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DYNACIAT™ LG/LGN

Instruction manual

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Prior to the initial start-up of the 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 units 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.

Be sure you understand and follow the procedures and safety precautions contained in the instructions supplied with the machine, as well as those listed in this guide.

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

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.

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

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

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

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

DO NOT COVER ANY PROTECTION DEVICES.

LGN units are provided without a relief valve on the high-pressure refrigerant circuit and are equipped with automatically reset pressure switches in accordance with EN378.

For unit installation and connection to the remote condenser it is necessary to:

- **Check the applicable air conditioning regulations and safety standards (e.g. PED and EN378 for the European Union)**
- **Determine which accessories (safety valves, fuses etc.) are required so that these circuits comply with the applicable regulations and standards.**

If shut-off valves are used on the circuit, ensure that these valves do not shut off the safety valve for the different containers that they protect.

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

Classification and control

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

	Safety accessories(1)	Over pressure protection in case of an external fire(2)
Refrigerant side		
High pressure switch	X	
External relief valve(3)		X
Rupture disk		X
Fuse plug		X
Heat transfer fluid side		
External relief valve	(4)	(4)

(1) Classified for protection in normal service situations.
(2) Classified for protection in abnormal service situations. These accessories are sized for fires with a thermal flow of 10kW/m². No combustible matter should be placed within 6.5 m of the unit.
(3) The instantaneous over-pressure limitation of 10% of the operating pressure does not apply to this abnormal service situation.
The control pressure can be higher than the operating 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.

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

All factory-fitted safety valves are lead-sealed to prevent any calibration change. If the safety valves are factory-fitted on a reversing valve (change-over), this is equipped with a valve on each of the two outlets. Only one of the two safety valves is in operation, the other one is isolated. Never leave the reversing valve in the intermediate position, i.e. with both ways open (locate the control element in the stop position).

If a safety stop is removed for checking or replacement please ensure that there is always an active safety stop on each of the reversing valves installed in the unit.

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

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

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

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

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

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

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

For LG/LGN units sized between 080 and 600, follow the instructions on the screen and those on the stickers. You must unscrew 4 fixing red plates keeping compressor from moving during transport. These red plates are placed in the extremity of the C shaped compressor support.

1.2 - Equipment and components under pressure

These products incorporate equipment or components under pressure.

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

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

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

1.3 - Maintenance safety considerations

Manufacturer recommends the following drafting for a logbook (the table below should not be considered as reference and does not involve the 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 authorised, trained and fully qualified to do so (e.g. electricians trained and qualified in accordance with IEC 60364 classification BA4).

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

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

Any intervention on the refrigerant circuit, including changing of drier blocks, is only permitted after the complete removal of the refrigerant charge. For these units transfer of the refrigerant charge from the high or low-pressure side is not possible, nor permitted.

Never use the compressor as a vaccum pump.

Technicians working on the units must be equipped as follows:

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

(1) We recommend to follow the instructions in standard EN 378-3.
(2) Performed in the presence of group A1 refrigerant according to EN 378-1.

Never work on a unit that is still energised.

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

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

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

Even if the compressor motors have been switched off, the power circuit remains energized, unless the unit or circuit disconnect switch is open. Refer to the wiring diagram for further details.

Attach appropriate safety labels.

If any intervention is required on the air-cooled condenser in LGN units, please refer to the safety instructions provided by the condenser manufacturer.

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

Operating checks:

Important information regarding the refrigerant used:

- **This product contains fluorinated greenhouse gas covered by the Kyoto protocol.**
- **Fluid type: R410A**
- **Global Warming Potential (GWP): 2088**

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

System WITHOUT leakage detection		No Check	12 Months	6 Months	3 Months
System WITH leakage detection		No Check	24 Months	12 Months	6 Months
Refrigerant charge/ circuit (CO_2 equivalent)		< 5 Tons	5 ≤ Charge < 50 Tons	50 ≤ Charge < 500 Tons	Charge > 500 Tons(1)
Refrigerant charge/ Circuit (kg)	R134A (GWP 1430)	Charge < 3,5 kg	3,5 ≤ Charge < 34,9 kg	34,9 ≤ Charge < 349,7 kg	Charge > 349,7 kg
	R407C (GWP 1774)	Charge < 2,8 kg	2,8 ≤ Charge < 28,2 kg	28,2 ≤ Charge < 281,9 kg	Charge > 281,9 kg
	R410A (GWP 2088)	Charge < 2,4 kg	2,4 ≤ Charge < 23,9 kg	23,9 ≤ Charge < 239,5 kg	Charge > 239,5 kg
	HFO's: R1234ze	No requirement			

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

7. **A logbook must be established for equipments subject to periodic leak tests. It should contain the quantity and the type of fluid present within the installation (added and recovered), the quantity of recycled fluid, regenerated or destroyed, the date and output of the leak test, the designation of the operator and its belonging company, etc.**
8. **Contact your local dealer or installer if you have any questions.**

The information on operating inspections given in annex C of standard EN378 can be used if no similar criteria exist in the national regulations.

Protection device checks:

- **If no national regulations exist, check the protection devices on site in accordance with standard EN378: once a year for the high-pressure switches, every five years for external safety valves.**
- **The detailed description of the high-pressure switch test method is given in the service manual for the unit.**

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 your nearest service office for this type of test. Here is mentions only the principle of a test without removing the pressure switch:

- Verify and record the set-points of pressure switches and relief devices (valves and possible rupture discs)
- Be ready to switch-off the main disconnect switch of the power supply if the pressure switch does not trigger (avoid over-pressure or excess gas in case of valves on the high-pressure side with the recovery condensers)
- Connect a calibrated pressure gauge (the values displayed on the user interface may be inaccurate in an instant reading because of the scanning delay applied in the control)
- Complete an HP Test as provided by the software (refer to the Control IOM for details).

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

Regularly carry out leak tests and immediately repair any leaks.

1.4 - Repair safety considerations

All installation parts must be maintained by the personnel in charge, in order to avoid material deterioration and injuries to people. Faults and leaks must be repaired immediately. The authorized technician must have the responsibility to repair the fault immediately. After each repair of the unit, check the operation of the protection devices and create a report of the parameter operation at 100%.

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

If a leak occurs or if the refrigerant becomes polluted (e.g. by a short circuit in a motor or BPHE frost) 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-410A charge, as indicated on the unit name plate. Do not top up the refrigerant charge. Only charge liquid refrigerant R-410A at the liquid line.

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

Charging any refrigerant other than the original charge type (R-410A) will impair machine operation and can even destroy the compressors. The compressors operating with this refrigerant type are lubricated with a synthetic polyolester oil.

Before any intervention on the refrigerant circuit the complete refrigerant charge needs to be recovered.

On LGN units with remote condenser, the installer must

clearly note the total amount of refrigerant used by the system (in kg) on the label affixed to the unit.

RISK OF EXPLOSION: Never use air or a gas containing oxygen during leak tests to purge lines or to pressurise a machine. Pressurised air mixtures or gases containing oxygen can be the cause of an explosion. Oxygen reacts violently with oil and grease.

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

Failure to observe the above recommendations can have serious or even fatal consequences and damage installations.

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

Do not unweld or flamecut the refrigerant lines or any refrigerant circuit component until all refrigerant (liquid and vapour) as well as the oil have been removed from unit. Traces of vapour should be displaced with dry 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.

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

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

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

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

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. 3/8'' SAE connectors on the liquid, suction and discharge lines are available for all units for connection to the transfer station. The units must never be modified to add refrigerant and oil charging, removal and purging devices. All these devices are provided with the units. Please refer to the certified dimensional drawings for the units.

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

Do not attempt to remove refrigerant circuit components or fittings, while the machine is under pressure or while it is running. Be sure pressure is at 0 kPa and that the unit has been shut down and de-energised before removing components or opening a circuit. If the refrigerant circuit is opened for repair, all circuit openings must be plugged if the repair takes longer than 30 minutes, in order to prevent humidity from contaminating the contents of the circuit, especially the oil. If the work is expected to take longer, charge the circuit with nitrogen.

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. 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.).

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.

1.5 - Measures, provisions, procedures against emergencies

When the machine is subjected to heat or fire, a device prevents explosion by releasing the refrigerant (via the relief valve). This fluid can be decomposed into toxic waste when subjected to 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.

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.
- Check the unit's name plate to ensure it matches the model ordered. The name plate is attached in two places to the unit:
- On one of the unit's external sides,
- On the control box door on the inside.
- The unit name plate must include the following information:
- Fluid being transported
- Version number
- Model number
- CE marking
- Serial number
- Year of manufacture and test date
- 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)
- Pressure switch cut-out pressure
- Unit leak test pressure
- Voltage, frequency, number of phases
- Maximum current drawn
- Maximum power input
- Unit net weight
- Confirm that the options ordered for on-site installation have been supplied, are complete and undamaged.
- Do not keep the units outside where they are exposed to the weather, as the sensitive control mechanism and the electronic modules may be damaged.

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, repair or replace the damaged parts (see chapter "Maintenance").

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

2.2 - Moving and placing the unit

2.2.1 - Moving

See chapter 1.1 - "Installation safety considerations".

2.2.2 - Placing 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.

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

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

Before siting the unit check that:

- The chosen location can support the weight of the unit, or that the appropriate reinforcement measures have been taken.
- the unit support points are located at the four lower corners.
- the positioning at these four points must be horizontal (level tolerance 1.5 mm/m in both axes)
- If the support structure is sensitive to vibration and/or noise transmission it is advisable to insert anti-vibration mounts (elastomer mounts or metal springs) between the unit and the structure. Selection of these devices is based on the system characteristics and the comfort level required and should be made by technical specialists.
- there is adequate space above 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.
- No material or object that can be affected by condensate (even a small amount) must be left under the machine or in the water flow direction.

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

If units are hoisted with rigging, it is necessary to protect the unit frame (side and rear panels and front doors) against accidental crushing. Use struts or lifting beams to spread the slings above the unit. Do not tilt the unit more than 15°. Always follow the instructions on the handling notice attached to the unit.

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

Never push or lever on any of the enclosure panels (panels, uprights, front access doors) of the unit. Only the base of the unit frame is designed to withstand such stresses.

2 - PRELIMINARY CHECKS

Checks before system start-up

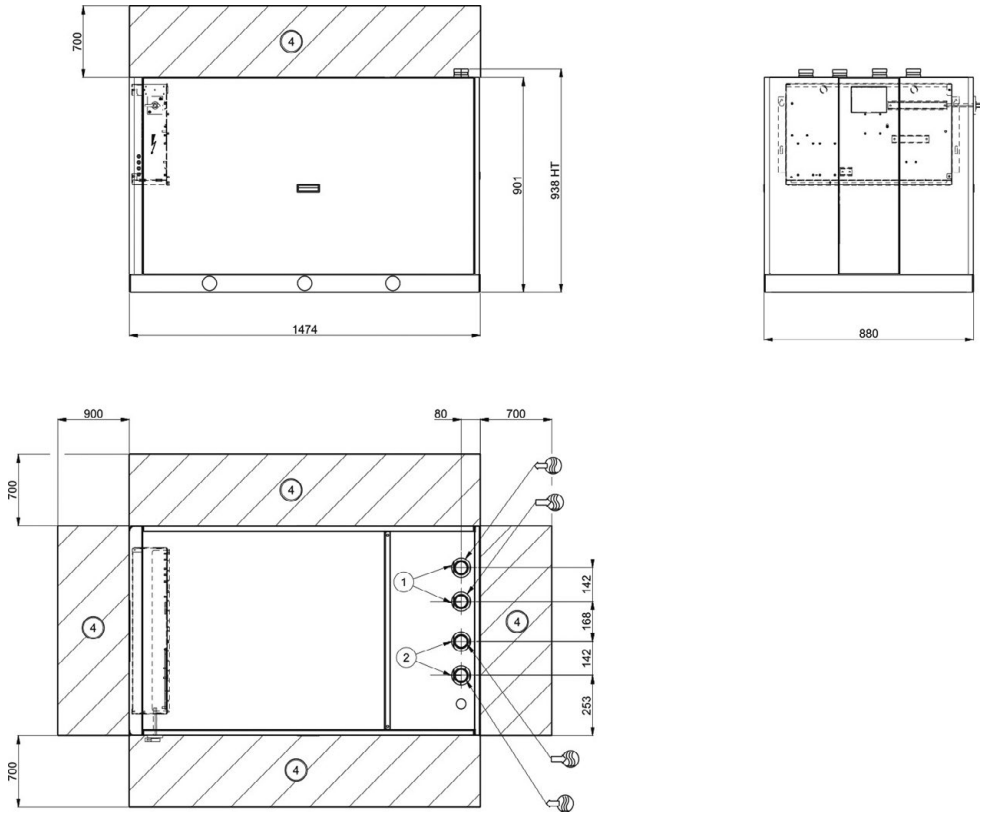
Before the start-up of the refrigeration system, the complete installation, including the refrigeration system must be verified against the installation drawings, dimensional drawings, system piping and instrumentation diagrams and the wiring diagrams.

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

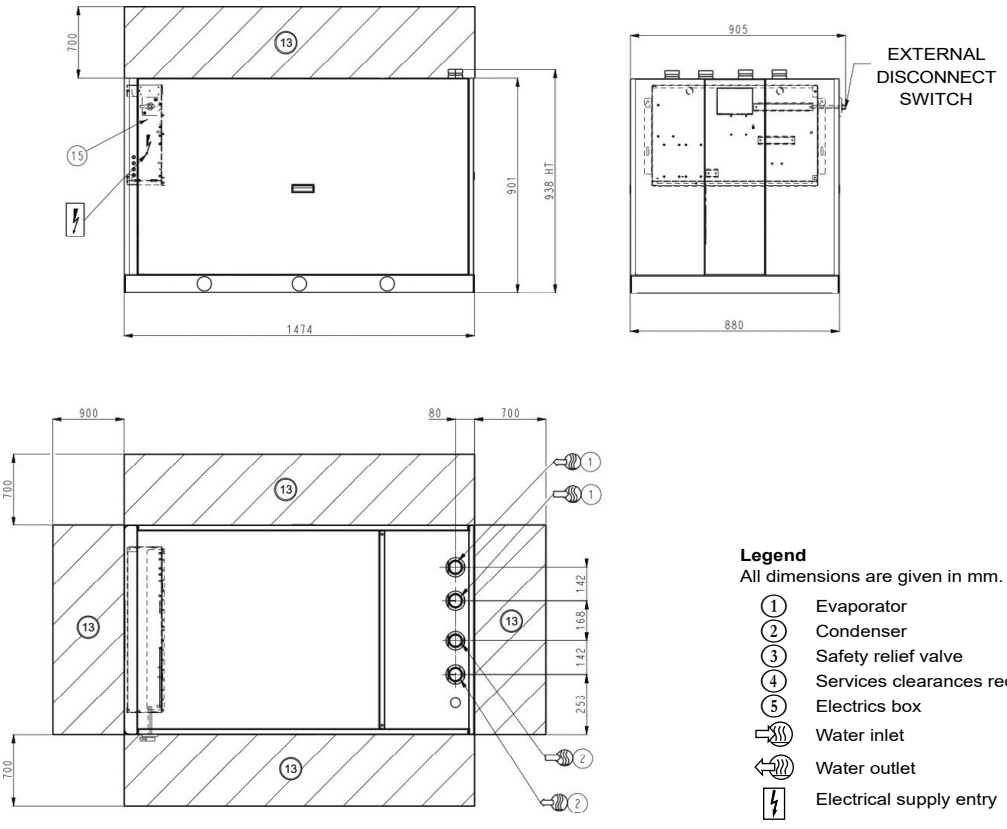
External visual installation checks:

- Ensure that the machine is charged with refrigerant, Verify on the unit nameplate that the 'fluid transported' is R410A and is not nitrogen.
- Compare the complete installation with the refrigeration system and power circuit diagrams.
- Check that all components comply with the design specifications.
- Check that all protection documents and equipment provided by the manufacturer (dimensional drawings, P&ID, declarations etc.) to comply with the regulations are present.
- Verify that the environmental safety and protection and devices and arrangements provided by the manufacturer to comply with the regulations are in place.
- Verify that all documents for pressure containers, certificates, name plates, files, instruction manuals provided by the manufacturer to comply with the regulations are present.
- Verify the free passage of access and safety routes.
- Check that ventilation in the plant room is adequate.
- Check that refrigerant detectors are present.
- Verify the instructions and directives to prevent the deliberate removal of refrigerant gases that are harmful to the environment.
- Verify the installation of connections.
- Verify the supports and fixing elements (materials, routing and connection).
- Verify the quality of welds and other joints.
- Check the protection against mechanical damage.
- Check the protection 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.
- Ensure that the position of the condensate drain piping allows draining and that the connections are correct for the water used.
- Avoid common routing of the customer power wiring and other machine wiring, especially for longer runs (> 200 mm).

3.1 - LG 080 - 150 - Standard unit



3.2 - LG 180 - 300 - Standard unit

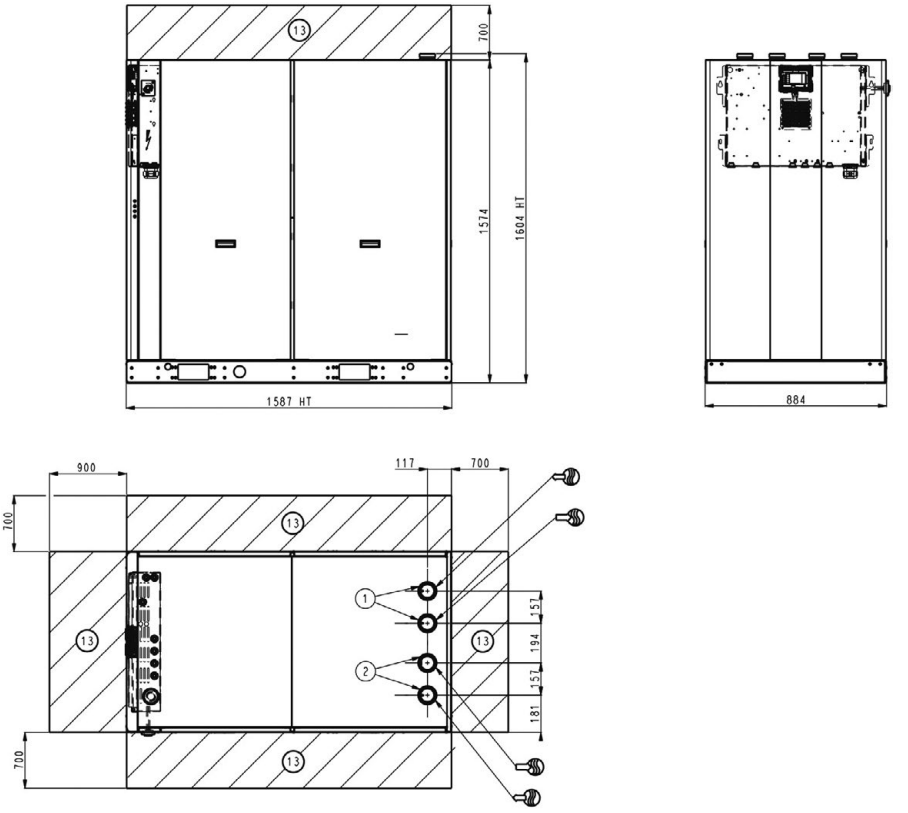


Legend
All dimensions are given in mm.

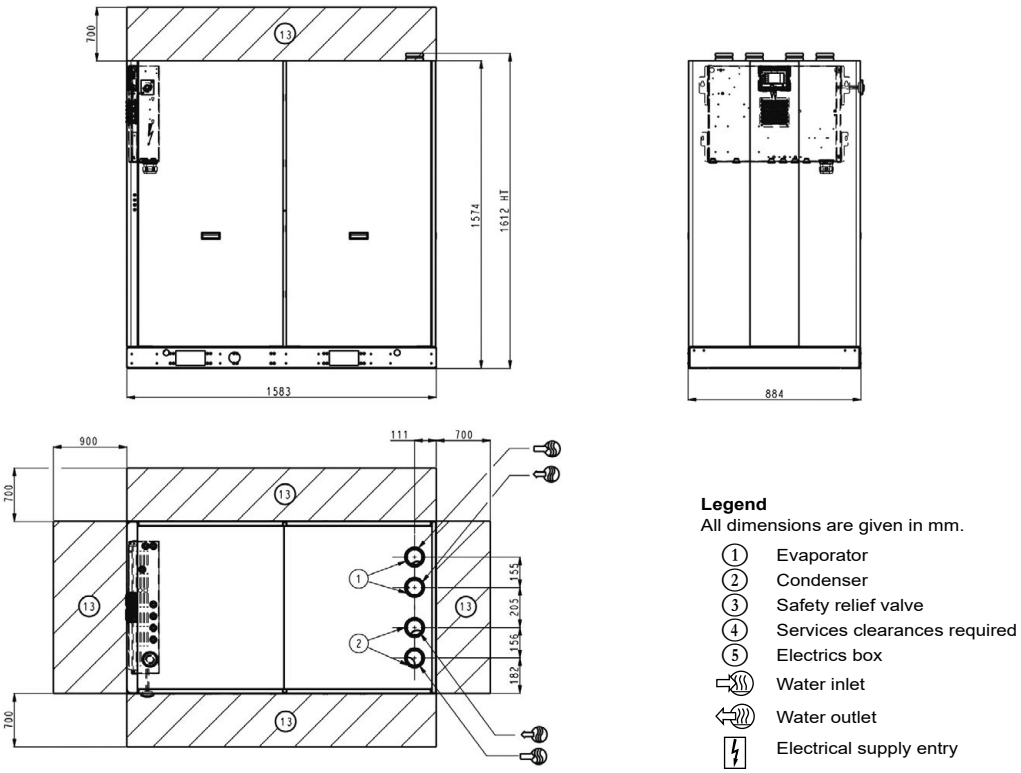
1. Evaporator
2. Condenser
3. Safety relief valve
4. Services clearances required
5. Electrics box
- Water inlet
- Water outlet
- Electrical supply entry

NOTE: Non-contractual drawings. Refer to the certified dimensional drawings,provided with the unit or available on request, when designing an installation.

3.3 - LG 360 - 450 - Standard unit



3.4 - LG 480 - 600 - Standard unit



Legend
All dimensions are given in mm.

1. Evaporator
2. Condenser
3. Safety relief valve
4. Services clearances required
5. Electrics box

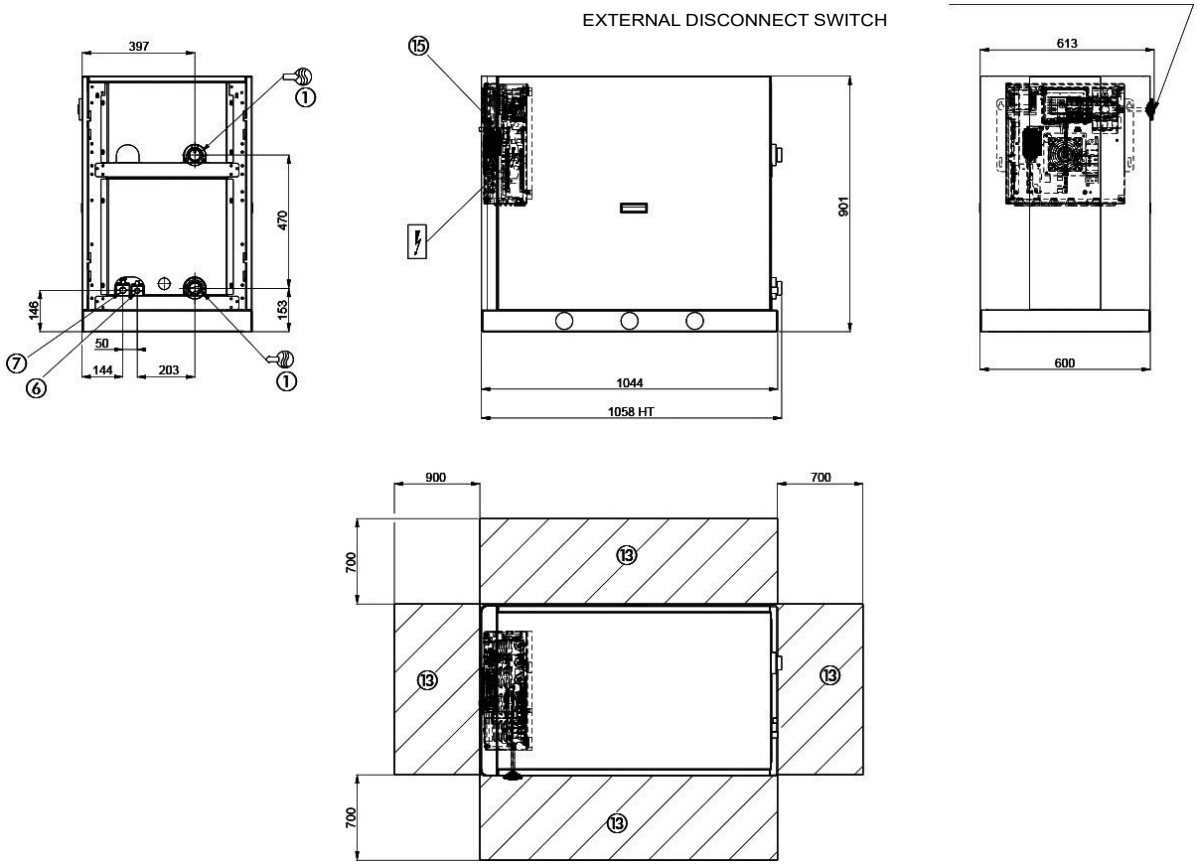
Water inlet

Water outlet

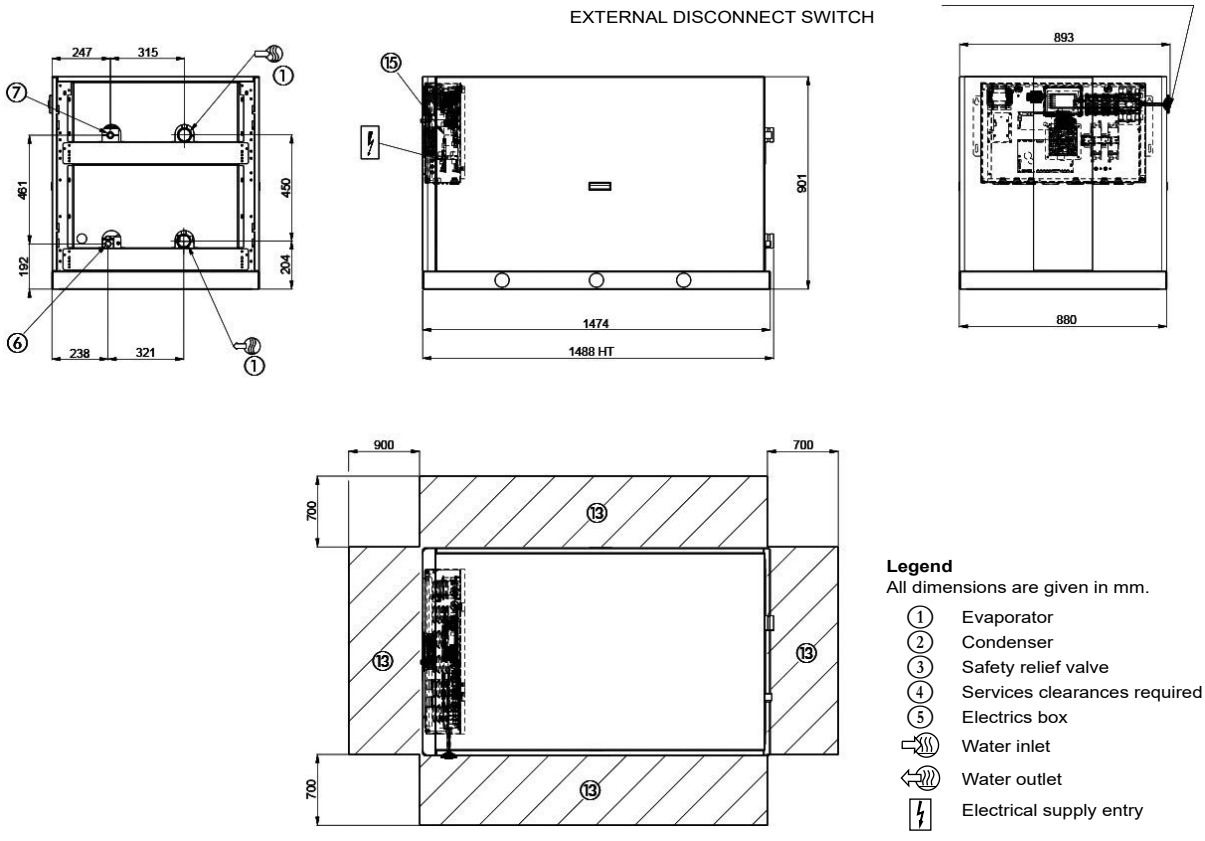
Electrical supply entry

NOTE: Non-contractual drawings. Refer to the certified dimensional drawings,provided with the unit or available on request, when designing an installation.

3.5 - LGN 080 - 150 - Standard unit



3.6 - LGN 180 - 300 - Standard unit

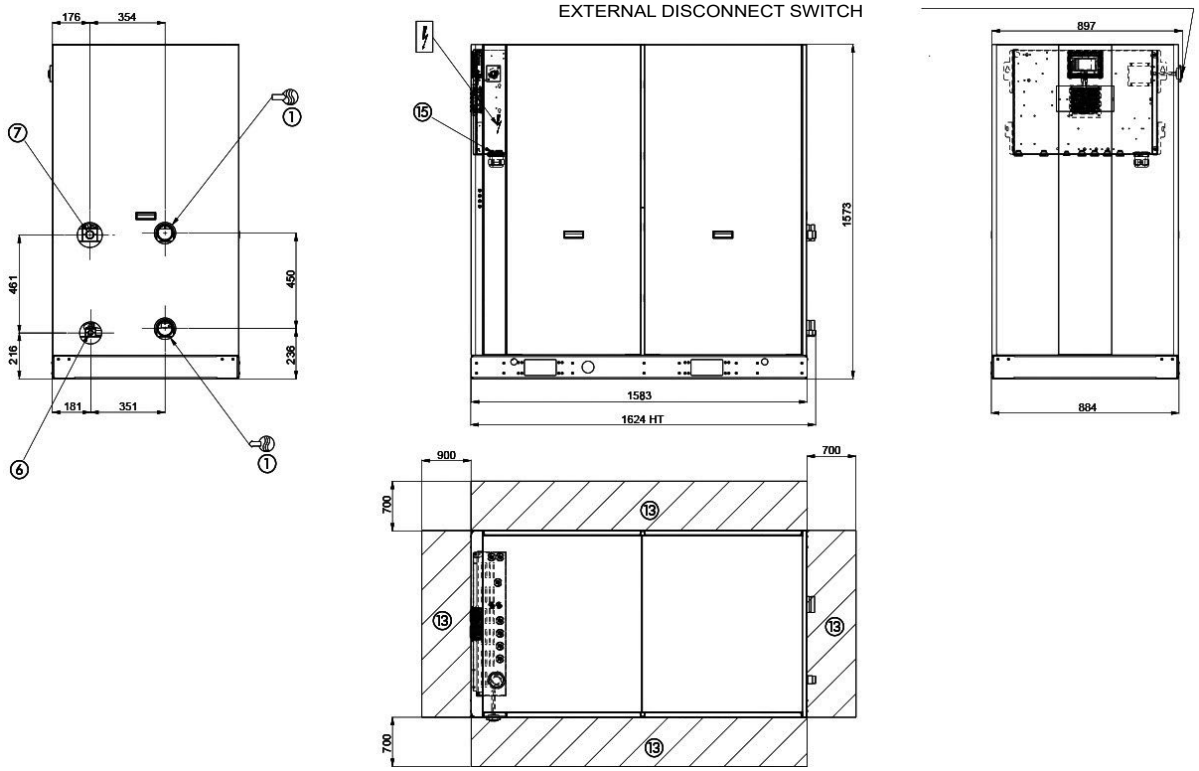


Legend
All dimensions are given in mm.

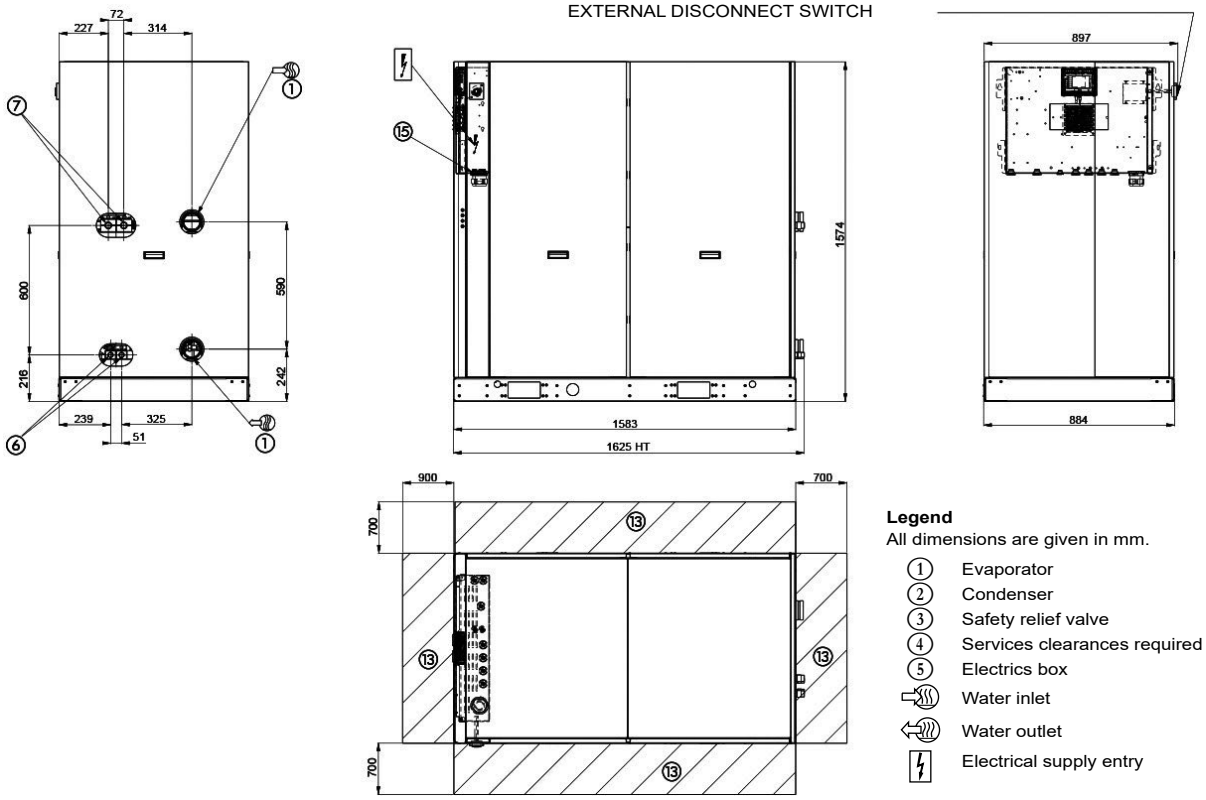
1. Evaporator
2. Condenser
3. Safety relief valve
4. Services clearances required
5. Electrics box
- Water inlet
- Water outlet
- Electrical supply entry

NOTE: Non-contractual drawings. Refer to the certified dimensional drawings,provided with the unit or available on request, when designing an installation.

3.7 - LGN 360 - 450 - Standard unit



3.8 - LGN 480 - 600 - Standard unit



Legend
All dimensions are given in mm.

1. Evaporator
2. Condenser
3. Safety relief valve
4. Services clearances required
5. Electrics box

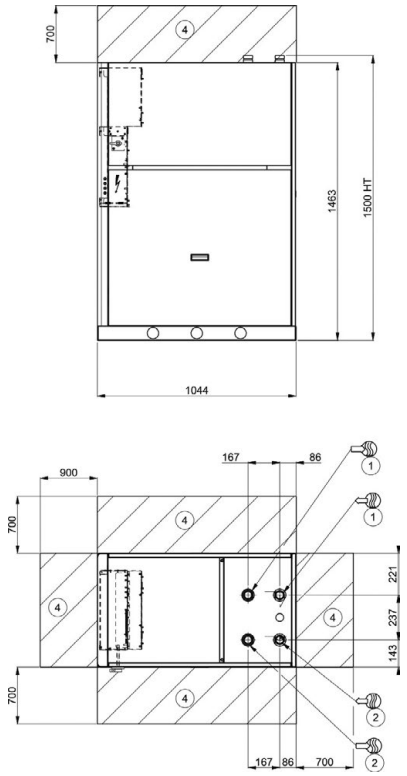
Water inlet

Water outlet

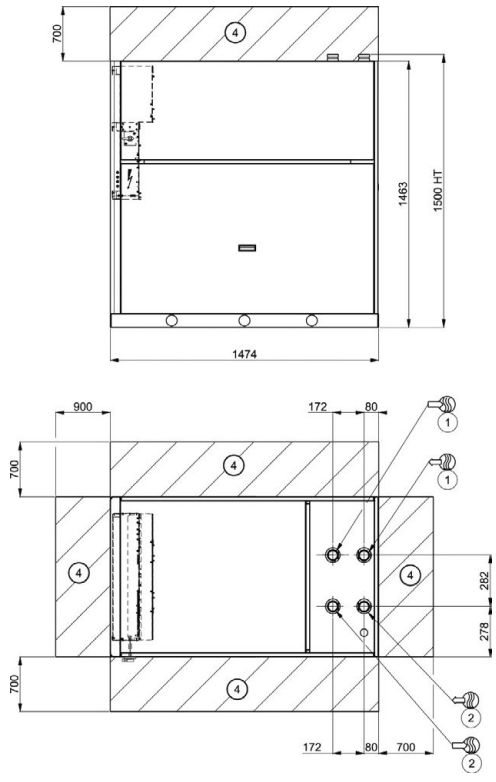
Electrical supply entry

NOTE: Non-contractual drawings. Refer to the certified dimensional drawings,provided with the unit or available on request, when designing an installation.

3.9 - LG 080 - 150 - Unit with hydraulic module



3.10 - LG 180 - 300 - Unit with hydraulic module



Legend
All dimensions are given in mm.

1. Evaporator
2. Condenser
3. Safety relief valve
4. Services clearances required
5. Electrics box

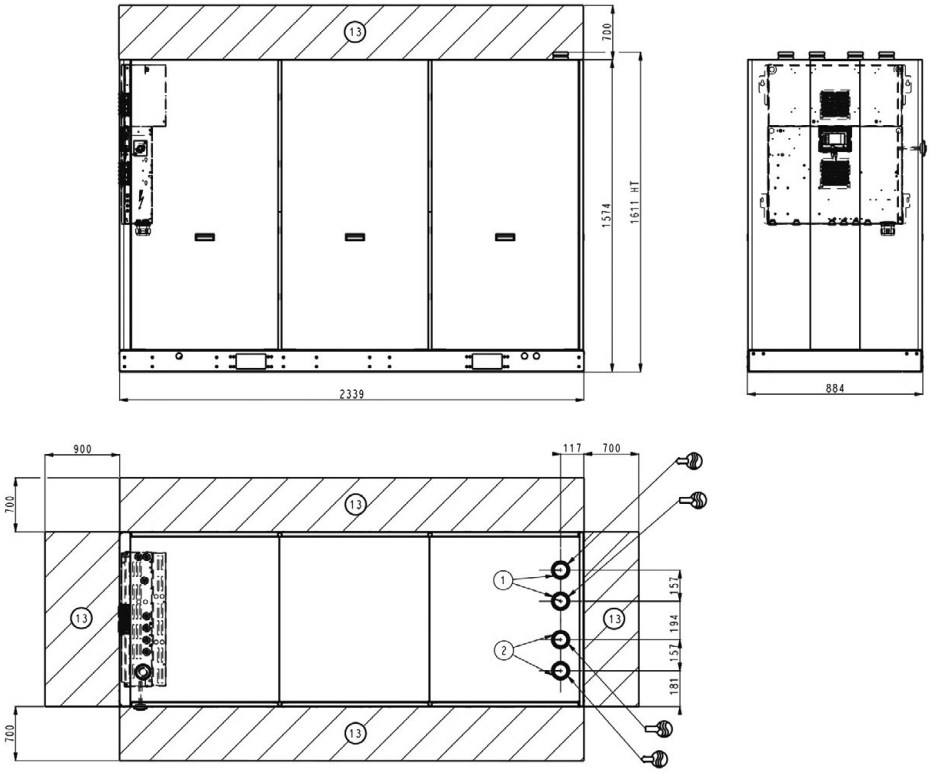
Water inlet

Water outlet

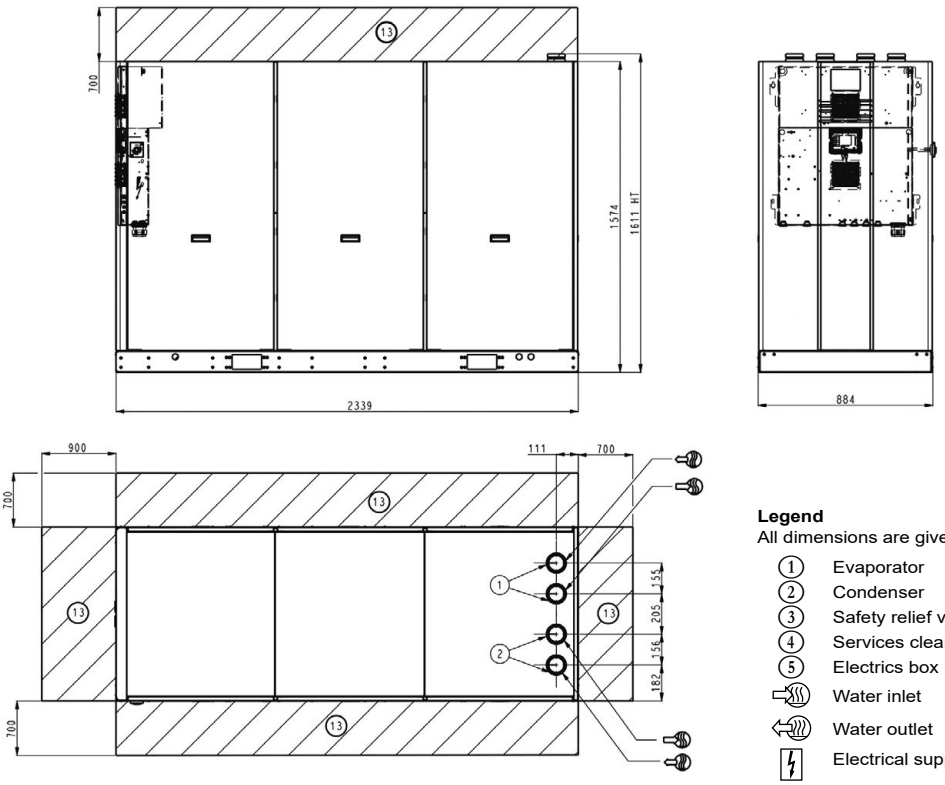
Electrical supply entry

NOTE: Non-contractual drawings. Refer to the certified dimensional drawings,provided with the unit or available on request, when designing an installation.

3.11 - LG 360 - 450 - Unit with hydraulic module



3.12 - LG 480 - 600 - Unit with hydraulic module

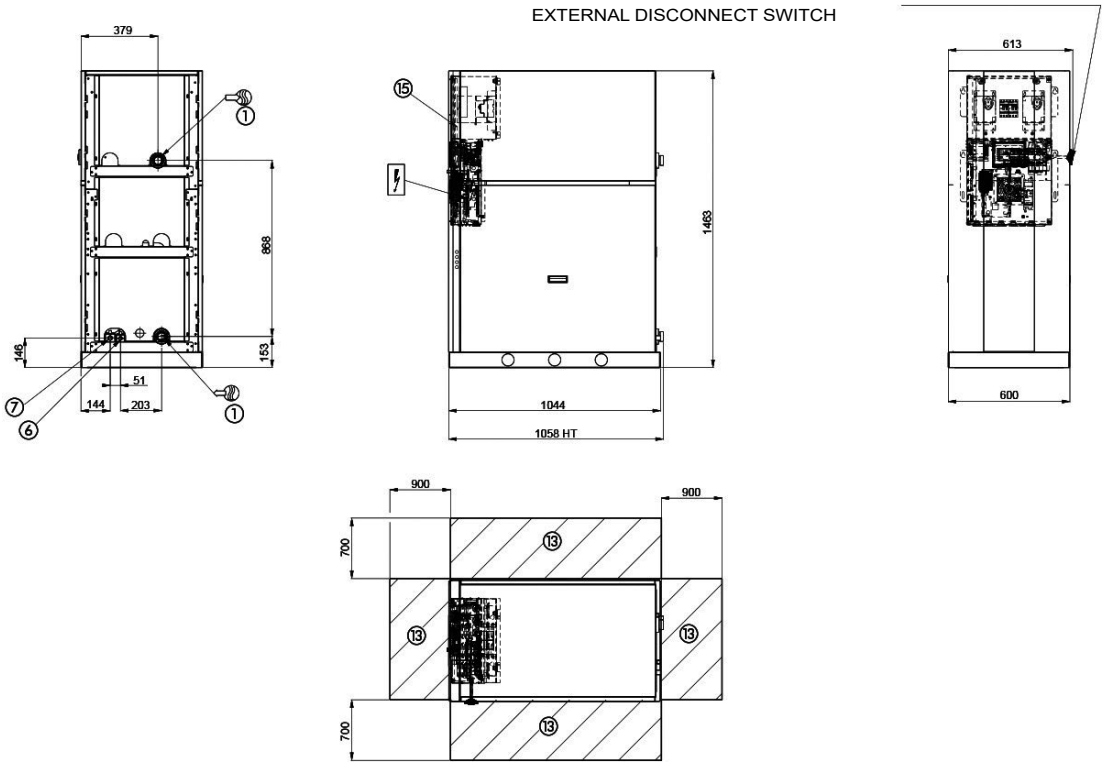


Legend
All dimensions are given in mm.

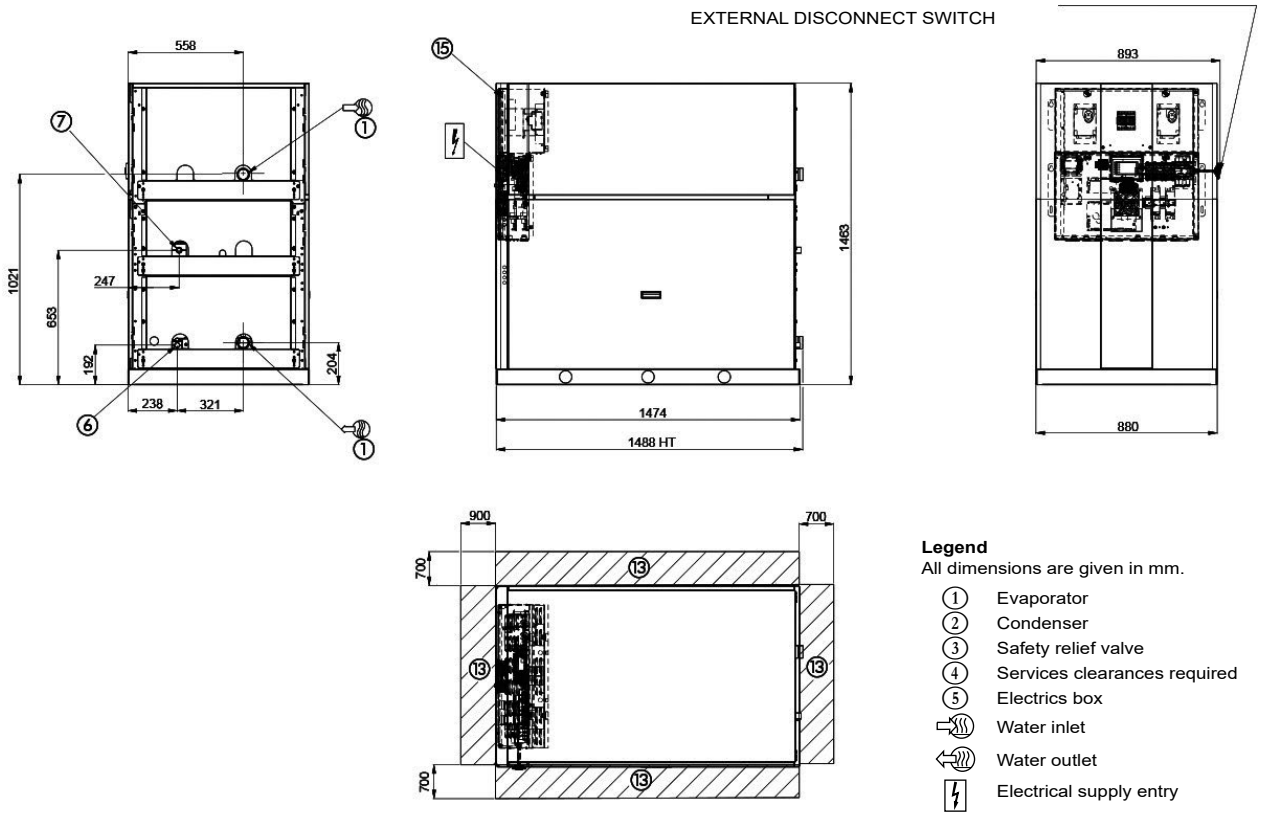
1. Evaporator
2. Condenser
3. Safety relief valve
4. Services clearances required
5. Electrics box
- Water inlet
- Water outlet
- Electrical supply entry

NOTE: Non-contractual drawings. Refer to the certified dimensional drawings,provided with the unit or available on request, when designing an installation.

3.13 - LGN 080 - 150 - Unit with hydraulic module



3.14 - LGN 180 - 300 - Unit with hydraulic module

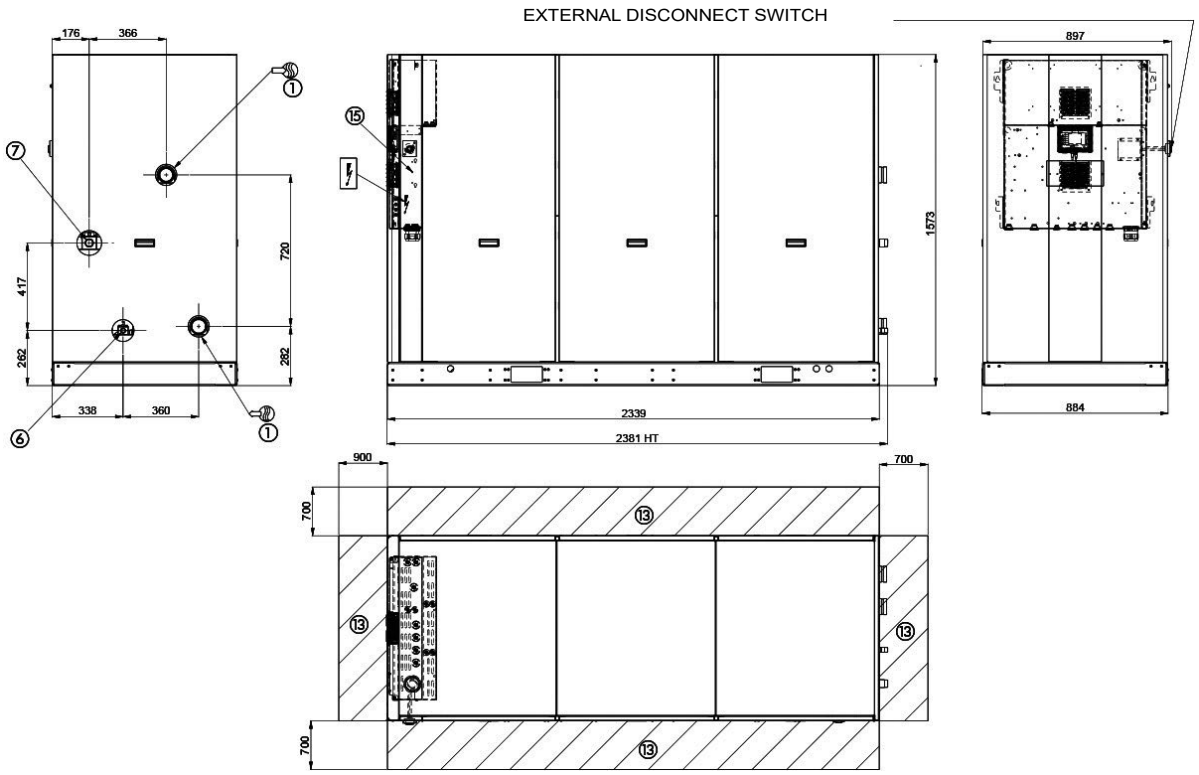


Legend
All dimensions are given in mm.

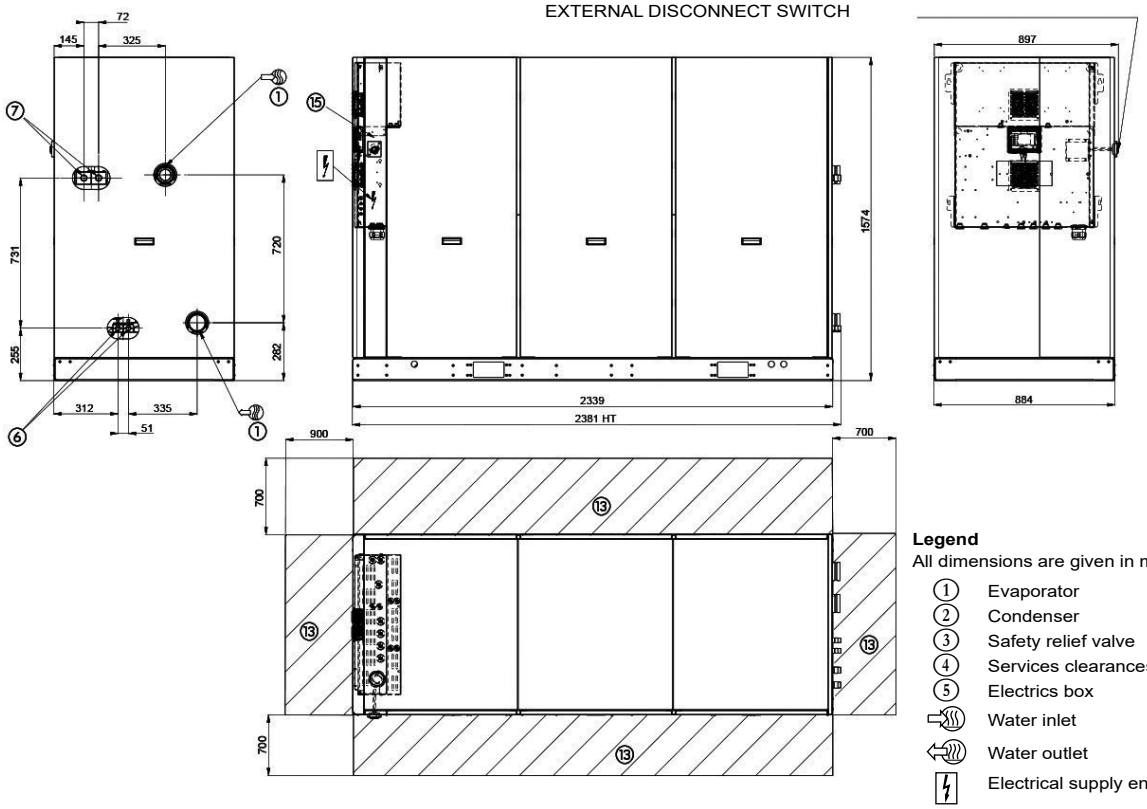
1. Evaporator
2. Condenser
3. Safety relief valve
4. Services clearances required
5. Electrics box
- Water inlet
- Water outlet
- Electrical supply entry

NOTE: Non-contractual drawings. Refer to the certified dimensional drawings,provided with the unit or available on request, when designing an installation.

3.15 - GN 360 - 450 - Unit with hydraulic module



3.16 - LGN 480 - 600 - Unit with hydraulic module



Legend
All dimensions are given in mm.

1. Evaporator
2. Condenser
3. Safety relief valve
4. Services clearances required
5. Electrics box
- Water inlet
- Water outlet
- Electrical supply entry

NOTE: Non-contractual drawings. Refer to the certified dimensional drawings,provided with the unit or available on request, when designing an installation.

4.1 - Physical data

LG 080-300 physical data

DYNACIAT™ LG		080	090	100	120	130	150	180	200	240	260	300
Sound levels												
Standard unit												
Sound power (1)	dB(A)	67,0	68,5	69,0	69,3	70,0	70,1	71,5	72,0	72,0	73,0	73,4
Sound pressure at 10m (2)	dB(A)	35,7	37,2	37,7	38,0	38,7	38,8	40,1	40,6	40,6	41,6	42,0
Low noise option unit												
Sound power (1)	dB(A)	65	65,8	65,8	66,6	68,4	68,4	68,4	68,6	69	69	69,9
Sound pressure at 10 m (2)	dB(A)	33,7	34,5	34,5	35,3	37,1	37,1	37,0	37,2	37,6	37,6	38,5
Dimensions												
Length	mm	600	600	600	600	600	600	880	880	880	880	880
Width	mm	1044	1044	1044	1044	1044	1044	1474	1474	1474	1474	1474
Height	mm	901	901	901	901	901	901	901	901	901	901	901
Operating weight (3)												
Standard unit	kg	191	200	200	207	212	220	386	392	403	413	441
Unit + LP evap. single-pump	kg	250	258	258	263	266	271	431	435	442	449	465
Unit + LP cond. single-pump	kg	250	258	258	263	266	271	431	435	442	449	465
Unit + HP evap. variable-speed single-pump + HP cond. variable-speed single-pump	kg	305	313	313	321	327	334	513	521	533	544	574
Compressors		Hermetic scroll 48,3 r/s										
Circuit A	Qty	1	1	1	1	1	1	2	2	2	2	2
Circuit B	Qty	-	-	-	-	-	-	-	-	-	-	-
No. of power stages	Qty	1	1	1	1	1	1	2	2	2	2	2
Refrigerant (3)		R-410A										
Circuit A	kg	3,5	3,5	3,6	3,7	4	4,6	7,6	7,8	7,9	8,7	11,5
	teqCO_2	7,3	7,3	7,5	7,7	8,4	9,6	15,9	16,3	16,5	18,2	24,0
Circuit B	kg	-	-	-	-	-	-	-	-	-	-	-
	teqCO_2	-	-	-	-	-	-	-	-	-	-	-
Oil charge		160SZ										
Circuit A	l	3	3,3	3,3	3,3	3,3	3,6	3,3	3,3	3,3	3,3	3,6
Circuit B	l	-	-	-	-	-	-	-	-	-	-	-
Power control		Connect'Touch control										
Minimum capacity	%	100	100	100	100	100	100	50	50	50	50	50
Water type heat exchanger		Direct-expansion plate heat exchanger										
Evaporator												
Water volume	l	3,3	3,6	3,6	4,2	4,6	5	8,4	9,2	9,6	10,4	12,5
Max. water-side operating pressure without hydraulic module	kPa	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Condenser		Plate heat exchanger										
Water volume	l	3,3	3,6	3,6	4,2	4,6	5	8,4	9,2	9,6	10,4	12,5
Max. water-side operating pressure without hydraulic module	kPa	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Hydraulic module (optional)												
Single pump (as required)		Pump, victaulic screen filter, purge valves (water and air), pressure sensors										
Expansion tank volume (Option)	l	8	8	8	8	8	8	12	12	12	12	12
Expansion vessel pressure (4)	bar	3	3	3	3	3	3	3	3	3	3	3
Max. water-side operating pressure with hydraulic module	kPa	300	300	300	300	300	300	300	300	300	300	300
Water connections with/without hydraulic module		Victaulic®										
Connections	in	1,5	1,5	1,5	1,5	1,5	1,5	2	2	2	2	2
External diameter	mm	48,3	48,3	48,3	48,3	48,3	48,3	60,3	60,3	60,3	60,3	60,3
Casing paint		Colour code RAL 7035/RAL 7024										

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

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

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

(4) Upon delivery, the standard preinflation of the vessels is not necessarily at the optimum value for the installation. To enable the water volume to be varied as desired, adapt the inflation pressure to a value close to that which corresponds to the static height of the installation. Fill the installation with water (bleeding out any air) at a pressure 10 to 20 kPa higher than that of the vessel.

LG 360-600 physical data

DYNACIAT™ LG		360	390	450	480	520	600
Sound levels							
Standard unit							
Sound power (1)	dB(A)	75,5	76,5	77,8	76,0	77,0	78,4
Sound pressure at 10 m (2)	dB(A)	43,9	44,9	46,2	44,4	45,4	46,8
Low noise option unit							
Sound power (1)	dB(A)	72,5	73,5	74,8	73,0	74,0	75,4
Sound pressure at 10 m (2)	dB(A)	40,9	41,9	43,2	41,4	42,4	43,8
Dimensions							
Length	mm	880	880	880	880	880	880
Width	mm	1583	1583	1583	1583	1583	1583
Height	mm	1574	1574	1574	1574	1574	1574
Operating weight (3)							
Standard unit	kg	762	787	814	909	944	975
Unit + LP evap. single-pump	kg	812	837	864	962	1011	1042
Unit + LP cond. single-pump	kg	827	852	879	975	1010	1041
Unit + HP evap. variable-speed single-pump + HP cond. variable-speed single-pump	kg	899	924	951	1048	1083	1114
Compressors		Hermetic scroll 48,3 r/s					
Circuit A	Qty	3	3	3	2	2	2
Circuit B	Qty	-	-	-	2	2	2
No. of power stages	Qty	3	3	3	4	4	4
Refrigerant (3)		R-410A					
Circuit A	kg	13,3	14,7	15,3	10,5	11,5	12,1
	teqCO_2	27,8	30,7	31,9	21,9	23,9	25,05
Circuit B	kg	-	-	-	10,5	11,25	12
	teqCO_2	-	-	-	21,9	23,9	25,05
Oil charge							
Circuit A	l	3,3	3,3	3,6	3,3	3,3	3,6
Circuit B	l	-	-	-	3,3	3,3	3,6
Power control		Connect'Touch control					
Minimum capacity	%	33	33	33	25	25	25
Water type heat exchanger							
Evaporator		Direct-expansion plate heat exchanger					
Water volume	l	15,18	17,35	19,04	23,16	26,52	29,05
Max. water-side operating pressure without hydraulic module	kPa	1000	1000	1000	1000	1000	1000
Condenser		Plate heat exchanger					
Water volume	l	15,18	17,35	19,04	23,16	26,52	29,05
Max. water-side operating pressure without hydraulic module	kPa	1000	1000	1000	1000	1000	1000
Hydraulic module (optional)							
Single pump (as required)		Pump, victaulic screen filter, purge valves (water and air), pressure sensors					
Expansion tank volume (Option)	l	25	25	25	35	35	35
Expansion vessel pressure (4)	bar	4	4	4	4	4	4
Max. water-side operating pressure with hydraulic module	kPa	400	400	400	400	400	400
Water connections with/without hydraulic module		Victaulic®					
Connections	in	2,5	2,5	2,5	3	3	3
External diameter	mm	73	73	73	88,9	88,9	88,9
Casing paint		Colour code RAL 7035/RAL 7024					

(1) In dB ref=10^{-12} W, weighting (A). Declared dual-number noise emission values in accordance with ISO 4871 (with an associated uncertainty of +/-3dB(A)). Measured in accordance with ISO 9614-1.
(2) In dB ref 20µPa, 'A' weighted. Declared dual-number noise emission values in accordance with ISO 4871 (with an associated uncertainty of +/-3dB(A)). For information, calculated from the sound power Lw(A).
(3) Values are guidelines only. Refer to the unit name plate.
(4) Upon delivery, the standard preinflation of the vessels is not necessarily at the optimum value for the installation. To enable the water volume to be varied as desired, adapt the inflation pressure to a value close to that which corresponds to the static height of the installation. Fill the installation with water (bleeding out any air) at a pressure 10 to 20 kPa higher than that of the vessel.

4 - PHYSICAL AND ELECTRICAL DATA

LGN 080 - 300 physical data

DYNACIAT™ LGN		080	090	100	120	130	150	180	200	240	260	300
Sound levels												
Standard unit												
Sound power (1)	dB(A)	67,0	68,5	69,0	69,3	70,0	70,1	71,5	72,0	72,0	73,0	73,4
Sound pressure at 10m (2)	dB(A)	35,7	37,2	37,7	38,0	38,7	38,7	40,1	40,6	40,6	41,6	42,0
Unit with Low Noise option												
Sound power (1)	dB(A)	65	66	66	67	68	68	68	69	69	69	70
Sound pressure at 10 m (2)	dB(A)	34	35	35	35	37	37	37	37	38	38	39
Dimensions												
Length	mm	600	600	600	600	600	600	880	880	880	880	880
Width	mm	1044	1044	1044	1044	1044	1044	1474	1474	1474	1474	1474
Height	mm	901	901	901	901	901	901	901	901	901	901	901
Operating weight (3)												
Standard unit	kg	160	168	168	172	176	180	313	315	322	329	342
Unit with evaporator with single LP pump	kg	250	258	258	263	266	271	431	435	442	449	465
Compressors		Hermetic scroll 48,3 rev/s										
Circuit A	Qty	1	1	1	1	1	1	2	2	2	2	2
Circuit B	Qty	-	-	-	-	-	-	-	-	-	-	-
No. of power stages	Qty	1	1	1	1	1	1	2	2	2	2	2
Refrigerant (3)		R-410A										
Oil charge		160SZ										
Circuit A	l	3	3,3	3,3	3,3	3,3	3,6	3,3	3,3	3,3	3,3	3,6
Circuit B	l	-	-	-	-	-	-	-	-	-	-	-
Power control		Connect'Touch Control										
Minimum capacity	%	100	100	100	100	100	100	50	50	50	50	50
Water type heat exchanger												
Evaporator		Direct expansion plate heat exchanger										
Water volume	l	3,3	3,6	3,6	4,2	4,6	5	8,4	9,2	9,6	10,4	12,5
Max. water-side operating pressure without hydraulic module	kPa	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Hydraulic module (optional)												
Single pump (as required)		Pump, victaulic screen filter, purge valves (water and air), pressure sensors										
Expansion tank volume	l	8	8	8	8	8	8	12	12	12	12	12
Expansion vessel pressure (4)	bar	3	3	3	3	3	3	3	3	3	3	3
Max. water-side operating pressure with hydraulic module	kPa	300	300	300	300	300	300	300	300	300	300	300
Water connections with or without hydraulic module		Victaulic®										
Connections	inches	1,5	1,5	1,5	1,5	1,5	1,5	2	2	2	2	2
External diameter	mm	48,3	48,3	48,3	48,3	48,3	48,3	60,3	60,3	60,3	60,3	60,3
Casing paint		Colour code RAL 7035/RAL 7024										

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

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

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

(4) Upon delivery, the standard preinflation of the vessels is not necessarily at the optimum value for the installation. To enable the water volume to be varied as desired, adapt the inflation pressure to a value close to that which corresponds to the static height of the installation. Fill the installation with water (bleeding the air) to a pressure 10 to 20 kPa higher than that of the vessel.

LGN 360 - 600 physical data

DYNACIAT™ LGN		360	390	450	480	520	600
Sound levels							
Standard unit							
Sound power (1)	dB(A)	75,5	76,5	77,8	76,0	77,0	78,4
Sound pressure at 10m (2)	dB(A)	43,9	44,9	46,2	44,4	45,4	46,8
Dimensions							
Length	mm	880	880	880	880	880	880
Width	mm	1583	1583	1583	1583	1583	1583
Height	mm	1574	1574	1574	1574	1574	1574
Operating weight (3)							
Standard unit	kg	630	647	665	751	774	796
Unit with evaporator with single LP pump	kg	674	691	709	797	846	868
Compressors		Hermetic scroll 48,3 rev/s					
Circuit A	Qty	3	3	3	2	2	2
Circuit B	Qty	-	-	-	2	2	2
No. of power stages	Qty	3	3	3	4	4	4
Refrigerant (3)		R-410A					
Oil charge		160SZ					
Circuit A	l	3,3	3,3	3,6	3,3	3,3	3,6
Circuit B	l	-	-	-	3,3	3,3	3,6
Power control		Connect'Touch Control					
Minimum capacity	%	33%	33%	33%	25%	25%	25%
Water type heat exchanger							
Evaporator		Direct expansion plate heat exchanger					
Water volume	l	15,18	17,35	19,04	23,16	26,52	29,05
Max. water-side operating pressure without hydraulic module	kPa	1000	1000	1000	1000	1000	1000
Hydraulic module (optional)							
Single pump (as required)		Pump, Victaulic screen filter, drain valves (water and air), pressure sensors					
Expansion tank volume	l	25	25	25	35	35	35
Expansion vessel pressure (4)	bar	4	4	4	4	4	4
Max. water-side operating pressure with hydraulic module	kPa	400	400	400	400	400	400
Water connections with or without hydraulic module		Victaulic®					
Connections	inches	2,5	2,5	2,5	3	3	3
External diameter	mm	73	73	73	88,9	88,9	88,9
Casing paint		Colour code RAL 7035/RAL 7024					

(1) in dB ref=10^{-12} W, 'A' weighted. Declared dual-number noise emission values in accordance with ISO 4871 (with an associated uncertainty of +/-3dB(A)). Measured in accordance with ISO 9614-1.
(2) In dB ref 20µPa, 'A' weighted. Declared dual-number noise emission values in accordance with ISO 4871 (with an associated uncertainty of +/-3dB(A)). For information, calculated from the sound power Lw(A).
(3) Values are guidelines only. Refer to the unit name plate.
(4) Upon delivery, the standard preinflation of the vessels is not necessarily at the optimum value for the installation. To enable the water volume to be varied as desired, adapt the inflation pressure to a value close to that which corresponds to the static height of the installation. Fill the installation with water (bleeding the air) to a pressure 10 to 20 kPa higher than that of the vessel.

4.2 - Electrical data

LG 080-300 electrical data

DYNACIAT™ LG - Standard unit (without hydraulic module)		080	090	100	120	130	150	180	200	240	260	300
Power circuit												
Nominal voltage	V-ph-Hz	400-3-50										
Voltage range	V	360-440										
Control circuit supply		24 V, via internal transformer										
Nominal unit operating current draw(3)												
Circuit A&B	A	10,5	13,2	13,8	15,6	16,2	20,2	26,4	27,6	31,2	32,4	40,4
Max. operating power (2)												
Circuit A&B	kW	9,2	10,8	11,7	13,7	15,1	17,1	21,5	23,3	27,3	30,3	34,2
Unit power factor at maximum capacity(2)		0,85	0,83	0,85	0,85	0,86	0,85	0,83	0,85	0,85	0,86	0,85
Unit max. operating current draw (Un-10%)(5)												
Circuit A&B	A	17,3	20,8	22	25,8	28,2	32,2	41,6	44	51,6	56,4	64,4
Maximum unit current draw (Un)(4)												
Circuit A&B - Standard unit	A	15,6	18,7	19,8	23,2	25,4	29	37,4	39,6	46,4	50,8	58
Maximum start-up current, standard unit (Un)(1)												
Circuit A&B	A	98	142	142	147	158	197	161	162	170	183	226
Maximum start-up current, unit with soft-starter (Un)(1)												
Circuit A&B	A	53,9	78,1	78,1	80,9	86,9	108,4	96,8	97,9	104,1	112,3	137,4

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

LG 360 - 600 electrical data

DYNACIAT™ LG - Standard unit (without hydraulic module)		360	390	450	480	520	600
Power circuit							
Nominal voltage	V-ph-Hz	400-3-50					
Voltage range	V	360-440					
Control circuit supply		24 V, via internal transformer					
Nominal unit operating current(3)							
Circuit A&B	A	46,8	48,6	60,6	62,4	64,8	80,8
Max. operating input power(2)							
Circuit A&B	kW	41	44,9	51,2	54,6	59,8	68,3
Cosine Phi unit at maximum power (2)		0,85	0,85	0,85	0,85	0,85	0,85
Maximum unit current draw (Un-10%) (5)							
Circuit A&B	A	77,3	84,7	96,7	103,1	112,9	128,9
Maximum unit current draw (Un)(4)							
Circuit A&B - Standard unit	A	69,6	76,2	87	92,8	101,6	116
Maximum start-up current, standard unit (Un)(1)							
Circuit A&B	A	193,4	208,8	255	216,6	234,2	284
Maximum start-up current, unit with soft-starter (Un)(1)							
Circuit A&B	A	127,3	137,7	166,4	150,5	163,1	195,4

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

LGN 080-300 electrical data

DYNACIAT™ LGN - Standard unit (without hydraulic module)		080	090	100	120	130	150	180	200	240	260	300
Power circuit												
Nominal voltage	V-ph-Hz	400-3-50										
Voltage range	V	360-440										
Control circuit supply		24 V, via internal transformer										
Nominal unit operating current draw(3)												
Circuit A&B	A	11,4	13,8	14,7	16,5	18,1	21,2	27,6	29,4	33,1	36,4	42,5
Max. operating input power(2)												
Circuit A&B	kW	9,2	10,8	11,7	13,7	15,1	17,1	21,5	23,3	27,3	30,3	34,2
Unit power factor at maximum capacity(2)		0,85	0,83	0,85	0,85	0,86	0,85	0,83	0,85	0,85	0,86	0,85
Unit max. operating current draw (Un-10%)(5)												
Circuit A&B	A	17,3	20,8	22	25,8	28,2	32,2	41,6	44	51,6	56,4	64,4
Maximum unit current draw (Un) (4)												
Circuit A&B - Standard unit	A	15,6	18,7	19,8	23,2	25,4	29	37,4	39,6	46,4	50,8	58
Maximum start-up current, standard unit (Un) (1)												
Circuit A&B	A	98	142	142	147	158	197	161	162	170	183	226
Maximum start-up current, unit with soft-starter (Un)(1)												
Circuit A&B	A	53,9	78,1	78,1	80,9	86,9	108,4	96,8	97,9	104,1	112,3	137,4

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

LGN 360 - 600 electrical data

DYNACIAT™ LGN - Standard unit (without hydraulic module)		360	390	450	480	520	600
Power circuit							
Nominal voltage	V-ph-Hz	400-3-50					
Voltage range	V	360-440					
Control circuit supply		24 V, via internal transformer					
Nominal unit operating current(3)							
Circuit A&B	A	49,5	54,3	63,6	66	72,4	84,8
Max. operating input power(2)							
Circuit A&B	kW	42	44,9	51,2	55,9	59,8	68,3
Cosine Phi unit at maximum power (2)		0,87	0,85	0,85	0,87	0,85	0,85
Maximum unit current draw (Un-10%) (5)							
Circuit A&B	A	77,3	84,7	96,7	103,1	112,9	128,9
Maximum unit current draw (Un)(4)							
Circuit A&B - Standard unit	A	69,6	76,2	87	92,8	101,6	116
Maximum start-up current, standard unit (Un) (1)							
Circuit A&B	A	193,4	208,8	255	216,6	234,2	284
Maximum start-up current, unit with soft-starter (Un)(1)							
Circuit A&B	A	127,3	137,7	166,3	150,4	163,1	195,3

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

4.3 - Short-circuit stability current (TN system(1)) - standard unit (with main disconnect switch)

DYNACIAT™ LG/LGN		080	090	100	120	130	150	180	200	240	260	300
Value without upstream protection												
Short time assigned current (1s) - Icw	kA rms	3	3	3	3	3	3	3	3	3	3	3
Allowable peak assigned current - Ipk	kA pk	6	6	6	6	6	6	6	6	6	6	6
Value with upstream protection												
Conditional short circuit assigned current Icc	kA rms	40	40	40	40	40	40	40	40	40	40	40
Associated Schneider circuit breaker - Compact type range (2)		NSX 100N										

DYNACIAT™ LG/LGN		360	390	450	480	520	600
Value with upstream protection							
Short time (1s) assigned current - Icw	kA rms	5,5	5,5	5,5	5,5	5,5	5,5
Allowable peak assigned current - Ipk	kA pk	20	20	20	20	20	20
Value with upstream protection							
Conditional short circuit assigned current Icc	kA rms	154	154	154	154	154	154
Associated Schneider circuit breaker - Compact type range (2)		NSX 100N					

(1) Earthing system type
(2) If another current limitation protection system is used, its time-current and thermal constraint (I^2t) trip characteristics must be at least equivalent to those of the recommended Schneider circuit breaker.
The short-circuit stability current values above are suitable with the TN system.

4.4 - Electrical data, optional hydraulic module

The pumps that are installed in DYNACIAT™ LG/LGN units have motors with efficiency class IE3. The additional electrical data required(1) is as follows:

DYNACIAT™ LG/LGN evaporator or condenser with variable or fixed speed low pressure hydraulic module and single pump option motors

N°(2)	Description(3)		DYNACIAT™ LG/LGN										
			080	090	100	120	130	150	180	200	240	260	300
1	Nominal efficiency at full load and nominal voltage	%	81,10	81,10	81,10	81,10	81,10	81,10	81,10	81,10	81,10	81,10	83,40
	Nominal efficiency at 75% rated load and nominal voltage	%	80,80	80,80	80,80	80,80	80,80	80,80	80,80	80,80	80,80	80,80	81,20
	Nominal efficiency at 50% rated load and nominal voltage	%	77,50	77,50	77,50	77,50	77,50	77,50	77,50	77,50	77,50	77,50	78,30
2	Efficiency level	%	IE3	IE3	IE3	IE3	IE3	IE3	IE3	IE3	IE3	IE3	IE3
3	Year of manufacture		This information varies depending on the manufacturer and model at the time of incorporation, Please refer to the motor name plates,										
4	Manufacturer's name and trademark, commercial registration number and place of manufacturer												
5	Product's model number												
6	Number of motor poles		2	2	2	2	2	2	2	2	2	2	2
7-1	Nominal shaft power output at full load and nominal voltage (400 V)	kW	0,8	0,8	0,8	0,8	0,8	0,8	0,8	0,8	0,8	0,8	1,3
7-2	Maximum input power (400 V)(4)	kW	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,6
8	Rated input frequency	Hz	50	50	50	50	50	50	50	50	50	50	50
9-1	Nominal voltage	V	400V 3P	400V 3P	400V 3P	400V 3P	400V 3P	400V 3P	400V 3P	400V 3P	400V 3P	400V 3P	400V 3P
9-2	Maximum current drawn (400 V)(5)	A	2,1	2,1	2,1	2,1	2,1	2,1	2,1	2,1	2,1	2,1	2,9
10	Rated speed	rpm	2850	2850	2850	2850	2850	2850	2850	2850	2850	2850	2890
		r/s	47	47	47	47	47	47	47	47	47	47	48
11	Product disassembly, recycling or disposal at end of life		Disassembly using standard tools, Disposal and recycling using an appropriate company,										
12	Operating conditions for which the motor is specifically designed												
	I - Altitudes above sea level	m	< 1000(6)										
	II - Ambient air temperature	°C	< 40										
	III - Maximum operating temperature	°C	Please refer to the operating conditions given in this manual or in the specific conditions in the manufacturer selection programs.										
	IV - Potentially explosive atmospheres		Non-ATEX environment										

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

DYNACIAT™ LG/LGN evaporator with variable or fixed speed low pressure hydraulic module and single pump option motors

N°(2)	Description(3)		DYNACIAT™ LG/LGN					
			360	390	450	480	520	600
1	Nominal efficiency at full load and nominal voltage	%	84,20	84,20	84,20	84,20	85,90	85,90
	Nominal efficiency at 75% rated load and nominal voltage	%	84,20	84,20	84,20	84,20	85,90	85,90
	Nominal efficiency at 50% rated load and nominal voltage	%	82,90	82,90	82,90	82,90	84,50	84,50
2	Efficiency level	%	IE3	IE3	IE3	IE3	IE3	IE3
3	Year of manufacture		This information varies depending on the manufacturer and model at the time of incorporation, Please refer to the motor name plates,					
4	Manufacturer's name and trademark, commercial registration number and place of manufacturer							
5	Product's model number							
6	Number of motor poles		2	2	2	2	2	2
7-1	Nominal shaft power output at full load and nominal voltage (400 V)	kW	1,5	1,5	1,5	1,5	2,2	2,2
7-2	Maximum input power (400 V)(4)	kW	1,83	1,83	1,83	1,83	2,56	2,56
8	Rated input frequency	Hz	50	50	50	50	50	50
9-1	Nominal voltage	V	400V 3P	400V 3P	400V 3P	400V 3P	400V 3P	400V 3P
9-2	Maximum current drawn (400 V)(5)	A	3,2	3,2	3,2	3,2	4,5	4,5
10	Rated speed	rpm	2890	2890	2855	2855	2890	2890
		r/s	48,17	48,17	47,58	47,58	48,17	48,17
11	Product disassembly, recycling or disposal at end of life		Disassembly using standard tools, Disposal and recycling using an appropriate company,					
12	Operating conditions for which the motor is specifically designed							
	I - Altitudes above sea level	m	< 1000(6)					
	II - Ambient air temperature	°C	< 40					
	III - Maximum operating temperature	°C	Please refer to the operating conditions given in this manual or in the specific conditions in the manufacturer selection programs.					
	IV - Potentially explosive atmospheres		Non-ATEX environment					

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

DYNACIAT™ LG/LGN condenser with variable or fixed speed low pressure hydraulic module and single pump option motors

No.(2)	Description (3)		DYNACIAT™ LG					
			360	390	450	480	520	600
1	Nominal efficiency at full load and nominal voltage	%	85,90	85,90	85,90	85,90	85,90	85,90
	Nominal efficiency at 75% rated load and nominal voltage	%	85,90	85,90	85,90	85,90	85,90	85,90
	Nominal efficiency at 50% rated load and nominal voltage	%	84,50	84,50	84,50	84,50	84,50	84,50
2	Efficiency level	%	IE3	IE3	IE3	IE3	IE3	IE3
3	Year of manufacture		This information varies depending on the manufacturer and model at the time of incorporation, Please refer to the motor name plates,					
4	Manufacturer's name and trademark, commercial registration number and place of manufacturer							
5	Product's model number							
6	Number of motor poles		2	2	2	2	2	2
7-1	Nominal shaft power output at full load and nominal voltage (400 V)	kW	2,2	2,2	2,2	2,2	2,2	2,2
7-2	Maximum input power (400 V)(4)	kW	2,56	2,56	2,56	2,56	2,56	2,56
8	Rated input frequency	Hz	50	50	50	50	50	50
9-1	Nominal voltage	V	400V 3P	400V 3P	400V 3P	400V 3P	400V 3P	400V 3P
9-2	Maximum current drawn (400 V)(5)	A	4,5	4,5	4,5	4,5	4,5	4,5
10	Rated speed	rpm	2890	2890	2890	2890	2890	2890
		r/s	48,17	48,17	48,17	48,17	48,17	48,17
11	Product disassembly, recycling or disposal at end of life		Disassembly using standard tools, Disposal and recycling using an appropriate company,					
12	Operating conditions for which the motor is specifically designed							
	I - Altitudes above sea level	m	< 1000(6)					
	II - Ambient air temperature	°C	< 40					
	III - Maximum operating temperature	°C	Please refer to the operating conditions given in this manual or in the specific conditions in the manufacturer selection programs.					
	IV - Potentially explosive atmospheres		Non-ATEX environment					

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

DYNACIAT™ LG/LGN evaporator or condenser with variable speed high pressure hydraulic module and single pump option motors

N°(2)	Description(3)		DYNACIAT™ LG/LGN										
			080	090	100	120	130	150	180	200	240	260	300
1	Nominal efficiency at full load and nominal voltage	%	83,4	83,4	83,4	83,4	83,4	83,4	84,8	84,8	84,8	84,8	84,8
	Nominal efficiency at 75% rated load and nominal voltage	%	81,2	81,2	81,2	81,2	81,2	81,2	82,2	82,2	82,2	82,2	82,2
	Nominal efficiency at 50% rated load and nominal voltage	%	78,3	78,3	78,3	78,3	78,3	78,3	79,0	79,0	79,0	79,0	79,0
2	Efficiency level	%	IE3	IE3	IE3	IE3	IE3	IE3	IE3	IE3	IE3	IE3	IE3
3	Year of manufacture		This information varies depending on the manufacturer and model at the time of incorporation, Please refer to the motor name plates,										
4	Manufacturer's name and trademark, commercial registration number and head office of manufacturer												
5	Product's model number												
6	Number of motor poles		2	2	2	2	2	2	2	2	2	2	2
7-1	Nominal shaft power output at full load and nominal voltage (400 V)	kW	1,3	1,3	1,3	1,3	1,3	1,3	1,7	1,7	1,7	1,7	1,7
7-2	Maximum input power (400 V)(4)	kW	1,6	1,6	1,6	1,6	1,6	1,6	2,4	2,4	2,4	2,4	2,4
8	Rated input frequency	Hz	50	50	50	50	50	50	50	50	50	50	50
9-1	Nominal voltage	V	400V 3P	400V 3P	400V 3P	400V 3P	400V 3P	400V 3P	400V 3P	400V 3P	400V 3P	400V 3P	400V 3P
9-2	Maximum current drawn (400 V)(5)	A	2,9	2,9	2,9	2,9	2,9	2,9	4,2	4,2	4,2	4,2	4,2
10	Rated speed	rpm	2890	2890	2890	2890	2890	2890	2870	2870	2870	2870	2870
		r/s	48	48	48	48	48	48	48	48	48	48	48
11	Product disassembly, recycling or disposal at end of life		Disassembly using standard tools, Disposal and recycling using an appropriate company,										
12	Operating conditions for which the motor is specifically designed												
	I - Altitudes above sea level	m	< 1000(6)										
	II - Ambient air temperature	°C	< 40										
	III - Maximum operating temperature	°C	Please refer to the operating conditions given in this manual or in the specific conditions in the manufacturer selection programs.										
	IV - Potentially explosive atmospheres		Non-ATEX environment										

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

DYNACIAT™ LG/LGN evaporator or condenser with variable or fixed speed high pressure hydraulic module and single pump option motors

N°(2)	Description(3)		DYNACIAT™ LG/LGN					
			360	390	450	480	520	600
1	Nominal efficiency at full load and nominal voltage	%	87,10	87,10	87,10	87,10	87,10	87,10
	Nominal efficiency at 75% rated load and nominal voltage	%	84,60	84,60	84,60	84,60	84,60	84,60
	Nominal efficiency at 50% rated load and nominal voltage	%	82,50	82,50	82,50	82,50	82,50	82,50
2	Efficiency level	%	IE3	IE3	IE3	IE3	IE3	IE3
3	Year of manufacture		This information varies depending on the manufacturer and model at the time of incorporation, Please refer to the motor name plates,					
4	Manufacturer's name and trademark, commercial registration number and place of manufacturer							
5	Product's model number							
6	Number of motor poles		2	2	2	2	2	2
7-1	Nominal shaft power output at full load and nominal voltage (400 V)	kW	3	3	3	3	3	3
7-2	Maximum input power (400 V)(4)	kW	3,44	3,44	3,44	3,44	3,44	3,44
8	Rated input frequency	Hz	50	50	50	50	50	50
9-1	Nominal voltage	V	400V 3P	400V 3P	400V 3P	400V 3P	400V 3P	400V 3P
9-2	Maximum current drawn (400 V)(5)	A	6,15	6,15	6,15	6,15	6,15	6,15
10	Rated speed	rpm	2915	2915	2915	2915	2915	2915
		r/s	48,58	48,58	48,58	48,58	48,58	48,58
11	Product disassembly, recycling or disposal at end of life		Disassembly using standard tools, Disposal and recycling using an appropriate company,					
12	Operating conditions for which the motor is specifically designed							
	I - Altitudes above sea level	m	< 1000(6)					
	II - Ambient air temperature	°C	< 40					
	III - Maximum operating temperature	°C	Please refer to the operating conditions given in this manual or in the specific conditions in the manufacturer selection programs.					
	IV - Potentially explosive atmospheres		Non-ATEX environment					

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

DYNACIAT™ LG/LGN evaporator with variable speed double high pressure hydraulic module and single pump option motors

N°(2)	Description(3)		DYNACIAT™ LG/LGN					
			360	390	450	480	520	600
1	Nominal efficiency at full load and nominal voltage	%	87,10	87,10	87,10	87,10	88,10	88,10
	Nominal efficiency at 75% rated load and nominal voltage	%	84,60	84,60	84,60	84,60	87,50	87,50
	Nominal efficiency at 50% rated load and nominal voltage	%	82,50	82,50	82,50	82,50	86,5	86,5
2	Efficiency level	%	IE3	IE3	IE3	IE3	IE3	IE3
3	Year of manufacture		This information varies depending on the manufacturer and model at the time of incorporation. Please refer to the motor name plates.					
4	Manufacturer's name and trademark, commercial registration number and place of manufacturer							
5	Product's model number							
6	Number of motor poles		2	2	2	2	2	2
7-1	Nominal shaft power output at full load and nominal voltage (400 V)	kW	3	3	3	3	4	4
7-2	Maximum input power (400 V)(4)	kW	3,44	3,44	3,44	3,44	4,54	4,54
8	Rated input frequency	Hz	50	50	50	50	50	50
9-1	Nominal voltage	V	400V 3P	400V 3P	400V 3P	400V 3P	400V 3P	400V 3P
9-2	Maximum current drawn (400 V)(5)	A	6,15	6,15	6,15	6,15	7,84	7,84
10	Rated speed	rpm	2915	2915	2915	2915	2930	2930
		r/s	48,58	48,58	48,58	48,58	48,83	48,83
11	Product disassembly, recycling or disposal at end of life		Disassembly using standard tools. Disposal and recycling using an appropriate company.					
12	Operating conditions for which the motor is specifically designed							
	I - Altitudes above sea level	m	< 1000(6)					
	II - Ambient air temperature	°C	< 40					
	III - Maximum operating temperature	°C	Please refer to the operating conditions given in this manual or in the specific conditions in the manufacturer selection programs.					
	IV - Potentially explosive atmospheres		Non-ATEX environment					

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

D YNACIAT LG/LGN condenser with variable speed double high pressure hydraulic module and single pump option motors

No.(2)	Description (3)		DYNACIAT™ LG					
			360	390	450	480	520	600
1	Nominal efficiency at full load and nominal voltage	%	87,10	87,10	87,10	88,10	88,10	88,10
	Nominal efficiency at 75% rated load and nominal voltage	%	84,60	84,60	84,60	87,50	87,50	87,50
	Nominal efficiency at 50% rated load and nominal voltage	%	82,50	82,50	82,50	86,50	86,5	86,5
2	Efficiency level	%	IE3	IE3	IE3	IE3	IE3	IE3
3	Year of manufacture		This information varies depending on the manufacturer and model at the time of incorporation. Please refer to the motor name plates.					
4	Manufacturer's name and trademark, commercial registration number and place of manufacturer							
5	Product's model number							
6	Number of motor poles		2	2	2	2	2	2
7-1	Nominal shaft power output at full load and nominal voltage (400 V)	kW	3	3	3	4	4	4
7-2	Maximum input power (400 V)(4)	kW	3,44	3,44	3,44	4,54	4,54	4,54
8	Rated input frequency	Hz	50	50	50	50	50	50
9-1	Nominal voltage	V	400V 3P	400V 3P	400V 3P	400V 3P	400V 3P	400V 3P
9-2	Maximum current drawn (400 V)(5)	A	6,15	6,15	6,15	7,84	7,84	7,84
10	Rated speed	rpm	2915	2915	2915	2930	2930	2930
		r/s	48,58	48,58	48,58	48,83	48,83	48,83
11	Product disassembly, recycling or disposal at end of life		Disassembly using standard tools. Disposal and recycling using an appropriate company.					
12	Operating conditions for which the motor is specifically designed							
	I - Altitudes above sea level	m	< 1000(6)					
	II - Ambient air temperature	°C	< 40					
	III - Maximum operating temperature	°C	Please refer to the operating conditions given in this manual or in the specific conditions in the manufacturer selection programs.					
	IV - Potentially explosive atmospheres		Non-ATEX environment					

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

4.5 - Compressor usage and electrical data table

LG						
Compressor	I Nom	I Max (Un)	I Max (Un - 10%)	LRA(1)	LRA(2)	Cos Phi Max
WSH090	10,5	15,6	17,3	98	53,9	0,85
WSH105	13,2	18,7	20,8	142	78,1	0,85
WSH120	13,8	19,8	22	142	78,1	0,85
WSH140	15,6	23,2	25,8	147	80,9	0,87
WSH161	16,2	25,4	28,2	158	86,9	0,85
WSH184	20,2	29	32,2	197	108,4	0,85

LGN						
Compressor	I Nom	I Max (Un)	I Max (Un - 10%)	LRA(1)	LRA(2)	Cos Phi Max
WSH090	11,4	15,6	17,3	98	53,9	0,85
WSH105	13,8	18,7	20,8	142	78,1	0,85
WSH120	14,7	19,8	22	142	78,1	0,85
WSH140	16,5	23,2	25,8	147	80,9	0,87
WSH161	18,1	25,4	28,2	158	86,9	0,85
WSH184	21,2	29	32,2	197	108,4	0,85

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

4 - PHYSICAL AND ELECTRICAL DATA

Compressor	Circuit	LG / LGN										
		080	090	100	120	130	150	180	200	240	260	300
WSH90	A	1	-	-	-	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-	-	-	-	-
WSH105	A	-	1	-	-	-	-	2	-	-	-	-
	B	-	-	-	-	-	-	-	-	-	-	-
WSH120	A	-	-	1	-	-	-	-	2	-	-	-
	B	-	-	-	-	-	-	-	-	-	-	-
WSH140	A	-	-	-	1	-	-	-	-	2	-	-
	B	-	-	-	-	-	-	-	-	-	-	-
WSH161	A	-	-	-	-	1	-	-	-	-	2	-
	B	-	-	-	-	-	-	-	-	-	-	-
WSH184	A	-	-	-	-	-	1	-	-	-	-	2
	B	-	-	-	-	-	-	-	-	-	-	-

Compressor	Circuit	LG / LGN					
		360	390	450	480	520	600
WSH90	A	-	-	-	-	-	-
	B	-	-	-	-	-	-
WSH105	A	-	-	-	-	-	-
	B	-	-	-	-	-	-
WSH120	A	-	-	-	-	-	-
	B	-	-	-	-	-	-
WSH140	A	3	-	-	2	-	-
	B	-	-	-	2	-	-
WSH161	A	-	3	-	-	2	-
	B	-	-	-	-	2	-
WSH184	A	-	-	3	-	-	2
	B	-	-	-	-	-	2

Electrical data notes and operating conditions:

- Units have a single power connection point, located immediately upstream of the main disconnect switch.
- The control box includes the following standard features:
  - A main disconnect switch,
  - the start-up and motor protection devices for each compressor and the pumps,
  - the control devices
- Field connections:
  All connections to the system and the electrical installations must be in full accordance with all applicable local codes.
- Units are designed and built to ensure conformance with these codes. The recommendations of European standard EN 60204-1 (machine safety - electrical machine components - part 1: general regulations - corresponds to IEC 60204-1) are specifically taken into account, when designing the electrical unit equipment.

Notes:

- Generally the recommendations of IEC 60364 are accepted as compliance with the requirements of the installation directives. Conformance with EN 60204-1 is the best means of ensuring compliance with the Machines Directive § 1.5.1.
- Annex B of EN 60204-1 describes the electrical characteristics used for the operation of the machines.

1. The operating conditions for the units are specified below:

Environment(1) - Environment as classified in EN 60721 (equivalent to CEI60721):
- Indoor installation,
- ambient temperature range: +5°C for the temperature minimum to +40°C, class 4K4H,
- humidity range (non-condensing)(1):
- 50% relative humidity at 40°C
- 90% relative humidity at 20°C
- altitude: ≤ 2000 m (see note for table 4.5 in the IOM)
- indoor installation(1)
- presence of water: class AD2 (possibility of water droplets)
- presence of hard solids, class 4S2 (no significant dust present)
- presence of corrosive and polluting substances, class 4C2 (negligible)
- vibration and shock, class AG2, AH2
- competence of personnel, class BA4(1) (trained personnel - IEC 60364)

2. Power supply frequency variation: ± 2 Hz.
3. The neutral (N) conductor must not be connected directly to the unit (if necessary use a transformer).
4. Over-current protection of the power supply conductors is not provided with the unit.
5. The factory-fitted disconnect switch(es)/circuit breaker(s) is (are) of a type suitable for power interruption in accordance with EN 60947.
6. The units are designed for simplified connection on TN(s) networks (IEC 60364). For IT networks provide a local earth and consult competent local organisations to complete the electrical installation. Units delivered with speed drive (option 116J and 270J) are not compatible with IT network.
7. Derived currents: If protection by monitoring of derived currents is necessary to ensure the safety of the installation, the control of the cut-out value must take the presence of leak currents into consideration that result from the use of frequency converters in the unit. A value of at least 150 mA is recommended to control differential protection devices.

NOTE:

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

(1) The protection level of the control boxes required to conform to this class is IPX1B (according to reference document IEC 60529). All units fulfil this protection condition.
Units equipped with front casing panel meet class IP23. If the casing panel has been removed, access to energised components is protected to level IPXXB.

5.1 - Operating limits

LG standard operating limits

LG		Minimum	Maximum
Water type heat exchanger			
Evaporator			
Water inlet temperature (at start-up)	°C	7,5(1)	27
Water outlet temperature (in operation)	°C	5(2)	20
Inlet/outlet temperature difference	K	2,5	7
Condenser			
Water inlet temperature (at start-up)	°C	15(3)	55(4)
Water outlet temperature (in operation)	°C	20	60
Inlet/outlet temperature difference	K	2,5	18

(1) For a water inlet temperature at start-up of less than 7.5°C, contact the manufacturer
(2) Use of antifreeze is obligatory if the water outlet temperature is below 5°C. Please refer to low temperature brine solution option for evaporator leaving water low-temperature applications (< 5°C).
(3) For applications with a condenser entering temperature below 15°C the use of a 3-way valve is recommended. This 3-way valve can be controlled by the 0-10 V analogue output of the Connect'Touch control.
(4) For a water flow rate that corresponds to a maximum water-side temperature difference of 5 K.

LG unit operating limits + drycooler

LG + drycooler		Minimum	Maximum
Water type heat exchanger			
Evaporator			
Water inlet temperature (at start-up)	°C	7,5(1)	27
Water outlet temperature (in operation)	°C	5(2)	20
Inlet/outlet temperature difference	K	2,5	7
Condenser without hydraulic module			
Air inlet temperature (at start-up) + during operation	°C	10-15(3)	40-45(4)
Condenser with option HP cond. variable-speed single-pump			
Air inlet temperature (at start-up) + during operation	°C	-10(5)	40-45(4)

(1) For a water inlet temperature at start-up of less than 7.5°C, contact the manufacturer.
(2) Use of antifreeze is obligatory if the water outlet temperature is below 5°C. Please refer to low temperature brine solution option for evaporator leaving water low-temperature applications (< 5°C).
(3) The minimum air inlet temperature is based on the drycooler selection.
(4) The maximum air inlet temperature is based on the drycooler selection.
(5) For applications with a low condenser entering air temperature the use of a 3-way valve is recommended. This 3-way valve can be controlled by the 0-10 V analogue output of the Connect'Touch control.

LG unit operating limits + Low temperature brine solution option

LG + Low temperature brine solution option		Minimum	Maximum
Water type heat exchanger			
Evaporator			
Water inlet temperature (at start-up)	°C	-9,5(1)	27
Water outlet temperature (in operation)	°C	-12(1)	20
Inlet/outlet temperature difference	K	2,5	3(4)
Condenser			
Water inlet temperature (at start-up)	°C	15(2)	55(3)
Water outlet temperature (in operation)	°C	20	60
Inlet/outlet temperature difference	K	2,5	18

(1) A frost protection solution must be used.
(2) For applications with a condenser inlet temperature below 15°C the use of a 3-way valve is recommended. This 3-way valve can be controlled by the 0-10 V analogue output of the Connect'Touch control.
(3) For a water flow rate that corresponds to a maximum water-side temperature difference of 5 K.
(4) For LG360-600, the maximum temperature is 5°C.

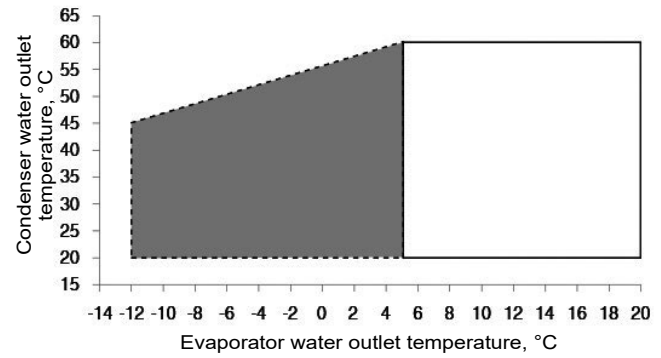
LGN unit operating limits

DYANACIAT LGN		Minimum	Maximum
Evaporator			
Water inlet temperature (at start-up)	°C	7,5(1)	27
Water outlet temperature (during operation)	°C	5(2)	20
Inlet/outlet temperature difference	K	2,5	7
Air inlet temperature (at start-up and during operation)(3)			
Air inlet temperature (fixed-speed fan)	°C	0(3)	35 to 48**
Air inlet temperature (variable-speed fan)	°C	-10 to -20*	35 to 48**

(1) For a water inlet temperature at start-up of less than 7.5°C, contact the manufacturer.
(2) LGN units can function up to 0°C if the type of fluid used is modified. If the water outlet temperature is below 5°C, an antifreeze protection must be used.
(3) The minimum operating temperature depends on the condenser selected. If the condenser has few ventilation stages, the use of variable-speed fans is recommended
* The minimum operating temperature depends on the condenser selected
** The maximum operating temperature depends on the condenser selected

5.2 - Operating range

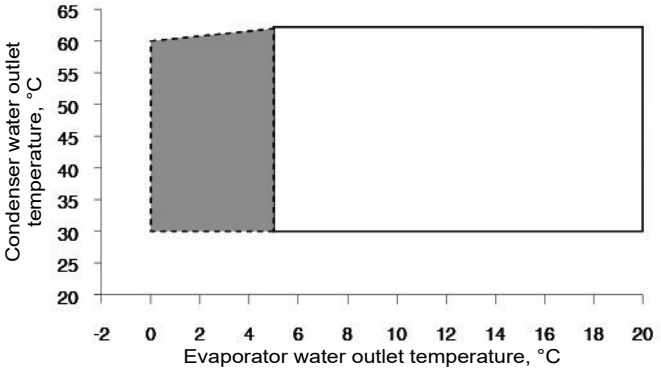
LG unit operating range



Standard unit

Low-temperature brine solution option (Not available on LG 360-450 models)

LGN unit operating range



Standard unit

Medium temperature brine option (% glycol < 25%)

5.3 - Minimum chilled water flow

If the system water flow rate is lower than the minimum water flow rate, recirculation of the evaporator flow may occur. The temperature of the mixture leaving the evaporator must never be less than 2.5 K lower than the chilled water entering temperature.

5.4 - Maximum chilled water flow

The maximum chilled water flow is limited by the maximum permitted pressure drop in the evaporator. It is provided in the tables in chapter 5.7. If the flow exceeds the maximum value, two solutions are possible:

- Modify the flow rate with a control valve.
- Bypass the evaporator to obtain a higher temperature difference with a lower evaporator flow rate.

5.5 - Variable flow

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

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

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

Water type heat exchanger min. water volume and flow rate LG/LGN 080 - 300

DYNACIAT™ LG/LGN		080	090	100	120	130	150	180	200	240	260	300
Evaporator												
Minimum system water volume, air conditioning application (litres)		61,5	71,7	78,8	91,8	104,6	116,6	145,3	158,5	184,4	209,8	236,4
Min/max water type heat exchanger flow rate without hydraulic module (l/s)		0,5/3,8	0,5/4,1	0,5/4,1	0,6/4,7	0,6/5	0,8/5,4	0,8/9,2	1,0/9,9	1,1/10,3	1,3/10,9	1,5/12,5
Maximum water type heat exchanger flow rate with low pressure hydraulic module (l/s)	Low pressure	3,5	3,8	3,8	4,1	4,3	4,5	6,1	6,2	6,3	6,4	8,1
	High pressure	3,7	3,9	3,9	4,3	4,5	4,8	7,9	8,1	8,3	8,4	8,8
DYNACIAT™ LG		**080**	**090**	**100**	**120**	**130**	**150**	**180**	**200**	**240**	**260**	**300**
Condenser												
Minimum system water volume, air conditioning application (litres)		75,0	87,5	95,0	110,0	125,0	140,0	175,0	192,5	222,5	252,5	285,0
Min/max water type heat exchanger flow rate without hydraulic module (l/s)		0,3/3,8	0,3/4,1	0,3/4,1	0,4/4,7	0,4/5,0	0,4/5,4	0,4/7,0	0,5/7,5	0,5/7,8	0,6/8,2	0,6/9,3
Maximum water type heat exchanger flow rate with low pressure hydraulic module (l/s)	Low pressure	3,5	3,7	3,7	4	4,2	4,4	5,4	5,6	5,7	5,8	7,4
	High pressure	3,6	3,9	3,9	4,2	4,4	4,6	6,9	7,1	7,3	7,5	8

(1) Maximum flow rate for a pressure drop of 100 kPa in the water exchanger
(2) Maximum flow rate for an available pressure of 20 kPa (unit with low-pressure pumps) or 50 kPa (high pressure).

Water type heat exchanger min. water volume and flow rate LG/LGN 360 - 600

DYNACIAT™ LG/LGN		360	390	450	480	520	600
Evaporator							
Minimum system water volume, air conditioning application (litres)		287,5	325	360	382,5	430	480
Min/max water type heat exchanger flow rate without hydraulic module (l/s)		0,8/14,4	0,9/16,6	1/18,3	0,8/16,1	0,9/18,3	1/20,2
Maximum water type heat exchanger flow rate with low pressure hydraulic module (l/s)	Low pressure	7,5	7,6	8,6	8,6	13,6	14
	High pressure	11,8	12,5	12,8	12,5	13,05	13,3
DYNACIAT™ LG		**360**	**390**	**450**	**480**	**520**	**600**
Condenser							
Minimum system water volume, air conditioning application (litres)		342,5	390	430	457,5	515	575
Min/max water type heat exchanger flow rate without hydraulic module (l/s)		0,5/13,05	0,5/15	0,6/16,66	0,5/16,38	0,5/18,8	0,6/20,5
Maximum water type heat exchanger flow rate with low pressure hydraulic module (l/s)	Low pressure	11,4	12,5	13,2	12,6	13,6	14,0
	High pressure	11,7	12,4	12,9	13,8	14,4	14,7

(1) Maximum flow rate for a pressure drop of 100 kPa in the water exchanger
(2) Maximum flow rate for an available pressure of 20 kPa (unit with low-pressure pumps) or 50 kPa (high pressure).

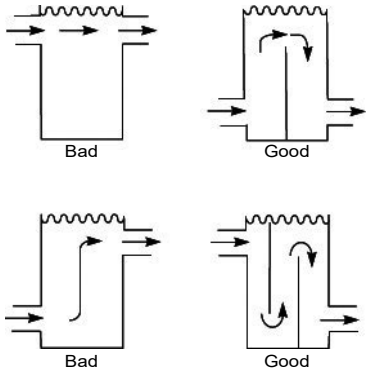
Minimum water volume required between the unit and possible customer-supplied valves to the outside of the unit.

Industrial process applications

Certain industrial processes may require high leaving water stability. In these cases the values above must be increased.

It may be necessary to add a buffer water tank to the circuit in order to achieve the required volume. The tank itself must be equipped with an internal baffle

in order to ensure proper mixing of the liquid (water or brine). See the following examples of an internal baffle to ensure proper mixing of the liquid (water or brine). Refer to the examples below.



5.7 - Maximum water loop volume (evaporator and condenser side)

Units with hydraulic module incorporate an expansion tank sized for the maximum water loop volume. The table below gives the maximum water loop volume (in litres) for pure water or ethylene glycol with various concentrations.

DYNACIAT™ LG/LGN		080-130			150-300			360-450			480-600		
Static pressure	bar	1	2	3	1	2	3	1	2	3	1	2	3
Pure water	l	220	150	75	340	225	115	1180	655	281	1376	918	393
10% EG	l	165	110	53	255	170	85	896	498	213	1045	697	299
20% EG	l	100	70	35	150	100	50	741	412	176	864	576	247
35% EG	l	85	55	30	130	85	45	638	354	152	744	496	213

EG : Ethylene glycol

5.8 - Expansion tank

The expansion tank is supplied with a pressure of 1 bar relative (±20%). The maximum operating pressure for the tank is 3 bar for range LG/LGN 080-300 and 4 bar for range LG 360-600.

5.9 - Protection against cavitation Evaporator pumps option

To ensure the durability of the pumps in the integrated hydraulic modules, the control algorithm of the units incorporates anti-cavitation protection.

It is therefore necessary to ensure a minimum pump entering pressure of 60 kPa (0.6 bar) during operation and at shut-down. A pressure below 60 kPa will prohibit unit start-up or cause an alarm with the unit shutting down.

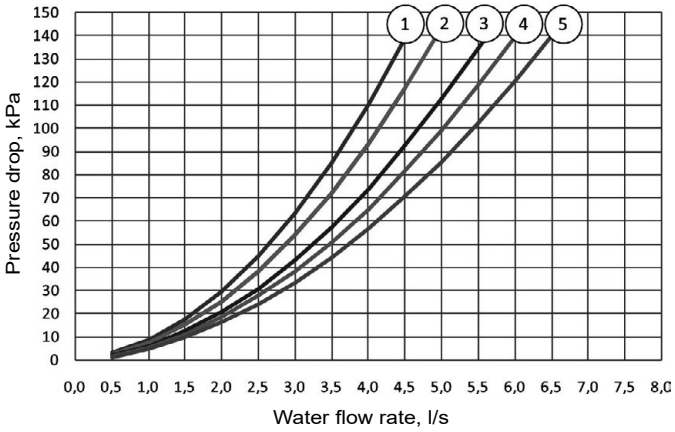
In order to obtain sufficient pressure, it is recommended:

- to pressurise the hydraulic circuit between 100 kPa (1 bar) and 300 kPa (3 bar) maximum on the suction side of the pump,
- to clean the hydraulic circuit before filling with water,
- to regularly clean the screen filter.

5.10 - Plate heat exchanger pressure drop (includes internal piping)

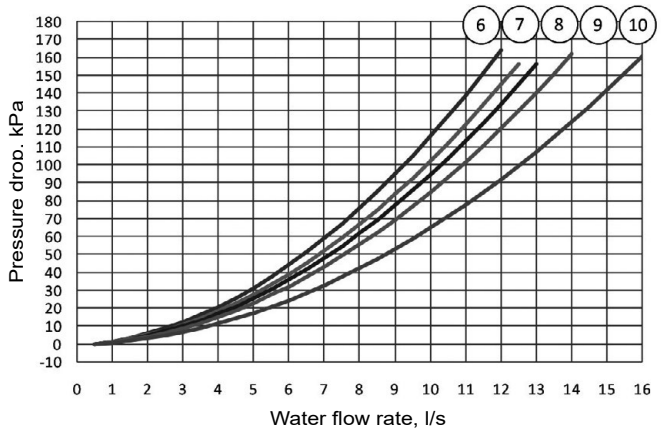
DYNACIAT™ LG/LGN evaporator

Sizes 080-150



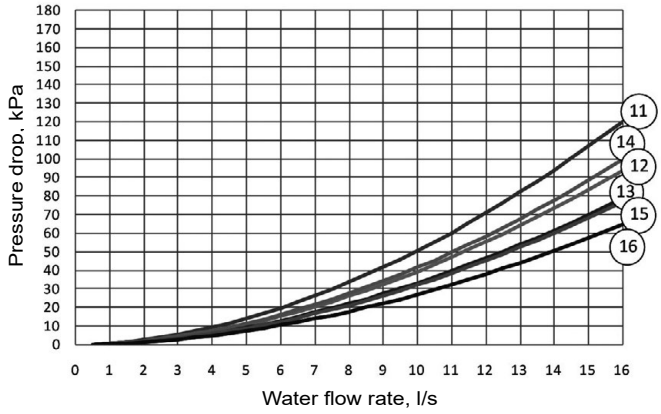
① 080
② 090/100
③ 120
④ 130
⑤ 150

Sizes 180-300



⑥ 180
⑦ 200
⑧ 240
⑨ 260
⑩ 300

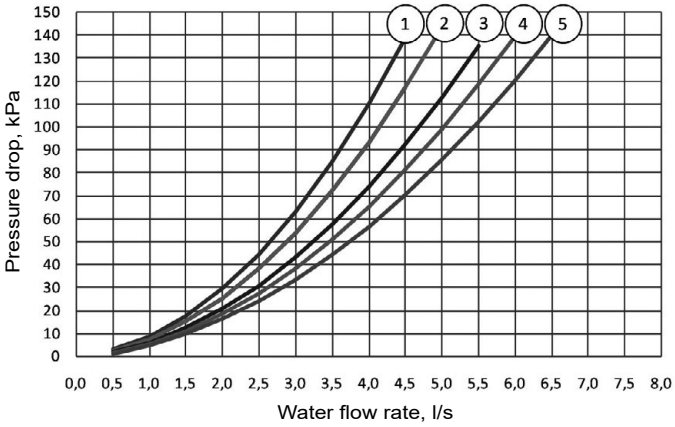
Sizes 360-600



⑪ 360
⑫ 390
⑬ 450
⑭ 480
⑮ 520
⑯ 600

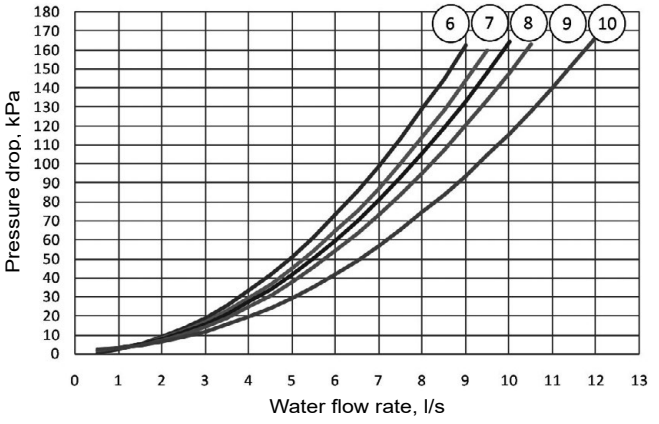
DYNACIAT™ LG condenser

Sizes 080-150



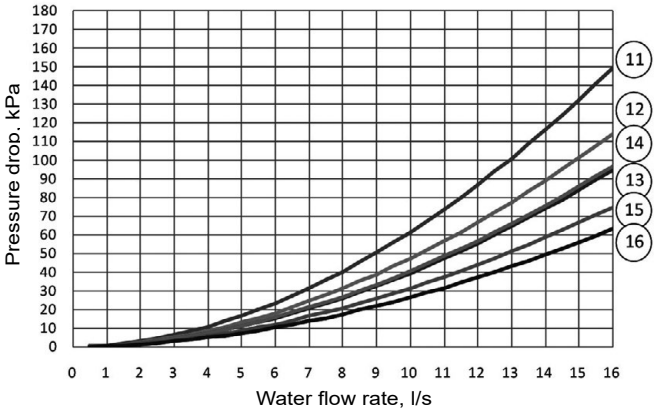
① 080
② 090/100
③ 120
④ 130
⑤ 150

Sizes 180-300



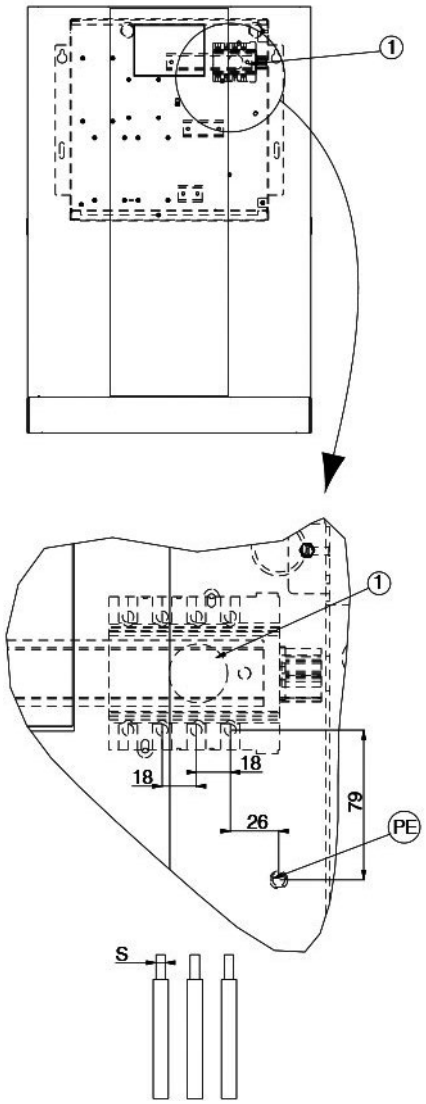
⑥ 180
⑦ 200
⑧ 240
⑨ 260
⑩ 300

Sizes 360-600



⑪ 360
⑫ 390
⑬ 450
⑭ 480
⑮ 520
⑯ 600

6.1 - Electrical connections, control box



Legend
1 Main disconnect switch
PE Earth connection
S Power supply cable section (see table “Recommended wire sections”).

NOTES:

The units have only one power connection point located at the main disconnect switch.

Before connecting electric power cables, it is imperative to check the correct order of the 3 phases (L1 - L2 - L3).

Non-certified drawings.

Refer to the certified dimensional drawings.

Before connecting the unit check that the phase order in the customer control box is the same as shown in the customer wiring diagrams.

6.2 - 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 connections refer to the wiring diagrams.

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

6.3 - Voltage phase imbalance (%)

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

Example:

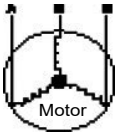
On a 400 V - 3 ph - 50 Hz supply, the individual phase voltages were measured to be:

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

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

Calculate the maximum deviation from the 400 V average:

(AB) = 406 - 400 = 6
(BC) = 400 - 399 = 1
(CA) = 400 - 394 = 6



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

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

6.4 - 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 the manufacturer 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 table on the next page.

The calculations are based on the maximum machine current (see electrical data tables). For the design the following standardised installation methods are used, in accordance with IEC 60364, table 52C:

- For units installed inside the building:

  No.13: perforated horizontal cable conduit, and No. 41: closed conduit.

The calculation is based on PVC or XLPE insulated cables with copper or aluminium core. A maximum ambient temperature of 40°C has been taken into account. The given wire length limits the voltage drop to < 5%.

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

6.4.1 - Field control wiring

Customer connection of interface circuits may lead to safety risks: Any modification to the electrics box must ensure the equipment remains compliant 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 DYNACIAT™ LG/LGN Connect'Touch control manual and the certified wiring diagram provided with the unit for the field control wiring of the following features:**
- **Remote on/off switch**
- **Remote heat/cool switch**
- **Demand limit external switch 1**
- **Remote dual set point**
- **Alarm report**
- **Pump control - unit without hydraulic module**
- **Relief boiler or electric heater**
- **Valve control - see description of specific dry cooler control option in the DYNACIAT™ LG/LGN Connect'Touch control manual**

6.4.2 - On-site control wiring

Selection of minimum and maximum wire sections for connection to DYNACIAT™ LG/LGN units

DYNACIAT™ LG / LGN	Max. connectable section(1)	Calculation of favourable case: - Suspended overhead line (standardised routing no. 17) - PVC and XLPE insulated cable			Calculation of unfavourable case: - Conductors on conduits or multi-conductor cables in closed conduit (standardised routing No. 41) PVC and XLPE insulated cable, if possible		
	Connection cage	Section(2)	Max. length for a voltage drop <5%	Cable type	Section(2)	Max. length for a voltage drop <5%	Cable type
	mm² (per phase)	mm² (per phase)	m	-	mm² (per phase)	m	-
080	1 x 35	1 x 2,5	60	PVC Cu	1 x 4	100	PVC Cu
090	1 x 35	1 x 2,5	60	PVC Cu	1 x 4	100	PVC Cu
100	1 x 35	1 x 4	80	PVC Cu	1 x 6	120	PVC Cu
120	1 x 35	1 x 4	80	PVC Cu	1 x 6	120	PVC Cu
130	1 x 35	1 x 4	80	PVC Cu	1 x 6	120	PVC Cu
150	1 x 35	1 x 6	100	PVC Cu	1 x 10	150	PVC Cu
180	1 x 35	1 x 10	120	PVC Cu	1 x 16	180	PVC Cu
200	1 x 35	1 x 10	120	PVC Cu	1 x 16	180	PVC Cu
240	1 x 35	1 x 16	140	PVC Cu	1 x 16	180	PVC Cu
260	1 x 35	1 x 16	140	PVC Cu	1 x 25	205	PVC Cu
300	1 x 35	1 x 16	140	PVC Cu	1 x 25	225	PVC Cu
360	1 x 95	1 x 25	163	XLPE Cu	1 x 50	317	XLPE Cu
390	1 x 95	1 x 25	149	XLPE Cu	1 x 50	291	XLPE Cu
450	1 x 95	1 x 25	134	XLPE Cu	1 x 70	360	XLPE Cu
480	1 x 95	1 x 35	175	XLPE Cu	1 x 70	338	XLPE Cu
520	1 x 95	1 x 35	157	XLPE Cu	1 x 95	403	XLPE Cu
600	1 x 95	1 x 50	197	XLPE Cu	1 x 95	358	XLPE Cu

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

6.5 - 24 V user power reserve

After all possible options have been connected, the transformer ensures the availability of a usable 24 VA or 1 A power reserve for the control circuit on site.

7.1 - Recommendations for the installation of liquid chillers with remote condenser.

LGN units (split units to connect to air-cooled condensers) have been specially designed to optimise the operation of split installations using air-cooled condensers as a cooler heat rejection system.

The cooling installation of an operational system is therefore limited to connect the LGN unit air-cooled condenser inlet and outlet.

Components such as the check valve (on the discharge line), liquid sight glass, solenoid valves are fitted and factory wired.

The drier is provided with the unit and must be installed upstream of the solenoid valve on the liquid line

The Pro-Dialog + LGN control integrates logics allowing the different fixed and variable speed fan variants to be controlled.

To ensure optimum and reliable performance of the units, it is necessary to respect several regulations mentioned below when these machines are connected to remote condensers:

- Size the discharge and liquid line pipes according to the recommendations in the following paragraphs (if required, install a double riser column to ensure correct oil circulation in the refrigerant circuit).
- Select a condenser with an integrated subcooler to obtain a minimum of 3 K subcooling at the expansion valve inlet.
- Install the drier provided with the unit as close as possible to the liquid line drier
- Install the outside air temperature sensor provided near the air-cooled condenser. For units with remote condenser control (option 154), the sensor is provided. The outside air temperature is vital in order for the entire system to run smoothly.

For remote air-cooled condenser control (option 154):

- Connect the fan stages electrically on the control panel using the auxiliary electronic board "AUX 1". Refer to chapters 14 and 15 for the description of the analogue and discrete inputs and outputs for assigning fan stages.
- Make the communication BUS (twisted and shielded BUS type communication cable RS485) between the specific electronic AUX 1 board, that must be integrated in the condenser control box, and the NRCP master board of the DYNACIAT™ LG unit.
- Configuration in Pro-Dialog + the number of fan stages and fan type based on the air-cooled condenser used in the installation. Use of a variable speed drive on the first fan stage is recommended for low ambient temperatures at partial load and for condensers with few fans.

It is essential to select an air-cooled condenser with a subcooler. Generally, 8°C of subcooling is recommended at the condenser outlet.

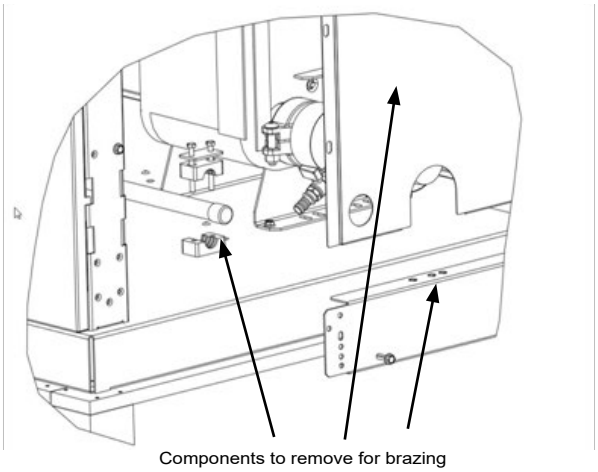
7.2 - Pipe routing and connection

On all units release the holding charge pressure before opening the circuit.

Use different valves and/or remove the safety cap provided from the conical Schraeder connections, press on the valve tip to release all the standby charge in the system (nitrogen).

Preparation before debrazing the liquid and discharge plugs:

- Remove all components that may be damaged during debrazing procedures
- Braze the pipes: Remove the conical Schrader connections near the area, remove the pipe collars, remove the casing panels and the metal crossbars.
- These components must be replaced before start-up of the system.



Components to remove for brazing

Unweld the caps and prepare the tubes for connection.

Connect the liquid line to the system, fit the drier upstream of the unit

Make the high-pressure connections (discharge line) between the unit and the condenser.

During these operations, allow an inert gas such as nitrogen to circulate in the ducts to prevent the formation of copper oxide.

The condenser circuit routing must primarily respect industry practices concerning the static support and the thermal expansion of copper pipes.

To control vibration in the system, the collar positions on the machine pipes must not be changed. Clamps for securing the pipes are provided at the refrigeration unit outlet. It is essential that these clamps are tightened to prevent vibrations and potential ruptures.

The pipes between the unit and the condenser must be correctly supported, according to their size and their operating weight. The pipes must be supported in order to ensure that the vibration levels on the pipes is lower than the existing values on the compressor. If resonance occurs, reduce the range between the collar until the vibration levels are acceptable.

8.1 - General information and sizing limits for the pipe system

Pipe sizing limits	
LGN	**Maximum**
Linear length (discharge - liquid line), m	30
Height difference, m	12

The pipes must be as short as possible and have as few as features, such as elbows, as possible to minimise the pressure drops. For pipes which are at risk of being incorrectly used, suitable measures (design, positioning, protection) must be taken to prevent incorrect use.

The refrigerant pipes must be sized taking the following into consideration.

Oil return is ensured by the drive principle. A minimum refrigerant speed is required to ensure this drive. This speed depends on the pipe diameter, the refrigerant and oil temperature (which, in most cases, are treated as being the same).

Reducing the diameter of the pipes enables the refrigerant speed to be increased. The minimum drive speed is not an issue for pipes inside which refrigerant is in the liquid phase as the oil is fully miscible.

Pressure drops at the compressor discharge (pipe joining the evaporator outlet to the compressor intake) must be limited to avoid reducing the performance of the system (increase in absorbed power and decrease in cooling capacity).

Increasing the diameter of pipes limits pressure drops.

Pressure drops in the liquid pipe (joining the condenser outlet to the expansion component) must not produce any phase changes.

The estimation of these pressure drops must include those created by any accessories, such as solenoid valves, filter dryers, etc.

When used in low outdoor temperatures and long pipes, in order to avoid poor supply to the system during the start-up phase, the use of a check valve on the condenser outlet is recommended. Select a non-sealed element in order to avoid the risk of an excessively high pressure increase of the liquid refrigerant which will be trapped between the solenoid valve (sealed) and this valve.

8.2 - Sizing the pipes

The following procedure may be used to size the pipes:

- Measure the length (in metres) of the pipe in question.
- Add 50% to take the pipe's features into account.
- Read the pipe size from tables 1 and 2 below.
- Calculate the equivalent lengths of the components fitted onto the pipe in question (such as valves, filter, connections, etc.). These equivalent lengths are generally available from the supplier of the components in question. Add these lengths to previously calculated length.
- Repeat steps 3 and 4 if necessary.
- See the table below:
- Discharge pipe(1) and liquid pipe(1)

Table 1 - Discharge pipe(1)

LGN		080	090	100	120	130	150	180	200	240
Equivalent length										
0-10 m	inch	3/4	3/4	7/8	7/8	7/8	7/8	1-1/8	1-1/8	1-1/8
10-20 m	inch	7/8	7/8	7/8	1-1/8	1-1/8	1-1/8	1-1/8	1-1/8	1-3/8
20-30 m	inch	7/8	1-1/8	1-1/8	1-1/8	1-1/8	1-1/8	1-3/8	1-3/8	1-3/8
30-40 m	inch	1-1/8	1-1/8	1-1/8	1-1/8	1-1/8	1-1/8	1-3/8	1-3/8	1-3/8
40- 50 m	inch	1-1/8	1-1/8	1-1/8	1-1/8	1-3/8	1-3/8	1-3/8	1-3/8	1-3/8
50-60 m	inch	1-1/8	1-1/8	1-1/8	1-1/8	1-3/8	1-3/8	1-3/8	1-3/8	1-3/8
60-70 m	inch	1-1/8	1-1/8	1-1/8	1-3/8	1-3/8	1-3/8	1-3/8	1-3/8	1-3/8
70 m or more	inch	1-1/8	1-1/8	1-1/8	1-3/8	1-3/8	1-3/8	1-3/8	1-3/8	1-3/8

LGN		260	300	360	390	450	480	520	600
Equivalent length									
0-10 m	inch	1-1/8	1-1/8	1-3/8	1-3/8	1-3/8	1-1/8	1-1/8	1-1/8
10-20 m	inch	1-3/8	1-3/8	1-3/8	1-3/8	1-3/8	1-1/8	1-1/8	1-1/8
20-30 m	inch	1-3/8	1-3/8	1-3/8	1-3/8	1-3/8	1-3/8	1-3/8	1-3/8
30-40 m	inch	1-3/8	1-5/8	1-5/8	1-5/8	1-5/8	1-3/8	1-3/8	1-3/8
40- 50 m	inch	1-3/8	1-5/8	1-5/8	1-5/8	1-5/8	1-3/8	1-3/8	1-3/8
50-60 m	inch	1-3/8	1-5/8	1-5/8	1-5/8	1-5/8	1-3/8	1-3/8	1-3/8
60-70 m	inch	1-3/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8
70 m or more	inch	1-3/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8

(1) Recommended diameters to ensure oil return within the application range.

Table 2 - Liquid pipe(1)

LGN		080	090	100	120	130	150	180	200	240
Equivalent length										
0-10 m	inch	1/2	1/2	1/2	1/2	1/2	1/2	1/2	5/8	5/8
10-20 m	inch	1/2	1/2	1/2	1/2	5/8	5/8	5/8	5/8	5/8
20-30 m	inch	1/2	1/2	1/2	5/8	5/8	5/8	5/8	5/8	3/4
30-40 m	inch	1/2	5/8	5/8	5/8	5/8	5/8	3/4	3/4	3/4
40- 50 m	inch	5/8	5/8	5/8	5/8	5/8	5/8	3/4	3/4	3/4
50-60 m	inch	5/8	5/8	5/8	5/8	5/8	3/4	3/4	3/4	3/4
60 m or more	inch	5/8	5/8	5/8	5/8	3/4	3/4	3/4	3/4	7/8

LGN		260	300	360	390	450	480	520	600
Equivalent length									
0-10 m	inch	5/8	5/8	7/8	7/8	7/8	7/8	7/8	7/8
10-20 m	inch	3/4	3/4	7/8	7/8	7/8	7/8	7/8	7/8
20-30 m	inch	3/4	3/4	1-1/8	1-1/8	1-1/8	7/8	7/8	7/8
30-40 m	inch	3/4	3/4	1-1/8	1-1/8	1-1/8	7/8	7/8	7/8
40- 50 m	inch	3/4	7/8	1-1/8	1-1/8	1-1/8	7/8	7/8	7/8
50-60 m	inch	7/8	7/8	1-1/8	1-1/8	1-1/8	1-1/8	1-1/8	1-1/8
60 m or more	inch	7/8	7/8	1-1/8	1-1/8	1-1/8	1-1/8	1-1/8	1-1/8

(1) Recommended diameters to limit pressure drops to 1.5K.

8.3 - Sizing the discharge pipe

The discharge pipe must be sized to achieve reasonable pressure drops: A variation of 1.5 K of the saturated temperature is normally accepted (approx. 90 kPa variation for a condensing temperature of 45°C).

For most applications, the refrigerant gas speeds are sufficient to drive the liquid refrigerant/oil mixture. Nevertheless, table 3 shows the minimum required cooling capacities for different pipe diameters and different saturated discharge temperatures.

Table 3 - Minimum power (kW) to ensure oil return based on pipe diameter

LGN	Exterior pipe diameter (inch)						
Saturated condensing temperature (°C)	**3/4**	**7/8**	**1-1/8**	**1-3/8**	**1-5/8**	**2-1/8**	**2-5/8**
080	3,8	5,6	11,5	19,7	31,0	48,9	86,5
090	3,8	5,7	11,7	19,9	31,5	49,5	87,7
100	3,9	5,8	11,8	20,2	31,9	50,2	88,9
120	3,9	5,9	12,0	20,5	32,3	50,9	90,1
130	4,0	5,9	12,1	20,8	32,7	51,5	91,2
150	4,0	6,0	12,3	21,0	33,1	52,2	92,4
180	4,1	6,1	12,4	21,3	33,5	52,8	93,6

Correction factor, oil drive in the discharge lines						
Saturated evaporation temperature, °C	-7	-1	4	10	16
Correction factor	0,94	0,97	1	1,03	1,06

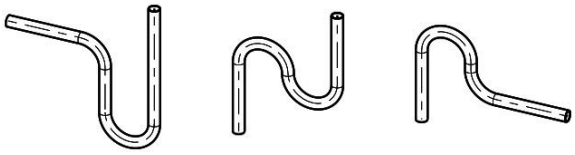
Table 1 "return pipe" shows the different pipe diameters based on the unit sizes and the equivalent circuit length.

These recommended diameters enable the return of oil in the application range.

Siphons must be fitted in the vertical riser pipe:

- **at the base of the pipe,**
- **every 3 m along the vertical length,**
- **at the top of the pipe (counter-siphon).**

Examples:



Base of the pipe | counter siphon | riser column

The trap must be sized correctly to ensure it does not trap too much of the oil/refrigerant liquid mix.

It is advisable to make a slight slope (10 to 20 mm/m) in the refrigerant circulation direction on the horizontal pipes between the LGN unit and the condenser unit.

8.4 - Sizing the liquid pipe

The LGN unit compressors are provided charged with completely miscible oil with R410A refrigerant in the liquid phase. As a result, low refrigerant speeds inside the liquid pipe are not a problem.

Table 2 "liquid pipe" shows the different pipe diameters based on the unit sizes and the equivalent circuit length.

To determine the equivalent length of the liquid line, the pressure drop generated by the filter dryer and the solenoid valves must be taken into consideration. Table 4 below gives the equivalent length for each machine based on the diameter used.

Table 4 - Equivalent length of filter dryer, solenoid valves, liquid sight glass (standard supply)

Equivalent length of the filter dryer, solenoid valves, liquid sight glass									
LGN		**080**	**090**	**100**	**120**	**130**	**150**	**180**	**200**	**240**
Diameter 1/2”	m	4,2	4,2	4,2	4,2	4,2	4,2	2,2	-	-
5/8" diameter	m	12,3	12,3	12,3	12,3	12,3	12,3	5,4	5,4	5,4
3/4" diameter	m	-	-	-	-	29,9	29,9	12,4	12,4	12,4
7/8" diameter	m	-	-	-	-	-	-	-	-	25,1

Equivalent length of the filter dryer, solenoid valves, liquid sight glass									
LGN		**260**	**300**	**360**	**390**	**450**	**480**	**520**	**600**
Diameter 1/2”	m	-	-	-	-	-	-	-	-
5/8" diameter	m	5,4	5,4	-	-	-	4,50	4,50	4,50
3/4" diameter	m	12,4	12,4	12,00	12,00	12,00	12,00	12,00	12,00
7/8" diameter	m	25,1	25,1	25,00	25,00	25,00	22,00	22,00	22,00

Permitted pressure drops within the liquid pipe depend primarily on the subcooling level of the liquid refrigerant at the condenser outlet. Pressure drops corresponding to 1.5°C saturated temperature must not be exceeded.

If the refrigerant liquid column is very large, it may then be necessary to increase the subcooling to prevent a phase change in the liquid pipe. This can be provided by a vapour-liquid exchanger or an additional coil, for example.

It is advisable to make a slight slope (10 to 20 mm/m) in the refrigerant circulation direction on the horizontal pipes between the remote condenser and the LGN unit.

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.

9.1 - Operating precautions

Design the water circuit with the least number of elbows and horizontal pipe runs at different levels. The main points to be checked for the connection are:

- The use of different metals on hydraulic piping could generate eletrolytic pairs and consequently corrosion. Verify then, the need to install sacrificial anodes.
- 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 safety valve as well as an expansion tank. Units with hydraulic module and safety hydraulic components option include the safety valve and expansion tank.
- 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 vibration transmission.
- If the insulation provided is not sufficient, insulate the cold-water piping, after testing for leaks, both to reduce heat loss and to prevent condensation.
- Cover the insulation with a vapour barrier.
- If the external water piping to the unit is in an area where the ambient temperature can fall below 0°C, insulate the piping and install an electric heater on the piping.

NOTE: For units without Safety hydraulic component option, a screen filter must be installed as close as possible to the heat exchanger and in a position that is easily accessible for removal and cleaning. Units with a hydraulic module include this filter.

The mesh size of the filter must be 1.2 mm. If this filter is not installed, the plate heat exchanger can quickly become contaminated at the first start-up, as it takes on the filter function, and correct unit operation is affected (reduced water flow due to increased pressure drop).

Damage due to absence of safety valve, expansion tank or screen filter (i.e. without Safety hydraulic component option) is not covered by the warranty.

Use of units in an open loop is forbidden.

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.

If 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.

Recommendations on heat exchange fluids:

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

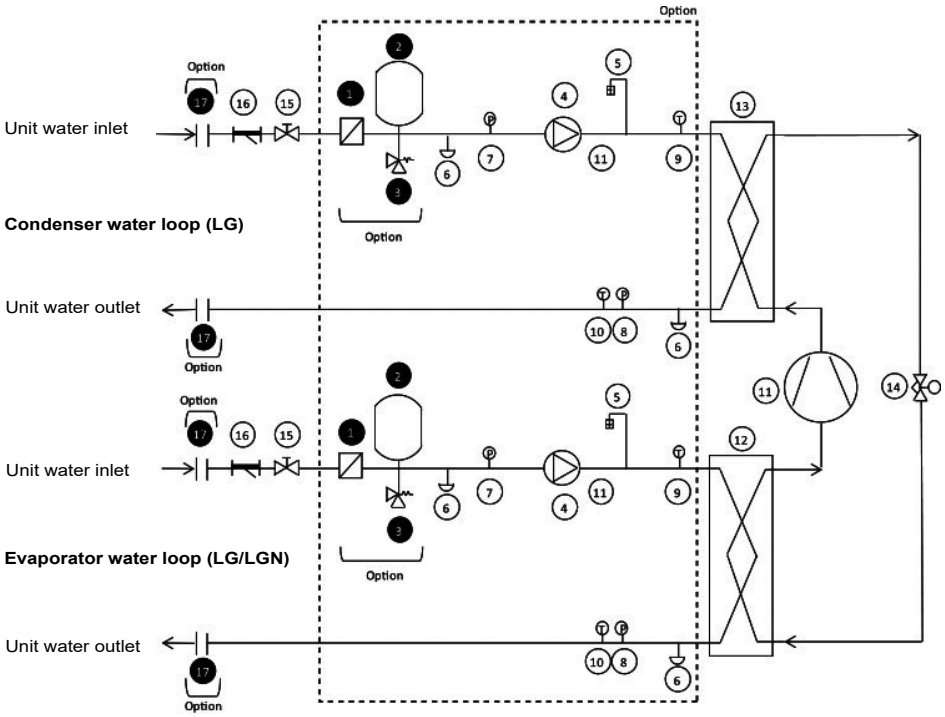
Filling, completing and draining the water circuit charge must be done by qualified personnel, using the air purges and materials that are suitable for the products.

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

9.2 - Water connections

The diagram below illustrates a typical hydraulic installation. When the hydraulic circuit is charged, use the air vents to evacuate any residual air pockets.

Typical water circuit diagram, LG/LGN units with hydraulic module



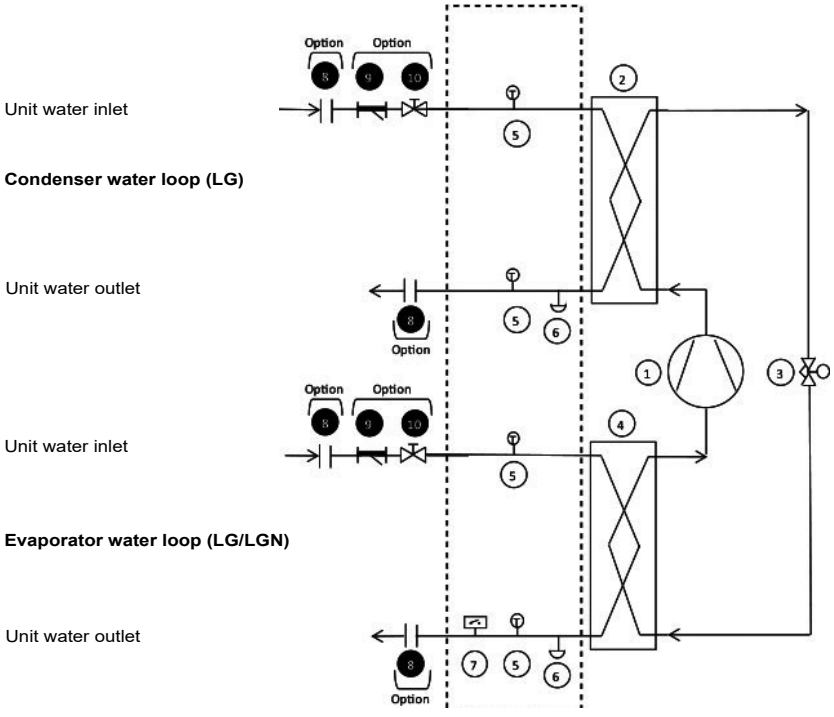
Components of unit and hydraulic module

1 Victaulic screen filter
2 Expansion tank (optional hydraulic safety components on evaporator and condenser side)
3 Relief valve (optional hydraulic safety components on evaporator and condenser side)
4 Water pump
5 Air bleed valve
6 Water drain valve
7/8 Pressure sensor inlet/outlet
9/10 Temperature sensor inlet/outlet
11 Compressor
12 Evaporator
13 Condenser
14 Expansion device
15/16 800 µm screen filter and valve (Compulsory with a pump option and optional without)
17 Flexible connection coupling (Option)

NOTE :

- **Units without hydraulic module include a flow switch.**
- **For LGN units, the evaporator and its water loop have been removed.**

Typical water circuit diagram, LG/LGN units without hydraulic modules



Components of unit and hydraulic module

1 Compressor
2 Condenser
3 Expansion device
4 Evaporator
5 Temperature sensor inlet/outlet
6 Water drain valve
7 Flow rate switch
8 Flexible connection coupling (Option)
09/10 800 µm screen filter and valve (compulsory with a pump option and optional without)

NOTE :

- **Units without hydraulic module include a flow switch.**
- **For LGN units, the evaporator and its water loop have been removed.**

9.3 - Frost protection

The units are designed to be installed under cover at outside temperatures between +5°C and +40°C. Therefore they do not include anti-freeze protection, as standard.

If the water piping is in an area where the ambient temperature can fall below 0°C it is recommended to install a trace heater on the piping and to add an antifreeze solution to protect the unit and the water piping to a temperature of 10 K below the lowest temperature likely to be reached at the installation site.

Use only antifreeze solutions, approved for heat exchanger duty. If the system is not protected by an antifreeze solution and will not be used during the freezing weather conditions, draining of the cooler and outdoor piping is mandatory. Damage due to freezing is not covered by the warranty.

Depending on the climatic conditions in your area you must:

- **Add ethylene glycol with an adequate concentration to protect the installation up to a temperature of 10 K below the lowest temperature likely to occur at the installation site.**
- **If the unit is not used for an extended period, it is recommended to drain it, and as a safety precaution add ethylene glycol to the heat exchanger, using the heat exchanger water entering purge valve connection.**
- **At the start of the next season, refill the unit with water and add an inhibitor.**
- **For the installation of auxiliary equipment, the installer must comply with basic regulations, especially for minimum and maximum flow rates, which must be between the values listed in the operating limit table (chapter 5 - "Application data").**
- **To avoid corrosion by differential aeration, the complete heat exchange circuit must be charged with nitrogen, if it is drained for longer than one month. If the heat exchange fluid does not comply with the manufacturer recommendations, the circuit must immediately be filled with nitrogen.**

9.4 - Flow switch (units without hydraulic module)

The unit water flow switch must be energised, and the chilled water pump interlock must be connected. Failure to follow this instruction will void the manufacturer's guarantee.

The flow switch is supplied, installed on the evaporator leaving water pipe and preset at the factory to cut out when there is insufficient water flow.

Terminals 34 and 35 are provided for field installation of the chilled water pump interlock (auxiliary contact for pump operation to be wired on site).

10.1 - General

The water circulation pumps of the units have been sized to allow the hydraulic modules to cover all possible configurations based on the specific installation conditions, i.e. for various temperature differences between the entering and the leaving water (ΔT) at full load, which can vary between 2.5 and 7 K for evaporators and 3 and 18 K for condensers.

This required difference between the entering and leaving water temperature determines the nominal system flow rate. It is above all absolutely necessary to know the nominal system flow rate to allow its control via a manual valve.

Manual control valves for the unit are not supplied and must be installed upstream and downstream of the evaporator and condenser water loops to ensure correct flow control.

With the pressure loss generated by the control valve in the hydraulic system, the valve is able to impose the system pressure/flow curve on the pump pressure/flow curve, to obtain the desired operating point (see example).

The pressure drop reading in the plate heat exchanger is used to control and adjust the nominal system flow rate. The pressure drop is measured with the pressure sensors connected to the heat exchanger water inlet and outlet.

Use this specification for the unit selection to know the system operating conditions and to deduce the nominal air flow as well as the plate heat exchanger pressure drop at the specified conditions. If this information is not available at the system start-up, contact the technical service department responsible for the installation to get it.

These characteristics can be obtained from the technical literature using the unit performance tables or the Electronic Catalogue selection program for all conditions.

10.2 - Water flow control procedure

As the total system pressure drop is not known exactly at the start-up, the water flow rate must be adjusted with the control valve to obtain the specific flow rate for this application.

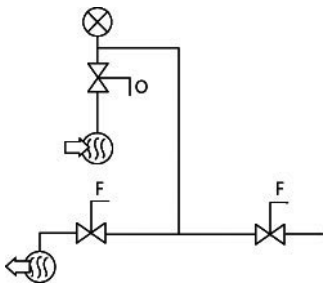
Proceed as follows:

Open the valve fully.

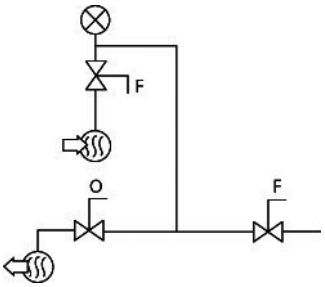
Start-up the pump using the forced start command (refer to the controls manual) and let the pump run for two consecutive hours to clean the hydraulic circuit of the system (presence of solid contaminants).

Read the hydraulic module pressure drop by taking the difference of the readings at the machine connected to the hydraulic module inlet and outlet. Compare this value after two hours of operation.

Entering water pressure reading



Leaving water pressure reading



O Open
F Closed
Water inlet
Water outlet
Pressure gauge

If the pressure drop has increased, this indicates that the screen filter must be removed and cleaned, as the hydraulic circuit contains solid particles. In this case, in units with Safety hydraulic component option, close the shutoff valves at the water inlet and outlet and remove the screen filter after emptying the hydraulic section of the unit. In units without Safety hydraulic component option, clean the screen filter on hydraulic circuit out of the unit.

Renew, if necessary, to ensure that the filter is not contaminated.

When the circuit is cleaned, read the pressures at the unit (entering water pressure - leaving water pressure), expressed in kPa to find out the plate heat exchanger pressure drop.

Compare the value obtained with the theoretical selection value. If the pressure drop measured is higher than the value specified this means that the flow rate in the plate heat exchanger (and thus in the system) is too high. The pump supplies an excessive flow rate based on the global pressure drop of the application. In this case close the control valve one turn and read the new pressure difference.

Proceed by successively closing the control valve until you obtain the specific pressure drop that corresponds to the nominal flow rate at the required unit operating point.

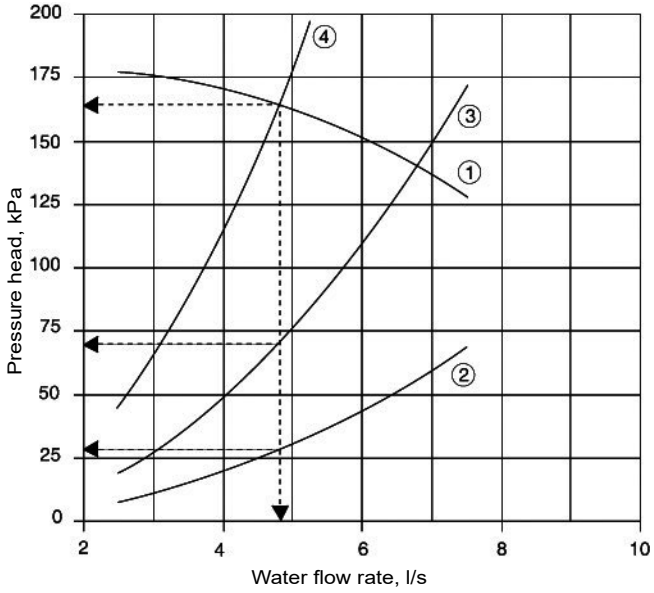
- If the system has an excessive pressure drop in relation to the available static pressure provided by the pump, the resulting water flow rate will be reduced and the difference between the input and output water temperature of the hydraulic module will be increased.

To reduce the hydraulic system pressure drops, it is necessary:

- to reduce the individual pressure drops as much as possible (bends, level changes, accessories, etc.)
- to use a correctly sized piping diameter.
- to avoid hydraulic system extensions, wherever possible.

10 - NOMINAL WATER FLOW CONTROL WITH FIXED-SPEED PUMP

Example: Unit with a given nominal flow rate of 4.8 l/s



Legend
① Unit pump curve
② Plate heat exchanger pressure drop (to be measured with the pressure gauge installed at the water inlet and outlet)
③ Installation pressure drop with control valve wide open
④ Installation pressure drop after valve control to obtain the specified flow rate

11 - NOMINAL WATER FLOW CONTROL WITH VARIABLE-SPEED PUMP

11.1 - Pump flow/pressure curve

Units with variable-speed hydraulic module include a water pump that automatically adjusts the flow to maintain a constant pressure or constant temperature difference.

No control is required at start-up, but the control mode must be selected on the unit interface (refer to the DYNACIAT™ LG/LGN Connect'Touch control manual).

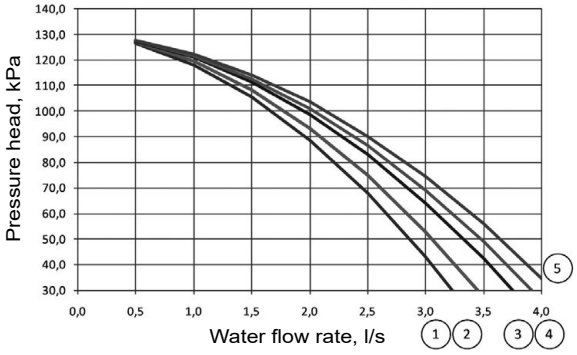
11.2 - Available external static pressure (Low-pressure pumps, units with hydraulic module)

Data applicable for:

- Fresh water 20°C
- In case of use of the glycol, the maximum water flow is reduced

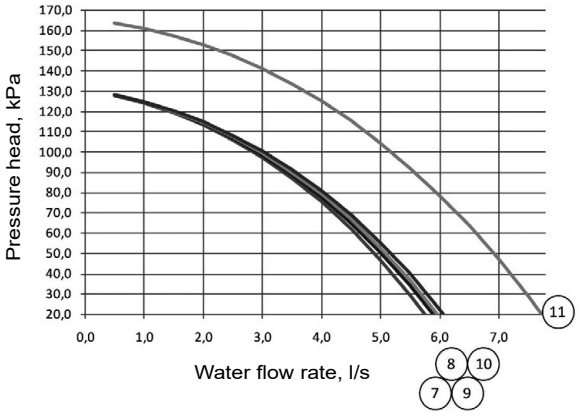
DYNACIAT™ LG/LGN evaporator

Sizes 080-150



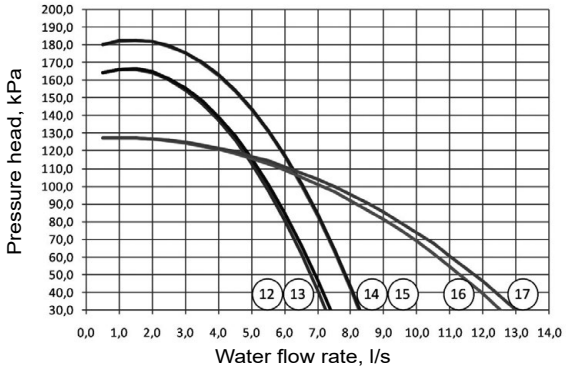
① LG/LGN 080 ③ LG/LGN 100 ⑤ LG/LGN 130
② LG/LGN 090-100 ④ LG/LGN 120 ⑥ LG/LGN 150

Sizes 180-300



⑦ LG/LGN 180 ⑨ LG/LGN 240 ⑪ LG/LGN 300
⑧ LG/LGN 200 ⑩ LG/LGN 260

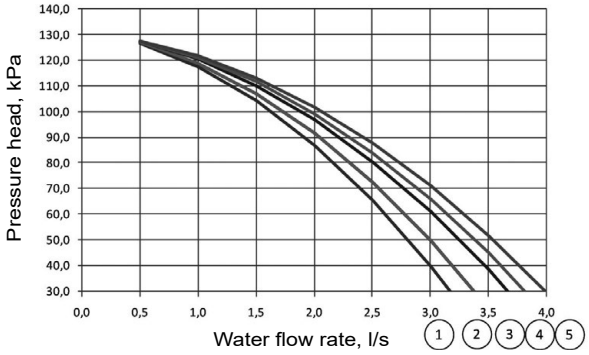
Sizes 360-600



⑫ LG/LGN 360 ⑭ LG/LGN 450 ⑯ LG/LGN 520
⑬ LG/LGN 390 ⑮ LG/LGN 480 ⑰ LG/LGN 600

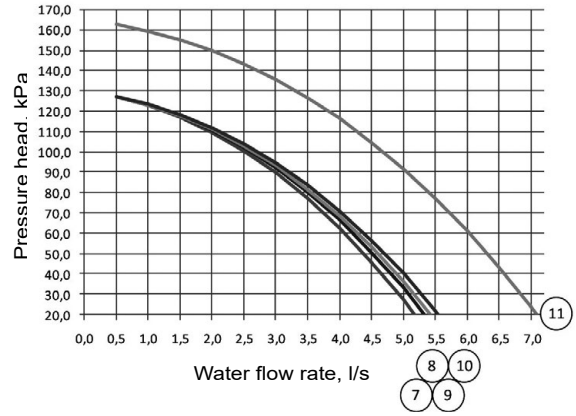
DYNACIAT™ LG condenser

Sizes 080-150



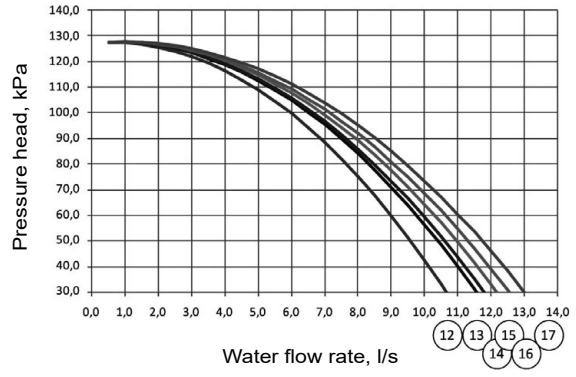
① LG 080 ③ LG 100 ⑤ LG 130
② LG 090-100 ④ LG 120 ⑥ LG 150

Sizes 180-300



⑦ LG 180 ⑨ LG 240 ⑪ LG 300
⑧ LG 200 ⑩ LG 260

Sizes 360-600

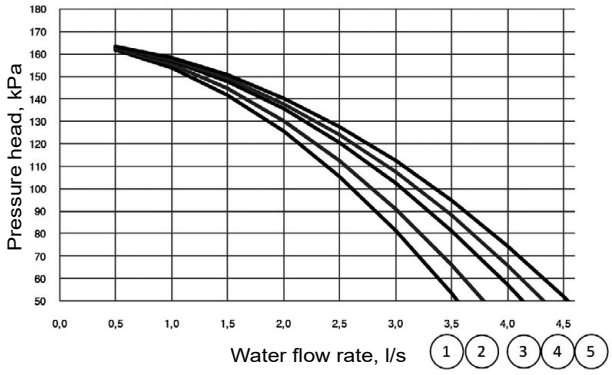


⑫ LG 360 ⑭ LG 450 ⑯ LG 520
⑬ LG 390 ⑮ LG 480 ⑰ LG 600

11.3 - Available external static pressure (High-pressure pumps, units with hydraulic module)

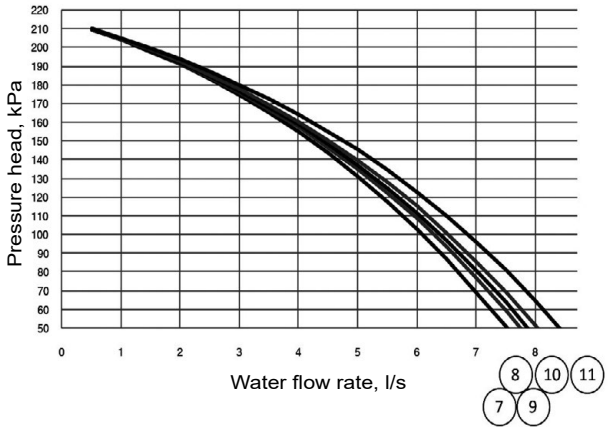
DYNACIAT™ LG/LGN evaporator

Sizes 080-150



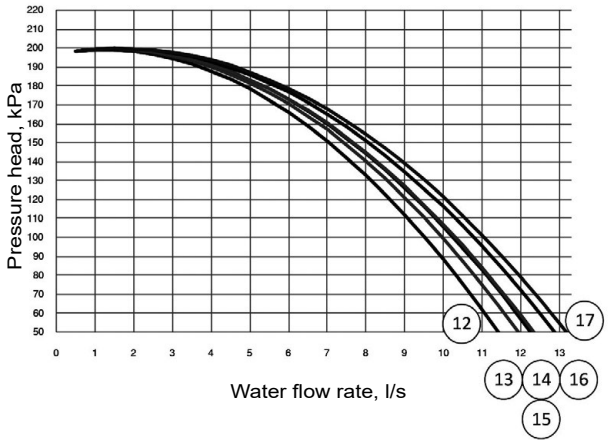
① LG/LGN 080
② LG/LGN 090-100
③ LG/LGN 100
④ LG/LGN 120
⑤ LG/LGN 130
⑥ LG/LGN 150

Sizes 180-300



⑦ LG/LGN 180
⑧ LG/LGN 200
⑨ LG/LGN 240
⑩ LG/LGN 260
⑪ LG/LGN 300

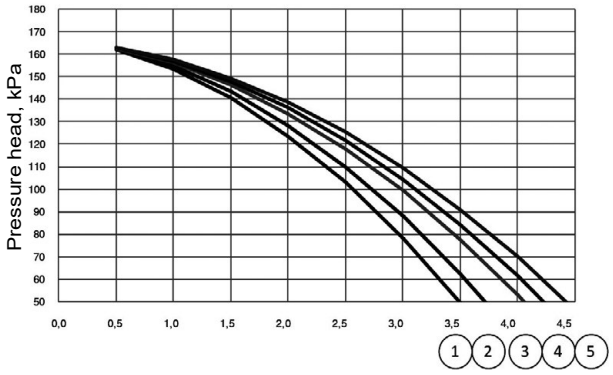
Sizes 360-600



⑫ LG/LGN 360
⑬ LG/LGN 390
⑭ LG/LGN 450
⑮ LG/LGN 480
⑯ LG/LGN 520
⑰ LG/LGN 600

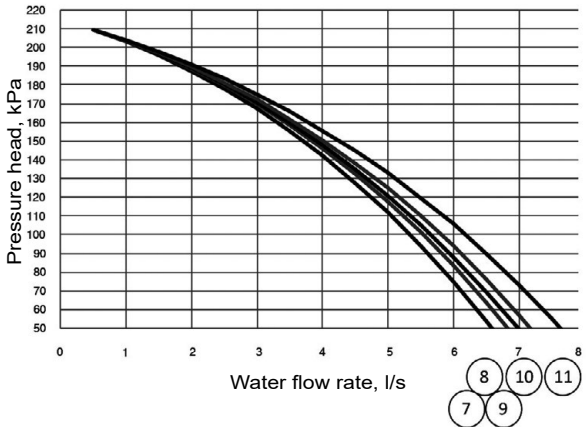
DYNACIAT™ LG condenser

Sizes 080-150



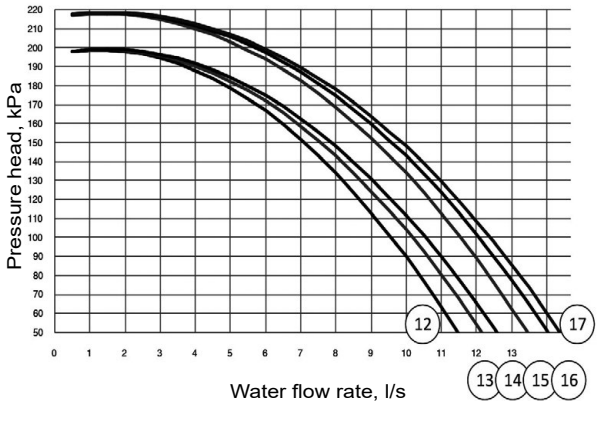
① LG 080
② LG 090-100
③ LG 100
④ LG 120
⑤ LG 130
⑥ LG 150

Sizes 180-300



⑦ LG 180
⑧ LG 200
⑨ LG 240
⑩ LG 260
⑪ LG 300

Sizes 360-600



⑫ LG 360
⑬ LG 390
⑭ LG 450
⑮ LG 480
⑯ LG 520
⑰ LG 600

12.1 - Preliminary checks

- Never be tempted to start the unit without reading fully, and understanding, the operating instructions and without having carried out the following pre-start checks:
- Check the chilled water circulation pump operation with the Quick Test function.
- Check the air handling units and all other equipment connected to the evaporator. Refer to the manufacturer's instructions.
- Check the condensing loop water circulation pump operation with the Quick Test function.
- For units without hydraulic module, the water pump overheat protection devices must be connected in series with the pump contactor power supply.
- Ensure that there are no refrigerant leaks.
- Confirm that all pipe securing bands are tight.
- Confirm the electrical connections are secure.
- Avoid a long common power wiring connection run inside the unit close to the control or signal wiring.
- Observe the clearances on each unit side to facilitate maintenance.
- The unit pipings are not 100% insulated whatever the options. The insulation only protects against running condensation.
- To ensure that no condensate can run under the unit, a condensate pan must be added under the unit that collects 100% of the condensate.
- If work is required inside a control box or on the compressor wiring, the phase order must be verified with a quick test (refer to the DYNACIAT™ LG/LGN Connect'Touch control manual. The compressors cannot support prolonged operation (>30 seconds) with reversed phases.
- Ensure that the last refrigerant charge made by the service team corresponds with the charge given on the name plate - otherwise the operating ranges and the unit efficiency will be impaired. The required tolerance for the charge is ±2%.
- Do not interchange material with another unit. The elements used for this unit are specific to this unit. Use the specific manufacturer component list when ordering any parts.
- Before start-up ensure that the unit is level (1.5 mm/m).
- Check the operation of the fans in the air-cooled condensers.

12.2 - Actual start-up

- **Commissioning and start-up of the unit must be supervised by a qualified refrigeration engineer.**
- **Start-up and operating tests must be carried out with a thermal load applied and water circulating in the evaporator and condenser.**
- **All set-point adjustments and control tests must be carried out before the unit is started up.**

Ensure that all safety devices are operational, especially that the high pressure switches are switched on and that the alarms are acknowledged.

For LGN units operating with a remote air-cooled condenser the compressor oil level must be monitored during the installation start-up phase.

This ensures that the oil charge from the original compressors is sufficient in relation to the size of the system and the pipe configuration. Once the oil level has stabilised, it must not be lower than ¼ of the oil sight glass level for the compressors during operation.

13.1 - Compressors

The units use hermetic scroll compressors. The only refrigerant permitted for these compressors is R-410A.

The compressors are not certified for mobile applications or use in explosive environments.

For more information contact the manufacturer service team for maintenance instructions.

All compressor and system pressure tests must be carried out by qualified personnel, taking the greatest care with potential dangers resulting from the pressures used, and respecting the maximum operating pressure limit on the high and low-pressure side, shown on the unit and compressor name plates.

- **Maximum operating pressure, low-pressure side: LG = 3330 kPa (33.3 bar) and LGN = 2820 kPa (28.2 bar)**
- **Maximum operating pressure, high-pressure side: LG = 4870 kPa (48.7 bar) and LGN = 4420 kPa (44.2 bar)**

Any modification or alteration such as soldering on the compressor shell may invalidate the right to use the equipment.

Units using these compressors are installed in areas where the temperature must be between 5°C minimum and 40°C maximum. The temperature around the compressors must not exceed 50°C during unit shutdown cycles.

Shock absorbers are installed under the compressor feet.

13.2 - Lubricant

The compressors have the following factory lubricant charge: polyolester oil (reference: POE 160SZ). Contact manufacturer to order the oil. This lubricant must not be mixed with other lubricant types.

Before start-up and after normal unit operation check that the oil level is visible.

If an additional oil quantity is required to compensate the initial low level in the compressors, top up the charge, using only the permitted lubricant shown on the compressor name plate: polyolester oil (ref: POE 160SZ).

NOTE: Only use oil approved for these compressors. Do not re-use oil that has been exposed to the air.

R22 oils are not compatible with R410A oils and vice-versa.

13.3 - Evaporators and water condensers

The evaporators and condensers are single-circuit plate heat exchangers. They are tested and stamped for a maximum service pressure of 5000 kPa, 4500 kPa on the refrigerant side and 1000 kPa on the water side.

The heat exchanger sizing for the whole range ensures a saturated evaporating temperature of 4.5°C and a condensing temperature of around 38°C with actual subcooling of around 4 K at the condenser leaving side, based on nominal Eurovent conditions.

The water connections between the heat exchangers and the piping of the hydraulic modules have quick-connect Victaulic couplings to facilitate pump disassembly, if required.

A drain with a 1/4 turn valve is included in the leaving water of all heat exchangers.

The evaporators have 19 mm thick polyurethane foam thermal insulation. For condenser insulation option, the condensers also have 19 mm thick polyurethane foam thermal insulation.

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.

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

- **Follow the regulations on monitoring pressurised equipment.**
- **It is normally required that the user or operator sets up and maintains a monitoring and maintenance file.**
- **If there are no regulations or to complement them follow the control programmes of EN 378.**
- **If they exist follow local professional recommendations.**
- **Regularly inspect the condition of the coating (paint) to detect blistering resulting from corrosion. To do this, check a non-insulated section of the container or the rust formation at the insulation joints.**
- **Regularly check for any impurities in the energy transfer fluids (e.g. silica grains). 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, annex C.**
- **In case of re-testing take the possible maximum pressure difference of 25 bar into consideration.**
- **The reports of periodical checks by the user or operator must be included in the supervision and maintenance file.**

Repair

Any repair or modification of the plate heat exchangers is forbidden.

Only the replacement of the complete heat exchanger by an original heat exchanger supplied by the manufacturer is permitted. The replacement must be carried out by a qualified technician.

- The heat exchanger replacement must be shown on the monitoring and maintenance file.

Recycling

The plate heat exchanger is 100% recyclable. After use it contains refrigerant vapours and oil residue.

Operating life

This unit is designed for:

- Prolonged storage of 15 years under nitrogen charge with a temperature difference of 20 K per day.
- 900,000 cycles (start-ups) with a maximum difference of 6 K between two neighbouring points in the container, based on 12 start-ups per hour over 15 years at a usage rate of 57%.

13.4 - Electronic expansion valve (EXV)

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

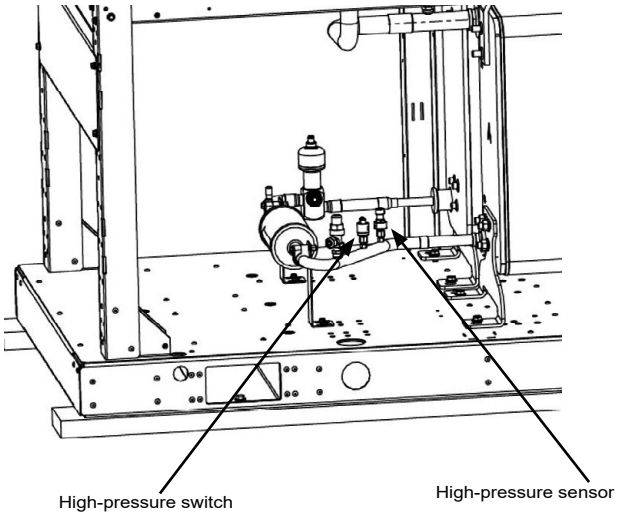
13.5 - Refrigerant

Units operate exclusively with R-410A.

13.6 - High-pressure switch and high-pressure sensor

Units are equipped with an automatically reset safety pressure switch on the liquid line. Refer to the controls manual for the alarm acknowledgements.

It is strictly forbidden to modify the unit refrigerant circuit. The pressure switch is specific to the units - do not interchange it with other units. The pressure switch tap does not include a Schrader valve.



The high-pressure sensor is however equipped with a Schrader valve. It is specific to these units and must not be replaced with one from other units.

LGN units are equipped with an automatically reset safety pressure switch on the discharge line. The pressure switch is specific to LGN units. Do not interchange it with other units, including LG units.

13.7 - High and low-pressure side relief valves

The units are equipped with safety valves in accordance with the European directive 2014/68/UE. These safety valves are calibrated and sized in accordance with the original high and low-pressure side equipment.

Units include high and low-pressure side safety valves.

LGN units are only equipped with low pressure side valves. The installer must determine which accessories (relief valves, fuses etc.) are required so that the completed high-pressure circuit complies with the applicable regulations and standards.

13.8 - Moisture indicator

Located in the liquid line, permits control of the unit charge, as well as the presence of moisture in the circuit. Bubbles in the sight glass indicate an insufficient charge or the presence of non-condensibles.

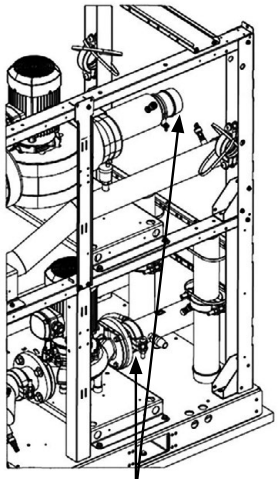
For LGN units, if the patch in the sight glass is yellow upon delivery, this indicates that it is not a nonconformity. However, after the unit is evacuated and after a certain operating time, check that colour of the patch in the sight glass is no longer yellow (indicator of the presence of humidity)

13.9 - Filter drier in the refrigerant circuit

The filter keeps the circuit clean and moisture-free. The moisture indicator shows when it is necessary to change the filter cartridges. A temperature difference between the filter drier inlet and outlet indicates a contamination of the cartridges.

LGN units are delivered as standard supply with a dryer for brazing on the liquid line. It must be brazed as close as possible to the unit, upstream of the solenoid valve and as soon as possible after the circuit has been exposed to the atmosphere while connecting the air-cooled condenser

13.10 - Evaporator and condenser pump suction filter



All pumps are protected by a suction filter. With the safety hydraulic component option, we have additional conical filter put on the inlet pipe (See picture above). This is easily removable to recover solid particles. It protects the pump and the plate heat exchanger against solid particles with a size exceeding 1,2 mm. Before the unit start-up it is important to turn the evaporator and condenser pump to decontaminate the water loops of any solid pollution.

A specific pump start-up function in the Quick Test menu is available for this task.

13.11 - External temperature sensor

The outside air temperature sensor is used to optimise setpoint control with outside air temperature variation measurement.

The position of the temperature sensor must be chosen with great care and must be representative of the outside temperature (limit any other source that could have a negative influence on the control: Gusts of wind, other heat sources such as sun radiation and hot air recycling).

The outside air temperature is also provided with drycooler control and drycooler free cooling management options.

LGN units require outside air temperature information. This information is essential in order for the entire system to run smoothly (EXV, fans, condensation temperature, setpoint). For units without remote condenser control (standard), the sensor (25 m) is provided with the LGN electrics box and must be installed near the air-cooled condenser.

For units with remote condenser control (option 154), the sensor is provided with the option and must be installed near the air-cooled condenser.

14 - OPTIONS ET ACCESSORIES

14.1 - Options table

Options	Description	Advantages	Use
Low-temperature brine solution	Low temperature glycol solution production down to -12°C with ethylene glycol	Covers specific applications such as ice storage and industrial processes	●
Soft Starter	Electronic starter on each compressor	Reduced start-up current	●
Master/slave operation	Unit equipped with supplementary water outlet temperature sensor kit (to be field-installed) allowing master/slave operation of two units connected in parallel	Optimised operation of two units connected in parallel operation with operating time equalisation	●
Evap. single pump power/ control circuit	Unit equipped with an electrical power and control circuit for one pump for the evaporator side	Quick and easy installation: the control of fixed speed pumps is embedded in the unit control	Sizes 360 to 600
Cond. 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	Sizes 360 to 600
Condenser insulation	Thermal condenser insulation	Minimizes thermal dispersions condenser side (key option for heat pump or heat recovery applications) and allows compliance with special installation criteria (hot parts insulated)	●
HP single-pump hydraulic module	Single high-pressure water pump, water filter, electronic water flow control, pressure transducers. For more details, refer to the dedicated chapter (expansion tank not included). Option with built-in safety hydraulic components available.)	Easy and fast installation (plug & play)	Sizes 360 to 600
LP evap. single-pump	Evaporator hydraulic module equipped with low pressure fixed-speed pump, drain valve, air vent and pressure sensors. For more details, refer to the dedicated chapter (expansion tank not included. Option with built-in safety hydraulic components available)	Easy and fast installation (plug & play)	●
HP evap. variable-speed single-pump	Evaporator hydraulic module equipped with high-pressure variable-speed pump, drain valve, air vent and pressure sensors. For more details, refer to the dedicated chapter (expansion tank not included. Option with built-in safety hydraulic components available)	Easy and fast installation (plug & play), significant pumping energy cost savings (more than two-thirds), tighter water flow control, improved system reliability	●
Lon gateway	Bi-directional communication board complying with Lon Talk protocol	Connects the unit by communication BUS to a building management system	●
Bacnet over IP	Bi-directional high-speed communication using BACnet protocol over Ethernet network (IP)	Easy and high-speed connection by ethernet line to a building management system. Allows access to multiple unit parameters	●
Specific dry cooler control	Control box for communication with the drycooler via a bus. For OPERA 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	●
External boiler management	Control board factory-installed on the unit to control a boiler	Extended remote control capabilities to a boiler on/off command. Permits easy control of a basic heating system	●
Electric heaters management	Control board factory-fitted on the unit with additional inputs/outputs in order to manage up to 4 external heating stages (electrical heaters…)	Extended remote control capabilities for up to 4 electric heaters. Permits easy control of a basic heating system	●
Compliance with Russian regulations	EAC certification	Compliance with Russian regulations	●
Insulation of the evap. in/out ref.lines	Thermal insulation of the evaporator entering/leaving refrigerant lines with flexible, UV resistant insulation	Prevents condensation on the evaporator entering/leaving refrigerant lines	●
Low noise level	Compressor sound enclosure	Reduced sound emissions	●
Evaporator screw connection sleeves (kit)	Evaporator inlet/outlet screw connection sleeves	Allows unit connection to a screw connector	●
Condenser screw connection sleeves kit	Condenser inlet/outlet screw connection sleeves	Allows unit connection to a screw connector	●
HP single-pump, condenser side	Condenser hydraulic module equipped with high pressure fixed-speed pump, drain valve, air vent and pressure sensors. Built-in safety hydraulic components available in option.	Easy and fast installation (plug & play)	Sizes 360 to 600
LP single-pump, cond. side	Condenser hydraulic module equipped with low pressure fixed-speed pump, drain valve, air vent and pressure sensors. Built-in safety hydraulic components available in option.	Easy and fast installation (plug & play)	●

Options	Description	Advantages	Use
HP cond. variable-speed single-pump	Condenser hydraulic module equipped with high-pressure variable-speed pump, drain valve, air vent and pressure sensors. (expansion tank not included). Built-in safety hydraulic components available in option	Easy and fast installation (plug & play), reduced power consumption of the water circulation pump	●
Safety hydraulic components, evap. side	Screen filter, expansion tank and relief valve integrated in the evaporator hydraulic module	Easy and fast installation (plug & play), operating safety	●
Safety hydraulic components, cond. side	Screen filter, expansion tank and relief valve integrated in the condenser hydraulic module	Easy and fast installation (plug & play), operating safety	●
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 anti-vibration mounts to be placed 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 the transmission of vibrations to the water network	●
Exchanger water filter (kit)	Water filter	Eliminate dust in the water network	● Without pump option
Condenser water filter (kit)	Water filter	Eliminate dust in the water network	● Without pump option
Set point adjustment by 4-20mA signal	Connections to allow a 4-20mA signal input	Easy energy managment, allow to adjust set point by a 4-20mA external signal	●
External temperature sensor	External temperature sensor control for using weather compensation	Allow to adjust set point using weather compensation and define authorisation operation mode to external temperature	●
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	●
Desuperheater flexibles connection (kit)	Flexibles connections on the desuperheaterr water side	Easy installation. Limit transmission of vibrationson the water network	Sizes 360 to 600

14.2 - Description

14.2.1 - Fixed-speed pump

This pump is factory-fitted as standard to guarantee nominal flow in the water loop. It is a fixed-speed pump with available system pressure. See the pump flow/pressure curves in chapters 8 and 9.

The system's nominal flow rate must be adjusted with a manual control valve provided by the customer (see chapters 10 and 11 on controlling the nominal water flow rate).

The maximum permitted concentration of the glycol additives (ethylene glycol or propylene glycol) is 35%.

The maximum pump suction pressure is limited to 400 kPa (4 bar) due to the valve installed the pipe that carries the water to the unit.

The use of any other glycol type additives must be approved by the manufacturer.

Use of hydraulic module in an open loop is forbidden.

14.2.2 - Variable-speed pump

This pump is factory-fitted. It is a variable-speed pump with available system pressure. See the pump flow/pressure curve.

The system flow rate is automatically adjusted via the frequency converter built into the pump, based on the heat rejection load on the drycooler.

The maximum permitted concentration of the glycol additives is 35%.

The maximum pump suction pressure is limited to 400k Pa (4 bar) due to the valve installed the pipe that carries the water to the unit.

The use of any other glycol type additives must be approved by the manufacturer.

Use of hydraulic module in an open loop is forbidden.

14.2.3 - Hydraulic option

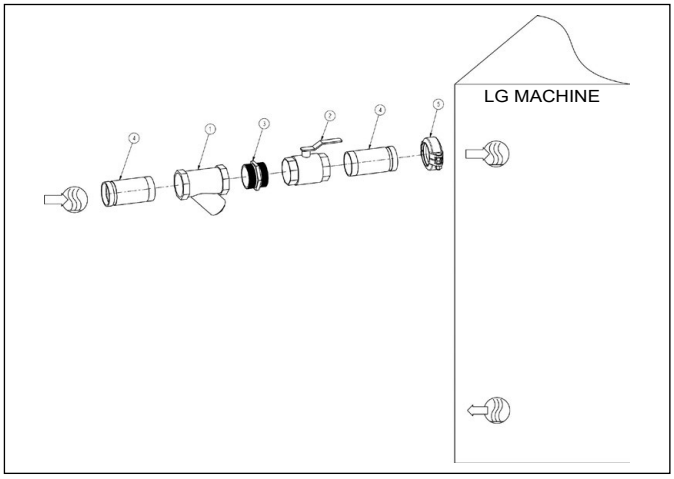
The evaporator/condenser water filter is provided on the units for those equipped with pump(s), or as an option for units without a pump. All other equipment is optional.

All components previously mounted must be disassembled and assembled in the right position and appropriate torque.

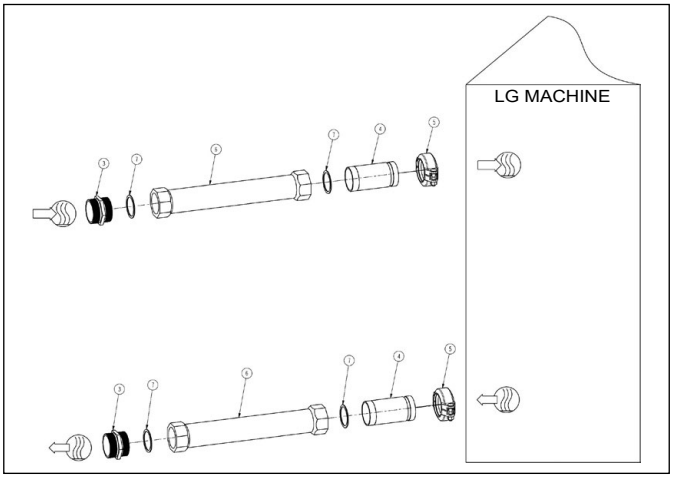
See below for the different option combinations available. These assembly examples apply to the evaporator side.

It's the same assembly on the condenser side.

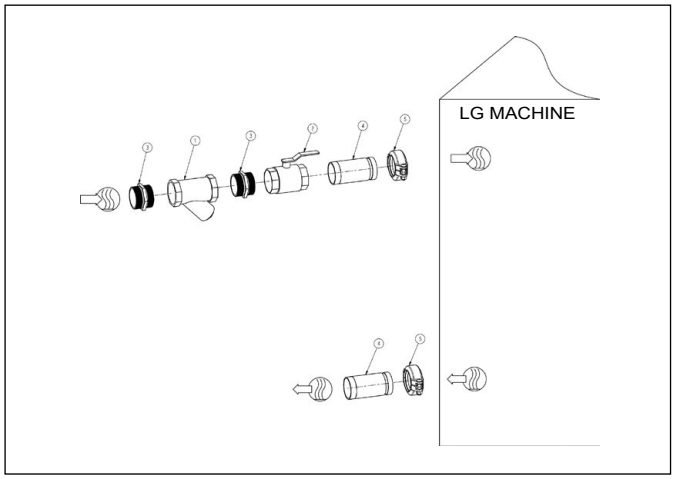
Screen filter evaporator option



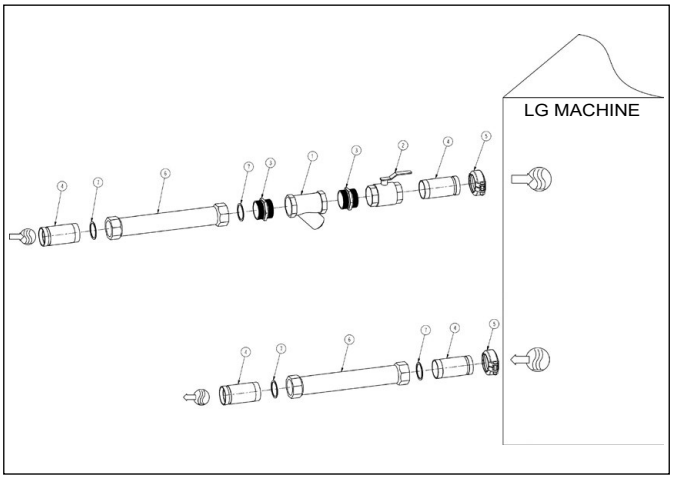
Flexible piping hydraulic + Customer screwed connection on evaporator option



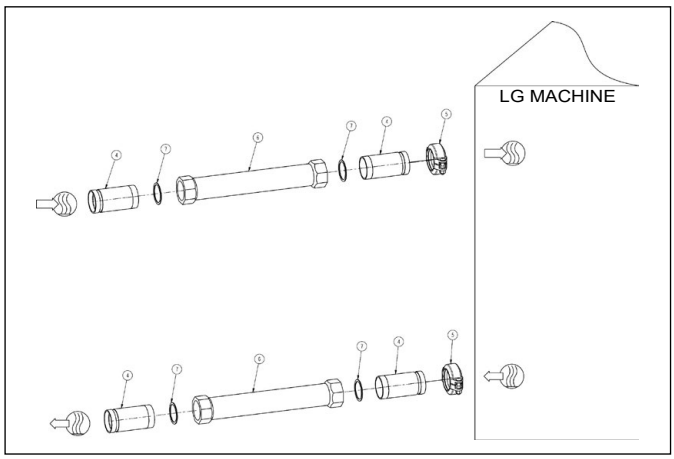
Screen filter evaporator + Customer screwed connection on evaporator option



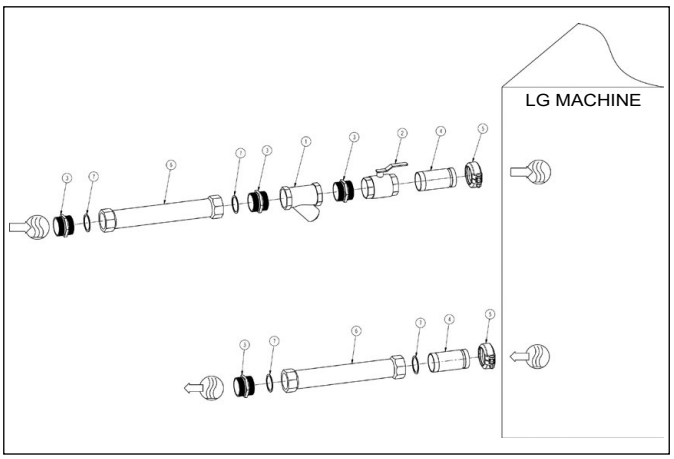
Screen filter evaporator + Flexible piping hydraulic option



Flexible piping hydraulic option



Screen filter evaporator + Flexible piping hydraulic + Customer screwed connection on evaporator option



14.2.4 - Operation of two units in master/slave mode

The master/slave assembly is controlled on the water inlet pipes (system return). All parameters, required for the master/slave function must be configured using the Service Configuration menu.

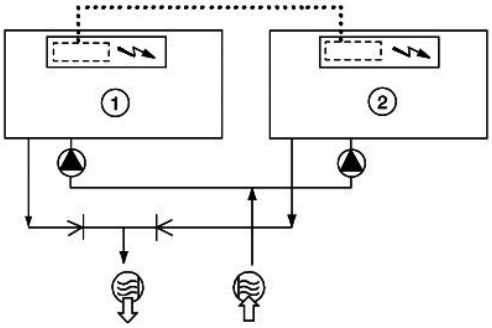
All remote controls of the master/slave assembly (start/stop, set point, load shedding etc.) are controlled by the unit configured as master and must only be applied to the master unit.

To permit master/slave operation both units must be equipped with master/slave option.

Depending on the installation and control type, each unit can control its own water pump.

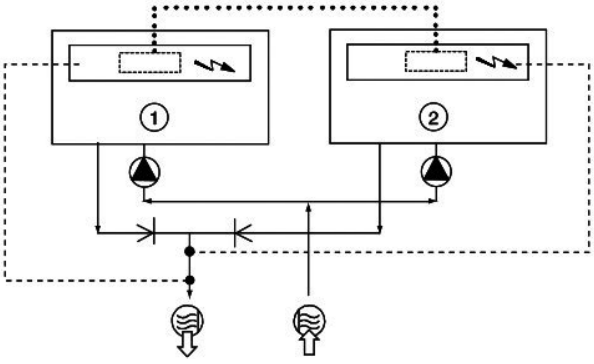
Parallel or serial connection of two units

Water inlet control for hydraulic module



See legend in the next column.

Water outlet control



See legend in the next column.

Legend

1 Master unit
2 Slave unit
Control boxes of the master and slave units
Water inlet (for customers with both units)
Water outlet (for customers with both units)
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

14.2.5 - LG unit operation with drycooler (specific drycooler control option)

14.2.5.1 - Operating principle

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

With a variable-speed condenser water pump integrated into the unit, the complexity of traditional systems using a 3-way valve has been reduced.

The installation of an operational system is limited on the condensing water loop side to connect the drycooler inlet and the water outlet pipe on the unit.

Connect'Touch control of the units 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 outside temperatures of -10°C without any additional control.

14.2.5.2 - Communication to control the drycooler

The electronic board and LEN communication BUS, integrated in the control box of the drycooler, via an option selected by the manufacturer, are used for controlling the whole system.

The drycooler and the unit must be equipped with the Drycooler Management option.

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

Connect'Touch 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 outlet water temperature sensors, as well as eight digital outputs permitting control of up to eight fan stages.

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

Please refer to the instructions in the DYNACIAT™ LG/LGN Connect'Touch control manual for the configuration of the number of fan stages to be controlled. Simply 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 the operating time and number of start-ups for each of the 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.

14.2.5.4 - Fan stage assignment

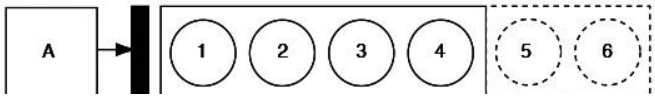
To ensure correct operation, a minimum of two stages is required.

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.

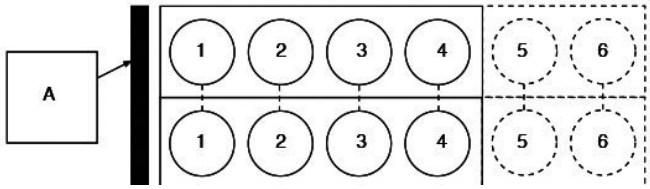
For example, a drycooler with 4 or 6 fans installed in series along the length of the unit will result in a configuration of 4 or 6 fan stages.

On the other hand, 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	Water inlet and outlet pipe side
1 to 6	Fans

14.2.5.5 - Units without evaporator and condenser pump, 3-way valve configuration for low outside temperature application

Units can be provided from the factory without evaporator and condenser pump. If year-round low-temperature operation is planned, the unit will be installed with a 3-way valve that is not provided with the unit.

In this case Connect'Touch should be configured for 3-way valve system control from an analogue 0-10 volt output on the master board. An adequate condensing temperature will be maintained with constant condenser flow rate. This configuration permits year-round system operation down to -20°C outside temperatures.

Controlling and changing-over the fan stages, described in chapter "Configuration of the number of fan stages and automatic changeover of the fan stages" is identical.

14.2.5.6 - Drycooler installation on units

When installing the drycooler, 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 (safety valve at 4 bar on the unit water circuit).
- Fan stage control (see "Fan stage control").
- Correct positioning of the outside air temperature and drycooler outlet water temperature sensors.

14.2.6 - LGN unit operation with a remote air-cooled condenser

14.2.6.1 - Operating principle

LGN units have been specially designed to optimise the operation of split installations, using air-cooled condensers as the chiller heat rejection system. The installation of an operational system is limited to the connection of the air-cooled condenser inlet and outlet piping to the LGN unit.

The Connect Touch control system of the LGN includes a logic to permit control the different fixed and variable-speed fan variants.

14.2.6.2 - Lead fan

The physical position of the air-cooled condenser with fixed or variable-speed fans depends on the position of the leaving liquid refrigerant manifold. In all cases there is always a so-called lead fan. This is the fixed or variable-speed fan that is physically the closest to the leaving liquid refrigerant manifold.

This ensures optimum subcooling on the condenser outlet side, especially at part load. This is the first fan to start in each circuit and the last fan to stop. A fan configuration with fixed-speed fans permits year-round system operation down to 0°C outside temperature.

A fan configuration with a variable-speed lead fan permits year-round operation down to -10°C outside temperature.

14.2.6.3 - Communication to control the remote condenser

The electronic board specifically integrated in the control box of the remote condenser(by an option selection on the manufacturer condenser) and a LEN communication BUS connected to the microprocessor board of the unit are used for the overall system control.

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

The option includes an air temperature sensor installed on the condenser.

Connect Touch continuously optimises system operation to obtain the best system efficiency by controlling the number of fans required for any thermal load and outside temperature conditions.

14.2.6.4 - Configuration of the number of fan stages and fan type based on the air-cooled condenser model used in the installation

Please refer to the instructions in the Connect Touch IOM units to carry out the parameter setting of the air-cooled condenser used in the installation:

- Use of speed variation on the lead fan(s)
- Number of fixed-speed fans
  Based on the parameter setting used, the arrangement of the digital and corresponding analogue outputs controlling the fans will be 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 condenser manufacturers to ensure a long operating life of the fan motors that are only used a little or not at all in these particular operating conditions.

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

14.2.7.1 - Operating principle

The units have been designed to optimize system operation, using drycoolers as a free cooling system (method using low outdoor air temperatures 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.

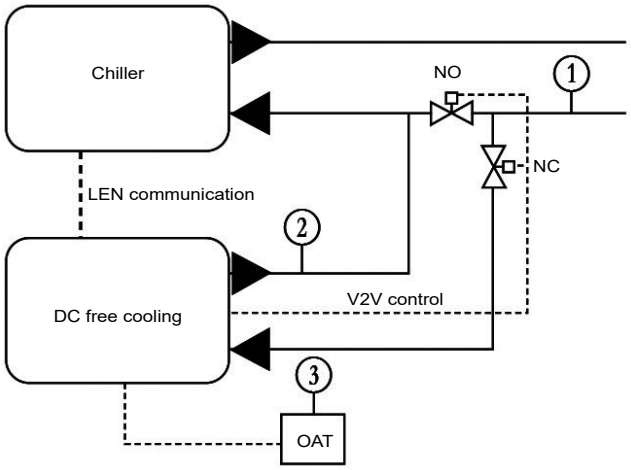
The Connect'Touch control of the unit includes algorithms to permit constant automatic optimization of:

- 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 configured:

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

14.2.7.2 - 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 the outside air temperature (mark 1), return water loop temperature (mark 3) and drycooler outlet temperature sensors (mark 2), as well as digital outputs to control the fans.

The option works as a system split in two parts:

Chiller (with free cooling option):

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

Drycooler (with free cooling option):

- AUX board with the I/O,
- OAT sensor to be placed outside,
- 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.

14.2.7.3 - Configuration of the fans control

To set the configuration corresponding to the drycooler installed (number of fans, control type – fixed or variable speed), please refer to the instructions in the Connect'Touch control 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 on 1 or 2 lines

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

14.2.7.4 - 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 a 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.

14.2.7.5 - System installations recommendation

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
- pPressure 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..

During the unit operating life the service checks and tests must be carried out in accordance with applicable national regulations.

If there are no similar criteria in local regulations, the information on checks during operation in annex C of standard EN 378 can be used.

External visual checks: annex A and B of standard EN378.

Corrosion checks: annex D of standard EN 378. These controls must be carried out:

- After an intervention that is likely to affect the resistance or lead to a change in use or change of high-pressure refrigerant, or after a shut down of more than two years. Components that do not comply, must be changed. Test pressures above the respective component design pressure must not be applied (annex B and D).
- After repair or significant modifications or significant system or component extension (annex B).
- After re-installation at another site (annexes A, B and D).
- After repair following a refrigerant leak (annex D). The frequency of refrigerant leak detection can vary from once per year for systems with less than 1% leak rate per year to once a day for systems with a leak rate of 35% per year or more. The frequency is in proportion with the leak rate.

NOTE: High leak rates are not acceptable. The necessary steps must be taken to eliminate any leak detected.

NOTE 2: Fixed refrigerant detectors are not leak detectors, as they cannot locate the leak.

15.1 - Soldering and welding

Component, piping and connection brazing and welding operations must be carried out using the correct procedures and by qualified operators. Pressurised containers must not be subjected to shocks, nor to large temperature variations during maintenance and repair operations.

Any technician attending the machine for any purpose must be fully qualified to work on refrigerant and electrical circuits.

Before doing any work on the machine ensure that the power is switched off. If a refrigerant circuit is opened, it must be evacuated, recharged and tested for leaks. Before any operation on a refrigerant circuit, it is necessary to remove the complete refrigerant charge from the unit with a refrigerant charge recovery unit.

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

If an oil draining or recovery operation becomes necessary, the fluid transfer must be made using mobile containers.

15.2 - General system maintenance

- Keep the unit itself and the space around it clean and free of obstructions. Remove all rubbish such as packing materials, as soon as the installation is completed.
- Regularly clean the exposed pipework to remove all dust and dirt. This makes detection of water leaks easier, and they can be repaired before more serious faults develop.
- Confirm that all screwed and bolted connections and joints are secure.
- Secure connections prevent leaks and vibration from developing.
- Check that all foam insulation joints on the heat exchanger piping are in good condition.
- Regularly check that the vibration levels remain acceptable and close to those at the start of using the unit.
- For units equipped with pump, regularly check that no leak appears on the pump. High concentration of glycol leads to faster degradation of pump mechanical seal.

15.3 - Refrigerant undercharge

If there is not enough refrigerant in the system, this is indicated by gas bubbles in the moisture sight glass.

If the undercharge is significant, large bubbles appear in the moisture sight glass, and the suction pressure drops. The compressor suction superheat is also high. The machine must be recharged after the leak has been repaired.

Find the leak and completely drain the system with a refrigerant recovery unit. Carry out the repair, leak test and then recharge the system.

After the leak has been repaired, the circuit must be tested, without exceeding the maximum low-side operating pressure shown on the unit name plate.

The refrigerant must always be recharged in the liquid phase into the liquid line. The refrigerant cylinder must always contain at least 10% of its initial charge. For the refrigerant quantity per circuit, refer to the data on the unit name plate.

15.4 - Refrigerant guidelines

Refrigeration installations must be inspected and maintained regularly and rigorously by specialists. Their activities must be overseen and checked by properly trained people. To minimise discharge to the atmosphere, refrigerants and lubricating oil must be transferred using methods which reduce leaks and losses to a minimum.

- Leaks must be repaired immediately.
- If the residual pressure is too low to make the transfer alone, a purpose-built refrigerant recovery unit must be used.
- Compressor lubricating oil contains refrigerant. Any oil drained from a system during maintenance must therefore be handled and stored accordingly.
- Refrigerant under pressure must never be discharged to the atmosphere.

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

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

If the refrigerant circuit 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 aim being to prevent penetration of atmospheric humidity as well as corrosion on the internal walls and on unprotected steel surfaces.

15.5 - Leak detection

Never use oxygen or dry air, as this would cause a risk of fire or explosion.

- Carry out a leak detection test on the whole system using the following methods: pressure test using dehydrated nitrogen or a mixture of nitrogen and refrigerant used for the system, helium leak test.
- Connect the compressor to the system by opening the valves.
- The duration of the test must be sufficient to guarantee the absence of very small leaks in the circuit.
- Use specific tools, designed for leak detection.
- The low-pressure side test pressure must not exceed pressure Ps indicated on the compressor and unit name plates.
- If there is a leak, repair it and carry out the leak detection test again.

15.6 - Evacuation

To evacuate the system, observe the following recommendations:

Connect the vacuum pump to the high (HP) and low-pressure (LP) side for evacuation of the complete circuit. Never use the compressor as a vaccum pump.

All units are equipped with valves with 3/8" SAE connections on the suction, discharge and liquid lines, permitting the connection of large-diameter flexible pipes limiting the pressure drops for the evacuation.

1. The vacuum level achieved must be 0.67 mbar (500 µm Hg).
2. Wait 30 minutes.
3. If the pressure increases rapidly, the system is not leak-tight. Localise and repair the leaks. Restart the evacuation procedure and repeat steps 1, 2, etc.
4. If the pressure increases slowly, this indicates that moisture is present inside the system. Break the vacuum with nitrogen and restart the evacuation procedure (steps 1, 2, etc.).
5. Repeat the evacuation procedure (steps 1, 2); a vacuum level of 0.67 mbar (500 µm Hg) must be achieved and maintained for four hours.
6. This vacuum level must be measured at one of the system connections and not at the vacuum pump pressure gauge.

Do not use a megohmmeter and do not place any stress on the compressor motor when the system has been evacuated. There is a risk of internal short circuits between the motor windings.

Do not use additives for leak detection. Do not use CFCs/ HCFCs as tracer fluids for leak detection.

15.7 - Recharging liquid refrigerant

The units are charged with liquid R-410A refrigerant.

With high-pressure R-410A refrigerant the unit operating pressure is above 4000 kPa (40 bar). Special equipment must be used when working on the refrigerant circuit (pressure gauge, charge transfer, etc.).

All checks must be pressure tests, and the appropriate pressure/temperature ratio table must be used to determine the corresponding saturated temperatures (saturated bubble point curve or saturated dew point curve).

Leak detection is especially important for units charged with refrigerant R-410A. Depending on whether the leak occurs in the liquid or in the vapour phase, the proportion of the different components in the remaining liquid is not the same.

NOTE: Regularly carry out leak checks and immediately repair any leak found.

15.8 - Characteristics of R-410A

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

15.9 - Electrical maintenance

When working on the unit comply with all safety precautions described in section 1.3.

It is strongly recommended to change the unit fuses every 15000 operating hours or every three years.

It is recommended to verify that all electrical connections are tight:

- After the unit has been received at the moment of installation and before the first start-up
- One month after the first start-up,when the electrical components have reached their nominal operating temperatures
- Then regularly once a year.

15.10 - Tightening torques for the main electrical connections

Component	Designation in the unit	Value (N,m)
Screw (PE) customer connection M8	PE	14,5
Screw on switch inlet zones		
Switch - MG 28904	QS_	8
Tunnel terminal screw, compressor contactor		
Contactor LC1D12B7	KM(1)	1,7
Contactor LC1D18B7	KM(1)	1,7
Contactor LC1D25B7	KM(1)	2,5
Tunnel terminal screw, compressor circuit breaker		
Circuit breaker 25507	QM(1)	3,6
Circuit breaker 25508	QM(1)	3,6
Circuit breaker 25509	QM(1)	3,6
Tunnel terminal screw, control power transformer		
Transformer - ABL6TS16B	TC	0,6
Compressor earth terminal in the power wiring control box		
M6	Gnd	5,5
Compressor earth connection		
M8	Gnd	2,83
Tunnel terminal screw, pump disconnect switch		
Disconnect switch GV2ME08	QM_	1,7
Disconnect switch GV2ME10	QM_	1,7
Tunnel terminal screw, pump contactor		
Contactor LC1K0610B7	KM	0,8 to 1,3
Contactor LC1K09004B7	KM	0,8 to 1,3
Contactor LC1K0910B7	KM	0,8 to 1,3
Contactor LC1K0901B7	KM	0,8 to 1,3
Variable-frequency switch ATV21	GS	1,3

15.11 - Tightening torques for the main bolts and screws

Screw type	Used for	Torque (N·m)
M8 nut	BPHE(1) fixing	15
M10 nut	Compressor mounting	30
Oil nut	Oil equalisation line	100
Taptite screw M6	Panel fixing	7
H M6 screw	Stauff clamps	10

(1) BPHE = Brazed plate heat exchanger

15.12 - Compressors

The compressors do not require any specific maintenance. Nevertheless the preventive system maintenance operations prevent specific compressor problems. The following periodic preventive maintenance checks are strongly recommended:

- Check the operating conditions (evaporating temperature, condensing temperature, discharge temperature, heat exchanger temperature difference, superheat, subcooling). These operating parameters must always be within the compressor operating range.
- Check that the safety devices are all operational and correctly controlled.
- Check oil level and quality. If there is a colour change in the sight glass, check the oil quality. This may include an acidity test, moisture control, a spectrometric analysis etc.
- Check the leak tightness of the refrigerant circuit.
- Check the compressor motor power input, as well as the voltage imbalance between phases.
- Check the tightening of all electrical connections.
- Ensure that the compressor is clean and runs correctly; verify that there is no rust on the compressor shell and no corrosion or oxidation at the electrical connections and the piping.

The compressor and piping surface temperatures can in certain cases exceed 100°C and cause burns. Particular caution is required during maintenance operations. At the same time, when the compressor is in operation, the surface temperatures can also be very cold (down to -15°C for units with a low leaving water temperature), and can cause frost burns.

15.13 - Evaporator and condenser maintenance

There is no particular maintenance necessary on the plate heat exchanger. Check:

- That the insulating foam has not become detached or damaged during work on the units
- That the entering and leaving water temperature sensors are well connected
- The cleanliness on the water heat exchanger side (no signs of leaks).
- That the periodic inspections required by local regulations have been carried out.

15.14 - Corrosion check

All metallic parts of the unit (chassis, casing panels, control boxes, heat exchangers etc.) are protected against corrosion by a coating of powder or liquid paint. To prevent the risk of blistering corrosion that can appear when moisture penetrates under the protective coatings, it is necessary to carry out periodic checks of the coating (paint) condition.

All maintenance operations must be carried out by technicians who have been trained on manufacturer products, observing all quality and safety standards.

16.1 - Maintenance schedule

Regular maintenance is indispensable to optimise equipment operating life and reliability. Maintenance operations must be carried out in accordance with the schedules below:

Service	Frequency
A	Weekly
B	Monthly
C	Annually
D	Special cases

If the equipment does not operate normally during maintenance operations, refer to the chapter on diagnostics and breakdowns of the DYNACIAT™ LG/LGN Connect'Touch control manual.

According to the selected maintenance type, the unit shall rise an alert (13004, Partial):

- 15 days before the estimated checking date if check < 3 months
- 21 days before the estimated checking date if check > 3 months.

Before each equipment maintenance operation please ensure that:

- **The unit is in the OFF position**
- **It is impossible for the unit to restart automatically during maintenance.**

16.2 - Description of the maintenance operations

The equipment is supplied with polyolester oil (POE). Use only the manufacturer-approved oil. On request the manufacturer can carry out an oil analysis of your installation.

Service A

Full-load operating test

Verify the following values:

- Compressor high-pressure side discharge pressure
- Compressor low-pressure side suction pressure
- Charge visible in the sight glass
- Temperature difference between the heat exchanger water entering and leaving temperature.

Verify the alarm status

Service B

CIAT out the operations listed under Service A.

Refrigerant circuit

- Full-load operating test. In addition to the operations described under Service A, check the following values:
- Compressor discharge pressure
- Compressor oil level
- Actual liquid subcooling
- Overheating at the expansion device
- Verify the charge status by checking the colour indicator of the sight glass. If the colour has turned to yellow, change the charge and replace the filter drier cartridges after carrying out a leak test of the circuit.

Electrical checks

- Check the tightening of the electric connections, contactors, disconnect switch and transformer.
- Check the phase direction upstream of the unit and in the customer's electrical data table.
- Check the status of the contactors and fuses.
- Carry out a quick test (refer to the DYNACIAT™ LG/LGN Connect'Touch control manual).

Mechanical checks

- Verify the correct operation of the evaporator and condenser pumps with the Quick Test function.
- Verify the correct operation of cooling fans, speed converter and condensing pumps.

Water circuit checks

- Check the leak-tightness of the circuit.

Service C

- Carry out the operations listed under Service B.

Refrigerant circuit

- Check the leak-tightness of the circuit and ensure that there is no piping damage.
- Carry out an oil contamination test. If acid, water or metallic particles are present, replace the oil in the circuit.
- Verify the tightening of the thermostatic mechanism of the expansion device.
- Full-load operating test. In addition to the checks carried out under Service B, validate the value between leaving water and the saturated evaporating temperature.
- Check the operation of the high-pressure switch(es). Replace them if there is a fault.
- Check the fouling of the filter drier (by checking the temperature difference in the copper piping). Replace it if necessary.

Electrical checks

- Check the status and insulation of the electrical cables.
- Check the phase/earth insulation of the compressors and pumps.
- Check the compressor and pump winding status.

Mechanical checks

- Check that no water has penetrated into the control box.
- Clean the filter of the air inlet grille and if necessary replace the filter.
- Water circuit checks
- Clean the water filter.
- Purge the circuit with air.
- Verify the correct operation of the water flow switch.
- Check the status of the thermal piping insulation.
- Check the water flow by checking the heat exchanger pressure difference (using a pressure gauge).
- Check the concentration of the anti-freeze protection solution (ethylene glycol or polyethylene glycol).
- Check the heat transfer fluid status or the water quality.
- Check the steel pipe corrosion.

17 - FINAL SHUTDOWN

17.1 - Shutting down

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

17.2 - Recommendations for disassembly

Use the original lifting equipment.

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

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

17.3 - Fluids to be recovered for treatment

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

17.4 - Materials to be recovered for recycling

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

17.5 - Waste electrical and electronic equipment (WEEE)

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

18 - START-UP CKECKLIST FOR UNITS (USE FOR JOB FILE)

Preliminary information

Job name:.....
Location:.....
Installing contractor: .....
Distributor: .....
Start-up preformed by:.....

Equipment

Model:.....Serial No.....

Compressors

1.Model No. ..... 2. Model No. .....
Serial No. ..... Serial No. .....
Motor No. ..... Motor No. .....

Evaporator

Model No. ..... Manufactured by .....
Serial No. ..... Date .....

Condensers

Model No. ..... Manufactured by .....
Serial No. ..... Date .....
Additional air handling units and accessories.....
.....

Preliminary equipment check

Is there any shipping damage? ..... If so, where? .....
Will this damage prevent unit start-up? .....
☐ Unit is level in its installation
☐ Power supply agrees with the unit nameplate
☐ Electrical circuit wiring has been sized and installed properly
☐ Unit ground wire has been connected
☐ Electrical circuit protection has been sized and installed properly
☐ All terminals are tight
☐ All cables and thermistors have been inspected for crossed wires
☐ All plug assemblies are tight

Check air handling systems

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

Unit start-up

☐ CWP starter has been properly interlocked with the unit
☐ Oil level is correct
☐ All discharge and liquid valves are open
☐ Unit has been leak checked (including fittings)
☐ Locate, repair, and report any refrigerant leaks
.....
.....

Check voltage imbalance: AB..... AC.....BC.....
Average voltage = ... (see installation instructions)
Maximum deviation = ... (see installation instructions)
Voltage imbalance =..... .. (see installation instructions)
☐ Voltage imbalance is less than 2.

18 - START-UP CKECKLIST FOR UNITS (USE FOR JOB FILE)

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

☐ All incoming power voltage is within rated voltage range

Check cooler water loop

Water loop volume = ...(litres)
Calculated volume = ...(litres)
☐ Proper loop volume established
☐ Proper loop corrosion inhibitor included..... litres of .....
☐ Proper loop freeze protection included (if required)..... litres of.....
☐ Piping includes electric heater tape, if exposed to the outside
☐ Inlet piping to cooler includes a 20 mesh strainer with a mesh size of 1.2 mm (unit without pump)

Check pressure drop across the evaporator

Entering evaporator = ... (kPa)
Leaving evaporator = ... (kPa)
(Leaving - entering) = ... (kPa)

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

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

Perform TEST function (indicate positive result):

Once power is supplied to the unit, check the display for any alarms, such as phase reversal. Follow the TEST function instructions in the Controls and Troubleshooting literature (follow the procedure in the Controls IOM).

Be sure that all service valves are open, before beginning the compressor test section.

To start the unit

Be sure that all service valves are open, and all pumps are on before attempting to start this machine. Once all checks have been made, move the switch to "LOCAL" or "REMOTE" from "OFF".

☐ Unit starts and operates properly

Temperatures and pressures

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

Evaporator EWT	Ambient temperature .....
Evaporator LWT	Condenser EWT .....
	Condenser LWT .....
Suction pressure, circuit A	Suction pressure, circuit B(1) .....
Discharge pressure, circuit A	Discharge pressure, cicuit B(1) .....
Suction temperature, circuit A	Suction temperature, circuit B(1) .....
Discharge temperature, circuit A	Discharge temperature, circuit B(1) .....
Liquid line temperature, circuit A	Liquid line temperature, circuit B(1) .....
Compressor oil pressure A1(2)	Compressor oil pressure B1(2) .....
Compressor oil pressure A2(2)	Compressor oil pressure B2(2) .....

(1) if available and installed
(2) if installed

NOTES:

.....
.....

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