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06 - 2018

HYDROCIAT TURBO LWT

Instruction Manual

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Content

Content

This manual applies to the following all Hydrociat^{Turbo} LWT versions.

For the operation of the control please refer to the Hydrociat^{Turbo} Connect'Touch Control manual.

The cover photograph is for illustrative purposes only and is not part of any offer for sale or contract.

1 - INTRODUCTION

The Hydrociat^{Turbo} LWT units are designed to cool water for the air conditioning of buildings and industrial processes.

Prior to the initial start-up of the Hydrociat^{Turbo} LWT units, the people involved in the on-site installation, start-up, operation, and maintenance of this unit should be thoroughly familiar with these instructions and the specific project data for the installation site.

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

They are designed for an operating life of 15 years by assuming a 75% utilisation factor; that is approximately 100,000 operating hours.

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

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

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

1.1 - Installation safety considerations

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

After the unit has been received, when it is ready to be installed or reinstalled, and before it is started up, it must be inspected for damage. Check that the refrigerant circuit(s) is (are) intact, especially that no components or pipes have shifted (e.g. following a shock). If in doubt, carry out a leak tightness check and verify with the manufacturer that the circuit integrity has not been impaired. If damage is detected upon receipt, immediately file a claim with the shipping company.

The manufacturer strongly recommends employing a specialised company to unload the machine.

It is compulsory to wear personal protection equipment.

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

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

Use slings or lifting beams with the correct capacity, and always follow the lifting instructions on the certified drawings supplied with the unit. Do not tilt the unit more than 15°.

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

Never cover any protection devices.

This applies to the relief valves (if used) in the refrigerant or heat transfer medium circuits, the fuse plugs and the pressure switches.

Ensure that the valves are correctly installed, before operating the unit.

Classification and control

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

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

(1) Classified for protection in normal service situations.

(2) Classified for protection in abnormal service situations. These accessories are sized for fires with a thermal flow of 10kW/m^2. No combustible matter should be placed within 6.5m of the unit.

(3) The instantaneous over-pressure limited to 10% of the operating pressure does not apply to this abnormal service situation. The control pressure can be higher than the service pressure. In this case either the design temperature or the high-pressure switch ensures that the service pressure is not exceeded in normal service situations.

(4) The selection of these discharge valves must be made by the personnel responsible for completing the hydraulic installation.

If the relief valves are installed on a change-over valve, this is equipped with a relief valve on each of the two outlets. Only one of the two relief valves is in operation, the other one is isolated. Never leave the change-over valve in the intermediate position, i.e. with both ways open bring the actuator in abutment, front or back according to the outlet to isolate. If a relief valve is removed for checking or replacement please ensure that there is always an active relief valve on each of the change-over valves installed in the unit.

All factory-installed relief valves are lead-sealed to prevent any calibration change.

The external relief valves and the fuses are designed and installed to ensure damage limitation in case of a fire.

In accordance with the regulations applied for the design, the European directive on equipment under pressure and in accordance with the national usage regulations:

- **These relief valves and fuses are not safety accessories but damage limitation accessories in case of a fire,**
- **The high pressure switches are the safety accessories.**

The relief valve must only be removed if the fire risk is fully controlled and after checking that this is allowed by local regulations and authorities. This is the responsibility of the operator.

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

- **Stay away from the unit**
- **Set up warnings and recommendations for personnel in charge to stop the fire.**

Fire extinguishers appropriate to the system and the refrigerant type must be easily accessible.

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

They include a sizing method and examples for configuration and calculation. Under certain conditions these standards permit connection of several valves to the same discharge pipe. Note: Like all other standards these EN standards are available from national standards organisations.

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

It is recommended to install an indicating device to show if part of the refrigerant has leaked from the valve.

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 a nuisance tripping or leaks, replace or re-calibrate the valve.

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

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

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

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

1.2 - Equipment and components under pressure

The units are intended to be stored and operate in an environment where the ambient temperature must not be less than the lowest allowable temperature indicated on the nameplate. See section "11.2 - Pressure vessels".

1.3 - Maintenance safety considerations

The manufacturer recommends the following drafting for a logbook (the table below should not be considered as reference and does not involve manufacturer responsibility):

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

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

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

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

The insulation must be removed and heat generation must be limited by using a wet cloth.

Any manipulation (opening or closing) of a shut-off valve must be carried out by a qualified and authorised engineer. These procedures must be carried out with the unit shut-down.

NOTE: The unit must never be left shut down with the liquid line valve closed, as liquid refrigerant can be trapped between this valve and the expansion device. (This valve is situated on the liquid line before the filter drier box.)

Equip the engineers that work on the unit as follows:

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

(1) We recommend to follow 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 energized.

The Hydrociat^{Turbo} LWT units are fitted with electrical circuit not disconnected by the main disconnect switch(es).

Never work on any of the electrical components, until the general power supply to the unit has been cut at field installation or using the main supply and the excepted disconnect switches in the control box.

A motor mechanism module is integrated to insure the automatic main supply disconnect switch closure. If any maintenance operations are carried out on the unit, lock all the power supply circuit(s) in the open position.

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

Even if the unit has been stopped the power circuit remains energized, unless the unit or circuit disconnect switch is open. Refer to the wiring diagram for further details. Attach appropriate safety labels.

The frequency variator drive integrated in the compressor(s) used in Hydrociat^{Turbo} LWT units are equipped with capacitor batteries. A delay of twenty (20) minutes after disconnecting the power, corresponding to the discharge time, must be observed before to remove the compressor(s) input cover.

Operating checks:

Important information regarding the refrigerant used:

- **This product contains fluorinated greenhouse gas covered by the Kyoto protocol.**
  Fluid type: R-134A
  Global Warming Potential (GWP): 1430

1. **Prevent the release of fluorinated gas from the unit. Ensure that fluorinated gas is never released to the atmosphere during installation, maintenance or disposal. If a leak of fluorinated gas is detected, ensure the leak is stopped and repaired as quickly as possible.**
2. **Only a qualified service technician is allowed to access this product and to correct the fault.**
3. **Any handling of fluorinated gas contained in this product (e.g. removing the charge or topping up the gas) must comply with the F-Gas Directive (EC) No. 517/2014 concerning certain fluorinated greenhouse gases and any other applicable local legislation.**
4. **The gas recovery for recycling, regeneration or destruction is at customer charge.**
5. **The deliberate gas release is strictly not allowed.**
6. **Contact your local dealer or installer if you have any questions.**

- **Carry out periodic leak tests. In the European Union, article 2 of regulation (EU) No.517/2014 makes these mandatory and sets their frequency. The table below shows this frequency, as originally published in the regulation. Check whether an inspection frequency is also set by other regulations or standards applicable to your system (e.g. EN 378, ISO 5149, etc.).**

  A logbook must be established for the systems that require a tightness check. It should contain the quantity and the type of fluid present within the installation (added and recovered), the quantity of recycled fluid, the date and output of the leak test, the designation of the operator and its belonging company, etc.

Leak test periodicity:

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

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

- **During the life-time of the system, inspection and tests must be carried out in accordance with national regulations.**

Protection device checks (EN 378):
The safety devices must be checked on site once a year for safety devices (see chapter 11.3 - High-pressure safety switch), and every five years for external overpressure devices (external relief valves).

The company or organisation that conducts a pressure switch test shall establish and implement a detailed procedure to fix:
- Safety measures
- Measuring equipment calibration
- Validating operation of protective devices
- Test protocols
- Recommissioning of the equipment.

Consult the manufacturer Service for this type of test. The manufacturer mentions here only the principle of a test without removing the pressure switch:
- Verify and and record the set-points of pressure switches and relief devices (valves and possible rupture discs)
- Be ready to switch-off the main disconnect switch of the power supply if the pressure switch does not trigger (avoid over-pressure or excess gas in case of valves on the high-pressure side with the recovery condensers)
- Connect a pressure gauge protected against pulsations (filled with oil with maximum pointer if mechanical), preferably calibrated (the values displayed on the user interface may be inaccurate in an instant reading because of the scanning delay applied in the control)
- Complete an HP Test
- Neutralize HP soft protection
- Cut condenser water flow
- Check the cut-off value
- Reactivate manually HP switch and reactivate HP soft value"
- Repeat the procedure for each unit compressor.

If the test leads to replacing the pressure switch, it is necessary to recover the refrigerant charge, these pressure switches are not installed on automatic valves (Schraeder type).

At least once a year thoroughly inspect the protection devices (valves). If the machine operates in a corrosive environment, inspect the protection devices more frequently.

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

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

Change the refrigerant when there are equipment failures, following a procedure such as the one described in NF E29-795 or carry out a refrigerant analysis in a specialist laboratory.

If the refrigerant circuit remains open for longer than a day after an intervention (such as a component replacement), the openings must be plugged and the circuit must be charged with nitrogen (inertia principle). The objective is to prevent penetration of atmospheric humidity and the resulting corrosion on the internal walls and on non-protected steel surfaces.

1.4 - Repair safety considerations

It is compulsory to wear personal protection equipment.

The insulation must be removed and warming up must be limited by using a wet cloth.

Before opening the unit always ensure that the circuit has been purged.

If work on the evaporator is required, ensure that the piping from the compressor is no longer pressurised (as the valve is not leaktight in the compressor direction.)

All installation parts must be maintained by the personnel in charge, in order to avoid material deterioration and injuries to people. Faults and leaks must be repaired immediately. The authorized technician must have the responsibility to repair the fault immediately. Each time repairs have been carried out to the unit, the operation of the protection devices must be re-checked.

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

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

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

Ensure that you are using the correct refrigerant type before recharging the unit

The compressors operating are NOT lubricated. Charging any oil type will impair machine operation and lead to a destruction of the compressor.

Charging any refrigerant other than the original charge type (R-134a) will impair machine operation and can even lead to a destruction of the compressors.

RISK OF EXPLOSION: 

Do not use oxygen to purge lines or to pressurize a machine for any purpose. Oxygen gas reacts violently with oil, grease, and other common substances.

Never exceed the specified maximum operating pressures. Verify the allowable maximum high- and low-side test pressures by checking the instructions in this manual and the pressures given on the unit name plate.

Do not use air for leak testing. Use only refrigerant or dry nitrogen.

Do not unweld or flamecut the refrigerant lines or any refrigerant circuit component until all refrigerant (liquid and vapour) has been removed from chiller. Traces of vapour should be displaced with dry air nitrogen. Refrigerant in contact with an open flame produces toxic gases.

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

Do not siphon refrigerant.

Avoid contact with liquid refrigerant on the skin or splashing it into the eyes. Use safety goggles. Wash any spills from the skin with soap and water. If liquid refrigerant enters the eyes, immediately and abundantly flush the eyes with water and consult a doctor.

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

Seek medical attention before treating such injuries.

Have access to a first-aid kit, especially for treating eye injuries.

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

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

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

Any refrigerant transfer and recovery operations must be carried out using a transfer unit. A 3/8" SAE connector on the manual liquid line valve is supplied with all units for connection to the transfer station. The units must never be modified to add refrigerant, removal and purging devices. All these devices are provided with the units. Please refer to the certified dimensional drawings for the units.Do not re-use disposable (non-returnable) cylinders or attempt to refill them. It is dangerous and illegal. When cylinders are empty, evacuate the remaining gas pressure, and move the cylinders to a place designated for their recovery. Do not incinerate.

Only use refrigerant R134a, in accordance with AHRI 700-2014 (Air conditioning, Heating and Refrigeration Institute). The use of any other refrigerant may expose users and operators to unexpected risks.

Do not attempt to remove refrigerant circuit components or fittings, while the machine is under pressure or while it is running. Be sure pressure is at 0 kPa before removing components or opening a circuit.

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

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

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

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

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

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

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

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

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

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

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

2 - PRELIMINARY CHECKS

2.1 - Check equipment received

- Inspect the unit for damage or missing parts. If damage is detected, or if shipment is incomplete, immediately file a claim with the shipping company.
- Confirm that the unit received is the one ordered. Compare the name plate data with the order.
- The unit name plate must include the following information:
  - Version number
  - Model number
  - CE marking
  - Serial number
  - Year of manufacture and test date
  - Fluid being transported
  - Refrigerant used and refrigerant class
  - Refrigerant charge per circuit
  - Containment fluid to be used
  - PS: Min./max. allowable pressure (high and low pressure side)
  - TS: Min./max. allowable temperature (high and low pressure side)
  - Pressure switch cut-out pressures
  - Unit leak test pressure
  - Voltage, frequency, number of phases
  - Maximum current drawn
  - Maximum power input
  - Unit net weight
- Confirm that all accessories ordered for on-site installation have been delivered, and are complete and undamaged.

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

2.2 - Moving and siting the unit

2.2.1 - Moving

See chapter 1.1 "Installation safety considerations".

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

2.2.2 - Siting the unit

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

Typical applications of these units are in refrigeration systems, and they do not require earthquake resistance. Earthquake resistance has not been verified.

Before siting the unit check that:

- the permitted loading at the site is adequate or that appropriate strenghtening measures have been taken.
- the unit is installed level on an even surface (maximum tolerance is 5 mm in both axes).
- there is adequate space above the unit for air flow and to ensure access to the components.
- the number of support points is adequate and that they are in the right places.
- the location is not subject to flooding.

Lift and set down the unit with great care. Tilting and jarring can damage the unit and impair unit operation.

2.2.3 - Checks before system start-up

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

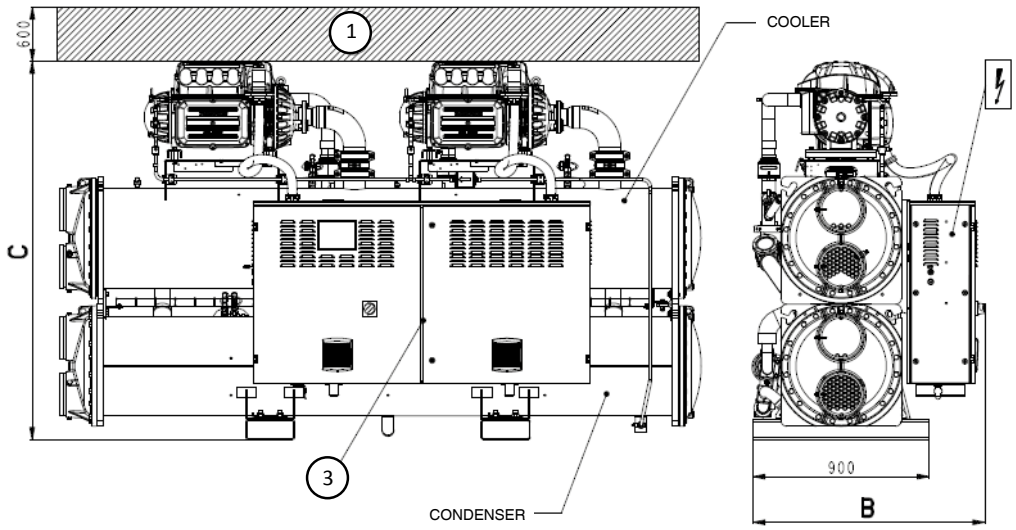
During the installation test national regulations must be followed. If no national regulation exists, standard EN 378 or ISO-5149 can be used as a guide.

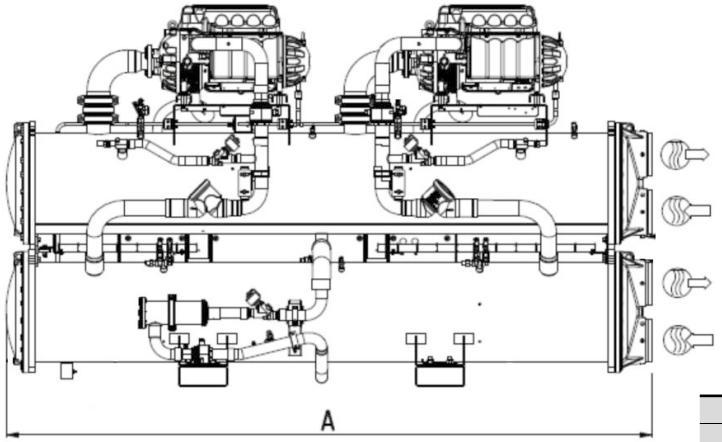
External visual installation checks:

- Ensure that the machine is charged with refrigerant. Verify on the unit nameplate that the 'fluid being transported' is R-134a and is not nitrogen.
- Compare the complete installation with the refrigeration system and power circuit diagrams.
- Check that all components comply with the design specifications.
- Check that all protection documents and equipment provided by the manufacturer (dimensional drawings, P&ID, declarations etc.) to comply with the regulations are present.
- Verify that the environmental safety and protection and devices and arrangements provided by the manufacturer to comply with the regulations are in place.
- Verify that all document for pressure containers, certificates, name plates, files, instruction manuals provided by the manufacturer to comply with the regulations are present.
- Verify the free passage of access and safety routes.
- Check that ventilation in the plant room is adequate.
- Check that refrigerant detectors are present.
- Verify the instructions and directives to prevent the deliberate removal of refrigerant gases that are harmful to the environment.
- Verify the installation of connections.
- Verify the supports and fixing elements (materials, routing and connection).
- Verify the quality of welds and other joints.
- Check the protection against mechanical damage.
- Check the protection against heat.
- Check the protection of moving parts.
- Verify the accessibility for maintenance or repair and to check the piping.
- Verify the status of the valves.
- Verify the quality of the thermal insulation and of the vapour barriers.

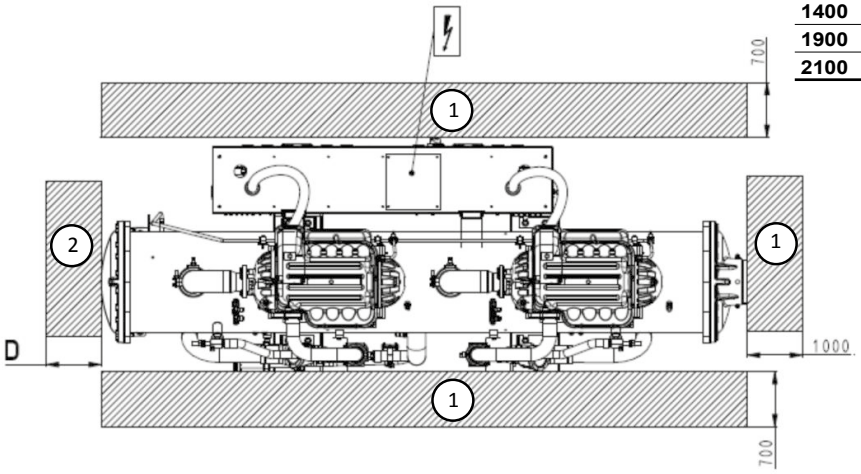
3 - DIMENSIONS, CLEARANCES

3.1 - LWT 1400 to 2100





Dimension (mm)				
	A	B	C	D
LWT				
1400	3045	1120	1745	2800
1900	3070	1155	1846	2800
2100	3270	1190	1925	3000



Legend:

All dimensions are given in mm.

1. Services clearances required
2. Space required to remove cooler tubes
3. Electrical box

Inlet water

Outlet water

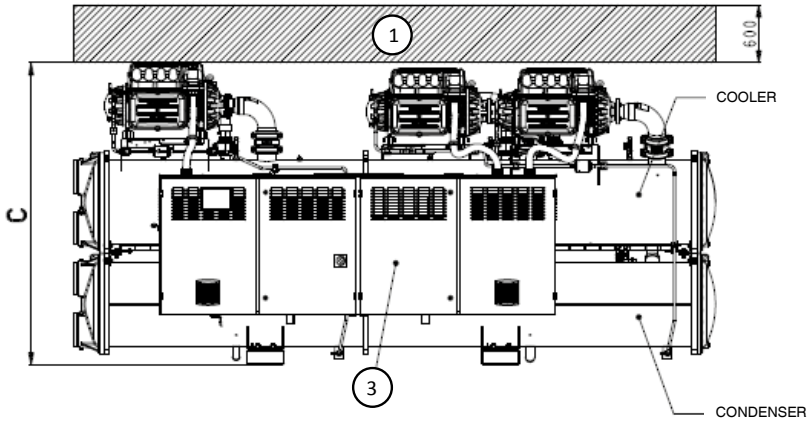
Electrical supply entry

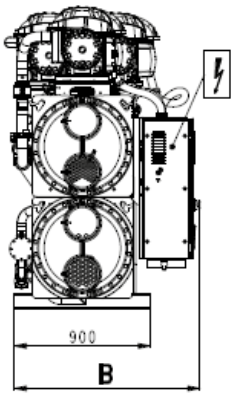
NOTES:

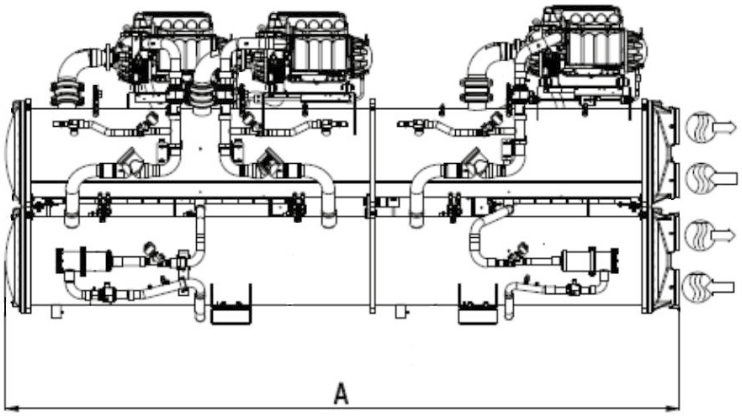
Drawings are not contractually binding. Before designing an installation, consult the certified dimensional drawings supplied with the unit or available on request.

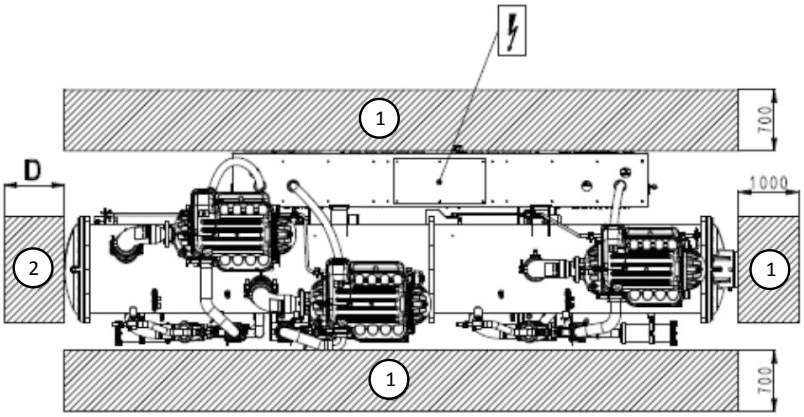
For the positioning of the fixing points, weight distribution and centre of gravity coordinates please refer to the dimensional drawings.

3.2 - LWT 2300 to 3100









Dimension (mm)				
	A	B	C	D
LWT				
2300	4257	1290	1955	3950
2600	4257	1290	1955	3950
3100	4257	1290	1955	3950

Legend:
All dimensions are given in mm.

1. Services clearances required
2. Space required to remove cooler tubes
3. Electrical box

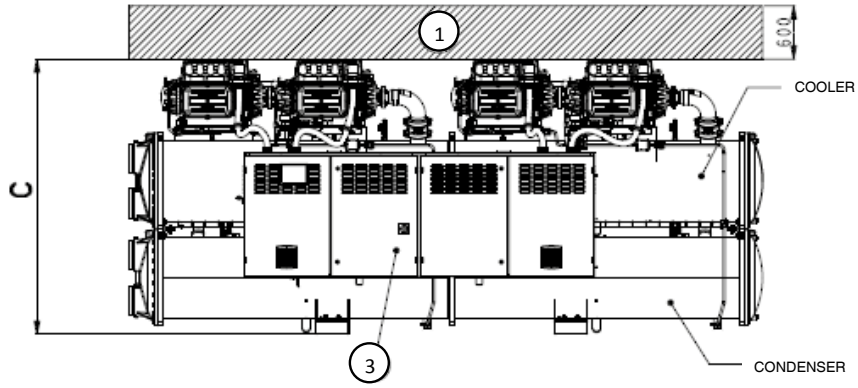
Inlet water

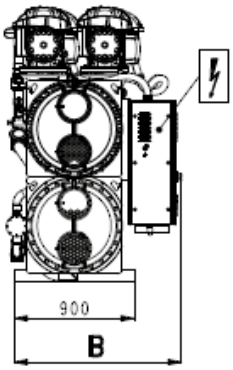
Outlet water

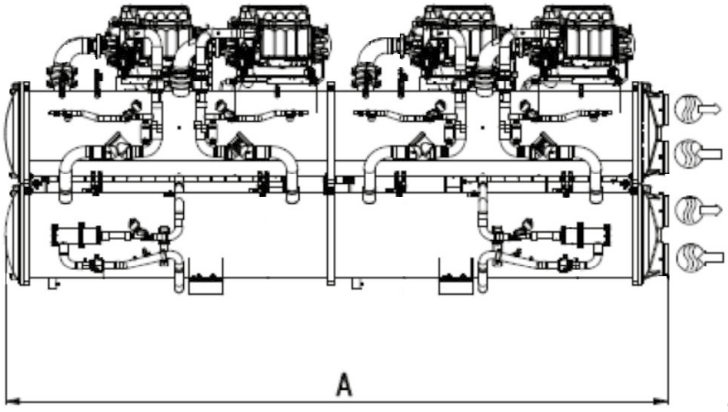
Electrical supply entry

NOTES:
Drawings are not contractually binding. Before designing an installation, consult the certified dimensional drawings supplied with the unit or available on request.
For the positioning of the fixing points, weight distribution and centre of gravity coordinates please refer to the dimensional drawings.

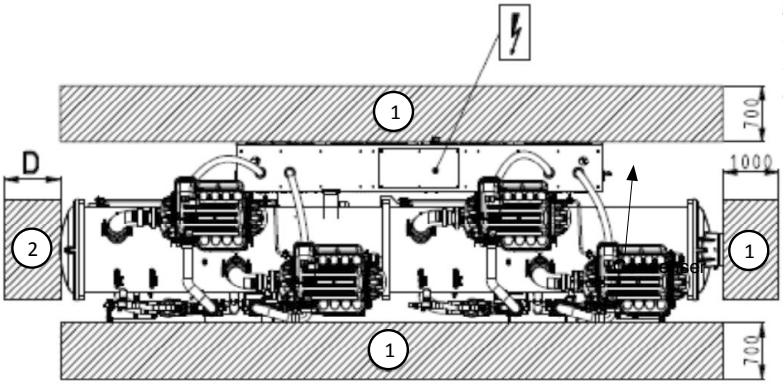
3.3 - LWT 3400 to 4200







Dimension (mm)				
	A	B	C	D
LWT				
3400	4705	1290	1955	4400
3800	4740	1290	2011	4400
4200	4740	1325	2065	4400



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Inlet water

Outlet water

Electrical supply entry

NOTES:

Drawings are not contractually binding. Before designing an installation, consult the certified dimensional drawings supplied with the unit or available on request.

For the positioning of the fixing points, weight distribution and centre of gravity coordinates please refer to the dimensional drawings.

4 - PHYSICAL AND ELECTRICAL DATA

4.1 - Physical data

LWT		1400	1900	2100	2300	2600	3100	3400	3800	4200
Sound levels - standard unit										
Standard unit										
Sound power(1)	dB(A)	89	92	94	92	94	95	94	95	97
Sound pressure at 10 m(2)	dB(A)	57	60	62	60	62	63	62	63	65
Dimensions										
Standard unit										
Length	mm	3140	3160	3360	4345	4345	4345	4800	4800	4800
Width	mm	1270	1310	1335	1385	1385	1385	1385	1390	1410
Height	mm	1780	1880	1965	2036	2036	2036	2000	2050	2100
Operating weight(3)										
Standard unit	kg	2402	2930	3376	4831	4855	4904	5504	6164	6730
Compressors		MagLev compressor TT300 / TT350								
Circuit A		2	2	2	1	1	1	2	2	2
Circuit B		-	-	-	2	2	2	2	2	2
Refrigerant(3)		R134a								
Circuit A	kg	95,0	120,0	140,0	100,0	100,0	100,0	125,0	135,0	150,0
	$teqCO_2$	135,9	171,6	200,2	143,0	143,0	143,0	178,8	193,1	214,5
Circuit B	kg	-	-	-	125,0	125,0	125,0	125,0	135,0	150,0
	$teqCO_2$	-	-	-	178,8	178,8	178,8	178,8	193,1	214,5
Capacity control		Connect'Touch, electronic expansion valves (EXV)								
Minimum capacity	%	15	15	15	10	10	10	10	10	10
Evaporator		Flooded multi-pipe type								
Water volume	l	115	165	180	285	285	285	330	330	365
Water connections (Victaulic)	in	6	6	8	8	8	8	8	8	8
Drain and vent connections (NPT)	in	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8
Max. water-side operating pressure	kPa	1000	1000	1000	1000	1000	1000	1000	1000	1000
Condenser		Flooded multi-pipe type								
Water volume	l	145	157	187	308	308	308	339	487	487
Water connections (Victaulic)	in	6	6	8	8	8	8	8	8	8
Drain and vent connections (NPT)	in	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8
Max. water-side operating pressure	kPa	1000	1000	1000	1000	1000	1000	1000	1000	1000

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

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

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

4.2 - Electrical data

LWT		1400	1900	2100	2300	2600	3100	3400	3800	4200
Power circuit supply										
Nominal voltage	V-ph-Hz	400-3-50								
Voltage range	V	360-440								
Control circuit supply		24 V via internal transformer								
Maximum operating input power[1]- Standard unit										
Circuit 1[a]	kW	140	201	230	76	116	111	133	187	222
Circuit 2[a]	kW	-	-	-	152	152	222	204	187	222
Single power connection point option	kW	-	-	-	229	269	333	337	375	445
Power factor at maximum power[1]		0,92	0,92	0,92	0,92	0,92	0,92	0,92	0,92	0,92
Total harmonic distortion	%	<45	<45	<45	<45	<45	<45	<45	<45	<45
Nominal operating current draw[2] - Standard unit										
Circuit 1[a]	A	162	208	244	93	129	119	151	210	243
Circuit 2[a]	A	-	-	-	185	187	237	229	210	243
Single power connection point option	A	-	-	-	278	315	356	380	420	486
Maximum operating current draw (Un)[1] - Standard unit										
Circuit 1[a]	A	220	315	361	119	183	174	209	294	349
Circuit 2[a]	A	-	-	-	239	239	349	319	294	349
Single power connection point option	A	-	-	-	358	422	523	528	588	697
Maximum current (Un-10%)[1] - Standard unit										
Circuit 1[a]	A	237	340	390	129	197	188	225	318	377
Circuit 2[a]	A	-	-	-	258	258	377	345	318	377
Single power connection point option	A	-	-	-	387	456	565	570	635	753
Maximum start-up current(Un) - Standard unit[3]		Lower than max current								
Dissipated power of electrical equipment[1]	W	782	1249	1249	1144	1347	1814	1884	2351	2351

(1) Values obtained at unit continuous maximum operating conditions (data given on the unit nameplate)

(2) Standardised EUROVENT conditions, water-cooled exchanger water inlet/outlet = 12°C/7°C, condenser entering/leaving water temperature = 30°C/35°C

(3) Start-up current is limited by the soft-start controller included in the compressor.

(a) When the machines are equipped with two power supplies, circuit 1 supplies the refrigerant circuit A and circuit 2 supplies the refrigerant circuit B

Note Evap. single pump power/control circuit and Cond. single pump power/control circuit options are not included in these values.

4.3 - Short-circuit stability current for all units

Short-circuit stability current for all units using the TN system (earthing system type): 50 kA (conditional system short-circuit current Icc/Icf at the unit connection point as rms value).

All units are equipped with circuit breakers located in the control box immediately downstream from the unit connection point.

4.4 - Compressor usage per circuit (A, B)

Compressor	Circuit	1400	1900	2100	2300	2600	3100	3400	3800	4200
TT300	A	2	-	-	1	-	-	2	-	-
	B	-	-	-	2	2	-	-	-	-
TT350	A	-	2	2	-	1	1	-	2	2
	B	-	-	-	-	-	2	2	2	2

Electrical data notes and operating conditions, Hydrociat^{Turbo} LWT units

- As standard:
  HYDROCIAT^{Turbo} LWT 1400 to HYDROCIAT^{Turbo} LWT 2100 units have a single power connection point located immediately upstream of the main supply disconnect switch.
  HYDROCIAT^{Turbo} LWT 2300 to HYDROCIAT^{Turbo} LWT 4200 units have two connection points located immediately upstream of the main supply disconnect switches.
- Control box includes the following standard features:
  - Two disconnect switches per circuit: One main supply disconnect switch and one disconnect switch for the supply of the control part, the undervoltage protection circuit and the motor mechanism module,
  - Filtering compressor currrent devices
  - Anti-short cycle protection devices
  - Control devices supply by internal transformers.
- Field connections:
  All connections to the system and the electrical installations must be in accordance with all applicable codes.*
- HYDROCIAT^{Turbo} LWT units are designed and built to ensure conformance with these codes. 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.
- Generally the recommendations of IEC 60364 are accepted as compliance with the requirements of the installation regulation.
- Annex B of standard EN 60204-1 specifies the electrical features used for the operation of the units. The features below complete the informations given in this document:

1. Physical environment:
   The classification of environment is specified in standard EN 60364:
   - Indoor installation**,
   - Ambient temperature range: minimum temperature +5°C to +42°C, class AA4
   - Altitude: AC1 of 2000 m or less,
   - Presence of water: Class AD3 (possibility of water droplets vertical 60°)**, AD2 (possibility of water droplets)**
   - Presence of hard solid: Class AE2 (no significant dust present)**,
   - Presence of corrosive and polluting substances, class AF1 (negligible),
   - Competence of persons: BA4 (Persons wise),
   - Overvoltage category: II (2,5KV).
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%
4. The neutral (N) line must not be connected directly to the unit (if necessary use a transformer).
5. Overcurrent protection of the power supply conductors is not provided with the unit.
6. The factory-installed disconnect switch(es)/circuit breaker(s) are of a type suitable for power interruption in accordance with EN 60947-3 (corresponds to IEC 60947-3).
7. The units are designed for connection to TN networks (IEC 60364). In IT networks,if noise filters are integrated into the compressor(s) variable frequency drive(s), this will render the units unsuitable for their intended purpose. In addition, the equipment characteristics in case of insulation failure are modified. For IT networks, the earth connection must not be at the network earth. Provide a local earth; consult competent local organisations to complete the electrical installation."
8. Electromagnetic environment:
   Classification of the electromagnetic environment is described in standard EN 61800-3 (corresponds to IEC 61800-3):
   - Immunity to external interference defined by the second environment***
   - Interference emission as defined in category C2

   Warning: In a residential environment, this product may cause radio interference in which case additional mitigation measures could be required.
   The compressor variable frequency drive is a source of perturbations from the harmonic currents. An investigation could be necessary to check that the perturbations don't exceed the compatibility limits with the other devices connected on the same power supply network. In an electrical installation, the levels of compatibility to be observed at the internal coupling point (IPC) to which other loads are connected are described in standard IEC 61000-2-4.

- 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 compressor must be considered. In particular, the reinforced immunity protection types and a control value not lower than 150 mA are recommended when selecting differential protective devices."

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

*Generally, the recommendations of the standard of International Electrotechnical Commission (IEC60364) are identified to meet the requirements of the installation guidelines.

** The required protection level for this class is IP21B or IPX1B (according to reference document IEC 60529). All HYDROCIAT^{Turbo} LWT units are IP23 and fulfil this protection condition.

***Example of second environnement installations: Industrial areas, technical facilities supplied by a dedicated transformer

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

5.1 - Power supply

The power supply must conform to the specification on the unit nameplate. The supply voltage must be within the range specified in the electrical data table. For connection details refer to the wiring diagrams.

Operation of the unit with an improper supply voltage or excessive phase imbalance constitutes abuse which will invalidate the manufacturer 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.

5.2 - Voltage phase imbalance (%)

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

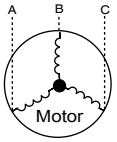
Example:

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

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

Average voltage = (406 + 399 + 394)/3 = 1199/3
= 399.7 say 400 V

Calculate the maximum deviation from the 400 V average:
(AB) = 406 - 400 = 6
(BC) = 400 - 399 = 1
(CA) = 400 - 394 = 6



The maximum deviation from the average is 6 V. The greatest percentage deviation is: 100 x 6/400 = 1.5 %. This is less than the permissible 2% and is therefore acceptable.

5.3 - Power connection/disconnect switch

Units	Connection points
LWT 1400 to 2100	1 per unit
LWT 2300 to 4200	1 for circuit A 1 for circuit B
Single power connection point option	1 per unit

5.4 - Recommended wire sections

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

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

The calculations for favourable and unfavourable cases are based on the maximum current for each unit (see electrical data tables). The design uses the standardised installation methods in accordance with IEC 60364: multiconductor PVC (70°C) or XLPE (90°C) insulated cables with copper core; arrangement to comply with table 52c of the above standard. The maximum temperature is 40°C. The given maximum length is calculated to limit the voltage drop to 5%.

Minimum and maximum connectable wire sections for HYDROCIAT^{TURBO} units

HYDROCIAT^{TURBO}	Max. connectable wire section(1)	Calculation of favourable case: - Perforated horizontal conduit (standardised routing No. 13) - 90°C insulated cable - Copper conductor (Cu)			Calculation of unfavourable case: - Closed conduit (standardised routing No. 41) - 70°C insulated cable if possible - Copper conductor (Cu)		
		Section(2)	Max. length for a voltage drop <5%	Cable type	Section(2)	Max. length for a voltage drop <5%	Cable type
	qty x mm² (per phase)	qty x mm² (per phase)	m	-	qty x mm² (per phase)	m	-
Standard unit							
1400	2x300	1x95	191	90°C	1x185	360	70°C
1900	2x300	1x150	217	90°C	2x150	383	70°C
2100	2x300	1x185	227	90°C	2x185	388	70°C
2300	2x300 / 2x300	1x50/1x120	177/208	90°C	1x95/2x150	348/382	70°C
2600	2x300 / 2x300	1x95/1x120	199/208	90°C	1x185/2x150	388/382	70°C
3100	2x300 / 2x300	1x70/2x95	186/196	90°C	1x185/2x240	388/366	70°C
3400	2x300 / 2x300	1x95/1x185	199/223	90°C	1x240/2x240	395/366	70°C
3800	2x300 / 2x300	1x185/1x185	223/223	90°C	2x185/2x185	374/374	70°C
4200	2x300 / 2x300	1x240/1x240	223/223	90°C	2x240/2x240	366/366	70°C
Unit with single power connection point							
2300	4x300	1x185	228	90°C	2x185	388	70°C
2600	4x300	1x240	236	90°C	2x240	396	70°C
3100	4x300	2x150	217	90°C	4x150	382	70°C
3400	4x300	2x150	217	90°C	4x150	382	70°C
3800	4x300	2x185	223	90°C	4x185	374	70°C
4200	4x300	2x240	224	90°C	4x240	366	70°C

(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 90°C cable type, this means that a selection based on a 70°C cable type can exceed the connection capacity actually available. Special attention must be given to selection.

Note: Evap. single pump power/control circuit and Cond. single pump power/control circuit options are not included in these values.

5.5 - Power cable entry

The power cables can enter the Hydrociat^{Turbo} LWT control box from above the unit. A removable aluminium plate on the upper part of the control box face allows introduction of the cables. Refer to the certified dimensional drawing for the unit.

5.6 - Field control wiring

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

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

Refer to the Hydrociat^{Turbo} Connect'Touch Control manual and the certified wiring diagram supplied with the unit for the field control wiring of the following features:

- Remote on/off switch
- Demand limit external switch
- Remote dual set point
- Heating/Cooling switch mode
- Alarm and operation report
- Evaporator flow control by 0-10V signal
- Heat condenser pump control
- Various interlocks on the Energy Management Module (EMM) board
- Condenser water inlet valve (option)
- Set-point adjustement by 4-20 mA signal

5.7 - 24 and 230 V power reserve for the user

Control circuit reserve:

After all required options have been connected, the TC transformer includes a power reserve that can be used for the field control wiring:

- Unit without pump power/control circuit option — 2 A (24 V a.c.) or 48 VA
- Unit with pump power/control circuit option — 1.3 A (24 V a.c.) or 30 VA

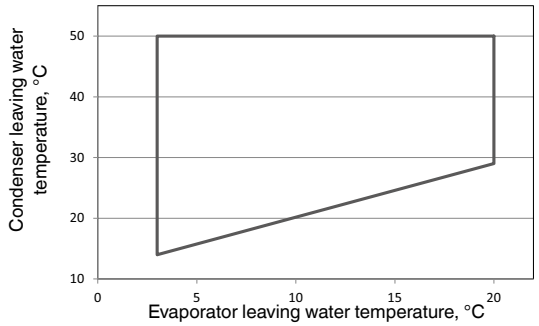
At this TC transformer the 230 V, 50 Hz circuit allows the supply of a battery charger for a laptop at 0.8 A maximum at 230 V. The connection is via an EEC 7/16 type socket (2 poles without earth) located under the control box and accessible from outside. Only devices with class II double insulation can be connected at this socket.

6.1 - Operating limits for HYDROCIAT^{TURBO} LWT units

LWT		Minimum	Maximum
Evaporator			
Entering temperature at start-up	°C	-	35
Leaving temperature during operation	°C	3,3	20
Entering/leaving water temperature difference	K	3	11,1
Condenser			
Entering temperature at start-up	°C	13*	-
Leaving temperature during operation	°C	14*	50
Entering/leaving water temperature difference	K	3	11,1

* For lower condenser temperatures a water flow control valve must be used at the condenser (two or three-way valve). Please refer to Control for low condensing temperature option to ensure the correct condensing temperature.

Note: Ambient temperatures: These units are dedicated for indoor environment. The external temperature at chiller start up should be at least 5°C. For such low ambient, Control for low cond. temperature option is recommended. During storage and transport of the LWT units (including by container) the minimum and maximum permissible temperatures are -20°C and 66 °C.

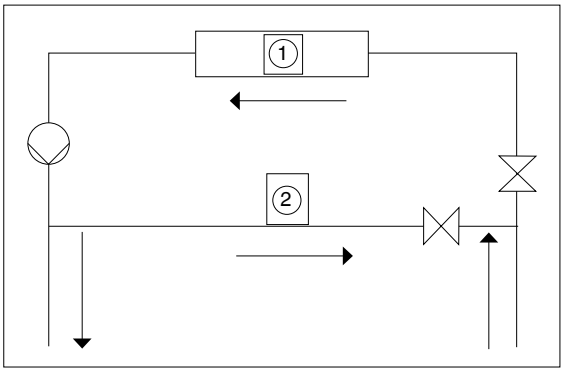


6.2 - Minimum chilled water flow

The minimum chilled water flow is shown in the table in chapter 6.7.

If the system flow is less than the minimum unit flow rate, the evaporator flow can be recirculated, as shown in the diagram.

For minimum chilled water flow rate



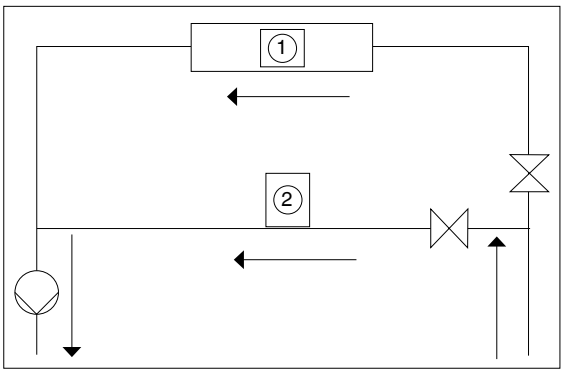
Legend
1. Evaporator
2. Recirculation

6.3 - Maximum chilled water flow

The maximum chilled water flow is limited by the permitted pressure drop in the evaporator. It is provided in the table in chapter 6.6

- Select the option with one water pass less that will allow a higher maximum water flow rate (see Evaporator with one pass less option in the table in chapter 6.5).
- Bypass the evaporator as shown in the diagram to obtain a lower evaporator flow rate.

For maximum chilled water flow rate



Legend
1. Evaporator
2. Bypass

6.4 - Condenser water flow rate

The minimum and maximum condenser water flow rates are shown in the table in chapter 6.6

If the system flow is higher than the maximum unit flow rate, select the option with one pass less that will allow a higher maximum water flow rate. Please refer to Condenser with one pass less option in the table in chapter 6.5.

6.5 - Standard and optional number of water passes

LWT	1400	1900	2100	2300	2600	3100	3400	3800	4200
Evaporator									
Standard	2	2	2	2	2	2	2	2	2
Evaporator with one pass less option	1	1	1	1	1	1	1	1	1
Condenser									
Standard	2	2	2	2	2	2	2	2	2
Condenser with one pass less option	1	1	1	1	1	1	1	1	1

6.6 - Min water volume and evaporator & condenser water flow rates

These below values are given for standard units. For Evaporator and condenser with one pass less options, please refer to the unit selection program.

LWT	1400	1900	2100	2300	2600	3100	3400	3800	4200
Minimum installation volume (l)									
Air conditioning application	1770	2310	2570	2890	3240	3790	4170	4640	5130
Industrial process application	3530	4620	5140	5780	6480	7570	8330	9290	10250
Evaporator water flow rate, (m^3/h)									
Minimum(1)	34	34	34	34	61	61	61	61	61
Maximum(3)	179	235	257	281	289	286	295	295	329
Condenser water flow rate, (m^3/h)									
Minimum(2)	21	21	36	36	36	36	36	36	36
Maximum(3)	245	299	346	486	457	454	428	594	526

(1) Minimum evaporator flow rate based on a water velocity of 0,5 m/s.

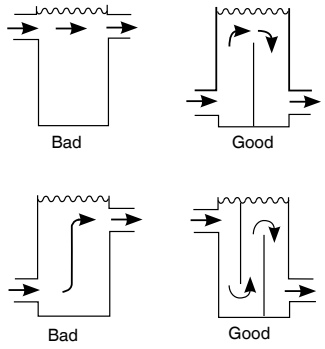
(2) Minimum condenser flow rate based on a water velocity of 0,3 m/s.

(3) Maximum flow rate based on a pressure drop of 120 kPa (units with two evaporator passes and two condenser passes).

This volume is necessary for stable operation.

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

Connection to a buffer tank



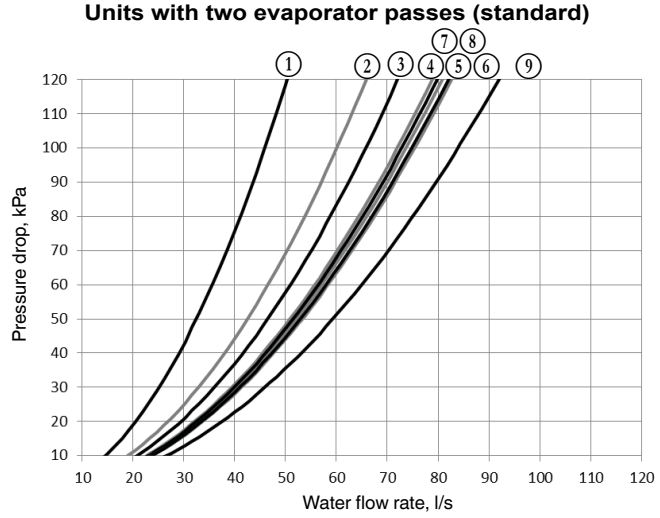
6.7 - Variable flow evaporator

Variable evaporator flow can be used. The controlled flow rate must be higher than the minimum flow given in the table of permissible flow rates and must not vary by more than 10% per minute.

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

6.8 - Evaporator pressure drop curves

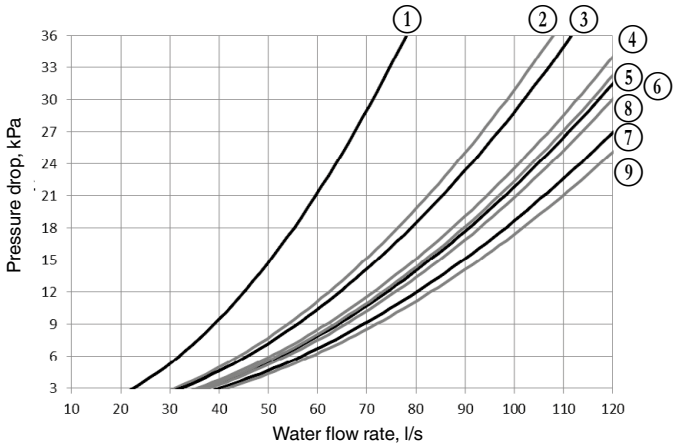
Units with two evaporator passes (standard)



Legend

1 LWT 1400
2 LWT 1900
3 LWT 2100
4 LWT 2300
5 LWT 2600
6 LWT 3100
7 LWT 3400
8 LWT 3800
9 LWT 4200

Units with one evaporator pass (Option)

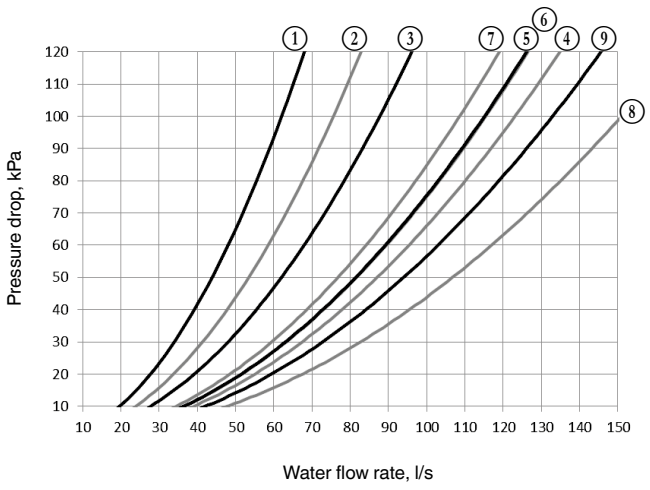


Legend

1 LWT 1400
2 LWT 1900
3 LWT 2100
4 LWT 2300
5 LWT 2600
6 LWT 3100
7 LWT 3400
8 LWT 3800
9 LWT 4200

6.9 - Condensor pressure drop curves

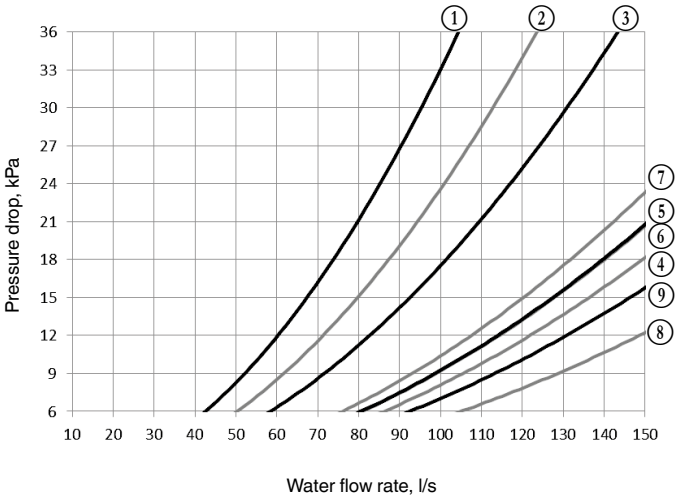
Units with two condenser passes (standard)



Legend

1 LWT 1400
2 LWT 1900
3 LWT 2100
4 LWT 2300
5 LWT 2600
6 LWT 3100
7 LWT 3400
8 LWT 3800
9 LWT 4200

Units with one condenser pass (Option)



Legend

1 LWT 1400
2 LWT 1900
3 LWT 2100
4 LWT 2300
5 LWT 2600
6 LWT 3100
7 LWT 3400
8 LWT 3800
9 LWT 4200

7 - WATER CONNECTIONS

ATTENTION: Before carrying out any water connections install the water box purge plugs (one plug per water box in the lower section - supplied in the control box).

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

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

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

7.1 - Operating precautions

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

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

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

The manufacturer recommendations on heat exchange fluids:

- No NH^{4+} ammonium ions in the water, they are very detrimental for copper. This is one of the most important factors for the operating life of copper piping. A content of several tenths of mg/l will badly corrode the copper over time.
- Cl^- Chloride ions are detrimental for copper with a risk of perforations by corrosion by puncture. If possible keep below 125 mg/l.
- SO_4^{2-} sulphate ions can cause perforating corrosion, if their content is above 30 mg/l.
- No fluoride ions (<0.1 mg/l).
- No Fe^{2+} and Fe^{3+} ions with non negligible levels of dissolved oxygen must be present. Dissolved iron < 5 mg/l with dissolved oxygen < 5 mg/l.
- Dissolved silicon: silicon is an acid element of water and can also lead to corrosion risks. Content < 1 mg/l.
- Water hardness: > 0.5 mmol/l. Values between 1 and 2.5 can be recommended. This will facilitate scale deposit that can limit corrosion of copper. Values that are too high can cause piping blockage over time. A total alkalimetric titre (TAC) below 100 mg/l is desirable.
- Dissolved oxygen: Any sudden change in water oxygenation conditions must be avoided. It is as detrimental to deoxygenate the water by mixing it with inert gas as it is to over-oxygenate it by mixing it with pure oxygen. The disturbance of the oxygenation conditions encourages destabilisation of copper hydroxides and enlargement of particles.
- Electric conductivity 10-600µS/cm.
- pH: Ideal case pH neutral at 20-25°C
  7 < pH < 8

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

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

7.2 - Water connections

The water connections are Victaulic type connections. The inlet and outlet connection diameters are identical.

Inlet/outlet diameters

LWT		1400	1900	2100	2300	2600	3100	3400	3800	4200
Evaporator										
Units without Evaporator with one pass less option										
Nominal diameter	in	6	6	8	8	8	8	8	8	8
Actual outside diameter	mm	168,3	168,3	219,1	219,1	219,1	219,1	219,1	219,1	219,1
Units with Evaporator one pass les option										
Nominal diameter	in	6	6	8	8	8	8	8	8	8
Actual outside diameter	mm	168,3	168,3	219,1	219,1	219,1	219,1	219,1	219,1	219,1
Condenser										
Units without Condenser one pass les option										
Nominal diameter	in	6	8	8	8	8	8	8	8	8
Actual outside diameter	mm	168,3	219,1	219,1	219,1	219,1	219,1	219,1	219,1	219,1
Units with Condenser one pass les option										
Nominal diameter	in	6	8	8	8	8	8	8	8	8
Actual outside diameter	mm	168,3	219,1	219,1	219,1	219,1	219,1	219,1	219,1	219,1

7.3 - Flow control

Evaporator flow switch and chilled water pump interlock

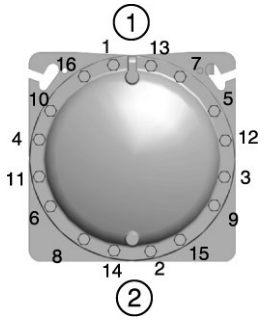
IMPORTANT: On Hydrociat^{Turbo} LWT units, the unit water flow switch must be energised. Failure to follow this instruction will void the manufacturer guarantee.

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

7.4 - Evaporator and condenser water box bolt tightening

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

Water box tightening sequence



Legend

1 Sequence 1: 1 2 3 4
Sequence 2: 5 6 7 8
Sequence 3: 9 10 11 12
Sequence 4: 13 14 15 16

2 Tightening torque
Bolt size M16 - 171 - 210 Nm

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

7.5 - Operation of two units in master/slave mode

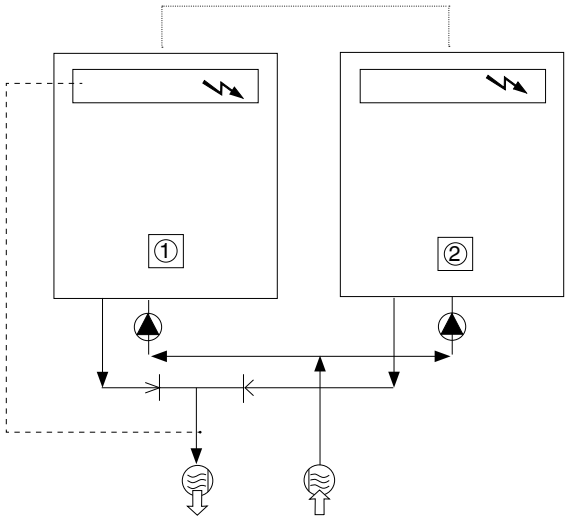
The control of a master/slave assembly is in the entering water and does not require any additional sensors (standard configuration). It can also be located in the leaving water. In this case two additional sensors must be added on the common piping.

All parameters, required for the master/slave function must be configured using the MST_SLV menu.

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

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

LWT with configuration: leaving water control



Legend

① Master unit

② Slave unit

Control boxes of the master and slave units

Water inlet

Water outlet

Water pumps for each unit (included as standard for units with hydraulic module)

Additional sensors for leaving water control, to be connected to channel 1 of the slave boards of each master and slave unit

IP communication bus

Connection of two additional sensors

8 - UNIT WITH HEAT PUMP APPLICATION OPTION

The physical data, electrical data, dimensions & clearances are the same as standard Hydrociat^{Turbo} LWT units.

Unlike in the cooling mode, the unit uses the heating setpoint in this configuration. The evaporator leaving water control (lowest setpoint taken into consideration) is still maintained to prevent operation at very low temperatures.

9 - Unit operation with a drycooler (Option)

9.1 - Operating principle

The units have been designed to optimise the operation of systems, using drycoolers as heat rejection system.

With a variable-speed condenser water pump integrated into the unit the complexity of traditional systems, using a three-way valve has been reduced.

The installation of an operational system is limited on the condensing water loop side to connect the drycooler entering and leaving water piping to the unit.

The Connect Touch control of the unit includes algorithms to permit constant automatic optimisation of:

- drycooler fan stage operation
- water flow rate variation in the loop between the condenser and the drycooler.

Parallel control of the fan stages (up to 8 stages maximum) and of the variable water flow rate of the loop permit year-round system operation down to -10 °C outside temperature without any additional control.

9.2 - Communication to control the drycooler

The electronic board specifically integrated in the control box of the drycooler, by an option selection on the manufacturer drycooler, and a communication LEN bus connected to the microprocessor board of the unit is used for the overall system control.

Pay attention that Dry cooler and Chiller have to be both equipped with the option Drycooler Management

The option is supplied in the manufacturer's drycooler control box. Connect the unit to board AUX1 in the drycooler, using a communication cable. the communication cable should be connect to the plug with 3 points Wago type (5 mm spacing or equivalent). the communication cable should be a shielded type.

The Connect Touch control optimises system operation to obtain the best efficiency with variation of the water flow rate and the number of fans required for any thermal load and outside temperature conditions.

The electronic board (AUX1) integrated in the control box of the drycooler has analogue inputs for outside air temperature and drycooler leaving water temperature sensors, as well as eight digital outputs permitting control of up to eight fan stages.

9.3 - Configuration of the number of fan stages and the automatic changeover of the fan stages

Please refer to the instructions in the Connect Touch IOM for the configuration of the number of fan stages to be controlled. It is enough to enter the number of fan stages of the drycooler in the Connect Touch service menu. The number of digital outputs controlling the fans are activated by the control.

Connect Touch controls the automatic switching of all fan stages, based on operating time and number of start-ups of the different stages. This function prevents fan motors from only running a little or not at all and the shafts seizing up, especially during periods with a low cooling demand, when the outside temperature is low. Switching is often specified by the drycooler manufacturers to ensure a long operating life of fan motors that are only used a little or not at all in these particular operating conditions.

9.4 - Fan stage assignment

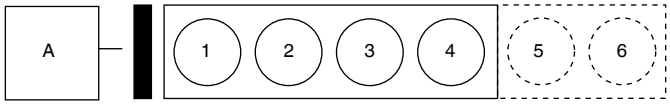
The minimum configuration of the number of fan stages is 2 for correct operation.

Depending on the drycooler capacity the number of fans can be between 2 and 8. They can be controlled by one fan or by linked pairs, if necessary.

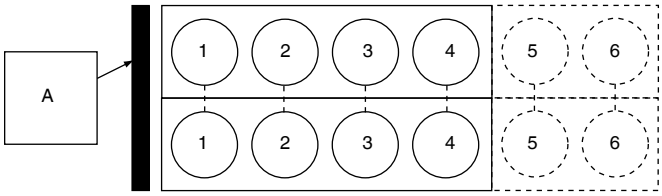
A drycooler with 4 or 6 fans installed in series for example along the length of the unit will result in a configuration of 4 or 6 fan stages.

Reciprocally a drycooler with 8 or 12 fans arranged in pairs along the length of the unit will also result in a configuration of 4 or 6 fan stages.

Configuration with 4 and 6 stages (min. 2 - max. 8)



Fans linked in pairs - 4 and 6-stage configuration (min. 2 - max. 8)



Legend

A	Entering and leaving water manifold side
1 to 6	Fans

9.5 - Drycooler installation on units

For the drycooler installation follow professional guidelines.

- Water pipe sizing
- Maximum piping and shut-off valve pressure drops based on the available pressure of the unit pumps
- Maximum drycooler elevation in relation to the unit (relief valve at 4 bar on the unit water circuit).
- Fan stage control (see "Fan stage control").
- Good positioning of the outside air temperature and drycooler leaving water temperature sensors.

10 - Unit operation with a free cooling drycooler (Option)

10.1 - Operating principle

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

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

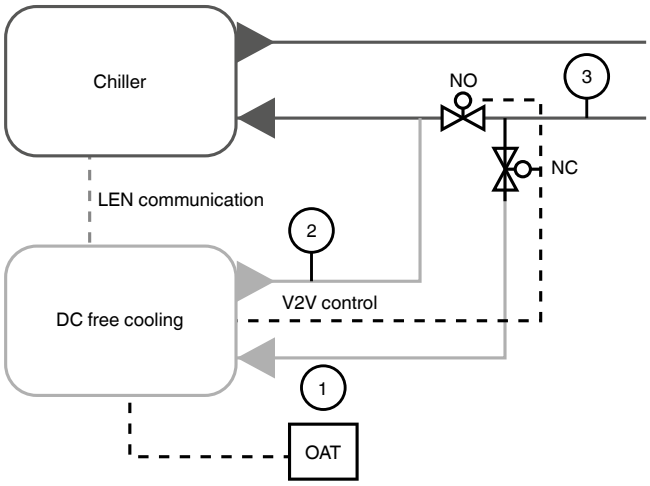
The Connect Touch control of the unit includes algorithms to permit constant automatic optimization of:

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

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

Parallel control of the fans and of the variable water flow rate of the loop permit system operation down to -20 °C outside temperature without any additional control.

Pay attention that drycooler and chiller have to be both equipped with the option Free Cooling Management



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

- on entering water temperature control
- on delta temperature control in case of variable speed pump option

10.2 - Communication to control the drycooler

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

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

The board integrated in the control box of the drycooler has analog inputs for outside air temperature (mark 1), return water loop temperature (mark 3) and drycooler leaving water temperature sensors (mark 2), as well as digital outputs permitting the control of the fans.

The option works as a system split in two parts:

The chiller (with free cooling option)

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

The drycooler (with free cooling option) :

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

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

10.3 - Configuration of the fans control

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

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

Compatible fans configuration:

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

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

10.4 - Water valves

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

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

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

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

Refer to drycooler electrical diagram for valves wiring on customer connections.

10.5 - System installations recommandation

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

For electrical connections information, refer to the electrical wiring delivered with the drycooler.

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

For a proper drycooler installation, follow the professional guidelines for the following topics:

- Water pipe sizing
- Pressure drops (verify that the available pressure of the unit pump is sufficient compared to the piping and valves pressure drops - check for all running modes)
- Maximum drycooler elevation (in relation to the unit safety valve)
- Good positioning for temperature sensors: outside air temperature and water loop temperature .

11.1 - MagLev centrifugal compressor

- Hydrociat^{Turbo} LWT units use TT (Twin-Turbine) MagLev centrifugal compressors equipped with an inlet guide valve and controlled by a speed variator.
- Compressor capacity control is ensured by successive use of speed variation (using a frequency variator) and swept volume variation at the turbine (using the Inlet Guide Valve).
- The combination of these two control modes permits fine control of the unit capacity between 15% and 100%.
- The MagLev centrifugal compressor models used are: TT300, TT350
- The MagLev centrifugal compressors are NOT lubrificated
- The compressor drive and the compressor motor are cooled by a liquid line. The cooling system is controlled by two valves located in the compressor drive.

11.1.1 - Refrigerant

The Hydrociat^{Turbo} LWT is a liquid chiller operating only with refrigerant R-134a.

11.1.2 - Capacity control system

Hydrociat^{Turbo} LWT units are equipped with a frequency variator that permits compressor capacity adjustment by varying the motor speed. The frequency range depends on the refrigerant pressure ratio. At the minimum speed, the compressor reduces the capacity by closing the inlet guide valve.

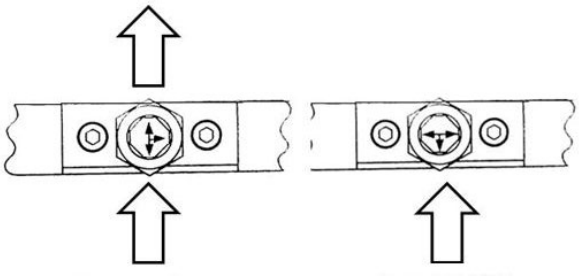
The compressor drive uses power supply waveform generation with variable frequency and voltage, generated by pulse width modulation (PWM).

Compressor start-up and stopping and the frequency setting for the operating range is only by RS485 communication in the MODBUS protocol via the controller.

11.1.3 - Suction valve (Service valve set option)

An isolating valve can be added to ease maintenance on compressor. This valve can be moved ONLY without pressure differential upstream and downstream of this valve.

The following markers indicate the fully opened position and the fully closed position of the valve.



Opened position Closed position

11.1.4 - Line reactor

A line reactor is a special form of inductor that is typically used between the line and the load to smooth current inrush, reduce harmonics and noise, and buffer the systems connected to it. Specifically it is an inductor that adds inductive impedance to a circuit

One Line reactor by compressor is mandatory and they are located in the electrical box.

11.1.5 - EMC Filter

The EMC filter reduces electrical noise on the power lines (conducted emissions), it is located close to the compressor to reduce broadcasting of the noise (radiated emissions) from the power lines themselves.

11.1.6 - Fast acting fuses

All compressors are fitted with class T fast acting fuses to protect the solid state inverter.

The fuses are included in the TT300 compressor under the main cover. With the TT350 compressor, the fast acting fuses are located in the electrical box.

11.2 - Pressure vessels

General

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

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

Repair

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

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

Recycling

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

Operating life

The evaporator is designed for:

- prolonged storage of 15 years under nitrogen charge with a temperature difference of 20 K per day.
- 452000 cycles (start-ups) with a maximum difference of 6 K between two neighbouring points in the vessel, based on 6 start-ups per hour over 15 years at a usage rate of 57%.

Corrosion allowances:

Gas side: 0 mm

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

11.2.1 - Evaporator

Hydrociat^{Turbo} LWT chillers use a flooded multi-tube evaporator. The water circulates in the tubes and the refrigerant is on the outside in the shell. One vessel is used to serve both refrigerant circuits. There is a centre tube sheet which separates the two refrigerant circuits. The tubes are 3/4" diameter copper with an enhanced surface inside and out. There is just one water circuit with two water passes (one pass with Evaporator with one pass less option, please refer to chapter 6.5).

The evaporator shell has a polyurethane foam thermal insulation and a water drain and purge.

It has been tested and stamped in accordance with the applicable pressure codes. The maximum standard relative operating pressure is 1850kPa for the refrigerant-side and 1000 kPa for the water-side. These pressures can be different depending on the code applied. The water connection of the heat exchanger is a Victaulic connection.

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

11.2.2 - Condenser

The Hydrociat^{Turbo} LWT chiller uses a flooded multi-tube condenser. It is mounted below the evaporator. The water circulates in the tubes and the refrigerant is on the outside in the shell. One vessel is used to serve both refrigerant circuits. There is a center tube sheet which separates the two refrigerant circuits. The tubes are 3/4" or 1" diameter internally and externally finned copper tubes.

There is just one water circuit with two water passes (one pass with Condenser with one pass less option, please refer to chapter 6.5). For the Heat Machine units the condenser shell can have a polyure-thane foam thermal insulation (Condenser insulation option) and a water drain and purge.

It has been tested and stamped in accordance with applicable pressure codes. The maximum standard relative operating pressure is 1850kPa for the refrigerant-side and 1000 kPa for the water-side. These pressures can be different depending on the code applied. The water connection of the heat exchanger is a Victaulic connection.

11.3 - Disconnect switches for power supply

Each circuit includes two disconnect switches: One main supply disconnect switch for the compressor(s) supply and one disconnect switch associated with a handle for the supply of the control part, the under-voltage protection circuit and the motor mechanism module.

The motor mechanism module and an under-voltage protection circuit are mounted on the main supply disconnect switch.

Note: The following procedure must be done to lock the main supply disconnect switch:

- Set the motor mechanism in "Manual" position. The circuit breaker must be to the O (OFF) position before this operation.
- Pull up the locking tab.
- Lock the circuit breaker using the keylock (leaving the tab out).

After removing the lock, the motor mechanism must be switch in "Auto" position before to supply the unit.

The command of the main supply disconnect switch closure is ensured by the software using the motor mechanism module when the unit is turned on (with the handle) or when the voltage is back after the loss of the power supply.

The under-voltage protection circuit ensures the main supply disconnect switch opening in case of a turn off (using the handle from the front panel), a high-pressure safety switch opening or when the doors is open.

The downstream circuit of the disconnect switch with the handle is consider as an excepted circuit and is identified with orange conductors.

11.3.1 - Safety chain of the automatic reset

11.3.1.a - High-pressure switch HP

Hydrociat^{Turbo} LWT units are equipped with high-pressure safety switches.

In accordance with the applicable code , the unit is equipped with high pressure switches with manual reset, called PZH (former DBK).

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

11.3.1.b - Safety door contacts

The purpose of the door contact is to inhibite the possibility of an automatic closure order of the main supply disconnect switch from the software while the door is opened

11.4 Electronic expansion valve (EXV)

The Hydrociat^{Turbo} LWT unit is equipped with two EXV :

- The main EXV located in the liquid line. The main EXV regulates refrigerant flow into the evaporator.
- The staging EXV located in the discharge line. The staging EXV regulates by-pass flow during compressor stat-up.

The EXV is equipped with a stepper motor 480 steps that is controlled via the EXV board.

The EXV is also equipped with a sightglass that permits verification of the mechanism movement and the presence of the liquid gasket (Relevant only for main EXV).

11.5 - Moisture indicator

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

11.6 - Filter drier

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

11.7 - Sensors

The units use thermistors to measure the temperature, and pressure transducers to control and regulate system operation (see Hydrociat^{Turbo} Connect'Touch Control manual for a more detailed explanation).

12 - OPTIONS

Options	Description	Advantages	HYDROCIAT^{TURBO} LWT range
Master/slave operation	Unit equipped with supplementary water outlet temperature sensor kit to be field-installed allowing master/slave operation of two units connected in parallel	Optimised operation of two units connected in parrallele operation with operating time equalisation	•
Low noise level	Discharge piping acoustic insulation	Up to 3 dB(A) quieter than standard unit	•
Single power connection point	Unit power connection via one main supply connection	Quick and easy installation	2300/4200
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	1400/3100
Cond. single pump power/ control circuit	Unit equipped with an electrical power and control circuit for one pump condenser side	Quick and easy installation: the control of fixed speed pumps is embedded in the unit control	1400/3100
Condenser insulation	Thermal condenser insulation	Minimizes thermal dispersions condenser side (key option for heat pump or heat recovery applications) and allows compliancy with special installation criteria (hot parts insulated)	•
Service valve set	Liquid line valve (evaporator inlet) and compressor suction line valve	Allow isolation of various refrigerant circuit components for simplified service and maintenance	•
Evaporator with one pass less	Evaporator with one pass on the water side. Evaporator inlet and outlet on opposite sides.	Easy to install, depending on site. Reduced pressure drops	•
Condenser with one pass less	Condenser with one pass on the water side. Condenser inlet and outlet on opposite sides.	Easy to install, depending on site. Reduced pressure drops	•
Reversed evaporator water connections	Evaporator with reversed water inlet/outlet	Easy installation on sites with specific requirements	•
Reversed condenser water connections	Condenser with reversed water inlet/outlet	Easy installation on sites with specific requirements	•
Bacnet over IP	Two-directional high-speed communication using BACnet protocol over Ethernet network (IP)	Easy and high-speed connection by ethernet line to a building management system. Allows access to multiple unit parameters	•
Control for low cond. temperature	Output signal (0-10 V) to control the condenser water inlet valve	Simple installation: for applications with cold water at condenser inlet (ex. ground-source, groundwater-source, superficial water-source applications) the signal permits to control a 2 or 3-way valve to maintain condenser water temperature (and so condensing pressure) at acceptable values	•
Specific dry cooler control	Control box for communication with the drycooler via a bus. For OPERA or Vextra drycooler need to select the cabinet with option control cabinet manage by the chiller Connect'Touch control	Permits the use of an energy-efficient plug-and-play system	•
Input contact for Refrigerant leack detection	0-10 V signal to report any refrigerant leakage in the unit directly on the controlller (the leak detector itself must be supplied by the customer)	Immediate customer notification of refrigerant losses to the atmosphere, allowing timely corrective actions	•
Compliance with Swiss regulations	Additional tests on the water heat exchangers: supply (additional of PED documents) supplementary certificates and test certifications	Conformance with Swiss regulations	•
Compliance with Russian regulations	EAC certification	Conformance with Russian regulations	•
Flanged evaporator water connection kit	Victaulic piping connections with flanged joints	Easy installation	•
Flanged condenser water connection kit	Victaulic piping connections with flanged joints	Easy installation	•
230V electrical plug	230V AC power supply source provided with plug socket and transformer (180 VA, 0,8 Amps)	Permits connection of a laptop or an electrical device during unit commissioning or servicing	•
M2M supervision (accessory)	Monitoring solution which allows customers to track and monitor their equipment remotely in real time	Real-time expert technical support to improve equipment availability and reports at customer hand to monitor and optimize operating equipment.	•
Anti-vibration mounts (kit)	Elastomer antivibratils mounts to be place under the unit (Material classified B2 fire class according to DIN 4102).	Isolate unit from the building, avoid transmission of vibration and associate noise to the buiding. Must be associate with flexible connection on water side	•
Exchangers flexibles connection (kit)	Flexibles connections on the exchanger water side	Easy installation. Limit transmission of vibrations on the water network	•
Free Cooling dry cooler management	Control & connections to a Free Cooling Drycooler Opera or Vextra fitted with option FC control box	Easy system managment, Extended control capabilities to a dryccoler used in Free Cooling mode	•
Heat Pump application	Unit configurated for Heat Pump application, include thermal condenser insulation	Optimisation on heating mode & minimize thermal dispersions condenser side	•

13 - STANDARD MAINTENANCE

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

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

- improved cooling performance
- reduced power consumption
- prevention of accidental component failure
- prevention of major time-consuming and costly interventions
- protection of the environment

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

13.1 - Level 1 maintenance

See note below.
Simple procedure can be carried out by the user:

- Air heat exchanger (condenser) cleaning - see chapter “Condenser coil - level 1”
- Check for removed protection devices, and badly closed doors/covers
- Check the unit alarm report when the unit does not work (see report in the Hydrociat^{Turbo} LWT Connect Touch Control instruction manual).

General visual inspection for any signs of deterioration.

13.2 - Level 2 maintenance

See note below.

This level requires specific know-how in the electrical, hydraulic and mechanical fields. It is possible that these skills are available locally: existence of a maintenance service, industrial site, specialised subcontractor.

In these cases, the following maintenance operations are recommended.

Carry out all level 1 operations, then:

- At least once a year tighten the power circuit electrical connections (see tightening torques table).
- Check and re-tighten all control/command connections, if required (see tightening torques table).
- Check the differential switches for correct operation every 6 months.
- Remove the dust and clean the interior of the control boxes, if required. Check the filter condition.
- Check the presence and the condition of the electrical protection devices.
- Replace the fuses every 3 years or every 15000 hours (age-hardening).
- Replace the control box cooling fans (if used) every five years.
- Check the water connections.
- Purge the water circuit (see chapter 7 “Water connections”).
- Clean the water filter (see chapter 7 “Water connections”).
- Check the unit operating parameters and compare them with previous values.
- Replace compressor capacitors every 10 years (if energized) or 5 years (if de-energized).
- Keep and maintain a maintenance sheet, attached to each HVAC unit.
- Replace compressor soft start fan every 5 years.

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

13.3 - Level 3 (or higher) maintenance

See note below.
The maintenance at this level requires specific skills/ approval/tools and know-how and only the manufacturer, his representative or authorised agent are permitted to carry out these operations. These maintenance operations concern for example:

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

NOTE: Any deviation or non-observation of these maintenance criteria will render the guarantee conditions for the HVAC unit nul and void, and the manufacturer, will no longer be held responsible.

13.4 - Tightening of the electrical connections

13.4.1 - Tightening torques for the main electrical connections

Component	Designation in the unit	value (N·m)
Screw on bus bar and PE, customer connection		
M6	L1/L2/L3	9,6
M8	L1/L2/L3	24
M10	L1/L2/L3	49
M12	L1/L2/L3	79,4
Screw on Main supply disconnect switch		
	QS10*	28
Screw on Control supply disconnect switch		
	QS10*A	1,7
Screw on Line reactor		
Line reactor for TT300 - M8	Z*	24
Line reactor for TT350 - M10	Z*	49
Screw on EMC Filter		
PE	ZC*	16 (+/- 1)
Phases	ZC*	15
Screw on Fast acting fuse connection		
	FU*	38
Screw on TT300 bar connection		
	L1/L2/L3	25
Screw on PE panels		
M8	PE	24
Screw on Compressor connection		
TT300 - Cap	L1/L2/L3	31
TT300 - M8	PE	21,7
TT350 - M10	L1/L2/L3	21,7
TT350 - M8	PE	21,7
Control disconnect switch connection		
Upstream and downstream screws at terminals	QF10* & QM10**	2
Power supply 24VDC unit		
Upstream and downstream screws at terminals	VC*	0,5

13.5 - Tightening torques for the main bolts and screws

Screw type	Used for	Torque Value (N.m)
M20 nut	Chassis	190
M20 nut	Heat exchanger side-side connection	240
M16 nut	Heat exchanger connection	190
M10 nut	Compressor fixing	30
H M16 screw	Heat exchanger water boxes, structure	190
Thx M16x65 screw	Compressor suction flanges	75
Thx M10x30 screw	Compressor discharge flanges	22
Brass fitting	TT300 Motor cooling brass fitting	40
Brass fitting	TT350 Motor cooling brass fitting	50
Phillips head screw	Compressor cover plate	13
H M8 Screw	Drier cover	35
H M10 Screw	Check valve cover	41
Taptite screw M10	Plate fixing, control box, terminal box	30
H nut	condenser Motor coolinh brass fitting	50

13.6 - Evaporator and condenser maintenance

Check that:

- the insulating foam is intact and securely in place,
- the sensors and flow switch are correctly operating and correctly positioned in their support,
- the water-side connections are clean and show no sign of leakage.

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

Preliminary information

Job name:.....
Location:.....
Installing contractor: .....
Distributor: .....

Unit

Model:.....

Compressors

Circuit A
Model number.....
Serial number .....
Motor number .....

Circuit B
Model number.....
Serial number .....
Motor number.....

Evaporator

Model number.....
Serial number .....

Condenser section

Model number.....
Serial number .....

Additional optional units and accessories.....
.....

Preliminary equipment check

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

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

☐ Unit is level in its installation
☐ Power supply agrees with the unit nameplate
☐ Electrical circuit wiring has been sized and installed properly
☐ Unit ground wire has been connected
☐ Electrical circuit protection has been sized and installed properly
☐ All terminals are tight
☐ All chilled water valves are open
☐ All chilled water piping is connected properly
☐ All air has been vented from the chilled water circuit
☐ The unit is switched off again, after the pump test has been completed
☐ Chilled water pump (CWP) is operating with the correct rotation. Check the phase sequence of the electrical connection.
☐ Circulate chilled water in the water circuit for at least two hours, then remove, clean and replace the screen filter. The unit is switched off again, after the pump test has been completed.
☐ Inlet piping to cooler includes a 20 mesh strainer with a mesh size of 1.2 mm.

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

Unit start-up

☐ All discharge and liquid line valves are open
☐ Locate, repair and mark all refrigerant leaks
☐ All suction valves are open, if used
☐ Checks have been carried out for any possible leaks. Unit has been leak checked (including fittings)
  ☐ - on the whole unit
  ☐ - at all connections
  Locate, repair, and report any refrigerant leaks.....
  .....
  .....
☐ Check voltage imbalance: AB ..... AC..... BC .....
  Average voltage = ... V
  Maximum deviation = ... V
  Voltage imbalance = ... %
☐ Voltage imbalance is less than 2%

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

Check cooler water loop

☐ Water loop volume = ... litres
☐ Calculated volume = ... litres
☐ 3.25 litres/nominal kW capacity for air conditioning
☐ 6.5 litres/nominal kW capacity for process cooling
☐ Proper loop volume established
☐ Proper loop corrosion inhibitor included..... litres of.....
☐ Proper loop freeze protection included (if required).....litres of.....
☐ Piping includes electric heater tape, if exposed to temperatures below 0°C
☐ Inlet piping to cooler includes a 20 mesh strainer with a mesh size of 1.2 mm

Check pressure drop across the cooler

☐ Entering cooler = ... kPa
☐ Leaving cooler = ... kPa
☐ Leaving - entering = ... kPa

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

☐ Total = ... l/s
☐ Nominal kW = ... l/s
☐ Total l/s is greater than unit's minimum flow rate
☐ Total l/s meets job specified requirement of.....l/s

Once power is supplied to the unit, check for any alarms (refer to the Hydrociat^{Turbo} LWT Connect Touch instruction manual for the alarm menu).

Note all alarms:.....
.....

N**OTE:**
The pouch supplied with the unit contains the label indicating the refrigerant used and describing the procedure required under the Kyoto Protocol F-Gas Regulation:
- **Attach this label to the machine.**
- **Follow and observe the procedure described.**

Notes: .....
.....

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