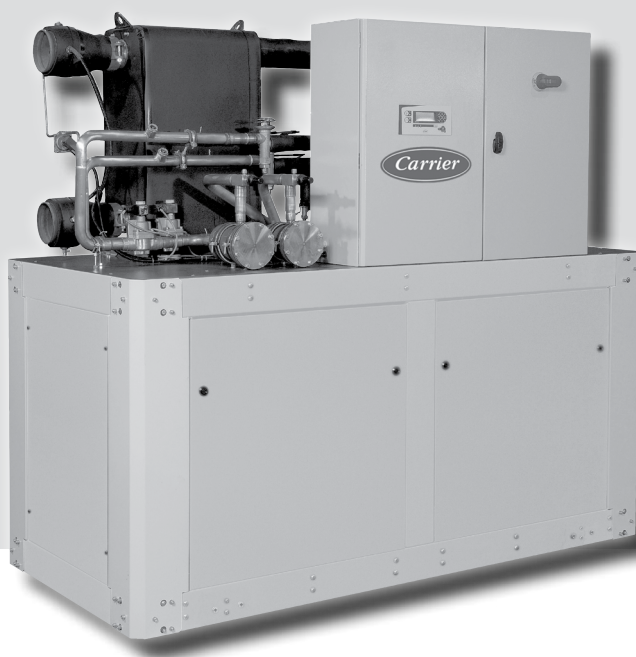




United Technologies

## INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS



# AQUASNAP

# 30WI

**Nominal cooling capacity: 220 - 720 kW**  
**Nominal heating capacity: 250 - 820 kW**  
**50 Hz**



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## 1 INTRODUCTION

**AQUASNAP 30WI** series water chiller units are designed to meet the air conditioning and heating requirements of residential and office buildings as well as the requirements of industrial processes. **AQUASNAP 30WI** series units are liquid chillers with water-cooled condensers which guarantee safe and reliable operation in the operating range for which they have been designed.

**All the units are factory tested and checked. They are supplied with a full refrigerant charge.**

These units meet standard EN 60-204 and standard EN378-2 as well as the following European directives:

- Machinery 2006/42 EC
- EMC 2014/30/EU
- LVD 2014/35/EU
- RoHS 2011/65/EC:
- PED 2014/68/EU, see table below

AQUASNAP 30WI	700 V to 1000 V	1100 V to 1200 V	1400 V to 1800 V	2100 V to 2400 V
Categories	II	III	II	III

### Pressure and temperature:

**Test pressure (TP):** because of the harmful effects it has on the unit, this test is carried out on a model representative of all 3 x PS assemblies in compliance with § 5.3.2.2 a and 6.3.3 iii of standard 378-2.

**Shipment temperature:**

Min. -30°C - Max. +50°C.

**Storage temperature:**

Min. -30°C - Max. +50°C.

**Operating temperature:**

Refer to section 10, "Operating limits", in these instructions.

Technicians who install, start up, operate and service the unit must possess the necessary training and certifications, understand the instructions given in this manual and be familiar with the specific technical characteristics of the installation site.

If they are to work on the unit's refrigeration circuit, such training and certification must meet the requirements of Regulation (EC) 842/2006.

## 2 TRANSPORTING THE UNIT

During shipment, the unit must be securely strapped in place to prevent it moving and to protect it from damage.

If the unit is shipped in a container, the container must be easy to load and unload.

Do not lift the unit using these accessories.

## 3 RECEIPT OF GOODS

### 3.1 Checking the equipment

Check the unit for any damage or missing components upon delivery.

Note any damaged or missing parts on the delivery slip.

#### IMPORTANT:

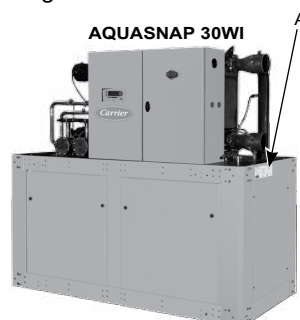
You must notify the carrier of any damage and/or missing parts by registered letter within three days of the delivery date.

Furthermore, ensure the unit is not stored in an outdoor location exposed to the elements.

### 3.2 Identifying the equipment

#### • Name plate:

Each unit has a manufacturer's name plate (A) bearing the unit's identification number (serial number) and description.



Make sure this information matches that on the order.

Markings (name plate, punch marks, labels) must remain visible. They must not be altered, removed or modified.

**Key:**


- **Désignation/Description:** Unit type.
- **An(Year):** Year of manufacture.
- **N° série/Serial No.:** Production number. (to be quoted in all correspondence)
- **Refrigerant:** Type of refrigerant.
- **Refrigerant kg/TeqCO2:** Refrigerant content in kg and in tonnes of CO2 equivalent.
- **BP/LP Mini/PSM/MOP:** For the low pressure circuit:
  - BP/LP. Mini = Minimum operating pressure in bar.
  - PSM/MOP = Maximum standard pressure in bar (SP according to PED 97/23/EC).
- **HP Maxi PSM/MOP:** For the high pressure circuit:
  - HP. Maxi. = Maximum operating pressure in bar.
  - PSM/MOP = Maximum standard pressure in bar (SP according to PED 97/23/EC).
- **kW Absorbee/Input kW:** Power input in kW.
- **Tension/Voltage:** Power supply.
- **Intensité/Current:** Nominal current in A.
- **Pression/Pressure Test:** See "Pressure and temperature" section on the previous page.
- **Service/Working kg :** Operating weight of the unit, in kg.
- **Min/Max Temperatures:** See "Pressure and temperature" section on the previous page.
- **IP:** Machine electrical protection rating.
- **No CE:** Notified Body number.





Please include the identification number in all correspondence with CIAT.

Ref. produit/Item Nbr		Designation/Description	
3025277 423727		30WI 1200V	
An(Year)	N. Serie/Serial Nbr	No Produit	
	02438040/0001		
Refrigerant	R410A	kW Absorbee/Input kW	46.2
Refrigerant kg / TeqCO2	13.5 + 14.0 / 28.2+29.2	Service/Working kg	1088
BP/LP Mini	2.5 BAR / 28 BAR	Tension/Voltage	3 50HZ 400V
PSM/MOP	41.5 BAR / 42 BAR	Temperature Min/Max	CF NOTICE
HP Maxi	PSM/MOP	Intensité/Current A	140
		IP	21
		Pression/Pressure Test	PT=3XPS CF NOTICE
		No CE	0060

Contient des gaz fluorés à effet de serre / Contains fluorinated greenhouse gases

 CARRIER SCS  
Rte de Thil  
01122 Montluel- France  
Tél.: (00 33) 4 72 25 21 21

   
Made in France

## 4 SAFETY INSTRUCTIONS

To avoid any risk of accident during installation, start-up and adjustments, the following equipment specifics must be taken into account:

- Pressurised refrigerating circuits
- Presence of refrigerant
- Presence of electrical voltage

Only experienced and qualified persons may work on such equipment.

The recommendations and instructions in this manual and on each drawing provided with the unit must be followed.

In the case of units with pressure equipment or components, we recommend that you contact your professional organisation for

information on the regulations that apply to operators or owners of pressure equipment or components. The specifications of this pressure equipment or these pressure components are given on the name plates or in the regulatory documentation provided with the product.

A fire protection device is fitted as standard on all units.

**IMPORTANT:** Make sure the main disconnect switch in the unit's electrical panel is in the OFF position before working on the unit.

## 5 MACHINE COMPLIANCE

Refer to the document entitled "Declaration of incorporation" supplied with your equipment.

The installer has full responsibility as Manufacturer (1) of the installation with regard to the Pressure Equipment Directive (PED). He must compile the technical dossier to allow the system to be certified in compliance with the PED and issue the customer with the certificate of conformity for the installation.

**The manufacturer's system start-up procedure is carried out once the assembly completion notice has been sent with the order acknowledgement of receipt and the installation's certificate of conformity.**

**This official document states that the installation has been set up in compliance with the requirements of decree no. 99-1046 dated 13 December 1999 and with the installation and operating conditions set out in section II of the modified order dated 15 March 2000.**

**The checks carried out by the manufacturer during system start-up are only functional and do not release the installer from his responsibilities with regard to the PED.**

(1) Manufacturer: The party responsible for designing and manufacturing equipment for sale on the market under its own name.

## 6 UNIT LOCATION

These units are typically used for refrigeration and are not required to withstand earthquakes. Earthquake resistance has therefore not been checked.

Before setting up the unit in its intended location, the installer must check the following points:

- These units are designed to be installed and stored inside a machine room that is sheltered from frost and the elements. Failure to do so will incur the loss of the manufacturer's warranty.
- The surface area of the ground or structure must be strong enough to bear the unit's weight.
- The unit must be perfectly level.
- There must be sufficient free space around and above the unit to allow servicing and maintenance (see dimensional drawing provided with unit).
- The room housing the unit must comply with the requirements of regulation EN 378-3 and other specifications applicable at

the installation site.

- The selected location must be above flood level.

- Sound level:

- Our units are designed to operate quietly.
- In the installation design, you must take into account the interior environment for radiated noise and the building type for airborne and solid-borne noise transmission.
- To ensure vibrations transmitted by solid materials are reduced as much as possible, it is strongly recommended to fit anti-vibration mounts between the unit support and frame (see the section on anti-vibration mounts), as well as flexible couplings on the hydraulic piping.
- Have an analysis carried out by an acoustics engineer.

**IMPORTANT:** The ambient temperature must not exceed 50°C during the unit's off cycles.

## 7 HANDLING AND POSITIONING

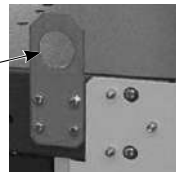
To raise the unit, attach the slings to the designated handling holes.

The data relating to the centre of gravity and the position of the anchorage points are given on the dimensional drawing.

### Detailed view of the anchorage point for handling

#### AQUASNAP 30WI

Holes for  
handling  
Ø 35.2 mm



The unit can be handled with a forklift truck (check the maximum permissible load of the forklift).

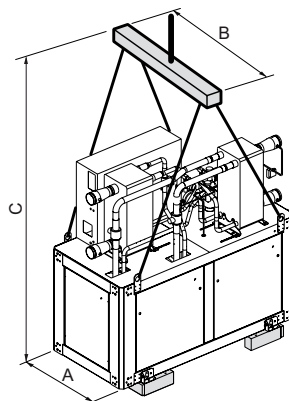
In this case, it is important that the necessary precautions be taken to avoid the unit sliding on the forks of the forklift. You must observe the instructions given on the label affixed to the unit. Failure to observe these instructions may result in the unit tipping over and causing physical injury.

### CAUTION:

- Attach the slings only to the anchorage points intended for this purpose and which are designated on the unit.
- Use slings with a suitable lifting capacity and follow the lifting instructions on the drawings provided with the unit.
- Caution: the centre of gravity is not necessarily at the middle of the unit and the forces applied to the slings are not always identical.

- Raise and set down the unit carefully. Take care not to tilt it by more than 15°, as this could adversely affect its operation.
- To avoid damaging the casing, use textile slings with shackles.
- Use a frame with an adjustable centre of gravity to keep the slings away from the top of the unit.
- Always protect the unit casing (panels, posts, front access door) from damage during handling. Only the base frame is designed to withstand handling.
- Safety when lifting can only be guaranteed if all these instructions are followed.

Otherwise, there is a risk of damage to the equipment and personal injury.



This diagram is provided as a guide;  
always refer to the  
pictograms on the unit

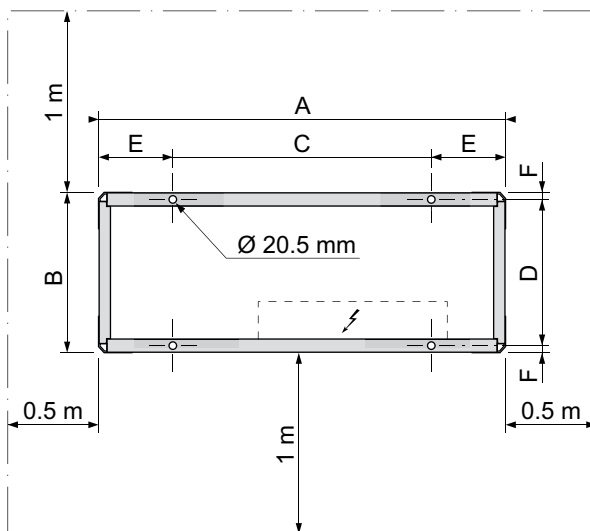
AQUASNAP 30WI	700 V	800 V	900 V	1000 V	1100 V	1200 V	1400 V	1600 V	1800 V	2100 V	2400 V
A	996										
B	1400										
C	2580						2930		2860		

For the empty weight, please refer to section 8.1

## 8 INSTALLING THE UNIT

### 8.1 Dimensions and floor mounting of the frames

The frame may be affixed to the ground. (Mounts with studs not supplied by CARRIER). The hardness is to be defined according to the unit's weight and centre of gravity.



Free space to be maintained to allow sufficient room for maintenance of the unit.  
It is important that the units are installed with the necessary clearances.

AQUASNAP 30WI		700 V	800 V	900 V	1000 V	1100 V	1200 V	1400 V	1600 V	1800 V	2100 V	2400 V
A		2099						2499		3350		
B		984						984		984		
C		1271						1671		2366		
D		916						916		916		
E		414						414		492		
F		34						34		34		
Weight (empty)	Kg	1044	1156	1189	1312	1363	1425	1613	1708	2284	2376	2418
Weight (in operation)	kg	1088	1205	1246	1378	1436	1510	1713	1818	2472	2588	2637

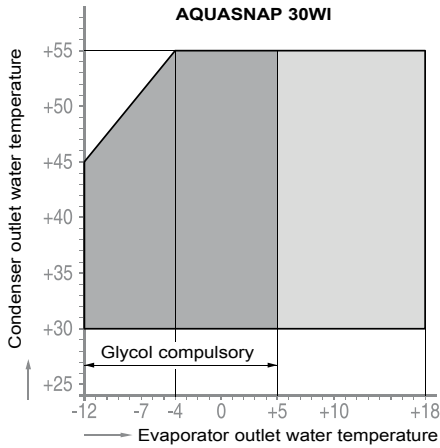
8.2 Anti-vibration mounts (not supplied by CARRIER)

Anti-vibration mounts must be installed beneath the unit for applications that generate extremely low vibrations. (See position (E) of the mounting holes in the floor of the frame on the previous diagram).

9 OPERATING LIMITS

9.1 Operating range

The graph below represents the area of application (under full load) of the units.



9.2 Limits

AQUASNAP 30WI	
Condenser ΔT min. °C/ΔT max. °C	Yes – 5/10 The customer should take all means necessary to achieve a minimum water inlet temperature of 25°C on the condenser side.
Evaporator ΔT min. °C/ΔT max. °C	Variable according to water outlet temperature. See evaporator limit curves

9.3 Evaporator limits

The curves below show the minimum and maximum allowable temperature differences for chilled water or glycol/water solution based on the water outlet temperature, for operation under full load.

— · — · ΔT calculation for performance tables

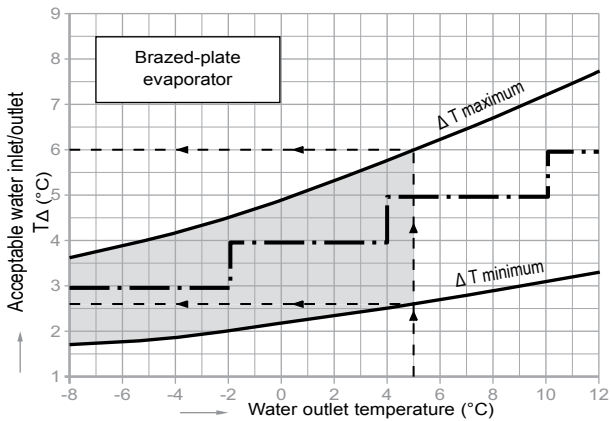
glycol/water mix

Example:

For a water outlet temperature of +5°C

- The minimum TΔ is 2.6°C, which gives a water temperature of 7.6/5°C
- The maximum TΔ is 6°C, which gives a water temperature of 11/5°C

If the temperature difference calculated is outside the two curves, contact us.



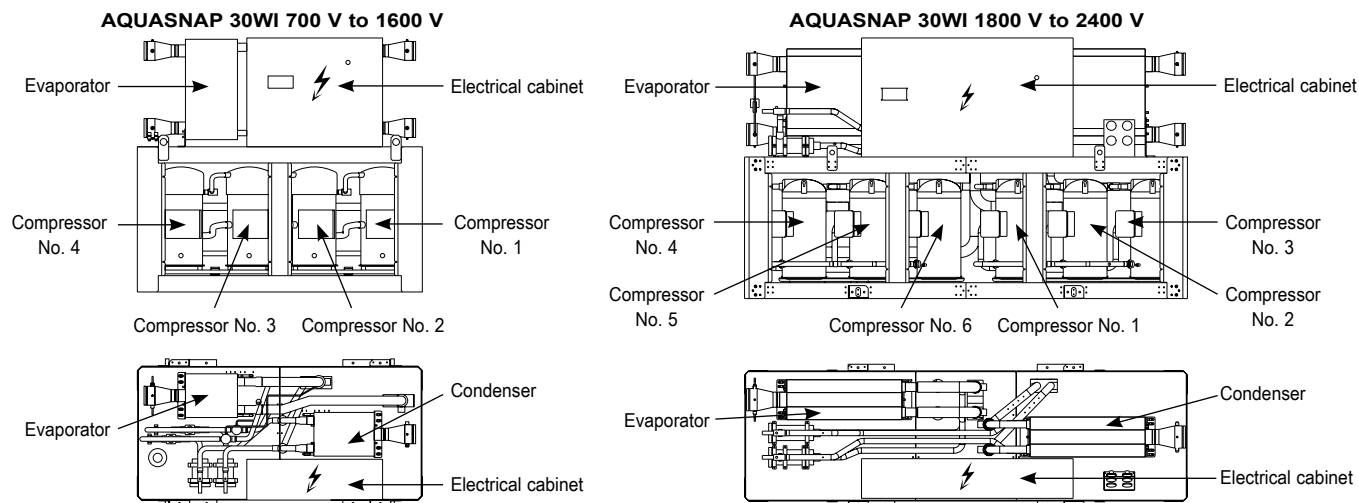


## 9.4 Minimum/maximum water flow rates

The flow rates in the exchangers must be maintained between the values given below.

AQUASNAP 30WI		700 V	800 V	900 V	1000 V	1100 V	1200 V	1400 V	1600 V	1800 V	2100 V	2400 V
Evaporator	min. m <sup>3</sup> /h	22	26	29	33	35	38	44	51	61	68	74
	max. m <sup>3</sup> /h	70	81	92	105	113	124	137	151	150	150	150
Condenser	min. m <sup>3</sup> /h	19	22	25	28	31	33	38	43	52	59	66
	max. m <sup>3</sup> /h	64	74	84	95	103	112	129	143	150	150	153

## 10 LOCATION OF THE MAIN COMPONENTS



## 11 MAIN COMPONENTS OF THE REFRIGERATING CIRCUIT

### Compressor

**AQUASNAP 30WI** units use hermetically sealed SCROLL compressors.

### Oil

The compressor is lubricated with a polyester oil, (POE) type 160SZ for the **AQUASNAP 30WI** 700 V to 1200 V chillers. This oil will be the 3MAF (32 cSt) type for the **AQUASNAP 30WI** 1400 V to 2400 V chillers.

If necessary, top up the compressors with ICI Emkarate RL 32 CF oil or Mobil EAL Arctic 22 CC oil if no 3MAF is available for R410A models.

### Refrigerant

**AQUASNAP 30WI** 700 V to 2400 V chillers operate using R410A.

The Global Warming Potential (GWP) is 2088 GWP for R410A, in compliance with standard EN378-1.

### Exchangers

With the **AQUASNAP 30WI**, the evaporators and condensers are double-circuit brazed-plate heat exchangers.

The evaporators are thermally insulated with 10 mm thick polyurethane foam. As an option, 19 mm insulation is available (standard equipment for operation with low-temperature glycol/water mix below 0°C).

The heat-transfer medium must be filtered and internal inspections must be carried out.

Repairs or modifications of any kind to the plate heat exchangers are prohibited. CIAT only authorises replacement of the heat exchanger by a qualified technician using original equipment. If the heat exchanger is replaced, this must be noted in the maintenance booklet.

### Electronic expansion valve

**AQUASNAP 30WI** units are equipped with electronic expansion valves. The electrical equipment is installed in the electrical cabinet.

All the expansion valve operating parameters are preset, including evaporator superheating. Only qualified, experienced personnel can carry out configuration.

A 24V backup battery is built into the driver. It allows the expansion valve to be closed in the event of a power failure. It has a service life of 8 years. After this time, the battery must be replaced.

**Important:** the valve must not be moved when there is no refrigerant flow rate. When the system is stopped or evacuated, the start-up potential-free (dry) contact must remain open.

### Dehumidifier

Every unit is fitted as standard with a dehumidifier filter (with a replaceable cartridge) to keep the refrigerating circuit clean and free of moisture. The dryer filter consists of aluminium oxide and a molecular sieve that neutralises any acids in the refrigeration circuit.

### Liquid sight glass

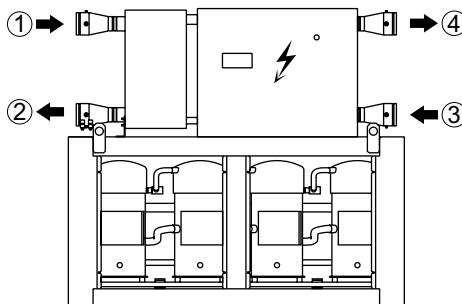
Located on the liquid line just after the filter dryer, the liquid sight glass is used to monitor the charge in the unit and to check for moisture in the circuit. Bubbles in the sight glass mean that the refrigerant load is insufficient or that non-condensable gases are in the refrigeration circuit. If the sight glass indicator paper changes colour, there is moisture in the circuit.

**Warning:** Some of the sight glasses may turn yellow when the machine is powered off, as their sensitivity is affected by the fluid temperature.

The sight glasses should return to green after the unit has been operating for a few hours.

If the sight glasses remain yellow, there is excessive moisture in the circuit. A specialist intervention is required.

## 12 HYDRAULIC CONNECTIONS



AQUASNAP 30WI		700 V	800 V	900 V	1000 V	1100 V	1200 V	1400 V	1600 V	1800 V	2100 V	2400 V
Chilled water inlet/outlet	① ② diameter	DN 100 PN 16 - VICTAULIC			DN 125 PN 16 - VICTAULIC					DN 150 PN 16 VICTAULIC		
Cooling water inlet/outlet	③ ④ diameter	DN 100 PN 16 - VICTAULIC			DN 125 PN 16 - VICTAULIC					DN 150 PN 16 VICTAULIC		

Hydraulic connections must be made in accordance with the diagram delivered with the unit. This diagram shows the positions and dimensions of the water inlets and outlets on the exchangers.

Follow the requirements below when making these connections:

- Ensure the inlet and outlet pipes are connected in the direction shown on the unit.
- In order to meet the operating conditions (flow rates, pressure loss), a sizing calculation must be performed. The diameter of the pipes may therefore be different to that specified on the exchanger.
- The pipes and tubes should not transmit any axial or radial forces to the exchangers or any vibrations.
- The water must be analysed and, if necessary, treated (we recommend contacting a qualified water treatment specialist).

The analysis will reveal whether the water is suitable for use with the various materials it will come into contact with and prevent the formation of electrolytic couples:

- 99.9% copper tubes brazed with copper and silver
- Threaded bronze couplings or flat steel flanges, depending on the unit model
- Plate heat exchangers and AISI 316 - 1.4401 stainless steel connections brazed with copper and silver
- The water circuit must have as few bends and horizontal sections at different levels as possible.
- Install shut-off valves near the water inlets and outlets in order to isolate the exchangers.
- Install manual or automatic air bleed valves at the high points of the circuit(s).
- The manual or automatic air bleed valves fitted on the machine are not intended to be used to bleed the rest of the hydraulic circuit.
- A static pressure of 1 bar must be maintained at all times (machine and pump off or on) on the pump intake.
- Install drain connections at all circuit low point(s).
- Install the accessories that are essential for any hydraulic circuit (balancing valves, expansion vessel, safety valve, thermometer pockets, etc.).
- Insulate the pipes and tubes (after performing leak tests) in order to reduce heat losses and prevent damage from frost.

- Install heating elements on all pipes that could be exposed to frost.

- The installer must provide the necessary systems for filling and draining the energy transfer fluid.

- To keep the pressure in the coolant circuit below the intended operating pressure, avoid introducing static or dynamic pressure into the circuit.

### IMPORTANT:

- To prevent any risk of fouling or damage to the plate heat exchangers (evaporator and condenser), it is essential to fit a strainer to the water inlets as close as possible to the exchangers and in a place which is easily accessible for disassembly and cleaning. The maximum mesh size of this filter should be 800 µm.
- Flexible couplings must be used on the hydraulic pipework (evaporator and condenser).

The system pipework must be secured to the wall of the building and must not place any additional load on the unit.

- Using untreated or incorrectly treated water may cause corrosion or erosion or the formation of scale, algae or sludge deposits. **CARRIER** shall not be held liable for damage resulting from the use of untreated or incorrectly treated water, or of saline or brackish water.

**When the unit is used as a heat pump, the maximum water return temperature of the installation will be 55°C. Never series-connect the condenser with a high-temperature water network (boiler). Doing so will result in damage.**

**NOTE:** The maximum operating pressure on the water side should be 10 bar (evaporator and condenser). The water flow sensor is supplied fitted to the unit. **Stopping the pumps will automatically cause the unit to stop to avoid any risk of freezing. The pump or pumps must be slaved to the refrigeration unit** (auxiliary operation switch of the pump to be wired).

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

#### IMPORTANT:

If antifreeze is not added to the circuit and the unit is not operated during periods of freezing weather, drain the evaporator and the outside pipes.

## 13 GLYCOL/WATER-MIX ANTIFREEZE PROTECTION

The table and the curves below indicate the minimum percentages of glycol with which the system must be provided depending on the freezing point.

**WARNING:** The glycol concentration must protect the fluid at least 6°C below the water outlet temperature specified for the evaporator to allow correct setting of the minimum pressure controller at the evaporator.

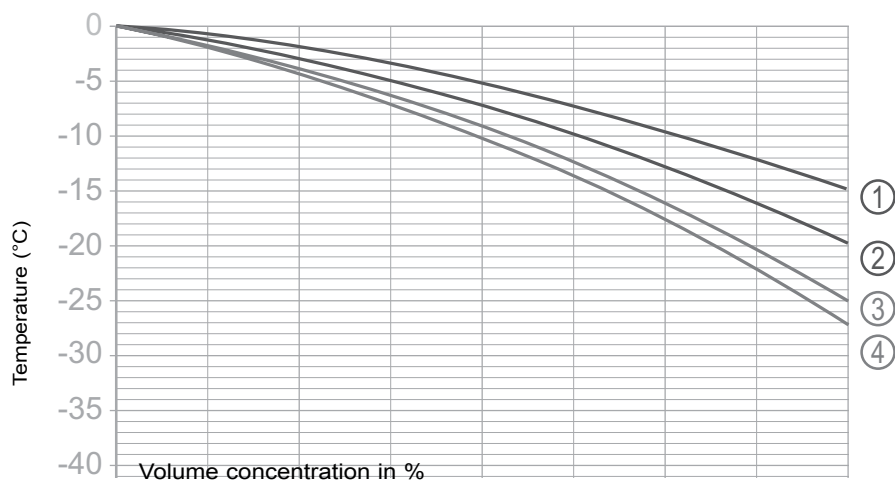
#### Glycol concentration required

Volume concentration in %		0	10	20	30	40
Ethylene glycol	Freezing point °C	0	-4	-10	-18	-27
	Minimum water outlet °C	5	+3	-1	-7	-14
Propylene glycol	Freezing point °C	0	-4	-9	-16	-25
	Minimum water outlet °C	5	+4	+1	-4	-9

**Important:** The values are given for guidance only, according to the standard characteristics of the MEG. These may vary depending on the MEG manufacturer, therefore it is important to refer to the manufacturer's data to ensure protection is provided to the required temperature.

For a glycol concentration greater than 40%, a special pump must be used.

#### Graph of minimum freezing and operating temperatures



Minimum operating temperature  
**1** - Monopropylene glycol  
**2** - Monoethylene glycol

Freezing temperature  
**3** - Monopropylene glycol  
**4** - Monoethylene glycol

## 14 ELECTRICAL CONNECTIONS

### 14.1 Power connection

The units are designed in accordance with the requirements of European standard EN 60204-1.

**They comply with the requirements of the machinery and EMC directives.**

All wiring must be connected in accordance with the codes and regulations that apply to the installation site (e.g. NFC 15100 in France).

In all cases:

- Refer to the wiring diagram attached to the unit.
- Follow the electrical supply specifications indicated on the data plate.

The voltage must remain within the range indicated:

- Power circuit:

400 V (+10%/-10%) - 3-ph - 50 Hz + Earth

\* 230 V (+10%/-10%) - 3-ph - 50 Hz + Earth

- Control circuit:

1 ~ 50 Hz 230 V (Transformer fitted as standard on the machine)

\* Installation according to French regulations

- Phase unbalance must not exceed 2% and 10% for voltage and current, respectively.

If any of the above requirements are not met, contact your power supplier immediately and make sure the unit is not turned on until the necessary corrective actions have been taken. Failure to do so will automatically void the manufacturer's warranty.

Wiring is to be sized by the installer to suit the characteristics of the installation site and comply with applicable regulations.

Once the size of the wires has been selected, the installer must determine any changes needed on site to facilitate connection.

- Wiring must be selected based on:

- The maximum rated current (refer to the "Electrical specifications").
- The distance between the unit and its power source.
- The protection to be fitted at the power source.
- The neutral mode.
- The electrical connections (refer to the wiring diagram provided with the unit).

- The electrical connections are to be made as follows:

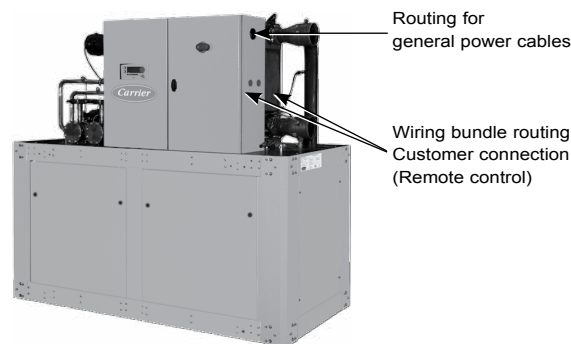
- Connection to the power circuit.
- Connect the protective conductor to the earth terminal.
- Connect the general fault display dry contact and the automatic operation control dry contact (where applicable).
- Interlock the compressors with the accelerator pump.

- The external control must be connected using a potential-free (dry) contact.

- The disconnect switch has a breaking capacity of:

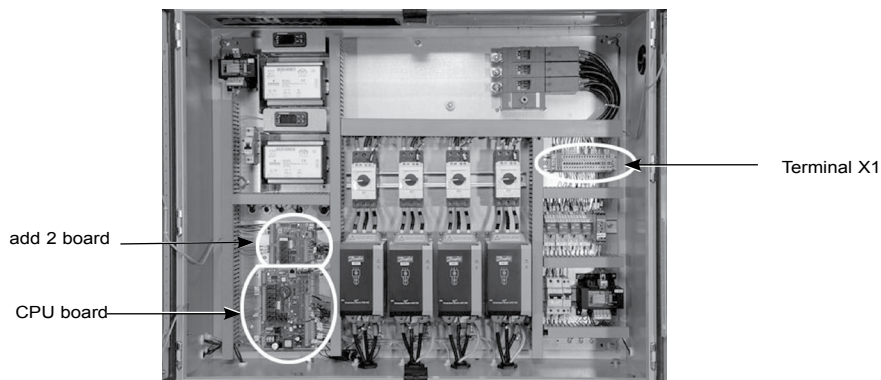
- 40.5 kA for 700 V to 1200 V versions,
- 61.5 kA for 1400 V to 2100 V versions,
- 70 kA for 2400 V version,

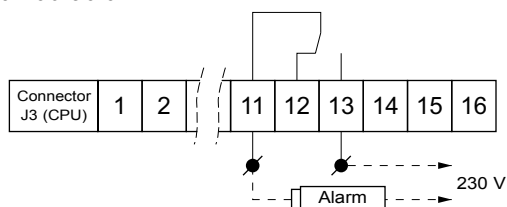
The unit is supplied by the upper right section of the electrical cabinet with an opening for routing the supply cables.



### 14.2 Customer connection for remote control functions.

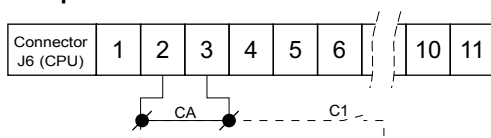
Certain operating states can be wired directly to terminal X1 provided for this purpose:



**General fault alarm:**

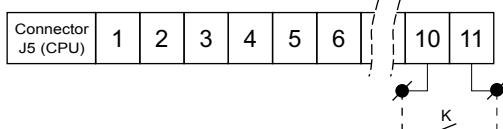
Remote control: Connect the unit's general fault reporting or alarm to the terminals on the unit's terminal strip (see wiring diagram).

- Output specification: 2 A under 250 V.

**Automatic operation control:**

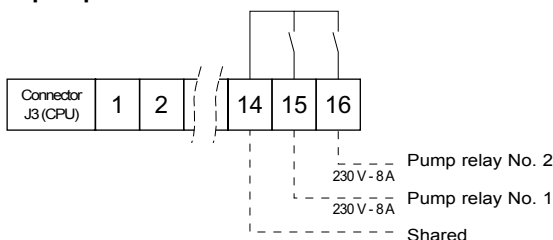
Remove shunt "CA" from between the terminals on the unit terminal strip (see wiring diagram) and connect a "C1" contact to these terminals (high-quality polarity-free contact).

- Contact open → unit off
- Contact closed → unit authorised to run
- Input specification: 24 V - 15 mA.

**Display of the operating state of pump No. 1**

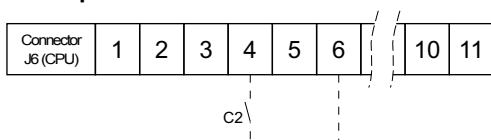
- Contact open → Pump off
- Contact closed → Pump in operation
- Input specification: 24 V - 15 mA.

Other connections can be made to the CPU board

**Water pump control**

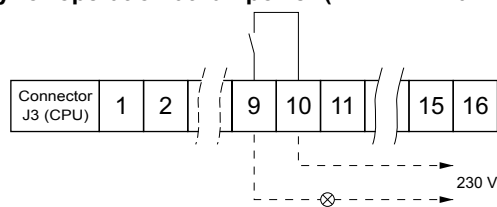
Connect the supply to the pump relays between the terminals of the connector on the main board.

- Output specification: 2 A under 250 V

**Setpoint 1/setpoint 2 selector control**

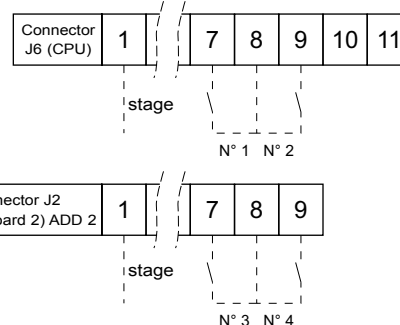
Connect a "C2" contact to the connector on the CPU board (high-quality polarity-free contact)

- Contact open → setpoint 1
- Contact closed → setpoint 2
- Input specification: 24 V - 15 mA

**Display for operation at full power (if P111 = max P)**

Connect the signalling of the unit operating at max. output to terminals 1 and 2 of the connector on the CPU board.

- Output specification: 2 A under 250 V.

**"Load shedding" function control**

Connect 1 to 4 contacts to the terminals of the connector of the CPU board according to the number of the compressors to be shed. 1 contact per compressor (contact free of any polarity and of good quality).

- Contact open → normal operation,
- Contact closed → compressor load shedding.
- Input specification: 24 V - 15 mA.

**NOTE:**

- Connection to be made on site by the customer,
- Precautions for connection. See manual for the regulator and the electrical diagram of the unit.

**Communication**

- In the room, a control and display console is used to run an instant check on the unit; it enables the user to communicate with the microprocessor, to configure the unit and to adjust the setpoints.
- Electronic remote control (option):  
Installed in the machine room, this will be connected to the unit by a pair of telephone-type wires (max. distance 1000 m). For a description of functions and connection, see CHILLER/HEATPUMP CONTROL manual.
- Relay board(s) (option):  
This board is installed in a cabinet in the machine room and can remotely report on all the unit's operating states and faults by providing contacts which are potential-free when closed. The board will be connected to the unit by a pair of telephone-type wires (max. distance 1000 m).
- Communication with centralised management system and see the

option in the CHILLER/HEATPUMP CONTROL manual.

For a description of boards and connection, see the CHILLER/HEATPUMP CONTROL manual.

## 15 CONTROL AND SAFETY DEVICES

### 15.1 Electronic control and display module

All units in the range are fitted with a CHILLER/HEATPUMP CONTROL microprocessor-controlled electronic control and display module.

The electronic module controls the operation of the compressors. Thus, depending on the difference between the cold water (or hot water) return temperature and the setpoint temperature, the electronic module will activate or deactivate the compressors in series.

In a standard configuration of the unit, the cold water or hot water control sensor is placed on the evaporator water return (chilled water production use) or condenser (heat pump use).

### 15.2 Main functions

- Water temperature control:
    - Evaporator chilled water.
    - Condenser hot water.
  - 3 possible types of control:
    - Water return difference.
    - Water outlet PID temperature.
    - Control according to the outdoor temperature.
- In the standard configuration, the units use the chilled water return control. For PID water outlet temperature control, refer to the CHILLER/HEATPUMP CONTROL control manual.
- Operating settings monitoring.
  - Fault diagnosis.
  - Fault storage in the event of a power failure.
  - Management and automatic equalisation of compressor operating time (multi-compressors).
  - Remote control (Start/stop, temperature setpoint adjustment, operating states, general fault) (OPTIONAL).
  - Remote control reporting of operating states and faults using an interface module (OPTIONAL).

**For a detailed description of all these functions refer to the CHILLER/HEATPUMP CONTROL user manual**

### 15.3 Safety device management

All of the unit's safety devices are managed by the electronic circuit board in the regulator. If a safety device is triggered and stops the unit, trace the fault, reset the safety device if necessary, and then clear the fault with the "RESET" button on the CHILLER/HEATPUMP CONTROL console.

The unit will restart when the minimum time required by the short-cycle protection elapses. To ascertain the setting values of the different safety devices and the fault clearance procedures, refer to the CHILLER/HEATPUMP CONTROL regulator instructions.

#### ➤ Low-pressure control (LP)

Each unit includes one low pressure sensor per refrigerating circuit as standard. This sensor enables the user to display the LP value and enables the electronic module to provide a safety function by ensuring that the LP value does not fall below the threshold parameter in the regulator.

#### ➤ High-pressure control (HP)

- High-pressure switch.

Each refrigerating circuit is equipped with an HP pressure switch.

The HP safety pressure switch is the main safety device for the unit during operation. Thus, when the HP value exceeds the preset value of the pressure switch, power to the compressor(s) in the refrigerating circuit concerned is cut off and the fault is indicated by an LED on the regulator console.

The HP pressure switches are reset manually, thus any fault will be cleared by resetting the pressure switch and by pressing the RESET button on the console.

**Note:** The units have two pressure switches per circuit (connected electrically in series).

- High-pressure sensor

Each unit includes one high-pressure sensor per refrigerating circuit as a standard item. This sensor enables the user to display the HP value and enables the electronic module to perform its safety function.

#### ➤ Evaporator frost protection

The evaporator is protected against freezing by two sensors:

- Evaporator chilled water outlet sensor

Each evaporator is fitted with an antifreeze protection sensor (located on the chilled water outlet) which monitors the temperature of the fluid to be cooled. If this temperature falls below the set value in the regulator, power to the compressor(s) in the refrigerating circuit concerned is cut off and the fault is indicated by an LED on the regulator console. This probe acts as a safety device and must therefore never be moved by the customer.

- Freon sensor on evaporator inlet or on the circuit 1 or 2 pressure sensor (LP) (1400 V to 2400 V models)

This sensor monitors the temperature of the refrigerant at the evaporator inlet. If this temperature falls below the set value in the regulator, power to the compressor(s) in the refrigerating circuit concerned is cut off and the fault is indicated by an LED on the regulator console.

#### ➤ **Evaporator water circulation controller**

Every unit is fitted with a water circulation control device as standard. Thus, if the water flow is insufficient, the power supply to the compressor(s) is cut and an LED indicates the fault on the regulator console.

#### ➤ **Internal compressor protection**

Every model in the range is protected against overheating of the electric motor and high discharge temperatures.

The units are equipped with compressors with internal protection against missing phases and phase reversal.

On all models, an optional phase controller may also be added if the customer wishes.

#### ➤ **Discharge sensor**

Each unit includes one discharge sensor per refrigerating circuit as standard. This sensor located on the discharge piping makes it possible for the user to view the discharge temperature value and enables the electronic module to provide a safety function.

If the discharge temperature exceeds the maximum temperature threshold set in the regulator, the power supply to the compressor(s) for the refrigerating circuit concerned is cut and the fault is indicated by an LED on the regulator console.

#### ➤ **Overpressure protection**

Each refrigerating circuit in each unit is protected against the risk of overpressure resulting from fire.

- Fire valves

- The fire valve protect the HP and LP circuits against overpressure caused by an increase in the outdoor temperature, when the unit is off. (E.g.: external fire)

- This fire valve is not considered a safety device as defined in section 2.11 of appendix 1 of the pressure equipment directive.

- Allowable pressure (PS) LP side

- The LP value (given on the name plate) corresponds to the situation with the unit switched off. This value is given according to the pressure/temperature ratio with an outdoor temperature of 50°C, depending on the unit. These temperatures correspond to the least favourable situation the unit could be subjected to, excluding an external fire.

The LP side pipes are sized for the maximum allowable pressure.

The LP value is linked to the relevant unit and cannot be exceeded.

### **15.4 Phase controller option**

The phase controller option performs the following functions:

- Controls the direction of rotation of each phase

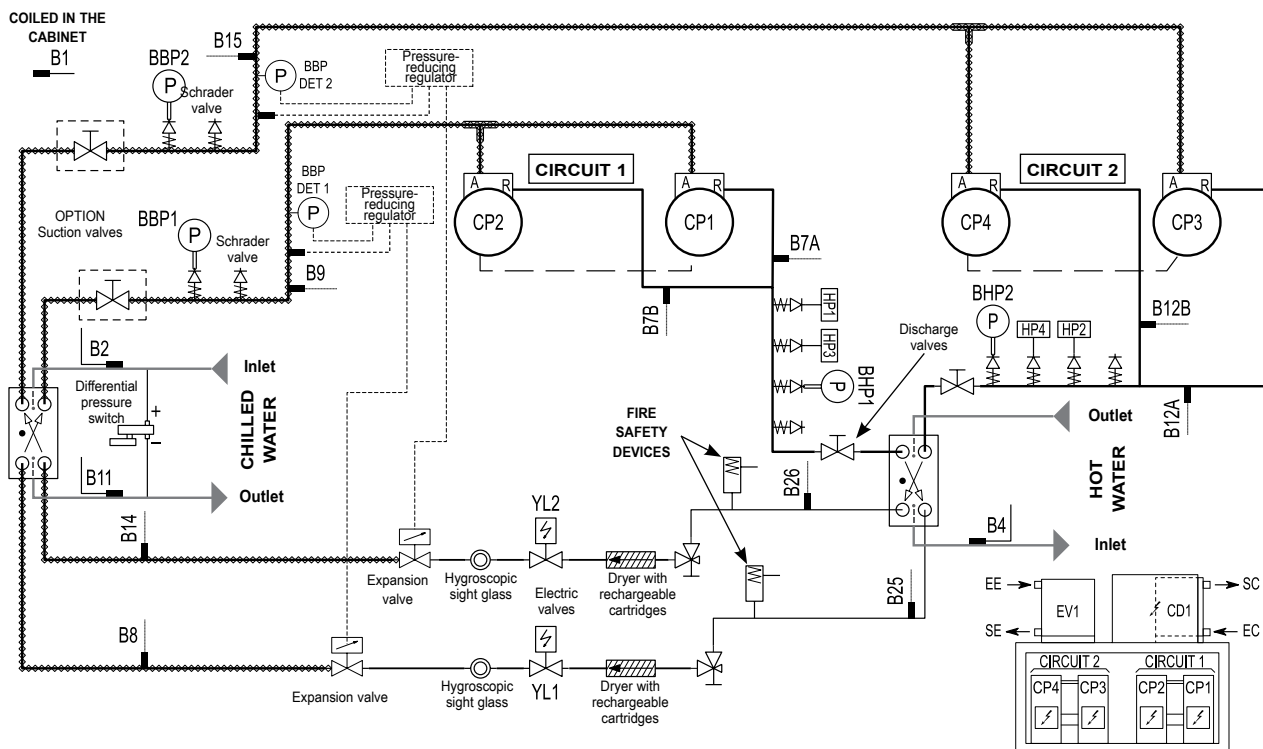
- Detects the absence of one or more phases

- Monitors for overvoltage or undervoltage

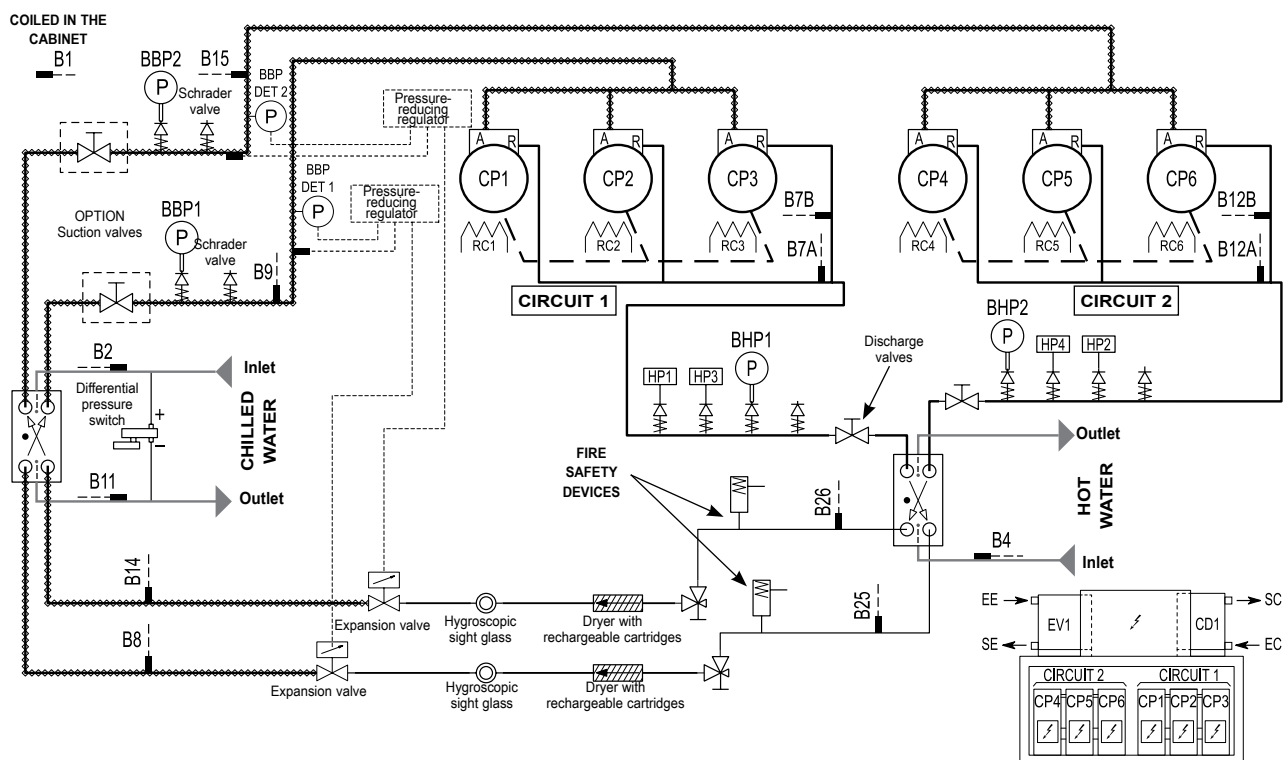


## 15.5 Location of the safety sensors and devices

### AQUASNAP 30WI 700 V to 1600 V



### AQUASNAP 30WI 1800 V to 2400 V



**SC:** Condenser water outlet

**EC:** Condenser water inlet

#### CIRCUIT 1

**B1:** Outdoor temperature sensor

**B2:** Chilled water inlet sensor

**B3:** Exchanger chilled water outlet sensor 1

**B4:** Exchanger ambient temperature/hot water sensor

**B7A:** Circuit 1 stage 1 discharge sensor

**B7B:** Circuit 1 stage 2 discharge sensor

**B8:** Antifreeze protection/exchanger refrigerant sensor 1

**B9:** Circuit 1 suction sensor

**B25:** Circuit 1 liquid/refrigerant sensor

**SE:** Evaporator outlet

**EE:** Evaporator inlet

#### CIRCUIT 2

**B10:** Exchanger chilled water outlet sensor 2

**B11:** Chilled water outlet, header sensor

**B12A:** Circuit 2 stage 1 discharge sensor

**B12B:** Circuit 2 stage 2 discharge sensor

**B14:** Antifreeze protection/exchanger refrigerant sensor 2

**B15:** Circuit 2 suction sensor

**B26:** Circuit 2 liquid/refrigerant sensor



## 15.6 Adjusting the control and safety devices

Units	Function	Electrical symbol	Settings
<b>Outdoor sensor</b>	Adjust the setpoint according to the outdoor temperature	B1	Controller for CHILLER/HEATPUMP CONTROL
<b>Chilled water inlet sensor</b>	Control of the unit on the water return	B2	
<b>Chilled water outlet manifold sensor</b>	Unit control if controller on water outlet	B11	
<b>Hot water inlet sensor</b>	Unit control in hot operation	B4	
<b>Discharge sensor circuit 1, circuit 2</b>	Compressor protection	Circ. 1: B7A, B7B Circ. 2: B12A, B12B	
<b>Circuit 1 and circuit 2 evaporator inlet freon sensor</b>	Evaporator frost protection	Circ. 1: B8 Circ. 2: B14	Controller for CHILLER/HEATPUMP CONTROL
<b>High-pressure switch circuit 1 and circuit 2</b>	Compressor safety devices	Circ. 1: HP1, HP3 Circ. 2: HP2, HP4	
<b>Circuit 1 and circuit 2 low-pressure sensor</b>	Low pressure value control Fluid leak detection	Circ. 1: BBP1 Circ. 2: BBP2	
<b>Circuit 1 and circuit 2 high-pressure sensor</b>	High pressure value control Controlling the unit by high pressure Condensing pressure control	Circ. 1: BHP1 Circ. 2: BHP2	

## 16 COMMISSIONING

**Checks prior to system start-up: Always read this manual in full before attempting to commission the system.**

Comply with applicable national regulations during testing and installation.

Before commissioning the system, carry out the following checks:

- Compare the complete system against the refrigeration and wiring diagrams
- Make sure that all components are as specified on the drawings
- Make sure that no documents and safety devices required by applicable European standards are missing
- Make sure that there is sufficient clearance around the system for maintenance and emergency purposes
- Check the assembled couplings
- Check the quality of the welds and seals and check for any refrigerant leaks
- Make sure that all mechanical guards are in place and functional
- Look into the problems of specific noise generated by the installation.
- After opening the water circuit valves, make sure that water is flowing in the cooler while the pump is running.
- **The air in the hydraulic circuit must be bled** before system start-up.

For this operation, the pump(s) must have been started up. To enable operation without triggering the compressor(s), all our machines are delivered with the parameter "*compressor on authorisation*" set to "NO".

The operation can therefore be carried out with no risk of starting up the compressors by setting the machine control to the "ON" position.

Once the hydraulic circuit has been bled, the machine is turned on by switching the "*compressor on authorisation*" setting to "YES" which authorises start-up.

List of parameters concerned:

- P230 Stage 1, circuit 1 "on" authorisation
- P231 Stage 2, circuit 1 "on" authorisation
- P232 Stage 1, circuit 2 "on" authorisation
- P233 Stage 2, circuit 2 "on" authorisation
- P235 Electric stage 1 "on" authorisation (Unit with Electric heater module)

- P236 Electric stage 2 "on" authorisation (Unit with Electric heater module)
- P237 Electric stage 3 "on" authorisation (Unit with Electric heater module)
- P238 Electric stage 4 "on" authorisation (Unit with Electric heater module)
- Check the operation of the circulation controller
- Check for loose clamps on all pipes
- Check for loose electrical connections
- Leave the compressor's crankcase heaters on for 6 hours before switching on the unit.
- After 6 hours, touch the crankcases to ensure that all heaters have been working correctly (they should be lukewarm)
- Make sure current is supplied to the general connection and that the voltage supplied remains within the acceptable limits (+10% to -10% compared to the rated voltage)

**FLEXIBLE COUPLINGS MUST BE USED ON THE HYDRAULIC PIPEWORK (EVAPORATOR AND CONDENSER).**



### 16.1 Commissioning


The system must be started and commissioned by a qualified technician.

- The system must be charged with refrigerant and water flowing in the exchangers when it is turned on and tested.
- Power up the main board



- Check that the machine is configured for local control (regulator selection)

- Select the operating mode using the  button (chilled or hot water operation)
- Enter the setpoints for:  
Chilled water  
Hot water 

- Start the unit by pressing the on/off button 
- The internal safety devices are now activated. If one of these safety devices is triggered, trace the fault, reset the safety device if necessary and press the RESET button on the console to clear the fault.
- The unit can only be started after 2 minutes (time required to scan and enable all the safety devices). The control stages should operate in cascade mode based on the demand.

**Use either of the following to turn off the unit in non-emergency situations:**

- The On/Off button on the console
- A dry contact on the automatic operation control.

**Do not use the master switch as the electrical cabinet must remain powered on (antifreeze protection, crankcase heater).**

**NOTE:**

AQUACIAT 30WI machines operate using R410A. It is essential that technicians use equipment which is compatible with R410A.

## 16.2 Essential points that must be checked

### Compressors:

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

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

### Hydraulics:

As the exact total drop in system pressure is not known at commissioning, adjust the flow of water with the control valve until the desired nominal rate is obtained. By causing the pressure in the water system to drop, this control valve aligns the system pressure/flow curve with that of the pump so that the nominal flow rate corresponding to the desired operating point is obtained.

The pressure drop in the plate 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 2 hours to flush out any solid particles in the circuit.
- Read the pressure drop in the plate exchanger when the pump is switched on and then 2 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.
- Once the circuit has been flushed of all contaminants, read the pressure drop in the plate exchanger and compare it to the theoretical pressure drop selected.

If the reading is higher than the theoretical value, the flow rate is too high. In other words, the pump is delivering too much flow for the system load drop. Close the control valve one complete turn and read the load drop. Continue by gradually closing the valve until the nominal flow rate for the desired operating point is obtained.

However, if the system pressure drops far below 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 higher. This is why pressure drops must be minimised.

### Refrigerant charge:

Each unit is shipped with an exact charge of refrigerant. To make sure that the unit is filled with the correct charge of refrigerant, perform the following checks circuit by circuit with the system running at full capacity:

- Check the overheating value which must be between 6 and 9°C depending on the type of unit.
- Check the actual subcooling value at the condenser outlet. It must be between 5 and 8°C, depending on the type of unit.
- Check there are no bubbles in the liquid sight glass.

If the charge is too low, large bubbles will appear in the liquid sight glass, the suction pressure will drop and overheating on the compressor inlets will be high. Locate the leak, completely drain the refrigerant charge using a recovery machine, and fill the unit with a new charge. Repair the leak, pressure test the unit (do not exceed the maximum service pressure on the low-pressure end) then refill the unit. The refrigerant must be liquid and charged via the liquid charging valve. The amounts of refrigerant indicated on the data plate must be added to each circuit in the unit. Repeat these steps if the subcooling temperature is below the specified values.

**NOTE:**

An excessively low suction pressure or an excessively high condensation pressure may sometimes be read when commissioning the unit. These problems may have numerous causes. Refer to the "Troubleshooting operating problems" section for more information.

### → Operation with negative temperatures

To guarantee operation of the unit, it is essential to:

- adjust the regulator's safety parameters for the operating temperature.
- optimise the electronic expansion valve settings.
- adjust the refrigerant charge, checking that the subcooling values are between 5 and 8°C.

## 17 TECHNICAL AND ELECTRICAL SPECIFICATIONS

AQUASNAP 30WI			700 V	800 V	900 V	1000 V	1100 V	1200 V	1400 V	1600 V	1800 V	2100 V	2400 V	
Net cooling capacity ①		kW	217	251	288	327	356	385	443	499	582	657	713	
Net power input ②		kW	48.20	55.20	64.20	73.00	79.20	85.60	97.40	110.40	125.00	146.00	168.00	
EER/ESEER efficiency ③			4.50/5.53	4.55/5.59	4.48/5.48	4.48/5.38	4.49/5.44	4.50/5.47	4.55/5.44	4.52/5.34	4.66/5.64	4.51/5.48	4.24/5.34	
Sound power level ④	Lw/Lp Standard	dB(A)	89/57	90/58		89/57	90/58	91/59	95/63	96/64	93/61	95/63	97/65	
	Lw / Lp Low Noise	dB(A)	84/52	85/53		86/54	87/55	88/56	90/58	91/59	89/57	90/58	91/59	
	Lw/Lp Xtra Low Noise	dB(A)	79/47	80/48			81/49	82/50	85/53	86/54	85/53	86/54	87/55	
Compressor														
Type		Hermetic SCROLL (2900 rpm)												
Quantity		4									6			
Start-up mode		Direct in line in series												
Refrigerant oil type		POE 160SZ							POE 3MAF					
Oil capacity (circ.1 + circ. 2)		l.	6.7 + 6.7				6.7 + 7.2	7.2 + 7.2	6.3 + 6.3		6.3 + 6.3 + 6.3			
Number of refrigerating circuits		2												
Refrigerant		R410A												
CO2 equivalent tonne		tCO2Eq	52.20	58.46	66.82	75.17	83.52	89.78	85.61	93.96	112.75	127.37	141.98	
Refrigerant charge (circ. 1 + circ. 2)		kg	12.5 + 12.5	14 + 14	16 + 16	18 + 18	20 + 20	21.5 + 21.5	21 + 20	23 + 22	27 + 27	27 + 34	34 + 34	
Power control	Stage number		6	4	6	4	6	4	6	4	6	8	6	
	%		100-78-71-50-28-21-0	100-75-50-25-0	100-78-71-50-28-21-0	100-75-50-25-0	100-78-71-50-28-21-0	100-75-50-25-0	100-78-71-50-28-21-0	700-75-50-25-0	100-83-66-50-33-16-0	100-84-66-48-36-30-18-15-0	100-83-66-50-33-16-0	
Evaporator														
Number and type		1 brazed plate heat exchanger												
Water content		l	20	23	26	29	32	37	50	57	64	77	77	
Min / max water outlet temperature		°C	-12 °C / +18 °C											
Min/max water flow		m³/h	22/70	26/81	29/82	33/105	35/113	38/124	44/137	51/151	61/150	68/150	74/150	
Water connections		diameter	VICTAULIC DN 100			VICTAULIC DN 125					VICTAULIC DN 150			
Minimum system diameter		diameter	DN 100			DN 125					DN 150			
Max service pressure		bar	10 bar water side											
Water-cooled condenser														
Number and type		1 brazed plate heat exchanger												
Water content		l	23	26	29	32	37	40	55	61	73	77	77	
Min./max. water outlet temperature		°C	-0/+18°C											
Min./max. water flow		m³/h	19/64	22/74	25/84	28/95	31/103	33/112	38/129	43/143	52/150	59/150	66/153	
Water connections		diameter	VICTAULIC DN 100			VICTAULIC DN 125					VICTAULIC DN 150			
Max service pressure		bar	10 bar water side											
Dimensions and weight														
Storage temperature		°C	See section 1, "Introduction"											
Min. water volume		l.	636	880	844	1146	1043	1346	1286	1735	1262	1336	1595	
Height in operation ⑤		mm	1869						1887		1970			
Length		mm	2099						2499		3350			
Depth		mm	996											
Weight (empty)/weight (in operation)		kg	See page 5											
Power supply														
Compressor voltage		ph/Hz/V	3/50 Hz/400 V (+10%/-10%)											
Index of Protection		Machine IP 43/Electrics box IP 43												
Max. rated current		A	140	160	182	205	218	232	266	295	356	399	443	
Starting current		A	316	334	391	414	480	494	586	615	607	720	763	
Starting current, Soft Start option ⑥		A	230	248	287	310	352	366	429	453	483	562	605	
Breaking capacity		kA	40.5						61.5				70	
Max. wire cross-section		mm²	240											
Control circuit voltage		ph/Hz/V	1/50 Hz/230 V (+10%/-10%) - Transformer fitted											
Max. rated current		A	0.8						1.3					
Transformer capacity		A	160						250					

① Cooling capacities for chilled water temperature +12°C/+7°C and condenser hot water temperature +30°C/+35°C

② Compressor net power input

③ Net COP performance, EER or ESEER efficiency values

④ Lw: Overall sound power level as per standard ISO 3744.

Cable selection nominal current = Sum of maximum nominal currents in the above tables.


Lp: Overall sound pressure level measured at 10 metres in a free field, calculated using the following formula  $L_p = L_w - 10 \log(S)$

⑤ Height excluding handling mounts

⑥ Starting current of largest compressor + maximum current of other compressors under full load

## 18. SERVICING AND MAINTENANCE

### 18.1 AQUASNAP 30WI operating readings

Date/Time						
Compressor	Suction pressure	bar				
	Intake temperature	°C				
	Condensing pressure	bar				
	Condensing temperature	°C				
Water-cooled condenser	Discharge inlet temperature	°C				
	Liquid outlet temperature	°C				
	Water inlet temperature	°C				
	Water outlet temperature	°C				
Evaporator	Water inlet temperature	°C				
	Water outlet temperature	°C				
	Liquid inlet temperature	°C				
	Evaporator outlet temperature	°C				
Nominal voltage		V				
Voltage at terminals		V				
Compressor input current		A				
Oil level						
Frost protection trigger temperature		°C				
Mechanical inspection: tubes, fastenings, etc.						
Electrical connection tightness check						
Control check						
Water flow rate check		m³/h				
HP disconnection safety check		bar				

### 18.2 Unit maintenance and servicing

#### 19.2.1 Safety instructions

- Perform operating inspections in accordance with national regulations.
- Do not climb on the machine; use a platform to work at the necessary height.
- Do not climb on the copper refrigerant pipes.
- All work on the unit's electrical or refrigerant systems must be carried out by a qualified authorised technician.
- Any opening or closing of a shut-off valve must be carried out with the unit off.
- The liquid valve (located just before the dryer) must always be opened completely when there is refrigerant in the circuit.
- **Do not work** on any electrical components without first turning off the unit's **main disconnect switch** in the electrics box. Although the compressor(s) is (are) turned off, the

power circuit remains energised until the unit cutoff switch is opened. Other components may remain powered by external controllers connected to the orange disconnect terminals on the main terminal strip.

Disconnect the removable portion of these terminals before commencing any work.

- The surfaces of the compressor and pipes may reach temperatures of over 100°C and cause burns if touched. Likewise, the surfaces of the compressor may in some cases drop to freezing temperatures which can cause frostbite.
- It is therefore important to take special care when carrying out maintenance work.

- Technicians working on the unit must wear the necessary safety gear (e.g. gloves, eye protection, insulating clothing, safety shoes).

#### 19.2.2 Noise

It is also recommended that persons working near significant sources of noise wear ear protection.

This ear protection should not in any way impede the wearing of other protective equipment.

#### 19.2.3 Oil

Oils for refrigeration units do not pose significant health hazards if they are used in accordance with the precautions for use:

- Avoid unnecessary handling of components lubricated with oil. Use protective creams.
- Oils are inflammable, and must be stored and handled with care. Disposable rags or cloths used for cleaning must be kept away from open flames and disposed of in the appropriate manner.
- Containers must be stored with their caps on. Avoid using oil from an opened container stored under incorrect conditions.

#### 19.2.4 Refrigerants - general information

- Always remember that refrigeration systems contain pressurised liquids and vapours.
- All necessary measures must be taken when partially opening the system: Make sure that there is no pressure in the part of the circuit concerned.
- Partial opening of the primary refrigerant circuit will cause a certain quantity of refrigerant to be released into the atmosphere.
- It is essential to keep the amount of lost refrigerant as low as possible by pumping the charge and isolating it in another part of the system.
- The refrigerant and lubricating oil, and the low-temperature liquid refrigerant in particular, may cause inflammatory lesions similar to burns if they come into contact with the skin or eyes. Always wear protective eyewear, gloves and other protective equipment when opening pipes or tanks liable to have liquids in them. Store unused refrigerant in the appropriate containers and limit the amounts stored in mechanical rooms.
- Cylinders and tanks of refrigerant must be handled with care and signs warning users of the related poisoning, fire and explosion hazards must be clearly visible. Refrigerant that reaches the end of its life must be collected and recycled in accordance with applicable regulations.

#### 19.2.5 Halocarbon and hydrofluorocarbon refrigerants

Although non-toxic, vapours from halocarbon and hydrofluorocarbon refrigerants are still hazardous because they are heavier than air and can force the latter out of the machine rooms.

If refrigerant is accidentally released, ventilate the room with fans. Exposure levels in workplaces must be kept to a practical minimum and must never exceed the recognised limit of 1000 ppm for an 8-hour working day and a 40-hour working week.

Although halocarbon and hydrofluorocarbon refrigerants are not flammable, keep them away from open flames (e.g. cigarettes, etc.), as temperatures of over 300°C cause their vapours to break down and form phosgene, hydrogen fluoride, hydrogen chloride and other toxic compounds. These compounds may produce severe physiological consequences if accidentally inhaled or swallowed.

**Warning:** Do not expose vapours and zeotropic blends of refrigerants containing R32 to open flames (such as cigarettes). Refrigerants must be evacuated from pipes and tanks before commencing any cutting or welding work. Do not use a torch to check for leaks of refrigerants containing halocarbons such as R410A, and its by-products.

**NOTE:** AQUACIAT 30WI machines operate using R410A. It is essential that technicians use equipment which is compatible with R410A with a working pressure which is approximately 1.5 times higher than that of units using R407C.

#### 19.2.6 Servicing

- Note down the operating readings and perform the checks indicated in the table on the previous page at least twice a year and each time a unit is started up.

##### • Weekly checks

With the unit running at full capacity, check the following values:

- Check the entire system for traces of water/oil under or around the unit and for any unusual noises.
- LP compressor suction pressure,
- HP compressor discharge pressure,
- The water inlet and outlet temperatures in the exchangers
- The charge via the liquid sight glass and the condition of the charge using the coloured indicator on the sight glass
- The oil level and its appearance. If the colour changes, check the quality.
- Keep the unit clean
- Also check whether the safety devices operate correctly.

##### • Monthly checks

- Check all the values listed in the "Operating readings" table on the previous page.
- Perform a corrosion check on all the metal parts. (Frame, casing, exchangers, electrical boxes etc.)
- Make sure that the insulating foam is not detached or torn.
- Check the energy transfer fluids for any impurities which could cause wear or corrosion in the exchanger.
- Check the circuits for leaks.
- Check whether the safety devices and the expansion valve(s) operate correctly

### • Annual checks

- Carry out the same inspections as during the monthly checks.
- Test the oil for contaminants: if acid, water or metal particles are detected in the oil, replace it in the corresponding circuit and the dryer.
- If the whole oil load is being changed, use only new oil of the same grade as the original oil, which has been stored in a hermetically sealed container until loading. Oil type: (see section 12 Main components of the refrigerating circuit).
- Check the filter dryer for clogging (measure the difference in the temperature of the pipes at the dryer inlet and outlet).
- Clean the water filter and vent air from the circuit.
- Clean the exchangers and check the pressure drop in each.
- Check the operation of the water flow switch.
- Check the water quality or condition of the coolant.
- Check the antifreeze concentration (MEG or PEG)
- Disconnect all the cables and check the insulation of the motor and the resistance of the windings.
- Check the electrical connections to ensure they are tight and in good condition.

- Check the condition of the contacts and the current at full load on all three phases

- Check the electrical box for water seepage.

NB: The cleaning intervals are given as a guide and should be adapted to each installation.

### 19.2.7 Disassembling the compressor

The compressor is fastened to the platform by four dia. 8 mm screws.

**Caution:** If you do not have a torque wrench when tightening these screws, you should only tighten them until they are snug and then tighten a further  $\frac{3}{4}$  turn.

#### IMPORTANT:

**To ensure your unit runs smoothly and to obtain service under the warranty, take out a maintenance contract with your installer or an approved maintenance company.**

## 19 ECODESIGN

The sealing test must be carried out in compliance with EC regulation no. 517/2014 relating to certain greenhouse gases.

R410A, R134a and R407C are refrigerant gases with the following environmental impact:

1/ No impact on the ozone layer.

They have an ODP (Ozone Depletion Potential) index of 0

2/ Impact on the greenhouse effect: Global Warming Potential (GWP) of each gas.

- R410A ----- GWP = 2088

- R407C ----- GWP = 1800

- R134a ----- GWP = 1430

- Users must ensure that periodic leak testing is carried out by qualified personnel based on the number of tonnes of CO<sub>2</sub> equivalent:

		≥ 5 tCO <sub>2</sub> eq	≥ 50 tCO <sub>2</sub> eq	≥ 500 tCO <sub>2</sub> eq
Frequency of check	Without leak detection system	Every 12 months	Every 6 months	Every 3 months
	With leak detection system	Every 24 months	Every 12 months	Every 6 months
Refrigerant charge*	R410A (GWP = 2088)	≥ 2.39 kg	≥ 23.9 kg	≥ 239 kg
	R407C (GWP = 1800)	≥ 2.77 kg	≥ 27.7 kg	≥ 277 kg
	R134a (GWP = 1430)	≥ 3.49 kg	≥ 34.9 kg	≥ 349 kg

\* To find out the refrigerant charge and the number of tonnes of CO<sub>2</sub> equivalent, refer to the technical characteristics in the unit's instruction manual.

- Users of any system subject to leak testing are required to keep a log of the quantities and types of fluids used, (added or recovered), and to include the dates and results of leak tests, as well as the name of the technician and the technician's company.

- A leak test must be carried out one month after any leak repairs.

- System users are responsible for collecting used refrigerant and having it recycled, regenerated or destroyed.

## 20 PERMANENT SHUTDOWN

### ➤ Shutting down

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

### ➤ 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.

### ➤ Fluids to be recovered for treatment

- R410A refrigerant
- Heat-transfer medium: depending on the installation, water, glycol/water mix, etc.
- Compressor oil

### ➤ Materials to be recovered for recycling

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

### ➤ Waste electrical and electronic equipment (WEEE)

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

Please refer to the legislation in force and the specific solutions available to ensure your waste is processed legally.

## 21 TROUBLESHOOTING OPERATING PROBLEMS

Initial advice:

- Faults detected by the safety devices are not necessarily caused by a sudden change in the measurement being monitored.
- Taken regularly, readings should make it possible to anticipate future trips.
- Perform the checks listed in the table below (next page) if you notice that a measurement deviates from its normal value and gradually moves closer to the safety limit.

**Important:** First and foremost, bear in mind that most faults potentially occurring on the units have simple causes that are often the same for all. Look for these causes first.

There are three such causes in particular:

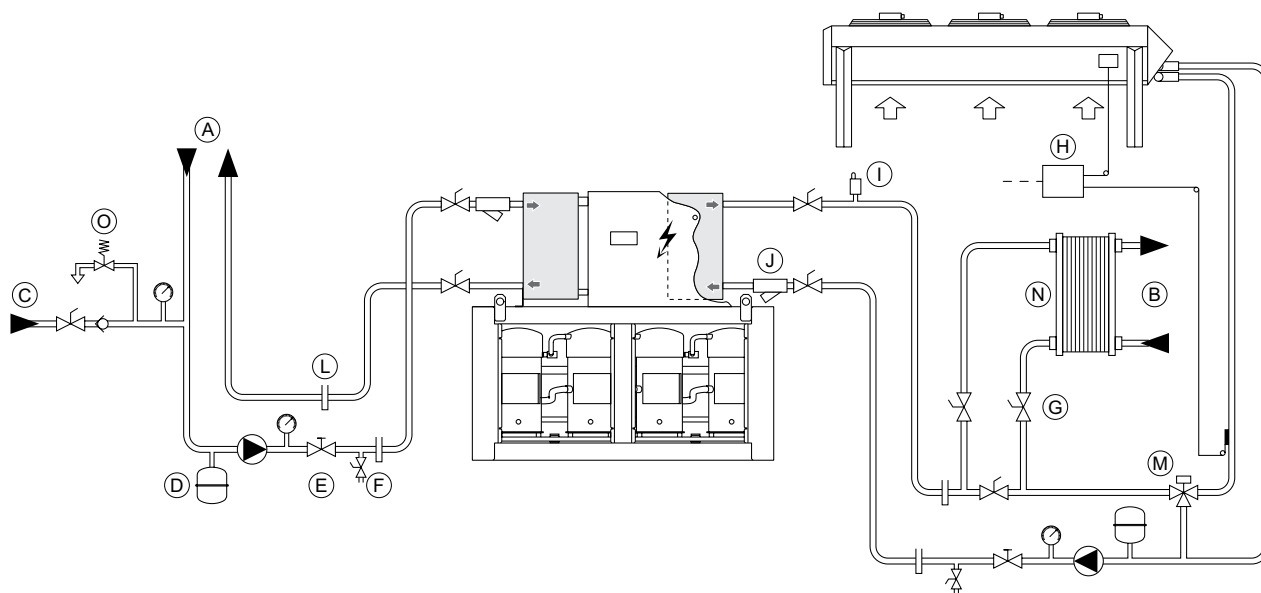
- The fouling level of the exchangers
- Problems with the fluid circuits
- Failures of electric components such as the relay coil or the electric valve etc.

Faults	Probable causes	Instructions
<b>Suction pressure too low</b>	<ul style="list-style-type: none"> <li>- Air in the chilled water circuit.</li> <li>- Chilled water flow insufficient.</li> <li>- Chilled water flow rate sufficient but chilled water temperature too low.</li> <li>- Lack of refrigerant fluid.</li> </ul>	<ul style="list-style-type: none"> <li>- Purge the chilled water circuit.</li> <li>- Check the opening of the chilled water circuit valves.</li> <li>- Check the direction of rotation of the pump, that there is no cavitation and that the pump is not too small.</li> <li>- Recalculate the heat load and check that the unit is not too powerful for this load.</li> <li>- Check the operation of the regulator.</li> <li>- Trace the leak(s) and top up the charge.</li> </ul>
<b>Excessive discharge pressure</b>	<ul style="list-style-type: none"> <li>- Air in the hot water circuit.</li> <li>- Hot water flow rate insufficient.</li> <li>- Cooling water flow rate sufficient but water temperature too high.</li> <li>- Tower or drycooler operating incorrectly.</li> <li>- Condenser fouled or scaled.</li> <li>- Too much refrigerant</li> </ul>	<ul style="list-style-type: none"> <li>- Drain the hot water circuit.</li> <li>- Check the opening of the hot water circuit valves.</li> <li>- Check the direction of rotation of the pump, that there is no cavitation and that the pump is not too small.</li> <li>- Recalculate the heat load and check that the unit is not too powerful for this load.</li> <li>- Check correct operation of the regulator and setpoint adjustment.</li> <li>- Check the operation of the tower or drycooler</li> <li>- Check the cooling water temperature control.</li> <li>- Clean the condenser tubes.</li> <li>- Check and adjust the load.</li> </ul>
<b>Insufficient oil</b>	<ul style="list-style-type: none"> <li>- Oil not topped up after servicing</li> </ul>	<ul style="list-style-type: none"> <li>- Top up with oil.</li> </ul>
<b>Water flow fault</b>	<ul style="list-style-type: none"> <li>- Water flow is either stopped or below the minimum rate.</li> </ul>	<ul style="list-style-type: none"> <li>- Check that the valves on the water circuit open and check the pump(s).</li> </ul>
<b>Motor winding fault</b>	<ul style="list-style-type: none"> <li>- Start-ups too close together; short-cycle protection disrupted.</li> <li>- Overload protection disrupted or defective.</li> <li>- Power supply voltage too low.</li> </ul>	<ul style="list-style-type: none"> <li>- Set the correct time between two start-ups.</li> <li>- Adjust or replace the overload protection.</li> <li>- Check the electrical wiring; if need be, contact your electricity supplier</li> </ul>
<b>Fluid outlet temperature too high</b>	<p><b>a) With above-normal low pressure</b></p> <ul style="list-style-type: none"> <li>- Controller setpoint incorrect</li> <li>- Heat load above unit capacity.</li> <li>- Water flow rate too high</li> </ul> <p>- Electronic control faulty.</p> <p><b>b) With below-normal low pressure</b></p> <ul style="list-style-type: none"> <li>- Lack of refrigerant</li> <li>- Incorrect refrigerant supply to evaporator</li> </ul>	<ul style="list-style-type: none"> <li>- Correct the setpoint value</li> </ul> <p><b>Two solutions:</b></p> <ul style="list-style-type: none"> <li>- Adjust the water flow rate to the specified value using the control valve.</li> <li>- Bypass the evaporator to obtain a greater difference in temperature with a lower flow rate to the evaporator.</li> <li>- Check the operation of the temperature and power controllers</li> <li>- Look for leaks and top up the load.</li> <li>- Check the expansion valve.</li> <li>- Ensure that the dehumidifier filter is not clogged and that the evaporator is not frozen</li> </ul>
<b>Discharge temperature insufficient and close to condensing temperature</b>	<ul style="list-style-type: none"> <li>- The compressor draws in too much liquid</li> </ul>	<ul style="list-style-type: none"> <li>- Check and adjust the refrigerant load</li> <li>- Check the expansion valve</li> </ul>
<b>Moisture indicator sight glass</b>	<ul style="list-style-type: none"> <li>- The sight glass remains yellow: Excessive moisture in the circuit.</li> </ul>	<ul style="list-style-type: none"> <li>- Refer to section 12, "Main components of the refrigerating circuit".</li> </ul>



## 22 SCHEMATIC INSTALLATION DIAGRAM

### 23.1 Cooling installation with drycooler

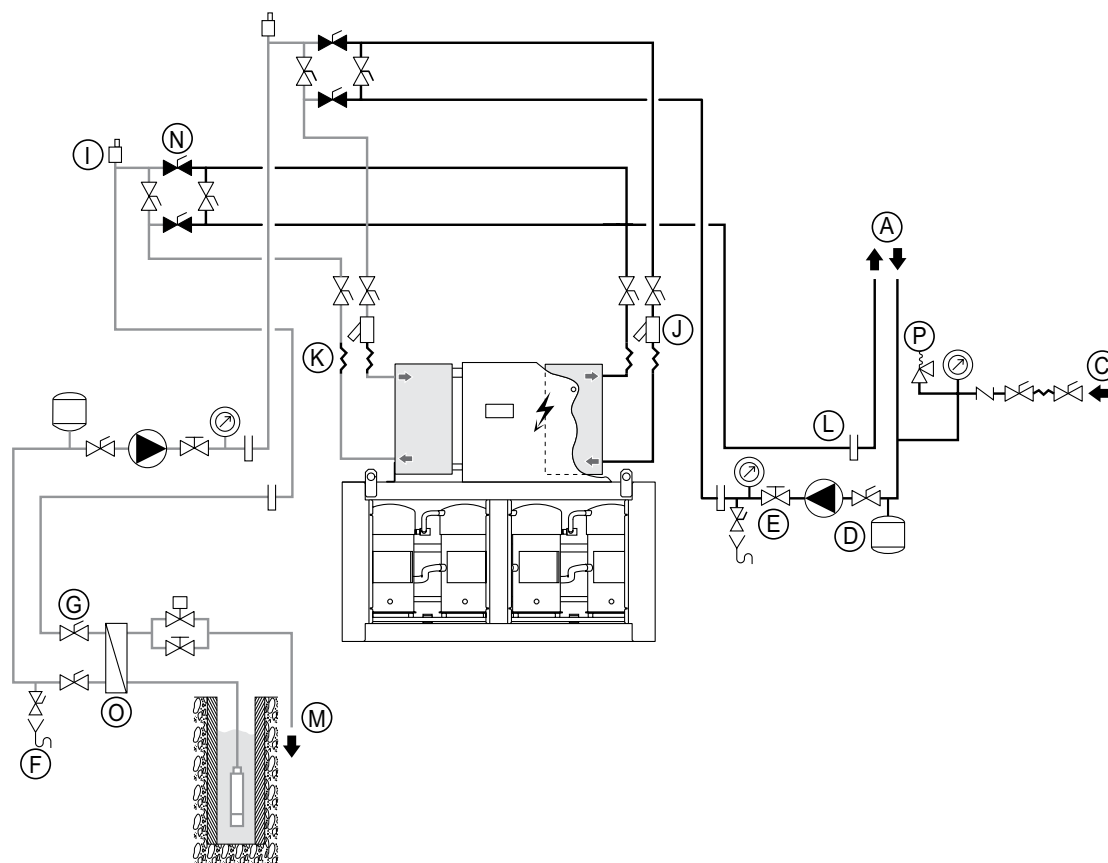


**A** : Chilled water circuit  
**B** : Recovery water circuit  
**C** : Water filling  
**D** : Expansion vessel  
**E** : Control valve

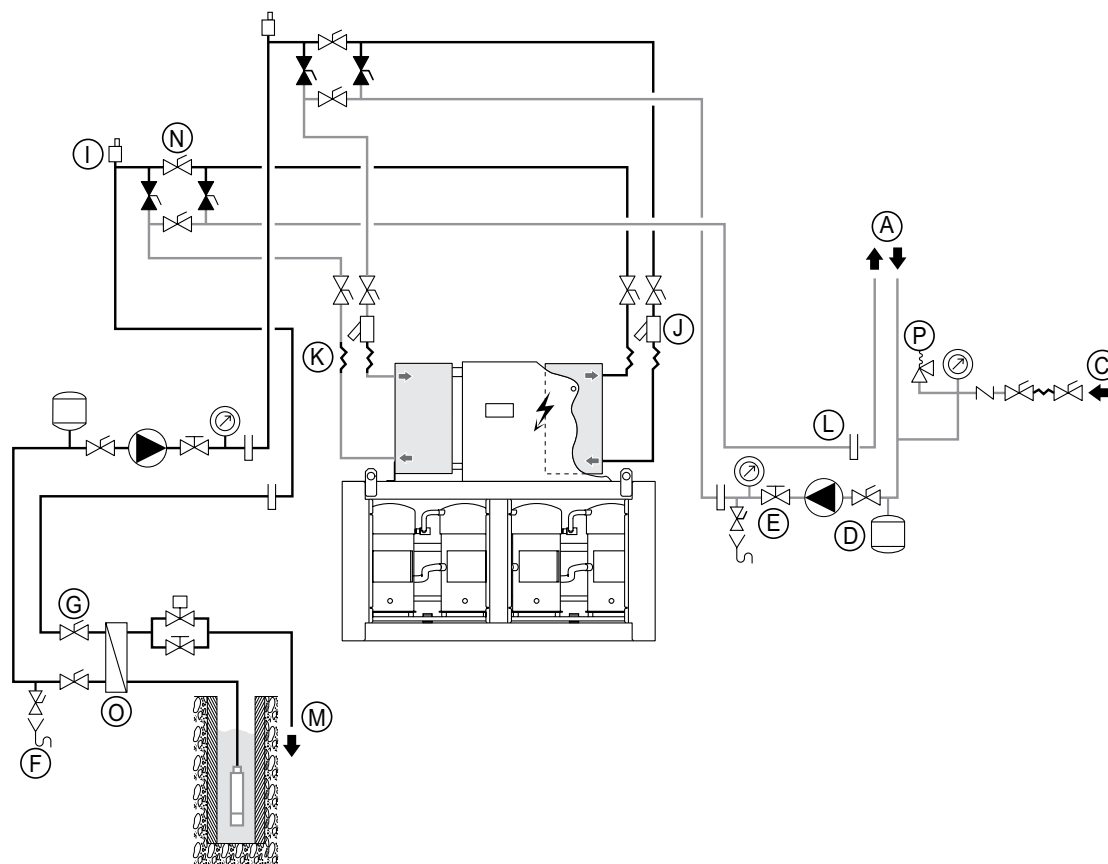
**F** : Drain  
**G** : Shut-off valve  
**H** : Temperature controller  
**I** : Air bleed  
**J** : Water filter (Compulsory)

**K** : Water hoses  
**L** : Thermowell  
**M** : Hydraulic 3-way valve  
**N** : Cleanable heat exchanger  
**O** : Safety valve

## 23.2 Cooling mode (Heating and cooling)



## 23.3 Heating mode (Heating and cooling)



**A:** Chilled water or hot water circuit

**C:** Water filling

**D:** Expansion vessel

**E:** Control valve

**F:** Drain

**G:** Shut-off valve

**I:** Air bleed valve

**J:** Water filter (compulsory)

**K:** Water hose (compulsory)

**L:** Thermowell

**M:** Well discharge

**N:** Hydraulic valve

**O:** Cleanable exchanger

**P:** Safety valve





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