



**INSTALLATION, OPERATION AND  
MAINTENANCE INSTRUCTIONS**



Liquid chiller with variable speed screw compressor  
and greenspeed™ smart technology

30KAV-ZE 350 - 800  
30KAVPZE 350 - 800

Rated cooling capacity: 371 - 819 kW - 50 Hz

**AQUAFORCE**  
PUREtec

# CONTENTS

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<b>1 - INTRODUCTION</b> .....	<b>4</b>
1.1 - Safety considerations related to protection devices .....	4
1.2 - Refrigerant safety considerations .....	5
1.3 - Installation safety considerations .....	7
1.4 - Maintenance safety considerations .....	7
1.5 - Safety considerations during system interventions .....	8
<b>2 - RECEIPT OF GOODS</b> .....	<b>9</b>
2.1 - Checking the equipment received .....	9
<b>3 - HANDLING AND POSITIONING</b> .....	<b>10</b>
3.1 - Handling .....	10
3.2 - Positioning.....	10
<b>4 - DIMENSIONS, CLEARANCES</b> .....	<b>11</b>
4.1 - 30KAV-ZE 350 & 400, without hydraulic module .....	11
4.2 - 30KAV-ZE 350 & 400, with hydraulic module .....	11
4.3 - 30KAV-ZE 450 & 500, without hydraulic module .....	12
4.4 - 30KAV-ZE 450 & 500, with hydraulic module .....	12
4.5 - 30KAV-ZE 350, 400, 450 & 500 opt. 119; & 30KAV-ZE 550 & 600; without hydraulic module 30KAVPZE 350, 400, 450 & 500; without hydraulic module .....	13
4.6 - 30KAV-ZE 350, 400, 450 & 500 opt. 119; & 30KAV-ZE 550 & 600; with hydraulic module 30KAVPZE 350, 400, 450 & 500; with hydraulic module .....	13
4.7 - 30KAV-ZE 550 opt. 119; & 30KAV-ZE 650 & 750; without hydraulic module & 30KAVPZE 550; without hydraulic module ...	14
4.8 - 30KAV-ZE 550 opt. 119, with hydraulic module & 30KAVPZE 550; with hydraulic module .....	14
4.9 - 30KAV-ZE 600 & 650 opt. 119; & 30KAV-ZE 800, without hydraulic module; & 30KAVPZE 600 & 650; without hydraulic module .....	15
4.10 - 30KAV-ZE 600 opt.119, with hydraulic module & 30KAVPZE 600; with hydraulic module .....	15
4.11 - 30KAV-ZE 750 & 800 opt. 119 & 30KAVPZE 750 & 800 .....	16
4.12 - Installation of multiple chillers.....	16
4.13 - Proximity to walls.....	16
4.14 - Underneath a roof .....	16
<b>5 - PHYSICAL PROPERTIES OF 30KAV-ZE / 30KAVPZE UNITS</b> .....	<b>17</b>
5.1 - Physical properties .....	17
5.2 - Electrical data .....	21
5.3 - Short circuit current withstand capability for all units.....	23
5.4 - Electrical data, optional hydraulic module .....	24
5.5 - Compressor usage per circuit (A, B) .....	25
<b>6 - ELECTRICAL CONNECTION</b> .....	<b>27</b>
6.1 - Power supply.....	27
6.2 - Voltage phase imbalance (%) .....	27
6.3 - Power connection/disconnect switch.....	27
6.4 - Recommended cable sections .....	27
6.5 - Power cable access routing .....	27
6.6 - Field-installed control wiring .....	28
6.7 - Customer and service power reserves.....	28
<b>7 - APPLICATION DATA</b> .....	<b>29</b>
7.1 - Unit operating range.....	29
7.2 - Minimum chilled water flow (units without hydraulic module).....	29
7.3 - Maximum chilled water flow (units without hydraulic module).....	29
7.4 - Variable flow evaporator (units without factory-fitted hydraulic module) .....	30
7.5 - Minimum system water volume .....	30
7.6 - Maximum system water volume .....	30
7.7 - Evaporator water flow rate .....	30
7.8 - Evaporator pressure drop curves .....	31
<b>8 - WATER CONNECTIONS</b> .....	<b>32</b>
8.1 - Operating precautions .....	32
8.2 - Victaulic type hydraulic connections.....	33
8.3 - Tightening the screws on the evaporator water boxes .....	34
8.4 - Flow rate detection .....	34
8.5 - Frost protection .....	34
8.6 - Protection against cavitation (with option 116).....	35
8.7 - Adjusting the installation nominal water flow rate.....	35
8.8 - Operation of two units as a master/slave pair (option 58).....	38
<b>9 - UNIT WITH HYDRAULIC KIT</b> .....	<b>39</b>
9.1 - Available static pressure for the system .....	39
9.2 - Required NPSH (Net Positive Suction Head); Hydraulic module option .....	40
9.3 - Flow rate calculation.....	40

# CONTENTS

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<b>10 - SYSTEM START-UP .....</b>	<b>41</b>
10.1 - Checks before system start-up.....	41
10.2 - Commissioning.....	41
10.3 - Essential points to check.....	42
<b>11 - MAJOR SYSTEM COMPONENTS AND OPERATION DATA.....</b>	<b>43</b>
11.1 - Compressors .....	43
11.2 - Oil filter .....	43
11.3 - Refrigerant.....	43
11.4 - Lubricant.....	43
11.5 - Oil supply solenoid valve.....	43
11.6 - Economiser and suction filters.....	43
11.7 - Pressure vessels .....	43
11.8 - High Pressure SRMCR safety loop .....	44
11.9 - Condensers .....	45
11.10 - Fans.....	45
11.11 - Electronic expansion valve (EXV).....	46
11.12 - Moisture indicator .....	46
11.13 - Filter drier .....	46
11.14 - Sensors .....	46
11.15 - Service valves (option 92) .....	46
11.16 - Speed regulator .....	46
11.17 - Cabinets for the electrical equipment .....	47
<b>12 - OPTIONS .....</b>	<b>48</b>
12.1 - Unit operation with a free cooling drycooler .....	50
12.2 - Brine options .....	51
12.3 - Physical properties of 30KAV/30KAVP units with partial heat recovery option (option 49 and 50) .....	53
<b>13 - STANDARD MAINTENANCE .....</b>	<b>57</b>
13.1 - Level 1 maintenance .....	58
13.2 - Level 2 maintenance .....	58
13.3 - Level 3 (or higher) maintenance.....	58
13.4 - Tightening the electrical connections .....	59
13.5 - Tightening torques for the main fastenings .....	60
13.6 - Condenser coil .....	60
13.7 - Evaporator maintenance .....	60
13.8 - Compressor maintenance .....	61
13.9 - Variable frequency drive maintenance .....	61
13.10 - Precautions when fitting the casing panel to the side of the control cabinet.....	61
13.11 - Periodic test of the high pressure safety loop.....	62
<b>14 - FINAL SHUTDOWN.....</b>	<b>63</b>
14.1 - Shutting down.....	63
14.2 - Recommendations for disassembly .....	63
14.3 - Fluids to be recovered for treatment .....	63
14.4 - Materials to be recovered for recycling .....	63
14.5 - Waste Electrical and Electronic Equipment (WEEE).....	63
<b>15 - UNIT START-UP CHECKLIST FOR INSTALLERS PRIOR TO CONTACTING CARRIER SERVICE.....</b>	<b>64</b>
<b>16 - APPENDICES (PROVIDED IN THE DOCUMENT WALLET WITH THE INSTRUCTION MANUAL).....</b>	<b>67</b>
16.1 - Appendix 1: Declaration of conformity.....	67
16.2 - Appendix 2: Wiring diagram .....	67
16.3 - Appendix 3: Machine PID.....	67
16.4 - Appendix 4: Dimensional drawings .....	67

# 1 - INTRODUCTION

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

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

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

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

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

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

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

## 1.1 - Safety considerations related to protection devices

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.

**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. 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. 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.**

## 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 10kW/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 11.8 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 11.8.

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

**When the unit is subjected to fire, a safety device prevents rupture due to over-pressure by releasing the refrigerant. The fluid 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.

**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.**

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

**The external relief valves must always be connected to drain pipes for units installed in a closed room. Refer to the installation regulations, for example those of European standard EN 378 and EN 13136. These pipes must be installed in a way that ensures that people and property are not exposed to refrigerant leaks. As the fluids can be diffused in the air, ensure that refrigerant is discharged away from building air intakes or that it is discharged into a sufficient quantity of suitable absorbent material (note that R1234ze(E) refrigerant is heavier than air). The valves must be checked periodically.**

# 1 - INTRODUCTION

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

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

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

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

## CHECKING THE PROTECTIVE DEVICE:

- 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.

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 the Service department for this type of test. An example of the test procedure without removing the pressure switch is given in section 13.11 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.

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

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

Do not install relief valves in series or backwards.

## 1.2 - Refrigerant safety considerations

Use safety goggles and safety gloves.

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

If a leak occurs or if the refrigerant becomes contaminated (e.g. by a short circuit in a motor), and before any intervention, remove the complete charge using a recovery unit and store the refrigerant in mobile containers. The compressors cannot transfer the whole refrigerant charge and can be damaged if used to pump-down. The refrigerant charge should not be transferred to the high-pressure side.

Detect and repair the leak, check the type of refrigerant in the machine and then recharge the machine/circuit with the total charge, as indicated on the unit nameplate. Do not top up the refrigerant charge. Only charge the liquid refrigerant given on the nameplate at the liquid line.

Charging any refrigerant other than the original type will impair machine operation and can even cause irreparable damage to the compressors. The compressors operating with this refrigerant type are lubricated with a synthetic polyolester oil.

Which are completely incompatible with mineral oils.

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

### Do not siphon refrigerant.

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

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

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

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

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

The refrigerant used in the units in this range is R1234ze(E).

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

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

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

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

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

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

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

# 1 - INTRODUCTION

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

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

## OPERATING CHECKS:

- Type of fluid: refer to the nameplate.
- Global Warming Potential (GWP): refer to the table below.

## WARNING:

1. Ensure that the refrigerant is never released to the atmosphere during installation, maintenance or equipment disposal.
2. Deliberate refrigerant release into the atmosphere is not allowed.
3. If a refrigerant leak is detected, ensure that the leak is repaired quickly.
4. Only certified, qualified personnel are permitted to install, service and perform leak tightness tests on the refrigerant, decommission the equipment and recover the refrigerant.
5. The operator must ensure that any refrigerant recovered is recycled, regenerated or destroyed.
6. 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:

System WITHOUT leakage detection	No test	12 months	6 months	3 months
System WITH leakage detection	No test	24 months	12 months	6 months
Refrigerant charge per circuit (equivalent CO <sub>2</sub> )	< 5 tons	5 ≤ charge < 50 tons	50 ≤ charge < 500 tons	Charge > 500 tons*
Refrigerant charge per circuit (kg)	R-1234ze(E) (PRP 1)	No requirement		

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

7. 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.
8. Contact your local dealer or installer if you have any questions.

While working in the fan area, especially when grilles or casings are removed, disconnect the fan power supply to prevent their automatic restart.

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.

## 1.2.1 - Flammable refrigerant safety considerations

### IMPORTANT INFORMATION REGARDING THE REFRIGERANT USED:

- Refrigerant type: R1234ze(E)
- Global warming potential (GWP following AR5): 1
- HFO gas

This refrigerant is classed in group 2 "non hazardous" according to the criteria of the European pressure equipment directives (PED) 2014/68/EC. In line with the standard ISO-819, R1234ze(E) refrigerant is classed in safety group A2L: low flammability.

One of the characteristics of this refrigerant is that no flammable mixture is created with air below a room temperature of 21 °C and under controlled humidity conditions.

Nevertheless, when the humidity or temperature increases, this refrigerant may become flammable and present a potential hazard if the flammability risks are not correctly mitigated within the installation's machine room.

The local safety regulations and standards relating to the buildings must be respected.

In the absence of local regulations and standards, refer to the standard EN-378 (2012) (Safety requirements for substances classed A2) or ISO-5149 (2014) (for substances classed A2L).

The customer must obtain the approval of the local authorities governing the building. Carrier may also provide guidelines on the safe use of refrigerant R1234ze(E), to complement the safety standards and regulations relating to the buildings with a view to ensuring risks are reduced to acceptable levels.

For more details on the physical properties, the flammability and toxicity characteristics, the identification of risks, the safety requirements for the installation, etc., refer to standards such as the following:

- ASHRAE 34, EN-378, ISO-817 and ISO-5149
- Safety Data Sheets (SDS) provided by the refrigerant manufacturer
- the European Union REACH database (registration, evaluation, authorisation and restriction of chemicals)

Only employ qualified technicians well-trained in the use and the risks associated with flammable refrigerants and the respect of local regulations (see standard EN 378-4 in appendix E - repair guidelines for equipment using flammable refrigerants).

Use a gas detector during any intervention on the machine.

As R1234ze(E) refrigerant is mildly flammable, an ATEX perimeter of 0.5 m must be put in place around the machine (see § 4 - Dimensions, Clearances). No source of ignition must be present within this zone (see standard EN 378-2, Appendix K).

If an ignition source is identified in the hazard area, additional ventilation is compulsory. Implement a no smoking area around the machine.

# 1 - INTRODUCTION

## 1.3 - Installation safety considerations

30KAV-ZE liquid chillers 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 authorised 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 or chillers 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-1234ze(E). 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 machine 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.

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

**NOTE: Monitoring during operation, re-qualification, re-testing, exemption from 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 monitor the surface of the components to detect pitting corrosion. To do this check an uninsulated part of the pressure vessel or at a joint in the insulation.
- Regularly check for the presence of any impurities (e.g. sand, grit) in the heat transfer fluids. These impurities can cause wear and/or pitting corrosion.
- Filter the heat-transfer fluid and carry out internal inspections as described in EN 378
- 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.

### Repair:

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

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

### Recycling:

- **The pressure equipment can be recycled in whole or in part. After use they may contain refrigerant vapours and oil residue. Some parts are painted.**

## 1.4 - Maintenance safety considerations

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

**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

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

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

Technicians working on the units must be equipped as follows:

Personal protective equipment (PPE) <sup>(1)</sup>	Operations		
	Handling	Maintenance, service	Welding or brazing <sup>(2)</sup>
Protective gloves, eye protection, safety shoe, 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.

Never work on a unit that is still energised.

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

# 1 - INTRODUCTION

**WARNING:** Even if the unit has been switched off, the power circuit remains energised, unless the unit or circuit disconnect switch is open. Refer to the wiring diagram for further details. Follow the appropriate safety guidelines. When working close to the condenser fans, particularly when removing the grilles, ensure the power supply to the fans is switched off to ensure they cannot run.

**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 variable drives.

*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.*

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

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

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.



**WARNING:** the compressors on 30KAVPZE 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.

## 1.5 - Safety considerations during system interventions

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:



**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.**

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

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

**Do not attempt to remove refrigerant circuit components or fittings, while the machine is under pressure or while it is running. Make sure the circuit pressure is zero and that the unit has been 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".**

**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.**

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

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

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

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

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

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

**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.

## 3 - HANDLING AND POSITIONING

### 3.1 - 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.

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

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

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

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

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.

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

**WARNING : Never push or lever on any of the enclosure panels of the unit. Only the base of the unit frame is designed to withstand such stresses.**

### 3.2 - Positioning

The unit 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.

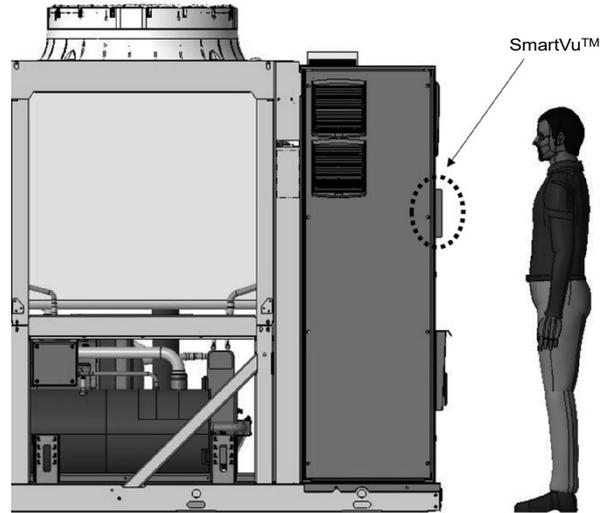
For the centre of gravity coordinates, the position of the unit mounting holes, and the weight distribution points, refer to the certified dimensional drawings. Ensure the free space shown in the dimensional drawings is respected to facilitate maintenance and connection.

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

Before refitting 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,
- Position of the operator workstation



**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 pressurised parts, especially via pipes connected to the water-cooled heat exchanger (with or without the hydraulic kit if the unit is equipped with this).**

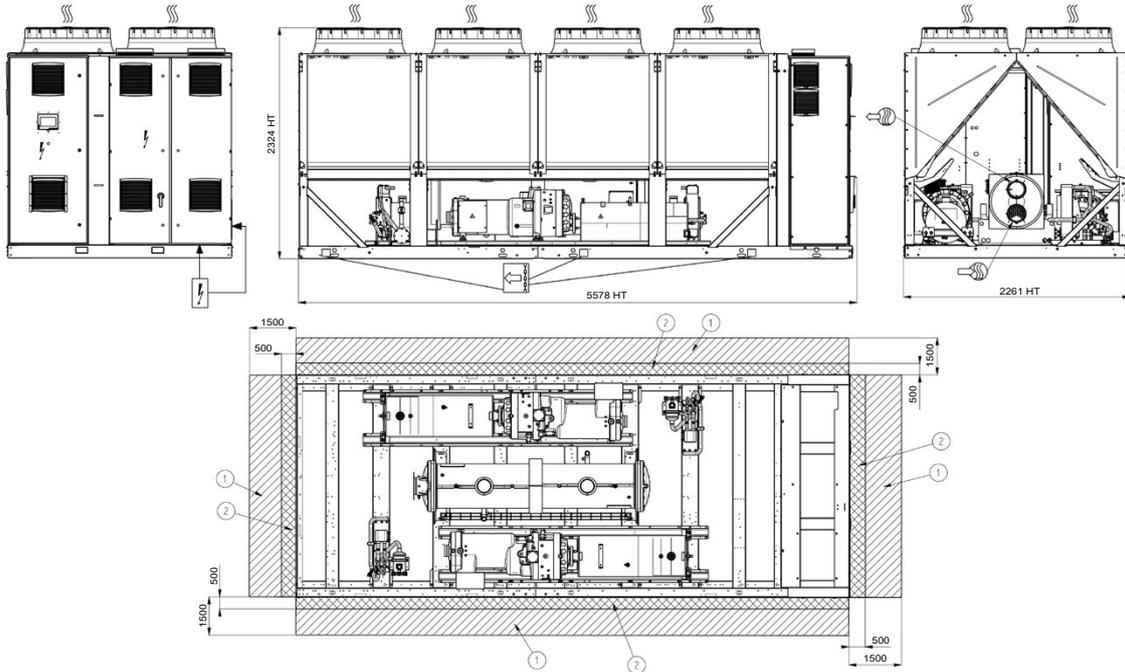
All welding operations (connection to the hydraulic network) must be performed by qualified welders. The Victaulic® connection or the counter-flange must be removed before welding as a matter of course.

**IMPORTANT : follow the disassembly procedure indicated in the disassembly instructions**

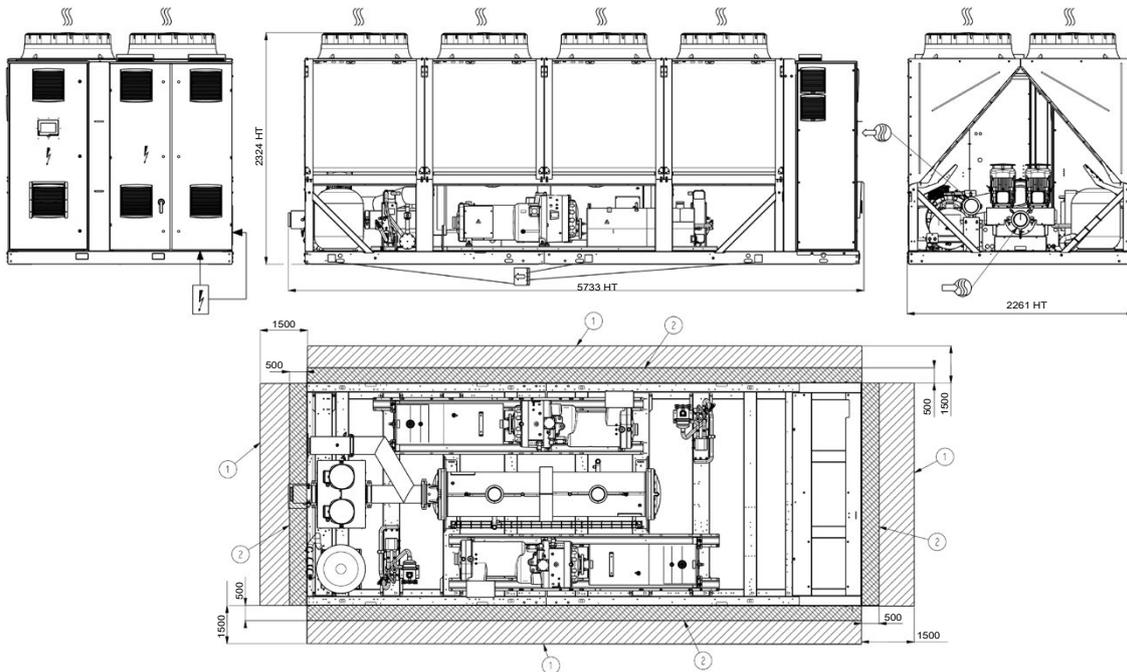


## 4 - DIMENSIONS, CLEARANCES

### 4.3 - 30KAV-ZE 450 & 500, without hydraulic module



### 4.4 - 30KAV-ZE 450 & 500, with hydraulic module



#### Key

All dimensions are given in mm

- ① Clearances required for maintenance (see Note)
- ② ATEX zone around the machine
-  Water inlet for standard units
-  Water outlet for standard units
-  Air outlet, do not obstruct
-  Power supply connection
-  Sling points

#### NOTE:

**Non-contractual drawings.**

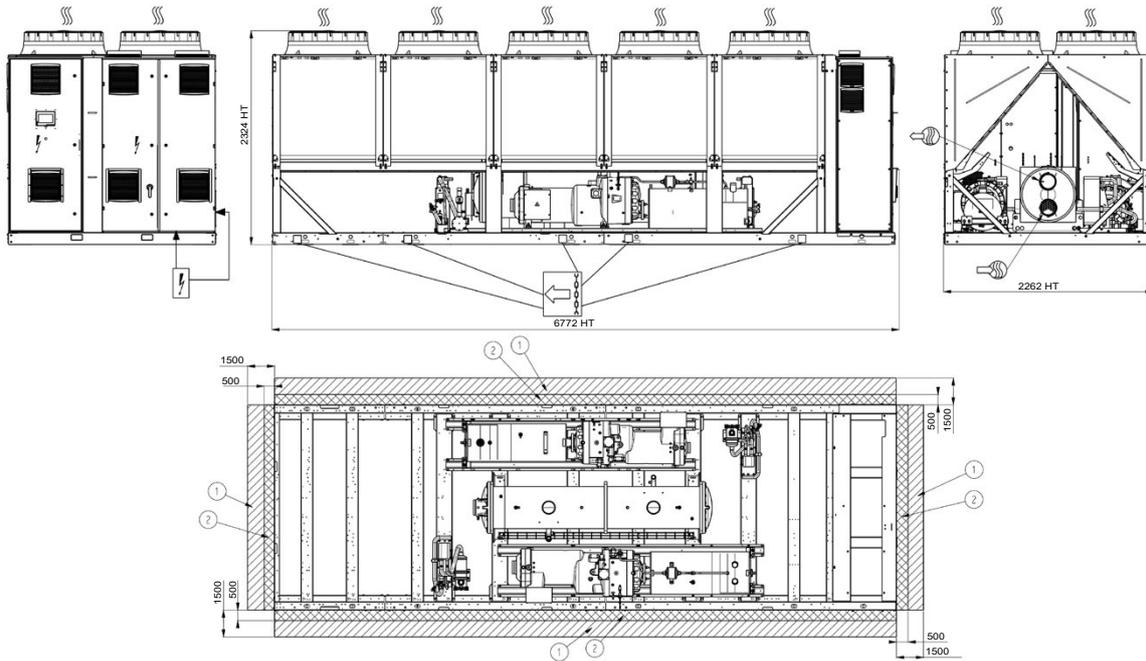
**Refer to the unit name plate to find out the machine weight. Refer to the certified dimensional drawings (appendix 4), provided with the unit or available on request, when designing an installation.**

**Please refer to the certified dimensional drawings (appendix 4) for the positioning of the fixing points, weight distribution points and centre of gravity coordinates.**

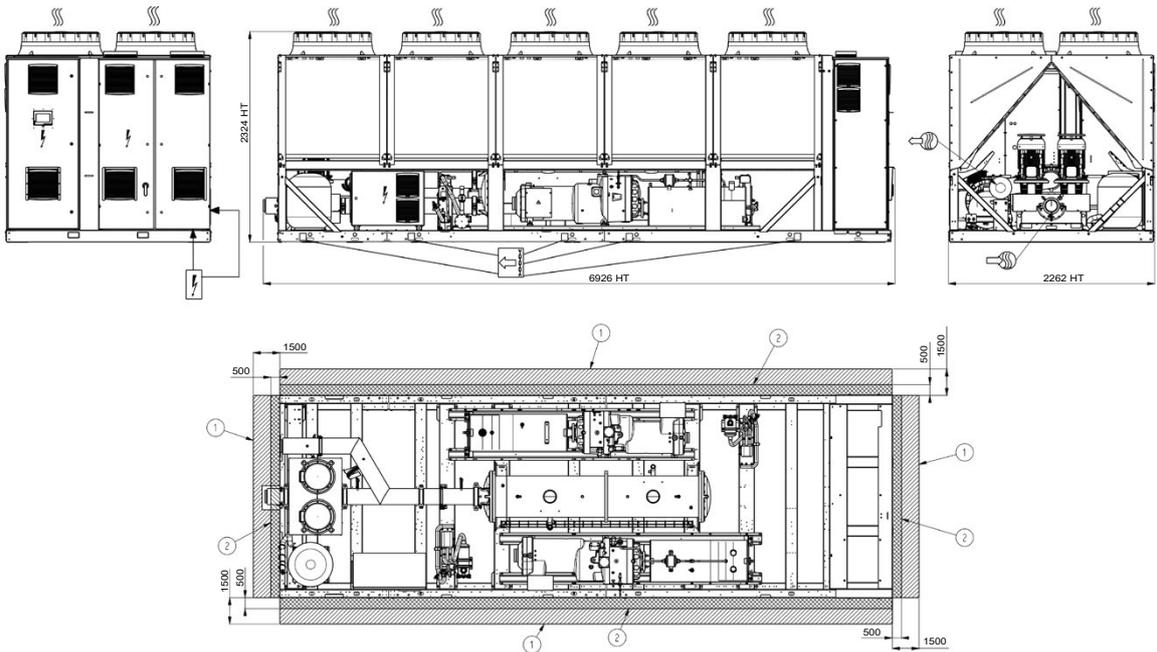
**If the installation comprises several units or if these are located close to walls, refer to sections 4.12 - Installation of multiple chillers and 4.13 - Proximity to walls, p. 16 of this manual, to determine the space required.**

## 4 - DIMENSIONS, CLEARANCES

### 4.5 - 30KAV-ZE 350, 400, 450 & 500 opt. 119; & 30KAV-ZE 550 & 600; without hydraulic module 30KAVPZE 350, 400, 450 & 500; without hydraulic module



### 4.6 - 30KAV-ZE 350, 400, 450 & 500 opt. 119; & 30KAV-ZE 550 & 600; with hydraulic module 30KAVPZE 350, 400, 450 & 500; with hydraulic module



#### Key

All dimensions are given in mm

- ① Clearances required for maintenance (see Note)
- ② ATEX zone around the machine
- Water inlet for standard units
- Water outlet for standard units
- Air outlet, do not obstruct
- Power supply connection
- Sling points

#### NOTE:

**Non-contractual drawings.**

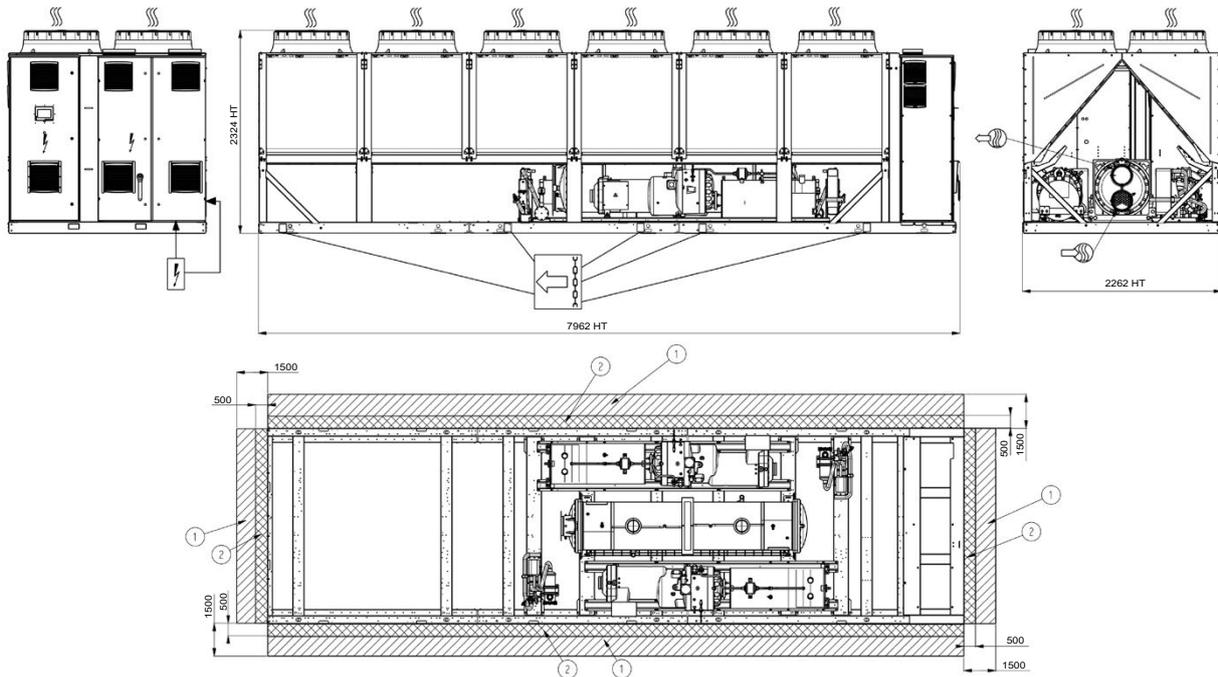
Refer to the unit name plate to find out the machine weight. Refer to the certified dimensional drawings (appendix 4), provided with the unit or available on request, when designing an installation.

Please refer to the certified dimensional drawings (appendix 4) for the positioning of the fixing points, weight distribution points and centre of gravity coordinates.

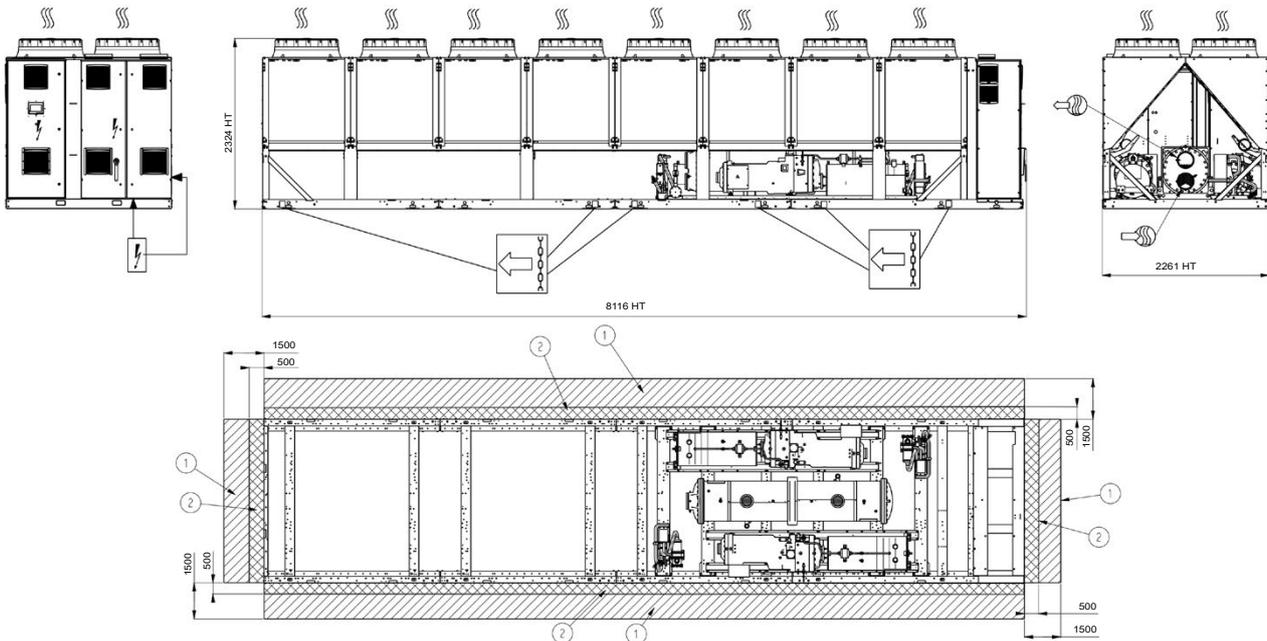
If the installation comprises several units or if these are located close to walls, refer to sections 4.12 - Installation of multiple chillers and 4.13 - Proximity to walls, p. 16 of this manual, to determine the space required.

## 4 - DIMENSIONS, CLEARANCES

### 4.7 - 30KAV-ZE 550 opt. 119; & 30KAV-ZE 650 & 750; without hydraulic module & 30KAVPZE 550; without hydraulic module



### 4.8 - 30KAV-ZE 550 opt. 119, with hydraulic module & 30KAVPZE 550; with hydraulic module



#### Key

All dimensions are given in mm

- ① Clearances required for maintenance (see Note)
- ② ATEX zone around the machine
-  Water inlet for standard units
-  Water outlet for standard units
-  Air outlet, do not obstruct
-  Power supply connection
-  Sling points

#### NOTE:

**Non-contractual drawings.**

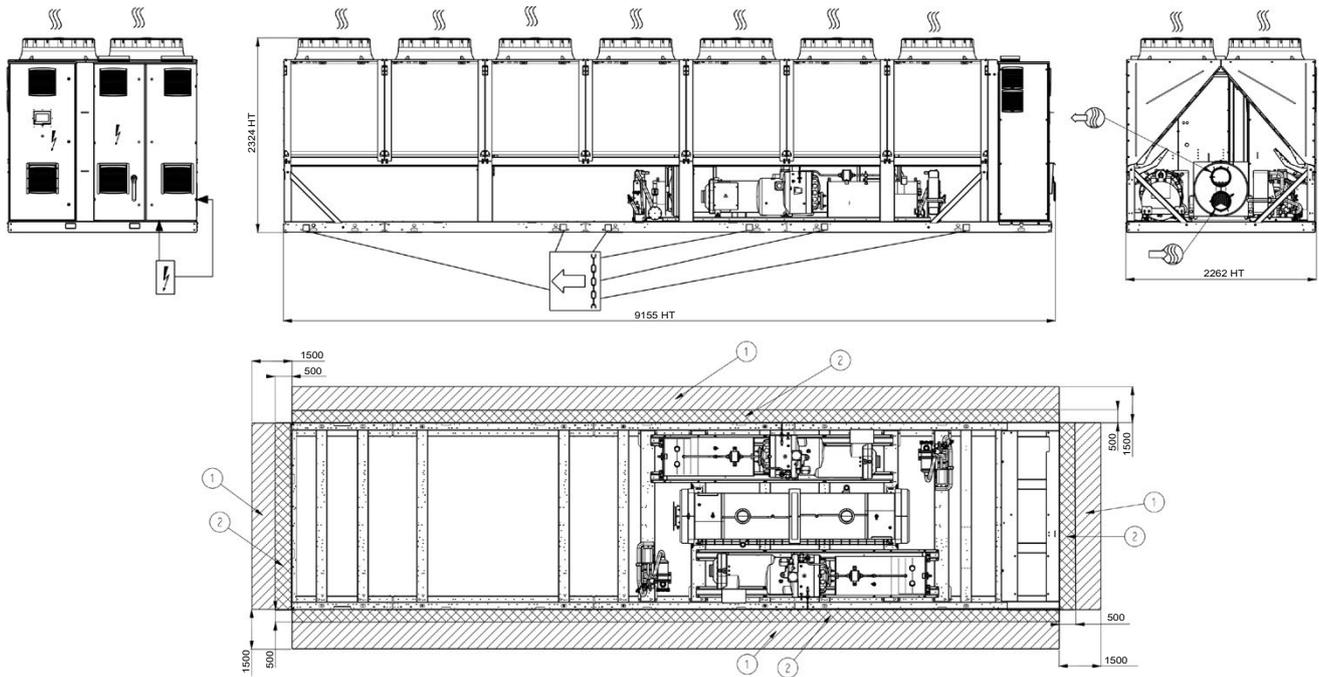
**Refer to the unit name plate to find out the machine weight. Refer to the certified dimensional drawings (appendix 4), provided with the unit or available on request, when designing an installation.**

**Please refer to the certified dimensional drawings (appendix 4) for the positioning of the fixing points, weight distribution points and centre of gravity coordinates.**

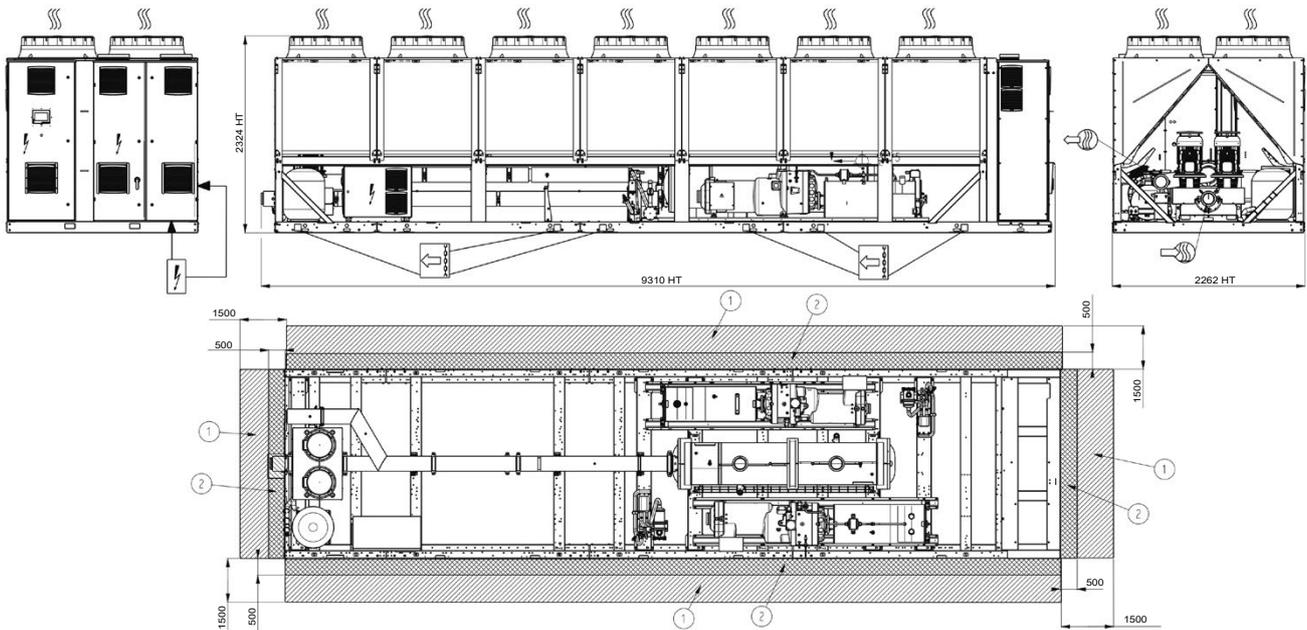
**If the installation comprises several units or if these are located close to walls, refer to sections 4.12 - Installation of multiple chillers and 4.13 - Proximity to walls, p. 16 of this manual, to determine the space required.**

## 4 - DIMENSIONS, CLEARANCES

### 4.9 - 30KAV-ZE 600 & 650 opt. 119; & 30KAV-ZE 800, without hydraulic module; & 30KAVPZE 600 & 650; without hydraulic module



### 4.10 - 30KAV-ZE 600 opt.119, with hydraulic module & 30KAVPZE 600; with hydraulic module



#### Key

All dimensions are given in mm

- ① Clearances required for maintenance (see Note)
- ② ATEX zone around the machine
- Water inlet for standard units
- Water outlet for standard units
- Air outlet, do not obstruct
- Power supply connection
- Sling points

#### NOTE:

**Non-contractual drawings.**

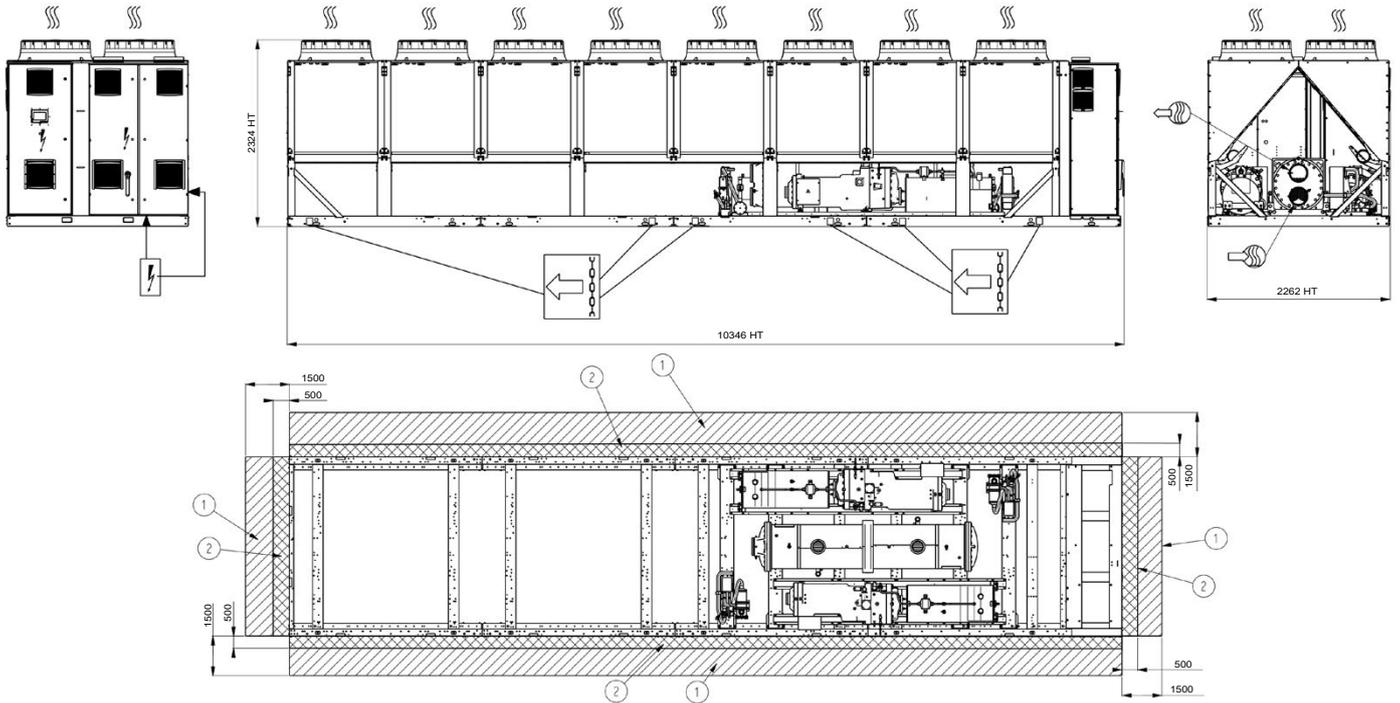
**Refer to the unit name plate to find out the machine weight. Refer to the certified dimensional drawings (appendix 4), provided with the unit or available on request, when designing an installation.**

**Please refer to the certified dimensional drawings (appendix 4) for the positioning of the fixing points, weight distribution points and centre of gravity coordinates.**

**If the installation comprises several units or if these are located close to walls, refer to sections 4.12 - Installation of multiple chillers and 4.13 - Proximity to walls, p. 16 of this manual, to determine the space required.**

## 4 - DIMENSIONS, CLEARANCES

### 4.11 - 30KAV-ZE 750 & 800 opt. 119 & 30KAVPZE 750 & 800



#### Key

All dimensions are given in mm

- ① Clearances required for maintenance (see Note)
- ② ATEX zone around the machine
- Water inlet for standard units
- Water outlet for standard units
- Air outlet, do not obstruct
- Power supply connection
- Sling points

#### NOTE:

#### Non-contractual drawings.

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.

Please refer to the certified dimensional drawings (appendix 4) for the positioning of the fixing points, weight distribution points and centre of gravity coordinates.

If the installation comprises several units or if these are located close to walls, refer to sections 4.12 - Installation of multiple chillers and 4.13 - Proximity to walls, p. 16 of this manual, to determine the space required.

### 4.12 - 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.

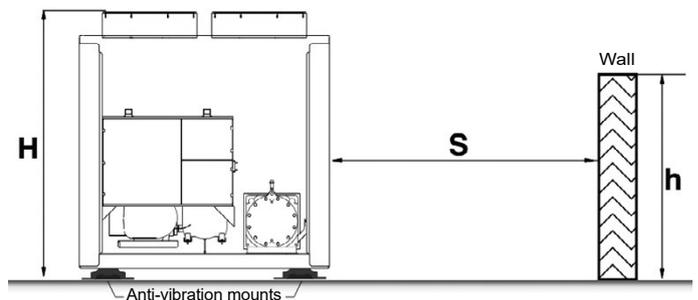


If the floor space does not allow this arrangement, contact your Carrier distributor to assess the various installation options.

### 4.13 - 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.



### 4.14 - 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.

# 5 - PHYSICAL PROPERTIES OF 30KAV-ZE / 30KAVPZE UNITS

## 5.1 - Physical properties

30KAV-ZE		350	400	450	500	550	600	650	750	800
<b>Sound levels</b>										
<b>Standard unit</b>										
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
Sound pressure level at 1 m	dB(A)	75	75	76	78	78	77	78	77	78
<b>Unit + option 15<sup>(3)</sup></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
Sound pressure level at 1 m	dB(A)	74	74	74	76	76	75	76	76	76
<b>Unit + option 15LS<sup>(3)</sup></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
Sound pressure level at 1 m	dB(A)	70	70	70	72	73	71	73	72	72
<b>Dimensions</b>										
<b>Standard unit</b>										
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
<b>Length: Unit + options</b>										
Options 49/50 <sup>(3)</sup>	mm	5578	5578	6772	6772	6772	6772	7962	7962	9155
Options 116A/116W <sup>(3)</sup>	mm	5578	5578	5578	5578	6772	6772	-	-	-
<b>Operating weight<sup>(4)</sup></b>										
Standard unit	kg	4777	4790	5166	5192	5667	6089	6558	7011	7430
Unit + option 49 <sup>(3)</sup>	kg	5177	5190	5592	5605	5843	6304	6741	7222	7657
Unit + option 50 <sup>(3)</sup>	kg	5230	5243	5718	5731	5969	6489	6927	7451	7860
Unit + options 116A/116W <sup>(3)</sup>	kg	5291	5405	5592	5618	6223	6644	-	-	-
<b>Compressors</b>										
Inverter driven 06Z twin screw compressor with AC motor										
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 capacity <sup>(5)</sup>	%	13	13	13	13	13	13	13	12	12
<b>Refrigerant<sup>(4)</sup></b>										
R1234ze (GWP=1, ODP=0)										
Circuit A	kg	49	50	57	60	67	83	93	87	94
	tCO <sub>2</sub> e	0	0	0	0	0	0	1	1	1
Circuit B	kg	50	51	58	61	68	62	73	88	95
	tCO <sub>2</sub> e	0	0	0	0	0	0	0	1	1
<b>Refrigerant<sup>(4)</sup> - Option 5<sup>(3)</sup> (Medium Brine)</b>										
R1234ze (GWP=1, ODP=0)										
Circuit A	kg	58	60	68	71	82	101	109	105	115
	teqCO <sub>2</sub>	0	0	0	0	0	1	1	1	1
Circuit B	kg	59	61	69	72	83	77	86	106	116
	teqCO <sub>2</sub>	0	0	0	0	0	0	1	1	1
<b>Refrigerant<sup>(4)</sup> - Option 6<sup>(3)</sup> (Low Brine)</b>										
R1234ze (GWP=1, ODP=0)										
Circuit A	kg	52	53	60	63	71	87	98	92	99
	tCO <sub>2</sub> e	0	0	0	0	0	1	1	1	1
Circuit B	kg	53	54	61	64	72	65	77	93	100
	tCO <sub>2</sub> e	0	0	0	0	0	0	0	1	1
<b>Oil</b>										
Hatcol 4496										
Circuit A	l	27	26	25	23	20	23	20	23	20
Circuit B	l	27	26	25	23	20	23	20	23	20

(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 L<sub>w</sub>(A).

(3) Options: 15=Low noise level; 15LS=Very low sound level; 116A=Variable speed dual LP pump; 116W=Variable speed dual HP pump; 49=Partial heat recovery; 50=Total heat recovery; 5=Medium-temperature brine solution; 6=Low-temperature brine solution

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

(5) Depending on the operating conditions, the unit may have a different minimum capacity and/or cycle on and off.



Eurovent certified values

## 5 - PHYSICAL AND ELECTRICAL DATA FOR 30KAV-ZE / 30KAVPZE UNITS

30KAV-ZE	350	400	450	500	550	600	650	750	800	
<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>Standard unit</b>	Inverter driven Flying Bird™ VI fans with AC motor									
<b>Unit + option 17</b>	Inverter driven Flying Bird™ VI fans 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
Maximum total air flow rate + option 15LS <sup>(3)</sup>	l/s	28920	26100	41600	43200	56000	50000	67200	57840	72800
Maximum rotation speed + option 15LS <sup>(3)</sup>	r/s	13,2	12,0	14,2	14,7	15,2	13,7	15,2	13,2	14,2
<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>Hydraulic module (option)</b>	Dual-pump, screen filter, relief valve, water drain tap, pressure sensors, expansion vessel (option), heaters (option)									
Pump	Variable speed dual pumps with AC motors									
Expansion vessel volume	l	80	80	80	80	80	80	-	-	-
Max. operating pressure, water side	kPa	400	400	400	400	400	400	-	-	-
<b>Water connections</b>	Victaulic® type									
<b>Without options 116A/116W<sup>(3)</sup></b>										
Connections	inches	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>With options 116A/116W<sup>(3)</sup></b>										
Connections	inches	5	5	5	5	5	5	-	-	-
External pipe diameter	mm	141,3	141,3	141,3	141,3	141,3	141,3	-	-	-
<b>Chassis paint colour</b>	Colour code RAL 7035									

(3) Options: 15=Low noise level; 15LS=Very low sound level; 116A=Variable speed dual LP pump; 116W=Variable speed dual HP pump; 49=Partial heat recovery; 50=Total heat recovery; 5=Medium-temperature brine solution; 6=Low-temperature brine solution

# 5 - PHYSICAL AND ELECTRICAL DATA FOR 30KAV-ZE / 30KAVPZE UNITS

Physical properties of units with High energy efficiency option (119) and High energy efficiency+ option (119+)

Physical properties of 30KAVPZE units

30KAV-ZE options 119/119+ & 30KAVPZE		350	400	450	500	550	600	650	750	800
<b>Sound levels</b>										
<b>30KAV-ZE_option_119+ &amp; 30KAVPZE</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
Sound pressure level at 1 m	dB(A)	75	75	76	77	78	76	78	76	78
<b>30KAV-ZE_option_119+ &amp; 30KAVPZE: option 15<sup>(3)</sup></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
Sound pressure level at 1 m	dB(A)	74	74	73	75	76	74	76	76	76
<b>30KAV-ZE_option_119+ &amp; 30KAVPZE: option 15LS<sup>(3)</sup></b>										
Sound power <sup>(1)</sup>	dB(A)	90	91	91	92	94	92	94	93	94
Sound pressure at 10 m <sup>(2)</sup>	dB(A)	57	58	58	59	61	60	61	60	61
Sound pressure level at 1 m	dB(A)	69	70	70	71	73	70	72	71	72
<b>Dimensions</b>										
<b>30KAV-ZE_option_119 &amp; 119+ &amp; 30KAVPZE</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>Length: Unit + options</b>										
Options 49/50 <sup>(3)</sup>	mm	6772	6772	6772	6772	7962	9155	9120	10346	10346
Options 116A/116W <sup>(3)</sup>	mm	6772	6772	6772	6772	7962	9155	-	-	-
<b>Operating weight<sup>(4)</sup></b>										
30KAV-ZE_option_119+ & 30KAVPZE	kg	5532	5545	5568	5594	6029	6825	6972	7752	7814
Unit + option 49 <sup>(3)</sup>	kg	5728	5735	5748	5751	6183	7007	7116	7891	7920
Unit + option 50 <sup>(3)</sup>	kg	5781	5788	5874	5877	6327	7192	7301	8120	8149
options 116A/116W <sup>(3)</sup>	kg	5941	6055	6043	6069	6029	7470	-	-	-
<b>Compressors</b>										
06Z twin-screw variable-speed compressor. 30KAV: AC motor. 30KAVP: permanent magnet motors.										
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 capacity <sup>(5)</sup>	%	13	13	13	13	13	13	13	12	12
<b>Refrigerant<sup>(4)</sup> - 30KAV-ZE_option_119+ &amp; 30KAVPZE</b>										
R1234ze (GWP=1, ODP=0)										
Circuit A	kg	67	67	68	66	74	96	100	100	101
	tCO <sub>2</sub> e	0	0	0	0	0	1	1	1	1
Circuit B	kg	68	68	68	67	75	75	80	101	102
	tCO <sub>2</sub> e	0	0	0	0	0	0	0	1	1
<b>Refrigerant<sup>(4)</sup> - Option 5<sup>(3)</sup> (Medium Brine)</b>										
R1234ze (GWP=1, ODP=0)										
Circuit A	kg	76	77	79	77	87	114	116	118	122
	tCO <sub>2</sub> e	0	0	0	0	1	1	1	1	1
Circuit B	kg	77	78	79	78	88	90	93	119	123
	tCO <sub>2</sub> e	0	0	0	0	1	1	1	1	1
<b>Refrigerant<sup>(4)</sup> - Option 6<sup>(3)</sup> (Low Brine)</b>										
R1234ze (GWP=1, ODP=0)										
Circuit A	kg	70	70	68	66	78	101	105	105	106
	tCO <sub>2</sub> e	0	0	0	0	0	1	1	1	1
Circuit B	kg	71	71	68	69	79	79	84	106	107
	tCO <sub>2</sub> e	0	0	0	0	0	0	1	1	1
<b>Oil</b>										
Hatcol 4496										
Circuit A	l	27	26	25	23	20	23	20	23	20
Circuit B	l	27	26	25	23	20	23	20	23	20

- (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 +/-3 dB(A). Measured in accordance with ISO 9614-1 and certified by Eurovent.
- (2) In dB ref 20 µPa, 'A' weighted. Declared dual-number noise emission values in accordance with ISO 4871 with an associated uncertainty of +/-3 dB(A). For information, calculated from the sound power Lw(A).
- (3) Options: 15=Low noise level; 15LS=Very low sound level; 116A=Variable speed dual LP pump; 116W=Variable speed dual HP pump; 49=Partial heat recovery; 50=Total heat recovery; 5=Medium-temperature brine solution; 6=Low-temperature brine solution
- (4) Values are guidelines only. Refer to the unit name plate.
- (5) Depending on the operating conditions, the unit may have a different minimum capacity and/or cycle on and off.



Eurovent certified values

## 5 - PHYSICAL AND ELECTRICAL DATA FOR 30KAV-ZE / 30KAVPZE UNITS

30KAV-ZE options 119/119+ & 30KAVPZE	350	400	450	500	550	600	650	750	800	
<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-ZE_option 119</b>	Inverter driven Flying Bird™ VI fans with AC motor									
<b>30KAV-ZE_option_119+ &amp; 30KAVP</b>	Inverter driven Flying Bird™ VI fans 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
Maximum total air flow rate + option 15LS <sup>(3)</sup>	l/s	44700	43500	52000	52000	64800	67480	75600	74080	83200
Maximum rotation speed + option 15LS <sup>(3)</sup>	r/s	12,3	12	14,2	14,2	14,7	13,2	14,7	12,7	14,2
<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>Hydraulic module (option)</b>	Dual-pump, screen filter, relief valve, water drain tap, pressure sensors, expansion vessel (option), heaters (option)									
Pump	Variable speed dual pumps with AC motors									
Expansion vessel volume	l	80	80	80	80	80	80	-	-	-
Max. operating pressure, water side	kPa	400	400	400	400	400	400	-	-	-
<b>Water connections</b>	Victaulic® type									
<b>Without options 116A/116W<sup>(3)</sup></b>										
Connections	inches	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>With options 116A/116W<sup>(3)</sup></b>										
Connections	inches	5	5	5	5	5	5	-	-	-
External pipe diameter	mm	141,3	141,3	141,3	141,3	141,3	141,3	-	-	-
<b>Chassis paint colour</b>	Colour code RAL 7035									

(3) Options: 15=Low noise level; 15LS=Very low sound level; 116A=Variable speed dual LP pump; 116W=Variable speed dual HP pump; 49=Partial heat recovery; 50=Total heat recovery; 5=Medium-temperature brine solution; 6=Low-temperature brine solution

## 5 - PHYSICAL AND ELECTRICAL DATA FOR 30KAV-ZE / 30KAVPZE UNITS

### 5.2 - Electrical data

30KAV-ZE		350	400	450	500	550	600	650	750	800
<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 unit power input<sup>(1)</sup></b>										
Standard unit	kW	180	196	214	232	257	293	325	366	393
Unit + option 16	kW	194	211	229	248	275	311	353	386	431
<b>Maximum capacity power factor<sup>(1) (2)</sup></b>										
0,91-0,93										
Cosine phi										
>0,98										
Total harmonic distortion (THDi) <sup>(1) (3)</sup>										
%										
35-45										
<b>Nominal unit current draw<sup>(4)</sup></b>										
Standard unit	A	189	211	232	245	264	303	333	372	403
<b>Maximum unit current draw (Un)<sup>(1)</sup></b>										
Standard unit	A	280	305	332	360	400	456	505	568	610
Unit + option 16	A	301	328	355	385	428	484	548	599	669
<b>Maximum unit current draw (Un-10%)<sup>(1)</sup></b>										
Standard unit	A	306	332	362	383	426	494	537	604	649
Unit + option 16	A	329	357	388	410	455	524	583	638	712
<b>Maximum starting current</b>										
Standard unit	A	180	192	206	220	240	314	341	334	335

(1) Values at the unit's maximum operating condition (as shown on the unit's nameplate).

(2) The value decreases as the input power is reduced

(3) May vary depending on the short-circuit ratio of the installation.

The THDi value increases as the input power drops. However, the effects on the installation are greater when the current is at its maximum. For this reason, the installation's compliance with standards relating to voltage harmonics (for example, the IEC standard 60000-2-4) must usually be checked at the maximum load condition, to ensure the other operating scenarios are covered.

(4) Standardised EUROVENT conditions, water-cooled exchanger water inlet/outlet = 12°C/7°C, outdoor air temperature = 35°C.

## 5 - PHYSICAL AND ELECTRICAL DATA FOR 30KAV-ZE / 30KAVPZE UNITS

Electrical data - Units with option permanent magnet motor (329), option High energy efficiency (119) and option High energy efficiency+ (119+)

30KAV-ZE options 119/119+		350	400	450	500	550	600	650	750	800
<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 unit power input<sup>(1)</sup></b>										
Unit + option 119	kW	181	200	209	226	250	288	315	358	380
Unit + option 119+	kW	179	198	206	223	247	285	311	354	375
Unit + option 119 + option 16	kW	195	215	224	242	268	306	343	378	418
Unit + option 119+ + option 16	kW	193	213	221	239	265	303	339	374	413
Unit + option 329	kW	169	185	202	219	248	272	313	337	378
Unit + option 329 + option 16	kW	175	193	209	227	258	282	325	350	392
Unit + option 329 + option 119	kW	170	189	197	213	241	267	303	329	365
Unit + option 329 + option 119 + option 16	kW	176	197	204	221	251	277	315	342	379
<b>Maximum capacity power factor<sup>(1) (2)</sup></b>										
0,91-0,93										
Cosine phi										
>0,98										
Total harmonic distortion (THDi) <sup>(1) (3)</sup>										
%										
35-45										
<b>Nominal unit current draw<sup>(4)</sup></b>										
Unit + option 119	A	171	193	216	227	253	282	315	348	384
Unit + option 119+	A	168	190	212	223	248	277	309	342	377
Unit + option 329	A	183	205	225	238	256	294	323	361	391
<b>Maximum unit current draw (Un)<sup>(1)</sup></b>										
Unit + option 119	A	281	311	324	350	389	449	489	556	590
Unit + option 119+	A	278	308	320	346	384	444	483	550	583
Unit + option 119 + option 16	A	302	334	347	375	417	477	532	587	649
Unit + option 119+ + option 16	A	299	331	343	371	412	472	526	581	642
Unit + option 329	A	263	288	313	340	386	423	486	523	587
Unit + option 329 + option 16	A	273	300	324	352	401	439	505	543	608
Unit + option 329 + option 119	A	264	294	305	330	375	416	470	511	567
Unit + option 329 + option 119 + option 16	A	274	306	316	342	390	432	489	531	588
<b>Maximum unit current draw (Un-10%)<sup>(1)</sup></b>										
Unit + option 119	A	306	331	353	367	413	485	520	591	635
Unit + option 119+	A	303	328	349	363	408	480	514	585	628
Unit + option 119 + option 16	A	329	356	379	394	442	515	566	625	698
Unit + option 119+ + option 16	A	326	353	375	390	437	510	560	619	691
Unit + option 329	A	289	315	343	363	412	461	518	559	626
Unit + option 329 + option 16	A	300	327	356	376	428	479	539	580	641
Unit + option 329 + option 119	A	289	314	334	347	399	452	501	546	612
Unit + option 329 + option 119 + option 16	A	300	326	347	360	415	470	522	567	627
<b>Maximum starting current</b>										
Unit + option 119	A	180	196	196	208	227	305	307	319	311
Unit + option 119+	A	178	195	194	206	224	302	304	316	308
Unit + option 329	A	171	185	191	203	225	292	313	303	310

(1) Values at the unit's maximum operating condition (as shown on the unit's nameplate).

(2) The value decreases as the input power is reduced

(3) May vary depending on the short-circuit ratio of the installation.

The THDi value increases as the input power drops. However, the effects on the installation are greater when the current is at its maximum. For this reason, the installation's compliance with standards relating to voltage harmonics (for example, the IEC standard 60000-2-4) must usually be checked at the maximum load condition, to ensure the other operating scenarios are covered.

(4) Standardised EUROVENT conditions, water-cooled exchanger water inlet/outlet = 12°C/7°C, outdoor air temperature = 35°C.

## 5 - PHYSICAL AND ELECTRICAL DATA FOR 30KAV-ZE / 30KAVPZE UNITS

30KAVPZE		350	400	450	500	550	600	650	750	800
<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 unit power input<sup>(1)</sup></b>										
Standard unit	kW	168	187	194	210	238	264	299	325	360
Unit + option 16	kW	174	195	201	218	248	274	311	338	374
<b>Maximum capacity power factor<sup>(1) (2)</sup></b>										
0,91-0,93										
Cosine phi		>0,98								
Total harmonic distortion (THDi) <sup>(1) (3)</sup>	%	35-45								
<b>Nominal unit current draw<sup>(4)</sup></b>										
Standard unit	A	163	184	205	216	240	268	299	331	365
<b>Maximum unit current draw (Un)<sup>(1)</sup></b>										
Standard unit	A	261	291	301	326	370	411	464	505	560
Unit + option 16	A	271	303	312	338	385	427	483	525	581
<b>Maximum unit current draw (Un-10%)<sup>(1)</sup></b>										
Standard unit	A	286	311	330	343	394	447	495	540	605
Unit + option 16	A	309	336	356	370	423	477	541	574	668
<b>Maximum starting current</b>										
Standard unit	A	173	188	193	206	228	287	320	306	334

(1) Values at the unit's maximum operating condition (as shown on the unit's nameplate).

(2) The value decreases as the input power is reduced

(3) May vary depending on the short-circuit ratio of the installation.

The THDi value increases as the input power drops. However, the effects on the installation are greater when the current is at its maximum. For this reason, the installation's compliance with standards relating to voltage harmonics (for example, the IEC standard 60000-2-4) must usually be checked at the maximum load condition, to ensure the other operating scenarios are covered.

(4) Standardised EUROVENT conditions, water-cooled exchanger water inlet/outlet = 12°C/7°C, outdoor air temperature = 35°C.

### 5.3 - Short circuit current withstand capability for all units

30KAVPZE/30KAVPZE		350	400	450	500	550	600	650	750 <sup>(1)</sup>	800
<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	11	26
Rated peak current - I <sub>pk</sub>	kA pk	80	80	80	80	80	80	80	80	110
<b>Value with upstream electrical protection<sup>(2)</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	630	630	800	800	800	800	1000
<b>Unit with option 70D</b>										
<b>Short-circuit withstand current</b>										
Conditional short circuit assigned current I <sub>cc</sub>	kA eff	50	50	50	50	50	50	50	50	50

(1) When this unit is equipped with option 16, the following modifications should be considered:

I<sub>cw</sub>/I<sub>pk</sub> = 26 kA eff / 110 kA eff; Maximum rating for gG/gL fuse for an I<sub>cc</sub> value of 50 kA eff: 1000 A

(2) 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 stability current values above are suitable with the TN system.

## 5 - PHYSICAL AND ELECTRICAL DATA FOR 30KAV-ZE / 30KAVPZE UNITS

### 5.4 - 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>		350	400	450	500	550	600
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	Year of manufacture	-	This information varies depending on the manufacturer and model at the time of incorporation. Please refer to the motor nameplates.					
4	Manufacturer's name and trademark, commercial registration number and place of manufacturer	-	Same as above					
5	Product's model number	-	Same as above					
6	Number of motor poles	-	2	2	2	2	2	2
7-1	Nominal shaft power output at full load and nominal voltage (400 V)	kW	5,5	7,5	7,5	7,5	11	11
7-2	Maximum input power (400 V) <sup>(4)</sup>	kW	6,17	8,31	8,31	8,31	12,05	12,05
8	Nominal input frequency	Hz	50	50	50	50	50	50
9-1	Nominal voltage	V	3 x 400					
9-2	Maximum current drawn (400 V) <sup>(5)</sup>	A	10,50	13,20	13,20	13,20	18,70	18,70
10	Nominal speed	r/s - rpm	48,6 - 2917	48,9 - 2935	48,9 - 2935	48,9 - 2935	49,1 - 2945	49,1 - 2945
11	Product disassembly, recycling or disposal at end of life	-	Disassembly using standard tools. Disposal and recycling using an appropriate company.					
12	Operating conditions for which the motor is specifically designed							
	I - Altitudes above sea level	m	< 1000 <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 No. 640/2009 concerning the application of directive 2009/125/EC on the eco-design requirements for electric motors.

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

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

(4) To obtain the maximum input power for a unit with hydraulic module, add the "maximum operating input power" for the unit (see Electrical data table) to the pump power.

(5) To obtain the maximum unit operating current draw for a unit with hydraulic module add the "maximum unit operating current draw" (Electrical data table) to the pump current draw.

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

## 5 - PHYSICAL AND ELECTRICAL DATA FOR 30KAV-ZE / 30KAVPZE UNITS

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

No.(2)	Description(3)		350	400	450	500	550	600
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	Year of manufacture	-	This information varies depending on the manufacturer and model at the time of incorporation. Please refer to the motor nameplates.					
4	Manufacturer's name and trademark, commercial registration number and place of manufacturer	-	Same as above					
5	Product's model number	-	Same as above					
6	Number of motor poles	-	2	2	2	2	2	2
7-1	Nominal shaft power output at full load and nominal voltage (400 V)	kW	7,5	11	11	11	15	15
7-2	Maximum input power (400 V)(4)	kW	8,31	12,05	12,05	12,05	16,38	16,38
8	Nominal input frequency	Hz	50	50	50	50	50	50
9-1	Nominal voltage	V	3 x 400					
9-2	Maximum current drawn (400 V)(5)	A	13,20	18,70	18,70	18,70	25,20	25,20
10	Nominal speed	r/s - rpm	48,9 - 2935	49,1 - 2945	49,1 - 2945	49,1 - 2945	49,1 - 2945	49,1 - 2945
11	Product disassembly, recycling or disposal at end of life	-	Disassembly using standard tools. Disposal and recycling using an appropriate company.					
12	Operating conditions for which the motor is specifically designed							
	I - Altitudes above sea level	m	< 1000(6)					
	II - Ambient air temperature	°C	< 40					
	III - Maximum operating temperature	°C	Please refer to the operating conditions given in this manual or in the specific conditions in the Carrier selection programs.					
	IV - Potentially explosive atmospheres	-	Non-ATEX environment					

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

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

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

(4) To obtain the maximum input power for a unit with hydraulic module, add the "maximum operating input power" for the unit (see Electrical data table) to the pump power.

(5) To obtain the maximum unit operating current draw for a unit with hydraulic module add the "maximum unit operating current draw" (Electrical data table) to the pump current draw.

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

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

#### 30KAV-ZE

30KAV-ZE compressor	Circuit	350	400	450	500	550	600	650	750	800
06ZCE1H3AA06013	A	1	1	-	-	-	-	-	-	-
	B	1	1	-	-	-	-	-	-	-
06ZCE1T3AA06013	A	-	-	1	1	1	-	-	-	-
	B	-	-	1	1	1	1	1	-	-
06ZFC2T3AA06013	A	-	-	-	-	-	1	1	1	1
	B	-	-	-	-	-	-	-	1	1

#### 30KAVPZE

30KAVPZE compressor	Circuit	350	400	450	500	550	600	650	750	800
06ZCEAT3AA06013	A	1	1	1	1	1	-	-	-	-
	B	1	1	1	1	1	1	1	-	-
06ZFCBT3AA06013	A	-	-	-	-	-	1	1	1	1
	B	-	-	-	-	-	-	-	1	1

The compressor motor (all models) does not fall within the scope of the regulation 640/2009 & its amendment 4/2014. in accordance with article 1)2.b.

## 5 - PHYSICAL AND ELECTRICAL DATA FOR 30KAV-ZE / 30KAVPZE UNITS

### Electrical data notes and operating conditions for 30KAV-ZE units

- 30KAV-ZE-30KAVP-ZE 0350 to 800 units have a single power connection point located immediately upstream of the main disconnect switch.
  - The two electrical cabinets contain:
    - A supply disconnecting component.
    - All or part of the equipment protecting the circuits inside the machine from short circuits.<sup>(1)</sup>
    - Frequency inverters for the compressors, fans, and pumps,
    - 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. 30KAV 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 EN60204-1 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 (2000 m) <sup>(4)</sup>
      - Presence of solid foreign bodies: Class AE3 (no significant dust present) <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 the IEC61000-2-4 standard:
      - Power supply frequency variation: +/-1 Hz,
      - Phase imbalance: 2 %,
      - Voltage Total Harmonic Distortion (THDV): 8 %,
    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 frequency inverter(s) prevents the machines from fulfilling their intended purpose. In addition, the equipment characteristics in case of insulation failure 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 emissions as defined in category C3 <sup>(6)</sup>
- The frequency inverters integrated into 30KAV-ZE machines 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 frequency inverters 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 to those listed above (or which are not listed), always contact your Carrier representative.**
- (1) With the exception of machines equipped with option 70D, 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 (according to the reference standard IEC 60529). All 30KAV-ZE units are classified as IP44CW, and fulfil this protection condition.
  - (3) The values in brackets correspond to operation with degraded thermal performances.
  - (4) Above 1000m, the maximum temperature must be reduced by 0.5K for every additional 100m up to 2000m,
  - (5) - Example of installations included in the first environment: commercial and residential buildings.
    - Example of installations of 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 locations. As an option, conformity with category C2 permits this type of installation.

## 6 - ELECTRICAL CONNECTION

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

### 6.1 - Power supply

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.**

### 6.2 - Voltage phase imbalance (%)

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

#### Example:

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

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

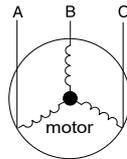
$$\begin{aligned} \text{Average voltage} &= (406 + 399 + 394)/3 = 1199/3 \\ &= 399.7 \text{ (rounded up to 400 V)} \end{aligned}$$

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.

### 6.3 - Power connection/disconnect switch

30KAV-ZE/30KAVPZE 0350 to 0800 machines are equipped with a single electrical power connection point.

### 6.4 - Recommended cable sections

Wire 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 wire sizing has been completed, using the certified dimensional drawing, the installer must verify the appropriate means of connection and define any modifications necessary on site.

The connections provided as standard for the customer-supplied power supply cables, 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 have been performed using the maximum possible current on the machine (see electrical data notes table).

The calculations of favourable and unfavourable cases have been performed using the maximum current for each unit (see electrical data notes table). The study includes the standardised installation cases according to IEC 60364: cable with PVC (70°C) or XLPE (90°C) insulation with copper core; fitted in accordance with table 52c of the standard. 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.**

### 6.5 - 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.**

## 6 - ELECTRICAL CONNECTION

Minimum and maximum cable section selection table for connection to 30KAV-ZE / 30KAVPZE units

30KAV-ZE/ 30KAVPZE	Max. connectable section <sup>(1)</sup>		Calculation of favourable case: - Suspended overhead line (standardised routing no. 17) - Cable insulated to 90°C - Copper conductor (Cu)			Calculation of unfavourable case - 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	-
<b>Standard unit</b>								
<b>350</b>	4 x 240	3 x 240	1 x 150	230	90 °C	2 x 150	420	70 °C
<b>400</b>	4 x 240	3 x 240	1 x 150	210	90 °C	2 x 185	450	70 °C
<b>450</b>	4 x 240	3 x 240	1 x 185	240	90 °C	2 x 185	420	70 °C
<b>500</b>	4 x 240	3 x 240	1 x 240	260	90 °C	2 x 240	460	70 °C
<b>550</b>	4 x 240	3 x 240	1 x 240	240	90 °C	2 x 240	430	70 °C
<b>600</b>	4 x 240	3 x 240	2 x 120	230	90 °C	3 x 240	480	70 °C
<b>650</b>	4 x 240	3 x 240	2 x 150	230	90 °C	3 x 240	420	70 °C
<b>750</b>	4 x 240	3 x 240	2 x 185	250	90 °C	4 x 240	440	70 °C
<b>800</b>	4 x 240	3 x 240	2 x 185	230	90 °C	4 x 240	410	70 °C

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

(2) Selection simulation result considering the hypotheses indicated.

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

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

### 6.6 - 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-ZE 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.

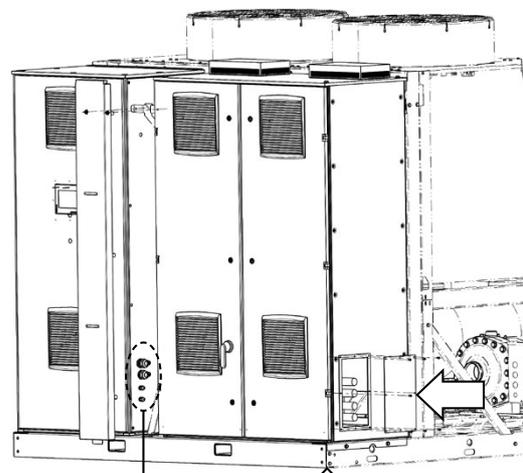
A shielding clamp for the cable from the system is provided near the permanent bus connectors.

### 6.7 - 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.

#### Location of the openings for inserting external connections



Location of the inputs for the remote control signals

Access routing for power supply cables from underneath or the side

# 7 - APPLICATION DATA

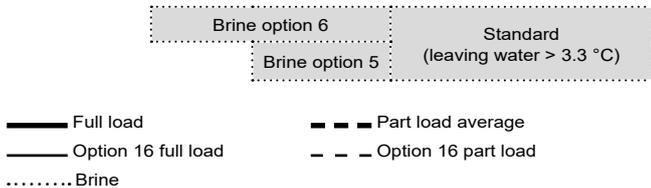
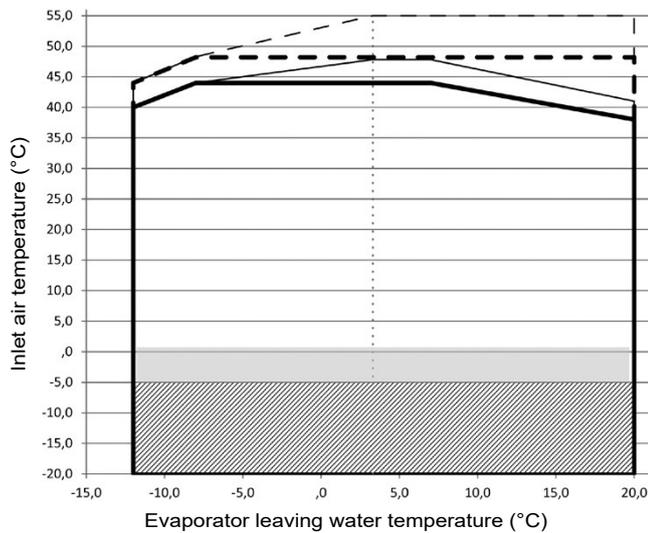
## 7.1 - Unit operating range

Evaporator water temperature		Minimum	Maximum
Water inlet at start-up	°C	-	45 <sup>(1)</sup>
Water inlet during operation	°C	6,8	25
Water outlet in operation			
Standard unit	°C	3,3 <sup>(2)</sup>	20
Unit + option 5 <sup>(3)</sup>	°C	-6	20
Unit + option 6 <sup>(3)</sup>	°C	-12	20
Air temperature at the condenser		Minimum	Maximum
Ambient air for storage	°C	-20	68
Ambient air during operation			
Standard unit	°C	-20 <sup>(4)</sup>	48 <sup>(1)</sup>
Unit + option 16 <sup>(3)</sup>	°C	-20 <sup>(4)</sup>	55 <sup>(1)</sup>

**NOTES:**

- The use of a glycol/water mix or the frost protection option is mandatory if the leaving water temperature is less than 4 °C
- The use of a glycol/water mix or the frost protection option is mandatory if the air temperature is less than 0°C.
- (1) Operating at partial load
- (2) Based on the installation type and the air temperature
- (3) Option 16 = High ambient temperature; 5=Medium-temperature brine solution; 6=Low-temperature brine solution
- (4) Option 41A compulsory for start-ups below -5°C

### Standard unit



**NOTE:**

- Evaporator  $\Delta T = 4 K$
- These ranges are guidelines only. Verify the operating range with the Carrier electronic catalogue.

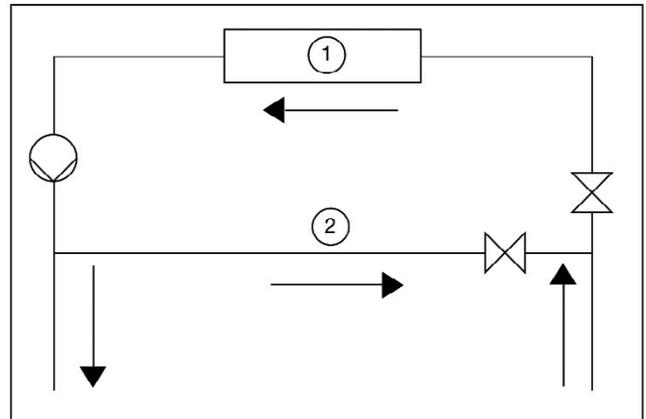
**Legend:**

- Operating range, standard unit
- At an air temperature of below 0°C, either the machine must be equipped with option 41A, or the water loop must be protected against freezing by an antifreeze solution (by the installer)
- ▨ For start-ups at an air temperature below -5°C, the machine must be equipped with option 41A

## 7.2 - Minimum chilled water flow (units without hydraulic module)

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



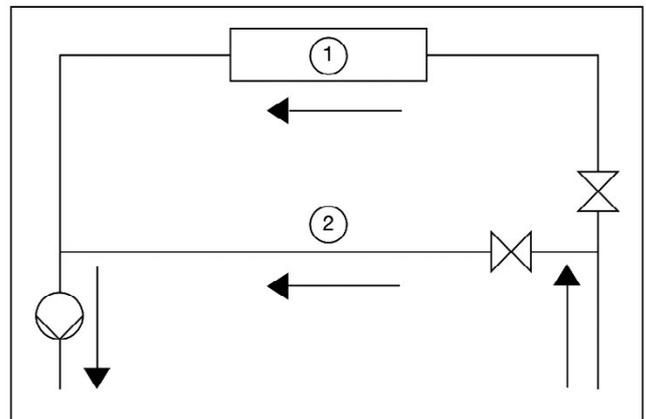
**Legend:**

- 1. Evaporator
- 2. Recirculation

## 7.3 - Maximum chilled water flow (units without hydraulic module)

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

## 7 - APPLICATION DATA

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

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.

### 7.5 - Minimum system water volume

Regardless of the system, the water loop minimum volume is given by the formula:

$$\text{Capacity} = \text{Cap (kW)} \times \text{N litres}$$

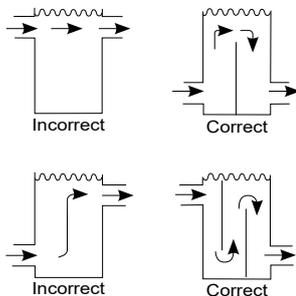
Application	N
Normal air conditioning	3,25
Process type cooling	6,5

where Cap is the nominal system cooling capacity (kW) at the nominal operating conditions of the installation.

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



### 7.6 - Maximum system water volume.

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

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

30KAV-ZE/30KAVPZE		30KAV-ZE/30KAVPZE 350-600		
Static pressure	bar	1	2	2,5
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

### 7.7 - Evaporator water flow rate

#### Units without hydraulic module

30KAV-ZE / 30KAVP-ZE	Minimum flow rate <sup>(1)</sup> (l/s)	Maximum flow rate <sup>(1)</sup> (l/s)
350	6,8	49,1
400	7,9	49,1
450	8,4	60,2
500	9,2	61,8
550	9,7	71,3
600	10,7	69,7
650	11,3	81,6
750	12,4	89,5
800	14,8	98,2

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

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

30KAV-ZE / 30KAVP-ZE	Minimum flow rate (l/s)	Maximum flow rate (l/s)
350	(1)	35,2
400	(1)	34,2
450	(1)	34,2
500	(1)	34,2
550	(1)	52,8
600	(1)	52,8

(1) See unit without hydraulic module

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

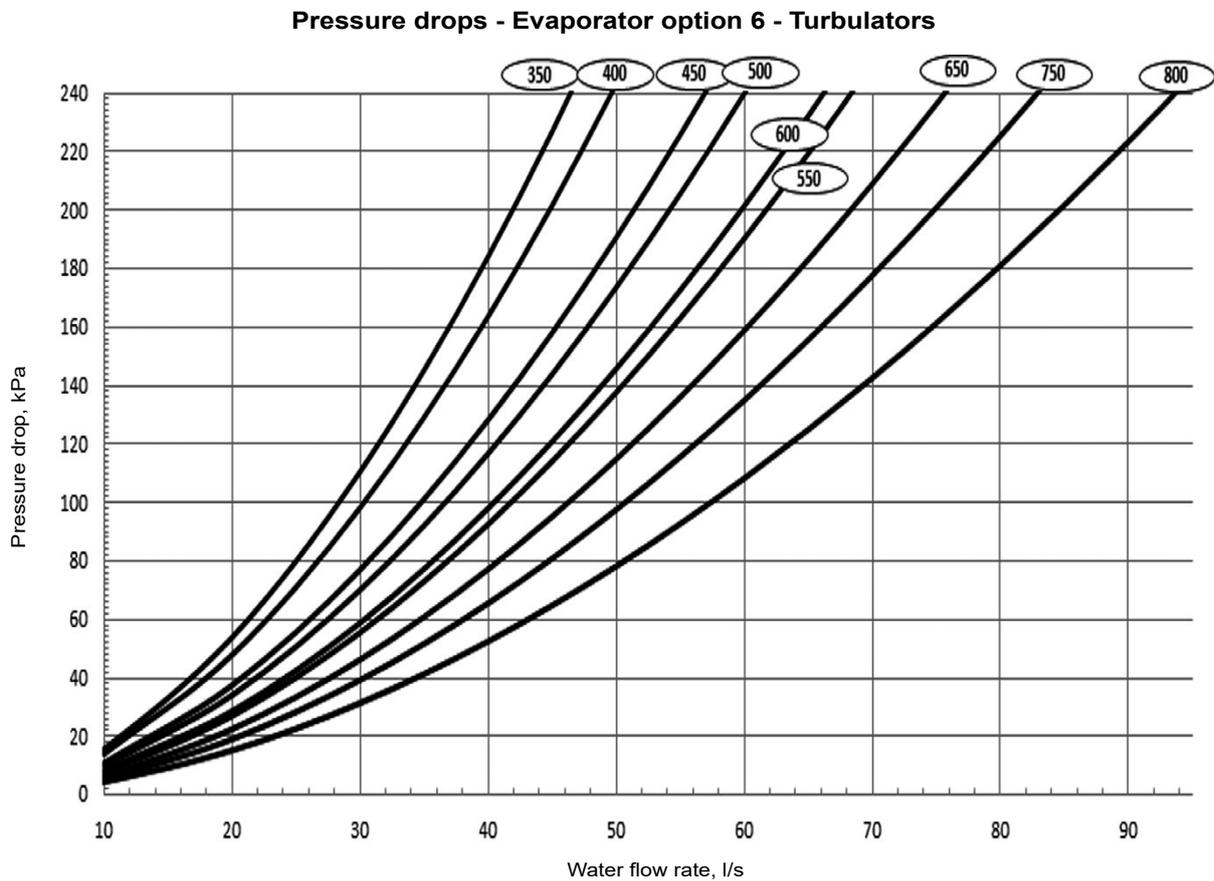
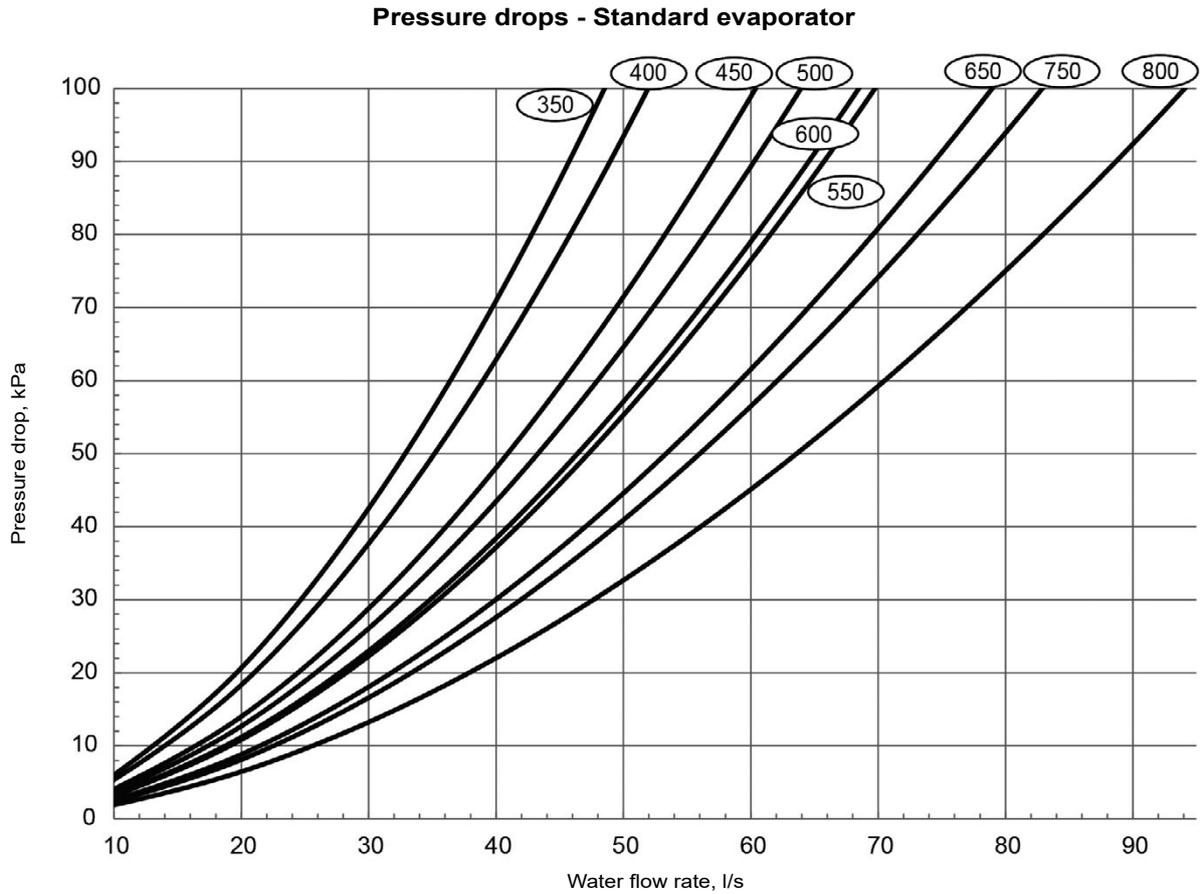
30KAV-ZE / 30KAVP-ZE	Minimum flow rate (l/s)	Maximum flow rate (l/s)
350	(1)	34,2
400	(1)	34,6
450	(1)	34,6
500	(1)	34,6
550	(1)	69,4
600	(1)	69,4

(1) See unit without hydraulic module

## 7 - APPLICATION DATA

### 7.8 - Evaporator pressure drop curves

Data applicable for pure water at 20°C.



## 8 - WATER CONNECTIONS

**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 heat exchange 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 10-600µS/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 water circuit must be carried out by qualified personnel using the air bleed devices and tools and equipment suitable for the products.**

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

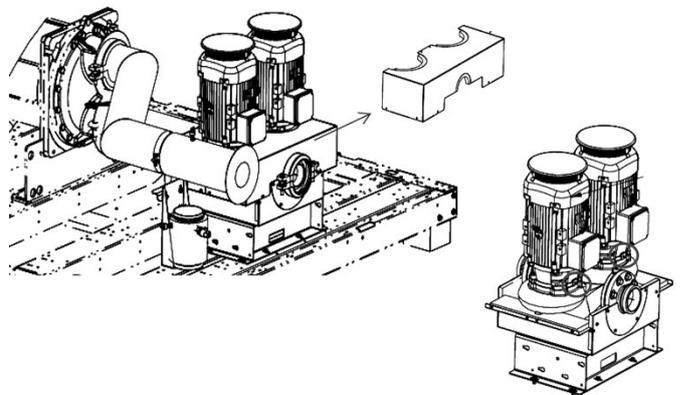
### 8.1 - Operating precautions

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

The water circuit should be designed to have the least number of elbows and horizontal pipe runs at different levels. 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). The latter must be installed outside of buildings (ATEX zone 2 possible at the air vent discharge).
- 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.
- 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 water 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. 116V & 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.

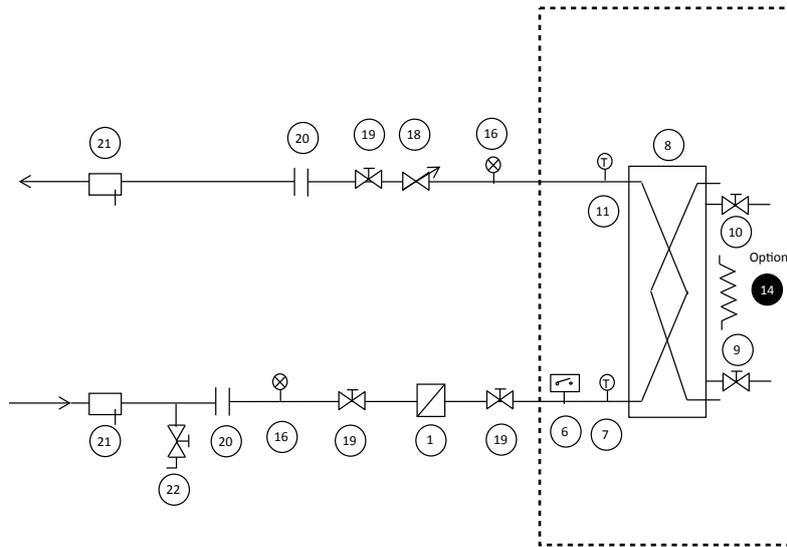
#### Procedure for venting air from the pumps



# 8 - WATER CONNECTIONS

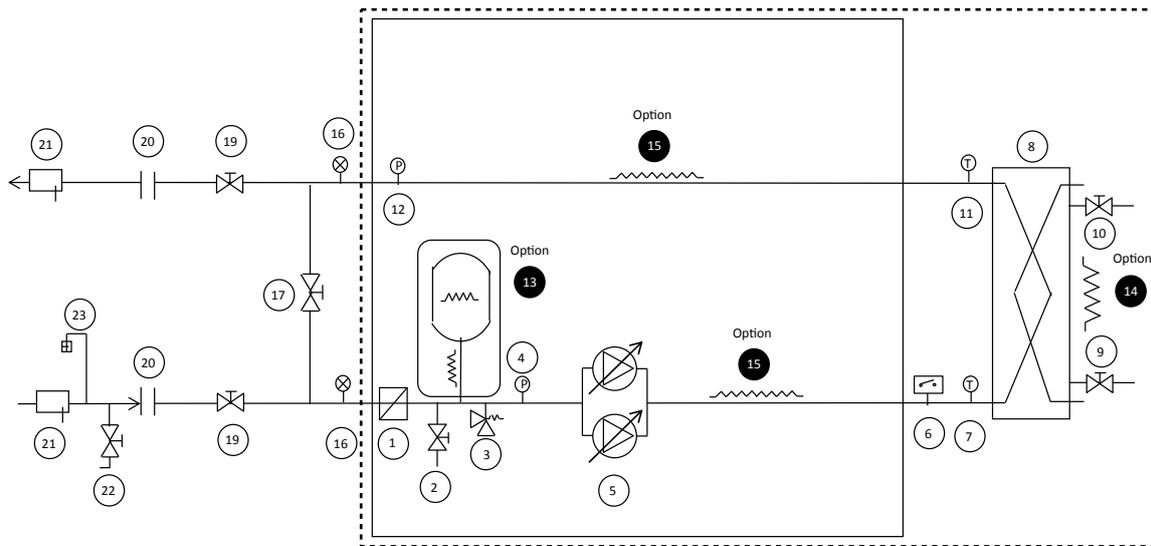
## 8.2 - Victaulic type hydraulic connections

Typical hydraulic circuit diagram without hydraulic module



The hydraulic module options are compatible only 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)

**Installation 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:**

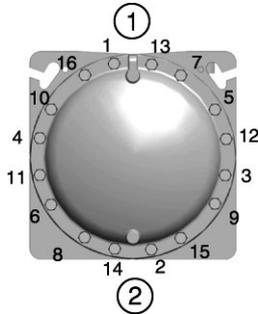
- The system must be protected against freezing.
- The unit's hydraulic module and the water type heat exchanger may be protected against freezing using electric heaters and heat trace cables (factory-fitted options 41A & 41B).
- The pressure sensors are assembled on connections without Schrader. Depressurise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

## 8 - WATER CONNECTIONS

### 8.3 - Tightening the screws on the evaporator water boxes

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.

### 8.4 - 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.

### 8.5 - 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.

#### 8.5.1 - 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.

#### 8.5.2 - Frost protection heater option

In cases where it is not possible to apply the recommendations in the paragraph above (§ 8.5.1), 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.

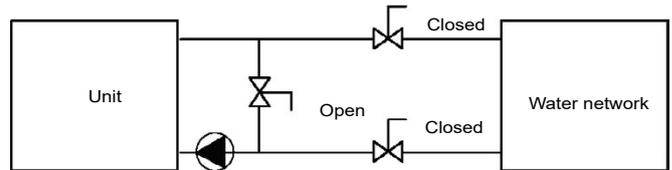
Protecting units with a hydraulic module against frost requires water circulation in the hydraulic circuit. The unit pump will start up automatically at regular intervals.

Combination of options for the periods when the machine is in standby mode		
Ambient unit temperature range	30KAV-ZE/ 30KAVPZE 350-800	30KAV-ZE/ 30KAVPZE 350-600
	without option 116	with option 116
> 0°C to 48°C	-	-
-20°C to 0°C	Option 41A or Suitable antifreeze solution (such as glycol)	Option 41B <sup>(1)</sup> or Suitable antifreeze solution (such as 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 ethylene 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 ethylene 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 (0.5 bar maximum). If the heat-transfer fluid does not meet the recommendations, a nitrogen blanket must be applied immediately.
- At the commencement of the next season, fill the system with water treated with appropriate corrosion inhibitors.
- 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.
- 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.

## 8 - WATER CONNECTIONS

- *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 13 - "Standard maintenance".

### 8.6 - Protection against cavitation (with option 116)

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 (see Chapter 9.2 - "NPSH"). A pressure below the predefined threshold will prevent unit start-up, or will cause an alarm and shut-down. 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 pressurised 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.

### 8.7 - 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 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 3 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 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 delta T (between 3K and 10K) can be obtained from the "Electronic Catalogue" selection program.

### 8.7.1 - Units without hydraulic module

#### 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 need 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 - WATER CONNECTIONS

### 8.7.2 - Units with hydraulic module and variable-speed pump - Temperature differential control

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

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

This is checked by the temperature sensors at the evaporator inlet and outlet (items 7 and 11).

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 (item 19) and remove the filters (item 1) after draining the hydraulic part of the unit (items 2 and 9).
- Purge the air from the circuit (items 10 and 23).
- 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).

### 8.7.3 - Units with hydraulic module and 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 (item 12).

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.**

## 8 - WATER CONNECTIONS

### 8.7.4 - Units with hydraulic module and 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 (items 4 and 12).

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.**

### 8.7.5 - Units with hydraulic module and 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.

## 8 - WATER CONNECTIONS

### 8.8 - Operation of two units as a master/slave pair (option 58)

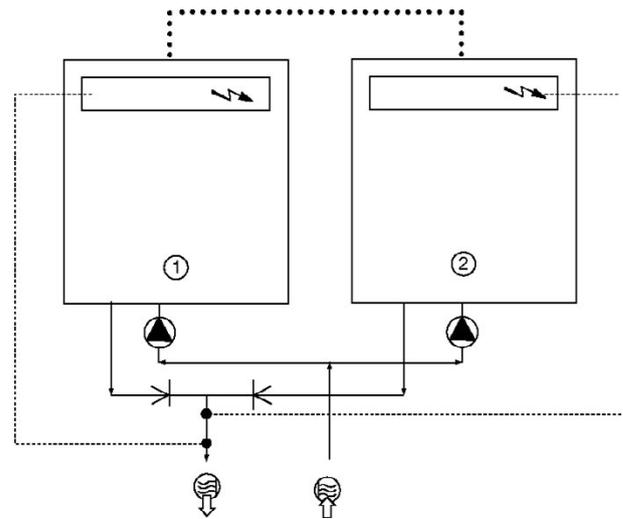
The master-slave pair is controlled on the water inlet without any additional sensors being added (standard configuration). It is also possible to control on the water outlet by adding two additional sensors in the common supply pipe work.

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

Each unit controls its own water pump. If there is only one common pump, in cases with 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 Master/Slave operation both units must be equipped with option 58.**

Configuration: control on the water outlet



#### Key

- ① Master unit
- ② Slave unit
- ⚡ Control panels for Master and Slave 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 slave boards of both Master and Slave unit
- Communication bus CCN
- Connection of two additional sensors

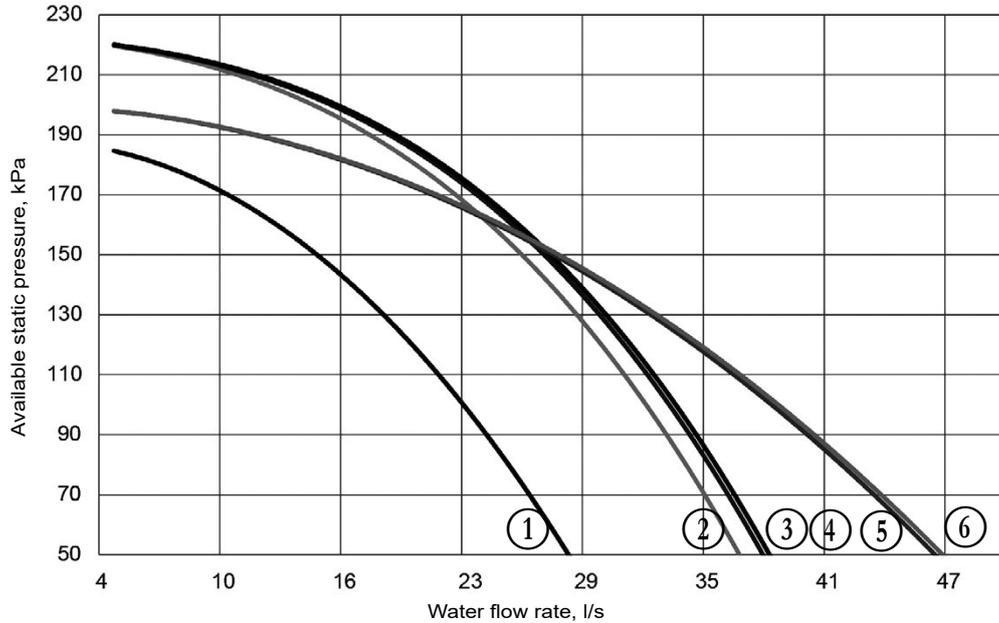
## 9 - UNIT WITH HYDRAULIC KIT

### 9.1 - Available static pressure for the system

Data applicable for:

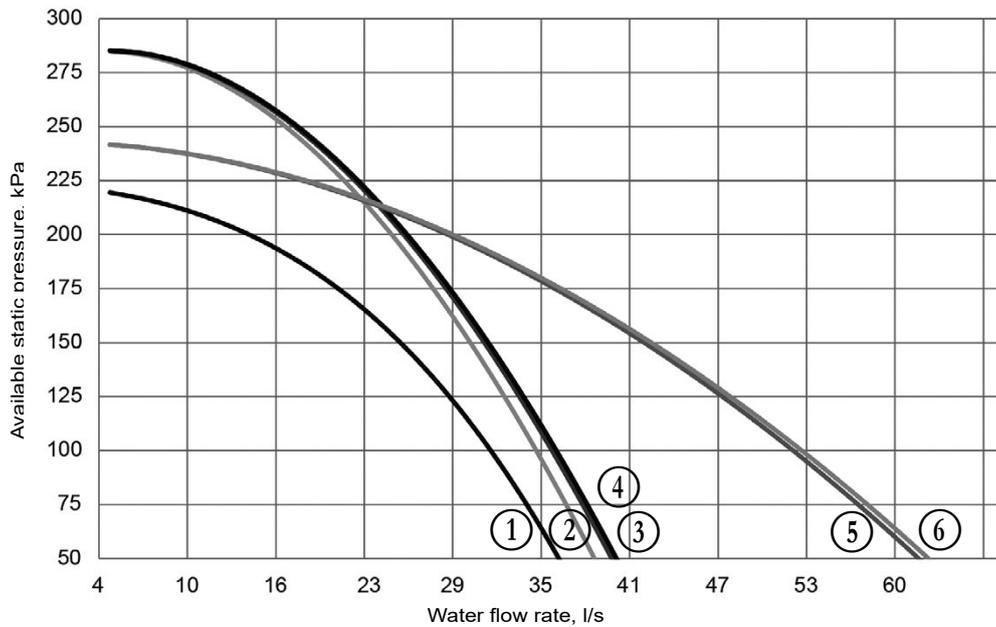
- Fresh water 20°C.
- Variable speed pump at 50 Hz.
- Refer to the paragraph on "Water exchanger min. water volume and flow rate" for the maximum water flow rate values.
- If ethylene glycol is used, the maximum flow rate is reduced.
- For an ambient temperature over 40°C, the maximum water flow rate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

**Low pressure (116A)**



- |                         |                         |                         |
|-------------------------|-------------------------|-------------------------|
| ① 30KAV-ZE/30KAVPZE 350 | ③ 30KAV-ZE/30KAVPZE 450 | ⑤ 30KAV-ZE/30KAVPZE 550 |
| ② 30KAV-ZE/30KAVPZE 400 | ④ 30KAV-ZE/30KAVPZE 500 | ⑥ 30KAV-ZE/30KAVPZE 600 |

**High pressure (116W)**

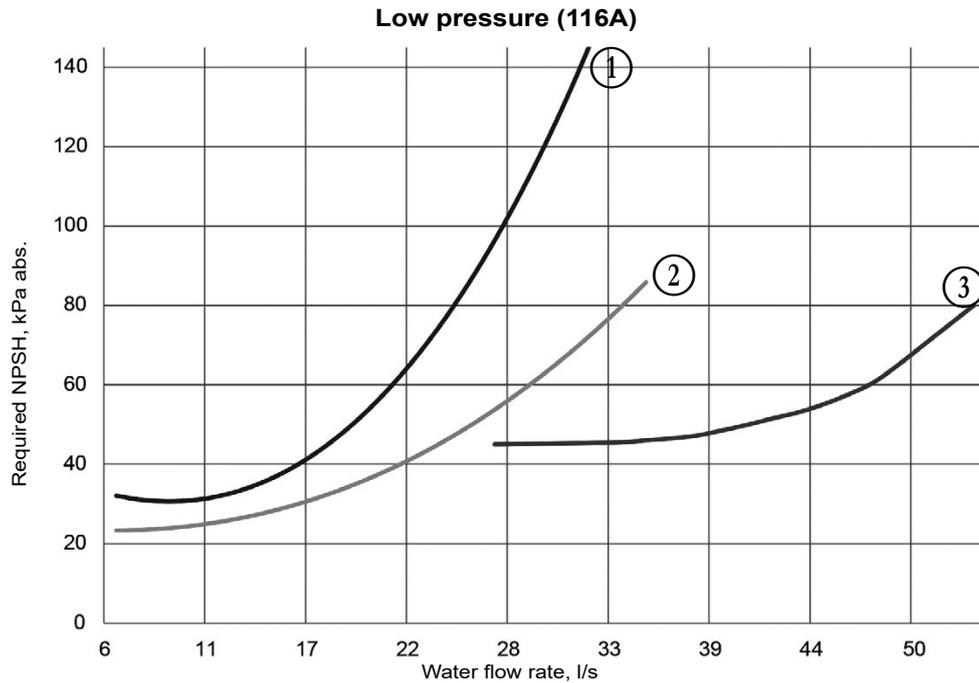


- |                         |                         |                         |
|-------------------------|-------------------------|-------------------------|
| ① 30KAV-ZE/30KAVPZE 350 | ③ 30KAV-ZE/30KAVPZE 450 | ⑤ 30KAV-ZE/30KAVPZE 550 |
| ② 30KAV-ZE/30KAVPZE 400 | ④ 30KAV-ZE/30KAVPZE 500 | ⑥ 30KAV-ZE/30KAVPZE 600 |

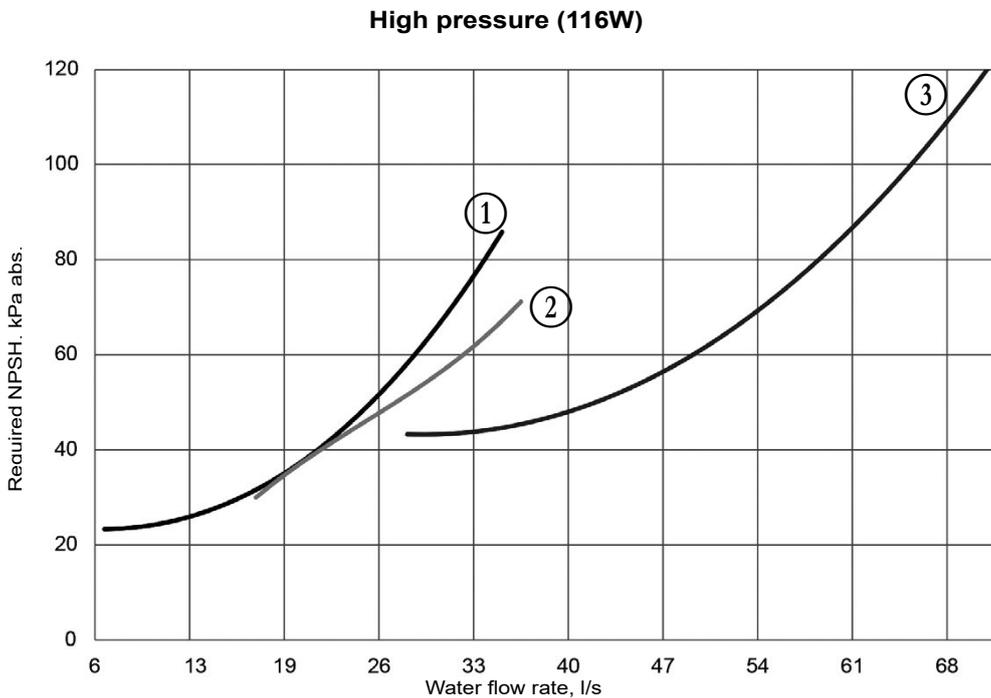
## 9 - UNIT WITH HYDRAULIC KIT

### 9.2 - 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.



- ① 30KAV-ZE/30KAVPZE 350
- ② 30KAV-ZE/30KAVPZE 400-450-500
- ③ 30KAV-ZE/30KAVPZE 550-600



- ① 30KAV-ZE/30KAVPZE 350
- ② 30KAV-ZE/30KAVPZE 400-450-500
- ③ 30KAV-ZE/30KAVPZE 550-600

### 9.3 - 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.

## 10 - SYSTEM START-UP

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### 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 nameplate that the 'fluid transported' is that recommended for operation, and is not nitrogen.
- Compare the complete system with the cooling system and power circuit diagrams.
- Check that all documents provided by the manufacturer (dimensional drawings, pipe and instrument diagram (PID), declarations, etc.) to comply with the regulations are present. If any documentation is missing, order a replacement.
- Verify that the environmental protection and safety devices and arrangements provided by the manufacturer to comply with the regulations are in place and compliant.
- Check that all declarations of conformity for the pressure containers, identification plates, and documentation required to comply with local regulations are present.
- 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, 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 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. Check that this difference is within the values on the curve (refer to the section "Water type heat exchanger min. water volume and flow rate")

#### 10.3.3 - Refrigerant charge

Each unit is shipped with an exact charge of refrigerant (see the table of physical properties).

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.

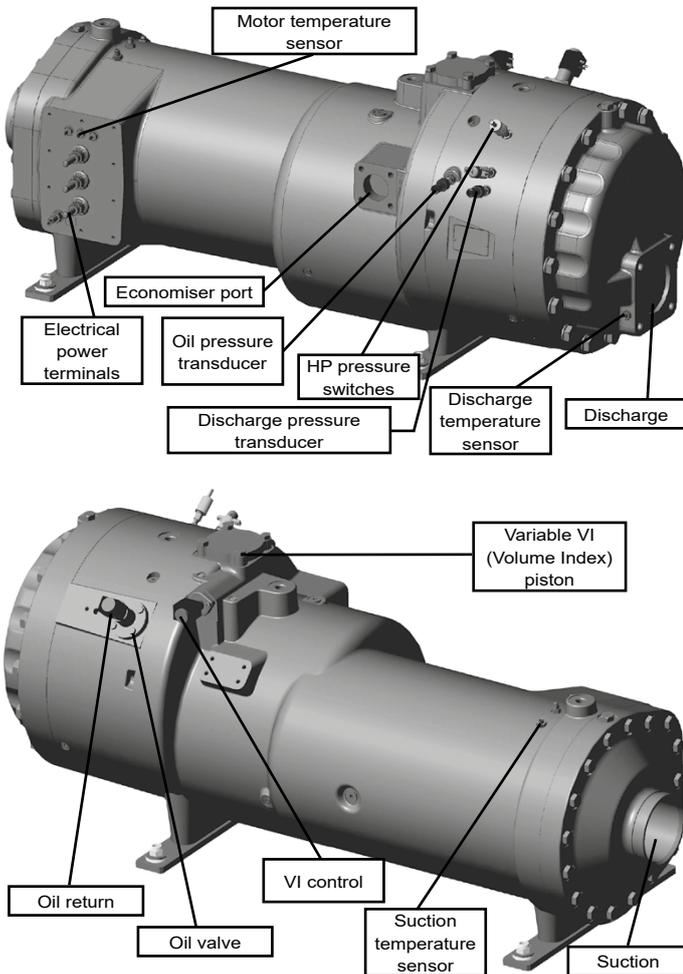
#### 10.3.4 - Ventilation for electrical cabinets

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).

# 11 - MAJOR SYSTEM COMPONENTS AND OPERATION DATA

## 11.1 - Compressors

30KAV-ZE units use 06Z twin-screw compressors fitted with an asynchronous motor. 30KAVPZE units use 06Z twin-screw compressors fitted with a synchronous motor featuring a permanent magnet. All these units are controlled by a speed regulator.



On the compressor with a synchronous motor featuring permanent magnets (30KAVPZE), it is prohibited to attempt to remove the motor from the compressor, owing to its strong magnetic field.

## 11.2 - Oil filter

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

## 11.3 - Refrigerant

This document concerns the version of the 30KAV-ZE which operates using R1234ze(E) only.

## 11.4 - Lubricant

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

lubricant (Carrier specification PP47-38).

Contact ERCD to purchase oil top up

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

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

## 11.5 - 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.

## 11.6 - Economiser and suction filters

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

## 11.7 - Pressure vessels

### 11.7.1 - General information

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) 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 medium and carry out internal inspections as described in EN 378-2 Appendix C.
- In case of re-testing, please refer to the maximum differential pressure given on the unit nameplate.
- The reports of the periodic checks by the user or the operator must be included in the monitoring and maintenance register.

### 11.7.2 - Repairs

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 the operating procedures,
- All modifications and repairs must be listed in the monitoring and maintenance register.

### 11.7.3 - Recycling

The device is wholly or partly recyclable. After use, it contains refrigerant vapours and oil residue. It is coated in paint.

# 11 - MAJOR SYSTEM COMPONENTS AND OPERATION DATA

## 11.7.4 - Corrosion build-up

Gas 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.

## 11.7.5 - Evaporator

30KAV-ZE / 30KAVPZE chillers 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 water 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.

## 11.7.6 - 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.

## 11.7.7 - Economiser 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, some of the liquid is expanded via the secondary EXV in one of the plate heat exchanger circuits and then is returned to the compressor economiser as a gas. This expansion provides an increase in the liquid subcooling of the rest of the refrigerant entering the evaporator via the principal EXV. This enables the system's cooling capacity and efficiency to be improved.

## 11.8 - High Pressure SRMCR safety loop

### 11.8.1 - 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 for each compressor called PZHH.
- The speed regulator which supplies the compressor 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.

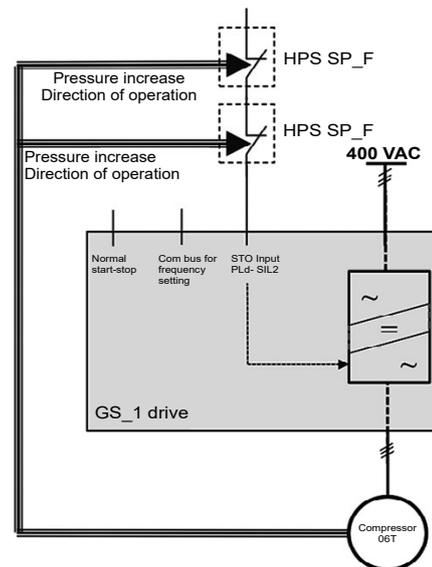
Demand mode: low and high.

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 13.11.

### 11.8.2 - 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.

### 11.8.3 - 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.

# 11 - MAJOR SYSTEM COMPONENTS AND OPERATION DATA

## 11.8.4 - 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.

## 11.9 - Condensers

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

## 11.10 - Fans

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.

### 11.10.1 - 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 drives. Each variable drive 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.

According to the Regulation 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		30KAV-ZE Standard	30KAV-ZE Options 17 / 119+ 30KAVPZE
Overall efficiency	%	40,1	47,3
Measurement category		A	A
Efficiency category		static	static
Target efficiency level ERP2015		N(2015) 40	N(2015) 40
Efficiency level at the optimum efficiency point		44,6	52,2
Speed regulator		YES	YES (built-in)
Year of manufacture		See label on the unit	See label on unit
Fan manufacturer		Simonin	Simonin
Motor manufacturer		Leroy Somer	EBM PAPST
Fan Part Number		00PSG002630700A	00PSG002630700A
Motor Part Number		00PPG000558700A	00PSG002696800A
Nominal motor power	kW	1,96	1,68
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	959
Specific 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).

## 11.10.2 - EC motors

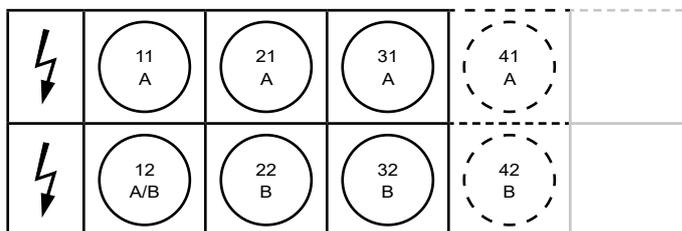
On 30KAV-ZE units with options 17 or 119+, and on 30KAVPZE units, the fans are driven by EC motors (electronically commutated motors). These are motors with permanent magnets, equipped with their own embedded electronics which enables the speed to be varied and also provides protection.

These motors are more efficient than asynchronous motors.

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

## 11.10.3 - 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.**

# 11 - MAJOR SYSTEM COMPONENTS AND OPERATION DATA

According to regulation No. 640/2009 and amendment 4/2014 implementing directive 2009/125/EC with regard to ecodesign requirements for electric motors.

30KAV		30KAV-ZE Standard	30KAV-ZE Options 17 / 119+ 30KAVPZE
Motor type		Asynchronous	EC motor
Number of poles		6	6
Nominal input frequency	Hz	50	50/60
Nominal voltage	V	400	380/480
Number of phases		3	3
Motor included in the application domain of the regulation 640/2009 and amendment 4/2014		NO	NO
Sales leaflet for exemption		Article 2.1	Article 2.1
Ambient air temperature for which the motor is specifically designed	°C	70	70

## 11.11 - 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 gasket.

## 11.12 - 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-condensables in the system.

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

## 11.13 - Filter drier

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

## 11.14 - Sensors

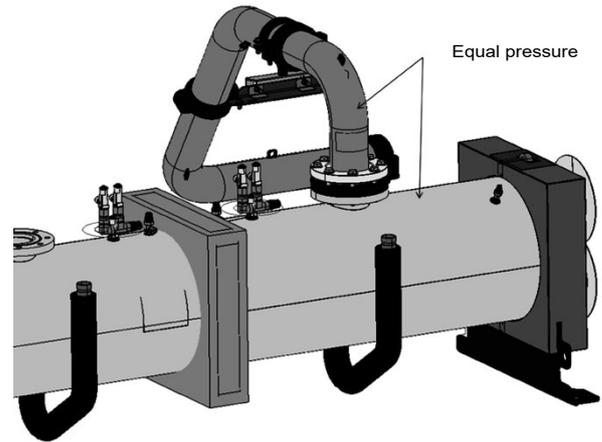
The unit uses thermistors to measure temperature, and pressure transducers to monitor and control the operation of the system. Refer to the SmartVu™ control manual for a more detailed explanation.

## 11.15 - 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 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.**



## 11.16 - Speed regulator

The units are equipped with variable speed drives for the compressors, condenser fans and pumps. 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).

The frequency setpoint on the operating range and the status feedback for the variable 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 pressostats cabled to the regulator's digital inputs.

# 11 - MAJOR SYSTEM COMPONENTS AND OPERATION DATA

## 11.17 - 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. 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.

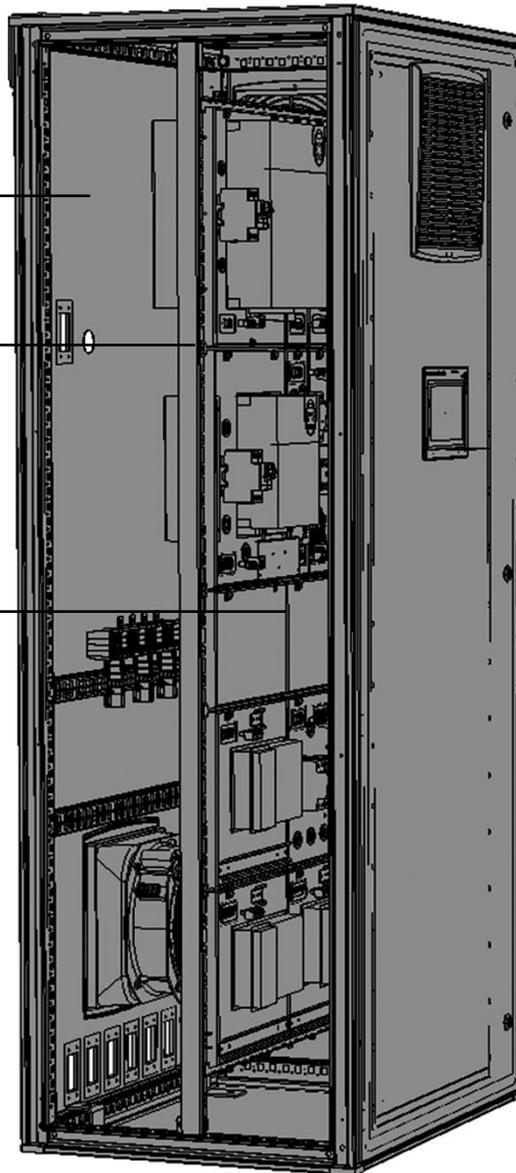
The mounting plate and the casing panel are designed to be easily removed for servicing operations (see also chapter 13 of this document).

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



## 12 - OPTIONS

Option	No.	Description	Advantage	Use 30KAV-ZE	Use 30KAVPZE
Medium-temperature brine solution	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.	350-800	350-800
Low-temperature brine solution down to -12°C	6	Redesigned evaporator including turbulators to allow chilled brine solution production with low pressure drops on the entire negative application range, down to -12°C (including turbulators, extra insulation, specific sensors and algorithms).	Covers specific applications such as ice storage and industrial processes.	350-800	350-800
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 for sensitive site	0350-0800	0350-0800
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	0350-0800	0350-0800
EC fans	17	Unit equipped with EC fans	Enhances the unit energy efficiency	0350-0800	NO
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	0350-0800	0350-0800
Grilles and enclosure panels	23	Metal protection grilles and side enclosure panels	Improves aesthetics, protection against intrusion to the unit interior, coil and piping protection against impacts.	0350-0800	0350-0800
Enclosure panels	23A	Side enclosure panels	Improves aesthetics and piping protection against impacts.	0350-0800	0350-0800
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	0350-0800	0350-0800
Evaporator and 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	0350-0600	0350-0600
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	0350-0800	0350-0800
Partial heat recovery	49	Unit equipped with a desuperheater on each refrigerant circuit (Each exchanger is equipped with electrical heaters and insulation)	Production of free high-temperature hot water simultaneously with chilled water production (or hot water for heat pump)	0350-0800	0350-0800
Total heat recovery	50	Unit equipped with an additional heat exchanger in series with the condenser coils (Each heat exchanger is equipped with electrical heaters and insulation)	Production of free hot-water with variable heat reclaim	0350-0800	0350-0800
Master/slave operation	58	Unit equipped with supplementary leaving water temperature sensor kit (to be field installed) allowing master/slave operation of two units connected in parallel	Optimised operation of two units connected in parallel operation with runtime balancing	0350-0800	0350-0800
Main disconnect switch with short-circuit protection	70D	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	0350-0800	0350-0800
Evap. and pumps with aluminium jacket	88A	Evaporator and pumps covered with an aluminium sheet for thermal insulation protection	Improved resistance to aggressive climate conditions	0350-0600	0350-0600
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	0350-0800	0350-0800
Compressor discharge valves	93A	Shut-off valve on the compressor discharge piping	Simplified maintenance	0350-0800	0350-0800
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 on the condenser side (typically high buildings)	0350-0800	0350-0800
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 system reliability	0350-0600	0350-0600
HP VSD dual-pump hydraulic mod.	116W	Dual high-pressure water pump with variable speed drive (VSD), pressure transducers. Multiple possibilities of water flow control. For more details, refer to the dedicated chapter (expansion tank not included; option with built-in hydraulic safety components available)	Easy and fast installation (plug & play), significant pumping energy cost savings (more than two-thirds), tighter water flow control, improved system reliability	0350-0600	0350-0600
High Energy Efficiency	119	Additional condenser coil to improve unit energy efficiency	Enhances the unit energy efficiency performance	0350-0800	NO
High Energy Efficiency+	119+	Additional condenser coil plus EC fans to improve unit energy efficiency	Enhances the unit energy efficiency performance	0350-0800	NO
Lon gateway	148D	Bi-directional communication board complying with Lon Talk protocol	Connects the unit by communication bus to a building management system	0350-0800	0350-0800

## 12 - OPTIONS

Option	No.	Description	Advantage	Use 30KAV-ZE	Use 30KAVPZE
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	0350-0800	0350-0800
Modbus over IP and RS485 communication gateway	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	0350-0800	0350-0800
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...)	0350-0800	0350-0800
Input contact for refrigerant leak detection	159	0-10 V signal to report any refrigerant leakage in the unit directly (the leak detector itself must be supplied by the customer)	Immediate customer notification of refrigerant losses to the atmosphere, allowing timely corrective actions	0350-0800	0350-0800
Dual relief valve 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	0350-0800	0350-0800
Compliance with Swiss regulations	197	Additional tests on the water type heat exchangers: supply supplementary certificates and test certifications (additional documents relating to the PED)	Compliance with Swiss regulations	0350-0800	0350-0800
Compliance with Russian regulations	199	EAC certification	Compliance with Russian regulations	0350-0800	0350-0800
Compliance with Australian regulations	200	Unit approved to Australian code	Compliance with Australian regulations	0350-0800	0350-0800
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	0350-0800	0350-0800
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. No heat transfer variation, tested 4000 hours salt spray per ASTM B117	Improved corrosion resistance, recommended for use in moderately corrosive environments	0350-0800	0350-0800
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	0350-0800	0350-0800
Welded evaporator connection kit	266	Victaulic piping connections with welded joints	Easy installation	0350-0800	0350-0800
Welded heat recovery condenser connection kit	267	Victaulic piping connections with welded joints	Easy installation	0350-0800	0350-0800
Evaporator with aluminium jacket	281	Evaporator covered with an aluminium sheet for thermal insulation protection	Improved resistance to aggressive climate conditions	0350-0800	0350-0800
EMC class. C2, as per EN 61800-3	282	Additional RFI filters on the unit power line	Reduces electromagnetic interferences. Decrease the variable frequency drive (VFD) emission level according to C2 category requirements and allow its compliancy with use in first environment (so called, residential environment).	0350-0800	0350-0800
230V electrical plug	284	230 VAC power supply source provided with plug socket and transformer (180 VA, 0.8 A)	Permits connection of a laptop or an electrical device during unit commissioning or servicing	0350-0800	0350-0800
Expansion tank	293	6-bar expansion tank integrated in the hydraulic module (requires a hydraulic module option)	Easy and fast installation (plug & play), & Protection of closed water systems from excessive pressure	0350-0600	0350-0600
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	0350-0800	0350-0800
US screw compressor	297	Screw compressor manufactured in the US		0350-0800	NO
Variable Water Flow control	299	The hydraulic control functions that permit 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	0350-0800	0350-0800
Free Cooling dry cooler management	313	Control and connections to a free cooling drycooler 09PE or 09VE fitted with the FC control box	Easy system management, extended control capabilities extended to a drycooler used in free cooling mode	0350-0800	0350-0800
Compliance with UAE regulation	318	Additional label on the unit with rated power input, rated current and EER following AHRI 550/590	Compliance with ESMA standard UAE.S 5010-5:2019	0350-0800	0350-0800
Compliance with Qatar regulation	319	Specific nameplate on the unit with power supply 415 V+/-6%	Compliance with KAHRAMAA regulation in Qatar.	0350-0800	0350-0800
Hydraulic connection kit	325	Hydronic fittings connected to the evaporator and condensers	Easy installation	0350-0800	0350-0800
Compliance with Moroccan regulations	327	Specific regulatory documentation	Compliance with Moroccan regulations	0350-0800	0350-0800
Permanent magnet motor	329	Twin screw compressor with permanent magnet motor	Enhances the unit energy efficiency performance	0350-0800	0350-0800

## 12 - OPTIONS

### 12.1 - Unit operation with a free cooling drycooler

#### 12.1.1 - Operating principle

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

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

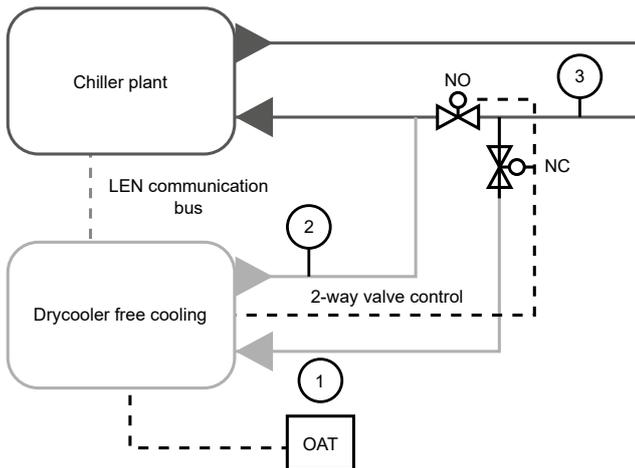
The unit's SmartVu™ control system includes algorithms to permit constant automatic optimisation of:

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

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

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

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



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

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

#### 12.1.2 - Communication to control the drycooler

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

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

The board integrated in the drycooler electrics box has analogue inputs for the outdoor air temperature sensor (1), water loop return sensor (3) and drycooler leaving water 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 drycooler.

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

- AUX board with the I/O,
- room air temperature sensor to be placed outdoors,
- drycooler leaving water temperature sensor (factory-fitted),
- water loop temperature sensor (to be fitted on the common pipe upstream of the valve),
- 230 V power supply and control for two 2-way valve or one 3-way valve.

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

#### 12.1.3 - Configuration of the fan control

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

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

Compatible fan configurations:

- 1 to 20 fans,
- fixed speed or variable speed,
- 1 or 2 rows of fans.

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

## 12 - OPTIONS

### 12.1.4 - 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 drycooler.

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

The drycooler control panel has a 230 V power supply for 2 two-way valves.

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

Refer to the wiring diagram for the drycooler for wiring the valves on the customer terminal strip.

### 12.1.5 - Guidelines for system installation

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

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

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

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

- sizing of the water piping;
- pressure drops (verify that the operating pressure of the unit pump is sufficient compared to the pipe and valve pressure drops; check for all operating modes);
- maximum height for the drycooler (in relation to the unit relief valve);
- suitable positioning of the temperature sensors: outdoor air temperature and water loop temperature.

### 12.2 - Brine options

Options 5 and 6 are used to cool the water down to negative temperatures.

For option 5, the number of tubes in the evaporator is adjusted to maintain a good heat exchange down to a leaving water temperature of -6°C.

For option 6, turbulators are installed in the pipes to maintain a good heat exchange down to a leaving water temperature of -12°C.

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 (ambient temperature).

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

### Frost protection

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

The evaporator pinch point ((leaving water 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:

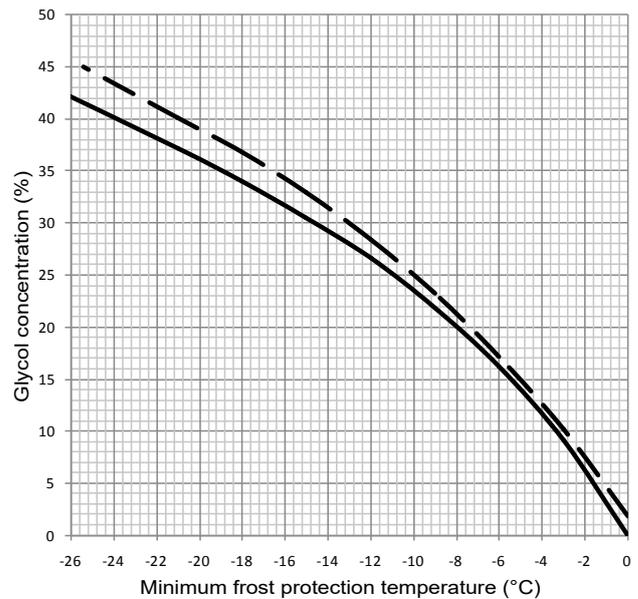
1. Evaporator antifreeze protection.
2. Low pressure protection.

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



— Ethylene glycol (%)  
- - 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.

## 12 - OPTIONS

Minimum glycol concentration					
30KAVZE 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 %	-	-	

Minimum glycol concentration					
30KAVZE 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 content 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 leaving water 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 respected for 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.

As the unit operates at a pressure which is close to atmospheric pressure, it is recommended that the moisture indicators on the EXV are checked regularly.

### 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, depending on 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).

## 12 - OPTIONS

### 12.3 - Physical properties of 30KAV/30KAVP units with partial heat recovery option (option 49 and 50)

30KAV-ZE/ 30KAVPZE		350	400	450	500	550	600	650	750	800
<b>Length: unit + options</b>										
30KAV-ZE + option 49	mm	5578	5578	6772	6772	6772	6772	7962	7962	9155
30KAV-ZE_option_119+ & 30KAVPZE + 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-ZE + option 49	kg	5177	5190	5592	5605	5843	6304	6741	7222	7657
30KAV-ZE + option 49 + option 325 <sup>(2)</sup>	kg	5321	5334	5757	5770	6008	6463	6906	7386	7822
30KAV-ZE_option_119+ & 30KAVPZE + option 49	kg	5728	5735	5748	5751	6183	7007	7116	7891	7920
30KAV-ZE_option_119+ & 30KAVPZE option 49 + option 325 <sup>(2)</sup>	kg	5869	5876	5912	5915	6347	7166	7280	8056	8085
<b>Partial heat recovery</b>										
Braze-plate heat exchanger										
Circuit A		B320 LTL								
Circuit B		B320 LTL								
Water volume	l	6 / 6	6 / 6	6 / 6	6 / 6	6 / 6	10 / 6	10 / 6	10 / 10	10 / 10
Victaulic® type										
<b>Hydraulic connections without option 325<sup>(2)</sup></b>										
Recovery condenser side connections	Inch	4	4	4	4	4	4	4	4	4
Diameter of the external pipes on the recovery condensers side	mm	114,3	114,3	114,3	114,3	114,3	114,3	114,3	114,3	114,3
Evaporator side connections	Inch	5	5	6	6	6	6	8	8	8
Diameter of the external pipes on the evaporator side	mm	141,3	141,3	168,3	168,3	168,3	168,3	219,1	219,1	219,1
Victaulic® type										
<b>Hydraulic connections without option 325<sup>(2)</sup></b>										
Recovery condenser side connections	Inch	5	5	5	5	5	5	5	5	5
Diameter of the external pipes on the recovery condensers side	mm	141,3	141,3	141,3	141,3	141,3	141,3	141,3	141,3	141,3
Evaporator side connections	Inch	5	5	6	6	6	6	6	6	6
Diameter of the external pipes on the evaporator side	mm	141,3	141,3	168,3	168,3	168,3	168,3	168,3	168,3	168,3
<b>30KAV-ZE /30KAVPZE with option 50</b>										
<b>Length: unit + options</b>										
30KAV-ZE + option 50	mm	5578	5578	6772	6772	6772	6772	7962	7962	9155
30KAV-ZE_option_119+ & 30KAVPZE + 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-ZE + option 50	kg	5230	5243	5718	5731	5969	6489	6927	7451	7860
30KAV-ZE + option 50 + option 325 <sup>(2)</sup>	kg	5380	5393	5899	5912	6149	6696	7140	7662	8072
30KAV-ZE_option_119+ & 30KAVPZE + option 50	kg	5781	5788	5874	5877	6327	7192	7301	8120	8149
30KAV-ZE_option_119+ & 30KAVPZE option 50 + option 325 <sup>(2)</sup>	kg	5934	5941	6054	6057	6507	7399	7514	8332	8361
<b>Total heat recovery</b>										
Braze-plate heat exchanger										
Circuit A		B320 LTH	B427M1	B427M1	B427M1	B427M1				
Circuit B		B320 LTH	B427M1	B427M1						
Water volume	l	18 / 18	18 / 18	29 / 29	29 / 29	29 / 29	48 / 29	48 / 29	48 / 48	48 / 48
Victaulic® type										
<b>Hydraulic connections without option 325<sup>(2)</sup></b>										
Recovery condenser side connections	Inch	4	4	4	4	4	4	4	4	4
Diameter of the external pipes on the recovery condensers side	mm	114,3	114,3	114,3	114,3	114,3	114,3	114,3	114,3	114,3
Evaporator side connections	Inch	5	5	6	6	6	6	8	8	8
Diameter of the external pipes on the evaporator side	mm	141,3	141,3	168,3	168,3	168,3	168,3	219,1	219,1	219,1
Victaulic® type										
<b>Hydraulic connections without option 325<sup>(2)</sup></b>										
Recovery condenser side connections	Inch	5	5	5	5	5	6	6	6	6
Diameter of the external pipes on the recovery condensers side	mm	141,3	141,3	141,3	141,3	141,3	168,3	168,3	168,3	168,3
Evaporator side connections	Inch	5	5	6	6	6	6	6	6	6
Diameter of the external pipes on the 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 name plate.

(2) Option 325 = Hydraulic connection kit

## 12 - OPTIONS

### 12.3.1 - 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)

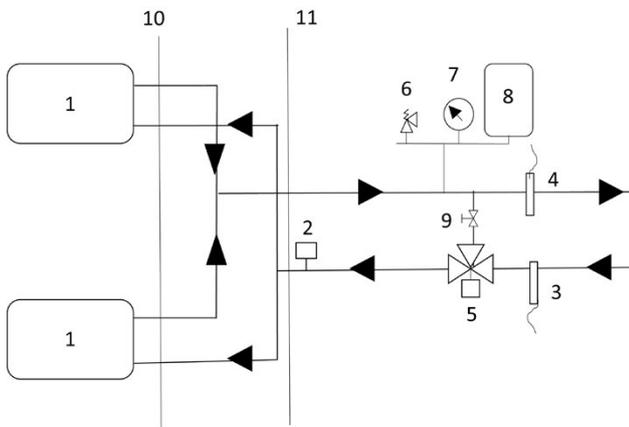
### 12.3.2 - Condenser hydraulic connections

The unit is delivered with two temperature sensors and a flow rate controller which provide the regulation of the heat recovery mode.

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 switch is 15 metres)

It is recommended to position the temperature sensors and flow switch as shown in the diagram below in order to ensure 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 outlet temperature sensor (supplied)
- 4 Water inlet temperature sensor (supplied)

#### Installation components (installation example)

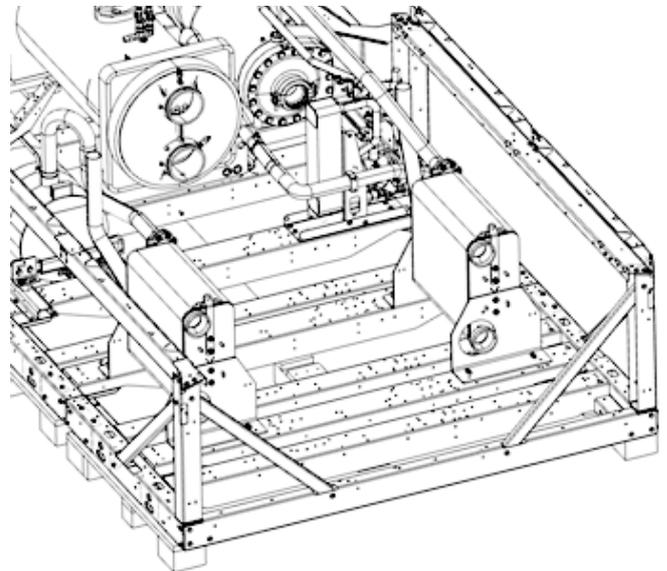
- 5 Three-way valve (recommended)
- 6 Safety valve
- 7 Pressure gauge
- 8 Expansion tank (100 °C minimum)
- 9 Recovery condenser water flow balancing valve
- 10 Border between the unit and the installation (without option 325)
- 11 Border between the unit and the installation (with option 325)

**Note: For the hydraulic installation, it is recommended that Carrier's recommendations are followed. (See chapter 8.1. Precaution for use)**

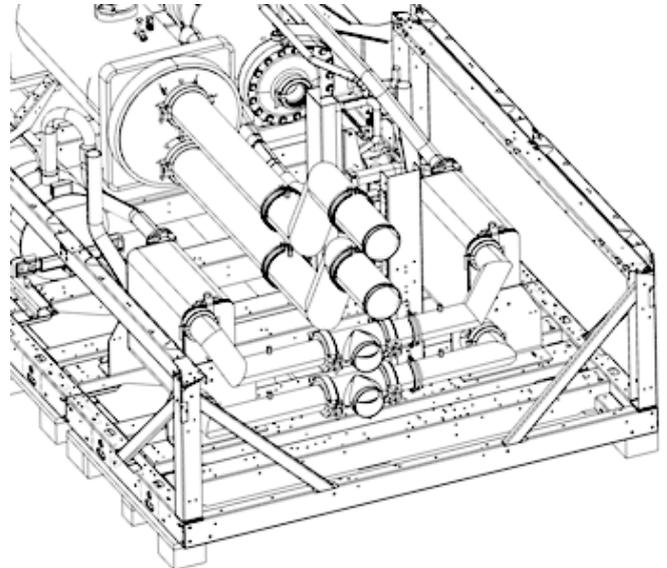
#### Hydraulic connection with option 325:

Option 325 is used to make the hydraulic connection between the two recovery heat exchangers to obtain a 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.

## 12 - OPTIONS

### 12.3.3 - Heat recovery operation

The heat recovery mode is activated and deactivated via 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.

#### Variable 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:

Two operating modes are available for options 49 and 50:

Optimised recovery mode: (configure by default with option 50)

This mode is used to adjust the recovered capacity by gradually reducing the ventilation speed to obtain the configured control point. When there is no longer a recovery request, the control system increases the ventilation speed and cuts off the water flow.

Economy mode: (configure by default 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.

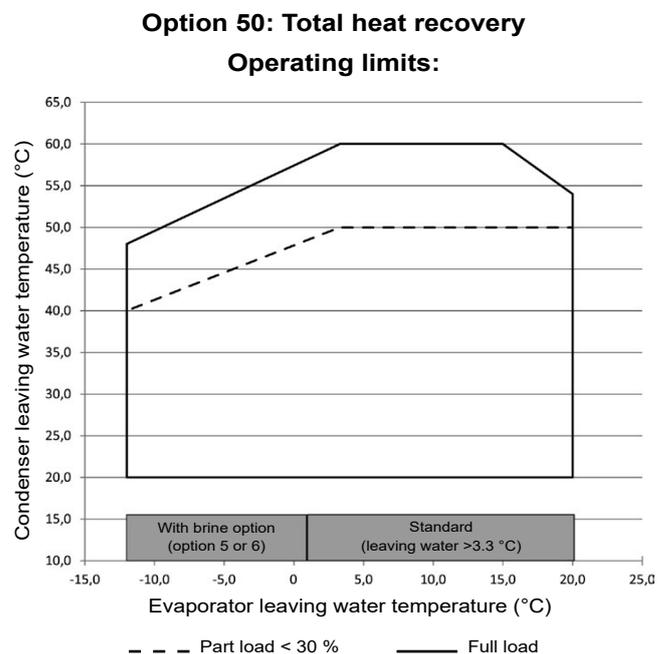
### 12.3.4 - Operating range:

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) A three-way valve must be used for installations with a lower temperature.
- (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

Limiting of the condenser leaving water temperature is due to the screw compressor operating range. If the condenser leaving water 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.



#### Note:

- Evaporator  $\Delta T = 5K$
- Condenser  $\Delta T = 5$
- These 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.

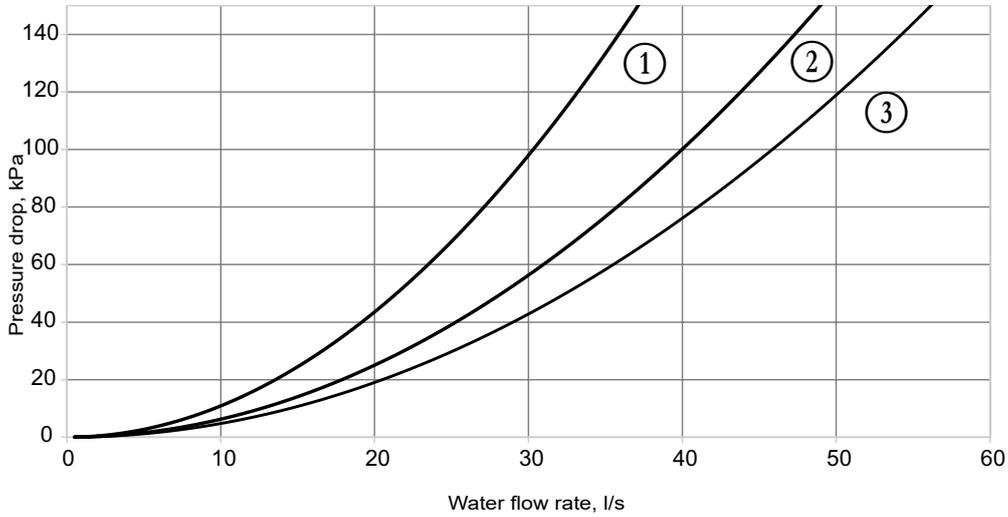
## 12 - OPTIONS

### 12.3.5 - Condenser hydraulic pressure drop:

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

#### Option 49 Partial heat recovery:

##### Hydraulic pressure drop



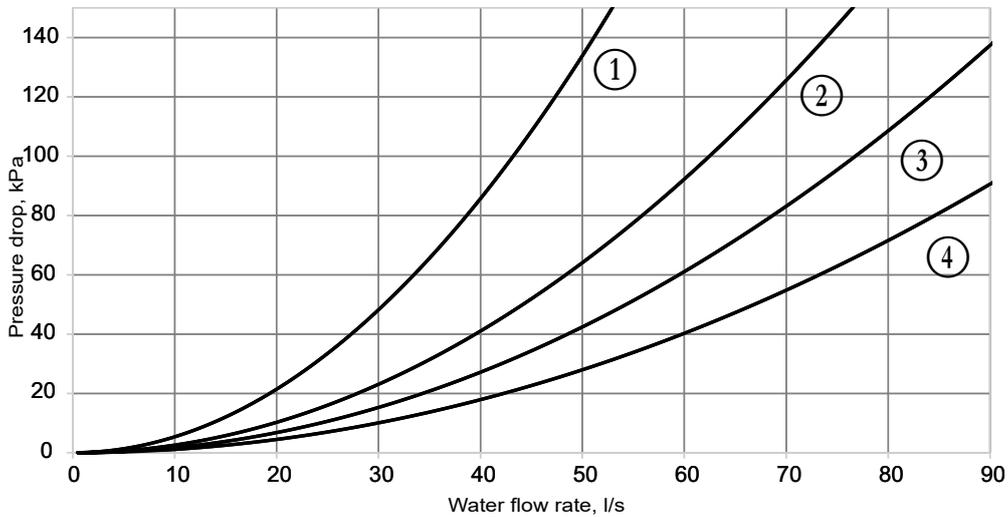
① 30KAV/P-0500; 30KAV/P-0550

② 30KAV/P-0600; 30KAV/P-0650; 30KAV/P-0720

③ 30KAV/P-0800; 30KAV/P-0900

#### Option 50 Total heat recovery:

##### Hydraulic pressure drop



① 30KAV/P-0500; 30KAV/P-0550

② 30KAV/P-0600; 30KAV/P-0650; 30KAV/P-0720

③ 30KAV/P-0800; 30KAV/P-0900

④ 30KAV/P-1000; 30KAV/P-1100

## 13 - STANDARD MAINTENANCE

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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 machine ensure it is deenergized. 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.**

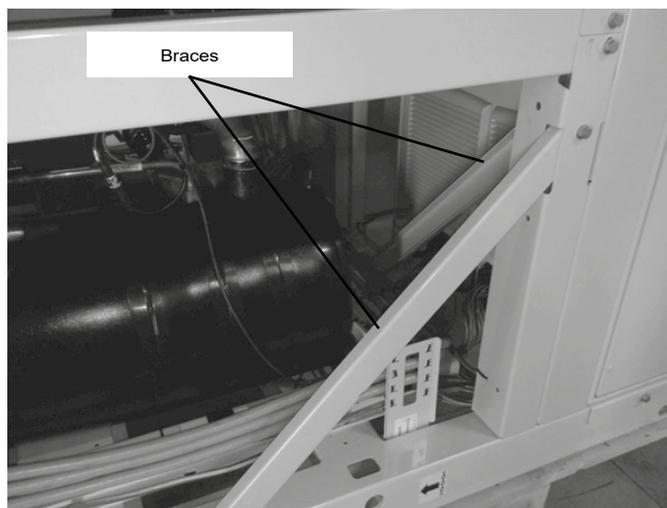
Simple preventive maintenance will allow you to get the best performance from your HVAC unit:

- Improved refrigerating 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 SCS, from its liability.**

The braces located at the back of the electrical cabinets (see photo 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.



## 13 - STANDARD MAINTENANCE

### 13.1 - 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 the temperature difference at the heat exchanger inlet and outlet is correct.
- Verify the refrigerant charge in the liquid line sight glass.
- Check the anti-corrosion coatings.

### 13.2 - 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.

#### Mechanical :

- Check that the mounting bolts for the ventilation sub-assemblies, fans, compressors and electricals 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 water 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.**

### 13.3 - 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.

Pressurised refrigerant must not be vented 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.

## 13 - STANDARD MAINTENANCE

### 13.4 - Tightening the electrical connections

#### 13.4.1 - 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
M12 screw-nut on earth strip	PE	49
<b>Compressor variable frequency drives</b>		
M10 nuts on phases	GS*	29,5
M10 or M8 nut on earth	R/S/T U/V/W	29,5
M8 nuts on internal connections (fuses and busbars)	GND	14,5
<b>Compressor connections</b>		
M12 nuts on phases	EC*	23
M12 screw 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 11kW	GS*	2,5
Screws on phases and earth, 15kW VFD	GS*	4,5
<b>Circuit breaker cage terminal and differential block screws</b>		
Schneider type GV2	QF100A	2
Schneider type IC60	QF*	3,5
ABB type S803S	QM10*	1,3
Switch cage terminal screws		
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

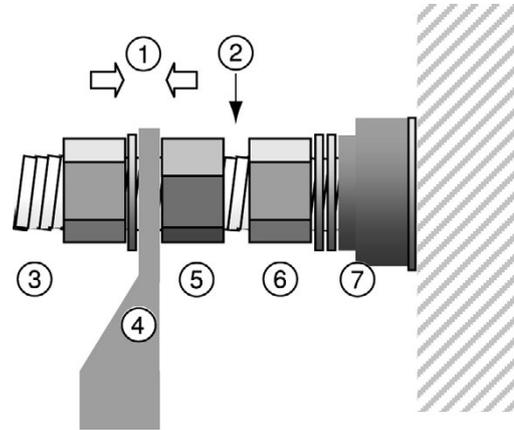
**WARNING: the compressors on 30KAVPZE units feature motors with permanent magnets. Do not open the compressor. Ensure that the terminal box is securely fixed in place before filling the machine with refrigerant, draining the refrigerant or rotating the motor shaft. The compressor cannot be removed.**

**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/empting the refrigerant.**

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

#### 13.4.2 - 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).

## 13 - STANDARD MAINTENANCE

### 13.5 - 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	Plastic impeller	4,2
M8 H screw	Condenser modules, impeller mounting	18
Taptite M10 screw	Condenser modules, chassis, structure, economizer assembly, electrical panels, compressor and oil separator mounting	30
Taptite M6 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

### 13.6 - Condenser coil

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.**

**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.**

### 13.7 - 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.

## 13 - STANDARD MAINTENANCE

### 13.8 - Compressor maintenance

#### 13.8.1 - Oil separator

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

#### 13.8.2 - 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.

#### 13.8.3 - Checking 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 compressor'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.

### 13.9 - 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 drive can be corrected by repairing or replacing an internal component. If the complete variable drive needs to be replaced, its removal will require prior removal of the ventilation ducts and the top of the cabinet: refer to the "service guide" document. Similarly, precautions must be taken for handling, as the variable drives are very heavy (between 65kg and 120kg, depending on their size).

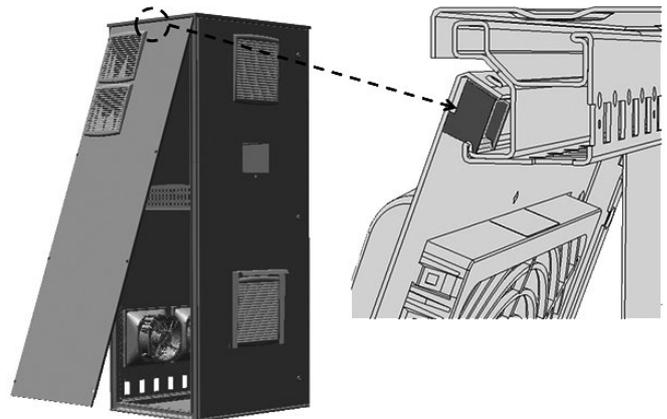
The frequency inverters fitted on the units do not require a dielectric test, even if being replaced: they are systematically checked before delivery. Moreover, the filtering components installed in the variable frequency drive can falsify the measurement and may even be damaged.

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

### 13.10 - 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, as this would irreparably damage the sealing of the cabinet:

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.



## 13 - STANDARD MAINTENANCE

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### 13.11 - 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 +0/-1.4 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 compressor terminal box. All the procedures for accessing an environment containing hazardous live parts must be respected.**

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

## 14 - FINAL SHUTDOWN

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### 14.1 - Shutting down

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

### 14.2 - Recommendations for disassembly

Use the original lifting equipment.

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

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

### 14.3 - Fluids to be recovered for treatment

- Refrigerant
- Heat-transfer fluid: depending on the installation, water, brine solution, etc.
- Compressor oil

### 14.4 - Materials to be recovered for recycling

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

### 14.5 - Waste Electrical and Electronic Equipment (WEEE)

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

# 15 - UNIT START-UP CHECKLIST FOR INSTALLERS PRIOR TO CONTACTING CARRIER SERVICE

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## Preliminary information

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

## Equipment

Model # : .....

## Compressors and variable drives

<b>Circuit A</b>	.....	<b>Circuit B</b>	.....
Model no.	.....	Model no.	.....
Serial number	.....	Serial number	.....
Motor #	.....	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 water 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 deenergized 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 deenergised 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)

# 15 - UNIT START-UP CHECKLIST FOR INSTALLERS PRIOR TO CONTACTING CARRIER SERVICE

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## 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 couplings
 Locate 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 up the cooler

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

- The unit starts and operates correctly

# 15 - UNIT START-UP CHECKLIST FOR INSTALLERS PRIOR TO CONTACTING CARRIER SERVICE

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## 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 .....

## **16 - APPENDICES (PROVIDED IN THE DOCUMENT WALLET WITH THE INSTRUCTION MANUAL)**

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**16.1 - Appendix 1: Declaration of conformity**

**16.2 - Appendix 2: Wiring diagram**

**16.3 - Appendix 3: Machine PID**

**16.4 - Appendix 4: Dimensional drawings**



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

