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11 - 2018

AQUACIATPOWER ILD

Instruction manual

CIAT

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

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

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

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

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

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

To find out if these products comply with European directives (machine safety, low-voltage, electromagnetic compatibility, pressurised equipment, 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 and not 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/m². No combustible matter should be placed within 6.5m of the unit.
(3) The instantaneous over-pressure limitation of 10% of the operating pressure does not apply to this abnormal service situation.
The set pressure can be higher than the operating pressure. In this case, either the design temperature or the high pressure switch ensures that the operating pressure is not exceeded in normal service situations.
(4) The classification 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 accessories have been re-installed if the system 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-fitted relief valves are lead-sealed to prevent any calibration change.

The external relief valves must always be vented to outside if the units are installed in a closed space. Refer to the installation regulations, for example those of European standard EN 378 and EN 13136. These pipes must be installed in a way that ensures that people and property are not exposed to vented refrigerant. As the fluids can be diffused in the air, ensure that refrigerant is discharged away from building air intakes, relief valves must be checked periodically. The valves must be checked periodically.

If the relief valves are factory-fitted on a changeover 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 EN378: once a year for the high pressure switches, every five years for the external relief valves.

The company or organisation that conducts a pressure switch test must establish and implement detailed procedures for:
- Safety measures,
- Measuring equipment,
- Values and tolerances for cut-off and discharge devices,
- Test stages,
- Recommissioning of the equipment.

The principle for performing a test without disassembly of the pressure switch is given here, however the manufacturer recommends contacting the Service for this type of test:
- Verify and record the setpoints of pressure switches and external relief devices (valves and possible rupture disks),
- 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 the refrigerant pressure to rise.

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 per circuit (equivalent CO_2)		< 5 tonnes	5 ≤ charge < 50 tonnes	50 ≤ charge < 500 tons	Charge > 500 tons(1)
Refrigerant charge per circuit (kg)	R134a (GWP 1430)	Charge < 3.5 kg	3.5 ≤ charge < 34.9 kg	34.9 ≤ charge < 349.7 kg	charge > 349.7 kg
	R407C (GWP 1774)	Charge < 2.8 kg	2.8 ≤ charge < 28.2 kg	28.2 ≤ charge < 281.9 kg	charge > 281.9 kg
	R410A (GWP 2088)	Charge < 2.4 kg	2.4 ≤ charge < 23.9 kg	23.9 ≤ charge < 239.5 kg	charge > 239.5 kg
	HFOs: R1234ze	No requirement			

(1) From 01/01/2017, units must be equipped with a leak detection system.

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

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

Check regularly for leaks and, if detected, have these repaired immediately.

1.3 - Installation safety considerations

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

Pressure equipment and components

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

These units comply with the European Pressure Equipment Directive.

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

Do not introduce significant static or dynamic pressure with regard to the operating pressures used 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.
- The user or operator is usually required to create and maintain a monitoring and maintenance log.
- In the absence of any regulations, or in addition to the regulations, follow the guidance in EN 378.
- Follow the local professional recommendations, whenever they exist.
- Regularly monitor the surface of the components to detect cavernous corrosion. To do this check an uninsulated part of the pressure vessel or at a joint in the insulation. Regularly check for the presence of any impurities (e.g. sand, grit) in the heat transfer fluids. These impurities can cause wear and/or pitting corrosion.
  Filter the heat transfer fluid and perform internal visits and inspections as described in EN 378
  Reports from the periodical checks by the user or the operator must be added to the monitoring and maintenance register.

Repair:

Any repair or modification, including replacement of removable parts:
- Must comply with local regulations and must be performed by qualified operators in accordance with qualified processes, including changing a wiring harness 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 specifically trained on this equipment and system.

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 shoe, 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 electrics box, wait 5 minutes before accessing the electrics 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 initial machine start-up.

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

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

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

1.5 - Safety considerations during system interventions

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

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

Risk of explosion:

Never use air or gases containing oxygen during leak tests, to purge 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 refrigerant circuit components 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 lines can break under the weight and release refrigerant, causing personal injury.

Do not climb on a machine. Use a platform to work at height.

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

For lighter components, use lifting equipment if there is any risk of slipping or losing your balance.

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

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

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

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

2 - RECEIPT OF GOODS

2.1 - Check equipment received

Check that the unit and the accessories have not been damaged during transport and that no parts are missing. If the unit and the accessories have been damaged or the shipment is incomplete, send a claim to the shipping company.

Compare the name plate data with the order.

The name plate is attached in two places to the unit:
- On the outside of one of the unit frames,
- On the inside of the electrical panel door.

The unit name plate must include the following information:
- Model number - size,
- CE marking,
- Serial number,
- Year of manufacture and pressure and leak tightness test date,
- Fluid used for transport,
- Refrigerant used,
- Refrigerant charge per circuit,
- PS: Min./max. allowable pressure (high and low pressure side),
- TS: Min./max. allowable temperature (high and low pressure side),
- Pressure switch cut-out pressure,
- Unit leak test pressure,
- Voltage, frequency, number of phases,
- Maximum current,
- Maximum power input,
- Unit net weight.

3 - HANDLING AND POSITIONING

3.1 - Handling

It is strongly recommended that a specialised 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.

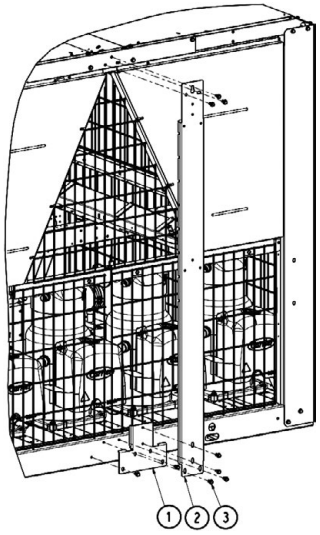
The units can also be lifted with slings, using only the designated lifting points marked on the unit (labels on the chassis and label with the unit handling instructions, attached to the unit).

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. Otherwise there is a risk of equipment deterioration or injury to personnel.



Keep the uprights following start-up and refit them when moving the unit.

In some cases, uprights are added for transporting and handling the unit. The uprights must be removed if necessary for access or connection.

Important:

follow the disassembly procedure indicated in the disassembly instructions.

- Undo the bolt (3).
- Remove the upright (2).
- Remove the plate (1).

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.

If the unit is to be raised, ensure the machine's surroundings 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.

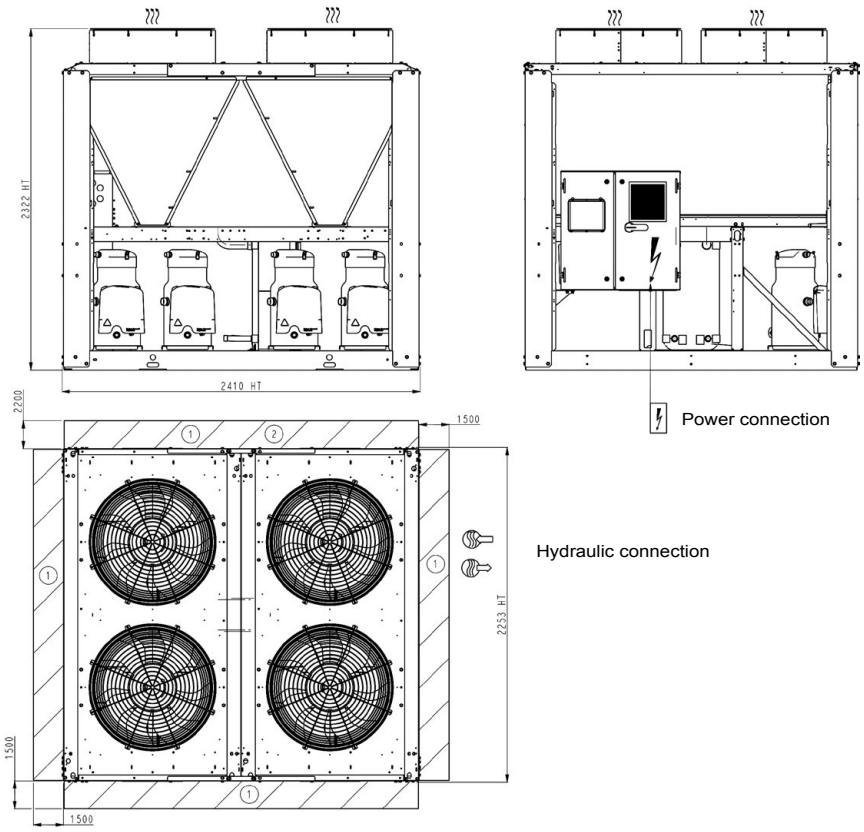
Before lifting the unit, check that all casing panels and grilles are securely fixed in place. Lift and set down the unit with great care. Tilting and jarring can damage the unit.

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-cooled heat exchanger (with or without the hydraulic 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.

4.1 - AQUACIAT^{POWER} ILD ST / HE 602-900

Without buffer tank module



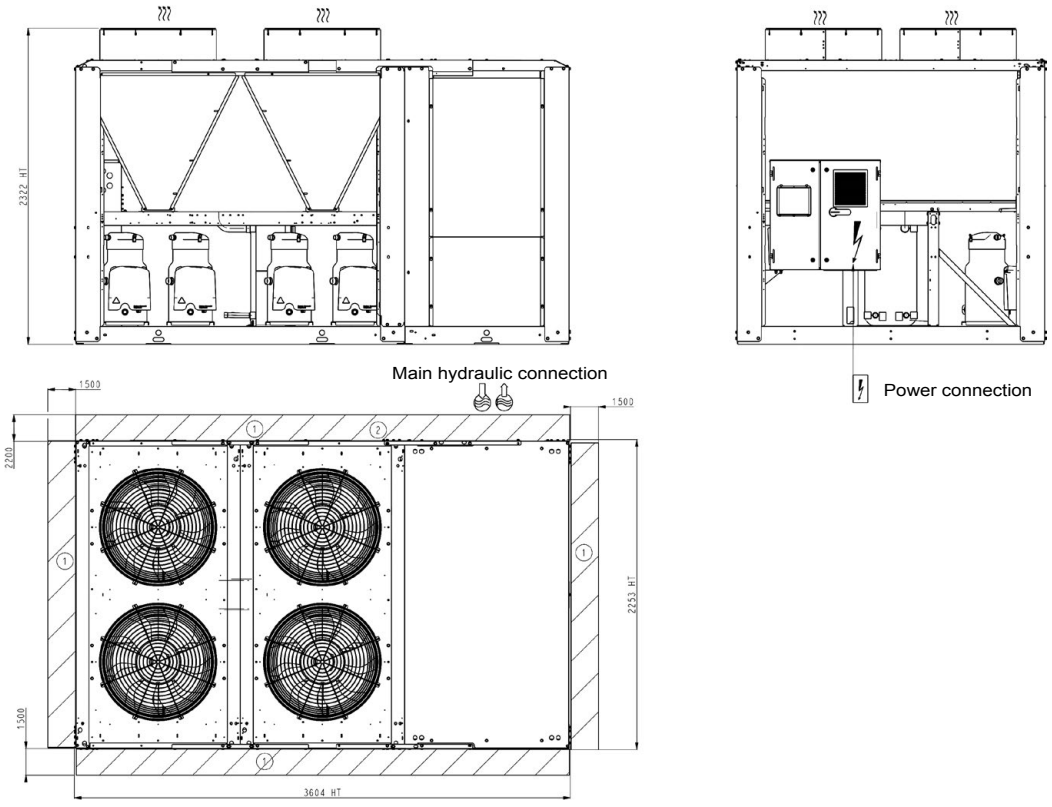
Legend:
All dimensions are in mm.

- (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:

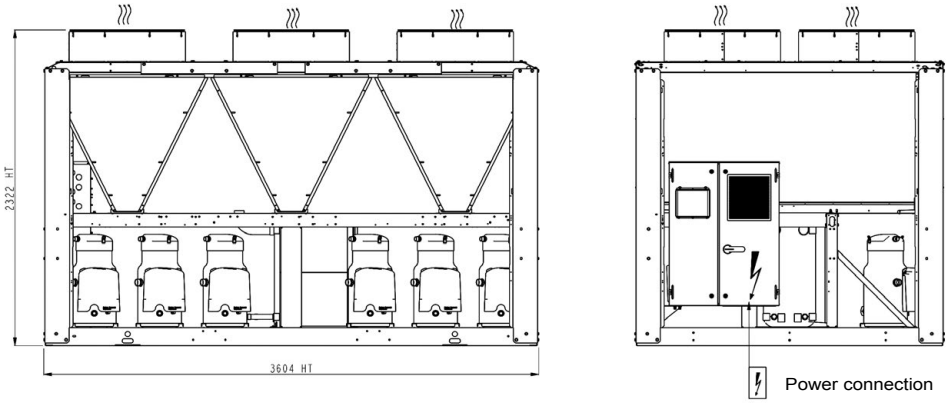
- **Non-contractual drawings.**
- **When designing a system, refer to the certified dimensional drawings provided with the unit or available on request.**
- **Please refer to the certified dimensional drawings, for the positioning of the fixing points, weight distribution points and centre of gravity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

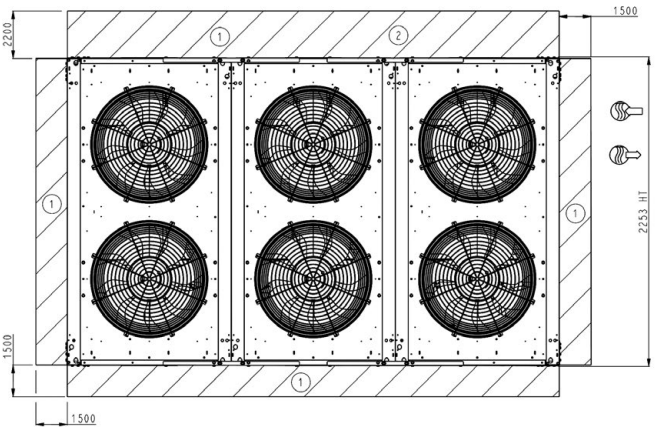
With buffer tank module



4.2 - AQUACIAT^{POWER} ILD ST / HE 902-1200

Without buffer tank module





Hydraulic connection

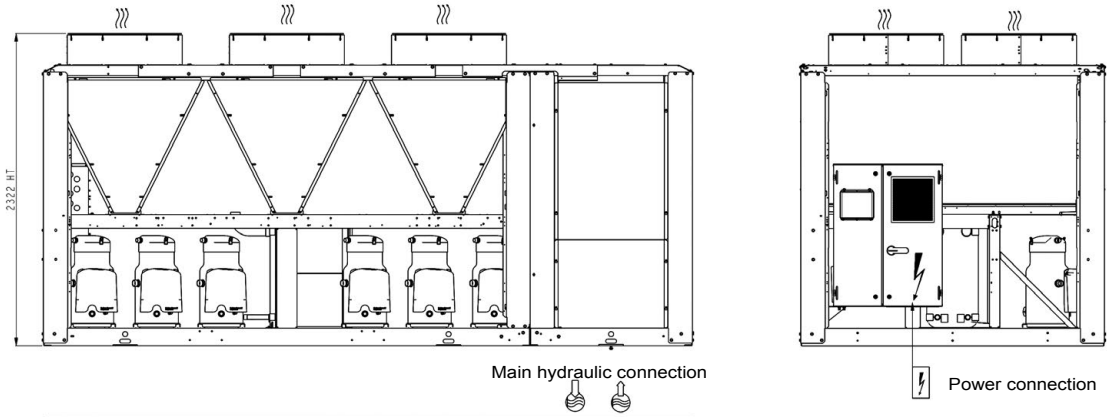
Legend:
All dimensions are in mm.

- (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

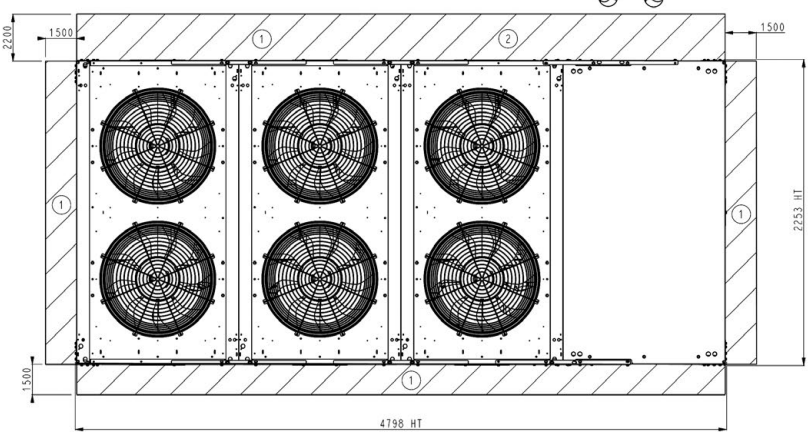
NOTE:

- **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

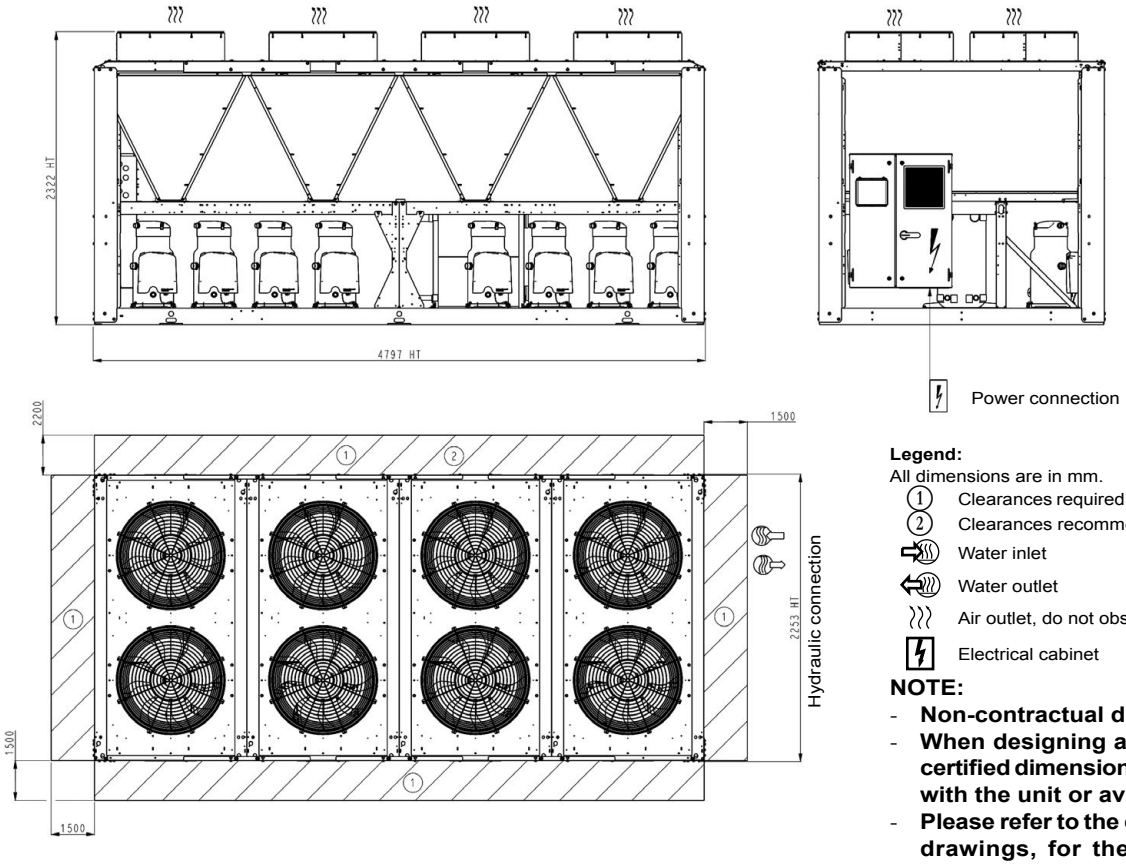


Main hydraulic connection



4.3 - AQUACIAT^{POWER} ILD ST / HE 1400-2000

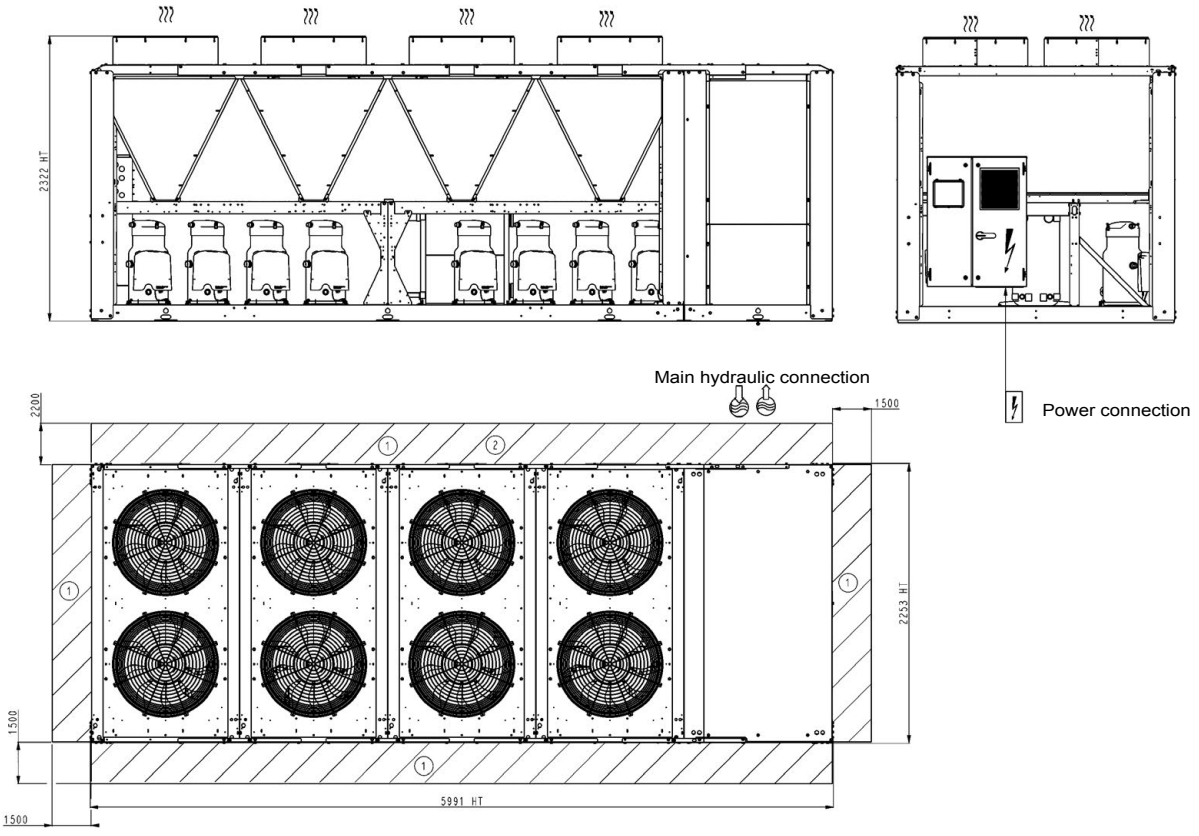
Without buffer tank module



Legend:
All dimensions are in mm.
- (1) Clearances required for maintenance and air flow
- (2) Clearances recommended for coil removal
- Water inlet
- Water outlet
- Air outlet, do not obstruct
- Electrical cabinet

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

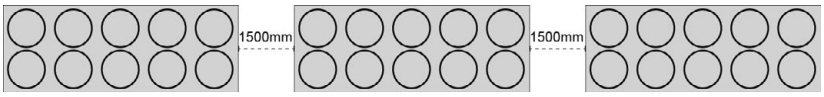
With buffer tank module



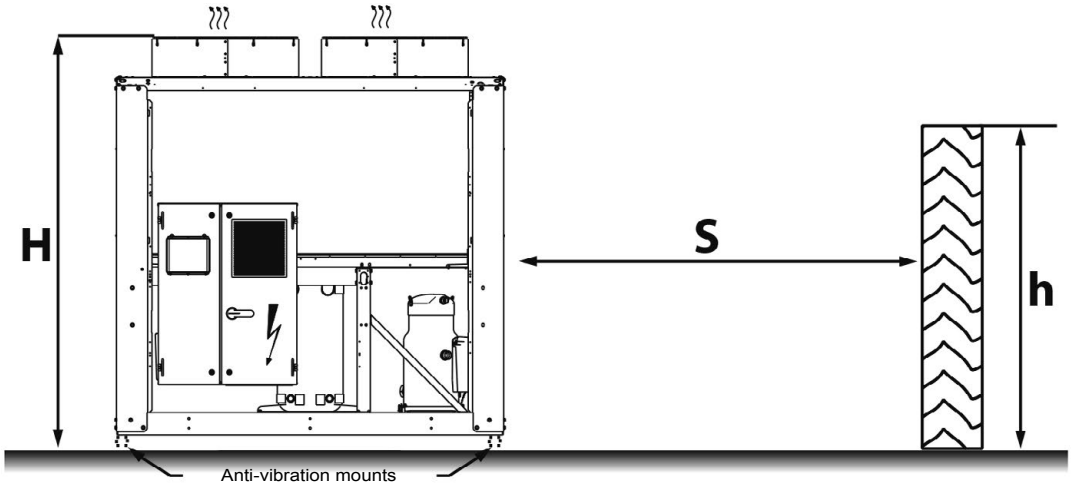
NOTE: For units with options other than the hydraulic module, refer to the certified dimensional drawings.

4.4 - 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.



4.5 - 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} ILD ST		602	650	800	900	902	1000	1150	1200	1400	1600	1800	2000
Sound levels													
Standard unit													
Sound power(1)	dB(A)	90	91	91	91	92	92	93	93	94	94	94	94
Sound pressure at 10 m(2)	dB(A)	58	59	59	59	60	60	61	61	62	62	62	62
Unit + Low Noise option													
Sound power(1)	dB(A)	89	90	90	90	91	91	91	92	92	93	93	93
Sound pressure at 10 m(2)	dB(A)	57	58	58	58	59	59	59	60	60	61	61	61
Dimensions													
Length	mm	2410				3604				4797			
Width	mm	2253				2253				2253			
Height	mm	2322				2322				2322			
Unit + Buffer tank module option	mm	3604				4798				5991			
Operating weight(3)													
Standard unit	kg	1443	1518	1646	1669	2090	2257	2382	2613	3094	3344	3356	3396
Unit + Low Noise option	kg	1514	1585	1739	1762	2179	2383	2508	2757	3256	3524	3536	3576
Unit + Low Noise option + HP dual-pump hydraulic module	kg	1704	1748	1913	1936	2398	2630	2763	2998	3538	3806	3855	3894
Unit + Low Noise option + HP dual-pump hydraulic module + Buffer tank module	kg	2652	2692	2857	2880	3338	3589	3722	3957	4497	4765	4814	4853
Compressors		Hermetic Scroll 48.3 rps											
Circuit A		1	1	2	2	2	2	2	2	3	4	4	4
Circuit B		2	2	2	2	2	3	3	4	4	4	4	4
No. of control stages		3	3	4	4	4	5	5	6	7	8	8	8
Refrigerant (3)		R410A											
Circuit A	kg	14,5	22,0	23,0	24,0	27,0	27,0	30,0	33,0	42,0	53,0	54,0	56,0
	tCO_2e	30,3	45,9	48,0	50,1	56,4	56,4	62,6	68,9	87,7	110,7	112,8	116,9
Circuit B	kg	23,0	23,0	23,0	24,0	35,0	36,0	48,5	53,0	53,0	53,0	54,0	56,0
	tCO_2e	48,0	48,0	48,0	50,1	73,1	75,2	101,3	110,7	110,7	110,7	112,8	116,9
Oil charge													
Circuit A	l	6,9	6,9	13,8	13,8	13,8	13,8	13,8	13,8	20,7	27,6	27,6	27,6
Circuit B	l	13,8	13,8	13,8	13,8	13,8	20,7	20,7	27,6	27,6	27,6	27,6	27,6
Control		Connect Touch Control											
Minimum capacity	%	33%	33%	25%	25%	25%	20%	20%	17%	14%	13%	13%	13%
Air-cooled exchanger		Grooved copper tubes and aluminium fins (RTPF)											

(1) in dB ref=10^{-12} W, 'A' weighted. Declared dual-number noise emission values in accordance with ISO 4871 (with an associated uncertainty of +/-3dB(A)). Measurements according to ISO 9614-1 under nominal operating conditions EN14511 - cooling mode.

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

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

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5 - PHYSICAL AND ELECTRICAL DATA FOR THE UNITS

AQUACIAT^{POWER} ILD ST		602	650	800	900	902	1000	1150	1200	1400	1600	1800	2000
Fans - Standard unit													
Quantity		3	4	4	4	5	5	6	6	7	8	8	8
Maximum total air flow	l/s	13542	18056	18056	18056	22569	22569	27083	27083	31597	36111	36111	36111
Maximum rotation speed	rps	16	16	16	16	16	16	16	16	16	16	16	16
Water-cooled heat exchanger		Dual-circuit plate heat exchanger											
Water volume	l	15	15	15	19	27	27	35	44	44	44	47	53
Max. water-side operating pressure without hydraulic module	kPa	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Hydraulic module (option)		Pump, Victaulic screen filter, relief valve, water and air drain valve, pressure sensors, expansion tank (option)											
Pump		Centrifugal pump, monocell, 48.3 r/s, low- or high-pressure (as required), single or dual (as required)											
Expansion vessel volume	l	50	50	50	50	80	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 hydraulic module	kPa	400	400	400	400	400	400	400	400	400	400	400	400
Water connections with/without hydronic module		Victaulic® type											
Connections	inches	3	3	3	3	4	4	4	4	4	4	4	4
External diameter	mm	88,9	88,9	88,9	88,9	114,3	114,3	114,3	114,3	114,3	114,3	114,3	114,3
Casing paint		Colour code RAL 7035/RAL 7024											

5 - PHYSICAL AND ELECTRICAL DATA FOR THE UNITS

AQUACIAT^{POWER} ILD HE		602	650	800	900	902	1000	1150	1200	1400	1600	1800	2000
Sound levels													
Standard unit													
Sound power(1)	dB(A)	90	91	91	91	92	92	93	93	94	94	94	94
Sound pressure at 10 m(2)	dB(A)	58	59	59	59	60	60	61	61	62	62	62	62
Unit + Low Noise option													
Sound power(1)	dB(A)	89	90	90	90	91	91	91	92	92	93	93	93
Sound pressure at 10 m(2)	dB(A)	57	58	58	58	59	59	59	60	60	61	61	61
Unit + Xtra Low Noise option													
Sound power(1)	dB(A)	84	85	86	86	86	87	87	87	88	89	89	89
Sound pressure at 10 m(2)	dB(A)	52	53	54	54	54	55	55	55	56	57	57	57
Unit + Super Low Noise option													
Sound power(1)	dB(A)	82	83	84	84	84	85	85	86	86	87	87	87
Sound pressure at 10 m(2)	dB(A)	50	51	52	52	52	53	53	54	54	55	55	55
Dimensions													
Length	mm	2410				3604				4797			
Width	mm	2253				2253				2253			
Height	mm	2322				2322				2322			
Unit + Buffer tank module option	mm	3604				4798				5991			
Operating weight(3)													
Standard unit	kg	1479	1554	1683	1705	2127	2274	2396	2626	3104	3370	3382	3432
Unit + Low Noise option	kg	1550	1622	1775	1798	2215	2400	2499	2747	3239	3520	3532	3612
Unit + Low Noise option + HP dual-pump hydraulic module	kg	1717	1785	1950	2003	2395	2648	2731	3012	3494	3771	3820	3929
Unit + Low Noise option + HP dual-pump hydraulic module + Buffer tank module	kg	2664	2728	2894	2946	3335	3588	3667	3948	4426	4699	4748	4858
Compressors		Hermetic Scroll 48.3 rps											
Circuit A		1	1	2	2	2	2	2	2	3	4	4	4
Circuit B		2	2	2	2	2	3	3	4	4	4	4	4
No. of control stages		3	3	4	4	4	5	5	6	7	8	8	8
Refrigerant (3)		R410A											
Circuit A	kg	14,5	22,0	23,0	24,0	27,0	27,0	30,0	33,0	42,0	53,0	54,0	56,0
	tCO_2e	30,3	45,9	48,0	50,1	56,4	56,4	62,6	68,9	87,7	110,7	112,8	116,9
Circuit B	kg	23,0	23,0	23,0	24,0	35,0	36,0	48,5	53,0	53,0	53,0	54,0	56,0
	tCO_2e	48,0	48,0	48,0	50,1	73,1	75,2	101,3	110,7	110,7	110,7	112,8	116,9
Oil charge													
Circuit A	l	6,9	6,9	13,8	13,8	13,8	13,8	13,8	13,8	20,7	27,6	27,6	27,6
Circuit B	l	13,8	13,8	13,8	13,8	13,8	20,7	20,7	27,6	27,6	27,6	27,6	27,6
Control		Connect Touch Control											
Minimum capacity	%	33%	33%	25%	25%	25%	20%	20%	17%	14%	13%	13%	13%
Air-cooled exchanger		Grooved copper tubes and aluminium fins (RTPF)											

(1) in dB ref=10^{-12} W, 'A' weighted. Declared dual-number noise emission values in accordance with ISO 4871 (with an associated uncertainty of +/-3dB(A)). Measurements according to ISO 9614-1 under nominal operating conditions EN14511 - cooling mode.

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

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

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5 - PHYSICAL AND ELECTRICAL DATA FOR THE UNITS

AQUACIAT^{POWER} ILD HE		602	650	800	900	902	1000	1150	1200	1400	1600	1800	2000
Fans - Standard unit													
Quantity		3	4	4	4	5	5	6	6	7	8	8	8
Maximum total air flow	l/s	13542	18056	18056	18056	22569	22569	27083	27083	31597	36111	36111	36111
Maximum rotation speed	rps	16	16	16	16	16	16	16	16	16	16	16	16
Water-cooled heat exchanger		Dual-circuit plate heat exchanger											
Water volume	l	15	15	15	19	27	27	35	44	44	44	47	53
Max. water-side operating pressure without hydraulic module	kPa	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Hydraulic module (option)		Pump, victaulic screen filter, relief valve, water and air drain valve, pressure sensors, expansion vessel (option)											
Pump		Centrifugal pump, monocell, 48.3 r/s, low- or high-pressure (as required), single or dual (as required)											
Expansion vessel volume	l	50	50	50	50	80	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 hydraulic module	kPa	400	400	400	400	400	400	400	400	400	400	400	400
Water connections with/without hydronic module		Victaulic® type											
Connections	inches	3	3	3	3	4	4	4	4	4	4	4	4
External diameter	mm	88,9	88,9	88,9	88,9	114,3	114,3	114,3	114,3	114,3	114,3	114,3	114,3
Casing paint		Colour code RAL 7035/RAL 7024											

5.2 - Electrical data notes

AQUACIAT^{POWER} ILD ST		602	650	800	900	902	1000	1150	1200	1400	1600	1800	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 the 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} ILD HE		602	650	800	900	902	1000	1150	1200	1400	1600	1800	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 the 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} ILD ST HE	**602**	**650**	**800**	**900**	**902**	**1000**	**1150**	**1200**	**1400**	**1600**	**1800**	**2000**
Value without upstream protection												
Short time (1s) assigned current - Icw - kA eff	8	8	8	8	8	15	15	15	15	20	20	20
Allowable peak assigned current - Ipk - kA pk	30	30	30	30	30	65	65	65	65	80	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	250	250	250	315	315	400	400	630	630	630

(1) Type of system earthing

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 (Single pump, hydraulic module option)

N°(2)	Description(3)	Units	ILD ST / ILD HE											
			602	**650**	**800**	**900**	**902C**	**1000**	**1150**	**1200**	**1400**	**1600**	**1800**	**2000**
1	Nominal efficiency at full load and nominal voltage	%	86,4	86,4	86,4	86,4	87,5	87,5	87,5	89,6	89,6	89,6	89,7	89,7
	Nominal efficiency at 75% of full load and nominal voltage	%	86,9	86,9	86,9	86,9	88,2	88,2	88,2	90,4	90,4	90,4	90,0	90,0
	Nominal efficiency at 50% of full load and nominal voltage	%	85,7	85,7	85,7	85,7	87,5	87,5	87,5	89,9	89,9	89,9	89,0	89,0
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	Manufacturer's name and trademark, commercial registration number and manufacturer's head office	-	Same as above											
5	Product's 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	3	3	3	4	4	4	5,5	5,5
7-2	Maximum input power (400 V)(4)	kW	2,80	2,80	2,80	2,80	3,81	3,81	3,81	4,96	4,96	4,96	6,80	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	6,81	6,81	6,81	8,27	8,27	8,27	11,30	11,30
10	Nominal speed	rps - rpm	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) Additional electrical data required by regulation No. 640/2009 concerning the application of directive 2005/32/EC on the eco-design requirements for electric motors.
(2) Item number imposed by regulation No. 640/2009, annex I2b.
(3) Description given by regulation No. 640/2009, annex I2b.
(4) To obtain the maximum input power for a unit with hydronic module, add the maximum unit input power from the electrical data table to the pump power input.
(5) To obtain the maximum unit operating current draw for a unit with hydronic module add the maximum unit current draw from the electrical data table to the pump current draw.
(6) Above 1000 m, a degradation of 3% for each 500 m should be taken into consideration.

5 - PHYSICAL AND ELECTRICAL DATA FOR THE UNITS

Low pressure dual-pump motors for units (Dual-pump hydraulic module option)

N°(2)	Description(3)	Units	ILD ST / ILD HE											
			602	650	800	900	902	1000	1150	1200	1400	1600	1800	2000
1	Nominal efficiency at full load and nominal voltage	%	85,9	86,4	87,5	87,5	87,5	87,5	87,5	89,6	89,6	89,6	89,7	89,7
	Nominal efficiency at 75% of full load and nominal voltage	%	86,4	86,9	88,2	88,2	88,2	88,2	88,2	90,4	90,4	90,4	90,0	90,0
	Nominal efficiency at 50% of full load and nominal voltage	%	84,9	85,7	87,5	87,5	87,5	87,5	87,5	89,9	89,9	89,9	89,0	89,0
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	Manufacturer's name and trademark, commercial registration number and manufacturer's head office	-	Same as above											
5	Product's 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	2,2	3	3	3	3	3	4	4	4	5,5	5,5
7-2	Maximum input power (400 V)(4)	kW	1,94	2,80	3,81	3,81	3,81	3,81	3,81	4,96	4,96	4,96	6,80	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	4,92	6,81	6,81	6,81	6,81	6,81	8,27	8,27	8,27	11,30	11,30
10	Nominal speed	rps - rpm	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) Additional electrical data required by regulation No. 640/2009 concerning the application of directive 2005/32/EC on the eco-design requirements for electric motors.
(2) Item number imposed by regulation No. 640/2009, annex I2b.
(3) Description given by regulation No. 640/2009, annex I2b.
(4) To obtain the maximum input power for a unit with hydronic module, add the maximum unit input power from the electrical data table to the pump power input.
(5) To obtain the maximum unit operating current draw for a unit with hydronic module add the maximum unit current draw from the electrical data table to the pump current draw.
(6) Above 1000 m, a degradation of 3% for each 500 m should be taken into consideration.

5 - PHYSICAL AND ELECTRICAL DATA FOR THE UNITS

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

N°(2)	Description(3)	Units	ILD ST / ILD HE											
			602	650	800	900	902	1000	1150	1200	1400	1600	1800	2000
1	Nominal efficiency at full load and nominal voltage	%	87,5	87,5	89,6	89,6	89,6	89,7	89,7	89,7	89,7	90,8	90,8	90,8
	Nominal efficiency at 75% of full load and nominal voltage	%	88,2	88,2	90,4	90,4	90,4	90,0	90,0	90,0	90,0	90,8	90,8	90,8
	Nominal efficiency at 50% of full load and nominal voltage	%	87,5	87,5	89,9	89,9	89,9	89,0	89,0	89,0	89,0	89,6	89,6	89,6
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	Manufacturer's name and trademark, commercial registration number and manufacturer's head office	-	Same as above											
5	Product's 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	4	4	4	5,5	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	4,96	4,96	4,96	6,80	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	8,27	8,27	8,27	11,30	11,30	11,30	11,30	15,30	15,30	15,30
10	Nominal speed	rps - rpm	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) Additional electrical data required by regulation No. 640/2009 concerning the application of directive 2005/32/EC on the eco-design requirements for electric motors.
(2) Item number imposed by regulation No. 640/2009, annex I2b.
(3) Description given by regulation No. 640/2009, annex I2b.
(4) To obtain the maximum input power for a unit with hydronic module, add the maximum unit input power from the electrical data table to the pump power input.
(5) To obtain the maximum unit operating current draw for a unit with hydronic module add the maximum unit current draw from the electrical data table to the pump current draw.
(6) Above 1000 m, a degradation of 3% for each 500 m should be taken into consideration.

5.5 - 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

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, 400 V, 50 Hz

5.6 - Distribution of compressors per circuit

Compressor	Circuit	602	650	800	900	902	1000	1150	1200	1400	1600	1800	2000
00PSG001961100A	A	1	-	2	2	2	2	2	2	3	4	4	-
	B	2	2	2	-	-	3	-	4	4	4	-	-
00PSG001748000A	A	-	1	-	-	-	-	-	-	-	-	-	4
	B	-	-	-	2	2	-	3	-	-	-	4	4

5.7 - Comments on electrical data notes

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

- The AQUACIAT^{POWER} ILD ST / ILD HE units only have a single power connection point located immediately upstream of the main disconnect switch.
- **Control box includes:**
  - Main disconnect switch,
  - Start-up and motor protection devices for each compressor, 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 AQUACIAT^{POWER} ILD ST / ILD 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 AQUACIAT^{POWER} ILD ST / ILD HE units are described below:

1. Environment(1)
   The classification of environment is specified in standard EN 60364:
   - Outdoor installation(1),
   - Ambient temperature range: minimum temperature -20°C to +48°C(2),
   - 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)(1),
   - 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.
   AQUACIAT^{POWER} ILD ST / 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) (AQUACIAT^{POWER} ILD ST, options: Winter operation down to -20°C, HP variable-speed single or dual pump, hydraulic 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(3).
   - 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/or 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.

(1) The required protection level for this class is IP43BW (according to reference document IEC 60529). All AQUACIAT^{POWER} ILD ST / ILD HE units are classified as IP44CW, and fulfil this protection condition.

(2) The maximum allowable ambient temperature for machines equipped with the Power factor correction option is +40°C

(3) - 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.(1)

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

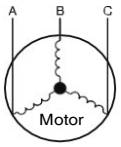
After the unit has been installed, the power supply must only be disconnected for quick maintenance operations (one day maximum). For longer maintenance operations or when the unit is taken out of service (for example, during winter when the unit does not need to generate cooling) the power supply of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

6.2 - Voltage phase imbalance (%)

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

Example:

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



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

= 1199/3

= 399.7, rounded up to 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 possible current for each unit fitted with a hydraulic kit (see the tables of electrical data notes for the unit and the hydraulic 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

AQUACIAT^{POWER} ILD ST / ILD HE	Max. connectable section(1)			Calculation of favourable case:			Calculation of unfavourable case:		
	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	200	XLPE Copper	2 x 50	388	PVC Copper
650	2x70	2x95	21	1 x 50	180	XLPE Copper	2 x 50	358	PVC Copper
800	2x70	2x95	21	1 x 70	210	XLPE Copper	2 x 70	380	PVC Copper
900	2x70	2x95	21	1 x 70	190	XLPE Copper	2 x 70	350	PVC Copper
902	2x70	2x95	21	1 x 70	180	XLPE Copper	2 x 70	350	PVC Copper
1000	2x70	2x95	21	2 x 35	160	XLPE Copper	2 x 95	400	PVC Copper
1150	2x95	2x185	24,5	2 x 50	200	XLPE Copper	2 x 120	430	PVC Copper
1200	2x95	2x185	24,5	2 x 50	190	XLPE Copper	2 x 150	490	PVC Copper
1400	2x95	2x185	24,5	2 x 70	220	XLPE Copper	2 x 150	420	PVC Copper
1600	2x95	2x185	24,5	2 x 70	190	XLPE Copper	2 x 185	430	PVC Copper
1800	2x240	2x240	37	2 x 95	230	XLPE Copper	2 x 240	470	PVC Copper
2000	2x240	2x240	37	2 x 95	210	XLPE Copper	2 x 240	430	PVC Copper

(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.

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 the use of steel wired armoured (SWA) cables.

Unit placed on the ground and use of a rigid power cable with a section > 250 mm².

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 current transformer provides a 230V, 50 Hz 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}
ILD ST / ILD HE 602-2000 units, cooling mode

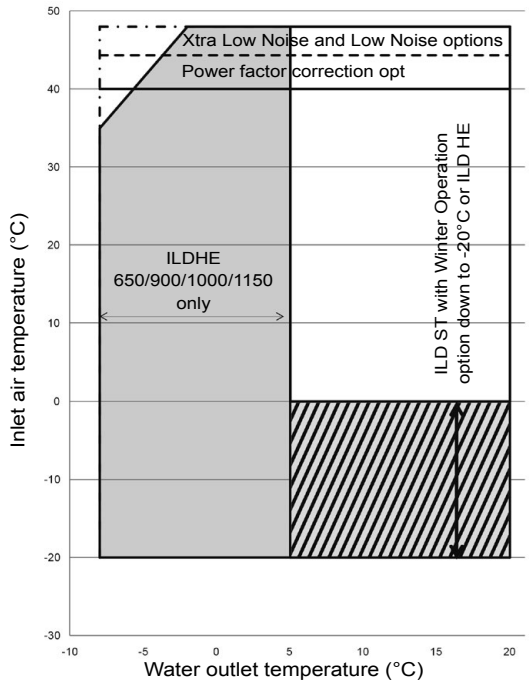
Water-cooled heat exchanger		Minimum	Maximum
Entering water temperature at start-up	°C	8(1)	40
Water outlet temperature during operation	°C	5(2)	20(3)
Leaving water temperature during operation low-temperature glycol/water mix option	°C	-8(8)	20(3)
Air-cooled exchanger			
Ambient operating temperature - ILD ST	°C	0(4)(6)	48(7)
Ambient operating temperature - ILD ST or ILD HE	°C	-20(4)(6)	48(7)
Available static pressure			
Standard units (outdoor installation)	Pa	0	0

AQUACIAT^{POWER}
ILD ST / ILD HE 602-2000 units, heating mode

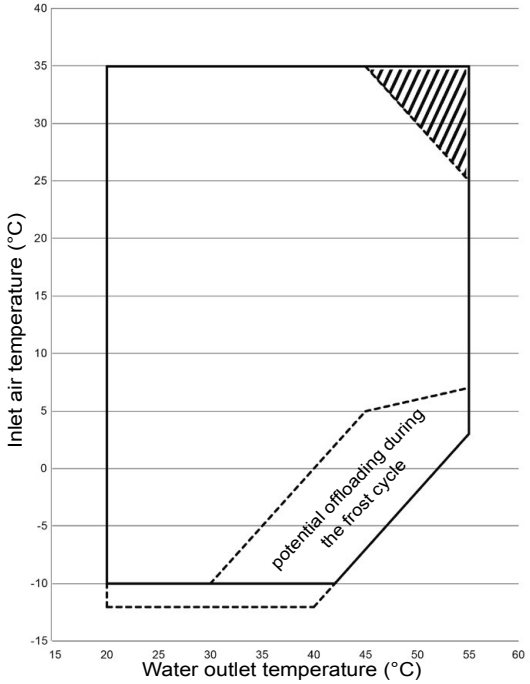
Water-cooled heat exchanger		Minimum	Maximum
Entering water temperature at start-up	°C	8(1)	50
Water outlet temperature during operation	°C	20	55
Air-cooled exchanger			
Outdoor ambient operating temperature	°C	-10(5)(6)	35
Available static pressure			
Standard units (outdoor installation)	Pa	0	0

(1) For an application requiring start-up at less than 8°C, contact the manufacturer to select a unit using the manufacturer's electronic catalogue.
(2) The use of antifreeze 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 at an ambient temperature of 0°C down to -20°C (cooling mode), the unit must be a ILD ST unit equipped with option "Winter operation" or an ILD HE unit.
(5) For operation at an ambient temperature of 0°C down to -10°C (heating mode), the unit must be equipped with the "Coil defrost heater" option
(6) For operation at an ambient temperature below 0°C (cooling mode and heating mode), the unit must either be equipped with the water heat exchanger frost protection option (for units without hydraulic module option) or the water heat exchanger and hydraulic module frost protection option (for units with hydraulic module option) or the water loop must be protected against frost by the installer, using an antifreeze solution.
(7) The maximum allowable ambient temperature for machines equipped with the Power factor correction option is +40°C
(8) Operation with low-temperature glycol/water mix only for ILDHE 650/900/1000/1150
Maximum ambient temperature: AQUACIAT^{POWER} ILD ST / ILD HE 602-2000 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.

ILD ST / HE 602-2000 units Cooling mode



ILD ST / HE 602-2000 units Heating mode



NOTE
1 Evaporator ΔT = 3K
2 The unit must be equipped with the water heat exchanger frost protection option (for units without hydraulic module option) or the water heat exchanger and hydraulic module frost protection option (for units with hydraulic module option) or the water loop must be protected against frost using an antifreeze solution for outdoor air temperatures below 0°C
3 Operating ranges are guidelines only. The operating range must be checked with the selection software

Legend

Operating range at full load for the AQUACIAT^{POWER} ILD ST or ILD HE unit

Extended operating range in cooling mode: ILD ST unit "Winter operation" option for outdoor air temperatures down to -20°C or ILD HE unit. The water heat exchanger must be protected against frost (see note 2).

Operating range at part load for the AQUACIAT^{POWER} ILD ST / ILD HE 1150 unit. Other sizes operate at full load.

Potential offloading during the de-frost cycle depending on the humidity conditions. Refer to the manufacturer's electronic catalogue.

Low-temperature brine solution option

Partial charge for low-temperature brine solution option

NOTE: Units equipped with speed regulators

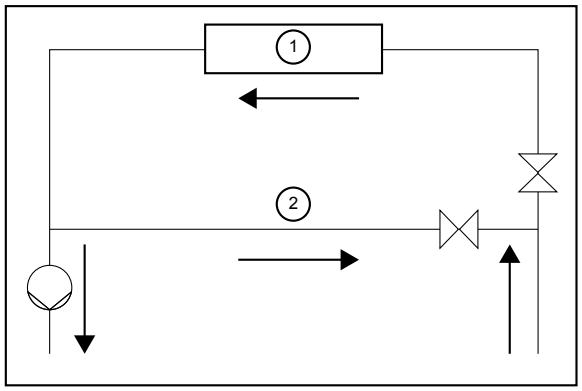
If the outside temperature is below -10°C and the unit has been switched off for more than 4 hours, it is necessary to wait two hours after the unit has been switched on again to allow the variable drive to warm up.

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 minimum 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



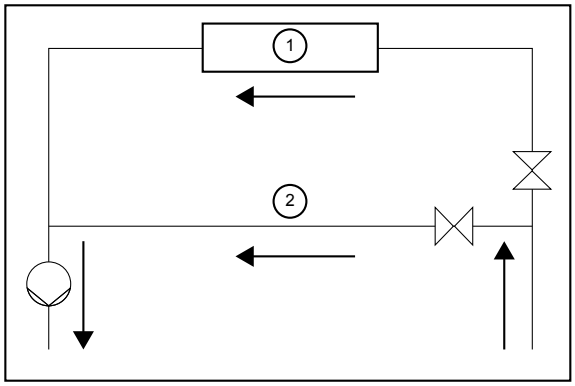
① Water-cooled heat exchanger
② Recirculation

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 (without factory-fitted hydronic module)

The maximum heat transfer fluid flow rate is given in the paragraph "water exchanger minimum 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-cooled heat 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.

7.5 - Water exchanger minimum 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 running times, it prevents short cycle protection cycles from starting and, in most cases, eliminates the need for a buffer tank.

Note: The minimum heat transfer fluid volumes are calculated for EUROVENT rated conditions:
- heat transfer fluid temperature in the water exchanger = 12°C / 7°C
- inlet air temperature in the air exchanger = 35°C

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

Note:

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

AQUACIAT^{POWER} ILD ST / ILD HE		602	650	800	900	902	1000	1150	1200	1400	1600	1800	2000
Minimum system water volume, air conditioning application - cooling (litres)		420	451	494	539	654	750	827	914	993	1076	1159	1306
Minimum system water volume, air conditioning application - heating (litres)		1386	1513	1374	1457	1523	1362	1553	1374	1382	1362	1478	1618
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	3.1 / 17.5	3.8 / 17.5	4.1 / 21.8	4.2 / 29.8	4.8 / 29.8	5.5 / 35.2	5.8 / 40.4	6.7 / 40.4	7.8 / 40.4	8.4 / 41.6	9.2 / 43.6
Water exchanger flow rate with low pressure hydronic module (l/s)	Min.(1) single	2,9	3,1	3,8	4,1	4,2	4,8	5,5	8	8	8	8,4	9,2
	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) single	2,9	3,1	3,8	4,1	4,2	4,8	5,5	5,8	6,7	7,8	8,4	9,2
	Min(1) / max dual	11.7 / 10.8	11.7 / 10.8	16.1 / 15.5	16.1 / 15.5	16.1 / 15.5	26.5 / 26.5	26.5 / 26.5	26.5 / 26.5	26.5 / 29.2	26.7 / 29.2	26.7 / 30.0	30.0 / 30.0

(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)

7.6 - Maximum system water volume

Units supplied with a hydronic module may include an expansion vessel 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.

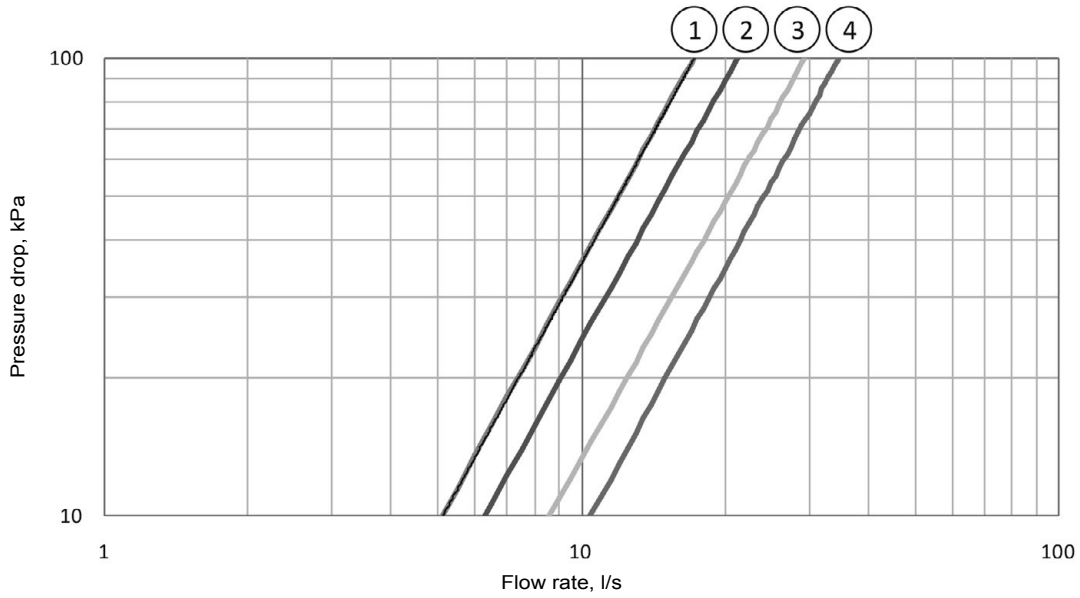
Maximum water loop volume (litres)						
AQUACIAT^{POWER} ILD ST / LD HE	602-900			902-2000		
Static pressure (bar)	1	2	2,5	1	2	2,5
Pure water	2400	1600	1200	3960	2640	1980
10% EG	1800	1200	900	2940	1960	1470
20% EG	1320	880	660	2100	1400	1050
30% EG	1080	720	540	1740	1160	870
40% EG	900	600	450	1500	1000	750

EG: Ethylene glycol

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

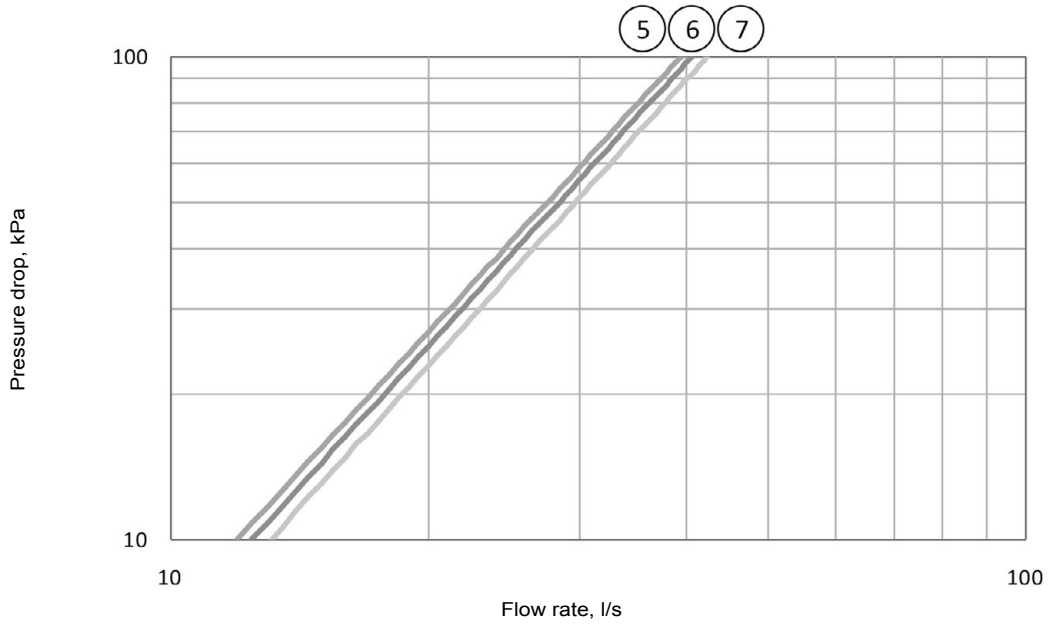
Data applicable for pure water at 20°C.

AQUACIAT^{POWER} ILD ST HE 602-1150 units



1 AQUACIAT^{POWER} ILD ST HE 602-650-800
2 AQUACIAT^{POWER} ILD ST HE 900
3 AQUACIAT^{POWER} ILD ST HE 902-1000
4 AQUACIAT^{POWER} ILD ST HE 1150

AQUACIAT^{POWER} ILD ST HE 1200-2000 units



1 AQUACIAT^{POWER} ILD ST / ILD HE 1200-1400-1600
2 AQUACIAT^{POWER} ILD ST / ILD HE 1800
3 AQUACIAT^{POWER} ILD ST / ILD HE 2000

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

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

The water supply must be analysed and appropriate filtering, treatment, control devices, isolation and bleed valves and circuits built in, to prevent corrosion, fouling and deterioration of the pump fittings.

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 NH_4^+ 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.
- SO_4^- sulphate ions can cause perforating corrosion if their content is above 30 mg/l.
- No fluoride ions (<0.1 mg/l).
- No Fe^{2+} and Fe^{3+} ions if non-negligible levels of dissolved oxygen are present. Dissolved iron < 5 mg/l with dissolved oxygen < 5 mg/l.
- Dissolved silica: Silica is an acid element of water and can also lead to corrosion risks. Content < 1 mg/l.
- Water hardness: >0.5 mmol/l. Values between 1.0 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 should be designed to have the least number of elbows and horizontal pipe runs at different levels.

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 shut-off valves close to the water inlet and outlet connections.
- Use flexible connections to reduce the transmission of vibrations.
- Insulate the cold water pipework, after testing for leaks, to prevent heat transmission and condensation.
- Cover the insulation with a vapour barrier. If the water pipes outside the unit pass through an area where the ambient temperature is likely to fall below 0°C, it must be protected against frost (antifreeze solution or electric heaters).
- If there are particles in the fluid which are liable to foul the exchanger, a screen filter must be installed upstream of the pump.

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

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

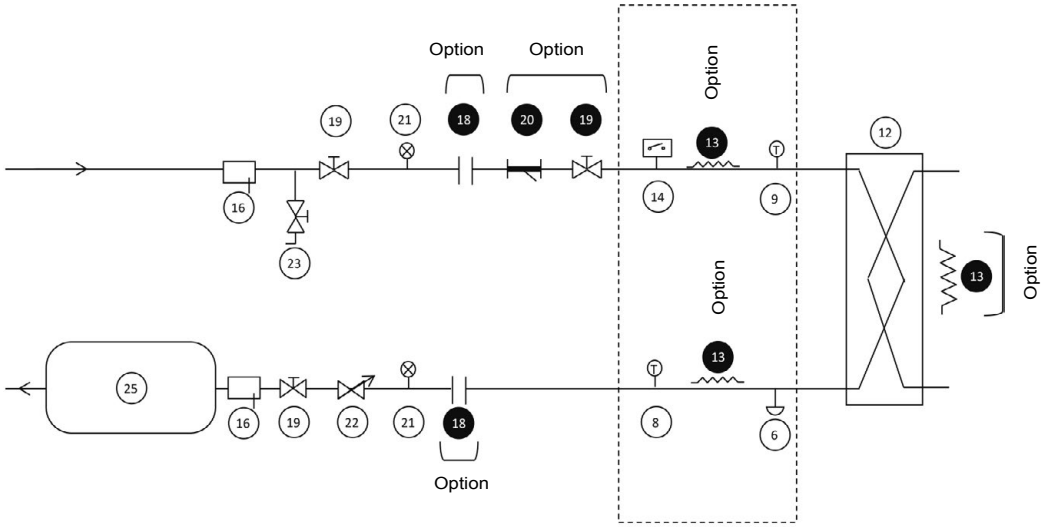
Units with hydronic module are equipped with this type of filter.

- Do not introduce any excessive static or dynamic pressure into the heat exchange circuit (with regard to the design operating pressures).
- Products used for thermal insulation of recipients during 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.

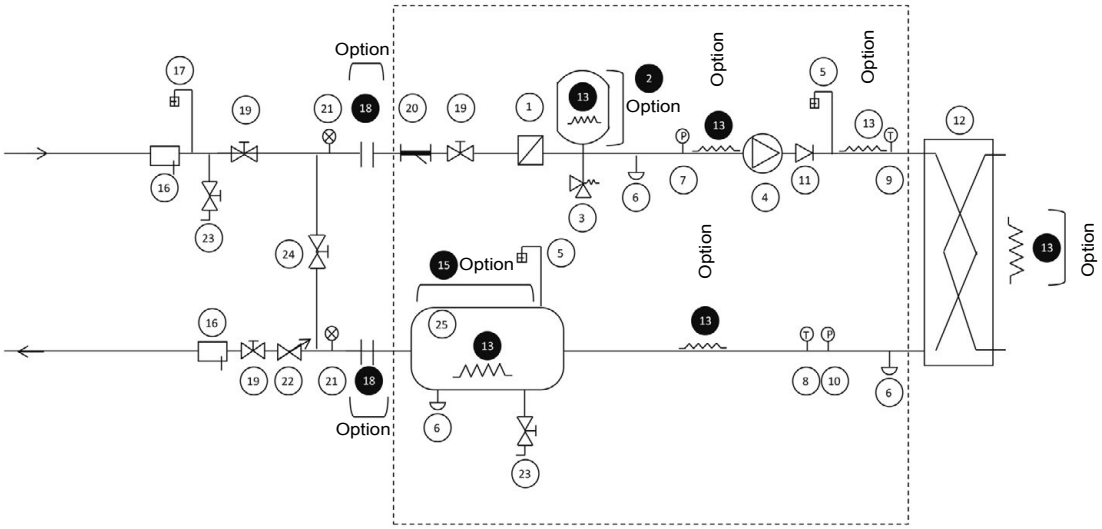
8.2 - Water connections

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

Typical hydraulic circuit diagram without hydronic module



Typical hydraulic circuit diagram with hydronic module



Legend

Components of the 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 purge
18 Flexible connection (Option)
19 Shut-off valve
20 800 µm screen filter (Option - mandatory in the case of a unit without hydraulic module)
21 Pressure gauge
22 Water flow control valve
Note: not required if hydronic module with variable speed pump
23 Charge valve
24 Bypass valve for frost protection (if shut-off valves are closed (item 19) during 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 type 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

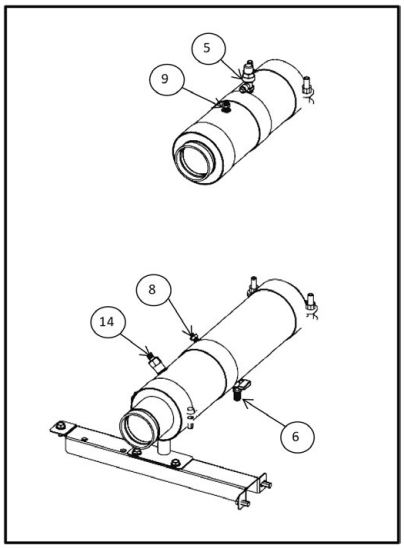


Figure 2: Water connections With hydronic module

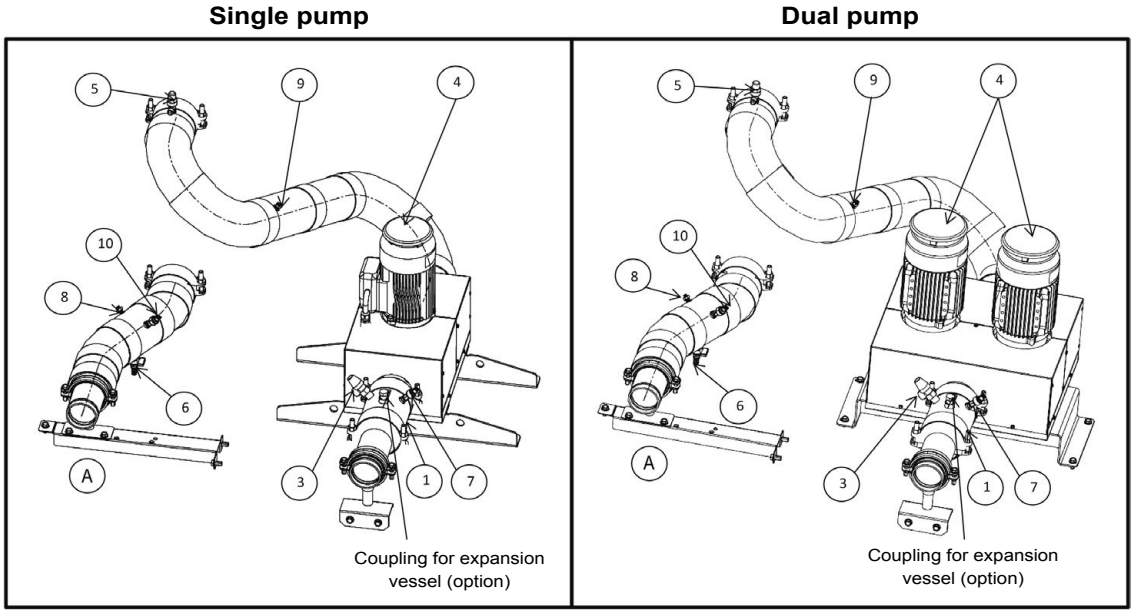
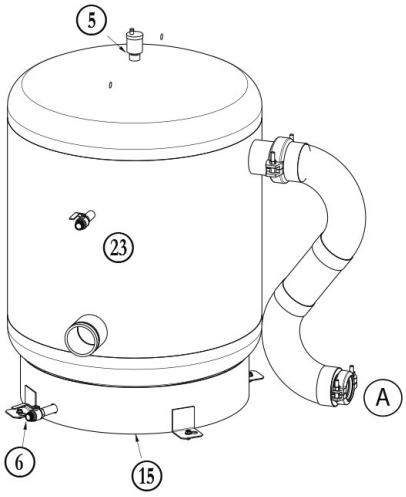


Figure 3: Water connections with hydronic module and with buffer tank module option



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 hydraulic module).
- Down to -20°C by heaters and heat trace cables (fitted as an option on the exchanger, buffer tank module (option) and internal pipe system) supplied automatically and pump circulation (for units with the hydronic module)

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.

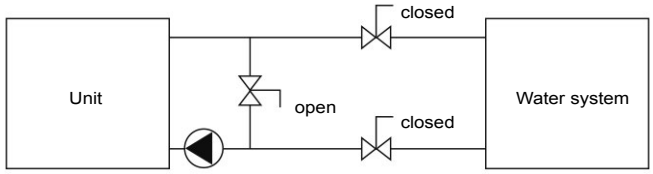
Combination of options for the periods when the machine is in standby mode

Ambient temperature range	AQUACIAT^{POWER} ILD ST / HE 602-2000	
	without "Hydronic module" option	with "Hydronic module" option
> 0°C to 48°C	-	-
-20°C to 0°C	Water exchanger frost protection option or Appropriate antifreeze solution (for example glycol)	Water exchanger and hydraulic module antifreeze protection option(1) or Appropriate antifreeze solution (for example glycol)(1)

(1) Allow the pumps to circulate. If there is a valve, 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 neutral gas (0.5 bar maximum). If the heat-transfer fluid does not meet the recommendations, a nitrogen blanket must be applied immediately.
- At the start of the next season, refill the unit with water and add an inhibitor.
- If additional equipment is added to the system, the installer must comply with the basic recommendations, especially the minimum and maximum flow rates which must be between the values shown in the operating limits table (application data).
- If frost protection is dependent on electric heaters, never deenergize the unit when frost protection is required. To ensure protection, the main unit disconnect switch 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).

8.6 - Auxiliary electrical heaters

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

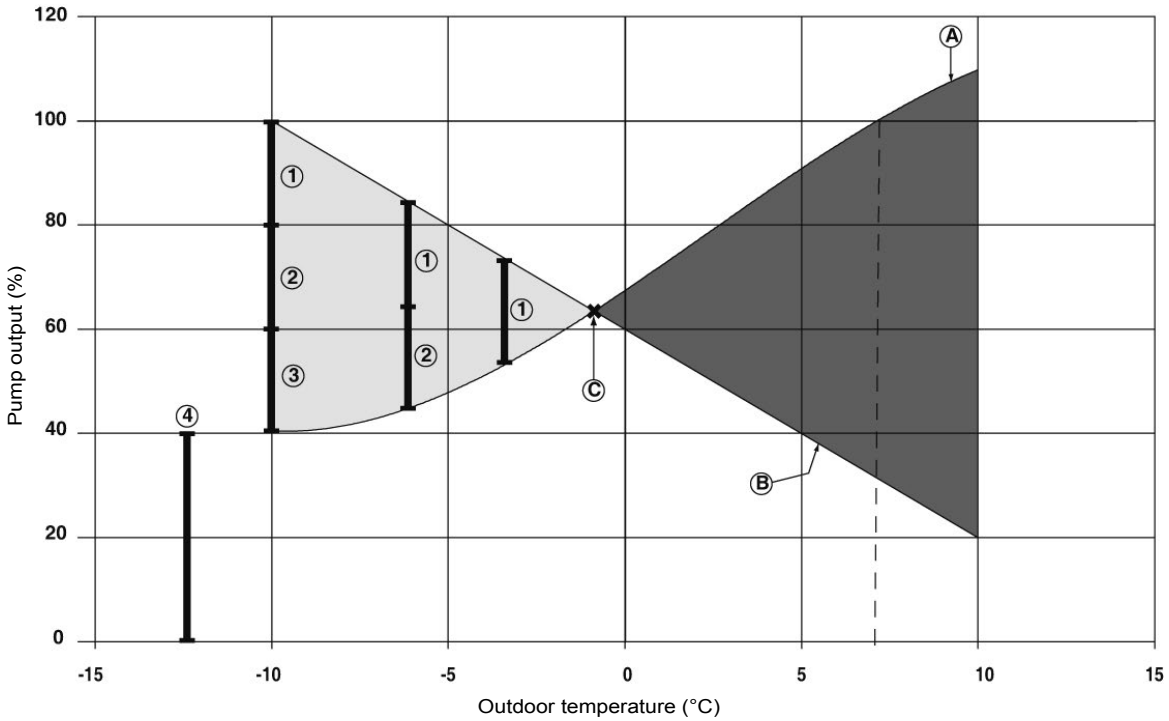
These heaters can be controlled via the dedicated option.

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

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

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

Example of additional electric heaters



Operating range for which the heat pump output is less than the building thermal load

Operating range for which the heat pump output is greater than the building thermal load

1	Stage 1
2	Stage 2
3	Stage 3
4	Stage 4 (safety)
A	Variation of the heat pump output with air temperature
B	Building thermal load
C	Point of equilibrium between the heat pump output and the building thermal load

Refer to the diagram in the "Hydraulic connections" section for all reference 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 setting the installation flow rate:

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

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

9.1 - Units without hydronic module

General

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 operation point.

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

As the exact total system pressure drop is not known at start-up, it is necessary to adjust the water flow with the control valve to obtain the system's specific flow rate.

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 hydraulic circuit of the system (presence of contaminating solids).
- Perform another reading.
- Compare this value to the initial value.
- A decrease in the flow value indicates that the filters in 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 then clean (items 20 and 1) after draining the hydraulic 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) to determine the pressure drop within the unit (plate heat exchanger + internal pipework).

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

If the pressure drop reading is above the preset 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 nominal flow rate at the required operation point 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

General

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 hydraulic circuit of the system (presence of contaminating solids).
- Perform another reading.
- Compare this value to the initial value.
- A decrease in the flow value indicates that the filters in 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.

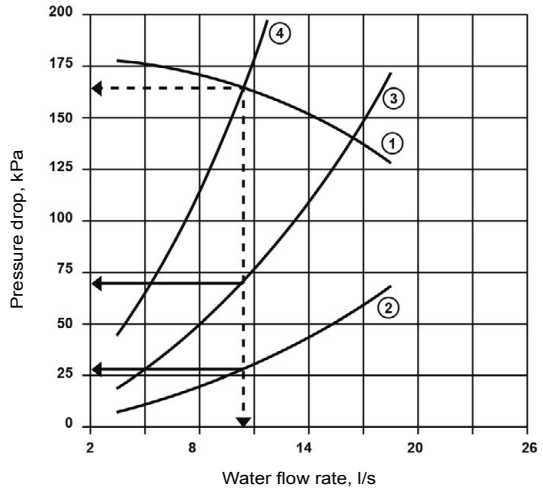
Repeat as necessary, closing the control valve (item 22) until the system's specific pressure drop corresponding to the unit's design flow rate is achieved.

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 hydronic systems

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



Legend
1 Unit pump curve
2 Pressure drop in the hydronic kit (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 system flow rate 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 water 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 decrease in the flow value indicates that the filters in the system need to be removed and cleaned. In this case, close the shut-off valves on the water inlet and outlet (item 19) and remove the filters (items 20 and 1) after draining the hydronic part of the unit (items 6).
- Remove the air from the circuit (items 5 and 17).
- Repeat until all fouling is removed from the filter

Procedure for controlling the pressure differential setpoint

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

Read the value of the flow on the user interface and compare it with the theoretical value of the range:
- If the flow rate read is greater than the preset value, reduce the pressure differential setpoint on the user interface to reduce the flow rate value;
- If the value read is lower than the preset value, increase the pressure differential setpoint on the user interface to increase the flow rate value

Repeat until the unit's nominal flow rate at the required operation point is achieved.

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 system flow rate 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.
- 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 Delta T° above the setpoint.

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

Hydraulic circuit cleaning procedure

Refer to the water circuit cleaning procedure.

Procedure for adjusting 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 water 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

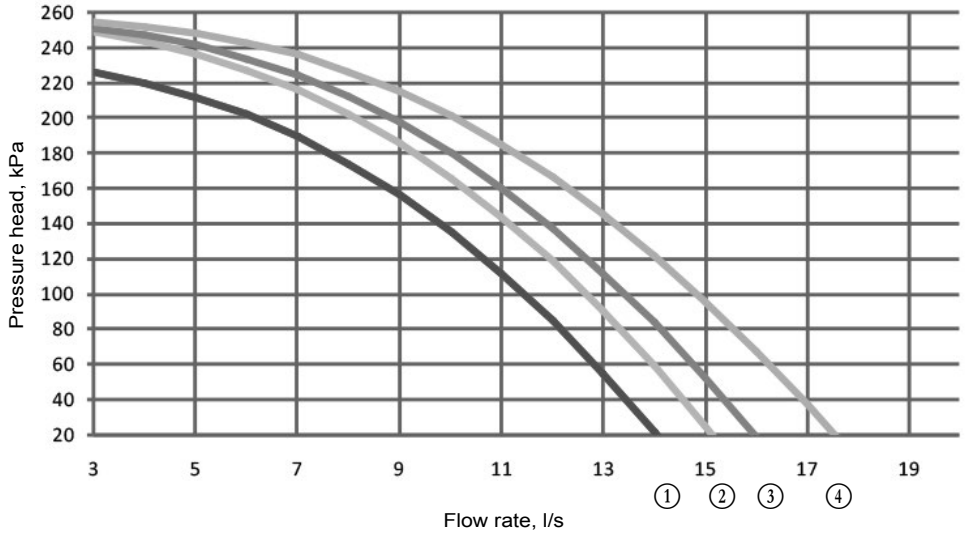
Units with hydronic module (fixed speed pump or variable speed pump at 50 Hz)

Data applicable for:
- Pure water at 20 °C.
- Refer to the "Water type heat exchanger water flow" section for the maximum water flow values.
- If ethylene glycol is used, the maximum flow rate is reduced.

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

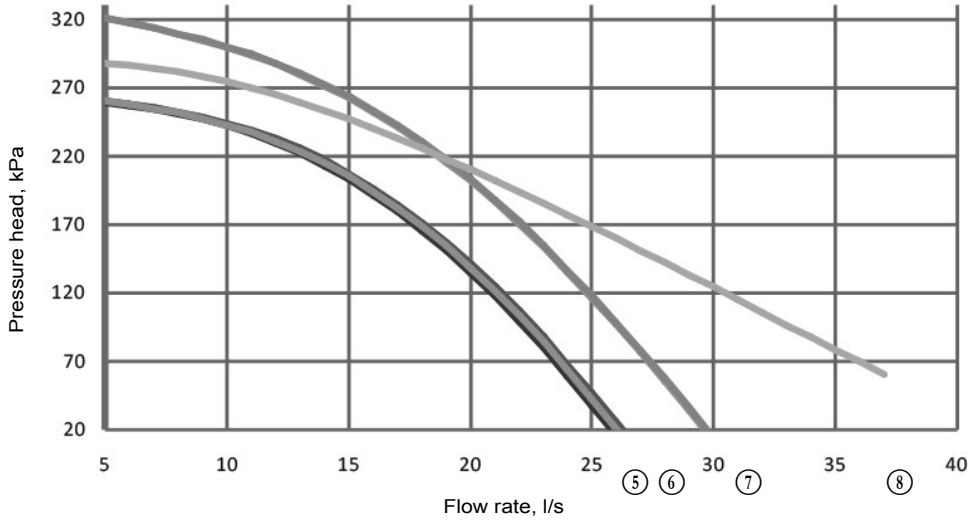
High pressure pumps (Single pumps)

Sizes 602-902



1 AQUACIAT^{POWER} ILD ST / HE 602-650
2 AQUACIAT^{POWER} ILD ST / HE 800
3 AQUACIAT^{POWER} ILD ST / HE 900
4 AQUACIAT^{POWER} ILD ST / HE 902

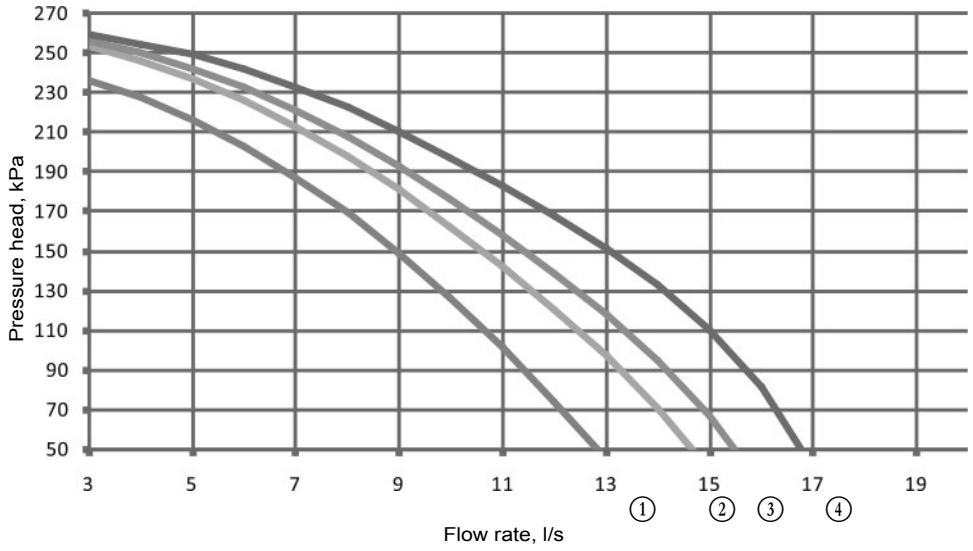
Sizes 1000-2000



5 AQUACIAT^{POWER} ILD ST / HE 1000-1150
6 AQUACIAT^{POWER} ILD ST / HE 1200-1400
7 AQUACIAT^{POWER} ILD ST / HE 1600-1800
8 AQUACIAT^{POWER} ILD ST / HE 2000

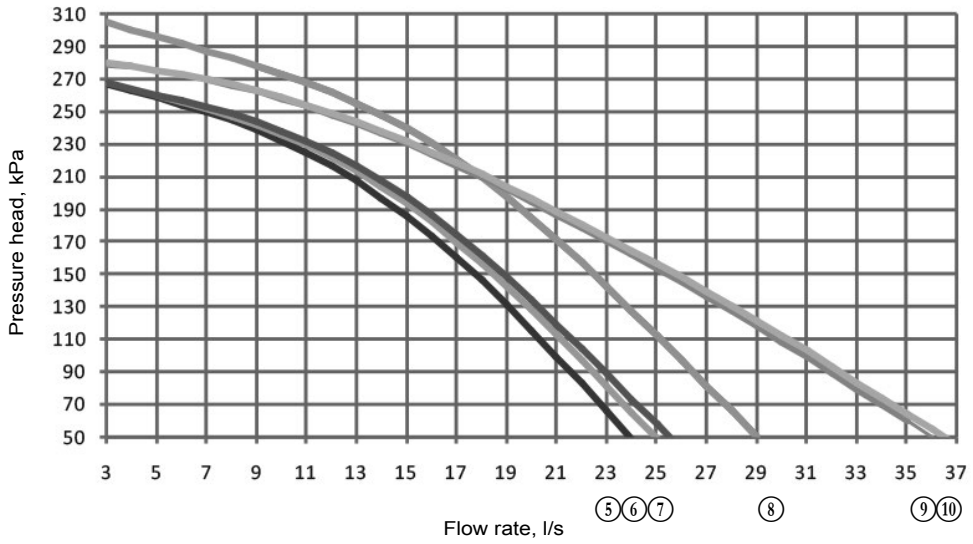
High pressure pumps (Dual pumps)

Sizes 602-902



1 AQUACIAT^{POWER} ILD ST / HE 602-650
2 AQUACIAT^{POWER} ILD ST / HE 800
3 AQUACIAT^{POWER} ILD ST / HE 900
4 AQUACIAT^{POWER} ILD ST / HE 902

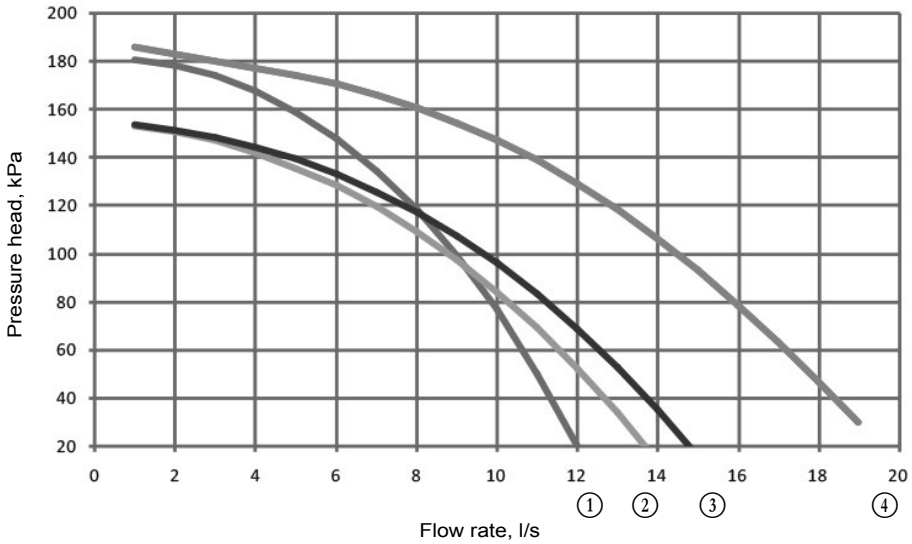
Sizes 1000-2000



5 AQUACIAT^{POWER} ILD ST / HE 1000
6 AQUACIAT^{POWER} ILD ST / HE 1150
7 AQUACIAT^{POWER} ILD ST / HE 1200
8 AQUACIAT^{POWER} ILD ST / HE 1400-1600
9 AQUACIAT^{POWER} ILD ST / HE 1800
10 AQUACIAT^{POWER} ILD ST / HE 2000

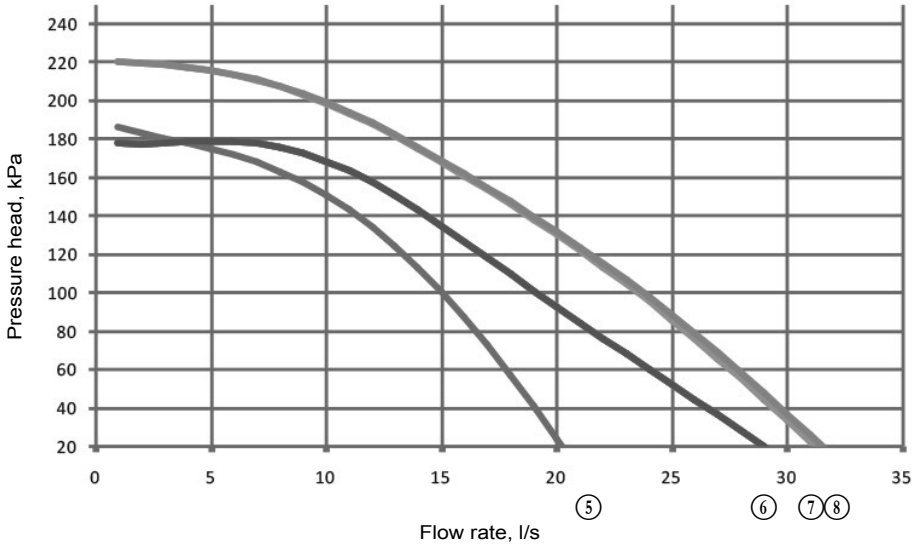
Low pressure pumps (Single pumps)

Sizes 602-1000



1 AQUACIAT^{POWER} ILD ST / HE 602-650
2 AQUACIAT^{POWER} ILD ST / HE 800
3 AQUACIAT^{POWER} ILD ST / HE 900
4 AQUACIAT^{POWER} ILD ST / HE 902-1000

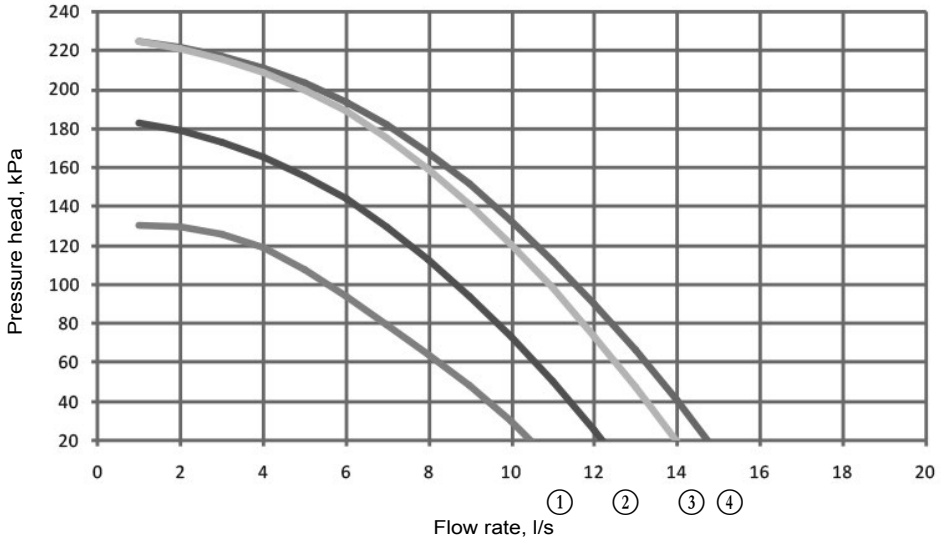
Sizes 1150-2000



5 AQUACIAT^{POWER} ILD ST / HE 1150
6 AQUACIAT^{POWER} ILD ST / HE 1200-1400-1600
7 AQUACIAT^{POWER} ILD ST / HE 1800
8 AQUACIAT^{POWER} ILD ST / HE 2000

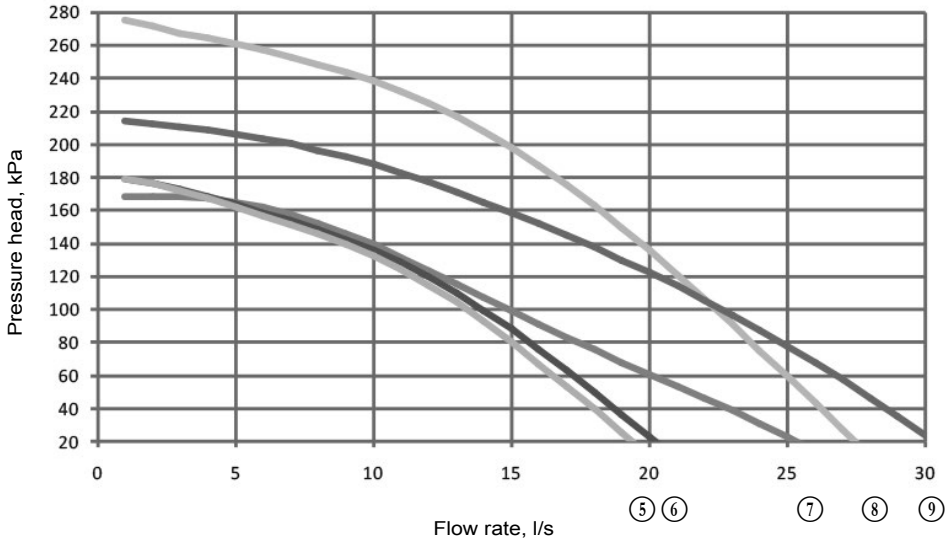
Low pressure pumps (Dual pumps)

Sizes 602-900



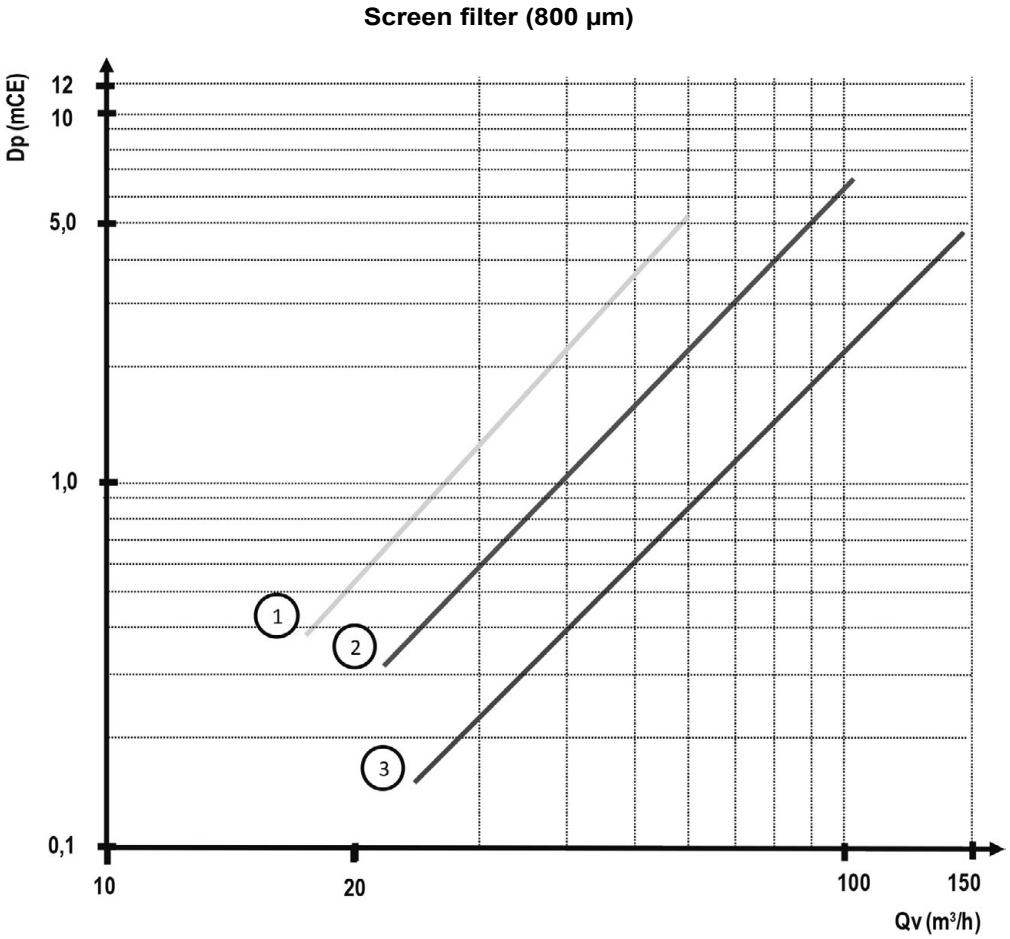
1 AQUACIAT^{POWER} ILD ST / HE 602
2 AQUACIAT^{POWER} ILD ST / HE 650
3 AQUACIAT^{POWER} ILD ST / HE 800
4 AQUACIAT^{POWER} ILD ST / HE 900

Sizes 902-2000



5 AQUACIAT^{POWER} ILD ST / HE 902-1000
6 AQUACIAT^{POWER} ILD ST / HE 1150
7 AQUACIAT^{POWER} ILD ST / HE 1200-1400-1600
8 AQUACIAT^{POWER} ILD ST / HE 1800
9 AQUACIAT^{POWER} ILD ST / HE 2000

800 µm water filter pressure drop curves



1 AQUACIAT^{POWER} ILD 602 - 650 (DN80 filter)
2 AQUACIAT^{POWER} ILD 800 - 1150 (DN100 filter)
3 AQUACIAT^{POWER} ILD 1200 - 2000 (DN125 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 unit 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 cooling system and power circuit diagrams.
- Check that all documents provided by the manufacturer (dimensional drawings, pipe and instrument diagram (PID), declarations, etc.) to comply with the regulations are present. If any documentation is missing, order a replacement.
- Verify that the environmental safety and protection devices and arrangements provided by the manufacturer to comply with the regulations are present and correct.
- 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 units.
- 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.

Make sure all safety devices are operational, and especially 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 are above 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 type heat 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.

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.

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

11.3 - Air-cooled exchanger

The coils on the units are composed of aluminium airfoils crimped onto internally grooved copper tubes (RTPF).

11.4 - Fans

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

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

Product		**AQUACIAT^{POWER} ILD ST / ILD HE**			
Option		**Standard ST**	**High Efficiency HE version**	**"Winter operation -20°C option (1)"**	**Xtrafan option**
Overall efficiency	%	39,3	41	41	40,9
Measurement category		A	A	A	A
Efficiency category		Static	Static	Static	Static
Target efficiency level ERP2015		N(2015) 40	N(2015) 40	N(2015) 40	N(2015) 40
Efficiency level at the optimum energy efficiency point		43,9	45,7	45,7	44,2
Variable speed drive		NO	YES	YES	YES
Year of manufacture		See label on the unit	See label on the unit	See label on the unit	See label on the unit
Fan manufacturer		Simonin	Simonin	Simonin	Simonin
Motor manufacturer		Leroy Somer	Leroy Somer	Leroy Somer	Leroy Somer
Fan PN		00PSG000000100A	00PSG000000100A	00PSG000000100A	00PSG000000100A
Nominal motor capacity	kW	1,85	1,84	1,84	2,97
Flow rate	m^3/s	4,28	4,15	4,15	5,31
Pressure at optimum energy efficiency	Pa	170	170	170	216
Nominal Speed	rpm	954	950	950	1127
Specific ratio		1,002	1,002	1,002	1,002
Relevant information to facilitate the disassembly, recycling or removal of the product at the end of life		See the Maintenance manual	See the Maintenance manual	See the Maintenance manual	See the Maintenance manual
Relevant information to minimise the impact on the environment		See the Maintenance manual	See the Maintenance manual	See the Maintenance manual	See the Maintenance manual

(1) Only for the lead fan on each circuit; the other fans are Standard

In accordance with regulation No. 640/2009 and amendment 4/2014 implementing Directive 2009/125/EC concerning eco-design requirements for electric motors.

Product		AQUACIAT^{POWER} ILD ST / ILD HE			
Option		Standard ST	High Efficiency HE version	"Winter operation -20°C option (1)"	Xtrafan option
Motor type		Asynchronous	Asynchronous	Asynchronous	Asynchronous
Number of poles		6	6	6	6
Rated input frequency	Hz	50	50	50	60
Nominal voltage	V	400	400	400	400
Number of phases		3	3	3	3
Motor included in the application domain of the regulation 640/2009 and amendment 4/2014		NO	NO	NO	NO
Justification for exemption		Article 2.1	Article 2.1	Article 2.1	Article 2.1
Ambient air temperature for which the motor is specifically designed	°C	70	70	70	70

(1) Only for the lead fan on each circuit; the other fans are Standard

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 - Refrigerant accumulator with filter drier

The refrigerant charge required in cooling mode is greater than the permissible refrigerant charge in heating mode. The accumulator is used to store the excess charge in heating mode.

A removable element and metal filter keep the refrigerant circuit clean and free from moisture, by capturing solid contaminants.

When the moisture indicator turns yellow, it is necessary to change the element. When the unit is operating in cooling mode, a difference in temperature between the accumulator inlet and outlet indicates fouling of the element and/or filter.

11.8 - Water-cooled heat exchanger

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

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 (evaporator 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.

NOTE - Monitoring in operation

Follow local regulations on the monitoring of pressure equipment.

The user or operator is usually required to create and maintain a monitoring and maintenance log.

In the absence of any regulations, or in addition to the regulations, follow the guidance in the EN 378 standard.

Follow the local professional recommendations, whenever they exist.

Regularly check for the presence of any impurities (e.g. sand, grit) in the heat transfer fluids. These impurities can cause wear and/or pitting corrosion.

The reports of the periodical checks by the user or the operator must be included in the monitoring and maintenance register.

11.9 - Refrigerant

Units running with R410A.

11.10 - HP safety pressostat

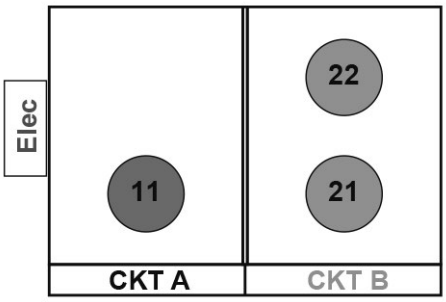
The units are equipped with high pressure safety switches with automatic reset on the HP side. These pressure switches are located at the discharge of each circuit.

11.11 - Frequency inverter

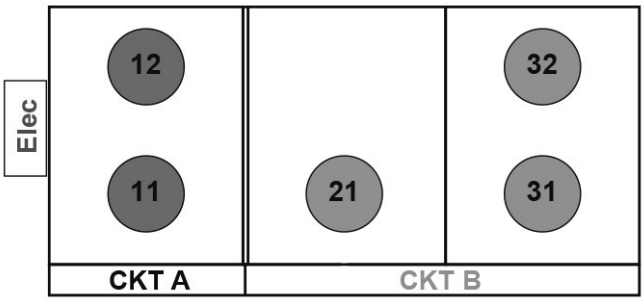
The units are equipped with inverters to control the fan speed within the fmin-fmax frequency range (standard, fmin=5 Hz and fmax=50 Hz). All fans on the same refrigerating circuit are controlled by a single variable frequency drive. Fan speed is changed by generating a controlled waveform in which frequency and voltage are varied (Pulse Width Modulation). Fan start-up/ shut-down and the working range frequency setpoint is controlled by the Controller through RS485 communication using the LEN Protocol.

11.12 - Fan arrangement

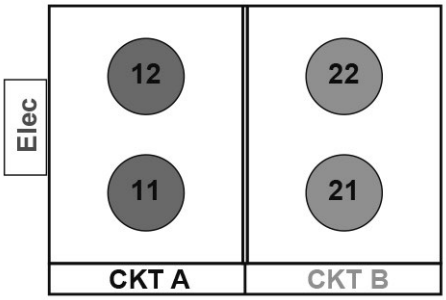
AQUACIAT^{POWER} ILD ST / HE 602



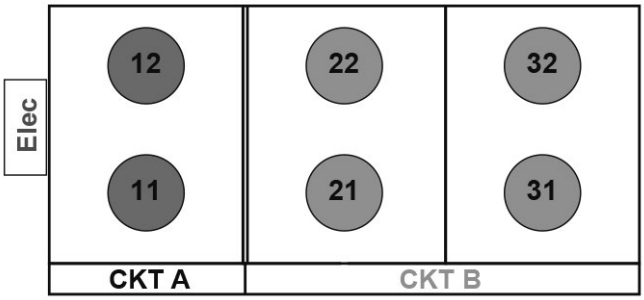
AQUACIAT^{POWER} ILD ST / HE 902-1000



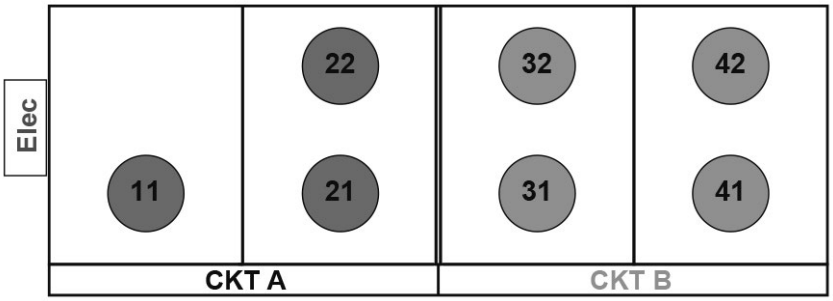
AQUACIAT^{POWER} ILD ST / HE 650-800-900



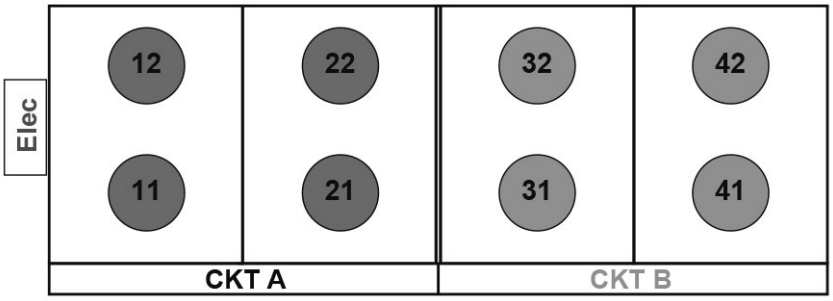
AQUACIAT^{POWER} ILD ST / HE 1150-1200



AQUACIAT^{POWER} ILD ST / HE 1400



AQUACIAT^{POWER} ILD ST / HE 1600-1800-2000



11.13 - Fan stages

AQUACIAT^{POWER} Standard ILD ST	Circuit	Stage 1	Stage 2	Stage 3	Stage 4	Inverter on AQUACIAT^{POWER} ILD HE	Inverter on Winter operation option (down to -20°C)
602	A	EV11				EV11	EV11
	B	EV21	EV21 + EV22			EV21 + EV22	EV21
650-800-900	A	EV11	EV11 + EV12			EV11 + EV12	EV11
	B	EV21	EV21 + EV22			EV21 + EV22	EV21
902-1000	A	EV11	EV11 + EV12			EV11 + EV12	EV11
	B	EV31	EV31 + EV21	EV31 + EV21 + EV32		EV31 + EV21 + EV32	EV31
1150-1200	A	EV11	EV11 + EV12	EV11 + EV12 + EV22		EV11 + EV12 + EV22	EV11
	B	EV31	EV31 + EV32	EV31 + EV32 + EV21		EV31 + EV32 + EV21	EV31
1400	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
1600-1800-2000	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

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.

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

11.15 - Tank

The units in the range are equipped with mechanically welded tanks that are capable of storing excess load when the unit is operating in heating mode.

11.16 - 4-way valve

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

11.17 - 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.

11.18 - Connect Touch control

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

- 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.

12.1 - Tables of options

Options	Description	Advantages	Use
Corrosion protection, traditional coils	Fins made of pre-treated aluminium (polyurethane and epoxy)	Improved corrosion resistance, recommended for moderate marine and urban environments	•
Low-temperature brine solution	Low temperature chilled water production down to -8°C with ethylene or propylene glycol	Covers specific applications such as ice storage and industrial processes	ILD HE 0650-0900-1000-1150
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	HE versions
Low Noise	Aesthetic and sound absorbing compressor enclosure	Noise level reduction	•
Xtra Low Noise	Acoustic compressor enclosure and low-speed fans	Noise emission reduction at reduced fan speed	HE versions
Super Low Noise	Acoustic compressor enclosure, low-speed fans and enhanced sound insulation of main noise sources	Noise level reduction for sensible sites	HE versions
IP54 control box	Increased leak tightness of the unit	Protects the inside of the control panel from dust, water and sand. As a rule, this option is recommended for installations located in polluted environments	•
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	•
Winter operation down to -20°C	Fan speed control	Stable unit operation when the air temperature is between 0°C and -20°C.	ST versions
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	•
Water type heat exchanger and hydraulic module frost protection	Electric heater on the water exchanger hydraulic module and optional expansion tank	Water type heat exchanger and hydraulic module frost protection down to an outside air temperature of -20°C	•
Water type heat exchanger and hydraulic module frost protection	Electrical heaters on the water type heat exchanger, water pipes, hydraulic module, expansion vessel and buffer tank module	Water type heat exchanger and hydraulic module frost protection down to an outside air temperature of -20°C	•
Partial heat recovery	Unit equipped with one desuperheater on each refrigerant circuit	Production of free high-temperature hot-water simultaneously with chilled water production (or hot water for Heat pump)	•
Master/slave operation	Unit equipped with supplementary water outlet temperature sensor kit to be field installed allowing master/slave operation of two units connected in parallel	Optimised operation of two units connected in parallel with run time equalisation	•
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	•
HP single-pump hydraulic module	Single high-pressure water pump, water filter, electronic water flow rate control, pressure sensors. For more details, refer to the dedicated chapter (expansion tank not included. Option with built-in hydraulic safety components available)	Quick, easy installation (plug & play)	•
HP dual-pump hydraulic module	Dual high pressure water pump, water filter, electronic water flow control, pressure transducers. For more details, refer to the dedicated chapter (expansion tank not included. Option with built-in hydraulic safety components available)	Quick, easy installation (plug & play)	•
LP single-pump hydraulic module	Single low pressure water pump, water filter, electronic water flow control, pressure transducers. For more details, refer to the dedicated chapter (expansion tank not included. Option with built-in hydraulic safety components available)	Quick, easy installation (plug & play)	•
LP dual-pump hydraulic module	Dual low pressure water pump, water filter, electronic water flow control, pressure transducers. For more details, refer to the dedicated chapter (expansion tank not included. Option with built-in hydraulic safety components available)	Quick, easy installation (plug & play)	•
HP variable speed single-pump hydraulic module	Single high pressure water pump with variable speed drive, water filter, electronic water flow control, pressure transducers. Multiple water flow rate control options. For more details, refer to the dedicated chapter (expansion tank not included. Option with built-in hydraulic safety components available)	Easy and fast installation (plug & play), significant pumping energy cost savings (more than two-thirds), tighter water flow control, improved sytem reliability	•
HP variable speed dual-pump hydraulic module	Dual high pressure water pump with variable speed drive, water filter, electronic water flow rate control, pressure transducers. Multiple water flow rate control options. For more details, refer to the dedicated chapter (expansion tank not included. Option with built-in hydraulic safety components available)	Easy and fast installation (plug & play), significant pumping energy cost savings (more than two-thirds), tighter water flow control, improved sytem reliability	•
Lon gateway	Two-directional communication board complying with Lon Talk protocol	Connects the unit by communication bus to a building management system	•
Bacnet over IP	Two-directional high-speed communication using BACnet protocol over Ethernet network (IP)	Easy, high-speed connection by Ethernet line to a building management system. Allows access to multiple unit parameters	•

• ALL MODELS

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

12 - OPTIONS

Options	Description	Advantages	Use
Energy Management Module	Control board with additional inputs/outputs. See Contacts available in option on control description.	Extended remote control capabilities (Set-point reset by 0-20ma 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 controller (the leak detector itself must be supplied by the customer)	Immediate customer notification of refrigerant losses to the atmosphere, allowing timely corrective actions	•
Compliance with Russian regulations	EAC certification	Compliance with Russian regulations	•
Power factor correction	Capacitors for automatic regulation of power factor (cos phi) value to 0.95	Reduction of the apparent electrical power, compliance with minimum power factor limit set by utilities	•
Coil defrost resistance heaters	Electric heaters under the coils and the condensate pans	Prevents frost formation underneath the coils; compulsory in heating mode if the outdoor temperature is below 0°C	•
230V electrical plug	230 VAC power supply source provided with plug socket and transformer (180 VA, 0.8 A)	Enables connection of a laptop or an electrical device during unit start-up or servicing	•
Expansion tank	6-bar expansion vessel integrated into the hydraulic module (requires option 116)	Easy, quick installation (ready to use), and closed circuit protection of hydraulic systems to counter excessive pressure	•
Connection sleeve to be screwed onto the desuperheater	Desuperheater connections with screwed joints	Easy to install. Used to connect the unit to a screw connector	•
Water buffer tank module	Integrates a water buffer tank module	Prevents compressor short cycling and provides stability of the water in the loop	• with hydraulic module
Anti-vibration mounts	Elastomer anti-vibration mounts to be fitted underneath the unit	Isolate the unit from the building, avoid transmission of vibration and associate noise to the building. Must be associated with a flexible connection on water side	•
Exchangers flexible sleeves connection	Flexible connections for the water type heat exchanger	Easy to install. Limits the transmission of vibrations to the water network	•
Exchangers water filter	Water filter	Prevents fouling in the water network	• with hydraulic module
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	•
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	•
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	•
Desuperheater flexible connection sleeves	Flexible connections on the desuperheater water side	Easy to install. Limits the transmission of vibrations to the water network	•

Options	Description	Advantages	Use
M2M supervision, 1 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 supervision, 3 units - France	Monitoring solution enabling customers to remotely track and monitor several items of equipment in real time, France only	Real-time expert technical support to improve equipment availability and reports at customer hand to monitor and optimize operating equipment.	•
M2M supervision, 1 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.

Additional 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 systems is prohibited.

12.2.2 - Hydronic module with variable speed

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

In this case, the pump is controlled by a frequency inverter 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 systems 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.

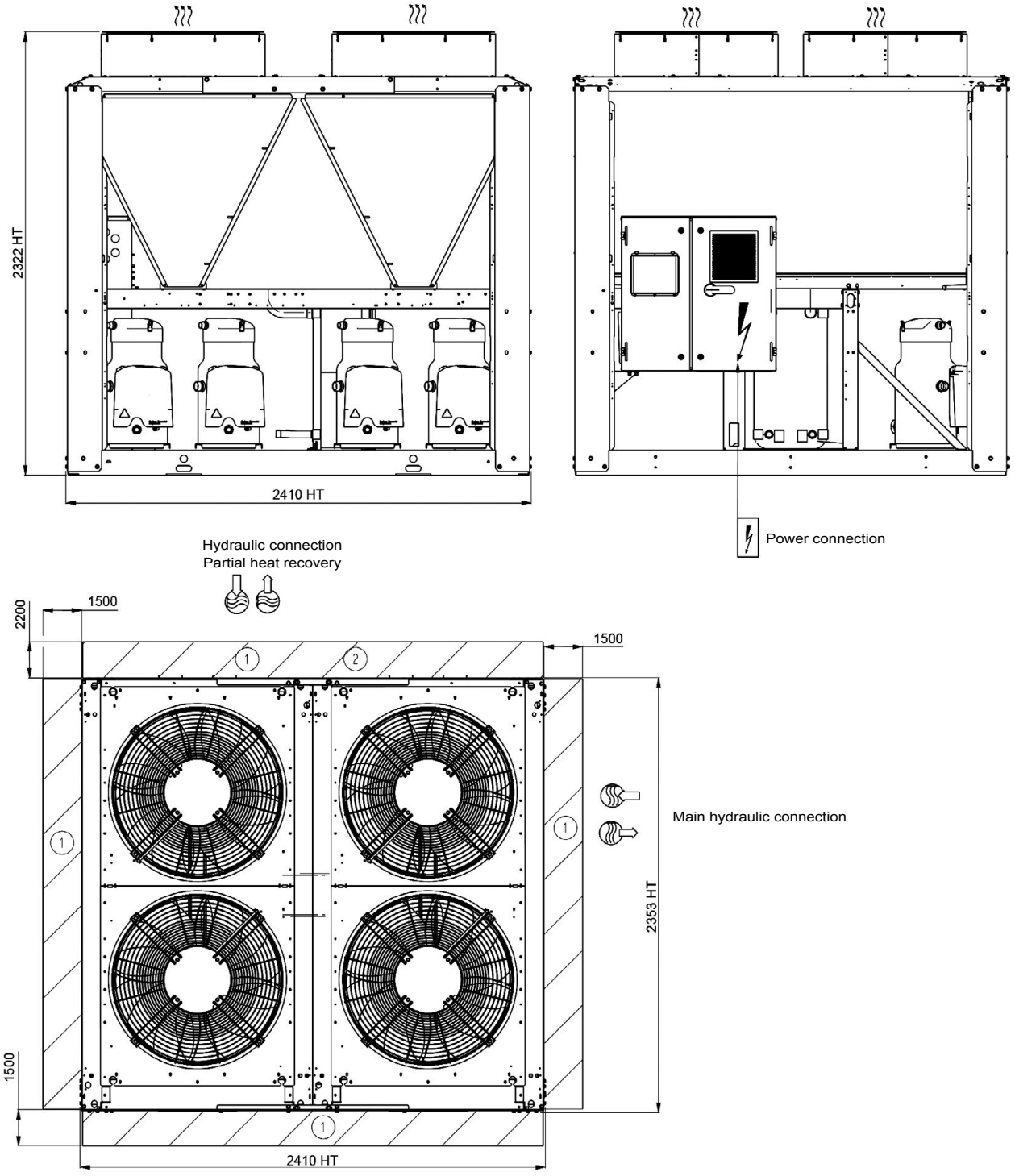
12.2.3.1 - Physical properties of units with partial heat recovery using desuperheaters

AQUACIAT^{POWER} ILD ST / LD HE		602	650	800	900	902	1000	1150	1200	1400	1600	1800	2000
Partial heat recovery on the A/B circuits		Plate heat exchanger											
Water volume circuits A/B	l	2/3.75	2/3.75	3.75/3.75	3.75/3.75	3.75/3.75	3.75/5.5	3.75/5.5	3.75/7.5	5.5/7.5	7.5/7.5	7.5/7.5	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	16,0	22,2	23,7	25,5	29,2	29,2	34,6	36,8	46,2	55,2	56,7	59,2
	tCO_2e	33,3	46,3	49,4	53,2	60,9	60,9	72,2	76,9	96,5	115,3	118,3	123,6
Circuit B(1)	kg	23,7	23,7	23,7	25,5	37,1	38,5	49,7	55,2	55,2	55,2	56,7	59,2
	tCO_2e	49,4	49,4	49,4	53,2	77,4	80,5	103,8	115,3	115,3	115,3	118,3	123,6
Water connections		Victaulic®											
Connection	Inches	2	2	2	2	2	2	2	2	2	2	2	2
External diameter	mm	60,3	60,3	60,3	60,3	60,3	60,3	60,3	60,3	60,3	60,3	60,3	60,3
AQUACIAT^{POWER} ILD ST													
Operating weight(1)													
Unit + Partial heat recovery option	kg	1472	1537	1681	1704	2112	2270	2390	2625	3099	3350	3362	3402
Unit with Xtra Low Noise + Partial heat recovery option	kg	1555	1620	1789	1812	2220	2396	2516	2769	3261	3530	3542	3582
Unit + Xtra Low Noise option + HP dual-pump hydraulic module + Partial heat recovery	kg	1695	1760	1941	1963	2381	2605	2734	2974	3506	3775	3824	3864
AQUACIAT^{POWER} LD HE													
Operating weight(1)													
Unit + Partial heat recovery option	kg	1508	1574	1717	1740	2149	2307	2426	2662	3135	3407	3419	3468
Unit with Xtra Low Noise + Partial heat recovery option	kg	1591	1657	1825	1848	2257	2432	2552	2806	3297	3587	3599	3648
Unit + Xtra Low Noise option + HP dual-pump hydraulic module + Partial heat recovery	kg	1731	1797	1977	1999	2417	2641	2770	3011	3543	3833	3881	3930

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

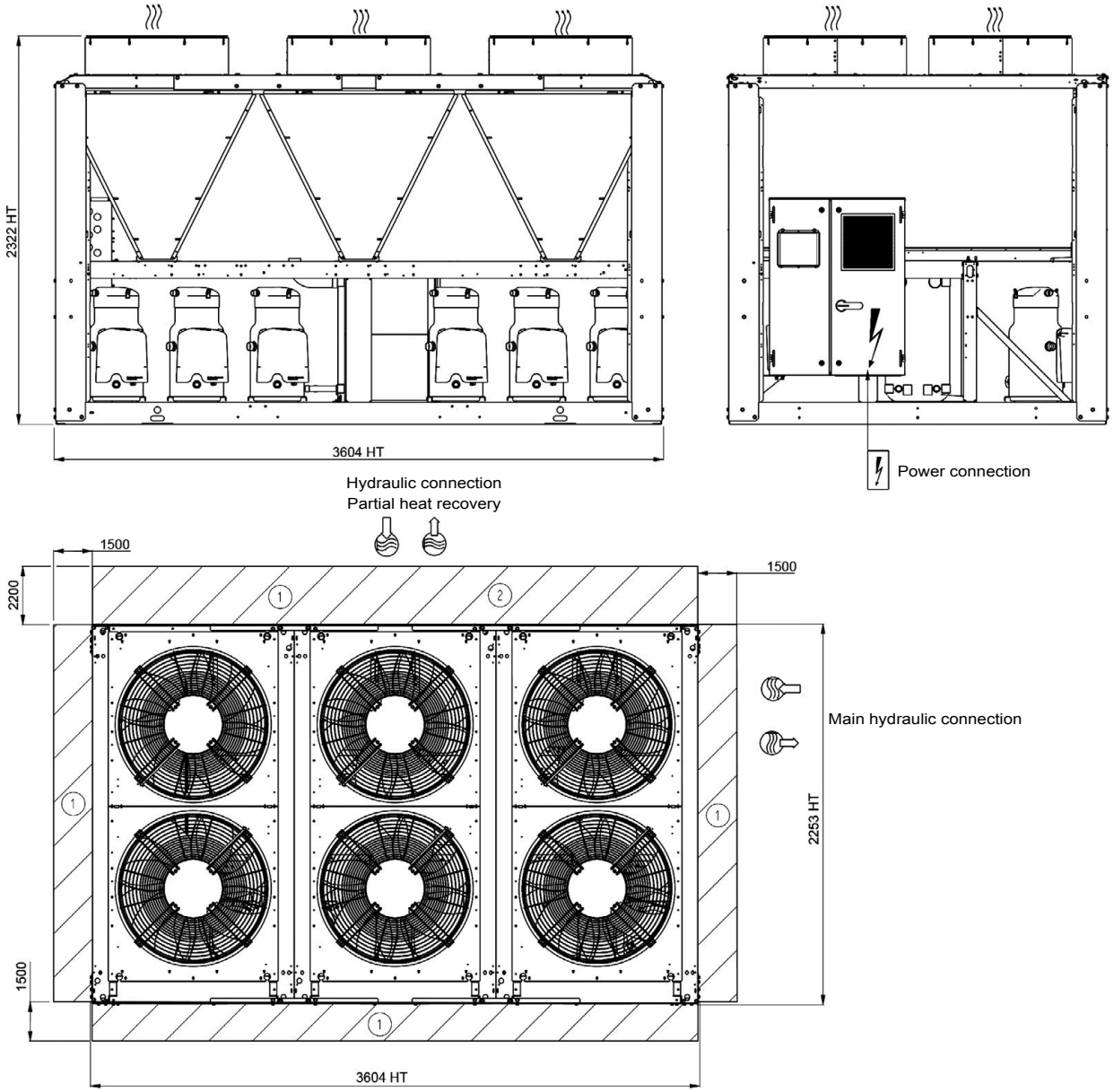
DIMENSIONS, CLEARANCES

AQUACIAT^{POWER} ILD ST/HE 602-900



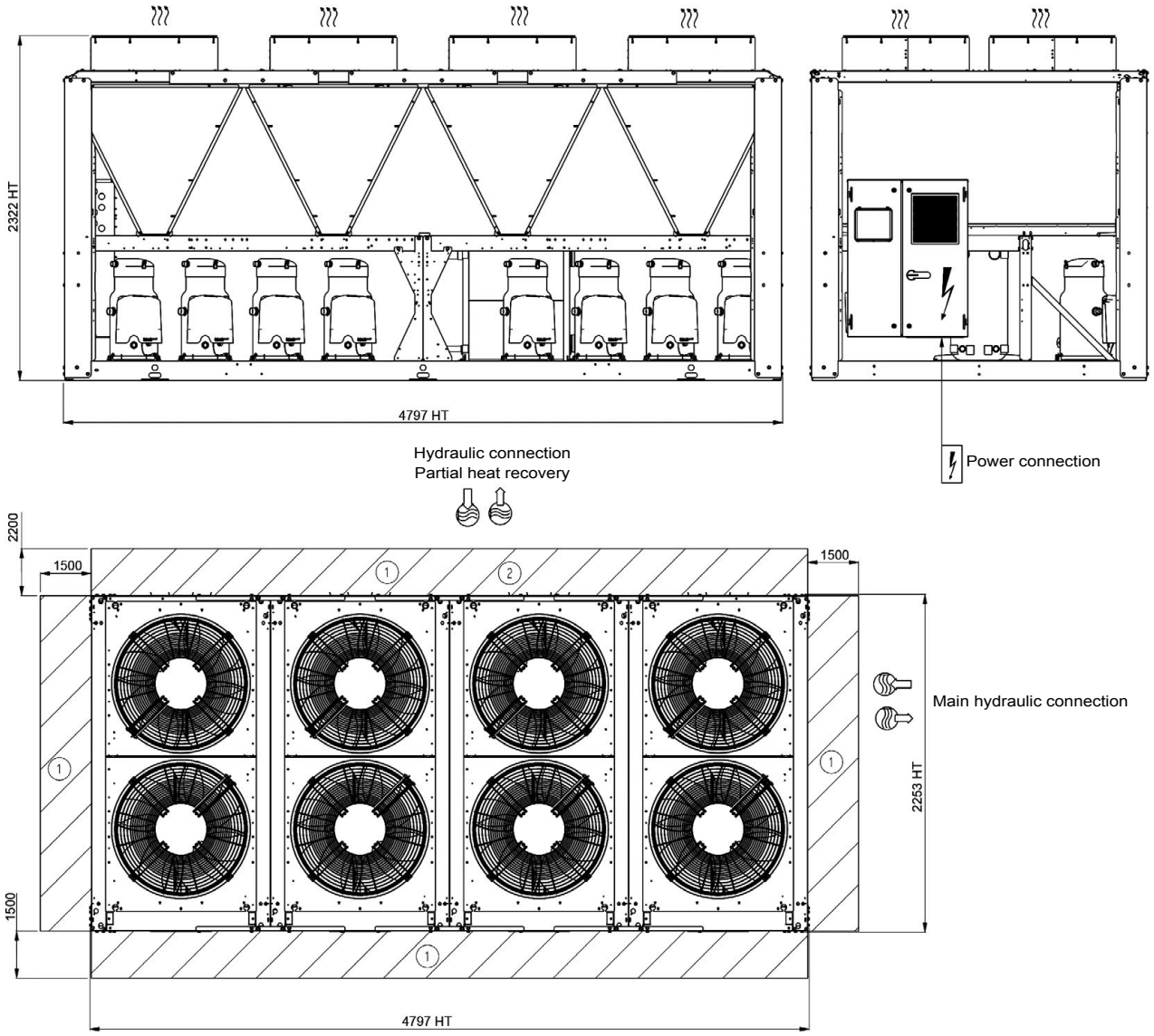
NOTE: For units with other options, refer to the certified dimensional drawings

AQUACIAT^{POWER} ILD ST/HE 902-1200



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

AQUACIAT^{POWER} ILD ST/HE 1400-2000



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

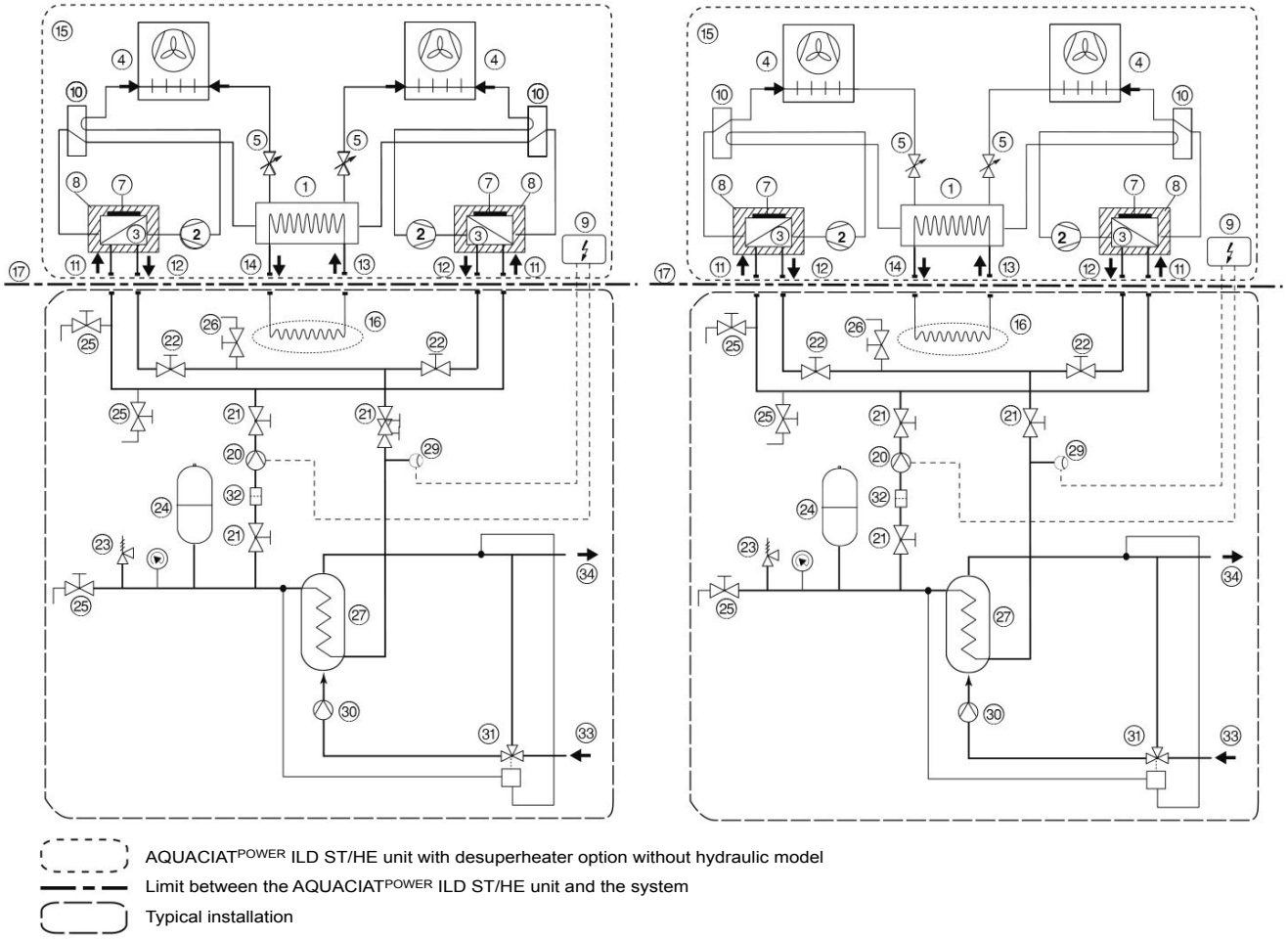
The units with the desuperheater option are supplied with one plate heat exchanger per refrigerant circuit.

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

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

Main diagram of the partial heat recovery option in a standard system

Heating mode **Cooling mode**



AQUACIAT^{POWER} ILD ST/HE unit with desuperheater option without hydraulic model

Limit between the AQUACIAT^{POWER} ILD ST/HE unit and the system

Typical installation

Legend:

Components of the AQUACIAT^{POWER} ILD unit

1- Water-cooled heat exchanger
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- Heating/cooling cycle four-way reversing valve
11- Water inlet on the desuperheater
12- Water outlet on the desuperheater
13- Water heat exchanger water inlet
14- Water heat exchanger water outlet
15- Unit with desuperheater option without hydronic module
16- System heat load
17- Limit between the AQUACIAT^{POWER} ILD ST/HE unit and the standard system

System components (installation example)

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

12.2.3.3 - Installation

The hydraulic supply for each desuperheater is delivered in parallel.

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

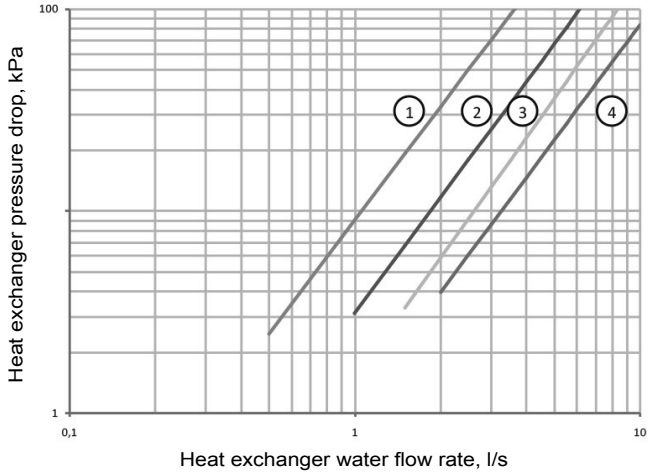
Fit water flow rate balancing and control valves at the exchanger outlet.

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

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

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

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



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

Cooling mode		Minimum	Maximum
water type heat exchanger			
Water inlet temperature at start-up(1)	°C	6.8(1)	30
Water outlet temperature during operation	°C	5	15
Water inlet temperature on shut-down	°C	-	60
Desuperheater			
Water inlet temperature at start-up(2)	°C	25	60
Water outlet temperature during operation	°C	30	80
Water inlet temperature on shut-down	°C	3	60
Water-cooled exchanger (condenser)			
Entering air temperature(3)	°C	0	46
Available static pressure	Pa	0	0
Heating mode		**Minimum**	**Maximum**
Water-cooled exchanger (condenser)			
Entering water temperature at start-up	°C	8	45
Water outlet temperature during operation	°C	20	50
Water inlet temperature on shut-down	°C	3	60
Desuperheater			
Water inlet temperature at start-up(2)	°C	25	60
Water outlet temperature during operation	°C	30	80
Water inlet temperature on shut-down	°C	3	60
water type heat exchanger (evaporator)			
Entering air temperature	°C	-10	35
Available static pressure	Pa	0	0

Note: Do not exceed the maximum operating temperature.

(1) For applications requiring operation below 6.8°C, contact the manufacturer.

(2) On start-up, the water inlet temperature must not be below 25°C. For installations with a lower temperature a three-way valve is necessary.

(3) For operation below -20°C, the unit must be equipped with the frost protection option, or the installer must protect the water loop by adding a frost protection solution.
Maximum outdoor temperatures: during storage and transportation, the minimum temperature of the AQUACIAT^{POWER} ILD ST/HE units must not be below -20°C and the maximum must not exceed +48°C. It is recommended to observe these temperatures during transport by container.

12.2.3.6 - Control configuration with the partial heat recovery 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.

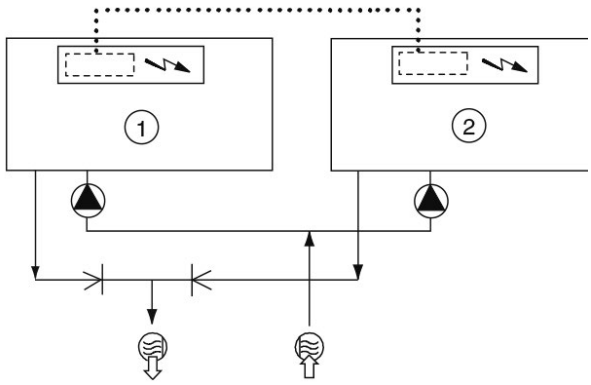
IMPORTANT:

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

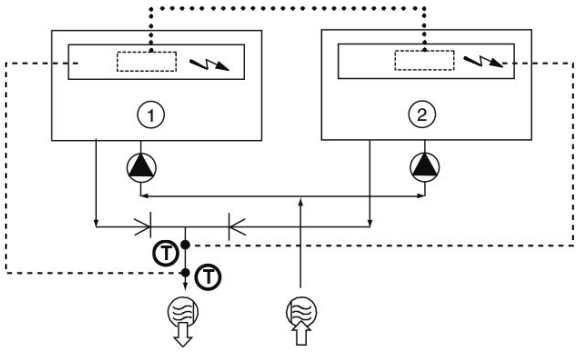
If one or both units is equipped with the variable speed pump option, it is strongly recommended not to set the control mode on the pressure differential.

The same setpoint is recommended for configuring the temperature differential mode.

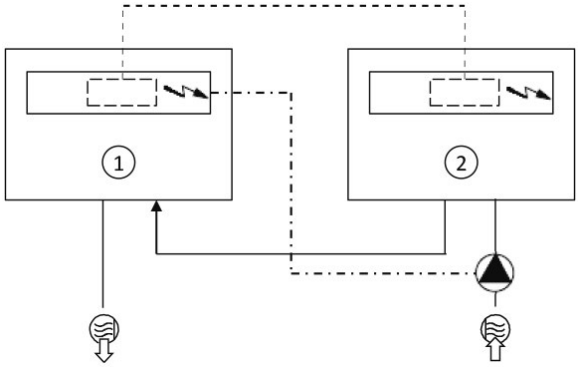
Case 1: operation in parallel - control on water inlet for units with hydronic modules



Case 2: operation in parallel - control on water outlet for units with hydronic modules



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 all of the machine's operating conditions.

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 battery is controlled by a controller which reads the current draw by the unit and adjusts the power factor to a setting of 0.95.

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

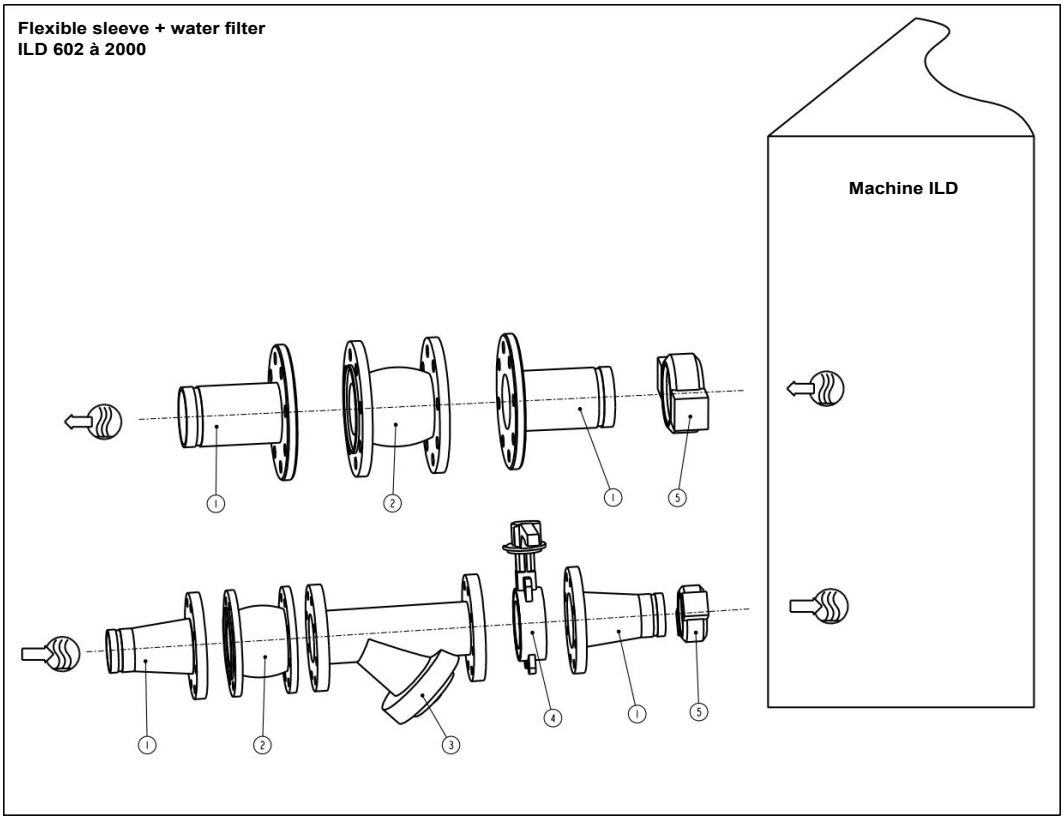
The capacitors are selected for each unit as per below table:

Size of the AQUACIAT^{POWER} ILD ST / HE unit		602	650	800	900	902	1000	1150	1200	1400	1600	1800	2000
Capacitors Capacity (kVAR)		30	30	40	40	40	50	50	60	70	80	80	80
Capacitor 1	Capacity (kVAR)	10	10	10	10	10	10	10	20	10	20	20	20
	Ir(A)	14	14	14	14	14	14	14	29	14	29	29	29
Capacitor 2	Capacity (kVAR)	20	20	10	10	10	20	20	20	20	20	20	20
	Ir(A)	29	29	14	14	14	29	29	29	29	29	29	29
Capacitor 3	Capacity (kVAR)	-	-	20	20	20	20	20	20	40	40	40	40
	Ir(A)	-	-	29	29	29	29	29	29	58	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

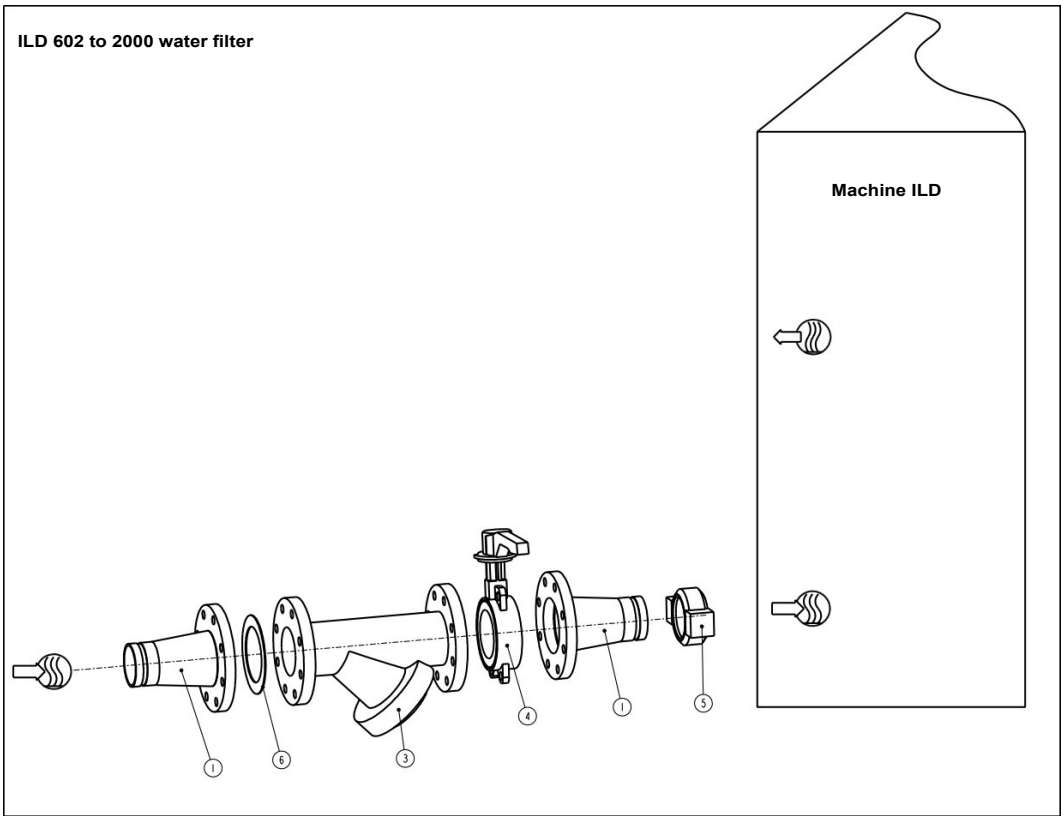
Below are the equipment diagrams depending on the different configurations:



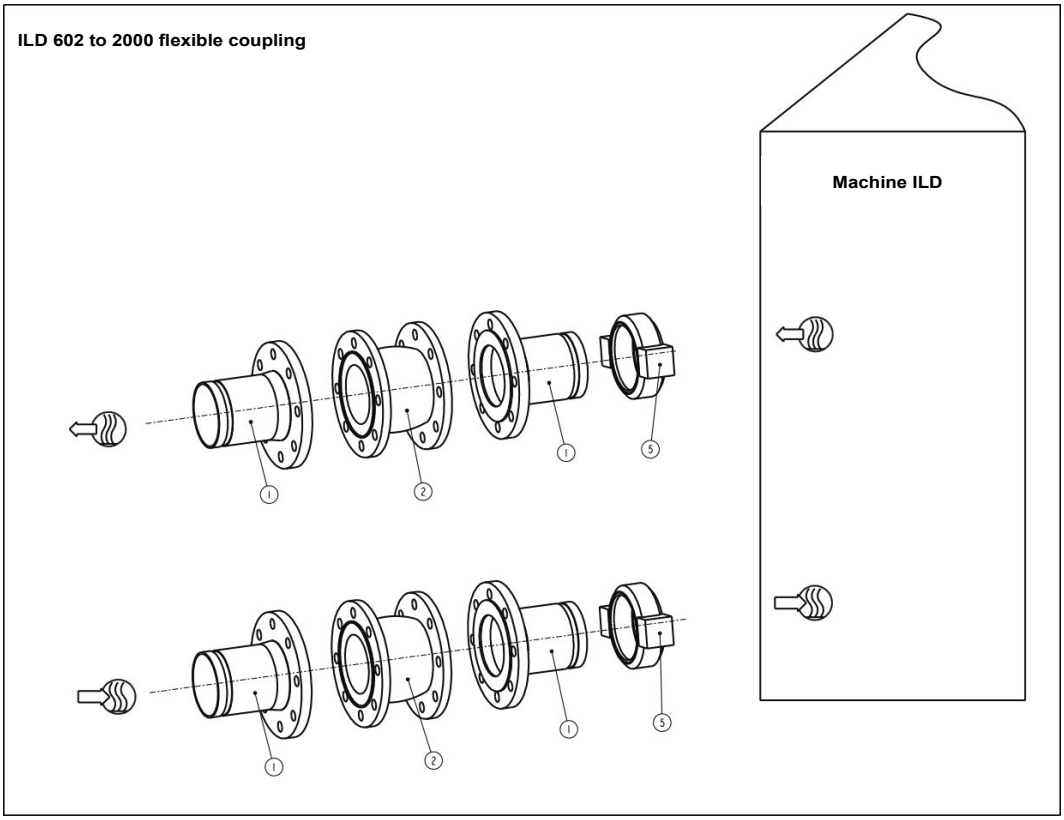
Legend

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

ILD 602 to 2000 water filter



ILD 602 to 2000 flexible coupling



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 - Low-temperature brine solution option

Glycol/water mix production from 0°C to -8°C is only possible with the low-temperature glycol/water mix option.

The unit is equipped with insulation on the suction pipes. The insulation is reinforced on the low-temperature brine solution option.

The operating range depends on:
- the unit size,
- the glycol type,
- its concentration,
- the flow rate,
- the temperature of the glycol solution,
- the condensing pressure (ambient temperature).

12.2.7.1 - 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.

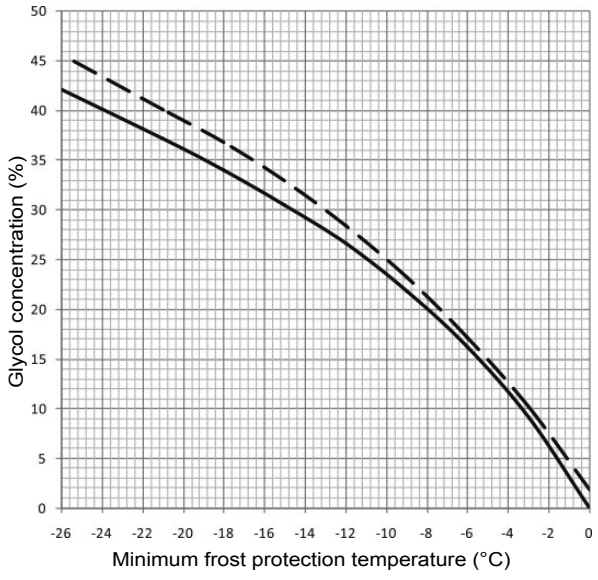
This value will be used to configure the following protection:

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).

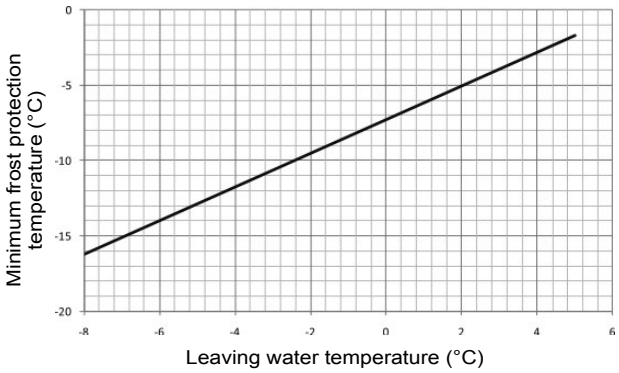
12.2.7.2 - Glycol concentration required

Ethylene and Propylene glycol freezing curve



12.2.7.3 - Minimum frost protection temperature to be observed based on the leaving water 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 30%, the frost protection temperature value of -14.8°C must be entered in the software. This corresponds to a minimum leaving water temperature of -6.7°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 machine

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

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

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

If required by a specific installation, the unit's maximum fan speed can be configured in the Service Configuration menu. Refer to the control manual.

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

The performances (capacity, efficiency, noise level) depend on the fan speed 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 - Specific installation on ductable units

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

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

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

The rotation speed of all the fans in the same circuit is controlled in the same way. Therefore each circuit operates independently.

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

On ductable units, each fan is equipped with a factory-fitted connection interface frame providing a link between the ductwork itself.

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

ILD HE	Circuit A Nominal/maximum air flow rate (l/s)	Circuit B Nominal/maximum air flow rate (l/s)
602	4767 / 5720	9534 / 11441
650-900	9534 / 11441	9534 / 11441
902-1000	9534 / 11441	14301 / 17161
1150-1200	9534 / 11441	19068 / 22882
1400	14301 / 17161	19068 / 22882
1600-2000	19068 / 22882	19068 / 22882

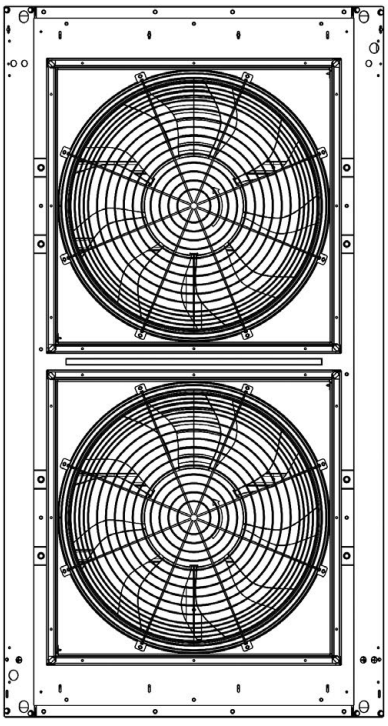
12.2.8.3 - Air connection on discharge

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.

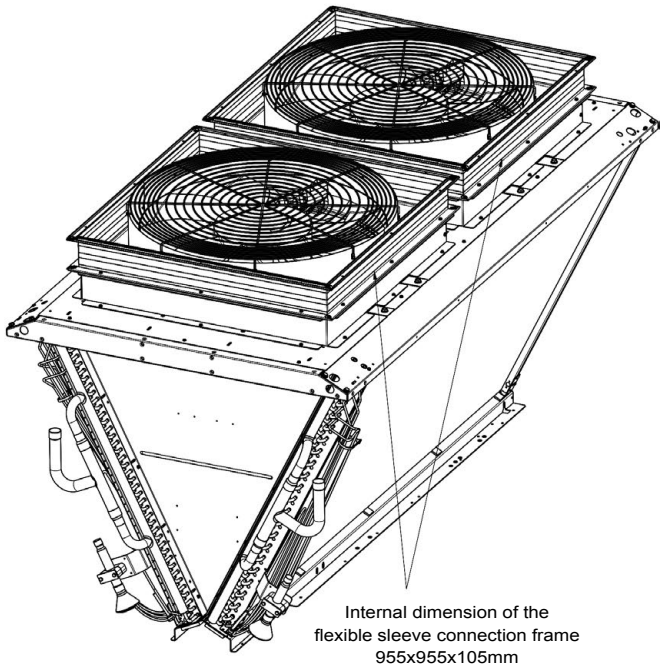
Factory-installed duct connection interface on each fan

V-shaped air heat exchanger

Top view

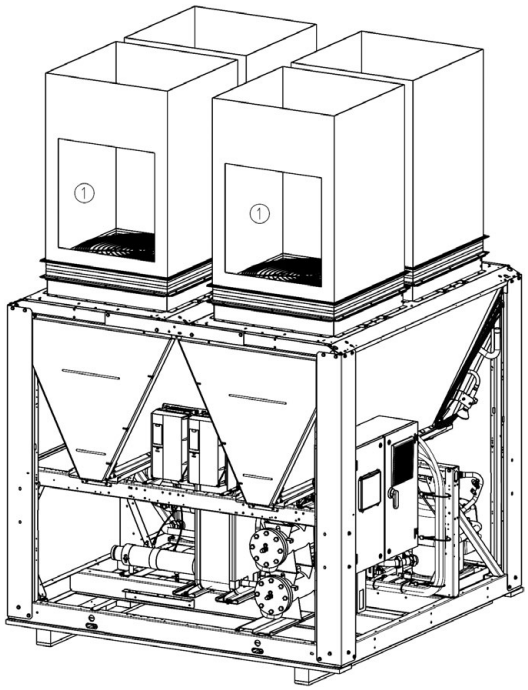


View from side

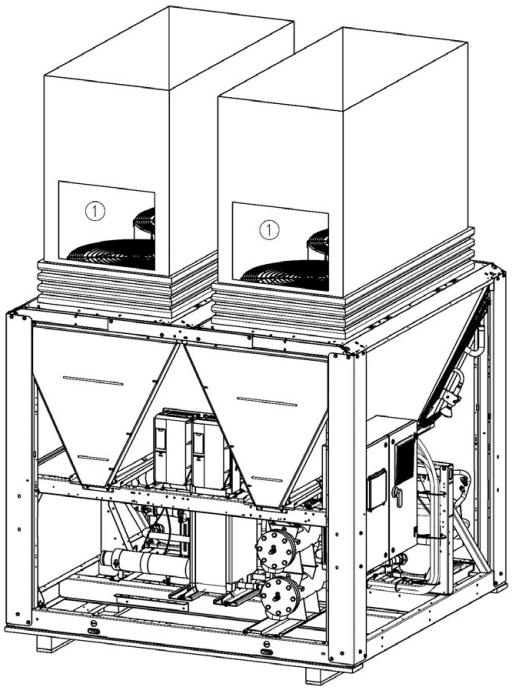


Principle of the installation of the ducts

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.

Fan motor electrical protection

In case of a locked rotor or an overload, the motors of each circuit are electrically protected by the circuit variable speed drive.

Each variable speed drive follows a variable current characteristic, based on the frequency from 10 to 60 Hz and the number of controlled fans.

If a fan stops working, the variable speed drive automatically detects the malfunction.

Refer to the control manual for the list of alarms specific to this option.

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 provide electrical protection via a thermal-magnetic circuit breaker and a control switch 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 hydraulic module".

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.

The refrigeration equipment must be serviced by professionals; however, routine checks may be carried out locally by specially-trained technicians. See the standard EN 378-4.

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

IMPORTANT: Before performing any work on the machine ensure it is deenergized. If a refrigerant circuit is opened, it must be evacuated, recharged and tested for leaks. Before any operation on a refrigerant circuit, it is necessary to evacuate the refrigerant 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,
- Prevention of accidental component failure
- Prevention of major time-consuming and costly work,
- Protection of the environment.

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

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

13.1 - Level 1 maintenance

These simple procedures can be carried out by the user:
- Visual inspection 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 may be monthly or annual, depending on the type of check.

In these cases, the following maintenance operations are recommended:

Carry out all level 1 operations, then:

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

Hydraulic:
- 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:
- The unit is subject to F-gas tight regulatory checks. Please refer to the table in the introduction.
- 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	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-, QF-	1
Screw terminal, pump contactor	KM90, KM90A	2,5
M8 screw customer connection (size 602-1000)	QS100	15 - 22
M10 screw customer connection (size 1150-1600)	QS100	30 - 44
M12 screw customer connection (size 1800-2000)	QS100	50 - 75
Screw terminal, circuit breakers (size 602-1200)	QF100	3.2-3.7
Screw terminal, circuit breakers (size 1400-2000)	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

13.5 - Tightening t orques for the main fastenings

Screw type	Use	Value (N.m)
Metal screw D=4.8	Condensing module, casing, supports	4,2
Metal screw D=6,3	Plastic volute	4,2
Taptite M10 screw	Air coil sub-assembly, chassis-structure, electrical box fixing, plate heat exchanger and pump	30
Taptite M6 screw	Pipe supports, enclosure, variable frequency drive supports	7
H M6 screw	Pipe clip	10
H M10 nut	Compressor chassis, Compressor fixing and buffer tank	30
Oil equalisation screw	Oil equalisation line	145
M16 screw	Refrigerant accumulator tank flange	180

13.6 - Air-cooled exchanger

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

Recommendations for maintenance and cleaning of copper pipe coils and aluminium fins (RTPF):
- Regularly cleaning the coil surface is essential for correct unit operation.
- Eliminating contamination and removal of harmful residue will increase the operating life of the coils and the unit.
- Specific recommendation in case of snow: For long term storage, regularly check that no snow has accumulated on the coil.
- Clean the coils completely using a low pressure jet and a biodegradable cleaning agent.
- It is essential to control the pressure and take care not to damage the fins.

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 2/3 of the corrosion problems. Protect the electrics box during cleaning operations.

13.7 - Water-cooled heat exchanger

Check that:

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

13.8 - Frequency inverter

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

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

The frequency inverters fitted on the units do not require a dielectric test, even if being replaced: they are systematically checked before delivery. Moreover, the filtering components installed in the frequency inverter 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 frequency inverter 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		

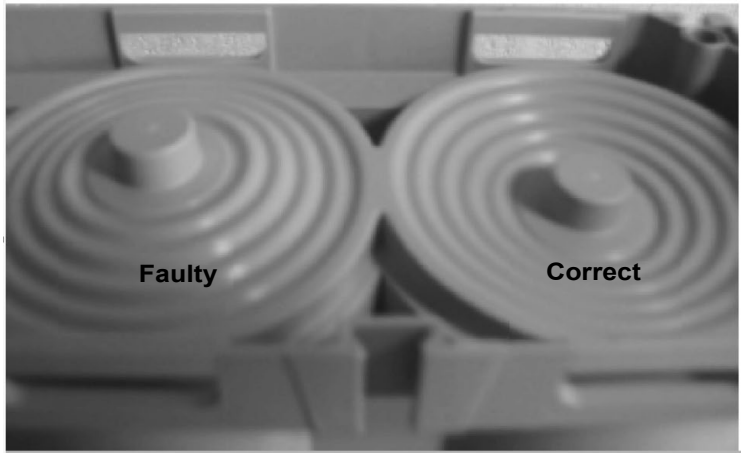
13.11 - Power factor correction

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 1.3 x Ir. 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
- Heat-transfer fluid: depending on the installation, water, glycol/water mix, etc.
- 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

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

Equipment

AQUACIAT^{POWER} ILD ST / HE model:..... Serial number.....

Compressors

Circuit A

1. Model #.....
   Serial number .....
2. Model #.....
   Serial number .....
3. Model #.....
   Serial number .....
4. Model #.....
   Serial number .....

Circuit B

1. Model #.....
   Serial number .....
2. Model #.....
   Serial number .....
3. 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 nameplate
☐ Power 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 air handling systems

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

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

Unit start-up

☐ Chilled water pump 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 evaporator water loop
Water loop volume = ... (litres)
Calculated volume = ... (litres)
2.5 litres/nominal kW capacity for air conditioning
6.50 litres/nominal kW capacity for air conditioning

☐ Proper loop volume established
☐ Correct loop corrosion inhibitor included ..... litres of.....
☐ Proper 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

Check pressure drop on the evaporator (without hydronic module) or ESP(1) (with hydronic module)
Evaporator inlet = (kPa)
Evaporator outlet = (kPa)
Pressure drop (Inlet - Outlet) = (kPa)

(1) 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 hydraulic module, an indication of the flow is displayed by the unit control (see the AQUACIAT^{POWER} ILD 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 corresponds to the specification of ..... (l/s)

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

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

Check and log on to the user menu configuration

Load sequence selection.....
Capacity ramp loading selection.....
Start-up delay .....
Pump control .....
Setpoint reset mode .....
Night mode capacity limitation.....

Re-enter the setpoints

To start up the chiller

Warning

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

The unit starts and operates properly

Temperatures and pressures

WARNING

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

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

NOTE:

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.....

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