10144

11 - 2018

AQUACIAT POWER LD

Instruction manual

CIAT

CONTENTS

ORIGINAL TEXT: FRENCH VERSION

CONTENTS

The units are intended to cool water for building air conditioning 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, if these products comply with European directives (machine safety, low voltage, electromagnetic compatibility, equipment under pressure, etc.) check the declarations of conformity for these products.

1.1 - Safety considerations related to protection devices

Do not obstruct any protective devices.
This applies to any fusible plugs, rupture disks and valves fitted on the refrigerant or heat transfer fluid circuits. Check whether 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 discharge 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 discharge piping, must not impair operation or lead to a pressure drop that is higher than 10% of the set pressure.

Classification and control:
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 device(1)	Device for limitation of damage in the event of an external fire (2)
Refrigerant side		
High-pressure switch	X	
External relief valve(3)		X
Rupture disk		X
Fusible 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/m^2. 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 set pressure can be higher than the service pressure. In this case either the design temperature or the high pressure switch ensures that the service pressure is not exceeded in normal service situations.
(4) The selection of these relief valves must be made by the personnel responsible for completing the hydraulic installation.

Do not remove valves / fusible plugs, even if the fire risk is under control for a particular installation. There is no guarantee that the devices 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 valve 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 valve 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 valves installed on the unit.

Provide a drain in the discharge pipework, 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 any refrigerant 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 Carrier Service for this type of test:

- Verify and record the rated values for tripping the pressure switches and external 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 environment, inspect the protection 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.

Detect and repair the leak, 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 pipework 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 to apply standard EN 378-3 Annex 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 may cause a pressure increase of 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 an 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/ circuit (CO_2 equivalent)		< 5 tons	5 ≤ charge < 50 tons	50 ≤ charge < 500 tons	Charge > 500 Tons*
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.

Regularly carry out leak tests and immediately repair any leaks.

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 during operation or for tests in the refrigerant circuit or in the heat exchange circuits.

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

- Follow the regulations on monitoring pressurised equipment.
- It is normally required that the user or operator sets up and maintains a monitoring and maintenance file.
- 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 periodic 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 conductor,
- 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 Organisation
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 brazing operations and for operation 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.

Technicians working on the units must be equipped as follows:

Personal protection equipment (PPE) (1)	Operations		
	Handling	Maintenance, service operations	Welding or strong brazing(2)
Protective gloves, eye protection, safety shoes, protective clothing.	X	X	X
Ear protection.		X	X
Filtering respirator.			X

(1) We recommend following the instructions in EN 378-3.

(2) Performed in the presence of A1 refrigerant according to EN 378-1.

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 variable drives.

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

Regularly check that the vibration levels remain acceptable and close to those at the start of using the unit.

Before opening a refrigerant circuit, drain and consult 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.

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 pipework 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.

A failure to observe the above recommendations 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. Make sure the circuit pressure is zero and that the unit has been stopped and powered off 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 pipework can break under the weight and release refrigerant, causing injury.

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

Use mechanical lifting equipment (crane, hoist, winch, etc.) to lift or move heavy components.

For lighter components, use lifting equipment 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.

3.1 - Handling

It is strongly recommended that a specialised lifting 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.

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

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. Failure to do so may result in damage to the equipment and physical injury.

3.2 - Positioning

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

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

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 positioning the unit, check that:

- The permitted loading at the site is adequate or that appropriate strengthening measures have been taken.
- The unit is installed level on an even surface (maximum tolerance is 5 mm 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.

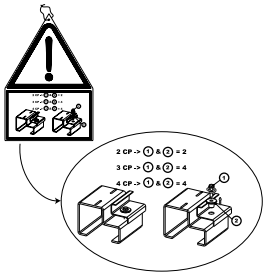
Before lifting the unit, check that all casing panels and grilles are securely fixed in place. Lift and set down the unit with great care. Tilting and jarring can damage the unit.

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 type heat exchanger (with or without the hydronic module if the unit is equipped with this).

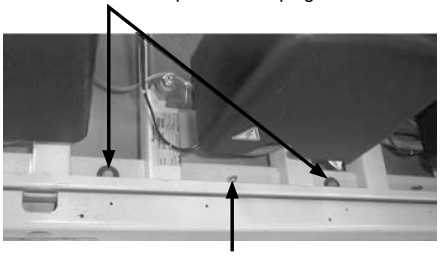
All welding operations (connection to the hydraulic network) must be performed by qualified welders. The Victaulic® connection or the counter-flange must be removed before welding as a matter of course.

IMPORTANT: The compressor assemblies are "suspended" using rubber mounts located between the unit frame and the sub-assembly frame (these are not visible). A factory-fitted clamping mechanism protects the pipes during transport.

This clamping mechanism must be removed. Clamping mechanisms are identified by red collars and indicated by a label affixed to the compressor sub-assembly.



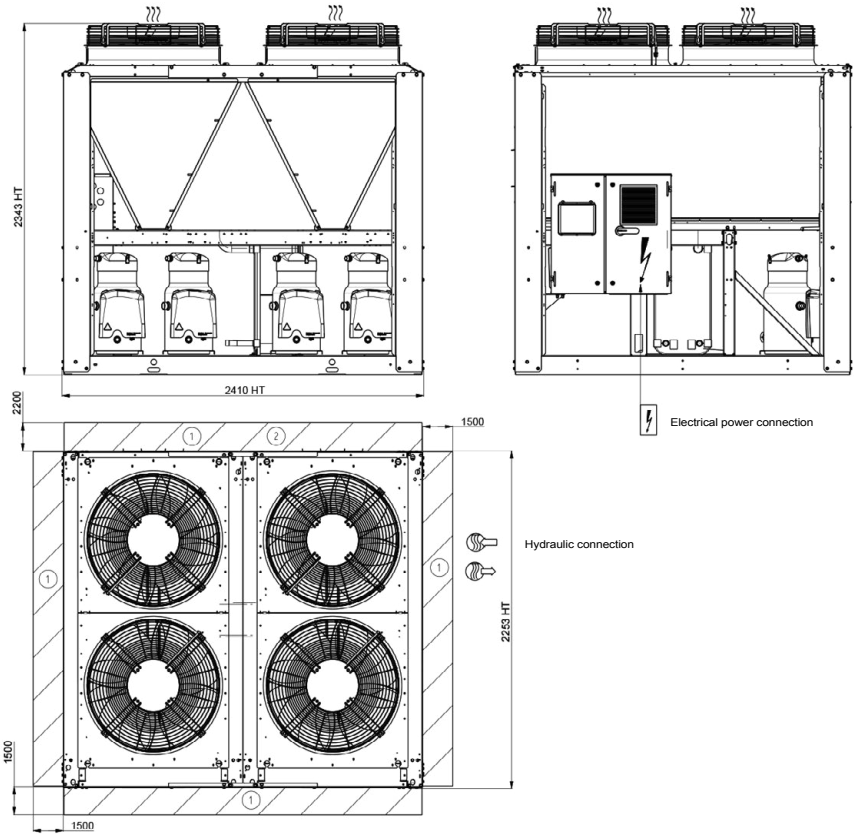
Remove the compressor clamping mechanism



Keep the frame mounting

4.1 - AQUACIAT^{POWER} LD ST / HE 602-1000

Without buffer tank module

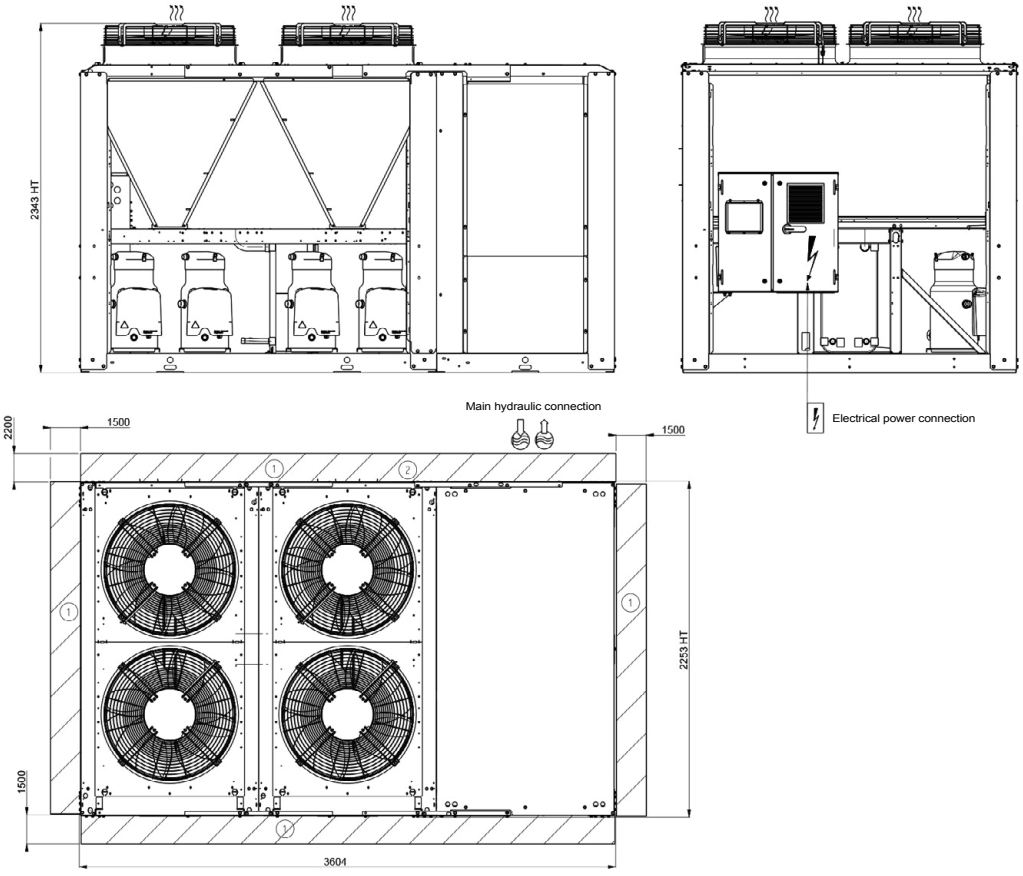


Legend:
All dimensions are in mm.

- (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

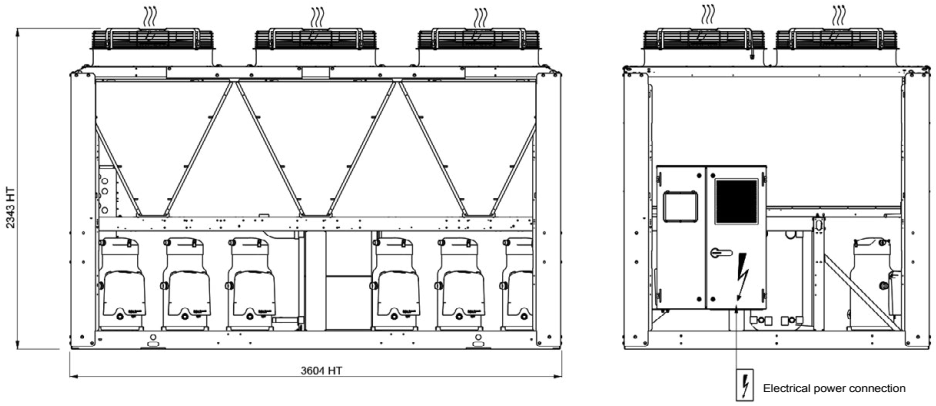
NOTE:
Non-contractual drawings.
When designing a system, refer to the certified dimensional drawings provided with the unit or available on request.
Please refer to the certified dimensional drawings, for the positioning of the fixing points, weight distribution points and centre of gravity coordinates.

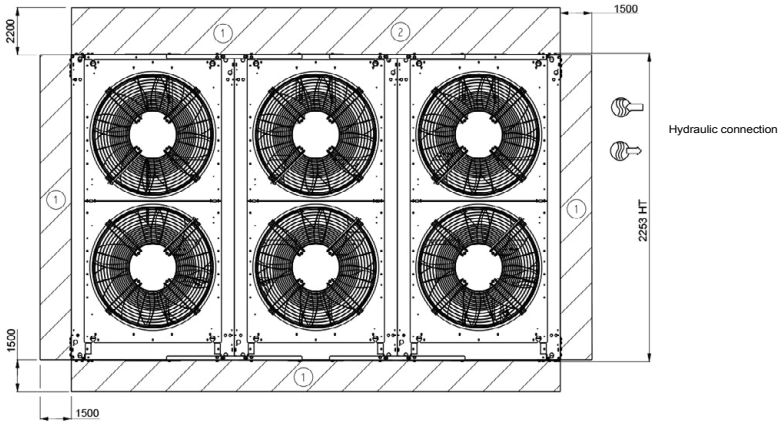
With buffer tank module



4.2 - AQUACIAT^{POWER} LD ST / HE 1100-1500

Without buffer tank module





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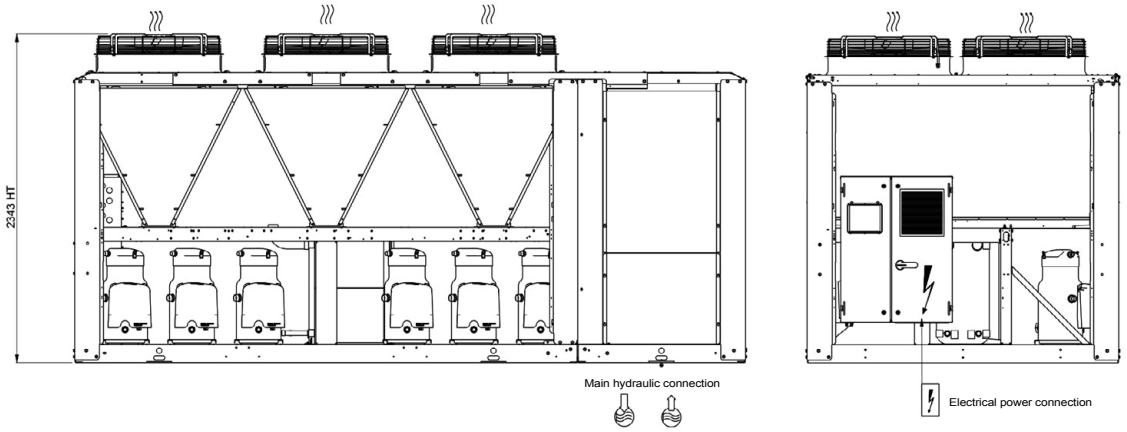
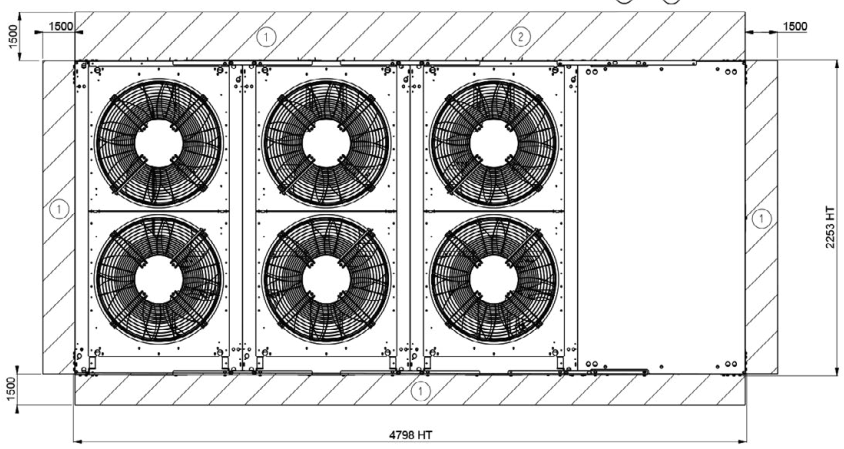
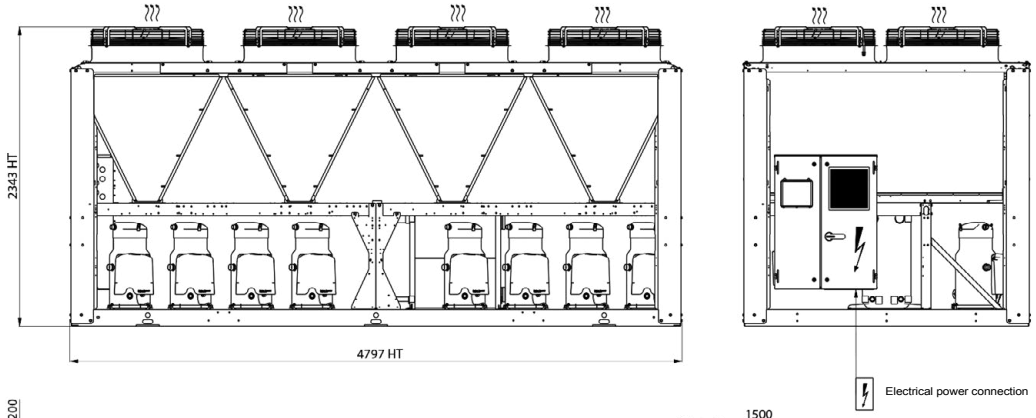
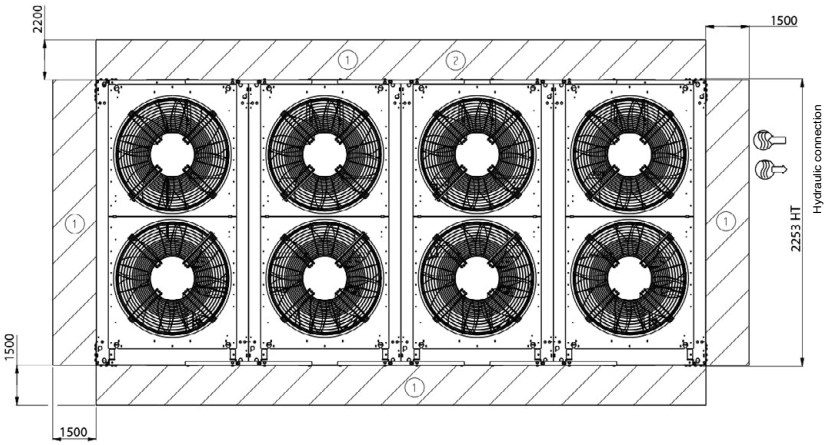




4.3 - AQUACIAT^{POWER} LD ST / HE 1600-2000

Without buffer tank module





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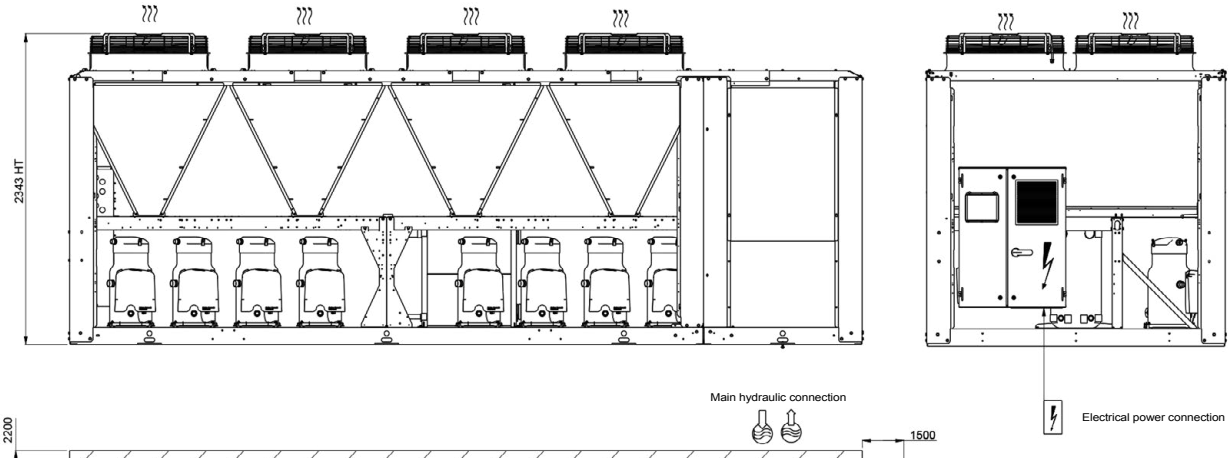
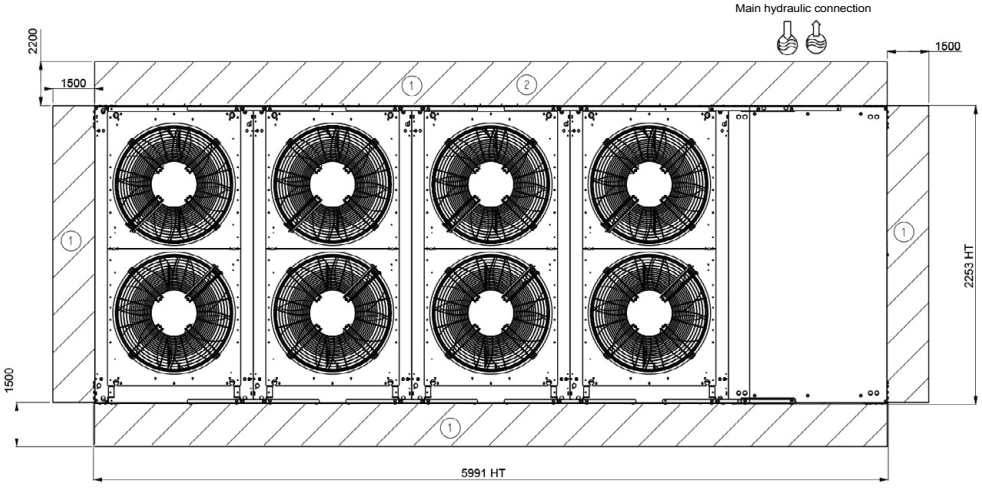
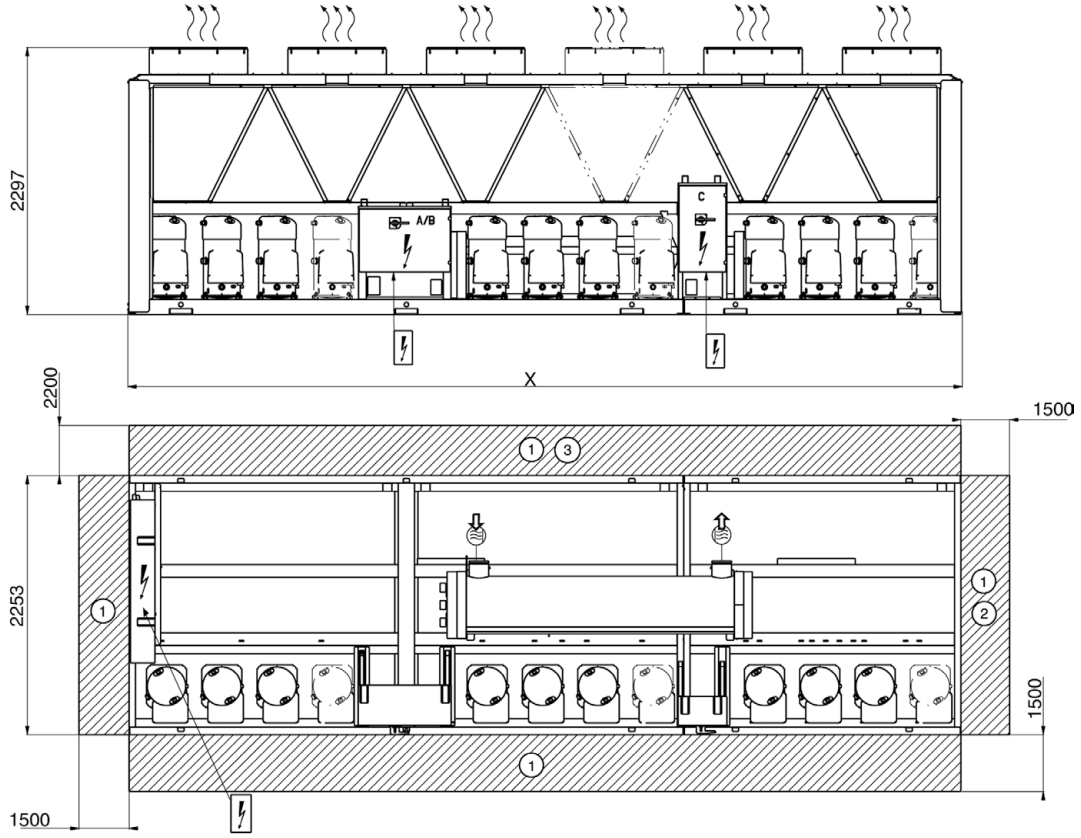
With buffer tank module





4.4 - AQUACIAT^{POWER} LD HE 2100-2800



LD HE	X
2100-2350	5992
2550-2800	7186

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

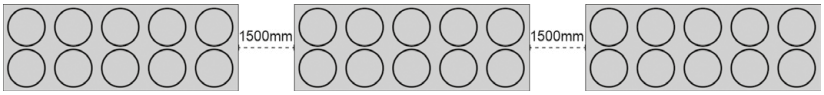
Electrical cabinet

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.

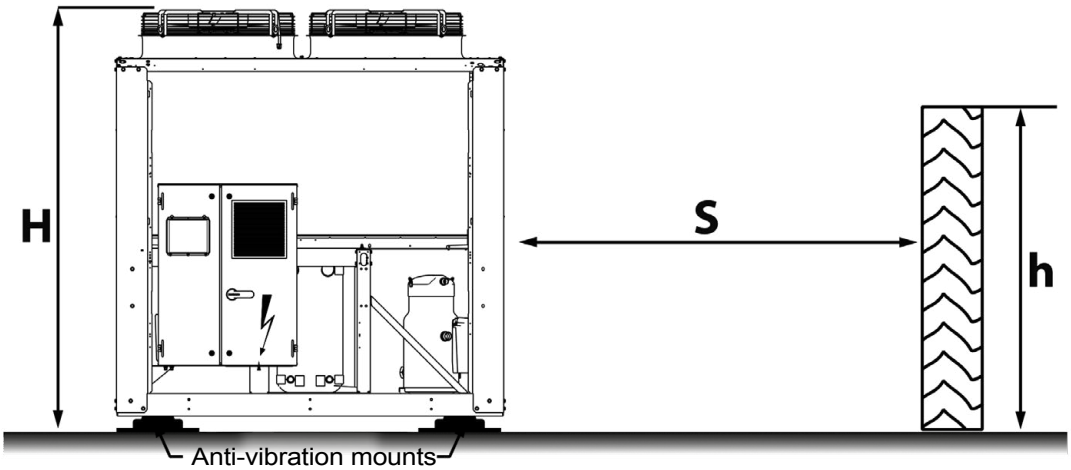
4 - DIMENSIONS, CLEARANCES (WITH OR WITHOUT THE HYDRONIC MODULE OPTION)

4.5 - Installing several units

It is recommended to install units in a single row, arranged as shown in the example below, to avoid recycling hot air between the machines.



4.6 - Distance to the wall



To guarantee correct operation in most cases:

If h < H, S minimum = 3 m

If h > H or S < 3 m, contact your distributor to assess the various installation options.

5 - PHYSICAL AND ELECTRICAL DATA FOR THE UNITS

5.1 - Physical characteristics

AQUACIAT^{POWER} LD ST		602	650	750	800	1000	1100	1250	1350	1500	1600	1750	2000
Sound levels													
Standard unit													
Sound power(1)	dB(A)	91	92	92	92	92	93	93	93	93	94	94	94
Sound pressure at 10 m(2)	dB(A)	59	60	60	60	60	60	60	61	61	62	62	62
Unit + Low Noise option													
Sound power(1)	dB(A)	86	87	87	88	88	89	89	90	90	90	90	91
Sound pressure at 10 m(2)	dB(A)	54	55	55	56	56	57	57	58	58	58	58	59
Unit + Xtra Low Noise option													
Sound power(1)	dB(A)	81	81	81	82	82	83	83	84	84	85	85	85
Sound pressure at 10 m(2)	dB(A)	49	49	49	50	50	51	51	52	52	53	53	53
Dimensions - Standard unit													
Length	mm	2410					3604				4797		
Width	mm	2253					2253				2253		
Height	mm	2343					2343				2343		
Unit + Buffer tank module option	mm	3604					4798				5991		
Operating weight (3)													
Standard unit	kg	1263	1309	1310	1439	1461	1938	1973	2146	2203	2641	2658	2864
Unit + Low Noise option	kg	1346	1392	1393	1547	1569	2064	2099	2289	2347	2803	2820	3044
Unit + Low Noise + HP dual-pump hydronic module option	kg	1524	1570	1570	1725	1761	2260	2340	2530	2587	3084	3101	3361
Unit + Low Noise + HP dual-pump hydronic module + Buffer tank module option	kg	2483	2529	2529	2684	2720	3219	3299	3489	3546	4043	4060	4320
Compressors		Hermetic Scroll 48.3 rps											
Circuit A		1	1	1	2	2	2	2	3	3	3	3	4
Circuit B		2	2	2	2	2	3	3	3	3	4	4	4
No. of control stages		3	3	3	4	4	5	5	6	6	7	7	8
Refrigerant (3)		R410A											
Circuit A	kg	8,40	10,90	10,90	12,60	13,10	14,70	15,40	20,30	21,10	23,50	23,50	26,75
	tCO_2e	17,5	22,8	22,8	26,3	27,4	30,7	32,2	42,4	44,1	49,1	49,1	55,9
Circuit B	kg	12,25	12,60	12,60	12,70	13,10	20,20	20,20	20,40	22,20	26,70	26,80	26,95
	tCO_2e	25,6	26,3	26,3	26,5	27,4	42,2	42,2	42,6	46,4	55,7	56,0	56,3
Oil charge	l/cp	6,9	6,9	6,9	6,9	6,9	6,9	6,9	6,9	6,9	6,9	6,9	6,9
Control		Connect Touch Control											
Minimum capacity	%	33%	33%	33%	25%	25%	20%	20%	17%	17%	14%	14%	13%
Air-cooled exchanger		All-aluminium microchannel heat exchanger (MCHE)											
Fans - Standard unit													
Quantity		3	4	4	4	4	5	5	6	6	7	7	8
Maximum total air flow	l/s	13542	18056	18056	18056	18056	22569	22569	27083	27083	31597	31597	36111
Maximum rotation speed	r/s	16	16	16	16	16	16	16	16	16	16	16	16
Water exchanger		Dual-circuit plate heat exchanger											
Water volume	l	15	15	15	15	19	27	35	33	42	44	47	53
Max. water-side operating pressure without hydronic module	kPa	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Hydronic module (option)		Pump, Victaulic screen filter, relief valve, water and air drain valve, pressure sensors, expansion tank (option)											
Pump		Centrifugal pump, monocell, 48.3 rps, low or high pressure (as required), single or dual (as required)											
Expansion tank volume	l	50	50	50	50	50	80	80	80	80	80	80	80
Buffer tank volume	l	550	550	550	550	550	550	550	550	550	550	550	550
Max. water-side operating pressure with hydronic module	kPa	400	400	400	400	400	400	400	400	400	400	400	400
Water connections with or without hydronic module		Victaulic® type											
Connections	inch	3	3	3	3	3	4	4	4	4	4	4	4
Outside tube diameter	mm	88,9	88,9	88,9	88,9	88,9	114,3	114,3	114,3	114,3	114,3	114,3	114,3
Casing paint		Colour code RAL 7035/RAL 7024											

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

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

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

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5 - PHYSICAL AND ELECTRICAL DATA FOR THE UNITS

AQUACIAT^{POWER} LD HE		602	650	750	800	1000	1100	1250	1350	1500	1600	1750	2000
Sound levels													
Standard unit													
Sound power(1)	dB(A)	91	92	92	92	92	93	93	93	93	94	94	94
Sound pressure at 10 m(2)	dB(A)	59	60	60	60	60	60	60	61	61	62	62	62
Unit + Low Noise option													
Sound power(1)	dB(A)	86	87	87	88	88	89	89	90	90	90	90	91
Sound pressure at 10 m(2)	dB(A)	54	55	55	56	56	57	57	58	58	58	58	59
Unit + Xtra Low Noise option													
Sound power(1)	dB(A)	81	81	81	82	82	83	83	84	84	85	85	85
Sound pressure at 10 m(2)	dB(A)	49	49	49	50	50	51	51	52	52	53	53	53
Dimensions - Standard unit													
Length	mm			2410				3604				4797	
Width	mm			2253				2253				2253	
Height	mm			2343				2343				2343	
Unit + Buffer tank module option	mm			3604				4798				5991	
Operating weight (3)													
Standard unit	kg	1292	1338	1338	1468	1489	1964	1999	2170	2228	2683	2700	2914
Unit + Low Noise option	kg	1375	1421	1421	1576	1597	2090	2125	2314	2371	2846	2863	3094
Unit + Low Noise + HP dual-pump hydronic module option	kg	1552	1598	1599	1753	1790	2285	2366	2555	2611	3126	3143	3411
Unit + Low Noise + HP dual-pump hydronic module + Buffer tank module option	kg	2511	2557	2558	2712	2749	3244	3325	3514	3570	4085	4102	4370
Compressors		Hermetic Scroll 48.3 rps											
Circuit A		1	1	1	2	2	2	2	3	3	3	3	4
Circuit B		2	2	2	2	2	3	3	3	3	4	4	4
No. of control stages		3	3	3	4	4	5	5	6	6	7	7	8
Refrigerant (3)		R410A											
Circuit A	kg	8,40	10,90	10,90	12,60	13,10	14,70	15,40	20,30	21,10	23,50	23,50	26,75
	tCO_2e	17,5	22,8	22,8	26,3	27,4	30,7	32,2	42,4	44,1	49,1	49,1	55,9
Circuit B	kg	12,25	12,60	12,60	12,70	13,10	20,20	20,20	20,40	22,20	26,70	26,80	26,95
	tCO_2e	25,6	26,3	26,3	26,5	27,4	42,2	42,2	42,6	46,4	55,7	56,0	56,3
Oil charge	l/cp	6,9	6,9	6,9	6,9	6,9	6,9	6,9	6,9	6,9	6,9	6,9	6,9
Control		Connect Touch Control											
Minimum capacity	%	33%	33%	33%	25%	25%	20%	20%	17%	17%	14%	14%	13%
Air-cooled exchanger		All-aluminium microchannel heat exchanger (MCHE)											
Fans - Standard unit													
Quantity		3	4	4	4	4	5	5	6	6	7	7	8
Maximum total air flow	l/s	13542	18056	18056	18056	18056	22569	22569	27083	27083	31597	31597	36111
Maximum rotation speed	r/s	16	16	16	16	16	16	16	16	16	16	16	16
Water exchanger		Dual-circuit plate heat exchanger											
Water volume	l	15	15	15	15	19	27	35	33	42	44	47	53
Max. water-side operating pressure without hydronic module	kPa	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Hydronic module (option)		Pump, Victaulic screen filter, relief valve, water and air drain valve, pressure sensors, expansion tank (option)											
Pump		Centrifugal pump, monocell, 48.3 rps, low or high pressure (as required), single or dual (as required)											
Expansion tank volume	l	50	50	50	50	50	80	80	80	80	80	80	80
Buffer tank volume	l	550	550	550	550	550	550	550	550	550	550	550	550
Max. water-side operating pressure with hydronic module	kPa	400	400	400	400	400	400	400	400	400	400	400	400
Water connections with or without hydronic module		Victaulic® type											
Connections	inch	3	3	3	3	3	4	4	4	4	4	4	4
Outside tube diameter	mm	88,9	88,9	88,9	88,9	88,9	114,3	114,3	114,3	114,3	114,3	114,3	114,3
Casing paint		Colour code RAL 7035/RAL 7024											

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

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

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

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5 - PHYSICAL AND ELECTRICAL DATA FOR THE UNITS

AQUACIAT^{POWER} LD HE		2100	2350	2550	2800
Sound levels					
Standard unit					
Sound power(1)	dB(A)	95	95	96	96
Sound pressure at 10 m(2)	dB(A)	63	63	63	63
Unit + Low Noise option					
Sound power(1)	dB(A)	93	94	94	94
Sound pressure at 10 m(2)	dB(A)	61	62	61	62
Unit + Xtra Low Noise option					
Sound power(1)	dB(A)	89	89	89	90
Sound pressure at 10 m(2)	dB(A)	57	57	56	57
Dimensions - Standard unit					
Length	mm	5995	5995	7189	7189
Width	mm	2253			
Height	mm	2297			
Operating weight (3)					
Standard unit	kg	4675	4930	5393	5649
Unit + Low Noise option	kg	4876	5148	5628	5901
Compressors		Hermetic Scroll 48.3 rps			
Circuit A		3	3	4	4
Circuit B		3	3	4	4
Circuit C		3	4	3	4
No. of control stages		9	10	11	12
Refrigerant (3)		R410A			
Circuit A	kg	21,50	21,50	26,00	26,00
	tCO_2e	44,9	44,9	54,3	54,3
Circuit B	kg	22,0	21,5	28,0	28,0
	tCO_2e	45,9	44,9	58,5	58,5
Circuit C	kg	23,50	28,00	24,00	31,00
	tCO_2e	49,1	58,5	50,1	64,7
Oil charge	l/cp	6,9	6,9	6,9	6,9
Control		Connect 3			
Minimum capacity	%	11%	10%	9%	8%
Air-cooled exchanger		All-aluminium microchannel heat exchanger (MCHE)			
Fans - Standard unit					
Quantity		9	10	11	12
Maximum total air flow	l/s	40623	45139	49653	54167
Maximum rotation speed	r/s	16	16	16	16
Water-cooled heat exchanger		Direct expansion dual-circuit with shell and tube bundle			
Water volume	l	284	284	284	284
Max. water-side operating pressure without hydronic module	kPa	1000	1000	1000	1000
Water connections without hydronic module		Victaulic® type			
Connections	inch	6	6	6	6
Outside tube diameter	mm	168,3	168,3	168,3	168,3
Casing paint		Colour code RAL 7035/RAL 7024			

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

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

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

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5.2 - Electrical data notes

AQUACIAT^{POWER} LD ST		602	650	750	800	1000	1100	1250	1350	1500	1600	1750	2000
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 current draw(1)													
Circuit A&B	A	100	110	124	133	161	180	201	221	242	261	282	322
Max. operating input power (2)													
Circuit A&B	kW	80	88	99	107	129	145	161	177	194	210	226	258
Cosine Phi unit at maximum power (2)		0,88	0,87	0,87	0,88	0,88	0,88	0,88	0,88	0,88	0,88	0,88	0,88
Maximum unit current draw (Un-10%)(3)													
Circuit A&B	A	144	158	176	192	230	259	288	317	345	374	403	460
Maximum unit current draw (Un)(4)													
Circuit A&B - Standard unit	A	133	146	163	177	212	239	266	292	319	345	372	425
Circuit A&B - Unit + Power factor corrector option	A	100	110	125	133	163	181	204	222	244	262	285	326
Maximum start-up current, standard unit (Un)(5)													
Circuit A&B	A	307	356	374	352	423	450	476	503	529	556	583	636
Maximum start-up current, unit with soft starter (Un)(5)													
Circuit A&B	A	261	283	300	305	349	376	403	429	456	482	509	562

(1) Conditions equivalent to the standardised Eurovent conditions (water-cooled exchanger water inlet/outlet temperature = 12 °C/7 °C, outdoor air temperature = 35 °C).

(2) Power input, compressors and fans, at the unit operating limits (saturated suction temperature 15 °C, saturated condensing temperature 68.3 °C) and nominal voltage of 400 V (data given on the unit nameplate).

(3) Maximum unit operating current at maximum unit input power and 360 V.

(4) Maximum unit operating current at maximum unit input power and 400 V (values given on the unit's nameplate).

(5) Maximum instantaneous starting current at operating limits (maximum operating current of the smallest compressor(s) + current of the fan(s) + locked rotor current of the largest compressor).
Fan motor electrical data at Eurovent equivalent conditions and motor ambient air temperature of 50 °C at 400 V: current 3.8 A, starting current 20 A, input power: 1.75 kW.

AQUACIAT^{POWER} LD HE		602	650	750	800	1000	1100	1250	1350	1500	1600	1750	2000
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 current draw(1)													
Circuit A&B	A	97	107	121	130	158	176	197	216	237	255	276	316
Max. operating input power (2)													
Circuit A&B	kW	81	88	99	108	129	145	162	178	194	210	226	259
Cosine Phi unit at maximum power (2)		0,88	0,88	0,88	0,88	0,88	0,88	0,88	0,88	0,88	0,88	0,88	0,88
Maximum unit current draw (Un-10%)(3)													
Circuit A&B	A	142	154	173	189	227	255	284	312	340	369	397	454
Maximum unit current draw (Un)(4)													
Circuit A&B - Standard unit	A	131	142	160	174	209	235	262	287	314	340	366	419
Circuit A&B - Unit + Power factor corrector option	A	98	108	123	131	161	178	201	219	241	259	281	321
Maximum start-up current, standard unit (Un)(5)													
Circuit A&B	A	305	353	371	349	420	446	472	498	525	550	577	629
Maximum start-up current, unit with soft starter (Un)(5)													
Circuit A&B	A	259	279	297	302	346	372	399	424	451	477	503	556

(1) Conditions equivalent to the standardised Eurovent conditions (water-cooled exchanger water inlet/outlet temperature = 12 °C/7 °C, outdoor air temperature = 35 °C).

(2) Power input, compressors and fans, at the unit operating limits (saturated suction temperature 15 °C, saturated condensing temperature 68.3 °C) and nominal voltage of 400 V (data given on the unit nameplate).

(3) Maximum unit operating current at maximum unit input power and 360 V.

(4) Maximum unit operating current at maximum unit input power and 400 V (values given on the unit's nameplate).

(5) Maximum instantaneous starting current at operating limits (maximum operating current of the smallest compressor(s) + current of the fan(s) + locked rotor current of the largest compressor).
Fan motor electrical data at Eurovent equivalent conditions and motor ambient air temperature of 50 °C at 400 V: current 3.8 A, starting current 20 A, input power: 1.75 kW.

5 - PHYSICAL AND ELECTRICAL DATA FOR THE UNITS

AQUACIAT^{POWER} LD HE		2100	2350	2550	2800
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 current draw(1)					
Circuit A&B (single supply)	A	216	216	288	288
Circuit C (separate supply)	A	118	158	118	158
Max. operating input power (2)					
Circuit A&B (single supply)	kW	178	178	237	237
Circuit C (separate supply)	kW	97	129	97	129
Cosine Phi unit at maximum power (2)		0,89	0,89	0,89	0,89
Maximum unit current draw (Un-10%)(3)					
Circuit A&B (single supply)	A	312	312	416	416
Circuit C (separate supply)	A	170	227	170	227
Maximum unit current draw (Un)(4)					
Circuit A&B (single supply)	A	287	287	383	383
Circuit C (separate supply)	A	157	209	157	209
Maximum start-up current, standard unit (Un)(5)					
Circuit A&B	A	498	498	594	594
Circuit C		368	420	368	420

(1) Conditions equivalent to the standardised Eurovent conditions (water-cooled exchanger water inlet/outlet temperature = 12 °C/7 °C, outdoor air temperature = 35 °C).

(2) Power input, compressors and fans, at the unit operating limits (saturated suction temperature 10 °C, saturated condensing temperature 65 °C) and nominal voltage of 400 V (data given on the unit nameplate).

(3) Maximum unit operating current at maximum unit input power and 360 V.

(4) Maximum unit operating current at maximum unit input power and 400 V (values given on the unit's nameplate).

(5) Maximum instantaneous starting current at operating limits (maximum operating current of the smallest compressor(s) + current of the fan(s) + locked rotor current of the largest compressor).

Fan motor electrical data at Eurovent equivalent conditions and motor ambient air temperature of 50 °C at 400 V: current 3.8 A, starting current 20 A, input power: 1.75 kW.

5.3 - Short circuit current withstand capability

Short circuit current withstand capability (TN system(1))												
AQUACIAT^{POWER} LD ST HE	**602**	**650**	**750**	**800**	**1000**	**1100**	**1250**	**1350**	**1500**	**1600**	**1750**	**2000**
Value without upstream protection												
Short time (1s) assigned current - Icw - kA eff	8	8	8	8	8	8	15	15	15	15	20	20
Allowable peak assigned current - Ipk - kA pk	30	30	30	30	30	30	65	65	65	65	80	80
Value with upstream protection												
Protection type: Fuse												
Conditional short circuit assigned current Icc or Icf - kA eff	50	50	50	50	50	50	50	50	50	50	50	50
Assigned gL/gG fuses	200	200	200	250	250	250	315	315	400	400	630	630

(1) Type of system earthing

Short circuit current withstand capability (TN system(1))					
AQUACIAT^{POWER} LD HE		**2100**	**2350**	**2550**	**2800**
Without disconnect switch					
With fuses upstream - maximum fuse values assigned (gL/gG)					
Circuits A & B	A	630/500	630/500	630/500	630/500
Circuit C	A	400	400	400	400
With fuses upstream - useful current carrying capacity (gL/gG)					
Circuits A & B	kA	70	70	60/70	60/70
Circuit C	kA	60	60	60	60
With main disconnect switch without fuse option					
Short-time assigned current Icw (1s) rms value/peak Ipk**					
Circuits A & B	kA/kA	13/26	13/26	15/30	15/30
Circuit C	kA/kA	13/26	13/26	13/26	13/26
With fuses upstream - maximum fuse values assigned (gL/gG)					
Circuits A & B	A	400	400	630	630
Circuit C	A	400	400	400	400
With fuses upstream - conditional short-circuit assigned current (Icc)/Icf††					
Circuits A & B	kA	50	50	50	50
Circuit C	kA	50	50	50	50
With main disconnect switch with fuses option					
Icc/Icf†† withstand current increased with fuses - maximum fuse values assigned (gL/gG)					
Circuits A & B	kA	400	400	630	630
Circuit C	kA	250	250	250	250
Icc/Icf†† withstand current increased with fuses - useful current carrying capacity (gL/gG)					
Circuits A & B	kA	50	50	50	50
Circuit C	kA	50	50	50	50

* Type of system earthing

** Icw: short-time assigned current

*** Ipk: allowable peak assigned current

†† Icc/Icf: conditional short circuit assigned current

5 - PHYSICAL AND ELECTRICAL DATA FOR THE UNITS

Low pressure dual pump motors for units (Fixed speed dual pump, hydronic module option)

No.(2)	Description(3)	Units	LD ST / LD HE											
			602	650	750	800	1000	1100	1250	1350	1500	1600	1750	2000
1	Nominal efficiency at full load and nominal voltage	%	84,9	84,9	85,7	85,7	87,5	87,5	87,5	87,5	89,9	89,9	89,9	89
1	Nominal efficiency at 75% of full load and nominal voltage	%	86,4	86,4	86,9	86,9	88,2	88,2	88,2	88,2	90,4	90,4	90,4	90
1	Nominal efficiency at 50% of full load and nominal voltage	%	85,9	85,9	86,4	86,4	87,5	87,5	87,5	87,5	89,6	89,6	89,6	89,7
2	Efficiency level	-	IE3											
3	Year of manufacture	-	This information varies depending on the manufacturer and model at the time of incorporation. Please refer to the motor nameplates.											
4	Company name or trademark, commercial registration number and head office of manufacturer	-	Same as above											
5	Product model number	-	Same as above											
6	Number of motor poles	-	2	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	1,5	1,5	2,2	2,2	3	3	3	3	4	4	4	5,5
7-2	Maximum input power (400 V)(4)	kW	1,94	1,94	2,80	2,80	3,81	3,81	3,81	3,81	4,96	4,96	4,96	6,80
8	Rated 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	3,41	3,41	4,92	4,92	6,81	6,81	6,81	6,81	8,27	8,27	8,27	11,30
10	Nominal speed	r/s - r/min	48 - 2900											
11	Product disassembly, recycling or disposal at end of life	-	Disassembly using standard tools. Disposal and recycling using an appropriate company.											
12	Operating conditions for which the motor is specifically designed													
	I- Altitudes above sea level	m	< 1000(6)											
	II - Ambient air temperature	°C	< 40											
	III - Maximum operating temperature	°C	Please refer to the operating conditions given in this manual or in the specific conditions given in the selection programs.											
	IV - Potentially explosive atmospheres	-	Non ATEX environment											

(1) Required by regulation No. 640/2009 concerning the application of directive 2009/125/EC on the eco-design requirements for electric motors.

(2) Item number imposed by regulation No. 640/2009, annex I2b.

(3) Description given by regulation No. 640/2009, annex I2b.

(4) To obtain the maximum input power for a unit with 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.

5.4 - 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:

Low pressure single pump motors for units (Fixed speed single pump, hydronic module option)

No.(2)	Description(3)	Units	LD ST / LD HE											
			602	650	750	800	1000	1100	1250	1350	1500	1600	1750	2000
1	Nominal efficiency at full load and nominal voltage	%	85,7	85,7	85,7	85,7	85,7	87,5	87,5	87,5	89,9	89,9	89,9	89
1	Nominal efficiency at 75% of full load and nominal voltage	%	86,9	86,9	86,9	86,9	86,9	88,2	88,2	88,2	90,4	90,4	90,4	90
1	Nominal efficiency at 50% of full load and nominal voltage	%	86,4	86,4	86,4	86,4	86,4	87,5	87,5	87,5	89,6	89,6	89,6	89,7
2	Efficiency level	-	IE3											
3	Year of manufacture	-	This information varies depending on the manufacturer and model at the time of incorporation. Please refer to the motor nameplates.											
4	Company name or trademark, commercial registration number and head office of manufacturer	-	Same as above											
5	Product model number	-	Same as above											
6	Number of motor poles	-	2	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	2,2	2,2	2,2	2,2	2,2	3	3	3	4	4	4	5,5
7-2	Maximum input power (400 V)(4)	kW	2,80	2,80	2,80	2,80	2,80	3,81	3,81	3,81	4,96	4,96	4,96	6,80
8	Rated 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	4,92	4,92	4,92	4,92	4,92	6,81	6,81	6,81	8,27	8,27	8,27	11,30
10	Nominal speed	r/s - r/min	48 - 2900											
11	Product disassembly, recycling or disposal at end of life	-	Disassembly using standard tools. Disposal and recycling using an appropriate company.											
12	Operating conditions for which the motor is specifically designed													
	I- Altitudes above sea level	m	< 1000(6)											
	II - Ambient air temperature	°C	< 40											
	III - Maximum operating temperature	°C	Please refer to the operating conditions given in this manual or in the specific conditions given in the selection programs.											
	IV - Potentially explosive atmospheres	-	Non ATEX environment											

(1) Required by regulation No. 640/2009 concerning the application of directive 2009/125/EC on the eco-design requirements for electric motors.

(2) Item number imposed by regulation No. 640/2009, annex I2b.

(3) Description given by regulation No. 640/2009, annex I2b.

(4) To obtain the maximum input power for a unit with 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.

(6) Above 1000 m, a degradation of 3% for each 500 m should be taken into consideration.

High pressure single and dual pump motors for units (Fixed and variable speed single and dual pumps, hydronic module option)

No.(2)	Description(3)	Units	LD ST / LD HE											
			602	650	750	800	1000	1100	1250	1350	1500	1600	1750	2000
1	Nominal efficiency at full load and nominal voltage	%	87,5	87,5	87,5	87,5	89,9	89,9	89	89	89	89,6	89,6	89,6
1	Nominal efficiency at 75% of full load and nominal voltage	%	88,2	88,2	88,2	88,2	90,4	90,4	90	90	90	90,8	90,8	90,8
1	Nominal efficiency at 50% of full load and nominal voltage	%	87,5	87,5	87,5	87,5	89,6	89,6	89,7	89,7	89,7	90,8	90,8	90,8
2	Efficiency level	-	IE3											
3	Year of manufacture	-	This information varies depending on the manufacturer and model at the time of incorporation. Please refer to the motor nameplates.											
4	Company name or trademark, commercial registration number and head office of manufacturer	-	Same as above											
5	Product model number	-	Same as above											
6	Number of motor poles	-	2	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	3	3	3	3	4	4	5,5	5,5	5,5	7,5	7,5	7,5
7-2	Maximum input power (400 V)(4)	kW	3,81	3,81	3,81	3,81	4,96	4,96	6,80	6,80	6,80	9,16	9,16	9,16
8	Rated 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	6,81	6,81	6,81	6,81	8,27	8,27	11,30	11,30	11,30	15,30	15,30	15,30
10	Nominal speed	r/s - r/min	48 - 2900											
11	Product disassembly, recycling or disposal at end of life	-	Disassembly using standard tools. Disposal and recycling using an appropriate company.											
12	Operating conditions for which the motor is specifically designed													
	I- Altitudes above sea level	m	< 1000(6)											
	II - Ambient air temperature	°C	< 40											
	III - Maximum operating temperature	°C	Please refer to the operating conditions given in this manual or in the specific conditions given in the selection programs.											
	IV - Potentially explosive atmospheres	-	Non ATEX environment											

(1) Required by regulation No. 640/2009 concerning the application of directive 2009/125/EC on the eco-design requirements for electric motors.
(2) Item number imposed by regulation No. 640/2009, annex I2b.
(3) Description given by regulation No. 640/2009, annex I2b.
(4) To obtain the maximum input power for a unit with 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.

5.5 - Electrical data notes for the compressors

Compressor	I Nom	I Max Un	I Max Un-10%	LRA Un	Cosinus Phi Max
00PSG001961100A	30	41	44	215	0,89
00PSG001748000A	37	50	54	260	0,89
00PPG000471003A	38	51	56	260	0,86

I Nom Nominal current draw (A) at standardised Eurovent equivalent conditions (see definition of conditions under nominal unit current draw)
I Max Maximum operating current (A)
LRA Locked rotor current, A
Cos phi Max @I Max

5.6 - Distribution of compressors per circuit

Compressor	Circuit	602	650	750	800	1000	1100	1250	1350	1500	1600	1750	2000
00PSG001961100A	A	1	-	-	2	-	-	-	3	-	3	-	-
	B	2	2	-	2	-	3	-	-	-	-	-	-
00PSG001748000A	A	-	1	1	-	2	2	2	-	3	-	3	4
	B	-	-	2	-	2	-	3	3	3	4	4	4

Compressor	Circuit	2100	2350	2550	2800
00PSG001961100A	A	3	3	4	4
	B	-	-	-	-
	C	-	-	-	-
00PPG000471003A	A	-	-	-	-
	B	3	3	4	4
	C	3	4	3	4

5.7 - Comments on electrical data notes

Electrical data notes for AQUACIAT^{POWER} LD ST/ LD HE units:

- The LD ST/LD HE (602-2000) units only have a single power connection point located immediately upstream of the main disconnect switch.
- The LD HE (2100-2800) units have two power connection points located upstream of the main disconnect switches.
- **Control box includes:**
  - A main disconnect switch,
  - Start-up and motor protection devices for each compressor, plus fans and pumps,
  - Control devices.
- **Field connections:**
  All connections to the system and the electrical installations must be in accordance with all applicable codes.
- The LD ST/ LD HE units are designed and manufactured to ensure that these regulations can be observed. The recommendations of European standard EN 60204-1 (corresponds to IEC 60204-1) (machine safety - electrical machine components - part 1: General regulations) are specifically taken into account, when designing the electrical equipment.

Notes

- Generally the recommendations of IEC 60364 are accepted as compliance with the requirements of the installation regulation.
- Conformance with EN 60204-1 is the best means of ensuring compliance (§1.5.1) with the Machinery Directive.
  Appendix B of standard EN 60204-1 specifies the electrical features used for the operation of the machines.
- The operating conditions for LD ST/ LD HE units are described below:
  1. Environment*
     The classification of environment is specified in standard EN 60364:
     - Outdoor installation*,
     - Ambient temperature range: minimum temperature -20 °C to +48 °C**,
     - Altitude: AC1 of 2000 m or less (for the hydronic module, see the paragraph "Electrical data notes for the hydronic module"),
     - Presence of hard solid: Class AE3 (no significant dust present)*,
     - Presence of corrosive and polluting substances, class AF1 (negligible),
     - Competence of persons: BA4 (Persons wise).
  2. Compatibility for low-frequency conducted disturbances according to class 2 levels per IEC61000-2-4 standard:
     - Power supply frequency variation: +-2Hz
     - Phase imbalance : 2%
     - Total Voltage Harmonic Distortion (THDV) : 8%
  3. The neutral (N) line must not be connected directly to the unit (if necessary use a transformer).
  4. Overcurrent protection of the power supply conductors is not provided with the unit.
  5. The factory installed disconnect switch(es)/circuit breaker(s) is (are) of a type suitable for power interruption in accordance with EN 60947-3 (corresponds to IEC 60947-3).
  6. The units are designed for connection to TN networks (IEC 60364). In IT networks, if noise filters are integrated into the variable frequency drive(s), this will render the machines unsuitable for their intended purpose. In addition, the short-circuit holding current characteristics are modified. Provide a local earth, consult competent local organisations to complete the electrical installation.
     LD ST/ LD HE machines are designed to be used in domestic/ residential and industrial environments:
     Machines that are not equipped with Variable speed drives comply with the standard regulations.
     - 61000-6-3: General standards - Standard emission for residential, commercial and light industry,
     - 61000-6-2: General standards - Immunity for industrial environments.

     Machines that are equipped with variable frequency drive(s) (LD HE, option: Winter operation down to -20 °C, HP variable-speed single or dual pump, hydronic module) comply with the standard EN61800 - 3 "Adjustable speed electrical power drive systems - Part 3: EMC requirements and specific test methods" for the following classifications: Use in the first and second environments***.
     - Category C2 applicable in the first environment, to stationary devices designed to be installed and commissioned by a professional.

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

Note: If particular aspects of an actual system do not conform to the conditions described above, or if there are other conditions which should be considered, always contact your manufacturer.

* The required protection level for this class is IP43BW (according to reference document IEC 60529). All units are classified as IP44CW, and fulfil this protection condition.

** The maximum allowable ambient temperature for units equipped with the Power factor correction option is +40 °C

*** - Example of installations of the first environment: Commercial and residential buildings.
- Example of installations of the second environment: Industrial zones, technical premises powered from a dedicated transformer.

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.

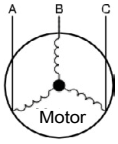
After the unit has been installed, the power supply must only be disconnected for quick maintenance operations (one day maximum). For longer maintenance operations or when the unit is taken out of service (for example, during winter when the unit does not need to generate cooling) the power supply of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

6.2 - Voltage phase imbalance (%)

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

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-supplied power supply cables are designed for the number and type of wires, listed in the table below.

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

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

	Max. connectable section(1)			Calculation of favourable case: - Suspended aerial line (standardised routing No. 17) - Cable with XLPE insulation			Calculation of unfavourable case: - Conductors in ducts or multi-conductor cables in closed conduits Closed conduit (standardised routing No. 41) - Cable with PVC insulation, if possible		
AQUACIAT POWER LD ST / LD HE	Standard lug	Narrow lug	Recommended max width lug	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)	mm	mm² (per phase)	m	-	mm² (per phase)	m	-
602	2x70	2x95	21	1 x 50	180	XLPE Copper	2 x 50	350	PVC Copper
650	2x70	2x95	21	1 x 50	170	XLPE Copper	2 x 50	320	PVC Copper
750	2x70	2x95	21	1 x 70	205	XLPE Copper	2 x 70	380	PVC Copper
800	2x70	2x95	21	1 x 70	190	XLPE Copper	2 x 70	350	PVC Copper
1000	2x70	2x95	21	2 x 50	220	XLPE Copper	2 x 70	300	XLPE Copper
1100	2x70	2x95	21	2 x 50	200	XLPE Copper	2 x 70	270	XLPE Copper
1250	2x95	2x185	24,5	2 x 70	240	XLPE Copper	2 x 95	310	XLPE Copper
1350	2x95	2x185	24,5	2 x 70	220	XLPE Copper	2 x 95	280	XLPE Copper
1500	2x95	2x185	24,5	2 x 70	200	XLPE Copper	2 x 120	310	XLPE Copper
1600	2x95	2x185	24,5	2 x 95	240	XLPE Copper	2 x 150	340	XLPE Copper
1750	2x240	2x240	37	2 x 95	220	XLPE Copper	2 x 150	320	XLPE Copper
2000	2x240	2x240	37	2 x 120	240	XLPE Copper	2 x 185	330	XLPE Copper

AQUACIAT POWER LD HE	Max. connectable section(1) mm² (per phase)			Min. connectable section (2) mm² (per phase)			Max length for a voltage drop < 5%	Cable type(3)	Max. connectable section (2) mm² (per phase)	Max length for a voltage drop < 5%	Cable type(3)
	Circuit A	Circuit B	Circuit C	Circuit A	Circuit B	Circuit C					
2100	2 x 240	2 x 240	2 x 185	1 x 185	1 x 185	1 x 70	190/155	XLPE Copper	2 x 185/2 x 95	430/325	XLPE Cu/XLPE Al
2350	2 x 240	2 x 240	2 x 185	1 x 185	1 x 185	1 x 95	190/178	XLPE Copper	2 x 185/2 x 150	430/375	XLPE Cu/XLPE Al
2550	3 x 240	3 x 240	2 x 185	2 x 95	2 x 95	1 x 70	190/155	XLPE Copper	3 x 185/2 x 95	490/325	XLPE Cu/XLPE Al
2800	3 x 240	3 x 240	2 x 185	2 x 95	2 x 95	1 x 95	190/178	XLPE Copper	3 x 185/2 x 150	490/375	XLPE Cu/XLPE Al

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.

6.4 - Power cable access routing

The power cables for devices in the range are routed into the electrical box from underneath the unit.
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.

Connection expansion box

This accessory is used to strip the power cable before it is routed inside the unit's electrical cabinet, and must be used when the cable bend radius is not compatible with the space available inside the electrical cabinet. The "connection expansion box" accessory provides mechanical protection for the stripped cable before it is routed inside the electrical cabinet.
It is recommended to use this accessory in the following cases:
Unit placed on the ground and use of a steel wired armoured power cable.
Unit placed on the ground and use of a rigid power cable with a section > 250 mm².
The power cables for devices in the range are routed into the electrical box from underneath the unit.
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.

Connection expansion box

This accessory is used to strip the power cable before it is routed inside the unit's electrical cabinet, and must be used when the cable bend radius is not compatible with the space available inside the electrical cabinet. The "connection expansion box" accessory provides mechanical protection for the stripped cable before it is routed inside the electrical cabinet.

It is recommended to use this accessory in the following cases:

Unit placed on the ground and use of a steel wired armoured power cable.

Unit placed on the ground and use of a rigid power cable with a section > 250 mm^2.

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
- Power limitation adjustable by 4-20 mA signal
- Second power limitation level
- End of storage cycle signal
- User fault display
- Time schedule override
- Partial heat recovery activation control
- Power indication on analogue output (0-10V)
- Unit shut down general fault reporting
- Minor alert reporting
- Partial heat recovery pump On/Off control
- 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.

With the electrical plug option, this CT transformer provides a 230V, 50Hz circuit to power laptop battery chargers only, maximum current of 0.8 A at 230 V

Important: Only connect class I and II equipment to this power socket.

6.7 - Power connection/disconnect switch

The power supply for the unit is connected at a single point upstream of the unit's disconnect switch.

7.1 - Operating range

AQUACIAT^{POWER} LD ST units

Water exchanger		Minimum	Maximum
Water inlet temperature at start-up	°C	8(1)	40
Water outlet temperature during operation	°C	5	20(3)
Water outlet temperature during operation medium temperature brine solution option	°C	0(2)	20(3)
Water outlet temperature during operation low temperature brine solution option	°C	-15(6)	20(3)
Air-cooled exchanger		**Minimum**	**Maximum**
Outdoor ambient operating temperature			
Standard units	°C	0(4)/10	48(5)
Units with Winter operation option (down to -20 °C)	°C	-20(4)(7)	48(5)
Available static pressure			
Standard units (outdoor installation)	Pa	0	0

AQUACIAT^{POWER} LD HE 602-2000 units

Water exchanger		Minimum	Maximum
Water inlet temperature at start-up	°C	8(1)	40
Water outlet temperature during operation	°C	5	20(3)
Water outlet temperature during operation medium temperature brine solution option	°C	0(2)	20(3)
Water outlet temperature during operation low temperature brine solution option	°C	-15(6)	20(3)
Air-cooled exchanger		**Minimum**	**Maximum**
Outdoor ambient operating temperature			
Standard units	°C	-20(7)	48(5)
Available static pressure			
Standard units (outdoor installation)	Pa	0	0

(1) For an application requiring operation at less than 8 °C, contact the manufacturer to select a unit using the manufacturer's electronic catalogue.

(2) The use of frost protection is required if the water outlet temperature is below 5 °C

(3) For applications requiring operation above a water outlet temperature of 20 °C, contact the manufacturer to select a unit using the manufacturer's electronic catalogue.

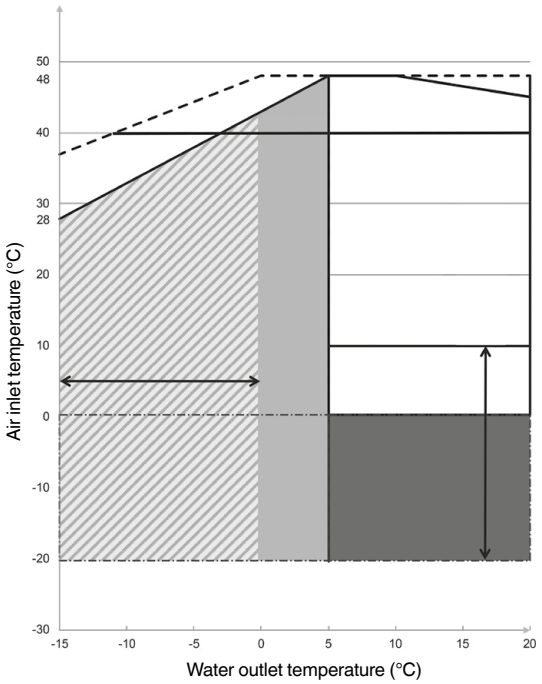
(4) For operation from 0 °C to -20 °C, the unit must be equipped with the Winter operation option (down to -20 °C).

(5) The maximum allowable ambient temperature for machines equipped with the Power factor correction option is +40 °C
Maximum ambient temperature: LD ST / LD HE units must be stored and transported at ambient temperatures of between -20 °C and +52 °C. These temperature limits shall be considered in case of container shipment.

(6) If using ethylene glycol and for LDST and LDHE 602 to 1500 units

(7) For operation from 0 °C to -20 °C:
- either the water heat exchanger frost protection option (for units without hydronic module option) or the water heat exchanger and hydronic module frost protection option (for units with hydronic module option) must be fitted to the machine,
- or the water loop must be protected against frost using an antifreeze solution.

LD ST/HE 602-2000 units



NOTE
- Evaporator ΔT = 3K
- The water exchanger is protected against freezing down to -20 °C (with the frost protection option for the water exchanger or hydronic module (if present) and water exchanger frost protection option or loop protected by an antifreeze solution for outdoor temperatures of less than 0 °C)
- These operating ranges are guidelines only. The operating range must be checked with the Selection software.

Key

LD ST/HE full load

ST version winter operation option (standard HE version)

Part load average

Medium temperature brine solution option

Low temperature brine solution option (limit -12 °C with Propylene Glycol and -15 °C with Ethylene Glycol)

Power factor correction option available for an inlet air temperature up to +40 °C

AQUACIAT^{POWER} LD HE 2100-2800 units

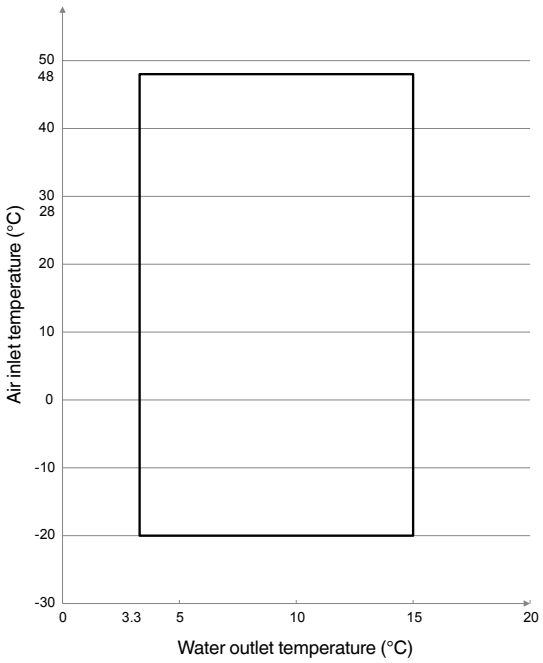
Water exchanger		Minimum	Maximum
Entering water temperature at start-up	°C	6.8(1)	40
Leaving water temperature during operation	°C	3.3	15(2)
Air-cooled exchanger		**Minimum**	**Maximum**
Outdoor ambient operating temperature			
Standard units	°C	-20(3)	48(2)
Available static pressure			
Standard units (outdoor installation)	Pa	0	0

(1) For an application requiring operation at less than 8 °C, contact the manufacturer to select a unit using the manufacturer's electronic catalogue.

(2) Maximum ambient temperature: LD HE units must be stored and transported at ambient temperatures of between -20 °C and +48 °C. These temperature limits shall be considered in case of container shipment.

(3) For operation from 0 °C to -20 °C:
- either the unit must be equipped with the water type heat exchanger frost protection option
- or the water loop must be protected against frost using an antifreeze solution.

LD HE 2100-2800 units



NOTE

- Evaporator ΔT = 5K
- The water type heat exchanger is protected against freezing down to -20 °C (with the frost protection option for the water type heat exchanger or water type heat exchanger frost protection option or loop protected by an antifreeze solution for outdoor temperatures of less than 0 °C)
- These ranges are given for indicative purpose. The operating range must be checked with the Selection software.

Key

LD HE full load

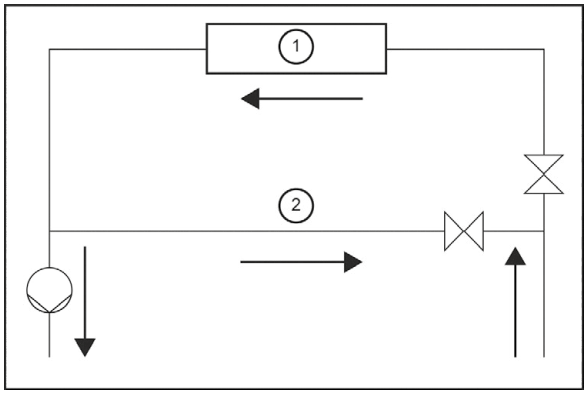
NOTE: Units equipped with speed regulators
If the air temperature is below -10 °C and the unit has been deenergised for more than 4 hours, it is necessary to wait two hours after the unit has been switched on again to allow the variable drive to warm up.

7.2 - 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



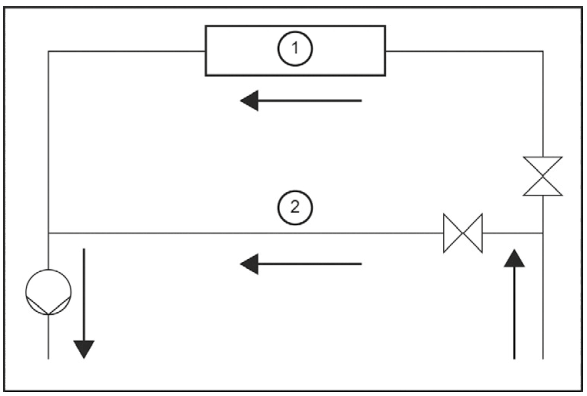
① Water exchanger
② Recirculation

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

7.3 - Maximum heat transfer fluid flow rate (units 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.

7.4 - Variable flow evaporator (units without factory-fitted hydronic module)

A variable water heat exchanger flow can be used in standard units. The flow rate must be higher than the minimum flow given in the table of permissible flow rates and must not vary by more than 10% per minute.

If the flow rate changes more rapidly, the system should contain a minimum of 6.5 litres of water per kW instead of 2.5 l/kW.

Sizes 2100-2800: A dedicated terminal is provided for controlling the pump (signal 0/10 V). Please refer to the LD-Connect 3 control manual.

7.5 - Water exchanger min. water volume and flow rate

The Connect Touch control is equipped with anticipation logic making it highly flexible in adjusting operation to parameter drift, particularly on hydraulic systems with low water volumes. By adjusting compressor runtimes, 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)

Note:

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

AQUACIAT^{POWER} LD ST / LD HE		602	650	750	800	1000	1100	1250	1350	1500	1600	1750	2000
Minimum system water volume, air conditioning application (litres)		420	451	494	539	654	750	827	914	993	1076	1159	1306
Minimum system water volume, industrial process application (litres)		1091	1173	1283	1401	1699	1949	2150	2375	2582	2796	3014	3396
Min(1) / max(2) water exchanger flow rate without hydronic module (l/s)		2.9 / 17.5	3.2 / 17.5	3.6 / 17.5	3.8 / 17.5	4.6 / 21.8	5.2 / 29.8	5.9 / 35.2	6.3 / 33.8	7.1 / 38.9	7.6 / 40.4	8.2 / 41.6	9.4 / 43.4
Water exchanger flow rate with low pressure hydronic module (l/s)	Min(1) / max single	2.8 / 12.2	2.8 / 12.2	2.8 / 12.2	2.8 / 12.2	4 / 14.3	3.1 / 20.2	3.4 / 20.2	3.7 / 20.2	9.5 / 25	9.5 / 25	9.5 / 25	5.4 / 26.6
	Min(1) / max dual	3.2 / 10.3	3.2 / 10.3	2.5 / 12.2	2.5 / 12.2	2.7/ 15	3.7 / 20.2	3.7 / 20.2	3.8 / 20.2	4.1/ 25	8/ 25	8/ 25	5.4 / 26.5
Water exchanger flow rate with high pressure hydronic module (l/s)	Min(1) / max single	2.5 / 11.7	2.5 / 11.7	2.5 / 11.7	2.5 / 11.7	5.2 / 16.1	6.4/16.1	3.6 / 26.5	3.7/26.5	4.1 / 26.5	4.4/26.7	4.8/26.7	5.4/26.7
	Min(1) / max dual	2.6/11.7	2.6/11.7	2.6/11.7	2.6/11.7	2.9 / 15.5	3.5 / 15.5	3.4/26.5	3.7/26.5	4.1 / 26.5	4.4/29.2	4.8/29.2	5.4 / 35

(1) Minimum flow rate for maximum allowable water temperature difference conditions (10K)

(2) Maximum flow rate for a pressure drop of 100 kPa in the plate heat exchanger

(3) Minimum factory flow rate setting according to the type of pump

NOTE: For the Buffer Tank Module option, the volume of the tank must be taken into account (550 litres)

AQUACIAT^{POWER} LD HE	2100	2350	2550	2800
Minimum system water volume, air conditioning application (litres)	1442	1582	1701	1840
Minimum system water volume, industrial process application (litres)	3749	4112	4421	4784
Min(1) / max(2) water exchanger flow rate without hydronic module (l/s)	7.9/ 50.6	8.7/ 50.6	9.6/ 50.6	10.3/ 50.6

(1) Minimum flow rate for maximum allowable water temperature difference conditions (10K)

(2) Maximum flow rate for a pressure drop of 100 kPa in the plate heat exchanger

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.

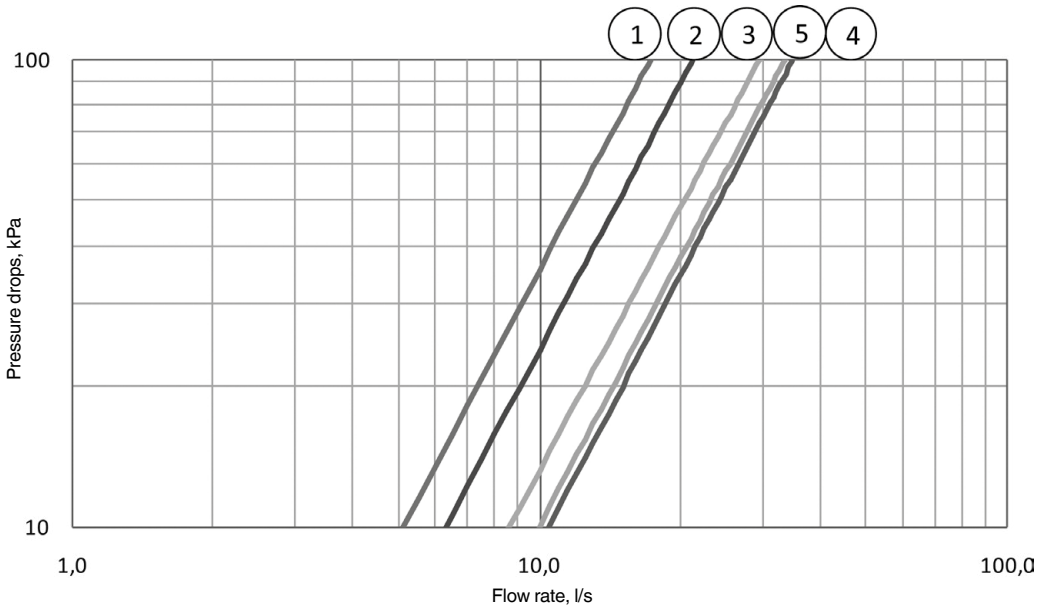
Maximum water loop volume (litres)						
AQUACIAT^{POWER} LD ST / LD HE	602-1000			1100-2000		
Static pressure (bar)	1	2	2,5	1	2	2,5
Pure water	2400	1600	1200	3960	2640	1980
10% EG	1800	1200	900	2940	1960	1470
20% EG	1320	880	660	2100	1400	1050
30% EG	1080	720	540	1740	1160	870
40% EG	900	600	450	1500	1000	750

EG: Ethylene glycol

7.7 - Pressure drop curves for the water exchanger and standard water inlet/outlet piping

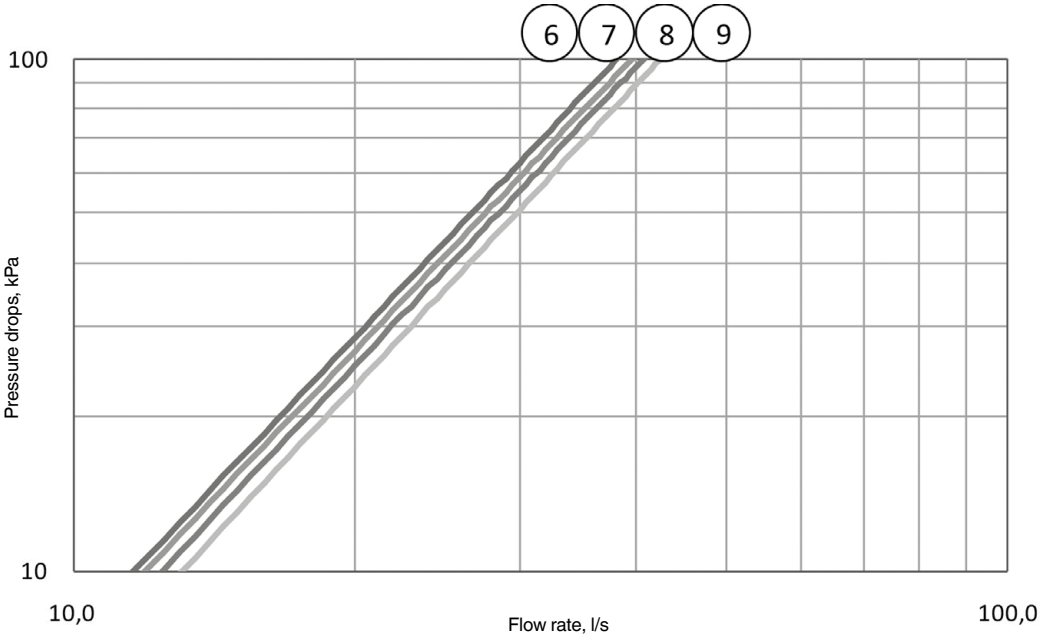
Data applicable for pure water at 20 °C.

AQUACIAT^{POWER} LD ST HE 602-1350 units

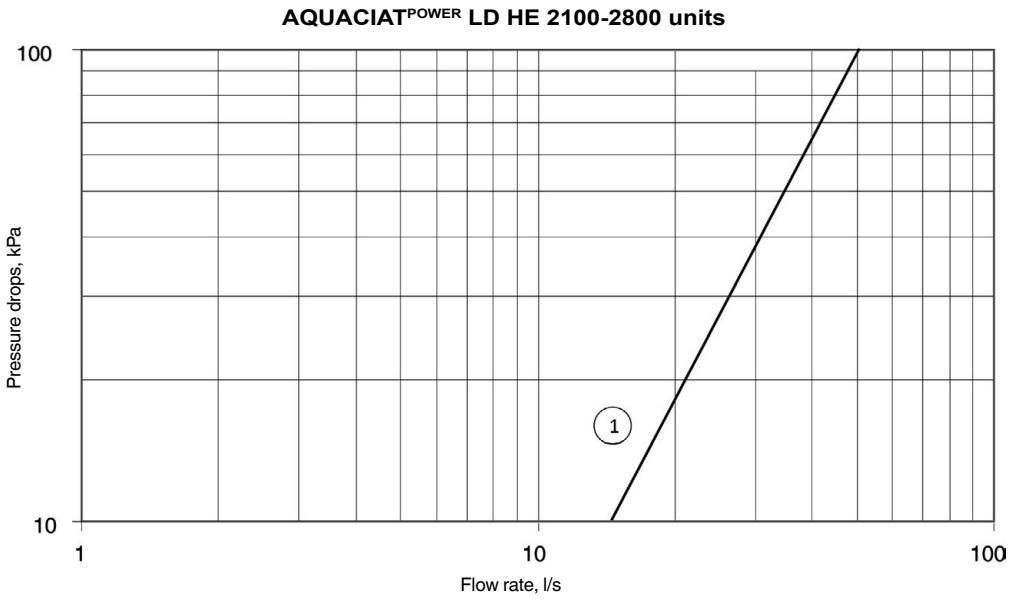


① AQUACIAT^{POWER} LD ST HE 602-800
② AQUACIAT^{POWER} LD ST HE 1000
③ AQUACIAT^{POWER} LD ST HE 1100
④ AQUACIAT^{POWER} LD ST HE 1250
⑤ AQUACIAT^{POWER} LD ST HE 1350

AQUACIAT^{POWER} LD ST HE 1500-2000 units



⑥ AQUACIAT^{POWER} LD ST HE 1500
⑦ AQUACIAT^{POWER} LD ST HE 1600
⑧ AQUACIAT^{POWER} LD ST HE 1750
⑨ AQUACIAT^{POWER} LD ST HE 2000



① AQUACIAT POWER LD HE 2100-2800

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 pipes and tubes should not transmit any axial or radial forces 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, make sure the heat-transfer fluid is compatible with the water circuit materials and coating. Where additives or fluids other 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 2014/68/EU.

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 a pressure-reducing valve and install a relief valve and an expansion vessel. 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 stop valves, close to the entering and leaving water 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).

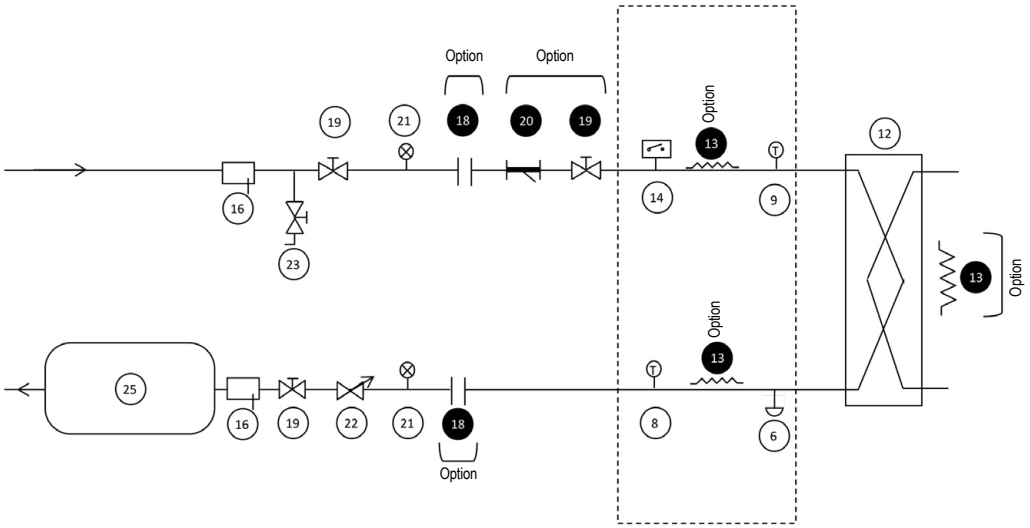
Units with hydronic module are equipped with this type of filter.

- 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 hydraulic connection must be chemically neutral to the surfaces on which they are applied. All original materials supplied by the manufacturer comply with this requirement.

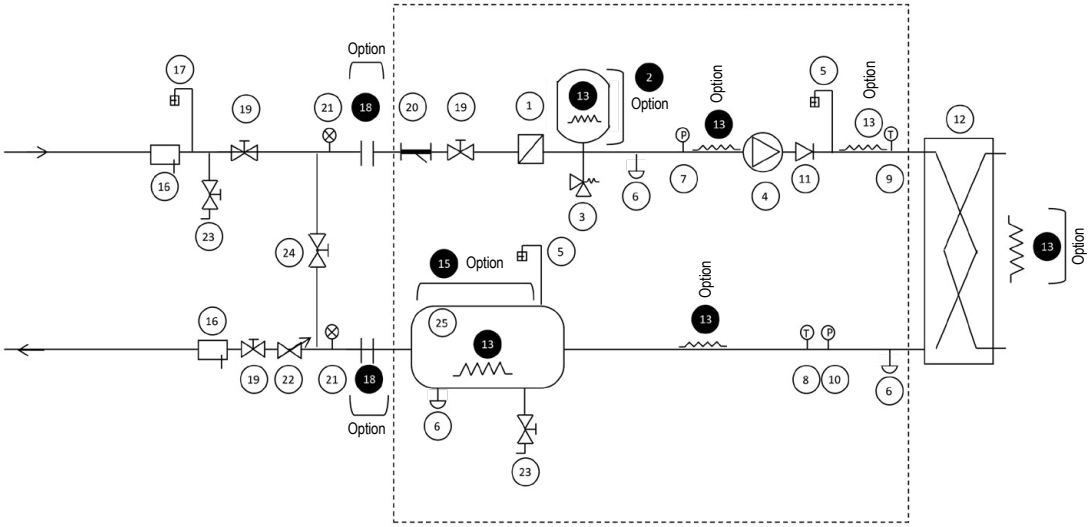
8.2 - Water connections

The hydronic module options are only compatible with closed heat transfer fluid loops.
The use of the hydronic module on open systems is prohibited.

Schematic diagram of the water circuit without the hydronic module



Schematic diagram of the water circuit with the hydronic module



Key

Components of unit and hydronic module

1 Screen filter (particle size of 1.2 mm)
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
13 Heater or heat trace cable for frost protection (Option)
14 Water type heat exchanger flow rate sensor
15 Buffer Tank Module (Option)

System components

16 Pocket
17 Air bleed valve
18 Hose connection (Option)
19 Shut-off valve
20 800 µm screen filter (Option - mandatory in the case of a unit without 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-down valves (item 19) are closed in winter)
25 Buffer tank (if required)

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

NOTE:

- The system 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 Schrader. Depressurise and drain the system before any work.

Figure 1: Water connections Without hydronic module

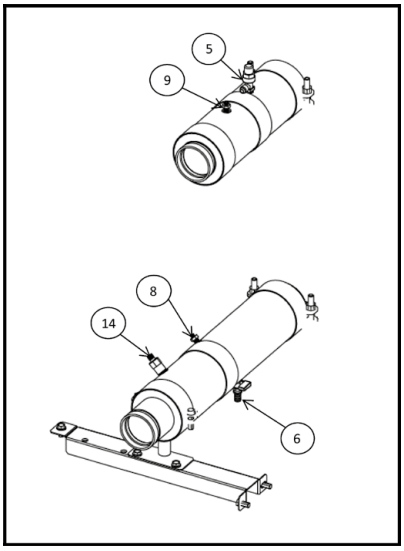


Figure 2: Water connections With hydronic module

Single pump **Dual pump**

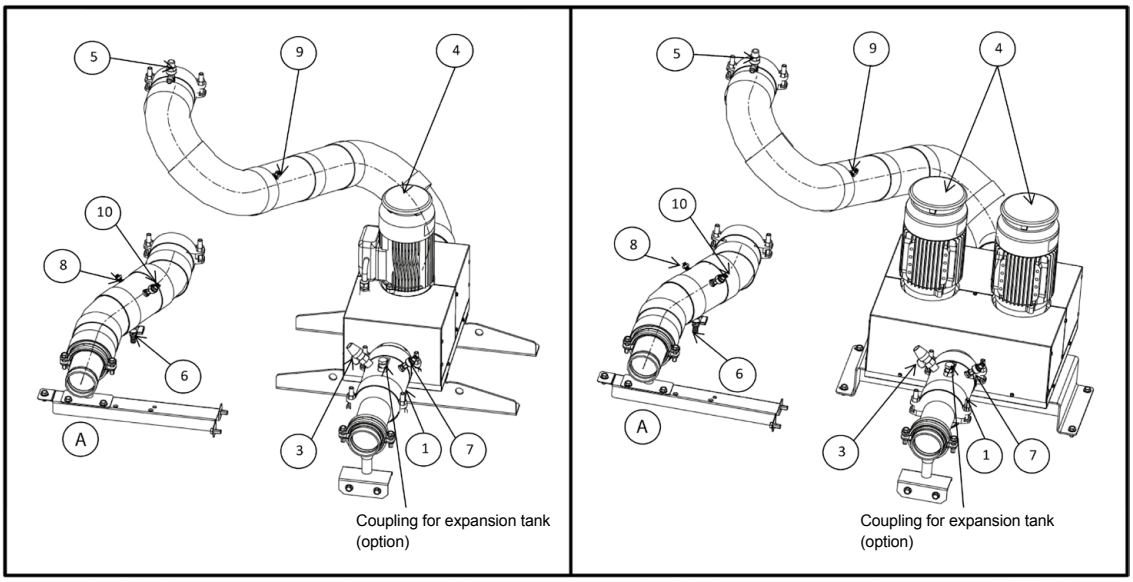
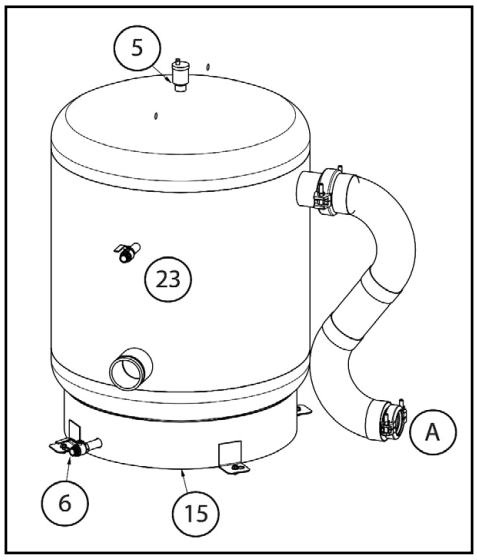


Figure 3: Water connections with hydronic module and with buffer tank module option



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.

A pressure below 100 kPa will trigger an alert on the user interface.

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 servo control (auxiliary operation switch of the pump 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 moduleule)
- 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)

If the water heat exchanger connection sleeves option is also ordered, it is necessary to install a heater on each extension in order to protect the water pipes down to outdoor temperatures of -20 °C.

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.

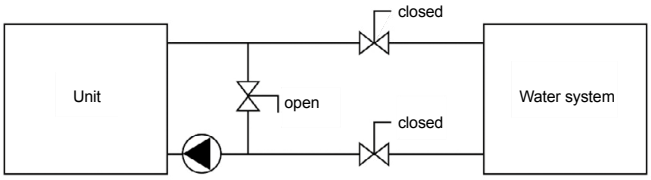
Combination of options for the periods when the machine is in standby mode

Ambiant unit temperature range	AQUACIAT^{POWER} LD ST / LD HE	
	without pump option	with pump option
> 0 °C to 48 °C	-	-
-20 °C to 0 °C	Frost protection option or Appropriate anti-freeze solution (for example glycol)	Hydronic module frost protection option (1) or Appropriate anti-freeze solution (for example glycol)(1)

(1) Allow the pumps to circulate. If the system is isolated by valves, install a bypass (see diagram for winter position).

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).

8 - WATER CONNECTIONS

- 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 and the auxiliary heater protection circuit breaker must be closed (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).

Refer to the chapter "Water connections" for all references points mentioned 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 the control of the system 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.
- Units with variable speed pumps – setting of a fixed flow rate for the system: nominal flow rate (see units with fixed speed pumps).

If this information is not available at the start-up of the system, contact the technical service department responsible for the installation to obtain them .

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 hydraulic 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 total system pressure drop is not known exactly at the start-up, it is necessary to adjust the water flow with the control valve to obtain the specific flow of the system.

Hydraulic 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 control procedure

Once the circuit is cleaned, read the pressures on the pressure gauges (water inlet and outlet pressure) determine the pressure drop within the unit (plate heat exchanger + internal pipe work).

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 rate at the terminals of the unit (and therefore within the installation) 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.

9.2 - Units with hydronic module and fixed speed pump

See the paragraph on "Units without hydronic module"

Hydraulic 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 control procedure

Once the circuit is cleaned, read the flow value on the user interface and compare it to 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.

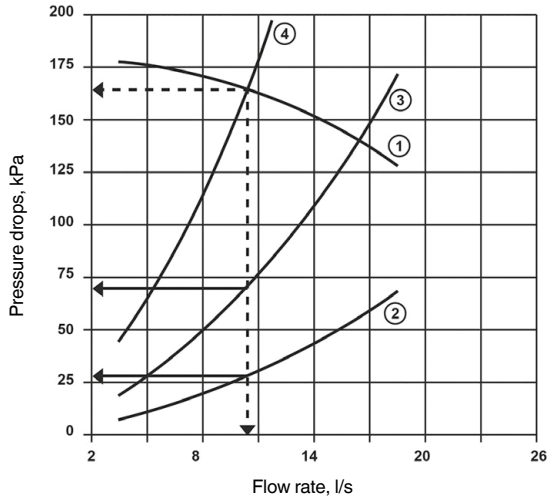
NOTE:

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

To reduce the system's hydraulic 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 hydraulic systems

Example: Unit with specified nominal flow rate of 10.6 l/s



Key

① Unit pump curve
② Pressure drop in the hydronic module (to be measured on the pressure gauge installed on the water inlet and outlet)
③ Pressure drop in the system with wide open control valve
④ Pressure drop in the system after controlling the valve to obtain the nominal flow specified.

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

The installation flow has not been set to 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.

Hydraulic circuit cleaning procedure

Before proceeding, it is advisable to remove any possible contamination from the hydraulic 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 required value:

- If the flow rate 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 flow rate at the unit's design condition.

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 minimum speed (frequency: 30 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

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

The installation flow has not been set to 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 Delta T, 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 Delta T exceeds the setpoint.
- This results in a decrease in the flow rate if the Delta T 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 resulting Delta T 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.

Hydraulic circuit cleaning procedure

Refer to the hydraulic circuit cleaning procedure.

Procedure for controlling the Delta T 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 factory configuration is the minimum speed (frequency: 30 Hz).

9.5 - Units with hydronic module and variable speed pump – Setting a fixed flow for the system

The flow will be set to a nominal value. This value shall remain constant, and will not be dependent on variations in the installation's load.

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

Hydraulic circuit cleaning procedure

Refer to the hydraulic circuit cleaning procedure.

Procedure for controlling the flow rate

Once the circuit has been cleaned, set the required water flow rate by adjusting the pump frequency on the user interface.

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

- Water flow rate control method (fixed speed)
- Constant frequency value.

The unit's default factory configuration is the minimum speed (frequency: 30 Hz).

9.6 - Available static pressure for the installation

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

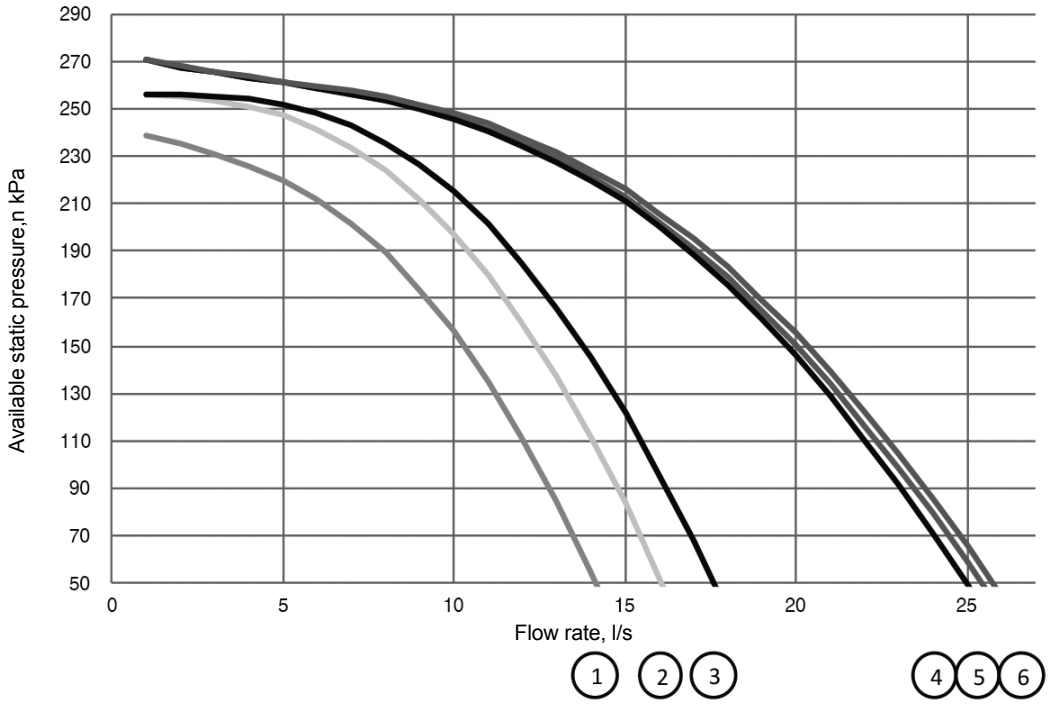
Data applicable for:

- Fresh water 20 °C.
- Refer to the paragraph on "Water exchanger min. water volume and flow rate" for the maximum water flow rate values.
- If ethylene glycol is used, the maximum flow rate is reduced.

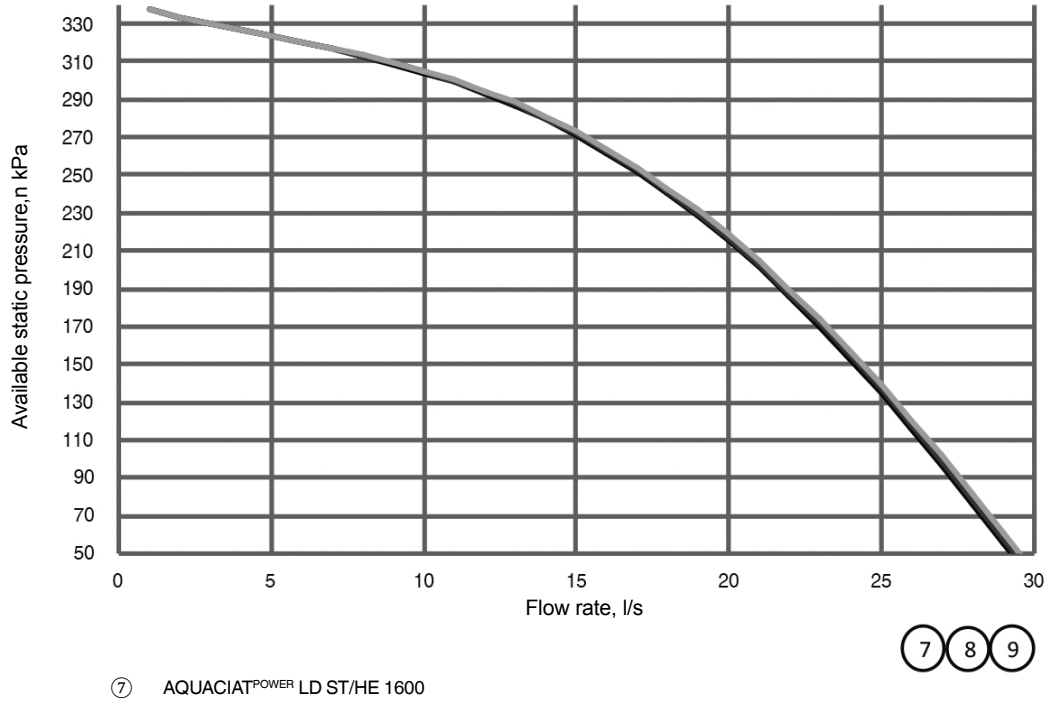
Warning: If the filter option is fitted, the curves below do not take the pressure drops for these components into account. If necessary, refer to the water filter specification curves to correct the data below.

High pressure pumps

Single pumps

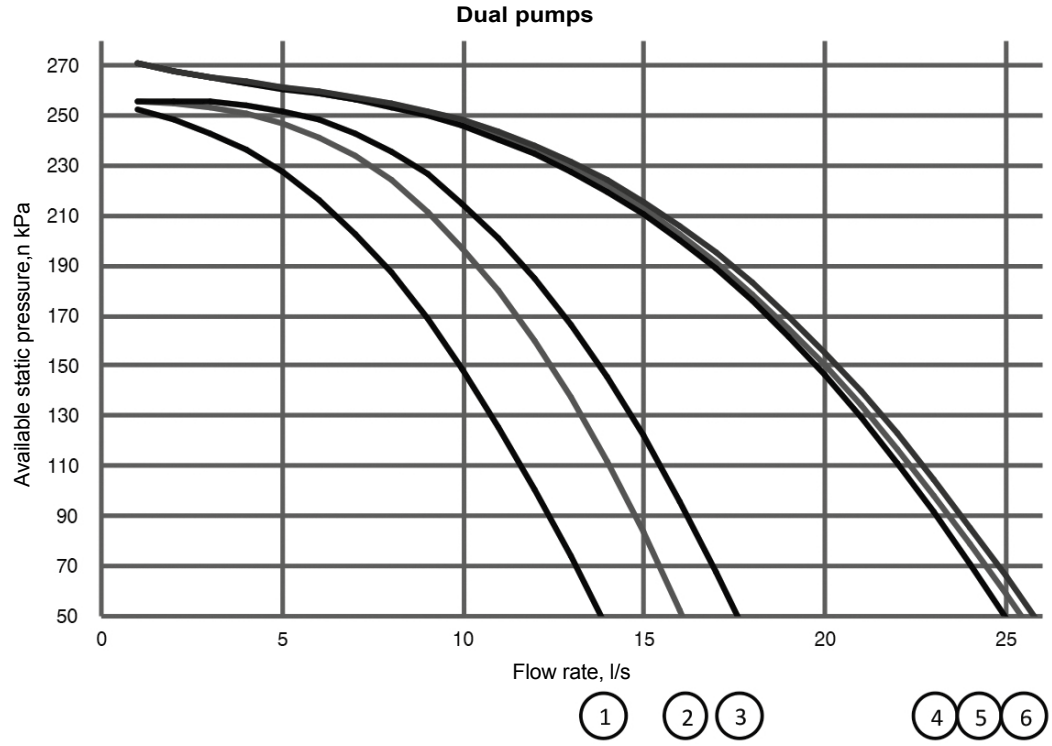


① AQUACIAT^{POWER} LD ST/HE 602 à 800
② AQUACIAT^{POWER} LD ST/HE 1000
③ AQUACIAT^{POWER} LD ST/HE 1100
④ AQUACIAT^{POWER} LD ST/HE 1350
⑤ AQUACIAT^{POWER} LD ST/HE 1250
⑥ AQUACIAT^{POWER} LD ST/HE 1500

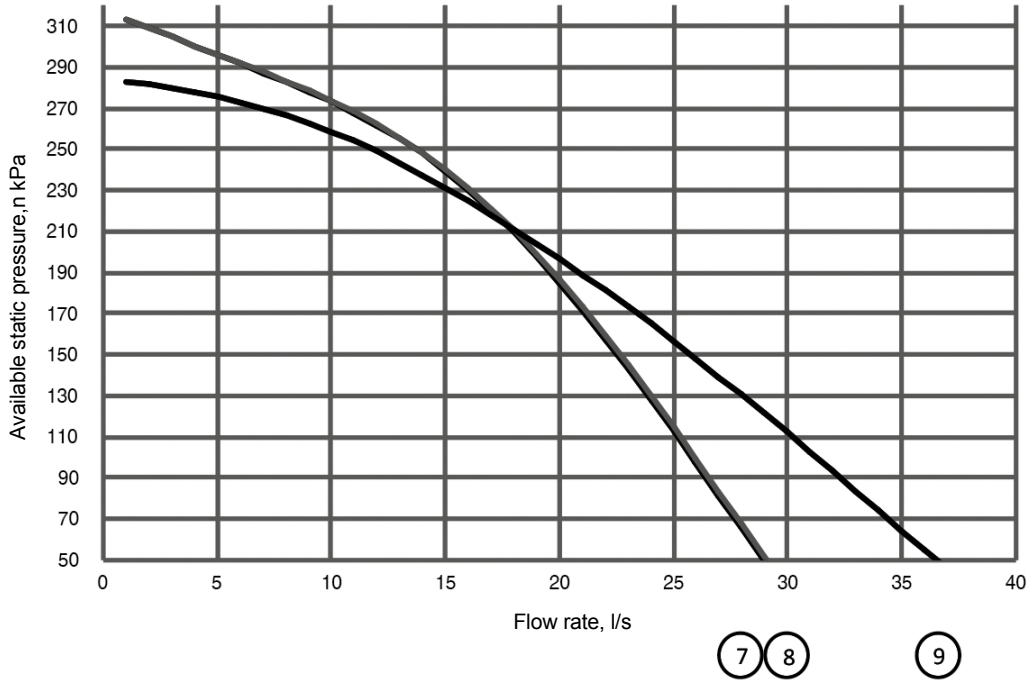


⑦ AQUACIAT^{POWER} LD ST/HE 1600
⑧ AQUACIAT^{POWER} LD ST/HE 1750
⑨ AQUACIAT^{POWER} LD ST/HE 2000

High pressure pumps



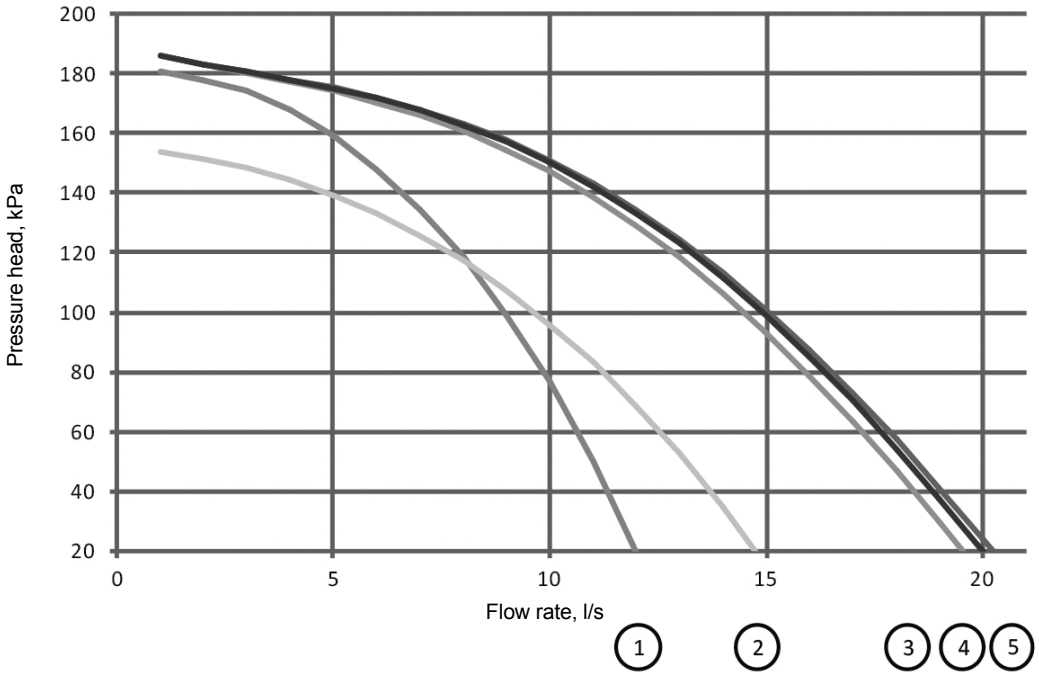
① AQUACIAT^{POWER} LD ST/HE 602 to 800
② AQUACIAT^{POWER} LD ST/HE 1000
③ AQUACIAT^{POWER} LD ST/HE 1100
④ AQUACIAT^{POWER} LD ST/HE 1350
⑤ AQUACIAT^{POWER} LD ST/HE 1250
⑥ AQUACIAT^{POWER} LD ST/HE 1500



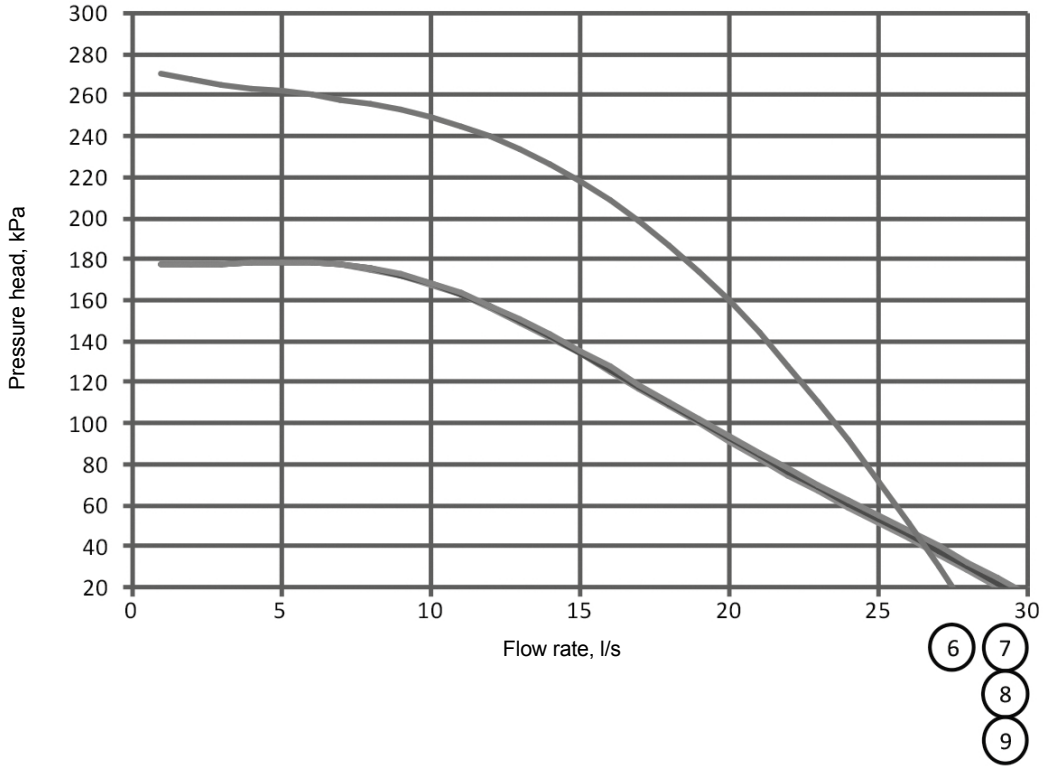
⑦ AQUACIAT^{POWER} LD ST/HE 1600
⑧ AQUACIAT^{POWER} LD ST/HE 1750
⑨ AQUACIAT^{POWER} LD ST/HE 2000

Low pressure pumps

Single pumps

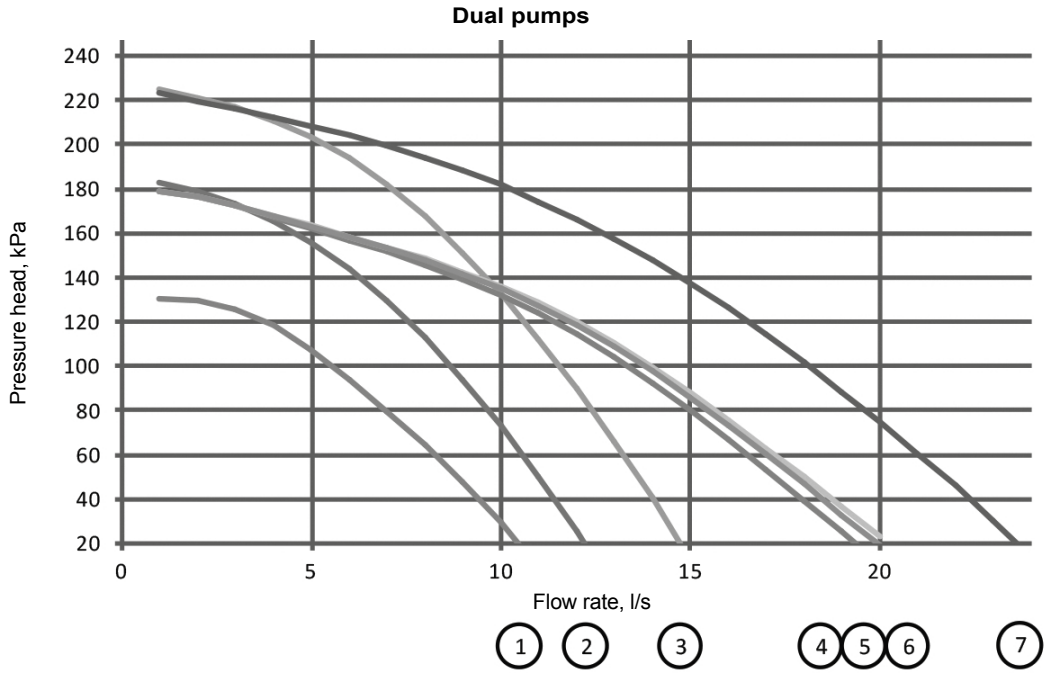


① AQUACIAT^{POWER} LD ST/HE 602 to 800
② AQUACIAT^{POWER} LD ST/HE 1000
③ AQUACIAT^{POWER} LD ST/HE 1100
④ AQUACIAT^{POWER} LD ST/HE 1350
⑤ AQUACIAT^{POWER} LD ST/HE 1250

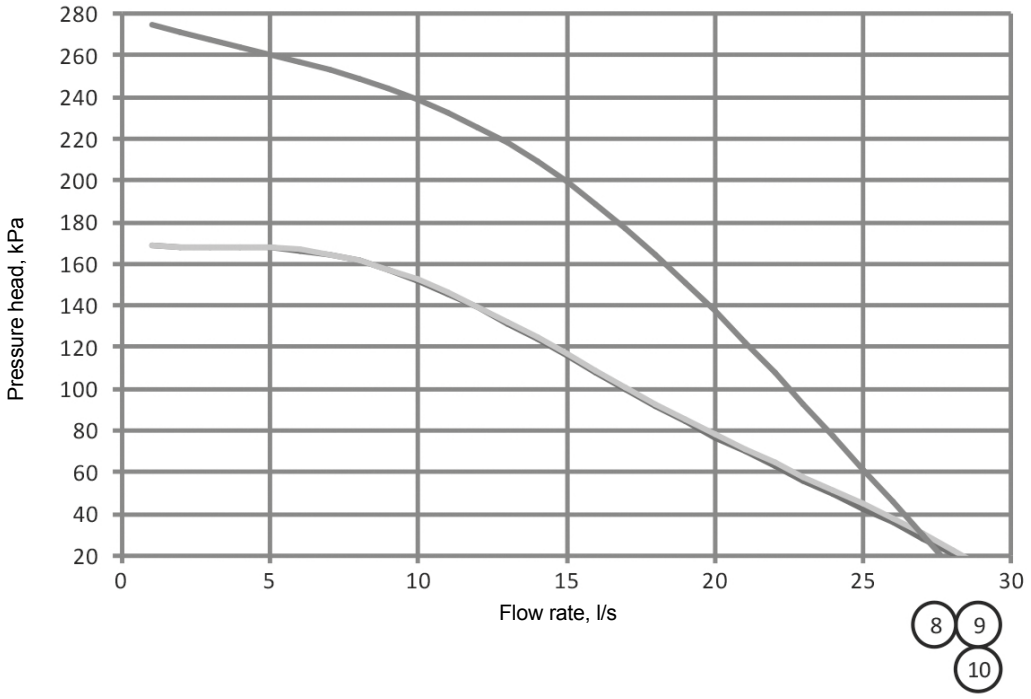


⑥ AQUACIAT^{POWER} LD ST/HE 2000
⑦ AQUACIAT^{POWER} LD ST/HE 1500
⑧ AQUACIAT^{POWER} LD ST/HE 1600
⑨ AQUACIAT^{POWER} LD ST/HE 1750

Low pressure pumps

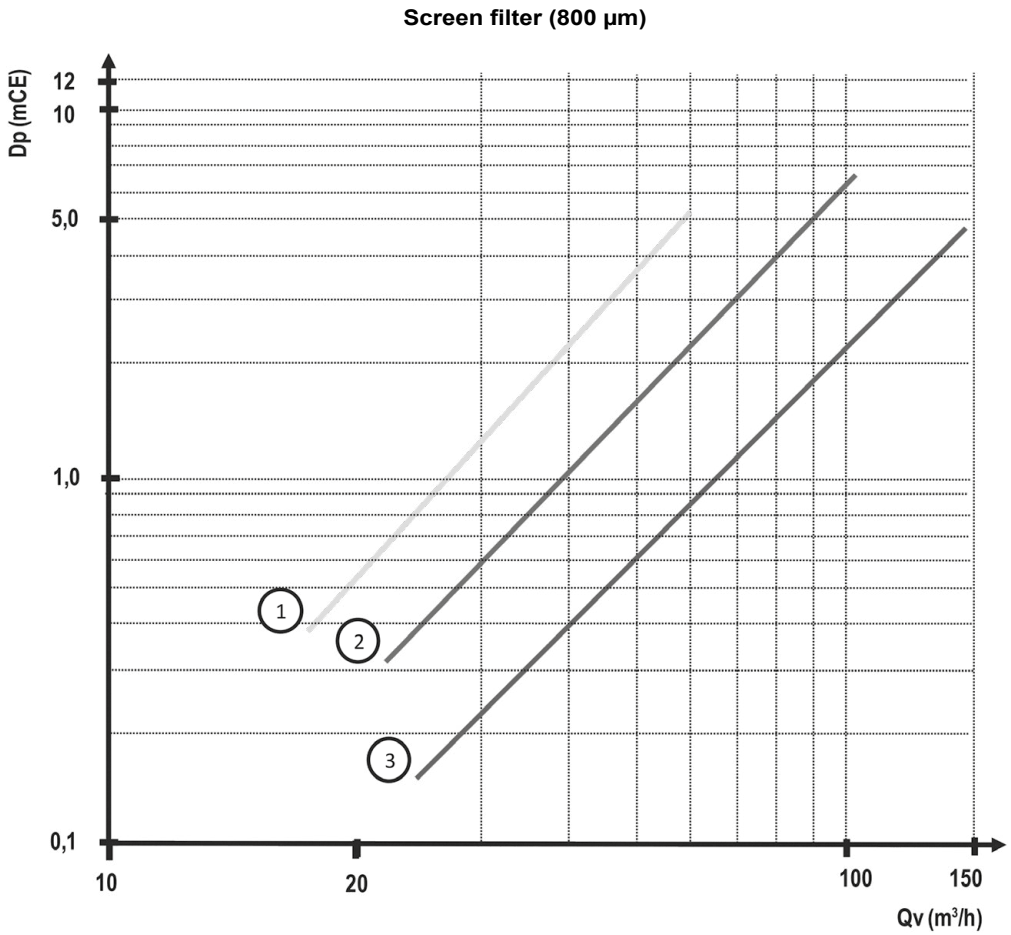


① AQUACIAT^{POWER} LD ST/HE 602 to 650
② AQUACIAT^{POWER} LD ST/HE 750 to 800
③ AQUACIAT^{POWER} LD ST/HE 1000
④ AQUACIAT^{POWER} LD ST/HE 1100
⑤ AQUACIAT^{POWER} LD ST/HE 1250
⑥ AQUACIAT^{POWER} LD ST/HE 1350
⑦ AQUACIAT^{POWER} LD ST/HE 1500



⑧ AQUACIAT^{POWER} LD ST/HE 2000
⑨ AQUACIAT^{POWER} LD ST/HE 1600
⑩ AQUACIAT^{POWER} LD ST/HE 1750

800 µm water filter pressure drop curves



① AQUACIAT^{POWER} LD 602 - 650 (DN80 filter)
② AQUACIAT^{POWER} LD 750 - 1100 (DN100 filter)
③ AQUACIAT^{POWER} LD 1250 - 2000 (DN120 filter)

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 checks of the installation:

- 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, piping and instrument diagram (PID), declarations, etc.) necessary to comply with the regulations are present. If any documentation is missing, order a replacement.
- Verify that the environmental protection and safety devices and arrangements provided by the manufacturer to comply with the regulations are in place and compliant.
- Check that all declarations of conformity for the pressure vessels, identification plates, and documentation required to comply with local regulations are present.
- Verify that access and safety routes are unobstructed.
- Comply with the instructions and directives to prevent the deliberate release of refrigerant fluids.
- 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 that all clamps securing the pipes are correctly tightened.
- 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, checking specifically that the high pressure switches are activated 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 at the discharge line of each circuit
- Restrictors (not visible) on the suction pipes (for 3 and 4 compressor modules) to ensure oil level equalisation between all compressors,
- 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 micro channel coils made entirely from aluminium (MCHE).

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).

In addition to this information, you will find in the table below the requirements of the regulation No. 327/2011 implementing Directive 2009/125/EC, with regard to eco-design requirements for fans driven by motors with an electric input power between 125 W and 500 kW

Product		AQUACIAT^{POWER} LD ST/LD HE 602-2000				
Option		**Standard ST**	**"Winter operation -20 °C" option(1)**	**Option "Xtra Low Noise"**	**High Efficiency HE version**	**XtraFan option**
Overall efficiency	%	42,9	54,8	38,7	54,8	55,8
Measurement category		A	A	A	A	A
Efficiency category		static	static	static	static	static
Target efficiency level ERP2015		40,0	40,0	40,0	40,0	40,0
Effciency level at optimum efficiency point		47,8	59,8	45,5	59,8	59,4
Speed regulator		NO	YES (integrated into the EC motor)	NO	YES (integrated into the EC motor)	YES (integrated into the EC motor)
Year of manufacture		See label on the unit	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	ebm-papst
Motor manufacturer		ebm-papst	ebm-papst	ebm-papst	ebm-papst	ebm-papst
Fan Part Number		00PSG002391800	00PSG002391900	00PSG002538000	00PSG002391900	00PSG002640700
Nominal motor power	kW	1,71	1,64	0,84	1,64	2,71
Flow rate	m^3/s	3,95	4,11	3,03	4,11	5,54
Pressure at optimum energy efficiency	Pa	187	205	109	205	260
Nominal Speed	rpm	900	925	675	925	1135
specifica ratio		1,00	1,00	1,00	1,00	1,00
Relevant information to facilitate the disassembly, recycling or removal of the product at the end of life		See the Maintenance manual	See the Maintenance manual	See the Maintenance manual	See the Maintenance manual	See the Maintenance manual
Relevant information to minimise the impact on the environment		See the Maintenance manual	See the Maintenance manual	See the Maintenance manual	See the Maintenance manual	See the Maintenance manual

(1) Only for EC fans [1 per circuit / the others are Standard]

11 - MAIN COMPONENTS OF THE UNIT AND OPERATING CHARACTERISTICS

Product		AQUACIAT^{POWER} LD HE 2100-2800
Option		**Standard**
Overall efficiency	%	41
Measurement category		A
Efficiency category		static
Target efficiency level ERP2015		40,0
Effciency level at optimum efficiency point		45,7
Speed regulator		YES upstream of the motor
Year of manufacture		See label on unit
Fan manufacturer		Simonin
Motor manufacturer		Leroy Somer
Fan Part Number		00PSG000000100A
Motor Part Number		00PPG000558700A
Nominal motor power	kW	1,84
Flow rate	m^3/s	4,15
Pressure at optimum energy efficiency	Pa	170
Nominal Speed	rpm	950
specifica ratio		1,00
Relevant information to facilitate the disassembly, recycling or removal of the product at the end of the life		See the Maintenance manual
Relevant information to minimise the impact on the environment		See the Maintenance manual

Product		AQUACIAT^{POWER} LD ST/LD HE 602-2000				
Option		**Standard**	**Winter operation -20 °C" option(1)**	**"Xtra Low Noise" option**	**High Efficiency HE version**	**XtraFan option**
Motor type		Asynchronous	EC	Asynchronous	EC	EC
Number of poles		6	.	8	.	.
Rated input frequency	Hz	50	50	50	50	50
Nominal voltage	V	400	400	400	400	400
number of phases		3	3	3	3	3
Fan included in the scope of Regulation 327/2011 of 30th March 2011		NO	NO	NO	NO	NO
Rationale for exemption		Article 1.2.b) and 2.1	Article 2.1 (EC)	Article 1.2.b) and 2.1	Article 2.1 (EC)	Article 2.1 (EC)
Ambient air temperature for which the motor is specifically designed	°C	+65	+65	+65	+65	+65

(1) Only for EC fans [1 per circuit / the others are Standard]

Product		AQUACIAT^{POWER} LD HE 2100-2800
Option		**Standard**
Motor type		Asynchronous
Number of poles		6
Rated input frequency	Hz	50
Nominal voltage	V	400
Number of phases		3
Motor included in the application domain of the regulation 640/2009 and amendment 4/2014		NO
Rationale for exemption		Article 2.1
Ambient air temperature for which the motor is specifically designed	°C	+70

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

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

11.8 - Water exchanger

11.8.1 Brazed plate heat exchanger sizes 602-2000

The water exchanger is a brazed plate heat exchanger with two refrigerant circuits.

11.8.2 Shell and tube heat exchanger sizes 2100-2800

The evaporator is a shell and tube type with 3 refrigerant circuits. It has been tested and stamped with the pressure code applicable for a maximum operating pressure of 2910 kPa on the refrigerant side and of 1000 kPa absolute on the water side. The seamless copper tubes are finned on the refrigerant side and expanded on the tube plates.

The water connections of the heat exchanger are Victaulic connections.

The water heat exchanger is thermally insulated with 19 mm of foam rubber. As an option it can be protected against frost by an electric heater (water exchanger frost protection option)

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.

NOTES - Monitoring during 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

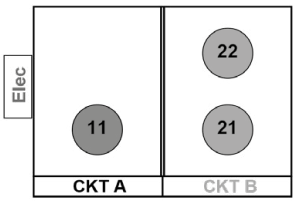
Units running with R410A

11.10 - HP safety pressostat

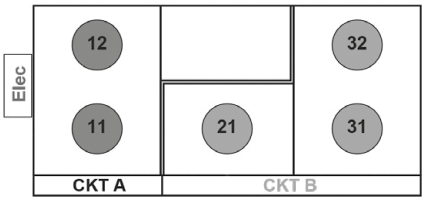
The units are equipped with high pressure safety switches with automatic reset on the HP side. These pressure switches are located at the discharge of each circuit.

11.11 - Disposition des ventilateurs

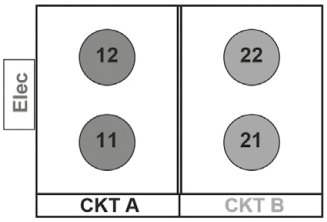
AQUACIAT^{POWER} LD ST / HE 602



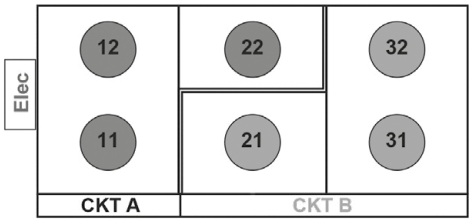
AQUACIAT^{POWER} LD ST / HE 1100-1250



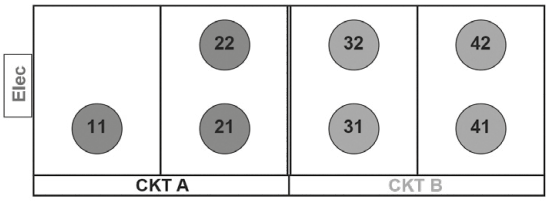
AQUACIAT^{POWER} LD 650-750-800-1000



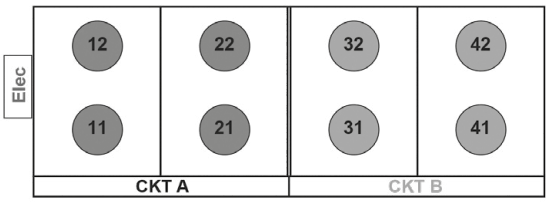
AQUACIAT^{POWER} LD ST / HE 1300-1500



AQUACIAT^{POWER} LD ST / HE 1600-1750

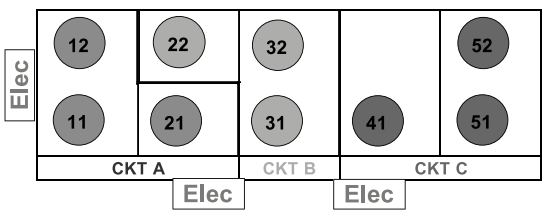


AQUACIAT^{POWER} LD ST / HE 2000

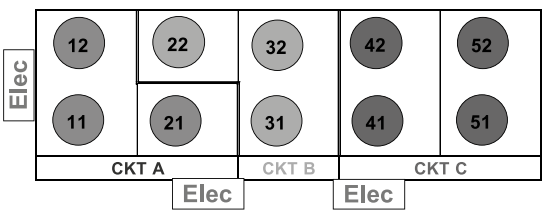


AQUACIAT^{POWER} LD HE 2100-2800

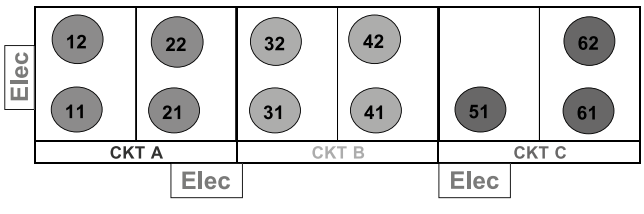
AQUACIAT^{POWER} LD HE 2100



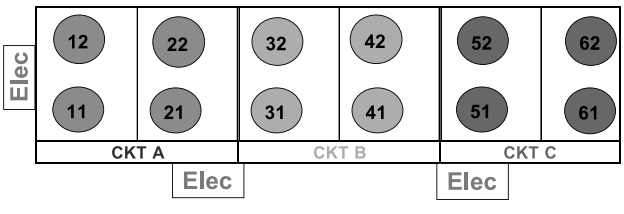
AQUACIAT^{POWER} LD HE 2350



AQUACIAT^{POWER} LD HE 2550



AQUACIAT^{POWER} LD HE 2800



11.12 - Fan stages

AQUACIAT^{POWER} LD ST / HE	Circuit	Stage 1	Stage 2	Stage 3	Stage 4	EC motor on AQUACIAT^{POWER} LD HE	Inverter on Winter operation option (down to -20 °C)
602	A	EV11				EV11	EV11
	B	EV21	EV21 + EV22			EV21 + EV22	EV21
650-750-800-1000	A	EV11	EV11 + EV12			EV11 + EV12	EV11
	B	EV21	EV21 + EV22			EV21 + EV22	EV21
1100-1250	A	EV11	EV11 + EV12			EV11 + EV12	EV11
	B	EV31	EV31 + EV21	EV31 + EV21 + EV32		EV31 + EV21 + EV32	EV31
1350-1500	A	EV11	EV11 + EV12	EV11 + EV12 + EV22		EV11 + EV12 + EV22	EV11
	B	EV31	EV31 + EV32	EV31 + EV32 + EV21		EV31 + EV32 + EV21	EV31
1600-1750	A	EV21	EV21 + EV11	EV21 + EV11 + EV22		EV21 + EV11 + EV22	EV21
	B	EV31	EV31 + EV41	EV31 + EV41 + EV32	EV31 + EV41 + EV32 + EV42	EV31 + EV41 + EV32 + EV42	EV31
2000	A	EV11	EV11 + EV21	EV11 + EV21 + EV12	EV11 + EV21 + EV12 + EV22	EV11 + EV21 + EV12 + EV22	EV11
	B	EV31	EV31 + EV41	EV31 + EV41 + EV32	EV31 + EV41 + EV32 + EV42	EV31 + EV41 + EV32 + EV42	EV31

AQUACIAT^{POWER} LD HE	Circuit	Motor on AQUACIAT^{POWER} LD HE
2100	A	EV11 + EV12+ EV21
	B	EV31 + EV32+ EV22
	C	EV51 + EV41+ EV52
2350	A	EV11 + EV12+ EV21
	B	EV31 + EV32+ EV22
	C	EV41 + EV51+ EV42+ EV52
2550	A	EV11 + EV21+ EV12+ EV22
	B	EV31 + EV41+ EV32+ EV42
	C	EV61 + EV51+ EV62
2800	A	EV11 + EV21+ EV12+ EV22
	B	EV31 + EV41+ EV32+ EV42
	C	EV51 + EV61+ EV52+ EV62

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 and controlled at 0-10V, and each variable-speed fan is equipped with its own inverter. The speed is controlled by the refrigerating circuit, which means that each fan for each circuit operates together at the same rotation speed.

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

11.15 - 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 (602-2000)

The interface for the ConnectTouch control has the following characteristics:

- It has a 5-inch colour screen.
- It is intuitive and user-friendly. Clear and concise information is presented in the local language (8 available)
- The complete menu can be adapted for different users (end client, maintenance personnel, manufacturers),
- 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.

11.17 - Connect 3 control (2100-2800)

The Connect 3 control interface (sizes 2100-2800) displays several parameters which can be modified.

It comprises:

- a two-digit display showing the number of the selected item.
- a four-digit display showing the content of the selected item.
- Diodes and keys for stopping/starting the unit, selecting menus and menu items and adjusting values.

Consult the "LD - Connect 3 control" manual for more details.

12.1 - Tables of options

Options	Description	Advantages	AQUACIAT^{POWER} LD ST/LD HE sizes 602-2000	AQUACIAT^{POWER} LD HE sizes 2100-2800
Medium temperature brine solution	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	●	No
Low temperature brine solution	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	602 to 1500	No
XtraFan	Unit equipped with specifics variable-speed fans : XtraFans (See specific chapter for maximum available static pressure according to size), each fan equipped with a connection flange & sleeves allowing the connection to the ducting system.	Ducted fan discharge, optimised temperature control, based on the operating conditions and system characteristics	All HE version	No
Low Noise	Aesthetic and sound absorbing compressor enclosure	Noise level reduction	●	●
Xtra Low Noise	Aesthetic and sound absorbing compressor enclosure associated with low-speed fans	Noise emission reduction at reduced fan speed	●	●
IP54 control box	Increased leak tightness of the unit	Protects the inside of the electrical box from dust, water and sand. As a rule, this option is recommended for installations in polluted environments	●	No
Protection grilles	Metal grilles on the 4 unit sides.	Improves protection against intrusion to the unit interior, coil and piping protection against impacts.	●	●
Soft Starter	Electronic starter on each compressor	Reduced start-up current	●	No
EC fans for winter operation cooling mode down to -20 °C	EC fan control via integrated Electronic Commutated motors One EC fan on each refrigerant circuit	Stable unit operation when the air temperature is between 0 °C and -20 °C.	ALL ST version	No
Water exchanger frost protection	Electric heater on the water exchanger and the water piping	Water exchanger module frost protection between 0 °C and -20 °C outside air temperature	●	●
Exchanger & hydraulic frost protection	Electric heater on the water exchanger hydronic module and optional expansion tank	Water exchanger and hydronic module frost protection down to an outside air temperature of -20 °C	All sizes with pump option	No
Exchanger & hydraulic frost protection	Electric heater on the water exchanger hydronic module and optional expansion tank & water buffer tank	Water exchanger and hydronic module frost protection down to an outside air temperature of -20 °C	ALL with water buffer tank	No
Partial heat recovery	Unit equipped with a desuperheater on each refrigerating circuit	Simultaneous free production of hot water (high temperature) and production of chilled water (or hot water for the heat pump)	●	●
Master/slave operation	Unit equipped with supplementary water outlet temperature sensor kit to be field-installed allowing master/slave operation of two units connected in parallel	Optimised operation of two units connected in parrallele operation with operating time equalisation	●	●
Shell and tube evaporator aluminium insulation	Evaporator covered with an aluminium jacket for thermal insulation protection	Improved resistance to aggressive climate conditions	602 to 1000	●
Compressor suction and discharge valves	Shut-off valves on the compressor suction and discharge piping	Simplified maintenance. Possibility to store the refrigerant charge in the cooler or condenser side during servicing	●	No
Compressor discharge valves	Shut-off valves on the compressor discharge piping	Simplified maintenance. Possibility to store the refrigerant charge in the condenser side during servicing	●	No
Compressor suction valve	Valve set for the compressor suction side to isolate it in the refrigerant circuit	Simplified service and maintenance	No	●
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 safety hydraulic components available.)	Easy and fast installation (plug & play)	●	No
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 vessel not included; option with built-in safety hydraulic components available)	Easy and fast installation (plug & play)	●	No
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 safety hydraulic components available)	Easy and fast installation (plug & play)	●	No

- ALL MODELS
  Refer to the selection tool to find out which options are not compatible.

Options	Description	Advantages	AQUACIAT^{POWER} LD ST/LD HE sizes 602-2000	AQUACIAT^{POWER} LD HE sizes 2100-2800
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 safety hydraulic components available)	Easy and fast installation (plug & play)	●	No
HP evap. variable-speed single-pump	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 safety hydraulic components available)	Easy and fast installation (plug & play), significant pumping energy cost savings (more than two-thirds), tighter water flow control, improved sytem reliability	●	No
HP VSD dual-pump hydraulic mod.	Dual high-pressure water pump with variable speed drive (VSD), pressure transducers. Multiple possibilities of water flow control. For more details, refer to the dedicated chapter (expansion tank not included Option with built-in safety hydraulic components available)	Easy and fast installation (plug & play), significant pumping energy cost savings (more than two-thirds), tighter water flow control, improved sytem reliability	●	No
BacNet gateway	Two-directional communication board complying with BacNet protocol	Easy connection by communication bus to a building management system	No	●
Lon gateway	Two-directional communication board complying with Lon Talk protocol	Connects the unit by communication bus to a building management system	●	●
BACnet/IP	Bi-directional high-speed communication using BACnet protocol over Ethernet network (IP)	Easy and high-speed connection by ethernet line to a building management system. Allows access to multiple unit parameters	●	No
Energy Management Module	Control board with additional inputs/outputs. See Contacts available in option on control description.	Extended remote control capabilities (setpoint reset by 0-20 mA input, ice storage end, demand limits, boiler on/off command...)	●	●
Input contact for Refrigerant leak detection	0-10 V signal to report any refrigerant leakage in the unit directly on the controlller (the leak detector itself must be supplied by the customer)	Immediate customer notification of refrigerant losses to the atmosphere, allowing timely corrective actions	●	●
Dual relief valves on 3-way valve	3-way valve upstream of the discharge valves on the shell and tube evaporator	Valve replacement and inspection facilitated without refrigerant loss. Comforms to European standard EN378/BGVD4	602 to 1000	●
Compliance with Russian regulations	EAC certification	Compliance with Russian regulations	●	●
Compliance with Australian regulations	Unit approved to Australian code	Compliance with Australian regulations	No	●
Power factor correction	Capacitors for automatic regulation of power factor (cos phi) value to 0,95.	Reduction of the apparent electrical power, compliance with minimum power factor limit set by utilities	●	No
MCHE anti-corosion protection Protect2	Coating by conversion process which modifies the surface of the aluminum producing a coating that is integral to the coil. Complete immersion in a bath to ensure 100% coverage. No heat transfer variation, tested 4000 hours salt spray per ASTM B117	Protect2 Improved corrosion resistance of the MCHE coils by 2, recommended for use in moderately corrosive environments	●	●
MCHE anti-corosion protection Protect4	Flexible, durable polyepoxide coating applied using an electroplating process to give micro-channel coils an anti-UV top layer. Minimal variation in the thermal transfer, tested to withstand more than 6000 hours of constant neutral salt spray as per ASTM B117, improved impact resistance as per ASTM D2794	Protect4 Improved corrosion resistance of the MCHE coils by 4, recommended for use in corrosive environments	●	●
Shell and tubes heat exchanger	Brazed plate heat exchanger replaced by shell & tube heat exchanger	Extended water flow range, reinforced fouling resistance	602 to 1000	No
230 V electric plug	230V AC power source with plug socket and transformer (180 VA, 0.8 A)	Permits connection of a laptop or an electrical device during unit commissioning or servicing	●	●
Expansion tank	6 bar expansion tank integrated in the hydronic module (requires hydronic module option)	Easy and fast installation (plug & play), & Protection of closed water systems from excessive pressure	All sizes with pump option	No
Screwed water connection sleeve kit for DSH	DSH connections with screw connection sleeves	Easy installation. Allows unit connection to a screw connector	●	No
M2M supervision (accessory)	Monitoring solution which allows customers to track and monitor their equipment remotely in real time	Real-time expert technical support to improve equipment availability and reports at customer hand to monitor and optimize operating equipment.	●	No
Water buffer tank module	Integrate water buffer tank	Avoid short cycle on compressors and ensure a stable water in the loop	All sizes with pump option	No
Anti-vibration mounts (kit)	Elastomer antivibratils mounts to be place under the unit (Material classified B2 fire class according to DIN 4102).	Isolate unit from the building, avoid transmission of vibration and associate noise to the buiding. Must be used in conjunction with a flexible connection on the water side	●	No

- ALL MODELS
  Refer to the selection tool to find out which options are not compatible.

11 - MAIN COMPONENTS OF THE UNIT AND OPERATING CHARACTERISTICS

Options	Description	Advantages	AQUACIAT^{POWER} LD ST/LD HE sizes 602-2000	AQUACIAT^{POWER} LD HE sizes 2100-2800
Exchangers flexibles connection (kit)	Flexibles connections on the exchanger water side	Easy installation. Limit transmission of vibrations on the water network	●	No
Exchangers water filter (kit)	Water filter	Eliminate dust in the water network	All sizes without pump option	No
Set point adjustment by 4-20mA signal	Connections to allow a 4-20mA signal input	Easy energy managment, allow to adjust set point by a 4-20mA external signal	●	No
Free Cooling dry cooler management	Control & connections to a Free Cooling Drycooler Opera or Vextra fitted with option FC control box	Easy system managment, Extended control capabilities to a dryccoler used in Free Cooling mode	●	No
Evap. single pump power/control circuit	Unit equipped with an electrical power and control circuit for one pump evaporator side	Quick and easy installation: the control of fixed speed pumps is embedded in the unit control	●	No
Evap. dual pumps power/control circuit	Unit equipped with an electrical power and control circuit for two pumps evaporator side	Quick and easy installation: the control of fixed speed pumps is embedded in the unit control	●	No

Accessories	Description	Advantages	602-2000 use
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.	●
M2M 3 supervision units - France	Monitoring solution which allows customers to track and monitor their equipment remotely 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.	●
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.	●
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
  Refer to the selection tool to find out which options are not compatible.

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 is placed at the pump inlet and protects the pump and the plate heat exchanger against solid particles that are greater than 1.2 mm.

Supplementary options can be ordered if necessary:

- Protection of the hydronic module in outdoor temperatures of down to -20 °C.
- Expansion vessel.
- Additional filter (particle size of 800 µm) for extra protection.

The use of the hydronic module on open loop 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 the pump's nominal flow to be adjusted based on the chosen control mode (constant pressure or temperature differential or fixed speed) and the installation's operating conditions.

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

12.2.3 Partial heat recovery

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

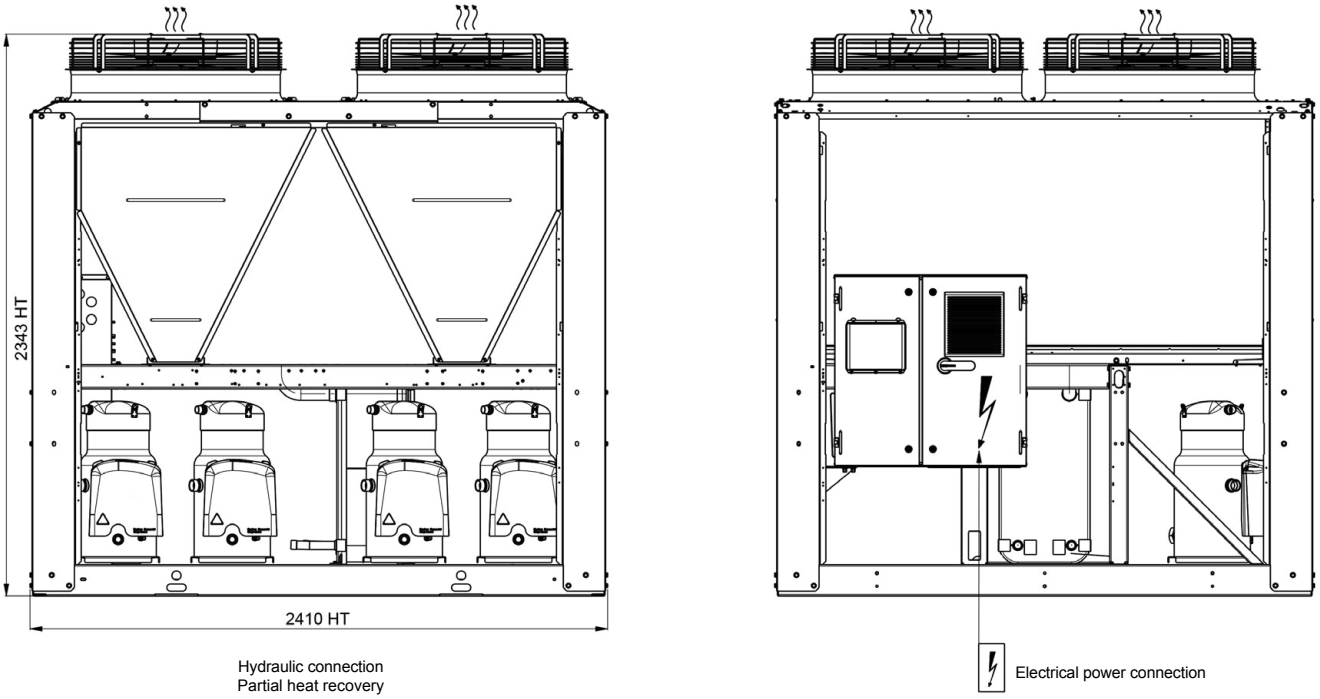
AQUACIAT^{POWER} LD ST / LD HE		602	650	750	800	1000	1100	1250	1350	1500	1600	1750	2000
Desuperheaters on the A/B circuits		Plate heat exchanger											
Water volume circuits A/B	l	2/3.75	2/3.75	2/3.75	3.75/3.75	3.75/3.75	3.75/5.5	3.75/5.5	5.5/5.5	5.5/5.5	5.5/7.5	5.5/7.5	7.5/7.5
Maximum operating pressure, water side	kPa	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Refrigerant													
Circuit A[1]	kg	9,1	12,9	12,9	14,3	13,6	15,0	16,9	22,8	21,4	26,3	23,7	27,3
	tCO_2e	19,1	26,9	26,9	30,0	28,4	31,3	35,3	47,6	44,7	54,9	49,6	57,0
Circuit B[1]	kg	13,5	14,3	13,3	14,5	13,6	22,8	21,1	20,9	22,4	27,4	27,3	27,5
	tCO_2e	28,1	30,0	27,7	30,2	28,4	47,6	44,1	43,7	46,8	57,1	57,1	57,4
Water connections		Victaulic®											
Connection	Inches	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"
Outside tube 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
AQUACIAT^{POWER} LD ST													
Operating weight*													
Unit + Partial heat recovery option	kg	1269	1310	1311	1446	1467	1932	1968	2143	2201	2626	2643	2849
Unit with Low Noise + Partial heat recovery option	kg	1352	1393	1394	1554	1575	2058	2094	2287	2344	2788	2805	3029
Unit + Low Noise + HP dual pump hydronic module + Partial heat recovery option	kg	1491	1533	1533	1693	1729	2218	2298	2491	2548	3032	3049	3309
AQUACIAT^{POWER} LD HE													
Operating weight[1]													
Unit + Partial heat recovery option	kg	1305	1347	1347	1482	1504	1969	2004	2180	2237	2683	2700	2915
Unit with Low Noise + Partial heat recovery option	kg	1388	1430	1430	1590	1612	2095	2130	2323	2381	2845	2862	3095
Unit + Low Noise + HP dual pump hydronic module + Partial heat recovery option	kg	1527	1569	1569	1729	1766	2254	2334	2528	2584	3089	3106	3375

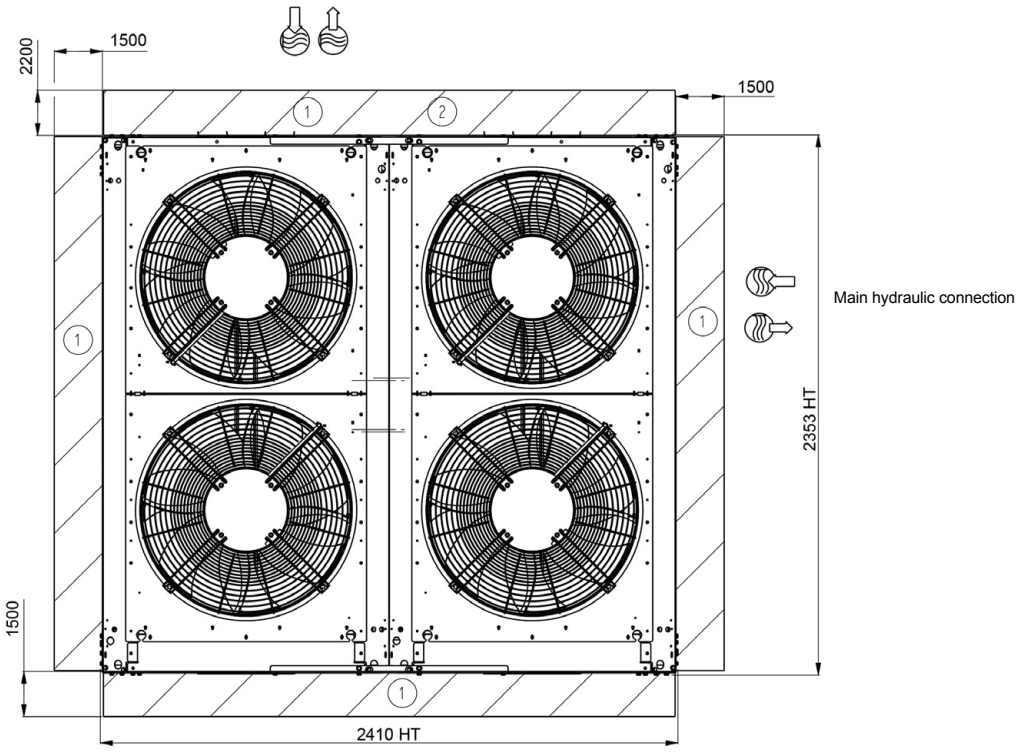
AQUACIAT^{POWER} LD HE		2100	2350	2550	2800
Desuperheaters on the A/B circuits		Plate heat exchanger			
Water volume circuits A/B/C	l	5.5/5.5/5.5	5.5/5.5/5.7	7.5/7.5/5.5	7.5/7.5/7.5
Maximum operating pressure, water side	kPa	1000	1000	1000	1000
Refrigerant					
Circuit A[1]	kg	22,0	22,0	27,0	27,0
	tCO_2e	45,9	45,9	56,4	56,4
Circuit B[1]	kg	22,5	22,0	29,0	29,0
	tCO_2e	47,0	45,9	60,6	60,6
Circuit C[1]	kg	24,0	27,0	24,5	32,0
	tCO_2e	50,1	56,4	51,2	66,8
Water connections		Cylindrical male gas thread			
Connection	Inches	2"	2"	2"	2"
Outside tube diameter	mm	60,3	60,3	60,3	60,3
AQUACIAT^{POWER} LD HE					
Operating weight[1]					
Unit + Partial heat recovery option	kg	4473	4698	5146	5373
Unit with Low Noise + Partial heat recovery option	kg	4689	4932	5398	5643

(1) Weights are guidelines only. Refer to the unit name plate.

Dimensions, clearances

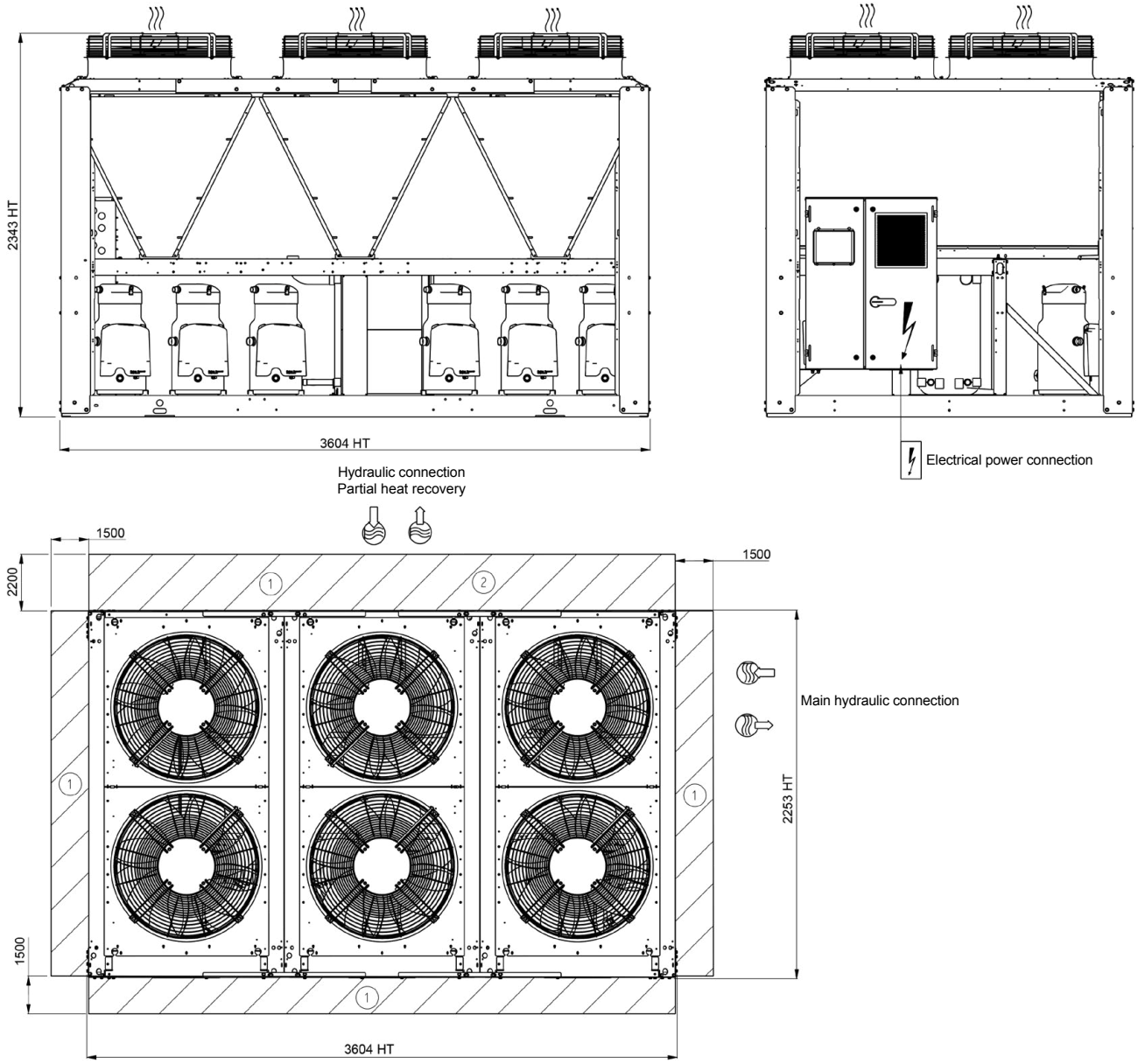
AQUACIAT^{POWER} LD ST / HE 602-1000





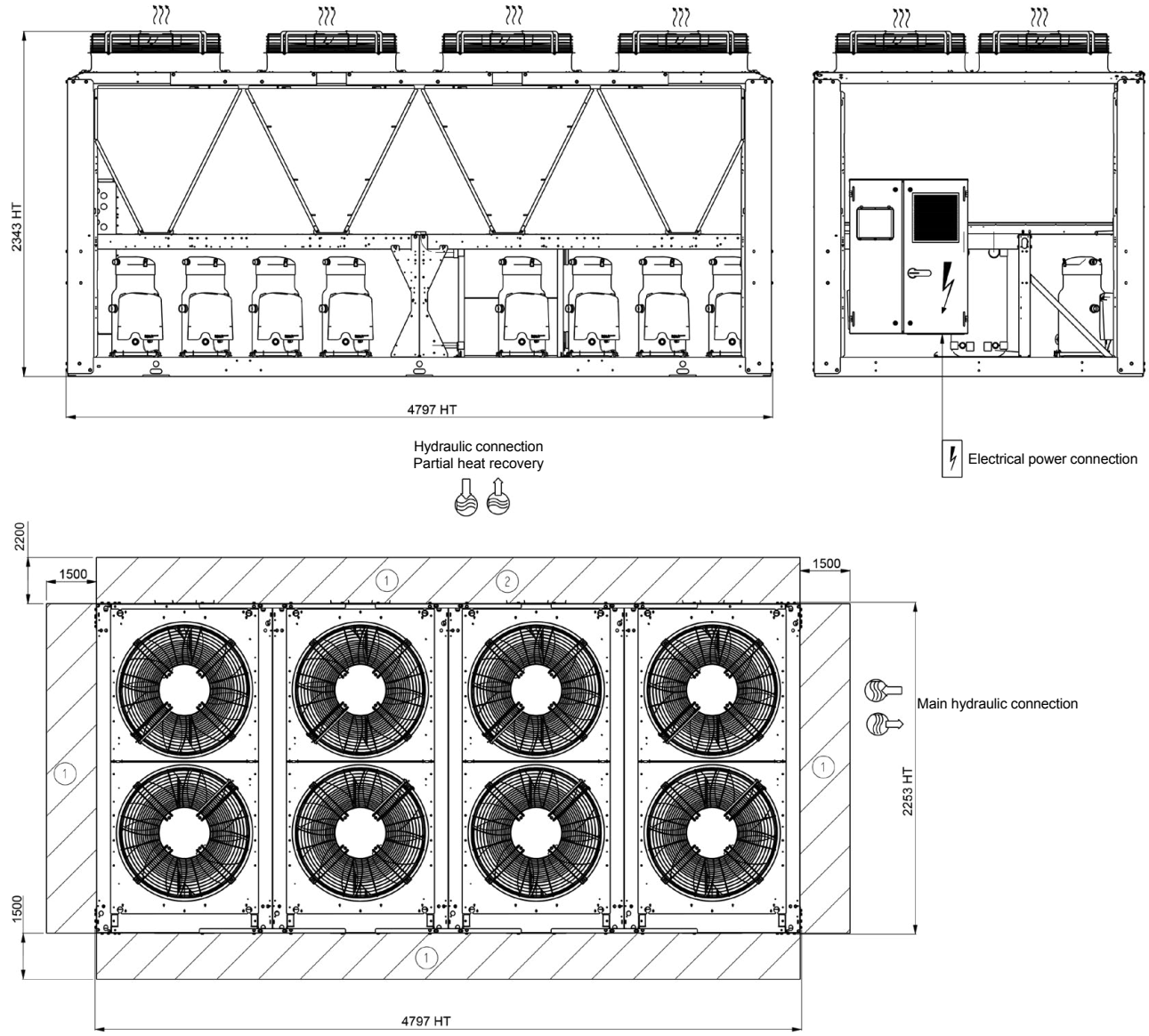
Note: For units with other options, refer to the certified dimensional drawings

AQUACIAT^{POWER} LD ST / HE 1100-1500



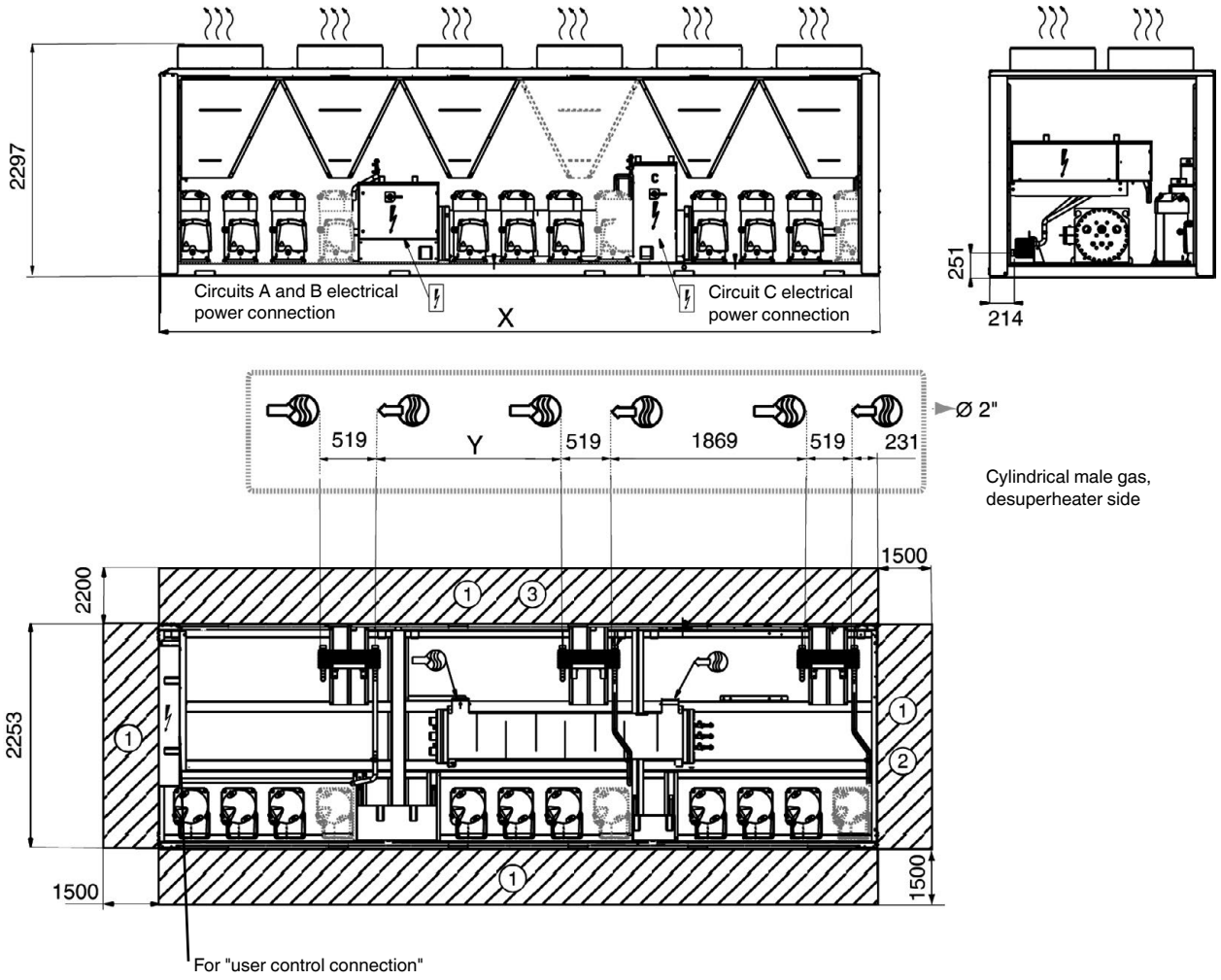
Note: For units with other options, refer to the certified dimensional drawings

AQUACIAT^{POWER} LD ST / HE 1600-2000



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

AQUACIAT^{POWER} LD HE 2100-2800



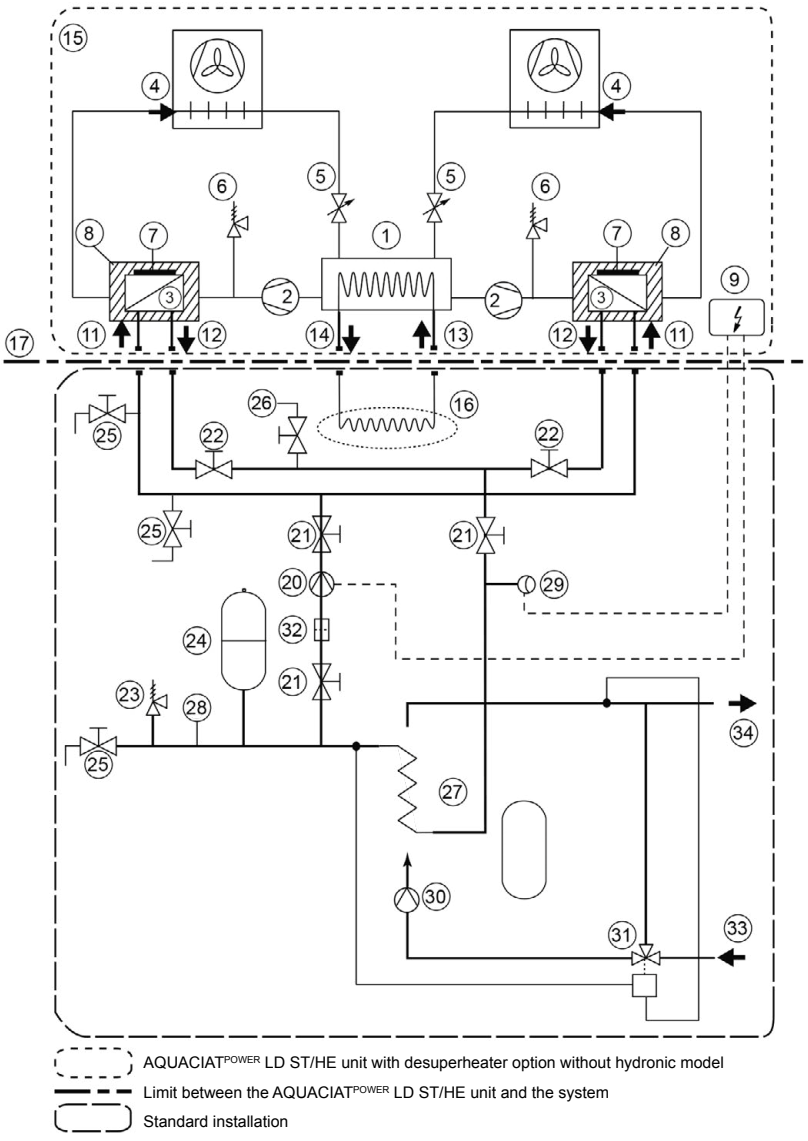
LD HE	X	Y
2100-2350	5992	1200
2550-2800	7186	1869

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

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

AQUACIAT^{POWER} LD ST/HE units with the desuperheater option are delivered with one plate heat exchanger per 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 an AQUACIAT^{POWER} LD ST/HE unit with desuperheater option in a standard system.



Key:

Components of the AQUACIAT^{POWER} LD 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- Limit between the AQUACIAT^{POWER} LD ST/HE

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.

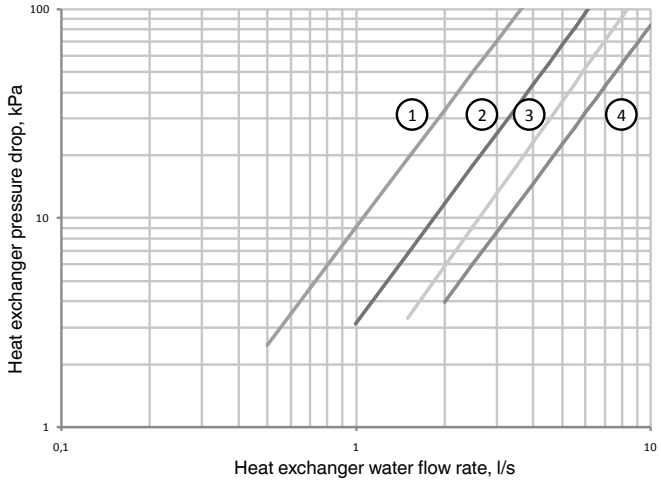
Balancing and control of the flow rates may be performed by reading the pressure drop in the exchangers.

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.

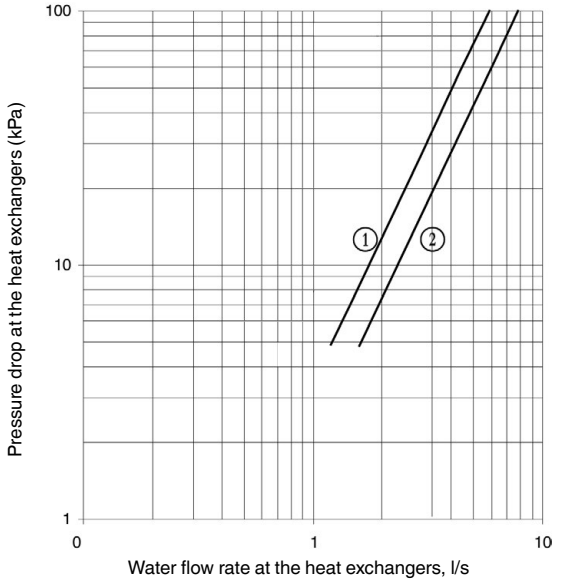
It is possible to fine-tune the water flow rate settings for each desuperheater when the unit is running at full load by trying to obtain leaving water temperatures which are strictly identical for each of the circuits.

Size 602 to 2000



① Circuit with 1 compressor
② Circuit with 2 compressors
③ Circuit with 3 compressors
④ Circuit with 4 compressors

Size 2100 to 2800



① Circuit with 3 compressors
② Circuit with 4 compressors

12.2.3.4 Operation

The desuperheater water circuit pump (see standard diagram – item 20, in the section on "Installation and operation of the heat recovery with desuperheater option") can be operated in conjunction with:

- Start-up of the first unit compressor: terminal 37/38
- Heating water requirement: output DO-01, terminal 491/492, on the EMM board.

A dedicated flow switch (item 29) can also be installed to generate an alarm if there is a problem with the pump (customer control system).

The volume of the desuperheater circuit water loop must be as low as possible to be able to rapidly increase the temperature during warm-up.

The minimum desuperheater entering water temperature is 25 °C.

This may require the use of a three-way valve (item 31), with its controller and sensor controlling the minimum required entering water temperature.

It is essential for the desuperheater water loop to comprise a valve and an expansion vessel which must be selected to take the volume of the water loop and the maximum possible temperature into account
(120 °C), in the event that pump (item 20) stops running.

12.2.3.5 Operating limits

Desuperheater		**minimum**	**maximum**
Entering water temperature at start-up	°C	25*	60 (602-2000) /75 (2100-2800)
Water outlet temperature during operation	°C	30	80
Air condenser		**minimum**	**maximum**
Water outlet temperature during operation	°C	0**	46

* 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.

** The minimum ambient temperature is 0 °C. With the "Winter operation" option it is -20 °C

12.2.3.6 Control configuration with the desuperheater option

This configuration enables the user to enter a setpoint relating to the minimum condensation temperature (default value = 30 °C) to increase the heating capacity recovered for 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.

The control of a variable speed pump must be, in this case, carried out by the unit via the 0-10 V dedicated output of the Master unit (control on Delta T° only).

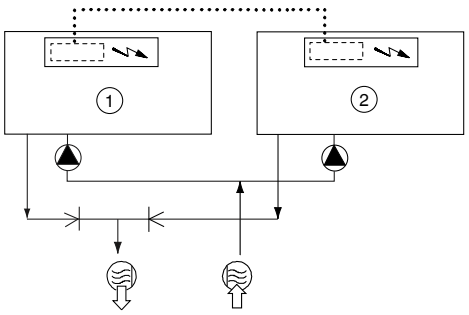
An installation in series is only possible with a fixed speed pump (example 3):

- The operation of the pump will be controlled by the Master unit.
- The Master-Slave assembly is controlled on the water outlet without additional sensor.
- The installation must be carried out only according to the diagram given in the example 3.

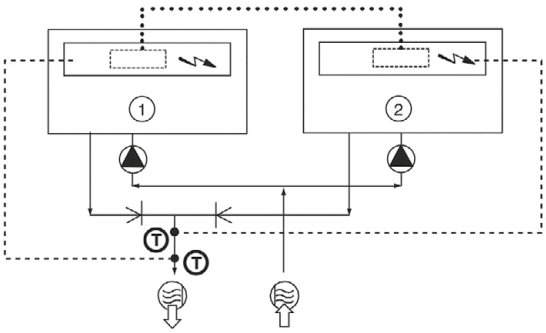
IMPORTANT:

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

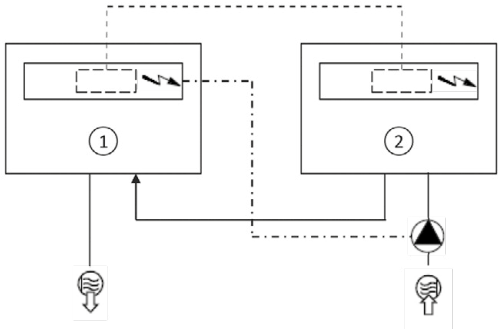
Case 1: operation in parallel - control on water inlet for a hydronic module



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



Case 3: operation in series - control on water outlet for a combination of units



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 CCN
·····	Connection of two additional sensors
	Non-return valve

12.2.5 Power factor correction

The power factor correction is active for any operating condition of the machine.

A power factor performance of 0.95 is guaranteed when the unit is running in conditions which require a power supply that exceeds the Eurovent standard condition.

A capacitor bank is controled by a regulator which read the current draw by the unit and ajust the power factor with a set up at 0,95.

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

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

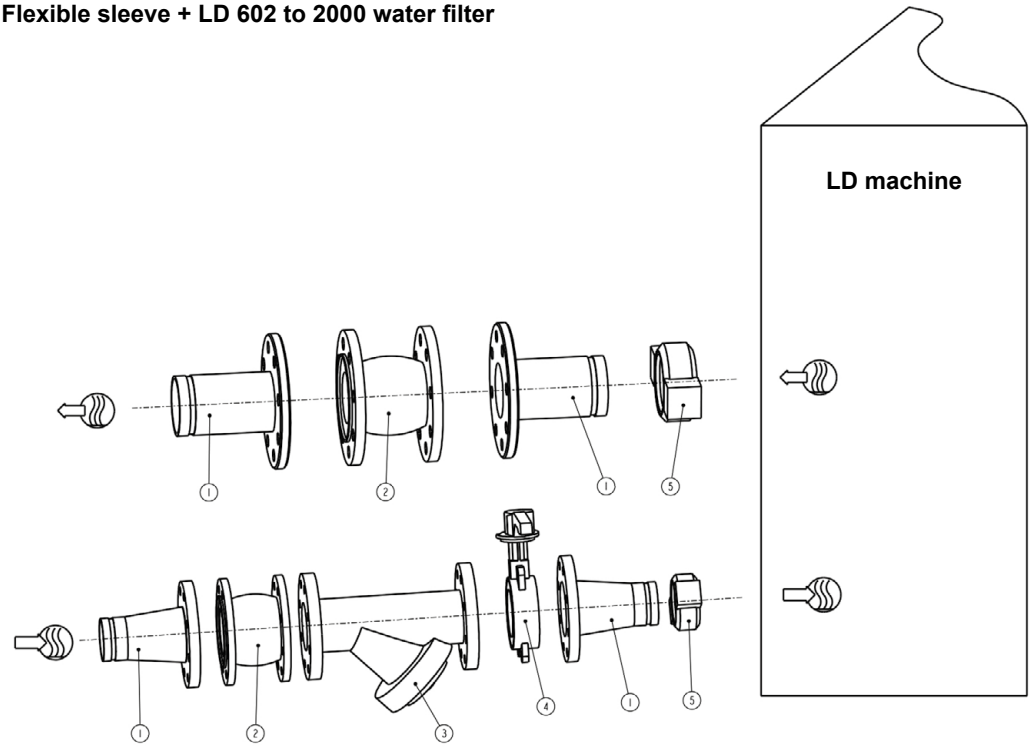
Size of the AQUACIAT^{POWER} unit		602	650	750	800	1000	1100	1250	1350	1500	1600	1750	2000
Capacitors Capacity (kVAR)		30	30	30	40	40	50	50	60	60	70	70	80
Capacitor 1	**Capacity (kVAR)**	10	10	10	10	10	10	10	20	20	10	10	20
	Ir(A)	14	14	14	14	14	14	14	29	29	14	14	29
Capacitor 2	**Capacity (kVAR)**	20	20	20	10	10	20	20	20	20	20	20	20
	Ir(A)	29	29	29	14	14	29	29	29	29	29	29	29
Capacitor 3	**Capacity (kVAR)**	-	-	-	20	20	20	20	20	20	40	40	40
	Ir(A)	-	-	-	29	29	29	29	29	29	58	58	58

Caution: Operation of the unit without capacitors results in an increase in the current.

12.2.6 Water filter and flexible connective couplings

Below are the equipment diagrams depending on the different configurations:

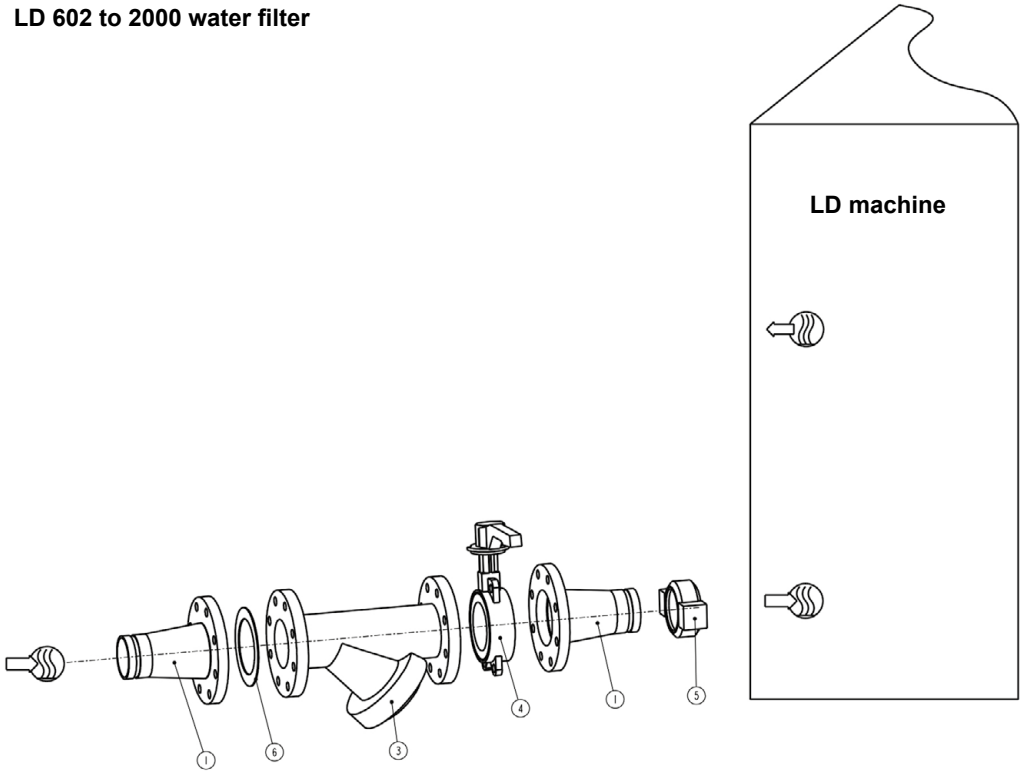
Flexible sleeve + LD 602 to 2000 water filter



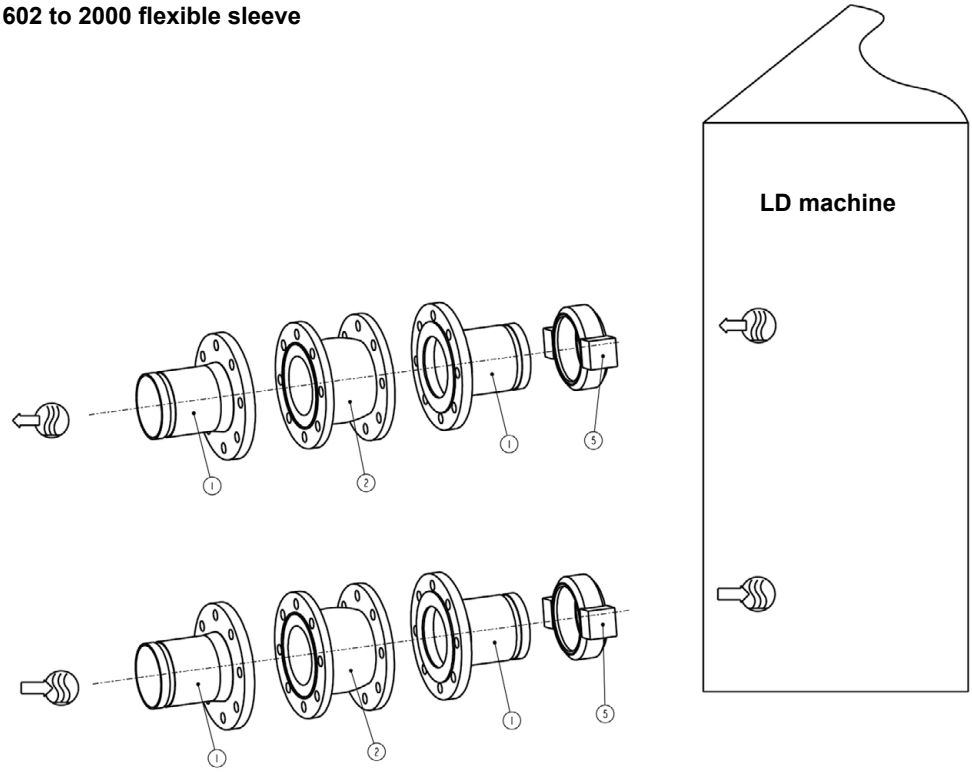
Legend:

①	Victaulic flange coupling	⑤	Victaulic clamp
②	Vibration-damping coupling	⑥	GRAPHITE gaskets (PH)
③	800 µm screen filter		Water outlet
④	Butterfly valve		Water inlet

LD 602 to 2000 water filter



LD 602 to 2000 flexible sleeve



Legend:

①	Victaulic flange coupling	⑤	Victaulic clamp
②	Vibration-damping coupling	⑥	GRAPHITE gaskets (PH)
③	800 µm screen filter		Water outlet
④	Butterfly valve		Water inlet

12.2.7 - Medium- and low temperature glycol/water solution options

The medium temperature glycol/water solution option is used for production of chilled water at low temperatures down to 0 °C.

Brine solution production from 0 °C to -15 °C is only possible with the low temperature brine solution option.

For the medium temperature brine solution option, the unit is equipped with insulation on the intake tubes.

For the low temperature brine solution option, the measuring and safety devices are protected by additional insulation.

The operating range depends on:

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

Refrigerant charge for the low temperature brine solution option

Aquaciat^{Power} LD		602	650	750	800	1000	1100	1250	1350	1500
Circuit A unit with low temperature brine solution option	kg	8,40	10,90	10,90	12,60	12,55	14,15	14,90	20,30	20,60
	tCO_2e	17,5	22,8	22,8	26,3	26,2	29,5	31,1	42,4	43,0
Circuit B unit with low temperature brine solution option	kg	12,25	12,60	12,05	12,70	12,55	20,20	19,70	19,90	21,70
	tCO_2e	25,6	26,3	25,2	26,5	26,2	42,2	41,1	41,6	45,3

Frost protection

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

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

It is therefore 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 or supplier data to define the freezing temperature according to the measured concentration level.

The minimum frost protection temperature must be entered in the unit controller's parameters.

This value will be used to configure the following protection:

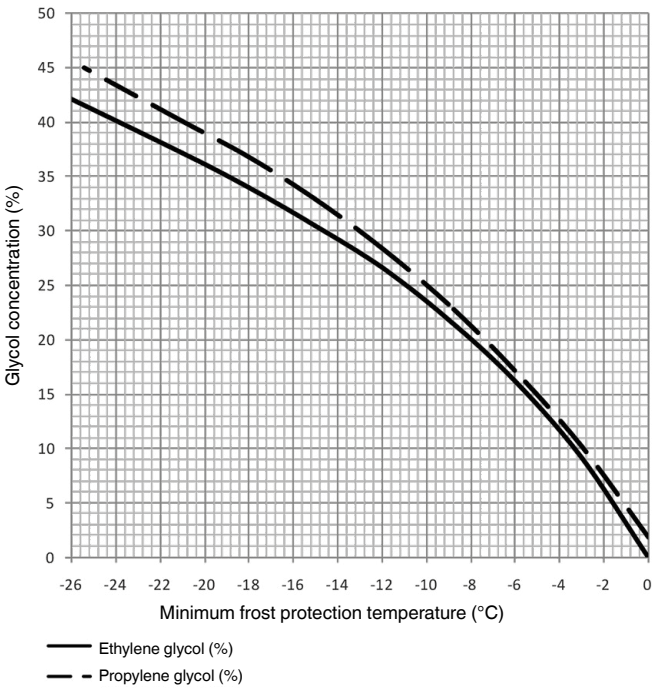
1. Evaporator antifreeze protection.

2. Low-pressure protection.

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):

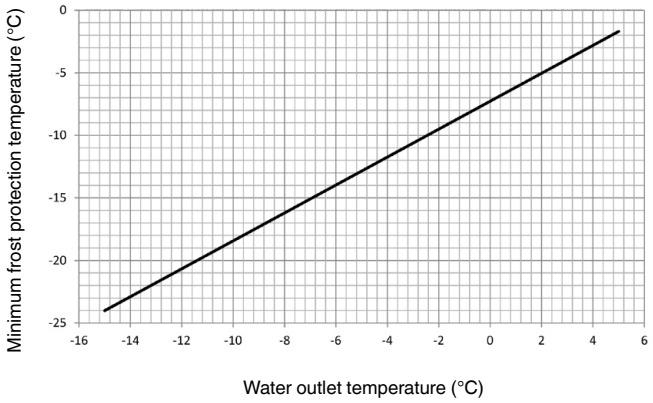
Glycol concentration required

Ethylene and Propylene glycol freezing curve



Minimum frost protection temperature to be observed based on the water outlet temperature.

Minimum frost protection temperature based on the leaving water temperature (example)



For example, based on the above curves, if the ethylene glycol mass concentration measured in the loop is 35%, the frost protection temperature value of -19.1 °C must be entered in the software. This corresponds to a minimum leaving water temperature of -9.6 °C. The control point must be adjusted as a result.

IMPORTANT:

- **It is vital to perform a (minimum) annual inspection of the glycol level and adjust the software's frost protection based on the measured level.**
- **This procedure must be systematic when topping up with water or antifreeze solution.**
- **Observe the minimum frost protection temperature based on the leaving water temperature.**

NOTE:

- **In the case of frost protection of the unit by low air temperature, the percentage of glycol must be evaluated accordingly.**
- **The maximum glycol level in the case of units equipped with a hydronic module is 45%.**
- **In order to facilitate maintenance operations, it is recommended to install isolation valves upstream and downstream of the unit**

12.2.8 - Units with available pressure fans

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 cold air produced by 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 generates a pressure drop due to the air flow resistance.

For each installation, the duct pressure drops differ, depending on the duct length, the duct section and the direction changes. Therefore, more powerful fan motors are installed in this option than on the standard units.

Ductable units equipped with this option are designed to operate with ducts whose air evacuation generates a maximum pressure drop of 200 Pa.

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 cooling mode, the full-load or part-load speed is controlled by a patented algorithm that permanently optimises the condensing temperature to ensure the best unit energy efficiency (EER) 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. Refer to the control manual.

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

12.2.8.1 - Nominal and maximum air flow rate per circuit and per unit type

LD HE	Circuit A	Circuit B
	Nominal/maximum air flow rate (l/s)	Nominal/maximum air flow rate (l/s)
602	5200 / 6240	10400 / 12480
650-1000	10400 / 12480	10400 / 12480
1100-1250	10400 / 12480	15600 / 18720
1350-1500	15600 / 18720	15600 / 18720
1600-1750	15600 / 18720	20800 / 24960
2000	20800 / 24960	20800 / 24960

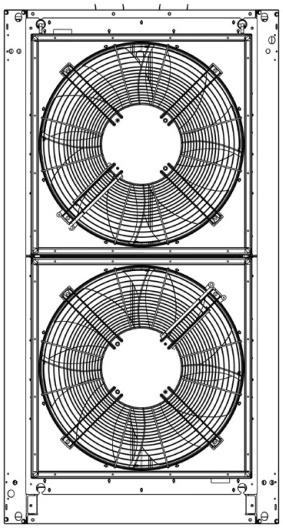
12.2.8.2 - Air connection on discharge

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.

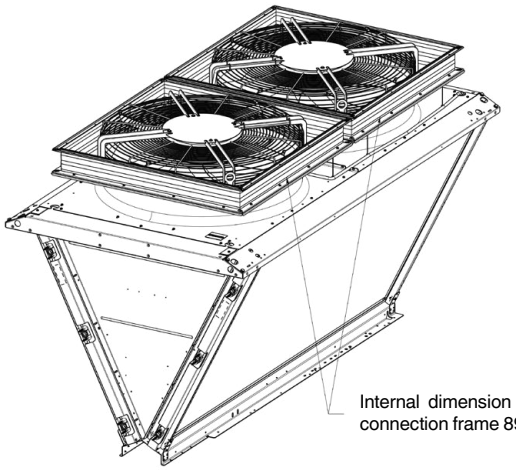
Factory-installed duct connection interface on each fan

V-SHAPED AIR-COOLED EXCHANGER

TOP VIEW

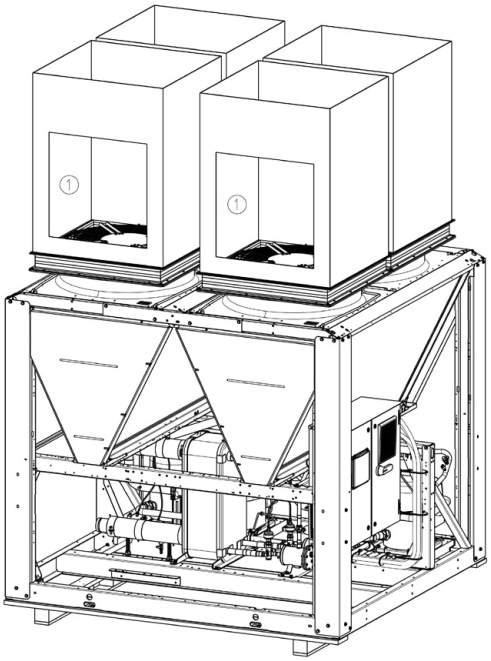


SIDE VIEW

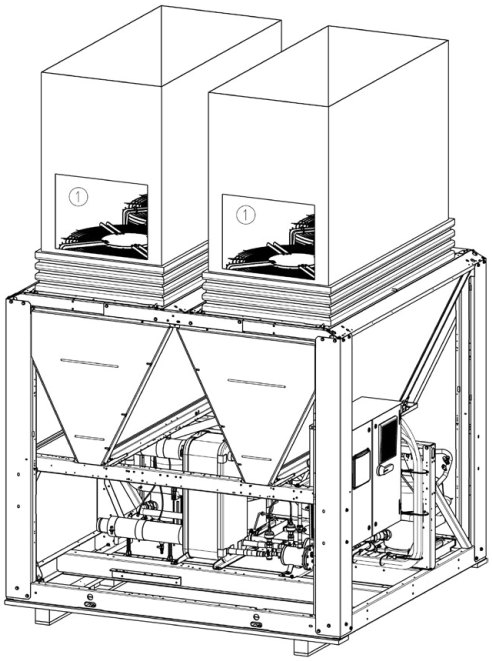


Principle of the installation of the ducts

Each fan-motor assembly has its own duct



2 fans can used the same duct



① Access hatch for maintaining the ventilation components for each duct.

Rules for a correct ductwork

- each duct must serve a maximum of 2 fans – DO NOT EXCEED this limit
- if multiple fans share the same duct, they must belong to the same refrigerant circuit and the same air-cooled exchanger system.

IMPORTANT: The duct connections on the units must not generate any mechanical stress on the fan supporting structure.

Install an access hatch at each duct outlet to promote maintenance of ventilation components.

Fan motor electrical protection

Each motor is electrically protected in case of a locked rotor or overload.

12.2.9 - Pump protection and control options

The pump protection and control options give the customer access to outlets designed for the supply and actuation of pumps external to the machine.

These outlets include electrical protection provided by a magnetothermal circuit breaker and a control contactor actuated by the machine's control system.

The protections and controls are sized based on the factory-fitted pumps outlined in the section "Electrical data for the hydronic module".

12.2.10 - Shell and tube water type heat exchanger

Units equipped with this option have an STHE direct expansion evaporator rather than a BPHE (brazed plate heat exchanger). The refrigerant is evaporated in a copper tube bundle and the water circulates in the heat exchanger's shell and tube assembly).

12.2.10.1 - Physical characteristics of units with shell and tube heat exchanger option

AQUACIAT^{POWER} LD ST + shell and tube heat exchanger option		602	650	750	800	1000
Operating weight(1)						
Standard unit	kg	1604	1650	1651	1780	1781
Unit + Low Noise option	kg	1687	1733	1734	1888	1889
Unit + Low Noise + HP dual-pump hydronic module option	kg	1865	1911	1912	2066	2082
Unit + Low Noise + HP dual-pump hydronic module + Buffer tank module option	kg	2824	2870	2871	3025	3041
AQUACIAT^{POWER} LD HE + shell and tube heat exchanger option						
Operating weight(1)						
Standard unit	kg	1633	1679	1679	1809	1809
Unit + Low Noise option	kg	1716	1762	1762	1917	1917
Unit + Low Noise + HP dual-pump hydronic module option	kg	1894	1940	1940	2095	2110
Unit + Low Noise + HP dual-pump hydronic module + Buffer tank module option	kg	2853	2899	2899	3054	3069
AQUACIAT^{POWER} LD ST/HE + shell and tube heat exchanger option						
Refrigerant(1)		R410A				
Circuit A	kg	9,80	12,60	12,60	13,60	13,60
	tCO_2e	20,5	26,3	26,3	28,4	28,4
Circuit B	kg	13,80	13,80	13,80	13,80	13,80
	tCO_2e	28,8	28,8	28,8	28,8	28,8
Water-cooled heat exchanger						
Water volume	l	92	92	92	92	92
Max. water-side operating pressure without hydronic module	kPa	1000	1000	1000	1000	1000
Water connections without hydronic module		Victaulic® type				
Connections	inch	4	4	4	4	4
Outside tube diameter	mm	114,3	114,3	114,3	114,3	114,3
Water connections with hydronic module		Victaulic® type				
Connections	inch	3	3	3	3	3
Outside tube diameter	mm	88,9	88,9	88,9	88,9	88,9

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

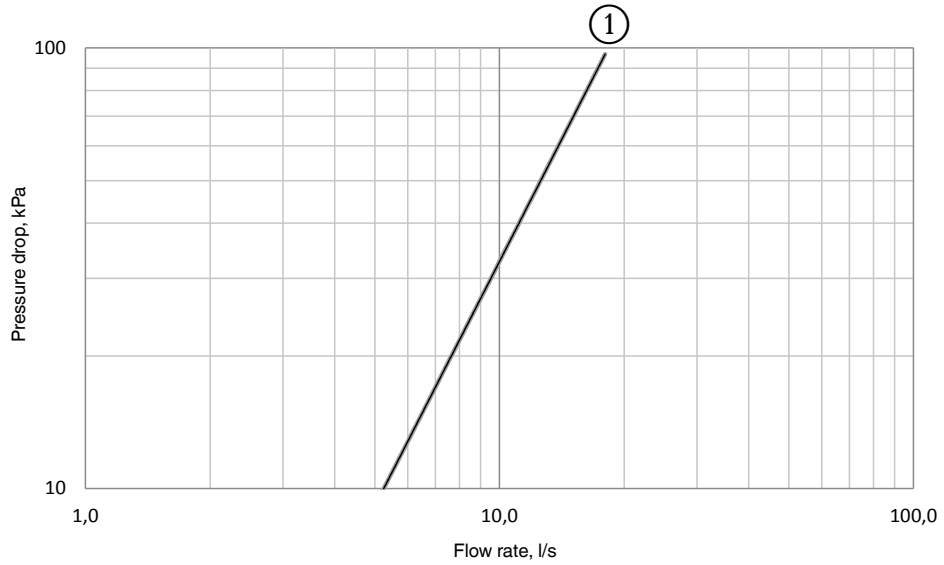
12.2.10.2 - Installation, operation, settings

The instructions supplied for standard units (plate heat exchanger) are applicable for units with the shell and tube heat exchanger option, in particular those relating to the operating area ("Application data" section), frost protection ("Water connections" section) and installation settings ("Setting the installation's nominal flow rate" section).

However, note that the data in the sub-sections must be replaced with the table and the graph shown below:

- Water exchanger min. water volume and flow rate
- Pressure drop curves for the water type heat exchanger and standard water inlet/outlet piping

AQUACIAT^{POWER} LD ST / LD HE		602	650	750	800	1000
Shell and tube evaporator	**Min(1) / max(2) water exchanger flow rate without hydronic module (l/s)**	2.9 / 18.3	3.2 / 18.3	3.6 / 18.3	3.8 / 18.3	4.6 / 18.3



① AQUACIAT^{POWER} LD ST HE 602 - 1000

12.2.10.3 - Combination with medium and low temperature brine solution options

The instructions supplied for standard units (plate heat exchanger) are applicable to units with the shell and tube heat exchanger option, except for:

- the minimum water outlet temperature for the heat exchanger, which is limited to -12 °C for use with low temperature brine solution. This remains unchanged, and limited to 0 °C for use with medium temperature brine solution.
- the refrigerant charge with low temperature brine solution option - the adjusted values are shown in the following table:

AQUACIAT^{POWER} LD ST + shell and tube heat exchanger option + low temperature brine solution option		602	650	750	800	1000
Refrigerant(1)		R410A				
Circuit A	kg	9,80	12,10	12,10	13,10	13,10
	tCO_2e	20,5	25,3	25,3	27,4	27,4
Circuit B	kg	13,30	13,30	13,30	13,30	13,30
	tCO_2e	27,8	27,8	27,8	27,8	27,8

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

12.2.11 - Unit operation with a free cooling drycooler (optional)

12.2.11.1 - Operating principle

The units have been designed to optimise the operation of systems, using drycoolers as a free cooling system (method using low outdoor air temperatures to chill the water in the air conditioning system).

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

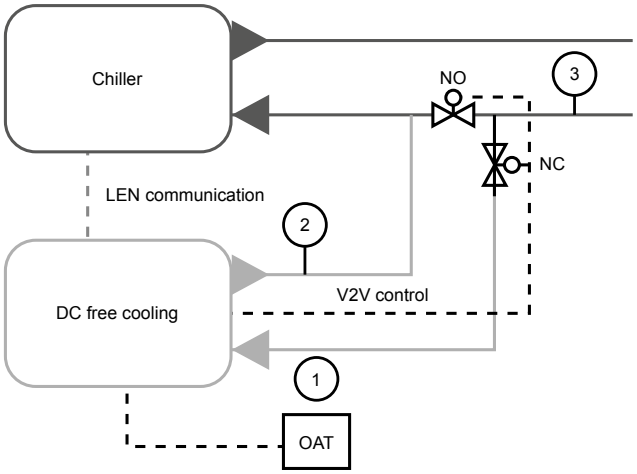
The unit's Connect Touch control system includes algorithms which enable continuous automatic optimisation of the following:

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

The control defines the optimal configuration, taking the water setpoint value, outdoor air temperature, and water loop temperature into account (the control will give priority to the drycooler).

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

Warning: the drycooler and chiller both need to be equipped with the Free cooling management option.



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

- using the water inlet temperature control,
- using the delta temperature control for the variable speed pump option.

12.2.11.2 - Communication to control the drycooler

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

This cable must be a 3-point Wago type cable (5 mm spacing or equivalent) and must be shielded.

The board integrated in the drycooler control panel has analogue inputs for the outside air temperature (item 1), water loop return (item 3), and drycooler water outlet temperature (item 2) sensors, as well as digital outputs for controlling the fans.

The option works as a system split in two parts:

The chiller (with free cooling option):

Dedicated control algorithms supplied with the LEN connector to control the drycooler.

The drycooler (with free cooling option):

- AUX board with the I/O
- room air temperature sensor to be placed outdoors,
- drycooler water outlet temperature sensor (factory-fitted),
- water loop temperature sensor (to be fitted on the common pipe upstream of the valve),
- Control & 230V power supply for 2 two-way valves or one three-way valve

The difference between the drycooler outdoor air temperature and the water loop sensor temperature determines whether or not it is possible to activate free cooling mode.

12.2.11.3 - Configuration of the fan control

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

Connect Touch controls the automatic switching of all fans, based on operating time and number of start-ups, to ensure the fan motors provide a long service life.

Compatible fans configuration:

- 1 to 20 fans,
- fixed speed or variable speed
- fans in one l or 2 lines

Refer to the drycooler wiring diagram to see the arrangement of the fan stages.

12.2.11.4 - Valves on the water loop

The free cooling system requires two two-way valves (one normally open, one normally closed) or a three-way valve, not supplied with the unit or the drycooler.

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

The drycooler control panel has a 230 V power supply for two two-way valves.

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

See the drycooler wiring diagram for cabling the valves to the customer terminal strip.

12.2.11.5 - Guidelines for system installation

For the physical properties, dimensions and performances: see the drycooler documentation.

For the electrical connections, see the electrical wiring diagram supplied with the drycooler.

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

For correct installation of the drycooler, the rules for calculation and sizing relating to the following areas must be observed:

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

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 profes-sional 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 material 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 refrigerating circuit, it is necessary to evacuate the refrigerant charge from the device using a charge transfer unit.

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

- Optimisation of energy performance,
- Reduced electricity consumption,
- Accidental breakage of components prevented,
- Prevention of major time-consuming and costly interventions,
- Protection of the environment.

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

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:

- Visual check for traces of oil (indicates a refrigerant leak),
- Check for leaks in the hydraulic circuit (monthly),
- Clean the air-cooled 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 level can be monthly or annually depending on the verification 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 a variable frequency drive, regularly check the cleanliness of the filter media to maintain the correct air flow.
- Check that the capacitor is operating correctly (Power factor correction option).

Mechanical:

- Check that the mounting bolts for the ventilation sub-assemblies, fans, compressors and electrics box are securely tightened

Hydraulics:

- 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 the electrical connections

Component 602-2000	Designation in the unit	Value (N.m)
Welded screw PE, customer connection	-	40
Screw terminal, fuse holder	FU1, FU2, FU3, FU4	10
Screw terminal, fuse holder	FU100	0.8-1.2
Screw terminal, compressor contactor	KM1-->KM12	3 - 4,5
Brass screw M6, compressor ground	EC-	5
M6 screw, compressor connection	EC-	5
Screw terminal, circuit breakers	QM-	2
Screw terminal, pump contactor	KM90 - KM90A	2,5
M8 screw customer connection (size 602-800)	QS100	15 to 22
M10 screw customer connection (size 1000-1500)	QS100	30 to 44
M12 screw customer connection (size 1600-2000)	QS100	50 to 75
Screw terminal, circuit breakers (size 602-1500)	QF100	3.2-3.7
Screw terminal, circuit breakers (size 1600-2000)	QF100	8-10
Screw terminal, fuse holder 32A (Power factor correction option)	Fu-	2,5
Screw terminal, fuse holder 100A (Power factor correction option)	Fu-	3.5 - 4

Component 2100-2800	Designation in the unit	Value (N.m)
M12 screw on customer busbars		80
Welded screw PE, customer connection		80
Screw terminal, fuse holder	Fu-	3-3.5
Tunnel terminal screw, compressor contactor	KM1-->KM12	3-4.5
M6 brass screw, compressor earth	EC-	5
M6 screw, compressor connection	EC-	5
Screw terminal, circuit breakers	QM-	0.8-1.2
Screw terminal, pump contactor	KM90 - KM90A	2.0-2.5
Power distribution M6 earth screw	-	10
Ventilation/control unit M6 earth screw	-	10

13.5 - Tightening torques for the main fastenings

602-2000 screw type	Use	Value (N.m)
Metal screw D = 4.8	Condensing module, Casing, Supports	4,2
Taptite screw M10	Condensation module, chassis-structure, electrical box fixing, plate heat exchanger and pump	30
Taptite screw M6	Pipe supports, enclosure, variable frequency drive supports	7
Oil equalisation screw	Oil equalisation line	145
H M6 screw	Pipe clip	10
Nut H M10	Compressor frame and mounting, fan module	30

2100-2800 screw type	Use	Value (N.m)
Metal screw D = 4.8	Condensing module, Casing, Supports	4,2
Screw H M8	Condensation module, compressor mounting	18
Taptite screw M10	Condensation module, frame - structure, control unit mounting	30
Taptite screw M6	Mounting pipes, enclosure	7
Screw H M8	Pipe clip	12
H M6 screw	Pipe clip	10
H M10 nut	Compressor frame	30

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, especially urban and industrial sites, and for units installed near trees that shed their leaves.

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 and scrub the entire connection with a flexible Nylon, PolyPro® or Tynex® brush and low pressure tap water.

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 three months) will prevent two-thirds of corrosion problems. Protect the electrics box during cleaning operations.

13.7 - Water 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 variable frequency drive, 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 variable frequency drive, contact the manufacturer's service.

The variable frequency drives 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-cooled 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 based on the gauge pressure (in kPag)

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		

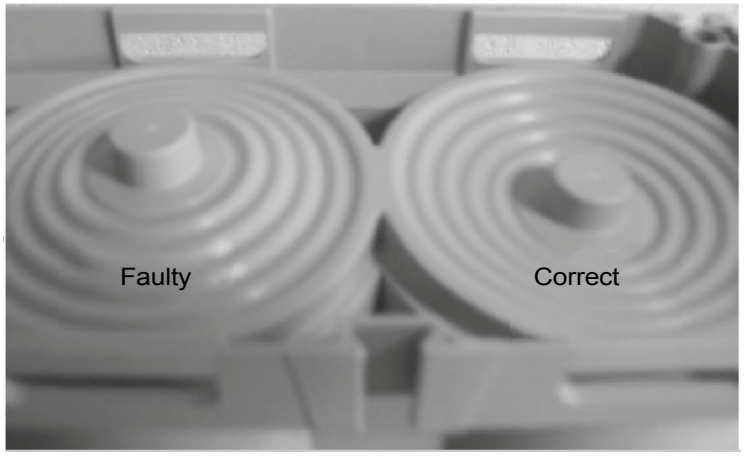
13.11 - Power factor correction

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

Check per phase current delivered by each capacitor and compare it to nominal values. In case of capacitance losses or unbalance, the capacitors must be replaced.

Ensure that the current through the capacitor doesn't exceed 1.3xIr. A higher value may indicate heavy presence of harmonics, that will impact the lifetime of the capacitor.

Absence of current despite capacitor is energized is an indication that there is a defect. This defect is confirmed by removing the capacitors and checking the underside.



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, brine solution...
- 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: ..... Serial number .....

Compressors

Circuit A	**Circuit B**
1. Model # ..... Serial number.....	1. Model # ..... Serial number.....
2. Model # ..... Serial number.....	2. Model # ..... Serial number.....
3. Model # ..... Serial number.....	3. Model # ..... Serial number.....
4. Model # ..... Serial number.....	4. Model # ..... Serial number.....

Air handling equipment

Manufacturer .....
Model #..... Serial number.....

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

Check of the 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

☐ The chilled water pump contactor has been correctly cabled 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
☐ The compressor crankcase heaters have been running for 6 hours

Check cooler 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 .....
☐ Correct loop frost protection included (if required)..... ..... litres of.....
☐ Water pipes have been fitted with trace heating up to the evaporator
☐ Return water piping is equipped with a screen filter with a mesh size of 1.2 mm

Checking the pressure drop across the evaporator (without hydronic module) or ESP* (with hydronic module)

Evaporator inlet = ... (kPa)
Evaporator outlet = ... (kPa)
Pressure drop (entering - leaving) = ... (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, an indication of the flow is displayed by the unit control (see the AQUACIAT^{POWER} LD ST / HE 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 .....
Set point reset mode .....
Night-time capacity setback.....

Re-enter the setpoints

To start up the cooler

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 are complete, start up 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 duct temperature.....
Circuit B liquid duct temperature .....

NOTES:

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