10147

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AQUACIAT LD/ILD

Instruction manual

CIAT

Contents

ORIGINAL TEXT: FRENCH VERSION

Contents

1 - INTRODUCTION

The units are intended to cool or heat water for building air conditioning or heating, or for industrial processes.

They are designed to provide a very high level of safety and reliability, making installation, start-up, operation and maintenance easier and safer.

They will provide safe and reliable service if used within their application ranges.

They are designed to offer a service life of 15 years, assuming a utilisation factor of 75%, which corresponds to approximately 100,000 operating hours.

Prior to the initial start-up of the units, everyone involved in the works should be thoroughly familiar with these instructions and with the characteristics of the installation site, and ensure these are respected.

The procedures in this manual are arranged in the sequence required for installation, start-up, operation and maintenance of the units. Ensure that you follow them and that you take the required safety precautions, including those listed in this guide, which include wearing personal protective equipment (gloves, safety glasses, safety shoes) and having the appropriate tools, skills and qualifications (electrical, air conditioning, local legislation).

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

1.1 Safety considerations related to protection devices

Do not obstruct any protective devices.

This applies to any fuse plugs, rupture disks and valves fitted on the refrigerant or heat transfer fluid 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. Fit devices at the valve or drain piping outlets to 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 setting:

In accordance with the Pressure Equipment Directive and national usage monitoring regulations in the European Union, the protective devices fitted to these machines are classified as follows:

	Safety accessories(1)	Over-pressure protection in case of an external fire(2)
Refrigerant side		
High-pressure switch	X	
External relief valve(3)		X
Rupture disk		X
Fuse plug		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 over-pressure 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 valve must be made by the personnel responsible for completing the hydronic installation.

Do not remove valves / fusible plugs, 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, a safety device prevents rupture due to over-pressure by releasing the refrigerant. The fluid can then break down into toxic residues when in contact with flames:

- Stay away from the unit;
- Ensure the personnel in charge of extinguishing the fire are duly warned and issued with recommendations;
- 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.

The external relief valves must always be vented to outside if the units are installed in a closed space. 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 vented refrigerant. As the fluids can be diffused in the air, ensure that refrigerant is discharged away from building air intakes, relief valves must be checked periodically. The valves must be checked periodically.

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 changeover switch in the intermediate position, i.e. with both circuits open (move the lever fully forwards or backwards depending on the output to be isolated). If a valve is removed for checking or replacement, make sure there is still a valve active on each of the changeover switches installed on the unit.

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

It is recommended to install an indicating device to check whether some of the fluid has leaked from the relief valve.

The presence of oil at the outlet orifice is a useful indicator that refrigerant has leaked. Keep this orifice clean to ensure that any leaks are obvious. The calibration of a valve that has leaked is generally lower than its original calibration. The new calibration may affect the operating range. To avoid nuisance tripping or leaks, replace or re-calibrate the valve.

Protective device checks:

If no national regulations exist, check the protective 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,
- Values and tolerances for cut-off and discharge devices,
- Test stages,
- Recommissioning of the equipment.

The principle for performing a test without disassembly of the pressure switch is given here, however the manufacturer recommends contacting the Service for this type of test:
- Verify and record the set-points of pressure switches and relief devices (valves and possible rupture discs)
- 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 if there are valves on the high pressure side on the recovery air exchangers, for example),
- Connect a calibrated pressure differential gauge with integral damping (oil bath with pointer if mechanical); instantaneous reading gauges may give inaccurate readings because of the control's scanning delay,
- Carry out the HP quicktest built into the control (refer to the Service Guide).

If the test results in the replacement of the pressure switch, it is necessary to recover the refrigerant charge; these pressure switches are not installed on Schrader type automatic valves.

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

Do not attempt to repair or recondition a valve if there has been any corrosion or build-up of foreign material (rust, dirt, scale, etc.) on the valve body or mechanism. In this case, it must be replaced.

Do not install relief valves in series or backwards.

1.2 Refrigerant safety considerations

Use safety goggles and safety gloves.

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

If a leak occurs or if the refrigerant becomes contaminated (e.g by a motor short circuit or BPHE freeze-up), and before any intervention, remove the complete charge using a recovery unit and store the refrigerant in mobile containers. The compressors cannot transfer the whole refrigerant charge and can be damaged if used to pump-down. The refrigerant charge should not be transferred to the high-pressure side.

Repair the leak, detect and check the type of refrigerant in the machine and then recharge the machine/circuit with the total charge, as indicated on the unit nameplate. Do not top up the refrigerant charge. Only charge the liquid refrigerant given on the nameplate at the liquid line.

Charging any refrigerant other than the original type will impair machine operation and can even cause irreparable damage to the compressors. The compressors operating with this refrigerant type are lubricated with a synthetic polyolester oil.

Do not unweld the refrigerant ductwork or any refrigerant circuit component or cut these with a torch until all refrigerant (liquid and vapour) as well as the oil have been removed from the unit. Traces of vapour should be displaced with dry nitrogen. Refrigerant in contact with an open flame produces toxic gases.

Do not siphon refrigerant.

Any accidental release of refrigerant, whether this is caused by a small leak or significant discharges following the rupture of a pipe or an unexpected release from a relief valve, may cause any personnel exposed to experience heart palpitations, faintness, frostbite and burns. Always take any such event seriously.

Installers, owners and especially service engineers for these units must:
- Create a procedure to ensure medical attention is sought before treating any symptoms;
- Provide first aid equipment, flush the eyes and skin immediately if splashed with refrigerant, and seek medical attention.

We recommend applying standard EN 378-3 Appendix 3.

Ensure there is sufficient ventilation if the unit is installed in an enclosed area. In gas form, refrigerant is heavier than air and, if allowed to accumulate in a confined area, it can reduce the quantity of oxygen in the air, causing respiratory issues.

The refrigerant used in units in this range is R410A, a high-pressure fluid (the operating pressure of the unit is greater than 40 bar).

Special equipment must be used when working on the refrigerant circuit (pressure gauge, charge transfer equipment, etc.).

Do not clean the unit with hot water or steam. This could pressurise the refrigerant.

NOTE: If a liquid line valve is present, never leave refrigerant in liquid form between this closed valve and the expansion valve as the change in temperature may cause the liquid to expand, rupturing this section of the circuit. This valve is situated on the liquid line before the filter drier.

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

The standard NF E29-795 describes the 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. If any damage is caused to the equipment, the refrigerant must be changed in accordance with this standard, or any analysis of the fluid must be performed by a specialist laboratory.

Any refrigerant transfer and recovery operations must be carried out using a transfer unit.

Service valves are positioned on the liquid, suction and discharge lines and are available on all units for connection to the transfer unit.

The units must never be modified to add refrigerant and oil charging, removal and purging devices. These units have the required openings. Refer to the certified dimensional drawings.

It is dangerous and illegal to re-use disposable (non-returnable) cylinders or attempt to refill them. When the cylinders are empty, evacuate the remaining gas pressure, fill out the relevant paperwork and hand them over to an approved recovery agency. Do not incinerate.

Operating checks:

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

Type of fluid: refer to the nameplate

Global Warming Potential (GWP): refer to the table below

- ► All interventions on this product's refrigerating circuit must be performed in accordance with applicable legislation. Within the European Union, this legislation notably includes regulation No. 517/2014, known as F-Gas.
- ► Ensure that refrigerant is never released to the atmosphere when the equipment is installed, maintained or sent for disposal.
- ► It is prohibited to deliberately release refrigerant into the atmosphere.
- ► If a refrigerant leak is detected, ensure that the leak is repaired quickly.
- ► Only certified, qualified personnel are permitted to install, service and perform sealing tests on the refrigerant, decommission the equipment and recover the refrigerant.
- ► The operator must ensure that any refrigerant recovered is recycled, regenerated or destroyed.
- ► The operator is bound by the obligation to perform sealing tests, or have these performed, at regular intervals.

  Regulations within the European Union have set the following intervals:

System WITHOUT leakage detection		No test	12 months	6 months	3 months
System WITH leakage detection		No test	24 months	12 months	6 months
Refrigerant charge per circuit (equivalent CO_2)		< 5 tons	5 ≤ charge < 50 tons	50 ≤ charge < 500 tons	Charge > 500 tonnes*
Refrigerant charge per circuit (kg)	R134a (PRP 1430)	Charge < 3.5 kg	3.5 ≤ charge < 34.9 kg	34.9 ≤ charge < 349.7 kg	charge > 349.7 kg
	R407C (PRP 1774)	Charge < 2.8 kg	2.8 ≤ charge < 28.2 kg	28.2 ≤ charge < 281.9 kg	charge > 281.9 kg
	R410A (PRP 2088)	Charge < 2.4 kg	2.4 ≤ charge < 23.9 kg	23.9 ≤ charge < 239.5 kg	charge > 239.5 kg
	HFOs: R1234ze	No requirement			

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

- ► For all equipment subject to regular sealing tests, the operator must keep a log used to record the following: the quantities and types of fluids contained in the system (added and recovered), the quantity of fluid recycled, regenerated or destroyed, the date and results of the sealing tests, the details of the technician and of the company performing the work, etc.
- ► Contact your local dealer or installer if you have any questions.

Information on operating inspections given in EN 378 standard can be used when similar criteria do not exist in the national regulation.

Check regularly for leaks and repair immediately.

1.3 Installation safety considerations

After the unit has been received, and before it is started up, it must be inspected for damage. Check that the refrigerant circuits are intact, especially that no components or pipes have shifted or been damaged (e.g. following a shock). If in doubt, carry out a leak tightness check.

Pressure equipment and components

These products include pressure equipment or components manufactured by the unit manufacturer or by other manufacturers. We recommend that you contact your professional body to find out which regulations affect you as the operator or owner of pressure equipment or components (declaration, re-qualification, re-testing). The characteristics of this equipment/ these components are given on the nameplate or in the required documentation, supplied with the products.

These units comply with the European Pressure Equipment Directive.

The units are intended to be stored and operated in an environment where the ambient temperature does not drop below the minimum allowable temperature indicated on the nameplate.

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

NOTE: Monitoring during operation, re-qualification, re-testing, exemption from re-testing:

- Follow local regulations on the monitoring of pressure-containing equipment.
- The user or operator is usually required to create and maintain a monitoring and maintenance log.
- In the absence of any regulations, or in addition to the regulations, follow the guidance in EN 378.
- Follow the local professional recommendations, whenever they exist.
- Regularly monitor the surface of the components to detect cavernous corrosion. To do this check an uninsulated part of the pressure vessel or at a joint in the insulation. Regularly check for the presence of any impurities (e.g. sand, grit) in the heat transfer fluids. These impurities can cause wear and/or pitting corrosion.
  Filter the heat transfer fluid and perform internal visits and inspections as described in EN 378 Reports from the periodical checks by the user or the operator must be added to the monitoring and maintenance register.

Repair:

Any repair or modification, including replacement of removable parts:

- Must comply with local regulations and must be performed by qualified operators in accordance with qualified processes, including changing a wiring harness tube,
- Must be approved by the original manufacturer. Repairs and modifications which involve a permanent assembly (welding, soldering, expansion of tubes, etc.) must be performed by qualified operators following operating procedures,
- All modifications and repairs must be listed in the monitoring and maintenance register,
- Never attempt to repair or modify a plate heat exchanger.

Recycling:

The pressure equipment can be recycled in whole or in part. After use they may contain refrigerant vapours and oil residue. Some parts are painted.

1.4 Maintenance safety considerations

The manufacturer recommends the following template for the maintenance log (the table below is only given as a guide and does not engage the manufacturer's liability).

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

(1) Maintenance

Any technician carrying out work on the electrical or refrigerating section must be authorised, with the relevant qualifications and certifications, including for soldering operations and for handling of the shut-off valve. He/she must have been trained and be familiar with the equipment and the installation.

The manual valves must only be manipulated when the machine is off. Do not forget to refit protective caps to prevent leaks.

During any handling, maintenance or service operations, the technicians involved must be equipped with safety gloves, glasses, shoes and insulating clothing.

Never work on a unit that is still energised.

Never work on any of the electrical components until the general power supply to the unit has been isolated and locked out.

Even if the unit has been shut down, the power circuit remains energized, unless the unit or circuit disconnect switch is open. Refer to the wiring diagram for further details. Follow the appropriate safety guidelines. When working in a fan area, specifically if the grilles have to be removed, isolate the power supply to the fans to prevent their operation.

Units equipped with the variable speed fan option, variable speed pump options and the power factor option are equipped with capacitor batteries which take 5 minutes to fully discharge once the power has been switched off.

After disconnecting the power supply to the electrical box, wait for 5 minutes before accessing the electrical box or inverters.

Before any intervention, verify that there is no voltage present at any accessible conducting parts of the power circuit.

Ensure regularly that the vibration levels remain acceptable and close to those at the initial machine start-up.

Before opening a refrigerating circuit, purge and read the pressure indicators.

If the refrigerant circuit remains open after an intervention (such as a component replacement, etc.):
- Seal the openings if the duration is less than a day
- Beyond this time, charge the circuit with a dry, inert gas (nitrogen).

The objective is to prevent penetration of atmospheric humidity and the resulting corrosion of the unprotected internal steel walls.

1.5 Safety considerations during system interventions

To prevent any damage or accidents, trained personnel must service the various parts of this machine and must resolve any malfunctions or leaks immediately.

Comply with the regulations and recommendations given in the safety standards for refrigerant systems and machines, such as: EN 378, ISO 5149, etc.

Risk of explosion:

Never use air or gases containing oxygen during leak tests, to purge ducts or to pressurise a unit. Pressurised air mixtures or gases containing oxygen can be the cause of an explosion. Oxygen reacts violently with oil and grease.

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 installations.

Never exceed the specified maximum operating pressures. Verify the maximum permissible high and low test pressures by checking the instructions in this manual or the pressures given on the unit nameplate.

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 attempt to remove components fitted to the refrigerant circuit or fittings while the machine is under pressure or while it is running. Be sure pressure is at 0 kPag and that the unit has been shut-down and de-energised before removing components or opening a circuit. When the refrigerant circuit is opened to repair, see the recommendations in chapter “Maintenance safety considerations”.

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 ducts can break under the weight and release refrigerant, causing injuries.

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 if there is any 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 original equipment.

Do not drain the heat exchange fluid circuit without informing the site technical / service department or other competent body first.

Close the shut-off valves on the water inlet and outlet and drain the unit's hydraulic circuit before working on the components installed on the circuit (screen filter, pump, water flow sensor, etc.).

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

2 - RECEIPT OF GOODS

2.1 Check equipment received

Check that the unit and the accessories have not been damaged during transport and that no parts are missing. If the unit and the accessories have 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 the outside of one of the unit frames,
- On the inside of the electrical panel door.

The unit name plate must include the following information:

- Model number - size,
- CE marking,
- Serial number,
- Year of manufacture and pressure and leak tightness test date,
- Fluid used for transport,
- Refrigerant used,
- Refrigerant charge per circuit,
- 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,
- Maximum power input,
- Unit net weight,

3 - HANDLING AND POSITIONING

3.1 Handling

It is strongly recommended that a specialised company is employed to unload the machine.

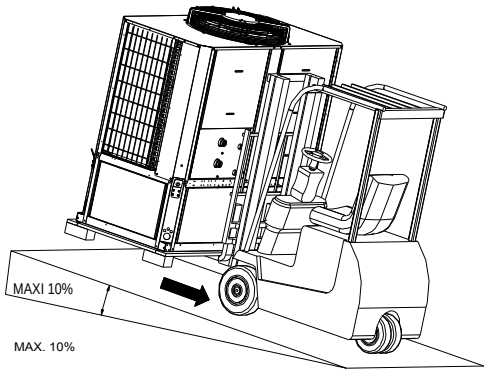
Do not remove the skid or the packaging until the unit is in its final position.

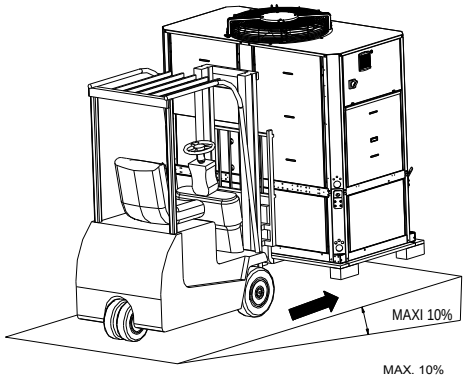
These units can be safely moved by trained personnel with a fork lift truck with the correct capacity for the dimensions and weight of the unit, as long as the forks are positioned in the location and direction shown on the unit.

More particularly, units equipped with the optional buffer tank module can be handled by forklift, in compliance with the instructions below:

- Pick up the load as close as possible to the mast (at the heel of the fork)
- The forks of the forklift must pass all the way under the load
- The load must be lowered down a slope in reverse, with the mast tilted backwards.
- The load must be raised up a slope in forward gear, with the mast tilted backwards

In both cases, drive at low speed, applying the brakes gradually.





The units can also be lifted with slings, using only the designated lifting points marked on the unit (labels on the chassis and a label with all unit handling instructions, attached to the machine).

Use slings with the correct capacity, and follow the lifting instructions on the certified dimensional drawings supplied for the unit.

Only attach slings to the clearly marked points on the unit provided for this purpose.

It is advisable to protect coils against crushing while a unit is being moved. Use struts or a lifting beam to spread the slings above the unit. Do not tilt a unit more than 15°.

Safety can only be guaranteed if these instructions are carefully followed. Otherwise there is a risk of equipment deterioration or injury to personnel.

3.2 Positioning

The machine must be installed in a place that is not accessible to the public and/or protected against access by unauthorised persons.

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

For the centre of gravity coordinates, the position of the unit mounting holes, and the weight distribution points, refer to the certified dimensional drawings. Ensure the free space shown in the dimensional drawings is respected to facilitate maintenance and connection.

The typical applications of these units are cooling and heating, which do not require earthquake resistance. Earthquake resistance has not been verified.

Before placing the device, 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 along both axes).
- If the support structure is sensitive to vibration and/or noise transmission it is advisable to insert anti-vibration mounts (elastomer mounts or metal springs) between the unit and the structure. Selection of these devices is based on the system characteristics and the comfort level required and should be made by technical specialists.
- There is adequate space above and around the unit for air to circulate and for access to the components (see dimensional drawings).
- The number of support points is adequate and that they are in the right places.
- If the optional anti-vibration mounts are present, their number and position must comply with the indications given on the certified dimensional drawing.
- The location is not subject to flooding.
- For outdoor applications, avoid installing the unit in a location where snow is likely to accumulate (in areas subject to long periods of sub-zero temperatures, the unit should be raised).
- 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 and grilles are securely fixed in place. Lift and set down the unit with great care. Tilting and jarring can damage the unit.

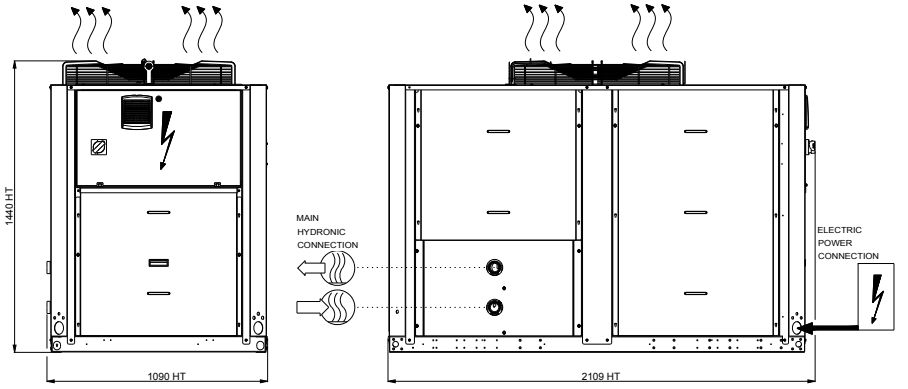
Never apply pressure or leverage to any of the unit's panels or uprights; only the base of the unit frame is designed to withstand such stresses. No force or effort must be applied to pressurised parts, especially via pipes connected to the water heat exchanger (with or without the hydronic kit if the unit is equipped with this).

All welding operations (connection to the hydraulic network) must be performed by qualified welders. The Victaulic® connection or the counter-flange must be removed before welding as a matter of course.

4 - DIMENSIONS, CLEARANCES

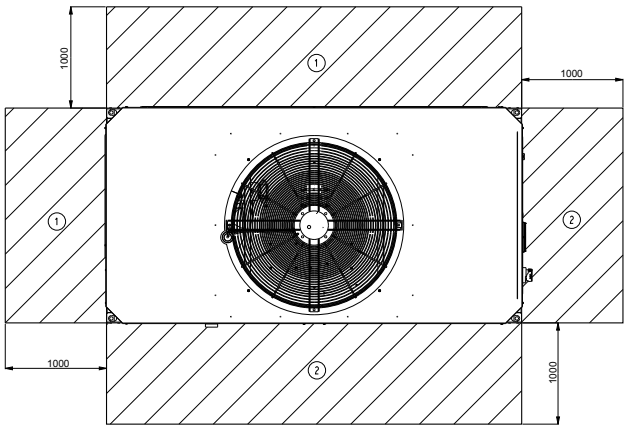
4.1 LD/ILD150A to LD/ILD300A

Without buffer tank module



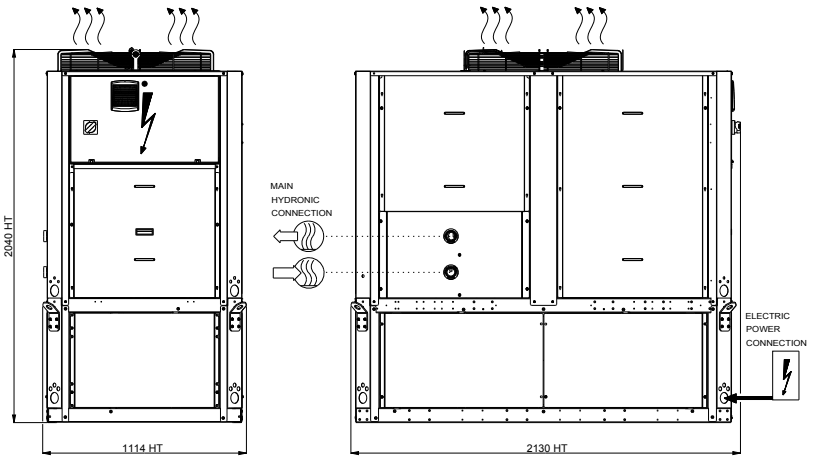
Legend:
All dimensions are in mm.

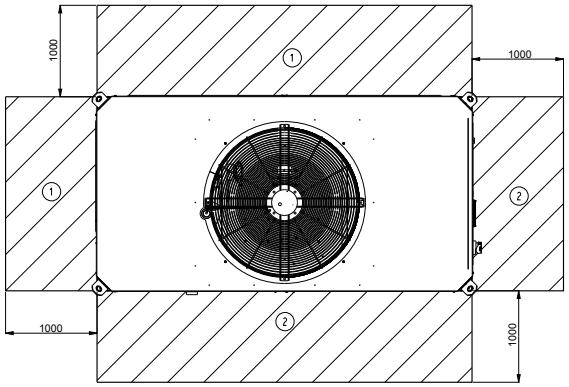
- (1) Clearances required for maintenance and air flow
- (2) Clearances recommended for coil removal
- Water inlet
- Water outlet
- Air outlet, do not obstruct
- Electrical cabinet



NOTE:
Non-contractual drawings.
When designing a system, refer to the certified dimensional drawings provided with the unit or available on request. Please refer to the certified dimensional drawings, for the positioning of the fixing points, weight distribution points and centre of gravity coordinates.

With buffer tank module



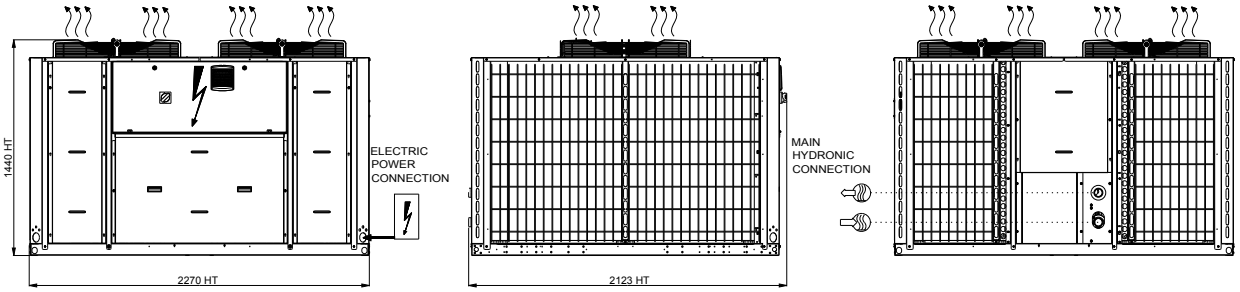


NOTE: For units with other options, refer to the certified dimensional drawings.

4 - DIMENSIONS, CLEARANCES

4.2 LD360A to LD600A and ILD302 to ILD600A

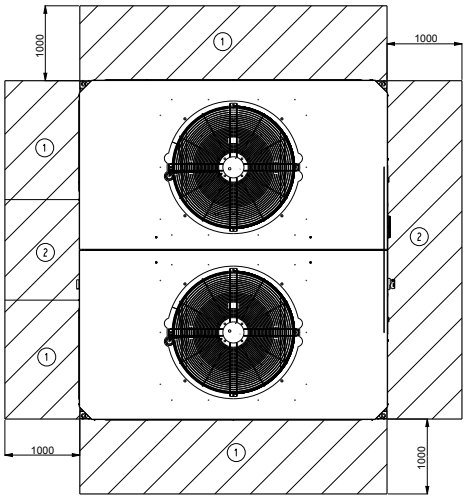
Without buffer tank module



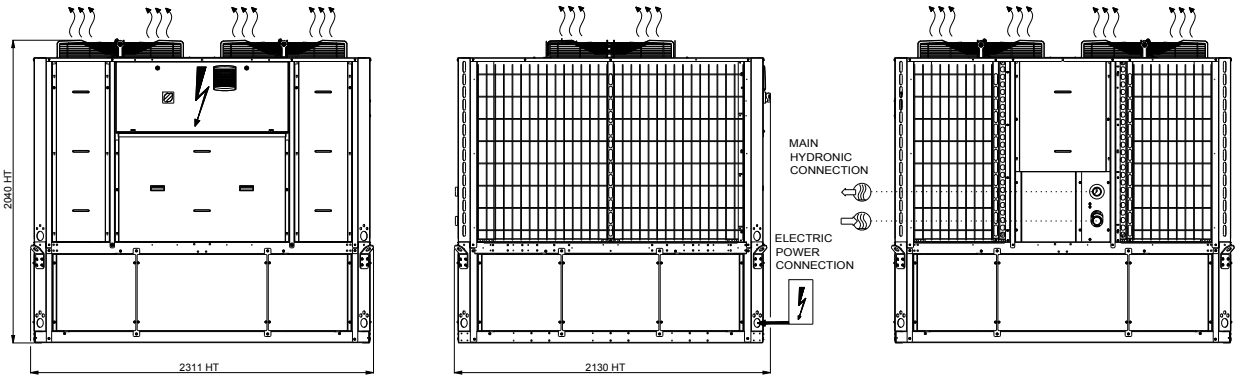
Legend:
All dimensions are in mm.

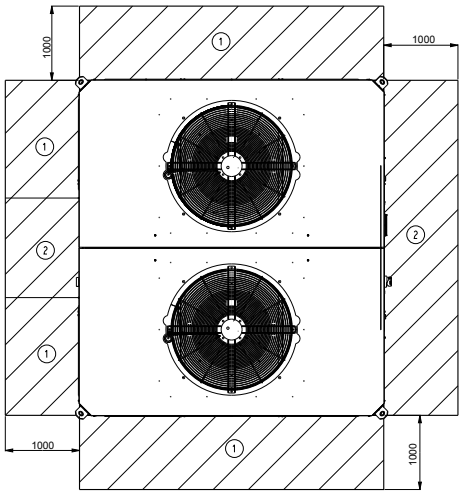
1. Clearances required for maintenance and air flow
2. Clearances recommended for coil removal
3. Water inlet
4. Water outlet
5. Air outlet, do not obstruct
6. Electrical cabinet

NOTE:
Non-contractual drawings.
When designing a system, refer to the certified dimensional drawings provided with the unit or available on request. Please refer to the certified dimensional drawings, for the positioning of the fixing points, weight distribution points and centre of gravity coordinates.



With buffer tank module



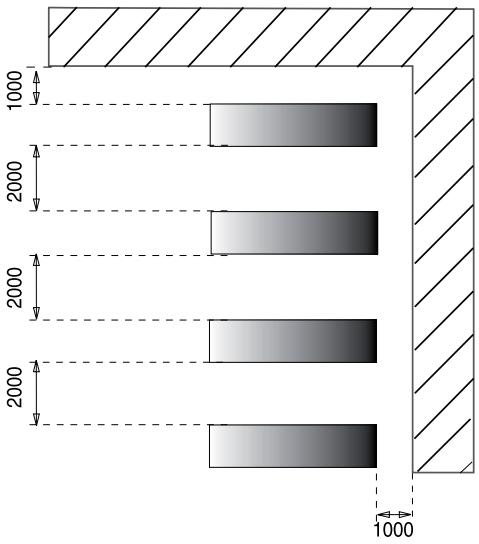


NOTE: For units with other options, refer to the certified dimensional drawings.

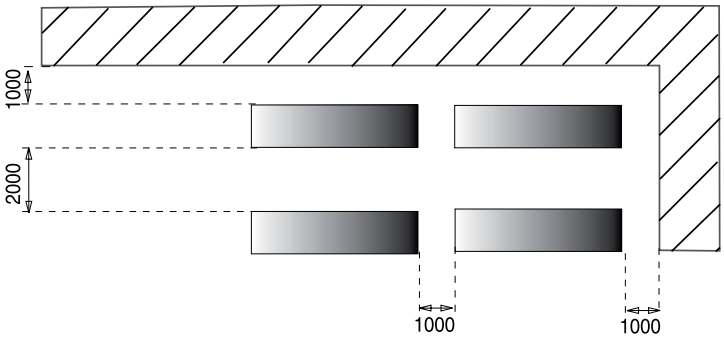
4.3 Installing several units

NOTE: if the height of the walls is more than 2 metres, consult the factory

Solid surface



Solid surface



5 - PHYSICAL AND ELECTRICAL PROPERTIES OF AQUACIAT LD/ILD UNITS

5.1 Physical properties of AQUACIAT LD units

AQUACIAT LD		150A	180A	200A	240A	260A	300A	360A	390A	450A	520A	600A
Noise levels												
Standard unit												
Sound power(1)	dB(A)	80	81	81	81	87	87	84	84	84	90	90
Sound pressure at 10 m(2)	dB(A)	49	49	49	49	55	55	52	52	52	58	58
Unit + Xtra Low Noise option												
Sound power(1)	dB(A)	79	80	80	80	80	80	83	83	83	83	83
Sound pressure at 10 m(2)	dB(A)	48	48	48	48	48	48	51	51	51	51	51
Dimensions												
Length	mm	1090	1090	1090	1090	1090	1090	2270	2270	2270	2270	2270
Width	mm	2109	2109	2109	2109	2109	2109	2123	2123	2123	2123	2123
Height	mm	1440	1440	1440	1440	1440	1440	1440	1440	1440	1440	1440
Height with Buffer Tank Module	mm	2040	2040	2040	2040	2040	2040	2040	2040	2040	2040	2040
Operating weight with Micro-Channel coils(3)												
Standard unit	kg	422	430	436	449	445	463	753	762	771	829	854
Unit + High-pressure single pump option	kg	463	472	478	491	487	505	820	829	842	903	928
Unit + High-pressure dual pump option	kg	489	498	504	517	513	531	865	874	891	940	965
Unit + High-pressure single pump + Buffer Tank module option	kg	859	868	874	887	883	901	1253	1262	1275	1336	1361
Unit + High-pressure dual pump + Buffer Tank module option	kg	885	894	900	913	909	927	1298	1307	1324	1373	1398
Compressors		Hermetic Scroll 48.3 r/s										
Circuit A	Qty	2	2	2	2	2	2	3	3	3	2	2
Circuit B	Qty	-	-	-	-	-	-	-	-	-	2	2
No. of power stages	Qty	2	2	2	2	2	2	3	3	3	4	4
Refrigerant with Micro-Channel coils(3)		R410A										
Circuit A	kg	4,7	5,3	5,9	6,7	6,2	7,3	10,7	10,8	11,4	6,5	7,4
	teqCO_2	9,8	11,1	12,3	14,0	12,9	15,2	22,3	22,6	23,8	13,6	15,5
Circuit B	kg	-	-	-	-	-	-	-	-	-	6,5	7,4
	teqCO_2	-	-	-	-	-	-	-	-	-	13,6	15,5
Oil charge		POE SZ160 (EMKARATE RL 32-3MAF).										
Circuit A	l	5,8	7,2	7,2	7,2	7	7	10,8	10,5	10,5	7	7
Circuit B	l	-	-	-	-	-	-	-	-	-	7	7
Capacity Control		Connect Touch Control										
Minimum capacity	%	50	50	50	50	50	50	33	33	33	25	25

(1) In dB ref=10^{-12} W, weighting (A). 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.

(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 level Lw(A).

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

5 - PHYSICAL AND ELECTRICAL PROPERTIES OF AQUACIAT LD/ILD UNITS

AQUACIAT LD		150A	180A	200A	240A	260A	300A	360A	390A	450A	520A	600A
Air heat exchanger		Micro-Channel coil										
Fans - Standard unit												
Quantity		1	1	1	1	1	1	2	2	2	2	2
Maximum total air flow	l/s	3885	3883	3687	3908	5013	5278	6940	6936	7370	10026	10556
Maximum rotation speed	rps	12	12	12	12	16	16	12	12	12	16	16
Water heat exchanger		Direct expansion, plate heat exchanger										
Water volume	l	2,6	3	3,3	4	4,8	5,6	8,7	9,9	11,3	12,4	14,7
Max water-side operating pressure without hydronic module	kPa	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Hydronic module (option)												
Single or dual pump (as required)		Pump, victaulic screen filter, relief valve, expansion vessel, purge valves (water and air), pressure sensors										
Expansion tank volume	l	18	18	18	18	18	18	35	35	35	35	35
Expansion vessel pressure(4)	l	1	1	1	1	1	1	1,5	1,5	1,5	1,5	1,5
Max. water-side operating pressure with hydronic module	kPa	400	400	400	400	400	400	400	400	400	400	400
Buffer Tank Module (option)												
Single or dual pump (as required)		Pump, victaulic screen filter, relief valve, expansion vessel, purge valves (water and air), pressure sensors										
Water volume	l	250	250	250	250	250	250	250	250	250	250	250
Expansion tank volume	l	18	18	18	18	18	18	35	35	35	35	35
Expansion vessel pressure(4)	bar	1	1	1	1	1	1	1,5	1,5	1,5	1,5	1,5
Max. water-side operating pressure with hydronic module	kPa	400	400	400	400	400	400	400	400	400	400	400
Water connections with/without hydronic module		Victaulic®										
Connections	inches	2	2	2	2	2	2	2	2	2	2	2
External diameter	mm	60,3	60,3	60,3	60,3	60,3	60,3	60,3	60,3	60,3	60,3	60,3
Casing paint		Colour code RAL 7035/RAL 7024										

(4) Upon delivery, the standard preinflation of the vessels is not necessarily at the optimum value for the installation. In order to enable free variation of the water volume, adjust the inflation pressure to a pressure close to that corresponding to the static head of the installation. Charge the installation with water (purging the air), to a pressure 10 to 20 kPa higher than that of the vessel.

5 - PHYSICAL AND ELECTRICAL PROPERTIES OF AQUACIAT LD/ILD UNITS

5.2 Physical properties of AQUACIAT ILD units

AQUACIAT ILD		150A	180A	200A	240A	260A	300A	302A	360A	390A	450A	520A	600A
Noise levels													
Standard unit													
Sound power(1)	dB(A)	80	81	81	86	87	87	84	84	84	84	90	90
Sound pressure at 10 m(2)	dB(A)	49	49	49	55	55	55	52	52	52	52	58	58
Unit + Xtra Low Noise option													
Sound power(1)	dB(A)	79	80	80	80	80	80	83	83	83	83	83	83
Sound pressure at 10 m(2)	dB(A)	48	48	48	48	48	48	51	51	51	51	51	51
Dimensions													
Length	mm	1090	1090	1090	1090	1090	1090	2270	2270	2270	2270	2270	2270
Width	mm	2109	2109	2109	2109	2109	2109	2123	2123	2123	2123	2123	2123
Height	mm	1440	1440	1440	1440	1440	1440	1440	1440	1440	1440	1440	1440
Height with Buffer Tank Module	mm	2040	2040	2040	2040	2040	2040	2040	2040	2040	2040	2040	2040
Operating weight(3)													
Standard unit	kg	497	506	543	549	559	564	777	896	905	979	1053	1057
Unit + High-pressure single pump option	kg	539	548	585	591	601	606	844	963	972	1050	1127	1131
Unit + High-pressure dual pump option	kg	565	574	611	617	627	632	889	1008	1017	1098	1164	1168
Unit + High-pressure single pump + Buffer Tank module option	kg	935	943	981	986	996	1001	1276	1395	1404	1482	1560	1563
Unit + High-pressure dual pump + Buffer Tank module option	kg	961	969	1006	1012	1022	1027	1321	1440	1449	1531	1597	1600
Compressors		Hermetic Scroll 48.3 r/s											
Circuit A	Qty	2	2	2	2	2	2	2	3	3	3	2	2
Circuit B	Qty	-	-	-	-	-	-	-	-	-	-	2	2
No. of power stages	Qty	2	2	2	2	2	2	2	3	3	3	4	4
Refrigerant (3)		R410A											
Circuit A	kg	12,5	13,5	16,5	17,5	18	16,5	21,5	27,5	28,5	33	19	18,5
	teqCO_2	26,1	28,2	34,5	36,5	37,6	34,5	44,9	57,4	59,5	68,9	39,7	38,6
Circuit B	kg	-	-	-	-	-	-	-	-	-	-	19	18,5
	teqCO_2	-	-	-	-	-	-	-	-	-	-	39,7	38,6
Oil charge		POE SZ160 (EMKARATE RL 32-3MAF)											
Circuit A	l	5,8	7,2	7,2	7,2	7,0	7,0	7,2	7,0	7,0	7,0	7,0	7,0
Circuit B	l	-	-	-	-	-	-	-	-	-	-	7,0	7,0
Capacity Control		Connect Touch Control											
Minimum capacity	%	50	50	50	50	50	50	50	33	33	33	25	25

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

(2) In dB ref 20µPa, weighting (A). Declared dual-number noise emission value in accordance with ISO 4871 (with an uncertainty of +/-3dB(A). Value calculated from the sound power level Lw(A).

(3) Weights given as a guide. Refer to the unit nameplate.

5 - PHYSICAL AND ELECTRICAL PROPERTIES OF AQUACIAT LD/ILD UNITS

AQUACIAT ILD		150A	180A	200A	240A	260A	300A	302A	360A	390A	450A	520A	600A
Air heat exchanger		Grooved copper tube and aluminium fins											
Fans													
Quantity		1	1	1	1	1	1	2	2	2	2	2	2
Maximum total air flow	l/s	3692	3690	3910	5285	5284	5282	7770	7380	7376	7818	10568	10568
Maximum rotation speed	rps	12	12	12	16	16	16	12	12	12	12	16	16
Water heat exchanger		Direct expansion, plate heat exchanger											
Water volume	l	2,6	3	4	4,8	4,8	5,6	8,7	8,7	9,9	11,3	12,4	14,7
Max. operating pressure, water side	kPa	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Hydronic module (option)													
Single or dual pump (as required)		Pump, victaulic screen filter, expansion vessel, relief valve purge valves (water and air), pressure sensors											
Expansion tank volume	l	18	18	18	18	18	18	35	35	35	35	35	35
Expansion vessel pressure(4)	l	1	1	1	1	1	1	1,5	1,5	1,5	1,5	1,5	1,5
Max. water-side operating pressure with hydronic module	kPa	400	400	400	400	400	400	400	400	400	400	400	400
Buffer Tank Module (option)													
Single or dual pump (as required)		Pump, victaulic screen filter, expansion vessel, relief valve purge valves (water and air), pressure sensors											
Water volume	l	250	250	250	250	250	250	250	250	250	250	250	250
Expansion tank volume	l	18	18	18	18	18	18	35	35	35	35	35	35
Expansion vessel pressure(4)	bar	1	1	1	1	1	1	1,5	1,5	1,5	1,5	1,5	1,5
Max. water-side operating pressure with hydronic module	kPa	400	400	400	400	400	400	400	400	400	400	400	400
Water connections with/without hydronic module		Victaulic®											
Connections	inches	2	2	2	2	2	2	2	2	2	2	2	2
External diameter	mm	60,3	60,3	60,3	60,3	60,3	60,3	60,3	60,3	60,3	60,3	60,3	60,3
Casing paint		Colour code RAL 7035 and RAL7024											

(4) "Upon delivery, the standard preinflation of the vessels is not necessarily at the optimum value for the installation. In order to enable free variation of the water volume, adjust the inflation pressure to a pressure close to that corresponding to the static head of the installation. Charge the installation with water (purging the air), to a pressure 10 to 20 kPa higher than that of the vessel.

5 - PHYSICAL AND ELECTRICAL DATA FOR THE UNITS

5.3 Electrical data notes for the Units

LD / ILD - Standard unit (without hydronic module)		150A	180A	200A	240A	260A	300A	302A	360A	390A	450A	520A	600A
Power circuit													
Nominal voltage	V-ph-Hz	400 - 3 -50											
Voltage range	V	360 - 440											
Control circuit supply		24 V via internal transformer											
Nominal unit operating current(3)													
Circuit A&B	A	25,6	29	33	36	42,4	52,8	53,4	55,4	61,7	77,3	84,8	105,6
Max. operating input power(2)													
Circuit A&B	kW	19,5	22,3	24,5	27,9	31,2	35,8	35,6	42,3	45,6	52,5	62,4	71,6
Cosine Phi unit at maximum power (2)		0,83	0,81	0,81	0,83	0,81	0,78	0,78	0,83	0,81	0,79	0,81	0,78
Unit max. operating current (Un-10%)(5)													
Circuit A&B	A	38	49,2	51,4	58,4	74,8	79,6	80,2	89	110,3	117,5	149,6	159,2
Maximum unit current draw (Un)(4)													
Circuit A&B - Standard unit	A	34,8	44,8	46,8	52,8	67	73	73,6	80,6	98,6	107,6	134	146
Maximum start-up current, standard unit (Un)(1)													
Circuit A&B	A	113,8	134,8	142,8	145,8	176	213	213,6	173,6	207,6	247,6	243	286
Maximum start-up current, unit with soft starter (Un)(1)													
Circuit A&B	A	74,7	86,5	93,8	96,2	114,4	139,8	139,8	130,4	155,4	181,4	186,4	215,4

(1) Maximum instantaneous starting current (maximum operating current of the smallest compressor(s) + fan current(s) + locked rotor current of the largest compressor).
(2) Input power, at the unit's continuous operating limits (indicated on the unit name plate).
(3) Standardised EUROVENT conditions, water-cooled exchanger water inlet/outlet = 12°C/7°C, outdoor air temperature = 35°C.
(4) Unit maximum current at 400 V, in non-continuous operation (indicated on the unit name plate)
(5) Unit maximum current at 360 V, in non-continuous operation

5.4 Short circuit current withstand capability

Short circuit current withstand capability (TN system(1))												
AQUACIAT LD / ILD	**150A**	**180A**	**200A**	**240A**	**260A**	**300A**	**302A**	**360A**	**390A**	**450A**	**520A**	**600A**
Value without upstream protection												
Short time (1s) assigned current - Icw - kA eff	3,36	3,36	3,36	3,36	3,36	3,36	3,36	5,62	5,62	5,62	5,62	5,62
Allowable peak assigned current - Ipk - kA pk	20	20	20	20	20	15	15	20	20	15	20	15
Value with upstream protection												
Conditional short circuit assigned current Icc - kA eff	40	40	40	40	40	40	40	40	40	40	30	30
Associated Schneider circuit breaker - Compact type range(2)	NS100H	NS100H	NS100H	NS100H	NS100H	NS100H	NS100H	NS100H	NS160H	NS160H	NS250H	NS250H

(1) Type of system earthing

(2) If another current limiting protection device is used, its time-current trip and I^2t thermal stress characteristics must be at least equivalent to those of the recommended Schneider circuit breaker. Contact your manufacturer's representative.

The short-circuit withstand values given above were determined for the TN system.

5 - PHYSICAL AND ELECTRICAL DATA FOR THE UNITS

5.5 Electrical data notes for the hydronic module

The pumps fitted to these units have motors which meet efficiency class IE2 for motors < 7.5kW and IE3 for motors > 7.5kW. The additional electrical data required(1) is as follows:

Unit low-pressure single and dual pumps (Fixed speed single pumps, hydronic module option)

No.(2)	Description(3)	Units	LD / ILD											
			150A	180A	200A	240A	260A	300A	302A	360A	390A	450A	520A	600A
1	Nominal efficiency at full load and nominal voltage	%	79,5	79,5	79,5	79,5	79,5	79,5	79,5	79,5	82,3	82,3	81,9	81,9
1	Nominal efficiency at 75% of full load and nominal voltage	%	78,2	78,2	78,2	78,2	78,2	79,5	78,2	78,2	81,8	81,8	81,8	81,8
1	Nominal efficiency at 50% of full load and nominal voltage	%	74,5	74,5	74,5	74,5	74,5	74,5	74,5	74,5	79,7	79,7	79,1	79,1
2	Efficiency level	-	IE2											
3	Year of manufacture	-	This information varies depending on the manufacturer and model at the time of incorporation. Please refer to the motor name plates.											
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	2	2	2	2	2	2	2	2	2	2	2
7-1	Nominal shaft power output at full load and nominal voltage (400 V)	kW	0,8	0,8	0,8	0,8	0,8	0,8	0,8	0,8	1,25	1,25	1,7	1,7
7-2	Maximum input power (400 V)(4)	kW	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,5	1,5	2,3	2,3
8	Nominal input frequency	Hz	50	50	50	50	50	50	50	50	50	50	50	50
9-1	Nominal voltage	V	3 X 400											
9-2	Maximum current drawn (400 V)(5)	A	2,3	2,3	2,3	2,3	2,3	2,3	2,3	2,3	3,1	3,1	4,3	4,3
10	Nominal speed	rps - rpm	2838	2838	2838	2838	2838	2838	2838	2838	2892	2892	2863	2863
			47	47	47	47	47	47	47	47	48	48	48	48
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	< 55											
	III - Maximum operating temperature	°C	Please refer to the operating conditions given in this manual or in the specific conditions given in the selection programs.											
	IV - Potentially explosive atmospheres	-	Non ATEX environment											

(1) Additional electrical data required by regulation No. 640/2009 concerning the application of directive 2005/32/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 hydronic 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 hydronic 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.

5.6 Electrical data notes for the compressors

Compressor	I Nom	I Max (Un)	I Max (Un-10%)	LRA(1) A	LRA(2) A	Cos Phi Max
ZP90	11,4	16	17,6	95	57	0,82
ZP103	13,1	21	23,1	111	67	0,84
ZP120	15,1	22	24,3	118	71	0,84
ZP137	16,6	25	27,8	118	71	0,86
ZP154	18,7	31	34,9	140	84	0,85
ZP182	23,9	34	37,3	174	104	0,84

I Nom: Nominal current (A) under Eurovent conditions (see definition of conditions under unit nominal current)
I Max: Maximum operating current (A), 360 V
(1) Locked rotor current (A), at nominal voltage
(2) Locked rotor current (A) with electronic starter, at nominal voltage

5 - PHYSICAL AND ELECTRICAL DATA FOR THE UNITS

5.7 Distribution of compressors per circuit

Compressor	Circuit	LD / ILD											
		150A	180A	200A	240A	260A	300A	302A	360A	390A	450A	520A	600A
ZP90	A	2	-	-	-	-	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-	-	-	-	-	-
ZP103	A	-	2	-	-	-	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-	-	-	-	-	-
ZP120	A	-	-	2	-	-	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-	-	-	-	-	-
ZP137	A	-	-	-	2	-	-	-	3	-	-	-	-
	B	-	-	-	-	-	-	-	-	-	-	-	-
ZP154	A	-	-	-	-	2	-	-	-	3	-	2	-
	B	-	-	-	-	-	-	-	-	-	-	2	-
ZP182	A	-	-	-	-	-	2	2	-	-	3	-	2
	B	-	-	-	-	-	-	-	-	-	-	-	2

I Nom: Nominal current (A) under Eurovent conditions (see definition of conditions under unit nominal current)
I Max: Maximum operating current (A), 360 V
(1) Locked rotor current (A), at nominal voltage
(2) Locked rotor current (A) with electronic starter, at nominal voltage

5.8 Comments on electrical data notes

Electrical data notes and operating conditions - Notes:

- LD / ILD 150A-600A units have a single connection point to the electrical mains, situated immediately upstream of the power supply connections.
- **The electrical box contains as standard:**
  - motor start-up and protection equipment for each compressor, the fans and the pump.
  - Main disconnect switch
  - A main disconnect switch is fitted as standard in the electrical box
- On-site connections:

  All connections to the system and the electrical installations must be in accordance with all applicable codes.
- CIAT LD / ILD units are designed to ensure compliance with these guidelines. European standard EN 60204-1 (Safety of machinery - electrical equipment of machines - part one: general requirements - equivalent to IEC 60204-1) is taken into account in the design of the machine's electrical equipment*.
- The QF circuit breaker is delivered with an auxiliary contactor which enables a safety loop to be installed, in order to provide status feedback on the heater and the power supply to the electronic boards, and thereby prevent the evaporator from freezing when the heaters and boards are off.

NOTE:

- Generally, the recommendations of the International Electrotechnical Commission (IEC 60364) are accepted as meeting the requirements of the installation guidelines.

  Compliance with standard EN 60204-1 is a good way of meeting the requirements (˜1.5.1) of the Machinery Directive.
- Appendix B of standard EN 60204-1 specifies the electrical data notes under which the machines operate.
- The operating conditions of the LD / ILD units are specified below:
  1. Environment**
  - The classification of the environment is specified in standard EN 60721 - equivalent to IEC 60721):
  - outdoor installation**,
  - ambient temperature range: -20°C for the minimum temperature, up to +48°C, classification 4K4H,
  - altitude less than or equal to 2000 m (see notes for tables in paragraph entitled - Electrical data notes for the hydronic module-).
  - presence of solids: classification 4S2 (presence of insignificant dust),
  - presence of corrosive and pollutant substances, classification 4C2 (negligible),
  2. Power supply frequency variations: ± 2 Hz.
  3. The neutral wire (N) must not be connected directly to the unit (if necessary use transformers.)
  4. Overcurrent protection of the power supply conductors is not provided with the unit.
  5. The factory-fitted switch is of a type suitable for power interruption in compliance with EN 60947-3 (equivalent to IEC 60947-3)
  6. The units are designed to be connected more easily to TN systems (IEC 60364). In the case of IT systems, provide a local earth. Consult the competent local organisations to perform the electrical installation. Units supplied with a speed drive (28 and 116J/K/V/W options) are not compatible with the TIC system.
  7. Leakage currents: if leakage current monitoring protection is required to guarantee the safety of the installation, its trip value must be set taking into consideration the presence of leakage currents induced by the presence of variable frequency drives on the machine. In particular, a value of at least 150 mA is recommended for the differential protection device setting.

Warning: If particular aspects of an installation require different properties to those listed above (or which are not listed), please contact your manufacturer.

* The absence of a main power disconnect switch on the standard machines is an exception to take into account during on-site installation.

** The required protection level for this class is IP43BW (according to reference document IEC 60529). Since all LD / ILD units are IP44CW, they fulfil this protection condition:

- The closed electrical box is IP44CW
- The open electrical box (for interface access) is IPxxB

6 - ELECTRICAL CONNECTION

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

6.1 Power supply

The power supply must meet the specification on the unit's nameplate.

The supply voltage must be within the range specified in the electrical data table.

For connections refer to the wiring diagrams and certified dimensional drawings.

WARNING: Operation of the unit with an incorrect supply voltage or excessive phase imbalance constitutes misuse which will invalidate the manufacturer's warranty. If the phase imbalance exceeds 2% for voltage, or 10% for current, contact your local electricity supplier at once and ensure that the unit is not switched on until corrective measures have been taken.

After the unit has been installed, the power supply must only be disconnected for quick maintenance operations (one day maximum). For longer maintenance operations or when the unit is taken out of service (for example, during winter when the unit does not need to generate cooling) the power supply of the unit must be maintained permanently.

6.2 Voltage phase imbalance (%)

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

Example:

On a 400 V - 3 ph - 50 Hz power supply, the individual phase voltages were measured with the following values: AB= 406V; BC= 399V; AC= 394V

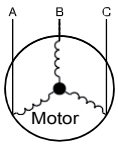
Average voltage =(406+399+394)/3=1199/3 =399.7 i.e. 400 V

Calculate the maximum deviation from the 400 V average:

(AB) = 406 - 400 = 6

(BC) = 400 - 399 = 1

(CA) = 400 - 394 = 6



6.3 Recommended cable 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 guideline, and does not engage the manufacturer's liability.

After wire sizing has been completed, using the certified dimensional drawing, the installer must verify the appropriate means of connection and define any modifications necessary on site.

The connections provided as standard for the customer's power supply cables are designed for the number and type of sections listed in the table below.

The calculations of favourable and unfavourable cases are performed by using the maximum current possible of each unit fitted with a hydronic kit (see the tables of electrical data of the unit and the hydronic module).

The study includes the standardised installation cases according to IEC 60364: cables with PVC (70°C) or XLPE (90°C) insulation with copper core; routing in accordance with table 52C of the standard.

The maximum length mentioned is calculated to limit the voltage drop to 5 %.

IMPORTANT: Before connecting the main power cables (L1 - L2 - L3), always check 3 phases are in the correct order (clockwise) before proceeding to the connection on the main disconnect switch.

6 - ELECTRICAL CONNECTION

Table of minimum and maximum cable sections (per phase) for connection to the units

AQUACIAT LD / ILD	Max. connectable section(1)	Calculation of favourable case: - Suspended overhead line (standardised routing no. 17) - Cable with XLPE insulation			Calculation of unfavourable case: - Conductors in ducts or multi-conductor cables in closed conduits (standardised routing no. 61) - Cable with PVC insulation		
	Connection cage	Section(2)	Max length for a voltage drop < 5%	Cable type(3)	Section(2)	Max length for a voltage drop < 5%	Cable type(3)
	mm² (per phase)	mm² (per phase)	m	-	mm² (per phase)	m	-
150A	1 x 95	1 x 16	165	XLPE Copper	1 x 25	300	PVC Copper
180A	1 x 95	1 x 16	165	XLPE Copper	1 x 25	300	PVC Copper
200A	1 x 95	1 x 16	165	XLPE Copper	1 x 25	300	PVC Copper
240A	1 x 95	1 x 25	210	XLPE Copper	1 x 35	305	PVC Copper
260A	1 x 95	1 x 35	220	XLPE Copper	1 x 50	350	PVC Copper
300A	1 x 95	1 x 35	220	XLPE Copper	1 x 70	380	PVC Copper
302A	1 x 95	1 x 35	220	XLPE Copper	1 x 70	380	PVC Copper
360A	1 x 95	1 x 35	220	XLPE Copper	1 x 70	380	PVC Copper
390A	1 x 95	1 x 70	280	XLPE Copper	1 x 95	410	PVC Copper
450A	1 x 95	1 x 70	280	XLPE Copper	1 x 95	410	PVC Copper
520A	1 x 185	1 x 95	305	XLPE Copper	1 x 185	465	PVC Copper
600A	1 x 185	1 x 120	320	XLPE Copper	1 x 185	465	PVC Copper

NOTE:

(1) Connection capacities actually available for each machine. These are defined according to the connection terminal size, the electrical box access opening dimensions and the available space inside the electrical box.

(2) Selection simulation result considering the hypotheses indicated.

(3) If the maximum calculated section is for an XLPE cable type, this means that a selection based on a PVC cable type can exceed the connection capacity actually available. Special attention must be given to selection.

The protection against direct contact at the electrical connection point is compatible with the addition of terminals extension. The installer must determine whether these are necessary based on the cable sizing calculation.

The protection against direct contact at the electrical connection point is compatible with the addition of terminals extension.

The installer must determine whether these are necessary based on the cable sizing calculation.

6.4 Power cable access routing

The power cables can be routed into the electrical box for the units:

- via the underside of the unit,
- via the side of the unit,
- on the bottom of the corner post.

A removable aluminium plate on the base of the electrical cabinet provides access for the power cables.

It is important to check that the power cable bend radius is compatible with the connection space available inside the electrical cabinet.

Refer to the certified dimensional drawing for the unit.

6.5 Field-installed control wiring

IMPORTANT: Connecting the interface circuits on-site creates certain safety risks; any modification to the electrical box must ensure the equipment remains compliant with local regulations. In particular, precautions must be taken to prevent accidental electrical contact between the circuits supplied by different sources:

- The choice of routing and/or insulation characteristics of the conductors ensures double electrical insulation.
- The conductors should be fixed together inside the electrical box to prevent contact between the end of the conductor and a live part in case of accidental disconnection.

See the control manual and the certified electric wiring diagram supplied with the unit for the field control wiring of the following devices:

- Device automatic operation control
- Setpoint 1/Setpoint 2 switching
- Heating / cooling selection
- Demand limits
- Operating fault display
- Locking switch (safety chain)
- Customer pump switch control (on/off)
- Setpoint adjustable by 4-20 mA signal
- Second power limitation level
- Desuperheater activation control
- Unit shut down general fault reporting
- Free cooling drycooler management

6.6 Electric power reserve for the user

Control circuit power reserve:

After all possible options have been connected, the CT transformer ensures the availability of 1 A of power for the control cabling on-site on 24 V, 50 Hz.

7 - APPLICATION DATA

7.1 AQUACIAT LD operating limits

AQUACIAT LD		Minimum	Maximum
Water heat exchanger			
Water inlet temperature (at start-up)	°C	7.5 (1)	30
Water outlet temperature (in operation)	°C	5 (2)	20
Water outlet temperature (in operation) / Low Temperature option	°C	0 (2)	20
Water outlet temperature (in operation) / Very Low Temperature option	°C	-15 (2)	20
Inlet / outlet temperature difference	K	3	10
Standard air-cooled exchanger			
Air inlet temperature at full load	°C	0	46
Air inlet temperature at partial load	°C	0	48
Air-cooled exchanger, Winter operation or Xtra Fan option(3)			
Air inlet temperature at full load	°C	-20	46
Air inlet temperature at partial load	°C	-20	48
Hydronic module(4)			
Air inlet temperature			
Without pump	°C	-20	-
With Single or Dual pump option (LP or HP)	°C	-10	-
With Single or Dual pump (LP or HP) + Frost protection option	°C	-20	-
With Buffer Tank option	°C	0	
With Buffer Tank + Frost protection option	°C	-20	-

Note: Do not exceed the maximum operating temperature.

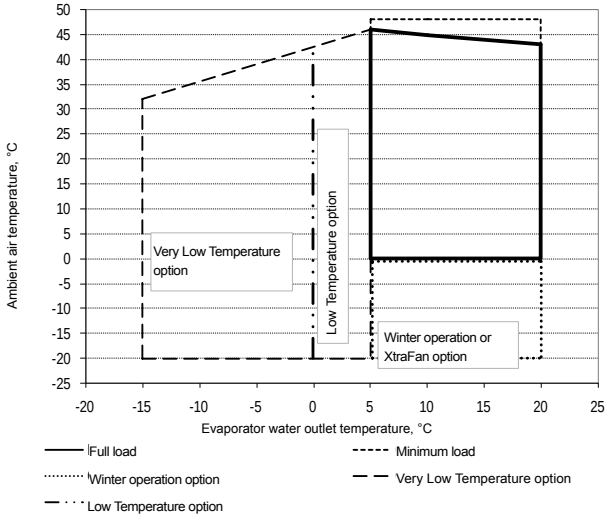
(1) For a water inlet temperature at start-up of less than 7.5°C, contact the manufacturer.

(2) Use of antifreeze is obligatory if the water outlet temperature is below 5°C.

(3) Ducted machines (Xtra Fan option) This operating range applies up to a static pressure of 130 Pa for sizes 260A-300A and 540A-600A, and up to 240 Pa for all other sizes.

(4) Defines the antifreeze protection temperature of the hydronic components for use without glycol

In case of storing and transporting AQUACIAT LD units, the min. and max. temperature limits are -20°C and +48°C. It is recommended to take into consideration these temperatures in case of container transport.



7.2 AQUACIAT ILD operating limits

AQUACIAT ILD / Cooling mode		Minimum	Maximum
Water heat exchanger			
Water inlet temperature (at start-up)	°C	7.5 (1)	30
Water outlet temperature (in operation)	°C	5 (2)	20
Inlet/outlet temperature difference	°C	3 (2)	10
Standard air-cooled exchanger			
Air inlet temperature	°C	0	48
Air inlet temperature at partial load	°C	0	48
Air-cooled exchanger, Winter operation or Xtra Fan option(3)			
Air inlet temperature at full load	°C	-20	46
Air inlet temperature at partial load	°C	-20	48
Hydronic module(4)			
Air inlet temperature			
Without pump	°C	-20	-
With Single or Dual pump option (LP or HP)	°C	0	-
With Single or Dual pump (LP or HP) + Frost protection option	°C	-20	-
With Buffer Tank option	°C	0	
With Buffer Tank + Frost protection option	°C	-20	-

Note: Do not exceed the maximum operating temperature.

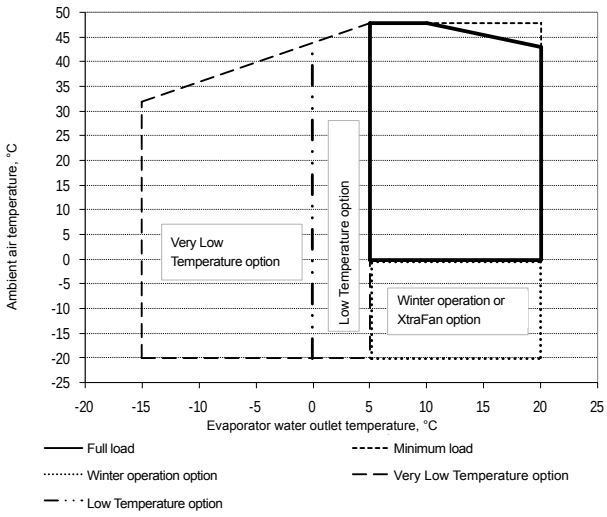
(1) For a water inlet temperature at start-up of less than 7.5°C, contact the manufacturer.

(2) Use of antifreeze is obligatory if the water outlet temperature is below 5°C.

(3) Ducted machines (Xtra Fan option) This operating range applies up to a static pressure of 130 Pa for sizes 260A-300A and 540A-600A, and up to 240 Pa for all other sizes.

(4) Defines the antifreeze protection temperature of the hydronic components for use without glycol

In case of storing and transporting AQUACIAT LD units, the min. and max. temperature limits are -20°C and +48°C. It is recommended to take into consideration these temperatures in case of container transport.



NOTE: Ducted machines (Xtra Fan option) This operating range applies up to a static pressure of 130 Pa without a suction duct for sizes 070-080 and 140-160, and up to 240 Pa for all other sizes.

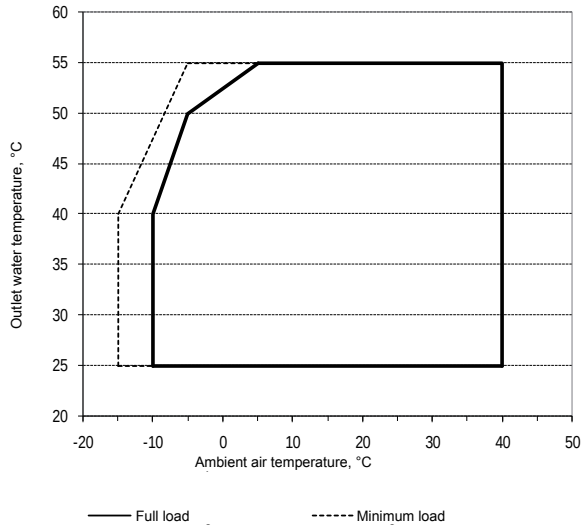
Operating range for standard unit, heating mode

AQUACIAT ILD / Cooling mode		Minimum	Maximum
Water heat exchanger			
Water inlet temperature (at start-up)	°C	8	45
Water outlet temperature (in operation)	°C	25	55
Inlet/outlet temperature difference	K	3	10
Air-cooled exchanger (3)			
Air inlet temperature	°C	-15	40
Hydronic module(4)			
Air inlet temperature			
Without pump	°C	-20	-
With Single or Dual pump option (LP or HP)	°C	0	-
With Single or Dual pump (LP or HP) + Frost protection option	°C	-20	-
With Buffer Tank option	°C	0	
With Buffer Tank + Frost protection option	°C	-20	-

Note: Do not exceed the maximum operating temperature.

(3) Ducted machines (Xtra Fan option) This operating range applies up to a static pressure of 130 Pa for sizes 240A to 300A and 540A-600A, and up to 240 Pa for all other sizes.

(4) Defines the frost protection temperature of the hydronic components for installation without glycol.

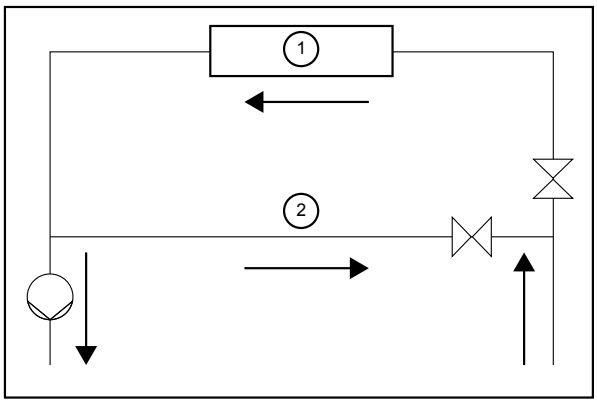


7.3 Minimum heat transfer fluid flow rate (units without factory-fitted hydronic module)

The minimum heat transfer fluid flow rate is given in the paragraph "water exchanger min. water volume and flow rate".

If the system flow is less than the unit's minimum flow, the exchanger flow can be recirculated, as shown in the diagram

For a minimum heat transfer fluid flow rate



① Water exchanger

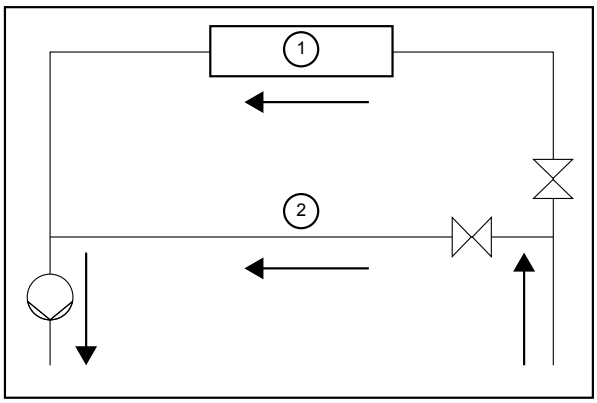
② Recirculation

If the system flow rate is less than the minimum flow rate, there may be a high risk of fouling.

7.4 Maximum heat transfer fluid flow rate (without factory-fitted hydronic module)

The maximum heat transfer fluid flow rate is given in the paragraph "water exchanger min. water volume and flow rate". If the system's flow exceeds the unit's maximum value, it can be bypassed as shown in the diagram.

For a maximum heat transfer fluid flow rate



① Water exchanger

② Recirculation

It is limited by the allowable pressure drop for the water exchanger. Furthermore, it must ensure a minimum ΔT in the water exchanger of 2.8 K, which corresponds to a flow rate of 0.09 l/s per kW.

7.5 Water exchanger min. water volume and flow rate

The Connect Touch controller is equipped with anticipation logic making it highly flexible in adjusting operation to parameter drift, particularly on hydronic systems with low water volumes. By adjusting compressor running times, it prevents short-cycle protection cycles from starting and, in most cases, eliminates the need for a buffer tank.

Note: The minimum heat transfer fluid volumes are calculated for EUROVENT rated conditions:

- heat transfer fluid temperature in the water exchanger = 12°C / 7°C
- inlet air temperature in the air exchanger = 35°C

This value applies to most air conditioning applications (assembly with fan coil units)

For reversible machines (ILD), these minimum volumes take into account the defrosting cycles in order to prevent temperature degradation of the water loop.

Note:
For installations operating on low water volumes (assembly with air handling unit) or for industrial processes, the buffer tank is essential.

AQUACIAT LD		150A	180A	200A	240A	260A	300A	360A	390A	450A	520A	600A
Minimum system water volume, air conditioning application (litres)		121	140	164	182	207	243	181	205	240	204	240
Minimum system water volume, industrial process application (litres)		304	351	410	454	518	608	452	513	601	510	601
Min. / max. water exchanger flow rate without hydronic module(1) (l/s)		0.9 / 3	0.9 / 3.4	0.9 / 4.2	0.9 / 5	1 / 5	1.2 / 5.5	1.3 / 6.8	1.5 / 7.7	1.7 / 8.5	2 / 10.6	2.3 / 11.2
Maximum water exchanger flow rate, Dual pump (l/s) (2)	Low pressure(3)	2,9	3,2	3,7	4,1	4,1	4,4	5,1	6,3	6,5	7,9	8,2
	High pressure (3)	3,4	3,8	4,4	5	5	5,2	6,2	6,5	8	8,7	8,9

(1) Maximum flow rate for a pressure drop of 100 kPa in the water exchanger

(2) Maximum flow rate for an available pressure of 20 kPa (unit with low-pressure pumps) or 50 kPa (high pressure).

(3) Maximum flow rate with single pump 2 to 4% higher, depending on the size.

NOTE: For the Buffer Tank Module option, the tank volume must be taken into account: 250 litres

AQUACIAT ILD		150A	180A	200A	240A	260A	300A	302A	360A	390A	450A	520A	600A
Minimum system water volume, air conditioning application (litres)		202	234	274	303	346	405	405	301	342	400	340	401
Minimum system water volume, industrial process application (litres)		304	351	410	454	518	608	608	452	513	601	510	601
Min. / max. water exchanger flow rate without hydronic module(1) (l/s)		0.9 / 3	0.9 / 3.4	0.9 / 4.2	0.9 / 5	1 / 5	1.2 / 5.5	1.2 / 6.8	1.3 / 6.8	1.5 / 7.7	1.7 / 8.5	2 / 10.6	2.3 / 11.2
Maximum water exchanger flow rate, Dual pump (l/s) (2)	Low pressure(3)	2,9	3,2	3,7	4,1	4,1	4,4	5,1	5,1	6,3	6,5	7,9	8,2
	High pressure (3)	3,4	3,8	4,4	5	5	5,2	6,2	6,2	6,5	8	8,7	8,9

(1) Maximum flow rate for a pressure drop of 100 kPa in the water exchanger

(2) Maximum flow rate for an available pressure of 20 kPa (unit with low-pressure pumps) or 50 kPa (high pressure).

(3) Maximum flow rate with single pump 2 to 4% higher, depending on the size.

NOTE: For the Buffer Tank Module option, the tank volume must be taken into account: 250 litres

7.6 Maximum system water volume

Units supplied with a hydronic module may include an expansion tank which limits the volume in the water loop.

The table below gives the maximum loop volume compatible with the expansion vessel (for pure water or ethylene glycol depending on the system's various concentrations and static pressures). If this volume is less than the volume of the installed loop, then it is necessary to add an additional expansion vessel within the system.

LD / ILD without Buffer Tank option		150A-300A			302A-600A		
Static pressure	bar	1	2	3	1	2	3
Pure water	l	597	398	199	1741	1161	580
10% EG	l	471	314	157	1373	915	458
20% EG	l	389	259	130	1135	757	378
30% EG	l	348	232	116	1014	676	338
40% EG	l	289	193	96	843	562	281

EG: Ethylene glycol

LD / ILD with Buffer Tank option		150A-300A			302A-600A		
Static pressure	bar	1	2	3	1	2	3
Pure water	l	896	597	299	1680	1120	560
10% EG	l	706	471	235	1260	840	420
20% EG	l	584	389	195	930	620	310
30% EG	l	522	348	174	750	500	250
40% EG	l	434	289	145	630	420	210

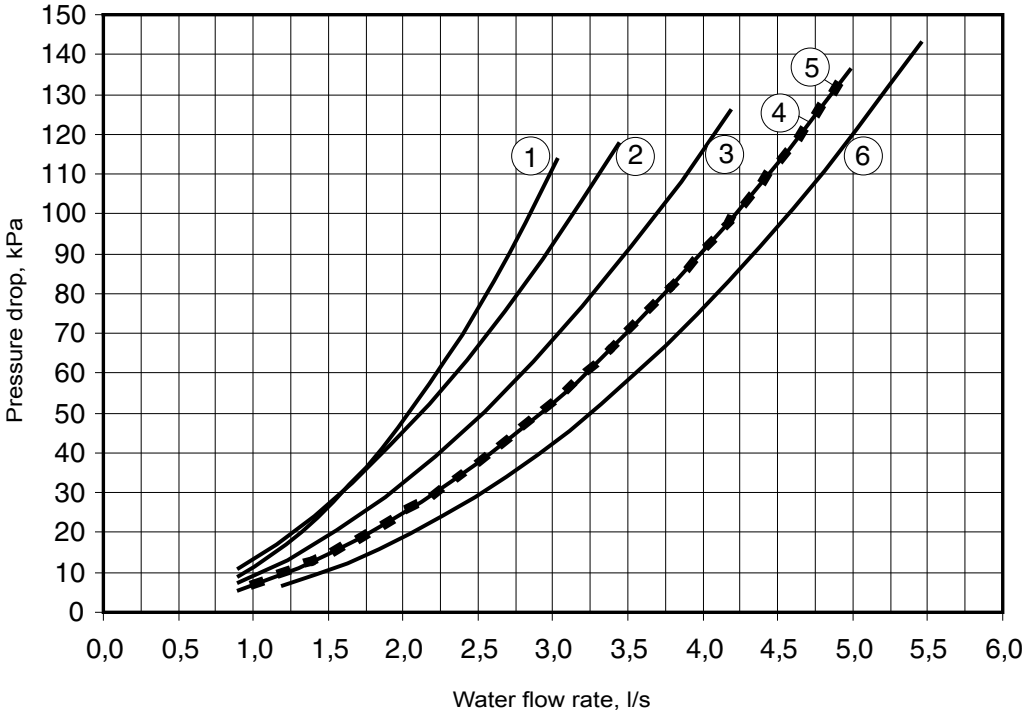
EG: Ethylene glycol

NOTE: Take into account the buffer tank volume (250 litres)

7.7 Pressure drop curves for the water exchanger and its water inlet/outlet piping (for units without pump)

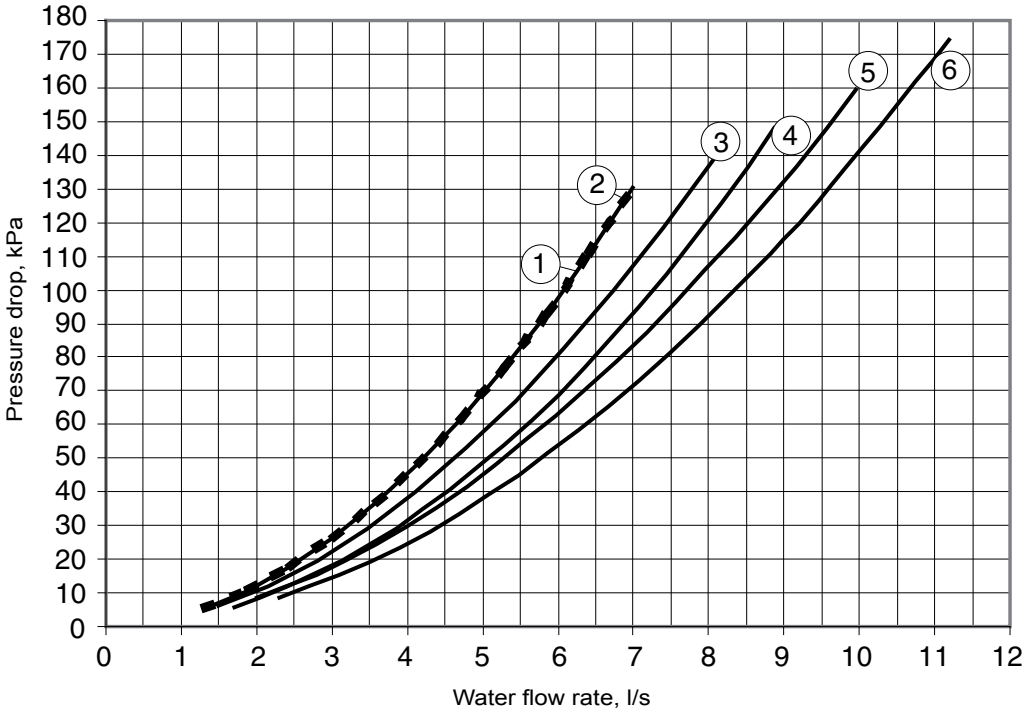
Data applicable for pure water at 20°C.

LD/ILD sizes 150A-300A



① LD/ILD 150A
② LD/ILD 180A
③ LD/ILD 200A
④ LD/ILD 240A
⑤ LD/ILD 260A
⑥ LD/ILD 300A

LD/ILD sizes 302A-600A



① ILD 302A
② LD/ILD 360A
③ LD/ILD 390A
④ LD/ILD 450A
⑤ LD/ILD 520A
⑥ LD/ILD 600A

8 - WATER CONNECTIONS

When connecting units to the water distribution pipe work, refer to the certified dimensional drawings supplied with the unit for the dimensions and position of the exchanger water inlet and outlet connections.

The piping must not transmit any axial or radial force to the exchangers, or any vibrations.

The water supply must be analysed and the circuit created must include the required water treatment elements: filters, additives treatment, bleed devices, vents, shut-off valves, etc., according to the results, to prevent corrosion (for example, damage to the tube protective surface if there is contamination in the fluid), fouling and deterioration of the pump lining

Before any start-up verify that the heat exchange fluid is compatible with the water circuit materials. Where additives or other fluids than those recommended by the manufacturer are used, ensure that these are not considered gases, and that they are class 2, as defined in directive 97/23/EC.

Manufacturer's recommendations concerning heat transfer fluids:

- No NH4+ ammonium ions in the water - these are very harmful to 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 also harmful to copper with a risk of perforating corrosion. Keep at a level below 125 mg/l.
- SO4- sulphate ions can cause perforating corrosion if their content is above 30 mg/l.
- No fluoride ions (<0.1 mg/l).
- No Fe2+ and Fe3+ ions if non-negligible levels of dissolved oxygen are present. Dissolved iron < 5 mg/l with dissolved oxygen < 5 mg/l.
- Dissolved silicon: Silicon 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 1.0 and 2.5 mmol/l are 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 mg/l is desirable.
- Dissolved oxygen: Avoid any sudden change in water oxygenation conditions. 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 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).

Filling, topping up or emptying of the water circuit must be carried out by qualified personnel using the air bleed devices and tools and equipment suitable for the products.

The heat transfer fluid should be filled and drained using devices fitted to the water circuit by the installer. The unit's exchangers must never be used to top up the heat transfer fluid charge.

8.1 Operating precautions and recommendations

Before the system start-up verify that the water circuits are connected to the appropriate heat exchangers.

The water circuit must have as few bends and horizontal sections at different levels as possible

Main points to be checked for the connection:

- Observe the water inlet and outlet connections shown on the unit.
- Install manual or automatic air purge valves at all high points in the circuit.
- Maintain the pressure of the circuit(s) with pressure reducers and install a safety relief valve and an expansion tank. Units supplied with a hydronic module include a valve. The expansion vessel is supplied as an option.
- Install thermometers in both the water inlet and outlet pipes.
- Install drain connections at all low points to allow the whole circuit to be drained.
- Install shut-off valves close to the water inlet and outlet connections.
- Use flexible connections to reduce the transmission of vibrations.
- Insulate the cold water pipework, after testing for leaks, to prevent heat transmission and condensation.
- Cover the insulation with a vapour barrier. If the water pipes outside the unit pass through an area where the ambient temperature is likely to fall below 0°C, it must be protected against frost (antifreeze solution or electric heaters)
- If there are particles in the fluid which are liable to foul the exchanger, a screen filter must be installed upstream of the pump.

NOTE: A screen filter must be installed for units supplied without a hydronic module. This must be installed on the unit's water inlet pipe, close to the unit heat exchanger. It must be located somewhere easily accessible to enable disassembly and cleaning.

If the filter is missing, the plate heat exchanger can quickly become fouled during the first start-up, as it will trap any debris in the system, and correct unit operation will be affected (reduced water flow rate due to the increased pressure drop).

Units with hydronic module are equipped with this type of filter.

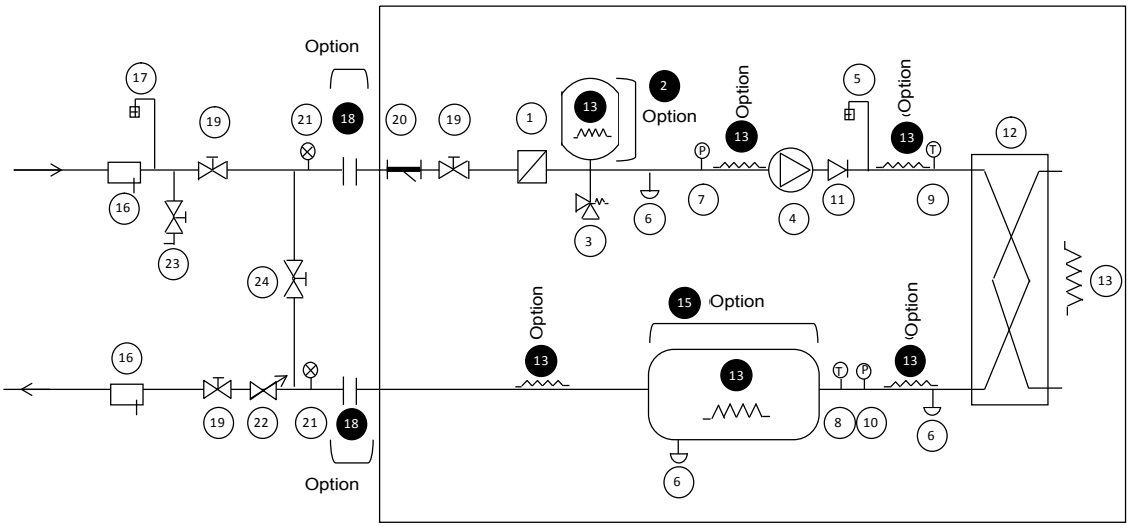
- Do not introduce any excessive static or dynamic pressure into the heat exchange circuit (with regard to the design operating pressures).
- Products used for thermal insulation of recipients during hydronic connection must be chemically neutral to the surfaces on which they are applied. All original materials supplied by the manufacturer comply with this requirement.

8 - WATER CONNECTIONS

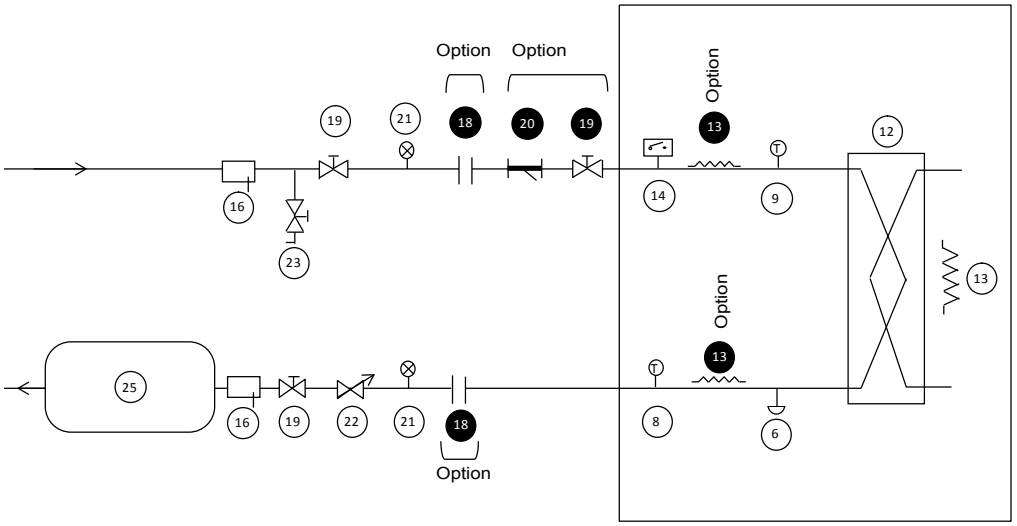
8.2 Water connections

The hydronic module options are compatible only with closed loops.
Use of the hydronic kit on open loops is prohibited.

Typical diagram of the hydronic circuit without the hydronic module



Schematic of the hydronic circuit with hydronic module



Legend

Components of the unit and hydronic module

1 Screen filter (particle size of 1.2 mm)
O 2 Expansion tank (option)
3 Relief valve
4 Circulating pump (single or dual)
5 Air purge
6 Water drain tap
7 Pressure sensor
Note: Provides pressure information for the pump inlet (see Control manual)
8 Temperature probe
Note: Provides temperature information for the water exchanger outlet (see Control manual)
9 Temperature probe
Note: Provides temperature information for the water exchanger inlet (see Control manual)
10 Pressure sensor
Note: Provides pressure information for the water exchanger outlet (see Control manual)
11 Check valve (if dual-pump)
12 Plate heat exchanger
O 13 Heater or heat trace cable for frost protection (Option)
14 Water exchanger flow rate sensor
O 15 Buffer Tank Module (Option)

Installation components

16 Pocket
17 Air purge
O 18 Flexible connector (option)
19 Shut-off valve
20 800 µm screen filter (option – mandatory in the case of a unit without hydronic module / Included on version with hydronic module)
21 Pressure gauge
22 Water flow rate control valve
Note: not required if hydronic module with variable speed pump
23 Charge valve
24 Bypass valve for frost protection (if shut-off valves closed (item 19) during winter)
25 Buffer tank (if required)

- - - - - Hydronic module (unit with hydronic module option)

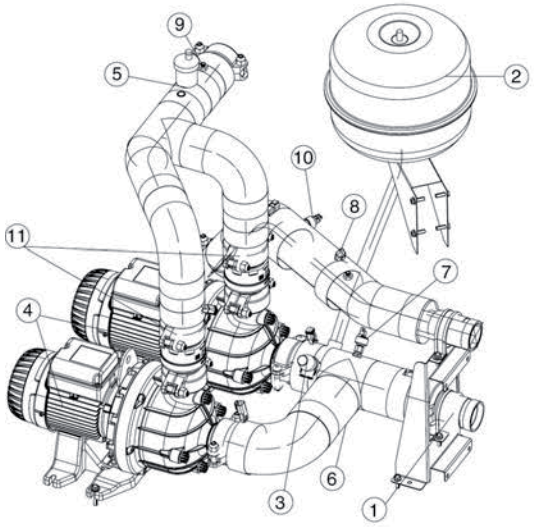
NOTE:

- The unit must be protected against frost.
- The unit's hydronic module and the water heat exchanger may be protected (factory-fitted option) against freezing using electric heaters and heat trace cables (13)
- The pressure sensors are assembled on connections without Schraeder. Depressurise and empty the network before intervention.

8 - WATER CONNECTIONS

Figure 1: Internal hydronic equipment with dual pump option

LD/ILD sizes 150A-300A



LD/ILD sizes 302A-600A

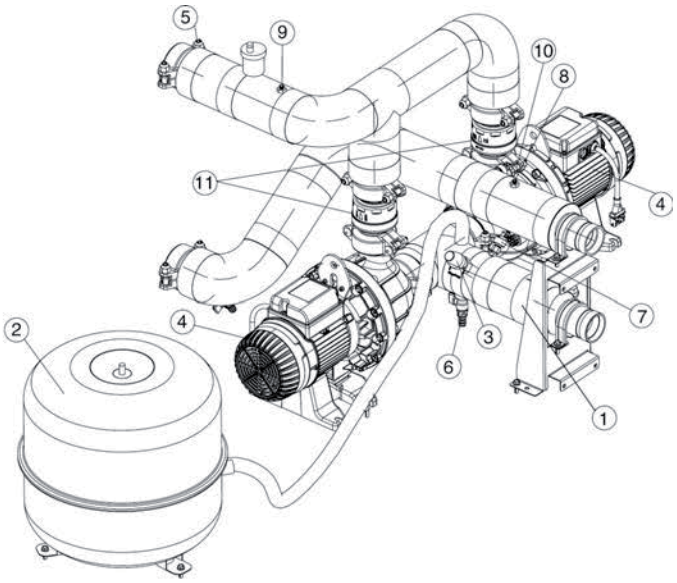
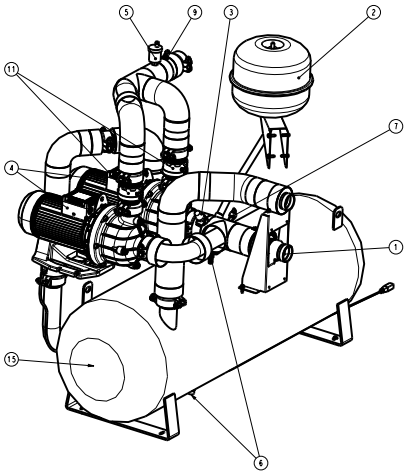
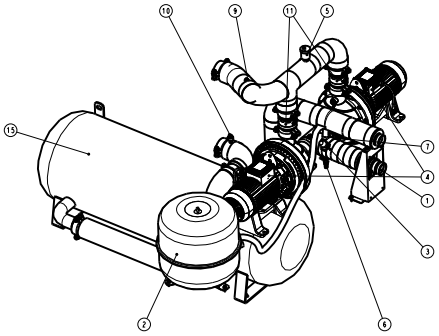


Figure 2: Internal hydronic equipment with dual pump option and buffer tank

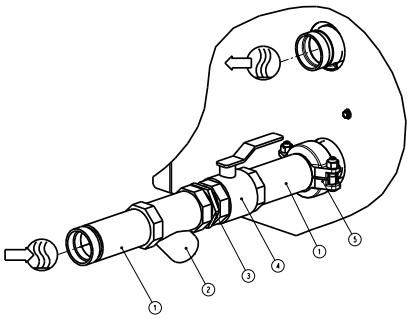
LD/ILD sizes 150A-300A



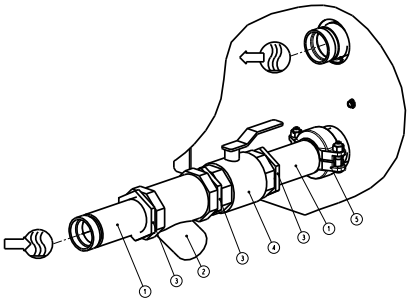
LD/ILD sizes 302A-600A



LD/ILD sizes 150A-300A



LD/ILD sizes 302A-600A



Legend

① Steel sleeve
② 800 µm screen filter
③ Brass connector
④ Shut-off valve
⑤ Victaulic clamp
⑥ Hose
Water outlet
Water inlet

8.3 Cavitation protection (with hydronic option)

To ensure the durability of pumps fitted on the integrated hydronic modules, the control algorithm of units in the range includes protection against cavitation.

It is therefore necessary to ensure a minimum pressure of 60 kPa (0.6 bar) at the pump inlet both when shut down and during operation.

A pressure below 60 kPa will prevent unit start-up, or will cause an alarm and shut-down.

To obtain an adequate pressure, it is recommended:

- To pressurise the hydraulic circuit between 100 kPa (1 bar) and 400 kPa (4 bar) maximum at the pump inlet;
- To clean the hydraulic circuit during water filling or after any modifications are made;
- To regularly clean the screen filter.

8.4 Flow rate detection

Standard machine

All units are equipped as standard with a factory-set flow switch. It cannot be adjusted on site.

The heat transfer fluid pump must be servo-controlled by the assembly if the unit is not equipped with the hydronic module option. Dedicated terminals are provided for installing the heat transfer fluid pump servocontrol (to be wired on site).

Machine with hydronic module (option)

The “flow rate detection” functionality is handled by the option via the pressure sensors.

8.5 Frost protection

Damage caused by frost is not covered by the warranty.

The plate exchangers, the pipes, the buffer tank pump(s) and the hydronic module pumps can be damaged by frost. The components of the unit (heat exchanger, pipes, hydronic module, buffer tank module) will be protected by following the recommendations below. Protection of the remainder of the system is the responsibility of the installer.

The plate heat exchanger and all the components of the water circuit can be protected against freezing by draining the entire machine completely, checking that there are no retention points.

If this is not possible, the plate heat exchanger and all the components of the water circuit can be protected against freezing:

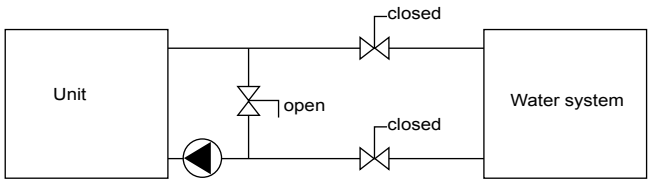
- Down to -20°C by heaters and heat trace cables (fitted as an option on the exchanger and internal pipe system) supplied automatically (for units without the hydronic module)
- Down to -10°C for cooling only machines (without buffer tank module option) and 0°C for reversible machines, Cooling only with buffer tank via a heater on the heat exchanger supplied automatically and pump cycling (for units with hydronic module).
- Down to -20°C by heaters and heat trace cables (fitted as an option on the exchanger, buffer tank module (option) and internal pipe system) supplied automatically and pump circulation (for units with the hydronic module)

Never power off the heaters for the water exchanger and the water circuit or pump, as they will no longer be providing frost protection.

To ensure they continue to receive power, the main switch for the unit or the customer's circuit and the auxiliary circuit breaker for the heaters must be left closed (see the wiring diagram for the location of these components).

To protect units with a hydronic module from freezing, water must be circulated in the water circuit by the pump, which is activated at regular intervals. If the system is isolated by a valve, it is imperative to install a bypass as indicated below.

Winter position



IMPORTANT:

Depending on the atmospheric conditions in your region, you need to:

- Add an appropriate antifreeze solution (maximum of 45%) to protect the system down to a temperature of 10 K below the lowest temperature likely to occur locally.
- For extended shut-downs, drain and add an anti-freeze solution to the heat exchanger (use the drain valve located at the water inlet).
- To prevent corrosion due to differential aeration, if the system is to be empty for more than 1 month, the heat transfer fluid circuit should be protected with a blanket of dry, inert gas. (0.5 bar maximum). If the heat transfer fluid does not meet the recommendations, a nitrogen blanket must be applied immediately.
- At the commencement of the next season, fill the system with water treated with appropriate corrosion inhibitors.
- For installation of auxiliary equipment, the installer must comply with the basic rules, especially by complying with the minimum and maximum flows which must be between the values mentioned in the operating limits tables (application data).
- If frost protection is dependent on electric heaters, never deenergize the unit when frost protection is required. To ensure protection, the main unit disconnect switch, auxiliary heater circuit and control circuit must be energized (see wiring diagram to locate these components). If it is not to be used in freezing conditions, or during a prolonged period without power (whether or not this is scheduled), the water exchanger and external pipes must be drained immediately
- In case of prolonged non-usage, the hydraulic circuits must be protected by circulating a passivating solution. (Consult a specialist).
- The exchanger temperature sensors are an essential frost protection element: if piping trace heaters are used, ensure the external heaters do not affect the measurements provided by these sensors.
- If auxiliary equipment is installed in the system, the installer must ensure that the resultant flow rates are still within the minimum and maximum values indicated in the operating limits table (application data).

8.6 Auxiliary electrical heaters

To compensate for the reduction in the heat pump's output at low ambient temperatures, which changes significantly as shown in the graph below, it is possible to install on the water outlet auxiliary electric heaters of sufficient power to offset the heat pump capacity drop.

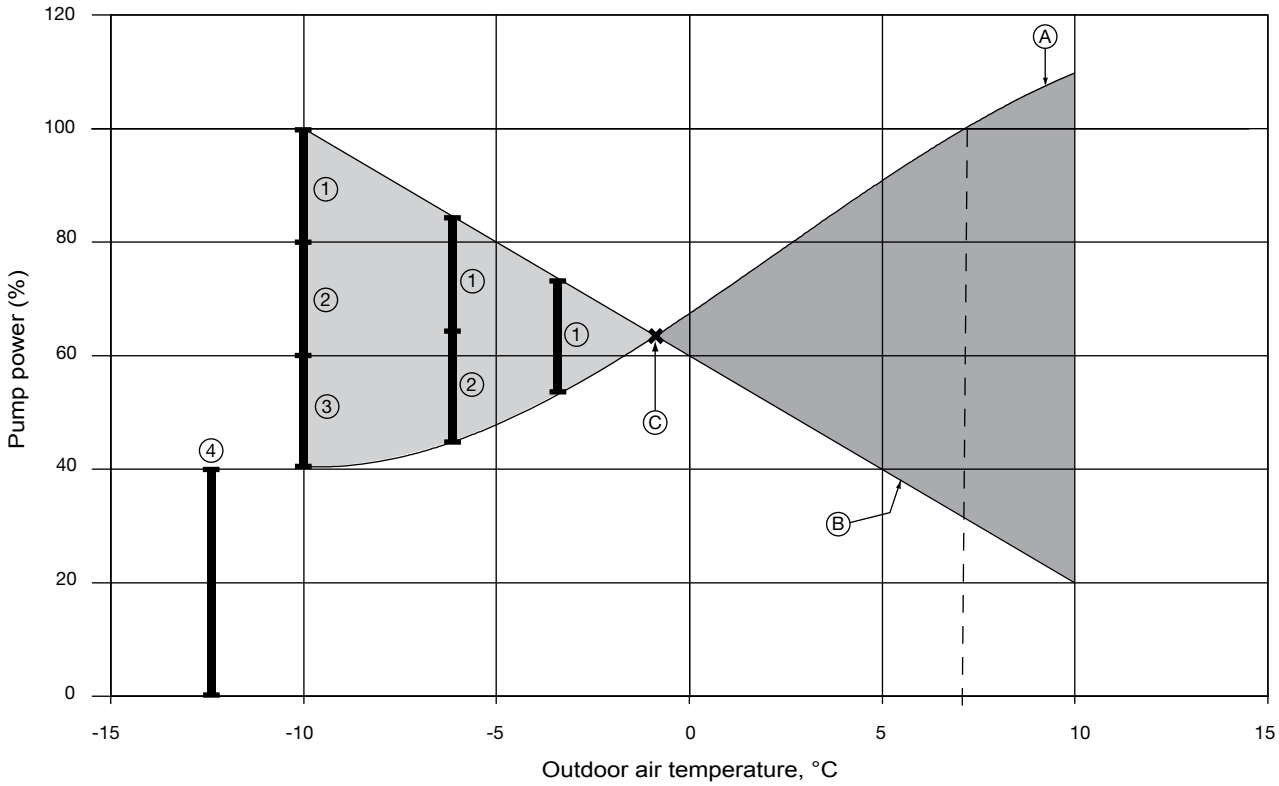
These heaters can be controlled via the dedicated option.

Four outputs are available to control the contactors (not supplied on the plate) on the heaters, thereby enabling gradual compensation of the heat pump output reduction.

These outputs are configurable to allow for two, three or four stages as required. The last stage is only activated in case of shut-down due to a fault on the heat pump (emergency).

In the graph below, the power of the four heaters equals the capacity of the heat pump at an outdoor air temperature of 7°C.

Example of additional electric heaters



Legend

1 Stage 1
2 Stage 2
3 Stage 3
4 Stage 4 (safety)
A Variation of the pump output with air temperature
B Building heat load
C Equilibrium point between the heat pump output and the building heat load
Operating range for which the heat pump output is less than the building thermal load
Operating range for which the heat pump output is greater than the building thermal load

9 - NOMINAL SYSTEM WATER FLOW CONTROL

Refer to the chapter "Water connections" for all item references in this chapter.

The water circulation pumps of unit range have been designed to allow the hydronic modules to operate at each possible conditions, i.e. with chilled water temperature differences at full load from 3 to 10 K.

This temperature difference required between the water inlet and outlet determines the nominal flow of the system. Use the specification provided while selecting the unit to determine the operating conditions of the system.

In particular, collect the data to be used for setting the installation flow rate:

- For a unit without hydronic module: nominal pressure drop at the unit terminals (plate heat exchanger + internal water pipe). This is measured with pressure differential gauges that must be installed at the unit's inlet and outlet (item 21).
- Units with fixed speed pumps: nominal flow rate .The pressure of the fluid is measured by sensors installed at the inlet of the pump and outlet of the unit (items 7 and 10). The system calculates the flow rate associated with this differential pressure. The flow rate can be read directly on the user interface (refer to the control manual for the range).
- Units with variable speed pumps – control on pressure difference: pressure difference at the hydronic module terminals; the buffer tank module option is not taken into account.
- Units with variable speed pumps - control on temperature difference: nominal temperature delta at the exchanger.

If this information is not available when activating the system, contact the design office responsible for the installation to obtain it.

These data can be obtained either from the performance tables included in the technical documentation (for cases where the water exchanger temperature delta is 5 K) or from the "Electronic Catalogue" selection program for all other applicable temperature delta in the range of 3 to 10 K.

9.1 Units without hydronic module

General information

The nominal flow rate of the system will be set using a manual valve that should be installed on the water outlet pipe (item 22 on the water circuit schematic diagram).

Due to the pressure drop it generates on the hydronic network, this flow control valve is used to set the network pressure / flow rate curve to the pump pressure / flow rate curve, to obtain the nominal flow rate at the desired operating point.

This is checked by reading the pressure drop on the unit (plate heat exchanger + internal piping).

As the exact total system pressure drop is not known upon commissioning, it is necessary to adjust the water flow rate with the control valve to obtain the installation's specific flow rate.

Hydronic circuit cleaning procedure

- Open all control valves completely (item 22).
- Start up the system pump.
- Read the pressure drop of the plate heat exchanger, using the pressure differential gauge to find the difference between the unit inlet and outlet (item 21).
- Let the pump run for 2 hours consecutively to clean up the hydronic circuit of the system (presence of contaminating solids).
- Perform another reading.
- Compare this value to the initial value.
- A reducing value of the flow indicates that the filters on the system need to be removed and cleaned. In this case, close the shut-off valves on the water inlet and outlet (item 19) and remove the filters (items 20 and 1) after draining the hydronic part of the unit (items 6).
- Remove the air from the circuit (items 5 and 17).
  Repeat until all fouling is removed from the filter.

Water flow rate control procedure

Once the circuit has been decontaminated, read the pressures on the pressure gauges (water inlet pressure - outlet pressure) to determine the pressure drop across the unit terminals (plate heat exchanger + internal pipework).

Compare the value obtained with the design value predicted by the selection software.

If the pressure drop reading is above the specified value, this indicates that the flow at the terminals of the unit (and therefore within the system) is too high. In this case, close the control valve and read the new difference in pressure.

Repeat as necessary, closing the control valve until the specific pressure drop corresponding to the unit's design flow rate is achieved

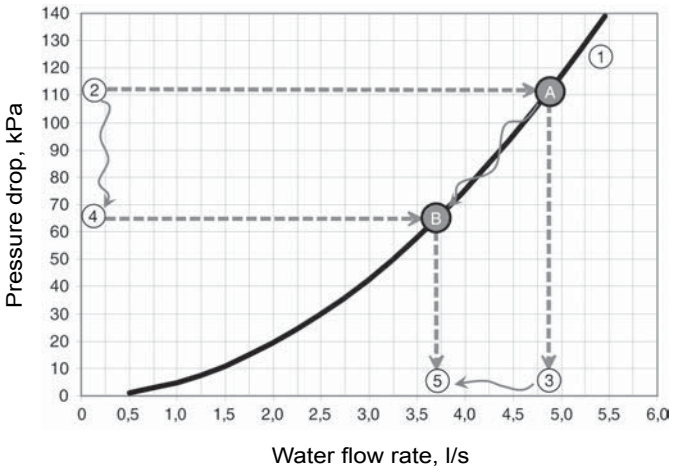
NOTE:

If the network has an excessive pressure drop in relation to the available static pressure delivered by the system's pump, the nominal water flow cannot be obtained (lower resulting flow) and the difference in temperature between the water inlet and outlet of the water heat exchanger will be increased.

To reduce the system's hydronic network pressure drop:

- Reduce the pressure drops of individual components (bends, level changes, options, etc.) as much as possible;
- Use the correct pipe diameter
- Do not extend the piping system.

Example: Unit with specified nominal flow rate of 3.7 l/s



Legend:

1 "Pressure drop across unit terminals / Flow rate" curve

2 With the valve open, the pressure drop reading (111 kPa) gives point A on the curve

A Operating point reached with the valve open

3 With the valve open, the flow rate reached is 4.8 l/s: this is too high, the valve needs to be re-closed

4 With the valve partially re-closed, the pressure drop reading (65 kPa) gives point B on the curve

B Operating point reached with the valve partially closed

5 With the valve partially re-closed, the flow rate reached is 3.7 l/s: this is the target flow rate, so the valve is suitably positioned

9.2 Units with hydronic module and fixed speed pump

See the paragraph on "Units without hydronic module"

Hydronic circuit cleaning procedure

- Open all control valves completely (item 22).
- Start up the unit's pump.
- Read the value of the flow on the user interface.
- Let the pump run for 2 hours consecutively to clean up the hydronic circuit of the system (presence of contaminating solids).
- Perform another reading.
- Compare this value to the initial value.
- A reducing value of the flow indicates that the filters on the system need to be removed and cleaned. In this case, close the shut-off valves on the water inlet and outlet (item 19) and remove the filters (items 20 and 1) after draining the hydronic part of the unit (items 6).
- Remove the air from the circuit (items 5 and 17).
- Repeat until all fouling is removed from the filter

Water flow rate control procedure

Once the circuit has been decontaminated, read the flow rate on the user interface and compare the value obtained with the theoretical selection value.

If the flow rate read is greater than the specified value, this indicates that the overall pressure drop in the system is too low compared to the available static pressure generated by the pump.

In this case, close the control valve (item 22) and read the new flow rate value.

Repeat as necessary, closing the control valve (item 22) until the system's specific pressure drop corresponding to the unit's design flow rate is achieved.

NOTE:

If the network has an excessive pressure drop in relation to the available static pressure delivered by the unit pump, the nominal water flow cannot be obtained (lower resulting flow rate) and the difference in temperature between the water inlet and outlet of the water heat exchanger will be increased

To reduce the system's hydronic network pressure drop:

- Reduce the pressure drops of individual components (bends, level changes, options, etc.) as much as possible;
- Use the correct pipe diameter;
- Do not extend the hydronic systems

9.3 Units with hydronic module and variable speed pump – Pressure differential control

The installation flow rate is not set at a nominal value.

The flow rate will be adjusted, by varying the pump speed, to maintain a system pressure differential value defined by the user.

This is checked by the pressure sensor at the water exchanger outlet (item 10 on the main water circuit diagram).

The system calculates the measured pressure difference, compares it with the setpoint value set by the user and then modulates the pump speed module, resulting in:

- an increase in the flow rate if the measurement is below the setpoint,
- a decrease in the flow rate if the measurement exceeds the setpoint.

This modulation is limited only by the maximum and minimum flow rates for the unit and by the maximum and minimum allowable pump speeds.

The maintained pressure difference value may, in certain cases, differ from the setpoint value:

- if the setpoint value is too high (obtained for a flow rate higher than the maximum value or a frequency greater than the maximum value), the system will stop once it reaches the maximum flow rate or maximum frequency, which will result in a pressure difference below the setpoint,
- if the setpoint value is too low (obtained for a flow rate lower than the minimum value or a frequency less than the minimum value), the system will stop once it reaches the minimum flow rate or minimum frequency, which will result in a pressure difference greater than the setpoint,.

Contact the manufacturer's service department to implement the procedures described below.

Hydronic circuit cleaning procedure

Before proceeding, it is advisable to remove any possible contamination from the hydronic circuit.

- Start-up the system pump by using the forced start command.
- Control the frequency to the maximum value to generate a higher flow.
- If there is a ‘‘Maximum flow exceeded’’ alarm, reduce the frequency until an acceptable value is reached.
- Read the value of the flow on the user interface.
- Let the pump run for 2 hours continuously to clean up the system's hydraulic circuit (presence of contaminating solids).
- Perform another reading of the flow and compare this value with the initial value. A reducing value of the flow indicates that the filters on the system need to be removed and cleaned. In this case, close the shut-off valves on the water inlet and outlet (item 19) and remove the filters (items 20 and 1) after draining the hydronic part of the unit (items 6).
- Remove the air from the circuit (items 5 and 17).
- Repeat until all fouling is removed from the filter

Procedure for controlling the pressure differential setpoint

Once the circuit is cleaned, place the water circuit in the configuration for which the unit selection was performed (generally, this will be all valves open and all cooling coils active)

Read the value of the flow on the user interface and compare it with the theoretical value of the range:

- If the value read is greater than the specified value, reduce the pressure differential setpoint on the user interface to reduce the flow rate value;
- If the value read is lower than the specified value, increase the pressure differential setpoint on the user interface to increase the flow rate value

Repeat until you obtain the flow rate corresponding to the nominal flow rate at the unit's requisite operating point.

Stop the forced operation of the pump and proceed to the configuration of the unit for the required control mode. Modify the control parameters:

- Set water flow control to ‘pressure differential’
- Set the value of the required pressure differential.

The unit's default factory configuration is the maximum speed (frequency: 50 Hz).

NOTE:

If during adjustment, the low or high frequency limits are reached before reaching the specified flow rate, keep the pressure differential value at its lower or higher limit as the control parameter value.

If the user knows in advance the pressure differential value at the unit outlet to be maintained, this value can be entered directly as data to be declared. You should not, however, omit the water circuit cleaning sequence

9 - NOMINAL SYSTEM WATER FLOW CONTROL

9.4 Units with hydronic module and variable speed pump – Temperature differential control

The installation flow rate is not set at a nominal value.

The flow rate will be adjusted, by varying the pump speed, to maintain a heat exchanger temperature differential value defined by the user.

This is checked by the temperature sensors at the water exchanger inlet and outlet (items 8 and 9 on the main water circuit diagram).

The system reads the measured temperature values, calculates the corresponding temperature delta, compares it with the setpoint value set by the user and then modulates the pump speed module.

- This results in an increase in the flow rate if the temperature delta exceeds the setpoint.
- This results in a decrease in the flow rate if the temperature delta is less than the setpoint.

This modulation is limited only by the maximum and minimum flow rates for the unit and by the maximum and minimum allowable pump speeds.

The maintained temperature delta may, in certain cases, differ from the setpoint value:

- if the setpoint value is too high (obtained for a flow rate lower than the minimum value or a frequency less than the minimum value), the system will stop once it reaches the minimum flow rate or minimum frequency, which will result in a temperature delta below the setpoint,
- if the setpoint value is too low (obtained for a flow rate higher than the maximum value or a frequency greater than the maximum value), the system will stop once it reaches the maximum flow rate or maximum frequency, which will result in a temperature delta above the setpoint, .

Contact the manufacturer's service department to implement the procedures described below.

Hydronic circuit cleaning procedure

Refer to the hydronic circuit cleaning procedure.

Procedure for controlling the temperature delta setpoint

Once the circuit is cleaned, stop the forced start of the pump and proceed to the configuration of the unit for the required control mode.

Modify the control parameters:

- Set water flow control to ‘temperature differential’
- Set the value of the required differential temperature.

The unit's default configuration is at the fixed speed (50 Hz)

9 - NOMINAL SYSTEM WATER FLOW CONTROL

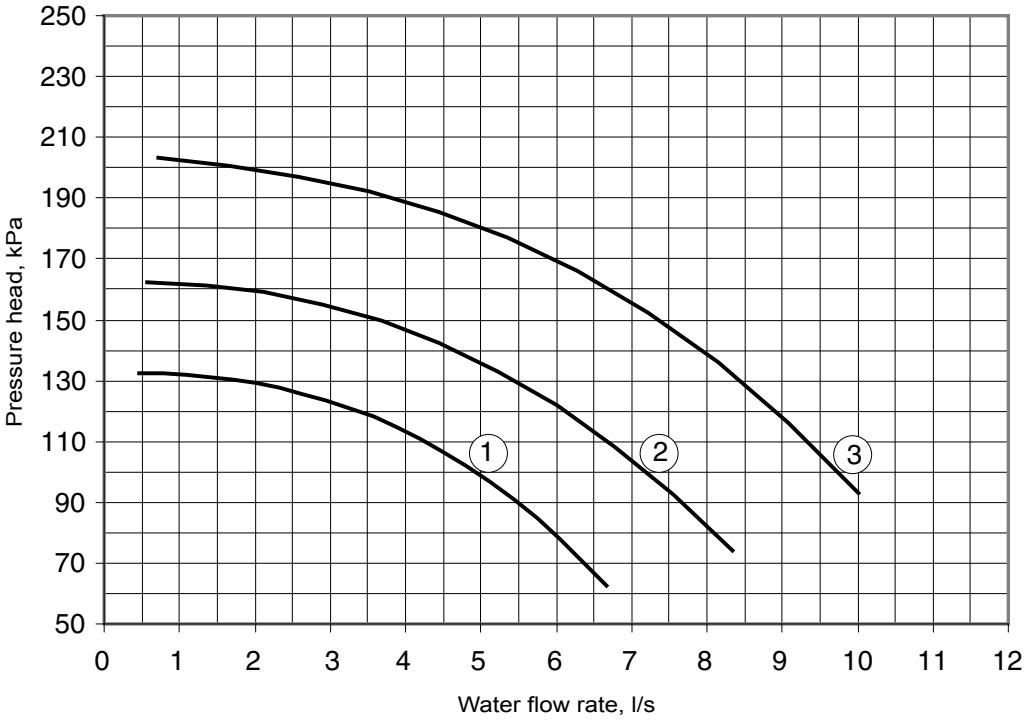
9.5 Pump pressure/flow rate curves

Units with hydronic module (fixed speed pump or variable speed pump at 50 Hz)

Data applicable for:

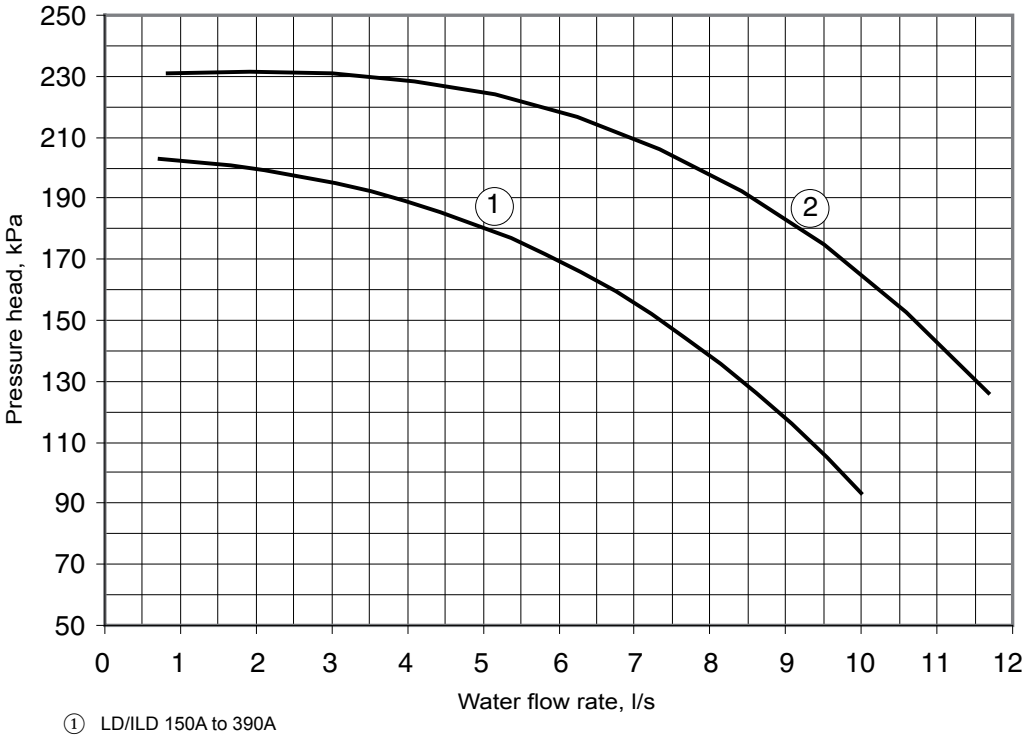
- Pure water at 20°C.
- Refer to the "Water exchanger water flow" paragraph for the maximum water flow rate values.
- If ethylene glycol is used, the maximum flow rate is reduced.

Low pressure pumps



① LD/ILD 150A to 360A
② LD/ILD 390A and 450A
③ LD/ILD 520A and 600A

High pressure pumps



① LD/ILD 150A to 390A
② LD/ILD 450A to 600A

9 - NOMINAL SYSTEM WATER FLOW CONTROL

9.6 Available static pressure for the installation

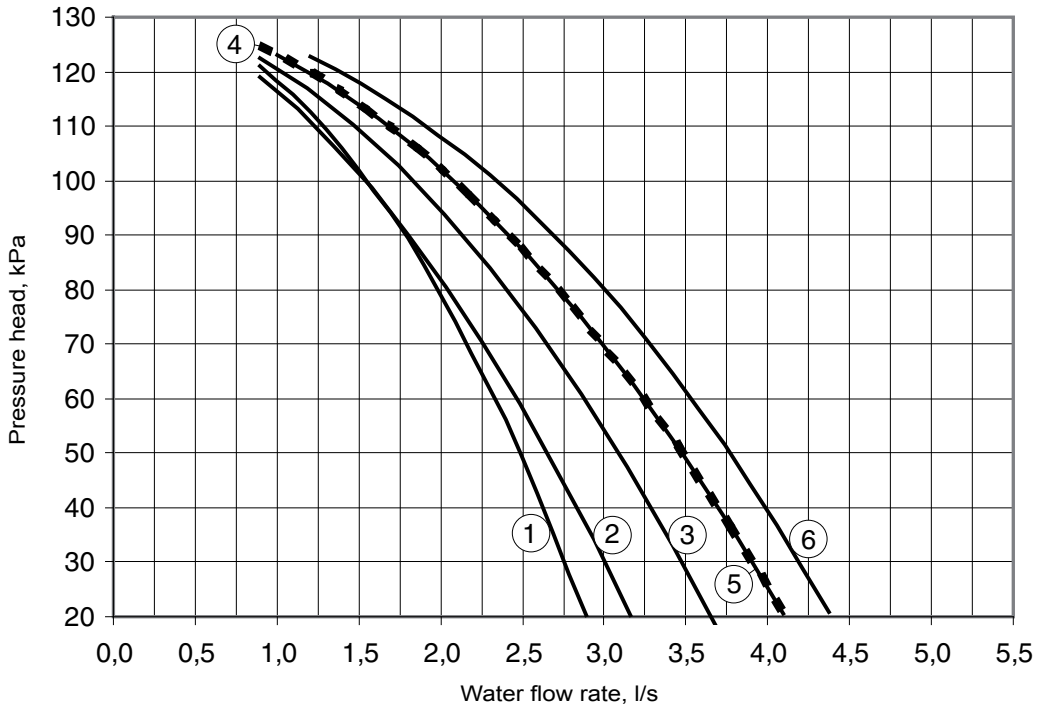
Units with hydronic module (fixed speed pump or variable speed pump at 50 Hz)

Data applicable for:

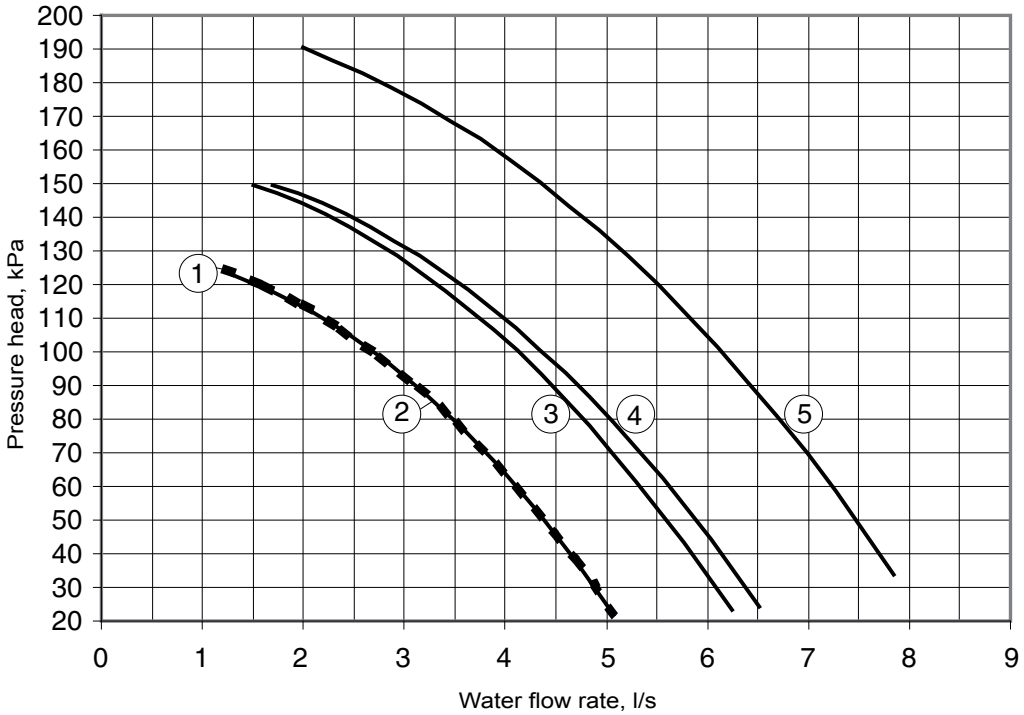
- Pure water at 20°C.
- Refer to the "Water exchanger water flow" paragraph for the maximum water flow rate values.
- If ethylene glycol is used, the maximum flow rate is reduced.

Warning: With the filter and/or buffer tank module option, the curves below do not take the pressure drops for these components into account. If necessary, refer to the water filter and/or buffer tank characteristic curves to correct the data below.

Low pressure pumps



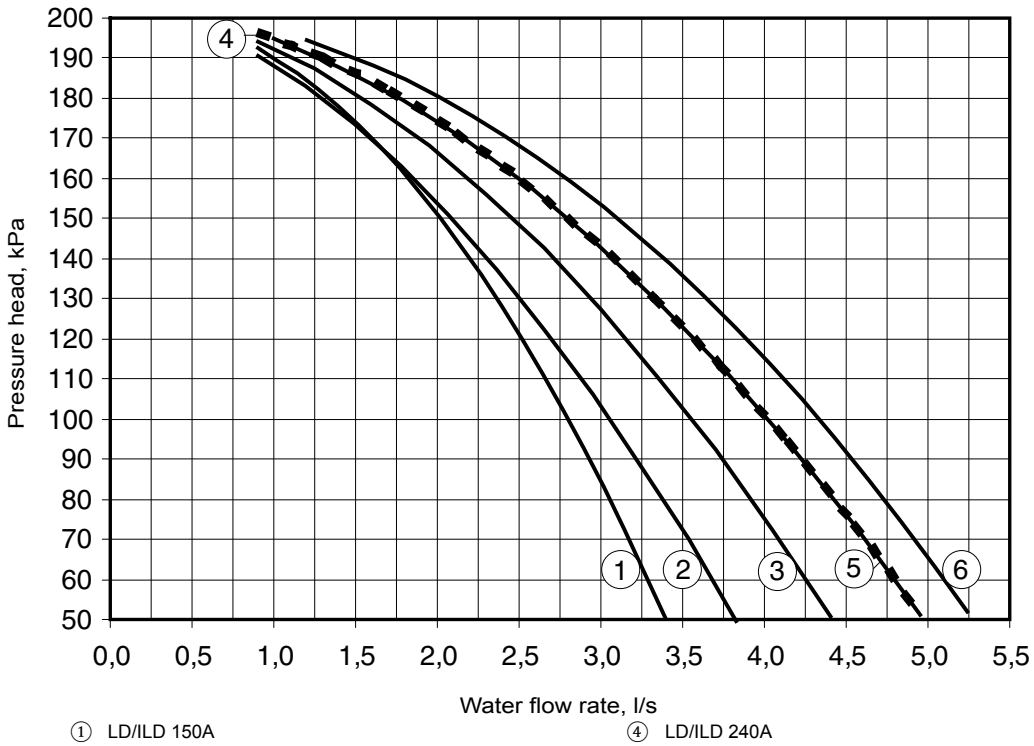
① LD/ILD 150A
② LD/ILD 180A
③ LD/ILD 200A
④ LD/ILD 240A
⑤ LD/ILD 260A
⑥ LD/ILD 300A & ILD 302A



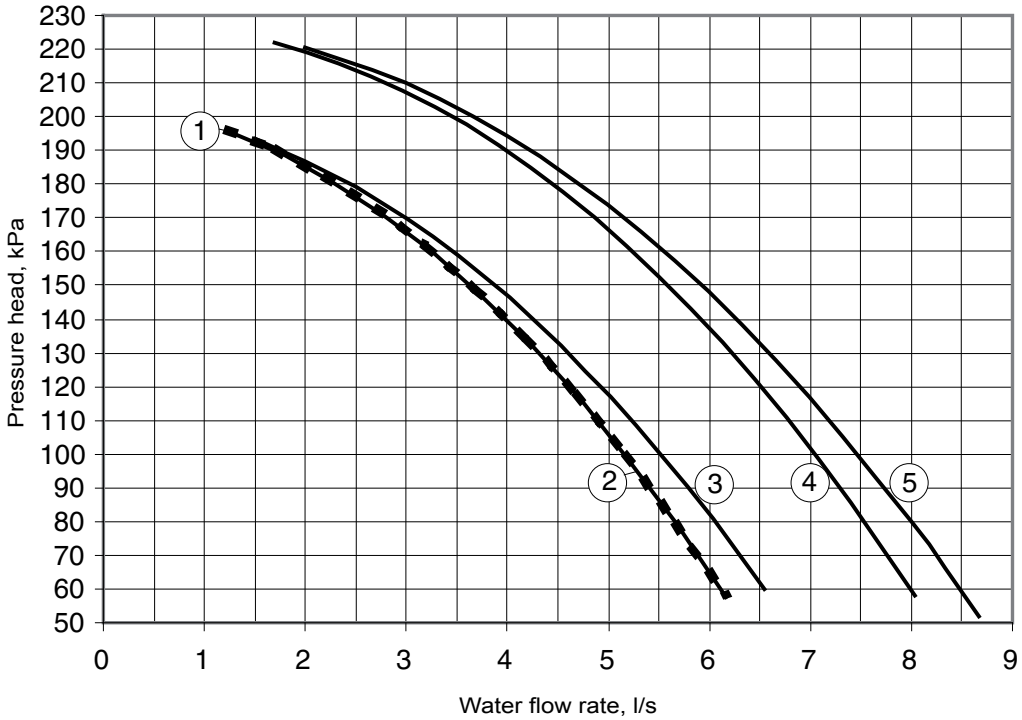
① LD/ILD 360A
② LD/ILD 390A
③ LD/ILD 450A
④ LD/ILD 520A
⑤ LD/ILD 600A

9 - NOMINAL SYSTEM WATER FLOW CONTROL

High pressure pumps

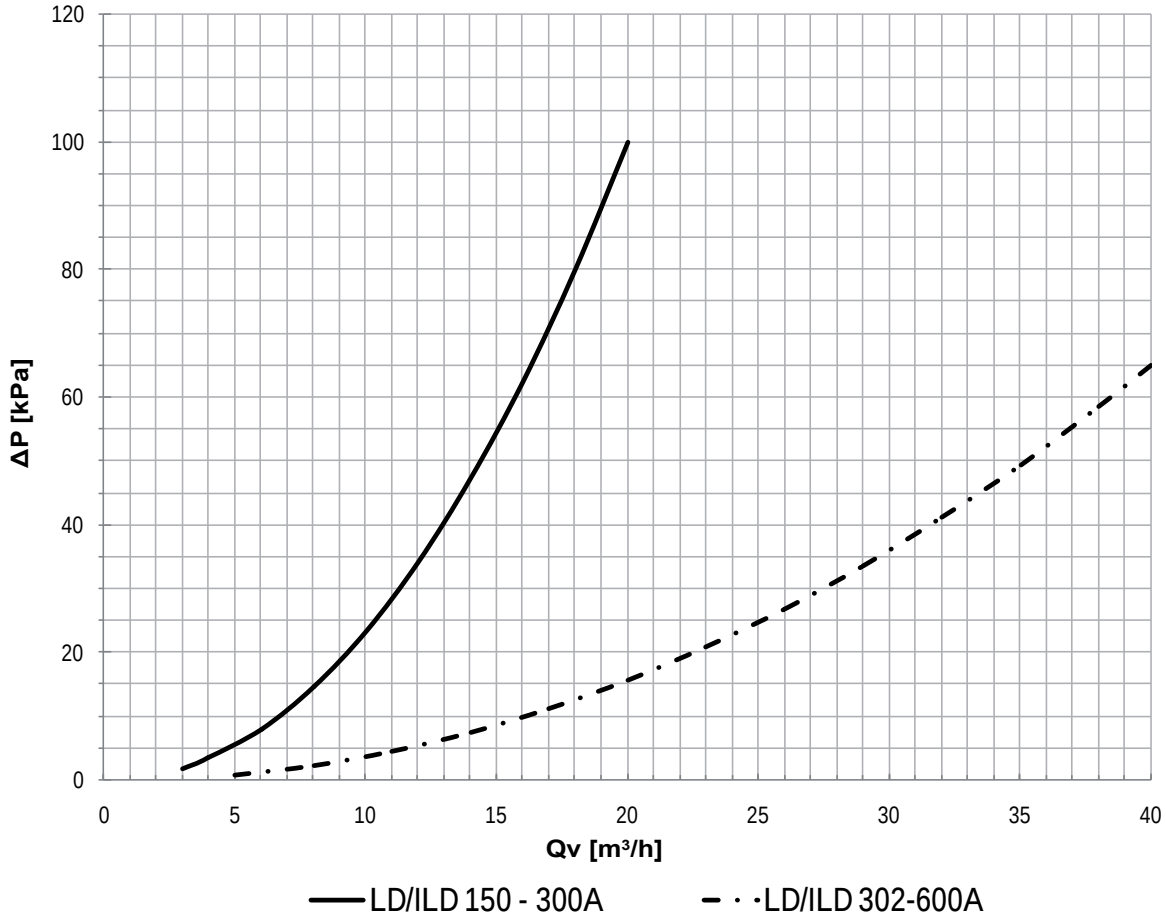


① LD/ILD 150A
② LD/ILD 180A
③ LD/ILD 200A
④ LD/ILD 240A
⑤ LD/ILD 260A
⑥ LD/ILD 300A & ILD 302A

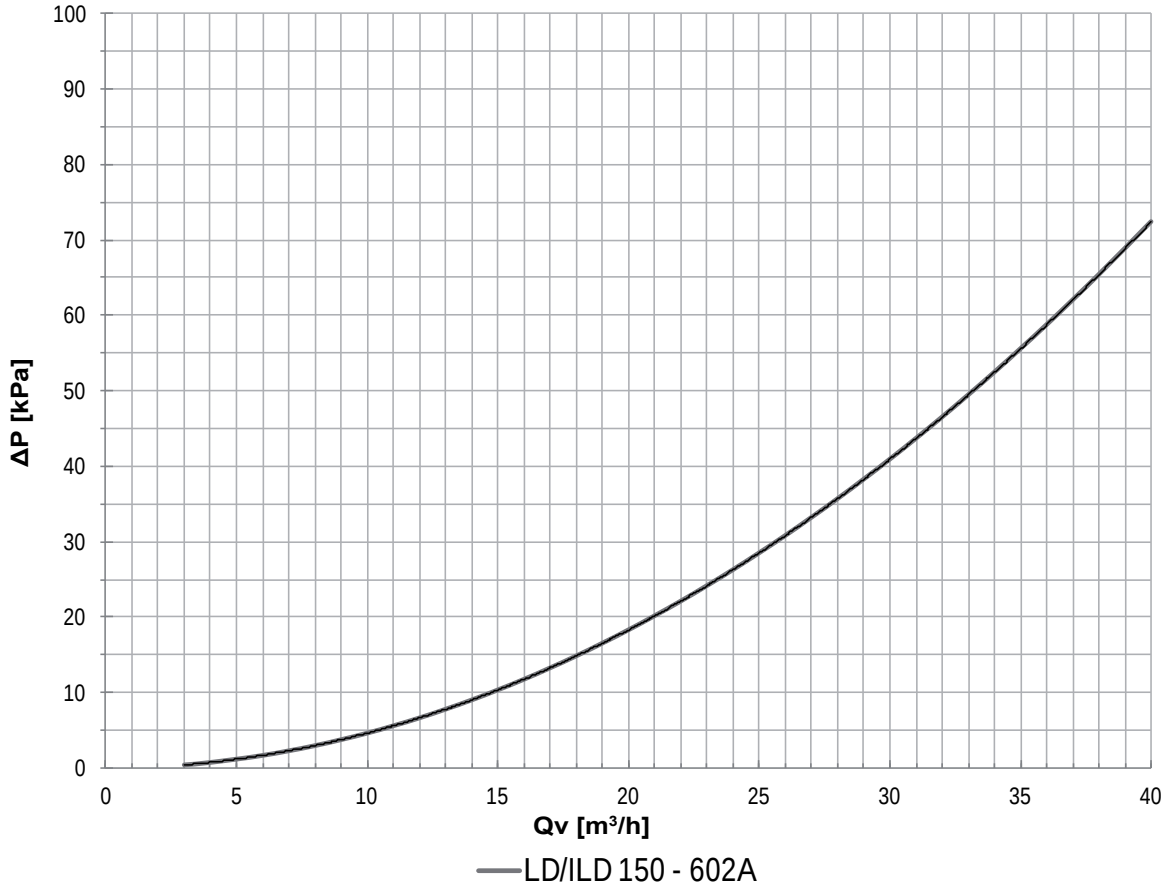


① LD/ILD 360A
② LD/ILD 390A
③ LD/ILD 450A
④ LD/ILD 520A
⑤ LD/ILD 600A

800 µm water filter pressure drop curves



Buffer tank pressure drop curves



10 - SYSTEM START-UP

10.1 Checks before system start-up

Before starting up the thermodynamic system, the complete system, including the thermodynamic system, must be verified against the installation drawings, dimensional drawings, system piping and instrumentation diagrams and the wiring diagrams.

All measures must be taken to ensure that the pressure and temperature limits, which are specifically those listed on the nameplates, are not exceeded during operation, maintenance and recirculation.

Heat exchange fluid temperatures above the maximum recommended can lead to an increase in the refrigerant pressure and can cause a loss of refrigerant due to the relief valve discharge.

National regulations must be followed during these checks. 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 that recommended for operation, and is not nitrogen.
- Compare the complete system with the refrigeration system and power circuit diagrams.
- Check that all documents provided by the manufacturer (dimensional drawings, pipe and instrument diagram (PID), declarations, etc.) to comply with the regulations are present. If any documentation is missing, order a replacement.
- Verify that the environmental safety and protection devices and arrangements provided by the manufacturer to comply with the regulations are in place.
- Check that all declarations of conformity for the pressure containers, identification plates, and documentation required to comply with local regulations are present.
- Verify that access and safety routes are unobstructed.
- Verify the instructions and directives to prevent the deliberate removal of refrigerant gases.
- 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.
- Check the condition of 400 V cable insulation.

IMPORTANT: If the compressors are equipped with mounts, check whether these mounts have clamping mechanisms. If they do, the clamping mechanisms must be removed before system start-up. Clamping mechanisms are identified by red collars and signalled by a label affixed to the compressor sub-assembly.

10.2 Commissioning

Always ensure you have read and fully understood the operating instructions for the units before starting up the unit, and ensure the following precautions have been taken:

- Check the heat transfer fluid circulation pumps, the air handling equipment, and any other equipment connected to the exchangers.
- Refer to these instructions.
- Refer to the electrical diagram delivered with the unit.
- Ensure that there is no refrigerant leak.
- Check the tightening of fixing clamps of all pipes.
- Check the power supply at the main connection point and the order of phases.
- Open the suction shut-off valves on each circuit for the corresponding machines.
- For units without the factory-fitted hydronic module option, the installer is responsible for heat protection and the connections relating to the system pump.
- Check the operation of the compressor oil crankcase heaters 6 hours before starting up the system.

IMPORTANT: Commissioning and start-up must be supervised by a qualified engineer.

- The system must have a heat load and water flowing in the exchangers when it is started up and tested.
- All setpoint adjustments and control tests must be carried out before the unit is started up.
- Refer to the Service guide.

Proceed with the unit commissioning.

Ensure that all safety devices are operational, especially that the high pressure switches are engaged and that any alarms have been cleared.

NOTE: If the manufacturer's recommendations (system, water and power connections) are not observed, no claims made under the warranty will be accepted.

10.3 Essential points to check

- **Compressors**

Ensure that each compressor is rotating in the correct direction, checking that the discharge temperature rises quickly, the HP increases and the LP drops. If it is rotating in the wrong direction, the electric power supply is incorrectly wired (reversed phases). To ensure rotation in the correct direction, swap the two power supply phases.

- Check the compressor discharge temperature with a contact sensor
- Check the input current; it should be normal
- Check all safety devices to make sure they operate correctly

- **Hydraulics**

The exact total drop in system pressure will not be known at commissioning. It will therefore be necessary to adjust the flow of water with the control valve until the desired nominal rate is obtained.

By causing the pressure in the water system to drop, this control valve aligns the system pressure/flow curve with that of the pump so that the nominal flow rate corresponding to the desired operating point is obtained. The pressure drop in the water exchanger (read using the pressure gauge placed on the exchanger inlet and outlet) is the reference to be used to check and adjust the nominal flow rate of the system.

Follow the procedure described below:

- Open the control valve completely
- Let the pump run for two hours to flush out any solid particles in the circuit
- Read the pressure drop in the water exchanger when the pump is turned on and then two hours afterwards
- If the pressure drop has decreased, this means that the screen filter is clogged. It must be removed and cleaned
- Repeat until the filter is completely clean
- If the system pressure drops far below the available static pressure delivered by the pump, the resulting water flow rate will be low and the difference in temperature between the exchanger inlet and outlet will be too high. This is why pressure drops must be minimised. Check that this difference is within the values on the curve (refer to section "Water exchanger min. water volume and flow rate")

- **Refrigerant charge**

Each unit is shipped with an exact charge of refrigerant.

11.1 Compressors

The units use hermetically sealed scroll compressors.

Each compressor is equipped with a crankcase oil heater, as standard. There is no heater fault detection.

Each compressor sub-assembly has:

- Anti-vibration mountings between the unit chassis and the chassis of the compressor sub-assembly,
- A safety pressure switch on the discharge line of each circuit,
- Pressure and temperature sensors at the common suction line and a pressure sensor at the common discharge line.

11.2 Lubricant

The compressors installed on the units have an oil charge, ensuring good lubrication under all operating conditions. The oil level check can be done:

- On the system: the oil levels must be greater than or equal to half of the sight glass.
- A few minutes after the sub-function has come to a complete stop: the oil levels must be visible in the sight glasses.

If this is not the case, there might be a leak or an oil trap in the circuit. If there is an oil leak, find and repair it, then refill with refrigerant and oil.

See the Service Guide for the oil removal and refill procedures.

WARNING: too much oil in the circuit can cause the unit to malfunction.

NOTE: only use oils which have been approved for the compressors. Never use oils which have been exposed to air.

WARNING: polyolester oils are completely incompatible with mineral oils. Only use the oils specified by the manufacturer.

11.3 Air-cooled exchanger

The unit coils are composed of aluminium fins crimped onto internally grooved copper tubes (RTPF) for reversible machines. Micro-channel coils made entirely from aluminium for cooling only machines (note that some options are delivered with RTPF coils).

11.4 Fans

Each fan motor is equipped with a high-performance impeller made from a recyclable composite material. The motors are three-phase, with permanently lubricated bearings and class F insulation (rated IP55).

For more detailed information, refer to the requirements in the table below. According to Regulation No. 327/2011 implementing Directive 2009/125/EC with regard to eco-design requirements for motor-driven fans with an electric input power of between 125 W and 500 kW

Product/Option		Standard LD(1) or with Xtra low noise option	Standard LD(2)	LD with Winter Operation option down to -20°C	LD with Xtra Fan option
Fan overall efficiency	%	32.90%	35.40%	44.20%	43.20%
Measurement category		Static	Static	Static	Static
Efficiency category		A	A	A	A
Target energy efficiency		40	40	40	40
Efficiency level at optimum energy efficiency point		40	40	48,4	46,9
Frequency inverter		NO	NO	YES	YES
Year of manufacture		See label on the unit	See label on the unit	See label on the unit	See label on the unit
Fan manufacturer		ebm-papst	ebm-papst	ebm-papst	ebm-papst
Motor manufacturer		ebm-papst	ebm-papst	ebm-papst	ebm-papst
Fan reference		00PSG002550200A	00PSG002550100A	00PSG002550300A	00PSG002550400A
Motor nominal power	kW	0.75 kW	1.85 kW	2.21 kW	2.6 kW
Flow rate	m^3/s	12710	17830	17535	18115
Pressure	Pa	69	130	189	212
Rotation speed	rpm	695	930	1020	1080
Specific ratio		1,00	1,00	1,00	1,00
Relevant information for disassembly, end-of-life recycling and disposal		See service manual	See service manual	See service manual	See service manual
Relevant information for minimising environmental impact		See service manual	See service manual	See service manual	See service manual

(1) For LD sizes 150A to 240A and 360 to 450A only

(2) For LD sizes 260A to 300A and 520 to 600 only

Product/Option		Standard LD(1) or with Xtra low noise option	Standard LD(2)	LD with Winter Operation option down to -20°C	LD with Xtra Fan option
Motor type		Dual-speed asynchronous	Dual-speed asynchronous	"EC"	"EC"
Number of poles		8	6		
Nominal input frequency	Hz	50	50	50	50
Nominal voltage	V	400	400	400	400
Number of phases		3	3	3	3
Fan included in the scope of Regulation 327/2011 of 30th March 2011		YES	YES	YES	YES
Ambient air temperature for which the motor is specifically designed	°C	+70°C	+65°C	+70°C	+65°C

(1) For LD sizes 150A to 240A and 360 to 450A only

(2) For LD sizes 260A to 300A and 520 to 600A only

In accordance with regulation No. 640/2009 and amendment 4/2014 implementing Directive 2005/32/EC concerning eco-design requirements for electric motors.

Product/Option		Standard ILD(1) or with Xtra low noise option	Standard ILD(2)	ILD with Winter Operation option down to -20°C
Fan overall efficiency	%	32,2	34	40,4
Measurement category		A	A	A
Efficiency category		static	static	static
Target energy efficiency		40	40	40
Efficiency level at optimum efficiency point		43,3	42.3	43,7
Frequency inverter		NO	NO	YES
Year of manufacture		See label on the unit	See label on the unit	See label on the unit
Fan manufacturer		Simonin	Simonin	Simonin
Motor manufacturer		Regal MANUFACTURING	Regal MANUFACTURING	Regal MANUFACTURING
Fan reference		00PSG000000100A	00PSG000000100A	00PSG000000100A
Motor reference		00PPG000464500A	00PPG000464600A	00PPG000464700A
Motor nominal power	kW	0.88	2.09	2.41
Flow rate	m^3/s	3.59	4.07	5.11
Pressure	Pa	90	195	248
Rotation speed	rpm	710	966	1137
Specific ratio		1,002	1,002	1,002
Relevant information for disassembly, end-of-life recycling and disposal		See service manual	See service manual	See service manual
Relevant information to minimise impact on the environment		See service manual	See service manual	See service manual

(1) For ILD sizes 150A to 200A and 302 to 450A only

(2) For ILD sizes 240A to 300A and 520 to 600A only

Product/Option		Standard ILD(1) or with Xtra low noise option	Standard ILD(2)	ILD with Winter Operation option down to -20°C
Motor type		Dual-speed asynchronous	Dual-speed asynchronous	Asynchronous
Number of poles		8	6	6
Nominal input frequency	Hz	50	50	60
Nominal voltage	V	400	400	400
Number of phases		3	3	3
Motor included in the scope of regulation 640/2009 & amendment 4/2014		NO	NO	NO
Rationale for exemption		Article 2.1	Article 2.1	Article 1.2.c).(ii)
Ambient air temperature for which the motor is specifically designed	°C	68.5	68.5	68.5

(1) For ILD sizes 150A to 200A and 302 to 450A only

(2) For ILD sizes 240A to 300A and 520 to 600A only

11.5 Electronic expansion valve (EXV)

The EXV has a stepper motor and a sight glass which can be used to check the mechanism movement and the presence of the liquid gasket.

11.6 Moisture indicator

Located on the EXV, permits monitoring 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

11.7 Dryer filter

This single-piece brazed component is situated on the liquid line. The role of the filter drier is to keep the circuit clean and moisture-free. The moisture indicator shows when the filter drier needs to be changed. A temperature difference between the box inlet and outlet indicates fouling of the component.

In the case of reversible machines, the dehydrator is "bi-flow", i.e. it filters and dehydrates in both operating modes. Its pressure drop is much bigger in heating mode.

11.8 Water exchanger

The water exchanger is a "brazed plate" type, with 1 or 2 refrigerating circuits

The water connections of the heat exchanger are Victaulic connections.

The water heat exchanger is thermally insulated with 19 mm of foam rubber. It is equipped as standard with an electric heater providing frost protection

Thermal insulation of chiller / piping must be chemically neutral to the surfaces on which they are applied. All original materials supplied by the manufacturer comply with this requirement.

NOTE - Monitoring in operation

- **Follow local regulations on the monitoring of pressure equipment**
- **The user or operator is usually required to create and maintain a monitoring and maintenance log.**
- **In the absence of any regulations, or in addition to the regulations, follow the guidance in the EN 378 standard.**
- **Follow the local professional recommendations, whenever they exist.**
- **Regularly check for the presence of any impurities (e.g. sand, grit) in the heat transfer fluids. These impurities can cause wear and/or pitting corrosion.**
- **The reports of the periodical checks by the user or the operator must be included in the monitoring and maintenance register.**

11.9 Refrigerant

Units running with R410A

11.10 HP safety pressostat

The units are equipped with high pressure safety switches with automatic reset on the HP side. These pressure switches are located at the discharge of each circuit.

11.11 Tank

The reversible units in the range are equipped with mechanically welded tanks which can store the excess load when the unit is operating in heating mode.

11.12 4-way valve

Used to reverse the cycle for operating in cooling and heating modes, as well as during defrosting cycles.

11.13 Electrical box

The electrical box for the units in the range is equipped with electric heaters to prevent the formation of condensation when running at low outdoor temperatures. These heaters are fitted on top of the box, on the outside, and are covered with a layer of thermal insulation. They are activated according to the ambient temperature.

11.14 Variable speed ventilation

The variable speed drives on the fans are used to optimise the efficiency of the unit depending on the condition of use (air temperature, circuit capacity) and hence improve the seasonal efficiency (ESEER and SCOP).

All the variable-speed fans are actuated by the machine controller, and each variable-speed fan is equipped with its own variable speed drive. The speed is controlled by the refrigerating circuit.

This rotation speed at full load or partial load for each circuit is controlled by an algorithm that continuously optimises the condensing temperature to obtain the best unit energy efficiency (EER and COP) whatever the operating conditions.

11.15 Electrical box

The electrical box for reversible units in the range is equipped with electric heaters to prevent the formation of condensation when operating at low outdoor temperatures. These heaters are fitted on top of the box, on the outside, and are covered with a layer of thermal insulation. They are activated according to the ambient temperature.

Fan motor electrical protection

Each fan is individually protected by a magnetothermal circuit breaker. Refer to the wiring diagram to identify the associated outlets.

11.16 Connect Touch control

The interface of the Connect Touch Control has the following properties:

- It is a 4-inch 1/3 colour interface.
- It is intuitive and user-friendly. Clear and concise information is presented in the local language (8 available).
- The complete menu can be adapted to the various users (end customer, maintenance personnel, manufacturer),
- Unit use and configuration are secure. Password protection prevents non-authorized access to advanced settings.
- No password is required to access the most important operating parameters.

12 - OPTIONS

12.1 Tables of options

Options	Description	Advantages	LD	ILD
Condenser with anti-corrosion post-treatment	Factory application of Blygold Polual treatment on the copper/aluminium coils	Improved corrosion resistance, recommended for industrial, rural and marine environments	ALL MODELS with desuperheater or low and very low temperature glycol/ water mix option	NO
Corrosion protection, traditional coils	Pre-treated aluminium fins (polyurethane and epoxy)	Improved corrosion resistance, recommended for moderate marine and urban environments	ALL MODELS with desuperheater or low and very low temperature glycol/ water mix option	ALL MODELS
Low temperature glycol/ water mix	Low temperature chilled water production down to 0°C with ethylene glycol and propylene glycol.	Covers specific applications such as ice storage and industrial processes	ALL MODELS	ALL MODELS
Very low temperature glycol/water mix	Low temperature chilled water production down to -15°C with ethylene glycol and -12°C with propylene glycol.	Covers specific applications such as ice storage and industrial processes	ALL MODELS	ALL MODELS
Xtra Fan	Unit equipped with specific variable-speed fans: Xtra Fan (see specific chapter for maximum available pressure according to size), each fan equipped with a connection flange and sleeves enabling connection to the ductwork.	Ducted fan discharge, optimised condensing (or evaporating on Heat pump version) temperature control, based on the operating conditions and system characteristics	ALL MODELS	ALL MODELS
Xtra Low Noise	Acoustic compressor enclosure and low-speed fans	Noise emission reduction at reduced fan speed	ALL MODELS	ALL MODELS
Protection grilles	Metallic protection grilles	Coil protection against possible impact	ALL MODELS	NO (*)
Soft Starter	Electronic starter on each compressor	Reduced start-up current	ALL MODELS	ALL MODELS
Winter operation (down to -20°C)	Fan speed control	Stable unit operation when the air temperature is between 0°C and -20°C.	ALL MODELS	ALL MODELS
Frost protection down to -20°C	Electric heater on the hydronic module	Hydronic module frost protection at low outside temperatures	ALL MODELS	ALL MODELS
Water exchanger and hydraulic mod. frost protection	Electric heaters on the water exchanger hydronic module, optional expansion tank and buffer tank module	Water exchanger and hydronic module frost protection down to -20°C outside air temperature	ALL MODELS	ALL MODELS
Partial heat recovery	Unit equipped with one desuperheater on each refrigerant circuit	Production of free high-temperature hot-water simultaneously with chilled water production (or hot water for Heat pump)	ALL MODELS	ALL MODELS
Master/slave operation	Unit equipped with an additional water outlet temperature sensor, to be installed on site, enabling master/slave operation of 2 units connected in parallel	Optimised operation of two units connected in parallel with run time equalisation	ALL MODELS	ALL MODELS
HP single-pump hydronic module	Single 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 hydraulic safety components available.)	Quick, easy installation (plug & play)	ALL MODELS	ALL MODELS
HP dual-pump hydronic 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 hydraulic safety components available.)	Quick, easy installation (plug & play)	ALL MODELS	ALL MODELS
LP single-pump hydronic 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.)	Quick, easy installation (plug & play)	ALL MODELS	ALL MODELS
LP dual-pump hydronic 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.)	Quick, easy installation (plug & play)	ALL MODELS	ALL MODELS

(*) = supplied as standard

12 - OPTIONS

Options	Description	Advantages	LD	ILD
HP variable-speed single-pump hydronic module	Single high-pressure water pump with variable speed drive (VSD), water filter, electronic water flow control, pressure transducers. Multiple possibilities of water flow control. For more details, refer to the dedicated chapter (expansion tank not included. Option with built-in hydraulic safety components available.)	Quick, easy installation (plug & play), significant pumping energy consumption savings (more than two-thirds), accurate water flow rate control, improved system reliability	ALL MODELS	ALL MODELS
HP variable-speed dual-pump hydronic module	Dual high-pressure water pump with variable speed drive (VSD), water filter, electronic flow switch, pressure transducers. Multiple possibilities of water flow control. For more details, refer to the dedicated chapter (expansion tank not included. Option with built-in hydraulic safety components available.)	Quick, easy installation (plug & play), significant pumping energy consumption savings (more than two-thirds), accurate water flow rate control, improved system reliability	ALL MODELS	ALL MODELS
Lon gateway	Two-directional communication board complying with Lon Talk protocol	Connects the unit by communication bus to a building management system	ALL MODELS	ALL MODELS
Bacnet over IP	Two-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	ALL MODELS	ALL MODELS
External boiler management	Control board factory-installed on the unit to control a boiler	Extended remote control capabilities to a boiler on/off command. Permits easy control of a basic heating system	NO	ALL MODELS
Electric heaters management	Control board factory-installed on the unit with additional inputs/outputs in order to manage up to 4 externals heating stage (electrical heaters…)	Extended remote control capabilities to up to 4 electric heaters. Permits easy control of a basic heating system	NO	ALL MODELS
Compliance with Russian regulations	EAC certification	Compliance with Russian regulations	ALL MODELS	ALL MODELS
Micro-channel exchangers anti-corrosion 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 coating doubles the corrosion resistance of micro-channel exchangers, recommended for use in moderately corrosive environments	ALL MODELS	NO
Micro-channel exchangers anti-corrosion protection Protect4	Extremely durable and flexible epoxy polymer coating applied on micro channel coils by electro coating process, final UV protective topcoat. Minimal heat transfer variation, tested 6000 hours constant neutral salt spray per ASTM B117, superior impact resistance per ASTM D2794	Protect4 coating quadruples the corrosion resistance of micro-channel exchangers, recommended for use in corrosive environments	ALL MODELS	NO
Water exchanger connection sleeves, screw-in	Water exchanger inlet/outlet connection sleeves, screw-in	Allows unit connection to a screw connector	ALL MODELS	ALL MODELS
Reinforced filtration of fan variable frequency drive	Fan variable frequency drive compliance to IEC 61800-3 C1 class	Allows unit installation in domestic residential environment by reducing electromagnetic interferences	NO	ALL MODELS with variable speed fan
Reinforced filtration of pump variable frequency drive	Pump variable frequency drive compliance to IEC 61800-3 C1 class	Allows unit installation in domestic residential environment by reducing electromagnetic interferences	ALL MODELS with variable speed pump option	ALL MODELS with variable speed pump option
Expansion tank	6 bar expansion vessel built into the hydronic module (option 116 required)	Easy and fast installation (plug & play), & Protection of closed water systems from excessive pressure	ALL MODELS	ALL MODELS
Buffer tank module	Integrates a buffer tank module	Avoid short cycle on compressors and ensure a stable water in the loop	ALL MODELS	ALL MODELS
Anti-vibration mounts	Elastomer anti-vibration mounts to be placed underneath the unit	Isolate unit from the building, avoid transmission of vibration and associate noise to the building. Must be associate with flexible connection on water side	ALL MODELS	ALL MODELS
Flexible couplings for connection to the exchanger	Flexible connections to the water exchanger	Easy installation. Limit transmission of vibrations on the water network	ALL MODELS	ALL MODELS
Evaporator water filter	Water filter	Prevents fouling within the water network	ALL MODELS without pump	ALL MODELS without pump
Set point adjustment by 4-20mA signal	Connections to allow a 4-20mA signal input	Easy energy management, allow to adjust set point by a 4-20 mA external signal	ALL MODELS	ALL MODELS
Free cooling mode dry cooler management	Control and connections of an Opera or Vextra free cooling mode dry cooler equipped with the FC control box option	Easy system management, extended control capabilities to a dry cooler used in free cooling mode	ALL MODELS	NO

Accessories	Description	Advantages	LD	ILD
M2M 1 supervision unit - France	Monitoring solution enabling customers to remotely track and monitor equipment in real time, France only	Real-time expert technical support to improve equipment availability and reports at customer hand to monitor and optimize operating equipment.	ALL MODELS	ALL MODELS
M2M 3 supervision units - France	Monitoring solution enabling customers to remotely track and monitor several items of equipment in real time, France only	Real-time expert technical support to improve equipment availability and reports at customer hand to monitor and optimize operating equipment.	ALL MODELS	ALL MODELS
M2M 1 supervision unit - International	Monitoring solution enabling customers to remotely track and monitor equipment in real time, outside of France	Real-time expert technical support to improve equipment availability and reports at customer hand to monitor and optimize operating equipment.	ALL MODELS	ALL MODELS
M2M 3 supervision units - International	Monitoring solution enabling customers to remotely track and monitor several items of equipment in real time, outside of France	Real-time expert technical support to improve equipment availability and reports at customer hand to monitor and optimize operating equipment.	ALL MODELS	ALL MODELS

12.2 Description

12.2.1 Hydronic module without variable speed

The hydronic module is composed of the system's main hydronic components: factory-fitted water pump, screen filter and relief valve.

This pump provides the fixed, nominal flow rate for the system.

Several types of water pump are available to suit all applications:

- Single or dual low pressure pumps
- Single or dual high pressure pumps.

The nominal flow of the system should be adjusted using a manual control valve provided by the client.

The relief valve placed on the water inlet pipes at the pump inlet limits the pressure to 400 kPa (4 bar).

A screen filter that can be easily removed placed at the pump inlet and an external filter protects both the pump and the plate heat exchanger against
solid particles greater than 800 µm in size.

Additional options can be ordered if necessary:

- Protection of the hydronic module in outdoor temperatures of down to -20°C.
- Expansion vessel.

The use of the hydronic module on open systems is prohibited.

12.2.2 Hydronic module with variable speed

The composition of the hydronic module with variable speed is similar to that of the hydronic module without variable speed.

In this case, the pump is controlled by a variable frequency drive that allows adjustment of the pump's nominal flow according to the chosen control mode (constant pressure or temperature differential, fixed flow) and the system operating conditions.

The use of the hydronic module on open systems is prohibited.

12.2.3 Partial heat recovery by desuperheaters

This option enables free hot water to be produced through heat recovery by desuperheating the compressor outlet gas. The option is available across the entire range.

A water-cooled heat exchanger is installed as standard with air-cooled exchangers on the compressor discharge line on each circuit.

The control is configured for the Partial heat recovery option in the factory (see the section on Control configuration with the desuperheater option).

The installer must protect the water-cooled exchanger against the risk of frost.

12.2.3.1 Physical properties of units with partial heat recovery using desuperheaters

LD partial heat recovery mode		150A	180A	200A	240A	260A	300A	360A	390A	450A	520A	600A
Standard unit	kg	459	467	496	521	505	541	841	853	878	939	1002
Unit + High-pressure single pump option	kg	500	509	538	563	547	583	908	919	949	1013	1076
Unit + High-pressure dual pump option	kg	526	535	564	589	572	609	953	964	997	1050	1113
Unit + high-pressure single pump + Buffer Tank module option	kg	896	905	934	959	943	979	1341	1352	1382	1446	1509
Unit + high-pressure dual pump + Buffer Tank module option	kg	922	931	960	985	968	1005	1386	1397	1430	1483	1546
Refrigerant with copper tube coils / aluminium fins(1)		R410A										
Circuit A	kg	8	9	12,5	15	12,5	15	19	20	23	12,5	16
Circuit B	kg	-	-	-	-	-	-	-	-	-	12,5	16
Air heat exchanger		Grooved copper tube and aluminium fins										
Desuperheater on circuits A and B		Plate heat exchanger										
Water volume	l	0,549	0,549	0,549	0,549	0,732	0,732	0,976	0,976	0,976	0,732	0,732
Water volume	l	-	-	-	-	-	-	-	-	-	0,732	0,732
Max water-side operating pressure without hydronic module	kPa	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Water connections		Cylindrical male gas thread										
Connections	inches	1	1	1	1	1	1	1	1	1	1	1
External diameter	mm	42	42	42	42	42	42	42	42	42	42	42

(1) Weights given as a guide.

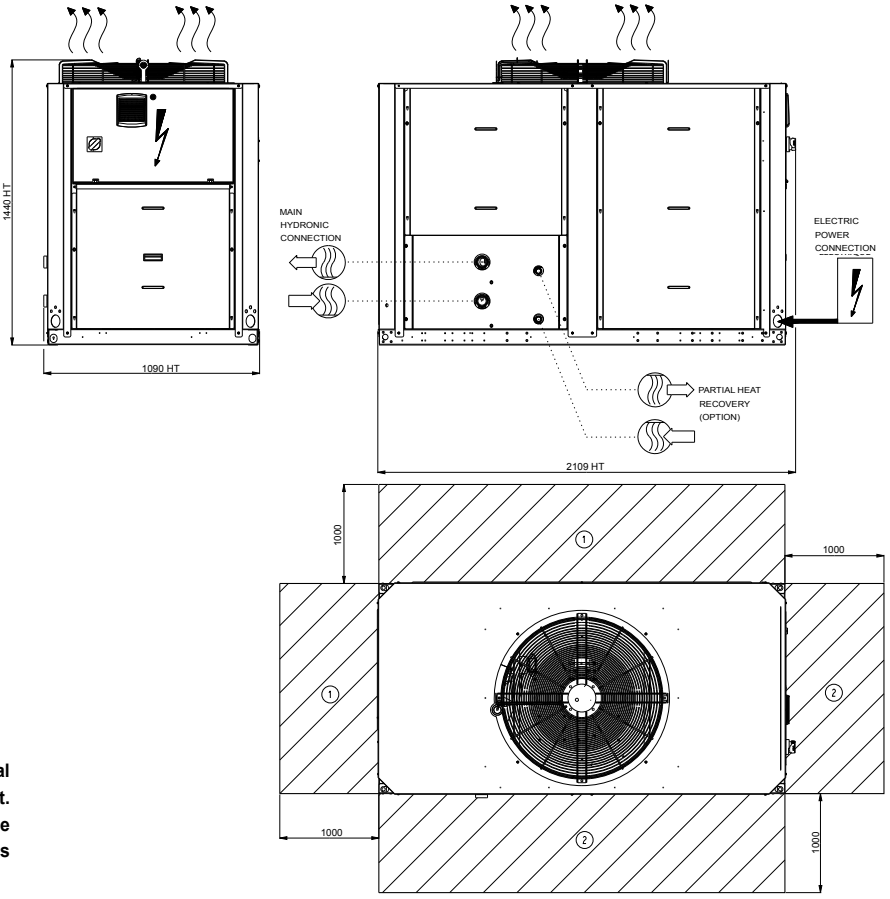
ILD partial heat recovery mode		150A	180A	200A	240A	260A	300A	302A	360A	390A	450A	520A	600A
Standard unit	kg	506	515	552	558	569	574	787	907	916	990	1068	1072
Unit + High-pressure single pump option	kg	548	557	594	600	611	616	854	974	983	1061	1142	1146
Unit + High-pressure dual pump option	kg	574	583	620	626	637	642	899	1019	1028	1109	1179	1183
Unit + high-pressure single pump + Buffer Tank module option	kg	944	952	990	995	1006	1011	1286	1406	1415	1493	1575	1578
Unit + high-pressure dual pump + Buffer Tank module option	kg	970	978	1015	1021	1032	1037	1331	1451	1460	1542	1612	1615
Refrigerant with copper tube coils / aluminium fins(1)		R410A											
Circuit A	kg	12,5	13,5	16,5	17,5	18	16,5	21,5	27,5	28,5	33	19	18,5
Circuit B	kg	-	-	-	-	-	-	-	-	-	-	19	18,5
Air heat exchanger		Grooved copper tube and aluminium fins											
Desuperheater on circuits A and B		Plate heat exchanger											
Water volume	l	0,549	0,549	0,549	0,732	0,732	0,732	0,732	0,976	0,976	0,976	0,732	0,732
Water volume	l	-	-	-	-	-	-	-	-	-	-	0,732	0,732
Max water-side operating pressure without hydronic module	kPa	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Water connections		Cylindrical male gas thread											
Connections	inches	1	1	1	1	1	1	1	1	1	1	1	1
External diameter	mm	42	42	42	42	42	42	42	42	42	42	42	42

(1) Weights given as a guide.

Dimensions, clearances

LD/ILD150A to LD/ILD300A

Without Buffer Tank module

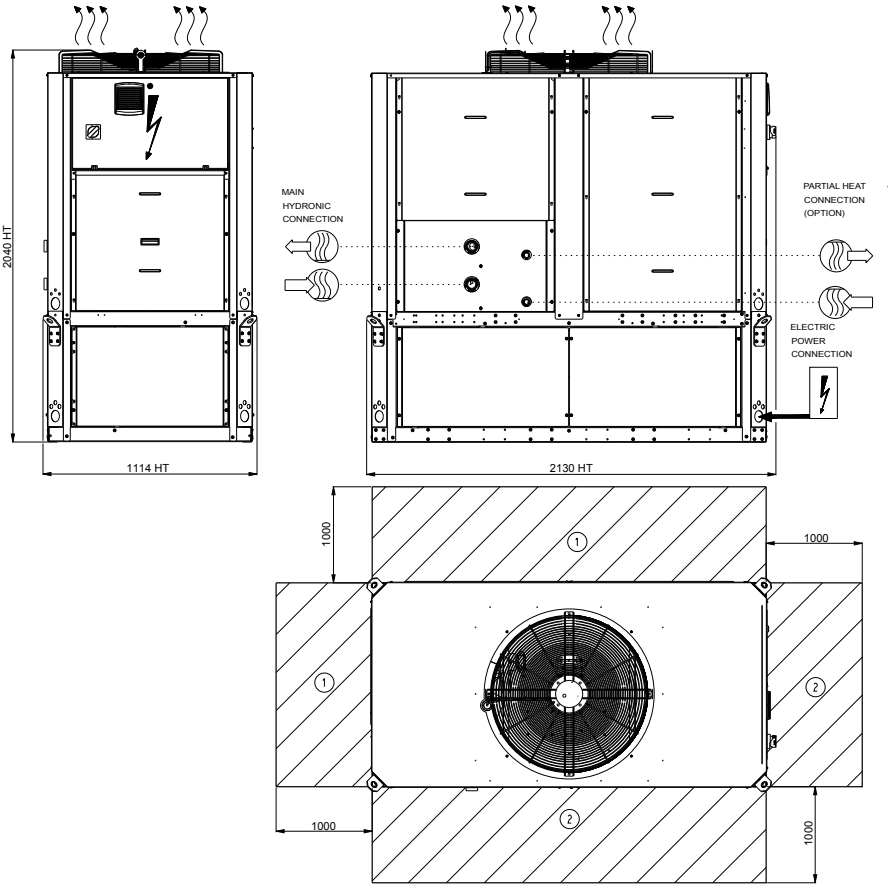


Legend:
All dimensions are in mm.

- (1) Clearances required for maintenance and air flow
- (2) Clearances recommended for coil removal
- Water inlet
- Water outlet
- Air outlet, do not obstruct
- Electrical cabinet

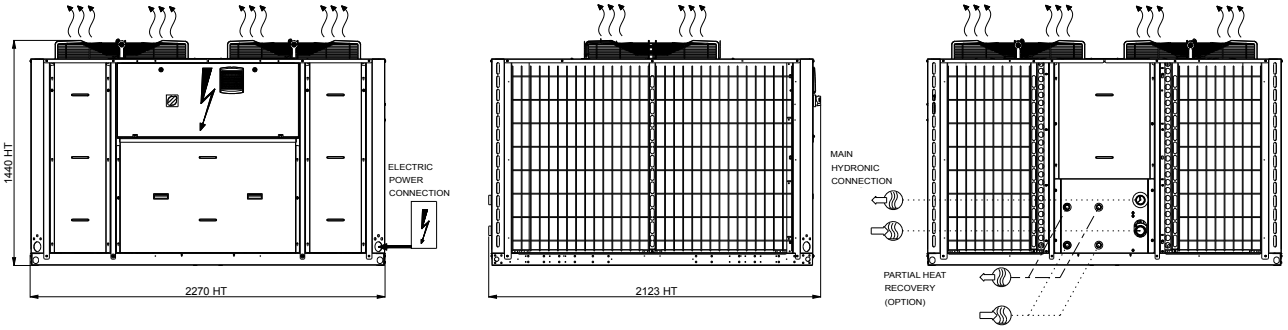
NOTE:
Non-contractual drawings.
When designing a system, refer to the certified dimensional drawings provided with the unit or available on request. Please refer to the certified dimensional drawings, for the positioning of the fixing points, weight distribution points and centre of gravity coordinates.

With Buffer Tank module



- **LD360A to LD600A and ILD302 to ILD600A**

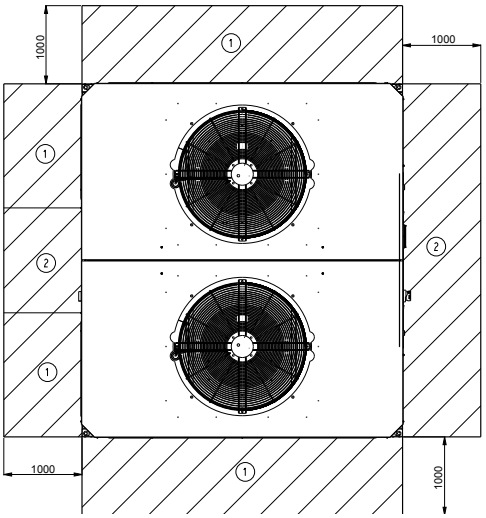
Without Buffer Tank module



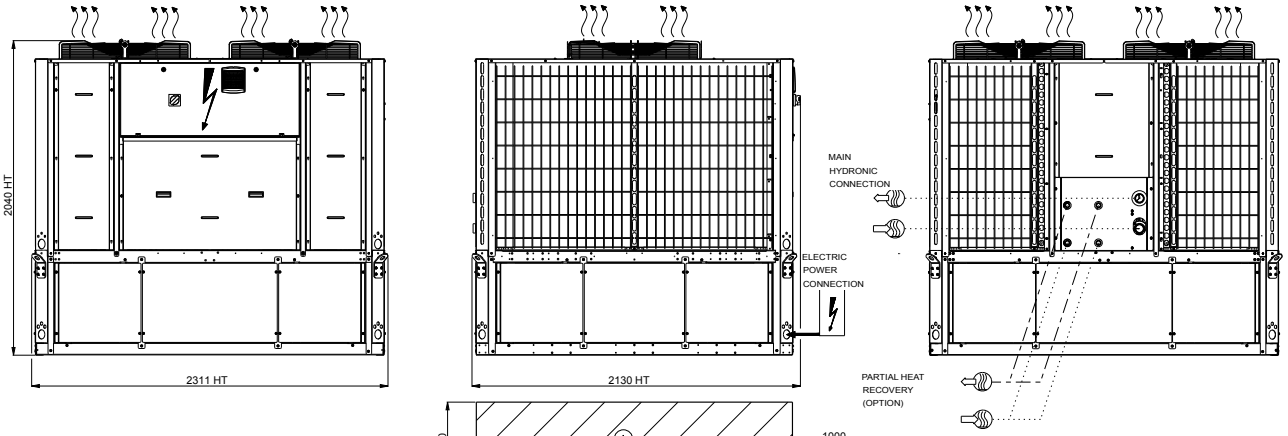
Legend:
All dimensions are in mm.

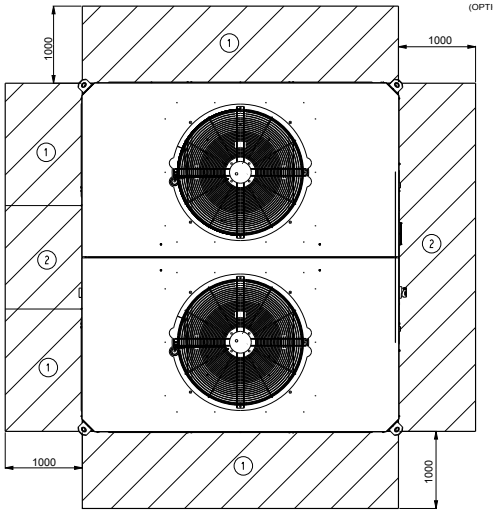
1. Clearances required for maintenance and air flow
2. Clearances recommended for coil removal
3. Water inlet
4. Water outlet
5. Air outlet, do not obstruct
6. Electrical cabinet

NOTE:
Non-contractual drawings.
When designing a system, refer to the certified dimensional drawings provided with the unit or available on request. Please refer to the certified dimensional drawings, for the positioning of the fixing points, weight distribution points and centre of gravity coordinates.



With Buffer Tank module



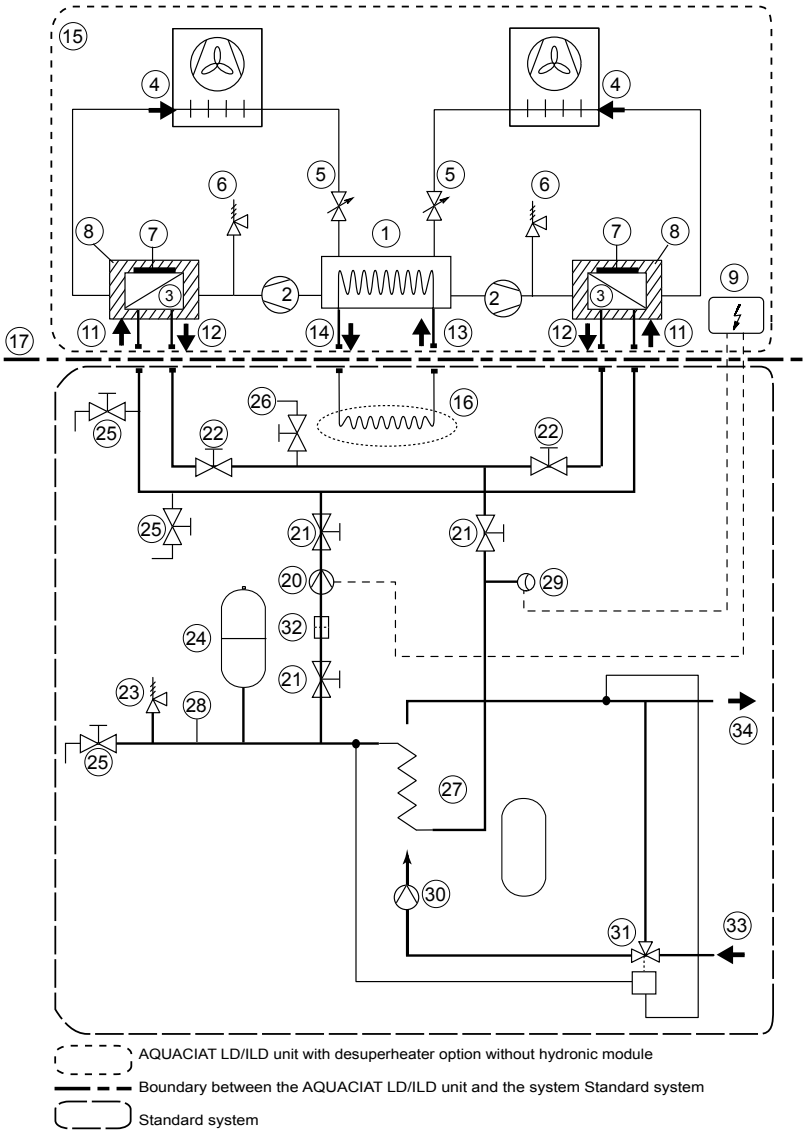


12.2.3.2 Installation and operation of the heat recovery with partial heat recovery option

Units with the desuperheater option are delivered with a plate heat exchanger for each refrigerating circuit.

When installing the unit, the heat recovery plate heat exchangers must be insulated and protected against frost if required.

Refer to the main diagram below for the main components or functions associated with a unit with desuperheater option in a standard system.



Legend:

Components of the AQUACIAT LD/ILD unit

1- Evaporator
2- Compressor
3- Desuperheater
4- Air condenser (coils)
5- Expansion valve (EXV)
6- Accessory for limitation of damage in the event of a fire (valve)
7- Electric heater for protecting the desuperheater from freezing (not provided)
8- Insulation for the desuperheater (not supplied)
9- Electrical box for the unit
10- NA
11- Water inlet on the desuperheater
12- Water outlet on the desuperheater
13- Evaporator water inlet
14- Evaporator water outlet
15- Unit with desuperheater option without hydronic module
16- System heat load
17- Boundary between the AQUACIAT LD/ILD unit

System components (installation example)

20- Pump (hydronic circuit for the desuperheater loop)
21- Shut-off valve
22- Desuperheater water flow rate control and balancing valve
23- Accessory for limitation of damage in the event of a fire (valve)
24- Expansion tank
25- Charge or drain valve
26- Air bleed
27- Coil heat exchanger or plate heat exchanger
28- Pressure gauge
29- Flow rate sensor
30- Pump (sanitary hot water circuit)
31- Three-way valves + controller
32- Filter to protect the pump and the desuperheaters
33- Municipal water inlet
34- Domestic hot water outlet

12.2.3.3 Installation

The hydraulic supply for each desuperheater is delivered in parallel.

The hydraulic connection on the desuperheater water inlet and outlets must not generate any localised mechanical stress on the exchangers. if necessary, install the flexible connective couplings.

Fit water flow rate balancing and control valves at the exchanger outlet.

Balancing and control of the flow rates may be performed by reading the pressure drop in the exchangers.

The pressure drop on each of these must be identical to the total water flow rate given by the selection programme.

To adjust the balancing valves before starting up the system, refer to the pressure drop curves below.

It is possible to fine-tune the water flow rate settings for each desuperheater when the unit is running at full load by trying to obtain water outlet temperatures which are strictly identical for each of the circuits.

Heating capacity recovered by the desuperheaters

- LD 150A - 600A

LD 150A - 600A									
	Water inlet temperature on desuperheater, °C								
	45			50			55		
	Qhr	q	Δp	Qhr	q	Δp	Qhr	q	Δp
	kW	l/s	kPa	kW	l/s	kPa	kW	l/s	kPa
150A	12,9	0,31	6,1	10,9	0,26	4,4	9,0	0,21	3,1
180A	16,5	0,40	9,5	14,3	0,34	7,4	12,0	0,29	5,2
200A	18,1	0,43	11,7	15,4	0,37	8,5	12,8	0,31	6,1
240A	19,3	0,46	12,9	16,6	0,40	9,8	13,7	0,33	6,9
260A	24,3	0,58	11,8	21,0	0,50	9,2	17,5	0,42	6,5
300A	28,6	0,68	16,3	24,4	0,58	12,1	20,6	0,49	8,8
360A	30,5	0,73	11,4	25,8	0,62	8,2	21,5	0,51	5,8
390A	36,4	0,87	16,0	31,9	0,76	12,4	27,0	0,64	8,9
450A	43,1	1,03	22,6	37,4	0,89	17,2	31,6	0,75	12,3
520A(1)	47,1	1,12	11,3	39,7	0,95	8,3	33,0	0,79	5,9
600A(1)	54,0	1,29	15,0	45,6	1,09	10,7	38,3	0,92	7,8

Legend:
Qhr Total heating capacity recovered by the desuperheater(s), kW
q Total water flow rate on the desuperheater loop, l/s
Δp Water pressure drop per desuperheater, kPa
(1) Sizes 520A and 600A are equipped with two desuperheaters, one per circuit.
Application data:
Water exchanger inlet/outlet temperature: 12/7°C
Outside air temperature: 35°C
Water inlet/outlet difference on desuperheater: 10 K
Evaporator fluid: chilled water
Fouling level coefficient: 0.18 x 10-4 m².K/W

- ILD 150A - 600A / Cooling mode

ILD 150A - 600A									
	Water inlet temperature on desuperheater, °C								
	45			50			55		
	Qhr	q	Δp	Qhr	q	Δp	Qhr	q	Δp
	kW	l/s	kPa	kW	l/s	kPa	kW	l/s	kPa
150A	10,9	0,26	4,4	9,1	0,22	3,1	7,1	0,18	2,1
180A	14,4	0,34	7,5	12,2	0,29	5,4	10,0	0,24	3,7
200A	17,2	0,41	10,5	14,7	0,35	7,8	12,3	0,29	5,6
240A	17,4	0,44	6,6	15,1	0,36	4,6	12,3	0,29	3,0
260A	21,4	0,51	9,3	17,9	0,43	6,7	14,7	0,35	4,8
300A	26,8	0,64	14,7	22,5	0,54	10,4	18,8	0,45	7,5
302A	23,9	0,57	12,1	21,2	0,51	7,8	16,3	0,39	5,8
360A	28,1	0,67	9,9	23,9	0,57	7,1	19,7	0,47	5,1
390A	33,9	0,81	14,0	28,3	0,68	10,1	23,7	0,57	7,2
450A	37,7	0,90	17,5	31,7	0,76	12,4	26,5	0,63	8,9
520A(1)	42,9	1,03	9,4	35,5	0,85	6,7	29,1	0,70	4,5
600A(1)	52,3	1,25	14,1	44,2	1,06	10,1	36,9	0,88	7,1

Legend:
Qhr Total heating capacity recovered by the desuperheater(s), kW
q Total water flow rate on the desuperheater loop, l/s
Δp Water pressure drop per desuperheater, kPa
(1) Sizes 520A and 600A are equipped with two desuperheaters, one per circuit.
Application data:
Water exchanger inlet/outlet temperature: 12/7°C
Outside air temperature: 35°C
Water inlet/outlet difference on desuperheater: 10 K
Evaporator fluid: chilled water
Fouling level coefficient: 0.18 x 10-4 m².K/W

- ILD 150A - 600A / Heating mode

ILD 150A - 600A									
	Water inlet temperature on desuperheater, °C								
	45			50			55		
	Qhr	q	Δp	Qhr	q	Δp	Qhr	q	Δp
	kW	l/s	kPa	kW	l/s	kPa	kW	l/s	kPa
150A	10,1	0,24	3,8	8,3	0,20	2,7	6,8	0,16	1,8
180A	11,1	0,27	4,6	9,3	0,22	3,3	7,7	0,18	2,3
200A	14,0	0,33	7,1	11,8	0,28	5,2	9,9	0,24	3,6
240A	14,3	0,34	4,4	11,8	0,28	3,0	9,4	0,22	2,0
260A	17,1	0,41	6,3	14,4	0,34	4,5	11,9	0,28	3,1
300A	19,1	0,46	7,8	16,0	0,38	5,6	13,2	0,32	3,9
302A	17,5	0,42	6,6	14,6	0,35	4,8	11,7	0,28	3,2
360A	21,4	0,51	6,0	17,7	0,42	4,1	14,7	0,35	2,8
390A	20,6	0,49	5,1	16,5	0,39	3,4	12,7	0,30	2,0
450A	23,0	0,55	6,9	18,5	0,44	4,7	14,5	0,35	3,0
520A(1)	32,0	0,77	5,5	26,7	0,64	3,8	21,6	0,52	2,6
600A(1)	37,5	0,90	7,3	31,2	0,75	5,4	25,4	0,61	3,7

Legend:
Qhr Total heating capacity recovered by the desuperheater(s), kW
q Total water flow rate on the desuperheater loop, l/s
Δp Water pressure drop per desuperheater, kPa
(1) Sizes 520A and 600A are equipped with two desuperheaters, one per circuit.
Application data:
Water exchanger inlet/outlet temperature: 40/45°C
Outside air temperature: 7°C
Water inlet/outlet difference on desuperheater: 10 K
Evaporator fluid: chilled water
Fouling level coefficient: 0.18 x 10-4 m².K/W

12.2.3.4 Operating limits

AQUACIAT LD

Operating mode		COOLING	
Desuperheater		**minimum**	**maximum**
Water inlet temperature at start-up	°C	25(1)	60
Water outlet temperature during operation	°C	30	65
Air condenser		**minimum**	**maximum**
Outdoor ambient operating temperature	°C	-10(2)	46

(1) The water inlet temperature at start-up must not drop below 25°C.
For installations with a lower temperature, a 3-way valve is required.
(2) With Winter Operation option

AQUACIAT ILD

Operating mode		COOLING		HEATING	
Desuperheater		**Minimum**	**Maximum**	**Minimum**	**Maximum**
Water inlet temperature at start-up	°C	25(1)	60	25(1)	60
Water outlet temperature during operation	°C	30	65	30	65
Air condenser		**Minimum**	**Maximum**	**Minimum**	**Maximum**
Outdoor ambient operating temperature	°C	-10(2)	46	-10	48

(1) The water inlet temperature at start-up must not drop below 25°C.
For installations with a lower temperature, a 3-way valve is required.
(2) With Winter Operation option

12.2.3.5 Control configuration with the desuperheater option

This configuration enables the user to enter a setpoint relating to the minimum condensation temperature (default value = 40°C) to increase the heating capacity recovered by the desuperheaters, if required.

In fact, the recovered heating capacity percentage in relation to the total capacity released by the air-cooled exchanger increase based on the saturated condensation temperature.

Refer to the control manual for adjustment of the minimum saturated condensation temperature setpoint.

Other parameters directly affect the effective capacity recovered from the desuperheater, which are mainly:

- The unit's load rate, which governs whether it runs at full load (100%) or at part load (depending on the number of compressors the unit has per circuit).
- The water inlet temperature in the desuperheater, depending on the unit's "Heating" or "Cooling" operating modes:
  - in "Heating" mode, the water inlet temperature in the water-cooled exchanger
  - in "Cooling" mode, the ambient temperature at the air-cooled exchanger air inlet.

12.2.4 Two units running as master/slave

The customer must connect both units with a communication bus using a 0.75 mm² twisted, shielded cable (contact the manufacturer's Service for installation).

All parameters required for Master/Slave operation must be configured by the Service configuration menu.

All remote controls of the Master/slave assembly (start/stop, unloading, etc.) are managed by the unit configured as Master and must be applied only to the Master unit.

Units supplied with hydronic module

Master/Slave operation is possible only when the units are installed in parallel:

- The master-slave assembly is controlled on the water inlet without any additional sensors (standard configuration) (see example 1).
- Control of Master and Slave on the water outlet is possible by adding two additional sensors in the common supply pipe work (see example 2).

Each unit controls its own water pump.

Units supplied without hydronic module

In the case of units installed in parallel and if there is only one common pump installed by the installer, isolating valves must be installed on each unit. These should be controlled (opened and closed) using the control for the relevant unit (valves for each unit can be controlled using the unit water pump control outputs). Refer to the control manual for the connections.

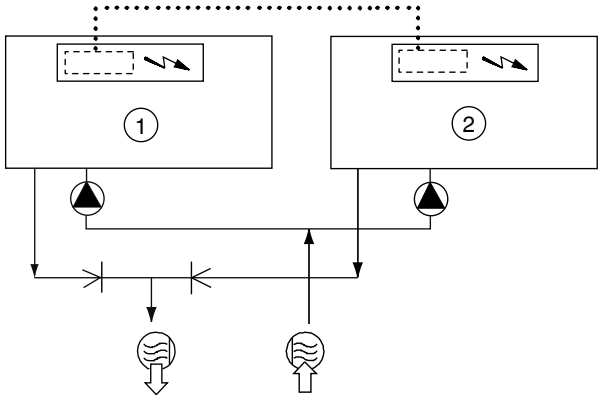
IMPORTANT:

Both of the units must be equipped with an option to allow Master-Slave operation

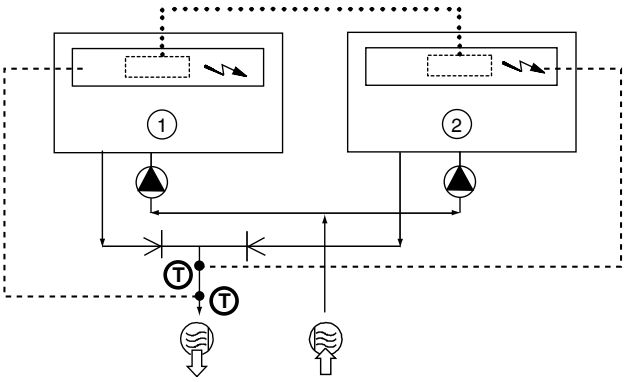
If the variable speed option is equipped on one or two units, it is strongly recommended not to configure the control mode on a pressure differential.

It is recommended to configure the temperature differential mode with the same setpoint.

Case 1: operation in parallel - control on water inlet for a hydronic kit



Case 2: operation in parallel - control on water outlet for a hydronic kit



Legend:

1	Master Unit
2	Slave unit
	Electrical boxes for Master and Slave units
	Water inlet
	Water outlet
	Water pumps for each unit (included as standard in units with hydronic module)
T	Additional sensors for the control of the water outlet to be connected on channel 1 of the slave boards of each Master and Slave unit
••••	Communication bus
·····	Connection of two additional sensors
	Non-return valve

12.2.5 Low temperature / Very low temperature glycol/water mix options

This option enables glycol/water mix production down to 0°C (low temperature glycol/water mix option) / -15°C (very low temperature glycol/water mix option)

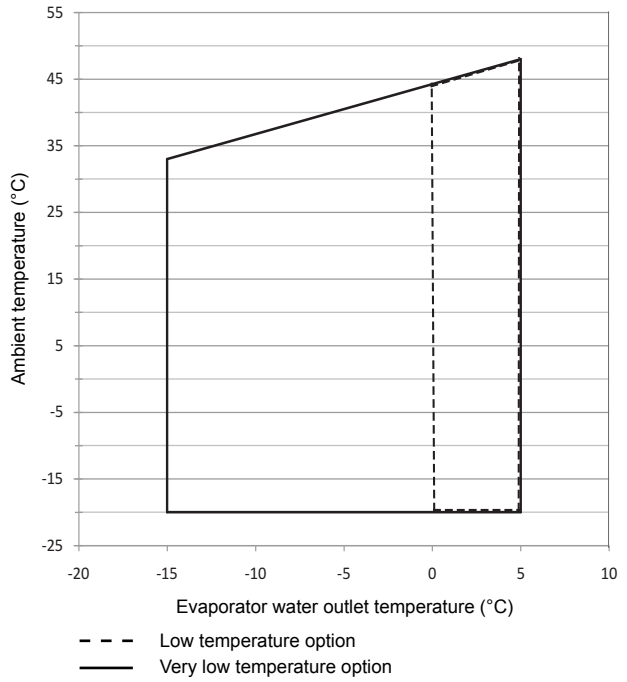
The unit is equipped with a suction tube isolation device (for very low temperature glycol/water mix only) and variable frequency drives on the ventilation.

The operating range depends on the suction pressure, which itself depends on:

- the glycol type,
- its concentration,
- the flow rate,
- the temperature of the glycol solution,
- the condensation pressure (ambient temperature).

Example: for operation with 45% ethylene glycol and brine temperature -15°C (with -10°C at the inlet), the maximum operating ambient temperature will be approximately 33°C.

Operating range with 45% ethylene glycol



Anti-freeze protection

The low-pressure and antifreeze protection of the evaporator depend on the antifreeze level in the water loop.

The evaporator pinch (LWT – SST) and the antifreeze protection depend on this level.

So it is essential, when first activating the unit, to check the antifreeze level in the loop (circulate for 30 minutes to ensure good mixing homogeneity before sampling).

Refer to the manufacturer data to define the antifreeze protection, dependent on the measured concentration level.

The antifreeze protection temperature must be entered in the unit's software parameters.

This value will be used to define the following limits:

1. Evaporator antifreeze protection.
2. Low-pressure protection.

It is recommended that a low or very low temperature installation be commissioned by the manufacturer.

For information, for the different antifreezes used in our laboratory, the protection values given by our supplier are as follows (these values may change depending on the suppliers):

% glycol mass	Freezing point, °C ethylene glycol	Freezing point, °C propylene glycol
10	-3.8	-2.6
15	-6.1	-4.3
20	-8.8	-6.6
25	-11.8	-9.6
30	-15.2	-13
35	-19.1	-16.7
40	-23.6	-20.7
45	-29	-25.3

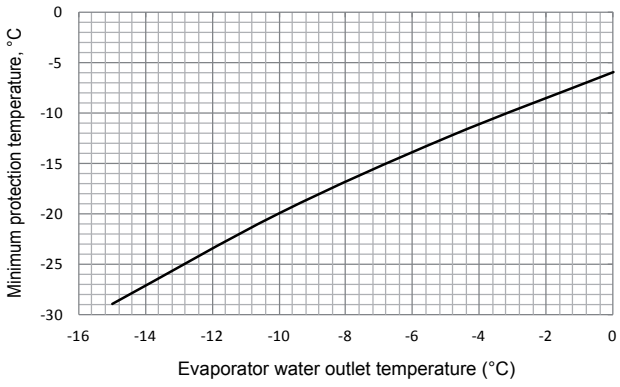
For example, depending on the table above, if an ethylene glycol mass concentration measured in the loop is 35%, the value of -19.1°C must be entered in the software.

It is vital to perform a (minimum) annual inspection of the glycol level and adjust the controller's frost protection value to the measured level.

This procedure must be systematic when topping up with water or antifreeze solution.

The curve below gives the minimum frost protection temperature to be observed depending on the water outlet temperature.

Minimum frost protection



NOTE:

- In the case of frost protection of the unit by low air temperature, the percentage brine must be evaluated accordingly.
- The maximum glycol level in the case of units equipped with a hydronic module is 45%.
- The brine temperature of -15°C is achievable only with 45% ethylene glycol.
- The maximum recommended temperature differential is 5K.

IMPORTANT:

For glycol concentrations of less than 20 %, it is essential to use a corrosion inhibitor suited to the application, to eliminate the risk of corrosion due to the aggressiveness of the brine.

The presence of glycol reduces the service life of the pump packings.

Changing the packings or pump is recommended:

- Every 40,000 hours for applications with water,
- Every 15,000 hours for applications with glycol concentrations of more than 30 %.

In order to facilitate maintenance operations, it is recommended to install isolation valves upstream and downstream of the machine.

12.2.6 Units with variable available pressure fans (XTraFan option)

Ductable units are intended to be ducted on the fan discharge, and can be installed inside a machine room.

For this type of installation, the hot or cold air emerging from the air-cooled exchangers is evacuated from the building by the fans by means of a ductwork system, which causes pressure drops in the air circuit.

Installing a ductwork system on the fan discharge generated a pressure drop due to the air flow resistance.

Therefore, more powerful fan motors are installed in this option than on the standard units.

For each installation, the duct pressure drops differ, depending on the duct length, the duct section and the direction changes.

Ductable units equipped with this option are designed to operate with ducts whose air evacuation generates a maximum pressure drop of 180 Pa or 240 Pa, depending on the models.

Using a speed variation up to 19 rps enables the system to overcome the pressure drops in the ducts while maintaining an optimised air flow in each circuit.

All the fans in the same circuit run at the same time at the same speed.

In the cooling / heating mode, the full-load or part-load speed is controlled by a patented algorithm that permanently optimizes the condensing / evaporating temperature to ensure the best unit energy efficiency (EER / COP) whatever the operating conditions and pressure drop of the system ductwork.

If required by a specific installation, the unit's maximum fan speed can be configured in the Service configuration menu. For this modification, consult the control manual.

The maximum configured speed applies to both the cooling and heating modes.

The performances (capacity, efficiency, noise level) depend on the fan speed. Please refer to the manufacturer's electronic catalogue to evaluate the estimated impact of the duct system on the unit's operating conditions.

12.2.6.1 Installation

IMPORTANT: In units which are ductable in heating mode, dehumidification of ambient air, as well as defrosting the air exchangers, produces a large volume of condensates which must be dealt with on the unit installation site.

Ductable units must be installed on a waterproof base enabling efficient drainage and evacuation of the condensate from the heat exchangers.

Similarly, in case of low outdoor temperatures when air-cooled exchangers freeze, the water from defrosting must be collected so as to prevent any risk of flooding the rooms where the heat pumps are installed.

Each fan is controlled by a variable speed drive. Therefore each circuit operates independently.

Each refrigerating circuit must have an independent ductwork system so as to prevent any air recycling between the air exchangers of different refrigerating circuits.

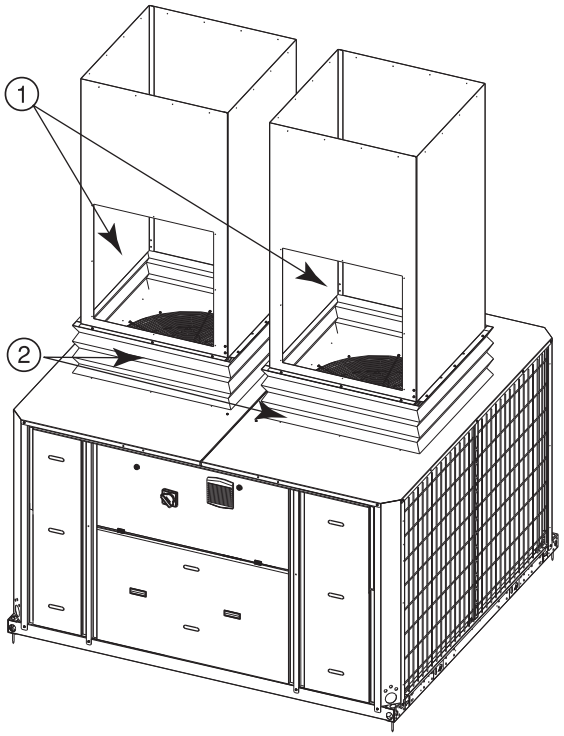
On ductable units, each fan is equipped with a factory-fitted connection interface frame providing a link between the ductwork itself and the refrigerating circuit to which the fan belongs.

Refer to the dimensional plans of the units for the precise dimensions of this connection interface.

12.2.6.2 Air connection on discharge

Refer to the dimensional plans of the units for the precise dimensions of the connection interface.

A flexible sleeve providing connection to the ductwork is delivered with the unit.



① Fan motor access hatches (allow for a 700 x 700 mm hatch) for each single or dual duct
② Connection bellows or sleeve

12.2.6.3 Rules applicable to units within an air ductwork system

Make sure that the suction or blowing ports cannot be inadvertently obstructed by fitting panels (low return for example, or when doors or other parts are opened).

12.2.6.4 Correction factors for Xtra Fan machine performances

The cooling/heating capacities are provided for an available pressure of 160 Pa.
To calculate the performances with other pressure drops, you can use the coefficients in the table below.

Xtrafan LD option

LD 150A-240A / LD 360A-450A

Duct pressure drop	Fan rotation speed (rps)	Power input variation	Cooling capacity variation
0	12	0,943	1,019
50	13,33	0,962	1,012
100	14,66	0,98	1,006
130	15,46	0,99	1,003
160	16,26	1	1
200	17,31	1,012	0,998
240	18,36	1,023	0,996

LD 260A-300A / LD 520A-600A

Duct pressure drop	Fan rotation speed (rps)	Power input variation	Cooling capacity variation
0	12	0,943	1,019
50	13,33	0,962	1,012
100	14,66	0,98	1,006
160	16,26	1	1
200	17,31	1,012	0,998
240	18,36	1,023	0,996

Xtrafan ILD option

Cooling mode

ILD 150A-200A / ILD 302A-450A

Duct pressure drop	Fan rotation speed (rps)	Power input variation	Cooling capacity variation
0	12	0,943	1,019
50	13,33	0,962	1,012
100	14,66	0,980	1,006
130	15,46	0,990	1,003
160	16,26	1,000	1,000
200	17,31	1,012	0,998
240	18,36	1,023	0,996

ILD 240A-300A / ILD 520A-600A

Duct pressure drop	Fan rotation speed (rps)	Power input variation	Cooling capacity variation
0	15,83	0,929	1,018
50	16,81	0,944	1,016
100	17,78	0,964	1,014
130	18,36	0,978	1,011
160	18,36	1,000	1,000
180	18,36	1,019	0,991

Heating mode

ILD 150A-200A / ILD 302A-450A

Duct pressure drop	Fan rotation speed (rps)	Power input variation	Cooling capacity variation
0	18,36	0,990	1,016
50	18,36	0,990	1,012
100	18,36	0,990	1,009
130	18,36	1,000	1,005
160	18,36	1,000	1,000
200	18,36	1,000	0,994
240	18,36	1,010	0,981

ILD 240A-300A / ILD 520A-600A

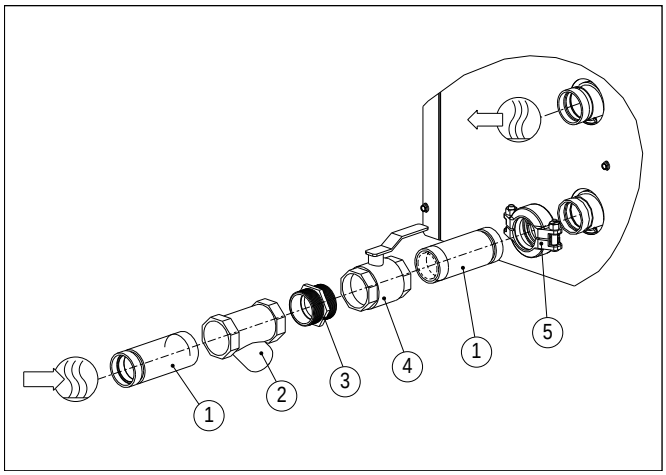
Duct pressure drop	Fan rotation speed (rps)	Power input variation	Cooling capacity variation
0	18,36	1,000	1,026
50	18,36	1,000	1,02
100	18,36	1,000	1,011
130	18,36	1,000	1,007
160	18,36	1,000	1,000
180	18,36	1,001	0,993

12.2.7 Water filter and flexible connective couplings

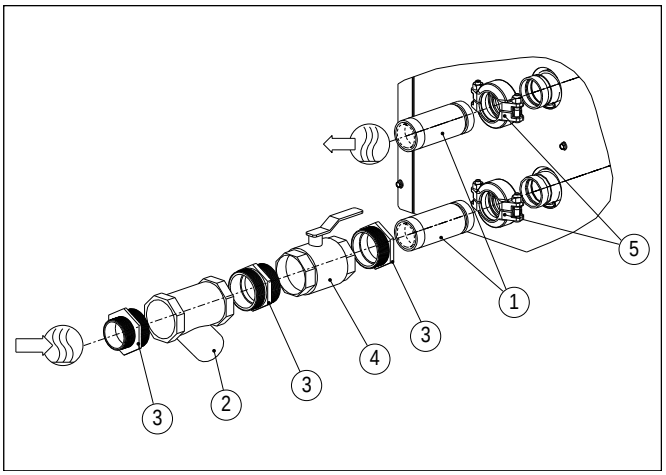
This equipment is supplied in the device for units equipped with pump(s), optionally for units without pumps.

Below are the equipment diagrams for the various configurations:

LD / ILD 150A - 300A water filter option

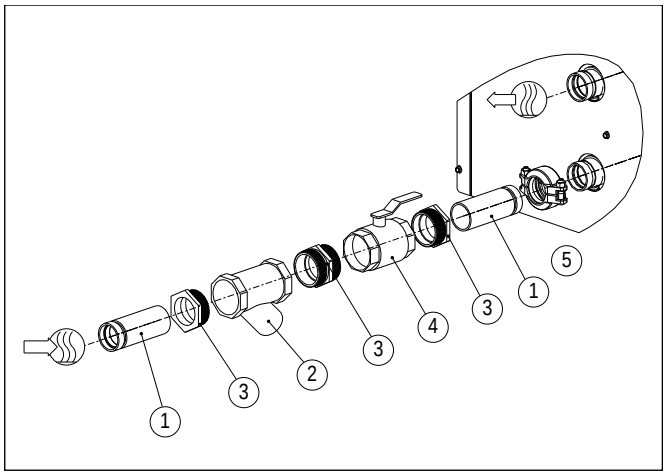


LD / ILD 302A - 600A water filter + screw-in connections option

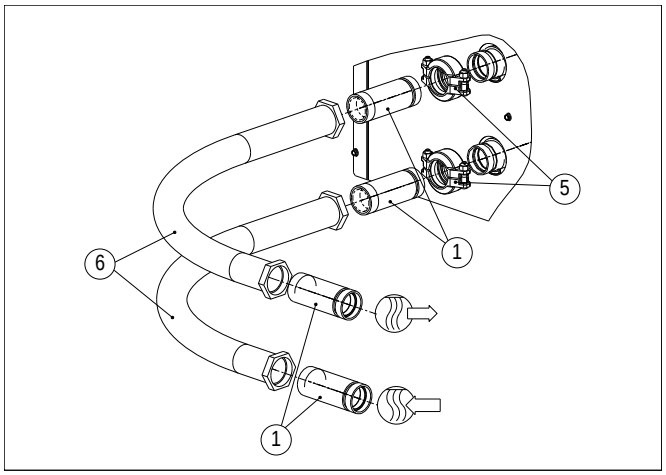


This optional equipment is delivered in the device

LD / ILD 302A - 600A water filter option

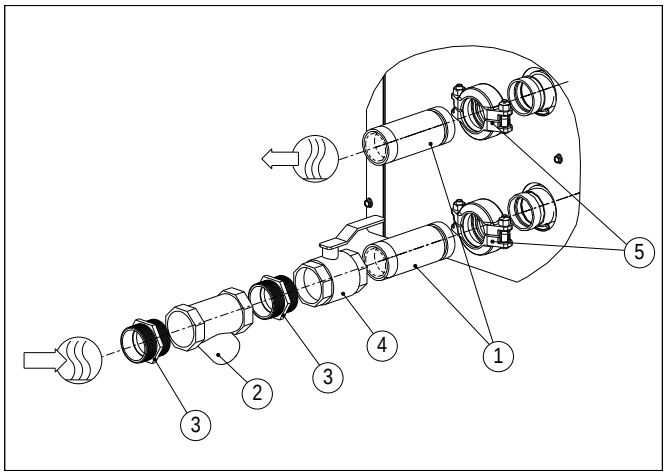


LD / ILD 150A - 600A connection hoses option



NOTE: The hoses must have a min. straight length of 205 mm, and a min. curve radius of 490 mm

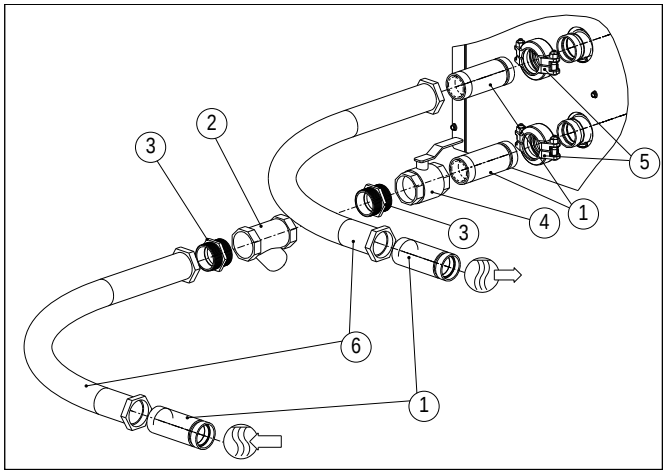
LD / ILD 150A - 300A water filter + screw-in connections option



Legend:

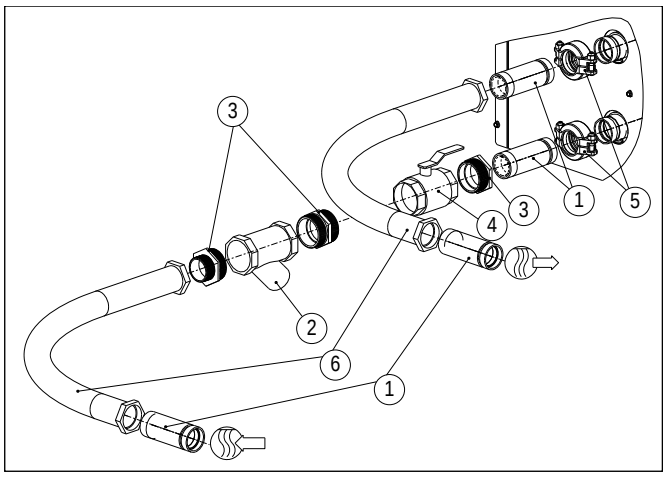
1	Steel sleeve
2	800 µm screen filter
3	Brass connector
4	Shut-off valve
5	Victaulic clamp
6	Hose
	Water inlet
	Water outlet

LD / ILD 150A - 300A water filter + connection hoses option



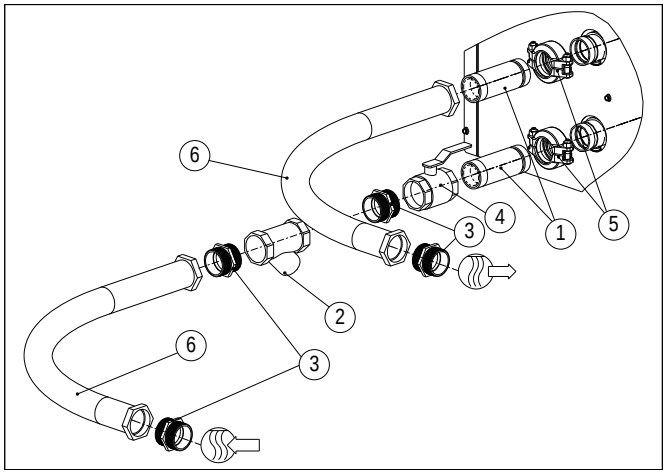
NOTE: The hoses must have a min. straight length of 205 mm, and a min. curve radius of 490 mm

LD / ILD 302A - 600A water filter + connection hoses option



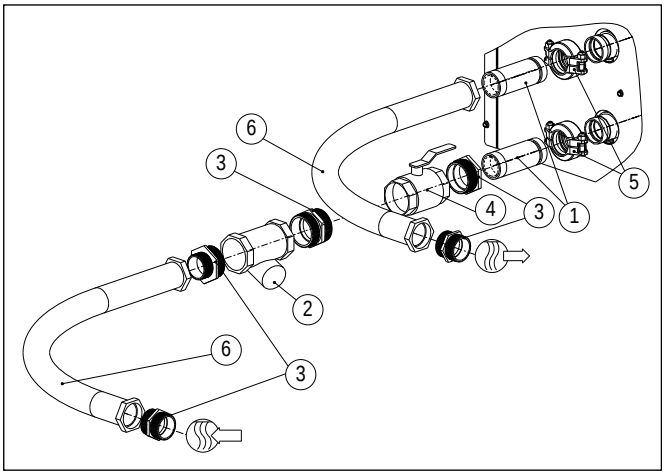
NOTE: The hoses must have a min. straight length of 205 mm, and a min. curve radius of 490 mm

LD / ILD 150A - 300A water filter + connection hoses + screw-in connections option



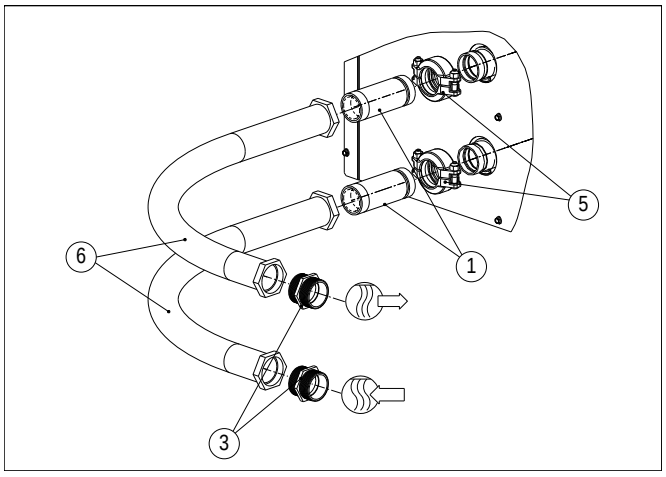
NOTE: The hoses must have a min. straight length of 205 mm, and a min. curve radius of 490 mm

Water filter + connection hoses + screw-in connections option LD / ILD 302A - 600A screw-in connections



NOTE: The hoses must have a min. straight length of 205 mm, and a min. curve radius of 490 mm

Connection hoses + screw-in connections option, LD / ILD 150A - 600A



Legend:

1. Steel sleeve
2. 800 µm screen filter
3. Brass connector
4. Shut-off valve
5. Victaulic clamp
6. Hose
- Water inlet
- Water outlet

13 - STANDARD MAINTENANCE

To ensure optimal efficiency and reliability of the equipment and all its functions, we recommend taking out a maintenance contract with the local organisation set up by your manufacturer. This contract will include regular inspections by the manufacturer's Service specialists so that any malfunction is detected and corrected quickly, ensuring that no serious damage can occur. The manufacturer's service maintenance contract is the best way to ensure the maximum operating life for your equipment and, through the expertise of manufacturer's qualified personnel, provides the ideal way to manage your system energy consumption effectively.

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.

All refrigerant charging, removal and draining operations must be carried out by a qualified technician and with the correct equipment for the unit. Any inappropriate handling can lead to uncontrolled fluid or pressure leaks.

IMPORTANT: Before performing any work on the machine ensure it is deenergized. If a refrigerant circuit is opened, it must be evacuated, recharged and tested for leaks. Before any operation on a refrigerant circuit, it is necessary to evacuate the refrigerant load from the device using a load transfer assembly.

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

- Optimisation of energy performance,
- Reduced power consumption,
- Prevention of accidental component failure,
- Prevention of major time-consuming and costly work,
- Protection of the environment.

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

NOTE: Any deviation from or failure to comply with these maintenance criteria will render the guarantee conditions for the refrigeration unit null and void, and will release the manufacturer from its liability.

13.1 Level 1 maintenance

These simple procedures can be carried out by the user:

- Check for traces of oil (indicates a refrigerant leak)
- Check for leaks in the hydraulic circuit (monthly),
- Clean the air exchangers (see the dedicated chapter),
- Check that the protective grilles are present and in good condition, and that the doors and covers are properly closed,
- Check the unit's alarm report (see the control manual),
- Verify the refrigerant charge in the liquid line sight glass,
- Verify the chilled water temperature difference at the heat exchanger outlet is correct,
- Check for any general signs of deterioration,
- Check the anti-corrosion coatings.

13.2 Level 2 maintenance

This level requires specific expertise in electrical, hydraulic and mechanical systems. it is possible that this expertise may be available locally; there may be a maintenance service, industrial site or specialist subcontractor in the area.

The frequency of this maintenance may be annual or monthly, depending on the check type.

In these cases, the following maintenance operations are recommended:

Carry out all level 1 operations, then:

Electrical checks (annual checks):

- At least once a year tighten the electrical connections for the power supply circuits (see tightening torques table),
- Check and tighten all control connections, if required,
- Check the labelling of the system and instruments, re-apply the missing labels if required,
- Remove the dust and clean the interior of the electrical boxes. Be careful not to blow dust or debris into components; use a brush and vacuum wherever possible,
- Clean the insulators and bus bar supports (dust combined with moisture reduces the insulation gaps and increases current leakage between phases and from phase to ground),
- Check the presence, condition and operation of electrical protective devices,
- Check the presence, condition and operation of control components,
- Check that all heaters are operating correctly,
- Replace the fuses every 3 years or every 15000 hours (ageing),
- Check that no water has penetrated into the electrical box,
- On the electrical box and for units equipped with an inverter, regularly check the cleanliness of the filter media to maintain the correct air flow.

Mechanical:

- Check the tightness of the fan sub- assemblies, fan, compressor and electrical box fixing bolts

Hydronic:

- When working on the water circuit, take care not to damage the adjacent air heat exchanger,
- Check the water connections,
- Check the condition of the expansion tank (presence of corrosion or loss of gas pressure) and replace it if required,
- Drain the water circuit (see chapter “Water flow control procedure”),
- Clean the water filter (see chapter “Water flow rate control procedure”),
- Replace the gland packing of the pump after 20000 hours of operation and the bearings after 17500 hours,
- Check the operation of the low water flow safety device,
- Check the condition of pipe thermal insulation,
- Check the concentration of the anti-freeze protection solution (ethylene glycol or propylene glycol),
- Check the water flow using the heat exchanger pressure difference,
- Check the condition of the heat transfer fluid or the water quality,
- Check for corrosion of the steel pipe work.

Refrigerant circuit checks:

- Check the unit operating parameters and compare them with the previous values,
- Check the operation of the high pressure switches. Replace them if defective,
- Check the fouling of the filter drier. Replace it if required
- Keep an up-to-date service booklet specific to the refrigeration unit in question.

Ensure all adequate safety measures are taken for all these operations: use appropriate PPE (personal protective equipment), comply with all industry and local regulations, use common sense.

13.3 Level 3 maintenance

Maintenance at this level requires specific skills, qualifications, tools and expertise. Only the manufacturer, his representative or authorised agent are permitted to carry out this work.

This maintenance work relates to the following:

- Replacement of major components (compressor, water heat exchanger),
- Operations on the refrigerant circuit (handling refrigerant),
- Modification of factory-set parameters (change of application),
- Movement or disassembly of the refrigeration unit,
- Any operation due to proven lack of maintenance,
- Any operation covered by the warranty
- One or two leak detection operations per year performed by qualified personnel using a certified leak detector.
- To reduce waste, the refrigerant and the oil must be transferred in accordance with applicable regulations, using methods that limit refrigerant leaks and pressure drops and with materials that are suitable for the products.
- Any detected leaks must be repaired immediately
- The compressor oil that is recovered during maintenance contains refrigerant and must be treated accordingly.
- Refrigerant under pressure must not be vented to the open air.
- If the refrigerating circuit must be opened, cap all openings for a period of up to one day. If open for longer, blanket the circuit with a dry, inert gas (e.g. nitrogen).

13.4 Tightening of electrical connections

Component / Screw type	Designation in the unit	Value (N.m)
Customer incoming PE terminal (M8)	PE	14,5
Screw on incoming terminal		
Terminal 56.395.0055.0	X100	10
Terminal 56.398.0055.0		14
Screw on incoming switch ranges		
Switch - MG 28908	QS_	8
Switch - MG 28910		8
Switch - MG 28912		8
Switch - MG 31102		15
Screw terminal, compressor contactor		
Contactor LC1D12B7	KM*	1,7
Contactor LC1D18B7		1,7
Contactor LC1D25B7		2,5
Compressor circuit breaker cage screw terminal		
Circuit breaker 25507	QM*	3,6
Circuit breaker 25508		
Circuit breaker 25509		
Control transformer cage screw terminal		
Transformer - 40958E	TC	0,6
Transformer - 40959E		
Transformer - 40888E		
Transformer - 40894E		
Compressor earth terminal in power box		
M6	Gnd	5,5
Earth connection on compressor		
M8	Gnd	2,83
Circuit breaker cage screw terminal (fan, pump)		
Circuit breaker GV2ME08	QM_	1,7
Circuit breaker GV2ME10		
Circuit breaker GV2ME14		
Contactor cage screw terminal (fan, pump)		
Contactor LC1K0610B7	KM	0.8 to 1.3
Contactor LC1K09004B7		
Contactor LC1K0910B7		
Contactor LC1K0901B7		

13.5 Tightening torques for the main fastenings

Screw type	Use	Tightening torque (Nm)	Tightening torque (Nm)
CP spacer	compressor support	30	30
M8 nut	BPHE mounting(1)	15	15
M10 nut	Compressor stud	30	30
M16 nut	Compressor mounting	30	30
Oil nut	Oil equalisation line	75	75
M6 taptite screw	Ventilation support	7	7
M8 taptite screw	Ventilation motor mounting	13	13
M8 H screw	Helix mounting	18	18
Panel screw	Metal panels	4,2	4,2
M6 H screw	Stauff clamp	10	10
Earth screw	Compressor	2,8	2,8

(1) **BPHE:** Brazed Plate Heat Exchanger

13.6 Air-cooled exchanger

We recommend that coils are inspected regularly to check the degree of cleanliness. This depends on the environment where the unit is installed, in particular urban and industrial sites, and for units installed near trees that shed their leaves.

Recommendations for maintenance and cleaning of copper tube coils and aluminium fins (RTPF):

- Regularly cleaning 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.
- Specific recommendation in case of snow: For long term storage, regularly check that no snow has accumulated on the coil.
- Fully clean the coils with a low-pressure jet plus a biodegradable cleaning agent.
- It is essential to control the pressure and take care not to damage the fins.

Recommendations for maintenance and cleaning of micro-channel coils (MCHE):

- Regularly cleaning 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 to increase the operating life of coils.
- Specific recommendation in case of snow: For long term storage, regularly check that no snow has accumulated on the coil.
- Clean the surface of the coil by spraying the coil regularly and uniformly from bottom to top, orienting the water jet at right angles to the surface. Do not exceed a water pressure of 6200 kPa (62 bar) or an angle of 45° to the coil. The nozzle must be at least 300 mm away from the coil surface.
- Clean the connections with tap water at a pressure of 2/3 bar and a distance of 30cm. Scrub with a flexible Nylon, PolyPro® or Tynex®brush.

Level 1 cleaning:

- Remove all foreign objects or fragments/debris attached to the coil surface or wedged between the chassis and the supports.
- Use a low-pressure dry air jet to remove all traces of dust from the coil.

Level 2 cleaning:

- Carry out the level 1 cleaning operations.
- Clean the coil using suitable products.

Use appropriate PPE including safety glasses and/or mask, waterproof clothes and safety gloves. It is recommended to wear clothing that covers the whole body.

Specific products approved by the manufacturer for cleaning coils are available from the manufacturer's spare parts network. The use of any other product is strictly prohibited. After the cleaning product is applied, rinsing with water is mandatory (see manufacturer's standard RW01-25).

IMPORTANT: Never use a pressure water spray without a large diffuser.

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 3 months) could prevent 2/3 of corrosion problems. Protect the electrical box during cleaning operations.

13.7 Water-cooled heat exchanger

Check that:

- The insulation has not been detached or torn during operations,
- The heaters and probes are operating and correctly positioned in their support,
- The water-side connections are clean and show no sign of leakage,
- The periodic inspections required by the local regulations have been carried out

13.8 Frequency inverter

Before any work on the frequency inverter, ensure that the circuit is isolated and there is no voltage present (reminder: the capacitors take approximately 5 minutes to discharge once the circuit breaker has been opened). Only appropriately qualified personnel are authorised to work on the variable frequency drive.

In case of any alarm or persistent problem related to the inverter, contact the manufacturer's service.

The frequency inverters fitted on the units do not require a dielectric test, even if being replaced: they are systematically checked before delivery. Moreover, the filtering components installed in the variable frequency drive can falsify the measurement and may even be damaged. If there is a need to test the insulation of the unit components (fan motors and pumps, cables, etc.), the variable frequency drive must be disconnected at the power circuit.

13.9 Refrigerant volume

It is essential to run the unit in cooling mode to find out whether the charge is correct; this is done by checking the actual subcooling.

Following a slight leak, it will be possible to feel a drop in the refrigerant charge from the initial charge, and this will affect the subcooling value obtained at the air exchanger outlet; it cannot, however, be felt in heating mode.

IMPORTANT: it is therefore not possible to optimise the charge in heating mode following a leak. The unit must be run in cooling mode if the charge needs topping up.

13.10 Refrigerant properties

Properties of R410A

Saturated temperatures (°C) based on the relative pressure (in kPa).							
Saturated temp.	**Pressure gauge**	**Saturated temp.**	**Pressure gauge**	**Saturated temp.**	**Pressure gauge**	**Saturated temp.**	**Pressure gauge**
-20	297	4	807	28	1687	52	3088
-19	312	5	835	29	1734	53	3161
-18	328	6	864	30	1781	54	3234
-17	345	7	894	31	1830	55	3310
-16	361	8	924	32	1880	56	3386
-15	379	9	956	33	1930	57	3464
-14	397	10	987	34	1981	58	3543
-13	415	11	1020	35	2034	59	3624
-12	434	12	1053	36	2087	60	3706
-11	453	13	1087	37	2142	61	3789
-10	473	14	1121	38	2197	62	3874
-9	493	15	1156	39	2253	63	3961
-8	514	16	1192	40	2311	64	4049
-7	535	17	1229	41	2369	65	4138
-6	557	18	1267	42	2429	66	4229
-5	579	19	1305	43	2490	67	4322
-4	602	20	1344	44	2551	68	4416
-3	626	21	1384	45	2614	69	4512
-2	650	22	1425	46	2678	70	4610
-1	674	23	1467	47	2744		
0	700	24	1509	48	2810		
1	726	26	1596	49	2878		
2	752	25	1552	50	2947		
3	779	27	1641	51	3017		

14 - FINAL SHUTDOWN

14.1 Shutting down

Separate the units from their energy sources, allow them to cool then drain them completely.

14.2 Recommendations for disassembly

Use the original lifting equipment.

Sort the components according to their material for recycling or disposal, in accordance with regulations in force.

Check whether any part of the unit can be recycled for another purpose.

14.3 Fluids to be recovered for treatment

- Refrigerant
- Energy transfer fluid: depending on the installation, water, glycol/water mix..
- Compressor oil

14.4 Materials to be recovered for recycling

- Steel
- Copper
- Aluminium
- Plastics
- Polyurethane foam (insulation)

14.5 Waste electrical and electronic equipment (WEEE)

At the end of its life, this equipment must be disassembled and contaminated fluids removed by professionals and processed via approved channels for electrical and electronic equipment (WEEE).

15 - UNIT START-UP CHECKLIST FOR INSTALLERS PRIOR TO CONTACTING THE MANUFACTURER

(USE FOR MACHINE FILE)

Preliminary information

Job name:.....
Location:.....
Installing contractor: .....
Distributor: .....
Commissioning performed by:..... Date: .....

Equipment

AQUACIAT^{POWER} LD ST / HE model: ..... S/N.....

Compressors

Circuit A	**Circuit B**
1. Model # ..... S/N	1. Model # ..... S/N .....
2. Model # ..... S/N	2. Model # ..... S/N .....
3. Model # ..... S/N	3. Model # ..... S/N .....
4. Model # ..... S/N	4. Model # ..... S/N .....

Air handling equipment

Manufacturer .....
Model #..... S/N .....

Additional air handling units and accessories.....
.....

Preliminary equipment check

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

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

☐ Unit is installed level
☐ Power supply agrees with the unit name plate
☐ Electrical circuit wiring has been sized and installed properly
☐ Unit earth wire has been connected
☐ Electrical circuit protection has been sized and installed properly
☐ All terminals are tight
☐ All cables and thermistors have been inspected for crossed wires
☐ All plug assemblies are tight

Check air handling systems

☐ All air handlers are operating
☐ All chilled water valves are open
☐ All fluid piping is connected properly
☐ All air has been vented from the system
☐ Chilled water pump is operating with the correct rotation. Amperage: Nominal..... ..... Actual.....

15 - UNIT START-UP CHECKLIST FOR INSTALLERS PRIOR TO CONTACTING THE MANUFACTURER

Unit start-up

☐ Chilled water pump starter has been properly interlocked with the chiller
☐ Oil level is correct
☐ Unit has been leak checked (including fittings)
☐ Locate, repair, and report any refrigerant leaks

.....

.....

.....

Check voltage imbalance: AB..... AC..... BC.....
Average voltage = ... (see installation instructions)
Maximum deviation = ... (see installation instructions)
Voltage imbalance = ... (see installation instructions).....

☐ Voltage imbalance is less than 2%

WARNING

Do not start the chiller if the voltage imbalance is greater than 2%. Contact your local power company for assistance.

☐ All incoming power voltage is within the nominal voltage range
☐ Compressor crankcase heaters have been activated for 6 hours

Check evaporator water loop

Water loop volume = ... (litres)
Calculated volume = ... (litres)
2.5 litres/nominal kW capacity for process cooling
6.50 litres/nominal kW capacity for process cooling

☐ Proper loop volume established
☐ Correct loop corrosion inhibitor included ..... litres of .....
☐ Proper loop frost protection included (if required) .... litres of.....
☐ Water piping includes electric tape heater up to the evaporator
☐ Return water piping is equipped with a screen filter with a mesh size of 1.2 mm

Check pressure drop on the evaporator (without hydronic module) or ESP* (with hydronic module)

Evaporator inlet = ... (kPa)
Evaporator outlet = ... (kPa)
Pressure drop (inlet - outlet) = ... (kPa)

*ESP : External Static Pressure

WARNING

Plot the pressure drop on the evaporator flow/pressure drop curve to determine the flow rate in l/s at the nominal operating conditions for the system.

If necessary use the control valve to adjust the flow rate to the desired value.

For units with hydronic module, the flow rate is indicated by the unit control (Consult the AQUACIAT control manual).

☐ Flow rate from the pressure drop curve, l/s = ...
☐ Nominal flow rate, l/s = ...
☐ The flow rate in l/s is higher than the minimum unit flow rate
☐ The flow rate in l/s corresponds to the specification of ..... (l/s)

15 - UNIT START-UP CHECKLIST FOR INSTALLERS PRIOR TO CONTACTING THE MANUFACTURER

Carry out the QUICK TEST function (Consult the manufacturer's service):

Check and log on to the user menu configuration

Load sequence selection.....
Capacity ramp loading selection.....
Start-up delay.....
Pump control.....
Setpoint re-set mode.....
Night mode capacity limit.....

Re-enter the setpoints

To start up the chiller

Warning

Be sure that all service valve sets are open, and that the pump is on before attempting to start this machine. Once all checks have been made, start the unit.

Unit starts and operates properly

Temperatures and pressures

WARNING

Once the machine has been operating for a while and the temperatures and pressures have stabilised, record the following:

Evaporator water inlet.....
Evaporator water outlet.....
Ambient temperature.....
Circuit A suction pressure.....
Circuit B suction pressure.....
Circuit A discharge pressure.....
Circuit B discharge pressure.....
Circuit A suction temperature.....
Circuit B suction temperature.....
Circuit A discharge temperature.....
Circuit B discharge temperature.....
Circuit A liquid line temperature.....
Circuit B liquid line temperature.....

NOTES:

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