



## INSTALLATION, OPERATING AND MAINTENANCE INSTRUCTIONS



Variable speed twin-screw liquid chillers

30KAV 500A - 1100A

Nominal cooling capacity: 493 - 1099 kW - 50 Hz

**AQUAFORCE**



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# 1 - SAFETY CONSIDERATIONS

## Units Application Range

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

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

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

## Units Lifetime

They are designed for a theoretical operating life of 15 years based on loads profile defined within the applicable Ecodesign regulations. Beyond this period, the manufacturer recommends to proceed to a fatigue prevention survey on the refrigerating circuit conducted by an operator qualified for the control of pressure equipment. It is recommended to repeat this check every 5 years. This control does not replace the requirements of applicable national regulations.

## Interventions Instructions

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

The procedures in this manual are arranged in the sequence required for installation, start-up, operation and maintenance of the units. Ensure that you follow them and that you take the required safety precautions, including those listed in this guide, which include wearing personal protective equipment (gloves, safety glasses, safety shoes), having the appropriate tools, and employing skilled and qualified technicians (electricians, refrigeration system specialists).

## Units Compliance to applicable directives

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

## 1.1 - Protection devices safety considerations

**Check that the protective devices are well installed before operating the unit.**

**Do not obstruct any protective devices:**

**This applies to any fusible plugs, rupture disks and valves fitted on the refrigerant or energy transfer fluid circuits.**

### Classification and control

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

	Safety device <sup>(1)</sup>	Device for limitation of damage in the event of an external fire <sup>(2)</sup>
<b>Refrigerant side</b>		
High pressure safety loop <sup>(3)</sup>	X	
External relief valve <sup>(4)</sup>		X
Rupture disk		X
<b>Heat transfer fluid side</b>		
External relief valve	(5)	(5)

(1) Classified for protection in normal service situations.

(2) Classified for protection in abnormal service situations. These devices are sized for fires with a thermal flow of 10 kW/m<sup>2</sup>. No combustible matter should be placed within 6,5m of the unit.

(3) High Pressure safety loop = SRMCR as described in section 6.2 and on the wiring diagram.

(4) The instantaneous overpressure limitation of 10% of the operating pressure does not apply to this abnormal service situation.

The set pressure can be higher than the operating pressure. In this case, either the design temperature or the high pressure switch ensures that the operating pressure is not exceeded in normal service situations.

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

**In compliance with the European Pressure Equipment Directive (PED) and national regulations relating to design:**

- **These valves are not safety devices but accessories which limit damage in the event of a fire,**
- **The safety device is the high pressure safety loop described in section 7.1.**

### Fire

**When the unit is subjected to fire, a safety device prevents rupture due to over-pressure by releasing the refrigerant. The fluid may then break down into toxic residues when in contact with flames:**

- **Stay away from the unit;**
- **Ensure the personnel in charge of extinguishing the fire are duly warned and issued with recommendations;**
- **Fire extinguishers appropriate to the system and the refrigerant type must be easily accessible.**

# 1 - SAFETY CONSIDERATIONS

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## Relief Valves - Installation guidelines

Refer to the installation regulations, for example those of European standard EN 378 and EN 13136.

Do not remove valves/fusible plugs, even if the fire risk is under control for a particular installation. There is no guarantee that the accessories have been re-installed if the system is changed or for transport with a gas charge.

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.

## Relief Valves - Indoor Installation guidelines

The external relief valves must always be connected to drain pipes for units installed in a closed room. 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 refrigerant is discharged away from building air intakes, or that it is discharged into a sufficient quantity of absorbent material.

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

## Relief Valves - Drainpipes Installation guidelines

Fit devices at the valve or discharge pipe outlets to prevent the penetration of foreign bodies (dust, building debris, etc.) and atmospheric agents (water can form rust or ice).

These devices, as well as the discharge piping, must not impair operation and not lead to a pressure drop that is higher than 10% of the set pressure.

## Option 194 : Dual relief valve on a changeover valve

If the relief valves are factory-fitted on a changeover valve, this is equipped with a relief valve on each of the two outlets. Only one of the two relief valves is in operation, the other one is isolated. Never leave the changeover valve in the intermediate position, i.e. with both circuits open (move the lever fully forwards or backwards depending on the output to be isolated). If a valve is removed for checking or replacement, make sure there is still a valve active on each of the changeover valves installed on the unit.

## Relief Valves - Leaks

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

It is recommended to install an indicating device to check whether any refrigerant has leaked from the relief valve.

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

## Overpressure Protective Devices - Periodical Checks

- External overpressure devices (external relief valves) must be replaced or checked to ensure that their settings and operation are correct at least every five years or in accordance with national regulations, at the earliest opportunity.
- The high pressure (SRMCR) safety loop must be tested at least once a year to check it is operating correctly; this must include the compressor shut-down and its activation and deactivation values.

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

## High Pressure Switch - Maintenance

The company or organisation that conducts a pressure switch test must establish and implement detailed procedures for:

- Safety measures,
- Measuring equipment,
- Values and tolerances for cut-off and discharge devices,
- Test stages,
- Recommissioning of the equipment.

The manufacturer recommends contacting Carrier Service for this type of test. An example of the test procedure without removing the pressure switch is given in section 11 of this manual.

**WARNING:** *If the test results in the replacement of the pressure switch, it is necessary to recover the refrigerant charge. These pressure switches are not installed on Schraeder type automatic valves.*

## Relief Valves - Maintenance

The valves must be checked periodically.

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

Do not install relief valves in series or backwards.

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## 1.2 - Refrigerant safety considerations

We recommend that standard EN 378-3 Annex 3 is applied.

The refrigerant used in the units in this range is R134a.

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

Detect and repair the leak, check the type of refrigerant in the machine and then recharge the machine/circuit.

### 1.2.1 - Refrigerant toxicity

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

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

Installers, owners and especially service engineers for these units must:

- Create a procedure to ensure medical attention is sought before treating any symptoms;
- Provide first aid equipment, flush the eyes and skin immediately if splashed with refrigerant, and seek medical attention.

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

Use safety goggles and safety gloves.

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

### 1.2.2 - Refrigerant & Oil charges transfer & storage

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

The standard NF E29-795 describes the regulations permitting conditioning and recovery of halogenated hydrocarbons under optimum conditions for the product and optimum safety conditions for people, property and the environment. If any damage is caused to the equipment, the refrigerant must be changed in accordance with this standard, or an analysis of the fluid must be performed by a specialist laboratory.

#### Transfer Service Valves

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

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

#### Refrigerant Charge removal

**Do not siphon refrigerant.** The compressors cannot transfer the whole refrigerant charge and can be damaged if used to pump-down. The refrigerant charge should not be transferred to the high-pressure side.

#### Refrigerant Charge filling

Charging any refrigerant other than the original type will impair machine operation and can even cause irreparable damage to the compressors.

Charge the machine/circuit with the total Charge, as indicated on the unit nameplate. Do not top up the refrigerant charge. Only charge the liquid refrigerant given on the nameplate at the liquid line.

#### Oil Charge filling

The compressors operating with this refrigerant type are lubricated with a synthetic polyolester oil which are completely incompatible with mineral oils.

#### Storage containers

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

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

#### **OPERATING CHECKS:**

- **IMPORTANT: This product contains R134a which is an HFC gas which are fluorinated greenhouse gases covered by the Kyoto protocol (1997).**
- **Type of fluid: Refer to the nameplate.**
- **Global Warming Potential (GWP) following AR4 : 1430.**

#### **WARNING:**

1. ***All interventions on this product's refrigerant circuit must be performed in accordance with applicable legislation. Within the European Union, this legislation notably includes regulation No. 2024/573/UE known as F-Gas.***
2. ***Ensure that the refrigerant is never released to the atmosphere during installation, maintenance or equipment disposal.***
3. ***Deliberate refrigerant release into the atmosphere is not allowed.***
4. ***If a refrigerant leak is detected, ensure that the leak is repaired quickly.***
5. ***Only certified, qualified personnel are permitted to install, service and perform leak tightness tests on the refrigerant circuit, decommission the equipment and recover the refrigerant.***
6. ***The operator must ensure that any refrigerant recovered is recycled, regenerated or destroyed.***



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## 7. The operator is bound by the obligation to perform leak tightness tests, or have these performed, at regular intervals. Regulations within the European Union have set the following intervals:

CO <sub>2</sub> equivalent refrigerant charge/ circuit		< 5 tons	5 ≤ charge < 50 tons	50 ≤ charge < 500 tons	Charge > 500 tons <sup>(1)</sup>
Refrigerant charge/ circuit (kg)	R-134a <sup>(2)</sup> (GWP 1430, following AR4)	Charge < 3,5 kg	3,5 ≤ charge < 34,9 kg	34,9 ≤ charge < 349,7 kg	Charge > 349,7 kg
System WITHOUT leakage detection		No check	12 months	6 months	3 months
System WITH leakage detection		No check	24 months	12 months	6 months

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

(2) Fluorinated greenhouse gas covered by the Kyoto protocol and the F-gas N°2024/573/UE

## 8. For all equipment subject to regular leak tightness tests, the operator must keep a log used to record the following: The quantities and types of fluids contained in the system (added and recovered), the quantity of fluid recycled, regenerated or destroyed, the date and results of the leak tightness tests, the details of the technician and of the company performing the work, etc.

## 9. Contact your local dealer or installer if you have any questions.

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

Check regularly for leaks and repair immediately.

### 1.3 - Installation safety considerations

The units are classified as “indirect heat exchange systems” and are designed to be installed in a special location (class C in accordance with ISO-5149 and EN-378) which only authorized personnel are permitted to access; this personnel must be aware of the general and special safety precautions for the establishment, and must also be qualified and trained in surveillance and maintenance. The customer is responsible for installing the access restriction device.

The chiller must be located at least 6 m from the nearest entrance to the building and must be installed in a room where air is able to circulate freely. No charge limitation applies to class “C” occupancy level for R-134a. Refer to these standards for further details. This level must be confirmed by the customer.

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

An extinguisher must be accessible and visible close to the unit installation area.

#### Pressure equipment and components

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

These units comply with the European Pressure Equipment Directive.

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

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

- Follow the regulations on monitoring pressure equipment.
- The user or operator is usually required to create and maintain a monitoring and maintenance log.
- In the absence of any regulations, or in addition to the regulations, follow the guidance in EN 378.
- Follow the local professional recommendations, whenever they exist.
- Regularly inspect the condition of the coating (paint) on the surface of the components to detect blistering resulting from corrosion. To do this, check an uninsulated part of the vessel, or for rust drips at a joint in the insulation.
- Regularly check for the presence of any impurities (e.g. sand, grit) in the heat transfer fluids. These impurities can cause wear and/or pitting corrosion.
- Filter the heat-transfer fluid and carry out internal inspections as described in EN 378-2 Appendix C.
- The reports of the periodical checks by the user or the operator must be included in the monitoring and maintenance log.
- In case of re-testing, please refer to the maximum operating pressure given on the unit nameplate.

**NOTE: Pressure equipment for the hydraulic side (optional) are delivered as separate items. Their integration in the complete hydraulic installation remain under the user's responsibility.**

#### Repair:

**Any repair or modification, including replacement of removable parts:**

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

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



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## Recycling:

- The unit is fully or partially recyclable. After use, it may contain refrigerant vapors and oil residues. Some parts are painted.

## Corrosion build-up :

Below thickness values are applicable on evaporator shell-and-tube heat exchanger and on oil separator :

Gaseous refrigerant side: 0 mm

Heat-transfer medium side:

- 1 mm for tube sheets in lightly alloyed steels,
- 0 mm for stainless steel plates or plates with copper-nickel or stainless-steel protection.

Water-box : 1 mm

Parts painted : 0 mm.

If any part of the piece (with 0mm of acceptable corrosion) shows corrosion, change the piece.

## 1.4 - Maintenance safety considerations

### Maintenance Logbook

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

Operation		Name of the commissioning engineer	Applicable national regulations	Verification organisation
Date	Nature <sup>(1)</sup>			

(1) Maintenance

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

### Qualifications Requirements

All welding operations must be performed by qualified welders.

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

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

### Personal Protective Equipment

Technicians working on the units must be equipped as follows:

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

(1) We recommend compliance with the instructions in the EN 378-3 standard.

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

The necessary protective equipment must be available.

It is compulsory to wear ear protection when working near the unit and the unit is in operation.

Appropriate fire extinguishers for the system and the refrigerant type used must be within easy reach.

### Refrigerant Circuit opening

Before opening a refrigerant circuit, drain and consult the pressure indicators.

If the refrigerant circuit remains open after an intervention (such as a component replacement, etc.):

- Seal the openings if the duration is less than a day.
- Beyond this time, charge the circuit with a dry, inert gas (nitrogen).

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

## 1.5 - Electrical safety considerations

ELECTRICAL RISK: 

Never work on a unit that is still energized.

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

**WARNING: Even if the unit is stopped, the power circuit remains energized, unless the unit or circuit disconnect switch is open. Refer to the wiring diagram for further details. Follow the appropriate safety guidelines.**

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

### Variable Frequency Drives (VFD)

An internal fault with the compressor variable frequency drive can cause serious injury if the variable frequency drive has not been closed correctly: it is essential to ensure that all covers are in place and correctly secured before switching on the power supply to the unit.

**WARNING: The variable frequency drives (VFD) fitted to the units have circuit capacitors which take twenty (20) minutes to discharge after the power supply is disconnected.**

After disconnecting the power supply to the electrical box, wait for twenty minutes before accessing the electrical box or VFD. This value is a guide and may differ from one VFD to another: refer to the information given on the VFD to find out the precise value.

### Option 295+ : Ultra Fast Capacity Recovery Module

**WARNING : When option 295+ for Ultra Fast Capacity recovery is present, energy is stored inside the equipment and 24Vdc voltage is present even if the main disconnect switch was switched off. Refer to section describing option 295+ in this document for more explanations.**

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## Option 329 : Compressor with Permanent Magnet motor



**WARNING:** The compressors on units feature motors with permanent magnets. Do not open the compressor. Ensure that the terminal box is securely fixed in place before filling the machine with refrigerant, draining the refrigerant or rotating the motor shaft. The compressor cannot be removed.

**WARNING:** Strong magnetic field inside the compressor casing. An electrical current may be generated on the compressor terminals and on the circuits which are connected when filling/emptying the refrigerant.

## 1.6 - System interventions safety considerations

Equip the engineers that work on the unit with the protections described in section 1.4 above.

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

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

### **RISK OF EXPLOSION:**



#### Oxygen Reaction

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

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

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

#### Maximum Pressure Levels

**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.**

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

#### Overpressure - Refrigerant Heating

**Do not clean the unit with hot water or steam. This may cause the refrigerant pressure to rise.**

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

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

## Refrigerant Circuit interventions

**Do not attempt to remove refrigerant circuit components or fittings, while the machine is under pressure or while it is running. Make sure the circuit pressure is zero and that the unit has been shut down and de-energised before removing components or opening a circuit. When the refrigerant circuit is opened to repair, see the recommendations in chapter "Maintenance safety considerations".**

### RISK OF FALLING

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

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

**Use a platform, or staging to work at higher levels.**

### MOVING PARTS : Propeller

When working close to the condenser fans, particularly when removing the grilles, ensure that the power supply to the fans is switched off to ensure they cannot run.

### Components Handling

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

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

### Hydraulic Circuit interventions

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

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

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

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

## 2 - RECEIPT OF GOODS

### 2.1 - Checking the equipment received

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

Compare the name plate data with the order.

The name plate is attached in two places to the unit:

- On the outside of one of the unit frames,
- On the electrical cabinet, inside.

The unit name plate must include the following information:

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

### 2.2 - Handling

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

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

#### Forklift truck

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

#### Units Slinging

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

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

**WARNING: Only attach slings to the designated lifting points which are marked on the unit.**

See the slinging plan for each machine in section 3 and in appendix 4.

#### Units Lifting

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

Safety can only be guaranteed if these instructions are carefully followed. Failure to do so may result in damage to the equipment and physical injury.

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

**WARNING: Never apply pressure or leverage to any of the unit's panels or uprights; only the base of the unit frame is designed to withstand such stresses. No force or effort must be applied to pressurized parts, especially via pipes connected to the water-cooled heat exchanger.**

### 2.3 - Positioning

#### 2.3.1 - Location

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

This machine is not intended to operate in an ATEX area.

The machine must be installed outdoors (open space). The volume of air supplied to the condenser coils must not be restricted to ensure the operation of the machine is not adversely affected.

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

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

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

Before positioning the unit, check that:

- The chosen location can support the weight of the unit, or that appropriate reinforcement measures have been taken,
- The unit is installed level on an even surface (maximum tolerance is 5 mm along both axes),
- If the support structure is sensitive to vibration and/or noise transmission it is advisable to insert anti-vibration mounts (elastomer mounts or metal springs) between the unit and the structure. Selection of these devices is based on the system characteristics and the comfort level required and should be made by technical specialists,
- There is adequate space above and around the unit for air to circulate and for access to the components (see dimensional drawings),
- The number of support points is adequate and that they are in the right places,
- If the optional anti-vibration mounts are present, their number and position must comply with the indications given on the certified dimensional drawing.,
- The location is not subject to flooding,
- For outdoor applications, avoid installing the unit in a location where snow is likely to accumulate (in areas subject to long periods of sub-zero temperatures, the unit should be raised),
- Baffles may be necessary to deflect strong winds. However, they must not restrict air flow into the unit,

Refer to the unit name plate to find out the machine weight.

Refer to the certified dimensional drawings (appendix 4), provided with the unit or available on request, when designing an installation.

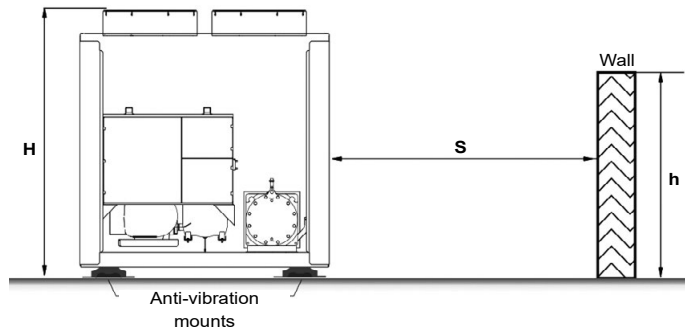
## 2 - RECEIPT OF GOODS

### 2.3.2 - Air Circulation

#### Proximity to walls

To guarantee correct operation in most cases:

- If  $h < H$  (2,3 m), minimum  $S = 3$  m
- If  $h > H$  or  $S < 3$  m, contact your Carrier distributor to assess the various installation options. An accessory (available for sale as a spare part) can be added to the unit in certain situations.



#### Underneath a roof

The upper part of the machine (on top of the fans) must not be covered.

If the floor space requires the machine to be partially covered, contact your Carrier distributor to assess the various installation options.

#### Installation of multiple chillers

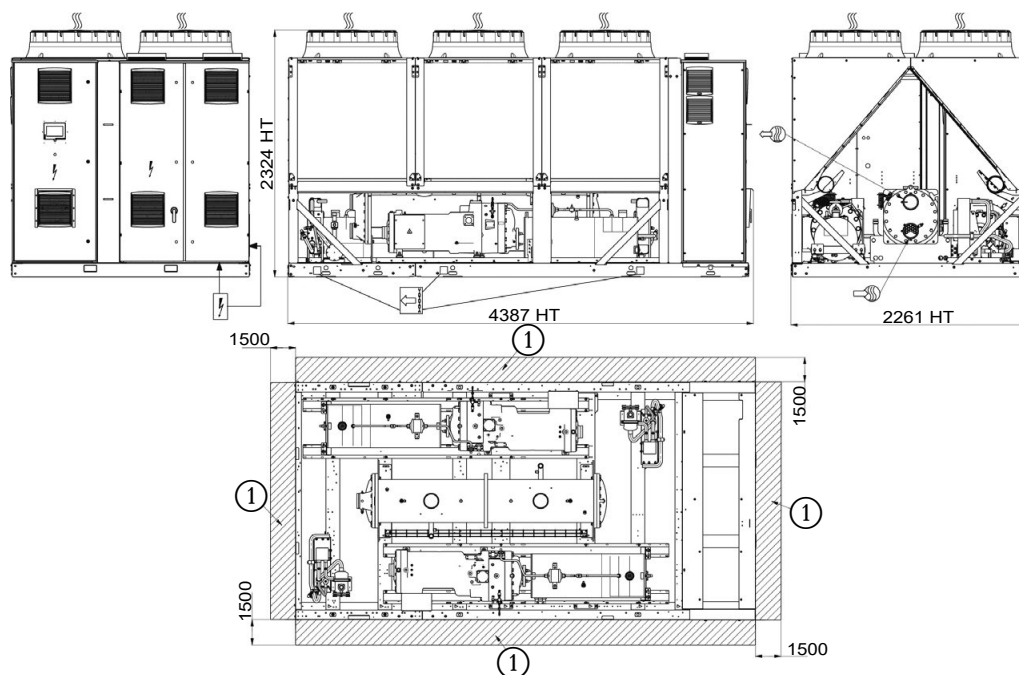
It is recommended that multiple chillers are installed in a single row, arranged as shown in the example below, to avoid warm air being recycled from one unit to another.



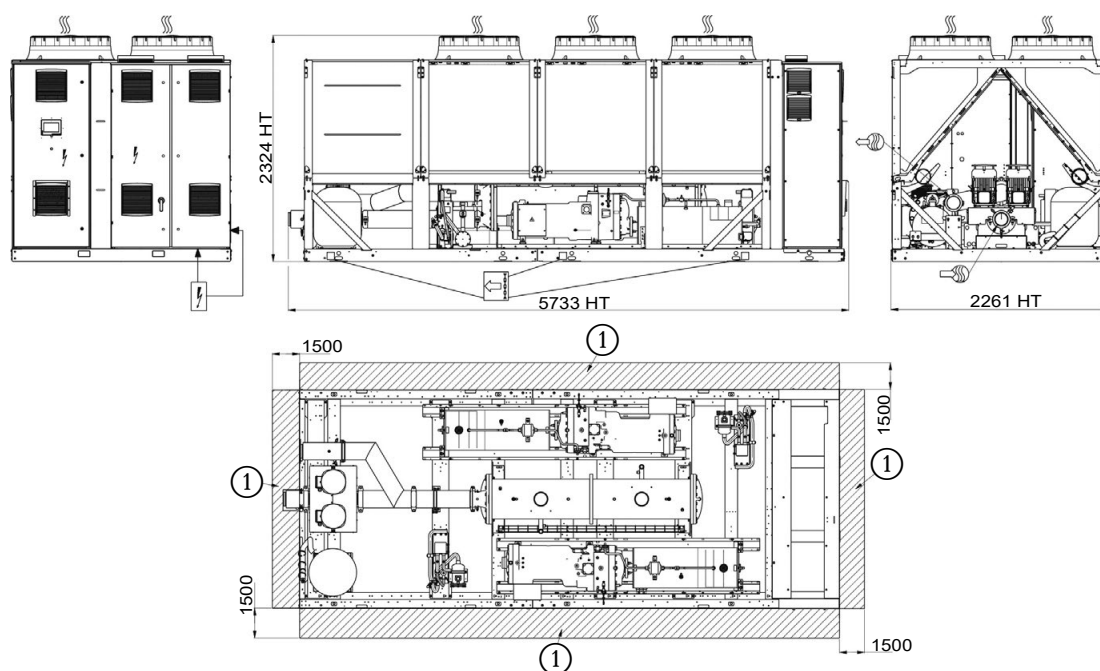
If the floor space does not allow this arrangement, contact your Carrier distributor to assess the various installation options.

### 3 - DIMENSIONS, CLEARANCES

#### 3.1 - 30KAV 500A & 550A, without hydraulic module



#### 3.2 - 30KAV 500A & 550A, with hydraulic module



#### Key

All dimensions are given in mm

① Clearances required for maintenance (see Note)

Water inlet for standard units

Water outlet for standard units

Air outlet, do not obstruct

Power supply connection

Sling points

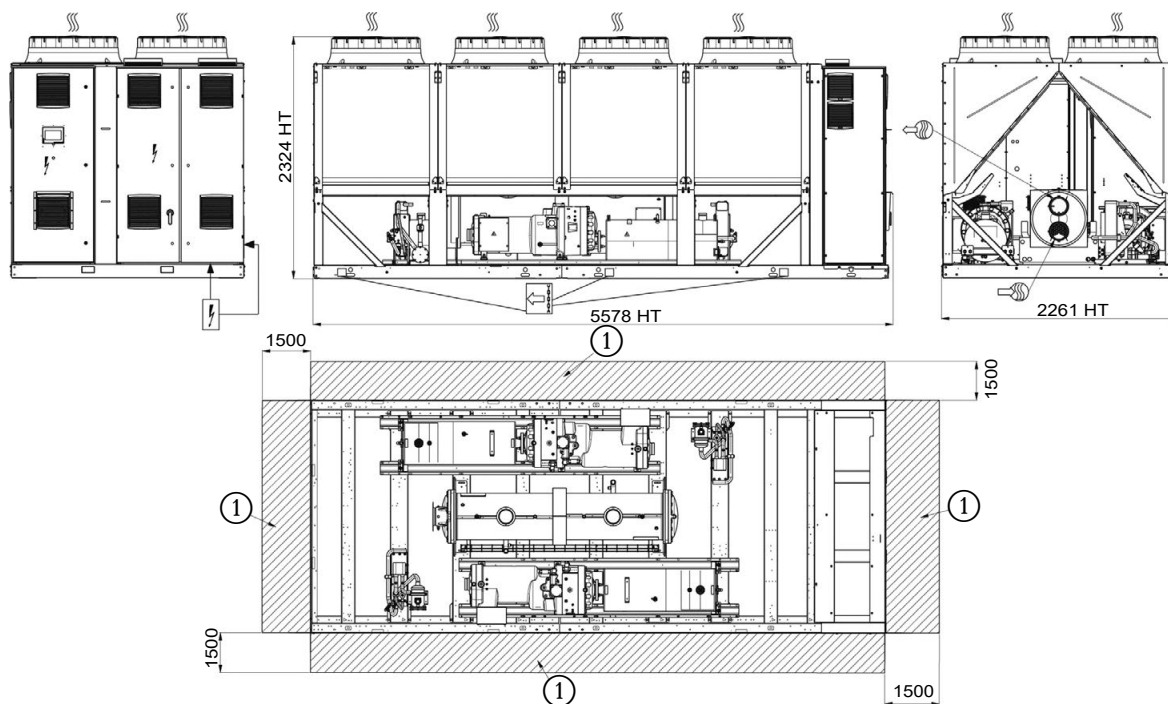
#### NOTE:

Non-contractual drawings.

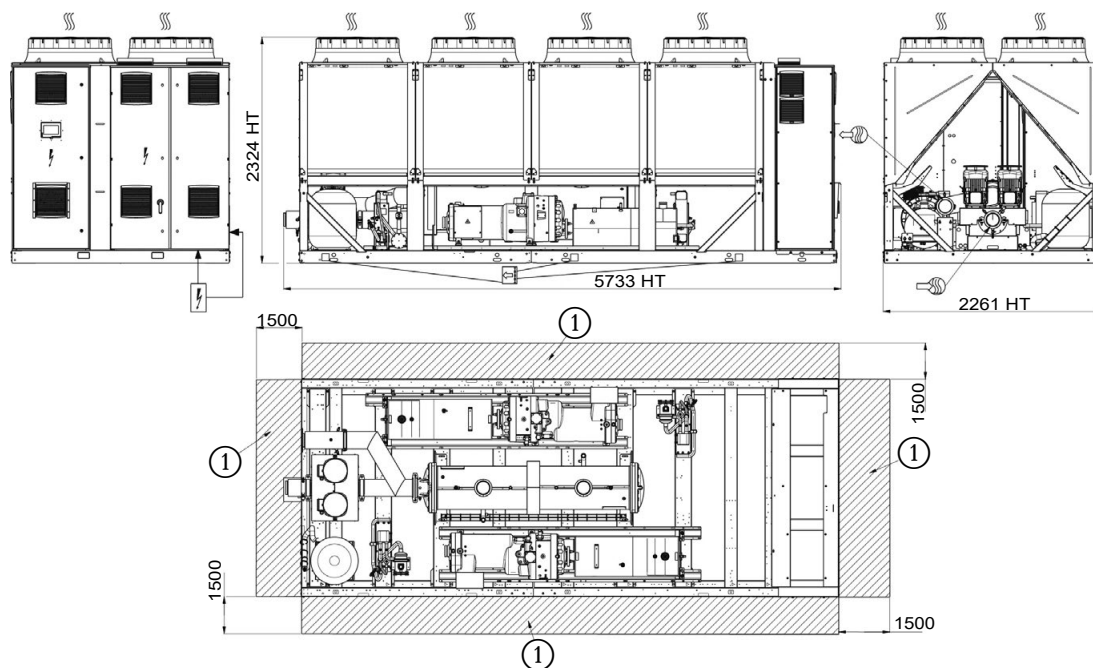


### 3 - DIMENSIONS, CLEARANCES

#### 3.3 - 30KAV 600A & 650A, without hydraulic module








#### 3.4 - 30KAV 600A & 650A, with hydraulic module



#### Key

All dimensions are given in mm

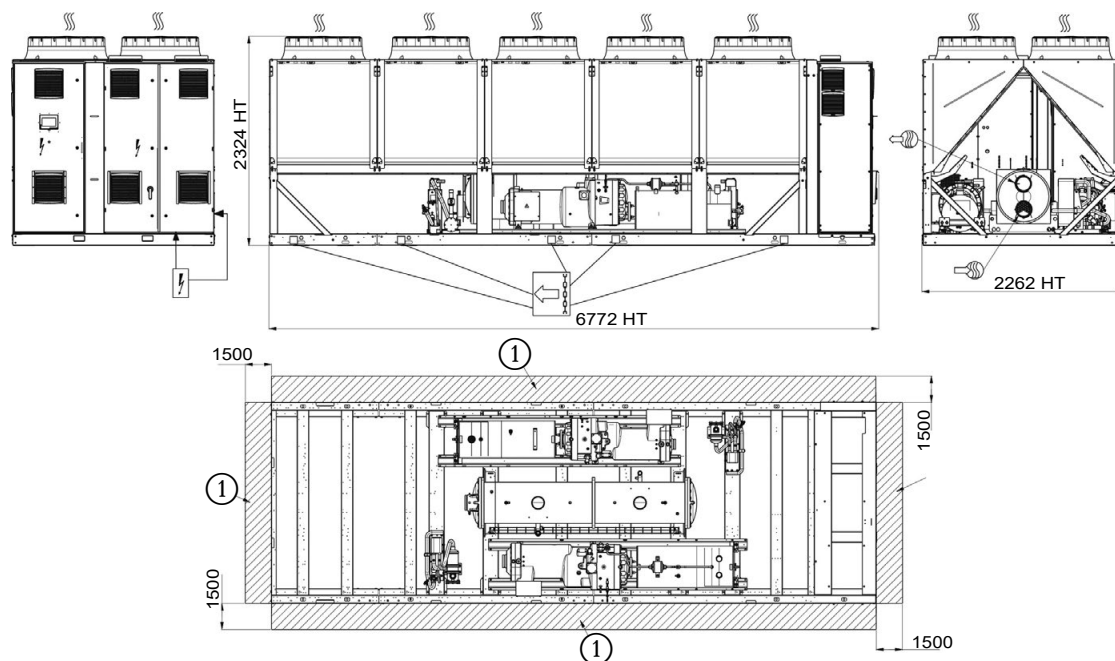
- ① Clearances required for maintenance (see Note)
-  Water inlet for standard units
-  Water outlet for standard units
-  Air outlet, do not obstruct
-  Power supply connection
-  Sling points

#### NOTE:

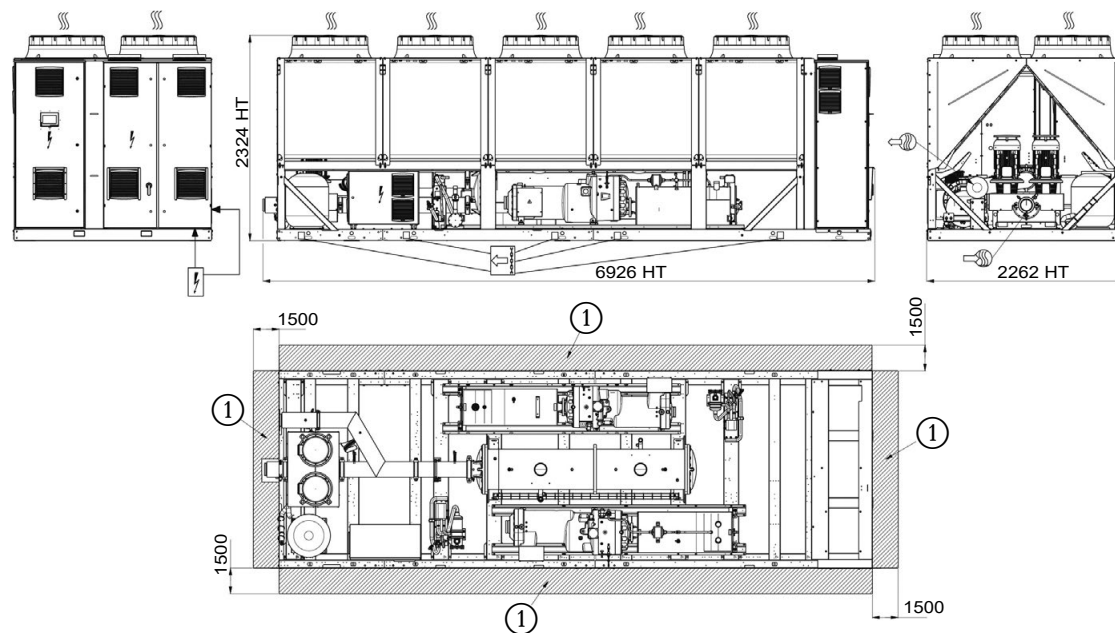
Non-contractual drawings.

### 3 - DIMENSIONS, CLEARANCES

#### 3.5 - 30KAV 720A & 800A ; 30KAV 500A, 550A, 600A, 650A - opt 119 ; without hydraulic module



#### 3.6 - 30KAV 720A & 800A ; 30KAV 500A, 550A, 600A, 650A - opt 119 ; with hydraulic module



#### Key

All dimensions are given in mm

① Clearances required for maintenance (see Note)

Water inlet for standard units

Water outlet for standard units

Air outlet, do not obstruct

Power supply connection

Sling points

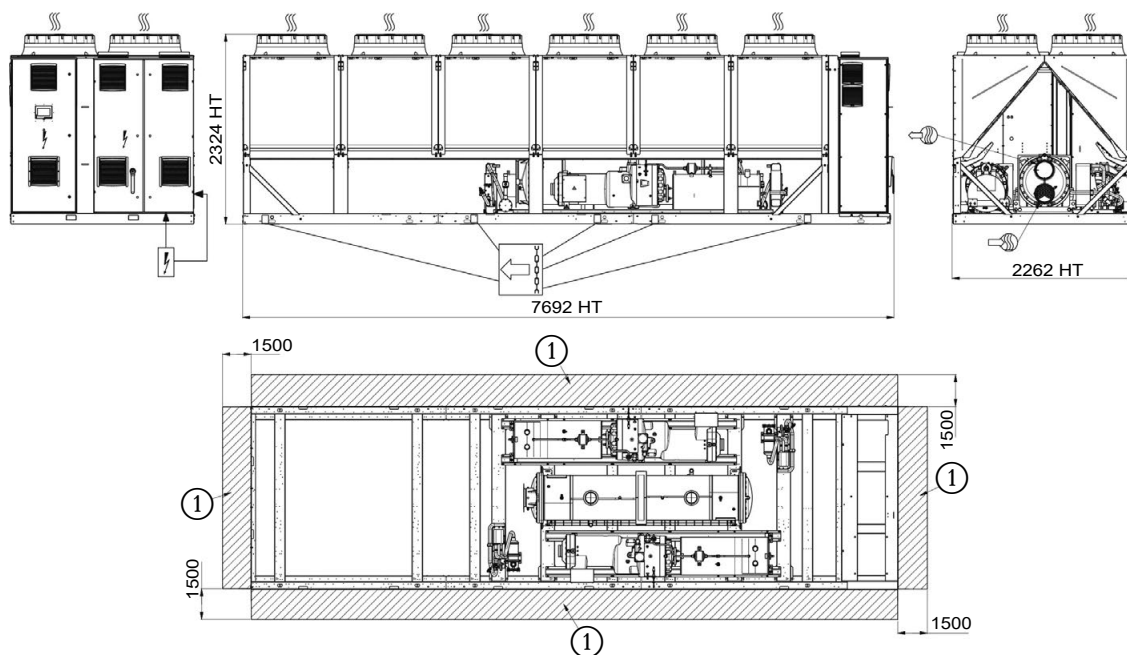
#### NOTE:

Non-contractual drawings.

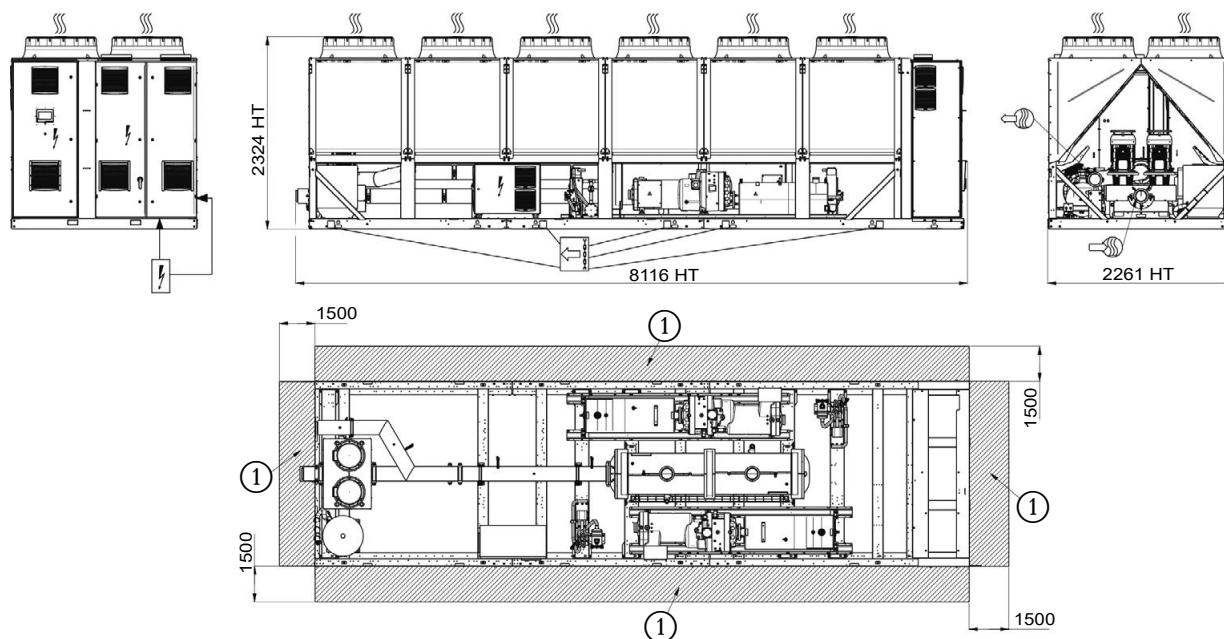


### 3 - DIMENSIONS, CLEARANCES

#### 3.7 - 30KAV 900A & 1000A ; 30KAV 720A - opt 119 ; without hydraulic module



#### 3.8 - 30KAV 720A - opt 119 ; with hydraulic module



#### Key

All dimensions are given in mm

① Clearances required for maintenance (see Note)

Water inlet for standard units

Water outlet for standard units

Air outlet, do not obstruct

Power supply connection

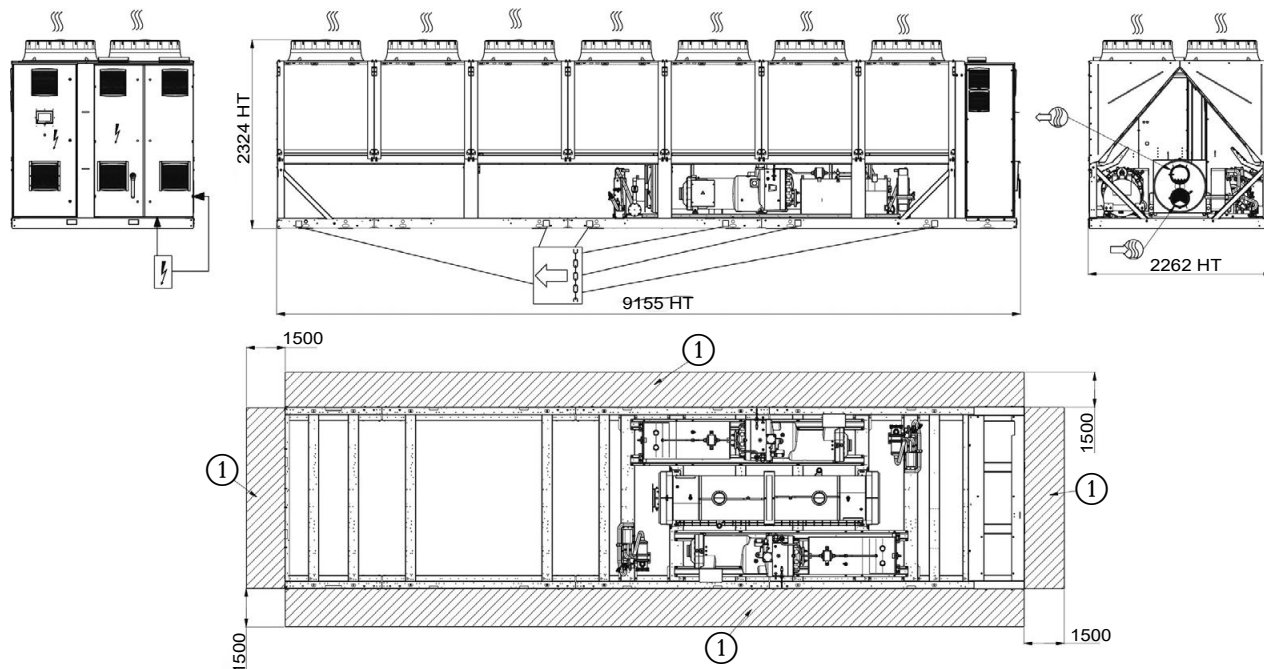
Sling points

#### NOTE:

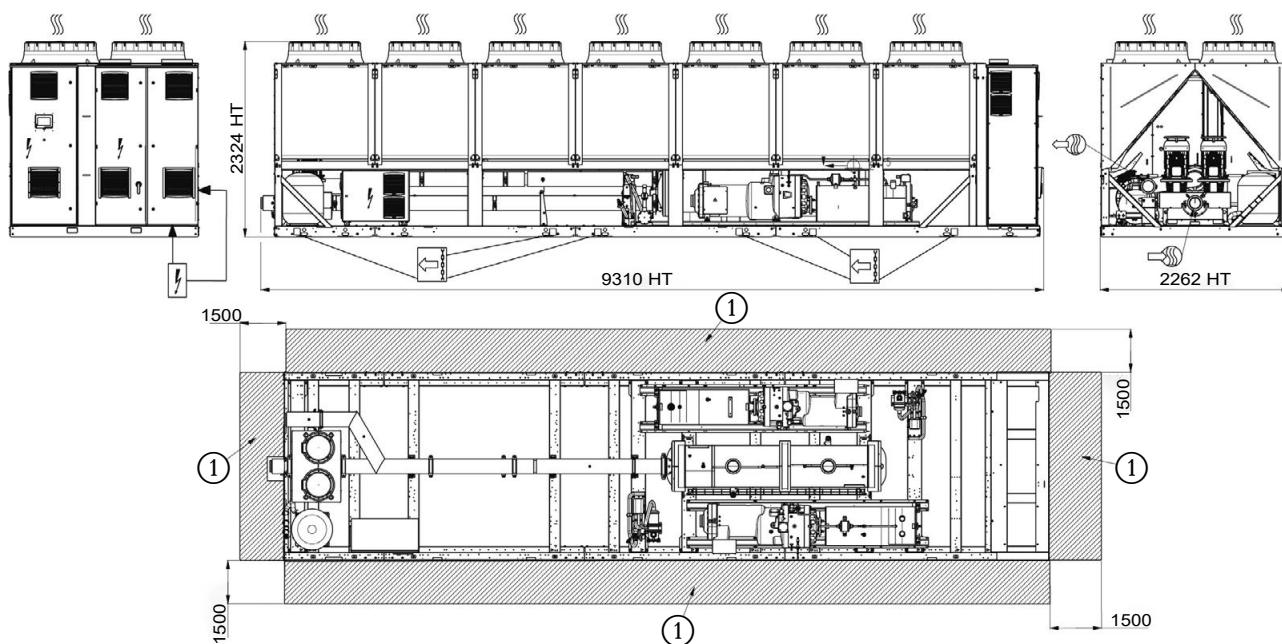
Non-contractual drawings.

### 3 - DIMENSIONS, CLEARANCES

#### 3.9 - 30KAV 1100A ; 30KAV 800A & 900A - opt 119 ; without hydraulic module



#### 3.10 - 30KAV 800A - opt 119 ; with hydraulic module



#### Key

All dimensions are given in mm

① Clearances required for maintenance (see Note)

Water inlet for standard units

Water outlet for standard units

Air outlet, do not obstruct

Power supply connection

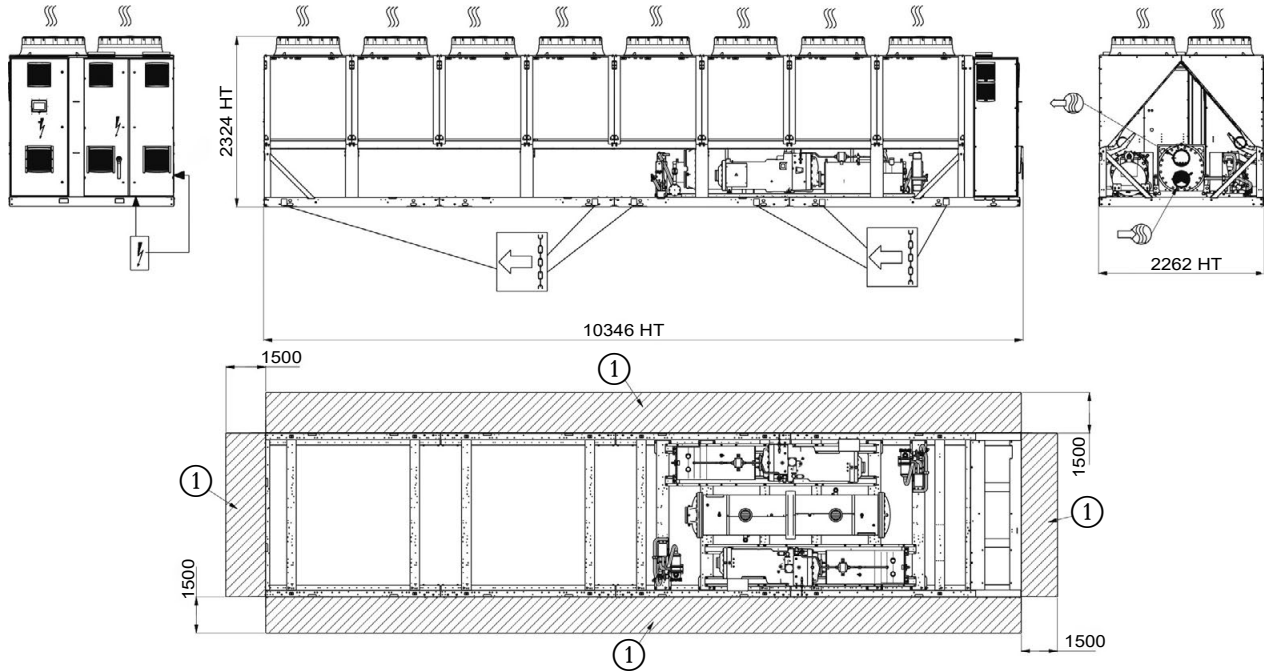
Sling points

#### NOTE:

Non-contractual drawings.






### 3 - DIMENSIONS, CLEARANCES

#### 3.11 - 30KAV 1000A & 1100A - opt 119



#### Key

All dimensions are given in mm

- ① Clearances required for maintenance (see Note)
-  Water inlet for standard units
-  Water outlet for standard units
-  Air outlet, do not obstruct
-  Power supply connection
-  Sling points

#### NOTE:

**Non-contractual drawings.**

## 4 - PHYSICAL DATA

### 4.1 - Physical data

#### 4.1.1 - Physical data of standard units

30KAV		500A	550A	600A	650A	720A	800A	900A	1000A	1100A
Sound levels										
Standard unit										
Sound power <sup>(1)</sup>	dB(A)	95	95	96	98	99	98	99	98	100
Sound pressure at 10 m <sup>(2)</sup>	dB(A)	63	63	64	65	66	65	67	65	67
Dimensions										
Standard unit										
Length	mm	4387	4387	5578	5578	6772	6772	7962	7962	9155
Width	mm	2261	2261	2261	2261	2261	2261	2261	2261	2261
Height	mm	2324	2324	2324	2324	2324	2324	2324	2324	2324
Operating weight <sup>(4)</sup>										
Standard unit	kg	4782	4796	5170	5184	5647	6088	6529	6993	7402
Compressors										
Standard unit		06Z twin screw variable speed with AC induction motor and variable frequency drive								
Unit + option 329		06Z twin screw variable speed with AC permanent magnet motor and variable frequency drive								
Circuit A	Quantity	1	1	1	1	1	1	1	1	1
Circuit B	Quantity	1	1	1	1	1	1	1	1	1
Unit minimum part load <sup>(5)</sup>	%	13	13	13	13	13	13	13	12	12
Unit PED Category		III	III	III	III	III	IV	IV	IV	IV
Refrigerant <sup>(4)</sup> - Standard unit		R134a (GWP=1430 following AR 4)								
Circuit A	kg	49	50	56	59	68	81	91	86	89
	tCO <sub>2</sub> e	70	72	80	84	97	116	130	123	127
Circuit B	kg	50	51	57	60	69	61	72	87	90
	tCO <sub>2</sub> e	72	73	82	86	99	87	103	124	129
Oil		Oil for R134a. Contact Carrier ERCD for supplying.								
Circuit A	l	27	26	25	23	20	23	20	23	20
Circuit B	l	27	26	25	23	20	23	20	23	20
Checking the unit		SmartVu™ interface with 7" colour touch screen								
Languages		10 languages (DE, EN, ES, FR, IT, NL, PT, TR, TU + one chosen by the customer)								
Smart energy metering		Standard feature								
Wireless connectivity		Option								
Expansion valve		Electronic expansion valve								
Air-cooled exchanger		Novation™ micro-channel heat exchanger								
Fans										
Standard unit		Flying Bird™ VI impeller variable speed with AC motor and variable frequency drive								
Unit + option 17 <sup>(3)</sup>		Flying Bird™ VI impeller variable speed with EC motor								
Quantity		6	6	8	8	10	10	12	12	14
Maximum total air flow	l/s	35580	35580	47440	47440	59300	59300	71160	71160	83020
Maximum rotation speed	r/s	16,0	16,0	16,0	16,0	16,0	16,0	16,0	16,0	16,0
Water exchanger		Flooded multi-tube type								
Water volume	l	83	88	96	100	115	126	144	165	183
Max. water-side operating pressure without hydraulic module	kPa	1000	1000	1000	1000	1000	1000	1000	1000	1000
Water connections		Victaulic® type								
Standard unit										
Connections	inch	5	5	6	6	6	6	8	8	8
External pipe diameter	mm	141,3	141,3	168,3	168,3	168,3	168,3	219,1	219,1	219,1
Casing paint		Colour code RAL 7035								

- (1) In dB ref=10<sup>-12</sup> W, 'A' weighted. Declared noise emission value in accordance with ISO 4871 with an uncertainty of +/-3 dB(A). Measured in accordance with ISO 9614-1 and certified by Eurovent.
- (2) In dB ref 20µPa, 'A' weighted. Declared noise emission value in accordance with ISO 4871 with an uncertainty of +/-3 dB(A). For information, calculated from the sound power Lw(A).
- (3) Options: 17=Fans motors EC type ; 329=Compressors motors PM type.
- (4) Values are guidelines only. Refer to the unit name plate.
- (5) For standard conditions. Depending on operating conditions, unit might have a different minimum part load or cycle.



Eurovent certified values

CARRIER participates in the ECP programme for LCP-HP Check ongoing validity of certificate: [www.eurovent-certification.com](http://www.eurovent-certification.com)

## 4 - PHYSICAL DATA

### 4.1.2 - Physical data of units with High energy Efficiency option (119 & 119+)

30KAV option 119 & 119+		500A	550A	600A	650A	720A	800A	900A	1000A	1100A
<b>Sound levels</b>										
<b>30KAV_option_119+</b>										
Sound power <sup>(1)</sup>	dB(A)	96	96	97	98	99	98	100	98	100
Sound pressure at 10 m <sup>(2)</sup>	dB(A)	63	63	64	66	66	65	67	65	67
<b>Dimensions</b>										
<b>30KAV option 119</b>										
Length	mm	6772	6772	6772	6772	7962	9155	9120	10346	10346
Width	mm	2261	2261	2261	2261	2261	2261	2261	2261	2261
Height	mm	2324	2324	2324	2324	2324	2324	2324	2324	2324
<b>Operating weight<sup>(4)</sup></b>										
30KAV option 119+	kg	5530	5543	5563	5570	6020	6836	6962	7743	7790
<b>Compressors</b>										
<b>30KAV option 119</b>		06Z twin screw variable speed with AC induction motor and variable frequency drive								
<b>30KAV option 119 + option 329<sup>(3)</sup></b>		06Z twin screw variable speed with AC permanent magnet motor and variable frequency drive								
Circuit A	Quantity	1	1	1	1	1	1	1	1	1
Circuit B	Quantity	1	1	1	1	1	1	1	1	1
Unit minimum part load <sup>(5)</sup>	%	13	13	13	13	13	13	13	12	12
<b>Unit PED Category</b>		III	III	III	III	III	IV	IV	IV	IV
<b>Refrigerant<sup>(4)</sup> - 30KAV option 119</b>		R134a (GWP=1430 following AR 4)								
Circuit A	kg	66	66	63	64	72	93	97	97	98
	tCO <sub>2</sub> e	94	94	90	92	103	133	139	139	140
Circuit B	kg	67	67	63	65	73	73	78	98	99
	tCO <sub>2</sub> e	96	96	90	93	104	104	112	140	142
<b>Oil</b>		Oil for R134a. Contact Carrier ERCD for supplying.								
Circuit A	l	27	26	25	23	20	23	20	23	20
Circuit B	l	27	26	25	23	20	23	20	23	20
<b>Checking the unit</b>		SmartVu™ interface with 7" colour touch screen								
Languages		10 languages (DE, EN, ES, FR, IT, NL, PT, TR, TU + one chosen by the customer)								
Smart energy metering		Standard feature								
Wireless connectivity		Option								
<b>Expansion valve</b>		Electronic expansion valve								
<b>Air-cooled exchanger</b>		Novation™ micro-channel heat exchanger								
<b>Fans</b>										
<b>30KAV option 119</b>		Flying Bird™ VI impeller variable speed with AC motor and variable frequency drive								
<b>30KAV option 119 + option 17<sup>(3)</sup></b>		Flying Bird™ VI impeller variable speed with EC motor								
Quantity		10	10	10	10	12	14	14	16	16
Maximum total air flow	l/s	59300	59300	59300	59300	71160	83020	83020	94880	94880
Maximum rotation speed	r/s	16,0	16,0	16,0	16,0	16,0	16,0	16,0	16,0	16,0
<b>Water exchanger</b>		Flooded multi-tube type								
Water volume	l	83	88	96	100	115	126	144	165	183
Max. water-side operating pressure without hydraulic module	kPa	1000	1000	1000	1000	1000	1000	1000	1000	1000
<b>Water connections</b>		Victaulic® type								
<b>Standard unit</b>										
Connections	inch	5	5	6	6	6	6	8	8	8
External pipe diameter	mm	141,3	141,3	168,3	168,3	168,3	168,3	219,1	219,1	219,1
<b>Casing paint</b>		Colour code RAL 7035								

(1) In dB ref=10<sup>-12</sup> W, 'A' weighted. Declared noise emission value in accordance with ISO 4871 with an uncertainty of +/-3 dB(A). Measured in accordance with ISO 9614-1 and certified by Eurovent.

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

(3) Options: 17=Fans motors EC type ; 329=Compressors motors PM type.

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

(5) For standard conditions. Depending on operating conditions, unit might have a different minimum part load or cycle.



Eurovent certified values

CARRIER participates in the ECP programme for LCP-HP Check ongoing validity of certificate: [www.eurovent-certification.com](http://www.eurovent-certification.com)



## 5 - ELECTRICAL CONNECTION

### 5.1 - Electrical data

#### 5.1.1 - Electrical data of standard units

30KAV		500A	550A	600A	650A	720A	800A	900A	1000A	1100A
<b>Power circuit supply</b>										
Nominal voltage	V-ph-Hz	400-3-50								
Voltage range	V	360-440								
<b>Control circuit supply</b>		24 V via internal transformer								
<b>Maximum operating input power<sup>(1)</sup></b>										
Standard unit	kW	225	246	272	296	320	367	402	451	484
<b>Power factor at maximum power<sup>(1) (2)</sup></b>		0,91-0,93								
Displacement Power Factor (Cos Phi)		>0,98								
Total harmonic distortion (THDi) <sup>(1) (3)</sup>		35-45%								
<b>Maximum unit current draw (Un)<sup>(1)</sup></b>										
Standard unit	A	350	382	423	460	498	570	625	701	752
<b>Maximum operating current draw (Un-10%)<sup>(1)</sup></b>										
Standard unit	A	383	416	463	490	530	618	666	747	801
<b>Start-up current<sup>(4)</sup></b>										
Standard unit	A	212	228	245	262	286	378	412	399	425

(1) Values obtained at operation with maximum operating power input (data given on the unit nameplate)

(2) Value decreases when load lowers

(3) May vary according to the installation's short circuit ratio

THDi increases when load lowers. But the highest impact on the installation occurs when the current is maximum. Therefore compliance of the installation regarding voltage harmonic distortion at PCC (per IEC61000-2-4 or other standard) shall be usually checked at max load in order to cover all load conditions.

(4) Operating current of the biggest compressor + fan current + starting current of the smallest compressor.

Starting current values used for the compressor are : 06ZCE1-H3AA06013 = 40A ; 06ZFC2-3AA06013 = 50A ; 06ZJG3-3AA06013 = 80A.

#### 5.1.2 - Electrical data of units with combination of options High energy efficiency (119), PM motor (329), EC motor (17)

30KAV options 119 & 329		500A	550A	600A	650A	720A	800A	900A	1000A	1100A
<b>Power circuit supply</b>										
Nominal voltage	V-ph-Hz	400-3-50								
Voltage range	V	360-440								
<b>Control circuit supply</b>		24 V via internal transformer								
<b>Maximum operating input power<sup>(1)</sup></b>										
Unit + option 119	kW	224	249	264	286	310	359	388	439	467
Unit + option 119 + option 17	kW	222	247	261	283	307	356	384	435	462
Unit + option 329	kW	220	241	256	279	314	350	395	436	476
Unit + option 329 + option 119	kW	219	244	248	269	304	342	381	424	459
<b>Power factor at maximum power<sup>(1) (2)</sup></b>		0,91-0,93								
Displacement Power Factor (Cos Phi)		>0,98								
Total harmonic distortion (THDi) <sup>(1) (3)</sup>		35-45%								
<b>Maximum operating current draw (Un)<sup>(1)</sup></b>										
Unit + option 119	A	348	386	411	445	482	558	603	683	725
Unit + option 119 + option 17	A	345	383	407	441	477	553	597	677	718
Unit + option 329	A	343	375	398	433	488	544	614	678	739
Unit + option 329 + option 119	A	341	379	386	418	472	532	592	660	712
<b>Maximum operating current draw (Un-10%)<sup>(1)</sup></b>										
Unit + option 119	A	379	411	448	474	512	603	642	726	772
Unit + option 119 + option 17	A	376	408	444	470	507	598	636	720	765
Unit + option 329	A	376	409	438	463	520	592	655	724	788
Unit + option 329 + option 119	A	372	404	423	447	502	577	631	703	759
<b>Start-up current<sup>(4)</sup></b>										
Unit + option 119	A	211	230	239	255	278	371	401	390	411
Unit + option 119 + option 17	A	209	229	237	253	275	369	398	387	408
Unit + option 329	A	204	219	220	240	271	353	391	376	400

(1) Values obtained at operation with maximum operating power input (data given on the unit nameplate)

(2) Value decreases when load lowers

(3) May vary according to the installation's short circuit ratio

THDi increases when load lowers. But the highest impact on the installation occurs when the current is maximum. Therefore compliance of the installation regarding voltage harmonic distortion at PCC (per IEC61000-2-4 or other standard) shall be usually checked at max load in order to cover all load conditions.

(4) Operating current of the biggest compressor + fan current + starting current of the smallest compressor.

## 5 - ELECTRICAL CONNECTION

Starting current values used for the compressor are : 06ZCE1-H3AA06013 = 40A ; 06ZFC2-3AA06013 = 50A ; 06ZJG3-3AA06013 = 80A.

### 5.1.3 - Short circuit current withstand capability

30KAV		500A	550A	600A	650A	720A	800A	900A	1000A	1100A
<b>Standard machine</b>										
<b>Rated short-circuit withstand currents</b>										
Short time (1s) assigned current - I <sub>cw</sub>	kA eff	11	11	11	11	11	11	11	26	26
Rated peak current - I <sub>pk</sub>	kA pk	80	80	80	80	80	80	80	110	110
<b>Value with electrical protection upstream<sup>(1)</sup></b>										
Conditional short circuit assigned current I <sub>cc</sub>	kA eff	50	50	50	50	50	50	50	50	50
Associated protection - type		Fuses (gG/gL)								
Associated protection - maximum rating	A	630	630	800	800	800	800	800	1000	1250
<b>Unit with option 70D</b>										
Short-circuit withstand current										
Conditional short circuit assigned current I <sub>cc</sub>	kA eff	50	50	50	50	50	50	50	50	50

(1) If another current limitation protection device is used, its time-current and thermal constraint (I<sup>2</sup>t) trip characteristics must be at least equivalent to those of the recommended protection.

**NOTE:** The short circuit current withstand capability values above are in accordance with the TN system.

### 5.2 - Compressor usage per circuit(A, B)

30KAV	Circuit	500A	550A	600A	650A	720A	800A	900A	1000A	1100A
<b>06ZCE1H3AA06013</b>	A	1	1	-	-	-	-	-	-	-
	B	1	1	-	-	-	-	-	-	-
<b>06ZCE1T3AA06013</b>	A	-	-	1	1	1	-	-	-	-
	B	-	-	1	1	1	1	1	-	-
<b>06ZFC2T3AA06013</b>	A	-	-	-	-	-	1	1	1	1
	B	-	-	-	-	-	-	-	1	1

The compressor motor (all models) does not fall within the scope of regulation (EU) 2019/1781 repealing (EU) 640/2009. in accordance with article (2) 2.b.



## 5 - ELECTRICAL CONNECTION

### 5.3 - Electrical data notes

- The units have a single power connection point located immediately upstream of the main disconnect switch.
- The two electrical cabinets contain:
  - A power supply disconnecting component : disconnect switch or circuit breaker if option 70 D was chosen
  - All or part of the equipment protecting the circuits inside the machine from short circuits.<sup>(1)</sup>
  - Variable frequency drives to manage and protect against overload the compressors, fans, and pumps motors,
  - The switching equipment for the heaters and fans for the electrical equipment
  - The control devices.

• Connections to the building installation:

Electrical installation and all the connections to the network must be carried out in compliance with all standards applicable to the installation location. Generally, the recommendations of the International Electrotechnical Commission document (IEC60364) are accepted as compliance with the requirements of the installation guidelines.

The units are designed and built to ensure compliance with these guidelines. The European standard EN 60204-1 (corresponds to IEC 60204-1: Machine safety - Electrical equipment of machines - Part 1: General requirements) was specifically taken into account when the electrical equipment was designed.

**Notes:**

- The standard EN 60204-1 enables the requirements of the Machinery Directive to be met.
- Annex B of standard EN 60204-1 is intended to define the electrical characteristics used for the operation of the machines. Those described below apply alongside the other information provided in this document:

1. Environment

The classification of the environment is specified in standard IEC60364:

- Outdoor installation<sup>(2)</sup>,
- Ambient temperature range for the standard machine: From -20°C to +44°C (48°C)<sup>(3)</sup>,
- Ambient temperature range for the machine with option 16: From -20°C to +48°C (55°C)<sup>(3)</sup>,
- Altitude: Up to 1000 m (2000m)<sup>(4)</sup>
- Presence of solid foreign bodies: Class AE3 (no significant dust present)<sup>(2)</sup>,
- Presence of water: Class AD4 (projection in all directions without pressure)<sup>(2)</sup>
- Presence of corrosive and polluting substances, class AF1 (negligible),
- Competence of personnel: BA4 (trained personnel).

2. Compatibility for low-frequency conducted disturbances according to class 2 levels as per IEC61000-2-4 standard:

- Power supply frequency variation: +/- 1 Hz
- Phase imbalance: 2 %
- Total Voltage Harmonic Distortion (THDV): 8%
- Rated impulse voltage Uw (IEC60664-1) :
  - Units without option 16 : 4 kV
  - Units with option 16 : 2,5 kV

3. The neutral wire (N) must not be connected directly to the unit (if necessary, use a transformer).

4. Overcurrent protection of the power supply conductors is not provided with the unit.

5. The factory-fitted disconnect switch is of a type suitable for power interruption in compliance with EN 60947-3 (equivalent to IEC 60947-3).

6. The units are designed for connection to TN networks (IEC 60364). In IT networks, the use of filters integrated into the variable frequency drive(s) prevents the machines from fulfilling their intended purpose. In addition, the equipment's short-circuit holding current characteristics have been modified. Provide a local earth, consult competent local organisations to complete the electrical installation.

7. Electromagnetic environment: The classification of the electromagnetic environment is described in the standard EN61800-3 (equivalent to IEC 61800-3):

- Immunity to external interference defined by the second environment<sup>(5)</sup>
- Interference emission as defined in category C3<sup>(6)</sup>

- The units integrate variable frequency drives which have harmonic currents which are a source of interference. An analysis may be required to verify if this interference exceeds the compatibility limits of the other devices connected to the same power supply network.

The compatibility levels inside an electrical installation, that must be met at the in-plant coupling point (IPC) to which other loads are connected, are described in standard IEC 61000-2-4.

- Leakage currents: If protection by monitoring the leakage currents is necessary to ensure the safety of the installation, the presence of DC voltage component as well as additional derived currents introduced by the use of variable frequency drive(s) in the unit must be considered. In particular it is recommended that the differential protection devices are :

- Suitable for protection of DC and AC circuitry
- Of reinforced immunity protection types and/or set at a threshold value not lower than 150 mA

**NOTE: If particular aspects of an installation require different specifications from those listed above (or which are not listed), always contact your Carrier representative.**

(1) With the exception of machines equipped with option 70 D, a part of the short circuit protection is not provided and must be carried out on the installation, in compliance with the instructions given in this document.

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

(3) The values in brackets correspond to operation with degraded thermal performances.

(4) Above 1000 m, the maximum temperature must be reduced by 0,5K for every additional 100 m up to 2000 m,

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

(6) Category C3 is suitable for use in an industrial environment and is not designed for use in a public low-voltage system that supplies residential or commercial locations. As an option, conformity with category C2 permits this type of installation.

**WARNING: In a residential or commercial environment, this product may cause radio interference in which case additional mitigation measures could be required.**

## 5 - ELECTRICAL CONNECTION

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

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

**WARNING: Operating the chiller with an incorrect supply voltage or excessive phase imbalance constitutes misuse which will invalidate the Carrier warranty. If the phase imbalance exceeds 2% for voltage, or 10% for current, contact your local electricity supplier and ensure that the chiller is not switched on until corrective measures have been taken.**

### Voltage phase imbalance (%)

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

#### Example:

On a 400 V - 3 ph - 50 Hz supply, the individual phase voltages were measured with the following values:

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

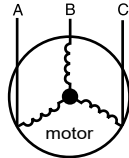
$$\begin{aligned} \text{Average voltage} &= (406 + 399 + 394)/3 = 1199/3 \\ &= 399,7 \text{ (rounded up to 400 V)} \end{aligned}$$

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:

$$100 \times 6/400 = 1,5\%$$

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

## 5.4 - Electrical Connections

### 5.4.1 - Power cable access routing

The power cable access routing into the electrical cabinet is from the side or underneath of the unit: Refer to the plans for the unit.

The choice depends on the installation configuration of the machine and the specifications of the cables to be connected:

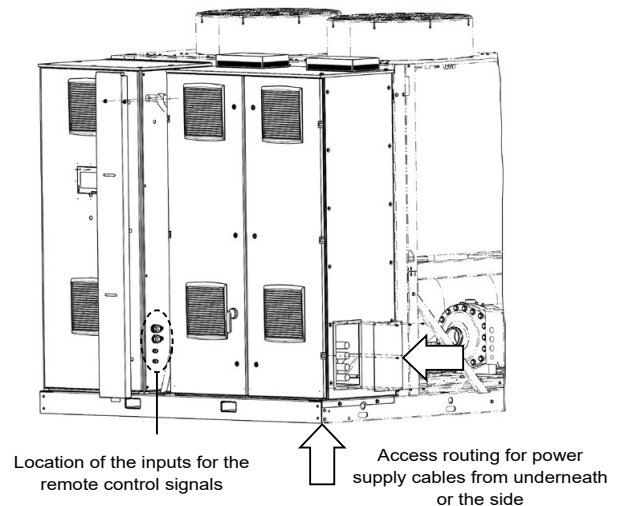
Cable access routing from the side of the unit: This configuration allows a larger number of cables to be connected and/or for larger curve radii.

Cable access routing from underneath: This configuration requires the unit to be raised in relation to the cable routing level (for example: Fitting on rails and supports). The quantity of conductors which can be connected, and the bending radius needed, are also restricted.

The installer is responsible for ensuring the electrical cabinet is sealed around the power cable access routing. Holes must be drilled in the plate provided, and the latter must be assembled.

**IMPORTANT: Check the bending radius for the cable access routing underneath the unit. Refer to the certified dimensional drawing for the unit.**

### Location of the openings for inserting external connections



## 5 - ELECTRICAL CONNECTION

### 5.4.2 - Recommended cable sections

Cable sizing is the responsibility of the installer, and depends on the characteristics and regulations applicable to each installation site.

The cable selections given in this document are therefore only given as a guide, and do not in any way incur Carrier's liability. After cable sizing has been completed, using the certified dimensional drawing, the installer must verify the appropriate means of connection and define any modifications necessary on site.

The connections provided as standard for the customer-supplied power supply cables, on the main disconnect switch, are designed for the number and type of cross sections given in the second column of the table below.

The calculations of favorable and unfavorable cases have been performed using the maximum possible current for each unit.

The study includes the standardized installation cases according to IEC 60364:

- Cable with PVC (70 °C) or XLPE (90 °C) insulation.
- Cable with copper core.
- Cable fitted in accordance with table 52 c of the standard.

Cables with aluminum core require higher cables sections. Please contact Carrier Service in case of such requirement.

The maximum ambient temperature taken into consideration for this study is 46 °C.

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

**IMPORTANT: Before connecting the main power cables (L1 - L2 - L3), it is imperative to check the correct order of the 3 phases before connecting to the main disconnect/isolator switch.**

Minimum and maximum cable section selection table for connection to 30KAV units

30KAV	Max. connectable section <sup>(1)</sup>		Calculation of favourable case:			Calculation of unfavourable case		
			- Suspended overhead line (standardised routing no. 17) - Cable insulated to 90 °C - Copper conductor (Cu)			- Conductors in ducts or multi-conductor cables in closed conduits (standardised routing no. 41) - Cable insulated to 70 °C when possible - Copper conductor (Cu)		
	Connected from the side	Connected from underneath	Section <sup>(2)</sup>	Max length for a voltage drop <5%	Cable type <sup>(3)</sup>	Section <sup>(2)</sup>	Max length for a voltage drop <5%	Cable type <sup>(3)</sup>
	qty x mm <sup>2</sup> (per phase)	qty x mm <sup>2</sup> (per phase)	qty x mm <sup>2</sup> (per phase)	m	-	qty x mm <sup>2</sup> (per phase)	m	-
Standard unit								
500A	4 x 240	3 x 240	1 x 185	260	90 °C	2 x 185	450	70 °C
550A	4 x 240	3 x 240	1 x 185	230	90 °C	2 x 240	490	70 °C
600A	4 x 240	3 x 240	1 x 240	260	90 °C	2 x 240	430	70 °C
650A	4 x 240	3 x 240	1 x 240	240	90 °C	3 x 185	460	70 °C
720A	4 x 240	3 x 240	2 x 120	300	90 °C	3 x 240	480	70 °C
800A	4 x 240	3 x 240	2 x 150	230	90 °C	3 x 240	420	70 °C
900A	4 x 240	3 x 240	2 x 185	240	90 °C	4 x 240	440	70 °C
1000A	4 x 240	3 x 240	2 x 240	260	90 °C	4 x 240	400	70 °C
1100A	4 x 240	3 x 240	3 x 150	230	90 °C	3 x 240	310	90 °C

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

(2) Selection simulation result considering the hypotheses indicated.

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

**NOTE: The currents considered are given for a machine without options.**

## 5 - ELECTRICAL CONNECTION

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### 5.4.3 - Field-installed control wiring

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

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

Refer to the 30KAV SmartVu™ control manual and the certified wiring diagram supplied with the unit for the field control wiring for the following features:

- Remote on/off switch,
- Capacity limit external switch,
- Remote dual setpoint,
- Operating and alarm feedback,
- Evaporator pump control,
- Setpoint offset,
- Various interlocks on the Energy Management Module (EMM) board option,
- Control of the variable speed evaporator pump (option),
- Refrigerant leakage detection signal (option).

#### **Connections to the customer communication bus**

The CCN bus is connected using the connectors specifically provided inside the electrical box. Two connectors are provided to allow both permanent and service connections.

The permanent Ethernet bus and USB service socket are connected using the connector integrated into the touchscreen interface.

A shielding clamp for the cable from the system is provided near the permanent bus connectors.

#### **Customer and service power reserves**

After all possible options have been connected, the CT transformer ensures the availability of a 1 A power reserve at 24 VAC for the on-site control cabling.

As an option, the second CT transformer also supplies the 230 V 50 Hz circuit provided to charge a laptop battery, maximum of 0,80 A. This is connected using a CEE7/17 standard, type E socket. An earth leakage switch provides this circuit with additional protection. Its cut-off setting is 10 mA.

## 6 - APPLICATION DATA

### 6.1 - Unit operating range

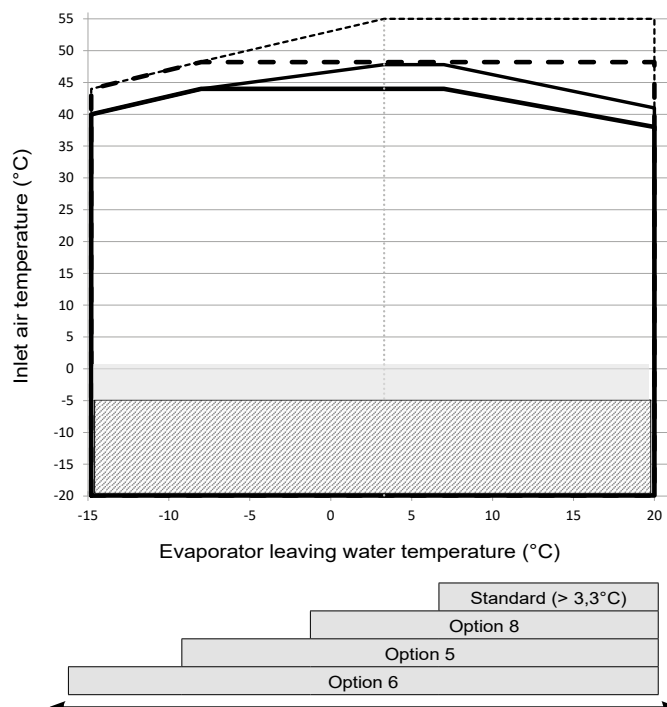
Evaporator water temperature		Minimum	Maximum
Entering temperature at start-up	°C	-	45 <sup>(1)</sup>
Entering temperature during operation	°C	6,8	34
Leaving temperature during operation	°C		
Standard unit	°C	3,3 <sup>(2)</sup>	20
Condenser air temperature		Minimum	Maximum
Storage	°C	-20	68
<b>Operation</b>			
Standard unit	°C	-20 <sup>(3)</sup>	48 <sup>(1)</sup>

#### NOTES:

- The use of brine or antifreeze protection option is required if the water outlet temperature is below 4 °C.
- If the air temperature is below 0 °C, a glycol/water solution or the freeze protection option must be used.

- (1) Operating at partial load  
 (2) According to the type of installation and air temperature  
 (3) Option 41A compulsory for start-ups below -5 °C

#### Standard unit



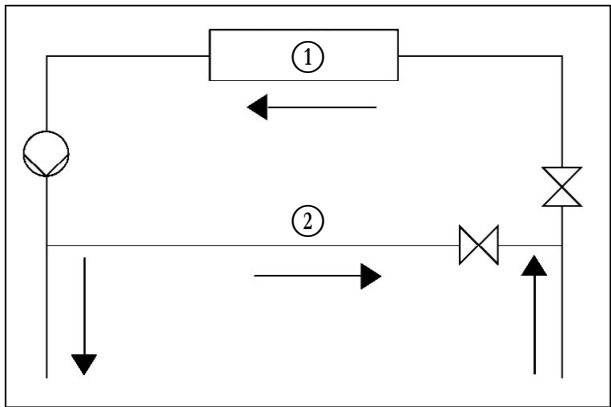
7 - WATER CONNECTIONS

7.1 - Water Flow

Evaporator water flow recirculation

The minimum chilled water flow is shown in the table on the next page. It is determined in order to allow sufficient exchange and prevent the risk of excessive fouling. If the installation flow rate is less than the minimum unit flow rate, the evaporator flow can be recirculated, as shown in the diagram.

For minimum chilled water flow rate



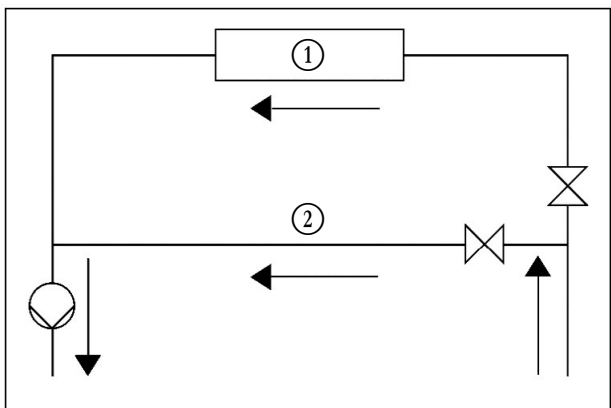
Legend:

- ① Evaporator
- ② Recirculation

Water flow evaporator bypass

The maximum chilled water flow is shown in the table on the next page. If the installation flow rate exceeds the maximum unit flow rate, it can be bypassed as shown in the diagram.

For maximum chilled water flow rate



Legend:

- ① Evaporator
- ② Bypass

Variable flow evaporator

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

If the flow rate changes more rapidly, the system should contain a minimum of 6,5 litres of water per kW instead of 3,25 l/kW.

The flow rate can also be controlled by the unit via option 299: Checking the variable water flow rate.

This option allows the unit to control an external pump in order to maintain a constant inlet/outlet temperature difference, a constant outlet pressure or an unoccupied mode.

7.2 - Water Volume

Minimum system water volume

Irrespective of the system, the water loop minimum capacity is given by the formula:

Volume [L] = Capacity [kW] x N

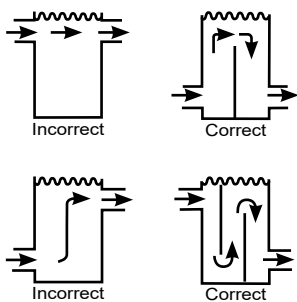
Where Capacity is the nominal system cooling capacity (kW) at the nominal operating conditions of the installation and N is the quantity of Liters per kW for the water loop, as follows :

Application	N
Normal air conditioning	3,25
Process type cooling	6,5

This volume is necessary for stable operation.

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

Connection to a buffer tank



## 7 - WATER CONNECTIONS

### Maximum system water volume (option 293).

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

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

30KAV		30KAV 500A-800A		
Static pressure	kPa	100	200	250
Pure water	l	3960	2640	1980
10% EG	l	2940	1960	1470
20% EG	l	2100	1400	1050
30% EG	l	1740	1160	870
40% EG	l	1500	1000	750

EG: ethylene glycol

### 7.4 - Evaporator pressure drop curves

Data applicable for pure water at 20 °C.

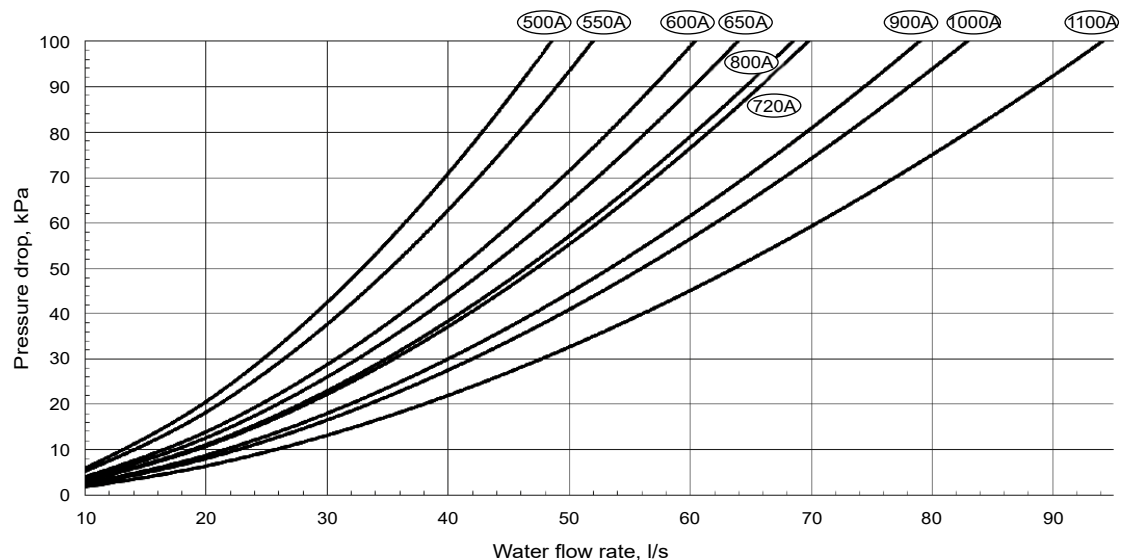
### 7.3 - Minimum & Maximum chilled water flow rate

The minimum chilled water flow is determined in order to allow sufficient exchange and prevent the risk of excessive fouling.

30KAV	Minimum flow rate <sup>(1)</sup> (l/s)	Maximum flow rate <sup>(1)</sup> (l/s)
500A	6,8	49,1
550A	7,9	49,1
600A	8,4	60,2
650A	9,2	61,8
720A	9,7	71,3
800A	10,7	69,7
900A	11,3	81,6
1000A	12,4	89,5
1100A	14,8	98,2

(1) Standard evaporator and heat-transfer medium = water

Pressure drops - Standard evaporator





## 7 - WATER CONNECTIONS

### 7.5 - Operating precautions

**WARNING:** Before carrying out any water connections, install the water box bleed plugs (one plug in the lower section of each water box -supplied in the electrical cabinet).

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

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

The water must be analysed. Depending on the results, the circuit created must include the elements needed for water treatment: Filters, additives, intermediate exchangers, bleed devices, vents, isolation valves, etc., to prevent corrosion, fouling, and deterioration of the pump fittings.

#### Carrier recommendations on energy transfer fluids:

1. **No NH<sup>4+</sup> ammonium ions in the water, as these cause significant damage to copper. This is one of the most important factors governing the service life of copper piping. A content of several tenths of mg/l will badly corrode the copper over time.**
2. **Cl<sup>-</sup> chloride ions also cause damage to copper with a risk of perforating corrosion. If possible keep below 125 mg/l.**
3. **SO<sub>4</sub><sup>2-</sup> sulphate ions can cause perforating corrosion if their content is above 30 mg/l.**
4. **No fluoride ions (<0,1 mg/l).**
5. **No Fe<sup>2+</sup> and Fe<sup>3+</sup> ions if non negligible levels of dissolved oxygen are present. Dissolved iron < 5 mg/l with dissolved oxygen < 5 mg/l.**
6. **Dissolved silicon: Silicon is an acid element of water and can also lead to a risk of corrosion. Content < 1 mg/l.**
7. **Water hardness: >0,5 mmol/l. Values between 1 and 2,5 mmol/l can be recommended. This will facilitate scale deposit that can limit corrosion of copper. Values that are too high can cause piping blockage over time. A total alkalimetric titre (TAC) below 100 mg/l is desirable.**
8. **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 shedding of particles.**
9. **Electric conductivity 10-600 µS/cm**
10. **pH: Ideal case pH neutral at 20-25 °C (7,5 < pH < 9).**

If the hydraulic circuit is drained for a period of more than one month, blanket the entire circuit with nitrogen to prevent any risk of corrosion by differential aeration.

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

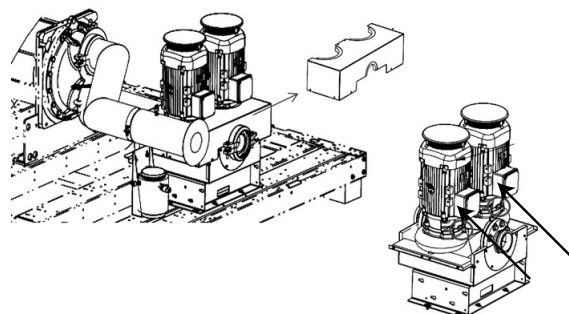
The heat-transfer medium should be filled and drained using devices fitted to the hydraulic circuit by the installer. Never use the unit heat exchangers to add heat exchange fluid.

Before commissioning, make sure the hydraulic circuits are connected to the appropriate heat exchangers.

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

- Ensure the inlet water and outlet pipes are connected in the direction shown on the unit.
- Install manual or automatic vents at all high points in the circuit(s).
- Maintain the pressure of the circuit(s) with pressure-reducing valves and install a relief valve and an expansion vessel.
- Units equipped with the hydraulic module include a relief valve. Units with option 293 include an expansion vessel.
- Install thermometers in both the water inlet and outlet pipes.
- Install drain connections at all low points to allow the whole circuit(s) to be drained.
- Install shut-off valves close to the water inlet and outlet connections.
- Use flexible connections to reduce the transmission of vibrations.
- Insulate the cold water pipework, after pressure testing, to prevent heat transmission and condensation.
- Cover the insulation with a vapour barrier.
- The brine loop must be clean. To ensure the exchangers are able to operate correctly, it is recommended that a sludge container, settling container, or another filtration system is also installed upstream of the unit, if necessary.
- If there are particles in the fluid which are liable to foul the exchanger, a screen filter must be installed upstream of the pump. It must be located somewhere easily accessible to enable disassembly and cleaning. The mesh size of this filter must be 1,2 mm (see Typical hydraulic installation diagram).
- Do not introduce any excessive static or dynamic pressure into the heat exchange circuit (with regard to the design operating pressures).
- Before any start-up, verify that the heat-transfer medium is compatible with the materials and the hydraulic circuit coatings.
- The use of different metals in the hydraulic system may create galvanic couples and lead to corrosion. Verify the need to install sacrificial anodes.
- If additives or fluids other than those recommended by Carrier are used, ensure that these are not considered gases, and that they are class 2, as defined in directive 2014/68/EU.
- For a hydraulic module (opt. 116A & 116W), when filling with heat-transfer medium, remember to vent the air contained in the pump body (see fig. below). Otherwise, there is a risk that the pump will deteriorate prematurely.

#### Procedure for venting air from the pumps



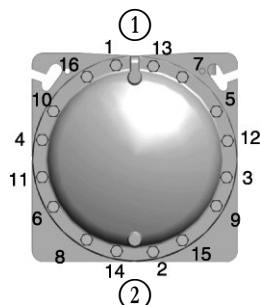


## 7 - WATER CONNECTIONS

### 7.7 - Evaporator water boxes screws tightening

The evaporator is of the shell and tube type with removable water boxes to facilitate cleaning. Before the unit is first filled with water, or after cleaning, tighten or re-tighten the boxes as per the diagram below.

**Water box tightening sequence**



**Key**

- |                         |                     |
|-------------------------|---------------------|
| ① Sequence 1: 1 2 3 4   | ② Tightening torque |
| Sequence 2: 5 6 7 8     | Bolt rating         |
| Sequence 3: 9 10 11 12  | M16 - 171 - 210 Nm  |
| Sequence 4: 13 14 15 16 |                     |

**NOTE:** During this procedure, we recommend that the circuit is drained and the pipes are disconnected to ensure that the bolts are tightened correctly and uniformly.

### 7.8 - Flow rate detection

All the units are equipped as standard with a flow switch set in the factory (according to the size of the unit and the application). If adjustment is necessary, it must be performed by qualified personnel, approved by Carrier Service.

The heat-transfer fluid pump must be controlled by the chiller if the unit is not equipped with the hydraulic module option.

Dedicated terminals are provided for connection to the pump control (wiring from chiller to pump control panel by others).

**IMPORTANT:** The water flow switch for the machine must be operational. The Carrier warranty will be voided if this instruction is not adhered to.

### 7.9 - Frost protection

**WARNING:** Damage caused by frost is not covered by the warranty.

The evaporator, the pipes, and the hydraulic module pumps can be damaged by frost. The components of the unit (evaporator & hydraulic module) will be protected by following the recommendations below. Protection of the remainder of the system is the responsibility of the installer.

#### 7.9.1 - Standard machine

If the chiller or the water pipes are in an area where the ambient temperature is liable to fall below 0 °C, it is recommended that antifreeze solution is added (maximum of 45%, 40% for a unit with a hydraulic module) to protect the unit and the water pipes to a temperature of 10 K below the lowest temperature likely to be reached at the installation site.

Only use antifreeze solutions approved for use with heat exchangers. If antifreeze solution is not added to the circuit, and the unit is not intended to be operated during freezing conditions, the evaporator, the hydraulic module, and the outside pipes must be drained. Check that there are no retention points.

#### 7.9.2 - Frost protection heater option

In cases where it is not possible to apply the recommendations in the paragraph above (§ 7.9.1), the units can be equipped with heaters to protect the evaporator and the hydraulic module against frost (option 41A or 41B).

The antifreeze solution and the heaters can be combined.

Protecting units with a hydraulic module against frost requires water circulation in the hydraulic circuit. The unit pump will start up automatically at regular intervals.

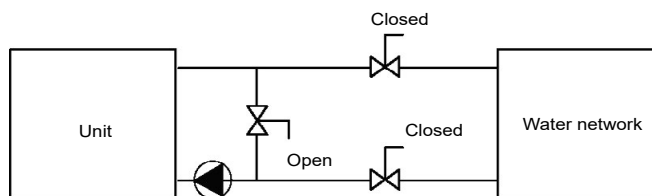
**Combination of options for the periods when the machine is in standby mode**

Ambient unit temperature range	30KAV 500A-1100A	30KAV 500A-800A
	Without option 116	With option 116
> 0 °C to 48 °C	-	-
-20 °C to 0 °C	Option 41A or Appropriate antifreeze solution (for example glycol)	Option 41B <sup>(1)</sup> or Appropriate antifreeze solution (for example glycol) <sup>(1)</sup>

(1) Allow the pumps to circulate. If there is a valve, install a bypass (see diagram for winter position).

If the system is isolated by a valve, it is imperative to install a bypass as indicated below.

**Winter position**



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

- Add propylene glycol in a suitable concentration to protect the installation.
- Where applicable, if a long period without use is expected, drain and, as a safety measure, add propylene glycol to the exchanger via the drain valve located on the water inlet (a drain is available on the water boxes either side of the exchanger if the machine is not perfectly level).
- To prevent corrosion due to differential aeration, any heat-transfer medium circuits drained for longer than 1 month should be protected with a blanket of dry, inert gas (50 kPa maximum). If the heat-transfer fluid does not meet the recommendations, a nitrogen blanket must be applied immediately.
- At the commencement of the next season, fill the system with water treated with appropriate corrosion inhibitors.
- If additional equipment is added to the system, the installer must comply with the basic recommendations, especially the minimum and maximum flow rates which must be between the values shown in the operating limits table (application data).
- If frost protection is dependent on electric heaters, never de-energize the unit when frost protection is required.

## 7 - WATER CONNECTIONS

- **To enable this, the unit's main disconnect switch and the auxiliary circuit breakers protecting the heaters must be left closed (see the wiring diagram for the location of these components).**
- **If it is not to be used in freezing conditions, or during a prolonged period without power (whether or not this is scheduled), the evaporator and the outside pipes must be drained without delay**
- **In case of prolonged non-usage, the hydraulic circuits must be protected by circulating a passivating solution. (Consult a specialist).**
- **The evaporator temperature sensors are an essential frost protection element: If piping trace heaters are used, ensure the external heaters do not affect the measurements provided by these sensors.**

To check the heater circuit is "operational". See Section 11- "Standard maintenance".

### 7.10 - Adjusting the installation nominal water flow rate

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

The water circulation pumps have been sized to allow the hydraulic module to operate in all likely system operating conditions, i.e. at a range of temperature differences between the water inlet and outlet at full load from 3 K to 10 K.

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

In particular, collect the data necessary for setting the installation flow rate:

- Unit without hydraulic module: The nominal pressure drop at the evaporator connections. This is measured with pressure differential gauges that must be installed at the unit's inlet and outlet (item 16).
- Unit with variable speed pump – control on temperature difference: Nominal Delta T at the evaporator.
- Unit with variable speed pump – control on constant outlet pressure: Pressure at the hydraulic module outlet.
- Unit with variable speed pump – control on pressure differential: Delta P at the hydraulic module connections.
- Unit with variable speed pump – control on fixed speed: Nominal flow rate.

If this information is not available when activating the system, contact the engineering and design department responsible for the system to obtain it.

Flow rates for a delta T of 5 K at the evaporator can be found in the product technical literature. Flow rates for any other delta T (between 3 K and 10 K) can be obtained from the "Electronic Catalogue" selection program.

### General information

The nominal flow rate of the installation will be set using a manual valve that should be installed on the leaving water piping (item 18).

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

This will be checked using the reading for the pressure drop in the unit (evaporator).

As the exact total installation pressure drop is not known prior to commissioning, it is necessary to adjust the water flow rate with the control valve (item 18) to obtain the installation's specific flow rate.

### Hydraulic circuit cleaning procedure

- Open all control valves completely (item 18).
- Start up the system pump.
- Read the evaporator pressure drop as the difference on the pressure gauge connected to the unit inlet then the outlet (item 16).
- Let the pump run for 2 hours continuously to flush the system's hydraulic circuit (presence of contaminating solids).
- Perform another reading.
- Compare this value to the initial value.

An increasing Delta P value indicates that the filters on the installation needs to be removed and cleaned. In this case, close the shut-off valves on the water inlet and outlet (item 19). Remove then clean the filters (item 1) after draining the hydraulic part of the unit (item 9).

Purge the air from the circuit (item 10).

Repeat until all fouling is removed from the filter.

### Water flow rate adjustment procedure

Once the circuit is cleaned, read the pressures on the pressure gauges (water inlet and outlet pressure) to determine the pressure drop at the evaporator terminals. Compare the value obtained with the design value predicted by the selection software.

If the pressure drop reading is above the specified value, this indicates that the flow rate at the terminals of the unit (and therefore within the system) is too high. In this case, close the control valve (item 18) and read the new pressure difference. Repeat as necessary, closing the control valve until the specific pressure drop corresponding to the unit's nominal flow rate at the design point is achieved.

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

To reduce the hydraulic system pressure drop:

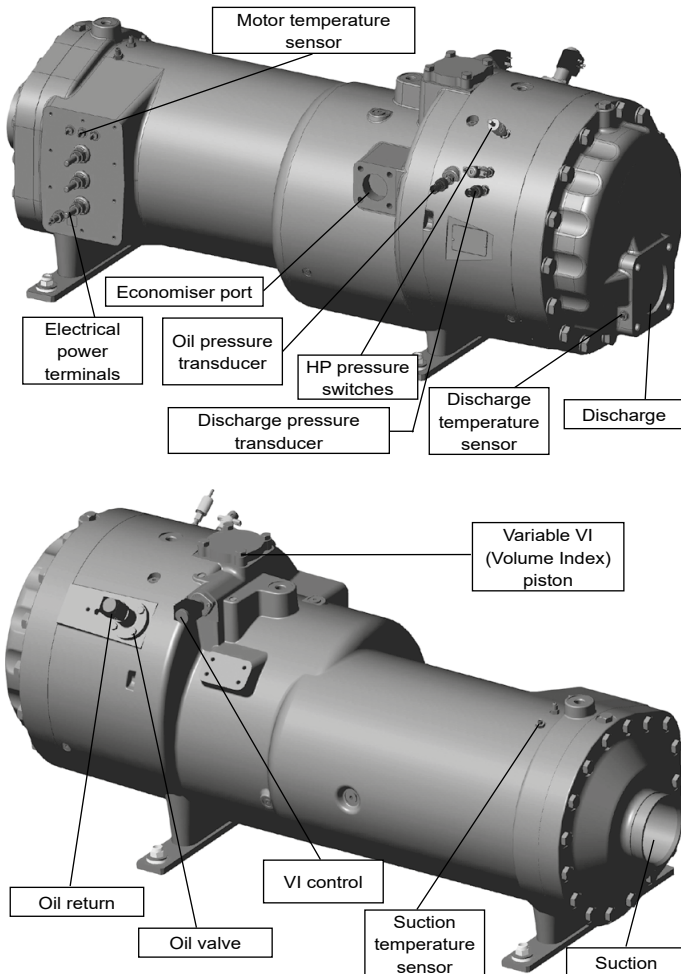
- Reduce the pressure drops of individual components (elbows, level changes, options, etc.) as much as possible,
- Use the correct pipe diameter,
- Do not extend the hydraulic systems.

## 8 - MAJOR SYSTEM COMPONENTS

### 8.1 - Compression function

#### 8.1.1 - Compressors

30KAV units use 06Z twin-screw compressors fitted with an asynchronous motor.



#### 8.1.2 - Refrigerant

This document concerns the 30KAV which operates using R134a only.

#### 8.1.3 - Economizer and suction filters

To improve the reliability of the compressor, filters are fitted on the compressor suction connection and economiser port, as standard.

#### 8.1.4 - Lubricant oil

The 06Z screw compressor is approved for use with the following lubricant:

Lubrizol Emkarate RL 220 H (Carrier material specification PP 47-13).

**CAUTION:** Too much oil in the circuit can cause the unit to malfunction.

**NOTE:** Never use oils that have been exposed to air.

#### 8.1.5 - Oil supply solenoid valve

An oil supply solenoid valve is installed on the oil return line as standard to isolate the compressor from oil flow when the compressor is not operating. The oil solenoid valve is field replaceable.

#### 8.1.6 - Oil filter

The 06Z screw compressor has an independent oil filter mounted on the oil separator. This filter is field replaceable.

#### 8.1.7 - Oil separator

On these units, the oil separator is a pressure vessel which is mounted underneath the condenser coils, at the compressor discharge. The gas discharged at the compressor outlet is directed to the oil separator and most of the oil is separated from the gas by a process of rapid deceleration and gravity. The gas is then directed to a mesh filter where the remaining oil is separated by coalescence, and flows to the bottom of the vessel. The oil-free gas exits via the top of the vessel towards the condenser.

The oil separator is equipped with a heater cable managed by the control system. The oil separator also has a built-in silencer.

#### 8.1.8 - High Pressure SRMCR safety loop

##### General description

The unit is equipped with a high pressure safety loop, known as the SRMCR (Safety-Related Measurement Control and Regulation) loop, comprising:

- 2 high pressure switches (HPS) that require resetting with a tool at the outlet of each compressor called PZHH
- The speed regulator which supplies the compressor and is equipped with the Safe Torque Off (STO) function.

Refer to the wiring diagram and the nomenclature for the machine (references).

This SRMCR device is designed in accordance with standard EN 61508 for SIL (safety integrity level): 2.

Demand mode: Low and high.

The mission time is 20 years.

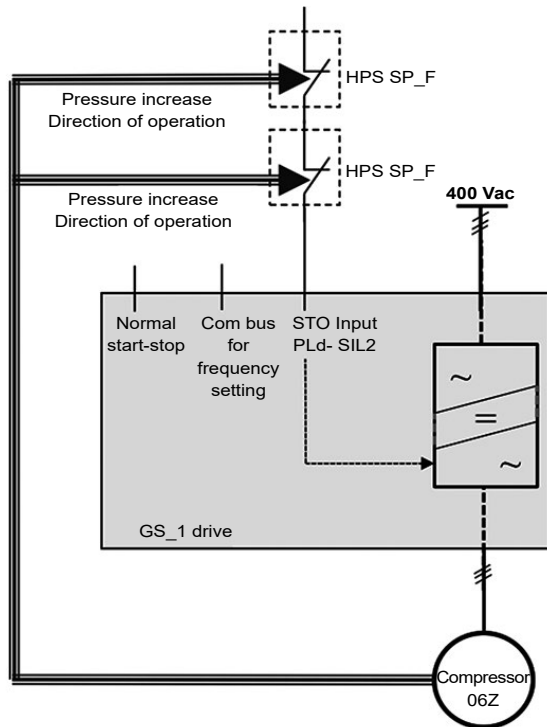
Periodic testing: The test must be performed at least once a year during the normal periodic pressure test. Refer to the description in section 11.



## 8 - MAJOR SYSTEM COMPONENTS

### Description of operation and resetting

The image below is intended to illustrate the operating description: Refer to the detailed machine drawing for the precise wiring diagram.



HPS: High pressure switch SP1F(A)/SP2F(A)  
GS\_1: Power drive for compressor GSA1/GSB1

During normal operation, the speed regulator supplies and controls the compressor once the control signal is received via the digital on-off input (normal on-off) and the communication bus (setting the frequency).

When one of the HPS sensors opens, the STO (Safe Torque Off) digital input opens, which instantly suppresses the control command for the thyristors which manage the supply for the compressor, independently of the on-off commands and frequencies: The compressor is no longer supplied and stops immediately.

### Restarting after high pressure is detected

After overpressure is detected, it is necessary to manually reset the switched HPS. A blunt tool with a diameter of less than 6 mm must be used for this.

### Verification in case of a safety device failure

If the unit operating pressure appears to have been exceeded at some point (for example, after the relief valves have been opened), the unit must be stopped immediately.

The safety loop unit must pass all the periodic verifications before any restart is possible.

If the test reveals malfunctions likely to have caused overpressure within the machine, a complete check of all the pressure equipment must be performed to check their mechanical integrity.

### 8.2 - Evaporator function

The units use a flooded shell-and-tube evaporator, the water (heat-transfer medium) circulates in the tubes and the refrigerant is inside the shell. A single shell is used to serve both refrigerant circuits. There is a centre tubular plate which separates the two refrigerant circuits. The tubes are copper, and 3/4" in diameter, with a finned surface inside and out. There is just one hydraulic circuit with two water passes.

The evaporator has been tested and stamped in accordance with the applicable pressure code. The maximum standard operating pressures are 2100 kPa relative for the refrigerant side and 1000 kPa relative for the water-side. These pressures may differ according to the regulation and the code applied.

The evaporator has thermal insulation formed of 19 mm thick polyurethane foam and aluminium cladding (optional), and is equipped with a water drain plug and a vent.

The heat exchanger water connections are Victaulic type connections. As an option, the evaporator is equipped with frost protection ("evaporator frost protection" option).

Products used for the thermal insulation of components during hydraulic connection must have a chemically neutral effect on the surfaces to which they are applied. All original materials supplied by Carrier comply with this requirement.

### 8.3 - Condenser function

The condensers in the units are micro-channel condensers made entirely of aluminium.

Depending on applications, silicon cover caps are required to be put on condenser coils block fittings. Please contact Carrier Service for more information.

## 8 - MAJOR SYSTEM COMPONENTS

### 8.4 - Fan motors

The fan motors are axial Flying Bird fans equipped with a rotating shroud and made of composite recyclable material. Each motor is fixed with transverse supports.

All the fans in the same refrigerating circuit run together at the same rotation speed. The fan speed is controlled by an algorithm that continuously optimises the condensing temperature to obtain the best energy efficiency (EER) for the units, whatever the operating conditions.

#### 8.4.1 - AC motors

The standard units are equipped with AC motors, controlled by one or more variable speed drives. The motors are three-phase, with lifetime lubricated bearings and class F insulation (IP55 level).

In case of a locked rotor or an overload, the motors of each circuit are electrically protected by the circuit's variable frequency drives (VFD). Each VFD follows an overcurrent curve, which varies according to the frequency from 5 to 50 Hz and the number of fans controlled.

If a fan fails to operate (in open circuit), the lack of current is detected, generating an alert on the user interface. Refer to the control manual for the description of alarms specific to this option.

#### 8.4.2 - EC motors

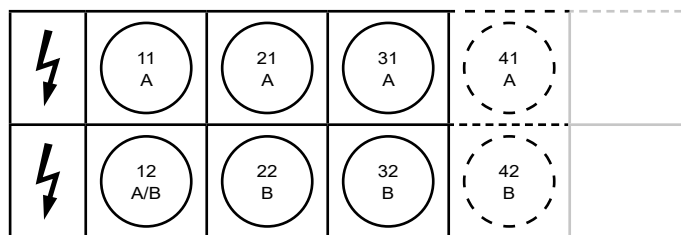
On 30KAV units with options 17 or 119+, the fans are driven by EC motors (electronically commutated motors). These are motors with permanent magnets, equipped with their own embedded electronics which enables the speed to be varied and also provides protection.

These motors are more efficient than asynchronous motors.

The speed is controlled by analogue voltage in the range 0-10 VDC. The motors for each refrigerating circuit are controlled by the same 0-10 VDC control signal. They are supplied with a three-phase 400 VAC power supply, and the order of phases has no impact on the direction of rotation, as this is factory-set.

#### 8.4.3 - Distribution of fans within the machine

The distribution of fans for the refrigerating circuits and their description is given below (simplified representation on the machine seen from above):



**WARNING:** The fan listed as 12 may be allocated to circuit A or to circuit B, depending on the machine. It may be powered by the variable drives from one or other of these circuits: Refer to the wiring diagram for the unit.

#### 8.4.4 - Fan General data

According to the Regulation (EU) No. 327/2011 implementing Directive 2009/125/EC with regard to ecodesign requirements for fans driven by motors with an electric input power between 125 W and 500 kW.

		30KAV Standard	30KAV option 17
Overall efficiency	%	40,1	48,2
Measurement category		A	A
Efficiency category		Static	Static
Target efficiency level ERP2015		N(2015) 40	N(2015) 40
Efficiency level at optimum efficiency point		44,6	53,2
Variable speed drive		YES	YES (embedded)
Year of manufacture		See label on the unit	See label on unit
Fan manufacturer		Simonin	Simonin
Motor manufacturer		Leroy Somer	EBM PAPST
Fan PN		00PSG002630700A	00PSG002630700A
Motor PN		00PPG000558700A	00PSG003716100A
Nominal power of the motor	kW	1,96	1,64
Flow rate	m <sup>3</sup> /s	4,22	4,24
Pressure at optimum energy efficiency	Pa	174,2	174,6
Nominal speed	rpm	948	960
Specifica ratio		1,002	1,002
"Relevant information to facilitate the disassembly, recycling or removal of the product at the end of life"		See the Maintenance manual	See the Maintenance manual
"Relevant information to minimise the impact on the environment"		See the Maintenance manual	See the Maintenance manual

Above data for fans and motors, which are mandatory regarding eco-design regulation, are provided for a stand-alone component (not included in the chiller system).



## 8 - MAJOR SYSTEM COMPONENTS

### 8.5 - Electrical Components

#### 8.5.1 - Speed regulator

The units are equipped with variable speed drives for the compressors and condenser fans motors. The variable speed drives are integrated into the electrical cabinets. If the fan motors are electronically commutated motors (optional EC motors), there is no corresponding variable speed drive in the electrical cabinet.

The variable speed drive enables the speed of the motors to be selected by adjusting the voltage and frequency by modulating the pulse width (PWM).

#### 8.5.2 - Cabinets for the electrical equipment

The machines are equipped as standard with two cabinets for the electrical equipment:

A power cabinet for the incoming power supply and the compressor variable-speed drives.

A control cabinet for the control system elements and the variable-speed drives and power circuits for the condenser fans and the water pumps.

In the control cabinet, the components are mounted on a mounting plate which ensures the flow of cooling air from the heat-dissipating elements is contained in the area to rear of the cabinet.

The frequency setpoint on the operating range and the status feedback for the variable speed drives is transmitted by communication via the internal RS485 Bus using the LEN Protocol by the "Carrier controller".

For the compressors, the variable-speed drive provides the unit shut down function via the pressure switches cabled to the regulator's digital inputs.

This design means that the mounting plate or the casing panel must be removed to access the equipment which is located in the back of the panel: Transformers, power distribution connections and cooling fans; refer to the wiring diagram for the unit.

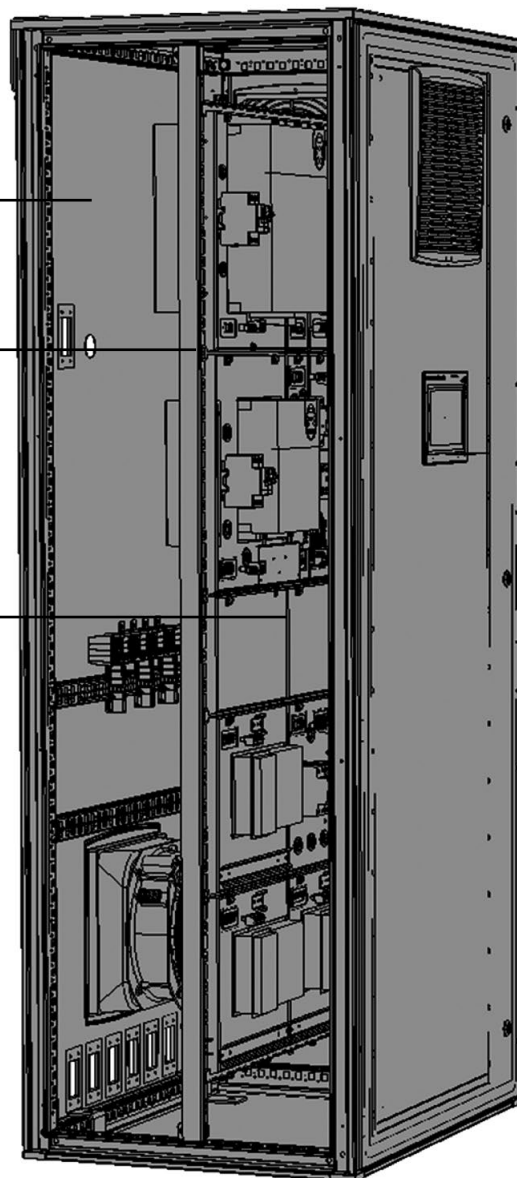
The mounting plate and the casing panel are designed to be easily removed for servicing operations (see also chapter 13 of this document).

Overall view of the control cabinet with the casing panel removed:

Rear section for components with high heat dissipation

Support plates for components and separation of air flows

Front section for components with low heat dissipation



## 8 - MAJOR SYSTEM COMPONENTS

Regulation (EU) 2019/1781 repealing (EU) 640/2009, governs the requirements relating to ecodesign applicable to electric motors and to speed regulators in accordance with the directive 2009/125/EC.

	30KAV Standard	30KAV Standard
Motor type	Asynchronous	EC motor
Number of poles	6	6
Nominal input frequency	50	50/60
Nominal voltage	400	380/480
Number of phases	3	3
Motor included in the application domain of the regulation (EU) 2019/1781	NO	NO
Sales leaflet for exemption	Article 2.2.a)	Article 2.2.a)
Ambient air temperature for which the motor is designed	70	70

### 8.6 - Economizer function

The economiser function includes a liquid valve, a filter drier, two electronic expansion valves (EXVs), a plate heat exchanger, and protection devices (fusible plug or valve).

At the condenser outlet, a small fraction of the liquid is expanded via the secondary EXV in one of the plate heat exchanger circuits and then is returned as a gas to the compressor via the economiser port. This expansion enables to increase the liquid subcooling of the other fraction of refrigerant entering the evaporator via the main EXV. This enables the system's cooling capacity and efficiency to be improved.

#### 8.6.1 - Electronic expansion valve (EXV)

The EXV is equipped with a stepper motor (2785 to 3690 steps, depending on the model) that is controlled via an electronic circuit board.

The EXV is also equipped with a sight glass used to check the mechanism movement and the presence of the liquid seal.

#### 8.6.2 - Moisture indicator

Located on the EXV, this enables the unit charge to be controlled and indicates moisture in the circuit.

The presence of bubbles in the sight-glass indicates an insufficient charge or non-condensable gases in the system.

The presence of moisture changes the colour of the indicator paper in the sight-glass.

#### 8.6.3 - Dehumidifier filter

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

### 8.7 - Sensors

The unit uses thermistors to measure temperature, and pressure transducers to monitor and control the operation of the system. Refer to the SmartVu™ control manual for a more detailed explanation.

## 9 - OPTIONS

Option	N°	Description	Advantage	Use 30KAV
Medium Brine down to -6 °C	5	Redesigned evaporator to allow chilled brine solution production down to -6 °C (including different number of tubes in the evaporator, extra insulation, specific sensors and algorithms).	Covers specific applications such as ice storage and industrial processes	0500-1100
Low Brine with turbulators down to -15 °C	6	Redesigned evaporator including turbulators to allow chilled brine solution production with low pressure drops on the entire negative application range, down to -15 °C (including turbulators, extra insulation and algorithms).	Covers specific applications such as ice storage and industrial processes	0500-1100
Light-brine solution, down to -4 °C	8	Implementation of new control algorithms and thermal insulation to allow chilled brine solution production down to -4 °C when ethylene glycol is used (-2 °C with propylene glycol)	Matches with most application requirements for ground-sourced heat pumps and fits with many industrial processes requirements	0500-1100
Low noise level	15	Sound absorbing & aesthetic compressor enclosure	Noise level reduction	0500-1100
Very low noise level	15LS	Sound absorbing & aesthetic compressor enclosure and oil separator, evaporator and suction line acoustic treatment, combined with low-speed fans	Noise level reduction in sensitive environments	0500-1100
High ambient temperature	16	Electrical components sized for part load operation up to 55 °C air ambient	Extended unit part-load operation up to 55 °C ambient temperature	0500-1100
EC fans	17	Unit equipped with EC fans	Enhances the unit energy efficiency	0500-1100
IP54 control box	20A	Increased leak tightness of the unit	Protects the inside of the electrical box from dust, water and sand. In general this option is recommended for installations in polluted environments	0500-1100
Grilles and enclosure panels	23	Metallic protection grilles and side enclosure panels	Improves aesthetics, protection against intrusion to the unit interior, coil and piping protection against impacts.	0500-1100
Enclosure panels	23A	Side enclosure panels	Improves aesthetics and piping protection against impacts.	0500-1100
Water exchanger frost protection	41A	Electric resistance heater on the water exchanger and discharge valve	Water exchanger frost protection down to -20 °C outside temperature	0500-1100
Evaporator & hydraulic module frost protection	41B	Electric resistance heater on water exchanger, discharge valve and hydraulic module	Water exchanger and hydraulic module frost protection down to -20 °C outside temperature	0500-0800
Evaporator & recovery condenser frost protection	41C	Electric resistance heater on evaporator exchanger, discharge valve and add heaters and insulation on hydraulic connection (option 325)	Water exchanger module frost protection between 0 °C and -20 °C outside air temperature	0500-1100
Partial heat recovery	49	Unit equipped with one desuperheater on each refrigerant circuit	Production of free high-temperature hot-water simultaneously with chilled water production (or hot water for Heat pump)	0500-1100
Total heat recovery	50	Unit equipped with additional heat exchanger in series with the condenser coils. (Each exchanger is equipped with heaters and insulation)	Production of free hot-water with variable heat reclaim	0500-1100
Lead /Lag operation	58	Unit equipped with supplementary water outlet temperature sensor kit (to be field installed) allowing Lead /Lag operation of two units connected in parallel	Optimised operation of two units connected in parallel operation with operating time equalisation	0500-1100
Main disconnect switch with short-circuit protection	70D	Disconnect circuit breaker equipped with an external disconnect switch handle	Ensure protection of main disconnect switch and associated cables against short-circuits when building devices are not compliant	0500-1100
Evap. and pumps with aluminum jacket	88A	Evaporator and pumps covered with an aluminum sheet for thermal insulation protection	Improved resistance to aggressive climate conditions	0500-0800
Service valve set	92	Liquid line valve (evaporator inlet) and compressor suction line valve	Allow isolation of various refrigerant circuit components for simplified service and maintenance	0500-1100
Compressor discharge valves	93A	Shut-off valve on the compressor discharge piping	Simplified maintenance	0500-1100
21 bar evaporator	104	Reinforced evaporator for extension of the maximum water-side service pressure to 21 bar (standard 10 bar)	Covers applications with a high water column evaporator side (typically high buildings)	0500-1100
LP VSD dual-pump hydraulic mod.	116A	Dual low-pressure water pump with variable speed drive (VSD), pressure transducers. Multiple possibilities of water flow control. For more details, refer to the dedicated chapter.	Easy and fast installation (plug & play), significant pumping energy cost savings (more than two-thirds), tighter water flow control, improved sytem reliability	0500-0800

## 9 - OPTIONS

Option	N°	Description	Advantage	Use 30KAV
HP VSD dual-pump hydraulic module	116W	Dual high-pressure water pump with variable speed drive (VSD), pressure transducers. Multiple possibilities of water flow control (expansion tank with built-in safety hydraulic components available in option)	Easy and fast installation (plug & play), significant pumping energy cost savings (up to two-thirds), tighter water flow control, improved system reliability	0500-0800
High Energy Efficiency	119	Additional condenser coil to improve unit energy efficiency	Enhances the unit energy efficiency performance	0500-1100
High Energy Efficiency+	119+	Additional condenser coil plus EC fans to improve unit energy efficiency	Enhances the unit energy efficiency performance	0500-1100
Lon gateway	148D	Bi-directional communication board complying with Lon Talk protocol	Connects the unit by communication bus to a building management system	0500-1100
Bacnet over IP	149	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	0500-1100
Modbus over IP and RS485	149B	Bi-directional high-speed communication using Modbus protocol over Ethernet network (IP)	Easy and high-speed connection by ethernet line to a building management system. Allows access to multiple unit parameters	0500-1100
Energy Management Module	156	EMM Control board with additional inputs/ outputs. See Energy Management Module option chapter	Extended remote control capabilities (Set-point reset, ice storage end, demand limits, boiler on/off command...)	0500-1100
Input contact for Refrigerant leak detection	159	0-10 V signal to report any refrigerant leakage in the unit directly on the controller (the leak detector itself must be supplied by the customer)	Immediate customer notification of refrigerant losses to the atmosphere, allowing timely corrective actions	0500-1100
Dual relief valves on 3-way valve	194	Three-way valve upstream of dual relief valves on the shell and tubes evaporator	Valve replacement and inspection facilitated without refrigerant loss. Comforms to European standard EN378/BGVD4	0500-1100
Compliance with Swiss regulations	197	Additional tests on the water heat exchangers: supply (additional of PED documents) supplementary certificates and test certifications	Conformance with Swiss regulations	0500-1100
Compliance with Russian regulations	199	EAC certification	Conformance with Russian regulations	0500-1100
Compliance with Australian regulations	200	Unit approved to Australian code	Conformance with Australian regulations	0500-1100
Insulation of the evap. in/out ref.lines	256	Thermal insulation of the evaporator entering/ leaving refrigerant lines with flexible, UV resistant insulation	Prevents condensation on the evaporator entering/leaving refrigerant lines	0500-1100
Enviro-Shield anti-corrosion protection	262	Coating by conversion process which modifies the surface of the aluminum producing a coating that is integral to the coil. Complete immersion in a bath to ensure 100% coverage. Minimal heat transfer variation, tested 4000 hours salt spray per ASTM B117	Improved corrosion resistance, recommended for use in moderately corrosive environments	0500-1100
Super Enviro-Shield anti-corrosion protection	263	Extremely durable and flexible epoxy polymer coating applied on micro channel heat exchangers by electro coating process, final UV protective topcoat. Minimal heat transfer variation, tested 6000 hours constant neutral salt spray per ASTM B117, superior impact resistance per ASTM D2794	Improved corrosion resistance, recommended for use in extremely corrosive environments	0500-1100
Welded evaporator connection (kit)	266	Victaulic piping connections with welded joints	Easy installation	0500-1100
Welded heat recovery condenser connection (kit)	267	Victaulic piping connection with welded joints	Easy installation	0500-1100
Evaporator with aluminum jacket	281	Evaporator covered with an aluminum sheet for thermal insulation protection	Improved resistance to aggressive climate conditions	0500-1100
EMC class. C2, as per EN 61800-3	282	Additional RFI filters on the unit power line	Reduces electromagnetic interferences for compliance with emission level category C2 in order to allow the units to operate in the first environment (so called, residential environment)	0500-1100
230 V electrical plug	284	230 VAC power supply source provided with plug socket and transformer (180 VA, 0,8 Amps)	Permits connection of a laptop or an electrical device during unit commissioning or servicing	0500-1100
Expansion tank	293	6 bar expansion tank integrated in the hydraulic module (requires hydraulic module option)	Easy and fast installation (plug & play). & Protection of closed water systems from excessive pressure	0500-0800
Electric energy meter	294	Electricity meter . Display of energy consumption, instantaneous (U, V, I) and cumulated (kWh) on the unit user interface datas available on communication bus	Permits the acquisition, (remote) monitoring of energy used.	0500-1100

## 9 - OPTIONS

Option	N°	Description	Advantage	Use 30KAV
Fast Capacity Recovery	295	New software algorithms to allow quick restart and fast loading while preserving unit-reliability	Full capacity recovery in less than 5 minutes after power failure. Matches requirements of typical critical missions applications	0500-1100
Ultra Fast Capacity Recovery	295+	Electrical capacity module to enable quick restart and fast loading preserving unit reliability	Ultra Fast full capacity recovery after power failure. Matches requirements of typical critical missions applications. (process, data centers)	0500-1100
Mexico screw compressor	297	Screw compressor made in Mexico	Mexico screw compressor	0500-1100
Connected Services	298A	Transmit the machine's operating data in real time via a 4G LTEM network.	Monitor and control machine status remotely.	0500-1100
Variable Water Flow control	299	Hydraulic control function package that permits control of the water flow rate based on different possible logics (at customer choice): constant delta T, constant outlet pressure and "fixed-speed" control	When variable-speed pumps on the primary circuit, the VWF control modulates flow rate through the evaporator, minimising pump consumption while ensuring safe/optimised chiller operation	0500-1100
Free-cooling Dry cooler control	313	Control & connections to a Free Cooling Dry cooler 09PE or 09VE fitted with option FC control box	Easy system management, Extended control capabilities to a Dry cooler used in Free Cooling mode	0500-1100
Compliance with UAE regulation	318	Additional label on the unit with rated power input, rated current and EER following AHRI 550/590 (I-P)	Compliance with ESMA standard UAE.S 5010-5:2019.	0500-1100
Compliance with Qatar regulation	319	Specific nameplate on the unit with power supply 415 V+/-6%	Compliance with KAHRAMAA regulation in Qatar.	0500-1100
Hydraulic connection kit	325	Water piping on condenser and evaporator side	Easy installation	0500-1100
Compliance with Morocco regulation	327	Specifics documents according Morocco regulation	Conformance with Morocco regulations	0500-1100
Compressor with permanent magnet	329	Screw compressor equipped with permanent magnet motor	Permanent magnet motor improves significantly compressor efficiency	0500-1100
Delivery with plastic tarp	331	Plastic sheeting covering the units, with strapping securing it on the wooden pallet.	Allow unit to avoid dust and dirt from the outside environment during stocking and shipping	0500-1100
400-3-60Hz power supply	335	400V - 3PH - 60Hz power supply	Permits unit connection to 400-3-60Hz power supply	0500-1100

## 9 - OPTIONS

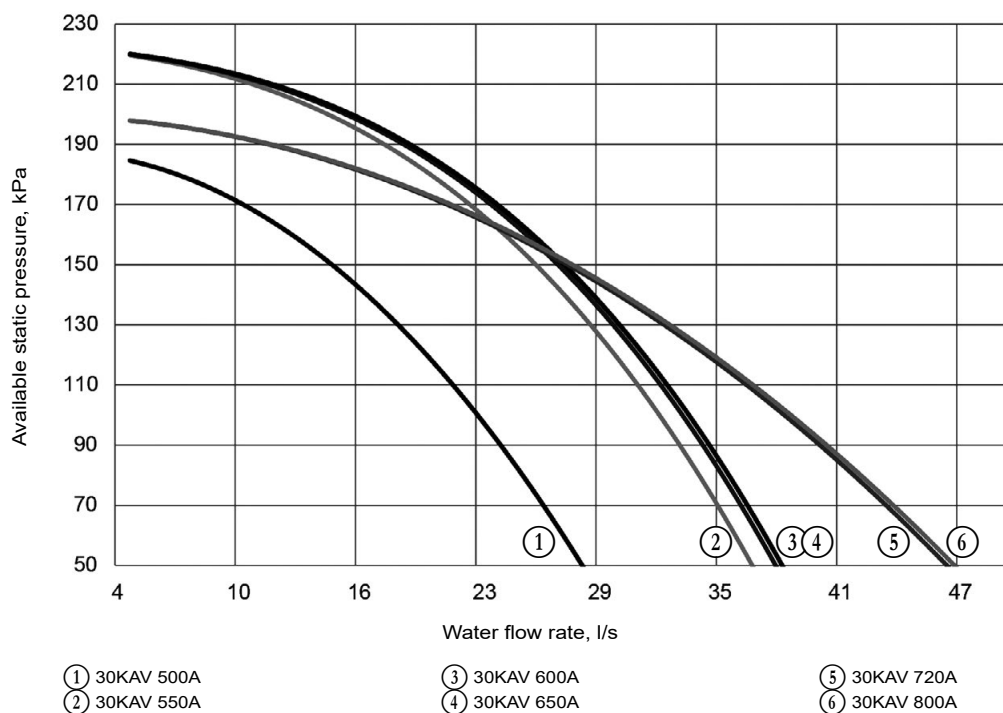
### 9.1 - Hydraulic module (options 116A / 116W)

#### 9.1.1 - Available static pressure for the system

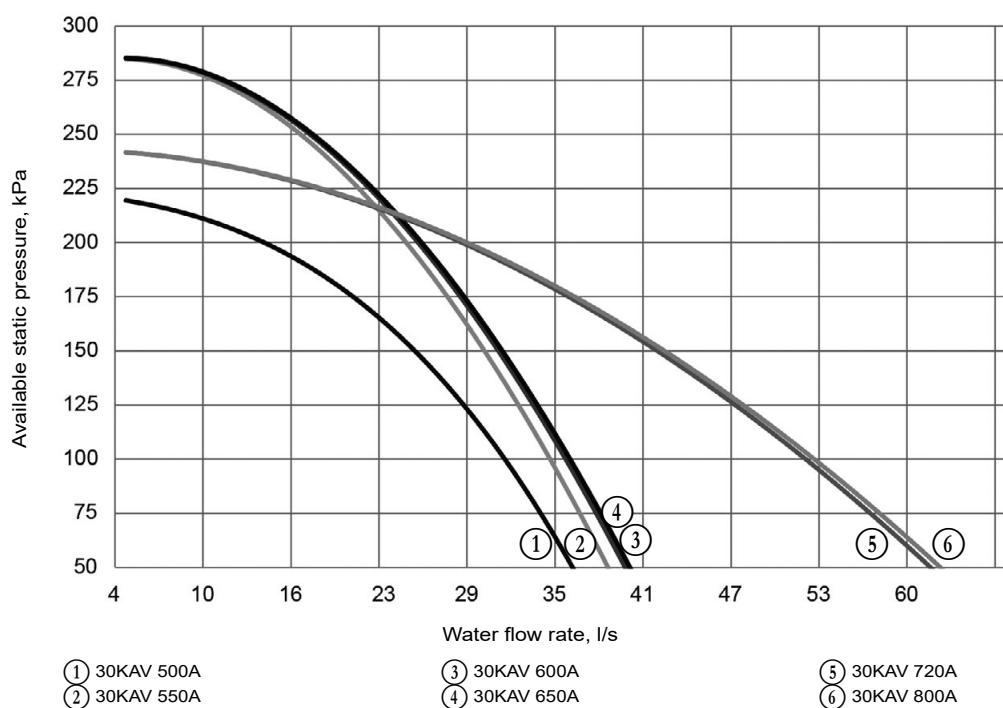
Data applicable for:

- Fresh water 20 °C.
- Variable speed pump at 50 Hz.
- Refer to the paragraph on “Water exchanger min. water volume and flow rate” for the maximum water flow rate values.
- If ethylene glycol is used, the maximum flow rate is reduced.
- For an ambient temperature over 40 °C, the maximum water flow rate is limited.

**Low pressure variable speed dual pumps at 50 Hz (116A)**



**High pressure variable speed dual pumps at 50 Hz (116W)**



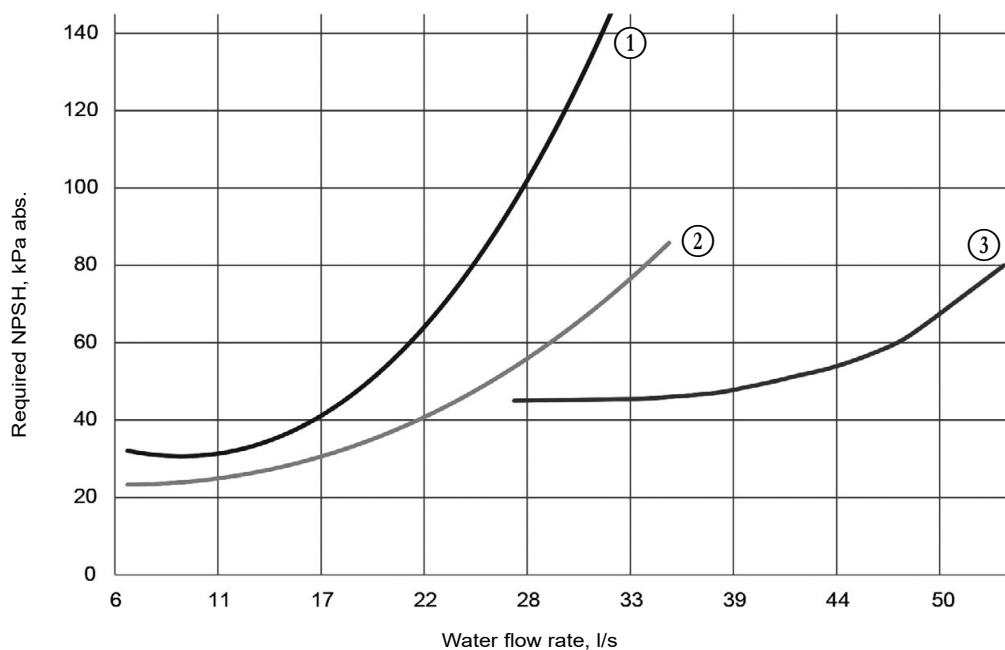


## 9 - OPTIONS

### 9.1.2 - Required NPSH (Net Positive Suction Head); Hydraulic module option

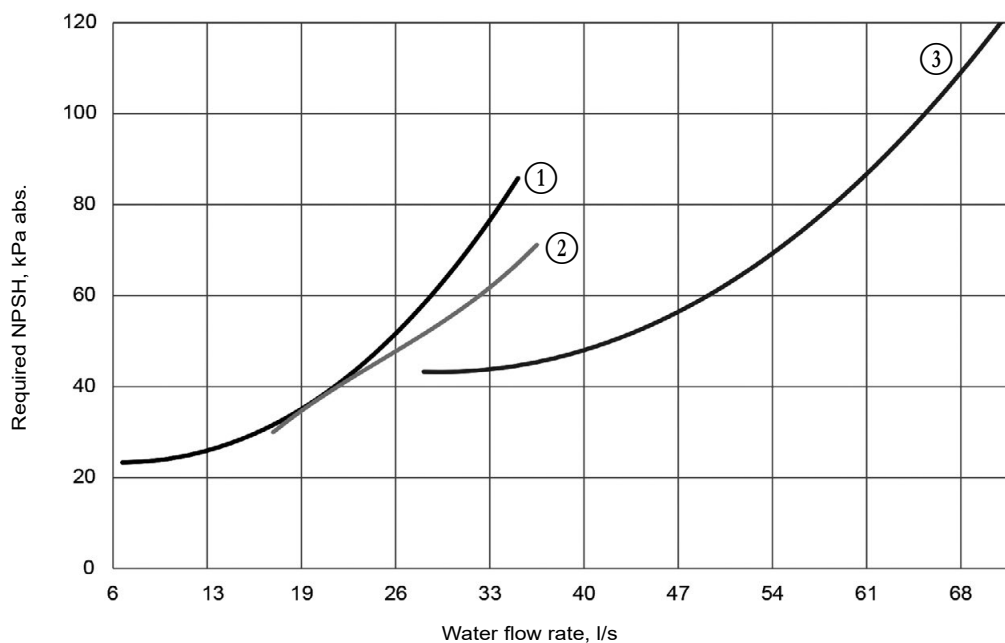
The hydraulic circuit must be designed to ensure that the NPSH (Net Positive Suction Head) is greater than or equal to the required NPSH + 50 kPa.

Low pressure variable speed dual pumps at 50 Hz (116A)



- ① 30KAV 500A
- ② 30KAV 550A-600A-650A
- ③ 30KAV 720A-800A

High pressure variable speed dual pumps at 50 Hz (116W)



- ① 30KAV 500A
- ② 30KAV 550A-600A-650A
- ③ 30KAV 720A-800A

## 9 - OPTIONS

### 9.1.3 - Flow rate calculation

Units equipped with the hydraulic module enable the flow rate to be monitored directly via the unit's user interface (see the control manual).

The pressure of the fluid is measured by the pressure sensors at the inlet of the pump and outlet of the unit. The system calculates the flow rate corresponding to measured differential pressure.

The calculations are only applicable for cold water. For a brine solution (e.g.: Glycol) other than cold water, the calculated flow rate will not be accurate.

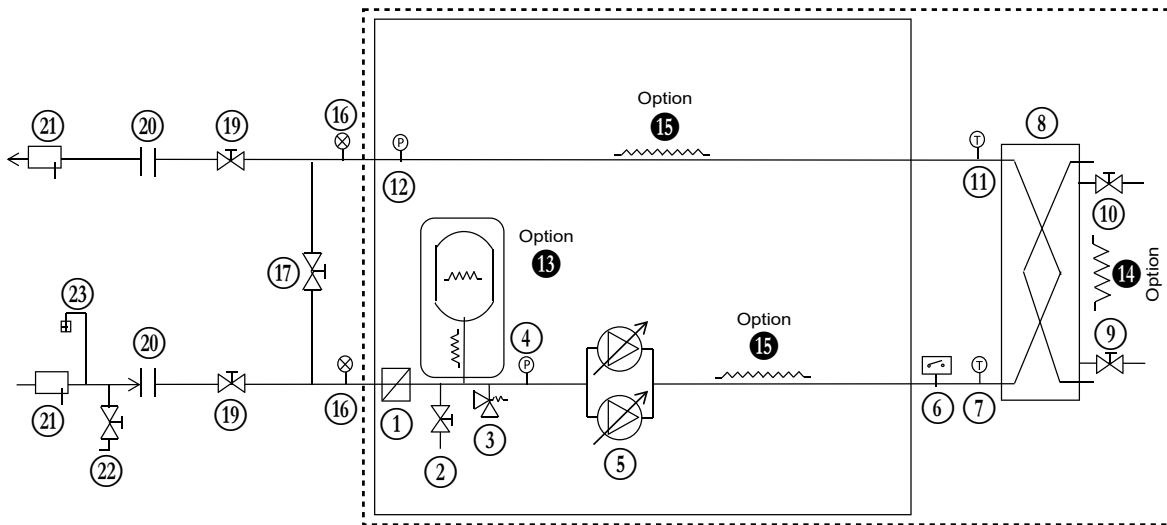
These values are given as a guide for the user and may vary depending on fouling of the hydraulic circuit and correct operation of the pump. The manufacturer cannot be held liable for the accuracy of this information.

### 9.1.4 - Hydraulic circuit diagram

The hydraulic module options are only compatible with closed loops.

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

Typical hydraulic circuit diagram with hydraulic module



#### Key

##### Components of the unit and hydraulic module

- ① Screen filter (particle size of 1,2 mm)
- ② Water drain tap
- ③ Relief valve
- ④ Pressure sensor  
**NOTE: Provides pressure information for the pump suction inlet (see Control manual)**
- ⑤ Variable speed dual pump (high or low pressure)
- ⑥ Water exchanger flow rate sensor
- ⑦ Temperature probe  
**NOTE: Provides temperature information for the water exchanger inlet (see Control manual)**
- ⑧ Evaporator
- ⑨ Water purge (evaporator)
- ⑩ Air purge (evaporator)
- ⑪ Temperature probe  
**NOTE: Provides temperature information for the water exchanger outlet (see Control manual)**
- ⑫ Pressure sensor  
**NOTE: Provides pressure information for the water exchanger outlet (see Control manual)**
- ⑬ Expansion vessel (Option 293)
- ⑭ Heater for evaporator frost protection (option 41A & 41B)
- ⑮ Heater for hydraulic module frost protection (option 41B)

##### System components

- ⑯ Pressure gauge
  - ⑰ Bypass valve for frost protection (if shut-off valves (item 19) are closed during winter)
  - ⑱ Water flow control valve
  - ⑲ Shut-off valve
  - ⑳ Pocket
  - ㉑ Flexible connection
  - ㉒ Charge valve
  - ㉓ Air bleed
- .....Included with the unit  
 ---Hydraulic module (unit with hydraulic module option 116A & 116W)

#### NOTES:

- The system must be protected against frost.
- The unit's hydraulic module and the water heat exchanger may be protected against freezing using electric heaters and heat trace cables (factory-fitted options 41A & 41B).
- The pressure sensors are assembled on connections without Schrader. Depressurise and drain the system before any work.

### Units with low pressure hydraulic module (116A)

30KAV	Minimum flow rate <sup>(1)</sup> (l/s)	Maximum flow rate <sup>(1)</sup> (l/s)
500A	(1)	35,2
550A	(1)	34,2
600A	(1)	34,2
650A	(1)	34,2
720A	(1)	52,8
800A	(1)	52,8

(1) See unit without hydraulic module in section 7.3.

### Units with high pressure hydraulic module (116W)

30KAV	Minimum flow rate <sup>(1)</sup> (l/s)	Maximum flow rate <sup>(1)</sup> (l/s)
500A	(1)	34,2
550A	(1)	34,6
600A	(1)	34,6
650A	(1)	34,6
720A	(1)	69,4
800A	(1)	69,4

(1) See unit without hydraulic module in section 7.3.

### 9.1.5 - Cavitation protection

To ensure the durability of pumps fitted within the integrated hydraulic modules, the control algorithm for units includes protection against cavitation. It is therefore necessary to ensure a minimum pressure at the pump inlet both when shut down and during operation. A pressure below the predefined threshold will prevent unit start-up or will cause an alarm and shutdown. Before complete shutdown following an alarm, the user interface will give an advance warning that this threshold has been exceeded.

To obtain an adequate pressure, it is recommended:

- That the hydraulic circuit is pressurized between 100 kPa (1 bar) and 400 kPa (4 bar) maximum at the pump inlet,
- That the hydraulic circuit is cleaned when filled with water or when modified,
- That the screen filter is cleaned regularly.

### 9.1.6 - Installation nominal water flow rate adjustment

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

The water circulation pumps have been sized to allow the hydraulic modules to operate in all likely system operating conditions, i.e. at a range of temperature differences between the water inlet and outlet at full load from 5 to 15 K.

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

In particular, collect the data necessary for setting the installation flow rate:

- Unit with variable speed pump – control on fixed speed: nominal flow rate.
- Unit with variable speed pump – control on temperature difference: nominal Delta T at the evaporator.
- Unit with variable speed pump – control on constant outlet pressure: pressure at the hydraulic module outlet.
- Unit with variable speed pump – control on pressure differential: Delta P at the hydraulic module connections.

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

Flow rates for a Delta T of 5K at the evaporator can be found in the product technical literature. Flow rates for any other DeltaT (between 3K and 10K) can be obtained from the "Electronic Catalogue" selection program.

#### 9.1.6.1 - Variable-speed pump - Setting a fixed flow rate for the system

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

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

#### Hydraulic circuit cleaning procedure

Refer to the water circuit cleaning procedure.

#### Procedure for controlling the flow rate

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

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

Modify the control parameters:

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

## 9 - OPTIONS

### 9.1.6.2 - Variable speed – Temperature differential control

The system flow rate has not been set to a nominal value.

The flow rate will be adjusted, by varying the pump speed, to maintain an evaporator Delta T value defined by the user.

This is checked by the temperature sensors at the evaporator inlet and outlet.

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

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

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

The resulting Delta T may, in certain cases, differ from the setpoint value:

- If the setpoint value is too high (corresponding to a flow rate lower than the minimum value or a frequency less than the minimum value), the system will be limited to the minimum flow rate or minimum frequency, which will result in a Delta T below the setpoint,
- If the setpoint value is too low (corresponding to a flow rate higher than the maximum value or a frequency greater than the maximum value), the system will be limited to the maximum flow rate or maximum frequency, which will result in a Delta T above the setpoint.

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

#### **Hydraulic circuit cleaning procedure**

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

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

### **Procedure for controlling the Delta T setpoint**

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

Modify the control parameters:

- Water flow rate control method (Delta T)
- Required Delta T value.
- If necessary, the control PID parameters can also be adjusted (refer to the control manual).

### 9.1.6.3 - Variable- speed pump - Control on constant leaving water pressure

The system flow rate has not been set to a nominal value.

It will be adjusted by the system, by varying the pump speed, to maintain a constant pressure value at the unit outlet, defined by the user.

This is checked by the pressure sensor at the hydraulic module outlet.

The system measures the pressure, compares it with the setpoint value set by the user and then modulates the pump speed module accordingly:

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

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

The maintained LWP (Leaving Water Pressure) value may, in certain cases, differ from the setpoint value:

- If the setpoint value is too high (corresponding to a flow rate higher than the maximum value or a frequency greater than the maximum value), the system will be limited to the maximum flow rate or maximum frequency, which will result in a leaving water pressure below the setpoint,
- If the setpoint value is too low (corresponding to a flow rate lower than the minimum value or a frequency less than the minimum value), the system will be limited to the minimum flow rate or minimum frequency, which will result in a leaving water pressure greater than the setpoint.

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

#### **Hydraulic circuit cleaning procedure**

Refer to the water circuit cleaning procedure.

### Procedure for controlling the leaving water pressure setpoint

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

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

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

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

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

Modify the control parameters:

- Water flow rate control method (fixed pressure)
- Required LWP value
- If necessary, the control PID parameters can also be adjusted (refer to the control manual)

**NOTE: If, during adjustment, the low or high frequency limits are reached before reaching the specified flow rate, keep the outlet pressure value at its lower or higher limit as the control set point.**

#### **9.1.6.4 - Variable-speed pump - Pressure differential control**

The system flow rate has not been set to a nominal value.

This will be adjusted by the system, by varying the pump speed, to maintain a constant Delta P value defined by the user.

This is checked by the pressure sensors at the hydraulic module inlet and outlet.

The system calculates the value for the measured pressure difference, compares it with the setpoint value set by the user and then modulates the pump speed module accordingly.

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

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

The maintained Delta P may, in certain cases, differ from the setpoint value:

- If the setpoint value is too high (corresponding to a flow rate higher than the maximum value or a frequency greater than the maximum value), the system will be limited to the maximum flow rate or maximum frequency, which will result in a Delta P below the setpoint.
- If the setpoint value is too low (corresponding to a flow rate lower than the minimum value or a frequency less than the minimum value), the system will be limited to the minimum flow rate or minimum frequency, which will result in a Delta P above the setpoint,

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

### Hydraulic circuit cleaning procedure

Refer to the water circuit cleaning procedure.

### Procedure for controlling the pressure differential setpoint

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

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

- If the flow rate read is greater than the specified value, reduce the Delta P setpoint on the user interface to decrease the flow rate value.
- If the flow rate read is less than the specified value, increase the Delta P setpoint on the user interface to increase the flow rate value.

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

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

Modify the control parameters:

- Water flow rate control method (Delta P),
- Required Delta P set point.
- If necessary, the control PID parameters can also be adjusted (refer to the control manual).

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

**If the user knows in advance the pressure differential value at the unit outlet, this value can be entered directly. You should not, however, avoid the sequence of cleaning the hydraulic circuit.**

## 9 - OPTIONS

### 9.1.7 - Physical data, optional hydraulic module

#### Standard units and Units with EC fans option (17)

##### Units 500 - 800 kW<sup>(2)</sup>

30KAV		500A	550A	600A	650A	720A	800A
<b>Dimensions</b>							
<b>Unit + options 116A / 116W</b>							
Length	mm	5578	5578	5578	5578	6772	6772
Width	mm	2261	2261	2261	2261	2261	2261
Height	mm	2324	2324	2324	2324	2324	2324
<b>Operating weight<sup>(1)</sup></b>							
<b>Unit + options 116A / 116W</b>	kg	5231	5341	5461	5471	6035	6467
<b>Hydraulic module (optional)</b>		Double pump, screen filter, relief valve, water drain valve, pressure sensors, expansion tank (option 293), heaters (option 41B)					
Pump (options 116A / 116W)		Dual pump variable speed with AC motor and variable frequency drive					
Expansion vessel volume (option 293)	l	80	80	80	80	80	80
Max. water-side operating pressure	kPa	400	400	400	400	400	400
<b>Water connections</b>		Victaulic® type					
<b>Unit + options 116A / 116W</b>							
Connections	inch	5	5	5	5	5	5
Outside tube diameter	mm	141,3	141,3	141,3	141,3	141,3	141,3

#### 30KAV (Index A) with High energy efficiency option (119) and High energy efficiency+ option (119+)

##### Units 500 - 800 kW<sup>(2)</sup>

30KAV option 119		500A	550A	600A	650A	720A	800A
<b>Dimensions</b>							
<b>Unit + options 116A / 116W</b>							
Length	mm	6772	6772	6772	6772	7962	9155
Width	mm	2261	2261	2261	2261	2261	2261
Height	mm	2324	2324	2324	2324	2324	2324
<b>Operating weight<sup>(1)</sup></b>							
<b>Unit + options 116A / 116W</b>	kg	5764	5872	5850	5853	6378	7205
<b>Hydraulic module (optional)</b>		Double pump, screen filter, relief valve, water drain valve, pressure sensors, expansion tank (option 293), heaters (option 41B)					
Pump (options 116A / 116W)		Dual pump variable speed with AC motor and variable frequency drive					
Expansion vessel volume (option 293)	l	80	80	80	80	80	80
Max. water-side operating pressure	kPa	400	400	400	400	400	400
<b>Water connections</b>		Victaulic® type					
<b>Unit + options 116A / 116W</b>							
Connections	inch	5	5	5	5	5	5
Outside tube diameter	mm	141,3	141,3	141,3	141,3	141,3	141,3

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

(2) Options 116A and 116W are not available on units 0900 to 1100.



## 9 - OPTIONS

### 9.1.8 - Electrical data, optional hydraulic module

The pumps that are factory-installed in these units comply with the European Ecodesign directive ErP. The additional electrical data required<sup>(1)</sup> is as follows:

#### Low pressure dual pump motors (option 116A)

No. <sup>(2)</sup>	Description <sup>(3)</sup>		500A	550A	600A	650A	720A	800A
1	Nominal efficiency at full load and nominal voltage	%	89,2	90,3	90,3	90,3	91,3	91,3
	Nominal efficiency at 75% of full load and nominal voltage	%	88,2	90,3	90,3	90,3	91,4	91,4
	Nominal efficiency at 50% of full load and nominal voltage	%	87,3	88,9	88,9	88,9	90,3	90,3
2	Efficiency level	-	IE3					
3	"Company name or trademark, commercial registration number and head office of manufacturer"	-	Same as above					
4	Product's model number	-	Same as above					
5	Number of motor poles	-	2	2	2	2	2	2
6	Nominal shaft power output at full load and nominal voltage (400 V)	kW	5,5	7,5	7,5	7,5	11	11
7	Nominal input frequency	Hz	50	50	50	50	50	50
8	Nominal voltage	V	3 x 400					
9	Nominal speed	r/min	2917	2935	2935	2935	2945	2945
10	Number of phase	-	Three-phase					
11	Operating conditions for which the motor is designed							
	I - Altitudes above sea level	m	< 1000 <sup>(6)</sup>					
	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 Carrier selection programs.					
	IV - Potentially explosive atmospheres	-	Non-ATEX environment					

(1) Required by regulation (EU) 2019/1781 concerning the application of directive 2009/125/EC on the eco-design requirements for electric motors.

(2) Item number imposed by regulation (EU) 2019/1781, annex I2.

(3) Description given by regulation (EU) 2019/1781, annex I2.

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

## 9 - OPTIONS

### High pressure dual pump motors (option 116W)

No. (2)	Description (3)		500A	550A	600A	650A	720A	800A
1	Nominal efficiency at full load and nominal voltage	%	90,3	91,3	91,3	91,3	91,9	91,9
	Nominal efficiency at 75% of full load and nominal voltage	%	90,3	91,4	91,4	91,4	92,1	92,1
	Nominal efficiency at 50% of full load and nominal voltage	%	88,9	90,3	90,3	90,3	90,4	90,4
2	Efficiency level	-	IE3					
3	"Company name or trademark, commercial registration number and head office of manufacturer"	-	Same as above					
4	Product's model number	-	Same as above					
5	Number of motor poles	-	2	2	2	2	2	2
6	Nominal shaft power output at full load and nominal voltage (400 V)	kW	7,5	11	11	11	15	15
7	Nominal input frequency	Hz	50	50	50	50	50	50
8	Nominal voltage	V	3 x 400					
9	Nominal speed	r/min	2935	2945	2945	2945	2945	2945
10	Number of phase	-	Three-phase					
11	Operating conditions for which the motor is designed							
	I - Altitudes above sea level	m	< 1000 <sup>(6)</sup>					
	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 Carrier selection programs.					
	IV - Potentially explosive atmospheres	-	Non-ATEX environment					

(1) Required by regulation (EU) 2019/1781 concerning the application of directive 2009/125/EC on the eco-design requirements for electric motors.

(2) Item number imposed by regulation (EU) 2019/1781, annex I2.

(3) Description given by regulation (EU) 2019/1781, annex I2.

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

## 9 - OPTIONS

### 9.2 - Free cooling Dry cooler (option 313)

#### 9.2.1 - Operating principle

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

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

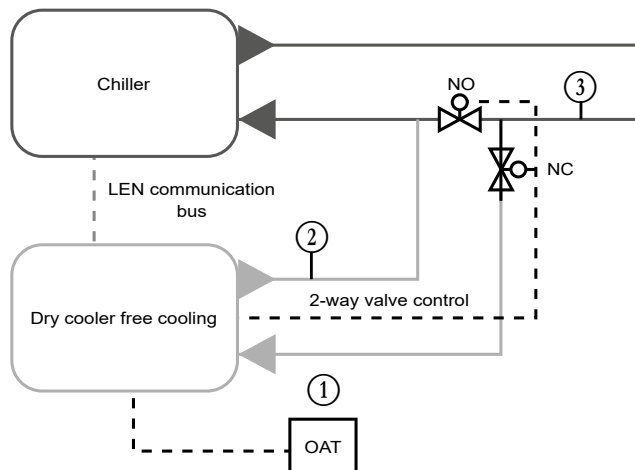
The unit's SmartVu™ control system includes algorithms to enable constant automatic optimisation of:

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

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

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

**WARNING: The dry cooler and chiller both need to be equipped with the Free cooling management option.**



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

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

#### 9.2.2 - Valves on the water loop

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

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

The dry cooler electrics box has a 230 V power supply for 2 two-way valves.

Recommended motorised valve (default component): 230 V 3-point.

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

#### 9.2.3 - Communication to control the dry cooler

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

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

The board integrated in the dry cooler electrics box has analogue inputs for the outdoor air temperature sensor (1), water loop return sensor (3) and dry cooler water outlet temperature sensor (2), as well as digital outputs for controlling the fans.

The option works as a system split in two parts:

**The chiller** (with free cooling option):

Dedicated control algorithms supplied with the LEN connector to control the dry cooler.

**The dry cooler** (with free cooling option):

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

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

#### 9.2.4 - Configuration of the fan control

To set the configuration corresponding to the dry cooler installed (number of fans, control type – fixed or variable speed), please refer to the instructions in the SmartVu™ control manual. Using these parameters, the SmartVu™ control will activate the adequate number of outputs to control the fans.

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

Compatible fan configuration:

- 1 to 20 fans,
- Fixed speed or variable speed,
- Fans in one 1 or 2 lines.

Refer to the dry cooler wiring diagram to see the arrangement of the fan stages.

## 9 - OPTIONS

### 9.2.5 - Guidelines for system installation

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

For the electrical connections, see the electrical wiring diagram supplied with the dry cooler.

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

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

- Sizing of the water piping;
- Pressure drops (verify that the operating pressure of the unit pump is sufficient compared to the pipes and valves pressure drops; check for all operating modes);
- Maximum height for the dry cooler (in relation to the unit relief valve);
- Suitable positioning of the temperature sensors: Outdoor air temperature and water loop temperature.

### 9.3 - Brine options (5 / 6 / 8)

Option 8 enables chilled water production down to a temperature of -4 °C with ethylene glycol and -2 °C with propylene glycol. The unit is equipped with insulation on the low pressure pipes and new control algorithms.

Option 5 enables chilled water production down to a temperature of -8 °C with ethylene glycol and -5 °C with propylene glycol. The unit is equipped with insulation on the low pressure pipes, new control algorithms, very low pressure sensors and an adjusted tubes number in the evaporator.

Option 6 enables chilled water production down to a temperature of -15 °C.

The unit is equipped with insulation on the low pressure pipes, new control algorithms, very low pressure sensors and turbulators in the water tubes.

The operating range is based on:

- The size of the machine,
- The type of glycol,
- Its concentration,
- The flow rate,
- The temperature of the glycol solution,
- The condensing pressure (room temperature).

Refer to the e-catalogue to find out the operating range for each unit.

#### Frost protection

The protection provided to the evaporator against low pressure and freezing depend on the amount of antifreeze in the water loop. The evaporator pinch point ((water outlet temperature) - (evaporation temperature)) and the protection against ice formation, depend on the amount.

It is therefore crucial to check the amount of antifreeze in the loop carefully during the initial system start-up (allow it to circulate for 30 minutes to check that the mixture is homogeneous before sampling).

Refer to the manufacturer's data to define the frost protection, based on the measured concentration amount.

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

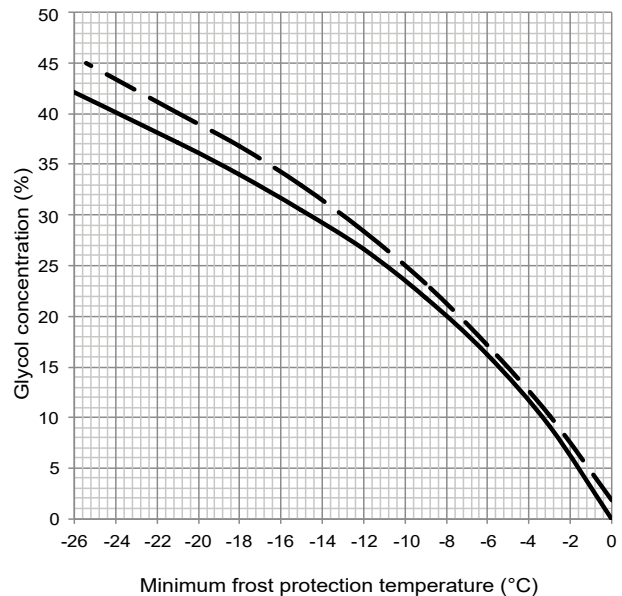
This value will enable the following limits to be defined:

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

For information, based on the antifreeze solutions used in our laboratories, the protection values provided by our supplier are as follows (these values may change depending on the supplier): It is therefore recommended that system start-up for a low or very low temperature installation is performed by the manufacturer.

#### Required glycol concentration

##### Freezing curve for Ethylene and Propylene glycol



For example, based on the curves given above, if the mass concentration measurement for ethylene glycol measured in the loop is 30 %, the frost protection temperature value to be entered in the software is -14,8 °C.

Minimum glycol concentration					
30KAV option 6 Fluid type: EG		Evaporator Delta T °C [EWT (°C) - LWT (°C)]			
		3	4	6	8
Evaporator water outlet LWT (°C)	3	1%	2%	3%	5%
	2	4%	4%	6%	8%
	1	6%	7%	9%	11%
	0	9%	10%	11%	14%
	-1	11%	12%	14%	17%
	-2	14%	15%	17%	19%
	-3	16%	17%	19%	22%
	-4	19%	20%	22%	25%
	-5	21%	22%	25%	27%
	-6	24%	25%	27%	30%
	-7	26%	27%	29%	33%
	-8	28%	29%	30%	35%
	-9	31%	32%	35%	35%
	-10	34%	35%	35%	35%
	-11	35%	35%	35%	-
	-12	35%	35%	-	-
	-13	35%	37%	-	-
	-14	37%	40%	-	-
	-15	40%	40%	-	-

## 9 - OPTIONS

Minimum glycol concentration					
30KAV option 6 Fluid type: PG		Evaporator Delta T °C [EWT (°C) - LWT (°C)]			
		3	4	6	8
Evaporator water outlet LWT (°C)	3	4%	7%	12%	17%
	2	7%	9%	15%	19%
	1	9%	12%	17%	22%
	0	12%	15%	20%	24%
	-1	15%	18%	22%	26%
	-2	18%	20%	25%	29%
	-3	21%	23%	28%	31%
	-4	23%	26%	30%	34%
	-5	26%	28%	33%	35%
	-6	29%	31%	35%	35%
	-7	31%	34%	35%	35%
	-8	34%	35%	35%	-
	-9	35%	35%	-	-
	-10	35%	-	-	-

### IMPORTANT:

- It is vital to perform a (minimum) annual inspection of the glycol level and adjust the software's frost protection based on the measured level.
- This procedure must be performed systematically if water or antifreeze solution is added.
- Observe the minimum frost protection temperature based on the water outlet temperature.

### NOTE:

- In the case of frost protection of the unit by low air temperature, the percentage brine must be evaluated accordingly.
- The maximum glycol content for units equipped with a hydraulic module is 45 %.
- The maximum recommended temperature differential is 5 K.

- To facilitate maintenance operations, it is recommended that isolation valves are installed upstream and downstream of the machine

It is essential to use precisely the correct concentration of glycol in the loop. Too high a concentration may have significant adverse effects on the performance of the evaporator, and therefore of the unit as a whole (decrease in the evaporation temperature). Too low a concentration may generate alarms or allow the evaporator to freeze. Damage caused by frost is not covered by the warranty.

### Evaporator minimal brine flow :

- Option 5 (no turbulator): Minimal flow is the flow from Ecat selection. Variable flow is not allowed. (A certain flow is necessary to the evaporator to work.)
- Option 6 (turbulator): Minimal flow is the same as for standard unit (see chapter "application data"). For variable flow, it is recommended to control pump on the Delta\_T given on the Ecat full load selection.

### IMPORTANT: Option 6 - Turbulators - water flow direction:

The water flow direction must be observed with the turbulators. If there is a risk that the flow will be reversed, check valves must be installed to guarantee the positioning of the turbulators.

### Hydraulic kit and option 5:

If the hydraulic kit option is selected alongside option 5, the pumps will be set at a default minimum frequency of between 35 Hz and 45 Hz, according to the options, to prevent the flow rate being too low. This minimum frequency may, however, be adjusted using the control.

### Brine + Heat recovery:

When the Brine and heat recovery options are combined, the glycol type and concentration must be entered in the software (Service1 table).

### Refrigerant charge for units with options 5 and 6 :

30KAV		500A	550A	600A	650A	720A	800A	900A	1000A	1100A
Refrigerant <sup>(1)</sup> - Option 5 (Medium Brine)		R134a (GWP=1430 following AR 4)								
Circuit A	kg	58	60	67	70	81	99	107	104	110
	teqCO <sub>2</sub>	83	86	96	100	116	142	153	149	157
Circuit B	kg	59	61	68	71	82	76	85	105	111
	teqCO <sub>2</sub>	84	87	97	102	117	109	122	150	159
Refrigerant <sup>(1)</sup> - Option 6 (Low Brine)		R134a (GWP=1430 following AR 4)								
Circuit A	kg	52	53	59	62	72	85	96	91	94
	teqCO <sub>2</sub>	74	75	84	89	103	122	137	130	134
Circuit B	kg	53	54	60	63	73	65	76	92	95
	teqCO <sub>2</sub>	75	77	86	90	104	93	108	132	135

30KAV option 119		500A	550A	600A	650A	720A	800A	900A	1000A	1100A
Refrigerant <sup>(1)</sup> - Option 5 (Medium Brine)		R134a (GWP=1430 following AR 4)								
Circuit A	kg	75	76	74	75	85	111	113	115	119
	teqCO <sub>2</sub>	107	109	106	107	122	159	162	164	170
Circuit B	kg	76	77	74	76	86	88	91	116	120
	teqCO <sub>2</sub>	109	110	106	109	123	126	130	166	172
Refrigerant <sup>(1)</sup> - Option 6 (Low Brine)		R134a (GWP=1430 following AR 4)								
Circuit A	kg	70	70	66	67	76	98	102	102	103
	teqCO <sub>2</sub>	100	100	95	96	108	140	146	146	147
Circuit B	kg	71	71	66	68	77	77	82	103	104
	teqCO <sub>2</sub>	102	102	95	98	110	110	117	147	149

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

## 9 - OPTIONS

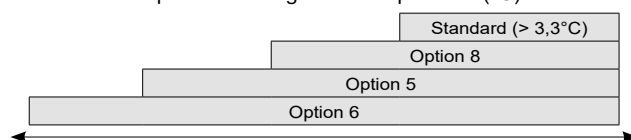
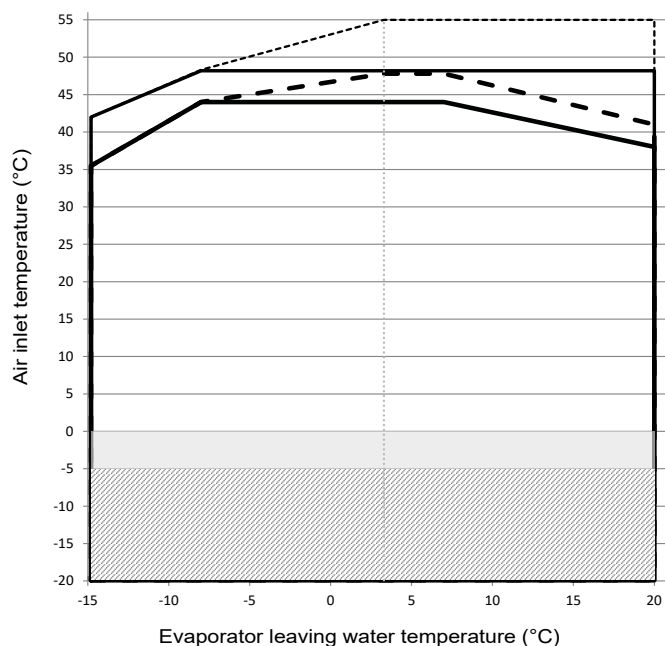
### Operating range

#### 30KAV

Evaporator water temperature		Minimum	Maximum
<b>Leaving temperature during operation</b>			
Unit + option 8	°C	-4	20
Unit + option 5	°C	-8	20
Unit + option 6	°C	-15	20

#### Notes:

- The use of brine or antifreeze protection option is required if the water outlet temperature is below 4 °C.



- Full load
- - - Opt. 16 Full load
- ..... < 3,3°C: Brine options
- Part load
- - - - Opt. 16 Part load

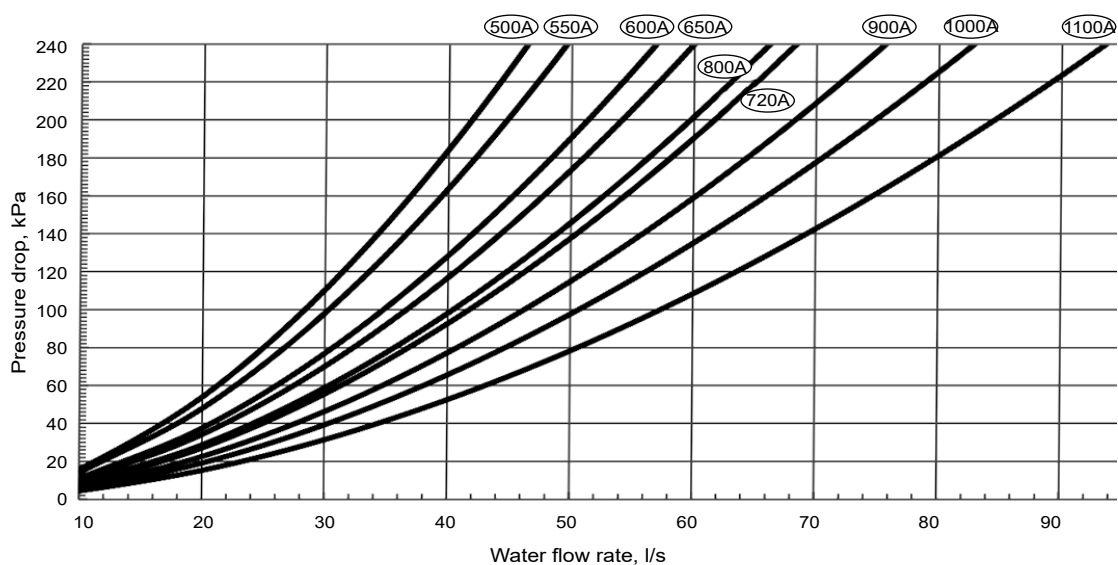
#### NOTE:

- Evaporator  $\Delta T = 4K$
- These ranges are given for indicative purpose. Check the operating range from Carrier electronic catalogue.

#### Legend:

- Operating range, standard units
- Below 0 °C air temperature the unit must either be equipped with the evaporator frost protection option 41A, or the water loop must be protected against frost by using a frost protection solution (by the installer).
- ▨ For start-ups with air temperature below -5 °C, the machine must be equipped with option 41A.

### Pressure drops - Evaporator option 6 - Turbulators





## 9 - OPTIONS

### 9.4 - Heat recovery (options 49 / 50)

30KAV		500A	550A	600A	650A	720A	800A	900A	1000A	1100A
<b>Unit length + options</b>										
30KAV + option 49	mm	5578	5578	6772	6772	6772	6772	7962	7962	9155
30KAV_option_119+ + option 49	mm	6735	6735	6735	6735	7925	9120	9120	10305	10305
Width	mm	2261	2261	2261	2261	2261	2261	2261	2261	2261
Height	mm	2324	2324	2324	2324	2324	2324	2324	2324	2324
<b>Operating weight<sup>(1)</sup></b>										
30KAV + option 49	kg	5182	5196	5597	5611	5860	6325	6761	7249	7655
30KAV + option 49 + option 325 <sup>(2)</sup>	kg	5331	5345	5777	5791	6040	6530	6976	7462	7869
30KAV_option_119+ + option 49	kg	5744	5756	5777	5784	6231	7069	7195	7993	8040
30KAV_option_119+ + option 49 + option 325 <sup>(2)</sup>	kg	5895	5907	5957	5964	6411	7274	7409	8206	8253
<b>Partial Heat recovery condenser</b>		Brazen-plate heat exchanger								
Circuit A		B320 LTL	B320 LTL	B320 LTL	B320 LTL	B320 LTL	B320 LTL	B320 LTL	B320 LTL	B320 LTL
Circuit B		B320 LTL	B320 LTL	B320 LTL	B320 LTL	B320 LTL	B320 LTL	B320 LTL	B320 LTL	B320 LTL
Water volume	l	18 / 18	18 / 18	29 / 29	29 / 29	29 / 29	48 / 29	48 / 29	48 / 48	48 / 48
<b>Hydraulic connections without option 325 <sup>(2)</sup></b>		Victaulic® type								
Connections on recovery condenser side	inches	4	4	4	4	4	4	4	4	4
Diameters of external pipes on recovery condenser side	mm	114,3	114,3	114,3	114,3	114,3	114,3	114,3	114,3	114,3
Connections on evaporator side	inches	5	5	6	6	6	6	8	8	8
Diameter of external pipes on evaporator side	mm	141,3	141,3	168,3	168,3	168,3	168,3	219,1	219,1	219,1
<b>Hydraulic connections with option 325 <sup>(2)</sup></b>		Victaulic® type								
Connections on recovery condenser side	inches	5	5	5	5	5	6	6	6	6
Diameters of external pipes on recovery condenser side	mm	141,3	141,3	141,3	141,3	141,3	168,3	168,3	168,3	168,3
Connections on evaporator side	inches	5	5	6	6	6	6	6	6	6
Diameter of external pipes on evaporator side	mm	141,3	141,3	168,3	168,3	168,3	168,3	168,3	168,3	168,3

30KAV		500A	550A	600A	650A	720A	800A	900A	1000A	1100A
<b>Unit length + options</b>										
30KAV + option 50	mm	5578	5578	6772	6772	6772	6772	7962	7962	9155
30KAV_option_119+ + option 50	mm	6735	6735	6735	6735	7925	9120	9120	10305	10305
Width	mm	2261	2261	2261	2261	2261	2261	2261	2261	2261
Height	mm	2324	2324	2324	2324	2324	2324	2324	2324	2324
<b>Operating weight<sup>(1)</sup></b>										
30KAV + option 50	kg	5257	5271	5785	5799	6048	6570	7006	7552	7958
30KAV + option 50 + option 325 <sup>(2)</sup>	kg	5406	5420	5965	5979	6228	6774	7221	7765	8172
30KAV_option_119+ + option 50	kg	5819	5831	5965	5972	6419	7314	7439	8295	8343
30KAV_option_119+ + option 50 + option 325 <sup>(2)</sup>	kg	5970	5982	6145	6152	6599	7518	7654	8509	8556
<b>Partial heat recovery</b>		Brazen-plate heat exchanger								
Circuit A		B320 LTH	B320 LTH	B320 LTH	B320 LTH	B320 LTH	B427 M1	B427 M1	B427 M1	B427 M1
Circuit B		B320 LTH	B320 LTH	B320 LTH	B320 LTH	B320 LTH	B320 LTH	B320 LTH	B427 M1	B427 M1
Water volume	l	18 / 18	18 / 18	29 / 29	29 / 29	29 / 29	48 / 29	48 / 29	48 / 48	48 / 48
<b>Hydraulic connections without option 325 <sup>(2)</sup></b>		Victaulic® type								
Connections on recovery condenser side	inches	4	4	4	4	4	4	4	4	4
Diameters of external pipes on recovery condenser side	mm	114,3	114,3	114,3	114,3	114,3	114,3	114,3	114,3	114,3
Connections on evaporator side	inches	5	5	6	6	6	6	8	8	8
Diameter of external pipes on evaporator side	mm	141,3	141,3	168,3	168,3	168,3	168,3	219,1	219,1	219,1
<b>Hydraulic connections with option 325 <sup>(2)</sup></b>		Victaulic® type								
Connections on recovery condenser side	inches	5	5	5	5	5	6	6	6	6
Diameters of external pipes on recovery condenser side	mm	141,3	141,3	141,3	141,3	141,3	168,3	168,3	168,3	168,3
Connections on evaporator side	inches	5	5	6	6	6	6	6	6	6
Diameter of external pipes on evaporator side	mm	141,3	141,3	168,3	168,3	168,3	168,3	168,3	168,3	168,3

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

(2) Option 325 = Hydraulic connection kit

## 9 - OPTIONS

### 9.4.1 - Operating principle

Options 49 and 50 enable free hot water to be produced by recovering the waste heat emitted at the compressor discharge point

Option 49 (partial heat recovery) is designed to recover approximately 20% of the total output discharged by the chiller (depending on the operating conditions).

Option 50 (total heat recovery) is designed to recover approximately 95% of the total output discharged by the chiller (depending on the operating conditions).

Both options have a plate heat exchanger installed as standard with air-cooled condensers on the compressor discharge line on each circuit. The flow of refrigerant still passes through the recovery exchangers, ensuring hot water is produced once the unit is in chilled water production mode.

There is no isolation valve or solenoid valve on the refrigerant circuit; hot water production is switched off by actuating a three-way valve and/or a pump on the hot water hydraulic circuit. (See the control manual)

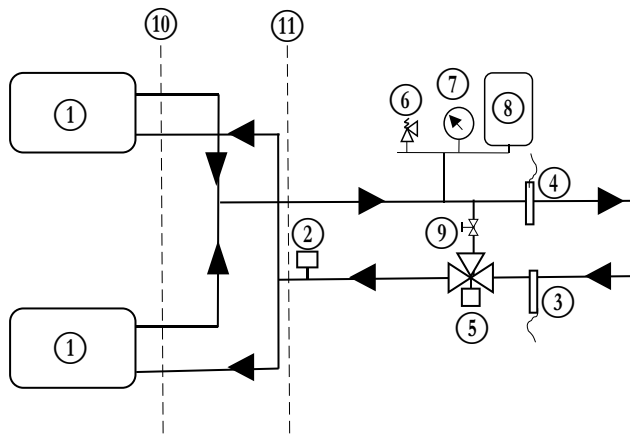
### 9.4.2 - Condenser hydraulic connection

The unit is delivered with two temperature sensors and a flow rate controller which control the heat recovery.

The water flow controller must be installed on the installation's water inlet leading to the heat recovery condensers. (The maximum length of the temperature sensors and flow rate controller is 15 metres)

It is recommended to place the temperature sensors and the flow rate controller as shown in the diagram below to guarantee optimal control of the hot water temperature.

**NOTE: The water can be regulated on the water inlet or outlet. (See the control manual)**



#### Key

#### Component of option 49 / 50

- ① Heat reclaim condenser
- ② Condenser water flow controller (supplied)
- ③ Water inlet temperature sensor (supplied)
- ④ Water outlet temperature sensor (supplied)

#### Installation components (installation example)

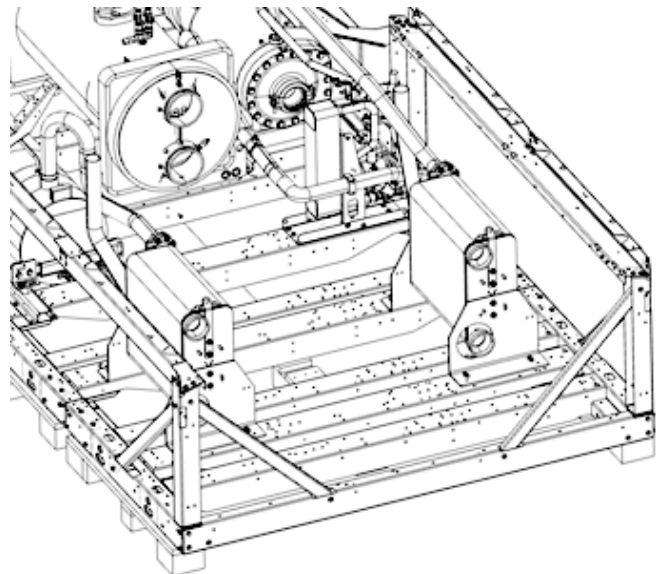
- ⑤ Three-way valve (recommended)
- ⑥ Safety valve
- ⑦ Pressure gauge
- ⑧ Expansion tank (100°C minimum)
- ⑨ Recovery condenser water flow rate balancing valve
- ⑩ Border between the unit and the installation (without option 325)
- ⑪ Border between the unit and the installation (with option 325)

**NOTE: For the hydraulic installation, it is recommended that Carrier's recommendations are followed. (See chapter 7.1 Operating precautions)**

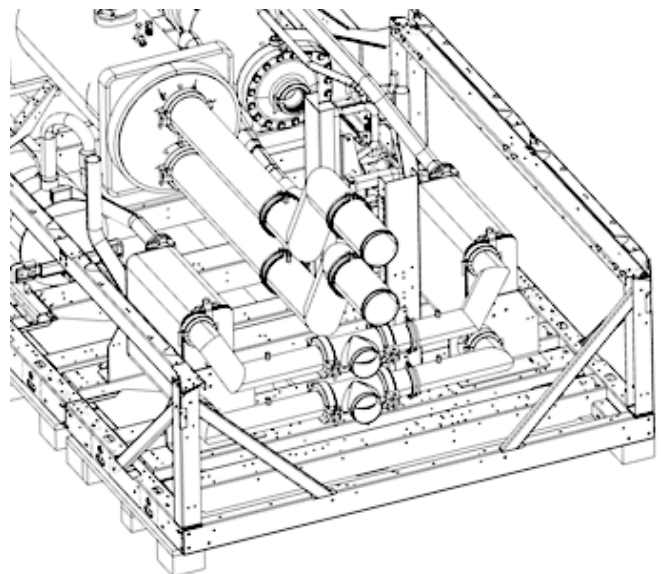
### Hydraulic connection with option 325:

Option 325 enables hydraulic connection between the two recovery exchangers to obtain only one hot water inlet/outlet.

#### Option 49/50: Without option 325



#### Option 49/50: With option 325



#### NOTE:

**Option 41C ensures thermal insulation of the recovery and evaporator water pipes to protect them from frost.**

## 9 - OPTIONS

### 9.4.3 - Heat recovery operation

Heat recovery mode is activated and deactivated by a three-way valve and/or a pump on the hot water hydraulic circuit. The control system will then adapt to the request by regulating the flow of water into the condensation exchangers and the flow of air into the air-cooled condenser.

#### Water flow control:

A 0-10 V output is available on the unit electronic board to control a three-way valve or a variable flow pump. It is strongly recommended that one of these two components is installed to ensure a fluid transition between recovery mode and standard mode. The control system will start heat recovery, and maintain the hot water setpoint temperature.

(See the control manual)

#### Controlling the recovery capacity:

There are two available operating modes for options 49 and 50:

Optimised recovery mode: (the default configuration with option 50)

This mode enables recovery capacity to be adjusted by gradually reducing the ventilation speed to the configured setpoint. When there is no longer a recovery request, the control system increases the ventilation speed and cuts off the water flow.

Economy mode: (the default configuration with option 49)

This mode enables recovery of desuperheating only. The machine's efficiency is not affected by the recovery request. The control system only adjusts the water flow and does not alter the ventilation speed.

#### Frost protection:

The heat recovery condensers are equipped with electrical heaters which protect them against frost. They are activated if the outdoor air temperature is less than 3 °C and if the machine is not in chilled water production mode.

**NOTE: If there is glycol in the hot water loop, it is possible to configure it and deactivate the frost protection on the water-cooled condenser side.**

### 9.4.4 - Operating range:

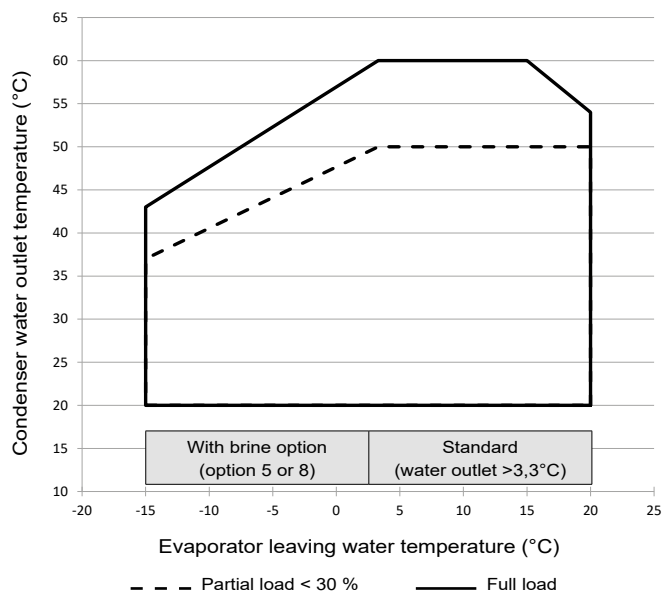
Operating range		Minimum	Maximum
Hot water temperature (option 49)	°C	18 <sup>(1)</sup>	65 <sup>(2)</sup>
Hot water temperature (option 50)	°C	18 <sup>(1)</sup>	60 <sup>(2)(3)</sup>

- (1) For installations with a lower temperature, a three-way valve must be used.
- (2) If the temperature difference between the air and the hot water demand is significant, it is recommended to activate optimised recovery mode (see recovery operation)
- (3) For option 50, the maximum hot water temperature depends on the water temperature at the evaporator. (See option 50: Operating limit graph)

#### Option 50: Operating limit

Limitation of the condenser water outlet temperature is due to the screw compressor operating range. If the condenser water outlet temperature is above the limit value given in the curves below, the unit will remain in heat recovery mode but will limit the recovered heating capacity by increasing the ventilation speed.

#### Option 50: Total heat recovery Operating limits:



#### NOTE:

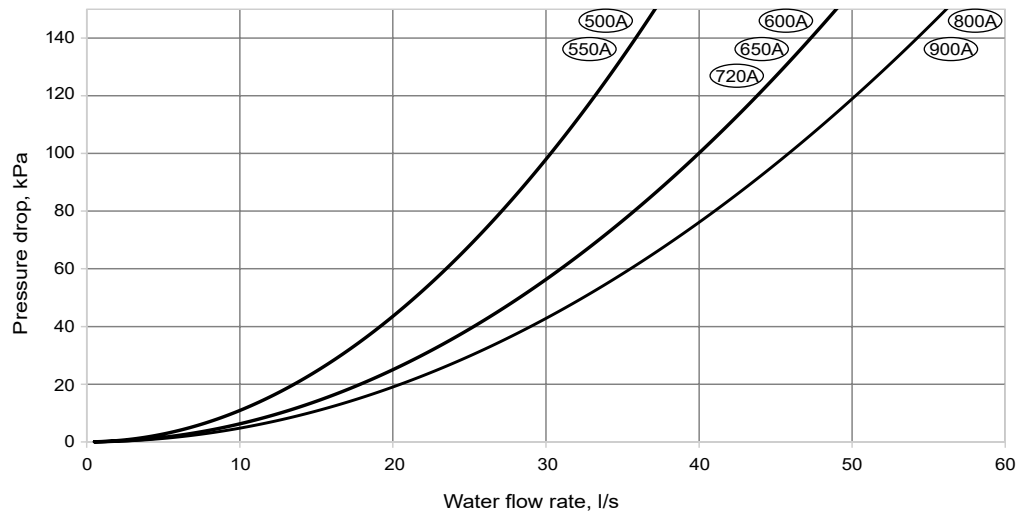
- Evaporator  $\Delta T = 5 \text{ K}$
- Condenser  $\Delta T = 5$
- These operating ranges are guidelines only. Verify the operating range with the Carrier electronic catalogue.

**NOTE: The Carrier electronic catalogue generates recovery performances under wind conditions of 12 km/h. If the unit is located in an area exposed to the wind, the recovery capacity may be affected.**

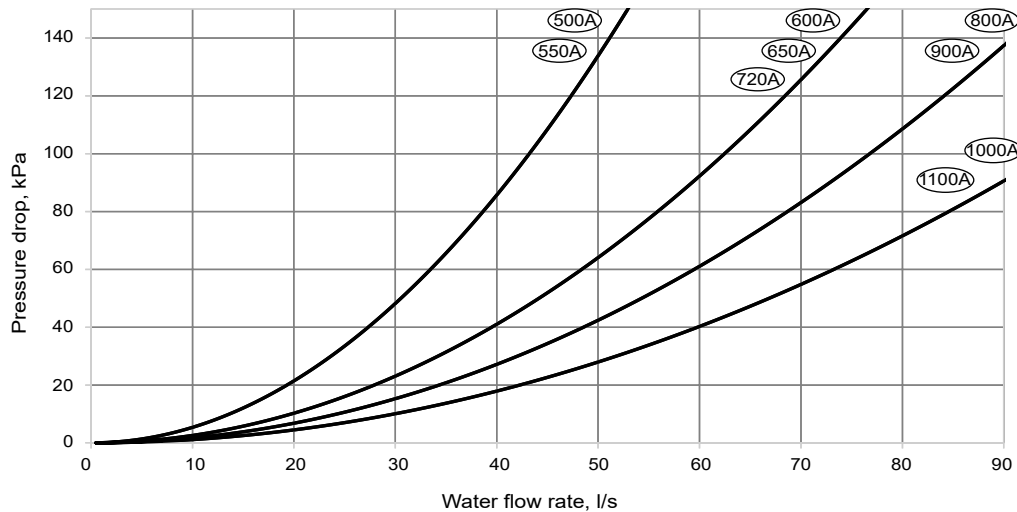
9.4.5 - Condenser hydraulic pressure drop:

The pressure drops below are calculated with the two recovery exchangers in parallel.

Option 49: Partial heat recovery  
Hydraulic pressure drop



Option 50: Total heat recovery  
Hydraulic pressure drop



## 9 - OPTIONS

### 9.5 - Operation of two units as a Lead /Lag pair (option 58)

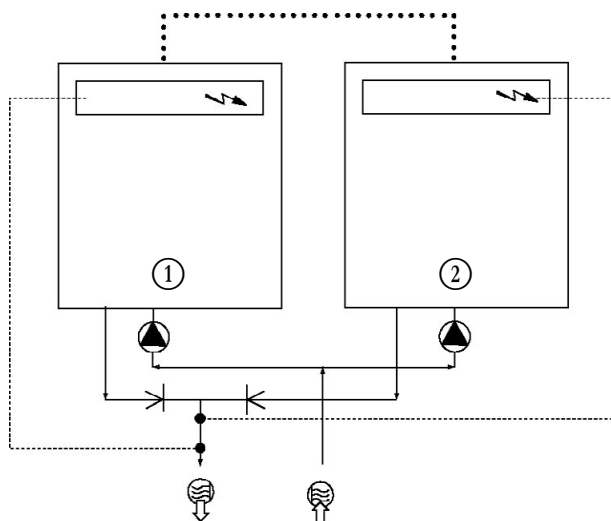
The Lead /Lag pair is controlled on the water inlet without any additional sensors being added (standard configuration). It is also possible to control on the water outlet by adding two additional sensors in the common supply pipe work.

All the parameters required for the Lead /Lag function must be configured using the MST\_SLV configuration menu. All remote controls of the Lead /Lag pair (start/stop, setpoint, load shedding, etc.) are managed by the unit configured as the lead and must only be applied to the lead unit.

Each unit controls its own water pump. If there is only one common pump, in cases with a variable flow, isolation valves must be installed on each unit. These should be controlled (opened and closed) using the controls for the relevant unit (in this case, valves will be controlled using the dedicated water pump outputs). Refer to the SmartVu™ control manual for a more detailed explanation.

**WARNING: To permit Lead /Lag operation both units must be equipped with option 58.**

**Configuration: Control on the water outlet**



#### Key

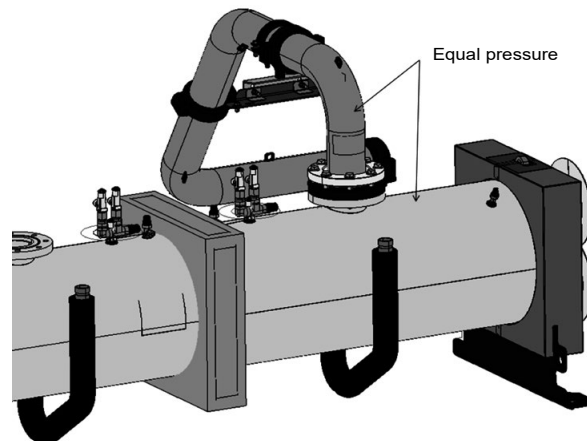
- ① Lead unit
- ② Lag unit
- ⚡ Control panels for Lead and Lag units
- 🔌 Water inlet
- 🔌 Water outlet
- ⬆ Water pumps for each unit (included as standard in units with hydraulic module)
- Additional sensors for the control of the leaving water temperature to be connected on channel 1 of the lag boards of both Lead and Lag unit
- ... Communication bus CCN
- Connection of two additional sensors

### 9.6 - Service valves (option 92)

The unit can be equipped with optional service valves to facilitate maintenance and repair operations.

If option 92 is ordered, each refrigerating circuit will be equipped with isolation valves on the economiser line, and at the compressor discharge and suction.

**WARNING: The valve at the compressor suction should only be operated when there is no differential pressure across it. Operating the valve when there is a pressure differential may compromise the valve's sealing or even result in failure.**



## 9 - OPTIONS

### 9.7 - Ultra fast capacity recovery (option 295+)

When option Ultra-fast recovery is present, the Touch Pilot is supplied at 24 VDC by a capacity module that keeps the supply after input voltage is switched OFF during 10 minutes. This will avoid resetting delay of the Touch Pilot when power supply is back and therefore allow the unit to be back at its original operating state within 3 minutes.

When the capacity module is fully unloaded, 15 minutes delay maximum shall be considered after unit power supply is switched ON in order to have the module fully loaded. The duration of 10 minutes for buffer supply is guaranteed only after the capacity module is fully loaded.

When the capacity module is fully loaded, a duration of up to 4 hours shall be considered before it is fully unloaded if no power consuming device is present.

**Caution : In case of access to the cabinet that encloses the capacity module, consider the occurrence of stored energy as well as 24 VDC even if power supply was switched OFF. Energy is present in the capacitor that are fitted inside the capacity module and voltage is present inside as well as outside on 24 VDC circuit between the capacity module and the Touch Pilot.**

**Occurrence of stored energy as well as 24 VDC voltage creates some hazards in case of careless handling. Particularly: arcing, burst, electric shock in wet environment.**

Module state can be checked through LED that are present on front side of the device :

Status LED			Decriptif
Uin OK (Green)	READY (Green)	ALARM (Red)	
o	o	o	Device off
.	.	.	Initialization, LED test (~3s)
.	.	o	Mains operation, buffer is ready. The SOC <sup>(1)</sup> of the capacitors is above READY threshold
	. 50%	o	Mains operation, charging process. The SOC <sup>(1)</sup> of the capacitors is below READY threshold
	. 50%	.	Mains operation, ALARM. The SOC <sup>(1)</sup> of the capacitors is below READY threshold
	.	.	Mains operation, ALARM. The SOC <sup>(1)</sup> of the capacitors is above READY threshold
o	.	o	Buffer mode
	.	.	Buffer mode, ALARM due to over temperature >70 °C
	o	.	Buffer mode, ALARM
	o	.	Start-up, ALARM
. 90%	.	o	Mains operation, REMOTE contact shorted to SGnd, buffer is READY.
	. 50%	o	Mains operation, REMOTE contact shorted to SGnd, Charging in process.
. 10%	. 50%	o	Mains operation, REMOTE contact shorted to SGnd or output delay on enable, charging process or CAP is fully charges <sup>(2)</sup> .
	. 50%	.	Mains operation, REMOTE contact shorted to SGnd or output delay on enable, charging process or READY, ALARM).
o	o	. 50%	The device is locked due to over temperature less or higher than 80 °C. No input, the device output is OFF.
.	o	. 50%	The device is locked. The temperature is less than 80 °C. The device output is ON.
. 10%	o	. 50%	The device is locked. The temperature less or higher than 80 °C, or BYPASS function is disabled, or BYPASS function is disabled. The device output is OFF.

(1) SOC : State of Charge

(2) Delay for the flashing READY LED max 10sec.



## 9 - OPTIONS

### 9.8 - Connected Services (option 298A)

#### Description :

The connectivity system is composed of a modem and an antenna with GPS localization that transmit the machine's operating data in real time via a 4G LTE-M

#### Modem precautions:

##### Do not :

Operate the Sierra Wireless product in areas where blasting is in progress, near medical equipment, near life support equipment, or any equipment which may be susceptible to any form of radio interference. In such areas, the Sierra Wireless product **MUST BE POWERED OFF**. The Sierra Wireless product can transmit signals that could interfere with this equipment.

##### For information :

The connectivity can start the machine only if it is in **network** mode. If there is a technician on site who prefers to start or stop the machine by pressing the "ON/OFF" button of the PIC 6 display, the control is no longer in **network** mode but in **local** mode. When the operator is in local mode the option is no longer capable to start the machine remotely. (While the machine is in local mode, the option is in monitoring mode.)

#### Antenna precautions:

##### Do not :

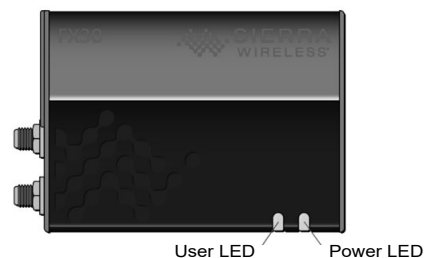
- Operate the transmitter when someone is within 20 cm of the antenna.
- Operate the equipment in an explosive atmosphere.
- Attempt to install the antennas without the proper safe equipment to access the install location.
- Install the antenna near overhead power lines.
- Chew parts or put them in mouth, keep away from unsupervised children.
- Cover the antenna in order to have a good signal.
- Place objects next to the antenna in order to have a good signal.

#### Activation of the connectivity:

Contact your Connectivity Service to ask the commissioning of the connectivity system included in your chiller. If the activation has not been done, the system will not send any data from the machine.

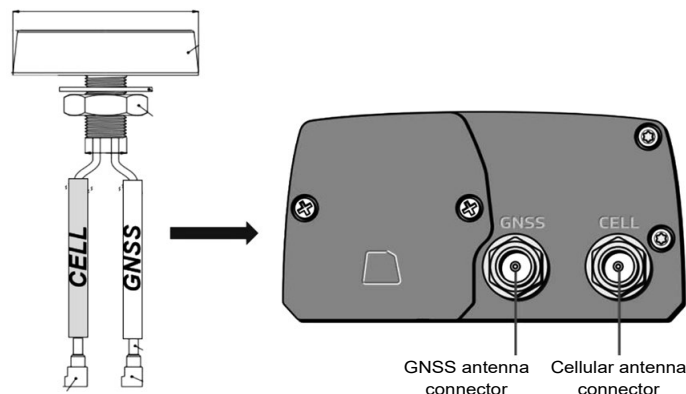
#### Modem LEDs to check the GSM signal :

##### LED Behavior



LED	Color/Pattern	Description
Power LED	Off	No power or input voltage $\geq 32$ VDC or $\leq 4,75$ VDC
	Solid Red	Gateway is powered on, not attached to cellular network.
	Solid Amber	Attached to cellular network.
User LED	Green	Good network signal
	Amber	Correct/Poor network signal
	RED	No signal

#### Technical specifications :



Modem (FX30S LTE-M)	
POWER VOLTAGE	DC 4,75V to 32V
POWER CONSUMPTION	
Ignition Off	400 $\mu$ W
Ultra-Low Power Mode	2 mW
Idle mode	0,4 W
4G LTE max	3,2 W, burst 7,5 W (USB at 110Mbps and Serial continuous)
Radio Module	WP7702
WEIGHT	158 g
ENVIRONEMENTAL	
Operational Temperature (Class B)	30 °C to +75 °C
Humidity	95% relative humidity over a temperature range of +20 °C to +60 °C

Antenna (LGP-7-38-03RSP & LGP-7-38-1-2SP)	
Operating temperature	-40 °C / +85 °C (-104 °F / 185 °F)
Material	ASA

## 9 - OPTIONS

### 9.9 - Low & very low noise (options 15 / 15LS)

Standard units and Units with EC fans option (17)

Units 500 - 1100 kW

30KAV		500A	550A	600A	650A	720A	800A	900A	1000A	1100A
<b>Sound levels</b>										
<b>Unit + option 15</b>										
Sound power <sup>(1)</sup>	dB(A)	94	94	94	96	97	96	97	97	98
Sound pressure at 10 m <sup>(2)</sup>	dB(A)	62	62	61	64	64	63	65	64	65
<b>Unit + option 15LS</b>										
Sound power <sup>(1)</sup>	dB(A)	90	90	90	92	94	92	94	93	94
Sound pressure at 10 m <sup>(2)</sup>	dB(A)	57	58	58	59	61	60	62	60	61
<b>Fans</b>										
Quantity		6	6	8	8	10	10	12	12	14
Maximum total air flow + option 15LS	l/s	28920	26100	41600	43200	56000	50000	67200	57840	72800
Maximum rotation speed + option 15LS	r/s	13,2	12,0	14,2	14,7	15,2	13,7	15,2	13,2	14,2

30KAV (Index A) with High energy efficiency option (119) and High energy efficiency+ option (119+)

30KAV option 119		500A	550A	600A	650A	720A	800A	900A	1000A	1100A
<b>Sound levels</b>										
<b>30KAV_option_119+ : option 15</b>										
Sound power <sup>(1)</sup>	dB(A)	95	95	94	96	97	96	98	98	98
Sound pressure at 10 m <sup>(2)</sup>	dB(A)	62	62	62	64	64	64	65	65	65
<b>30KAV_option_119+ : option 15LS</b>										
Sound power <sup>(1)</sup>	dB(A)	90	91	91	92	94	92	94	93	95
Sound pressure at 10 m <sup>(2)</sup>	dB(A)	57	58	58	59	61	60	61	60	61
<b>Fans</b>										
Quantity		10	10	10	10	12	14	14	16	16
Maximum total air flow + option 15LS	l/s	44700	43500	52000	52000	64800	67480	75600	74080	83200
Maximum rotation speed + option 15LS	r/s	12,3	12,0	14,2	14,2	14,7	13,2	14,7	12,7	14,2

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

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



Eurovent certified values

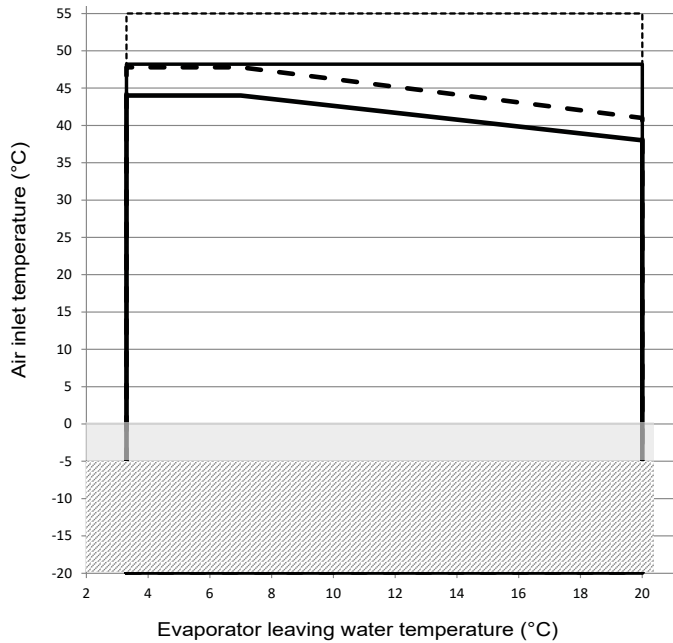
CARRIER participates in the ECP programme for LCP-HP Check ongoing validity of certificate: [www.eurovent-certification.com](http://www.eurovent-certification.com)

9.10 - VFD High Ambient (option 16)

30KAV

Condenser air temperature	Minimum	Maximum
Operation		
Unit + option 16	°C	-20 <sup>(2)</sup> 55 <sup>(1)</sup>

- Notes:
- If the air temperature is below 0 °C, a glycol/water solution or the freeze protection option must be used.
- (1) Operating at partial load  
(2) Option 41A mandatory for start-ups below -5 °C



- Full load
- Part load
- Opt. 16 Full load
- Opt. 16 Part load

NOTE:

- Evaporator  $\Delta T = 4K$
- These ranges are given for indicative purpose. Check the operating range from Carrier electronic catalogue.

- Legend:
- Operating range, standard units
  - Below 0 °C air temperature the unit must either be equipped with the evaporator frost protection option 41A, or the water loop must be protected against frost by using a frost protection solution (by the installer).
  - For start-ups with air temperature below -5 °C, the machine must be equipped with option 41A.

## 9 - OPTIONS

### Electrical data

#### Units 500 - 1100 kW

30KAV		500A	550A	600A	650A	720A	800A	900A	1000A	1100A
<b>Maximum operating input power<sup>(1)</sup></b>										
Unit + option 16	kW	239	260	288	313	340	390	430	481	519
<b>Maximum operating current draw (Un)<sup>(1)</sup></b>										
Unit + option 16	A	371	404	448	487	529	606	668	747	807
<b>Maximum operating current draw (Un-10%)<sup>(1)</sup></b>										
Unit + option 16	A	406	441	490	519	563	658	711	796	859

### Electrical data of units with combination of options High energy efficiency (119) & High Energy Efficiency + (119+), compressor with PM motor (329), fans with EC motor (17)

#### Units 500 - 1100 kW

30KAV options 119 & 329		500A	550A	600A	650A	720A	800A	900A	1000A	1100A
<b>Maximum operating input power<sup>(1)</sup></b>										
Unit + option 119 + option 16	kW	238	263	280	303	330	382	416	469	502
Unit + option 119 + option 17 + option 16	kW	236	261	277	300	327	379	412	465	497
Unit + option 329 + option 16	kW	234	255	272	296	334	373	423	466	511
Unit + option 329 + option 119 + option 16	kW	233	258	264	286	324	365	409	454	494
<b>Maximum operating current draw (Un)<sup>(1)</sup></b>										
Unit + option 119 + option 16	A	369	408	436	472	513	594	646	729	780
Unit + option 119 + option 17 + option 16	A	366	405	432	468	508	589	640	723	773
Unit + option 329 + option 16	A	364	397	423	460	519	580	657	724	794
Unit + option 329 + option 119 + option 16	A	362	401	411	445	503	568	635	706	767
<b>Maximum operating current draw (Un-10%)<sup>(1)</sup></b>										
Unit + option 119 + option 16	A	402	436	475	503	545	643	687	775	830
Unit + option 119+ + option 16	A	399	433	471	499	540	638	681	769	823
Unit + option 329 + option 16	A	399	434	465	492	553	632	700	773	846
Unit + option 329 + option 119 + option 16	A	395	429	450	476	535	617	676	752	817

(1) Values obtained at operation with maximum operating power input (data given on the unit nameplate)

## 9 - OPTIONS

### 9.11 - 400V-3Ph-60Hz Power supply (option 335)

#### 9.11.1 - Physical data

30KAV		500A	550A	600A	650A	720A	800A	900A	1000A	1100A
Sound levels										
Standard unit										
Sound power <sup>(1)</sup>	dB(A)	95	95	96	98	99	98	99	98	100
Sound pressure at 10 m <sup>(2)</sup>	dB(A)	63	63	64	65	66	65	67	65	67
Dimensions										
Standard unit										
Length	in	173	173	220	220	267	267	313	313	360
Width	in	89	89	89	89	89	89	89	89	89
Height	in	91	91	91	91	91	91	91	91	91
Operating weight <sup>(4)</sup>										
Standard unit	lb	10543	10573	11398	11429	12450	13422	14394	15417	16319
Compressors										
Standard unit		06Z twin screw variable speed with AC induction motor and variable frequency drive								
Unit + option 329 <sup>(3)</sup>		06Z twin screw variable speed with AC permanent magnet motor and variable frequency drive								
Circuit A	Quantity	1	1	1	1	1	1	1	1	1
Circuit B	Quantity	1	1	1	1	1	1	1	1	1
Unit minimum part load <sup>(5)</sup>	%	13	13	13	13	13	13	13	12	12
Unit PED Category		III	III	III	III	III	IV	IV	IV	IV
Refrigerant <sup>(4)</sup> - Standard unit		R134a (GWP=1430 following AR4)								
Circuit A	lb	108	110	123	130	150	179	201	190	196
	teqCO <sub>2</sub>	154	158	177	186	214	255	287	271	281
Circuit B	lb	110	112	126	132	152	134	159	192	198
	teqCO <sub>2</sub>	158	161	180	189	218	192	227	274	284
Oil		Oil for R134a. Contact Carrier for supplying.								
Circuit A	gal	7	7	7	6	5	6	5	6	5
Circuit B	gal	7	7	7	6	5	6	5	6	5
Unit control		SmartVu™ with 7 inch coloured touch screen interface								
Languages		10 languages (DE, EN, ES, FR, IT, NL, PT, TR, TU + one on customer choice)								
Smart energy metering		Standard feature								
Wireless connectivity		Option								
Expansion valve		Electronic expansion valve								
Air heat exchanger		Novation™ Micro Channel Heat Exchanger								
Fans										
Standard unit		Flying Bird™ VI impeller variable speed with AC motor and variable frequency drive								
Unit + option 17 <sup>(3)</sup>		Flying Bird™ VI impeller variable speed with EC motor								
Quantity		6	6	8	8	10	10	12	12	14
Maximum total air flow	gpm	669696	669696	892928	892928	1116160	1116160	1339392	1339392	1562624
Maximum rotation speed	r/s	19	19	19	19	19	19	19	19	19
Water heat exchanger		Flooded shell and tube heat exchanger								
Water volume	gal	22	23	25	26	30	33	38	44	48
Max. water-side operating pressure without hydraulic module	ft.H <sub>2</sub> O	335	335	335	335	335	335	335	335	335
Water connections		Victaulic® type								
Standard unit										
Connections	inch	5	5	6	6	6	6	8	8	8
Outside tube diameter	inch	5"1/2	5"1/2	6"1/2	6"1/2	6"1/2	6"1/2	8"1/2	8"1/2	8"1/2
Casing paint		Colour code RAL 7035								

(1) In dB ref=10<sup>-12</sup> 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) Options: 17=Fans motors EC type ; 329=Compressors motors PM type

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

(5) For standard conditions. Depending on operating conditions, unit might have a different minimum part load or cycle.

## 9 - OPTIONS

### 9.11.2 - Electrical data

30KAV		500A	550A	600A	650A	720A	800A	900A	1000A	1100A
<b>Power circuit supply</b>										
Nominal voltage	V-ph-Hz	400-3-60								
Voltage range	V	360-440								
<b>Control circuit supply</b>		24 V via internal transformer								
<b>Maximum operating input power<sup>(1)</sup></b>										
Standard unit	kW	225	246	272	296	320	367	402	451	484
<b>Power factor at maximum power<sup>(1) (2)</sup></b>		0,91-0,93								
Displacement Power Factor (Cos Phi)		>0,98								
Total harmonic distortion (THDi) <sup>(1) (3)</sup>		35-45%								
<b>Maximum operating current draw (Un)<sup>(1)</sup></b>										
Standard unit	A	350	382	423	460	498	570	625	701	752
<b>Maximum operating current draw (Un-10%)<sup>(1)</sup></b>										
Standard unit	A	383	416	463	490	530	618	666	747	801
<b>Start-up current<sup>(4)</sup></b>										
Standard unit	A	212	228	245	262	286	378	412	399	425

(1) Values obtained at operation with maximum operating power input (data given on the unit nameplate)

(2) Value decreases when load lowers

(3) May vary according to the installation's short circuit ratio

THDi increases when load lowers. But the highest impact on the installation occurs when the current is maximum. Therefore compliance of the installation regarding voltage harmonic distortion at PCC (per IEC61000-2-4 or other standard) shall be usually checked at max load in order to cover all load conditions.

(4) Operating current of the biggest compressor + fan current + starting current of the smallest compressor.

Starting current values used for the compressor are : 06ZCE1-H3AA06013 = 40A ; 06ZFC2-3AA06013 = 50A ; 06ZJG3-3AA06013 = 80A.



## 10 - SYSTEM INITIAL START-UP

### 10.1 - Checks before system start-up

Before commissioning the chiller the complete system must be verified against the installation drawings, dimensional drawings, system piping and instrumentation diagrams and the wiring schematics. All measures must be taken to ensure that the pressure and temperature limits, specifically those listed on the unit nameplates, are not exceeded during operation, maintenance and recycling. Heat exchange fluid temperatures above the maximum recommended can lead to an increase in the refrigerant pressure and can cause a loss of refrigerant due to the relief valve discharge. National regulations must be followed during these checks. If the national regulation does not specify any details, refer to standard EN 378 as follows:

External visual installation checks:

- Ensure that the machine is charged with refrigerant. Verify on the unit name plate that the 'fluid transported' is that recommended for operation, and is not nitrogen.
- Compare the complete system with the cooling system and power circuit diagrams.
- Check that all documents provided by the manufacturer (dimensional drawings, pipe and instrument diagram (PID), declarations, etc.) to comply with the regulations are present. If any documentation is missing, order a replacement.
- Verify that the environmental protection and safety devices and arrangements provided by the manufacturer to comply with the regulations are in place and compliant.
- Check that all declarations of conformity for the pressurized ensemble mentions all of the circuit equipment.
- Verify that access and safety routes are unobstructed.
- Verify the instructions and directives to prevent the deliberate removal of refrigerant gases.
- Verify the installation of connections.
- Verify the supports and fixing elements (materials, routing and connection).
- Verify the quality of welds and other joints.
- Check the protection against mechanical damage.
- Check the protection against heat.
- Check the protection of moving parts.
- Verify the accessibility for maintenance or repair and to check the piping.
- Verify the status of the valves.
- Verify the quality of the thermal insulation.
- Check the condition of 400 V cable insulation.

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

### 10.2 - Commissioning

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

- Check the heat transfer fluid circulation pumps, the air handling equipment, and any other equipment connected to the system.
- Refer to these instructions.
- Refer to the electrical diagram delivered with the unit.
- Ensure that there is no refrigerant leak.
- Check that all clamps securing the pipes are correctly tightened.
- Check the power supply at the main connection point and the order of phases.
- Open the suction shut-off valves on each circuit for the corresponding machines.
- For units without the factory-fitted hydraulic module (option 116), the installer is responsible for insulation and frost protection and the connections relating to the system pump.
- Check the operation of the oil heaters (present on the oil separator) 24 hours before starting up the system.

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

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

Proceed with the unit commissioning.

Ensure that all safety devices are operational, checking specifically that the high pressure switches are activated and that any alarms have been cleared.

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

## 10 - SYSTEM INITIAL START-UP

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### 10.3 - Essential points to check

#### 10.3.1 - Compressors

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

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

#### 10.3.2 - Hydraulics

As the exact total system pressure drop is not known at commissioning, adjust the flow of water with the control valve until the desired nominal rate is obtained.

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

Follow the procedure described below:

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

#### 10.3.3 - Refrigerant charge

Each unit is shipped with an exact charge of refrigerant and oil. Check that there are no visible refrigerant or oil leaks :

- No apparent damage on the refrigerant circuit pipes (no trauma, cracks, deformation)
- No traces of grease on the connections and refrigerant circuit sensors.

In case of doubt, use a refrigerant leak detection device suited to the fluid in the unit.

#### 10.3.4 - Ventilation for electrical cabinets

Check that the air flows from the cooling fans are directed from the outside of the cabinets to the inside (ensuring fresh air is drawn towards the inside).

## 10 - SYSTEM INITIAL START-UP

### 10.4 - Unit start-up checklist for installers prior to contacting carrier service

#### Preliminary information

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

#### Equipment

Model # : .....

#### Compressors and variable drives

##### Circuit A

Model no. ....  
Serial number .....  
Motor # .....

##### Circuit B

Model no. ....  
Serial number .....  
Motor # .....

#### Compressor variable frequency drive

Model no. (circuit A/B): .....  
Serial number (circuit A/B): .....

#### Fan variable frequency drive

Model no. (circuit A/B): .....  
Serial number (circuit A/B): .....

#### Evaporator

Model # : .....  
Serial number .....

#### Condenser section

Model # : .....

#### Unit options and additional accessories

.....  
.....

Is there any shipping damage? .....

If so, where? .....

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

- ☐ The unit is installed level
- ☐ The power supply corresponds to the unit nameplate
- ☐ The electrical circuit wiring has been sized and installed correctly
- ☐ The unit earth cable has been connected
- ☐ The electrical circuit protection has been sized and installed correctly
- ☐ All the customer connection terminals (power) are tightened
- ☐ All the chilled water valves are open
- ☐ The chilled water pipes are correctly connected
- ☐ The air present in the chilled hydraulic circuit has been purged
- ☐ The chilled water pump is operating with the correct rotation. Check the phase sequence of the electrical connection.
- ☐ In the case of a unit equipped with the hydraulic module, use the pump test function (refer to the manual control for a more detailed explanation).  
The machine is de-energised once the pump test is complete.
- ☐ Circulate chilled water in the hydraulic circuit for at least 2 hours, then remove, clean, and refit the screen filter.  
The machine is de-energised once the pump test is complete.
- ☐ The water inlet pipe at the evaporator comprises a filter with a mesh size of 1,2 mm (20 mesh)

## 10 - SYSTEM INITIAL START-UP

### Unit start-up

- ☐ a. The oil heaters have been energised for at least 24 hours
- ☐ b. All the discharge and liquid valves are open
- ☐ c. All suction valves are open, if fitted
- ☐ d. All the oil line valves and economiser valves (if fitted) are open
- ☐ e. Any leaks have been located. The unit has been checked for leaks (including couplings)
  - ☐ f1. on the whole unit
  - ☐ f2. on the couplingsLocate and report any refrigerant leaks

.....  
.....

- ☐ g. Check voltage imbalance:                      AB..... AC ..... BC.....  
Average voltage = ..... V  
Maximum deviation = ..... V  
Voltage imbalance = ..... %

- ☐ h. Voltage imbalance less than 2%

**WARNING: Operating the chiller with an incorrect supply voltage or excessive phase imbalance constitutes misuse which will invalidate the Carrier warranty. If the phase imbalance exceeds 2% for voltage, or 10% for current, contact your local electricity supplier immediately and ensure that the chiller is not switched on until corrective measures have been taken.**

### Checking the evaporator water loop

- ☐ Water loop volume = ..... litres
- ☐ Calculated volume = ..... litres
- ☐ 3,25 litres/nominal kW capacity for air conditioning
- ☐ 6,5 litres/nominal kW capacity for cooling in industrial processes
- ☐ Correct loop volume established
- ☐ Proper loop corrosion inhibitor included ..... litres of .....
- ☐ Correct loop frost protection included (if required) ..... litres of .....
- ☐ The installation pipework is equipped with heater cables, if exposed to temperatures below 0°C.
- ☐ The water inlet pipe at the evaporator comprises a 20 mesh filter with a mesh size of 1,2 mm

### Evaporator pressure drop check

- ☐ Evaporator inlet = .....kPa
- ☐ Evaporator outlet = .....kPa
- ☐ Outlet - inlet = .....kPa

**WARNING: Calculate the evaporator pressure drop and use it with the performance tables (in the product documentation) to determine the flow rate in litres per second. Check the unit's minimum flow rate.**

- ☐ Total = .....l/s
- ☐ Nominal kW = .....l/s
- ☐ The total is greater than unit's minimum flow rate
- ☐ The total corresponds to the specifications of.....l/s

**WARNING: Once the unit is energised, check for alarms (refer to the control manual to check the alarm menu).**

Report all alarms: .....

Special notes: .....

### To start the chiller

**WARNING: Be sure that all service valves are open, and that the pump is on before attempting to start this machine. Once all checks have been made, try to start the unit.**

- ☐ The unit starts and operates correctly

10 - SYSTEM INITIAL START-UP

Temperatures and pressures

**WARNING:** Once the unit has been operating for a while and the pressures have stabilised, record the following:

Evaporator water inlet .....  
Evaporator water outlet .....  
Room temperature .....  
Circuit A suction pressure .....  
Circuit B suction pressure .....  
Circuit A discharge pressure .....  
Circuit B discharge pressure .....  
Circuit A suction temperature .....  
Circuit B suction temperature .....  
Circuit A discharge temperature .....  
Circuit B discharge temperature .....  
Refrigerant liquid pressure and temperature, Circuit A .....  
Refrigerant liquid pressure and temperature, Circuit B .....  
Subcooling value, Circuit A .....  
Subcooling value, Circuit B .....

## 11 - SYSTEM STANDARD MAINTENANCE

To ensure optimal efficiency and reliability of the units, we recommend establishing a maintenance contract with your local Carrier Service organisation. This contract will include regular inspections by Carrier Service specialists so that any malfunction is detected and corrected quickly, ensuring that no serious damage can occur.

A Carrier Service maintenance contract is the best way to ensure the maximum operating life for your equipment and, through the expertise of Carrier technicians, provides the ideal way to manage your system cost effectively.

Refrigeration equipment must be maintained by professional technicians, whilst routine checks can be carried out locally by specialist technicians (refer to the standard EN 378-4).

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

**IMPORTANT: Before performing any work on the unit ensure it is de-energised. If a refrigerant circuit is opened, it must be evacuated, recharged and tested for leaks. Before any operation on the refrigerant circuit, it is necessary to remove the complete refrigerant charge from the unit with a refrigerant charge transfer unit.**

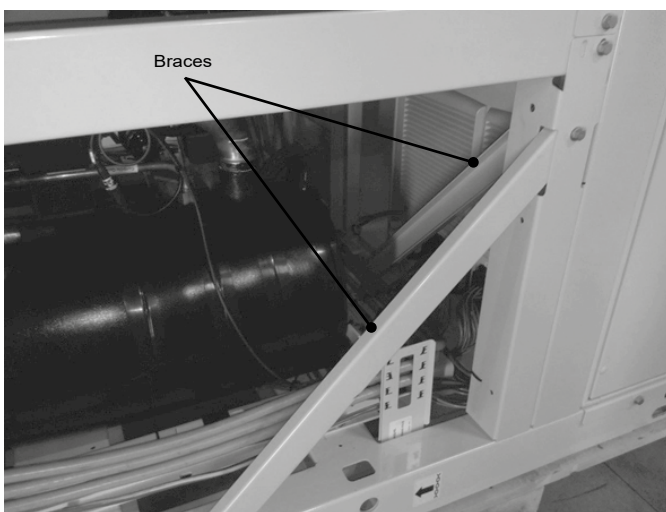
Simple preventive maintenance will allow you to get the best performance from your HVAC unit:

- Improved cooling performance,
- Reduced electricity consumption,
- Prevention of accidental component failure,
- Prevention of major time-consuming and costly work,
- Protection of the environment.

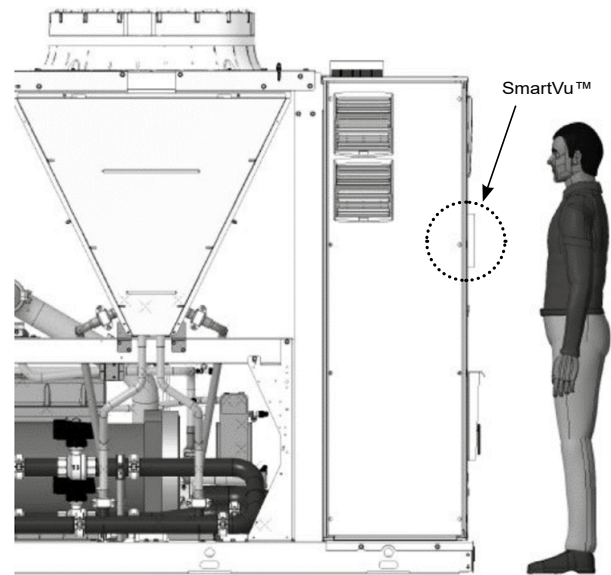
There are five maintenance levels for refrigeration units, as defined by the AFNOR X60-010 standard.

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

The braces located at the back of the electrical cabinets (see picture below) are provided to reinforce the machine structure when being transported. Once the unit has been installed in its operating location, they can be removed to facilitate any maintenance operations which need to be performed in this area.



Position of the operator workstation :



### 11.1 - Level 1 maintenance

See Note above.

These simple procedures can be carried out by the user:

- Visual inspection for oil traces (sign of a refrigerant leak).
- Check for detached protective devices, and improperly closed doors / covers.
- If the unit does not operate, check its alarm report (see the report in the SmartVu™ control manual).
- Check the filter fouling level at the air vents in the electrical box.
- Check the fouling level at the exhaust air openings on the top of the power cabinet (fouling, snow, sand, etc.).
- Check for any general visible signs of deterioration.
- Clean the air-cooled exchangers (see the dedicated chapter),
- Verify that the temperature difference at the heat exchanger inlet and outlet is correct,
- Verify that the refrigerant charge in the liquid line sight glass,
- Check the anti-corrosion coatings.



# 11 - SYSTEM STANDARD MAINTENANCE

## 11.2 - Level 2 maintenance

See Note above.

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

In these cases, the following maintenance operations are recommended:

Carry out all level 1 operations, then:

### Electrical :

- At least once a year, tighten the electrical connections for the power supply circuits (see tightening torques table)
- Check and tighten all control connections, as required.
- Check that the differential circuit breakers are operating correctly every 6 months (if present).
- Remove the dust and clean the interior of the electrical boxes, as necessary. Check the condition of the filters.
- Check that the electrical protective devices are present and in good condition.
- Replace the fuses every 3 years or every 15000 hours (ageing).
- Replace the electrical box cooling fans every 5 years.
- Check the height of the anti-vibration mounts (located between the feet of the oil separator and the support rails) after 5 years of use, and each year thereafter. Once the total minimum height of the mount is less than 25 mm, the mounts will need replacing.
- Check the correct operation of all heaters.

### Mechanical :

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

### Hydraulics :

- When working on the hydraulic circuit, take care not to damage the adjacent air heat exchanger,
- Check the water connections,
- Check the condition of the expansion tank (presence of corrosion or loss of gas pressure) and replace it if required,
- Drain the hydraulic circuit (see chapter "Water flow control procedure"),
- Clean the water filter (see chapter "Water flow rate control procedure"),
- Replace the packing around the pump body after 20,000 hours of operation and the bearings after 20,000 hours,
- Check the operation of the flow switch,
- Check the condition of pipe thermal insulation,
- Check the concentration of the anti-freeze protection solution (ethylene glycol or propylene glycol),
- Check the water flow via the heat exchanger pressure difference,
- Check the condition of the heat-transfer fluid or the water quality,
- Check for corrosion of the steel pipe work.
- Check the unit operating parameters, compare them with the previous values and note any changes,
- Keep an up-to-date service record specific to the refrigeration unit in question.
- Inside the electrical box, check that there is voltage on the connection terminals for the evaporator heaters and variable-speed drives (activate quick test mode to control the heaters).

### Refrigerant circuit :

- The unit is subject to F-gas tight regulatory checks. Please refer to the table in the introduction,
- Check the unit operating parameters and compare them with the previous values,
- Check the operation of the high-pressure switches. Replace them if there is a fault,
- Check the fouling of the filter drier. Replace it if necessary,
- Keep an up-to-date service booklet specific to the refrigeration unit in question.

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

## 11.3 - Level 3 (or higher) maintenance

Maintenance at this level requires specific skills/qualifications/tools and expertise that only the manufacturer, or one of its approved representatives, is able to ensure. This maintenance work relates to the following:

- Replacement of a major component (compressor, evaporator).
- Operations on the refrigerating circuit (handling refrigerant).
- Modification of factory-set parameters (change of application).
- Movement or disassembly of the refrigeration unit.
- Any operation due to proven lack of maintenance.
- Any operation covered by the warranty.

To reduce waste, the refrigerant and the oil must be transferred in accordance with applicable regulations, using methods that limit refrigerant leaks and with materials that are suitable for the products.

Any leak detected must be repaired immediately.

The compressor oil that is recovered during maintenance contains refrigerant and must be treated accordingly.

Refrigerant under pressure must not be purged to the open air.

If the refrigerant circuit is opened for a period of up to one day, cap all openings. If open for longer, blanket the circuit with nitrogen.

## 11 - SYSTEM STANDARD MAINTENANCE

### 11.4 - Tightening

#### 11.4.1 - Tightening torques for the main fastenings

Screw type	Use	Value (N.m)
Metal screw D = 4,8mm	Condenser modules, fan protection grilles, panels	4,2
Metal screw D = 6,3 mm	Plastic impeller	4,2
M8 H screw	Condenser modules, impeller mounting	18
Taptite M 10 screw	Condenser modules, chassis, structure, economizer assembly, electrical panels, compressor and oil separator mounting	30
Taptite M 6 screw	Pipe supports, condenser modules	7
M8 H screw	MCHE coil	14
M6 H screw	Pipe clip	10
M8 H nut	Oil separator mounting	14
M16 H stud	Compressor mounting	30
M10 H screw	Oil separator mounting	30
M16 H lock nut	Compressor mounting	23
M8 H screw	Filter unit cover	35
M12 H screw	Economiser-compressor flange	40
M16 H stud and nut	Discharge- oil separator flange	130
M8 H screw	Oil line-compressor flange	25
M16 H screw	Exchanger water boxes	190
5/8 ORFS nut	Oil line	65
M12/M16 H nut	Victaulic 4" (M12 nut), and 5" (M16 nut) clamps on suction line	65
M16 H screw	Evaporator on chassis	130
Rotalock 1"3/4-12-UN	Liquid line	100
Rotalock 2"1/4-12-UN	Liquid line	145
M20 H nut	Victaulic 5 and 6" clamp on water pipe	45
M6 T30 torx screw	Control cabinet casing panel	4,5

#### 11.4.2 - Tightening torques for the main electrical connections

Component	Designation in the unit	Value (N.m)
<b>Customer connections</b>		
M10 screw-nut on phases	L1/L2/L3	49
M10 screw-nut on earth strip	PE	49
<b>Main disconnect switch without option 70D</b>		
Circuit breaker - all calibers	QS 100	62,5
<b>Main disconnect switch with option 70D</b>		
Circuit breaker - caliber 630/800A	QF 100	9
Circuit breaker - caliber 1000A	QF 100	18
<b>Compressor variable frequency drive</b>		
M 10 nuts on phases	GS*	29,5
M 10 or M 8 nut on earth	R/S/T U/V/W	29,5
M 8 nuts on internal connections (fuses and busbars)	GND	14,5
<b>Earth strip connections</b>		
M 8		24
M 10		49
<b>Compressor connections</b>		
M 12 nuts on phases	EC*	23
M 12 screws on ground	1/2/3	25
<b>Variable frequency drives for the fans and hydraulic pumps</b>		
Screws on phases and earth, VFD up to 11 kW	GS*	2,5
Screws on phases and earth, VFD up to 15 kW	GS*	4,5
<b>Circuit breaker cage terminal and differential block screws</b>		
Schneider type GV 2	QM*	1,7
Schneider type IC 60	QF100A	2
ABB type S803S	QF*	3,5
ABB type MS 132	QM10*	1,3
<b>Switch cage terminal screws</b>		
Schneider LC1K0610B7 AC3 6A	K*	1,3
Schneider LC1SKGC200B7 AC3 5A	K*	0,8
ABB type AS09	K*	1,2
<b>Potential transformer</b>	TC*	0,6
<b>Control cabinet distributor</b>		13

**WARNING:** if the compressor's motor is with permanent magnet (option 329), do not open the compressor. Ensure that the terminal box is securely fixed in place before filling the machine with refrigerant, draining the refrigerant or rotating the motor shaft. The compressor cannot be removed.

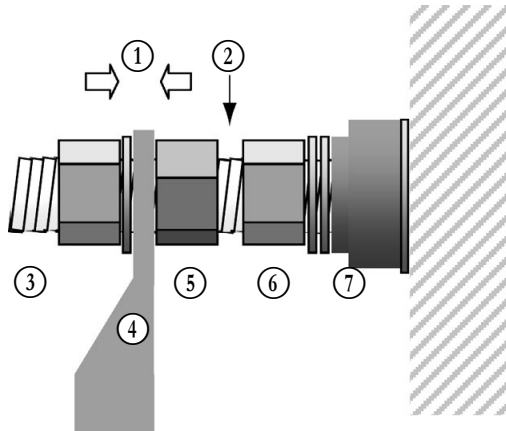
**WARNING:** Strong magnetic field inside the compressor casing. An electrical current may be generated on the compressor terminals and on the circuits which are connected when filling/emptying the refrigerant.

**WARNING:** The tightening of the connections at the compressor terminals requires special precautions. Refer to the next section.

## 11 - SYSTEM STANDARD MAINTENANCE

### 11.4.3 - Precautions for connecting to the compressor power terminals

These precautions need to be applied whenever an operation requires removal of the power conductors connected to the compressor power supply terminals.



- ① Torque application to tighten the lug
- ② Avoid contact between the two nuts
- ③ Lug tightening nut
- ④ Flat lug
- ⑤ Counter-nut
- ⑥ Terminal tightening nut
- ⑦ Isolator

The tightening nut on the terminal ⑥ supporting the isolator ⑦ must never be loosened, as it keeps the terminal secure and stops the compressor leaking.

The phase lug ④ must be tightened applying the torque between the counter nut ⑤ and the tightening nut ③: During this operation a counter-torque must be applied at counter nut ⑤.

The lock nut ⑤ must not be in contact with the terminal securing nut ⑥.

### 11.5 - Condenser Coils maintenance

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

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

- Regularly cleaning the coil surface is essential for correct unit operation.
- Eliminating contamination and removal of harmful residue will increase the operating life of the coils and the unit.
- The maintenance and cleaning procedures below are part of the regular maintenance to increase the operating life of coils.
- Specific recommendation in case of snow: For long term storage, regularly check that no snow has accumulated on the coil.
- Clean the surface of the coil by spraying the coil regularly and uniformly from bottom to top, orienting the water jet at right angles to the surface. Do not exceed a water pressure of 6200 kPa (62 bar) or an angle of 45° to the coil. The nozzle must be at least 300 mm away from the coil surface.
- Clean and scrub the entire coil connections with a soft Nylon, PolyPro® or Tynex® brush and low pressure tap water.

#### Level 1 cleaning:

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

#### Level 2 cleaning:

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

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

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

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

Concentrated and/or rotating water jets are strictly forbidden.

Never use a fluid with a temperature above 45 °C to clean the air heat exchangers.

Correct and frequent cleaning (approximately every three months) will prevent 2/3 of the corrosion problems. Protect the electrical cabinets, the motorised ball valve and the VFDs during cleaning operations. Don't forget to remove protections after cleaning operations.

### 11.6 - Flooded Evaporator maintenance

Check that:

- The insulating foam is neither detached nor torn during works,
- The heaters and probes are operating and correctly positioned in their supports,
- The water-side connections are clean and show no sign of leakage.

### 11.7 - Screw Compressor maintenance

#### 11.7.1 - Checking the compressor rotation

Ensuring the compressor rotation is correct is one of the most critical considerations.

Reverse rotation, even for a short period, will have a considerable adverse effect on the compressors's reliability, and may even cause irreparable damage. The reverse rotation protection process must be capable of determining the direction of rotation and stopping the compressor within one second.

Reverse rotation is most likely to occur whenever the wiring at the compressor terminals has been modified.

To minimise any risk of reverse rotation, the following procedure must be applied.

Rewire the electrical wires to the compressor terminals as originally wired. Keep a counter torque on the lower nut on the power supply cable terminal lug when the latter is installed.

When a compressor is replaced, a low pressure switch must be installed temporarily as a safety measure on the high pressure part of the compressor. The purpose of this pressure switch is to protect the compressor against any wiring errors at the compressor terminals.

The electrical contact of the switch would be wired in series with the high pressure switch.

The pressure switch must remain in place until the compressor has been started and direction of rotation has been verified; at this point, the pressure switch can be removed.

The switch that has been selected for detecting reverse rotation is Carrier part number HK01CB001. This pressure switch opens the contacts when the pressure falls below 7 kPa. The pressure switch has a manual reset, which can be reset when the pressure exceeds 70 kPa once more. The pressure switch must be a manual reset type to prevent any risk of the compressor short cycling in the reverse direction.

#### 11.7.2 - Oil separator

Check that the heaters are operating correctly and that they are firmly attached to the oil separator.

#### 11.7.3 - Oil filter change schedule

As keeping the system clean is critical to ensure its reliable operation, there is a filter in the oil pipe at the oil separator outlet.

The oil filter is specified to provide a high level of filtration (5  $\mu$ ), necessary for ensuring the compressor has a long service life.

The filter should be checked after the first 500 hours of operation, and every subsequent 2000 hours. The filter must be replaced as soon as the pressure differential on the filter exceeds 200 kPa (2 bar).

The pressure drop on the filter is determined by measuring the pressure at the discharge (dp) and the oil pressure (op).

The difference in these two pressures will be the pressure drop on the filter, check valve, and solenoid valve.

The pressure drop on the check valve and solenoid valve is approximately 40 kPa (0,4 bar), which should be subtracted from the two oil pressure measurements to give the oil filter pressure drop.

#### 11.7.4 - Periodic test of the high pressure safety loop

The aim of this periodic test is to check the settings of the high pressure safety loop on one of the unit's refrigerant circuits and check it is operating correctly. This procedure must be repeated for each circuit.

1. Fit a calibrated pressure gauge on the high pressure part of the circuit (compressor discharge)
2. Reset all the active alarms
3. Activate the HP test mode for the corresponding circuit via the control interface.

The high pressure test maybe defined in the fan addressing menu (FAN DRV2).

To activate the high pressure test for a specific circuit, access the Maintenance menu.

Select Fan addressing (section 5.5.10).

Set the high pressure test A or high pressure test B to "yes".

4. Save the fault trip value
5. Check that the two HPS have tripped  
If the two HPS have tripped, move on to step 9  
If just one of the HPS has tripped,
6. Replace the tripped HPS with another system which has a greater value.  
Alternatively, an emergency stop button can be installed.
7. Repeat steps 2 to 5
8. Check whether the trip values are correct  
The trip values must be between -1,4/+0 bars of the rated value indicated on the unit.
9. Reset all the alarms
10. Reset both the HPS
11. Deactivate the HP test mode for the circuit

**NOTE: For step 6, electrical disconnection of the tripped HPS and its substitution must be performed within the electrical box that encloses the control and regulation components. Identify the HPS connectors with the detailed electrical diagram.**

**The connector type must be WAGO 231-302 or equivalent.**

## 11 - SYSTEM STANDARD MAINTENANCE

### 11.8 - Variable frequency drive maintenance

**WARNING:** Before any work on the variable frequency drive, ensure that the circuit breaker/disconnect switch is open and there is no voltage present (reminder: The capacitors take approximately 20 minutes to discharge. This value is a guide, and may differ from one VFD to another: Refer to the information given on the VFD to find out the precise value). Only appropriately qualified personnel are authorised to replace or make modifications to components inside the variable frequency drive.

During periodic inspections, check the condition of the ventilation grilles on the variable frequency drive door; ensure that they are not pierced, damaged or obstructed.

Replace the fan if a "fan replacement" alert/warning is displayed in the list of alarms.

For any other alarm or problem relating to the variable frequency drive, contact Carrier Service

In general, a fault with the variable frequency drive can be corrected by repairing or replacing an internal component. If the complete variable frequency drive needs to be replaced, its removal will require prior removal of the ventilation ducts and the top of the cabinet: Please contact Carrier Service. Similarly, precautions must be taken for handling, as the variable frequency drives are very heavy (between 65kg and 120kg, depending on their size).

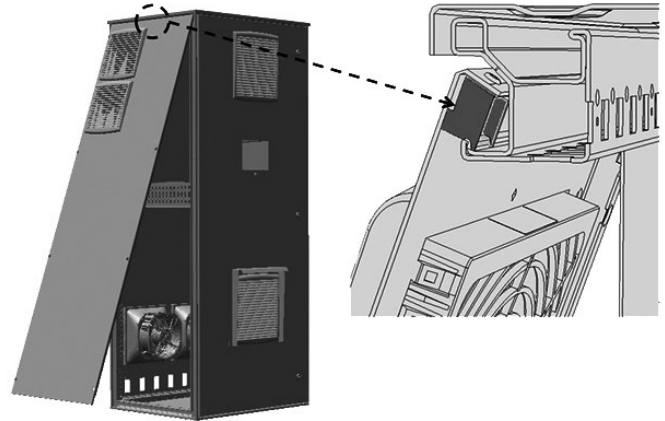
The variable frequency drives fitted on the units do not require a dielectric test, even if being replaced: They are systematically checked before delivery. Moreover, the filtering components installed in the variable frequency drive can falsify the measurement and may even be damaged.

If the insulation of a component (compressor, cables, etc.) requires testing, the variable frequency drive must be disconnected from the power circuit.

### 11.9 - Precautions when fitting the casing panel to the side of the control cabinet

The control cabinet casing panel may need to be removed to access the back of the internal partition which houses the electrical components. In this case, precautions must be taken when refitting to ensure the panel is not deformed:

The upper section of the casing panel is equipped with a hook which must be engaged in the cabinet's frame: Before it is screwed in, the panel should stay in place on the cabinet by itself, and assembly should not require a second person to be present.



**IMPORTANT :** If the panel is deformed, it would irreparably damage the sealing of the cabinet, which would enable water drops to infiltrate the cabinet and degrade the electrical components.

## 12 - SYSTEM FINAL SHUTDOWN

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### 12.1 - Shutting down

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

### 12.2 - Recommendations for disassembly

Read the information relating to the presence of potentially dangerous substances in the product and their precautions for use (REACH, Regulation (EC) No. 1907/2006). This information is available on the Manufacturer's website.

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.

### 12.3 - Fluids to be recovered for treatment

- Refrigerant (In compliance with regulation F-GAS no. 2024/573/UE).
- Heat-transfer fluid: Depending on the installation, water, brine solution, etc.
- Compressor oil.

### 12.4 - Materials to be recovered for recycling

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

### 12.5 - 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 waste electrical and electronic equipment (WEEE).



## **13 - APPENDICES (PROVIDED IN THE DOCUMENT WALLET WITH THE INSTRUCTION MANUAL)**

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**13.1 - Appendix 1: Declaration of conformity**

**13.2 - Appendix 2: Wiring diagram**

**13.3 - Appendix 3: Machine PID**

**13.4 - Appendix 4: Dimensional drawings**



CARRIER participates in the ECP programme for LCP-HP  
Check ongoing validity of certificate:  
[www.eurovent-certification.com](http://www.eurovent-certification.com)

The quality management system of this product's assembly site has been certified in accordance with the requirements of the ISO 9001 standard (latest current version) after an assessment conducted by an authorized independent third party.

The environmental management system of this product's assembly site has been certified in accordance with the requirements of the ISO 14001 standard (latest current version) after an assessment conducted by an authorized independent third party.

The occupational health and safety management system of this product's assembly site has been certified in accordance with the requirements of the ISO 45001 standard (latest current version) after an assessment conducted by an authorized independent third party.

Please contact your sales representative for more information.

Order No.: 10200, 09.2024. Supersedes order No.: 10200, 10.2023.

Manufacturer reserves the right to change any product specifications without notice.

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