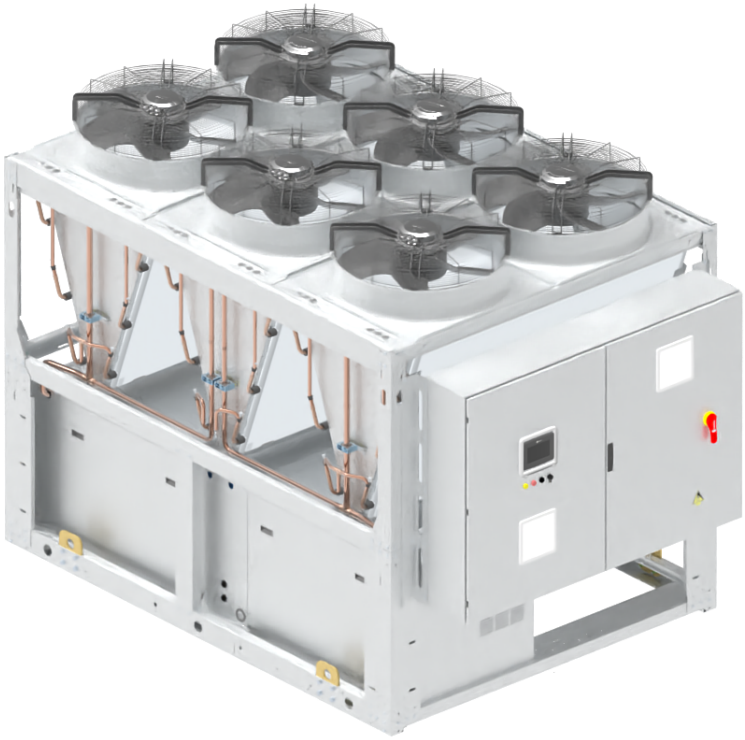
Installation, Operation, and Maintenance

ASCO 050-070

Air-cooled Liquid Chillers with
Scroll Compressors
150 – 260 kW
R290



⚠ WARNING

This unit uses R290 flammable refrigerant (propane). Only experienced, responsible personnel are allowed to use the unit; incorrect use may lead to serious harm to people and damage to property.

July 2025

CG-SVX072A-GB

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CHAPTER 1

GENERAL INFORMATION

1.1 Terminology

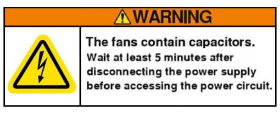
The machines described in this manual are called “CHILLERS”.
This manual is written for those responsible for the installation, use and maintenance of the unit.
These units have been designed to cool a liquid flow.
In most applications, the liquid to be cooled is water and the term “WATER” will be used even if the liquid to be cooled is different from water (for example mixtures of water and ethylene or propylene glycol).
The liquid to be cooled must be compatible with the materials used. This analysis must be made before purchasing or installing the unit.
Here below the term “PRESSURE” will be used to indicate the gauge pressure.

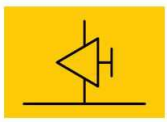
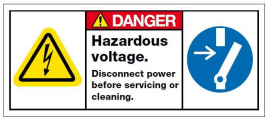
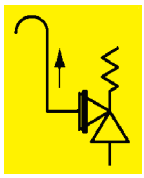
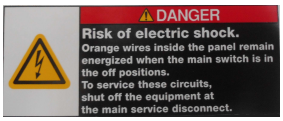
CAUTION

This manual provides the user, installer and maintenance technician with all the technical information required for installation, operation and carrying out routine maintenance operations to ensure long life.
Use only original spare parts for repairs and replacements. Requests for SPARE PARTS and for any INFORMATION concerning the unit must be sent to the distributor or to the nearest service centre, providing the MODEL and SERIAL NUMBER shown on the machine data plate and in this manual.

1.2 Symbols

The following symbols are shown on the stickers on the unit as well as on the overall dimension drawing and refrigeration circuits in this manual. Their meaning is the following:

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	Machine water-inlet		Machine water outlet
	Water inlet to the desuperheater (only if present)		Water outlet from the desuperheater (only if present)
	Indication of the axis of reference for lifting operations		Unit drain point
	Electrocution risk		Cooling air flow
	Direction of flow of refrigerant fluid		Rotation direction of pump and fans
	The fans contain condensers. After disconnecting the electricity supply, wait at least 5 minutes before accessing the power circuit.		Risk of injury due to sharp edges

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	If the product is marked with this symbol, this means that the electric and electronic products cannot be disposed of together with non-separated domestic waste.		Air bleed valve
	Moving parts can cause damage. Do not operate with guards removed. Follow lockout procedure before servicing.		Risk of burns from contact with high-temperature surfaces
	Hazardous voltage. Disconnect power before servicing or cleaning.		Safety valve discharge
	Attention: the unit contains R290 flammable refrigerant (propane)		Unit with nitrogen pre-charge (see 9.2.4 “Coolant charging procedure”)
	Electric shock risk. The orange wires in the panel remain live when the main switch is in the off position. To repair these circuits, switch off the appliance from the mains disconnecting switch.		System charged with flammable refrigerant R290. After positioning the machine and before unpacking, check that there are no refrigerant leaks using a specific gas detector. Check that there are no sources of ignition/open flames/sparks etc. within the safety zone. Do not smoke near the unit. (see ch. 4.2 “Installation precautions”)

1.3 How to interpret the model

MODEL	DESCRIPTION
ASCO ◊◊◊/◊◊◊	Machine version (SN, LN, XLN) Nominal power of compressor expressed in HP Model ASCO with R290

1.4 How to interpret the codes

/SN	Noise operation value: Standard Noise. Fully cased compressor compartment.
/LN	Noise operation value: Low Noise. Fully cased compressor compartment with the addition of soundproofing hood on the compressors.
/XLN	Noise operation value: Extra Low Noise. Cased compressor and acoustically insulated compartment with the addition of soundproofing hood on the compressors.

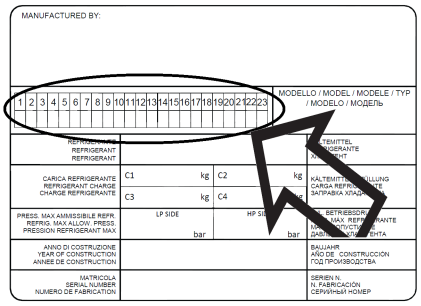
1.5 Data plate

The data plate attached to the machine shows the main technical data.

MODEL and CODE	Identifies the size of the machine (see Chapter 1 “General Information”) and the type of construction which distinguishes it.
OPERATING MANUAL	Code number of this manual.
SERIAL NUMBER	Unit serial number or manufacturing number.
YEAR OF CONSTRUCTION	Year of unit's final testing.
VOLTAGES/PHASES/ FREQUENCY	Power supply specifications.
MAX. CONSUMPTION	Unit current input in limit working conditions
POWER INSTALLED	Unit power input in limit working conditions
PROTECTION LEVEL	Protection level of the entire machine, according to European Standard EN 60529.
ELECTRICAL DIAGRAM	Indicates the electrical diagram number.
REFRIGERANT	This is the refrigerant fluid in the unit.
GLOBAL WARMING POTENTIAL	Global warming potential.
REFRIGERANT CHARGE	Amount of refrigerant fluid in the system.
MAX. REFRIG. MAX. HP SIDE (PS)	This is the design pressure of the HP side refrigeration circuit.
MAX. REFRIG. MAX. LP SIDE (PS)	This is the design pressure of the LP side refrigeration circuit.
PERMITTED TEMP. HP SIDE (TS)	Cooling circuit design temperature (high pressure side).
PERMITTED TEMP. LP SIDE (TS)	Cooling circuit design temperature (low pressure side).
FLUID CIRC. OF USE	Fluid cooled or heated by the machine (usually: water).
MAX. PRESSURE ALLOWED (PS)	Max. design pressure of the circuit.
PERMITTED TEMPERATURE (TS)	Min. and max. design temperature of the circuit (not to be confused with the maximum operating temperature, defined at the project quote stage).
SOUND PRESSURE LEVEL	Free field sound pressure level in hemispherical radiation conditions (open field) at a distance of 1m from the condenser side of the unit and a height of 1.6m from the ground.
AMBIENT TEMPERATURE	Air minimum and maximum temperature values.
WEIGHT	Weight of the unit.

1.6 How to interpret the alphanumeric string

The alphanumeric string-code is reproduced on the metallic plate on the manual.



The empty alphanumerical string is circled in the adjacent figure; each position in the upper row is associated with an alphanumeric value in the lower row (0, 1, 2, A, B, etc.) and each character is associated with a specific feature of the unit.

	POS.	VALUE	DESCRIPTION
VERSION	1-2-3	SN	SN
		LN	LN
		XLN	XLN
COMPRESSOR CONTROL	4	A	ON/OFF
VOLTAGE	5	0	400/3/50
REFRIGERANT	6	B	R290
SYSTEM COOLANT LOAD	7	0	LOAD COMPLETE
		1	PRESSURISATION IN NITROGEN
EVAPORATOR	8	A	PLATE EVAPORATOR
UNIT AMBIENT TEMPERATURE	9	0	STANDARD
		1	-20°C
HYDRAULIC UNIT	10	0	NONE
		1	P2
		2	P2+P2
		3	TANK+P2
		4	TANK+P2+P2
		6	P3
		7	P3+P3
		8	TANK+P3
		9	TANK+P3+P3
		T	VF P2
		V	VF P2+P2
		X	TANK+VF P2
		Z	TANK+VF P2+P2
		K	VF P3
		Q	VF P3+P3
		J	TANK+VF P3
		R	TANK+VF P3+P3
HEAT RECOVERY	11	0	NO
		4	DESUPERHEATER 20%
FAN CONTROL	12	4	EC BRUSHLESS FANS
		6	HIGH PRESSURE EC FANS
EVAP. ANTIFREEZE PROTECTION	13	0	NO
		1	YES
COMPRESSOR START-UP	14	0	DIRECT
		2	SOFT STARTER
		5	DIRECT + STATIC SHUNT CONDENSERS
METERING	15	0	NO
		1	ENERGY METER
COMPRESSOR TAPS	16	0	NO
		1	YES
CONDENSING COILS TYPE	17	B	MICRO-CHANNEL COIL

	POS.	VALUE	DESCRIPTION
CONDENSING COILS PROTECTION	18	0	NONE
		1	FILTERS
		2	WIRE MESH
		4	FILTERS + WIRE MESH
PREPAINTED CONDENSING COILS	19	0	NO
		1	YES
MACHINE ENCLOSURE PANELS	20	0	NO
		5	COIL PROTECTION PANELS
PRODUCT TYPE	21	0	STANDARD
		X	SPECIAL

1.7 Performance

The performance of the unit depends mainly on the flow rate and temperature of chilled water and ambient temperature.
Performance values are defined at the time of the contract, refer to the offer data if necessary.

1.8 Sound level measurements

CAUTION

⚠ In case of sound pressure levels exceeding 80dB(A) during maintenance of the installation, the maintenance technician must be provided with appropriate PPE.

Model	ASCO 050			ASCO 060			ASCO 070		
Version	SN	LN	XLN	SN	LN	XLN	SN	LN	XLN
Lp dB(A) *	76	74	72	78	76	74	78	76	74
Lw dB(A) **	89	87	85	91	89	87	91	89	87

* at distance of 1 m
** global

Test conditions
Noise levels refer to operation of the unit at full load in nominal conditions. Values with tolerance of +/- 2 dB.
Sound pressure level in hemispherical irradiation conditions at a distance of 1m from the condenser side of the unit and height of 1.6m from the ground.
Sound power level: in accordance with ISO 3744.

CHAPTER 2

SAFETY

This system is designed for safety in its intended use, provided it is installed, commissioned, and serviced in compliance with the instructions given in the present manual.
The company excludes any contractual and non-contractual liability for damage caused to people, animals or property, due to installation, adjustment and maintenance errors, improper use or partial or superficial reading of the information contained in this manual.

CAUTION

⚠ All persons who interact with the system must be informed of the indications, regulations and prescriptions given in this manual.

Pay special attention when working on the unit: the unit contains electrical components that operate at mains voltage and also moving parts such as fan units.
It must therefore be isolated from the electricity supply network before being opened.
Any maintenance operation that is outside the usual interventions must be carried out by authorised operators that are informed and trained on the specific risks of flammable gases according to good practices and/or current standards in accordance with ANNEX HH IEC 60335-2-40.
Keep unauthorized persons (e.g. children) away from the place of installation of the unit.

2.1 General information

When handling or servicing the unit, personnel must work safely and comply with the prescriptions concerning health and safety in the installation site.

CAUTION

⚠ Personnel must be authorised, informed and trained on the specific risks from flammable gases according to good practices and/or current regulations in accordance with ANNEX HH IEC 60335-2-40.

CAUTION

⚠ Numerous accidents that occur during operation and maintenance of the units are caused by failure to comply with basic safety rules or precautions.

An accident can often be avoided by recognising a situation that is potentially hazardous.
The user must ensure that all personnel involved in operating and servicing the unit **have read and understood** all the warnings, precautions, prohibitions and notes given in this manual and attached to the machine.
Improper operation or maintenance of the unit and auxiliary equipment could be dangerous and result in an accident causing injury or death.
It is not possible to cover all possible circumstances that could feasibly give rise to potential hazards for persons.
The warnings in this manual are therefore not all-inclusive.
If the user adopts operational procedures or uses tools or working procedures that are not specifically recommended, care must be taken to ensure that the unit and the auxiliary equipment are not damaged or made unsafe and that no risks emerge in relation to persons or property.

CAUTION

⚠ Use exclusively suitable methods that offer the maximum environmental respect in daily operation, routine or supplementary maintenance, and at the time of decommissioning of the system.

Any improper conduct or incorrect use of the unit by the user automatically releases the manufacturer from all liability for possible damage, injury and/or accidents affecting persons or property.
Arbitrary modifications made to the unit will automatically invalidate all forms of guarantee provided by the manufacturer.

WARNING

⚠ The hot / cold water produced by units cannot be used directly for domestic hygiene or food applications.

In the case of such applications, the installer is responsible for fitting an intermediate exchanger.
If the intermediate exchanger is not fitted, the installer should affix a notice stating “non-drinking water”.

2.2 Instructions for the user

The machines must be installed in safe places, free of areas with potentially explosive atmospheres. They must be connected to electrical systems designed according to current standards, in areas compliant with the standards imposed by the Fire Brigade and in environments compliant with local building standards.
Within the potentially explosive areas generated by the machine, also taking into account the national regulations of the country of use, it is necessary to:

- Do not install equipment that is unsuitable for use in these potentially explosive zones (the minimum requirements of the equipment are: 3G IIB T4);
- Avoid naked flames, sparks and hot works;
- Avoid the presence of sources of ignition due to processes that may generate remote triggers (ionising and non-ionising radiation);
- Avoid the direct and indirect effects of lightning;
- Avoid electrostatic charges;
- Avoid interference with potentially hazardous elements such as drains, openings in the earth, basements, power lines, stores of flammable substances, railways, motorways etc.

As the refrigerant gas used is heavier than air, even a small gas leak, which in itself is not dangerous, can cause a build-up of gas if it infiltrates into underground areas, forming pockets.
A suitable “safety” distance should be assured also for chilling systems installed outdoors, in order to minimise the risk that flammable concentrations enter premises occupied by humans (e.g. through windows, ventilation openings, where people meet outdoors, etc.). However, external wind speeds tend to be quite high (compared to indoor environments) even when the air seems “still”, so also the amount of flammable mixture should be adjusted to consider the additional dispersion caused by the surrounding air.

WARNING

⚠ The safety zone/area around the machine must be at least 3 meters. Potentially explosive atmospheres may build up inside this area, and it is therefore necessary to avoid sources of ignition, as defined in standard EN378-2.

For installation precautions refer to paragraph 4.2 “Installation precautions”.

2.3 Safety aspects relating to maintenance

WARNING

⚠ Maintainers working on the electrical components or on the components of the refrigerant circuit must be authorised, informed and trained on the specific risks from flammable gases according to good practices and/or current standards in accordance with ANNEX HH IEC 60335-2-40.

Electrostatic charge may build up if refrigerant is leaked into a potentially explosive atmosphere.
To avoid this build-up, antistatic clothing (complying with Standard EN 1149-5) must be worn during machine inspection and maintenance.

DANGER

⚠ **Never use sharp tools to clean the condensing coil. The chiller contains flammable refrigerant.**

Do not clean the chiller with detergent liquid at temperatures greater than 50°C. A temperature greater than that which has been indicated could result in excess pressure inside the cooling circuit, which in turn could cause the refrigerant safety valve to open.
All repairs of the refrigerant circuit must be carried out by authorised, informed and trained operators on the specific risks of flammable gases according to good practices and/or current standards in accordance with ANNEX HH IEC 60335-2-40.

The maintenance operator must also be:

- trained and familiar with the equipment and the installation (including the refrigerant used)
- aware of the potential risks present in explosive atmospheres, and therefore able to prevent them
- knowledgeable of the work procedure, in order to avoid - as far as possible - the risk of inflammable refrigerant being leaked into the atmosphere

In the case of extraordinary maintenance operations, the refrigerant circuit must be emptied using a machine suitable for recovering the type of flammable refrigerant in question. During the course of these operations, the surrounding area must be properly ventilated and monitored with the aid of a leak detection device.
In order to avoid creating potential ignition sources, only roller pipe cutters should be used to open the refrigerant circuit.
All subsequent brazing operations must be carried out by authorised operators, informed, trained and trained on the specific risks of flammable gases according to good practices and/or current standards in accordance with Annex HH IEC 60335-2-40 and taking care to flush the refrigeration circuit with nitrogen. The maintenance operations must be carried out in accordance with the national standards and regulations relating to explosive atmospheres (e.g. reference to the **EN 1127-1 standard**).

2.4 General precautions

2.4.1 Liquids in the circuit

The liquids in the circuit must be compatible with the materials that make up the hydraulic circuit of the machine.
The use of suitable chemical additives (contact your glycol supplier) is very important even in the case of glycol mixtures, to protect the machine materials from the risk of corrosion caused by the chemical deterioration that glycol is susceptible to.
If the liquids in the circuit contain dangerous substances (e.g. ethylene glycol), any leaking liquid must be collected up to prevent any harm to the environment.
Furthermore, when the unit will not be used for a long period, dangerous liquids must be disposed of by firms specialised and authorised for treating them.

2.4.2 Characteristics of the recommended glycol

Product identification: **MONOPROPYLEN GLYCOL PROPANE**-1,2-DIOL
Below are the characteristics of propylene glycol:

Appearance:	Liquid
Colour:	Colourless
Odour:	Odourless
Melting point/range: (1013 hPa)	-68°C
Boiling point/range: (1013 hPa)	185°C
Autoflammability:	371°C
Flash point:	101°C
Lower explosion threshold:	2,6 Vol-%
Upper explosion threshold:	12,6 Vol-%
Vapour pressure: (20°C)	0,1 hPa
Density: (20°C)	Data not available
Bulk density: (20°C)	1,036 kg/m^3
Solubility in water: (20°C)	Soluble
Soluble in:	Polar solvents
PH value:	Neutral
Viscosity: (20°C)	46 mPa.s

2.4.3 Transporting the unit

The unit must be transported in full compliance with local legislation. The maximum quantity of refrigerant that can be transported will be determined by the applicable transport regulations.

For shipping methods, the international directives ADR, IMDG and IATA are of reference. For road transport in Europe the European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR) shall apply. This regulation allows a partial exemption provided that the total amount of refrigerant carried on the same truck does not exceed 1000 points (1 kg of A3 corresponds to 3 points, 1 kg of A1 corresponds to 1 point). For example, a truck could be loaded as follows:

- 10 units with 100 kg of R410 per unit => Total Points: 1000
- 10 units with 33 kg of R290 per unit => Total Points: 990≤1000
- 4 units with 200 kg of R410 per unit + 2 units with 33 kg of R290 per unit => Total Points: 998≤1000

To take advantage of this partial exemption from ADR, some simple requirements must be respected, including (non-exhaustive list):

- that the means of transport is equipped with a fire extinguisher of at least 2 kg of powder
- that the means of transport is equipped with a non-sparking torch
- that the correct ADR marking and labelling is placed on the outer packaging of the equipment (a red class 2 label with a minimum side of 10 cm and the number UN 3358 with characters of minimum height of 12 mm)

Refrigerating machines and refrigerating machine components are not subject to ADR requirements if they contain less than 12 kg of gas or if the units are charged with nitrogen under pressure of less than 2 barg.

The unit, if equipped with pressure relief valves, could release refrigerant if exposed to high temperatures. The transport temperature must not exceed 50°C.

In the case of road-sea shipments, the ADR Agreement for road transport and the IMDG code for maritime transport are applicable. The provisions of the IMDG generally prevail over those of the ADR. For maritime transport some limitations may apply and the partial exemption of 1,000 points provided for by the ADR is not applicable, please contact the shipping company.

Transport of refrigerant-laden units by area is not allowed.

2.4.4 Precautions upon receipt of the machine

Upon receipt, check the integrity of the machine considering that the machine has been shipped in perfect condition.
Check the supply of all the accessories supplied.
In case of shortages or damage, inform the sales department as soon as possible and fill out a written report complete with photographs.

2.4.5 Lifting and transport precautions

The lifting and transport operations must be carried out by properly qualified expert personnel, with all necessary precautions and protections (active and passive, such as protective gloves, protective helmet) in order to work in complete safety.
Check all chains, hooks, shackles and slings are in good condition and are of the correct capacity.
They must be tested and approved according to local safety regulations.
Cables, chains or ropes must never be applied directly to lifting eyes.

NOTES

The lifting material is not furnished with the unit.

Always use an appropriate shackle or hook properly positioned. Make sure the lifting cables don't form sharp bends.
Use a spreader bar to avoid side loads on hooks, eyes and shackles. When a load is lifted from the ground, keep well clear of the area beneath it and the surrounding area. Keep lifting acceleration and speed within safe limits and never leave a load hanging on a hoist for longer than is necessary.
All unit models have different weights according to the model.
Please see Technical Catalogue or the data plate applied on the casing for weight data.
Handling is possible with the aid of 1 linear lifting beam.
The following material is necessary:

- no. 4 belts with a minimum capacity of 5t;
- no. 1 linear type balancing lifting with minimum length of 2.4m and minimum capacity of 10t;
- no. 1 crane with capacity adequate to the handling type.

The slings must be connected to the base (see Fig. A) and to the balancing lifting (if the balancing lifting has hooks be sure they have anti-unhitching system, see Fig. B).

ASCO 050

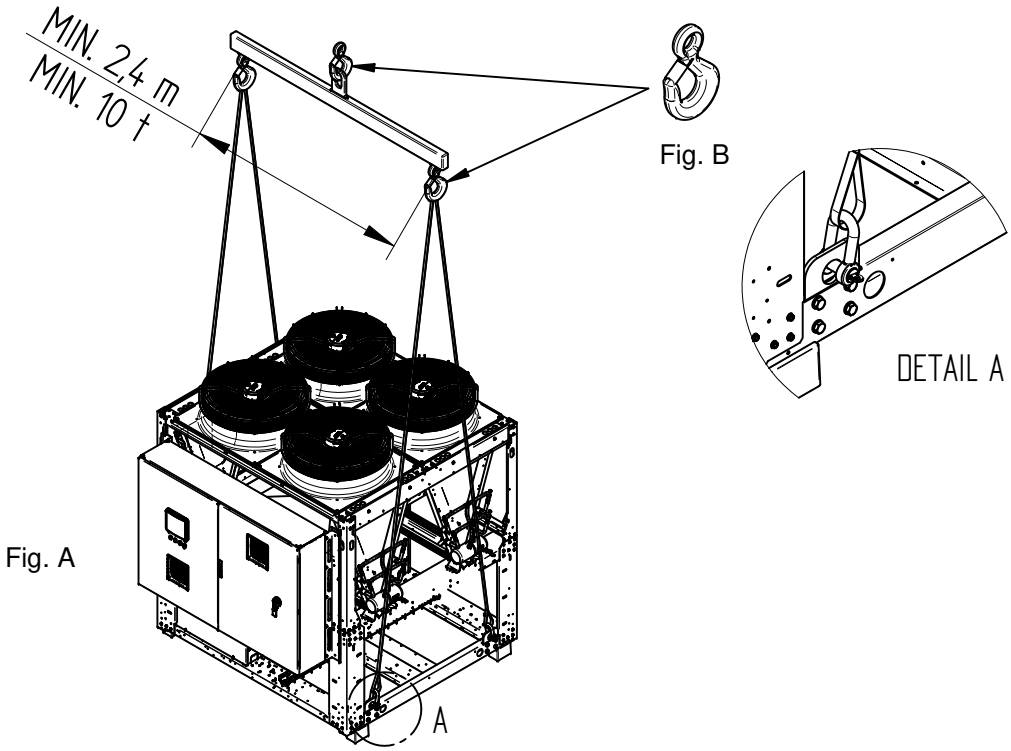


Fig. A

Fig. B

ASCO 060 - 070

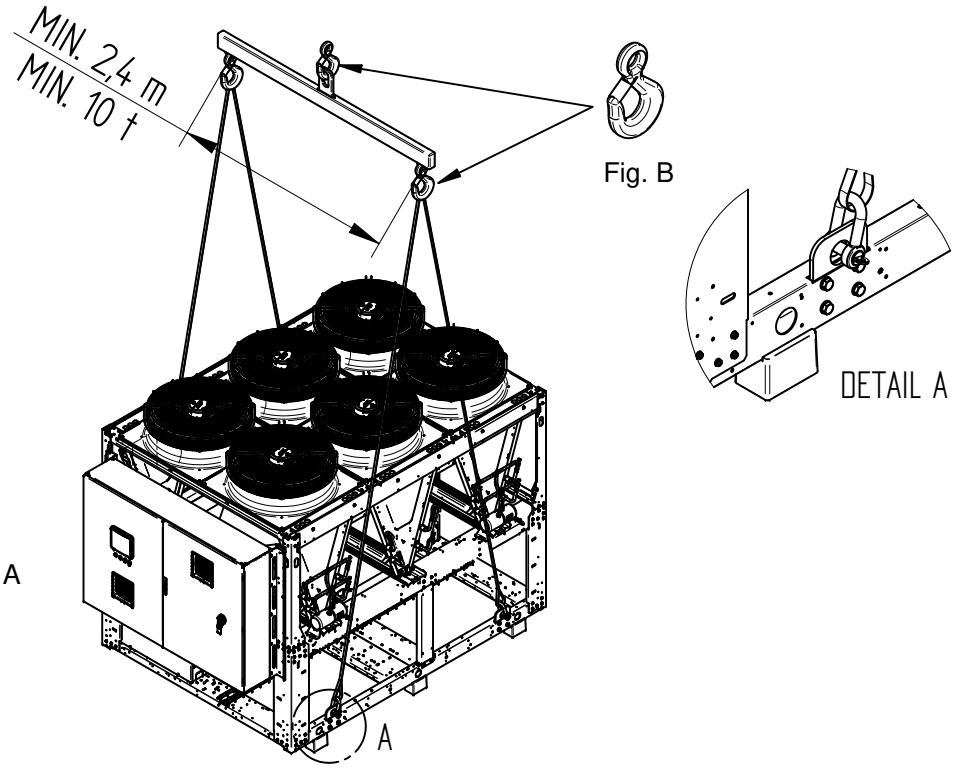


Fig. A

Fig. B

CAUTION

⚠ The images are purely representative, therefore the correct position of lifting lugs is the one indicated on the unit.
NEVER MOVE THE LIFTING LUGS.

2.4.6 Storage of the unit

A3 chiller units and heat pumps with refrigerant must be stored outdoors.
In the event of storage inside the building, it must meet the following requirements (non-exhaustive list):

- Well ventilated and free of combustible materials or waste
- Free of ignition sources
- Absence of direct sunlight and out of the reach of heat sources
- The storage area must be provided with safety signs
- Adequate fire safety measures must have been taken

It is also recommended to use a detection sensor for flammable gases every 36-40 m2. Always refer to national regulations.
Whether the equipment is stored indoors or outdoors, it must comply with applicable regulations, local legislation and building regulations.
The unit may be equipped with pressure relief valves that could release refrigerant if the unit is exposed to high temperatures.
The storage temperature must not exceed 50°C.

2.4.7 Precautions during exercise

Operation must be carried out by competent personnel under a qualified supervisor.
All connections of the refrigerant circuit, electrical system and control unit wiring must be easily identifiable, painted or marked clearly in compliance with local safety prescriptions in force in the place of installation.

DANGER

⚠ **Do not remove or tamper with safety devices, protections, or the insulating materials installed in the unit or in the auxiliary equipment.**

All electrical connections must comply with local prescriptions in force in the installation site.
The unit and its auxiliary equipment must be connected to earth and protected against short circuits and overloads.
When the main power switch is closed the voltage in the electrical circuit assumes potentially lethal values.
The maximum precautions must be adopted if work is to be carried out on the electrical circuit.
Do not open any protection panels on the electrical equipment while it is live, unless it is necessary for measurements, tests or adjustments.
This work should only be carried out by authorised operators, informed and trained on the specific risks caused by flammable gases according to good practices and/or current standards in accordance with Annex HH IEC 60335-2-40, equipped with adequate equipment and wearing protections against electrical hazards.

2.4.8 Precautions for maintenance and repair

Accumulations of electrostatic charges can generate, in the event of loss of refrigerant, a trigger in the event of a potentially explosive atmosphere; to avoid accumulation, antistatic clothing complying with EN 1149-5 must be worn during maintenance and inspection of the machine. Antistatic clothing bears the following symbol:


EN 1149-5

WARNING

⚠ Maintainers working on the electrical components or on the components of the refrigerant circuit must be authorised, informed and trained on the specific risks from flammable gases according to good practices and/or current standards in accordance with ANNEX HH IEC 60335-2-40.

CAUTION

⚠ When it is necessary to discharge waste material do not pollute water pipelines, groundwater or watercourses. Avoid the combustion of materials that could cause atmospheric pollution. Protect the environment by using only approved storage methods.

Keep a written record of all maintenance and repair work carried out on the unit and auxiliary equipment. The frequency and nature of the work required of the unit must not cause abnormal operating conditions.

WARNING

⚠ Use exclusively the refrigerant specified on the unit's data plate.

Make sure that all the instructions concerning operation and maintenance are followed scrupulously and that the entire unit and all the accessories and safety devices are maintained in proper working order.
The accuracy of pressure and temperature gauges must be regularly checked. If values exceeding the permitted tolerances are detected, the gauges must be replaced.
Coloured tracers can be used in service-maintenance operations.

CAUTION

⚠ Do not weld or perform work that generates heat close to a system that contains oil or inflammable liquids. Systems that may contain oil or inflammable liquids must be completely drained and cleaned, for example with steam, before performing any such operations.

To prevent an increase in working temperature and pressure values clean the heat exchange surfaces (e.g. the fins of condensers) regularly. For each unit, establish a time interval for cleaning operations (see ch. 9.2.6 "Cleaning the condenser coils").

WARNING

⚠ DO NOT damage the pressure relief valves and other pressure limiting devices.

Do not clog these devices with paint, oil, or accumulated dirt.
Use exclusively original spare parts.
Never use an open flame as a light source to inspect parts of the unit.
When a repair has been completed make sure that no tools or detached parts are left in the unit.
The pipes of the cooling circuit, and generally speaking all cooling circuit components, are not designed to be used in any way other than that specified. Do not use the pipes as a support surface or a step for climbing up.

WARNING

⚠ Check the direction of rotation of the motors when starting the unit for the first time and after work has been performed on the electrical connections or on the power supply sectioning device.

All guards and panels of the machine must be reinstalled after maintenance or repair (see ch. 9.2.1 "Accessing the internal machine compartments").
Do not use flammable liquid to clean any component during operation.
If non-inflammable hydrocarbons containing chloride are used all the relevant safety precautions must be adopted to protect against the toxic fumes that may be given off.

CAUTION

⚠ Before removing any panels or dismantling any parts of the unit perform the following steps:

- Isolate the unit from the electrical power supply by disconnecting the supply upstream of the power feeding line.
- Lock out the disconnect switch on the "OFF" position by fitting a padlock.
Attach a tag to the disconnecting switch, stating "WORK IN PROGRESS - DO NOT SWITCH ON".
- Do not switch on electrical power or attempt to start the unit if a warning label is attached.
- Make sure the motor is completely idle. A freely rotating motor may produce dangerous voltage on the inverter terminals, even when the inverter isn't powered.
- Always use a multimeter to make sure there is no dangerous voltage present.

Coloured tracers can be used in service-maintenance operations.
Inspect all joints of the refrigeration system such as vents, folders, and more generally all critical points (decoupled joints) in order to prevent any phenomena of refrigerant gas leakage.

CAUTION

⚠ The R290 refrigerant used in the chiller is odour-free.

Maintenance and repair must only be carried out by authorised operators, that are informed and trained on the specific risks of flammable gases according to good practices and/or current standards in accordance with ANNEX HH IEC 60335-2-40.
Inspect all the cooling system joints including connectors, flanges and more generally all critical points (open joints) in order to prevent possible leakage of refrigerant gas using specific tools suited for use with flammable refrigerants.

2.4.9 Warnings for extraordinary maintenance and repair

The following list of procedures is intended as a reminder and a check-list for the appointed technician.
It does not give anyone else the authority to carry out maintenance work on the unit.

- Switch the unit off, disconnecting it from the mains supply.
- Check there are no flammable materials stored in the work area, and no ignition sources such as naked flames, electric heaters, etc.
- Make sure the work area is **well aired** before doing any work on the refrigerant circuit or carrying out any welding or brazing tasks.
- Drain off the refrigerant, using a recovery machine suitable for this type of flammable refrigerant. In the meantime, monitor the area with a gas leak detector.
- Flush the circuit with inert gas (e.g. nitrogen).
- Drain the circuit with a suitable vacuum pump.
- Flush again with inert gas (e.g. nitrogen).
- Open the circuit.
- Using a pipe cutter, cut the cooling circuit components that need to be replaced. DO NOT debraze.



2.4.10 Disposal, disassembly and recycling

The product was designed and built with recyclable materials.
The correct waste sorting for the subsequent start-up of the equipment disposed of for recycling, treatment and for compatible environmental disposal, contributes to prevent possible negative consequences on the environment and health. It also favour the recycling of the materials the equipment is made up with.
The unit may include all or some of the materials listed below:

- refrigerant fluid R290
- copper parts
- aluminium parts
- carbon steel parts
- stainless steel parts
- PVC parts
- CFC-free synthetic insulating material
- polystyrene parts
- polyester oil
- brass

During dismantling, the compressor, pumps, fans, exchangers (if working) can be recovered for possible re-use thanks to specialised centres. All materials must be recycled or disposed of in compliance with the corresponding national regulations.
Refrigerant, oil and possible anti-freeze solutions recycling must be done by specialised companies in compliance with the corresponding local and national legislation.
Electrical and electronic materials cannot not be disposed of together with domestic general waste. They must be disposed of in special collection centres.
Units must be treated at a centre specialised in re-conditioning, recycling and recovery of materials.
The waste sorting of this equipment that reached the end of its useful life is organized and managed by the manufacturer of the newly purchased equipment replacing the present one, if applicable, or, in all other cases by the manufacturer of this equipment.
Therefore, the user who wishes to discard this equipment and has decided to purchase a new equivalent one to replace the present one, must refer to the manufacturer of the new equipment and follow the procedures established by the latter in terms of selective collection of the equipment that has reached the end of its useful life.
Conversely, the user who wishes to discard this equipment and has not decided to purchase a new equivalent one to replace the present one, must refer to the manufacturer of this equipment and follow the procedures established by the latter in terms of selective collection of the equipment that has reached the end of its useful life.

2.5 Refrigerant gases

R290 refrigerant is classified as group 1 “dangerous” on the basis of the criteria of the pressurised equipment directive 2014/68 / EU.

- Type of refrigerant: R290
- Global warming potential GWP: 0,02

In accordance with Standard ISO-817, R290 (E), it is classified in safety group A3: HIGH flammability.
The refrigerant generates toxic gases when placed in contact with open flames.
In order to ensure proper installation, the local regulations and the specified safety standards must be respected. In their absence, reference must be made to the EN-378 standard, with particular regard to the sections concerning flammable refrigerants. The end user must check whether approval is required from the competent authorities for the installation of the unit.
These units may be charged exclusively with R290.
Never attempt to mix refrigerant gases.
To clean a heavily contaminated refrigerant circuit, e.g. after the burning of a compressor, it is necessary that the work is carried out by authorised operators, that are informed and trained on the specific risks of flammable gases according to good practices and/or current standards in accordance with ANNEX HH IEC 60335-2-40.
The use and storage of cylinders containing refrigerants must be in compliance with the prescriptions of the manufacturers of the cylinders and in compliance with the applicable safety laws and prescriptions in force in the place of installation.

CAUTION

⚠ Maintainers working on the electrical components or on the components of the refrigerant circuit must be authorised, informed and trained on the specific risks from flammable gases according to good practices and/or current standards in accordance with ANNEX HH IEC 60335-2-40.

2.5.1 Refrigerants safety datasheet

	R290
Name:	Propane.
HAZARDS	
Main hazards:	Highly flammable gas.
Specific hazards:	Contains pressurised gas; may explode when heated.
FIRST AID MEASURES	
General information:	In high concentrations, it can cause asphyxiation. Symptoms may include loss of mobility and/or consciousness. The victim may not be aware that they are suffering from asphyxia. In low concentration, it can have a narcotic effect. Symptoms may include dizziness, headaches, nausea and loss of coordination.
Inhalation:	Move the victim to a non-contaminated area using the self-contained breathing apparatus. Keep the patient relaxed and warm. Call a doctor. Proceed with the artificial respiration in case of respiratory failure.
Contact with the eyes/face:	Wash the eyes immediately with water, continuing for at least 15 minutes.
Contact with the skin:	In case of contact with liquid, wash with water for at least 15 minutes.
FIRE-FIGHTING MEASURES	
General fire risks:	Exposure to naked flame may cause the container to rupture or explode.
Means of extinction:	Water spray. Dry powder.
Inappropriate extinguishing media:	Do not use water jets to extinguish the fire. Carbon dioxide.
Specific methods:	Use appropriate fire-fighting methods for the fire in the area. Exposure to naked flame and heat may cause the container to rupture. Keep exposed containers cool by showering with water from a safe position. Do not pour water contaminated by the fire into drains. Stop the leakage of product if possible. If possible, use water mist to abate fumes. Do not attempt to extinguish a burning gas leak unless absolutely necessary. The gas may re-ignite spontaneously and cause an explosion. Extinguish all flames in the vicinity. If it is possible to do so safely, move the recipients to a location at a safe distance from the fire.

MEASURES IN THE EVENT OF ACCIDENTAL LEAKAGE

Individual precautions:	Try to stop the leakage. Evacuate the area. Consider the risk of explosive atmosphere. If it has not been proven that the air is breathable, use self-contained breathing apparatus to enter the area involved. Remove the sources of ignition. Ensure adequate ventilation. Prevent it from running into drains, cellars, excavation areas or places where the accumulation may be dangerous. Follow the local emergency plan. Stay upwind.
Environmental precautions:	Try to stop the leakage.

HANDLING AND STORAGE

Handling: Technical measures/precautions:	Use only in well ventilated spaces.
Recommendations for safe use:	The product must be handled according to the good safety and industrial hygiene practices. The pressurised gas should be handled exclusively by experienced and suitably trained personnel. Install any safety relief valves necessary in the gas circuit. Before use, make sure that the entire gas distribution system has been (or is regularly) checked for leaks. Do no smoke while handling the product. Only use specific equipment, suitable for the product, pressure and temperature of use. In case of doubts, contact the gas supplier. Assess the risk of a potentially explosive atmosphere and the need for explosion-proof equipment. Bleed all the air from the system before inserting the gas. Take precautions against the risk of electrostatic discharges. Keep away from sources of ignition (including electrostatic charges). Assess the need for using only reduced-sparking tools. Do not inhale the gas. Avoid releasing the product in the atmosphere.
Storage:	Observe the local regulations and legal requirements concerning the storage of the containers. The containers should not be stored in conditions that may lead to corrosion. Fit all caps and/or plugs correctly. Containers in storage must be kept in an upright position and secured so that they cannot fall over. The stored containers should be checked regularly to assess their general state and identify any leaks. Keep the container at a temperature below 50°C, in a well-ventilated area. Store de containers in areas in which there is no risk of fire, away from heat and ignition sources. Keep away from combustible substances. Do not store with oxidising gases or other oxidants in general. All electrical equipment in the storage area must be certified for use in explosive atmospheres.

CONTROL OF INDIVIDUAL EXPOSURE/PROTECTION

Control parameters:	OEL (Occupational exposure limits): Data not available. DNEL (Derived no-effect level): Data not available. PNEC (Predicted no-effect concentration): Data not available.
Respiratory protection:	Filter masks may only be used if all surrounding environmental conditions (e.g. type and concentration of contaminant/s) and the envisaged duration of use are known. Recommended: AX filter (brown). See the instructions provided by the supplier for selecting suitable personal protective equipment. Filter masks do not protect against oxygen-deficient atmospheres. EN 14387 - Respiratory protective devices - Gas filters and combined filters. EN 136 - Respiratory protective devices. Full face masks.
Eye/face protection:	Wear safety eyewear with side shields. Wear safety googles when filling containers and disconnecting the hose.
Protection of the hands:	Wear safety work gloves when handling gas containers.

PHYSICAL AND CHEMICAL PROPERTIES	
Colour:	Colourless
Odour:	Often odourless. Sweetish. Less noticeable at low concentrations.
Boiling point:	-42.1°C
Relative density (water =1):	0.58
Relative density (air=1):	1.5
Solubility in water:	75 mg/l
Upper flammability limit	9.5% (V)
Lower flammability limit	1.7% (V)
Auto-ignition temperature:	470°C

STABILITY AND REACTIVITY	
Stability:	Stable under normal conditions.
Possibility of dangerous reactions:	May react violently with oxidants. May form explosive mixtures with air.
Materials to avoid:	Air, oxidising agents. Refer to the ISO 11114 standard for further information regarding the material compatibility.
Hazardous decomposition products:	Should not product hazardous decomposition products in normal storage and usage conditions.

TOXICOLOGICAL INFORMATION	
Acute toxicity:	This product has no known toxicological effect.
Local effects:	In high concentrations, it can cause asphyxiation. Symptoms may include loss of mobility and/or consciousness. The victim may not be aware that they are suffering from asphyxia. In low concentration, it can have a narcotic effect. Symptoms may include dizziness, headaches, nausea and loss of coordination.
Long term toxicity:	No carcinogenic, teratogenic or mutagenic effects observed in laboratory animals.

ECOLOGICAL INFORMATION	
Global warming potential GWP (EN378-1:2021):	0,02
Ozone depletion potential ODP (R11=1):	0
Disposal:	Do not discharge gas in areas where there is a risk of the gas forming an explosive atmosphere with air. The gas should be disposed of in a suitable torch with an anti-backfire device. Do not drain the product in places where accumulation may be harmful. Make sure that the emissions limits specified by local regulations or indicated in authorisation documentation are not exceeded.

CHAPTER 3

DESCRIPTION

3.1 Casing

The casing is made of galvanised panels with a polyester powder coating.

3.2 Operating principle

All the units described in this manual use the same operating principle.
The refrigerant circuit consists of two separate, independent circuits which cool the water with a plate evaporator in which a heat exchange process takes place between the refrigerant and the heat transfer fluid. Suitable compressors are used to compress refrigerant in order to change it from a gas to a liquid. At this stage, the refrigerant gas releases energy in the form of heat. The liquid refrigerant enters the evaporator, where it expands and returns to its initial gaseous state. As it returns to a gaseous state, it absorbs energy in the form of heat. In compliance with the first principle of thermodynamics, the heat is released by the process fluid that flows over the evaporator surface at a higher temperature than that of the refrigerant fluid.
An electronic control unit regulates:

- the evaporator water inlet temperature, to keep it within the pre-set limits
- the evaporator water outlet temperature and the water flow, to avoid the risk of freezing in zero flow conditions.

3.3 Components

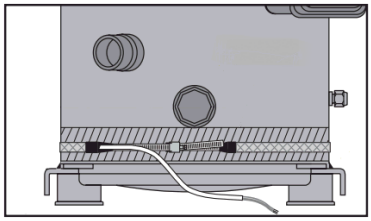
Information on the components of standard machines is given below.
Non-standard components may sometimes be used to meet particular needs.
In this case, refer to the project quote data.
All standard units can be equipped with the following components:

- high pressure switches (see chapter “8.2 High pressure switches (HP)”);
- high/low pressure transducers
- relief valves on the high and low pressure line;
- refrigerant shut-off taps
- dehydrating filters
- sight glass
- electronic expansion valve;
- flow switch (see ch. 8.4 “Flow switch”).

All the connections between the various components are welded with silver alloy, and the cold sections of the copper pipes are clad with insulating material to prevent the formation of condensate.

3.3.1 Compressors

The compressors are of the SCROLL type. They have built-in protection against overtemperatures on the electric motor windings.
Shut-off taps on the suction and discharge lines can be supplied upon request.
Each unit circuit has an oil equalisation line between the compressors.
The compressors are installed on rubber antivibration mounts.
The casing heating is belt-type.



NOTES

Compressor start-up with Soft Starter is available as an optional extra. The Soft Starter is combined with each compressor and limits the start-up current during compressor activation.
Soft starters are not compatible with capacitive elements (e.g. condensers with power factor correction) installed between the soft starter and compressor motor. Any static shunt systems or dynamic PFC (Power Factor Correction) systems, installed upstream from the main switch, must not be operated simultaneously with soft starter activation.

WARNING

⚠ At the first start-up after a stop of several days, make sure the casing heater of each compressor has been activated for at least 12 hours before pressing the start button.

3.3.2 Condensing coils

Micro-channel coils

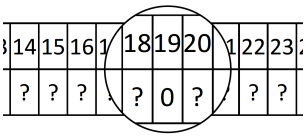
Heat exchangers consisting of an aluminium coil and copper connections. In particular, each section of the heat exchanger is formed of an aluminium micro-channel of varying height, bent several times to create a coil and then connected to the two manifolds (input and output). The advantages of these heat exchangers are basically linked to their lighter weight and a notable reduction in the refrigerant load of the machine.

Pre-painted coils (optional)

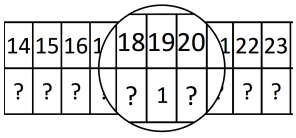
Upon request, the units can be fitted with coils with pre-painted fins (shoulders and manifolds) for use in marine areas where the ambient may be overly aggressive for the standard aluminium fins. The fins are treated with polyurethane paint that helps prevent corrosion. The shoulders are made of aluminium.

The presence or otherwise of the painted coils depend on the alphanumeric string-code. For further information see paragraph 1.6 “How to interpret the alphanumeric string”:

position 19 value 0 WITHOUT pre-painted coils



position 19 value 1 WITH pre-painted coils

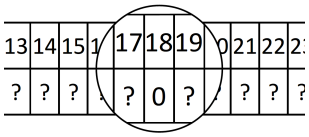


Air filters in the condensers (optional)

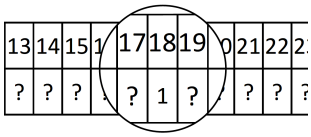
Upon request, the machines can be fitted with air filters made of galvanised sheet metal and aluminium. They are installed to prevent accidental contact with the sharp fin edges, and to protect the front surface of the condensing coils.

The presence or otherwise of the filters depends on the alphanumeric string-code. For further information see paragraph 1.6 “How to interpret the alphanumeric string”:

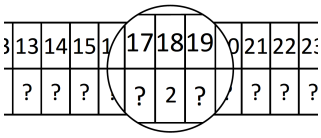
position 18 value 0 WITHOUT filters



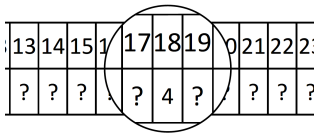
position 18 value 1 WITH filters



position 18 value 2 WITH wire mesh



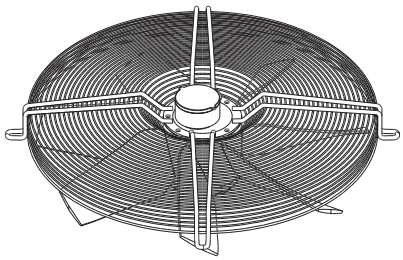
position 18 value 4 WITH filters + wire mesh



CAUTION

⚠ In the event that filters are not provided, the user must create a buffer zone that prevents unauthorised personnel from approaching the machine.

3.3.3 Motor fans



The motor fans are of the axial type, and have safety grilles. They are commanded by a pressure transducer that stops them when the condensation pressure falls below a certain value.

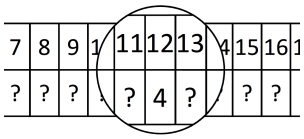
The protection level is IP54, with insulation class F. The blast tube has an aerodynamic shape.

Upon request, the units can be fitted with high-efficiency fans that work quietly, with an integrated inverter motor and EC technology (permanent magnets with electronic switchover).

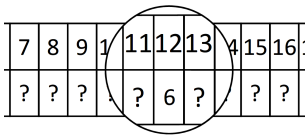
Adjustment is managed by the electronic control.

The type of fan adjustment depends on the alphanumeric string-code. For further information see paragraph 1.6 “How to interpret the alphanumeric string”:

position 12 value 4, EC BRUSHLESS FANS



position 12 value 6, HIGH PRESSURE EC FANS



DANGER

⚠ **In the event of maintenance work on the EC fans, the fact that condensers are used means it is necessary to wait at least 5 minutes after disconnecting the power supply to the unit before opening the box containing the electrical contacts.**

CAUTION

⚠ To avoid condensation, the drive must be continuously energised due to the application of heat, with interruptions such that cooling to the point of condensation does not occur.

3.3.4 Evaporator

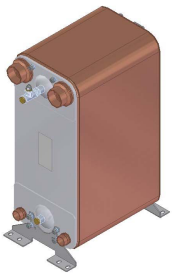


Plate type:

The plates are made of braze-welded stainless steel and convey the cooling fluid and the process fluid to be cooled. The heat exchangers are highly efficient and compact, so they require minimal space inside the unit. The housing is covered with an anti-condensate insulating layer of adequate thickness. The evaporator is protected from the risk of freezing due to low evaporation temperatures by means of the anti-freeze function of the electronic control, which adjusts the water outlet temperature. In addition, each evaporator is equipped with a flow switch to protect it from an insufficient water flow rate. All the evaporators can handle anti-freeze solutions and, in general, all other liquids that are compatible with the hydraulic circuit construction materials. All evaporators respect the “EC” normative about the pressure vessels.

CAUTION

⚠ The flow rate of fluid passing through the heat exchangers must not exceed the values given in the table in Chapter 4 “Installation”.

NOTES

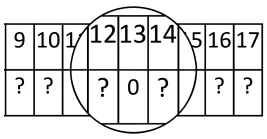
The evaporator is fitted with a tap on its lower part, for releasing the water inside when draining the system (see ch. 9.2.3 “Draining the water circuit”).

Electric evaporator heater (optional)

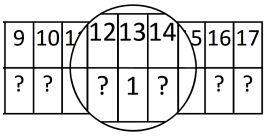
Upon request, the evaporators can be protected from the risk of freezing by means of an electric heater (optional) commanded via the control panel.

The presence or otherwise of the electric heater depends on the alphanumeric string-code. For further information see paragraph 1.6 “How to interpret the alphanumeric string”:

position 13 value 0 WITHOUT resistors



position 13 value 1 WITH resistors



3.4 Desuperheater

The desuperheaters for the recovery of about 20% of the heat to be disposed of at the condenser are placed in series, on the compressor supply and take advantage of the desuperheating heat from the compressor discharge temperature to the condensation start temperature (about 20% of the total heat disposed of at the condenser). There are two desuperheaters, one for each circuit.

3.5 Energy meter

The units equipped with Energy Meter provide the user with information in real time regarding the instantaneous energy consumption of the unit by making the following data available to the user:

- Current:
  instantaneous value: I1, I2, I3, In
  average max. value: I1, I2, I3, In
- Voltages and frequency:
  instantaneous value: V1, V2, V3, U12, U23, U31, F
- Power:
  instantaneous value: 3P, ΣP, 3Q, ΣQ, 3S, ΣS
  average max. value: ΣP, ΣQ, ΣS
- Power factors:
  instantaneous value: 3PF, ΣPF
- Active energy:
  +/- kWh

This data is visible on the Energy Meter display.

3.6 Hydraulic circuit

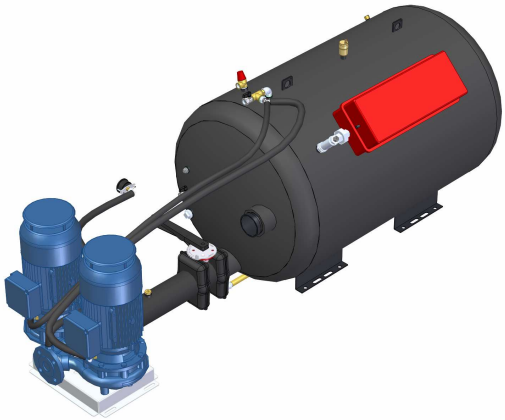
The hydraulic circuit is composed of the following components:

- plate evaporator;
- flow switch;
- air vent on plate evaporator;
- automatic vent on the tank (if present);
- tank drainage tap (if tank is present);
- drainage cock on the lower side of the evaporator;
- victaulic type water connections (consult the attached drawings);
- counter connection points (with quickcoup joints supplied)

3.6.1 Hydraulic unit (optional)

Upon request, these units can be equipped with a hydraulic unit that may consist of:

- pump P2
- pump P3
- pump VF P2
- pump VF P3
- double pump P2+P2
- double pump P3+P3
- double pump VF P2+P2
- double pump VF P3+P3
- tank + pump P2
- tank + pump P3
- tank + pump VF P2
- tank + pump VF P3
- tank +double pump P2+P2
- tank +double pump P3+P3
- tank +double pump VF P2+P2
- tank +double pump VF P3+P3



Pump P2:
With a working head of approx. 20 m.c.a. The pump is already connected to the evaporator and the water inlets/outlets (see overall dimension diagrams in the manual). The electronic control unit commands the pump and manages the thermal protection alarm. Two taps (inlet/outlet) allow the pump to be isolated during maintenance.
Pump P3:
With a working head of approx. 30 m.c.a. The pump is already connected to the evaporator and the water inlets/outlets (see overall dimension diagrams in the manual). The electronic control unit commands the pump and manages the thermal protection alarm. Two taps (inlet/outlet) allow the pump to be isolated during maintenance.
Pump VF P2:
Inverter pump with a working head of approx. 20 m.c.a. The pump is already connected to the evaporator and the water inlets/outlets (see overall dimension diagrams in the manual). The electronic control unit commands the pump and manages the thermal protection alarm. Two taps (inlet/outlet) allow the pump to be isolated during maintenance.
The speed is variable and is regulated by the difference between the evaporator water inlet and outlet temperatures.
The default rpm parameters are set at the factory and correspond to the nominal design conditions.
For any changes, please contact the Service Centre.

Pump VF P3:
Inverter pump with a working head of approx. 30 m.c.a. The pump is already connected to the evaporator and the water inlets/outlets (see overall dimension diagrams in the manual). The electronic control unit commands the pump and manages the thermal protection alarm. Two taps (inlet/outlet) allow the pump to be isolated during maintenance.
The speed is variable and is regulated by the difference between the evaporator water inlet and outlet temperatures.
The default rpm parameters are set at the factory and correspond to the nominal design conditions.
For any changes, please contact the Service Centre.

Pumps P2+P2 (unit in standby):
Each with a working head of approx. 20 m.c.a. The two pumps are linked by rigid connections, and connected to the evaporator and the water inlets/outlets. The electronic control automatically commands the operation of one pump or the other, and manages the thermal protection alarm.
One inlet tap allows the pump to be isolated during maintenance (see ch. 9.2.7 “Pump maintenance (when there is a double pump)”).

Pumps P3+P3 (unit in standby):
Each with a working head of approx. 30 m.c.a. The two pumps are linked by rigid connections, and connected to the evaporator and the water inlets/outlets. The electronic control automatically commands the operation of one pump or the other, and manages the thermal protection alarm.
One inlet tap allows the pump to be isolated during maintenance (see ch. 9.2.7 “Pump maintenance (when there is a double pump)”).

Pumps VF P2+P2 (unit in standby):
Two inverter pumps each with a working head of approx. 20 m.c.a. The two pumps are linked by rigid connections, and connected to the evaporator and the water inlets/outlets. The electronic control automatically commands the operation of one pump or the other, and manages the thermal protection alarm.
One inlet tap allows the pump to be isolated during maintenance (see ch. 9.2.7 “Pump maintenance (when there is a double pump)”).
The speed is variable and is regulated by the difference between the evaporator water inlet and outlet temperatures.
The default rpm parameters are set at the factory and correspond to the nominal design conditions.
For any changes, please contact the Service Centre.

Pumps VF P3+P3 (unit in standby):
Two inverter pumps each with a working head of approx. 30 m.c.a. The two pumps are linked by rigid connections, and connected to the evaporator and the water inlets/outlets. The electronic control automatically commands the operation of one pump or the other, and manages the thermal protection alarm.
One inlet tap allows the pump to be isolated during maintenance (see ch. 9.2.7 “Pump maintenance (when there is a double pump)”).
The speed is variable and is regulated by the difference between the evaporator water inlet and outlet temperatures.
The default rpm parameters are set at the factory and correspond to the nominal design conditions.
For any changes, please contact the Service Centre.

Tank and pump unit:
A horizontal, cylindrical tank made of carbon steel with an aluminium-plated, anti-condensate insulating layer. For the description of the pump, see above (first or second option). The tank and pump are installed on the machine base and are linked with rigid pipes insulated with armaflex. The connections between the evaporator, pumps and machine connection points are made with tubes insulated with armaflex. This option also includes:

- an expansion tank,
- an automatic air vent valve,
- a drainage tap,
- a safety valve,
- a level sensor.

NOTES
Units with a pump are always fitted with a water pressure gauge.

WARNING
⚠ The pump must never operate in the absence of water.

CHAPTER 4

INSTALLATION

CAUTION

⚠ Before installing or operating these machines, ensure that all personnel have read and understood the chapter on " Safety" this manual. The unit must be installed in accordance with current national legislation in the country of use.

4.1 Overall dimensions

See enclosures.

4.2 Installation precautions

WARNING

⚠ System charged with flammable refrigerant R290.

After positioning the machine and before unpacking, check that there are no refrigerant leaks using a specific gas detector.
Check that there are no sources of ignition/open flames/sparks etc. within the safety zone.
Do not smoke near the unit. (see adhesive ch. 1.2 "Symbols")

Always perform maximum preparatory work before the unit arrives on site: drilling holes and penetrations, installing cable walkways, installing water piping, etc.
Before transporting the unit to its final location, perform a complete leak detection.
It is also strongly recommended to repeat the detection during the different phases of installation, especially if commissioning takes several days.
Installation work must be carried out by competent personnel under a qualified supervisor.
The connections to be made concern the process water circuit. For the connection to the mains power supply consult the technical documentation attached to the machine.

DANGER

⚠ **The unit must be positioned in an area where there are no continuous ignition sources (e.g. naked flames).**

DANGER

⚠ **This unit is equipped with a safety device that can detect the gas leakage.**

AFTER INSTALLATION, THIS UNIT MUST NEVER BE TURNED OFF, EXCEPT DURING MAINTENANCE.

4.3 Instructions for the user

The machines must be installed in safe places, free of areas with potentially explosive atmospheres. They must be connected to electrical systems designed according to current standards, in areas compliant with the standards imposed by the Fire Brigade and in environments compliant with local building standards.
Within the potentially explosive areas generated by the machine, also taking into account the national regulations of the country of use, it is necessary to:

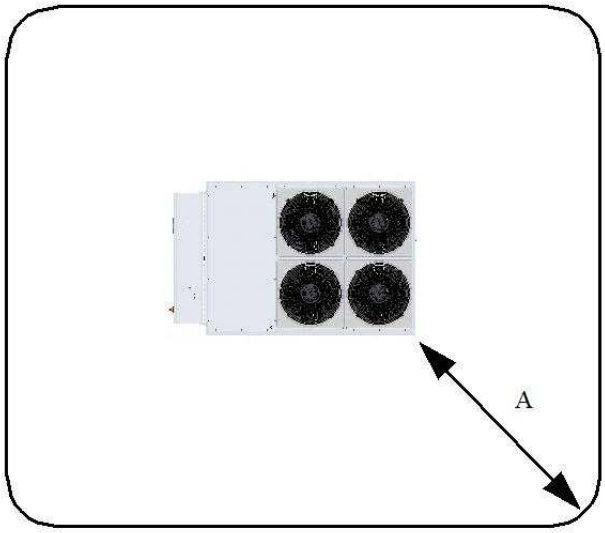
- Do not install equipment that is unsuitable for use in these potentially explosive zones (the minimum requirements of the equipment are: 3G IIB T4);
- Avoid naked flames, sparks and hot works;
- Avoid the presence of sources of ignition due to processes that may generate remote triggers (ionising and non-ionising radiation);
- Avoid the direct and indirect effects of lightning;
- Avoid electrostatic charges;
- Avoid interference with potentially hazardous elements such as drains, openings in the earth, basements, power lines, stores of flammable substances, railways, motorways etc.

As the refrigerant gas used is heavier than air, even a small gas leak, which in itself is not dangerous, can cause a build-up of gas if it infiltrates into underground areas, forming pockets.
A suitable "safety" distance should be assured also for chilling systems installed outdoors, in order to minimise the risk that flammable concentrations enter premises occupied by humans (e.g. through windows, ventilation openings, where people

meet outdoors, etc.). However, external wind speeds tend to be quite high (compared to indoor environments) even when the air seems “still”, so also the amount of flammable mixture should be adjusted to consider the additional dispersion caused by the surrounding air.

WARNING

⚠ The safety zone/area around the machine must be at least 3 meters. Potentially explosive atmospheres may build up inside this area, and it is therefore necessary to avoid sources of ignition, as defined in standard EN378-2.



A = 3 meters

CAUTION

⚠ The flammability and classification of the danger zone for the place of installation must be assessed by the final customer, who shall refer to the local regulations in force and consequently adopt the most restrictive result.

CAUTION

⚠ Cordon off access to the area to prevent accidents.

The electricity supply line to the machine must be protected with the aid of devices that should be chosen and installed by the user on the basis of the data in the wiring diagram and in ch. 6.2 “Electrical connections”. If the unit is connected to a closed hydraulic circuit with an automatic supply system, and the supply system pressure exceeds the maximum unit operating pressure, a pressure limiter device must be installed (e.g. a safety valve that intervenes at a pressure level lower than the maximum machine operating pressure) near the inlet connection point. All the piping of the cooled water must be painted or clearly marked in compliance with the local safety in force in the installation place. Manual on-off valves should be provided for the unit so that the hydraulic circuit can be by-passed to carry out maintenance. All electrical connections must comply with the local prescriptions in the installation place. The machine and the auxiliary apparatus must be earthen and protected against short-circuits and overloading. If raised platforms are required to provide access to the unit they must not interfere with normal operation or obstruct access for lifting or dismantling components. Platforms and stairs should be of grid or plate construction with safety rails on all open sides.

4.4 Location

1. Max. height above sea level 2000 m.
2. The machine must only be installed outdoors and in places where natural ventilation is not hampered.
3. In fact, it is strictly forbidden to install the machine within Atex environments generated by other machinery/ plants. If the machine is installed on the roof of a building, the place of installation must be inspected in order to ensure that it is protected against lightning (evaluation of the risk of lightning according to EN 62305).
4. The refrigerant is heavier than air, so even a small leakage may cause a build-up of gas if it seeps into closed areas and stagnates; For this reason, it is important to ensure natural ventilation in the area where the unit is installed.

5. Install the unit so that, in the event of a leakage, the refrigerant cannot seep into buildings; this means guaranteeing that it cannot penetrate via doors, windows or any ventilation opening, and ensuring there is no underground infiltration leading to pockets of refrigerant. The technical rule states the need to maintain minimum installation distances from underground rooms, sewage traps, rainwater traps and any other accessible opening or empty underground container. The distance is determined on the basis of the deposit volume. This problem can be managed by applying the technical fire prevention rule in the place where the machine is installed.
6. The safety valves (refrigerant side) must be facing towards the outside of the unit, in a safe area and away from any possible ignition sources. The discharge must be conveyed at least 1 metre from the ground, and facing upwards. The cross section and length of the discharge pipe must comply with the national laws and the directives applicable in the place of installation.
   To avoid any possible clogging of the pressure discharge pipe, fit a cover to keep out rainwater.
7. The ambient air must be clean, avoid sea ambients (brackish air), and not contain flammable gas or corrosive solvents.
8. The minimum and maximum working ambient temperature are specified on the unit data plate. Ensure that the unit is not installed in flows of hot air emitted by other equipment.
   In extreme temperature conditions, the protection devices may be triggered.
9. Do not obstruct or interfere with the air flow produced by the unit; comply strictly with the minimum spaces/ distances specified in the installation drawings.
10. The machine must be installed on a perfectly horizontal flat surface, sized and built to withstand the operating weight, especially in the contact points highlighted on the overall dimensions drawing. **In the event of installations which fail to comply with the above requirements, the manufacturer's warranty cover will immediately become null and void and the unit could malfunction or even lock out.**
11. The units are shipped from the factory with plastic or wooden supports placed underneath the base, which should be removed during installation (see ch. 9.2.1 "Accessing the internal machine compartments"). It is advisable, however, to insert a stiff rubber belt between the main frame and the support surface. If greater insulation is needed, anti-vibration supports should be used.
12. Leave some clearance around the machine for access during service interventions (see installation drawings).
13. Install a water tank if necessary. This will help reduce the extent of the temperature swings of the chilled water (DT). The total minimum volume of hydraulic inertia will depend on the model selected according to the table below, in standard operating conditions:

Model	ASCO 050	ASCO 060	ASCO 070
Minimum volume [m^3]	0.2	0.4	0.4

14. Install appropriate windbreak barriers near the condensing batteries if the machine needs to operate with an outdoor air temperature below 0°C and there is a risk that the condensing batteries might be struck by winds at a speed higher than 2 m/s. Make sure these barriers do not prevent the natural ventilation of the compressor compartment.

CHAPTER 5

HYDRAULIC CONNECTIONS

5.1 Liquids to be cooled

The liquids to be cooled must be compatible with the materials used.
These can be water or mixtures of water and ethylene or propylene glycol, for example.
The addition of anti-corrosive chemical additives and operating in a pH range between 7.5 and 9 is recommended.
Even in the case of glycol mixtures, the use of appropriate chemical additives (consult the glycol supplier) is very important to protect the unit materials from possible corrosion caused by the chemical degradation to which glycol is subject. The use of chemical additives is necessary when the unit is part of an hydraulic circuit opened in at least one side to the atmosphere. In this case, in fact, the continuous supply of oxygen facilitates possible corrosive reactions inside the unit. The liquids to be cooled must not be flammable.

DANGER

⚠ **If the liquids to be cooled contains dangerous substances (e.g. glycol) it is very important to collect any liquid which leaks because it could cause damages to the ambient.**

Furthermore, when the unit will not be used for a long period, dangerous liquids must be disposed of by firms specialised and authorised for treating them.

5.1.1 Evaporator water limit features

Contents		Concentration mg/l or ppm	Material	
			AISI 316L	Copper
pH		<6	o	o
		6-7.5	o	o
		7.5-9	+	+
		>9	+	o
Alkalinity	HCO_3^-	<70	+	o
		70-300	+	+
		>300	+	o
Sulphate	SO_4^{2-}	**<70**	+	+
		70-300	+	-
		>300	+	-
Alkalinity/Sulfate	HCO_3^-/SO_4^{2-}	**>1**	+	+
		<1	+	-
Electrical conductivity	µS/cm	<10	+	o
		10-500	+	+
		>500	+	o
Ammonium	NH_4	**<2**	+	+
		2-20	+	o
		>20	+	-
Free chlorine	Cl_2	**<1**	+	+
		1-5	-	o
		>5	-	-
Hydrogen sulphide	H_2S	**<0.05**	+	+
		>0.05	+	-
Free carbon dioxide (aggressive)	CO_2	**<5**	+	+
		5-20	+	o
		>20	+	-
Nitrate	NO_3^-	**<100**	+	+
		>100	+	o
Iron	Fe	**<0.2**	+	+
		>0.2	+	o

Contents		Concentration mg/l or ppm	Material	
			AISI 316L	Copper
Aluminium	Al	**<0.2**	+	+
		>0.2	+	o
Manganese	Mn	**<0.1**	+	+
		>0.1	+	o

Chloride content (Cl^-)	Maximum temperature			
	60°C	80°C	120°C	130°C
< 10 ppm	AISI 304L	AISI 304L	AISI 304L	AISI 316L
≤ 25 ppm	AISI 304L	AISI 304L	AISI 316L	AISI 316L
≤ 50 ppm	AISI 304L	AISI 316L	AISI 316L	
≤ 80 ppm	AISI 316L	AISI 316L	AISI 316L	
≤ 150 ppm	AISI 316L	AISI 316L		
≤ 300 ppm	AISI 316L			

+	Good resistance
o	When multiple factors are “o” corrosion can occur
-	Not recommended

WARNING

⚠ Note: It is important to note that this water specification is not a guarantee against corrosion, but should be considered a tool to avoid the most critical water applications.

5.2 Hydraulic connections

The unit is equipped with “Victaulic” connections (see drawing below).

1. Connect the unit to the water pipes as shown in the diagram below.
2. Provide two valves (one at the inlet, one at the outlet) to isolate the unit in the case of maintenance work without having to empty the user water circuit.
3. If the machine is supplied without the pump, ensure that the pump installed by the user is connected as follows:
   - With intake connected directly to the machine outlet connector if the utility circuit is closed.
   - With delivery connected directly to the machine inlet connector if the utility circuit is open to the atmosphere.
4. If the machine is supplied with the hydraulic unit, the utility circuit must be closed.
5. Install a water filter at evaporator inlet (with 0.8 mm mesh).

DANGER

⚠ **Failure to observe this prescription can result in irreparable damage to the evaporator.**

In the case of plate evaporators, the clogging of even a few plates (or gaps) can cause the plate to seize (clogging), leading to damage of part of the exchanger, even if water flow seems regular and operation is apparently normal.

DANGER

⚠ **In the event of evaporator failure, any loss of refrigerant may leak into the hydraulic circuit of the unit. To prevent the refrigerant from leaking into the building, pay attention to the design of the hydraulic circuit. In particular, safety valves and automatic air vents must be installed outside the building; if this is not possible, they must be conveyed outside.**

WARNING

⚠ In case of breakage of the evaporator, it is necessary to replace all the automatic vent valves present in the hydraulic circuit.

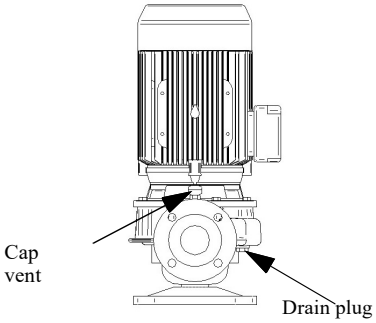
WARNING

⚠ The pump must never operate in the absence of water.

CAUTION

⚠ If the mechanical seal is lost during the start-up of an electric pump, quickly open and close the delivery baffle valve several times while the pump is operating; the aim is to create sudden pressure variations inside the pump to help the mechanical seal to settle down. You are advised to do this at least 2 or 3 times, switching the pump off and then back on again between one attempt and the next.

Lowara pump

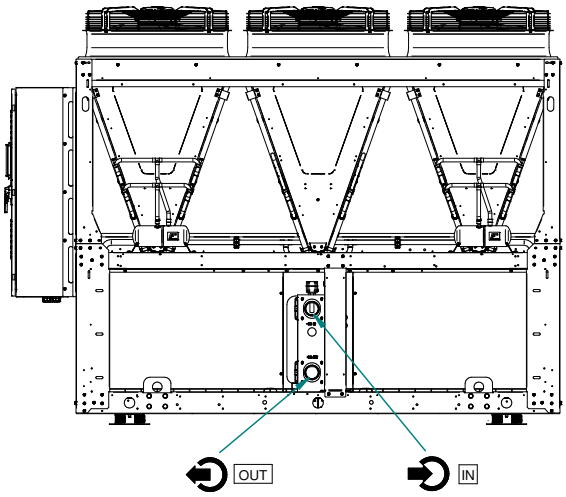


When charging the liquid circuit, make sure there are no air bubbles or impurities. Vent the liquid circuit in order to prime the pump.
The procedure is as follows:

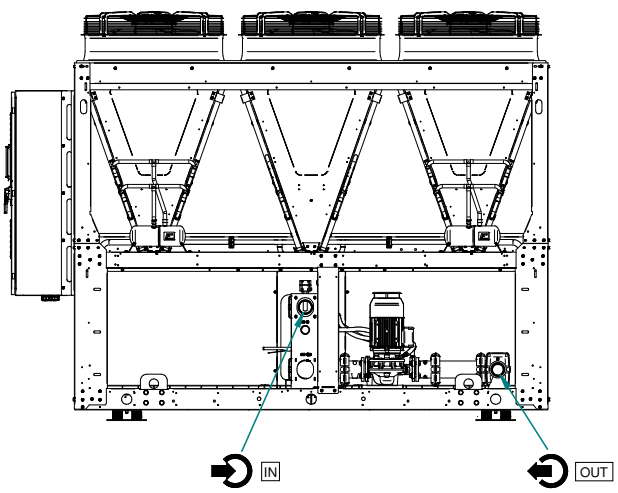
- unscrew the breather cap on the pump at the top
- proceed with filling the hydraulic circuit until the water comes out of the cap
- close the cap

Repeat the operation, if the pump shows abnormal noise, in order to eliminate the residual air present in the impeller.

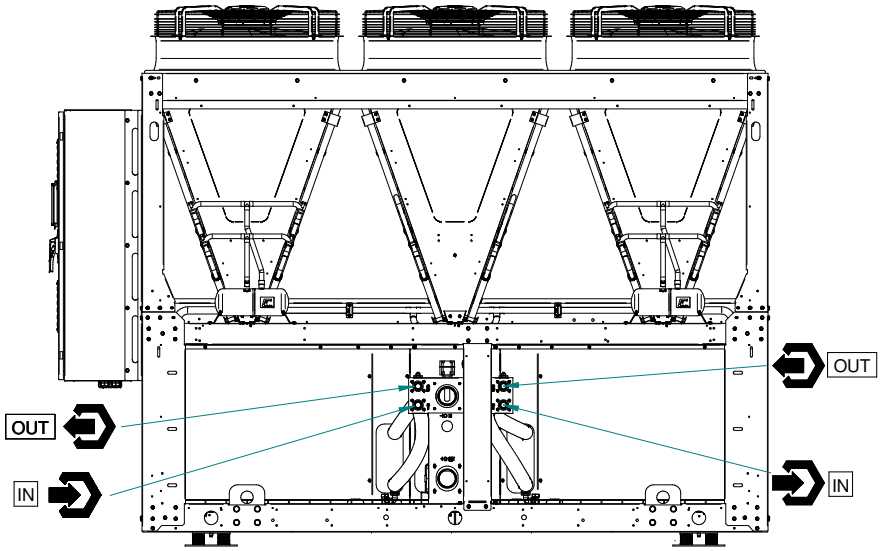
Without hydraulic unit



With pump

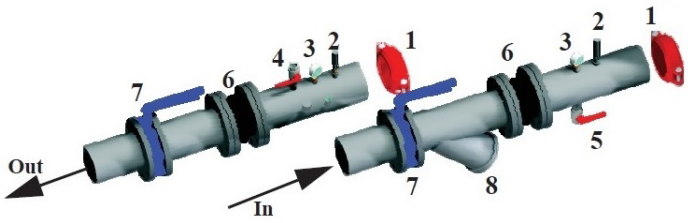


With desuperheaters (if present)



Typical water side connection

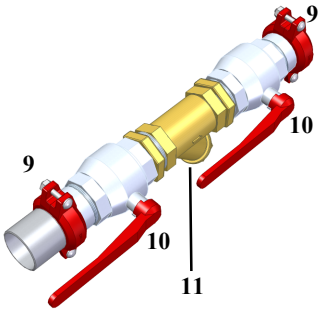
1. "Victaulic" Attacks
2. Thermometer
3. Pressure gauge
4. Vent
5. Discharge
6. Anti-vibration joint
7. Shut-off valve
8. Filter with removable filter cage

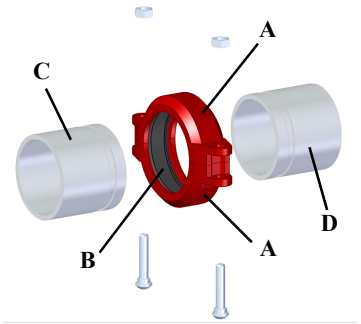


Water side connection kit (*)

9. "Victaulic" Attacks
10. Shut-off valve
11. Filter with removable filter cage

(*) The images are purely rapresentative





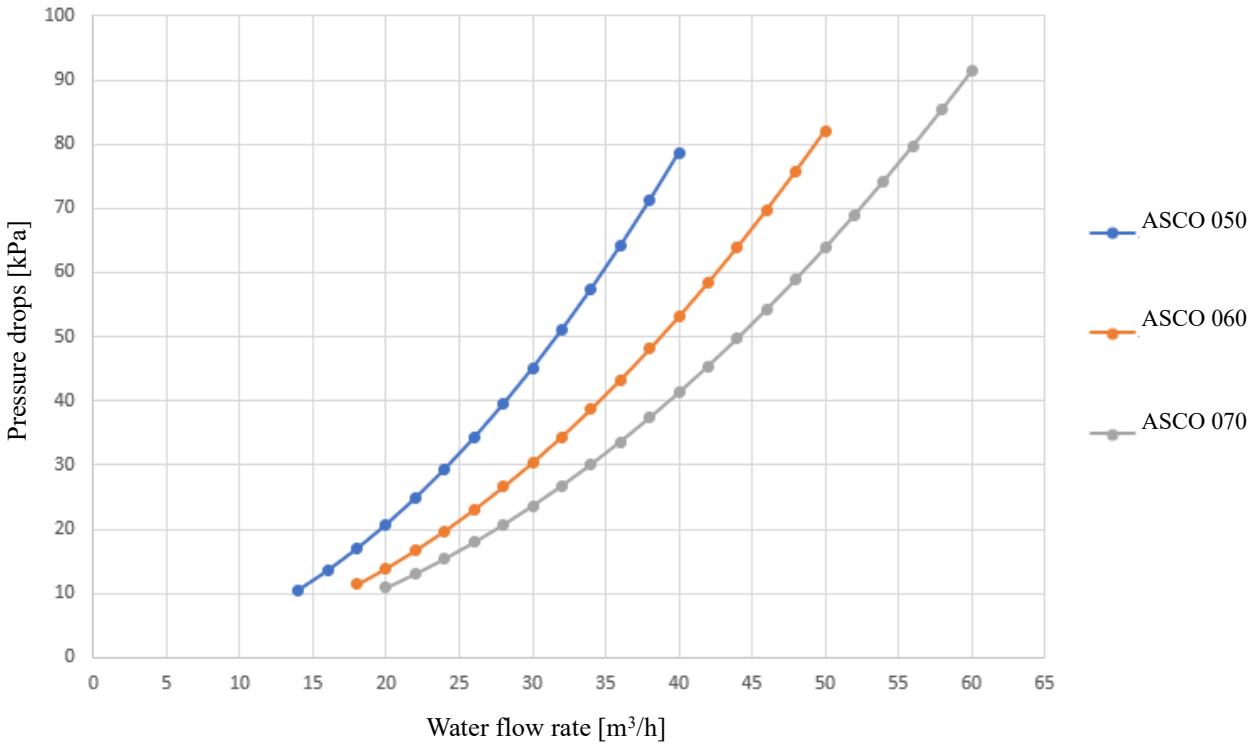
"VICTAULIC" TYPE ATTACK

A clamping jaws
B sealing gasket
C welding ankle boot
D evaporator ankle boot

The hydraulic circuit must be sized in such a way as to comply with the pressure limit value specified on the data plate and ensure the flow rate shown in the following table is not exceeded:

	PLATE EVAPORATOR Maximum flow rate [m^3/h]
ASCO 050	40
ASCO 060	50
ASCO 070	60

Plate type evaporator pressure drops:



5.3 Anti-freeze protection

Even if the minimum ambient operating temperature is higher than 0°C, the machine may be installed in a place where the temperature falls below 0°C in periods of non-use during the winter. In these cases (and if the unit circuit is not drained), ice formation must be avoided by adding an anti-freeze solution (ethylene or propylene glycol) in the following percentages:

Ambient temperature up to [°C]	Ethylene Glycol [wt %]	Propylene Glycol [wt %]
0	0	0
-5	15	20
-10	25	30
-15	30	35
-20	40	40

Depending on the cooled water outlet temperature, antifreeze (ethylene or propylene glycol) must be added in the following percentages to prevent the formation of ice:

T water outlet up to [°C]	Ethylene or Propylene Glycol [wt %]
6	0
3	20
0	25
-5	30
-7	35
-10	40

NOTES

With intake temperature control, the reference for the glycol percentage is equal to the setpoint less 6°C.
E.g. Setpoint 11.0°C (reference for glycol 5°C) recommended percentage 20%.

NOTES

- The minimum recommended antifreeze % takes the coolant's operating conditions into consideration and is not strictly dependant on the freezing point of the chilled water leaving the unit.
- The water flow rate must comply with the value stated in the performance technical data or the selection software.

CHAPTER 6

ELECTRICAL CONNECTIONS

6.1 Electrical circuit

The electrical circuit schematic is given in the annexed diagrams.

6.2 Electrical connections

The connection of the machine to the electricity supply must be made in compliance with the laws and regulations in force in the place of installation.
The voltage, frequency and number of phases must comply with the information on the machine data plate.
The power supply voltage must not be outside the tolerance range shown on the electrical diagram, even for short periods.
Unless otherwise specified, the frequency tolerance is +/-1% of the nominal value (+/-2% for short periods).
With a three-phase power supply, the voltage must be symmetrical (the effective values of phase to phase voltages and consecutive phase angles must be identical).
In particular, unless otherwise indicated, the maximum permissible phase imbalance is 2%, calculated according to the formula:

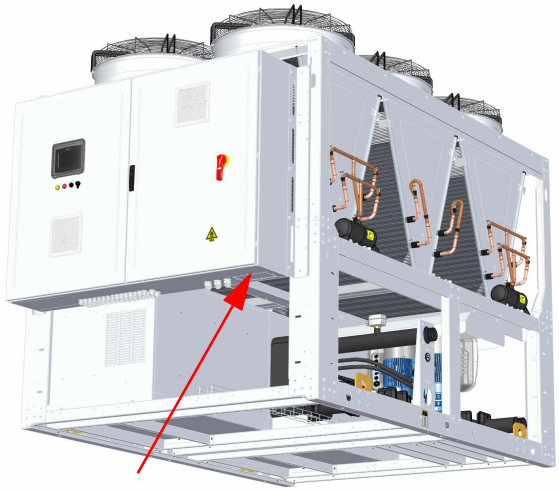
$$\frac{MaxPhaseVoltageDifferenceFromVavg}{Vavg} \bullet 100$$

Vavg= average phase voltage

Example: supply with nominal voltage 400V/3Ph/50Hz
L1-L2 = 410; L2-L3 = 400V; L1-L3 = 398V
Vavg= (410+ 400 + 398) / 3 = 403V

$$\frac{(410 - 403)}{403} \times 100 = 1{,}73$$

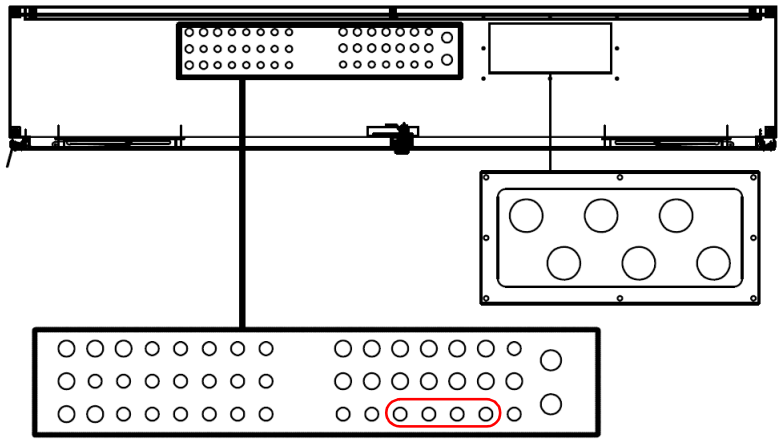
The unit must be connected to a three-phase supply TN(S)
Use the specific plate for feeding the electrical cables inside the machine; drill the plate and equip with suitable cable glands for the power cable entry.



Do not modify the casing for any reason; use only the holes provided, equipping them with cable glands to connect the foreseen optionals.

ELECTRIC PANEL BOX DRILLING

The contoured holes are available to the customer to manage the options.



For the electricity supply:

1. ⚠ connect the machine (terminal PE on the control panel) to the earthing system of the building
2. ⚠ ensure the automatic cut-off of the power supply in the event of an isolation fault (protection against indirect contact as per the indications of Standard IEC 60364), by fitting a **type A or B differential current device**; drill holes in the plate and use suitable cable glands to feed in the power cable
3. make sure the level of protection against direct contact at the power cable source is at least IP2X or IPXXB (reference CEI EN 60529)
4. Install a device at the power cable source to protect it from current surges (short-circuits).
5. use wires rated to carry the maximum current required at the maximum ambient operating temperature, according to the chosen installation type (IEC 60364-5-523)
6. Install protection devices that limit the short-circuit current to 17 kA peak in correspondence with the rated breaking capacity if the short-circuit current in the point of installation is greater than an effective value of 10 kA.

CAUTION

⚠ In the event of failure of one cooling circuit, it must be cut off electrically in order to operate the machine with the other circuit only.

CAUTION

⚠ Inside the control panel, on the earth bar, there is a terminal that must be used to connect the conductive parts outside the machine (extraneous conducting parts) located at less than 2.5m, if these have an earth connection that is separate from the electricity supply to the machine and if they could produce further potential (metal pipes, railings, stairs, handrails, etc.).

The terminal is identified by the symbol IEC 60417-5021

6.3 Phase Monitor

The electronic controller, with the aid of a Phase Monitor (see unit electrical diagram), enables to control unit electric power feeding.
Tripping of the Phase Monitor stops the unit and the appropriate alarm is displayed.
Voltage surges or an incorrect phase sequence on the unit's power feeding line can result in faults of electrical devices (motors, control devices, etc.) and can cause damage over the long term, especially to compressors.
Some measure of instability on the power feeding line can be considered to be normal.
If the frequency of unit shut-downs caused by Phase Monitor tripping should increase, contact your electricity company in order to solve the problem.

CAUTION

⚠ It is strictly prohibited to tamper with the Phase Monitor.

6.4 Protection rating

The protection level of the entire unit is **IP54** with insulation class F to ensure it is compatible with outdoor operation in all climates.

CHAPTER 7

MACHINE OPERATION

7.1 Precautions during operation

Operation must be carried out by competent personnel under a qualified supervisor.
Never remove or tamper with the safety devices, guards or insulation materials fitted to the unit or auxiliary equipment.
When the mains switch is ON, lethal voltages are present in the electrical circuit so extreme caution must be exercised if work needs to be carried out on the electrical system.

CAUTION

⚠ Do not exceed the liquid flow to be cooled specified in Chapter 4 “Installation”.

7.2 Start-up

CAUTION

⚠ The first commissioning must be carried out by personnel trained in authorised service centres.

CAUTION

⚠ Before starting up these machines, make sure all personnel involved have read and understood chapter “ Safety” of this manual.

WARNING

⚠ At the first start-up, check the correct operation of all electrical connections.

WARNING

⚠ At the first start-up after a stop of several days, make sure the casing heater of each compressor has been activated for at least 12 hours before pressing the start button.

CAUTION

⚠ After pressing the main switch, the control display will remain off until the gas leak detector (fixed inside the compressor compartment) has completed the warm-up phase. The waiting time will be about 300 sec.

DANGER

⚠ **Open the compressor suction and delivery taps before starting the unit.**

1. Check the unit shut-off valves are open.
2. If the hydraulic circuit is of the closed type, check that an expansion tank has been installed with an adequate capacity.
3. Check that the ambient temperature is within the limits indicated on the machine data plate.
4. Check the main switch is in the OFF position (“0”).
5. Check that the power supply voltage is correct.
6. Power the machine by means of the line protection device.

7. Turn the unit main switch to the ON position ("|"). The presence of mains voltage is guaranteed by the activation of the display, after the warm-up time of the leak detector.
8. Models without pump: make sure water is flowing through the evaporator.
9. Check that the outlet cocks of the compressors are open.
10. Wait for the gas leak detector warm-up time (around 300 seconds). At the end of the warm-up time, if no refrigerant leaks are detected, the red indicator light on the electrical panel goes out; the unit can be started.
11. Press and hold 

the display button to activate the unit.
The pump, if installed, starts immediately.
After the set delay the compressors can start.
12. The compressors, pump and fans have only one correct rotation direction.
Check the rotation direction of all components at first start-up and after every maintenance operation. If all the components are rotating in the wrong direction, invert two phases on the main terminals of the control panel. If one component or more is not correctly connected, invert two phases on the terminals of the corresponding contactor(s) (see attached wiring diagram).
13. **If with the first start-up**, there is a high ambient temperature and the temperature of the water in the hydraulic circuit is much higher than the working value **(e.g. 25-30°C)** this means that the machine starts up overloaded with the consequence of possible protection device tripping. To reduce the overload, partially and **progressively** (but not completely!) **close a unit outlet valve to reduce the flow rate of water passing through.** The valve can be opened fully when the water temperature in the hydraulic circuit reaches the working value.

CHAPTER 8

FUNCTIONS AND COMPONENTS OF THE UNIT

8.1 Electronic thermostatic

The electronic thermostatics of each circuit is controlled by the electronic board that processes the information sent to it by the pressure and temperature transducers.
The electronic thermostatic valve regulates the flow of refrigerant fluid to the evaporator, based on the superheat value obtained by measuring the evaporation pressure and the suction temperature of the compressor. The adoption of the electronic lamination device instead of the traditional one allows to operate with significantly less condensation and allows to use partialisations of the total power without incurring dangerous liquid returns or evaporator instability.

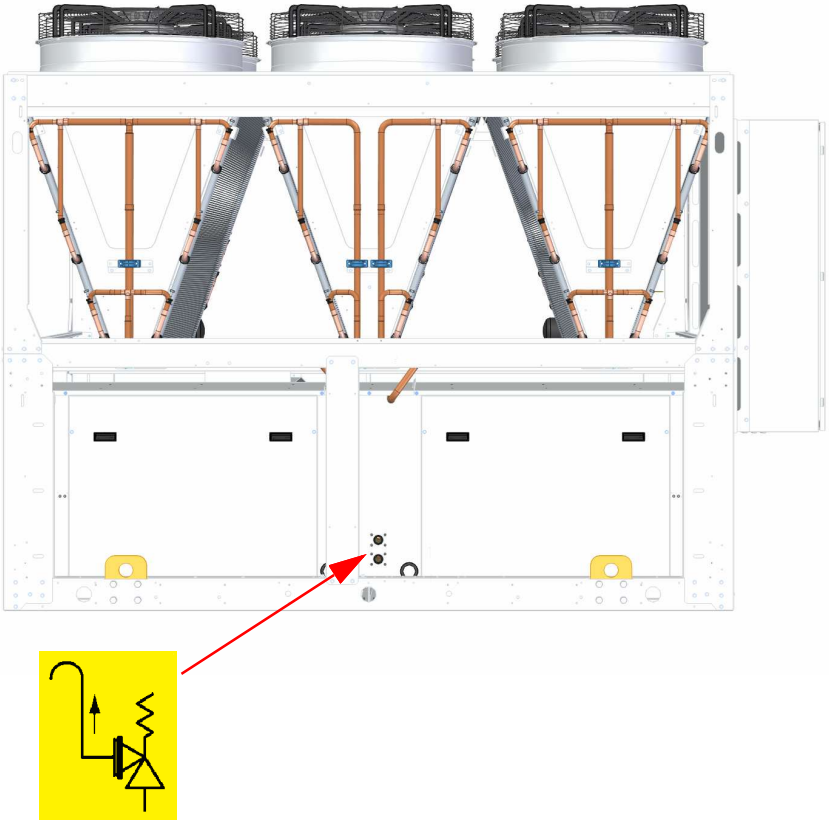
8.2 High pressure switches (HP)

They ensure an electromechanical protection beyond that offered by the respective transducers present in the unit.
They are installed at the delivery of the refrigeration compressor to prevent dangerous pressure values from being reached for the proper functioning of the unit and for the safety of people.
There is a manual reset pressure switch on the high pressure side of each circuit. Its intervention opens the compressor power supply circuit (see wiring diagram). When the pressure decreases and drops below the reset point, the pressure switch must be manually reset, after which the machine can be restarted by pressing the electronic control ALARM button.
For a correct operation of the machine, the intervention-reset values of the pressure switches are indicated in the following table and must not be modified:

COMPONENT	REFRIGERANT	INTERVENTION		RESTORE	
		bar	°C	bar	°C
High pressure switch	R290	34.0	86.0	26.0	72.2

8.3 Safety valve

Its task is to protect the system from pressures so high as to cause serious damage to the machine and surrounding things in the event of failure to intervene with other protections.
When the pressure of the refrigerant fluid exceeds the intervention value of the valve (see table below), the latter opens the circuit and lets the gas discharge into the atmosphere until the pressure has reached values lower than those set.
Under these conditions, the valve will automatically return to closing.
It is of the fixed calibration type and its calibration is in relation to the design pressure of the weakest component of the circuit.
The valve must be checked regularly, as laid down by the regulations in force.
Upstream of the safety valve, a shut-off valve is installed. Before removing the safety valve (for example, for periodic verification), make sure that the shut-off valve is in the closed position. After repositioning the safety valve, before starting the machine, check that the shut-off valve is in the open position and has been correctly plunged.
The unloading of the safety valve must be conveyed to the outside of the unit in a safe area according to the requirements of EN378-3 and the regulations in force at the place of installation and away from possible sources of ignition.
The discharge must be positioned at least 1 metre from the ground, and facing upwards.
The cross-section and length of the drain pipe must be sized in accordance with national laws and directives applicable in the country of installation.
The images below show the drains of the safety valves, whose positions are indicated by the relative adhesive (see 1.2 “Symbols”).



Convey the unloading of the safety valve (to be borne by the end user). Size the conveyor according to standard 13136:2019. To avoid any possible clogging of the pressure discharge pipe, fit a cover to keep out rainwater.

DANGER

⚠ **Zone 2 that is generated by the emission of a safety valve can have a horizontal extension of up to 23 metres and up to 25 metres of vertical extension.**
The assessment of the risk areas is carried out by the installer.
Do not convey the exhaust in the proximity of ignition sources as defined by EN378-2.
If more restrictive, always refer to the local regulations in force.

WARNING

⚠ Do not remove or tamper with the safety valve.

COMPONENT	REFRIGERANT	INTERVENTION	
		bar	°C
HP Safety Valve	R290	38	90
LP Safety Valve		20	60

WARNING

⚠ The intervention of the safety valve is a symptom of an abnormal operation of the machine.

Identify the cause of the anomaly as soon as possible and restore normal conditions.

8.4 Flow switch

The machine is equipped with a flow switch, of the vane type, which detects the correct circulation of water inside the evaporator. Otherwise an alarm system locks the machine after the set delay. When the water flow is restored, the machine can be restarted by resetting the alarm. This situation should be isolated and limited in time.

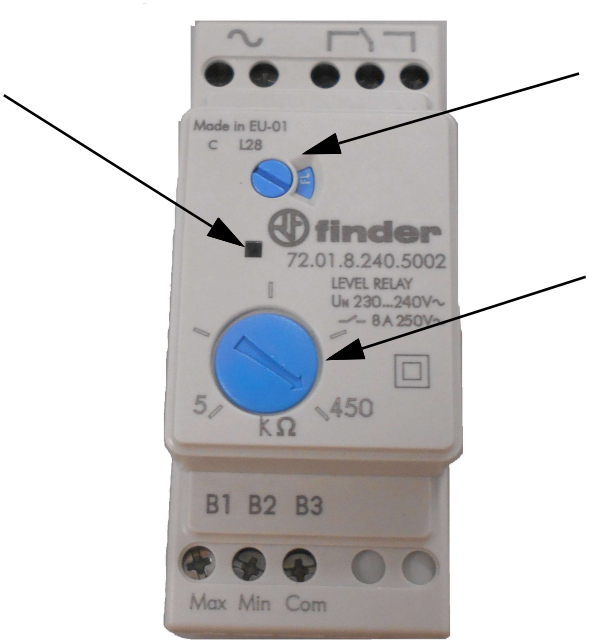
8.5 Level sensor

The sensor is installed inside the evaporator or tank and has the task of detecting any lack of water. If this anomaly is detected, the sensor sends an alarm signal to the control unit causing the chiller to stop immediately.

CAUTION

⚠ Implement all possible precautions in order to avoid accidental contact with live elements.

The voltage present in the electrical panel can reach lethal values for humans.

Led: steady on = alarm active flashing = normal operation, water present (alarm NOT active)		**A** Emptying / filling setting **B** Sensitivity setting range

WARNING

⚠ The level sensor has been calibrated to operate with a sensitivity of 100kOhm.

The calibration of the level sensor is the responsibility of the manufacturer, therefore it must not be modified.

WARNING

⚠ An anti-tamper label is placed above the adjustment potentiometers (A and B).

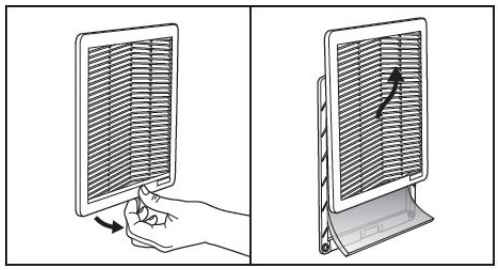
Its total or partial damage entails the forfeiture of the guarantee.

8.6 Forced ventilation of the electrical panel

The machines are equipped with a thermostat ventilation system for the electrical panel.
The circulation fan is activated when the temperature of the electrical panel exceeds about 40°C.
For adequate ventilation, it is necessary to provide for a regular cleaning of the filter cloth present both on the ventilation system and on the ventilation grille.

Replacing and cleaning the filter cloth:

To replace the filter cloth, slide the cover over the base by lifting the lower tab and pushing upwards.
Then reposition the cover.
The filter cloth can be cleaned by rinsing, water jet treatment or tapping.



NOTES

The frequency of its cleaning varies depending on the amount of dust present and the operating time; it must therefore be determined from time to time by the user for each individual use.

DANGER

⚠ **The dirty filter cloth decreases the efficiency of the filter unit causing insufficient or even a total lack of ventilation.**

8.7 Function -20

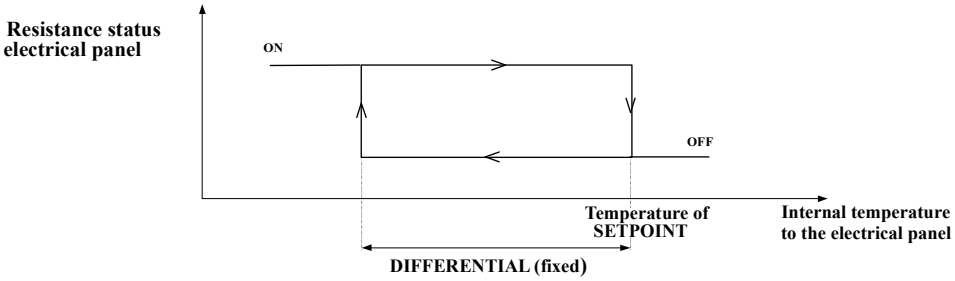
It imposes the electronic regulation of the fans and the resistors on the electrical panel. As an option, antifreeze resistors can be installed to protect the pump and tank against frost hazards when the ambient temperature is below 0°C. The antifreeze resistors option protects the components of the hydraulic circuit for ambient temperatures up to -10°C. For ambient temperatures below -20°Cit is necessary to glycol the circuit.

8.8 Anti-freeze control

The antifreeze control action depends on the temperature measured at the outlet of the evaporator.
When the temperature drops below the antifreeze threshold value previously set, the control signals an alarm that blocks the machine.
Once activated, the diagnostic will automatically reset when both the evaporator inlet and outlet water temperatures are above the antifreeze threshold value for 30 minutes.

8.9 Electrical panel resistance

In the electrical panel of units designed to work up to -20°C, an electrical resistance is installed, which is intended to heat the electrical components inside the panel itself, to safeguard them from problems related to temperature lowering.
The resistance is controlled by a thermostat inside the electrical panel and is activated when the temperature of the environment inside the electrical panel drops below the setpoint value minus the differential.



The setpoint is 5°C.
The differential, with a value of 10°C, is fixed.

8.10 Coolant leak detector

DANGER

⚠ **This unit is equipped with a safety device that can detect the gas leakage.**

AFTER INSTALLATION, THIS UNIT MUST NEVER BE TURNED OFF, EXCEPT DURING MAINTENANCE.

DANGER

⚠ **Before starting the machine, make sure that all the panels have been correctly installed.**

On board the units a refrigerant leak detector (Leak Detector) is installed with catalytic sensor that allows the immediate identification of refrigerant leaks. Upon exceeding 25% of the LFL (Lower Flammable Limit), the detector closes an alarm contact and, by means of a specific remote control, disconnects the control circuit of the electrical panel and the power circuit present in the compressor box; the electrical circuit of the Leak Detector always remains energised.
To restore the system, after the refrigerant gas loss falls below 25% of the LFL, use the "ALARM/reset" button on the left door of the electrical panel to restart the machine.
The restoration operation must be carried out only after careful verification of "non-leakage" by authorised operators, that are informed and trained on the specific risks from flammable gases according to good practices and/or current standards in accordance with ANNEX HH IEC 60335-2-40.
By default, the device is calibrated to 25% of the "LFL".
Operators must be aware of regulations established by the industrial sector and/or the country of installation to test and calibrate the device.
The sensitive element of the device must be reset annually (see chapter 9.2.8 "Control and maintenance schedule").
For the method and methods of testing, calibrating and replacing the device, refer to the authorised service centre.

WARNING

⚠ Refer to your service centre for testing and calibration of the sensitive element.

Replacement is only provided in case of damaged sensor.

WARNING

⚠ On first start-up, it is mandatory to recalibrate the sensor and reset the sensor operation counter.

8.10.1 Leak Detector: checks

The procedure for recalibrating the sensor must be requested at the email address **service@mta-it.com**.
Perform the following checks after recalibration:

1. Reposition all the panels of the machine taking care to position and close all the screws.
2. Turn the unit main switch to the ON position ("|").
3. Check that the red light (WARNING) and the yellow light (FAULT SENSOR) are on, that the display is off and that the washing fan is operating.
4. If one of the two lights is off, immediately disconnect the power to the machine and check its operation by powering it separately (check to be carried out in a safe area), replace it if necessary.
   If the fan should be switched off, immediately disconnect the power to the machine and check its operation; replace it if necessary.
   Restart from point 2.
5. Wait for the end of the leak detector warm-up phase; at the end of the warm-up phase the lights go off, the wash fan turns off and the TD7 display lights on.
6. Using the air/propane mixture of the calibration kit, simulate an intervention by the Leak Detector.
7. Check that the red light (WARNING) lights on, that the TD7 display lights off and that the wash fan is switched on.
8. Leave the wash fan on for at least 5 minutes to allow the air and propane mixture to dilute; press the ALARM/RESET button to allow the machine to restart.
   The TD7 display is powered.

9. Press and hold 

the display button to activate the unit.

   After the unit has restarted press the 

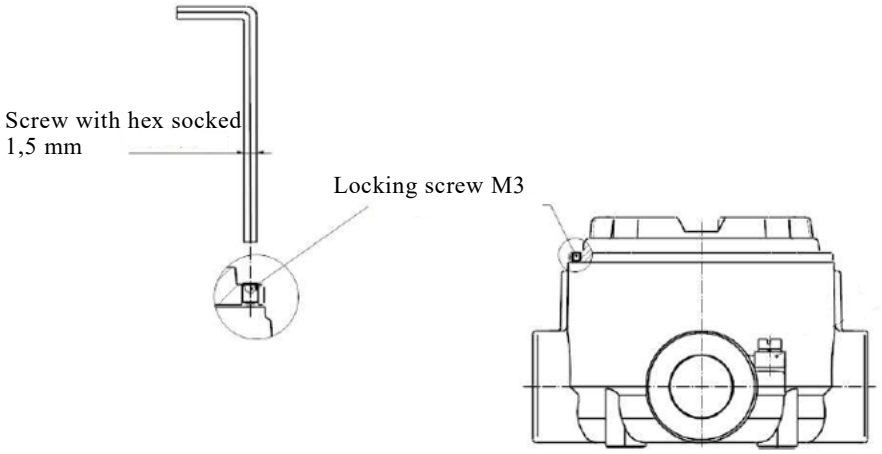
button to put the unit on standby.
10. Disconnect power to the machine by acting on the disconnecting device by moving it to the "O" position.
11. Connect power to the machine by acting on the disconnecting device by moving it to the "|" position.
12. Wait for the warm-up time (equal to 300 sec.) of the leak detector: during this phase, the machine display will be off, but the red light (WARNING) and the yellow light (FAULT SENSOR) under it and the washing fan will be on.
13. At the end of the warm-up time, the red light (WARNING) and the yellow light (FAULT SENSOR) and the washing fan switch off; at this point, the machine is ready to be started safely.

WARNING

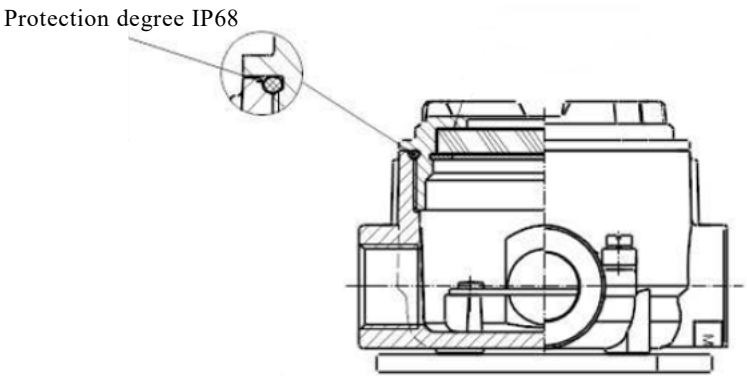
⚠ To ensure correct sealing of the Leak Detector case, follow the procedure below.

COVER LOCKING

Lock the cover by screw with hex socked using hex spanner with across flat 1,5mm.



Tighten up the cover with normal hand force until the end.



CHAPTER 9

OPERATION AND MAINTENANCE

9.1 Operation

WARNING

⚠ Never switch off the water circuit pump before stopping the machine.

The machine is designed to work autonomously, and switches off when the pre-set temperature is reached.

DANGER

⚠ **Never exceed the water flow values specified in the table in Chapter 5 "Hydraulic connections".**

9.2 Maintenance

WARNING

⚠ The maintenance operations, for which the intervention inside the machine is foreseen, must be carried out by authorised operators, informed and trained on the specific risks from flammable gases according to good practices and/or current standards incompliance with Annex HH IEC 60335-2-40, equipped with the appropriate precautions and protections (active and passive e.g. work gloves) in order to be able to operate in maximum safety.
Refer to the provisions of local laws and, in Europe, standard EN378-4 and standard EN13313.

WARNING

⚠ Before installing or operating this machine, make sure all personnel involved have read and understood the chapter " Safety" of this manual.

WARNING

⚠ This unit will give many years of trouble-free service if properly maintained and serviced.

DANGER

⚠ **This unit is equipped with a safety device that can detect the gas leakage.**

AFTER INSTALLATION, THIS UNIT MUST NEVER BE TURNED OFF, EXCEPT DURING MAINTENANCE.

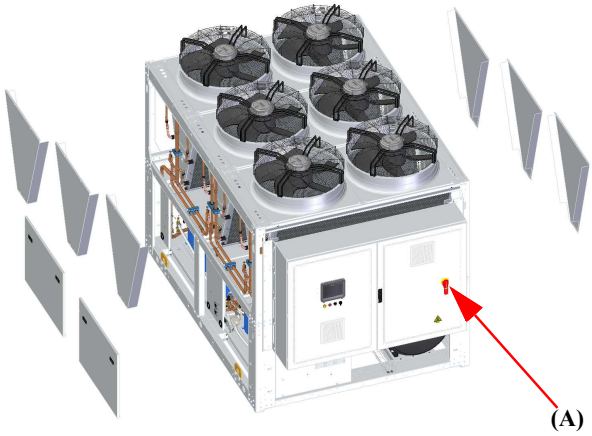
9.2.1 Accessing the internal machine compartments

See the attached drawings

DANGER

⚠ **The control panel must only be opened when the machine is switched off.**

To gain access to the components of the electrical board, turn the main switch/circuit breaker **(A)** to the open "O" position and open the closing bolts with the provided key.
To remove the side panels, use a screwdriver to loosen the screws fixing it to the top and bottom.



CAUTION

⚠ Given the presence of sharp corners and edges in the rear compartment, service personnel must protect themselves from accidental contact when working inside the compartment.
Caution must also be used in relation to the floor of the compartment, as it may be wet and slippery.

9.2.2 Filling the water circuit

The procedure for filling the units (according to the hydraulic circuit fitted on the machine) is explained below:

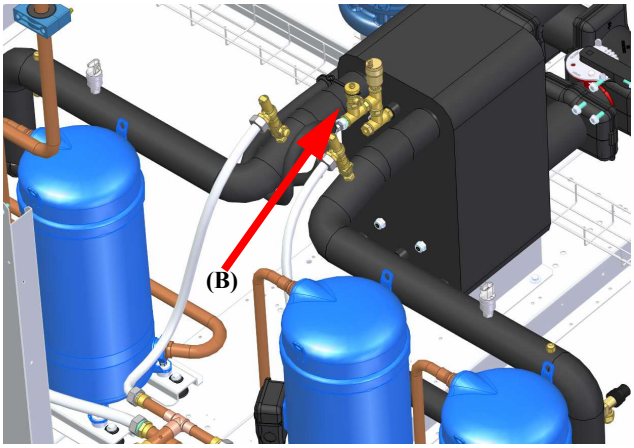


Plate evaporator:
Connect the water pipes to the machine.
Make sure there is a filling point on the water inlet pipe.
Make sure there are vents on the highest points of the hydraulic circuit, where air may collect.
Fill the system until water seeps out of the vents on the circuit and out of the evaporator's vent (**B**). The water pressure gauge on the hydraulic circuit must show a value that's compatible with the expansion tank (fitted by the installer).
Start up the pumps without activating the compressors, to fully bleed the system, and continue filling if necessary.

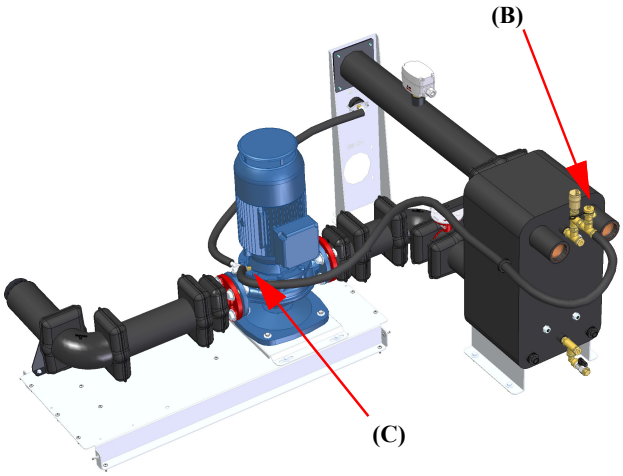
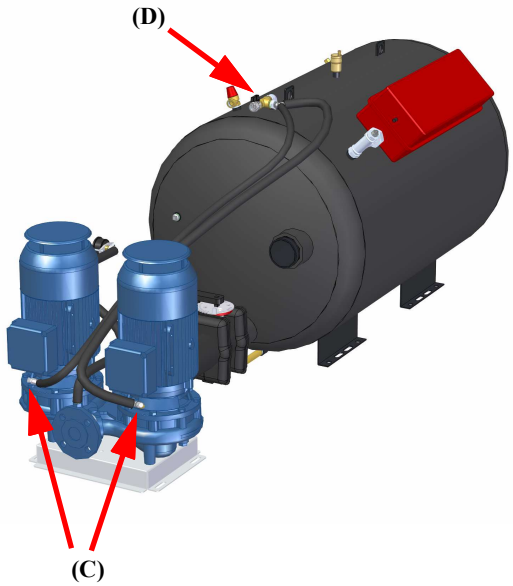


Plate evaporator + pumps:
Connect the water pipes to the machine.
Make sure there is a filling point on the water inlet pipe.
Make sure there are vents on the highest points of the hydraulic circuit, where air may collect.
Fill the system until water seeps out of the vents on the hydraulic circuit, from the vent of the plate evaporator **(B)** (accessed via the compressor compartment), the pump vent cap **(C)**. The water pressure gauge on the hydraulic circuit must show a value that's compatible with the expansion tank (fitted by the installer).
Start up the pumps without activating the compressors, to fully bleed the system, and continue filling if necessary.



Accumulation + plate evaporator:
Connect the water pipes to the machine.
Make sure there is a filling point on the water inlet pipe.
Make sure there are vents on the highest points of the hydraulic circuit, where air may collect.
Fill the system until water seeps out of the vents on the hydraulic circuit, the accumulation tank vent **(D)**, from the vent of the plate evaporator **(B** - see above**)** (accessed via the compressor compartment), the pump vent cap **(C)**. The water pressure gauge on the hydraulic circuit must show a value that's compatible with the components installed in the hydraulic circuit itself.
Start up the pumps without activating the compressors, to fully bleed the system, and continue filling if necessary.

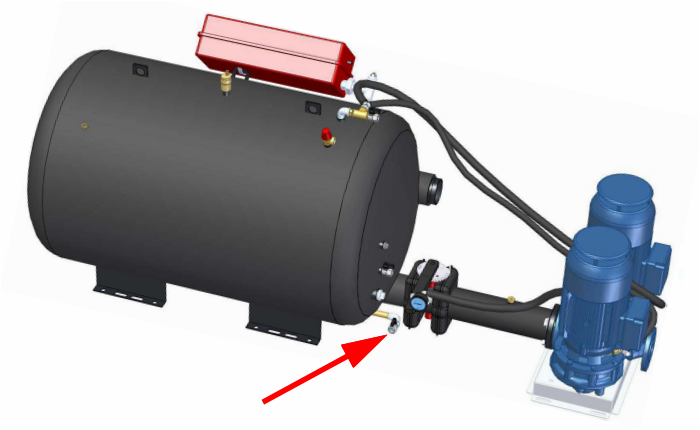
CAUTION

⚠ If the mechanical seal is lost during the start-up of an electric pump, quickly open and close the delivery baffle valve several times while the pump is operating; the aim is to create sudden pressure variations inside the pump to help the mechanical seal to settle down. You are advised to do this at least 2 or 3 times, switching the pump off and then back on again between one attempt and the next.

9.2.3 Draining the water circuit

If the machine is idle and not fitted with an anti-freeze heater, the water circuit must be drained if the ambient temperature reaches the freezing value of the water in the unit.

There is a tap on the lower part of the evaporator, to be used for draining it.



Only units equipped with a tank have a tap on the lower part, for draining the hydraulic circuit.

If it will be necessary to empty the water circuit it is possible to:

- discharge the water using the drainage cocks of the unit (see paragraph 5.2 “Hydraulic connections”)
- if the unit is not fitted with these taps, the water can be drained via the delivery pipe.

CAUTION

⚠ The water circuit drainage operation is indispensable when the machine must remain OFF for a long time in a place where temperatures which could reach the freezing values of the water inside the evaporator and condenser (risk of breakage).

9.2.4 Coolant charging procedure

The systems with container shipment are supplied with a nitrogen pre-charge of 1bar (indicated by the sticker below).

When the machine is put into operation this sticker must be removed.
To allow the machine to start up, it is necessary to charge the R290 refrigerant.

NOTES

The quantity of refrigerant per circuit is indicated on the data plate.

CAUTION

⚠ Vacuum / refrigerant gas filling procedures can only be performed by authorised operators, informed and trained on the specific risks of flammable gases according to good practices and/or current standards in accordance with ANNEX HH IEC 60335-2-40.

Comply with the following instructions:

- ensure that other types of refrigerant do not contaminate the R290 (the minimum purity of the refrigerant gas used for charging operations must be at least 99.5%);
- before charging the refrigerant gas, carry out three washing cycles with pressurised nitrogen followed by a suitable vacuum procedure;
- keep the gas cylinder in an upright position at the time of loading;
- use work equipment suitable for use with flammable gas.
  Keep the work area always well ventilated and equip yourself with detection devices for R290;
- do not charge more refrigerant gas than necessary. It is advisable to charge the unit using calibrated scales with a reading sensitivity of at least one tenth of a gram;
- after loading, carry out the leak detection operations before the functional test;
- once all the previous operations have been completed, it is good to carry out a second check to detect any leaks.

CAUTION

⚠ Each unit is equipped with charging connections (high pressure side and low pressure side) to ensure the charging and discharging operations of the refrigerant circuit. The tightening torque of the charging connections is 15 Nm.

9.2.5 Cleaning the plate heat exchanger

The plate heat exchanger may be susceptible to limescale.
The deposit of limescale in the long term compromises the performance of the heat exchanger, leading to inefficiencies of the machine. It is therefore a good idea to monitor the performance of the heat exchanger over time, verifying that the design DeltaT and also the pressure losses of the heat exchange fluid are maintained.
To clean the exchanger, use organic acids such as formic, acetic, or citric acid, in a concentration between 1 and 5%.
Carry out the following procedure:

1. Turn off the machine and make sure the pump is switched off.
2. Disconnect the main circuit from the exchanger, or provide threaded connections during installation to connect with the pipes in which to slide the cleaning solution.

3. Pump the detergent solution through the plate heat exchanger using the bottom connection.
   Reverse the flow every 30 minutes and, if possible, apply a flow rate equal to 1.5 times the nominal flow rate.
   Monitor pH and/or pressure drop. Cleaning is finished when the pH has remained constant for 30 minutes and/or the pressure drop has returned to the initial value.
4. Discharge the detergent from the exchanger and the machine.
5. Rinse the plate heat exchanger starting from the bottom connection until the water becomes neutral (pH 7).
   The steel can be passivated after cleaning by circulating 2% phosphoric acid at 50°C for 4-6 hours. This will reduce the corrosion rate due to precipitation of the corrosion product on the metal surface and inhibit further corrosion in water or air.

9.2.6 Cleaning the condenser coils

It is mandatory to clean regularly the coils for a proper unit operation. Eliminate pollution and other residual material help to extend the life of the coils and the unit.

CAUTION

⚠ **Equipment Damage!**

Do not use coil cleaning agents to clean uncoated coils. Use clean water only.
Use of coil cleaning agents on uncoated coils could cause damage to coils.

Regular coil maintenance, including frequent cleaning- enhances the unit's operating efficiency by minimizing compressor head pressure and amperage draw. The condenser coil (non-coated and e-coated) should be cleaned at least once each quarter or more if the unit is located in a "dirty" or corrosive environment.
Cleaning with cleansers or detergents is strongly discouraged due to the all-aluminium construction; straight water should prove sufficient. Any breach in the tubes can result in refrigerant leaks.
Only in extreme cases should any type of chemical cleaner or detergent be used on micro channel coils.
If it becomes absolutely necessary because water alone did not clean the coil, specify a cleaner that is:

- A is pH neutral cleaner.
- An alkaline cleaner that is no higher than 8 on the pH scale.
- An acidic cleaner that is no lower than 6 on the pH scale.
- Does not contain any hydrofluoric acids.

Be sure to follow the instructions provided with any cleaner chosen. Keep in mind that it is still MANDATORY that the coils are thoroughly rinsed with water after the application of the cleaner even if the instructions specify a "No Rinse" cleaner.
Cleaners or detergents that are left on the coil due to improper rinsing will significantly increase the possibility of corrosion damage on the micro channel coil.

NOTES

Quarterly cleaning (or more for harsh environment) is essential to extend the life of a coil and is required to maintain warranty coverage.
Failure to clean a coil will void the warranty and may result in reduced efficiency and durability in the environment.

DANGER

⚠ **Hazardous Voltage!**

Disconnect all electric power, including remote disconnects before servicing.

Follow proper lockout/ tagout procedures to ensure the power cannot be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

1. Disconnect power to the unit.
2. Wear proper personal protection equipment such as a face shield, gloves and waterproof clothing.
3. Remove enough panels from the unit to gain safe access to the microchannel coil.

NOTES

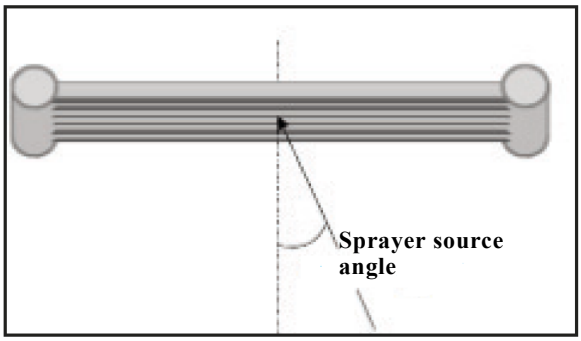
It is better to clean the coil from the opposite direction of normal airflow (inside of unit out) because this allows the debris to be pushed out rather than forced further into the coil.

4. Use a soft brush or vacuum to remove base debris or surface loaded fibers from both sides of the coil.

NOTES

Remove solid residue is essential to preserve performance of the coil and avoid corrosion over the length of the product life.

5. Using a sprayer and water ONLY, clean the coil following the guidelines below.
   a. Sprayer nozzle pressure should not exceed 40 bars.
   b. The maximum source angle should not exceed 25 degrees (see figure below) to the face of the coil. For best results spray the micro channel perpendicular to face of the coil.
   c. Spray nozzle should be approximately 5 to 10 cm from the coil surface.
   d. Use at least a 15° fan type of spray nozzle.



To avoid damage from the spray wand contacting the coil, make sure the 90° attachment does not come in contact with the tube and fin as abrasion to the coil could result.

9.2.7 Pump maintenance (when there is a double pump)

Should it be necessary to perform maintenance on only one pump, in the case of a double pump unit, it is possible to operate the other pump by installing a closure flange.
Proceed as follows:

1. Switch off the machine
2. Close the suction and delivery valves
3. Remove the damaged motor
4. Insert the flange as shown in the figure
5. Open the valves and switch on the unit

9.2.8 Control and maintenance schedule

OPERATION	1 Day	1 Month	3 Months	6 Months	1 Year
Check there are no alarm signals.	◊				
Check the water outlet temperature is within the correct range.	◊				
Check the user water inlet temperature is OK for the machine configuration.		◊			
Check that the difference between the pump output pressure (if installed) and intake pressure (measured by a pressure gauge with the pump stopped) is within the limits envisaged and, in particular, is not lower than the value corresponding to the maximum flow.		◊			
Check the liquid sight glass is full - or shows only a minimum amount of bubbles - when the compressor is running.				◊	
Check that the unit current absorption is within the data plate values.				◊	
Make a visual inspection of the refrigerant circuit to check the condition of the pipes and to make sure there are no traces of oil (which may indicate a refrigerant leakage).				◊	
Check the condition and firmness of the pipe connections.				◊	
Check the condition and security of wiring and electrical connections.				◊	
Check the ambient air temperature is OK for the machine configuration. Check that the environment is well ventilated.		◊			
Check the fan motors are automatically activated by the electronic control unit. Check they are not noisy. Check that the grilles of the unit are free from dirt and any other obstructions.				◊	
Clean the condenser fins (see ch. 9.2.6 “Cleaning the condenser coils”).			◊		
Clean the water filter. In any case, you are advised to clean the filter one week after the initial machine start-up.		◊			
Calibration or replacement of the sensitive element of the refrigerant leak detector.					◊

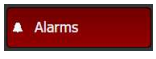
CAUTION

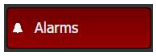
⚠ The above maintenance schedule is based on average operating conditions.

In some cases it may be necessary to increase maintenance frequency.

CHAPTER 10

TROUBLESHOOTING

PROBLEM	MANIFESTATION	CAUSE/REMEDY
A Unit fails to start	• Unit is powered and yet fails to start.	**Presence of shut-down alarms** Check for the presence of alarms that prevent the unit from starting. **Unit programmed to run by time band** The unit is set to start only within the programmed time bands. **Supervision active** Check that supervision is not enabled on the unit, otherwise disable it.
B Water outlet temperature higher than set-point.	• Unit is operational but water temperature is higher than the set-point value. • Temperature higher than the value envisaged. • High water outlet temperature alarm trip. • Low evaporation pressure. • Presence of a large number of air bubbles in the liquid sight glass. • Excessively noisy operation of compressors.	**Water flow rate too high** Increase the pressure drop in the water circuit (e.g.: partially closing a tap on the pump delivery line). **Thermal load too high** Reduce the thermal load to within preset limits. **Ambient temperature too high** Increase air recirculation. **Condenser fins fouled** Clean the condenser fins. **Front surface of the condenser blocked** Remove the obstruction from the front surface of the condenser. **Circuit has insufficient refrigerant charge** Call in a qualified refrigeration engineer to check for leaks and eliminate them. Fill the plant. **Incorrect compressors rotation** Invert the position of two phase wires of the compressors power supply (see chap.“7.2 Start-up”).
C Insufficient pressure head (water pressure) at the outlet of the pump (if present).	• Rise of water outlet temperature. • With pump installed: pressure difference (read on the unit pressure gauge) with pump running and pump stopped is too low. • Increase in the pressure drop due to the presence of ice. • High temperature difference between water inlet and outlet.	**Water flow rate too high** Reduce water flow within design limits, for example by partially closing a pump outlet cock. **Presence of ice in the evaporator** Stop the unit, leave the pump running, edit the set-point value and add glycol to the water. **Evaporator blocked** Supply a high flow rate of water in counter-current conditions. Install a filter upline from the unit.
D The unit is blocked and water does not flow.	• No water flow. • Flow switch alarm trip. • Low pressure alarm trip. • Suction pressure too low.	**Set-point value too low** Increase the SET-POINT value or add glycol (antifreeze) in adequate percentage (see heading “5.3 Anti-freeze protection”). ⚠ **The formation of ice can severely damage the unit.**
E High pressure	• High pressure switch trip. • Refrigerant compressor stops. • The icon  lights up. • Intervention of general alarm relay. • Fans stopped or reverse rotation direction. • Water outlet temperature too high.	**Fans stopped** Repair or replace the fan. **Warm air recirculation** Change the position of the unit or the position of any adjacent obstructions to avoid recirculation. **Coil fouled** Clean the condenser fins. **Thermal load too high** Reduce the thermal load to within preset limits.
F Low pressure.	• Refrigerant compressor stops. • The icon  lights up. • Intervention of general alarm relay.	**Circuit has insufficient refrigerant charge** Call in a qualified refrigeration engineer to check for leaks and eliminate them. Fill the plant.

PROBLEM	MANIFESTATION	CAUSE/REMEDY
G Compressor internal protection trip	• The icon  lights up. • Intervention of general alarm relay. • Refrigerant compressor stops.	**Thermal load too high** Check that user water temperature and ambient air temperature are within rated limits. Restore the load within the preset limits. Wait a few minutes before turning on again. **Circuit has insufficient refrigerant charge** Call in a qualified refrigeration engineer to check for leaks and eliminate them. Fill the plant.
H Display off.	• Despite the presence of voltage on the board terminals the display remains blank.	**Control board fuse has blown** Change the fuse. Provide cleaner power supply to the unit.
I Pressure transducer faulty or disconnected	• Intervention of general alarm relay.	**Transducer disconnected or short-circuited** Check that the transducer is correctly connected to the control board terminals and the cable is undamaged. If necessary, replace the transducer with a genuine original replacement part.
J Fans overload	• Fans stopped. • Intervention of general alarm relay. • Refrigerant compressor stops. • The icon  lights up. • One of the fans is running noisily.	Check the status of fans, electrical connections, and power supply.
K Pump overload	• The pump doesn't work. • Intervention of general alarm relay. • Refrigerant compressor and pump stop. • The icon  lights up. • Pressure difference (read on the unit pressure gauge) with pump running and pump stopped is lower than the available pressure head.	Reset thermal cut-out. Increase the pressure drop in the hydraulic circuit, for example by partially closing the pump supply cock. Check for the presence of electrical power.
L Flow switch alarm trip	• The icon  lights up. • Intervention of general alarm relay. • Refrigerant compressor and pump stop.	Check condition of pump. The water circuit is obstructed outside the machine.
M The desuperheater is enabled but the water is cold.	• Cold desuperheater water.	Check operating mode (chiller only).

CHAPTER 11

RISK ANALYSIS: RESIDUAL RISK

Description of risk:	Effect:	User instructions:
1. Risk of crushing	Machine falling onto persons and/or limbs crushed.	Use lifting equipment suitable for the task, to be performed by qualified personnel referring to the labelling instructions and manual.
2. Risk of cutting and detachment caused by sheets or profiles in general	Risk of cuts to upper limbs on sharp edges created by the shearing of sheets or saw cutting of profiles.	Strictly observe all manual instructions. Chapter 2 “Safety”; Chapter 4 “Installation” and Chapter 9 “Operation and maintenance”.
3. Risk of cutting or detachment due to the finned surface of air-cooled condensers.	Risk of cutting upper limbs.	Strictly observe all manual instructions. Chapter 1 “General Information”; Chapter 2 “Safety” and Chapter 9 “Operation and maintenance”.
4. Risk of cutting or detachment due to fan blades.	Cuts or dissection.	Strictly observe all manual instructions. Chapter 1 “General Information”; Chapter 2 “Safety” and Chapter 9 “Operation and maintenance”.
5. Risk of high pressure fluid ejection from pipelines and/or pressure tanks in cooling circuit due to accidental bursting.	Contact of body parts with refrigerant gas or parts of cooling circuit pipelines launched at high speed.	Strictly observe all manual instructions. Chapter 2 “Safety” and Chapter 4 “Installation”.
6. Risk of high pressure fluid ejection from pipelines and/or pressure tanks in cooling circuit due to design pressure values being exceeded.	Contact of body parts with refrigerant gas or parts of cooling circuit pipelines launched at high speed.	Strictly observe all manual instructions. Chapter 2 “Safety”; Chapter 4 “Installation” and Chapter 9 “Operation and maintenance”.
7. Risk of high pressure fluid ejection from pipelines and/or pressure tanks in the hydraulic circuit, due to accidental explosions.	Contact of body parts with fluids or residual parts of hydraulic circuit pipelines launched at high speed.	Disconnect the machine from the electricity supply during interventions on the hydraulic circuit. Strictly observe all manual instructions. Chapter 2 “Safety”; Chapter 4 “Installation” and Chapter 9 “Operation and maintenance”.
8. Risk of high pressure fluid ejection from pipes and/or pressure tanks in the hydraulic circuit, if the project pressure values are exceeded.	Contact of body parts with fluids or residual parts of circuit pipes launched at high speed.	Depressurise the machine before intervening on the hydraulic circuit. Strictly observe all manual instructions. Chapter 2 “Safety”; Chapter 4 “Installation” and Chapter 9 “Operation and maintenance”.
9. Electrical hazards due to direct contact with live parts	Risk of electrocution and burns.	Strictly observe all manual instructions. Chapter 2 “Safety” and 6.2 “Electrical connections”.
10. Electrical hazards due to indirect contact with parts that are live due to faults, in particular due to an insulation fault.	Risk of electrocution and burns.	Strictly observe all manual instructions. Chapter 2 “Safety” and 6.2 “Electrical connections”.

Description of risk:	Effect:	User instructions:
11. Electrical hazards: electrostatic phenomena.	Uncontrolled movements by victim of electrostatic discharge due to contact.	Strictly observe all manual instructions. 6.2 “Electrical connections”.
12. Electrical hazards: heat radiation or other phenomena such as the projection of melted particles, and chemical effects deriving from short circuits, overloads.	Risk of electrocution with live parts due to short-circuits, scalding on contact with hot components due to overload.	Strictly observe all manual instructions. Chapter 2 “Safety” and 6.2 “Electrical connections”.
13. Heat-associated risk: burns and/or scalding.	Scalding on contact with pipes at temperatures over 65°C and/or freezing due to contact with surfaces at temperatures below 0°C.	Strictly observe all manual instructions. Chapter 2 “Safety”.
14. Hazards generated by noise levels that may impair hearing capacity (deafness) and other physical disorders (such as loss of balance, consciousness).	Loss of hearing capacity by operator.	Secure all components correctly after interventions and maintenance.
15. Hazards generated by materials or substances handled, used, produced or offloaded from the machine, and by the materials used to construct the machine: inhalation of refrigerant gases.	Inhalation of refrigerant gas.	Strictly observe all manual instructions. Chapter 2 “Safety”.
16. Hazards generated by materials or substances handled, used, produced or offloaded from the machine, and by the materials used to construct the machine: discharge of polluting cooling fluids.	Risk of environmental pollution caused by the drainage of water-glycol mixtures.	Strictly observe all manual instructions. Chapter 2 “Safety”.
17. Hazards generated by materials or substances handled, used, produced or offloaded from the machine and materials used to construct the machine: fire or explosion.	Risk of fire or explosion.	Install the system in an environment fitted with adequate fire fighting equipment. Strictly observe all manual instructions. Chapter 4 “Installation”.
18. Hazards generated by failure to use personal protective equipment	Lacerations to upper limbs during maintenance or installation.	Use adequate personal protective equipment and observe all the instructions given in the manual. Chapter 1 “General Information”; Chapter 2 “Safety”; Chapter 4 “Installation” and Chapter 9 “Operation and maintenance”.
19. Hazards generated by failure to observe principles of ergonomics during machine design, caused, for example, by: unsuitable design, layout or identification of manual controls.	Hazards associated with failure to correctly identify manual controls.	Consult all sections of the manual.
20. Hazards generated by failure to observe principles of ergonomics during machine design, caused, for example, by: inadequate design or layout of visual display units.	Hazards associated with failure to correctly understand the visual display units.	Consult all sections of the manual.

Description of risk:	Effect:	User instructions:
21. Inadvertent start-up, unexpected overstroke/excess speed (or any other similar malfunction) caused by: a fault or malfunction of the command system.	Electrical or mechanical hazard due to incorrect settings of operating parameters or settings.	Strictly observe all manual instructions. Chapter 2 “Safety”; Chapter 9 “Operation and maintenance”; 6.2 “Electrical connections” and Chapter 4 “Installation”.
22. Inadvertent start-up, unexpected overstroke/excess speed (or any other similar malfunction) caused by: fault or malfunction of control system with possibility of disabling safety devices.	Electrical hazard during interventions on machine with safety devices inhibited.	Strictly observe all manual instructions. Chapter 2 “Safety”; 6.2 “Electrical connections”; Chapter 4 “Installation” and Chapter 9 “Operation and maintenance”.
23. Inadvertent start-up, unexpected overstroke/excess speed (or any other similar malfunction) caused by: a fault or malfunction of the command system.	Electrical hazards associated with environmental work conditions.	Strictly observe all manual instructions. Chapter 2 “Safety”; Chapter 4 “Installation” and 6.2 “Electrical connections”.
24. Inadvertent start-up, unexpected overstroke/excess speed (or any other similar malfunction) caused by: the return of the electricity supply after a failure.	Hazards associated with inadvertent start-up of the machine when electric power supply is restored.	Strictly observe all manual instructions. Chapter 2 “Safety”; 6.2 “Electrical connections”and 7.2 “Start-up”.
25. Inadvertent start-up, unexpected overstroke/excess speed (or any other similar malfunction) caused by external factors on the electrical equipment (EMC).	Electrical hazards associated with electric stress faults on internal machine components, short-circuits and overloads.	Strictly observe all manual instructions. Chapter 2 “Safety”; 6.2 “Electrical connections”and Chapter 7 “Start-up”.
26. Hazards caused by assembly errors.	Hazards associated with machine instability caused by vibrations. Hazards on contact with operating fluids, risk of pollution due to dispersion of fluids into the environment.	Strictly observe all manual instructions. Chapter 2 “Safety”; Chapter 4 “Installation” and 7.2 “Start-up”.
27. Risk of falling or projection of objects or fluids.	Contact of body parts with metallic materials such as the fan blades or moving parts of the compressor.	Disconnect the machine from the electricity supply during interventions on the hydraulic circuit. Strictly observe all manual instructions. Chapter 2 “Safety”; Chapter 4 “Installation” and Chapter 9 “Operation and maintenance”.
28. Loss of machine stability / machine overturning.	Crushing of body parts.	Strictly observe all manual instructions. Chapter 4 “Installation” and the indications on the unit.
29. Loss of stability/overturning of the machine due to installation on unstable ground and/or vibrations caused by the connection pipes.	Crushing of body parts due to overturning of the machine. Contact of body parts with water due to loss of hydraulic circuit connections because of excessive vibrations.	Strictly observe all manual instructions. Chapter 4 “Installation” and 7.2 “Start-up”.

Description of risk:	Effect:	User instructions:
30. Hazards generated by the absence or incorrect position of safety measures/tools: all guards.	Hazard caused by contact with machine components and processed or used materials due to sudden ejections.	Strictly observe all manual instructions. Chapter 2 “Safety”; Chapter 4 “Installation”; 7.2 “Start-up” and Chapter 9 “Operation and maintenance”.
31. Hazards generated by the absence or incorrect position of safety measures/tools: graphic safety signs.	Hazard associated with the lack of or inadequate graphic instruction and warning symbols related to dangers that could not be eliminated in design.	The operator must respect all the graphic symbols on the machine, and replace them when worn or illegible. Strictly observe all manual instructions. Chapter 1 “General Information”.
32. Hazards generated by the absence or incorrect position of safety measures/tools: manual.	Hazards associated with incorrect preparation of the manual due to absent and/or unclear information required to ensure operator safety and safe machine use.	Consult all sections of the manual.
33. Hazards generated by the absence or incorrect position of safety measures/tools: disconnection of power sources.	Contact with live parts, contact with high pressure fluids or gas.	Strictly observe all manual instructions. Chapter 2 “Safety” and 6.2 “Electrical connections”.
34. Hazards generated by the absence or incorrect position of safety measures/tools: instruments and accessories for adjustments and/or maintenance in safe conditions.	Hazard of cutting, ejection of high pressure fluids or gases, scalding, or vibrations caused by incorrect maintenance.	Strictly observe all manual instructions. Chapter 2 “Safety”; Chapter 4 “Installation”; Chapter 9 “Operation and maintenance”.

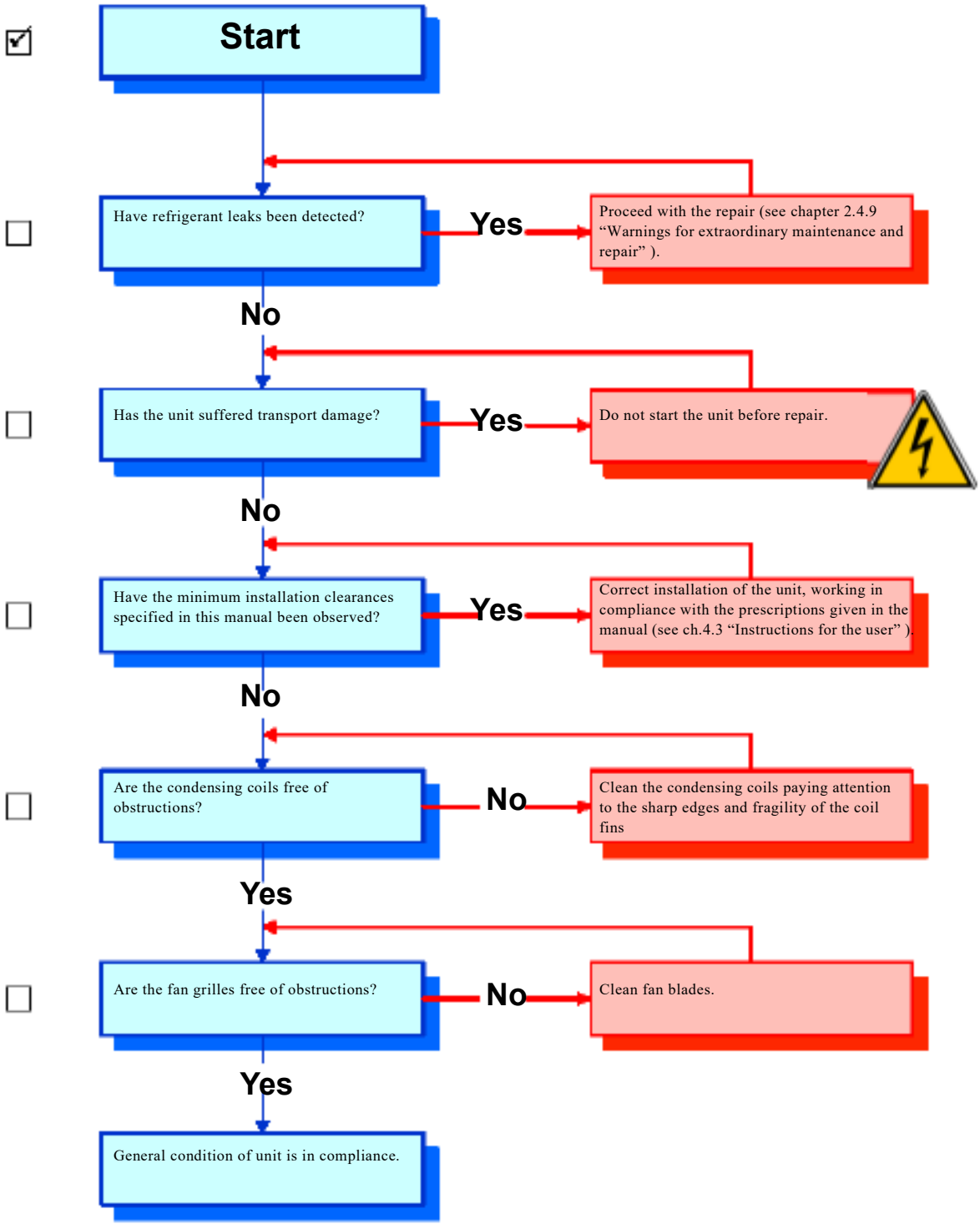
CHAPTER 12

APPENDIX

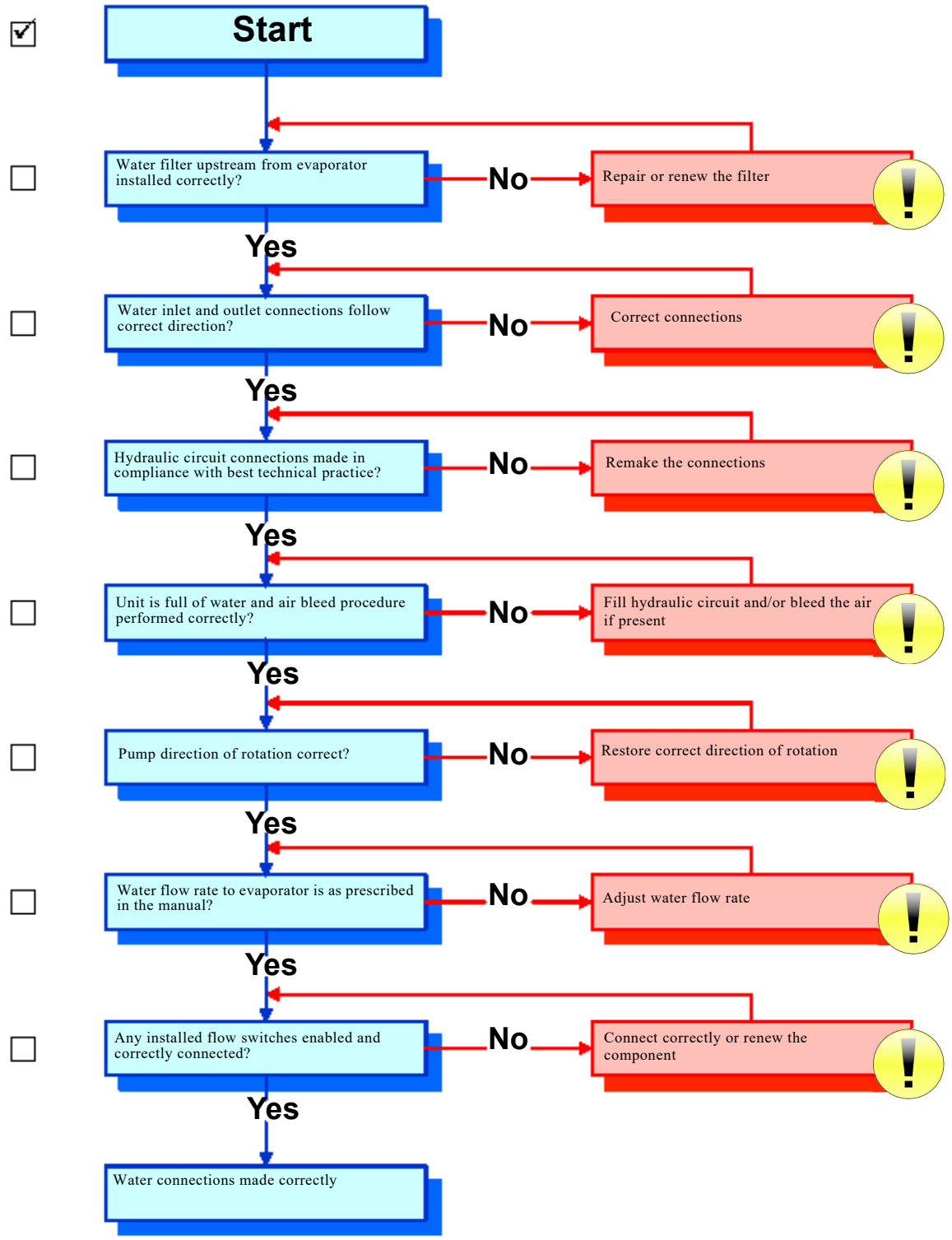
GENERAL CONDITIONS CHECKLIST

CAUTION

⚠ DO NOT SUPPLY THE UNIT

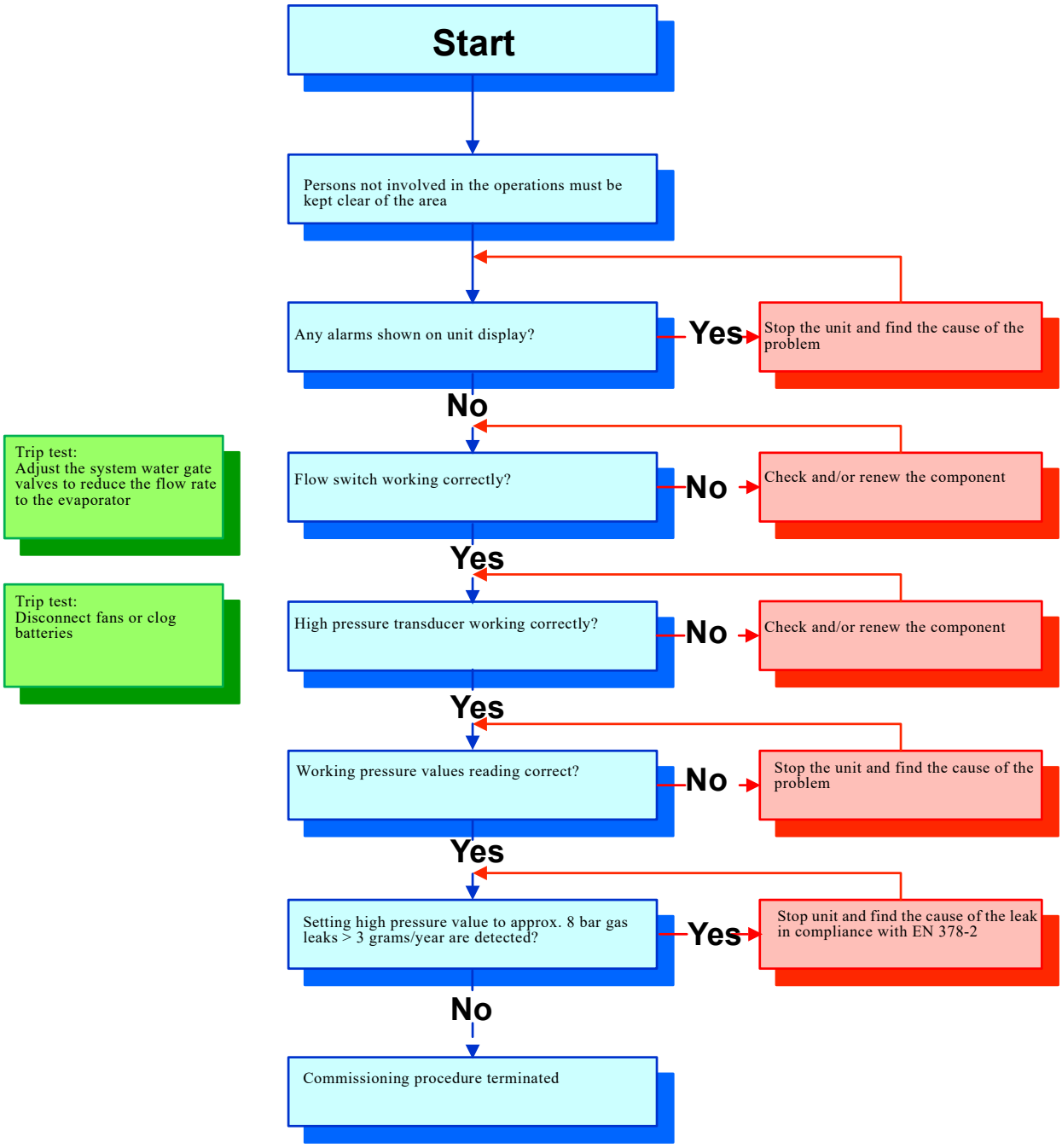


HYDRAULIC CIRCUIT CHECK LIST

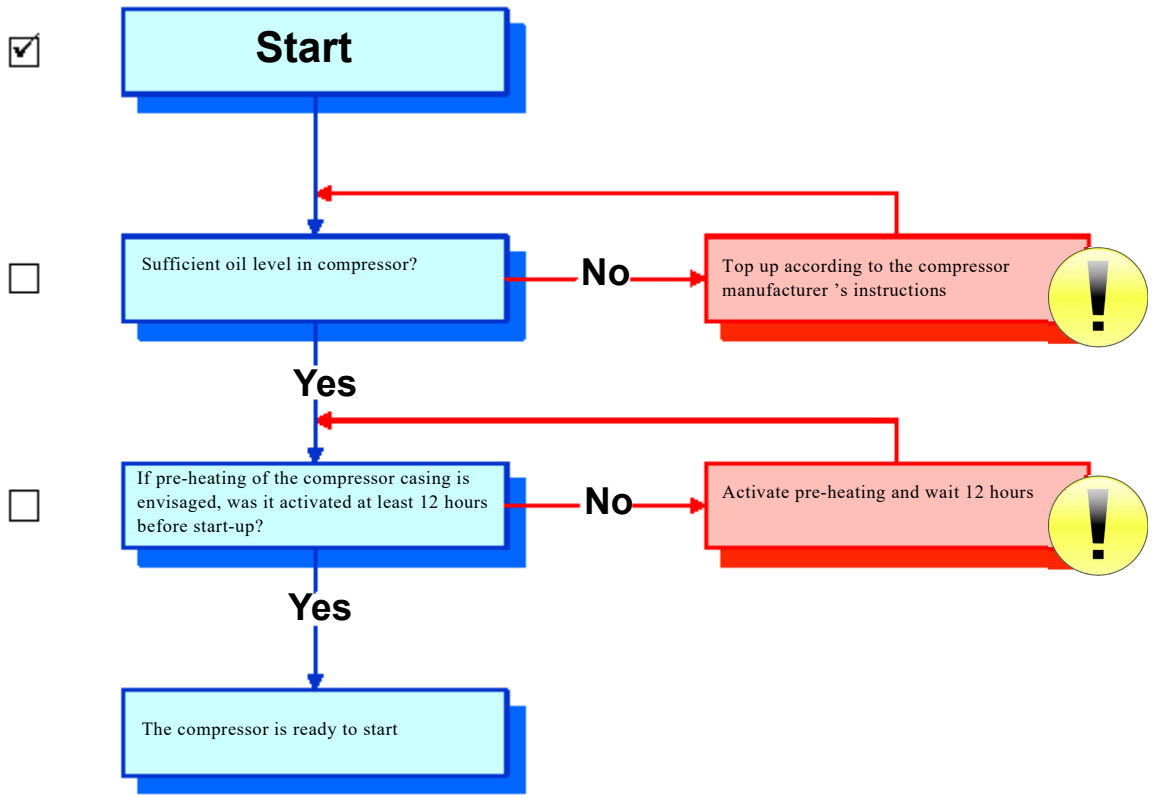


CONTROLLER CHECK

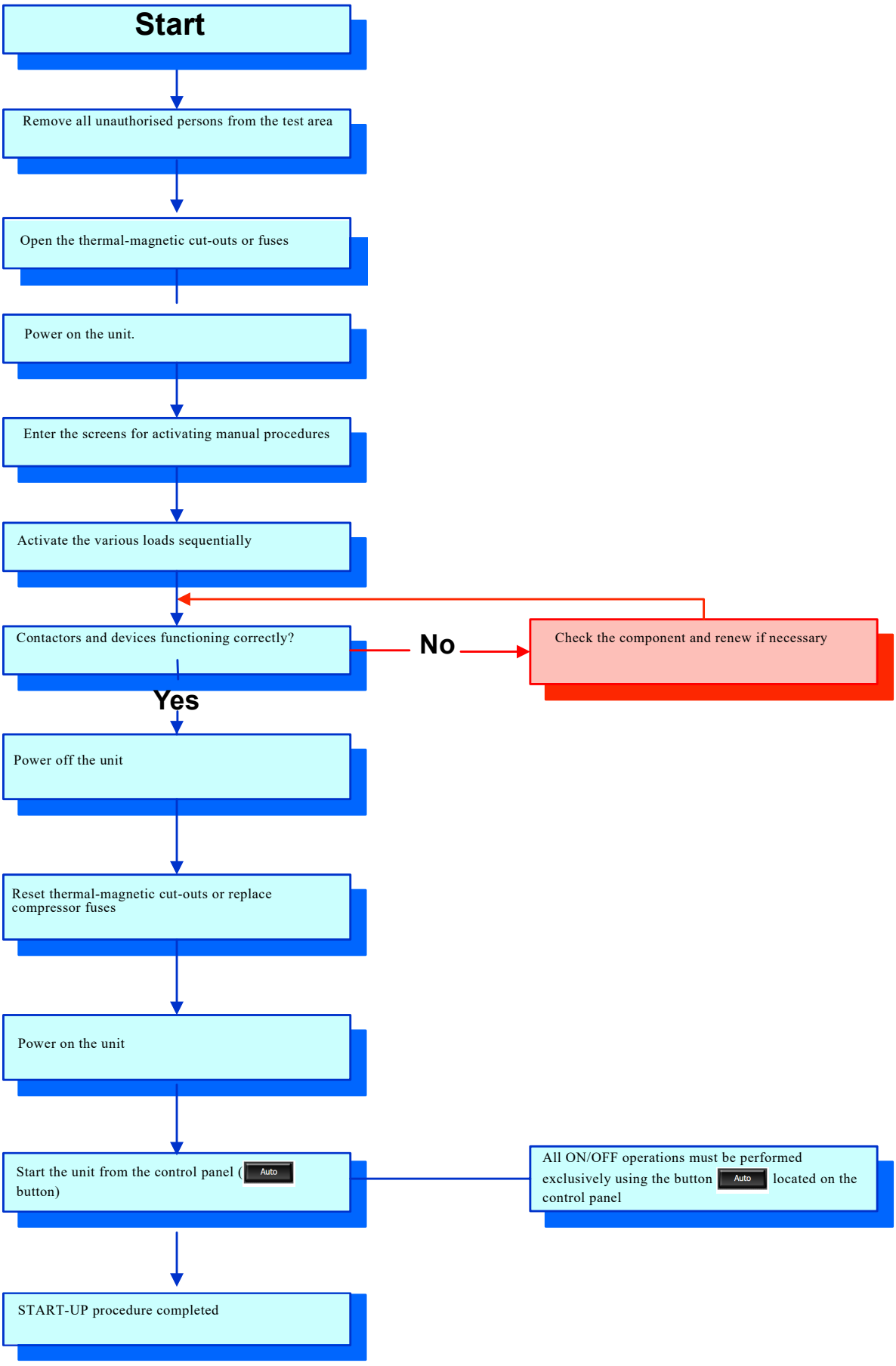
FIRST START CHECKLIST



OIL CHECKLIST



UNIT OPERATING CHECKLIST



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CG-SVX072A-GB July 2025
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