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POWERCIAT LX

ST/HE/XE

Instruction manual

CIAT

CONTENTS

CONTENTS

This manual applies to the following two PowerCiat versions:
- LX ST units, standard efficiency
- LX HE units, high seasonal efficiency
- LX XE Premium units

For the operation of the control, please refer to the POWERCIAT Connect'Touch control manual.

PowerCiat™ LX ST/HE/XE units are designed to cool water for the air conditioning of buildings or for industrial processes.

Prior to the initial start-up of LX units, the persons responsible for the on-site installation, start-up, operation, and maintenance of this unit should be thoroughly familiar with these instructions and the technical characteristics for the project, specific to the installation site.

They are designed for an operating life of 15 years by assuming a 57 % utilisation factor; that is approximately 75,000 operating hours.

LX liquid chillers are designed to provide a very high level of safety during installation, start-up, operation and maintenance. They will provide safe and reliable service when operated within their application range.

This manual provides the necessary information to familiarize yourself with the control system before performing start-up procedures. The procedures in this manual are arranged in the sequence required for machine installation, start-up, operation and maintenance.

Always ensure that all required safety measures are followed, including those in this document, such as, wearing protective clothing (gloves, ear defenders, safety glasses and shoes), using appropriate tools, employing qualified and skilled technicians (electricians, refrigeration engineers) and following local regulations.

To find out, if these products comply with European directives (machine safety, low voltage, electromagnetic compatibility, equipment under pressure etc.) check the declarations of conformity for these products.

1.1 - Installation safety considerations

Access to the unit must be reserved to authorised personnel, qualified and trained in monitoring and maintenance. The access limitation device must be installed by the customer (e.g. cut-off, enclosure).

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. Check that the refrigerant circuit(s) is (are) intact, especially that no components or pipes have shifted (e.g. following a shock). If in doubt, carry out a leak tightness check and verify with the manufacturer that the circuit integrity has not been impaired. If damage is detected upon receipt, immediately file a claim with the shipping company.

CIAT strongly recommends employing a specialised company to unload the machine.

Do not remove the skid or the packaging until the unit is in its final position. These units can be moved with a fork lift truck, as long as the forks are positioned in the right place and direction on the unit.

The units can also be lifted with slings, using only the designated lifting points marked on the unit.

These units are not designed to be lifted from above. Use slings with the correct capacity, and always follow the lifting instructions on the certified drawings supplied with the unit.

Safety is only guaranteed, if these instructions are carefully followed. If this is not the case, there is a risk of material deterioration and injuries to personnel.

DO NOT COVER ANY PROTECTION DEVICES.

This applies to fuse plugs and relief valves (if used) in the refrigerant or heat transfer medium circuits. Check if the original protection plugs are still present at the valve outlets. These plugs are generally made of plastic and should not be used. If they are still present, please remove them. Install devices at the valve outlets or drain piping that prevent the penetration of foreign bodies (dust, building debris, etc.) and atmospheric agents (water can form rust or ice). These devices, as well as the drain piping, must not impair operation and not lead to a pressure drop that is higher than 10% of the control pressure.

Classification and control

In accordance with the Pressure Equipment Directive and national usage monitoring regulations in the European Union the protection devices for these machines are classified as follows:

	Safety accessory(1)	Damage limitation accessory in case of an external fire (2)
Refrigerant Side		
High pressure switch	x	
External relief valve(3)		x
Heat transfer fluid side		
External relief valve	(4)	(4)

(1) Classified for protection in normal service situations.
(2) Classified for protection in abnormal service situations. These accessories are sized for fires with a thermal flow of 10kW/m². No combustible matter should be placed within 6.5m of the unit.
(3) The instantaneous overpressure limitation of 10% of the operating pressure does not apply to this abnormal service situation.
The control pressure can be higher than the service pressure. In this case, either the design temperature or the high pressure switch ensures that the service pressure is not exceeded in normal service situations.
(4) The selection of these relief valves must be made by the personnel responsible for completing the hydraulic installation.

Do not remove these valves and fuses, even if the fire risk is under control for a particular installation. There is no guarantee that the accessories are re-installed if the installation is changed or for transport with a gas charge.

When the unit is subjected to fire, safety devices prevent rupture due to over-pressure by releasing the refrigerant. The fluid may then be decomposed into toxic residues when subjected to the flame:

- **Stay away from the unit.**
- **Set up warnings and recommendations for personnel in charge to stop the fire.**
- **Fire extinguishers appropriate to the system and the refrigerant type must be easily accessible**

All factory-installed relief valves are lead-sealed to prevent any calibration change. If the relief valves are installed on a change-over valve, this is equipped with a relief valve on each of the two outlets. Only one of the two relief valves is in operation, the other one is isolated. Never leave the change-over valve in the intermediate position, i.e. with both ways open (Bring the actuator in abutment, front or back according to the outlet to isolate).

If a relief valve is removed for checking or replacement please ensure that there is always an active relief valve on each of the change-over valves installed in the unit.

The external relief valves must always be connected to drain pipes for units installed in a closed room. Refer to the installation regulations, for example those of European standard EN 378 and EN 13136.

These pipes must be installed in a way that ensures that people and property are not exposed to refrigerant leaks. As the fluids can be diffused in the air, ensure that the outlet is far away from any building air intake, or that they are discharged in a quantity that is appropriate for a suitably absorbing environment.

Periodic check of the relief valves: See chapter 1.3 "Maintenance safety considerations".

Provide a drain in the drain pipe, close to each relief valve, to avoid an accumulation of condensate or rain water.

All precautions concerning handling of refrigerant must be observed in accordance with local regulations.

Ensure good ventilation, as accumulation of refrigerant in an enclosed space can displace oxygen and cause asphyxiation or explosions.

Inhalation of high concentrations of vapour is harmful and may cause heart irregularities, unconsciousness, or death. Vapour is heavier than air and reduces the amount of oxygen available for breathing. These products cause eye and skin irritation. Decomposition products are hazardous.

1.2 - Equipment and components under pressure

These products incorporate pressure equipment or components. We recommend that you consult your appropriate national trade association or the owner of the equipment or components under pressure (declaration, re-qualification, retesting, etc.). The characteristics of this equipment/these components are given on the nameplate or in the required documentation, supplied with the products.

These units are intended to be stored and operated in an environment where the ambient temperature must be not less than the lowest allowable temperature indicated on the nameplate.

Do not introduce significant static or dynamic pressure with regard to the operating pressures used during operation or for tests in the refrigerant circuit or in the heat exchange circuits.

See section 11.2 - "Pressure vessels".

1.3 - Maintenance safety considerations

CIAT recommends using the following maintenance logbook template (the table below should not be considered a reference, nor does it invoke the manufacturer's liability):

Intervention		Name of the commissioning engineer	Applicable national regulations	Verification Organism
Date	Nature (1)			

(1) Maintenance, repairs, regular verifications (EN 378), leakage, etc.

Engineers working on the electric or refrigeration components must be authorized, trained and fully qualified to do so.

All refrigerant circuit repairs must be carried out by a trained person, fully qualified to work on these units. He must have been trained and be familiar with the equipment and the installation. All welding operations must be carried out by qualified specialists.

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.

NOTE: The unit must never be left shut down with the liquid line valve closed, as liquid refrigerant can be trapped between this valve and the expansion device and lead to the risk of a pressure increase. This valve is situated on the liquid line before the filter drier box.

During any handling, maintenance and service operations the engineers working on the unit must be equipped with safety gloves, glasses, shoes and protective clothing.

Never work on a unit that is still energized.

Never work on any of the electrical components, until the general power supply to the unit has been cut using the disconnect switch(es) in the control box(es).

If any maintenance operations are carried out on the unit, lock the power supply circuit in the open position ahead of the machine.

If the work is interrupted, always ensure that all circuits are still deenergised before resuming the work.

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. Attach appropriate safety labels.

Units with the Power Factor Correction option are equipped with capacitor batteries with a discharge time of five (5) minutes after disconnecting the power. After disconnecting the power to the control box, wait five minutes before opening the control box. Before any intervention, verify that there is no voltage present at any accessible conducting parts of the power circuit.

OPERATING CHECKS:

Important information regarding the refrigerant used:

This product contains fluorinated greenhouse gas covered by the Kyoto protocol.

Fluid type: R134a

Global Warming Potential (GWP): 1430

1. **Any intervention on the refrigerant circuit of this product should be performed in accordance with the applicable legislation. In the EU, the regulation is called F-Gas, N°517/2014**
2. **Ensure that the refrigerant is never released to the atmosphere during installation, maintenance or equipment disposal.**
3. **The deliberate gas release into the atmosphere is not allowed.**
4. **If a refrigerant leak is detected, ensure that it is stopped and repaired as quickly as possible.**
5. **Only qualified and certified personnel can perform installation and maintenance work, run the refrigerant circuit leak tests, prepare the equipment for disposal, and recover the refrigerant.**
6. **The gas recovery for recycling, regeneration or destruction is at customer charge.**
7. **Periodic leak tests have to be carried out by the customer or by third parties. The EU regulation set the periodicity here after:**

System WITHOUT leakage detection		No Check	12 Months	6 Months	3 Months
System WITH leakage detection		No Check	24 Months	12 Months	6 Months
Refrigerant charge/circuit (CO_2 equivalent)		< 5 Tons	5 ≤ Charge < 50 Tons	50 ≤ Charge < 500 Tons	Charge > 500 Tons*
Refrigerant charge/ Circuit (kg)	**R134A (GWP 1430)**	Charge < 3.5 kg	3.5 ≤ Charge < 34.9 kg	34.9 ≤ Charge < 349.7 kg	Charge > 349.7 kg
	R407C (GWP 1774)	Charge < 2.8 kg	2.8 ≤ Charge < 28.2 kg	28.2 ≤ Charge < 281.9 kg	Charge > 281.9 kg
	R410A (GWP 2088)	Charge < 2.4 kg	2.4 ≤ Charge < 23.9 kg	23.9 ≤ Charge < 239.5 kg	Charge > 239.5 kg
	HFO's: R1234ze	No requirement			

* From 01/01/2017, units must be equipped with a leak detection system.

8. **A logbook must be maintained for equipment subject to periodic leak tests. It should contain the quantity and the type of fluid present in the installation (added and recovered), the quantity of recycled fluid, the date and result of the leak test, the name of the operator and the name of his/her company, etc.**
9. **Contact your local dealer or installer if you have any questions.**

The information on operating inspections given in annex C of standard EN 378 can be used if no similar criteria exist in the national regulations.

While working in the fan area, especially when grilles or casings are removed, disconnect the fan power supply to prevent their automatic restart.

PROTECTION DEVICE CHECKS:

If no national regulations exist, check the protection devices on site in accordance with standard EN 378: Once a year for the high-pressure switches, every five years for external relief valves.

The company or organisation that conducts a pressure switch test must establish and implement detailed procedures for:

- Safety measures
- Measuring equipment calibration
- Validating operation of protective devices
- Test protocols
- Recommissioning of the equipment.

Consult CIAT Service for this type of test. In this document, CIAT only outlines the principle for a test without removal of the pressure switches:

- Check and record the nominal values for triggering the pressure switches and external relief devices (valves, if present).
- Be ready to switch-off the main disconnect switch of the power supply if the pressure switch does not trigger (avoid over-pressure or excess gas in case of valves on the high-pressure side with the recovery condensers)
- Connect a pressure gauge protected against pulsations (filled with oil with maximum pointer if mechanical), preferably calibrated (the values displayed on the user interface may be inaccurate in an instant reading because of the scanning delay applied in the control)
- Complete an HP Test as provided by the software (refer to the Control IOM for details).

If the machine operates in a corrosive environment, inspect the protection devices more frequently.

Regularly carry out leak tests and immediately repair any leaks. Ensure regularly that the vibration levels remain acceptable and close to those at the initial unit start-up.

Before opening a refrigerant circuit, purge and consult the pressure gauges.

Change the refrigerant after an equipment failure, following a procedure such as the one described in NF E29-795 or carry out a refrigerant analysis in a specialist laboratory.

If the refrigerant circuit is opened for a day or less, block all openings; fill the circuit with a nitrogen charge if open for longer periods.

1.4 - Repair safety considerations

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. After each repair of the unit, check the operation of the protection devices and create a report of the parameter operation at 100%.

Comply with the regulations and recommendations in unit and HVAC installation safety standards, such as: EN 378, ISO 5149, etc.

If a leak occurs or if the refrigerant becomes contaminated (e.g. by a short circuit in a motor) remove the complete charge using a recovery unit and store the refrigerant in mobile containers.

Repair the leak detected and recharge the circuit with the total R-134a charge, as indicated on the unit name plate. Certain parts of the circuit can be isolated. Only charge liquid refrigerant R-134a at the liquid line.

Ensure that you are using the correct refrigerant type before recharging the unit. Charging any refrigerant other than the original charge type (R-134a) will impair machine operation and even destroy the compressors. The compressors operating with this refrigerant type are lubricated with a synthetic polyolester oil.

RISK OF EXPLOSION: 

Never use air or a gas containing oxygen during leak tests to purge lines or to pressurise a machine. Pressurised air mixtures or gases containing oxygen can be the cause of an explosion.

Only use dry nitrogen for leak tests, possibly with an appropriate tracer gas.

If the recommendations above are not observed, this can have serious or even fatal consequences and damage the installation.

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 unweld or flamecut the refrigerant lines or any refrigerant circuit component until all refrigerant (liquid and vapour) as well as the oil have been removed from chiller. Traces of vapour should be displaced with dry air nitrogen. Refrigerant in contact with an open flame produces toxic gases.

The necessary protection equipment must be available, and appropriate fire extinguishers for the system and the refrigerant type used must be within easy reach.

Do not siphon refrigerant.

Avoid spilling liquid refrigerant on skin or splashing it into the eyes. Use safety goggles and safety gloves. 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.

The accidental releases of the refrigerant, due to small leaks or significant discharges following the rupture of a pipe or an unexpected release from a safety valve, can cause frostbites and burns to personnel exposed. Do not ignore such injuries. Installers, owners and especially service engineers for these units must:

- **Seek medical attention before treating such injuries.**
- **Have access to a first-aid kit, especially for treating eye injuries.**

We recommend to apply standard EN 378-3 Annex 3.

Never apply an open flame or live steam to a refrigerant container. Dangerous overpressure can result. If it is necessary to heat refrigerant, use only warm water.

During refrigerant removal and storage operations follow applicable regulations. These regulations, permitting conditioning and recovery of halogenated hydrocarbons under optimum quality conditions for the products and optimum safety conditions for people, property and the environment are described in standard NF E29-795.

Any refrigerant transfer and recovery operations must be carried out using a transfer unit. A 3/8" SAE connector on the manual liquid line valve is supplied with all units for connection to the transfer station. The units must never be modified to add refrigerant and oil charging, removal and purging devices. All these devices are provided with the units. Please refer to the certified dimensional drawings for the units.

Do not re-use disposable (non-returnable) cylinders or attempt to refill them. It is dangerous and illegal. When cylinders are empty, evacuate the remaining gas pressure, and move the cylinders to a place designated for their recovery. Do not incinerate them.

Only use R134a refrigerant, in accordance with AHRI Standard 700 (published by the US Air conditioning, Heating and Refrigeration Institute). The use of any other refrigerant may expose users and operators to unexpected risks.

Do not attempt to remove refrigerant circuit components or fittings, while the machine is under pressure or while it is running. Be sure pressure is at 0 kPa and that the unit has been shut-down and de-energised before removing components or opening a circuit.

Do not attempt to repair or recondition any safety devices when corrosion or build-up of foreign material (rust, dirt, scale, etc.) is found within the valve body or mechanism. If necessary, replace the device. Do not install relief valves in series or backwards.

No part of the unit must be used as a walkway, rack or support. Periodically check and repair or if necessary replace any component or piping that shows signs of damage.

The refrigerant lines can break under the weight and release refrigerant, causing personal injury.

Do not climb on a machine. Use a platform, or staging to work at higher levels.

Use mechanical lifting equipment (crane, hoist, winch, etc.) to lift or move heavy components. For lighter components, use lifting equipment when there is a risk of slipping or losing your balance.

Use only original replacement parts for any repair or component replacement. Consult the list of replacement parts that corresponds to the specification of the original equipment.

Do not drain water circuits containing industrial brines, without informing the technical service department at the installation site or a competent body first.

Close the entering and leaving water shutoff valves and purge the unit water circuit, before working on the components installed on the circuit (screen filter, pump, water flow switch, etc.).

Do not loosen the water box bolts until the water boxes have been completely drained.

Periodically inspect all valves, fittings and pipes of the refrigerant and hydraulic circuits to ensure that they do not show any corrosion or any signs of leaks.

It is recommended to wear ear defenders, when working near the unit and the unit is in operation.

2.1 - Checking the equipment received

- Check that the unit has not been damaged during transport and that no parts are missing. If the unit has been damaged or the shipment is incomplete, send a claim to the shipping company.
- Compare the name plate data with the order. The name plate is attached in two places to the unit:
  - On one of the unit sides on the outside,
  - On the control box door on the inside.
- The unit name plate must include the following information:
  - Version number
  - Model number
  - CE marking
  - Serial number
  - Year of manufacture and test date
  - Fluid being transported
  - Refrigerant used and refrigerant class
  - Refrigerant charge per circuit
  - Containment fluid to be used
  - **PS:** Min./max. allowable pressure (high and low pressure side)
  - **TS:** Min./max. allowable temperature (high and low pressure side)
  - Pressure switch cut-out pressure
  - Unit leak test pressure
  - Voltage, frequency, number of phases
  - Maximum current drawn
  - Maximum power input
  - Unit net weight
- Confirm that all accessories ordered for on-site installation have been supplied, are complete and undamaged.

The unit must be checked periodically during its whole operating life to ensure that no shocks (handling accessories, tools etc.) have damaged it. If necessary, damaged parts must be repaired or replaced. See also chapter 13 "Standard maintenance".

2.2 - Handling and positioning the unit

2.2.1 - Handling

See chapter 1.1 "Installation safety considerations".

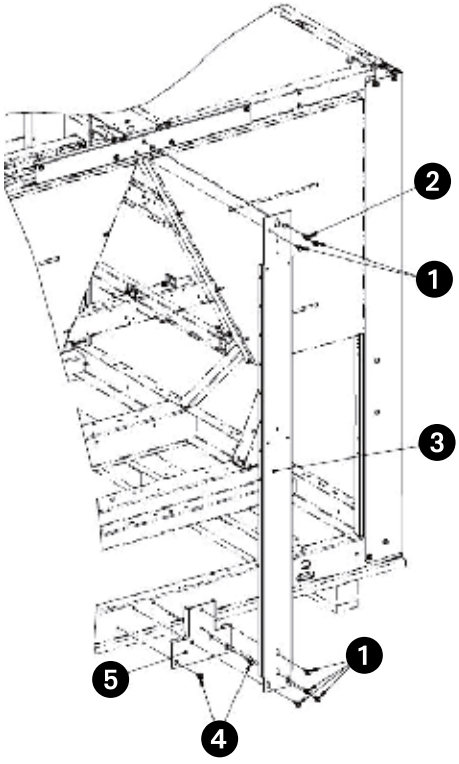
In some cases vertical supports are added for the transport and handling of the unit. These supports can be removed for access or connection, if required.

IMPORTANT: Follow the disassembly sequence shown in the disassembly instructions.

NOTE:

- **Unbolt item: 1**
- **Loosen screw item: 2**
- **Raise and remove frame post item: 3**
- **Screw off item: 4 and remove reinforcement plate item: 5**

Keep the vertical supports after commissioning the units and re-insert them when the unit is moved.



2.2.2 - Positioning the unit

The machine must be installed in a place that is not accessible to the public or protected against access by non-authorised persons.

In case of extra-high units the machine environment must permit easy access for maintenance operations.

Always refer to the chapter 3 “Dimensions, clearances” to confirm that there is adequate space for all connections and service operations. For the centre of gravity coordinates, the position of the unit mounting holes, and the weight distribution points, refer to the certified dimensional drawing supplied with the unit.

The support points under the chassis must have at least the size of the chassis opening at the lifting point (minimum 220 x 180 mm) in order to prevent a deformation of the chassis.

These units are typically used in refrigeration systems, and therefore do not need to be able to withstand earthquakes or high winds. Earthquake resistance has not been verified.

Only use slings at the designated lifting points which are marked on the unit.

Before siting the unit check that:

- The permitted loading at the site is adequate or that appropriate strengthening measures have been taken.
- The unit is installed level on an even surface (maximum tolerance is 5 mm in both axes).
- There is adequate space above the unit for air flow and to ensure access to the components.
- The number of support points is adequate and that they are in the right places.
- The location is not subject to flooding.
- For outdoor installations, where heavy snowfall is likely and long periods of sub-zero temperatures are normal, provision has to be made to prevent snow accumulating by raising the unit above the height of drifts normally experienced.
- Baffles may be necessary to deflect strong winds. They must not restrict air flow into the unit.

Before lifting the unit, check that all casing panels are securely fixed in place. Lift and set down the unit with great care. Tilting and jarring can damage the unit and impair unit operation.

If units are hoisted with rigging, it is advisable to protect the coils against accidental impacts. Use struts or spreader bar to spread the slings above the unit. Do not tilt a unit more than 15°.

WARNING: Never push or lever on any of the enclosure panels of the unit. Only the base of the unit frame is designed to withstand such stresses.

If a unit contains a hydraulic module, the hydraulic module and pump piping must be installed in a way that does not submit it to any strain. The hydraulic module pipes must be fitted so that the pump does not support the weight of the pipes.

2.2.3 - Checks before system start-up

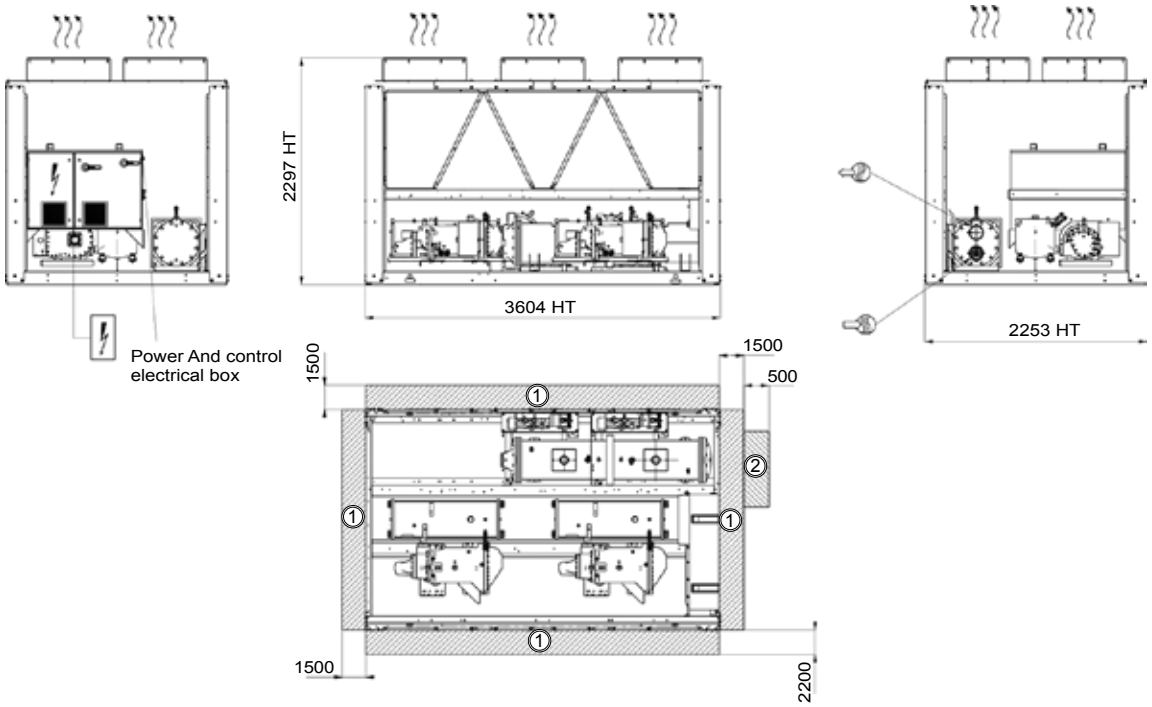
Before the start-up of the refrigeration system, the complete installation, including the refrigeration system must be verified against the installation drawings, dimensional drawings, system piping and instrumentation diagrams and the wiring diagrams.

For these checks national regulations must be followed. If the national regulation does not specify any details, refer to standard EN 378 as follows:

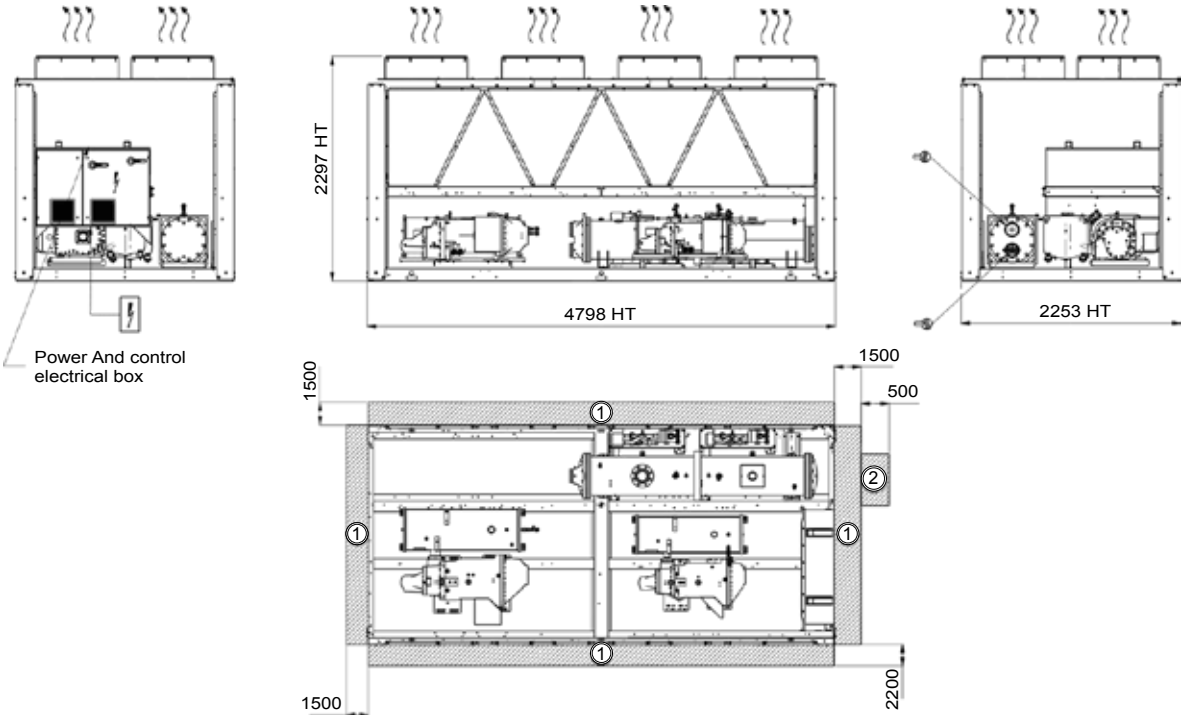
External visual installation checks:

- Ensure that the machine is charged with refrigerant. Verify on the unit nameplate that the ‘fluid transported’ is R134A and is not nitrogen.
- Compare the complete installation with the refrigeration system and power circuit diagrams.
- Check that all components comply with the design specifications.
- Check that all protection documents and equipment provided by the manufacturer (dimensional drawings, P&ID, declarations etc.) to comply with the regulations are present.
- Verify that the environmental safety and protection and devices and arrangements provided by the manufacturer to comply with the regulations are in place.
- Verify that all documents for pressure containers, certificates, name plates, files, instruction manuals provided by the manufacturer to comply with the regulations are present.
- Verify the free passage of access and safety routes.
- Check that ventilation in the plant room is adequate.
- Check that refrigerant detectors are present.
- Verify the instructions and directives to prevent the deliberate removal of refrigerant gases that are harmful to the environment.
- Verify the installation of connections.
- Verify the supports and fixing elements (materials, routing and connection).
- Verify the quality of welds and other joints.
- Check the protection against mechanical damage.
- Check the protection against heat.
- Check the protection of moving parts.
- Verify the accessibility for maintenance or repair and to check the piping.
- Verify the status of the valves.
- Verify the quality of the thermal insulation and of the vapour barriers.

3.1 - LX 0808 to 1008



3.2 - LX 1108 to 1358



Key

All dimensions are given in mm.

① Required clearances for maintenance (see note)

② Recommended space for evaporator tube removal

Water inlet for standard unit
For the Brine and evaporator options with one pass less or one pass more, refer to the certified dimensional drawing.

Water outlet for standard unit
For the Brine and evaporator options with one pass less or one pass more, refer to the certified dimensional drawing.

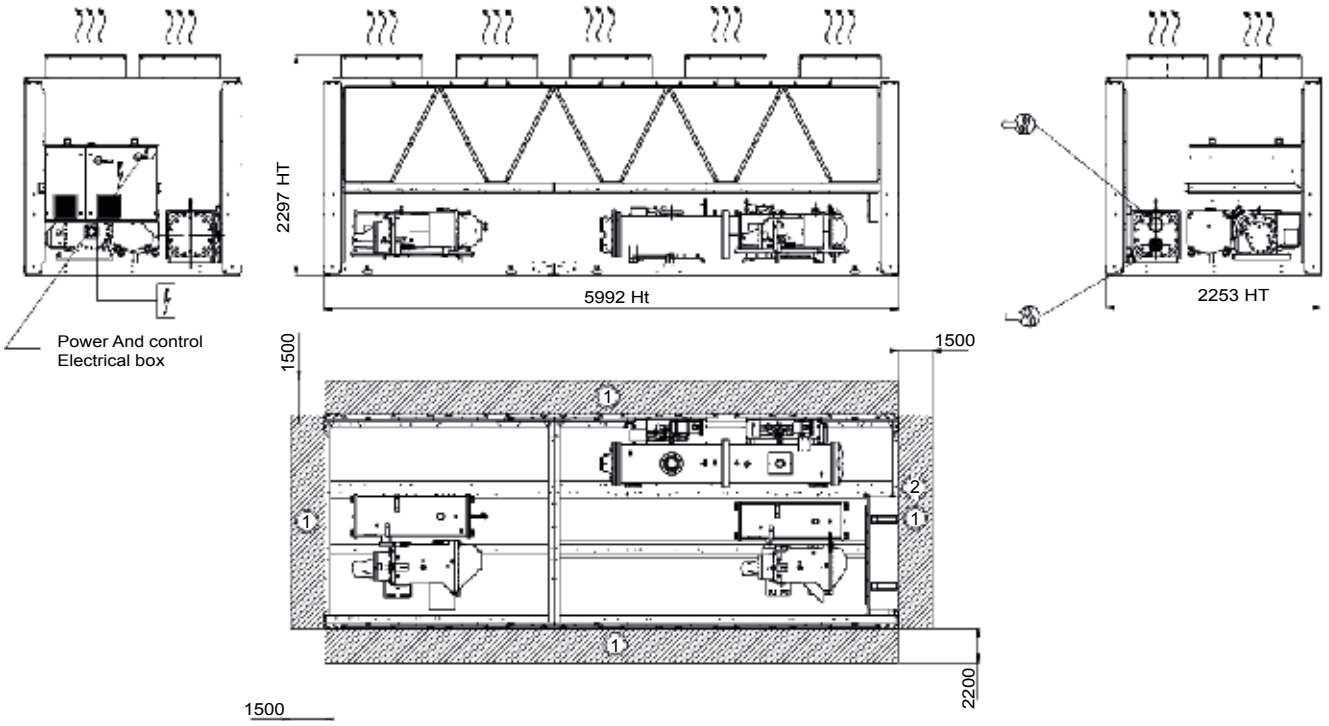
Air outlet – do not obstruct

Power supply and control connection

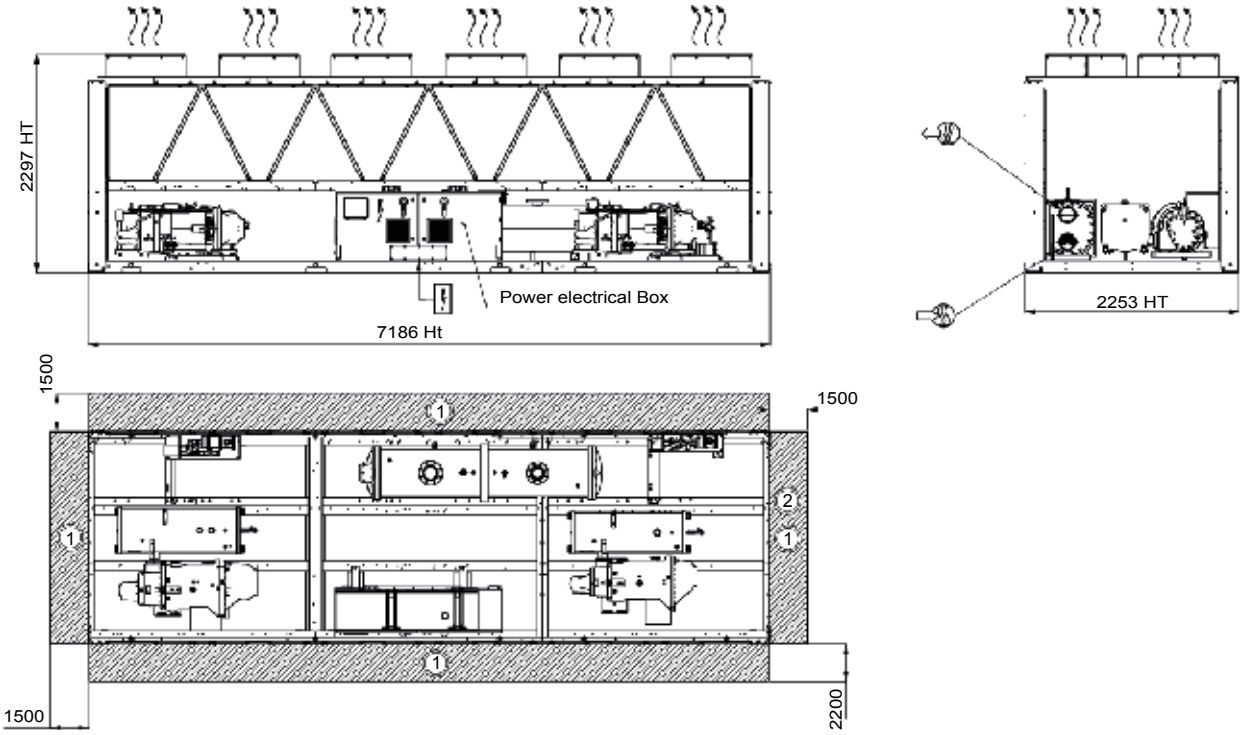
NOTES:

- **Drawings are not contractually binding.**
- **Before designing an installation, consult the certified dimensional drawings, available on request.**
- **For the positioning of the fixing points, weight distribution and centre of gravity coordinates please refer to the dimensional drawings.**
- **If the installation includes several units or if this (these) is (are) close to walls, please refer to chapters 3.12 "Multiple chiller installation" and 3.13 "Distance to the wall" of this document to determine the space required.**

3.3 - LX 1528



3.4 - LX1858 to 2308



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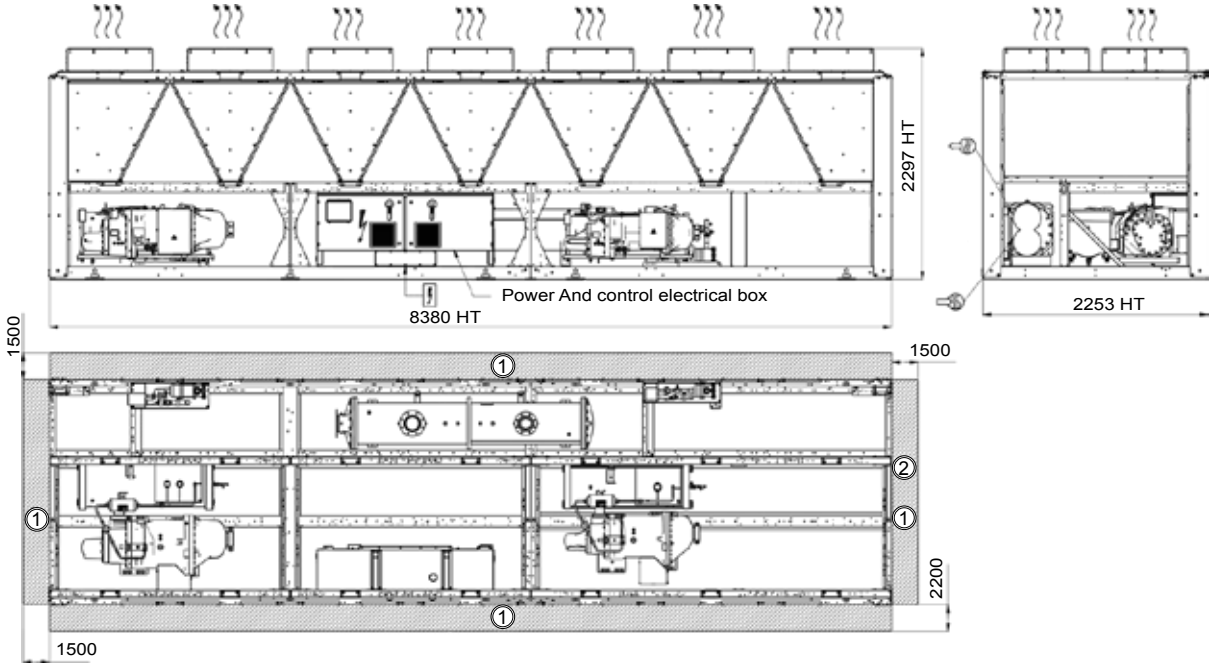
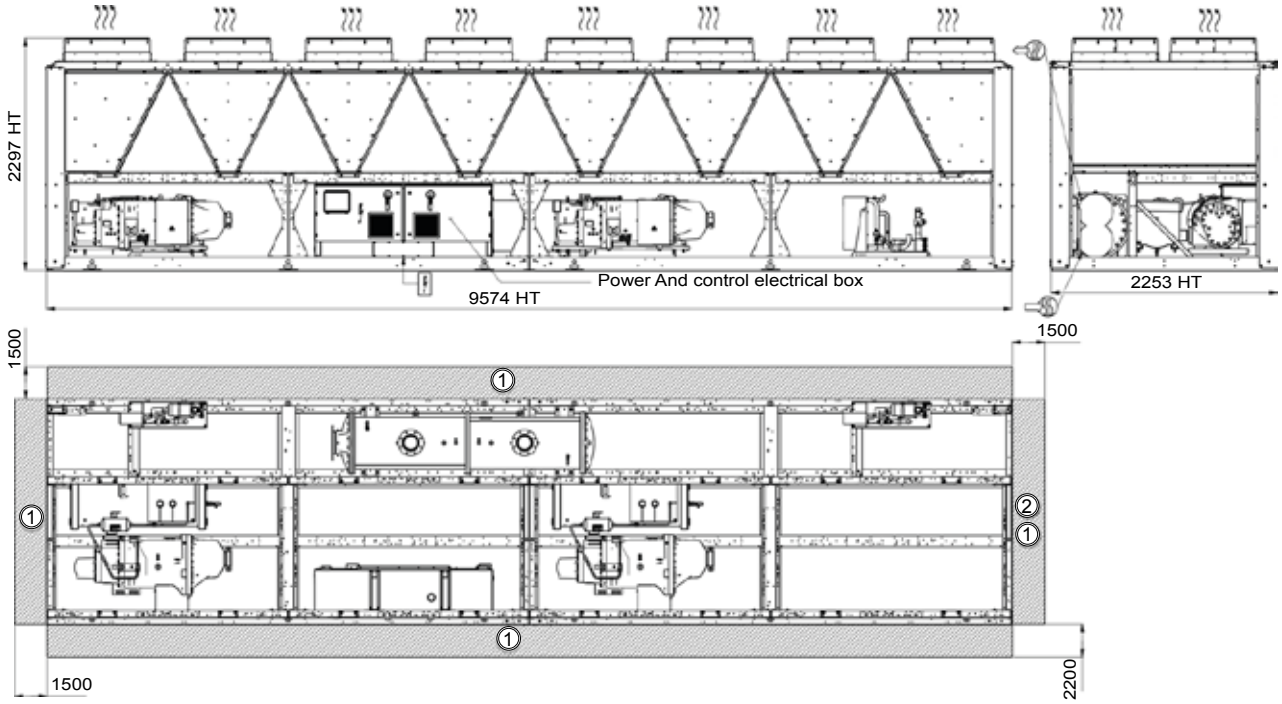
3.5 - LX2528 to 2628



3.6 - LX 3028



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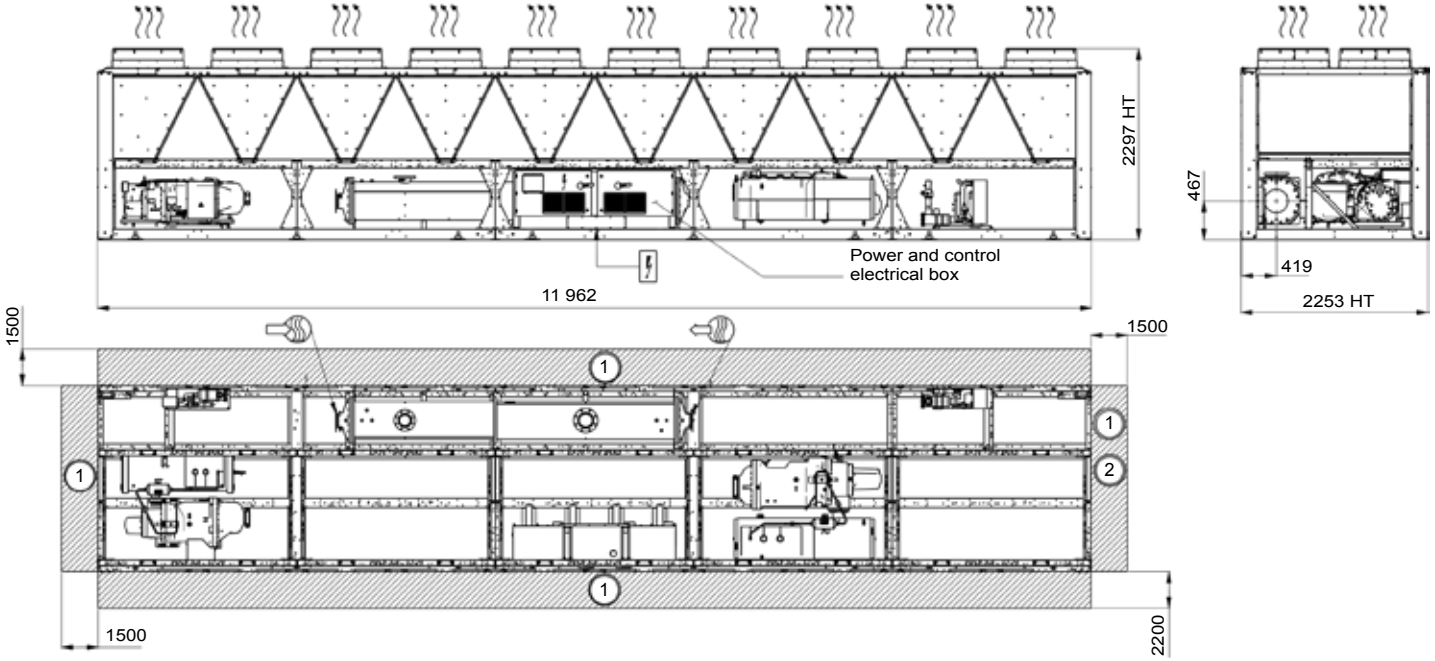
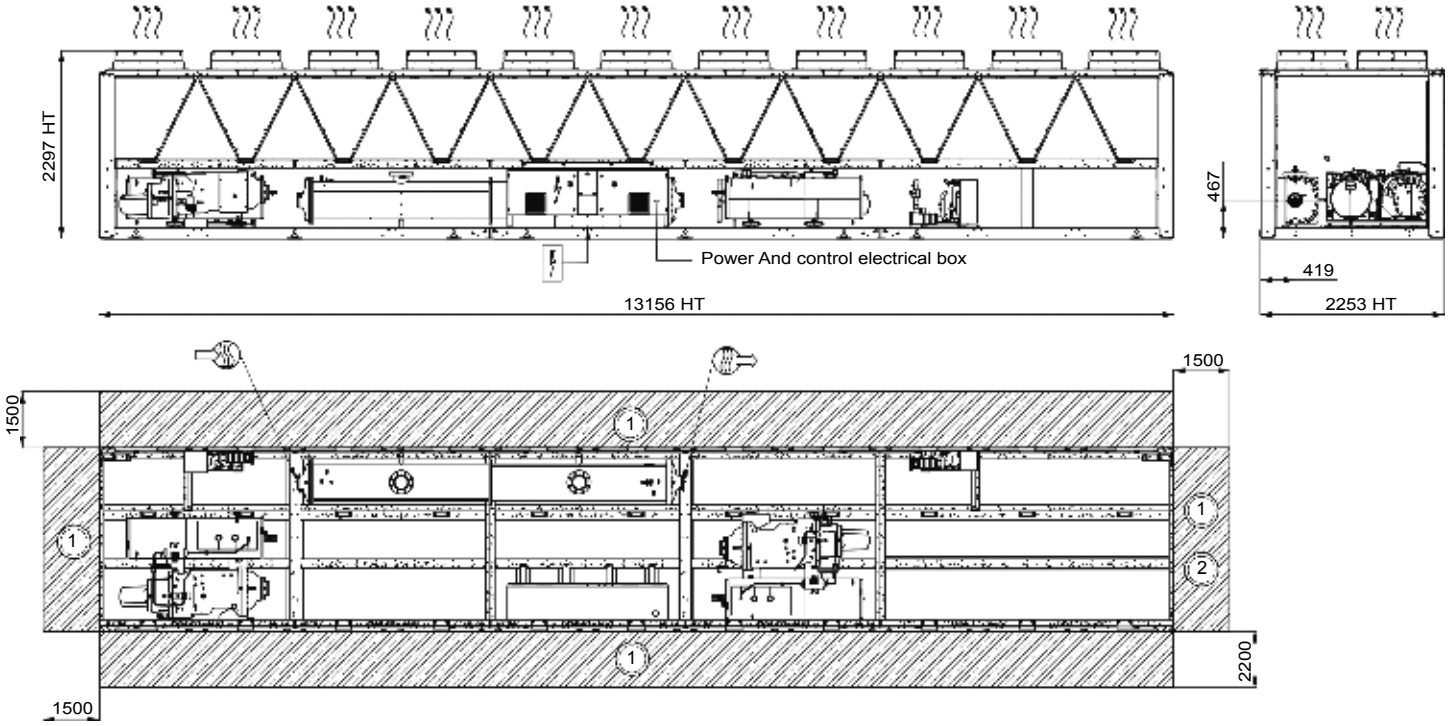
3.7 - LX 3428 to 4408



3.8 - LX 4608



Key

All dimensions are given in mm.

① Required clearances for maintenance (see note)

② Recommended space for evaporator tube removal

Water inlet for standard unit
For the Brine and evaporator options with one pass less or one pass more, refer to the certified dimensional drawing.

Water outlet for standard unit
For the Brine and evaporator options with one pass less or one pass more, refer to the certified dimensional drawing.

Air outlet – do not obstruct

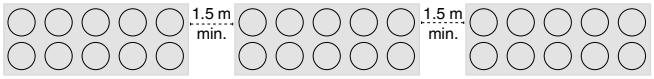
Power supply and control connection

NOTES:

- **Drawings are not contractually binding.**
- **Before designing an installation, consult the certified dimensional drawings, available on request.**
- **For the positioning of the fixing points, weight distribution and centre of gravity coordinates please refer to the dimensional drawings.**
- **If the installation includes several units or if this (these) is (are) close to walls, please refer to chapters 3.12 "Multiple chiller installation" and 3.13 "Distance to the wall" of this document to determine the space required.**

3.9 - Installation of multiple chillers

It is recommended to install multiple chillers in a single row, arranged as shown in the example below, to avoid recycling of warm air from one unit to another.



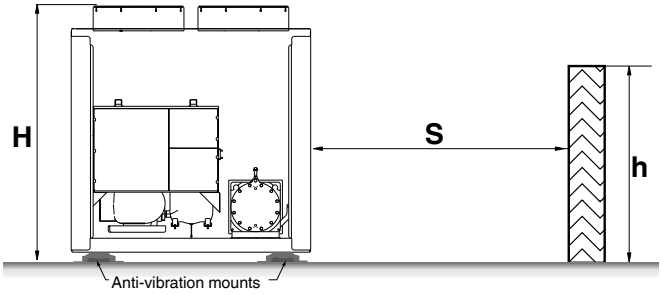
If the situation at the site does not permit this arrangement, contact your distributor to evaluate the various possible arrangements. In certain situations an accessory (supplied loose at the time of purchase) can be added.

3.10 - Distance from the wall

To ensure correct operation for most cases:

If h < H (2.3 m), minimum S = 3 m

If h > H or S < 3 m, contact your CIAT distributor to evaluate the various possible arrangements. In certain situations an accessory (supplied loose at the time of purchase) can be added.



4 - PHYSICAL PROPERTIES AND ELECTRICAL DATA FOR LX UNITS

4.1 - Physical properties of LX units

LX 0808 to 2158 units

LX ST-HE		0808	0908	1008	1108	1358	1528	1858	2008	2158
Sound levels										
LX ST HE										
Sound power(1)	dB(A)	100	100	100	100	102	100	102	100	103
Sound pressure at 10 m(2)	dB(A)	68	68	68	68	70	68	69	68	71
LX ST HE + low noise option										
Sound power(1)	dB(A)	94	94	95	96	96	96	98	96	98
Sound pressure at 10 m(2)	dB(A)	62	62	63	64	64	64	66	63	65
LX ST HE + Xtra low noise option										
Sound power(1)	dB(A)	87	87	87	90	91	91	93	92	93
Sound pressure at 10 m(2)	dB(A)	55	55	55	58	59	59	60	59	60
LX ST HE + Super low noise option										
Sound power(1)	dB(A)	-	-	-	-	89	89	91	90	91
Sound pressure at 10 m(2)	dB(A)	-	-	-	-	57	56	58	57	59
Dimensions										
LX ST HE										
Length	mm	3604	3604	3604	4798	4798	5992	7186	7186	7186
Width	mm	2253	2253	2253	2253	2253	2253	2253	2253	2253
Height	mm	2297	2297	2297	2297	2297	2297	2297	2297	2297
Operating weight(3)										
LX ST standard	kg	3190	3224	3245	3834	3899	4261	4962	5093	5376
LX ST Unit + low noise option	kg	3458	3492	3513	4133	4198	4560	5293	5424	5707
LX HE standard	kg	3240	3274	3295	3934	3999	4411	5112	5293	5526
LX HE Unit + low noise option	kg	3508	3542	3563	4233	4298	4710	5443	5624	5857
Compressors		06T semi-hermetic screw, 50 r/s								
Circuit A		1	1	1	1	1	1	1	1	1
Circuit B		1	1	1	1	1	1	1	1	1
Refrigerant(3)		R134a								
Circuit A	kg	37	35	35	51	52	54	58	58	65
	tCO_2e	52,9	50,1	50,1	72,2	74,4	76,5	82,9	82,9	93,0
Circuit B	kg	38,5	36	37	36,5	37	32,5	59	62	58
	tCO_2e	55,1	51,5	52,9	52,2	52,9	46,5	84,4	88,7	82,9
Oil										
Circuit A	l	20,8	20,8	20,8	23,5	23,5	23,5	23,5	23,5	27,6
Circuit B	l	20,8	20,8	20,8	20,8	20,8	20,8	23,5	23,5	23,5
Capacity control		Connect Touch, electronic expansion valve (EXV)								
Minimum capacity	%	15	15	15	15	15	15	15	15	15
Air-cooled exchanger		Aluminium micro-channel coils (MCHE)								
Fans										
LX ST/HE		Axial type, with rotating impeller								
Quantity		6	6	6	8	8	9	11	12	12
Maximum total air flow	l/s	27082,98	27082,98	27082,98	36110,64	36110,64	40624,47	49652,13	54165,96	54165,96
Maximum rotation speed	r/s	15,7	15,7	15,7	15,7	15,7	15,7	15,7	15,7	15,7
LX ST/HE Unit + Xtra low noise option										
Maximum total air flow	l/s	20500	20500	20500	27333	27333	30750	37583	41000	41000
Maximum rotation speed	r/s	11,7	11,7	11,7	11,7	11,7	11,7	11,7	11,7	11,7
Exchanger		Flooded multi-pipe type								
Water volume	l	58	61	61	66	70	77	79	94	98
Max. water-side operating pressure without hydraulic module	kPa	1000	1000	1000	1000	1000	1000	1000	1000	1000
Hydraulic module (option)		Pump, Victaulic screen filter, relief valve, water and air vent valve, pressure sensors								
Pump		Centrifugal pump, monocell, 48.3 r/s, low- or high-pressure (as required), single or dual (as required)								
Expansion vessel volume	l	50	50	50	50	50	80			
Max. water-side operating pressure with hydraulic module	kPa	400	400	400	400	400	400			
Water connections with or without hydraulic module		Victaulic® type								
Connections	inch	5 or 4	5 or 4	5 or 4	5 or 4	5 or 4	5 or 4	5	6	6
External diameter(4)	mm	114.3 or 141.3	114.3 or 141.3	114.3 or 141.3	114.3 or 141.3	114.3 or 141.3	114.3 or 141.3	141,3	168,3	168,3
Casing paintwork		Colour code RAL 7035 & RAL 7024								

(1) In dB ref=10^{-12} W, 'A' weighted. Declared dual-number noise emission values in accordance with ISO 4871 with an associated uncertainty of +/-3dB(A). Measured in accordance with ISO 9614-1 and certified by Eurovent.

(2) In dB ref 20µPa, 'A' weighted. Declared dual-number noise emission values in accordance with ISO 4871 with an associated uncertainty of +/-3dB(A). For information, calculated from the sound power Lw(A).

(3) Values are guidelines only. Refer to the unit name plate.

(4) Depends on the number of passes on the evaporator

4 - PHYSICAL PROPERTIES AND ELECTRICAL DATA FOR LX UNITS

4.1 - Physical properties of LX units

LX 2308 to 4608 units

LX ST-HE		2308	2528	2628	3028	3428	3828	4008	4408	4608
Sound levels										
LX ST-HE										
Sound power(1)	dB(A)	103	101	104	103	104	103	105	105	105
Sound pressure at 10 m(2)	dB(A)	70	70	71	70	71	70	72	72	72
LX ST-HE + low noise option										
Sound power(1)	dB(A)	98	98	99	98	98	98	101	99	99
Sound pressure at 10 m(2)	dB(A)	65	66	66	65	65	65	68	65	65
LX ST-HE + Xtra low noise option										
Sound power(1)	dB(A)	94	93	95	94	94	94	99	95	96
Sound pressure at 10 m(2)	dB(A)	61	60	62	61	61	61	66	62	63
LX ST-HE + Super low noise option										
Sound power(1)	dB(A)	92	91	93	92	93	93	97	94	95
Sound pressure at 10 m(2)	dB(A)	59	58	60	59	60	60	64	61	62
Dimensions										
Standard unit										
Length	mm	7186	8380	8380	9574	11962	11962	11962	11962	13157
Width	mm	2253	2253	2253	2253	2253	2253	2253	2253	2253
Height	mm	2297	2297	2297	2297	2297	2297	2297	2297	2297
Operating weight(3)										
LX ST standard	kg	5687	6072	6376	6827	8070	8211	8790	8867	9181
LX ST Unit + low noise option	kg	6018	6403	6707	7158	8441	8582	9162	9239	9553
LX HE standard	kg	5687	6072	6376	6827	8070	8211	8790	8867	9181
LX HE Unit + Low noise option	kg	6018	6403	6707	7158	8441	8582	9162	9239	9553
Compressors		06T semi-hermetic screw, 50 r/s								
Circuit A		1	1	1	1	1	1	1	1	1
Circuit B		1	1	1	1	1	1	1	1	1
Refrigerant(3)		R134a								
Circuit A	kg	69	72	69	75	76	76	110	116	132
	tCO_2e	98,7	103,0	98,7	107,3	108,7	108,7	157,3	165,9	188,8
Circuit B	kg	65	63	76	79	108	120	116	124	120
	tCO_2e	93,0	90,1	108,7	113,0	154,4	171,6	165,9	177,3	171,6
Oil										
Circuit A	l	27,6	27,6	27,6	27,6	27,6	27,6	36,0	36,0	36,0
Circuit B	l	23,5	23,5	27,6	27,6	36,0	36,0	36,0	36,0	36,0
Capacity control		Connect Touch, electronic expansion valve (EXV)								
Minimum capacity	%	15	15	15	15	15	15	15	15	15
Air-cooled exchanger		Aluminium micro-channel coils (MCHE)								
Fans		Axial type, with rotating impeller								
LX ST/HE										
Quantity		12	14	14	16	20	20	20	20	22
Maximum total air flow	l/s	54166	63194	63194	72221	90277	90277	90277	90277	99304
Maximum rotation speed	r/s	15,7	15,7	15,7	15,7	15,7	15,7	15,7	15,7	15,7
LX ST/HE Unit + Xtra low noise option										
Maximum total air flow	l/s	41000	47833	47833	54667	68333	68333	68333	68333	75167
Maximum rotation speed	r/s	11,7	11,7	11,7	11,7	11,7	11,7	11,7	11,7	11,7
Exchanger		Flooded multi-pipe type								
Water volume	l	119	119	130	140	164	174	180	189	189
Max. water-side operating pressure without hydraulic module	kPa	1000	1000	1000	1000	1000	1000	1000	1000	1000
Water connections with or without hydraulic module		Victaulic® type								
Connections	inch	6	6	6	8	6	6	6	6	6
External diameter	mm	168,3	168,3	168,3	219,1	168,3	168,3	168,3	168,3	168,3
Casing paintwork		Colour code RAL 7035 & RAL 7024								

(1) In dB ref=10^{-12} W, 'A' weighted. Declared dual-number noise emission values in accordance with ISO 4871 with an associated uncertainty of +/-3dB(A). Measured in accordance with ISO 9614-1 and certified by Eurovent.

(2) In dB ref 20 µPa, 'A' weighted. Declared dual-number noise emission values in accordance with ISO 4871 with an associated uncertainty of +/-3dB(A). For information, calculated from the sound power Lw(A).

(3) Values are guidelines only. Refer to the unit name plate.

4 - PHYSICAL PROPERTIES AND ELECTRICAL DATA FOR LX UNITS

4.1 - Physical properties of LX units

LX 0808 to 2158 units

LX XE		0808	0908	1008	1108	1358	1528	1858	2008	2158
Sound levels										
LX XE										
Sound power(1)	dB(A)	99	99	99	99	101	99	101	99	103
Sound pressure at 10 m(2)	dB(A)	67	67	67	67	69	67	68	67	70
LX XE + low noise option										
Sound power(1)	dB(A)	93	93	94	95	95	95	97	96	97
Sound pressure at 10 m(2)	dB(A)	61	61	62	63	63	63	65	63	64
LX XE + Xtra low noise option										
Sound power(1)	dB(A)	87	87	87	90	91	91	93	92	94
Sound pressure at 10 m(2)	dB(A)	55	55	55	58	59	59	60	59	61
LX XE + Super low noise option not available										
Sound power(1)	dB(A)	-	-	-	-	-	-	-	-	-
Sound pressure at 10 m(2)	dB(A)	-	-	-	-	-	-	-	-	-
Dimensions										
Standard unit										
Length	mm	3604	3604	3604	4798	4798	5992	7186	7186	7186
Width	mm	2253	2253	2253	2253	2253	2253	2253	2253	2253
Height	mm	2297	2297	2297	2297	2297	2297	2297	2297	2297
Operating weight(3)										
LX XE standard	kg	3190	3224	3245	3834	3899	4261	4962	5093	5376
LX XE + low noise option	kg	3458	3492	3513	4133	4198	4560	5293	5424	5707
Compressors		06T semi-hermetic screw, 50 r/s								
Circuit A		1	1	1	1	1	1	1	1	1
Circuit B		1	1	1	1	1	1	1	1	1
Refrigerant(3)		R134a								
Circuit A	kg	37	35	35	51	52	54	58	58	65
	tCO_2e	52,9	50,1	50,1	72,2	74,4	76,5	82,9	82,9	93,0
Circuit B	kg	38,5	36	37	36,5	37	32,5	59	62	58
	tCO_2e	55,1	51,5	52,9	52,2	52,9	46,5	84,4	88,7	82,9
Oil										
Circuit A	l	20,8	20,8	20,8	23,5	23,5	23,5	23,5	23,5	27,6
Circuit B	l	20,8	20,8	20,8	20,8	20,8	20,8	23,5	23,5	23,5
Capacity control		Connect Touch, electronic expansion valve (EXV)								
Minimum capacity	%	15	15	15	15	15	15	15	15	15
Air-cooled exchanger		Aluminium micro-channel coils (MCHE)								
Fans										
LX XE		Axial type, with rotating impeller								
Quantity		6	6	6	8	8	9	11	12	12
Maximum total air flow	l/s	28920	28920	28920	38560	38560	43380	53020	57840	57840
Maximum rotation speed	r/s	15,7	15,7	15,7	15,7	15,7	15,7	15,7	15,7	15,7
LX XE + Xtra low noise option										
Maximum total air flow	l/s	23580	23580	23580	31440	31440	35370	43230	47160	47160
Maximum rotation speed	r/s	11,7	11,7	11,7	11,7	11,7	11,7	11,7	11,7	11,7
Exchanger		Flooded multi-pipe type								
Water volume	l	58	61	61	66	70	77	79	94	98
Max. water-side operating pressure without hydraulic module	kPa	1000	1000	1000	1000	1000	1000	1000	1000	1000
Hydraulic module (option)		Pump, Victaulic screen filter, relief valve, water and air vent valve, pressure sensors								
Pump		Centrifugal pump, monocell, 48,3r/s, low or high pressure (as required), single or dual (as required)								
Expansion vessel volume	l	50	50	50	50	50	80			
Max. water-side operating pressure with hydraulic module	kPa	400	400	400	400	400	400			
Water connections with or without hydraulic module		Victaulic® type								
Connections	inch	5 or 4	5 or 4	5 or 4	5 or 4	5 or 4	5 or 4	5	6	6
External diameter	mm	114.3 or 141.3	114.3 or 141.3	114.3 or 141.3	114.3 or 141.3	114.3 or 141.3	114.3 or 141.3	141,3	168,3	168,3
Casing paintwork		Colour code RAL 7035 & RAL 7024								

(1) In dB ref=10^{-12} W, 'A' weighted. Declared dual-number noise emission values in accordance with ISO 4871 with an associated uncertainty of +/-3dB(A). Measured in accordance with ISO 9614-1 and certified by Eurovent.

(2) In dB ref 20µPa, 'A' weighted. Declared dual-number noise emission values in accordance with ISO 4871 with an associated uncertainty of +/-3dB(A). For information, calculated from the sound power Lw(A).

(3) Values are guidelines only. Refer to the unit name plate.

4 - PHYSICAL PROPERTIES AND ELECTRICAL DATA FOR LX UNITS

4.1 - Physical properties of LX units

LX 2308 to 4608 units

LX XE		2308	2528	2628	3028	3428	3828	4008	4408	4608
Sound levels										
LX XE										
Sound power(1)	dB(A)	103	101	104	102	103	102	104	104	104
Sound pressure at 10 m(2)	dB(A)	70	70	71	69	70	69	71	71	71
LX XE + low noise option										
Sound power(1)	dB(A)	98	97	99	98	98	98	100	99	99
Sound pressure at 10 m(2)	dB(A)	65	65	66	65	65	65	67	65	65
LX XE + Xtra low noise option										
Sound power(1)	dB(A)	94	94	95	94	94	94	99	95	96
Sound pressure at 10 m(2)	dB(A)	61	61	62	61	61	61	66	62	63
LX XE + Super low noise option not available										
Sound power(1)	dB(A)	-	-	-	-	-	-	-	-	-
Sound pressure at 10 m(2)	dB(A)	-	-	-	-	-	-	-	-	-
Dimensions										
Standard unit										
Length	mm	7186	8380	8380	9574	11962	11962	11962	11962	13157
Width	mm	2253	2253	2253	2253	2253	2253	2253	2253	2253
Height	mm	2297	2297	2297	2297	2297	2297	2297	2297	2297
Operating weight(3)										
LX XE standard	kg	5687	6072	6376	6827	8070	8211	8790	8867	9181
LX XE + low noise option	kg	6018	6403	6707	7158	8441	8582	9162	9239	9553
Compressors		06T semi-hermetic screw, 50 r/s								
Circuit A		1	1	1	1	1	1	1	1	1
Circuit B		1	1	1	1	1	1	1	1	1
Refrigerant(4)		R134a								
Circuit A	kg	69	72	69	75	76	76	110	116	132
	tCO_2e	98,7	103,0	98,7	107,3	108,7	108,7	157,3	165,9	188,8
Circuit B	kg	65	63	76	79	108	120	116	124	120
	tCO_2e	93,0	90,1	108,7	113,0	154,4	171,6	165,9	177,3	171,6
Oil										
Circuit A	l	27,6	27,6	27,6	27,6	27,6	27,6	36,0	36,0	36,0
Circuit B	l	23,5	23,5	27,6	27,6	36,0	36,0	36,0	36,0	36,0
Capacity control		Connect Touch, electronic expansion valve (EXV)								
Minimum capacity	%	15	15	15	15	15	15	15	15	15
Air-cooled exchanger		Aluminium micro-channel coils (MCHE)								
Fans		Axial type, with rotating impeller								
LX XE										
Quantity		12	14	14	16	20	20	20	20	22
Maximum total air flow	l/s	57840	67480	67480	77120	96400	96400	96400	96400	106040
Maximum rotation speed	r/s	15,7	15,7	15,7	15,7	15,7	15,7	15,7	15,7	15,7
LX XE + Xtra low noise option										
Maximum total air flow	l/s	47160	55020	55020	62880	78600	78600	78600	78600	86460
Maximum rotation speed	r/s	11,7	11,7	11,7	11,7	11,7	11,7	11,7	11,7	11,7
Exchanger		Flooded multi-pipe type								
Water volume	l	119	119	130	140	164	174	180	189	189
Max. water-side operating pressure without hydraulic module	kPa	1000	1000	1000	1000	1000	1000	1000	1000	1000
Water connections with or without hydraulic module		Victaulic® type								
Connections	inch	6	6	6	8	6	6	6	6	6
External diameter	mm	168,3	168,3	168,3	219,1	168,3	168,3	168,3	168,3	168,3
Casing paintwork		Colour code RAL 7035 & RAL 7024								

(1) In dB ref=10^{-12} W, 'A' weighted. Declared dual-number noise emission values in accordance with ISO 4871 with an associated uncertainty of +/-3dB(A). Measured in accordance with ISO 9614-1 and certified by Eurovent.

(2) In dB ref 20µPa, 'A' weighted. Declared dual-number noise emission values in accordance with ISO 4871 with an associated uncertainty of +/-3dB(A). For information, calculated from the sound power Lw(A).

(3) Values are guidelines only. Refer to the unit name plate.

4.2 - Electrical data

LX ST HE units 0808 to 3028

LX ST-HE		0808	0908	1008	1108	1358	1528	1858	2008	2158	2308	2528	2628	3028
Power circuit supply														
Nominal voltage	V-ph-Hz	400-3-50												
Voltage range	V	360-440												
Control circuit supply		24 V via internal transformer												
Maximum operating input power(1) - LX ST/HE														
Standard unit	kW	121	135	148	170	197	216	266	288	322	340	369	397	459
Unit + Xtra / Super Low Noise option	kW	115	128	141	161	188	206	253	274	308	326	354	383	443
Power factor at maximum power(2) - LX ST/HE														
Displacement Power Factor (Cos Phi)		0,88	0,88	0,88	0,88	0,89	0,89	0,89	0,89	0,89	0,89	0,89	0,90	0,90
Displacement Power Factor (Cos Phi) unit + Xtra / Super Low noise option		0,88	0,88	0,88	0,88	0,89	0,89	0,89	0,89	0,89	0,89	0,89	0,90	0,90
Nominal unit current draw(3) - LX ST/HE														
Standard unit	A	154	170	186	215	246	267	332	358	409	430	446	502	542
Unit + Xtra / Super Low Noise option	A	143	159	175	200	231	252	311	335	386	407	423	479	515
Maximum operating current draw (Un)(1) - LX ST/HE														
Standard unit	A	198	220	242	278	319	349	431	466	521	551	597	636	736
Unit + Xtra / Super Low Noise option	A	187	209	231	263	304	334	410	443	498	528	574	613	709
Maximum current (Un-10 %)(2) - LX ST/HE														
Standard unit	A	198	220	242	278	319	349	431	466	521	551	597	636	736
Unit + Xtra / Super Low Noise option	A	187	209	231	263	304	334	410	443	498	528	574	613	709
Start-up current(3)+(4) - LX ST/HE														
Standard unit	A	213	224	224	346	442	442	492	492	676	691	691	733	756
Unit + Xtra / Super Low Noise option	A	210	221	221	343	439	439	487	486	671	686	686	727	750
Maximum start-up current (Un)(2)+(4) - LX ST/HE														
Standard unit	A	213	224	224	346	442	442	492	492	676	691	691	733	756
Unit + Xtra / Super Low Noise option	A	210	221	221	343	439	439	487	486	671	686	686	727	750

(1) Values at the unit's permanent maximum operating condition (as shown on the unit's nameplate).
(2) Values at the unit's maximum operating condition (as shown on the unit's nameplate).
(3) Maximum operating current of the smallest compressor(s) + fan current + locked rotor current of the largest compressor.
(4) Standardised EUROVENT conditions, water-cooled exchanger inlet/outlet = 12°C/7°C, outdoor air temperature = 35°C.
(a) When the machines are equipped with two power supplies, circuit 1 is intended to supply refrigerant circuit A and circuit 2 supplies the refrigerant circuit B.
For units LX3428 to 4608: circuit 1 supplies circuit A, circuit 2 supplies circuit B.

4.2 - Electrical data

LX ST/HE units 3428 to 4608

LX ST/HE		3428	3828	4008	4408	4608
Power circuit supply						
Nominal voltage	V-ph-Hz	400-3-50				
Voltage range	V	360-440				
Control circuit supply		24 V via internal transformer				
Maximum operating input power(1) - LX ST/HE						
Standard unit	kW					
Circuit 1(a)	kW	198	226	269	288	311
Circuit 2(a)	kW	288	314	287	309	311
Single power connection point option	kW	485	539	556	596	622
Unit with Xtra & Super Low Noise option						
Circuit 1(a)	kW	190	218	258	276	298
Circuit 2(a)	kW	277	301	276	297	298
Single power connection point option	kW	466	519	533	573	597
Power factor at maximum power(1) - LX ST/HE						
Standard unit						
Displacement Power Factor (Cos Phi)		0,88	0,88	0,88	0,88	0,88
Unit + Xtra & Super low noise option						
Displacement Power Factor (Cos Phi)		0,88	0,88	0,88	0,88	0,88
Nominal unit current draw(2) - LX ST/HE						
Standard unit						
Circuit 1(a)	A	255	271	345	358	394
Circuit 2(a)	A	354	394	358	390	394
Single power connection point option	A	609	665	703	748	789
Unit + Xtra & Super low noise option						
Circuit 1(a)	A	242	258	326	339	373
Circuit 2(a)	A	337	373	339	371	373
Single power connection point option	A	579	631	665	710	747
Maximum operating current draw (Un)(1) - LX ST/HE						
Standard unit						
Circuit 1(a)	A	322	368	443	473	512
Circuit 2(a)	A	469	512	473	508	512
Single power connection point option	A	791	880	916	981	1025
Unit with Xtra & Super Low Noise option						
Circuit 1(a)	A	309	355	424	454	491
Circuit 2(a)	A	452	491	454	489	491
Single power connection point option	A	761	846	878	943	983
Maximum current (Un-10 %)(1) - LX ST/HE						
Standard unit						
Circuit 1(a)	A	322	368	443	473	512
Circuit 2(a)	A	469	512	473	508	512
Single power connection point option	A	791	880	916	981	1025
Unit with Xtra & Super Low Noise option						
Circuit 1(a)	A	309	355	424	454	491
Circuit 2(a)	A	452	491	454	489	491
Single power connection point option	A	761	846	878	943	983
Start-up current(3) - LX ST/HE						
Standard unit						
Circuit 1(a)	A	587	587	629	629	629
Circuit 2(a)	A	629	629	629	629	629
Single power connection point option	A					
Single power connection point option & Opt 25c	A	687	702	729	744	744
Unit + Xtra & Super low noise option						
Circuit 1(a)	A	587	587	629	629	629
Circuit 2(a)	A	629	629	629	629	629
Single power connection point option	A	687	702	729	744	744
Single power connection point option & Opt 25c	A					
Maximum start-up current (Un)(2) - LX ST/HE						
Standard unit						
Circuit 1(a)	A	587	587	629	629	629
Circuit 2(a)	A	629	629	629	629	629
Single power connection point option	A	687	702	729	744	744
Unit + Xtra & Super low noise option						
Circuit 1(a)	A	576	576	613	613	611
Circuit 2(a)	A	615	611	613	613	611
Single power connection point option		687	702	729	744	744

(1) Values at the unit's permanent maximum operating condition (as shown on the unit's nameplate).
(2) Values at the unit's maximum operating condition (as shown on the unit's nameplate).
(3) Maximum operating current of the smallest compressor(s) + fan current + locked rotor current of the largest compressor.
(4) Standardised EUROVENT conditions, water-cooled exchanger inlet/outlet = 12°C/7°C, outdoor air temperature = 35°C.
(a) When the machines are equipped with two power supplies, circuit 1 is intended to supply refrigerant circuit A and circuit 2 supplies the refrigerant circuit B. For units LX3428 to 4608: circuit 1 supplies circuit A, circuit 2 supplies circuit B.

4.2 - Electrical data

LX XE 0808 to 2158 units

LX XE		0808	0908	1008	1108	1358	1528	1858	2008	2158	2308	2528	2628	3028
Power circuit supply														
Nominal voltage	V-ph-Hz	400-3-50												
Voltage range	V	360-440												
Control circuit supply		24 V via internal transformer												
Maximum operating input power(1)														
Standard unit	kW	116	130	144	164	191	209	258	278	313	332	361	385	446
Unit + Xtra / Super Low Noise option	kW	112	126	140	159	186	204	251	271	305	324	352	377	437
Power factor at maximum power(2)														
Displacement Power Factor (Cos Phi)+		0,88	0,88	0,88	0,88	0,89	0,89	0,89	0,89	0,89	0,89	0,89	0,90	0,90
Displacement Power Factor (Cos Phi) unit + Xtra / Super Low noise option		0,88	0,88	0,88	0,88	0,89	0,89	0,89	0,89	0,89	0,89	0,89	0,90	0,90
Nominal operating current draw(3)														
Standard unit	A	146	162	178	205	236	257	318	342	393	414	430	486	524
Unit + Xtra / Super Low Noise option	A	140	156	172	197	228	248	307	330	381	402	416	472	510
Maximum operating current draw (Un)(1)														
Standard unit	A	190	212	234	268	309	339	417	450	505	535	581	620	718
Unit + Xtra / Super Low Noise option	A	184	206	228	260	301	330	406	438	493	523	567	606	704
Maximum current (Un-10 %)(2)														
Standard unit	A	190	212	234	268	309	339	417	450	505	535	581	620	718
Unit + Xtra / Super Low Noise option	A	184	206	228	260	301	330	406	438	493	523	567	606	704
Start-up current(3)+(4)														
Standard unit	A	207	218	218	338	434	434	481	480	664	679	679	721	742
Unit + Xtra / Super Low Noise option	A	204	215	215	335	431	431	476	474	659	674	674	715	736
Maximum start-up current (Un)(2)+(3)														
Standard unit	A	207	218	218	338	434	434	481	480	664	679	679	721	742
Unit + Xtra / Super Low Noise option	A	204	215	215	335	431	431	476	474	659	674	674	715	736

(1) Values at the unit's permanent maximum operating condition (as shown on the unit's nameplate).
(2) Values at the unit's maximum operating condition (as shown on the unit's nameplate).
(3) Maximum operating current of the smallest compressor(s) + fan current + locked rotor current of the largest compressor.
(4) Standardised EUROVENT conditions, water-cooled heat exchanger water inlet/outlet = 12 °C/7 °C, outdoor air temperature = 35 °C.

4.2 - Electrical data

LX XE 3428 to 4608

Product		3428	3828	4008	4408	4608
Power circuit supply						
Nominal voltage	V-ph-Hz	400-3-50				
Voltage range	V	360-440				
Control circuit supply		24 V via internal transformer				
Maximum operating input power(1) or (2)						
Standard unit	kW					
Circuit 1(a)	kW	189	217	260	278	301
Circuit 2(a)	kW	276	300	278	299	300
Single power connection point option	kW	465	517	537	576	601
Unit + Xtra & Super low noise option	kW					
Circuit 1(a)	kW	184	212	253	271	294
Circuit 2(a)	kW	271	294	272	293	294
Single power connection point option	kW	453	505	525	564	588
Power factor at maximum power(1) or (2)						
Standard unit		0,87	0,87	0,87	0,87	0,87
Displacement Power Factor (Cos Phi)		0,87	0,87	0,87	0,87	0,87
Unit + Xtra & Super low noise option						
Displacement Power Factor (Cos Phi) unit + Xtra & Super Low noise option		0,86	0,87	0,87	0,86	0,86
Nominal operating current draw(3)						
Standard unit	A					
Circuit 1(a)	A	246	262	332	345	380
Circuit 2(a)	A	342	380	345	377	380
Single power connection point option	A	588	642	677	722	760
Unit + Xtra & Super low noise option	A					
Circuit 1(a)	A	239	255	322	335	369
Circuit 2(a)	A	333	369	335	367	369
Single power connection point option	A	569	622	657	702	738
Maximum operating current draw (Un)(1) or (2)						
Standard unit	A					
Circuit 1(a)	A	313	359	430	460	498
Circuit 2(a)	A	457	498	460	495	498
Single power connection point option	A	770	857	890	955	996
Unit + Xtra & Super low noise option	A					
Circuit 1(a)	A	306	352	420	450	487
Circuit 2(a)	A	448	487	450	485	487
Single power connection point option	A	751	837	870	935	974
Maximum current (Un-10 %)(1) or (2)						
Standard unit	A					
Circuit 1(a)	A	313	359	430	460	498
Circuit 2(a)	A	457	498	460	495	498
Single power connection point option	A	770	857	890	955	996
Unit + Xtra & Super low noise option	A					
Circuit 1(a)	A	306	352	420	450	487
Circuit 2(a)	A	448	487	450	485	487
Single power connection point option	A	751	837	870	935	974
Start-up current(3) + (4)						
Standard unit	A					
Circuit 1(a)	A	587	587	629	629	629
Circuit 2(a)	A	629	629	629	629	629
Single power connection point option	A	675	687	716	731	729
Unit + Xtra & Super low noise option	A					
Circuit 1(a)	A	587	587	629	629	629
Circuit 2(a)	A	629	629	629	629	629
Single power connection point option	A	658	666	697	712	708
Maximum start-up current (Un)(2) + (4)						
Standard unit	A					
Circuit 1(a)	A	587	587	629	629	629
Circuit 2(a)	A	629	629	629	629	629
Single power connection point option	A	675	687	716	731	729
Unit + Xtra & Super low noise option	A					
Circuit 1(a)	A	587	587	629	629	629
Circuit 2(a)	A	629	629	629	629	629
Single power connection point option		658	666	697	712	708

(1) Values at the unit's permanent maximum operating condition (as shown on the unit's nameplate).
(2) Values at the unit's maximum operating condition (as shown on the unit's nameplate).
(3) Maximum operating current of the smallest compressor(s) + fan current + locked rotor current of the largest compressor.
(4) Standardised EUROVENT conditions, water-cooled exchanger inlet/outlet = 12°C/7°C, outdoor air temperature = 35°C.
(a) When the machines are equipped with two power supplies, circuit 1 is intended to supply refrigerant circuit A and circuit 2 supplies the refrigerant circuit B

4.3 - Compressor electrical data

Compressor	I Nom(1)	I Max (Un)(2)	I Max (Un - 10%)(3)	LRYA A(4)	LRDA A(5)	Cos Phi nom.(6)	Cos Phi Max.(7)
06TSA155	64	93	99	170	530	0,87	0,9
06TSA186	80	111	118	170	530	0,86	0,89
06TTA266	117	162	172	303	945	0,86	0,9
06TTA301	132	177	188	388	1210	0,87	0,9
06TTA356	153	207	220	388	1210	0,87	0,9
06TUA483	225	292	311	587	1828	0,87	0,88
06TUA554	241	338	360	587	1828	0,88	0,89
06TVA680	302	400	436	629	1919	0,87	0,89
06TVA753	315	430	468	629	1919	0,88	0,89
06TVA819	347	465	496	629	1919	0,88	0,89

Key
(1) Nominal current draw at standard Eurovent conditions (see definition of conditions under nominal unit current draw)
(2) Maximum operating current
(3) Maximum compressor operating current, limited by the unit (current given for maximum capacity at 360 V)
(4) Locked rotor current for star connection (connection during compressor start-up)
(5) Locked rotor current for delta connection
(6) Value at standard Eurovent conditions: evaporator entering/leaving water temperature 12°C/7°C, condenser entering/leaving water temperature 30°C/35°C.
(7) Value at maximum capacity and nominal voltage

4.4 - Compressor usage per circuit (A, B, C, D)

Compressor	Circuit	0808	0908	1008	1108	1358	1528	1858	2008	2158	2308	2528	2628	3028	3428	3828	4008	4408	4608
06TSA155	A	1																	
	B	1	1		1														
06TSA186	A		1	1															
	B			1		1	1												
06TTA266	A				1														
	B																		
06TTA301	A					1													
	B							1		1									
06TTA356	A						1	1	1										
	B								1		1	1							
06TUA483	A									1	1		1		1				
	B												1						
06TUA554	A											1		1		1			
	B													1					
06TVA680	A																1		
	B																		
06TVA753	A																	1	
	B														1		1		
06TVA819	A																		1
	B															1		1	1

4 - PHYSICAL PROPERTIES AND ELECTRICAL DATA FOR LX UNITS

Electrical data notes and operating conditions for LX units:

- LX 0808 to 3028 units have a single power connection point, while LX 3428 to 4608 units have two connection points.
- The electrics box includes the following standard features:
  - one main disconnect switch per circuit,
  - starter and motor protection devices for each compressor, the fan(s) and the pump,
  - control devices.

Field connections:

- All connections to the system and the electrical installations must be in full compliance with all applicable local regulations.
- LX ST/HE/XE units are designed and manufactured to ensure that these regulations can be observed. The recommendations of European standard EN 60204-1 (corresponds to IEC 60204-1) (machine safety - electrical machine components - part 1: General regulations) are specifically taken into account, when designing the electrical equipment.

IMPORTANT:

- Generally, the recommendations of standard IEC 60364 are accepted as compliance with the requirements of the installation regulations.
- The EN 60204 standard is the best means of ensuring compliance with point 1.5.1 of the Machinery Directive.
  Annex B of EN 60204-1 describes the electrical characteristics used for the operation of the machines.
  1. Environment* . Environment as classified in EN 60364 (corresponds to IEC 60364):
  - outdoor installation*;
  - ambient temperature range: from -20 °C to +55 °C**
  - altitude less than or equal to 2000 m (for the hydraulic module, see paragraph 4.7 of the installation, operation and maintenance manual)
  - presence of hard solids, class AE3 (no significant dust present)*;
  - presence of corrosive and polluting substances, class AF1 (negligible);
  - competence of personnel: BA4 (trained personnel); LX ST/HE/XE machines are not intended to be installed in locations open to the public, including people with disabilities and children.
  2. Compatibility for low-frequency conducted disturbances according to IEC61000-2-2 and to class 2 levels per IEC61000-2-4 standard:
  - power supply frequency variation : +-2 Hz;
  - phase imbalance: 2 %;
  - voltage total harmonic distortion (THD): 8 %.
  3. The neutral wire (N) must not be connected directly to the unit (if necessary, use a transformer).
  4. Overcurrent protection of the power supply conductors is not provided with the unit.
  5. The factory.installed disconnect switch(es)/circuit breaker(s) is (are) of a type suitable for power interruption in accordance with EN 60947-3 (corresponds to IEC 60947-3).
  6. The units are designed for simplified connection on TN(s) networks (IEC 60364). For IT networks provide a local earth and consult competent local organisations to complete the electrical installation. Units delivered with one or more variable frequency drives are not compatible with an IT network. LX machines are designed for use in domestic / residential and industrial environments:
     Machines that are not equipped with variable frequency drive(s) are in accordance with the codes :
     - 61000-6-3: Generic standards - Emission standard for residential, commercial and light-industrial environments.
     - 61000-6-2: Generic standards - Immunity for industrial environments. Machines that are equipped with variable frequency drive(s) are compliant with the standard EN61800-3 - Adjustable speed electrical power drive systems – part 3: EMC requirements and specific test methods for the following classifications:
     - Use in the first and second environments***.
     - Category C2 applicable in the first environment, on stationary devices designed to be installed and commissioned by a professional.

     Warning: In a residential environment, this product may cause radio interference in which case additional mitigation measures could be required.
- Leakage currents: if protection by monitoring the leakage currents is necessary to ensure the safety of the installation, the presence of additional leakage currents introduced by the use of variable frequency drive(s) in the unit must be considered. In particular, the reinforced immunity protection types and/or a control value not lower than 150 mA are recommended when selecting differential protection devices.
- Capacitors integrated into the Power factor correction option may generate electrical disturbances on the system to which the unit is connected. Presence of these capacitors must be considered during the electrical study prior to the start-up.

NOTE: If particular aspects of an actual installation do not conform to the conditions described above, or if there are other conditions which should be considered, always contact your local CIAT representative.

* The required protection level for this class is IP43BW (according to reference document IEC 60529). All LX ST/HE/XE units are protected to IP44CW and fulfil this protection condition.

** The maximum ambient temperature allowed for machines equipped with option 231 is +40°C

4.5 - Electrical data, optional hydraulic module

The pumps that are factory-installed in these units comply with the European Ecodesign directive ErP. The additional electrical data required(1) is as follows:

Low pressure single and dual pump motors for LX units

No.(2)	description(3)		0808	0908	1008	1108	1358	1528
1	Nominal efficiency at full load and nominal voltage	%	86,7	86,7	87,2	88,1	89,4	89,4
	Nominal efficiency at 75% full load and nominal voltage	%	87,0	87,0	86,9	88,0	88,9	88,9
	Nominal efficiency at 50% full load and nominal voltage	%	85,5	85,5	84,5	86,1	86,7	86,7
2	Efficiency level	-	IE3					
3	Year of manufacture	-	This information varies depending on the manufacturer and model at the time of incorporation. Please refer to the motor nameplates.					
4	Company name or trademark, commercial registration number and head office of manufacturer	-	Same as above					
5	Product model number	-	Same as above					
6	Number of motor poles	-	2					
7-1	Nominal shaft power output at full load and nominal voltage (400 V)	kW	2,2	2,2	3,0	4,0	5,5	5,5
7-2	Maximum input power (400V)(4)	kW	2,54	2,54	3,44	4,54	6,15	6,15
8	Nominal input frequency	Hz	50					
9-1	Nominal voltage	V	3*400					
9-2	Maximum current drawn (400V)(5)	A	4,2	4,2	5,5	7,4	9,7	9,7
10	Nominal speed	r/s - r/min	48 - 2900	48 - 2900	49 - 2915	49 - 2915	49 - 2930	49 - 2930
11	product disassembly, recycling or disposal at end of life	-	Disassembly using standard tools. Disposal and recycling using an appropriate company.					
12	Operating conditions for which the motor is specifically designed							
	I - Altitudes above sea level	m	< 1000(6)					
	II - Ambient air temperature	°C	< 40					
	III - Maximum operating temperature	°C	Please refer to the operating conditions given in this manual or in the specific conditions given in the CIAT selection programs.					
	IV - Potentially explosive atmospheres	-	Non ATEX environment					

Low pressure single and dual pump motors for LX units

No.(2)	description(3)		0808	0908	1008	1108	1358	1528
1	Nominal efficiency at full load and nominal voltage	%	88,1	89,4	89,4	90,1	91,3	91,3
	Nominal efficiency at 75% full load and nominal voltage	%	88,0	88,9	88,9	89,7	91,4	91,4
	Nominal efficiency at 50% full load and nominal voltage	%	86,1	86,7	86,7	87,9	90,3	90,3
2	Efficiency level	-	IE3					
3	Year of manufacture	-	This information varies depending on the manufacturer and model at the time of incorporation. Please refer to the motor nameplates.					
4	Company name or trademark, commercial registration number and head office of manufacturer	-	Same as above					
5	Product model number	-	Same as above					
6	Number of motor poles	-	2					
7-1	Nominal shaft power output at full load and nominal voltage (400 V)	kW	4	5,5	5,5	7,5	11	11
7-2	Maximum input power (400V)(4)	kW	4,5	6,2	6,2	8,3	12,0	12,0
8	Nominal input frequency	Hz	50					
9-1	Nominal voltage	V	3*400					
9-2	Maximum current drawn (400V)(5)	A	7,4	9,7	9,7	13,2	18,7	18,7
10	Nominal speed	r/s - r/min	49 - 2915	49 - 2930	49 - 2930	49 - 2935	49 - 2945	49 - 2945
11	product disassembly, recycling or disposal at end of life	-	Disassembly using standard tools. Disposal and recycling using an appropriate company.					
12	Operating conditions for which the motor is specifically designed							
	I - Altitudes above sea level	m	< 1000(6)					
	II - Ambient air temperature	°C	< 40					
	III - Maximum operating temperature	°C	Please refer to the operating conditions given in this manual or in the specific conditions given in the CIAT selection programs.					
	IV - Potentially explosive atmospheres	-	Non ATEX environment					

(1) Required by regulation No. 640/2009 concerning the application of directive 2009/125/EC on the eco-design requirements for electric motors.
(2) Item number imposed by regulation No. 640/2009, annex I2b.
(3) Description given by regulation No. 640/2009, annex I2b.
(4) To obtain the maximum input power for a unit with hydraulic module, add the maximum unit input power from the electrical data table to the pump power input.
(5) To obtain the maximum unit operating current draw for a unit with hydraulic module, add the maximum unit current draw from the electrical data table to the pump current draw.
(6) Above 1000 m, a degradation of 3% for each 500 m should be taken into consideration.

Please refer to the certified dimensional drawings, supplied with the unit.

5.1 - Power supply

The power supply must conform to the specification on the chiller nameplate. The supply voltage must be within the range specified in the electrical data table. For connections refer to the wiring diagrams and the certified dimensional drawings.

WARNING: operating the chiller with an incorrect supply voltage or excessive phase imbalance constitutes improper use and will invalidate the CIAT warranty. If the phase imbalance exceeds 2% for voltage, or 10% for current, contact your local electricity supply at once and ensure that the chiller is not switched on until corrective measures have been taken.

5.2 - Voltage phase imbalance (%)

$$\frac{100 \times \text{max. deviation from average voltage}}{\text{Average voltage}}$$

Example:

On a 400 V - 3 ph - 50 Hz supply, the individual phase voltages were measured to be:

AB = 406 V; BC = 399; AC = 394 V

Average voltage = (406 + 399 + 394)/3 = 1199/3

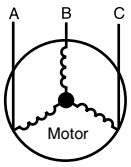
= 399.7 say 400 V

Calculate the maximum deviation from the 400 V average:

(AB) = 406 - 400 = 6

(BC) = 400 - 399 = 1

(CA) = 400 - 394 = 6



The maximum deviation from the average is 6 V. The greatest percentage deviation is: 100 x 6/400 = 1.5 %

This is less than the permissible 2% and therefore acceptable.

5.3 - Power connection/disconnect switch

Units	Connection points
LX 0808 to 3028	1 per unit
LX 3428 to 4608	1 for circuit 1
	1 for circuit 2

5.4 - Recommended wire sections

Wire sizing is the responsibility of the installer, and depends on the characteristics and regulations applicable to each installation site. The following is only to be used as a guide-line, and does not make in any way liable. After wire sizing has been completed, using the certified dimensional drawing, the installer must ensure easy connection and define any modifications necessary on site.

The connections provided as standard for the field-supplied power entry cables to the general disconnect/isolator switch are designed for the number and type of wires, listed in column 2 of the table on the next page.

The calculations are based on the maximum machine current (see electrical data tables).

The calculations for favourable and unfavourable cases are based on the maximum current for each unit (see electrical data tables). For the design the standardised installation methods in accordance with IEC 60364 are used: PVC (70 °C) or XLPE (90 °C) insulated cables with copper core; arrangement to comply with table 52c of the above standard. The maximum temperature is 46 °C. The given maximum length is calculated to limit the voltage drop to 5%.

IMPORTANT: Before connection of the main power cables (L1 - L2 - L3) on the terminal block, it is imperative to check the correct order of the 3 phases before proceeding to the connection on then terminal block or the main disconnect/ isolator switch.

5.5 - Power cable entry

The power cables can enter the unit's electrics box from below or from the unit side. For LX unit sizes 1858 to 4608, the electrics box that includes the power supply cable connection terminal is located in the lower part of the unit. In this case the control box is raised by 120 mm compared to the lowest point of the chassis.

The cable entry point depends on the unit configuration:

1. Unit raised from the ground (e.g. installation on sup-port rails): It is recommended to enter the power cables from below the control box. A removable aluminium plate below the control box allows introduction of the cables.
2. Unit placed on the ground: For power cable entry from below the control box ensure that the cable bend radius is compatible with the connection space available in the control box. If not, an aluminium plate on the control box face allows introduction of the cables.

IMPORTANT: Check the cable bend radius for cable entry into a control box, located in the lower part of the unit.

Refer to the certified dimensional drawing for the unit.

5.6 - Field control wiring

Important: Field connection of interface circuits may lead to safety risks: Any control box modification must maintain equipment conformity with local regulations. Precautions must be taken to prevent accidental electrical contact between circuits supplied by different sources:

- **The routing selection and/or conductor insulation characteristics must ensure dual electric insulation.**
- **In case of accidental disconnection, conductor fixing between different conductors and/or in the control box prevents any contact between the conductor ends and an active energised part.**

Refer to the Touch Pilot Control manual for POWERCIAT LX units and the certified wiring diagram supplied with the unit for the field control wiring for the following functions:

- Remote on/off switch
- Demand limit external switch
- Remote dual set point
- Alarm, alert and operation report
- Evaporator pump control
- Heat reclaim condenser pump control (option)
- Hot water valve control (option)
- Set point reset via outside air temperature sensor reset
- Various interlocks on the Energy Management Module (EMM) board (option).

Selection of minimum and maximum wire sections for connection to LX units

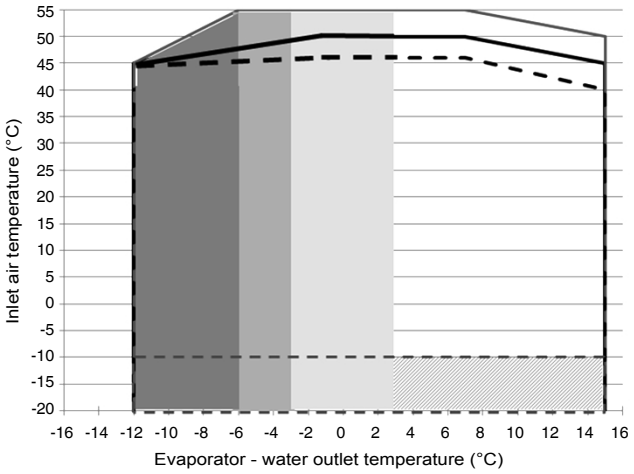
	Max. connectable section(1)	Calculation of favourable case: - Suspended overhead line (standardised routing no. 17) - Cable insulated to 90°C - Copper conductor (Cu)			Calculation of unfavourable case: - Conductors in ducts or multi-conductor cables in closed conduits (standardised routing no. 41) - Cable insulated to 70°C when possible - Copper conductor (Cu)		
		Calculation of favourable case: - Perforated horizontal conduit (standardised routing no.. 13/15) - Cable insulated to 90°C - Copper conductor (Cu)			Calculation of unfavourable case: - Closed conduit (standardised routing No. 41) - Cable insulated to 70°C when possible - Copper conductor (Cu)		
		Section(2)	Max. length for a voltage drop <5%	Cable type(3)	Section(2)	Max. length for a voltage drop <5%	Cable type(3)
	qty x mm² (per phase)	qty x mm² (per phase)	m	-	qty x mm² (per phase)	m	-
LX ST/HE/XE							
0808	2 × 185	1 x 95	190	XLPE Cu	2 x 95	450	PVC Cu
0908	2 × 185	1 x 95	190	XLPE Cu	2 x 95	420	PVC Cu
1008	2 × 185	1 x 120	197	XLPE Cu	2 x 95	390	PVC Cu
1108	2 × 185	1 x 150	200	XLPE Cu	2 x 120	400	PVC Cu
1358	2 × 185	1 x 185	205	XLPE Cu	2 x 150	420	PVC Cu
1528	2 × 185	1 x 240	205	XLPE Cu	2 × 185	430	PVC Cu
1858	2 × 240	2 x 95	190	XLPE Cu	2 × 240	440	PVC Cu
2008	2 × 240	2 x 120	198	XLPE Cu	2 × 185	330	XLPE Cu
2158	2 × 240	2 x 120	198	XLPE Cu	2 × 240	370	XLPE Cu
2308	2 × 240	2 x 150	200	XLPE Cu	2 × 240	330	XLPE Cu
2528	2 × 240	2 x 150	200	XLPE Cu	2 × 240	320	XLPE Cu
2628	2 × 240	2 × 185	205	XLPE Cu	Not compatible - -		
3028	4 × 300	2 × 240	205	XLPE Cu	4 x 185	320	XLPE Cu
3428	2x240/3x240	1x185/2x120	291/240	XLPE Cu	2x240/3x240	600/530	PVC Cu/PVC Cu
3828	2x240/3x240	1x240/2x150	310/270	XLPE Cu	2x150/2x240	380/380	XLPE Cu/XLPE/Cu
4008	2x240/3x240	2x120/2x120	260/240	XLPE Cu	2x240/2x240	420/400	XLPE Cu/XLPE Cu
4408	2x240/3x240	2x120/2x150	240/270	XLPE Cu	2x240/2x240	400/380	XLPE Cu/XLPE Cu
4608	2x240/3x240	2x120/2x150	240/270	XLPE Cu	2x240/2x240	400/380	XLPE Cu/XLPE Cu
LX ST/HE/XE + Single power connection point option							
3428 to 4608	5x240						

(1) Connection capacities actually available for each machine. These are defined according to the connection terminal size, the opening dimensions for electrical/control box access and the available space inside the electrical/control box.
(2) Selection simulation result considering the hypotheses indicated.
(3) If the maximum calculated section is for a 90°C cable type, this means that a selection based on a 70°C cable type can exceed the connection capacity actually available. Special attention must be paid to selection.
The protection against direct contact at the electrical connection point is compatible with the addition of extension for the terminals. The installer must determine whether these are necessary based on the cable sizing calculation.

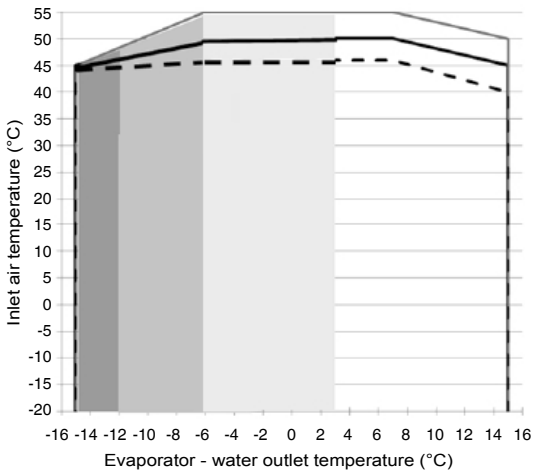
Note: The currents considered are given for a machine equipped with a hydraulic module operating at maximum current.

6.1 - Operating range

Operating range - LX ST HE



Operating range - LX XE



Ranges given as a guide using ethylene glycol for an evaporator ΔT = 3K. Refer to the electronic catalogue.

- Winter operation option for the ST version (standard for HE and XE versions)
- Very low temperature brine, ST-HE (-12°C ethylene glycol / -8°C propylene glycol) / XE (-15°C ethylene glycol / -10°C propylene glycol)
- Medium temperature brine, ST-HE (-6°C ethylene glycol / -3°C propylene glycol) / XE (-12°C ethylene glycol / -8°C propylene glycol)
- Medium temperature brine, ST-HE (-3°C ethylene glycol / 0°C propylene glycol) / XE (-6°C ethylene glycol / -3°C propylene glycol)
- Full load operation
- Part load operation
- Operating limit for units equipped with the Xtra and super low noise options

Power factor correction option available for an inlet air temperature up to +40°C
For operation in pure water at an inlet air temperature below 0°C, the frost protection option must be provided

Winter operation option

If the outside temperature is below -10 °C and the unit has been switched off for more than 4 hours, it is necessary to wait 2 hours after the unit has been switched on again to allow the frequency converter to warm up.

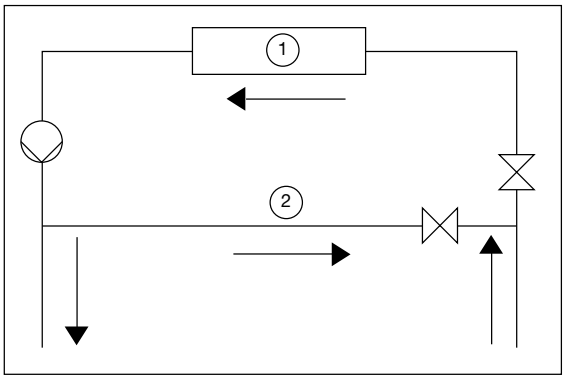
Water heat exchanger		Minimum	Maximum
Entering temperature at start-up	°C	-	45(1)
Leaving temperature during operation	°C	3,3	15
Entering/leaving water temperature difference	K	2,8	10
Condenser air temperature		**Minimum**	**Maximum**
Storage		-20	68
Operation, standard unit		-10	55(2)
With winter operation option		-20	55(2)
With low noise level option		-10	52(2)

Note: If the air temperature is below 0°C, a glycol/water solution or the frost protection option must be used.
Note: If the leaving water temperature is below 4°C, a glycol/water solution or the frost protection option must be used.
(1) Based on the installation type and the air temperature
(2) Part load, depended of sizes & leaving water temperature

6.2 - Minimum chilled water flow (unit without hydraulic module)

The minimum chilled water flow is shown in the table on the next page. If the system flow is less than this, the evaporator flow can be recirculated, as shown in the diagram.

For minimum chilled water flow rate

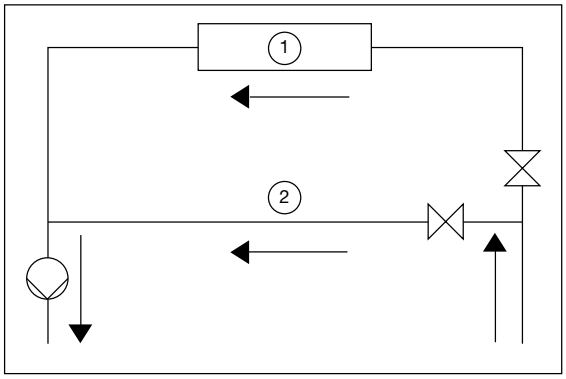


1 Evaporator
2 Recirculation

6.3 - Maximum chilled water flow (units without hydraulic module)

The maximum chilled water flow is shown in the table on the next page. If the system flow exceeds the maximum value, it can be bypassed as shown in the diagram.

For maximum chilled water flow rate



1 Evaporator
2 Bypass

6.4 - Variable flow evaporator

A variable evaporator flow can be used in LX standard coolers. The chillers maintain a constant leaving water temperature under all flow conditions. For this to happen, the minimum flow rate must be higher than the minimum flow given in the table of permissible flow rates and must not vary by more than 10% per minute.

If the flow rate changes more rapidly, the system should contain a minimum of 6.5 litres of water per kW instead of 3.25 l/kW.

6.5 - Minimum system water volume

Whichever the system, the water loop minimum capacity is given by the formula:

Capacity = Cap (kW) x N litres

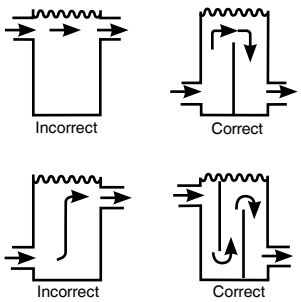
Application	N
Normal air conditioning	3,25
Process type cooling	6,5

Where Cap is the nominal system cooling capacity (kW) at the nominal operating conditions of the installation.

This volume is necessary for stable operation and accurate temperature control.

It is often necessary to add a buffer water tank to the circuit in order to achieve the required volume. The tank must itself be internally baffled in order to ensure proper mixing of the liquid (water or brine). Refer to the examples below.

Connection to a buffer tank



6.6 - Maximum system water volume

Units with hydraulic module incorporate an expansion tank that limits the water volume. Maximum water loop volume (litres) If the maximum volume is insufficient, compared to the minimum system water loop volume, an additional expansion tank must be added to the system.

LX ST/HE/XE		Sizes 0808 to 1358			1528		
Static pressure	bar	1	2	2,5	1	2	2,5
Pure water	l	2400	1600	1200	3960	2640	1980
10% EG	l	1800	1200	900	2940	1960	1470
20% EG	l	1320	880	660	2100	1400	1050
30% EG	l	1080	720	540	1740	1160	870
40% EG	l	900	600	450	1500	1000	750

EG : Ethylene Glycol

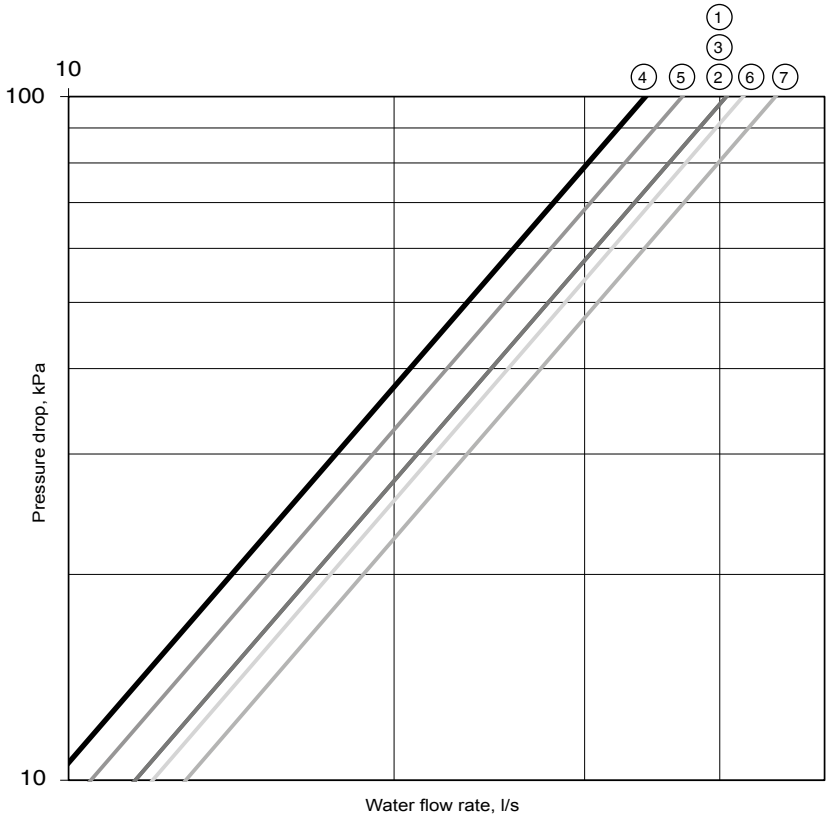
6.7 - Evaporator water flow rate

LX ST/HE/XE	Minimum flow rate (1) (l/s)	Maximum flow rate (2) (l/s)
0808	3,6	37,5
0908	4,0	40,5
1008	4,3	40,5
1108	5,3	34,1
1358	6,0	36,9
1528	6,7	42,0
1858	8,1	45,0
2008	8,9	56,1
2158	9,6	59,1
2308	10,4	67,1
2528	11,0	67,1
2628	11,8	73,9
3028	13,1	83,9
3428	15,1	87,8
3828	16,4	126,5
4008	17,5	92,9
4408	16,4	132,1
4608	18,8	107,4

(1) Minimum flow rate for maximum allowable water temperature difference conditions (10K) under Eurovent conditions
(2) Maximum flow rate for a pressure drop of 100 kPa in the plate heat exchanger

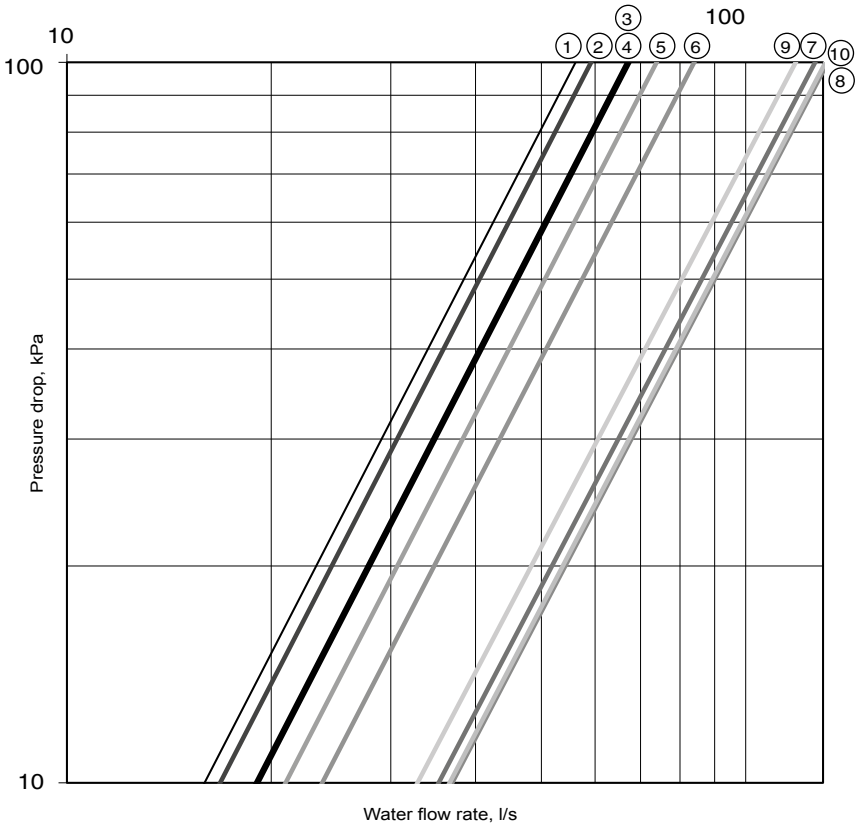
6.8 - Evaporator pressure drop curve

Sizes 0808 to 1858



Key
1. 808
2. 908
3. 1008
4. 1108
5. 1358
6. 1528
7. 1858

Sizes 2008 to 4608



Key
1. 2158
2. 2308
3. 2528
4. 2628
5. 3028
6. 3428
7. 3828
8. 4008
9. 4408
10. 4608

Before carrying out any water connections, install the water box vent plugs (one plug per water box in the lower section - supplied in the electrics box).

For size and position of the heat exchanger water inlet and outlet connections refer to the certified dimensional drawings supplied with the unit.

The water pipes must not transmit any radial or axial force to the heat exchangers nor any vibration.

The water supply must be analysed and appropriate filtering, treatment, control devices, isolation and bleed valves and circuits built in, to prevent corrosion, fouling and deterioration of the pump fittings. Consult either a water treatment specialist or appropriate literature on the subject.

7.1 - Operating precautions

The water circuit should be designed to have the least number of elbows and horizontal pipe runs at different levels. Below the main points to be checked for the connection:

- Comply with the water inlet and outlet connections shown on the unit.
- Install manual or automatic air purge valves at all high points in the circuit(s).
- Use a pressure reducer to maintain pressure in the circuit(s) and install a relief valve as well as an expansion tank.
- Install thermometers in both the entering and leaving water connections.
- Install drain connections at all low points to allow the whole circuit to be drained.
- Install stop valves, close to the entering and leaving water connections.
- Use flexible connections to reduce the transmission of vibrations.
- Insulate all pipework, after testing for leaks, both to reduce heat gains and to prevent condensation.
- Cover the insulation with a vapour barrier.
- Where there are particles in the fluid that could foul the exchangers, a screen filter should be installed upstream of the pump or directly at the exchanger inlet if the pump is more than 20m away. The mesh size of the filter must be 1.2 mm (see 'Typical water circuit diagram').
- Before the system start-up verify that the water circuits are connected to the appropriate heat exchangers (e.g. no reversal between evaporator and condenser).
- Do not introduce any significant static or dynamic pressure into the heat exchange circuit (with regard to the design operating pressures).
- Before any start-up verify that the heat exchange fluid is compatible with the materials and the water circuit coating.
- The use of different metals on hydraulic piping could generate eletrolytic pairs and consequently corrosion. Verify then, the need to install sacrificial anodes.

If additives or other fluids than those recommended by CIAT are used, ensure that the fluids are not considered as a gas, and that they belong to class 2, as defined in directive 2014/68/UE.

Manufacturer's recommendations concerning heat-transfer fluids:

- No NH^{4+} ammonium ions in the water, they are very detrimental for copper. This is one of the most important factors for the operating life of copper piping. A content of several tenths of mg/l will badly corrode the copper over time.
- Cl^- Chloride ions are detrimental for copper with a risk of perforations by corrosion by puncture. If possible keep below 125 mg/l.
- SO_4^{2-} sulphate ions can cause perforating corrosion, if their content is above 30 mg/l.
- No fluoride ions (<0.1 mg/l)
- No Fe^{2+} and Fe^{3+} ions with non negligible levels of dissolved oxygen must be present. Dissolved iron < 5 mg/l with dissolved oxygen < 5 mg/l.
- Dissolved silica: silica is an acid element of water and can also lead to corrosion risks. Content < 1 mg/l.
- Water hardness: > 0.5 mmol/l. Values between 1 and 2.5 can be recommended. This will facilitate scale deposit that can limit corrosion of copper. Values that are too high can cause piping blockage over time. A total alkalimetric titre (TAC) below 100 is desirable.
- 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.
- Electric conductivity 10-600 µS/cm
- pH: Ideal case pH neutral at 20-25 °C 7.5 < pH < 9.

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.

The water circuit charge must be filled, topped up and drained by qualified personnel, using air purge equipment and systems that are suitable for the products.

Charging and removing heat exchange fluids should be done with devices that must be included on the water circuit by the installer. Never use the unit heat exchangers to add heat exchange fluid.

7.2 - Victaulic water connections

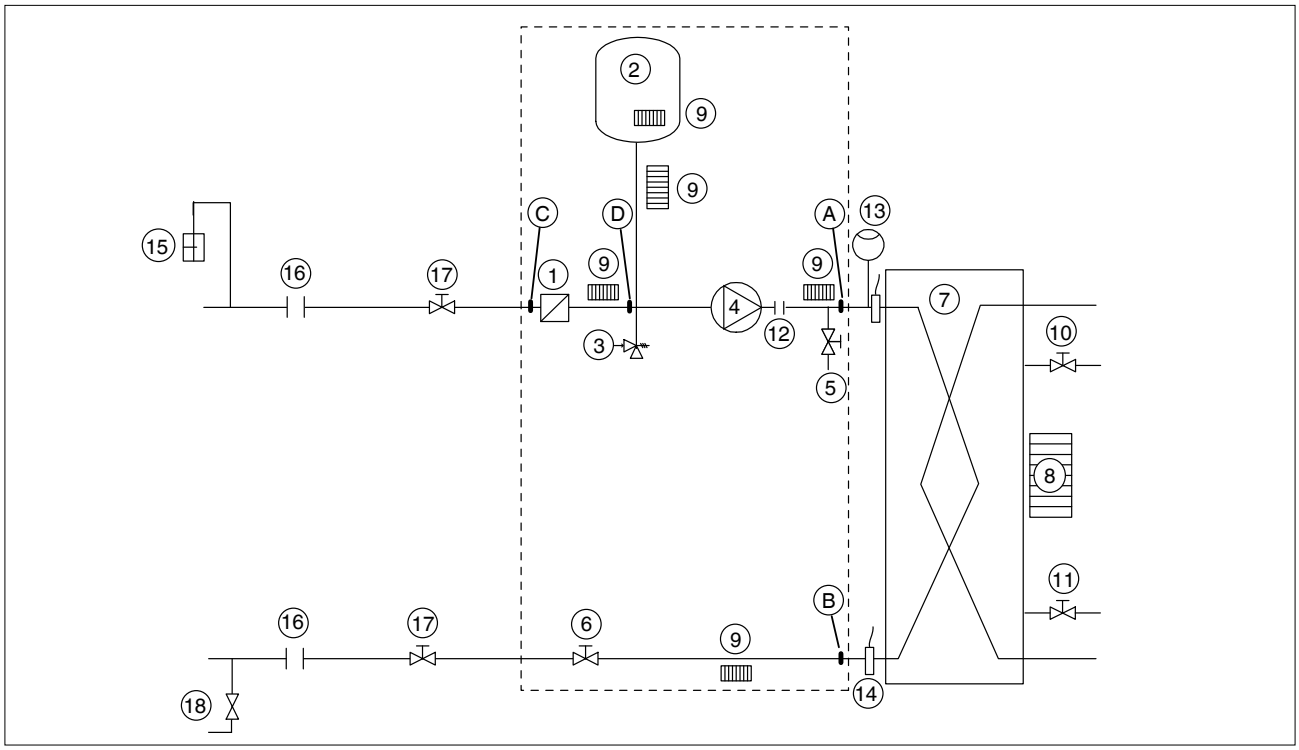
Inlet/outlet diameters without hydraulic module

LX		0808	0908	1008	1108	1358	1528	1858	2008	2158	2308
Standard & brine temperature down to -3°C option											
Nominal diameter	in	5	5	5	5	5	5	5	6	6	6
Actual outside diameter	mm	141,3	141,3	141,3	141,3	141,3	141,3	141,3	168,3	168,3	168,3
Medium and low temperature and one pass more options											
Nominal diameter	in	4	4	4	4	4	4	5	5	5	5
Actual outside diameter	mm	114,3	114,3	114,3	114,3	114,3	114,3	141,3	141,3	141,3	141,3
1 pass less evaporator options											
Nominal diameter	in	5	5	5	5	5	5	6	6	6	6
Actual outside diameter	mm	141,3	141,3	141,3	141,3	141,3	141,3	168,3	168,3	168,3	168,3

LX		2528	2628	3028	3428	3828	4008	4408	4608
Standard & brine temperature down to -3°C option									
Nominal diameter	in	6	6	8	6	6	6	6	6
Actual outside diameter	mm	168,3	168,3	219,1	168,3	168,3	168,3	168,3	168,3
Medium and low temperature and one pass more options									
Nominal diameter	in	5	5	6	6	6	6	6	6
Actual outside diameter	mm	141,3	141,3	168,3	168,3	168,3	168,3	168,3	168,3
1 pass less evaporator options									
Nominal diameter	in	6	6	8	-	-	-	-	-
Actual outside diameter	mm	168,3	168,3	219,1	-	-	-	-	-

* The evaporator with one pass less option is not available for sizes 3428 to 4608

Typical water circuit diagram



Key

Components of the unit and hydraulic module

A	Pressure sensor (A-B = ΔP evaporator)	6	Flow control valve	**Installation components**	
B	Pressure sensor	7	Evaporator	15	Air vent
C	Pressure sensor (C-D = ΔP water filter)	8	Evaporator antifreeze heater (optional)	16	Flexible connection
D	Pressure sensor	9	Hydraulic module defrost heater (option)	17	Shut-off valve
1	Victaulic screen filter	10	Air vent (evaporator)	18	Charge valve
2	Expansion tank	11	Water drain (evaporator)	---	Hydraulic module (supplied as an option)
3	Relief valve	12	Expansion compensator (flexible connections)		
4	Available pressure pump	13	Flow switch		
5	Drain valve	14	Water temperature sensor		

7.3 - Flow control

Evaporator flow switch and chilled water pump interlock

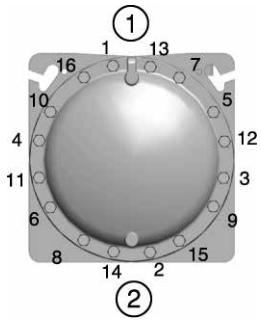
IMPORTANT: On LX ST/HE/XE units, the water flow switch must be powered up. Failure to follow this instruction will invalidate the CIAT warranty.

The water flow switch is installed on the evaporator water inlet and adjusted by the control, based on unit size and application. If adjustment is necessary, it must be carried out by qualified personnel trained by CIAT Service.

7.4 - Tightening the evaporator water box bolts

The evaporator (and condenser) are of the shell and tube type with removable water boxes to facilitate cleaning. Re-tightening or tightening must be done in accordance with the illustration below.

Water box tightening sequence



Key:

1	Sequence 1: 1, 2, 3, 4 Sequence 2: 5, 6, 7, 8 Sequence 3: 9, 10, 11, 12 Sequence 4: 13, 14, 15, 16	2	Tightening torque Bolt size M16 - 171 - 210 Nm

NOTE: Before this operation we recommend draining the circuit and disconnecting the pipes to be sure that the bolts are correctly and uniformly tightened.

7.5 - Frost protection

7.5.1 - Standard machine

If the chiller or the water piping is in an area where the ambient temperature can fall below 0 °C it is recommended to add an antifreeze solution to protect the unit and the water piping to a temperature of 10 K below the lowest temperature likely to be reached at the installation site. Use only antifreeze solutions, approved for heat exchanger duty. If the system is not protected by an antifreeze solution and will not be used during the freezing weather conditions, draining of the cooler and outdoor piping is mandatory. Damage due to freezing is not covered by the warranty.

IMPORTANT: Depending on the climatic conditions in your area you must:

- **Add ethylene glycol with an adequate concentration to protect the installation up to a temperature of 10 K below the lowest temperature likely to occur at the installation site.**
- **If the unit is not used for an extended period, it is recommended to drain it, and as a safety precaution add ethylene glycol to the heat exchanger, using the water entering purge valve connection (a purge connection is available somewhere on the heat exchanger water box in case the machine is not perfectly level).**
- **At the start of the next season, refill the unit with water and add an inhibitor.**
- **For the installation of auxiliary equipment, the installer must comply with basic regulations, especially for minimum and maximum flow rates, which must be between the values listed in the operating limit table (application data).**

7.5.2 - Optional evaporator frost protection

In cases where it is not possible to apply the recommendations in paragraph 7.5.1, the units can be equipped with heaters to protect the evaporator against freezing (option).

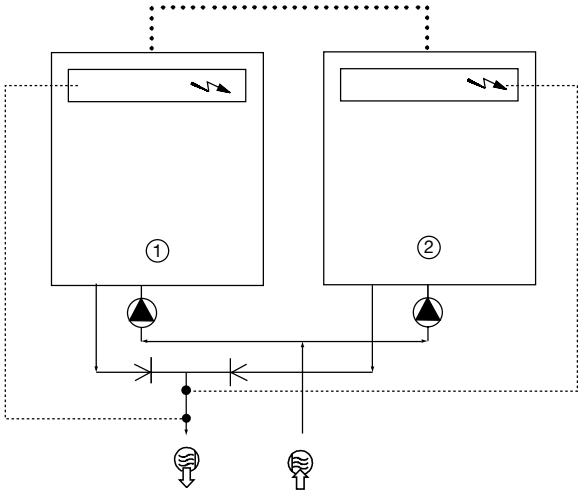
7.6 - Operation of two units in master/slave mode (option)

The control of a master/slave assembly is in the entering water and does not require any additional sensors (standard configuration). It can also be located in the leaving water. In this case two additional sensors must be added on the common piping.

All parameters, required for the master/slave function must be configured using the Service Configuration menu. All remote controls of the master/slave assembly (start/stop, set point, load shedding etc.) are controlled by the unit configured as master and must only be applied to the master unit.

Each unit controls its own water pump. If there is only one common pump, in cases with variable flow, isolation valves must be installed on each unit. They will be activated at the opening and closing by the control of each heat pump (in this case the valves are controlled using the dedicated water pump outputs). Refer to the optional POWERCIAT Connect'Touch control manual for a more detailed explanation.

LX with configuration: water outlet control



Key

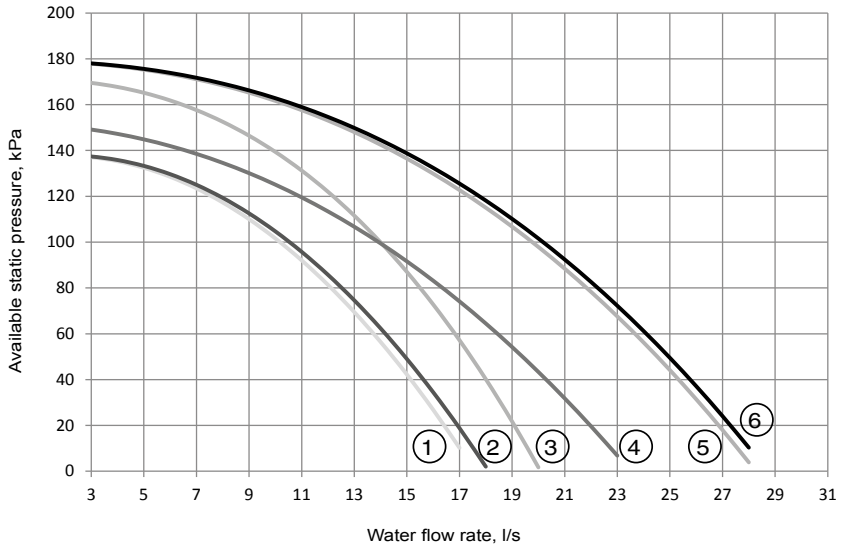
1. Master unit
2. Slave unit
- Control boxes of the master and slave units
- Water inlet
- Water outlet
- Water pumps for each unit (included as standard for units with hydraulic module)
- Additional sensors for leaving water control, to be connected to channel 1 of the slave boards of each master and slave unit
- CCN communication bus
- Connection of two additional sensors

7.7 - Pump specifications

7.7.1 - Available external static pressure (hydraulic module option)

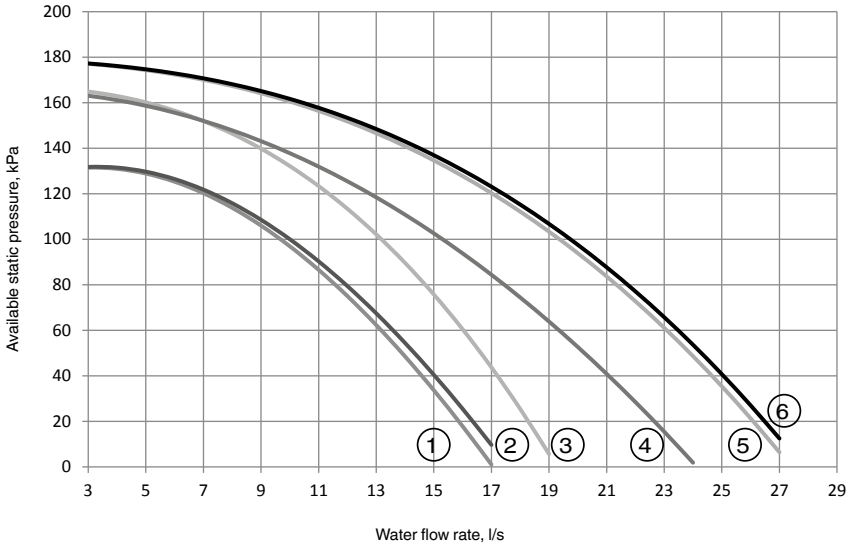
Data applicable for:
- Fresh water 20 °C
- In case of use of the glycol, the maximum water flow is reduced.
- When the glycol is used, it's limited to 40%.

Single pump low pressure



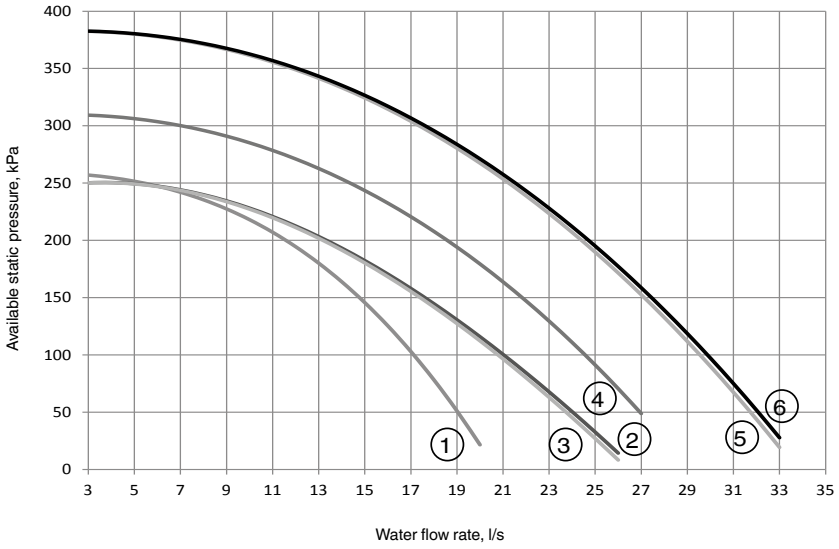
1. LX 0808
2. LX 0908
3. LX 1008
4. LX 1108
5. LX 1358
6. LX 11528

Dual pump low pressure



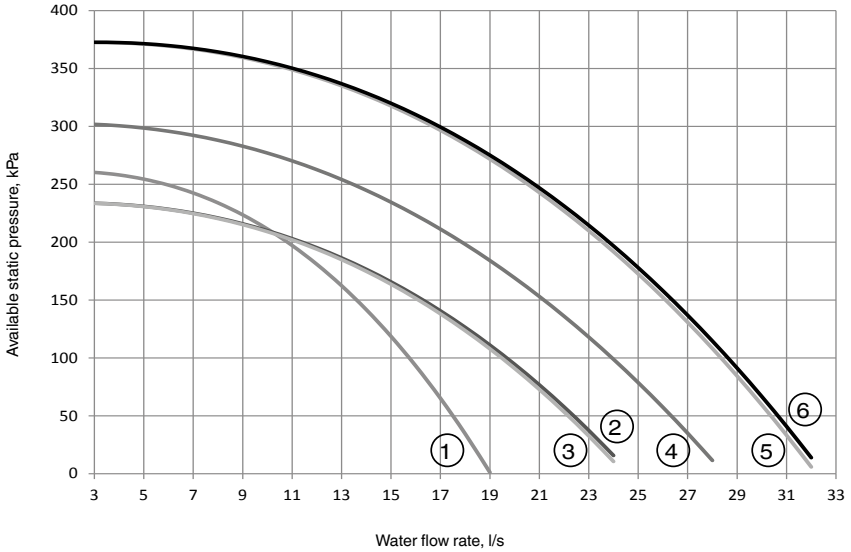
① LX 0808
② LX 0908
③ LX 1008
④ LX 1108
⑤ LX 1358
⑥ LX 1528

Single pump high pressure



① LX 0808
② LX 0908
③ LX 1008
④ LX 1108
⑤ LX 1358
⑥ LX 11528

Dual pump high pressure



① LX 0808
② LX 0908
③ LX 1008
④ LX 1108
⑤ LX 1358
⑥ LX 1528

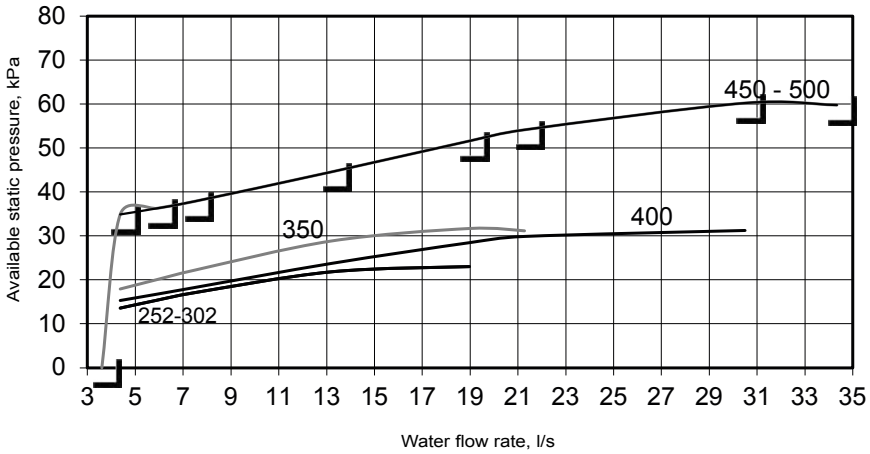
7.7.2 - Net positive suction head (NPSH) required, hydraulic module option

Size the hydraulic circuit to ensure a net positive suction head that is higher than or equal to the required NPSH + 50 kPa.

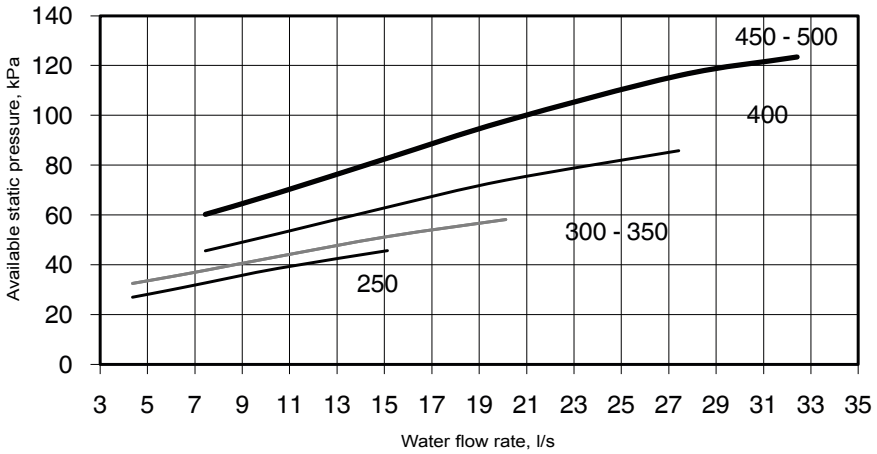
Data applicable for:

- Fresh water 20 °C
- In case of use of the glycol, the maximum water flow is reduced.
- When the glycol is used, it's limited to 40%.

Low pressure pumps



High pressure pumps



8 - HEAT RECOVERY CONDENSER OPTION

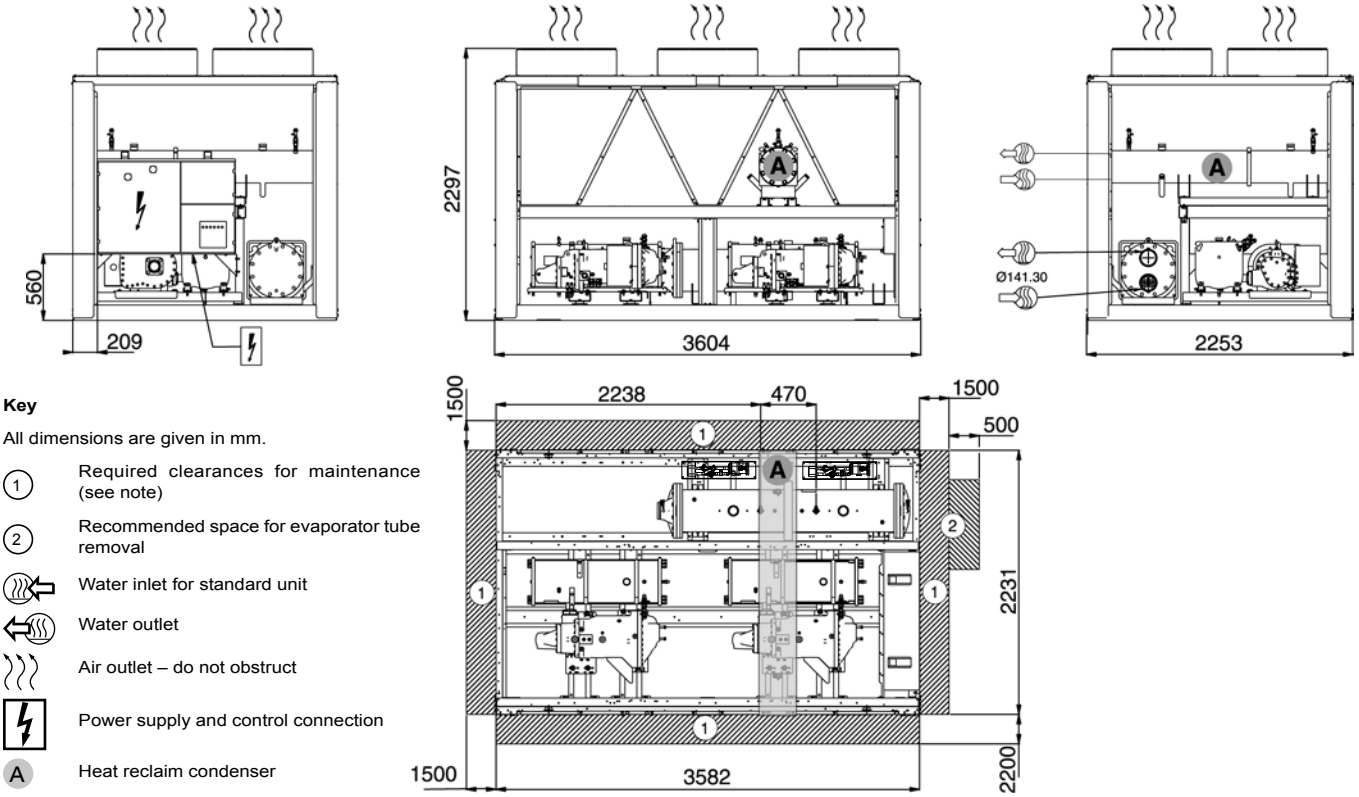
8.1 - Physical properties, LX units with heat recovery condenser option

LX ST/HE/XE heat reclaim mode		0808	0908	1008	1108	1358	1528	1858	2008	2158	2308	2528	2628	3028
Operating weight(1)	kg	3370	3404	3425	4102	4245	4601	5551	5782	6065	6382	6430	6805	7272
Condenser diameter	inches	10	10	10	12	14	14	12+12	12+12	14+12	14+12	14+12	14+14	14+14
Refrigerant charge														
Circuit A	kg	37	35	35	51	52	59	58	58	65	69	72	69	91
Circuit B	kg	39	37	37	37	37	36	59	62	58	65	63	76	89
Heat reclaim condenser		Flooded multi-pipe condenser												
Water volume	l	38	38	38	55	68	68	55+55	55+55	68+55	68+55	68+55	68+68	68+68
Water connections		Type Victaulic												
Nominal diameter	inches	3	3	3	4	4	4	4	4	4	4	4	4	4
Actual outside diameter	mm	88,9	88,9	88,9	114,3	114,3	114,3	114,3	114,3	114,3	114,3	114,3	114,3	114,3

(1) Weights are for guidance only

8.2 - Dimensions and clearances

8.2.1 - LX 0808 to 1008 - heat recovery option



Key

All dimensions are given in mm.

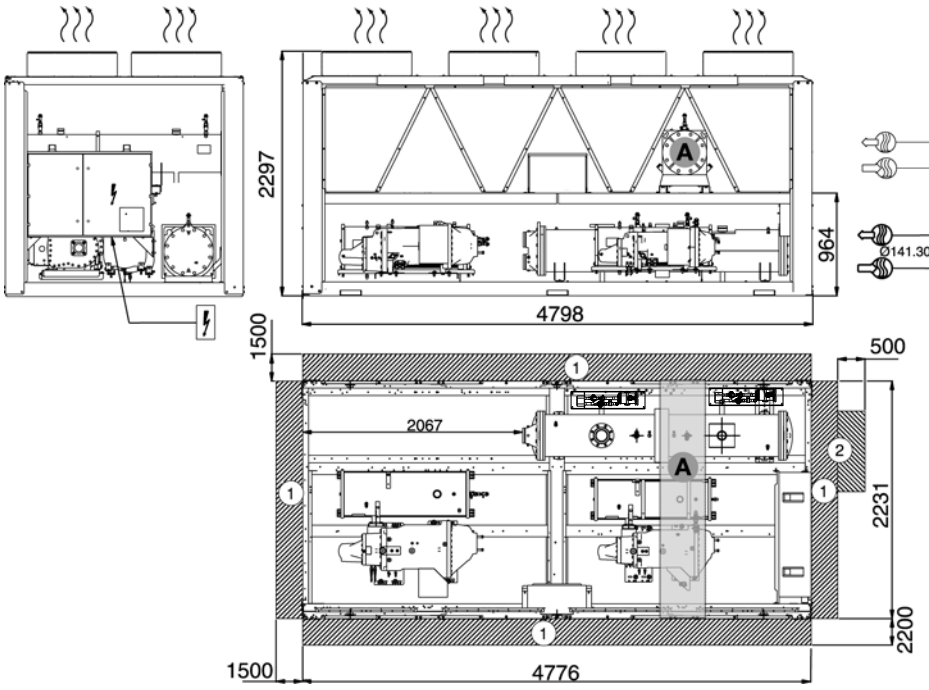
- (1) Required clearances for maintenance (see note)
- (2) Recommended space for evaporator tube removal
- Water inlet for standard unit
- Water outlet
- Air outlet – do not obstruct
- Power supply and control connection
- A Heat reclaim condenser

The condenser connection sleeves are not installed, but supplied with the unit. The sealing gaskets are in the electrics box. The temperature sensors and the condenser flow switch are wired and fixed in the machine. They must be installed as described in the chapter "Condenser water connections".

NOTES:

- **Drawings are not contractually binding.**
- **Before designing an installation, consult the certified dimensional drawings, available on request.**
- **For the positioning of the fixing points, weight distribution and centre of gravity coordinates please refer to the dimensional drawings.**
- **If the installation includes several units or if this (these) is (are) close to walls, please refer to chapters 3.11 "Multiple chiller installation" and 3.12 - "Distance to the wall" of this document to determine the space required.**

8.2.2 - LX 1108 to 1358 - heat recovery option



Key

All dimensions are given in mm.

1. Required clearances for maintenance (see note)
2. Recommended space for evaporator tube removal

Water inlet for standard unit
For the evaporator with one pass more, one pass less, or inverted options, refer to the certified dimensional drawing.

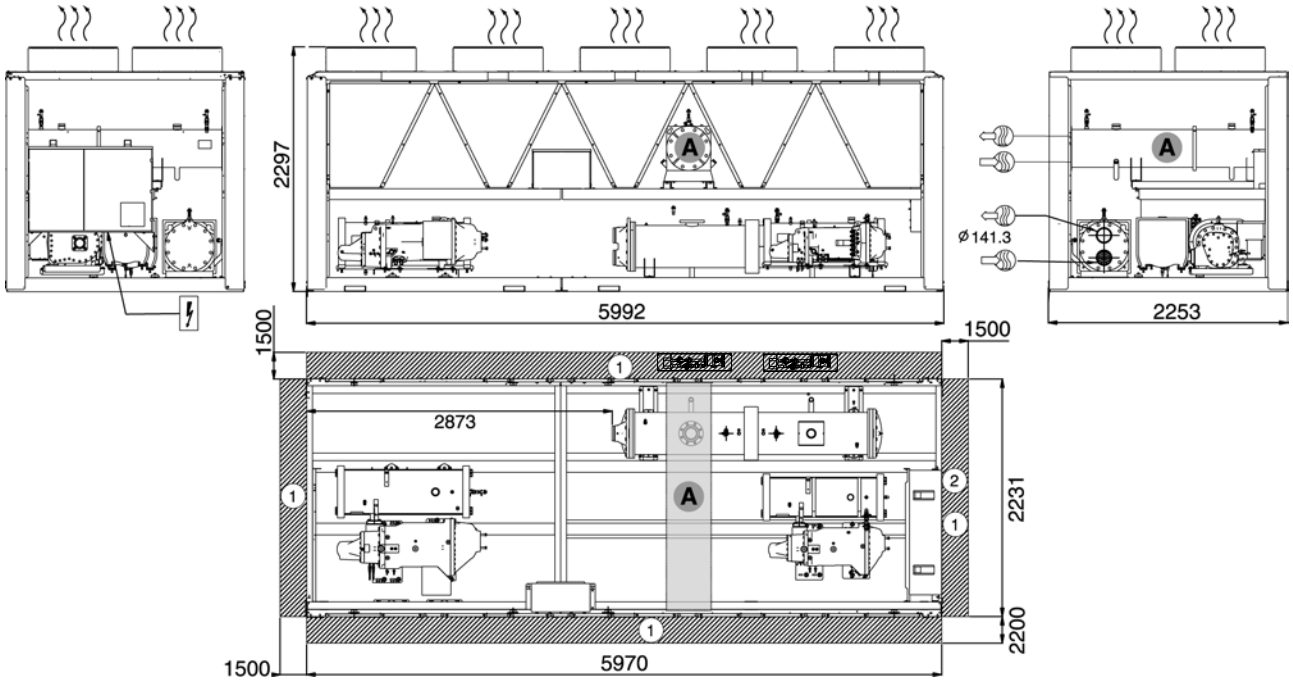
Water outlet
For the evaporator with one pass more, one pass less, or inverted options, refer to the certified dimensional drawing.

Air outlet – do not obstruct

Power supply and control connection

A Heat reclaim condenser

8.2.3 - LX 1528 - heat recovery option

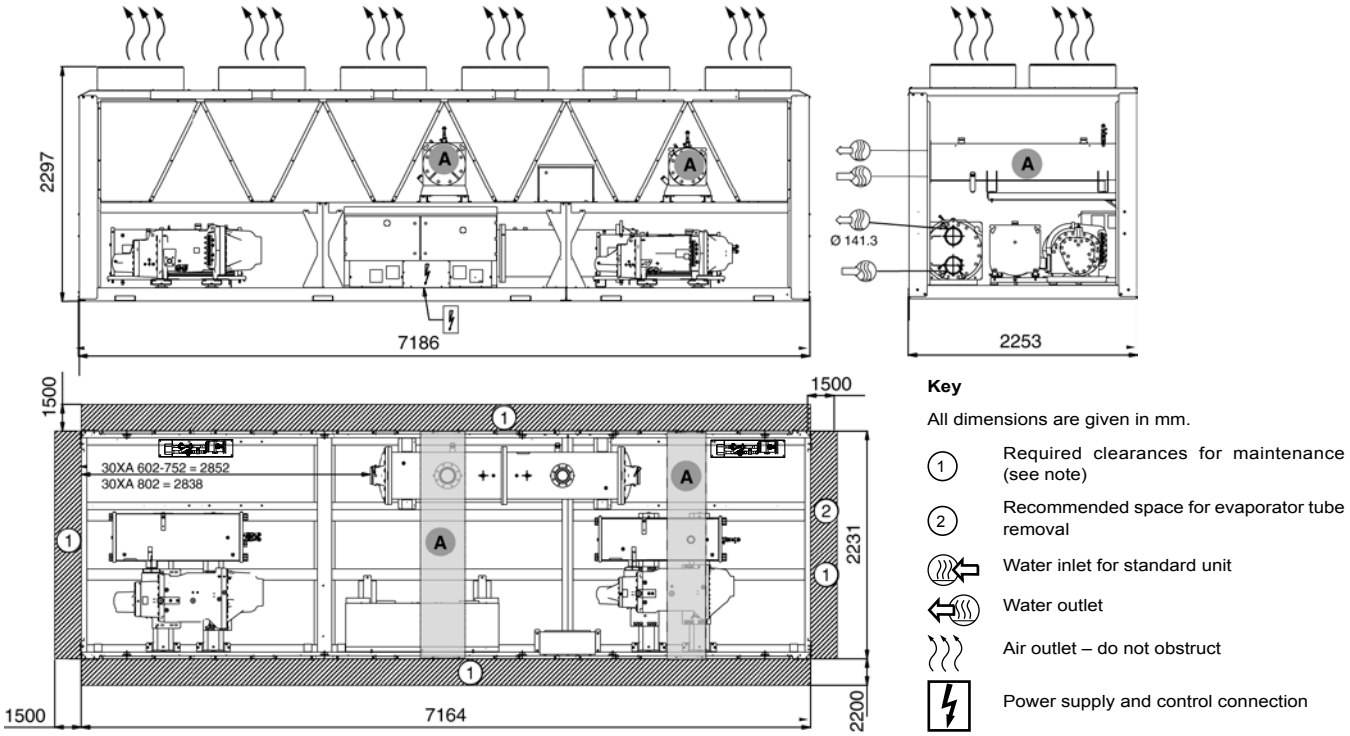


The condenser connection sleeves are not installed, but supplied with the unit. The sealing gaskets are in the electrics box. The temperature sensors and the condenser flow switch are wired and fixed in the machine. They must be installed as described in the chapter "Condenser water connections".

NOTES:

- **Drawings are not contractually binding.**
- **Before designing an installation, consult the certified dimensional drawings, available on request.**
- **For the positioning of the fixing points, weight distribution and centre of gravity coordinates please refer to the dimensional drawings.**
- **If the installation includes several units or if this (these) is (are) close to walls, please refer to chapters 3.11 "Multiple chiller installation" and 3.12 - "Distance to the wall" of this document to determine the space required.**

8.2.4 - LX 1858 to 2308 - heat recovery option

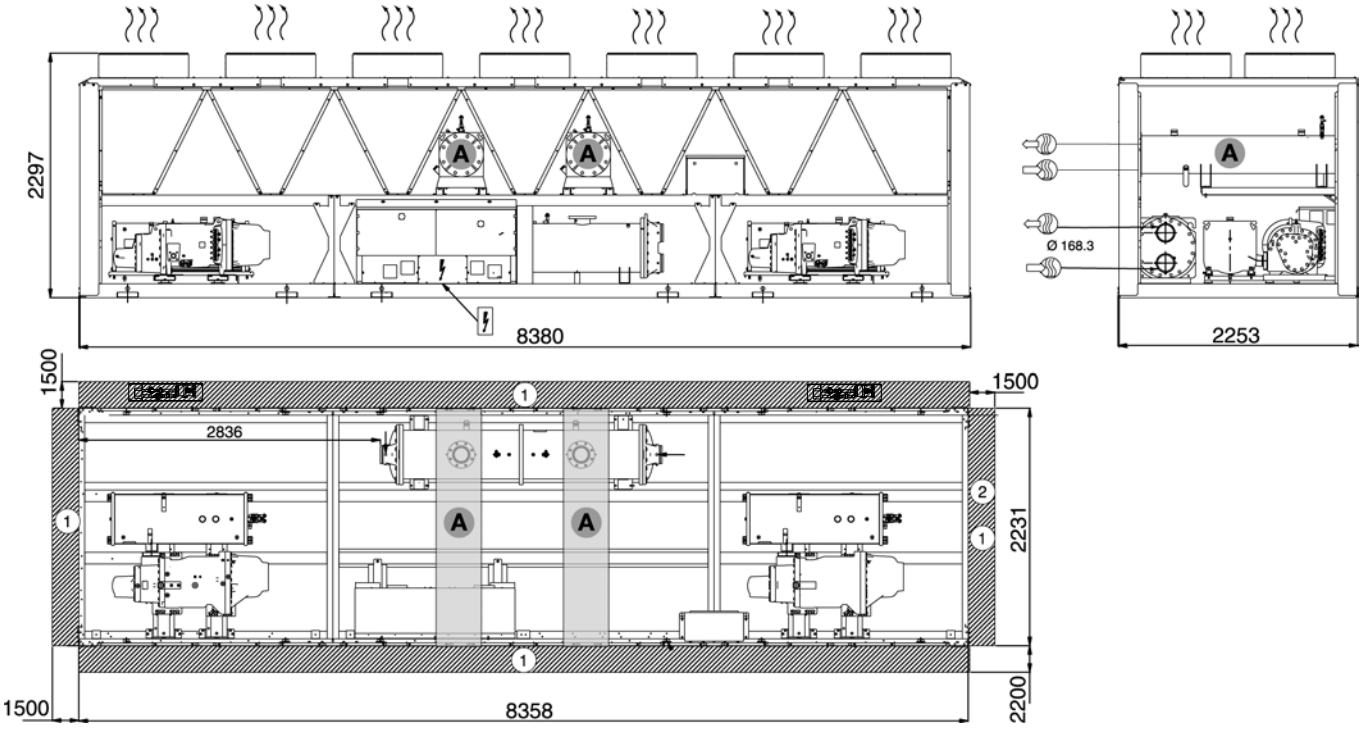


Key

All dimensions are given in mm.

- (1) Required clearances for maintenance (see note)
- (2) Recommended space for evaporator tube removal
- Water inlet for standard unit
- Water outlet
- Air outlet – do not obstruct
- Power supply and control connection
- (A) Heat reclaim condenser

8.2.5 - LX 2528 to 2628 - heat recovery option

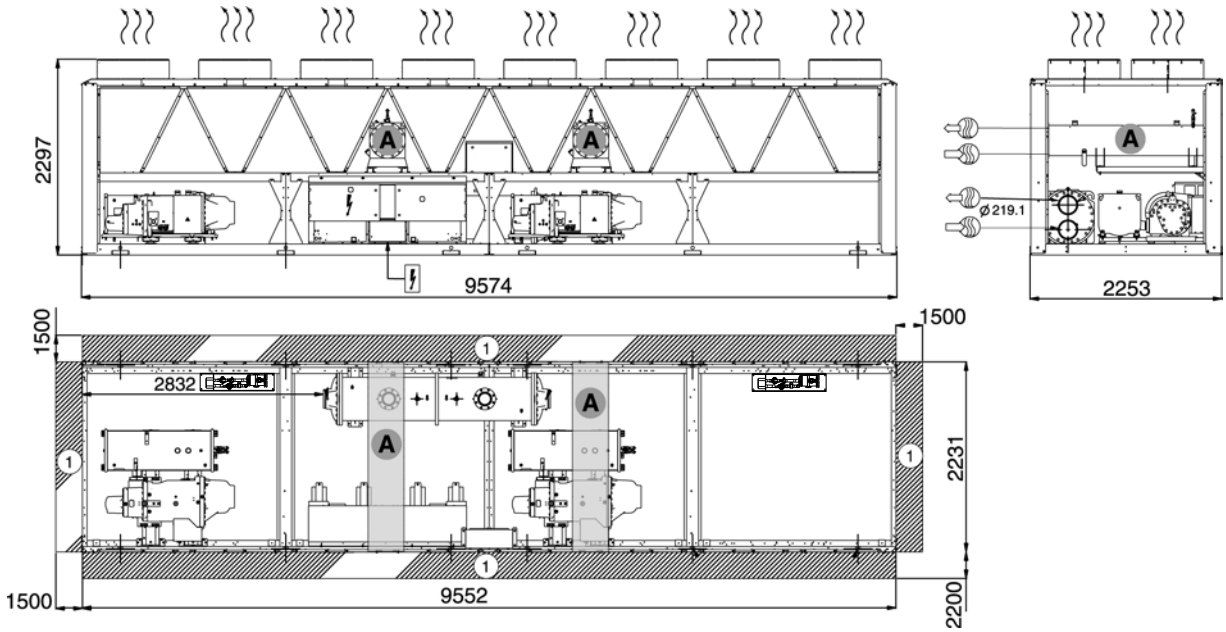


The condenser connection sleeves are not installed, but supplied with the unit. The sealing gaskets are in the electrics box. The temperature sensors and the condenser flow switch are wired and fixed in the machine. They must be installed as described in the chapter "Condenser water connections".

NOTES:

- **Drawings are not contractually binding.**
- **Before designing an installation, consult the certified dimensional drawings, available on request.**
- **For the positioning of the fixing points, weight distribution and centre of gravity coordinates please refer to the dimensional drawings.**
- **If the installation includes several units or if this (these) is (are) close to walls, please refer to chapters 3.11 "Multiple chiller installation" and 3.12 "Distance to the wall" of this document to determine the space required.**

8.2.6 - LX 3028 - heat recovery option



Key

All dimensions are given in mm.

①	Required clearances for maintenance (see note)
②	Recommended space for evaporator tube removal
	Water inlet for standard unit
	Water outlet
	Air outlet – do not obstruct
	Power supply and control connection
A	Heat reclaim condenser

The condenser connection sleeves are not installed, but supplied with the unit. The sealing gaskets are in the electrics box. The temperature sensors and the condenser flow switch are wired and fixed in the machine. They must be installed as described in the chapter "Condenser water connections".

NOTES:

- **Drawings are not contractually binding.**
- **Before designing an installation, consult the certified dimensional drawings, available on request.**
- **For the positioning of the fixing points, weight distribution and centre of gravity coordinates please refer to the dimensional drawings.**
- **If the installation includes several units or if this (these) is (are) close to walls, please refer to chapters 3.11 "Multiple chiller installation" and 3.12 "Distance to the wall" of this document to determine the space required.**

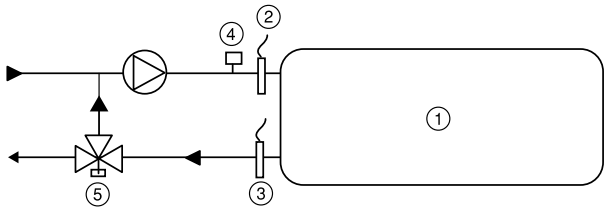
8.3 - Condenser location

All heat reclaim condensers are located between the air-cooled condensers on the upper part of the chassis, supported by two cross rails. The water inlet and outlet are on the same side.

8.4 - Condenser water connections

8.4.1 - Unit with one heat recovery condenser, LX 0808 to 1528

The water flow switch must be installed at the water inlet of the installation that arrives at the heat reclaim condenser.

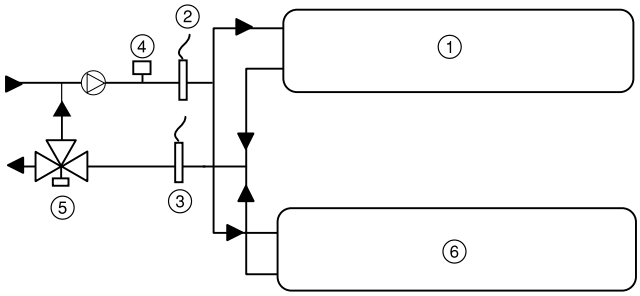


Key
1 Heat reclaim condenser
2 Entering water temperature sensor (supplied)
3 Leaving water temperature sensor (supplied)
4 Condenser water flow switch (supplied)
5 Three-way valve (not supplied)

8.4.2 - Unit with two heat recovery condensers, LX 1858 to 3028

The two condensers must be installed in parallel in the water system of the installation. The water flow switch and the entering/leaving water temperature sensors must be installed in the line that is common to both heat reclaim circuits and as close as possible to the condensers. A T-piece must be provided by the installer at the water inlet and outlet of the condensers.

For units with two condensers the maximum cable length of the temperature sensors and the flow switch (7.5 m) is designed to allow connection to the common inlet or outlet in a radius of 4.5 m after routing along the width of the unit.



Key
Please refer to the legend in chapter 9.4.1 opposite, noting that items 2, 3 and 4 - flow switch and sensors - are placed on the common sections.

8.4.3 - Three-way valves

It is strongly recommended to install a three-way valve in the system (not supplied with the unit). A 0-10 V output is available on the unit electronic board to control this valve. The valve allows bypassing of the heat reclaim condenser entering/leaving circuit to ensure unit operation with heat reclaim at low entering water temperature (< 12.5 °C). It also ensures an optimal and controlled leaving water temperature.

8.5 - Operating limits for stable operation (no mode changeover)

8.5.1 - Cooling mode only

Please refer to the earlier chapters in this manual:

6.1 - Unit operating range

6.7 - Evaporator water flow rate

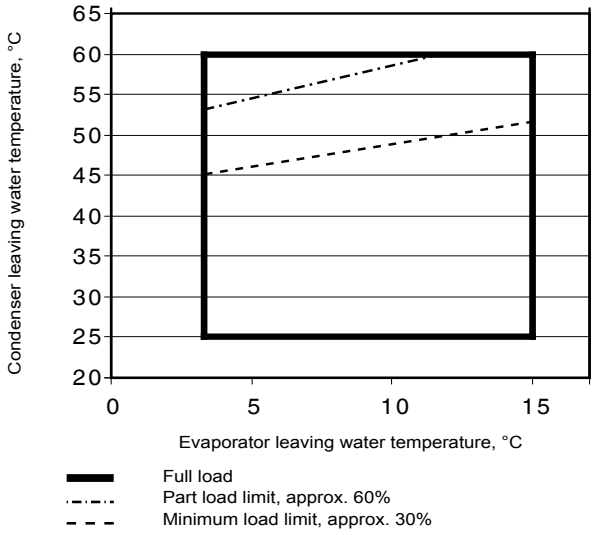
8.5.2 - Heat recovery mode

Condenser water temperature °C	Minimum	Maximum
Water entering temperature at start-up	12.5*	55
Water entering temperature during operation	20	55
Water leaving temperature during operation	25	60
Evaporator water temperature °C	**Minimum**	**Maximum**
Water entering temperature at start-up	-	45
Water entering temperature during operation	6.8	21
Water leaving temperature during operation	3.3	15

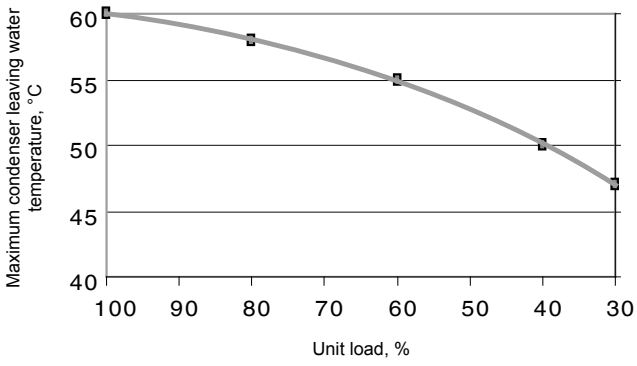
* The water entering temperature at start-up must not be lower than 12.5 °C. For installations with a lower temperature a three-way valve must be used.

NOTE: If the temperature at the evaporator is below 4 °C, a glycol/water solution or the frost protection option must be used.

In part-load operation, the limitation of the condenser leaving water temperature is due to the operating range of the screw compressor. If the condenser leaving water temperature is above the limit value given in the curves below, the unit will automatically change over to the mode without heat recovery:



Part load operating limits (evaporator water outlet temperature = 7 °C)



8.6 - Operating ranges for changeover between modes

From cooling only to heat reclaim and vice versa.

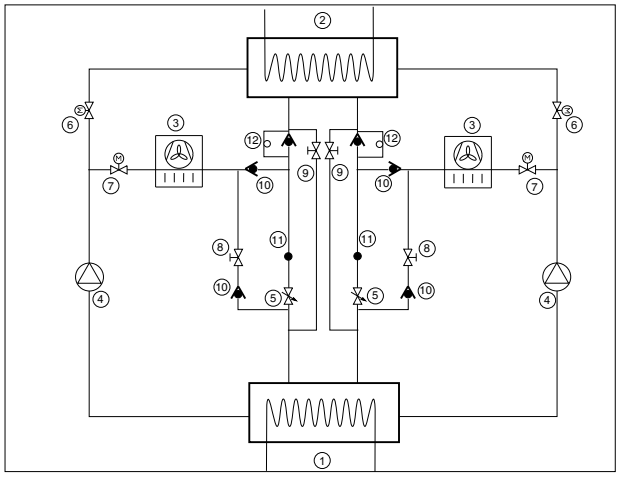
Heat reclaim condenser water temperature		
°C	Minimum	Maximum
Water entering temperature	12.5	57.5
Ambient operating temperature	-10*	45

* -20 °C with winter operation option

8.7 - Flow control

The water flow switch supplied needs to be installed at the heat reclaim condenser water inlet and protects the condenser loop against low water flow conditions. When the heat reclaim mode is required, a signal from the additional board output activates the system pump. Once the pump is started, flow detection takes place for one minute. If no flow is detected by the end of this time:

1. Changeover to the heat reclaim mode is not permitted
2. Mode is changed to cooling only mode when the water flow rate is low, accompanied by a water flow detection alarm.



Key
1 Evaporator
2 Heat reclaim condenser
3 Air condenser (coils)
4 Compressor
5 Expansion device (EXV)
6 Motorised valve - heat reclaim mode
7 Motorised valve - cooling only mode
8 Solenoid valve - charge recovery in heat reclaim mode
9 Solenoid valve - charge recovery in cooling only mode
10 Check valve
11 Pressure and temperature measurement to calculate the liquid sub-cooling to optimise the charge recovery
12 Check valve with capillary

8.8 - Heat recovery operation

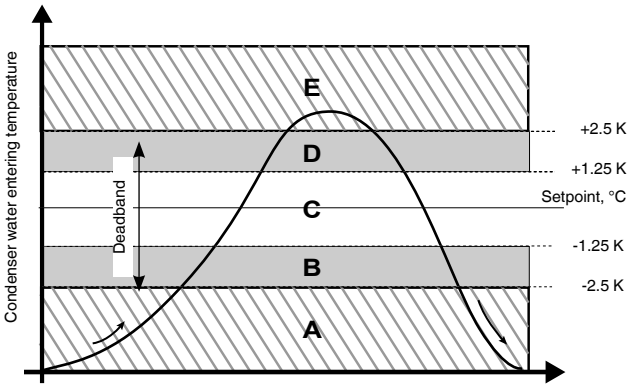
The heat reclaim condenser option is only available on units with two circuits. It has been designed with one or two single or two-circuit shell-and-tube heat exchangers, depending on the unit size.

The two circuits are independently controlled. One circuit can be in cooling only and the other in heat reclaim mode.

Changeover from one mode to the other (changeover from heat exchange at the air condenser to heat exchange at the water condenser and vice versa) is ensured by motorised two-way valves located upstream of the air and water condensers.

ATTENTION: Mode changes may lead to higher sound levels than the levels at stable operation.

Depending on the mode selected (heat reclaim or cooling), the logic compares the water entering temperature required with the setpoint. Depending on this difference the unit circuits are either activated or deactivated in heat reclaim mode (one or two together), as shown in the following diagram and table.



The deadband of 5 K is controlled by default.

Case	Selection of the heat reclaim mode	Number of circuits in heat reclaim mode	Action
-	NO	0	+ 2 circuits in cooling mode
A	YES	Whatever the number	+ 2 circuits in heat reclaim mode
B	YES	0	+ 1 circuit in heat reclaim mode
		1	No change
		2	No change
C	YES	Whatever the number	No change
D	YES	1	No change
		2	- 1 circuit in heat reclaim mode
E	YES	Whatever the number	- 2 circuits in heat reclaim mode

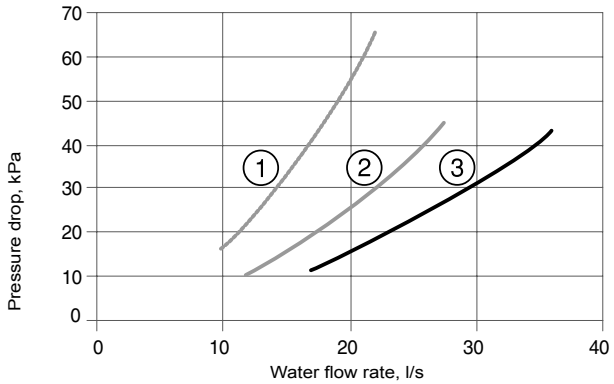
For more details on the heat reclaim mode operating logic, please refer to the POWERCIAT Connect'Touch control manual, chapter 6.15 "Optional heat reclaim module".

8 - HEAT RECLAIM CONDENSER OPTION

8.9 - Selecting the condenser pump

Heat reclaim condenser water flow rate/pressure drop

Heat reclaim condenser pressure drop in water flow rate function



1 Condenser 10" (water volume = 38 litres)
2 Condenser 12" (water volume = 55 litres)
3 Condenser 14" (water volume = 68 litres)

For units with a water-cooled condenser, please refer to chapter 9.1 "Technical data, LX units with heat reclaim condenser option".

8.10 - Frost protection

The heat reclaim condenser is equipped with electric heaters to protect the condenser against frost. These are activated if the condenser entering and leaving water temperatures are below 3 °C and deactivated, if they are higher than 4.3 °C.

9 - FANS WITH AVAILABLE PRESSURE

If this option has been selected, the fans with available pressure are equipped with discharge connection flanges to facilitate the duct connection.

Note: For LX ST units, each fan must be connected individually.

10 - OPERATION WITH A FREE COOLING DRYCOOLER

10.1 - Unit operation option with a free cooling drycooler

10.1.1 - Operating principle

The units have been designed to optimise the operation of the systems by using drycoolers as a

free cooling system (this process uses the low temperature of outdoor air to cool the air conditioning system water).

This system allows substantial energy and cost savings, which is the most effective when the outdoor air temperature is low.

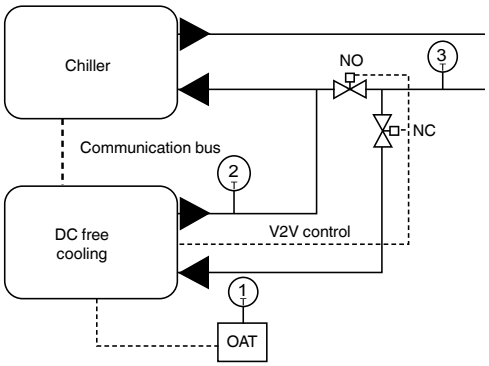
The TouchPilot control of the unit includes algorithms to permit constant automatic optimization of:

- the operation of the drycooler fans,
- the flow rate variation in the water loop,
- the cooling capacity (the drycooler and chiller can operate independently or simultaneously),
- the positions of the valves depending on the operating mode

The control defines the optimal configuration considering water set point value, outdoor air temperature and water loop temperature (the control will give priority to the drycooler).

Parallel control of the fans and of the variable flow rate in the water loop enable the system to operate in outdoor temperatures of down to -20 °C without any additional control

Both the drycooler and the chiller must be equipped with the option Free Cooling Management option.



For an optimal free cooling operation, the chiller has to be configured:

- during regulation of the water inlet temperature,
- during regulation of the delta temperature, with the variable-speed pump option.

10.1.2 - Communication to control the drycooler

When the option is selected, a specific electronic board is integrated in the control box of the drycooler. A communication LEN bus connected between the drycooler (board AUX1) and the chiller is needed for the overall system control.

This cable should be a 3 points Wago type (5 mm spacing or equivalent) and should be shielded.

The board integrated in the control box of the drycooler has analogue inputs for outside air temperature and drycooler leaving water temperature sensors, as well as digital outputs permitting the control of the fans.

The option works as a system split in two parts:

The chiller (with free cooling option)

- Dedicated control algorithms with LEN connector to communicate and control the drycooler

The drycooler (with free cooling option):

- AUX board with the I/O
- OAT sensor to be place in outdoor zone.
- Dry Cooler Leaving Water Temperature (factory mounted)
- Water loop Temperature (to be mounted on the common pipe before valve)
- Control & 230V power supply for 2 two ways valve or one three ways valve

The temperature difference between dry-cooler OAT and water loop sensor defines if free cooling mode can be activated.

10.1.3 - Configuration to control the fans

To set the configuration corresponding to the drycooler installed (number of fans, control type – fixed or variable speed), please refer to the instructions in the TouchPilot control IOM. Following these parameters, the TouchPilot control will activate the adequate number of digital outputs to control the fans.

TouchPilot controls the automatic switching of all fans, based on operating time and number of start-up, to ensure a long operating life of fan motors.

Compatible fans configuration:

- 1 to 20 fans,
- fixed speed or variable speed,
- 1 or 2 rows of fans.

Refer to the drycooler electrical diagram to see the fan stages arrangement.

10.1.4 - Valves on the water loop

The free cooling system requires 2 two-way valves (one Normally Opened, one Normally Closed) or a three-way valve, not supplied with the unit or the dry cooler.

A two-way valves kit is available in the list of drycooler accessories.

The drycooler electrics box includes a 230 V power supply for 2 two-way valves.

Recommended motor valve (per default): 230V 3 points

Refer to the wiring diagram for the drycooler for wiring the valves on the customer terminal strip.

10.1.5 - Recommendations for system installation

For physical properties, dimensions, performances: refer to the drycooler documentation.

For electrical connections, refer to the wiring diagram provided with the drycooler.

For software configuration information, refer to the control documentation of the chiller.

For correct installation of the drycooler, follow the professional guidelines for the following topics:

- sizing the water piping;
- pressure drops (verify that the operating pressure of the unit pump is sufficient compared to the pipes and valves pressure drops; check for all operating modes)
- maximum height for the drycooler (in relation to the unit safety valve)
- suitable positioning of the temperature sensors: outdoor air temperature and water loop temperature.

11.1 - Direct-drive twin-screw compressor with variable capacity slide valve

- LX units use 06T geared twin-screw compressors equipped with a variable capacity slide valve for continuous control between 30% and 100% of full load.
- Nominal capacities range from 120 to 750 kW. The ten models in the LX range are equipped with an economiser.

11.1.1 - Oil filter

The 06T screw compressor has an independent oil filter attached to the oil separator. This filter is field replaceable.

11.1.2 - Refrigerant

The units in the LX range can operate with R-134a refrigerants.

11.1.3 - Lubricant

The 06T screw compressor is approved for use with the following lubricants:

- Castrol Icematic SW220 (CIAT specification PP47-32),
- Lubrizol Emkarate RL220H (CIAT specification PP47-13).

11.1.4 - Oil supply solenoid valve

An oil supply solenoid valve is installed on the oil return line as standard to isolate the compressor from oil flow when the compressor is not operating. The oil solenoid valve is field replaceable.

11.1.5 - Economiser and suction filters

To increase the reliability of the compressor, a screen has been incorporated as a standard feature into suction and economizer inlets of the compressor.

11.1.6 - Capacity control

The 06T screw compressor has an unloading system that is standard on all compressors. This unloading system consists of slide valve that permits changing the length of the screw used for the refrigerant compression. This valve is controlled by the action of a piston controlled by two solenoid valves on the oil return line.

11.2 - Pressure vessels

General information

Monitoring during operation, re-qualification, re-testing and re-testing dispensation:

- Follow the regulations on monitoring pressurised equipment.
- It is normally required that the user or operator sets up and maintains a monitoring and maintenance file.
- If there are no regulations or to complement them follow the control programmes of EN 378.
- If they exist follow local professional recommendations.
- Regularly inspect the condition of the coating (paint) to detect blistering resulting from corrosion. To do this, check a non-insulated section of the container or the rust formation at the insulation joints.
- Regularly check for possible presence of impurities (e.g. silicon grains) in the heat exchange fluids. These impurities maybe the cause of the wear or corrosion by puncture.
- Filter the heat exchange fluid check and carry out internal inspections as described in EN 378.
- In case of re-testing please refer to the maximum operating pressure given on the unit nameplate.
- The reports of periodical checks by the user or operator must be included in the supervision and maintenance file.

Repair

Any repair or modification, including the replacement of moving parts:

- Must follow local regulations and be made by qualified operators and in accordance with qualified procedures, including changing the heat exchanger tubes.
- Must be made in accordance with the instructions of the original manufacturer; repairs and modifications that necessitate permanent assembly (soldering, welding, expanding, etc.) must be made using the correct procedures and by qualified operators;
- An indication of any modification or repair must be shown in the monitoring and maintenance file.

Recycling

The unit is wholly or partly recyclable. After use it contains refrigerant vapours and oil residue. It is coated by paint.

Operating life

This unit is designed for:

- Prolonged storage of 15 years under nitrogen charge with a temperature difference of 20 K per day.
- 452000 cycles (start-ups) with a maximum difference of 6 K between two neighbouring points in the vessel, based on 6 start-ups per hour over 15 years at a usage rate of 57%.
- The service life has been used to calculate fatigue using the highest number of start-ups authorised by the system; however, this number is rarely encountered in practice over the full duration. As a consequence, conduct an inspection every 15 years to check there is no fatigue-related cracking of the steel welded assemblies on the refrigerant circuit. Assemblies with components featuring a break in their form, such as plate or tapping type collars, are the most sensitive. Use an endoscope to conduct an internal inspection wherever possible.

Corrosion allowances:

Gas side: 0 mm

Heat exchange fluid side: 1 mm for tubular plates in lightly alloyed steels, 0 mm for stainless steel plates or plates with copper-nickel or stainless steel protection.

11.2.1 - Evaporator

LX coolers use a flooded shell-and-tube evaporator. The water circulates in the tubes and the refrigerant is on the outside in the shell. One vessel is used to serve both refrigerant circuits. There is a centre tube sheet which separates the two refrigerant circuits. The tubes are 3/4" diameter copper with an enhanced surface inside and out. There is just one water circuit, and depending on the size of the chiller, there may be one, two or three water passes.

The evaporator has a thermal insulation of 19 mm thick polyurethane foam, an aluminium sheet (option) and is equipped with a water drain and purge.

The water connection of the heat exchanger is a Victaulic connection. As an option the evaporator is available with frost protection (evaporator frost protection option).

The products that may be added for thermal insulation of the containers during the water piping connection procedure must be chemically neutral in relation to the materials and coatings to which they are applied. This is also the case for the products originally supplied by CIAT.

11.2.2 - Oil separator

In these units, the oil separator is a pressure vessel that is mounted under the outside vertical condenser coils. Dis-charge gas at the compressor outlet is directed towards the bottom of the oil separator ring and most of the oil separates from the gas by strong deceleration and by gravity. The gas then flows through a wire mesh screen where the remaining oil is separated by coalescence and flows to the bottom of the ring. The gas is now free from oil and leaves the ring at the top towards the condenser.

The oil separator is equipped with a trace heater regulated by the control.

11.2.3 - Economiser function

The economiser function includes a liquid duct valve, a dehumidifier filter, two electronic expansion valves (EXV), a plate heat exchanger, and protection devices (valve).

At the condenser outlet a part of the liquid is expanded via the secondary EXV in one of the heat exchanger circuits and then returns as gas at the compressor economiser. This expansion permits increase of the liquid sub-cooling of the rest of the flow that penetrates the evaporator via the principal EXV. This permits increasing the cooling capacity of the system as well as its efficiency.

11.3 - High-pressure safety pressostat

LX units are equipped with high-pressure safety pressostats.

In accordance with the applicable code the high-pressure switches with manual reset, called PZH (former DBK), may be backed up by high-pressure switches that require resetting with a tool. The high-pressure switches that require resetting with a tool are called PZHH (former SDBK). If a PZHH cuts out, the corresponding PZH in the same compressor is faulty and must be replaced. The PZHH must be reset with a blunt tool with a diameter of less than 6 mm. Insert this tool into the opening on the pressure switch and push the reset button in this location.

These pressure switches are located at the discharge of each compressor.

11.4 - Condensers

The coils in LX units are all-aluminium micro-channel condensers.

11.5 - Fans

The fans are axial Flying Bird fans equipped with rotating shroud and made of composite recyclable material. Each motor is fixed with transverse supports. The motors are three-phase, with permanently lubricated bearings and insulation class F (level IP55).

According to the Regulation No. 327/2011 implementing Directive 2009/125/EC with regard to ecodesign requirements for fans driven by motors with an electric input power between 125 W and 500 kW.

Product		LX ST	LX ST Super/ Xtra low noise option	LX HE	LX XE
Overall efficiency	%	39,3	35,9	41	47,3
Measurement category		A	A	A	A
Efficiency category		static	static	static	static
Target effciency level ERP2015		N(2015) 40	N(2015) 40	N(2015) 40	N(2015) 40
Efficiency level at optimum efficiency point		43,9	42,4	45,7	52,2
Variable speed drive		NO	NO	YES	YES (embedded)
Year of manufacture		See label on unit	See label on unit	See label on the unit	See label on the unit
Fan manufacturer		Simonin	Simonin	Simonin	Simonin
Motor manufacturer		Leroy Somer	Leroy Somer	Leroy Somer	EBM Papst
Fan PN		00PSG000000100A	00PSG000000100A	00PSG000000100A	00PSG002630700
Motor PN		00PPG000558400A	00PPG000558500A	00PPG000558700A	00PSG002696800A
Nominal power of the motor	kW	1,85	0,83	1,84	1,68
Flow rate	m^3/s	4,28	3,12	4,15	4,24
Pressure at optimum energy efficiency	Pa	170	95	170	174,6
Nominal Speed	rpm	954	712	950	959
specifica ratio		1,002	1,002	1,002	1,002
Relevant information to facilitate the disassembly, recycling or removal of the product at the end of life		See the maintenance manual	See the maintenance manual	See the maintenance manual	See the maintenance manual
Relevant information to minimise the impact on the environment		See the maintenance manual	See the maintenance manual	See the maintenance manual	See the maintenance manual

According to the Regulation No. 640/2009 and amendment 4/2014 implementing Directive 2009/125/EC with regard to ecodesign requirements for electric motors.

Product		LX ST	LX ST 15LS & 15LS+ option	LX HE	LX XE
Motor type		Asynchronous	Asynchronous	Asynchronous	EC motor
Number of poles		6	8	6	6
Nominal input frequency	Hz	50	50	50	50/60
Nominal voltage	V	400	400	400	380/480
number of phases		3	3	3	3
Motor included in the application domain of the regulation 640/2009 and amendment 4/2014		NO	NO	NO	NO
Rationale for exemption		Article 2.1	Article 2.1	Article 2.1	Article 2.1
Ambient air temperature for which the motor is specifically designed	°C	70	70	70	70

11.6 - Electronic expansion valve (EXV)

The EXV is equipped with a stepper motor (2785 to 3690 steps, depending on the model) that is controlled via the EXV board. The EXV is also equipped with a sightglass that permits verification of the mechanism movement and the presence of the liquid gasket.

11.7 - Moisture indicator

Located on the EXV, permits control of the unit charge and indicates moisture in the circuit. The presence of bubbles in the sight-glass indicates an insufficient charge or non-condensables in the system. The presence of moisture changes the colour of the indicator paper in the sight-glass.

11.8 - Dehumidifier filter

The role of the filter drier is to keep the circuit clean and moisture-free. The moisture indicator shows, when it is necessary to change the element. A difference in temperature between the filter inlet and outlet shows that the element is dirty.

11.9 - Sensors

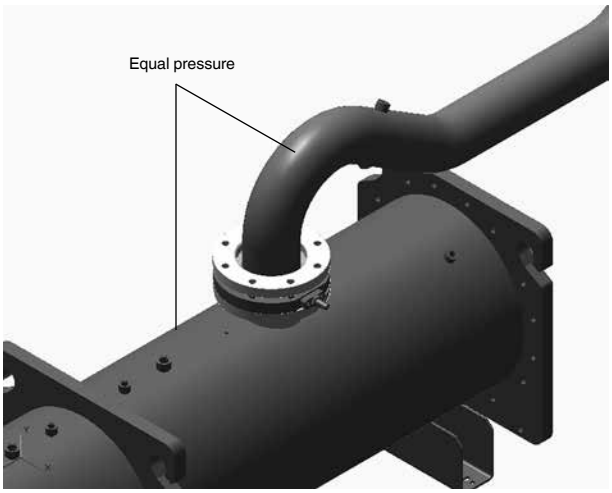
The units use thermistors to measure the temperature, and pressure transducers to control and regulate system operation. Refer to the POWERCIAT Connect'Touch control manual for a more detailed explanation.

11.10 - Service valve (option)

The unit can be equipped with optional service valves to facilitate maintenance and repair operations.

If the service valves option is ordered, the refrigerant circuit will be supplied with shut-off valves on the compressor economiser, discharge and suction lines.

The compressor suction valve must be used without pressure difference at the inlet and outlet. If there is a pressure difference, leak-tightness at the valve may be lost and the valve can even fail altogether.



11.11 - Power factor correction capacitors (option)

They guarantee a minimum power factor performance of 0.95 when unit operates at a condition that involves a power input that exceeds the Eurovent standard condition.

A fix capacitor bank is switched at start of each compressor. It provides individual power factor correction for each machine refrigerant circuit.

Capacitors are dry type : no risk of leakage or fire.

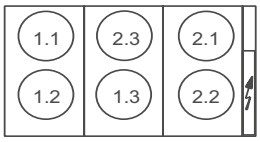
The capacitors are selected for each compressor as per below table:

Compressor	Capacitor (kVAR)	Ir (A)
06TSA155	15	22
06TSA186	20	29
06TTA266	35	51
06TTA301	35	51
06TTA356	35	51
06TUA483	45	65
06TUA554	45	65

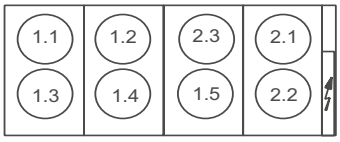
Operation of the unit without capacitors results in an increase in the current

LX - Fan arrangement

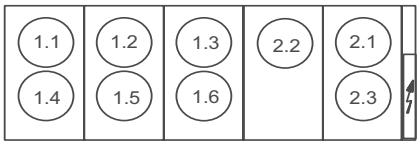
LX 0808 à 1008



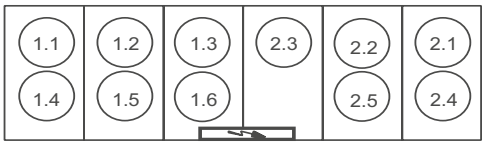
LX 1108 à 1358



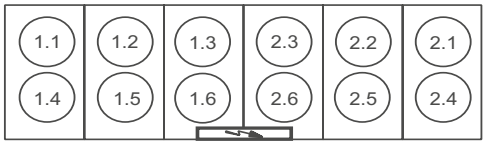
LX1528



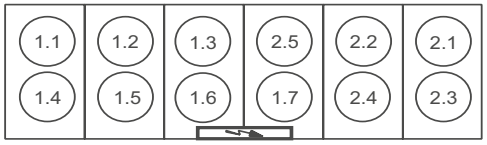
LX 1858



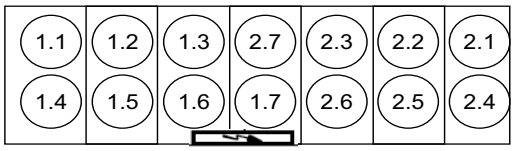
LX 2158 à 2308



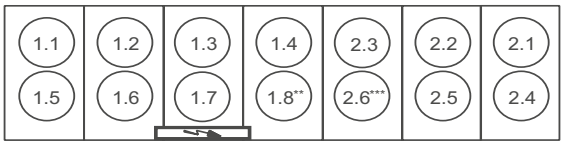
LX 2158 à 2308



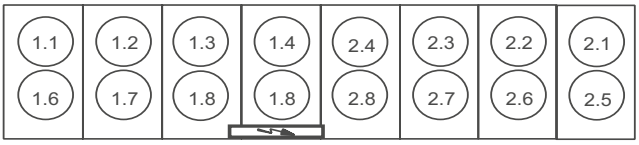
LX 2628



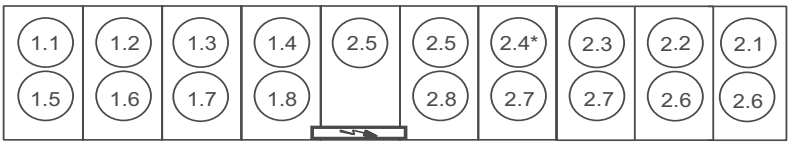
LX 2528



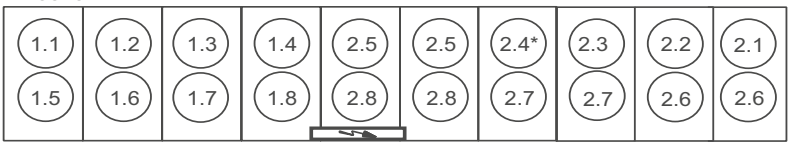
LX 3028



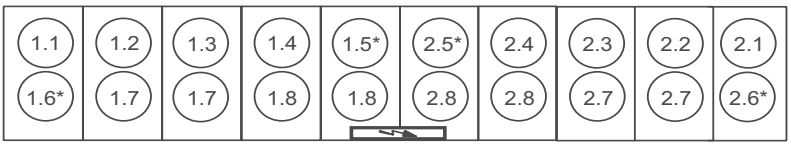
LX 3428



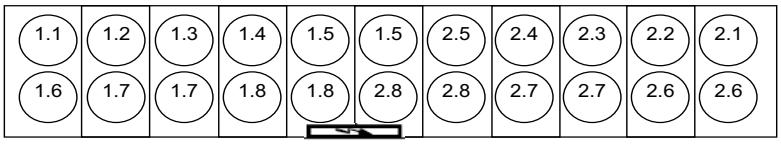
LX 3828



LX 4008 et 4408



LX 4608



NOTE: the above values do not correspond to the designation of the fan. The fan designation and position are given on the unit drawings and wiring diagrams supplied with the unit.

* These fans are also used to reduce the ventilation steps during change-over of dual stages: They may stop and then restart depending on the stage ordered.

x = Circuit number
y = Start-up order

12 - MAIN OPTIONS

Options	Description	Advantages	Use for POWERCIAT LX ST / HE / XE
Medium-temperature brine solution	Implementation of new control algorithms and redesigned evaporator to allow chilled brine solution production down to -6°C when ethylene glycol is used (-3°C with propylene glycol)	Covers specific applications such as ice storage and industrial processes	●
Low-temperature brine solution	Implementation of new control algorithms and redesigned evaporator to allow chilled brine solution production down to -12°C when ethylene glycol is used (-8°C with propylene glycol)	Covers specific applications such as ice storage and industrial processes	●
Light-brine solution, down to -3°C	Implementation of new control algorithms to allow chilled brine solution production down to -3°C when ethylene glycol is used (0°C with propylene glycol)	Matches with most application requirements for ground-sourced heat pumps and fits with many industrial processes requirements	●
Unit equipped for air discharge ducting	Fans equipped with discharge connection flanges - maximum available pressure 60 Pa	Facilitates connections to the discharge ducts	●
Low Noise	Aesthetic and sound absorbing compressor enclosure	Noise level reduction	●
Xtra Low Noise	Acoustic compressor enclosure and low-speed fans	Noise emission reduction at reduced fan speed	●
Super Low Noise	Acoustic compressor enclosure, low-speed fans and enhanced sound insulation of main noise sources	Noise level reduction for sensible site	ST / HE version, sizes 1308 to 4608
IP54 control box	Increased leak tightness of the unit	Protects the inside of the electrical box from dusts, water and sand. In general this option is recommended for installations in polluted environments	●
Tropicalisation of the electrical box	Electrical box equipped with an electrical heater and a fan. Electrical connections on the compressor painted with a special varnish.	Allows safe operation in typical "tropical" climate. This option is recommended for all applications where humidity inside the electrical box can reach 80% at 40°C and unit can remain in stand-by for a long time under these conditions.	●
Protection grilles	Metallic grilles on the 4 unit sides.	Improves protection against intrusion to the unit interior, and protects the coil and piping against impacts.	●
Winter operation down to -20°C	Fan speed control via frequency converter	Stable unit operation for air temperature down to -20°C	ST version, all sizes
230V electrical plug	230 V AC power supply source provided with plug socket and transformer (180 VA, 0.8 A)	Permits connection of a laptop or an electrical device during unit commissioning or servicing	●
Water exchanger frost protection	Electric resistance heater on the water exchanger and discharge valve	Water exchanger frost protection down to -20°C outside temperature	●
Evaporator & hydraulic module frost protection	Electric resistance heater on water exchanger, discharge valve and hydraulic module	Water exchanger and hydraulic module frost protection down to -20°C outside temperature	Sizes 808 to 1528
Total heat recovery	Unit equipped with additional heat exchanger in parallel with the condenser coils.	Production of free hot-water simultaneously with chilled water production	Sizes 808 to 3028
Evaporator with one pass less	Evaporator with one pass on the water side. Evaporator inlet and outlet on opposite sides.	Easy to install, depending on site. Reduced pressure drops	Sizes 808 to 3028
Master/slave operation	Unit equipped with supplementary water outlet temperature sensor kit to be field installed allowing master/slave operation of two units connected in parallel	Optimised operation of two units connected in parallel operation with operating time equalisation	●
21 bar evaporator	Reinforced evaporator for extension of the maximum water-side service pressure to 21 bar (standard 10 bar)	Covers applications with a high water column evaporator side (typically high buildings)	●
Single power connection point	Unit power connection via one main supply connection	Quick and easy installation	Sizes 3428 to 4608
Reversed evaporator water connections	Evaporator with reversed water inlet/outlet	Easy installation on sites with specific requirements	●
Service valve set	Liquid line valve (evaporator inlet), compressor suction and discharge line valves and economiser line valve	Allow isolation of various refrigerant circuit components for simplified service and maintenance	●
Compressor discharge valves	Shut-off valve on the compressor discharge piping	Simplified maintenance	●
Evaporator with one pass more	Evaporator with one pass more on the water side	Optimise chiller operation when the chilled water circuit is designed with low waterflows (high evaporator delta T)	●
Lon gateway	Bi-directional communication board complying with Lon Talk protocol	Connects the unit by communication bus to a building management system	●
HP single-pump hydraulic module	Complete hydronic module equipped with water filter, relief valve, one high pressure pump and drain valve. For more details, refer to the dedicated chapter (expansion tank not included; option with built-in hydraulic safety components available).	Easy and fast installation (plug & play)	Sizes 808 to 1528
HP dual-pump hydraulic module	Dual high pressure water pump, water filter, electronic water flow control, pressure transducers. For more details, refer to the dedicated chapter (expansion tank not included; option with built-in safety hydraulic components available)	Easy and fast installation (plug & play)	Sizes 808 to 1528
LP single-pump hydraulic module	Single low-pressure water pump, water filter, electronic water flow control, pressure transducers. For more details, refer to the dedicated chapter (expansion tank not included; option with built-in hydraulic safety components available)	Easy and fast installation (plug & play)	Sizes 808 to 1528
LP dual-pump hydraulic module	Dual low pressure water pump, water filter, electronic water flow control, pressure transducers. For more details, refer to the dedicated chapter (expansion tank not included; option with built-in hydraulic safety components available)	Easy and fast installation (plug & play)	Sizes 808 to 1528

11 - MAIN OPTIONS

Options	Description	Advantages	Use for POWERCIAT LX ST / HE / XE
Dual relief valve on 3-way valve	Three-way valve upstream of dual relief valves on the evaporator and the oil separator	Valve replacement and inspection facilitated without refrigerant loss. Conforms to European standard EN378/BGVD4	Sizes 808 to 3028
Compliance with Swiss regulations	Additional tests on the water heat exchangers: supply (additional of PED documents) supplementary certificates and test certifications	Compliance with Swiss regulations	●
Compliance with Russian regulations	EAC certification	Compliance with Russian regulations	●
Bacnet over IP	Bi-directional high-speed communication using BACnet protocol over Ethernet network (IP)	Easy and high-speed connection by Ethernet line to a building management system. Allows access to multiple unit parameters	●
Energy Management Module	Control board with additional inputs/outputs. See Contacts available in option on control description.	Extended remote control capabilities (setpoint reset by 0-20 mA input, ice storage end, demand limits, boiler on/off command...)	●
7" user interface	Control supplied with a 7 inch colour touch screen user interface	Enhanced ease of use.	●
Input contact for Refrigerant leak detection	0-10 V signal to report any refrigerant leakage in the unit directly on the controller (the leak detector itself must be supplied by the customer)	Immediate customer notification of refrigerant losses to the atmosphere, allowing timely corrective actions	●
Compliance with Australian regulations	Unit approved to Australian code	Conformance with Australian regulations	●
Power factor correction	Capacitors for automatic regulation of power factor (cos phi) value to 0.95.	Reduction of the apparent electrical power, compliance with minimum power factor limit set by utilities	Sizes 808 to 3028
Insulation of the evap. in/out ref.lines	Thermal insulation of the evaporator entering/leaving refrigerant lines with flexible, UV resistant insulation	Prevents condensation on the evaporator entering/leaving refrigerant lines	●
MCHE anti-corosion protection Protect2	Coating by conversion process which modifies the surface of the aluminium producing a coating that is integral to the coil. Complete immersion in a bath to ensure 100% coverage. No heat transfer variation, tested 4000 hours salt spray per ASTM B117	Protect2 Improved corrosion resistance of the MCHE coils by 2, recommended for use in moderately corrosive environments	●
MCHE anti-corosion protection Protect4	Extremely durable and flexible epoxy polymer coating applied on micro channel coils by electro coating process, final UV protective topcoat. Minimal thermal transfer variation, tested 6000 hours constant neutral salt spray per ASTM B117, superior impact resistance per ASTM D2794	Protect4 Improved corrosion resistance of the MCHE coils by 4, recommended for use in corrosive environments	●
Evaporator with aluminium jacket	Evaporator covered with an aluminium sheet for thermal insulation protection	Improved resistance to aggressive climate conditions	●
Expansion tank	6 bar expansion tank integrated in the hydraulic module (requires hydronic module option)	Easy and fast installation (plug & play), & protection of closed water systems from excessive pressure	Sizes 808 to 1528
Anti-vibration mounts	Elastomer anti-vibration mounts to be placed under the unit (material classified B2 according to DIN 4102).	Isolate unit from the building, avoid transmission of vibration and associate noise to the building. Must be used in conjunction with a flexible connection on the water side	●
Free Cooling dry cooler management	Control and connections to a free cooling drycooler Opera or Vextra fitted with option FC control box	Easy system management, extended control capabilities to a drycooler used in free cooling mode	●

Air conditioning equipment must be maintained by professional technicians, whilst routine checks can be carried out locally by specialised technicians. See the standard EN 378-4.

Simple preventive maintenance will allow you to get the best performance from your HVAC unit:

- Improved cooling performance
- Reduced power consumption
- Prevention of accidental component failure
- Prevention of major time-consuming and costly interventions
- Protection of the environment.

There are five maintenance levels for HVAC units, as defined by the AFNOR X60-010 standard.

13.1 - Level 1 maintenance

See note “Any deviation or non-observation ...” in chapter 12.3 “Level 3 (or higher) maintenance”. Simple procedure can be carried out by the user:

- Visual inspection for oil traces (sign of a refrigerant leak)
- Air-cooled exchanger (condenser) cleaning - see chapter 12.6.1 “Level 1”,
- Check for removed protection devices, and badly closed doors/covers
- Check the unit alarm report when the unit does not work. Refer to the POWERCIAT Connect’touch Touch Pilot control manual for a more detailed explanation.

General visual inspection for any signs of deterioration.

13.2 - Level 2 maintenance

See note “Any deviation or non-observation ...” in the ext column. This level requires specific know-how in the electrical, hydraulic and mechanical fields. It is possible that these skills are available locally: Existence of a maintenance service, industrial site, specialised subcontractor. In these cases, the following maintenance operations are recommended.

Carry out all level 1 operations, then:

- At least once a year tighten the power circuit electrical connections (see table 12.4).
- Check and re-tighten all control/command connections, if required (see table 12.4).
- Remove the dust and clean the interior of the control boxes, if required.
- Check the presence and the condition of the electrical protection devices.
- Check the correct operation of all heaters.
- Replace the fuses every 3 years or every 15000 hours (age-hardening).
- Replace the electrics box cooling fans used with the Tropicalisation of the electrical box option (with designation EF22_) every five years.
- Check the height of the anti-vibration mountings (located between the compressor rails and the unit chassis) after 5 years of operation, and then each year. When the total minimum height of the mountings is less than 25 mm replace the mountings.
- Check the water connections.
- Purge the water circuit.
- Clean the water filter.
- Fully clean the condensers with a low-pressure jet and a biodegradable cleaner (counter-current cleaning - see chapter 12.6.2 “Level 2”).
- Replace the stuffing box packing of the pump after 10000 hours of operation.
- Check the unit operating parameters and compare them with previous values.
- Keep and maintain a maintenance sheet, attached to each HVAC unit.
- Check the correct operation of the capacitor (Power Factor Correction option)

All these operations require strict observation of adequate safety measures: Individual protection garments, compliance with all industry regulations, compliance with applicable local regulations and using common sense.

13.3 - Level 3 (or higher) maintenance

NOTE: Any deviation from, or failure to observe, these maintenance criteria will render the warranty conditions for the refrigeration unit null and void, and shall release the manufacturer, CIAT France, from all liability.

At this level, maintenance requires specific skills/certification/ tools and expertise. Only the manufacturer, its representative or its approved agents may perform these operations. These maintenance operations concern for example:

- A major component replacement (compressor, evaporator)
- Any intervention on the refrigerant circuit (handling refrigerant)
- Changing of parameters set at the factory (application change)
- Removal or dismantling of the HVAC unit
- Any intervention due to a missed established maintenance operation
- Any intervention covered by the warranty.

13.4 - Tightening torques for the main electrical connections

13.4.1 - Tightening torques for the main electrical connections

Screw type	Use	Value (N.m)
(N·m)		
Metal screw D = 4.8	Condensing module, housing supports	4,2
Screw H M8	Condensing module, compressor fixing	18
Taptite screw M10	Condensing module, chassis - structure fixing, control box fixings, compressor fixings, oil separator fixing	30
Taptite screw M6	Piping support, cowling	7
Screw H M8	Piping clip	12
Screw H M6	Piping clip	10
Nut H M10	Compressor chassis	30
Nut H M10	Hydraulic pump chassis	30
Screw H M8	Filter drier cover	35
Screw H M12	Economiser port flange	40
Screw H M16	Oil separator flanges, suction flanges	110
Screw H M16	Heat exchanger water boxes	190
Screw H M20	Suction flanges	190
Nut 5/8 ORFS	Oil line	65
Nut 3/8 ORFS	Oil line	26
Nut H M12/M16	Victaulic collars on suction piping	60/130
Self-locking Nut M16	Compressor fixing	30

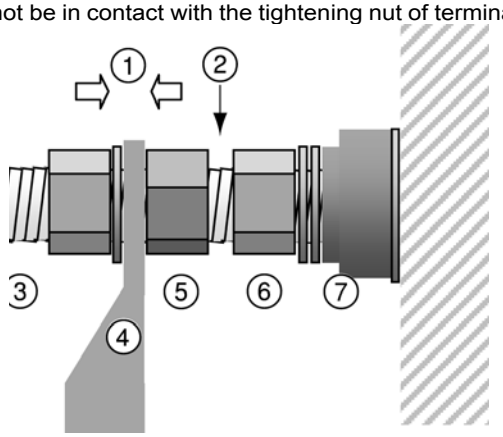
The tightening of the connections at the compressor terminals requires special precautions. Please refer to the chapter below.

13.4.2 - Precautions for connecting the compressor power terminals

These precautions must be applied during an intervention that requires the removal of the power conductors connected to the compressor supply terminals.

The tightening nut of terminal (6) supporting the isolator (7) must never be loosened, as it ensures terminal tightness and compressor leak tightness.

The tightening of phase lug (4) must apply the torque between counter nut (5) and tightening nut (3): During this operation a counter-torque must be applied at counter nut (5). Counter-nut (5) must not be in contact with the tightening nut of terminal (6).



1. Torque application to tighten the lug
2. Avoid contact between the two nuts
3. Lug tightening nut
4. Flat lug
5. Counter-nut
6. Terminal tightening nut
7. Isolator

13.5 - Tightening torques for the main fastenings

Screw type	Use	Value (N.m)
(N·m)		
Metal screw D = 4.8	Condensing module, housing supports	4,2
Screw H M8	Condensing module, compressor fixing	18
Taptite screw M10	Condensing module, chassis - structure fixing, control box fixings, compressor fixings, oil separator fixing	30
Taptite screw M6	Piping support, cowling	7
Screw H M8	Piping clip	12
Screw H M6	Piping clip	10
Nut H M10	Compressor chassis	30
Nut H M10	Hydraulic pump chassis	30
Screw H M8	Filter drier cover	35
Screw H M12	Economiser port flange	40
Screw H M16	Oil separator flanges, suction flanges	110
Screw H M16	Heat exchanger water boxes	190
Screw H M20	Suction flanges	190
Nut 5/8 ORFS	Oil line	65
Nut 3/8 ORFS	Oil line	26
Nut H M12/M16	Victaulic collars on suction piping	60/130
Self-locking Nut M16	Compressor fixing	30

The tightening of the connections at the compressor terminals requires special precautions. Please refer to the chapter below.

13.6 - Condenser coil

We recommend, that coils are inspected regularly to check the degree of fouling. This depends on the environment where the unit is installed, and will be worse in urban and industrial installations and near trees that shed their leaves.

For coil cleaning, two maintenance levels are used, based on the AFNOR X60-010 standard:

13.6.1 - Level 1

12.6.1.1 - Recommendations for maintenance and cleaning of MCHE (microchannel) condenser coils

- Regular cleaning of the coil surface is essential for correct unit operation. Eliminating contamination and removal of harmful residue will increase the operating life of the coils and the unit.
- The maintenance and cleaning procedures below are part of the regular maintenance and will prolong the life of the coils.

Do not use chemical cleaning products on MCHE condenser coils. These cleaning agents can accelerate corrosion and damage the coils.

- Remove foreign objects and debris attached to the coil surface or wedged between the chassis and the supports.
- Provide personal protection equipment including safety glasses and/or a face mask, waterproof clothing and safety gloves. It is recommended to wear clothing that covers the whole body.
- Start the high-pressure spray gun and remove any soap or industrial cleaner from it before cleaning the condenser coils. Only drinkable cleaning water is permitted to clean the condenser coils.
- Clean the condenser face by spraying the coil evenly and in a stable manner from bottom to top, directing the water jet at right angles to the coil. Do not exceed 6200 kPa (62 bar) or an angle of 45° related to the coil. The diffuser must be at least 300 mm away from the coil surface. It is essential to control the pressure and to be careful not to damage the fins.

Excessive water pressure can break the weld points between the fins and the flat micro-channel heat exchanger tubes.

13.6.2 - Level 2

Clean the coil, using appropriate products. We recommend cleaning with clear water to remove pollutants. If the use of cleaning products is necessary, we specify:
- pH between 7 and 8
- Absence of chlorine, sulphate, copper, iron, nickel or titanium
- Chemical compatibility with aluminium and copper.

For RTPF coils this process can either be carried out using a high-pressure spray gun in the low-pressure position. With pressurised cleaning methods care should be taken not to damage the coil fins.

The spraying of the coil must be done:
- In the direction of the fins
- In the opposite direction of the air flow direction
- With a large diffuser (25-30°)
- At a minimum distance of 300 mm from the coil.

It is not necessary to rinse the coil, as the products used are pH neutral. To ensure that the coil is perfectly clean, we recommend rinsing with a low water flow rate.

For MCHE condenser coils refer to the instructions in chapter 12.6.1.2 under level 1 maintenance for use of a high-pressure spray gun.

IMPORTANT:
- **Never use pressurised water without a large diffuser. High pressure cleaners are only permitted for MCHE coils (maximum permitted pressure 6200 kPa (62 bar).**
- **Concentrated and/or rotating water jets are strictly forbidden.**
- **Never use a fluid with a temperature above 45 °C to clean the air heat exchangers.**
- **Correct and frequent cleaning (approximately every three months) will prevent 2/3 of the corrosion problems.**
- **Protect the control box during cleaning operations.**

13.7 - Evaporator maintenance

Check that:
- The insulating foam is intact and securely in place.
- The cooler heaters are operating, secure and correctly positioned.
- The water-side connections are clean and show no sign of leakage.

13.8 - Compressor maintenance

13.8.1 - Oil separator

Check the correct operation of the heaters and check that they are well attached to the oil separator ring.

13.8.2 - Replacing the built-in oil filter

As system cleanliness is critical to reliable system operation, there is a filter in the oil line at the oil separator outlet. The oil filter is specified to provide a high level of filtration (5 µm) required for long bearing life.

The filter should be checked after the first 500 hours of operation, and every subsequent 2000 hours. The filter should be replaced at any time when the pressure differential across the filter exceeds 200 kPa (2 bar).

The pressure drop across the filter can be determined by measuring the pressure at the filter service port and the oil pressure port. The difference in these two pressures will be the pressure drop across the filter, check valve, and solenoid valve. The pressure drop across the check valve and solenoid valve is approximately 40 kPa (0.4 bar), which should be subtracted from the two oil pressure measurements to give the oil filter pressure drop.

13.8.3 - Checking compressor rotation

Correct compressor rotation is one of the most critical application considerations. Reverse rotation, even for a very short duration, damages the compressor.

The reverse rotation protection scheme must be able to determine the direction of rotation and stop the compressor within 300 ms. Reverse rotation is most likely to occur when-ever the wiring to the compressor terminals is disturbed.

To minimize the opportunity for reverse rotation, the following procedure must be applied. Rewire the power cables to the compressor terminal pin as originally wired.

For replacement of the compressor, a low pressure switch is included with the compressor. This low pressure switch should be temporarily installed as a hard safety on the high pressure part of the compressor. The purpose of this switch is to protect the compressor against any wiring errors at the compressor terminal pin. The electrical contact of the switch would be wired in series with the high pressure switch. The switch will remain in place until the compressor has been started and direction of rotation has been verified; at this point, the switch will be removed.

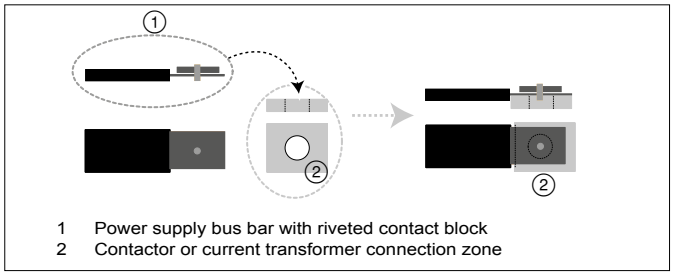
The pressure switch that has been selected for detecting reverse rotation has the manufacturer part number HK01CB001. This switch opens the contacts when the pressure falls below 7 kPa. It is a switch with manual reset that can be reset after the pressure rises back above 70 kPa. The pressure switch must be a manual reset type to prevent any risk of the compressor short cycling in the reverse direction.

13.9 - Precautions for connecting the compressor power supply bus bar

This note applies to units using power supply bus bars with riveted contact block at the level of the connection cages in the control box. During re-connection it is imperative to:

- Engage each bus bar in the cage up to the stop
- Ensure visually that the bus bars have good contact at the connection areas: There must not be any free movement between the bus bar and the connection area created by the fixing rivet of the contact block.

Connection of the contactor or current transformer



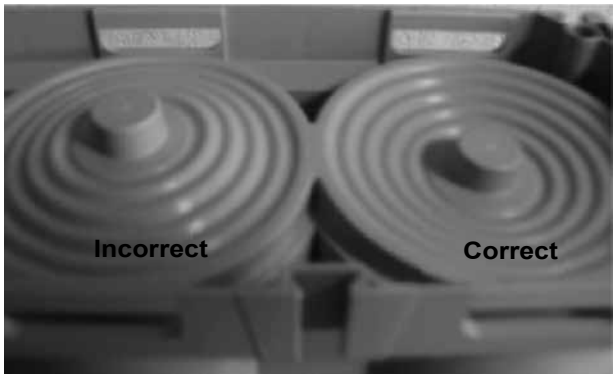
1 Power supply bus bar with riveted contact block
2 Contactor or current transformer connection zone

13.10 - Checking the power factor correction capacitors

The verification consists in measuring input current of each capacitor bank. Check shall be done using a true RMS meter reading:

Check that the input current absorbed by the capacitor is between 0.8 and 1.3 × Ir. A higher value may indicate heavy presence of harmonics.

Absence of current despite capacitor is energized is an indication that there is a defect. Confirmation shall be done by removing the capacitors and checking the underside.



14 - START-UP CHECKLIST FOR LX LIQUID CHILLERS (USE FOR JOB FILE)

Preliminary information

Job name:.....

Location:.....

Installing contractor:.....

Distributor:.....

Unit

Model:.....

Compressors

Circuit A

Model number.....

Serial number.....

Motor number.....

Circuit B

Model number.....

Serial number.....

Motor number.....

Circuit C

Model number.....

Serial number.....

Motor number.....

Circuit D

Model number.....

Serial number.....

Motor number.....

Evaporator

Model number.....

Serial number.....

Condenser

Model number.....

Additional optional units and accessories.....

.....

Preliminary equipment check

Is there any shipping damage? ..... If so, where? .....

.....

Will this damage prevent unit start-up? .....

- ☐ Unit is level in its installation
- ☐ Power supply agrees with the unit nameplate
- ☐ Electrical circuit wiring has been sized and installed properly
- ☐ Unit ground wire has been connected
- ☐ Electrical circuit protection has been sized and installed properly
- ☐ All terminals are tight
- ☐ All chilled water valves are open
- ☐ All chilled water piping is connected properly
- ☐ All air has been vented from the chilled water circuit
- ☐ Chilled water pump (CWP) is operating with the correct rotation. Check the phase sequence of the electrical connection. If the unit is equipped with a hydraulic module, use the pump test function. Refer to the POWERCIAT Connect'Touch control manual for a more detailed explanation.
- ☐ Circulate chilled water in the water circuit for at least two hours, then remove, clean and replace the screen filter. After the pump test has been completed, switch the unit off again.
- ☐ Inlet piping to cooler includes a 20 mesh strainer with a mesh size of 1.2 mm.
- ☐ The compressor flange has been removed.

13 - START-UP CHECKLIST FOR LX LIQUID CHILLERS (USE FOR JOB FILE)

Unit start-up

☐ a. The oil heaters have been powered up for at least 24 hours.

☐ b. Oil level is correct

☐ c. All discharge and liquid valves are open

☐ d. All suction valves are open, if equipped

☐ e. All the oil line valves and economiser ball valves (if installed) are open.

☐ f. The contactor

☐ g. Checks have been carried out for any possible leaks. Unit has been leak checked (including fittings)

☐ g1 - on the whole unit

☐ g2 - at all connections

Locate, repair, and report any refrigerant leaks .....

.....

.....

☐ h. Check voltage imbalance: AB ..... AC..... BC .....

Average voltage = ... V

Maximum deviation = ... V

Voltage imbalance = ... %

☐ i. Voltage imbalance less than 2 %

WARNING: operating the chiller with an incorrect supply voltage or excessive phase imbalance constitutes improper use and will invalidate the CIAT warranty. If the phase imbalance exceeds 2% for voltage, or 10% for current, contact your local electricity supply at once and ensure that the chiller is not switched on until corrective measures have been taken.

Check cooler water loop

☐ Water loop volume = ... litres

☐ Calculated volume = ... litres

☐ 3.25 litres/nominal kW capacity for air conditioning

☐ 6.5 litres/nominal kW capacity for process cooling

☐ Proper loop volume established

☐ Proper loop corrosion inhibitor included..... litres of .....

☐ Proper loop freeze protection included (if required)..... litres of .....

☐ Piping includes electric heater tape, if exposed to the outside

☐ Inlet piping to cooler includes a 20 mesh strainer with a mesh size of 1.2 mm

Check pressure drop across the cooler

☐ Entering cooler = ... kPa

☐ Leaving cooler = ... kPa

☐ Leaving - entering = ... kPa

WARNING: Plot cooler pressure drop on performance data chart (in product data literature) to determine total litres per second (l/s) and find unit's minimum flow rate.

☐ Total = ... l/s

☐ Nominal kW = ... l/s

☐ Total l/s is greater than unit's minimum flow rate

☐ Total l/s meets job specified requirement of..... l/s

WARNING: Once power is supplied to the unit, check for any alarms. Refer to the POWERCIAT Connect'Touch control manual for the menu of alarms.

Note all alarms:.....

.....

Notes: .....

.....

CIAT Service
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This document is not legally binding.
As part of its continuous drive to improve its equipment, CIAT reserves the right to make any technical modifications without prior notice.

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