperatures. When the temperature reaches critical values, protection opens a safety dry contact of the circuit and cuts power supply to compressor.

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

1. Thermometers and pressure switches installed in the chilled water circuit.
Check these safety devices in this order: high pressure switch

2. Run evaporator pump prior to start the chiller.

3. Flow switch installed and wired into the control box operates properly.

5. Check that there is sufficient cooling load on the day the start up is conducted (at least 50 % of the nominal load).

PROCEDURE TO FOLLOW WHEN STARTING THE UNIT

5a. 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.

5b Check the sight glass (upstream of the expansion valve if available) that the bubbles disappear progressively, indicating a correct refrigerant charge and without non condensable gas. If the humidity indicator changes colour, indicating the presence of humidity, replace the filter-drier cartridge if the latter is of the replaceable type.

5c The best practice recommends checking the sub cooling after the condenser.

5d Check that, when the cooling load has been balanced by the capacity of the unit, the chilled liquid is at design temperature.

7. Check the current values per phase on each compressor motor.

8. Check the current values per phase on each fan motor (If available)

9. Check compressor discharge temperature.

10. Check suction and discharge pressures and compressor suction and discharge temperatures.

11. Check chilled liquid entering and leaving temperatures.

12. Check condenser leaving air temperatures.

13. 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 can only be made once the proper operation of all safety devices and unit controls has been established.

## 2 - WATER FLOW CHECKS

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

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 chiller will be different from those at design conditions. Use the chiller performance charts of the AGU to find the right $\Delta T$ on the evaporator (and condenser side). For a unit selected at design conditions, this will give the nominal delta T on the evaporator side ($\Delta Ten$), and the nominal flows (den). At ambient start-up conditions, the charts will give start-up flows on the evaporator side (desu). If the water flows are correct, for this start-up conditions, the delta T on the evaporator ($\Delta Tesu$) should be $\Delta Tesu = \Delta Ten * desu/den$.

## 3 - FUNCTIONS AND MAIN REFRIGERANT COMPONENTS

1. Compressor (scroll type): a compressor is a device driven by a motor to bring a refrigerant gas from a low pressure, low temperature phase to a high pressure, high temperature phase.

2. Evaporator (brazed plate type): a heat exchanger in which on one side the refrigerant evaporates, thus extracting heat from the water or brine on the other side.

3. Condenser (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.

6. High pressure switch: this pressure switch initiates unconditional stoppage of the unit if compressor discharge pressure exceeds the operating limits. Reset is manual. HP setting=44 bar.

7. High pressure safety relief valve (Option): ultimate safety device that releases refrigerant if the pressure exceeds the service pressure.

8. Filter dryer: this is designed to keep the circuit clean and to remove all traces of humidity from within the refrigeration circuit, since this can impair operation of the unit, by acidification of the oil, which causes slow disintegration of the varnish protecting of the compressor motor windings.

9. Crankcase heater: Every compressor is fitted with a single phase crankcase heater that is activated when the compressor stops to ensure separation of the refrigerant and the compressor oil. It is therefore powered up when the compressor is not running.

## 1 - OPERATING LIMITS

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

### 1.1 – Standard unit without brine operation (B2)

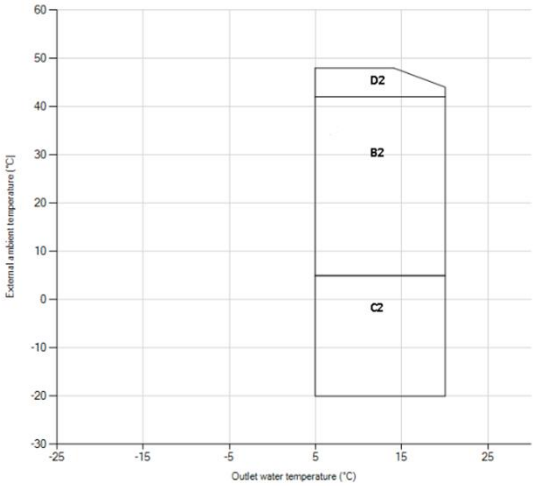
| GAC | | 170 | 200 | 230 | 270 | 300 | 330 | 370 | 400 |
|---|---|---|---|---|---|---|---|---|---|
| Min. outlet water temperature | °C | 5 | | | | | | | |
| Max. inlet water temperature | | 25 | | | | | | | |
| Min. difference water inlet/outlet | | 3 | | | | | | | |
| Max. difference water inlet/outlet | | 10 | | | | | | | |
| Min. outside air temperature | | 15 | | | | | | | |
| Maximum outside air temperature, full capacity operation | | 42 | 42 | 42 | 42 | 42 | 42 | 42 | 42 |

### 1.2 – Unit with all season's kit without brine operation (B2 + C2)

| GAC | | 170 | 200 | 230 | 270 | 300 | 330 | 370 | 400 |
|---|---|---|---|---|---|---|---|---|---|
| Min. outlet water temperature | °C | 5 | | | | | | | |
| Max. inlet water temperature | | 25 | | | | | | | |
| Min. difference water inlet/outlet | | 3 | | | | | | | |
| Max. difference water inlet/outlet | | 10 | | | | | | | |
| Min. outdoor air temperature, winter operation option | | -20 | | | | | | | |
| Maximum outside air temperature, full capacity operation | | 42 | 42 | 42 | 42 | 42 | 42 | 42 | 42 |

### 1.3 – Unit with high airflow all season's kit without brine operation (D2 + B2 + C2)

| GAC | | 170 | 200 | 230 | 270 | 300 | 330 | 370 | 400 |
|---|---|---|---|---|---|---|---|---|---|
| Min. outlet water temperature | °C | 5 | | | | | | | |
| Max. inlet water temperature | | 25 | | | | | | | |
| Min. difference water inlet/outlet | | 3 | | | | | | | |
| Max. difference water inlet/outlet | | 10 | | | | | | | |
| Min. outdoor air temperature, winter operation option | | -20 | | | | | | | |
| Maximum outside air temperature, full capacity operation | | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 |

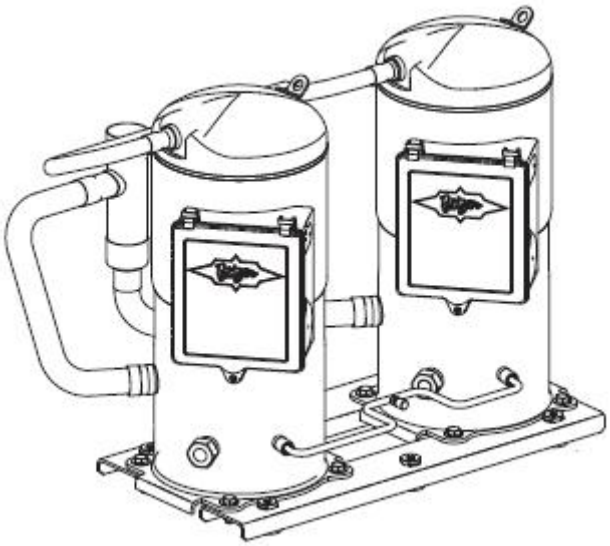


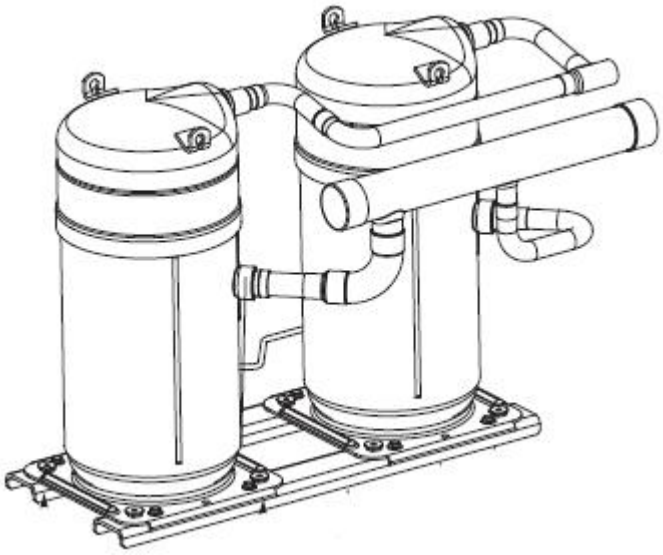
## 2 - UNIT OPERATION: REFRIGERATION CIRCUIT

### 2.1 - Tandem and Trios scroll assemblies

With tandem and trios assemblies the oil balancing is achieved through the use of either :
- a large two phase line tube on GSD80295 trio OR
- a oil repartition system patented by Bitzer (BATH) on others assemblies

**With two phase line, it is IMPERATIVE that this tube is perfectly level during operation to ensure proper oil balancing between the two crankcases**
**It is also IMPERATIVE for the compressor to be mounted on a rigid base frame as there is no flexibility in the oil equalizing line. The whole assembly is mounted on silencers.**





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

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

Contact LENNOX after sales offices for additional informations.

### 2.2 – Oil charge

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

| Oil Recommendation for eComfort | | | |
|---|---|---|---|
| **Refrigerant** | **Compressor type** | **Brand** | **Oil Type** |
| R32 | Orbit Scroll | Bitzer | BVC32 |

### 2.3 - Bitzer scroll discharge temperature protection

If the oil in the compressor gets too hot it will start to deteriorate and loose its ability to lubricate, and will eventually cause a compressor failure. LENNOX compressors are fitted with a specially designed sensor in the hottest part of the compression cycle on the discharge pipe of the scroll sets. This sensor is connected to the unit which will manage the compressor engagement to avoid temperature rise too high.

### 2.4 - Antifreeze function

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

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

*CASE 2: Antifreeze pressure transducer:*
This monitors evaporating pressure of the refrigerant. It triggers when the temperature goes below the preset minimum value.
Note: see the CLIMATIC user manual for more specific details.

## 3. UNIT OPERATION: ELECTRICAL AND CONTROL FEATURES

See the specific «Basic CLIMATIC controller» manual

### 1. - Fan over current protection

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

### 2. - Compressor motor over current protection

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

### 3. - Chilled liquid pump interlock

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

### 4. - Flow switch for the chilled liquid

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

### 5. - Antifreeze protection (standard)

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

### 6. - Loss of power supply

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

## 4 - CLIMATIC CONTROL

See the specific CLIMATIC manual
See the specific «Basic CLIMATIC controller» manual

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

**During the life-time of the system, inspection and tests must be carried out in accordance with national regulations. The information on operating inspections given in annex C of standard EN378-2 can be used if no similar criteria exist in the national regulations.**

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

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

Nonetheless, we recommend a regular maintenance schedule:
- 4 times a year for chillers operating all year long
- 2 times a year for chiller 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», for weekly records of operating conditions of the machine. This log will serve as an excellent diagnostic tool for maintenance personnel ; likewise, the machine operator, by noting down changes in machine operating conditions, will often be able to anticipate and avoid problems before they actually occur or worsen.

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

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

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

**Symbols and Legend:**

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

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

| MAINTENANCE PLAN | | | | |
|---|---|---|---|---|
| **Task** | **Operating mode** | **Monthly** | **+ Quarterly** | **Half Yearly** |
| Inspection of the microchannel coils aluminum-copper connections for corrosion | Proper care to be given when cleaning the coils. If corrosion is detected, a preventive treatment needs to be done following our recommendations | ▌ | | |
| Cleaning the coils (In accordance with local regulations) | It's mandatory to clean the external coils, according to the environment where the unit is located, the frequency of the cleaning varies from once in a month to minimum twice in a year. The performance and the sustainability of the machine is based on the perfect heat exchange. The use of a neutral pH cleaning product is mandatory (WARNING: Fins and copper tubes are very fragile! Any damage WILL reduce the performances of the unit). | ▌ | ▌ | ▌ |
| Inspection of compressor's electrical current | Check the electrical current of each compressor on the 3 phases of partial load and at 100% - with a certain frequency, according to the utilization of the machine. Example : **Monthly :** If the unit is used all over the year **Half Year :** if seasonal use | ▌ | ▌ | ▌ |
| Electrical cabinets air-filters cleaning | It's mandatory to clean the filters at least once a month according to environment where the unit is located to avoid overheating the electrical components. Check the filter fouling rate, clean or replace it when needed by an original filter | ● | ● | ● |
| Inspection of the condensers fans | Check the rotation of the fan ( free rotation, detection of vibrations or bearing noises) . Check for the Amps consumed on all three phases; compare it with the nominal value given in the electrical wiring diagram. Check the status of the fan blades and its protections. | | ▌ | |

| MAINTENANCE PLAN | | | | |
|---|---|---|---|---|
| **Task** | **Operating mode** | **Monthly** | **+ Quarterly** | **Half Yearly** |
| Visual inspection of the oil level and check the oil for traces of acidity in the refrigerant circuits | Visually check the oil level through the sight glass on the side of the compressor casing. Test the oil every 3 years and/or after each intervention on the refrigerant circuit | | \| | |
| Inspect the four way valve | During cooling mode, reverse to Heat Pump mode. Reset the control. | | \| | – |
| Check the position of the crankcase heaters ( around the compressor) and it's proper functioning | Ensure crankcase heaters is well fitted and secured.<br>Verify the operation of the crankcase heaters. | | \| | |
| Verify 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.<br>Check the operation of the defrost cycle. | | \| | |
| If possible, check for water pressure in the circuit | Check the water pressure in the circuit and the efficiency of the expansion vessels | | • | |
| 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. | | \| | |
| 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. | | \| | |
| Check the water flow | Measure the water flow rate and compare to the selected value from the technical datasheet | | \| | |
| Inspection and cleaning the water filter | ATTENTION : The water circuit can be under pressure. Follow the usual precautions when depressurizing the circuit before opening. Ignoring this rules can lead to accidents and cause injury to the personal. | | \| | |
| Check for water leakage in the unit and it's accessories | Verify the gaskets, if cracked or ripped, repair them or replace them.<br>Check for water leaks and repair if it's needed. | | | \| |
| Check CLIMATIC™ control, set-points and variables | Refer to the commissioning sheet; Check all set points are set according to this document. | | | \| |
| Check refrigeration system for proper functioning (Thermal expansion valve) | Retrieve/Check the values for superheating and sub cooling. Resume the expansion valve settings when needed, verify the behavior in partial loads and at 100%. Resume settings to obtain superheat between 5K and 10K. | | | \| |
| 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. | | | \| |
| 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. | | | \| |
| SIGHT GLASS (when applicable) | The liquid refrigerant flow through the sight glass should be steady and without bubbles. Bubbles are a sign of a low charge, a possible leak, or of a restriction in the liquid line. Each sight glass is fitted with a humidity indicator. The color of the element changes according to the level of humidity in the refrigerant, also according to the temperature. It should indicate «dry» refrigerant. If it shows «wet» or «CAUTION», contact a qualified refrigeration technician.<br>**CAUTION:** when starting up the unit, run the compressor for at least 2 hours before taking a humidity reading. The humidity detector is also sensitive to temperature, and as a consequence, the system must be at normal operating temperature to give a meaningful reading. | | | \| |
| Check antifreeze protection | Test antifreeze function (leakage rate, frost protection thermostat) | | | \| |
| Check refrigeration 3-way valve | Check the proper functioning of the system. | | | \| |
| 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)<br>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. | | | \| |
| Check HP / LP safety switches | Install a pressure gauge HP / LP and check if the safety switches for its overall working. | | | \| |

| MAINTENANCE PLAN | | | | |
|---|---|---|---|---|
| **Task** | **Operating mode** | **Monthly** | **+ Quarterly** | **Half Yearly** |
| Check the position of all sensors | Check the position and the fixation of all sensors. | | | ● |
| Check anti-vibration mountings, for wear and tear. | Visually check anti-vibration mountings on compressors and centrifugal fan. Replace it, if damaged. | | | ● |
| 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 | | | \| |
| Check casing and equipment corrosion | To treat and neutralize eventual rust spots | | | ● |
| 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) | | | \| |
| Plate exchanger | Verify the general insulation state, the tightness of the water connection and the freeze protection. | | | \| |
| Check the expansion vessel (if applicable) | Measure the pressure under the different water modes ( from +7°C to +45°C) | | | \| |
| Check the software version | Contact the manufacturer for updates | | | \| |

When carrying out maintenance works on these units, please make a correct segregation of the non-hazardous waste generated : insulation, air filters, plastic or metallic elements, packaging, etc. as well as waste considered hazardous: oil filters and rags impregnated with oils, welding elements such as filler material, strippers, electrical and electronic waste, batteries, lamps, etc. They must be managed by an authorized dealer.
The refrigerant gas can be reused, or collected in a bottle and managed as hazardous waste by an authorized dealer.

## 2 - CLEANING THE CONDENSER

### 2.1 – Tube and fins air cooled condensers

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

### 2.2 – Micro Channel aluminum air cooled condensers

Method and frequency of cleaning are linked with the environment where the chiller is located. The sensitive sites where the cleaning process must be strictly applied are industrial or costal environment combined with a foggy weather. The cleaning intervals must be shorter than a no polluted site or dry area. Fog absorbs gaseous air pollutants and contains moisture in excess of the critical threshold of relative humidity. A thin film is raised on the material including all chemicals elements to start a corrosion process. It must be removed to slow down this corrosion process. Method and frequency cleaning are under customer responsibility.
Usage of protective coating for these sensitive sites is recommended. The recommended way to clean the coils is to use a “high” pressure device but without exceeding 20 bars at 30 cm distance. Cleaner (alkaline product) is forbidden. A cleaner PH7 can be used if the coils are very dirty.

For microchannel heat exchangers, the coil connection to the circuit is made by means of a solder copper / aluminum. This connection is protected from galvanic corrosion by a special resin encapsulated in a bitumen like sleeve.

This sleeve must be visually inspected regularly during unit cleaning operations to detect a possible premature deterioration.

Indeed with slightly corrosive atmospheres, a small copper etching can lead to a loss of adhesion of the resin thus allowing moisture to seep under the sleeve while triggering galvanic corrosion phenomena between the aluminum and the Copper.
If this attack is not detected in time, a leak may appear and then force change of the exchanger.

Galvanic corrosion under the plastic sleeve.

**A LEAKAGE BY CORROSION DUE TO A LACK OF CONDENSER MAINTENANCE IS NOT COVERED BY UNIT WARRANTY**
In case of deterioration of the sleeve, it must be removed and replaced. Please contact your Lennox representative.

## 3 - COMPRESSORS / OIL DRAINAGE

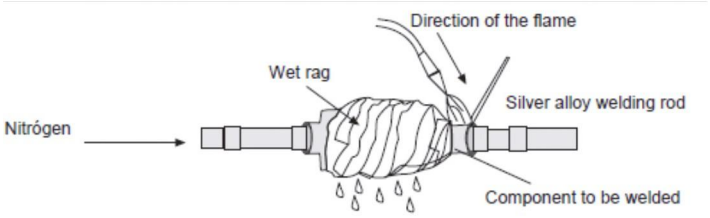
Oil for refrigeration equipment is clear and transparent. It keeps its colour over a long period of operation.
Given that a correctly designed and installed refrigeration system will operate without any problems, there is no need to replace the compressor oil even after a very long period of operation.
Oil that has become dark in colour has been exposed to impurities in the refrigeration piping system or to excessive temperatures on the discharge side of the compressor, and this inevitably impairs the quality of the oil. Darkening of the colour of the oil or degradation of its qualities can also be caused by the presence of humidity in the system. When the oil has changed colour or has been degraded, it must be changed.
In this event, before putting the unit back into service, the compressor and the refrigeration circuit will have to be evacuated.

## 4 - CORRECTIVE MAINTENANCE

**MAKE SURE THAT THE UNIT IS COMPLETELY DISCONNECTED FROM THE POWER SUPPLY BEFORE CARRYING OUT ANY TYPE OF WORK ON THE UNIT.**
**REMEMBER THAT ONLY TRAINED AND QUALIFIED PERSONNEL ARE AUTHORIZED TO OPERATE ON A REFRIGERATION CIRCUIT.**

If some component in the cooling circuit must be replaced, follow these recommendations:

- Always use original replacement parts.
- Environment laws stipulate recovery of refrigerants and prohibit their release into the atmosphere.
- If cuts must be made in the pipe work, use pipe cutters. Do not use saws or any other tools that produce filings.
- All brazing must be carried out in a nitrogen atmosphere to prevent corrosion from forming.
- Use silver alloy brazing rod.
- Take special care that the flame from the torch is aimed in the opposite direction from the component to be welded and is covered with a wet rag in order to avoid overheating.
- 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.




- Carry out the vacuum above and below through the Schrader valves of the outdoor unit until -750 mm Hg is reached. 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.
- Charge the unit with refrigerant according to the data on the Name Plate of the unit and check that there are no leaks.

**PRECAUTIONS TO BE TAKEN IN THE USE OF R-32 REFRIGERANT**

The following precautions characteristic of this gas should be taken:

- The vacuum pump must have a check valve or solenoid valve and compliant with R32 (A2L).
- Pressure gauges and hoses for the exclusive use with R-32 refrigerant should be used.
- To open the pipelines, use only pipe cutters and no open flame.
- The charge should be carried out in the liquid phase.
- Always use weighing scales to charge the refrigerant.
- Use the leak detector exclusive for R-32 refrigerant.
- Do not use mineral oil, only synthetic oil to ream, expand or make connections.
- Keep pipes capped before using them and be very thorough about any possible moisture and dirt (dust, filings, burrs, etc.).
- Brazing should always be carried out in a nitrogen atmosphere.
- Reamers should always be well sharpened.
- The refrigerant bottle must contain at least 2 % of the total amount.

**WARNING**
**Be careful to remove refrigerant from the circuit prior to cut or unbraze any piping with appropriate tool for use with R32 (A2L)**
**We advise the following protocol prior to any piping work :**

- **Vacuum the unit with appropriate vacuum device for R32 (A2L)**
- **Charge the unit with dry nitrogen to enable possible remaining R32 to be removed from oil**
- **Repeat these operations twice**
- **Release the pressure**

## 5 - DISPOSAL OF EQUIPMENT

Equipment shutdown and oil and refrigerant recovery should be performed by qualified personnel in accordance with NF EN 378. All parts of the refrigeration system, for example, refrigerant, oil, heat transfer fluid, filter, dehydrator, insulation materials must be recovered, reused and / or made available properly (see NF EN 378 part 4). No rejections will be made 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.**

## 1 - LIST OF THE MOST COMMON PROBLEMS

### A. THE COMPRESSOR DOES NOT START

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

| PROBLEMS – SYMPTOMS | PROBABLE CAUSE | RECOMMENDED ACTION |
|---|---|---|

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

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

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

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

| PROBLEMS – SYMPTOMS | PROBABLE CAUSE | RECOMMENDED ACTION |
|---|---|---|

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

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

## E. THE COMPRESSOR CUTS OUT ON ANTIFREEZE ALARMS

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

| PROBLEMS – SYMPTOMS | PROBABLE CAUSE | RECOMMENDED ACTION |
|---|---|---|

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

| | | |
|---|---|---|
| | • 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

| | | |
|---|---|---|
| | • Faulty windings | • Replace the compressor |
| | • Mechanical problem | • Replace the compressor |

### H. THE COMPRESSOR IS NOISY

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

### I. DISCHARGE PRESSURE TOO HIGH

| | | |
|---|---|---|
| • 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

| | | |
|---|---|---|
| • No sub-cooling when operating at full load. | • Low refrigerant charge | • Repair the leak and add refrigerant |

### K. SUCTION PRESSURE IS TOO HIGH

| | | |
|---|---|---|
| • 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 |

| PROBLEMS – SYMPTOMS | PROBABLE CAUSE | RECOMMENDED ACTION |
|---|---|---|

## L. SUCTION PRESSURE IS TOO LOW

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

## 2 - CONTROL DEVICES

### Operation

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

- A dirty condenser
- Low air flow

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

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

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

- Low water flow
- Thermostat setting too low

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

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

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

## 3 - REGULAR CHECKS TO BE MADE - CHILLER 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

## 4 - MANUFACTURER'S RECOMMENDED INSPECTIONS

### 4.1 - LIQUID CHILLERS WITH SCROLL COMPRESSOR(S)

***4.1.1 - Number of recommended preventive maintenance visits:***

**NUMBER OF RECOMMENDED PREVENTIVE MAINTENANCE VISITS**

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

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

(1) Depending on the quality of the water

***4.1.2 - Description of inspection duties - Liquid chiller with scroll compressor(s)***

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

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

**INSPECTION VISIT**
- Leak test
- Operating test with record of measurements taken and functional analysis.

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

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**.**

| | | |
|---|---|---|
| Machine identifications: | Affair number: | |
| Year of manufacture: | | |
| **NORMAL CONDITIONS OF USE** | | |
| Leaving chilled water temperature: | | °C |
| Outdoor air temperature: | Max: °C | Min: °C |
| 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: | | |

| | | Circuit 1 | | | Circuit 2 | | | Circuit 3 | Circuit 4 |
|---|---|---|---|---|---|---|---|---|---|
| | | Compr. 1 | Compr. 2 | Compr. 3 | Compr. 1 | Compr. 2 | Compr. 3 | Compr. 1 | Compr. 1 |
| Number of hours of operation | | | | | | | | | |
| Compressors in service per circuit | | | | | | | | | |
| Evaporating pressure | Bar | | | | | | | | |
| Suction piping temperature | °C | | | | | | | | |
| Condensing pressure | Bar | | | | | | | | |
| Discharge piping temperature | °C | | | | | | | | |
| Oil pump temperature | °C | | | | | | | | |
| Oil pressure | Bar | | | | | | | | |
| Oil level | A | | | | | | | | |
| Current on phase 1 per compressor | A | | | | | | | | |
| Current on phase 2 per compressor | A | | | | | | | | |
| Current on phase 3 per compressor | °C | | | | | | | | |
| Liquid line temperature | Bar | | | | | | | | |
| Evaporator pressure drop | °C | | | | | | | | |
| Chilled water temperature | °C | | | | | | | | |
| Leaving chilled water temperature | Bar | | | | | | | | |
| Condenser pressure drop | °C | | | | | | | | |
| Condenser entering water temperature | °C | | | | | | | | |
| Condenser leaving water temperature | Bar | | | | | | | | |
| 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:<br>(cut-out / bar) | Fan 2 : | Fan 3 : | Fan 4 : |

**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 Lennox
- ❑ Check for missing items
- ❑ Availability of suitable lifting gear, slings and spacers

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

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

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

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

CUSTOMER ORDER NUMBER ..... LENNOX REFERENCE: .....
DESIGNATION .....
COMMENTS: .....
.....
NAME: ..... SIGNATURE: .....

# APPENDICIES

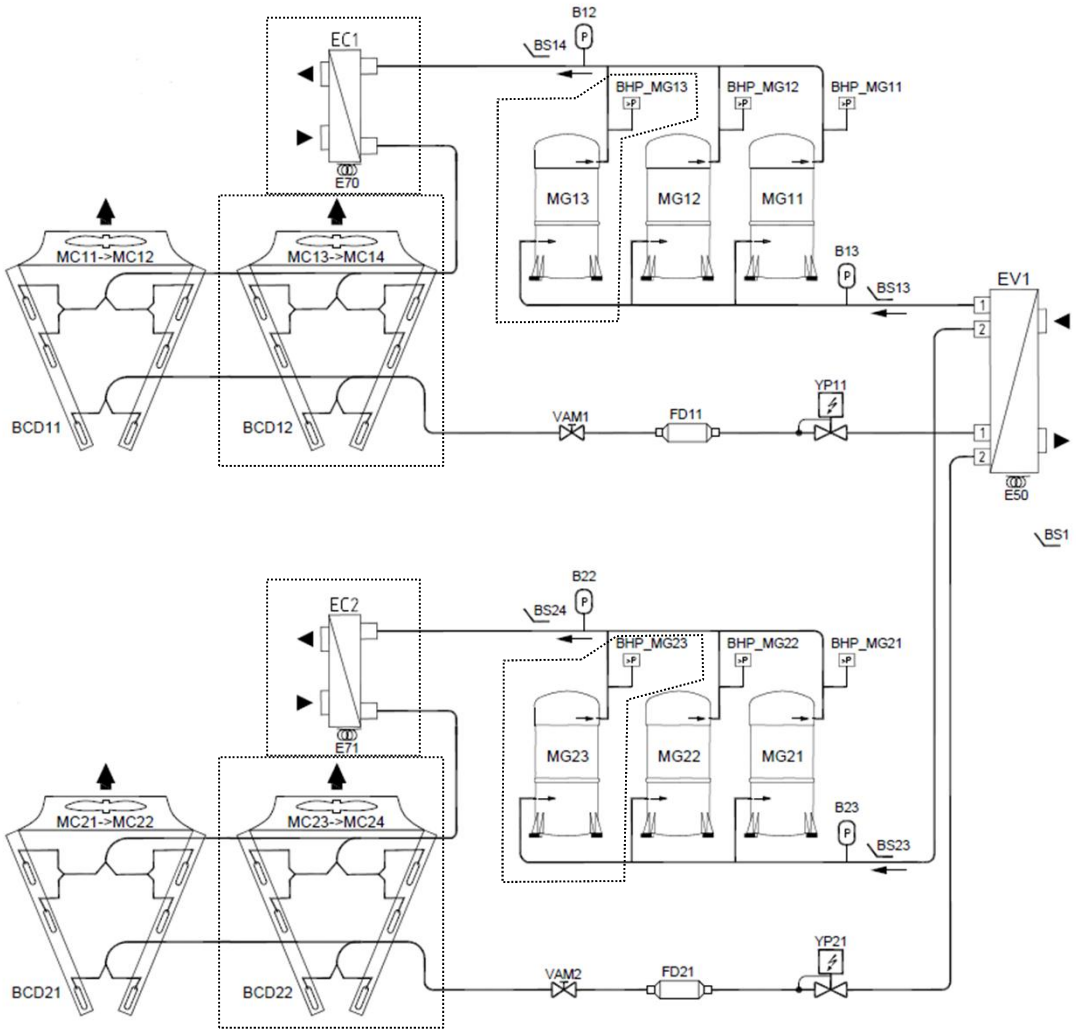
## RISK ANALYSIS AND HAZARDOUS SITUATIONS ACCORDING TO PED DIRECTIVE

| N° | Event | Effect | Risk | Actions to Eliminate the Risk | Information to minimise the occurrence of a risk |
|---|---|---|---|---|---|
| 1A | Violent Shocks, Static or Dynamic Loads applied | Appearance of cracks, distortions, possibility of rupture | Leaks, liquid or gas projections, Metal parts projections. | Handle the units using the chassis and lifting. | Handling procedure shown in the IOM supplied with the unit. |
| 2A | Unit not installed properly or leveled to the ground | Unusual stress in the frame leading to possible vibrations and cracks | Leaks | Level the machine during commissioning. In the case where the unit is installed on anti-vibration mountings, all supporting points must be used and the block hardness must be selected according to the type of units being installed. | Indications on general mechanical drawings in the technical guide and the IOM supplied with the unit. |
| 3A | Unsuited hydraulic or refrigeration pipe-work | Unusual stress on the pipe-work leading to possible vibrations and cracks | Leaks | Proper support and fitting of the pipe-work on site. | Indications in the technical IOM supplied with the unit. |
| 4A | Outdoor temperature below freezing | Stress, vibrations and cracks, resulting in pipe bursting. | Partial or complete destruction of the circuit, Liquid/ gas could be released from the unit | Provide anti-frost protection (ei: Water treated with Glycol, or trace heaters along the pipe-work) | Indications in the technical IOM supplied with the unit. |
| 5A | Circuits exposed to an unusual heat source. | Modification of the mechanical properties of certain materials with a risk or rupture or pipe bursting, leaks or cracks appearing. | Partial or complete destruction of the circuit, Liquid/ gas could be released from the unit | Recommended minimum and maximum outdoor temperature– 20°C to 50°C during operation. –30°C to 50°C during storage Do not expose any part of the machine to a naked flame | Indications of the Min and Max outdoor temperature on the unit nameplate |
| 6A | Unusual increase in the temperature of the Chilled water return to the evaporator or the hot return water to the condenser | Increase of the refrigerant pressure in the heat exchanger with a risk of exceeding the working pressure leading to possible stress, vibrations, cracks and pipe or vessel bursting. | Partial or complete destruction of the circuit, Liquid/ gas could be released from the unit | Maximum chilled water return temperature: 45°C Maximum hot return water temperature: 50°C Install a temperature limitation device | Indications in the technical IOM supplied with the unit. |
| 7A | Possibility of a unit being hit by lightning | Extreme heat, explosion, cracks, damage to electrical system | Partial or complete destruction of the circuit, Liquid/ gas could be released from the unit | Provide an appropriate protection against lightning. | Indications in the technical IOM supplied |

| N° | Event | Effect | Risk | Actions to Eliminate the Risk | Information tominimise the Occurrence of a risk |
|---|---|---|---|---|---|
| 8A | Unit exposed to extremely corrosive materials. | Modification of the mechanical and chemical properties of certain materials with a risk or corrosion rupture, pipe bursting, leaks and cracks. | Partial or complete destruction of the circuit, Liquid/ gas could be released from the unit | Protect the units against environements | Indications in the technical IOM supplied |
| 9A | Unit exposed to explosive materials. | Risk of explosion or pipe bursting. | Partial or complete destruction of the circuit, Liquid/ gas could be released from the unit | Protect the units against environements | Indications in the technical IOM supplied |
| 10A | Inappropriate Heat Transfer Fluid | Corrosion, excessive heat | Partial or complete destruction of the circuit. Leaks | Usual fluids are Water or Water with Glycol. | Indications in the technical IOM supplied |
| 11A | Inappropriate refrigerant fluid in the circuit | Corrosion, excessive heat, combustion or explosion | Partial or complete destruction of the circuit, Liquid/ gas could be released from the unit | Only use the fluid specified on the unit's nameplate. | I ndicat ions of t he refrigerant fluid on the unit nameplate |
| 12A | Inappropriate oil in the compressor | Corrosion, excessive heat, | Partial or complete destruction of the circuit. Leaks | Authorized oils: Refer to the compressor nameplate or the documentation. | Indication on the compressor nameplate or the manufacturer documentation. |
| 13A | Working on a part under pressure | Risk of explosion or part bursting away from the machine. | Liquid/gas/metal parts could be thrown out of the unit | Isolate the section of the circuit to be worked on and recover the refrigerant before any work. Always wear propoer Personal Protectiive Equipment. | Indications in the technical IOM supplied |
| 14A | Brazing or un-brazing parts from the circuit | Stress, cracks, pipe bursting | Partial or complete destruction of the circuit, Liquid/ gas could be released from the unit | Parts to be brazed using best engineering practices. Use brazing materials approved by LENNOX. Ensure the circuit is leak free before refilling with refrigerant. | Indications in the technical IOM supplied |
| 15A | Unit exposed t o induct ive interferences | Corrosions, cracks | leaks | Ensure the unit is earthed properly | Indications in the technical IOM supplied |
| 16A | Unit exposed to internal or external vibrations | Stress, cracks, explosions | Partial or complete destruction of the circuit, Liquid/ gas could be released from the unit | Inspect the unit regularly | Indications in the technical IOM supplied |

## GENERAL REFRIGERATION CIRCUIT DIAGRAM:
## eComfort COOLING ONLY

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

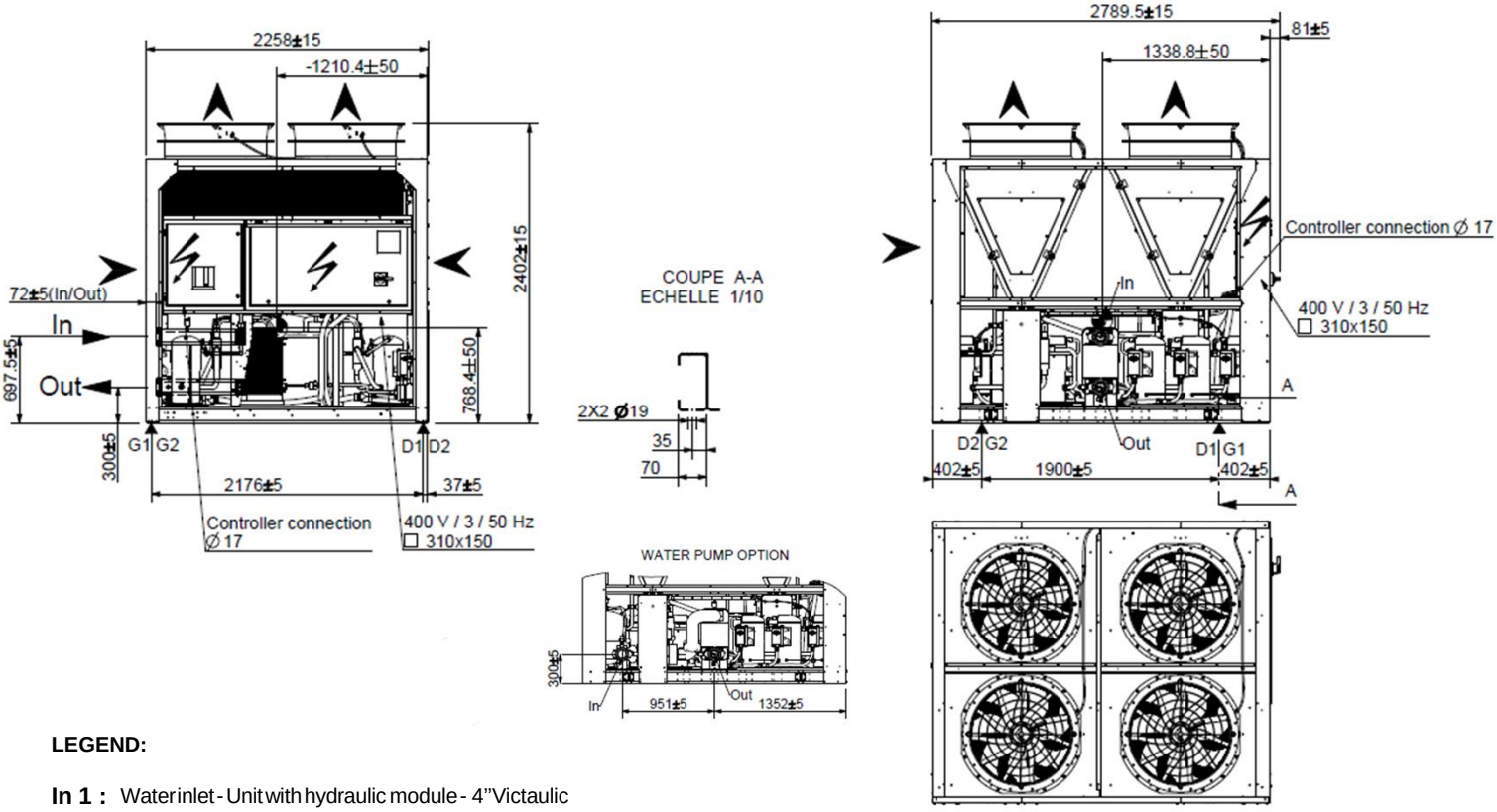



Component in use depending on selected unit

| | | | | | |
|---|---|---|---|---|---|
| **MG11 / MG12<br>MG21 / MG22<br>MG13 / MG23** | Scroll compressors | **BCD11<br>BCD12<br>BCD21<br>BCD22** | Air cooled condenser | **YP11<br>YP21** | Electronic expansion valve |
| **BHP_MG11<br>BHP_MG12<br>BHP_MG21<br>BHP_MG22** | High pressure switches | **MC11 / MC12<br>MC13 / MC14<br>MC21 / MC22<br>MC23 / MC24** | Condenser motor Fan | **EV1** | Evaporator heat exchanger |
| **B12 / B13<br>B22 / B23** | Pressure transducers HP & BP | **VAM1<br>VAM2** | Manual isolating valve | **BS13 / BS14<br>BS23 / BS24** | Suction / Discharge temperature sensor |
| | Heating resistance (OPTION) | **FD11<br>FD21** | Cartridge filter drier | **BS1** | External temperature sensor |
| **EC1 / EC2** | Desuperheater | | | | |

## GENERAL MECHANICAL DRAWING

**GAC 170 / 200 / 230**
**GAH 170 / 200 / 230**




**LEGEND:**

**In 1 :** Water inlet - Unit with hydraulic module - 4"Victaulic

**In 2 :** Water inlet - Unit without hydraulic module - 4"Victaulic

**Out :** Water outlet - 4" Victaulic

## LOAD DITRIBUTION

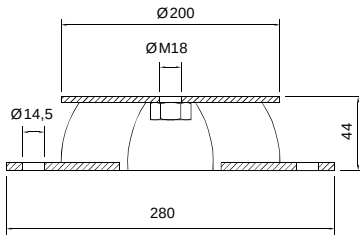
(Kg - Operating weights with dual pump hydraulic module)

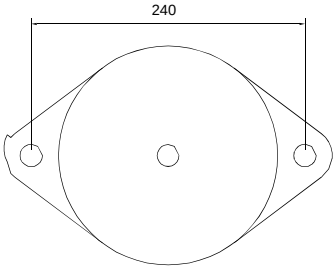
| | G1/D1 | G2/D2 |
|---|---|---|
| **GAC 170** | 500 | 500 |
| **GAC 200** | 500 | 500 |
| **GAC 230** | 550 | 550 |

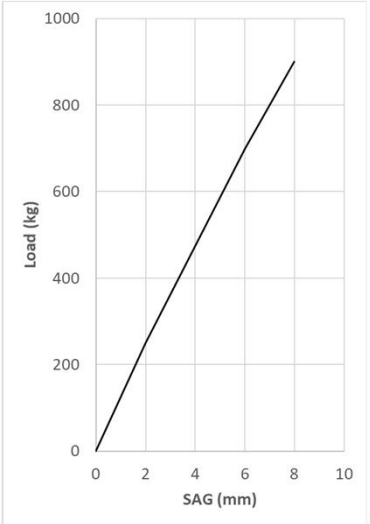
| | G1/D1 | G2/D |
|---|---|---|
| **GAH 170** | n.a. | n.a. |
| **GAH 200** | n.a. | n.a. |
| **GAH 230** | n.a. | n.a. |

Lennox recommend load distribution as detailed above.

## ANTI-VIBRATION MOUNTS (OPTION)

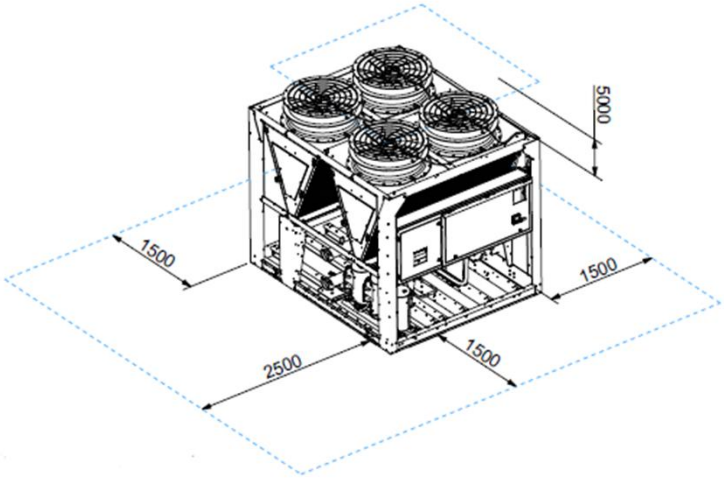


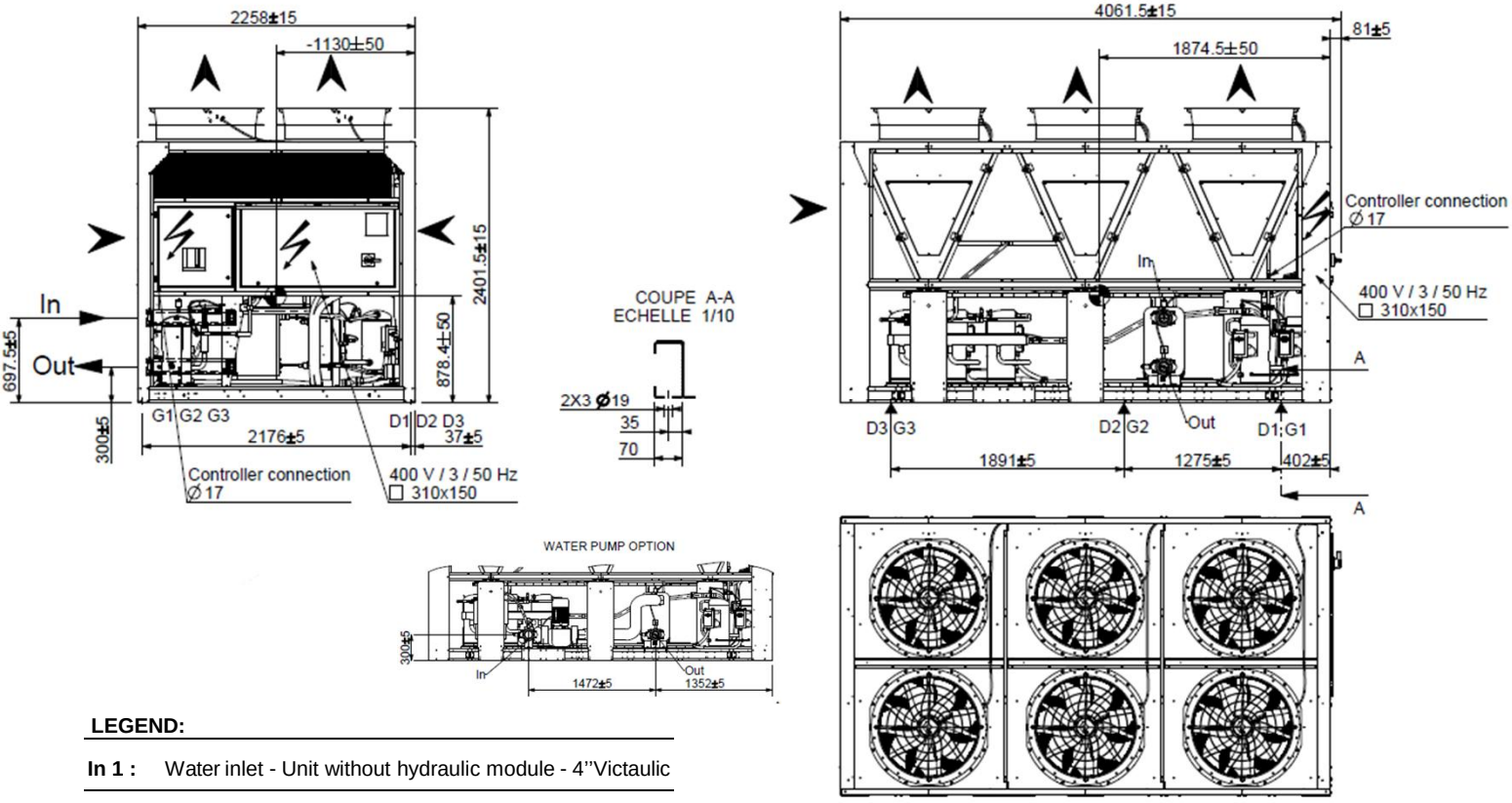

## CLEARANCES

Overhead obstructions are not permitted



## GENERAL MECHANICAL DRAWING

**GAC 270 / 300**
**GAH 270 / 300**




**LEGEND:**

| | |
|---|---|
| **In 1 :** | Water inlet - Unit without hydraulic module - 4''Victaulic |
| **In 2 :** | Water inlet - Unit with hydraulic module - 4''Victaulic |
| **Out :** | Water outlet - 4''Victaulic |

## LOAD DITRIBUTION

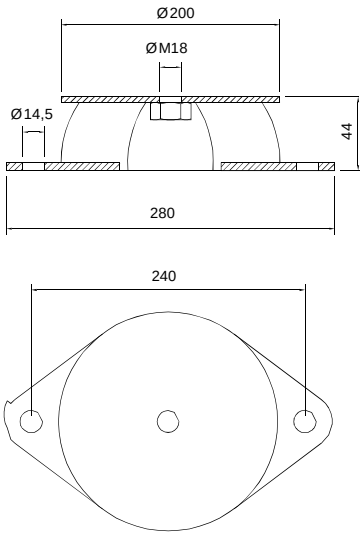
(Kg - Operating weights with dual pump hydraulic module)

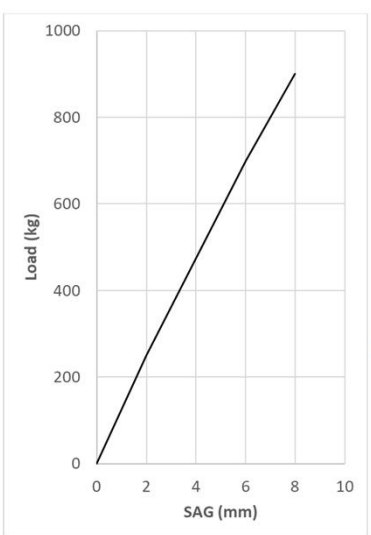
| | G1/D1 | G2/D2 | G3/D3 |
|---|---|---|---|
| **GAC 270** | 417 | 417 | 417 |
| **GAC 300** | 450 | 450 | 450 |

| | G1/D1 | G2/D2 | G3/D3 |
|---|---|---|---|
| **GAH 270** | n.a. | n.a. | n.a. |
| **GAH 300** | n.a. | n.a. | n.a. |

Lennox recommend load distribution as detailed above,

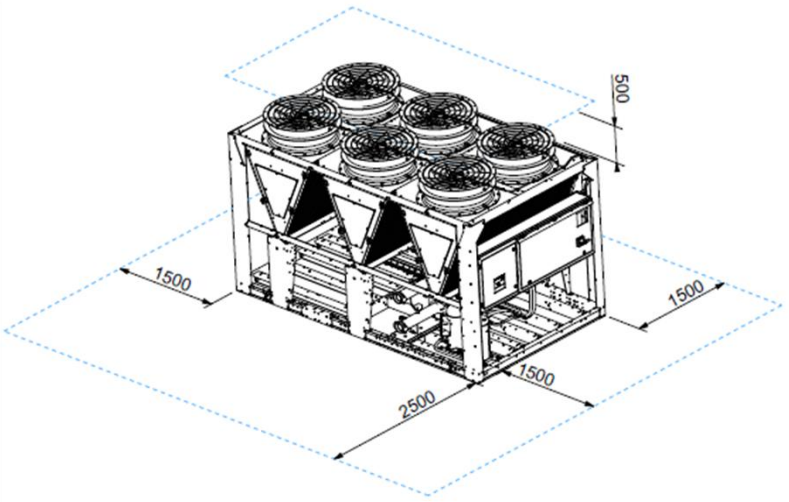
## ANTI-VIBRATION MOUNTS (OPTION)



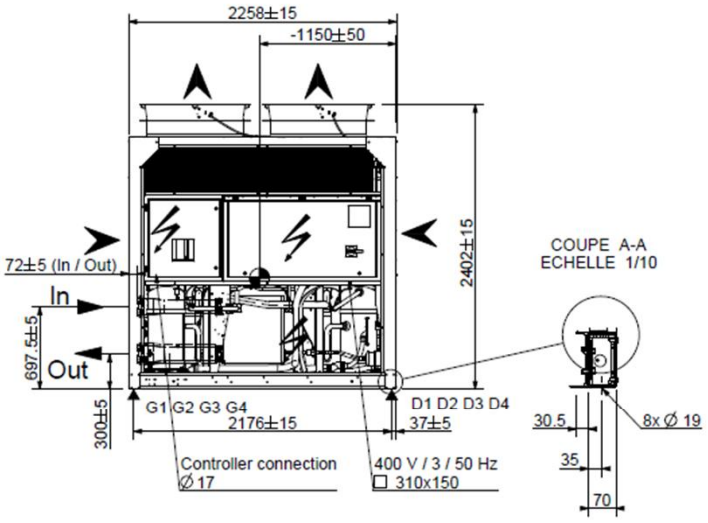

## CLEARANCES

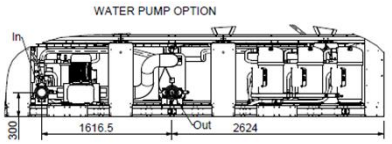
Overhead obstruction are not permitted

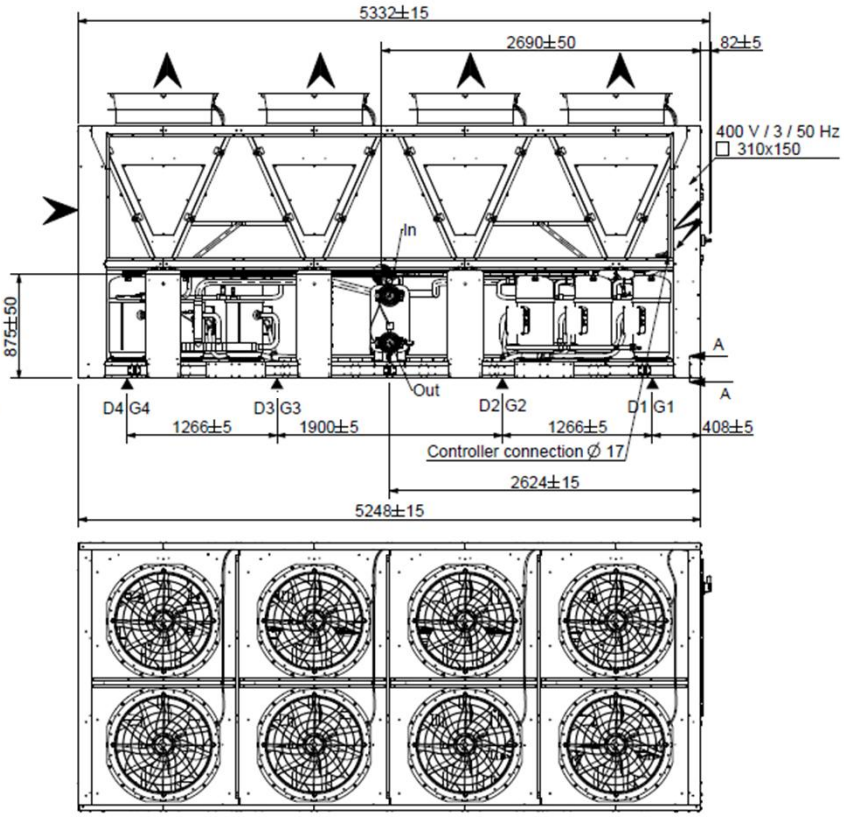


## GENERAL MECHANICAL DRAWING

**GAC 330 / 370 / 400**
**GAH 330 / 370 / 400**




**LEGEND:**

| | |
|---|---|
| **In** | Water inlet - Unit with hydraulic module - 5''Victaulic |
| **In 2 :** | Water inlet - Unit without hydraulic module - 5''Victaulic |
| **Out :** | Water outlet - Unit with hyrdaulic module - 5''Victaulic |

## LOAD DITRIBUTION

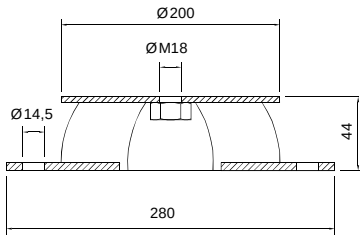
(Kg - Operating weights with dual pump hydraulic module)

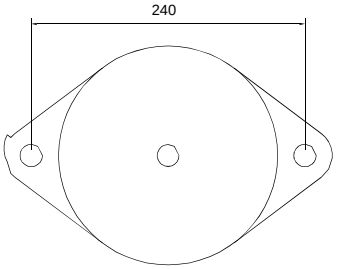
| | G1/D1 | G2/D2 | G3/D3 | G4/D4 |
|---|---|---|---|---|
| **GAC 330** | 388 | 388 | 388 | 388 |
| **GAC 370** | 413 | 413 | 413 | 413 |
| **GAC 400** | 450 | 450 | 450 | 450 |

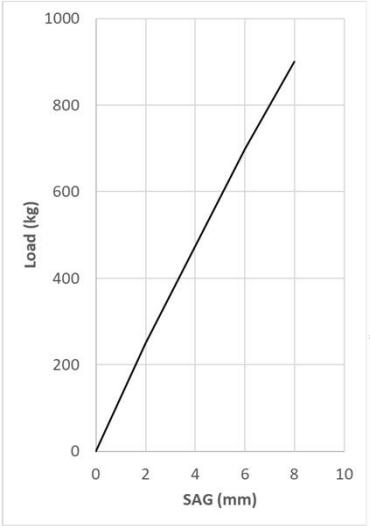
Lennox recommend load distribution as detailed above,

| | G1/D1 | G2/D2 | G3/D3 | G4/D4 |
|---|---|---|---|---|
| **GAH 330** | n.a. | n.a. | n.a. | n.a. |
| **GAH 370** | n.a. | n.a. | n.a. | n.a. |
| **GAH 400** | n.a. | n.a. | n.a. | n.a. |

## ANTI-VIBRATION MOUNTS (OPTION)

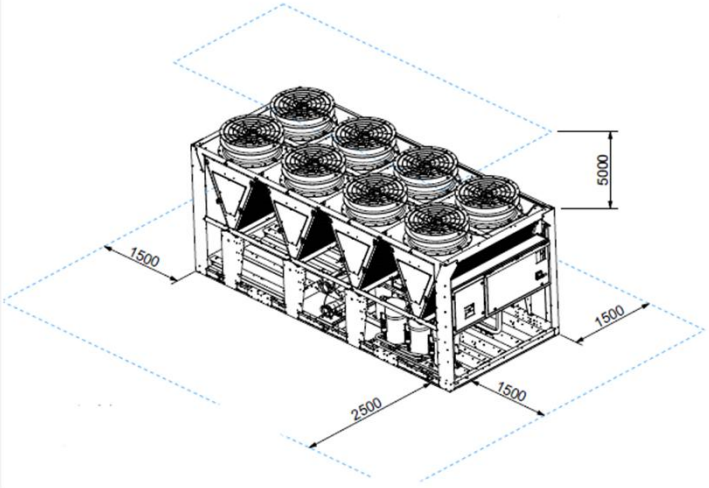


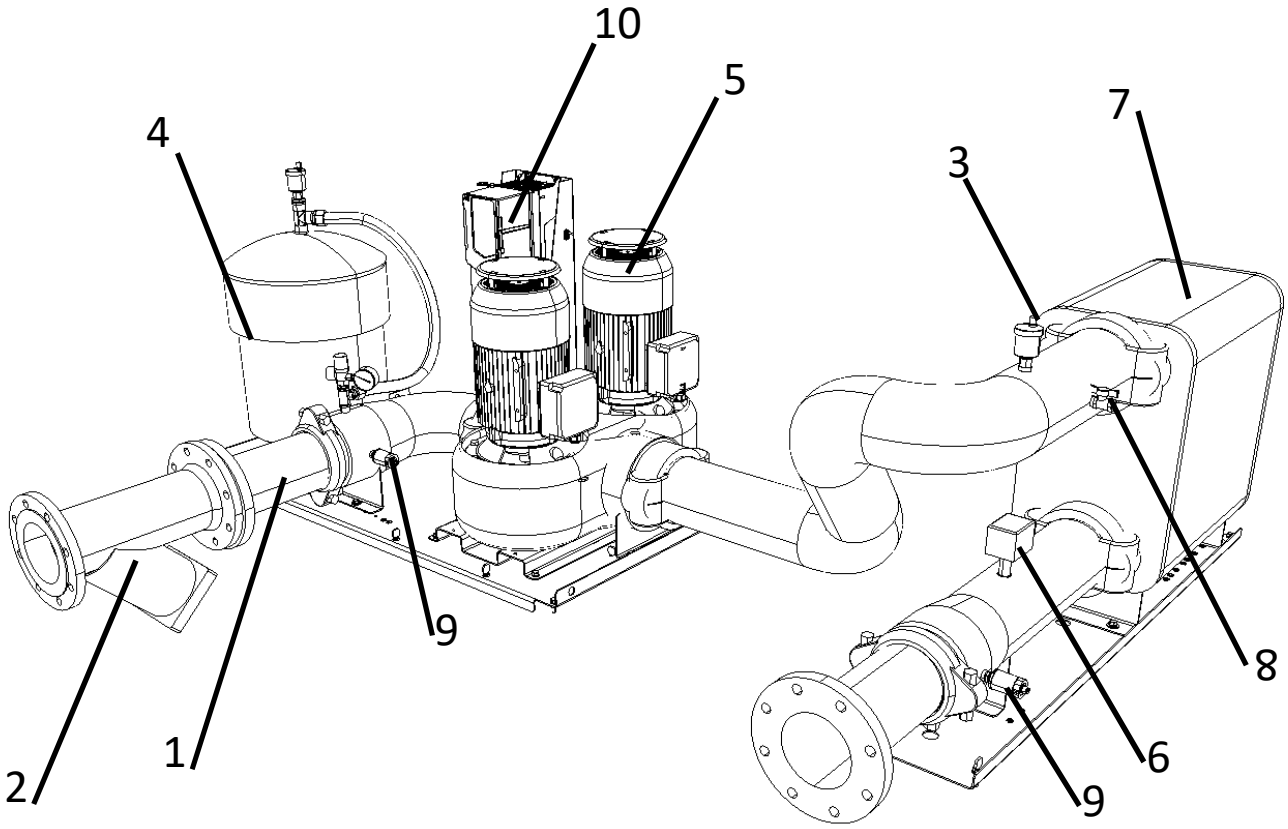




## CLEARANCES

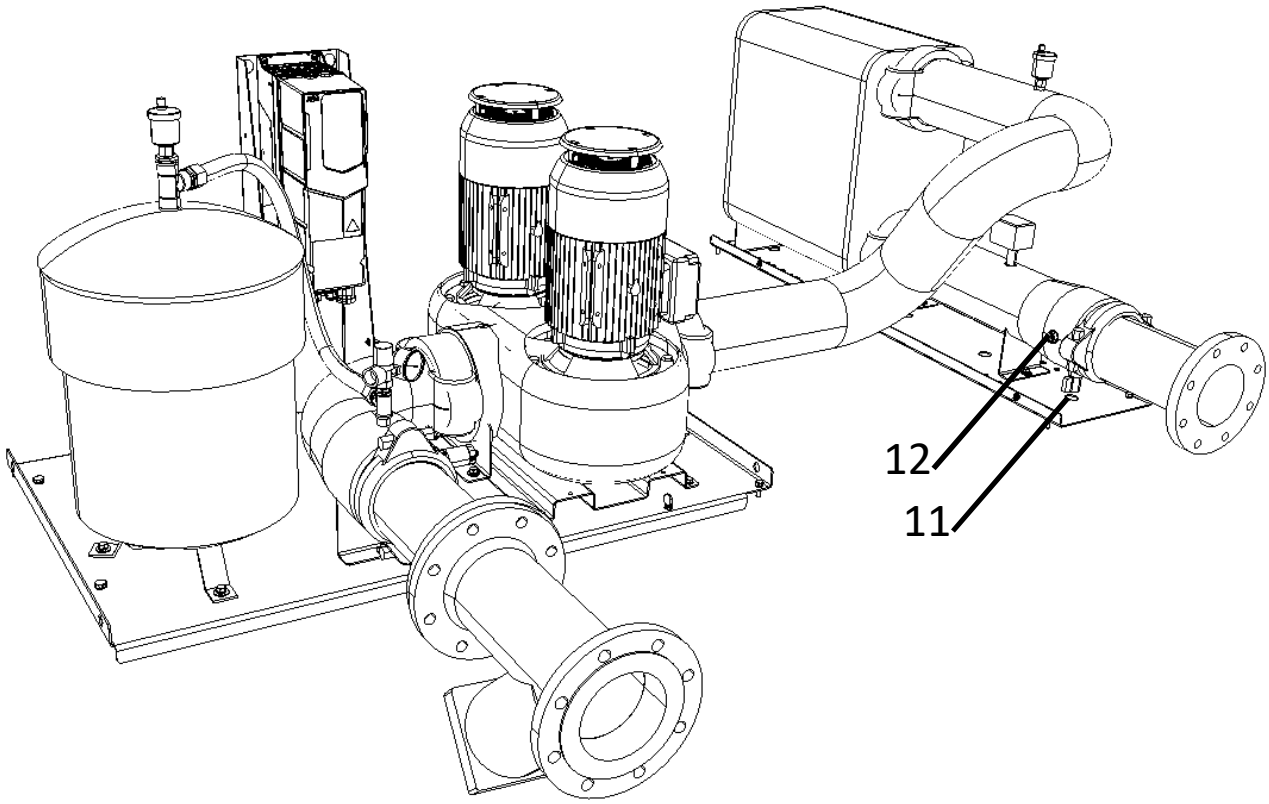
Overhead obstruction are not permitted



## HYDRAULIC DATA




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

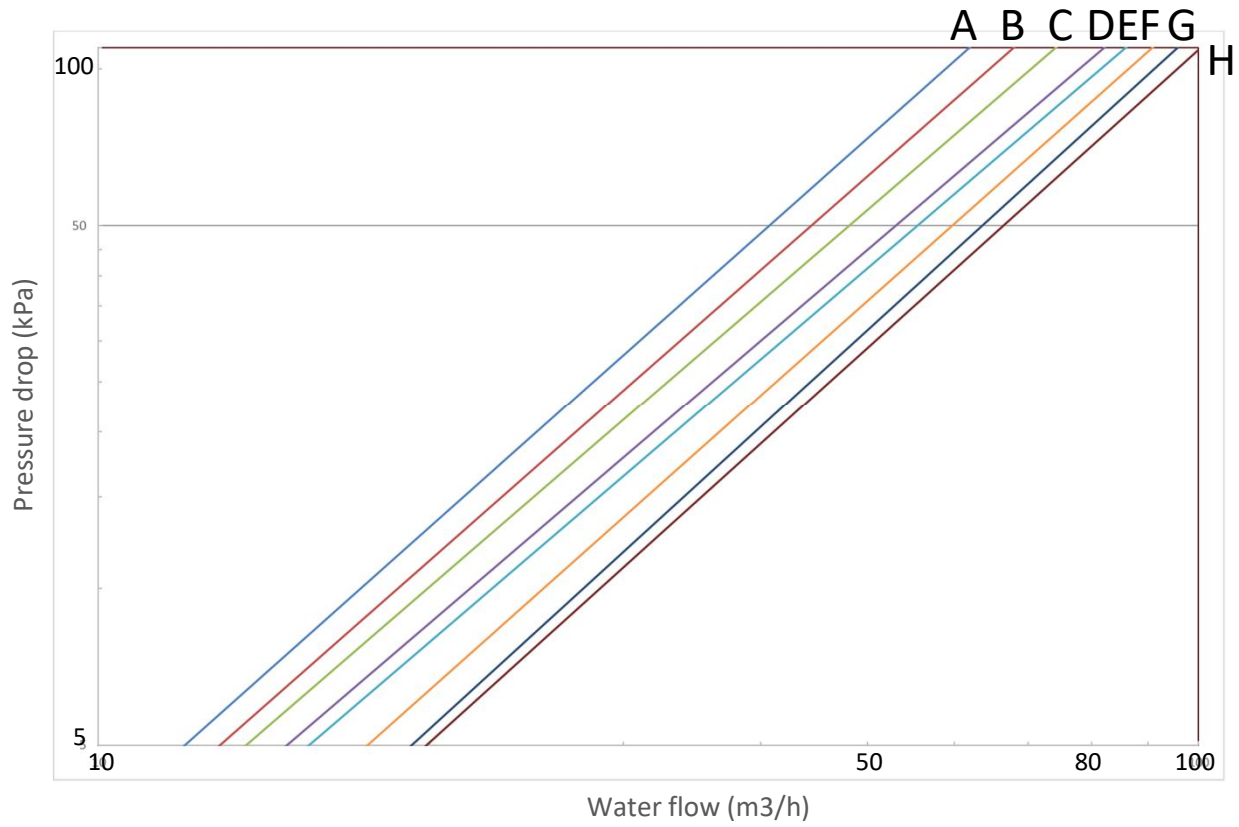


## PRESSURE DROPS

**eComfort**

## EVAPORATOR AND CONDENSER CURVES

| | | Curves |
|---|---|---|
| | | Evaporator |
| GAC/GAH | 170 | A |
| | 200 | B |
| | 230 | C |
| | 270 | D |
| | 300 | E |
| | 330 | F |
| | 370 | G |
| | 400 | H |




| eComfort | $\Delta P = a\,X^b$ | |
|---|---|---|
| | a | b |
| 170 | 0.0466 | 1.8825 |
| 200 | 0.0430 | 1.8603 |
| 230 | 0.0427 | 1.8243 |
| 270 | 0.0380 | 1.8084 |
| 300 | 0.0349 | 1.8097 |
| 330 | 0.0227 | 1.8827 |

| eComfort | $\Delta P = a\,X^b$ | |
|---|---|---|
| | a | b |
| 370 | 0.0167 | 1.9284 |
| 400 | 0.0167 | 1.9074 |

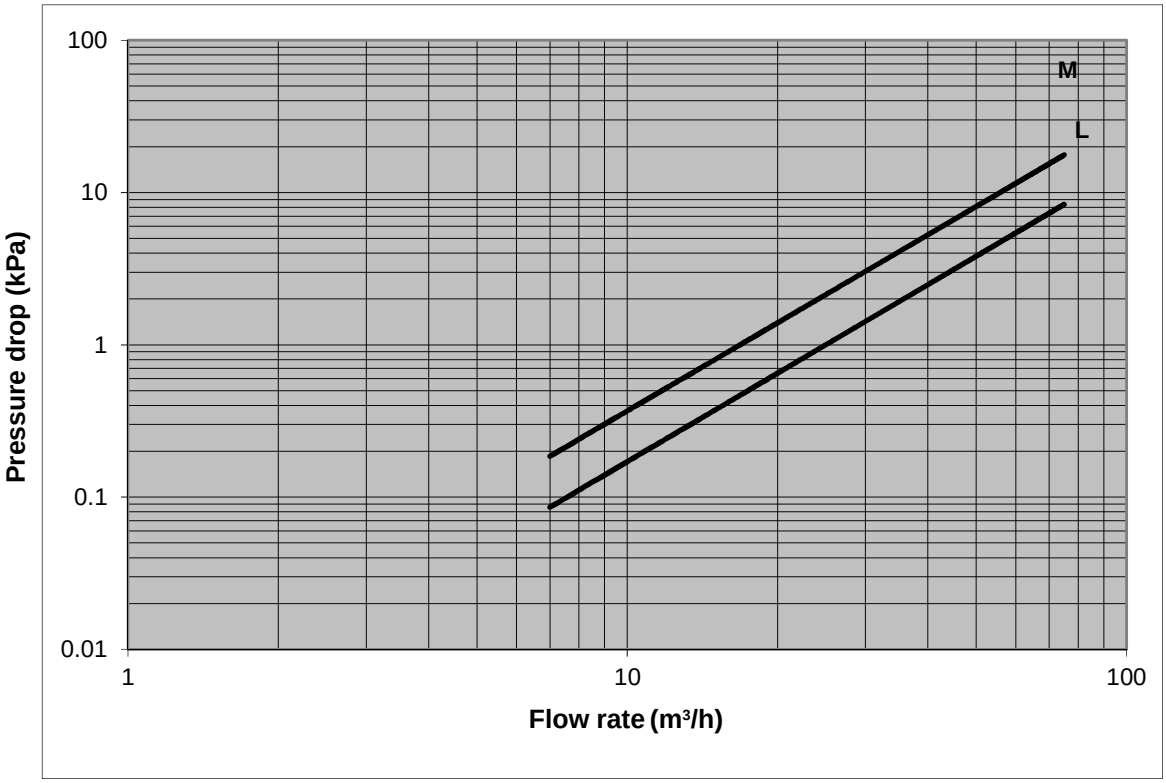
*Pressure drops are given for information only. A tolerance of +/- 20 kPa must be considered when selecting water pumps.*

## PRESSURE DROPS

**eComfort**

## FILTER CURVE

| GAC/GAH | Curve |
|---|---|
| **170** | L |
| **200** | |
| **230** | |
| **270** | |
| **300** | |
| **330** | M |
| **370** | |
| **400** | |




*Size of the filter mesh: 1 mm*

| eComfort | $\Delta P = a X^b$ | |
|---|---|---|
| | a | b |
| **170/200/230/270/300** | 0,0044 | 1,9207 |
| **330/370/400** | 0,002 | 1,9305 |

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

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CE

Due to LENNOX EMEA 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.

**eComfort MC-IOM-1910-E**

LENNOX