CLOSE CONTROL
AIR CONDITIONERS

TECHNICAL MANUAL

INSTALLATION AND ROUTINE AND SPECIAL MAINTENANCE

SYMBOLS

WARNING!
This symbol is used to indicate helpful hints for the operator.

ATTENTION! DANGER!
This symbol is used to indicate situations or operations that may be potentially dangerous or that require the operator's attention.

RISK OF ELECTRIC SHOCK!
This symbol is used to indicate situations or operations that may pose a risk of electric shock for the operator.

DANGEROUS HANDLING!
This symbol is used to indicate situations or operations that may pose a risk of crushing for the operator.

HEAVY LOADS!
This symbol is used to indicate situations or operations which require heavy loads to be handled by the operator.

RISK OF BURNS!
This symbol is used to indicate situations or operations that may pose a risk of burns for the operator.

RISK OF CUTS!
This symbol is used to indicate situations or operations that may pose a risk of cuts or abrasions for the operator.

The Manufacturer adopts a policy of continuous development and therefore reserves the right to make changes and improvements to any product described in this document without prior notice. Technical data and dimensions are not binding.

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List of revisions				
Revision	**Date**	**Author**	**Chapters**	**Descriptions**
A	04/2011	AF	All	First version
B	12/2011	AF	All	Revision of content
C	12/2012	AF	All	Revision of content
D	03/2014	AF	All	Revision of content and insertion of R series
E	05/2015	AF	All	Revision of content for SURVEY^{EVO} operation
F	05/2016	AF	All	Revision of content
G	10/2017	AF	All	Revision of content
H	04/2018	AF	All	Revision of content and introduction of Free Cooling plenum
I	10/2018	AF	All	Revision of content

CONTENTS

WARRANTY CONDITIONS

All Products of the Manufacturer or bearing the trademark of the Manufacturer are built according to the state of the art techniques, in compliance with the current reference standards, as stipulated in the certificate of conformity provided together with the products.

All Products of the Manufacturer or bearing the trademark of the Manufacturer are designed to be installed inside a system that controls them. The designer or installer of the Product assumes all liability and risk relating to its installation in the destination system.

The Manufacturer and its Branches/Affiliates do not guarantee that all aspects of the Product and any software included will comply with the requirements of the destination system. In this case, following specific agreements, the Manufacturer can act as a consultant for the successful start-up of the Product, but will not be held liable, under any circumstances, for the smooth operation of the destination system.

All Products of the Manufacturer or bearing the trademark of the Manufacturer are subject to the following warranty which is deemed as entirely accepted and signed at the time of placing the order.

The warranty on the Products of the Manufacturer or bearing the trademark of the Manufacturer is valid for TWENTY-FOUR MONTHS (2 years) from the shipment date of the material.

If start-up is not carried out by Manufacturer-authorised technicians, the warranty is validated by submitting a completed copy of the Product's technical start-up report.

During the warranty period, the Manufacturer, under its sole discretion and as quickly as possible, undertakes to repair or provide as new any parts with acknowledged defects relating to material, construction or workmanship, which make them unsuitable for their intended use.

The claim must be submitted in writing, indicating the details of the reported fault, the serial number or code of the Product, where the fault was identified and indication of the component that caused the fault, if this is easily identifiable. The Manufacturer will accept no claim made over the phone.

For operational purposes, claims can only be accepted during office hours, Monday to Friday. If a request is submitted on a public holiday, the Manufacturer will consider it as received at the beginning of the next business day after it was sent.

Faulty components are replaced ex works (EXW). Transport costs are borne by the Customer, even if the warranty cover is applied, unless specified otherwise by the Manufacturer.

The costs to replace faulty components (labour, materials, refrigerant, etc.) are borne by the Customer, even if the warranty cover is applied, unless specified otherwise by the Manufacturer.

Materials replaced while under warranty are the property of the Customer, who must dispose of them according to current regulations. Any disposal costs are borne by the Customer.

If parts should be returned while under warranty, they must be returned no later than three (3) months from the shipment date of the replacement part, organised and the expenses borne by the Customer. Otherwise, all the parts will be charged at the applicable list price at the time of their shipment.

The Manufacturer is not liable to pay compensation for direct or indirect damage, of any kind and for any reason. The Manufacturer is also not liable for any delay in the supply of parts under warranty or in the execution of work under warranty.

WARRANTY RESTRICTIONS

The above mentioned warranty conditions are valid as long as the Customer has fulfilled all obligations according to the contract and in particular those relating to payment. A delayed payment or non-payment of the supply, even if partial, suspends any warranty. The warranty does not give the Customer any right to suspend or delay payments, which must be paid in any case according to the stipulations of the order and specified in the written order confirmation.

Without precluding due compliance with other instructions provided in the technical documentation supplied with the Product, it must be noted that the following instructions must be complied with accordingly, in order for the warranty to be valid:

Transport and positioning

- Do not remove the Product from its original packaging until it has reached the installation site.
- Do not drop, knock or shake the Product, as the internal circuits and mechanisms may be irreparably damaged.
- Store the Product in an environment that complies with the temperature and humidity limits specified in the technical documentation.

Installation

1) The Product must be installed by skilled personnel who fulfil the adequate requisites for the task as defined by the regulations in the country where positioning and installation take place.
2) The system that will control the Product must be implemented according to professional standards, according to the instructions provided in the technical documentation and the regulations of the country where positioning and installation take place, with particular attention to the setting up of:

- Water or cooling lines serving the Product and the relevant components.
- Electrical power and connection lines of the Product and the relevant components.
- Aeraulic lines of the Product and the relevant components.

3) Do not install the Product outdoors or in areas that are subject to adverse weather.
4) Do not install the Product in areas where there is oil, or where there are oil vapours or various kinds of aerosols, and where there are flammable vapours.
5) Do not install the Product in an environment where there are corrosive gases, such as sulphur gases.
6) Do not install the Product in environments where there is equipment that generates electromagnetic waves, and where the line voltage is subject to great fluctuations.
7) Do not install the device in an environment where the air is highly saline, such as near sea cliffs.
8) Do not install the device in vehicles or boats.

First start-up

1) The Product must be started up by skilled personnel who fulfil the qualification requisites for the task as defined by the regulations in the country where positioning and installation take place.
2) The system controlling the units must be started up according to professional standard, according to the instructions provided in the technical documentation and the regulations of the country where positioning and installation take place.
3) A copy of the technical start-up report of the Product must be delivered to the Manufacturer.

Use and maintenance

1) Do not use the Product for applications other than those specified in the technical documentation.
2) Do not use the Product in an environment that does not comply with the temperature and humidity limits specified in the technical documentation.
3) Perform maintenance cycles according to the schedules specified in the technical documentation.
4) Clean the Product with neutral detergents. Do not use corrosive chemicals and solvents or aggressive detergents.

Furthermore, the Manufacturer reserves the right to void the warranty of the products sold if:

A) The labels or plates bearing the trademark of the Manufacturer and the serial number or the registration number of the Product have been deleted and/or removed.
B) The Product has been subjected to alterations or mechanical processes not specifically authorised by the Manufacturer.
C) The Product has been used inconsistently with the instructions provided in the technical documentation and regulations of the country where positioning and installation take place, or for purposes other than what it was designed for.
D) The defects are due to negligence, incompetence, poor maintenance, carelessness and inability of the End-user, damage caused by third parties, unforeseeable circumstances or force majeure or for any other reason not attributable to defects in the construction quality.

The following are henceforth considered excluded from the warranty:

A) All parts with marginal defects that have a negligible effect on the value or function of the Product.
B) All parts typically subject to sliding or rolling friction (bearings, brushes, etc.);
C) All parts typically subject to consumption (filters, humidifier cylinders, etc.);
D) All parts typically subject to oxidation or corrosion if not properly used or serviced (headers, wires and copper contacts or metal alloys, internal or external parts of the units, etc.);
E) All parts not supplied by the Manufacturer, even if these are an integral part of the plant which controls the product.

1 DESCRIPTION OF UNITS AND OPERATING LIMITS

1.1 P SERIES, G SERIES AND R SERIES UNITS

The machines in question are Close Control air conditioners with direct expansion or chilled water coil designed for use in technology centres. The machines in question are comprised of the following sections:

- The structure is made of hot-galvanised painted RAL 7024 sheet panels or in a frame constructed of aluminium section; the panels are made from hot-galvanised sheet steel painted RAL 7024, secured by quick-thread screws that can be unscrewed using a special safety wrench. The structure incorporates a thermal and acoustic insulation system using self-extinguishing materials protected by plastic film (polyurethane foam).
- Electrical power control panel with main switch door lock and microprocessor terminal.
- Supply ventilated section: composed of one or more EC electric brushless Plug Fans (with electronic regulation) fixed to the structure of the machine.
- Filtering section: self-extinguishing non-regenerable filters; the machine includes provision for the use of a differential pressure probe to allow display of the clogged filter warning signal.
- Cooling circuit (direct expansion versions): consisting of a direct expansion coil with expanded copper pipes inside aluminium fins and hot-dip galvanised steel sheet structure, copper cooling circuit with anti-condensation thermal insulation, scroll compressor fastened to the machine's structure with rubber vibration damping supports, electronic adjustment expansion valves (EEV), filter-drier, pressure probes for monitoring low pressure and high pressure, temperature probes for controlling temperature of intake, of the liquid and compressor discharge, high pressure manual reset safety sensor (PS HP 41 BarG).
- Hydraulic circuit (chilled water versions): consisting of a chilled water expansion coil with expanded copper pipes inside aluminium fins, copper water circuit with anti-condensation thermal insulation, 2- or 3-way motorised valve with manual emergency opening control.
- Electric post-heating coil with differentiated stages (Accessory): consisting of one or more filament heating stages with low thermal inertia, hot-dip galvanised steel sheet structure, thermal protection system with manual reset thermostat.
- Submerged electrode humidifier (Accessory): consisting of a steam production cylinder, charging valve, discharge valve, plastic support and water circuit.

1.2 TMC SERIES UNIT

The machines in question are air-cooled condensers with axial blowers. The machines in question are comprised of the following sections:

- The structure is made of painted RAL 9003 hot-galvanized steel sheet metal.
- Main switch.
- Ventilated section: composed of one or more electric axial fans fixed to the structure of the machine.
- Cooling circuit that consists of a condenser coil with expanded copper pipes in aluminium fins.

1.3 OPERATING LIMITS

WARNING!

The Manufacturer tests the hydraulic parts with dried compressed air. This ensures that no water is present in the water circuits, thereby preventing the possibility of freezing during storage prior to installation.

However, during storage, positioning and installation procedures, it is essential to take extra care not to fill the water circuits, even accidentally, before all the necessary antifreeze measures stipulated in the design specifications and in this manual have been implemented (e.g. Insulation, added glycols, etc.).

Air conditioners		
Infeed air temperature		
	Direct Expansion	Chilled Water
Maximum temperature	40°C	40°C
Minimum temperature	20°C	18°C
Maximum humidity	60%	60%
Minimum humidity	25%	25%
Storage Conditions		
Temperatures from -20°C to + 45°C. Humidity 10%RH to 90 %RH non-condensing. Store indoors and sheltered from weather elements.		

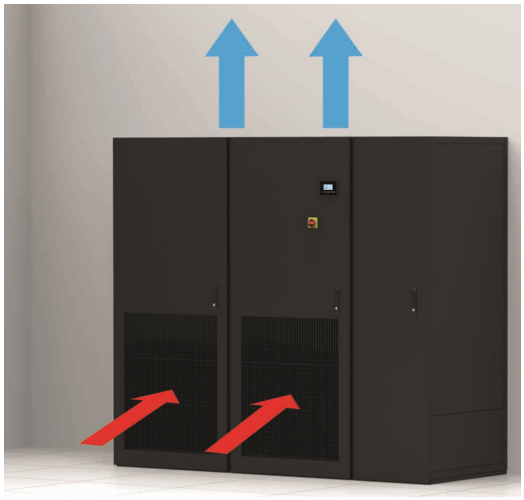
TMC Air-cooled condensers	
Infeed air temperature	
Maximum temperature	55 °C
Minimum temperature	- 40 °C
Storage Conditions	
Store in environments with temperatures no lower or higher than the functional limits.	

Water circuits				
	Chilled Water	Hot Water	Plate Condenser	Internal Humidifier
Maximum pressure	16 bar (1.6 MPa)	16 bar (1.6 MPa)	16 bar (1.6 MPa)	8 bar (0.8 MPa)
Minimum pressure	-	-	1 bar (0.1 MPa)	1 bar (0.1 MPa)
ΔP Maximum adjustment valve	2.5 bar (250 kPa)	2.5 bar (250 kPa)	2.5 bar (250 kPa)	-
Maximum temperature	40 °C	85 °C	45 °C	40 °C
Minimum temperature	5°C	5°C	-10 °C	5°C
Maximum glycol concentration	60%	60%	60%	-
Type of glycol	Ethylene	Ethylene	Ethylene	-

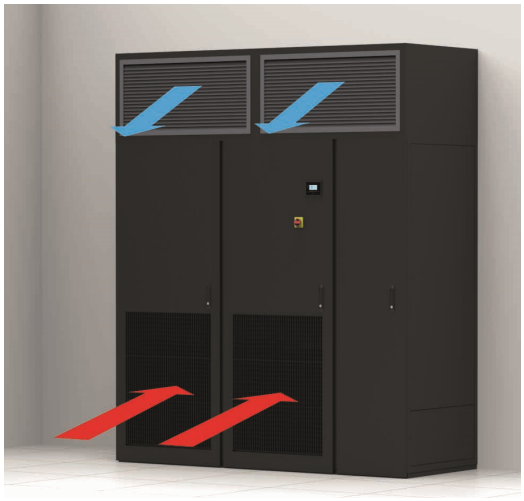
For different work conditions contact the Manufacturer

1.4 CONFIGURATION EXAMPLES

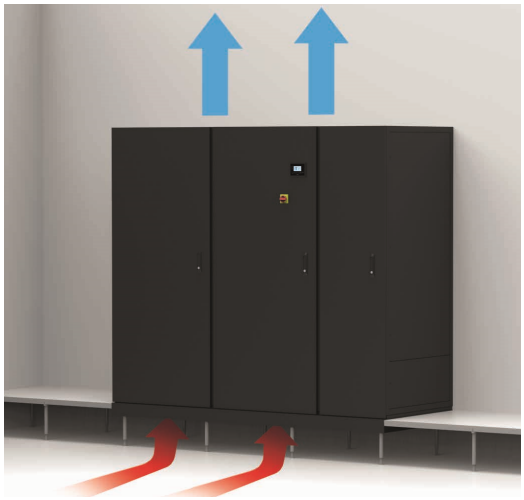
1.4.1 P SERIES - OVER (SUPPLY FROM ABOVE)



Standard version

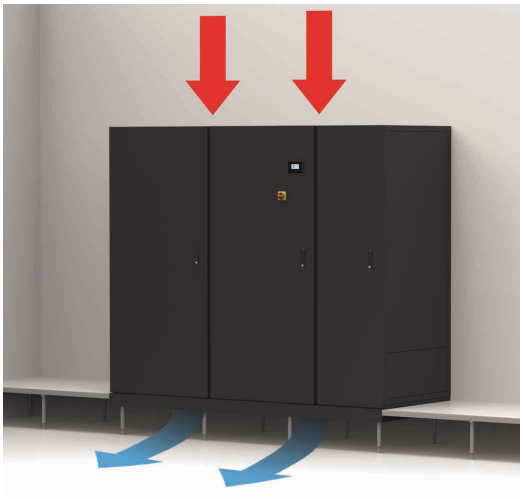


Version with supply plenum



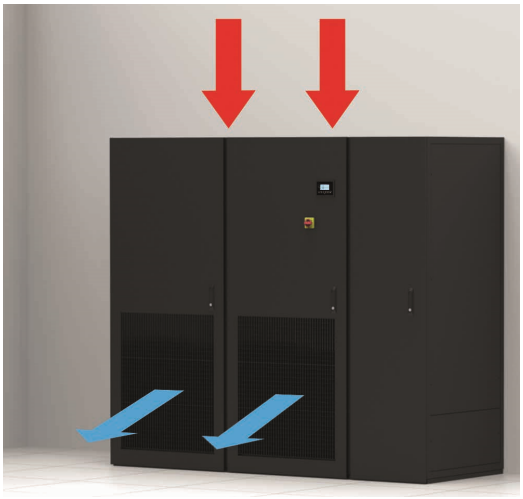
Version with suction from the bottom and closed front panel

1.4.2 P SERIES - UNDER (SUPPLY FROM BELOW)



Standard version

Version with supply plenum



Version with front supply

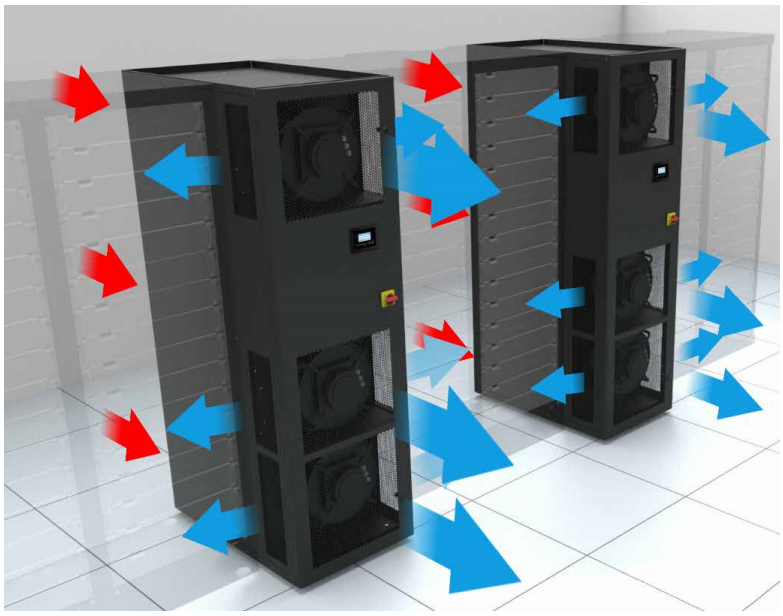
1.4.3 G SERIES - UNDER (SUPPLY FROM BELOW)

Standard version

Version with closed supply plenum for installations above the raised floor

Version with rear supply and rear suction plenum

1.4.4 R SERIES - HORIZONTAL (HORIZONTAL/FRONT SUPPLY)



Standard version with rear suction and front and side

1.4.5 TMC SERIES - HORIZONTAL (HORIZONTAL INSTALLATION) AND VERTICAL (VERTICAL INSTALLATION)

Horizontal installation

Vertical installation

2 TRANSPORTATION, POSITIONING AND INSTALLATION PROCEDURES

DANGEROUS HANDLING! HEAVY LOADS!

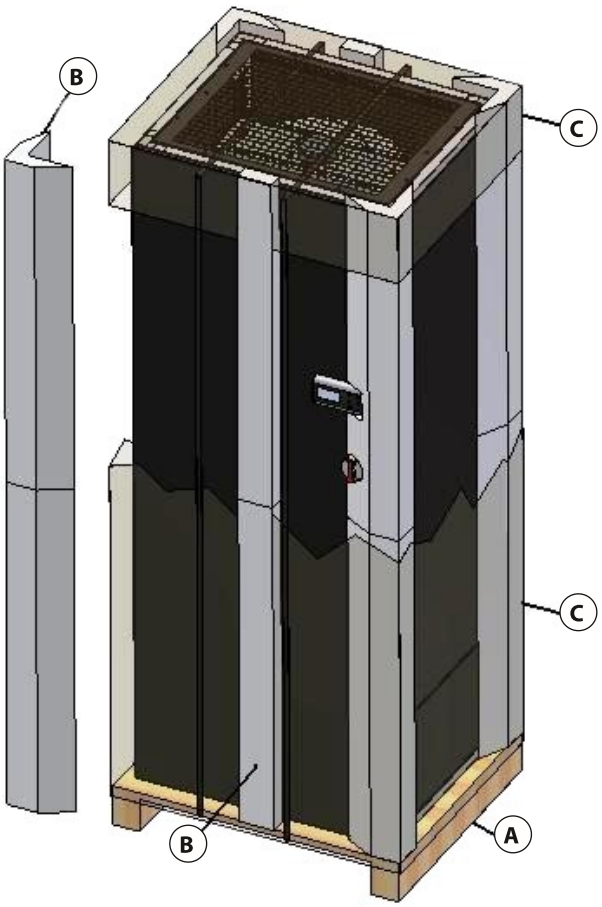
Always use suitable equipment to move the unit!

2.1 TRANSPORTATION AND RECEIVING THE MACHINES ON SITE

During transport the machines cannot be laid down or turned over; hence they must always stay in vertical position. Turning the unit over would cause damage to the internal components.

Unless different and more specific agreements are made with the Customer, the Manufacturer delivers its machines ex works (EXW) in standard packaging, which consists of: A wooden pallet, shockproof polystyrene cladding and a protective polyethylene film.

As the Carrier is always responsible for damage sustained by the goods during transport, before signing the delivery note to accept the supply, make sure the packaging is intact and that there are no visible signs of damage to the machine or traces of oil or refrigerant liquid leakage. If there is visible damage to the units, or if there is the slightest doubt that the conditioner may have concealed damage caused during transport, you must indicate your reservations in writing to the carrier themselves, while also informing the Manufacturer.



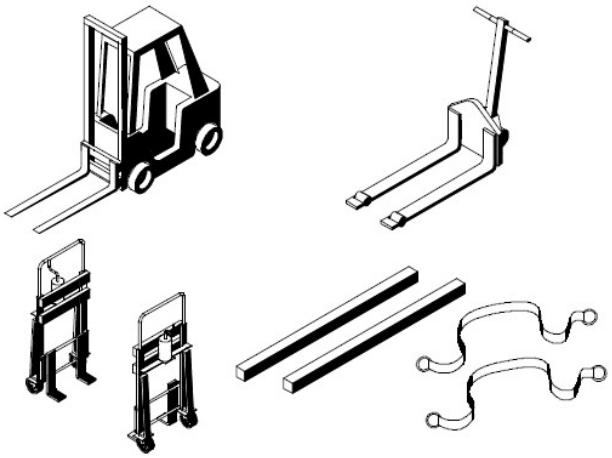
A Wood pallet
B Shock-resistant polystyrene cladding
C Protective polyethylene film

2.1.1 HANDLING THE UNITS

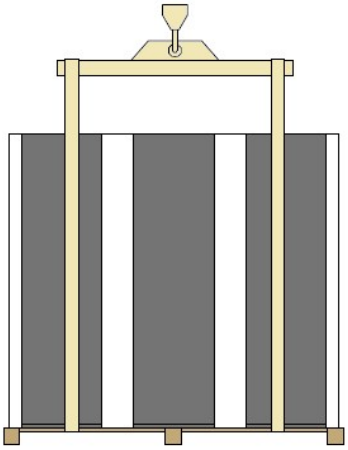
During site handling the machine must be left in its original packaging until it has reached the installation position.

The unit must be lifted and transported by means of a forklift truck, pallet truck, winch hoist or through a rope lifting system. In case of rope lifting, the ropes must be slid underneath the pallet the unit is fitted with, and stiff spacers must be arranged to ensure the ropes do not crush the unit's structure during lifting.

To avoid any form of damage it is necessary not to set the machines horizontally during storage, handling and installation operations.



Handling equipment



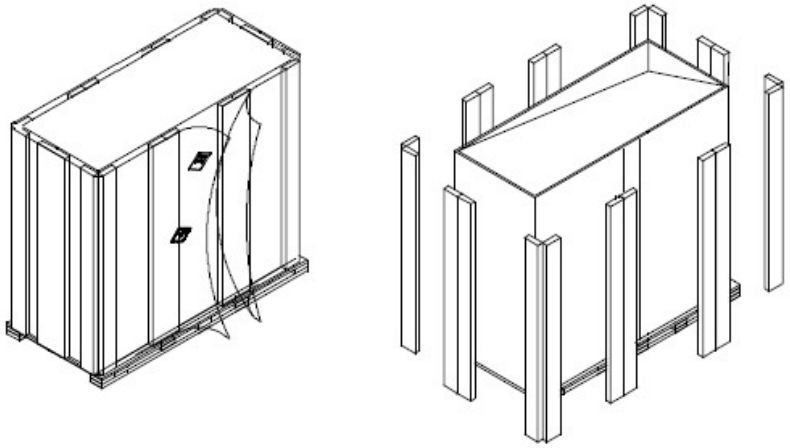
Position of ropes for lifting

2.1.2 REMOVING THE PACKAGING

If the unit is not to be installed immediately after its arrival on site, it should be stored in its original packaging, in a dry, enclosed area that is preferably heated during the winter months.

For final placement of the units the shipping packaging must be removed. Remove the packaging as follows:

1) Cut the protective polyethylene sheet that the unit is wrapped in, paying attention not to damage the paint while cutting.
2) Remove the shock-resistant polystyrene cladding.



Removing the packaging

2.2 OVERALL WEIGHT AND CLEARANCES FOR ROUTINE MAINTENANCE

2.2.1 OVERALL WEIGHT

For correct installation of the units, and to ensure safety of the operators, it is essential to make sure that the surface on which the air conditioners are to be installed is capable of supporting the overall weight.

If the units are installed on a normal floor, without vibration damping supports, it is necessary to place a layer of vibration damping material (rubber or equivalent material with a minimum thickness of 10 mm) between the machine and the floor to avoid transmitting vibrations to the structure of the building.

This layer of vibration damping material also makes up for floors that are not perfectly flat, guaranteeing the air seal between the elements and containing the noise level of the installation.

The overall weight can be found in the table below, for standard models (identified by the code number sequence).

Overall weight					
Standard models	Weight kg	Standard models	Weight kg	Standard models	Weight kg
P Series					
071	180	**302**	340	**10**	155
141	210	**422**	450	**20**	160
211	270	**512**	500	**30**	220
251	270	**662**	640	**50**	240
301	320	**852**	660	**80**	340
361	440	**932**	860	**110**	360
461	450			**160**	540
				220	700
G Series					
461	630	**70**	610	**300**	1250
612	680	**150**	750		
932	870	**230**	930		
R Series					
121	190	**361**	280	**20**	120
231	280			**40**	190

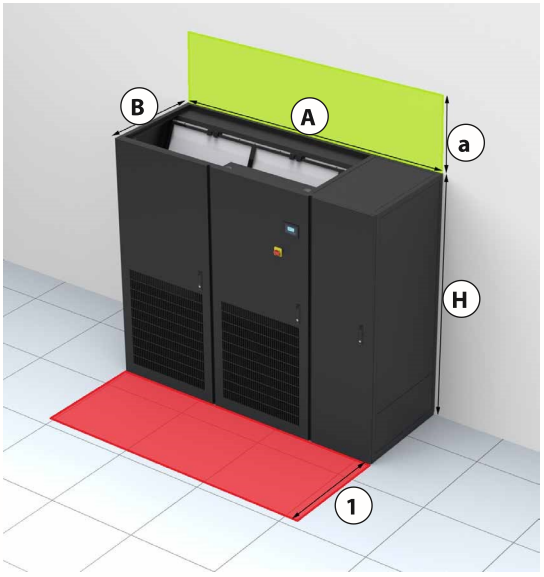
2.2.2 DIMENSIONS FOR INSTALLATION AND CLEARANCES

The figure below shows the dimensions to be taken into account during installation. For the exact values referring to the dimensions indicated in the figure, refer to the following table and, in any case, to the drawings supplied with the order confirmation.

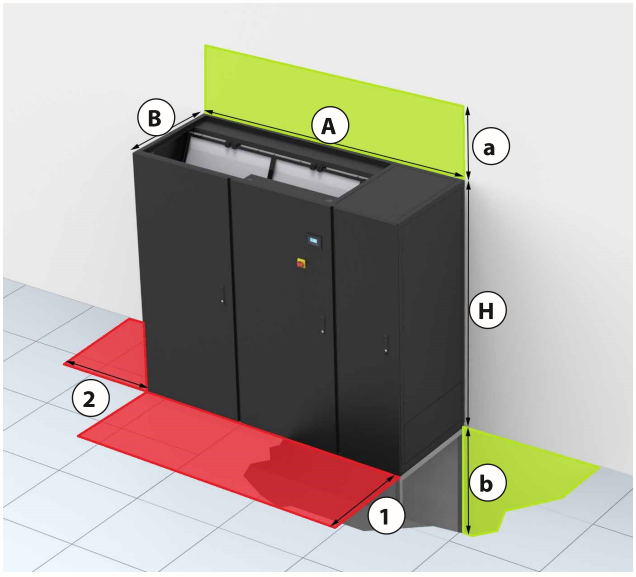
The units must be positioned differently based on the type of unit, and always following the design and manufacturing requirements of the unit.

During installation, observe the clearances required for routine maintenance (and if special, if necessary) indicated in the order confirmation or the table below, with reference to the standard models (identified by the code number sequence).

Clearances P Series



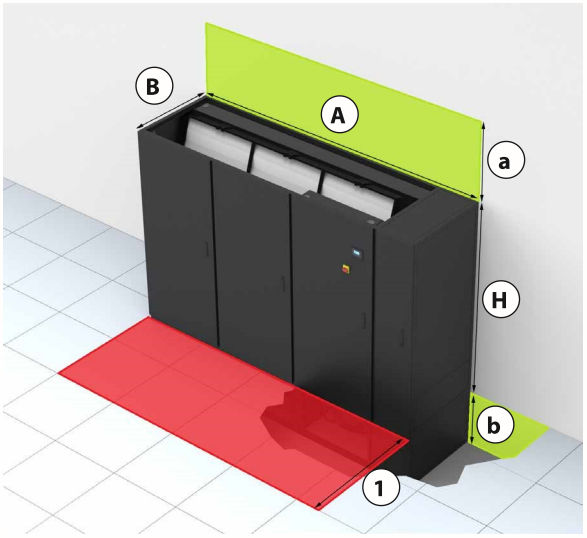
Over



Under

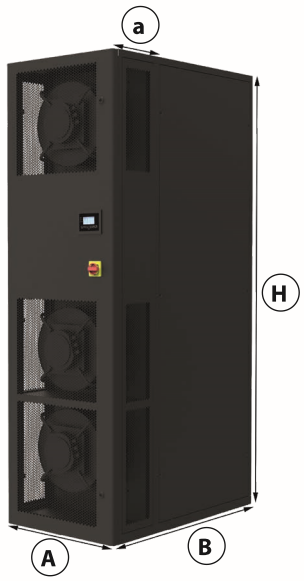
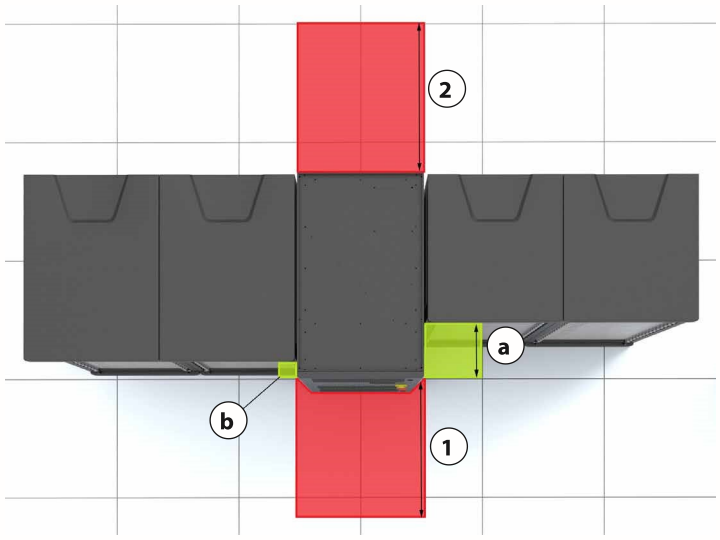
Standard models		Plan dimensions						
		Dimensions (mm)			Clearances (mm)		Routine maintenance (mm)	
		Length	Depth	Height	Upper	Lower	Front	Left
		A	B	H	a	b	1	2
P Series								
071 – 141 10 – 20	Over	750	601	1990	300	300	750	-
	Under							
211 – 251 30 – 50	Over	860	880				860	
	Under							600
301 – 302	Over	1410						-
	Under							
361 – 461 422 – 512 80 – 110	Over	1750						
	Under							
662 – 852	Over	2300						
	Under							
932 160	Over	2640						
	Under							
220	Over	3495						
	Under							

Clearances G Series



Standard models	Plan dimensions					
	Dimensions (mm)			Clearances (mm)		Routine maintenance (mm)
	Length	Depth	Height	Upper	Lower	Front
	A	B	H	a	b	1
P Series						
70	1320	921	1990	300	550*	860
461 - 612	1490					
150	2220					
932	2390					
230	3120					
300	4020					

*** Minimum height of ventilating plinth. Check definitive height when placing the order.**

Clearances R Series	
	
Front view	**Top view**

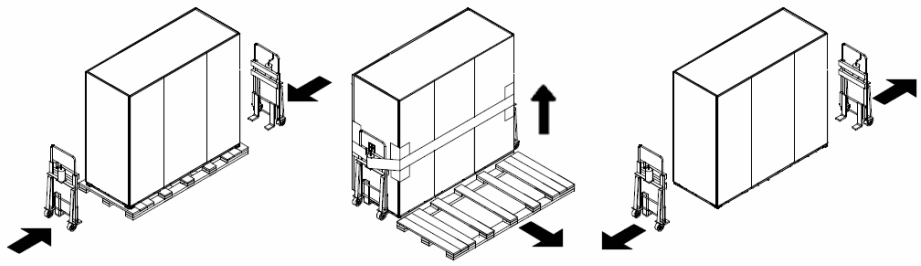
Standard models	Plan dimensions						
	Dimensions (mm)			Clearances (mm)		Routine maintenance (mm)	
	Length	Depth	Height	Front and side intake	Front intake only	Front	Rear
	A	B	H	a	b	1	2
P Series							
121	300	1200	1975 + 70*	200	-	800	800
20							
231 - 361	600	1222	1985 + 30*	315	45		
40							
*** Height of the "Wheel kit" accessory**							

2.3 UNIT POSITIONING

2.3.1 UNIT POSITIONING WITH WINCH HOIST

To remove the unit from the wood pallet for final positioning, use one or more winch lifters of sufficient capacity (see previous chapters). Proceed as follows for the handling operations:

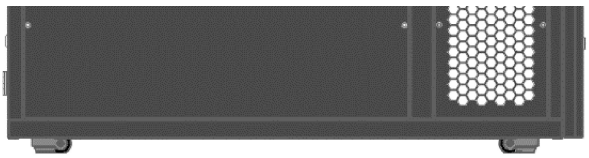
1) Remove the straps and clamps on the wooden pallet.
2) Push the winch lifters to the edge of the pallet while holding it securely.
3) Make sure the lifting parts of the winch lifters are positioned at the bottom of the unit.
4) Secure the units to the winch hoists by means of safety ropes, to avoid accidentally dropping the unit.
5) Lift the unit and remove the wooden pallet.
6) Bring the unit to the final installation position, taking care not to tilt it, thereby risking damage or drops.
7) Should the units need to be placed on a base or plenum, ensure this is already in the final installation position (see following chapters).
8) When placement is completed, remove the safety beds and extract the winch hoists.



Handling with winch hoist

2.3.2 WHEELS TO SET SERIES R IN POSITION (ACCESSORY)

R series units can be equipped with 4 wheels at the corners of the unit to facilitate handling during installation. If these wheels are ordered, they are supplied pre-installed, therefore, they will only need to be removed from the wooden pallet.



Positioning wheels

2.3.3 FRONT PANEL KEYS

Keys for the front panels are supplied with the unit. These keys are inserted in duplicate copy for each lock and a safety backup copy is also left inside of the electrical panel.

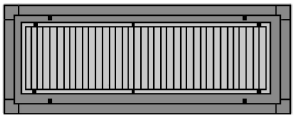
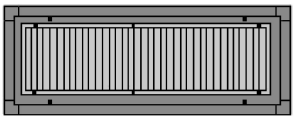
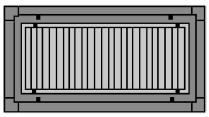
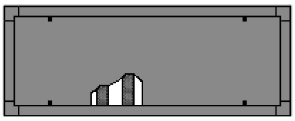
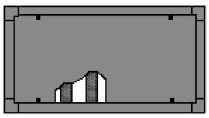
The type of keys used in P and G series is numbered, whereas for R series it is standard size, it is therefore always possible to purchase a duplicate in a hardware shop, by providing the number stamped on the lock (5333) or the type of engagement.

Front panel keys

3 PLENUMS, VENTILATED PLENUMS AND DUCT SECTIONS (ACCESSORY)

Various types of air distribution plenums are available as accessories for both the Under and Over versions of the unit.
During plenum and duct section installation it is advisable to place a seal (rubber or equivalent material with minimum 5 mm thickness) between them and the unit so as to guarantee the air-tightness of the element.

Below are the various types of plenums:

Plenums and duct sections		
Type	**Front View**	**Right/Left side view**
Plenum with solid panels (Drilling must be carried out by the customer) **G series ventilated plenums with solid panels**		
Plenum with front grilles **G series ventilated plenums with front grilles**		
Plenum with front and side grilles		
Soundproofed duct section		

3.1 PLENUM AND PLINTH DIMENSIONS

The dimensions of the plenum and the plinths are found in the order confirmation or in the following tables for standard models (identified by the code number sequence).

Plenum and duct section dimensions			
Standard models	**Plan dimensions (mm)**		
	Length	**Depth**	**Height**
P Series			
071 – 141 – 10 – 20	750	580	450 / 550 (Lower plenum)
211 – 251 – 30 – 50	860	850	550
301 – 302	1410		
361 – 461 – 422 – 512 – 80 – 110	1750		
662 – 852	2300		
932 – 160	2640		
220	3495		
G Series			
70	1320	900	550
461 - 612	1490		
150	2220		
932	2390		
230	3120		
300	4020		

3.2 INSTALLATION OF PLENUMS AND DUCT SECTIONS ABOVE THE UNIT

Depending on the type of plenum, they are attached in two different ways:

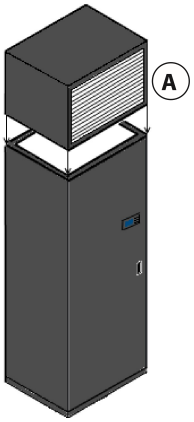
- Unit with sheet metal structure: With bolts inserted in the relative holes.
- Unit with aluminium profile structure: With brackets.

With bracket-mounted models, the brackets need to be attached to the unit's aluminium uprights with self-drilling screws. The brackets should be attached, in a central position, to each side of the unit.

Securing the brackets

Do the following to install plenums and duct sections:

1) Place a seal on the plenum profiles (rubber or equivalent material with minimum 5 mm thickness) and position the plenum on the unit, taking care to line the profiles up.
2) Attach the unit to the plenum with duly-sized self-drilling screws or bolts (models without clamping brackets).



A Plenum

Example of installation with upper plenum

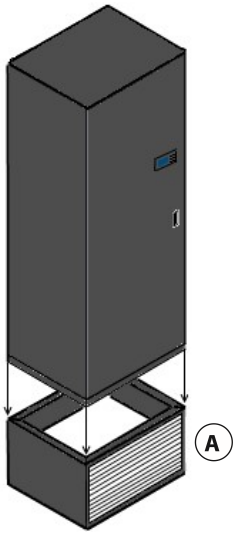
3.3 INSTALLATION OF PLENUMS AND VENTILATED PLENUMS (G SERIES UNIT) UNDER THE UNIT

When installing plenums under the unit, it is advisable to place a layer of vibration damping material (rubber or equivalent material with a minimum thickness of 10 mm) between them and the floor to avoid transmitting vibrations to the structure of the building.

The interposition of vibration damping material also enables the recovery of a slight lack of flatness of the floor and to contain the noise level of installation.

Do the following to install a plenum under the unit:

1) Set the plenum on the floor and place a seal (rubber or other equivalent material with minimum 5 mm thickness) on the plenum profiles.
2) Position the unit on the plenum, making sure that the sections are properly aligned with each other.
3) Attach the unit to the plenum with duly-sized self-drilling screws or bolts (optional).



A Plenum

Example of installation with lower plenum

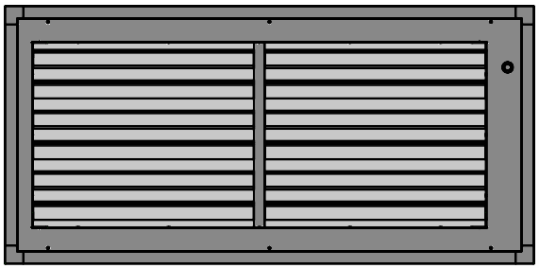
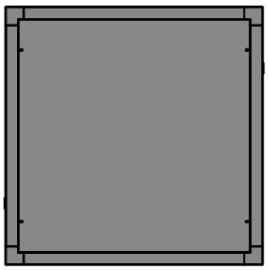
4 FREE COOLING PLENUM (ACCESSORY)

WARNING!

If the Free Cooling plenum is used with chilled water units, it is essential to use glycol if outdoor temperatures below 5°C are expected!

Free Cooling plenums can be supplied as an accessory for the Under version units. These plenums make it possible to use outdoor air to cool the environments, and consist of:

- A structure in galvanised sheet metal or in aluminium sections (depending on the model).
- Two panels fitted with motorised dampers.
- Three solid panels.

Free cooling plenum (standard configuration)	
Front and rear view	**Right/Left side view**
	

4.1 FREE COOLING PLENUM DIMENSIONS

The dimensions of the Free Cooling plenums are found in the order confirmation or in the following table for standard models (identified by the code number sequence).

Free Cooling plenum dimensions				
Standard models	**Plan dimensions (mm)**			
	Length	**Depth**	**Height**	**Damper depths**
P Series				
071 – 141 – 10 – 20	750	580	580	130
211 – 251 – 30 – 50	860	850	850	
301 – 302	1410			
361 – 461 – 422 – 512 – 80 – 110	1750			
662 – 852	2300			
932 – 160	2640			
220	3495			
G Series				
70	1320	900	900	130
461 - 612	1490			
150	2220			
932	2390			
230	3120			
300	4020			

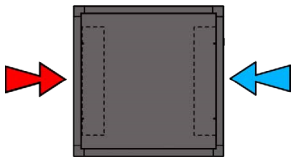
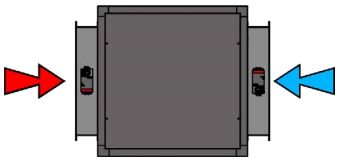
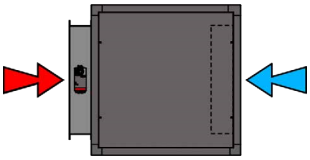
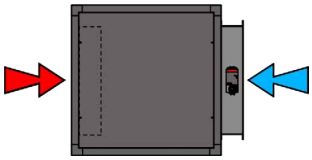
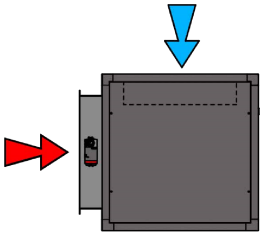
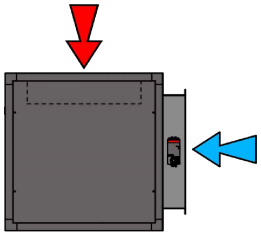
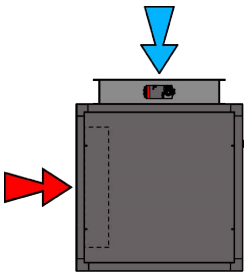
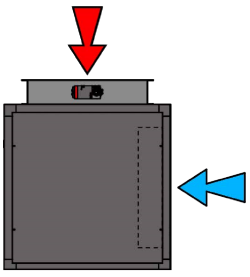
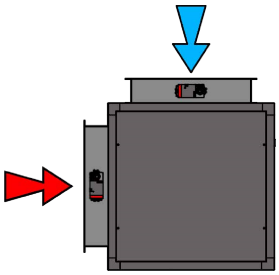
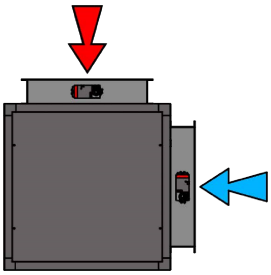
4.2 MOUNTING FREE COOLING PLENUMS

4.2.1 DAMPER POSITIONING

Free Cooling plenums are supplied with a standard configuration, for transport, with the dampers positioned at the front and back inside the plenum.

When mounting and installing the plenum, the position of the dampers can be changed so that they can be adapted to the system requirements. Position it as follows:

1) Define the position of the dampers (see table below).
2) Remove the screws to take the panels off.
3) Place the panels in the final position.
4) Screw the panels on with the screws.

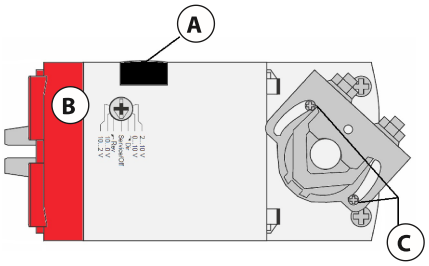
Position of the Free Cooling plenum dampers	
	
	
	
	
	

4.2.2 ADJUSTING THE OPENING OF THE DAMPERS

If it is necessary to always guarantee a percentage of outdoor air intake or room air recirculation, the opening of the dampers can be adjusted with the servomotors installed on them:

Adjust by calibrating the limit switch screws on the servomotor. Adjust as follows:

1) Set the motor at "Service OFF" with the function selector.
2) Adjust the position of the limit switch blocks.
3) Test movement of the dampers with the manual release button.



A Manual release button
B Function selector
C Limit switch blocks

4.2.3 INSTALLATION OF FREE COOLING PLENUM ABOVE THE UNIT

Depending on the type of plenum, they are attached in two different ways:

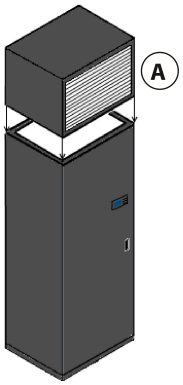
- Unit with sheet metal structure: With bolts inserted in the relative holes.
- Unit with aluminium profile structure: With brackets.

With bracket-mounted models, the brackets need to be attached to the unit's aluminium uprights with self-drilling screws. The brackets should be attached, in a central position, to each side of the unit.

Securing the brackets

Do the following to install Free Cooling plenums:

1) Place a seal on the plenum profiles (rubber or equivalent material with minimum 5 mm thickness) and position the plenum on the unit, taking care to line the profiles up.
2) Attach the unit to the plenum with duly-sized self-drilling screws or bolts (models without clamping brackets).



A Free Cooling plenum

4.2.4 SETTING UP THE DUCT FOR OUTDOOR AIR INTAKE

For optimal operation of the Free Cooling plenum, the outdoor air damper will have to be connected to the outside of the building so that it can draw in outdoor air:

The installer will set up the connection duct and outdoor air intake. It is advisable to provide:

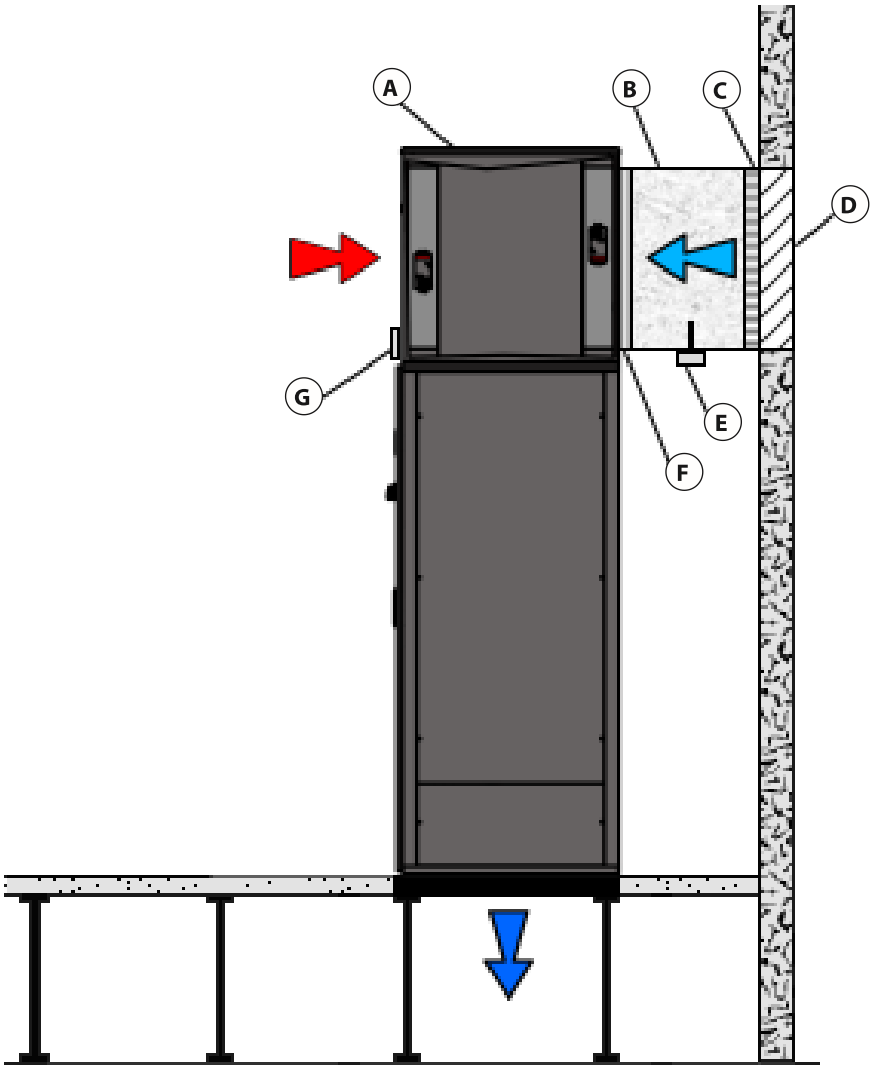
- An external opening with slots or grilles to prevent rainfall, harmful animals and human entry.
- An outdoor air filtration system, with G4 efficiency level.
- A vibration damping joint, connected to the plenum, to prevent the propagation of any vibrations from operation of the unit.

4.2.5 INSTALLATION OF FREE COOLING PLENUM TEMPERATURE PROBES

For optimal operation of the Free Cooling plenum, it will be necessary to position the outdoor air and return air temperature probes, both supplied as standard:

The outdoor air temperature probe, to be installed on the duct, must be positioned in the outdoor air intake duct so that it can detect the outdoor air temperature.

The return air temperature probe, to be installed on the wall, must be positioned so that it can detect the controlled room temperature.



A Free Cooling plenum
B Outdoor air duct
C G4 outdoor air filter
D Outdoor air intake protection grille
E Outdoor air temperature probe
F Vibration damping joint
G Return air temperature probe.

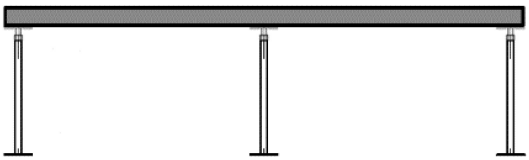
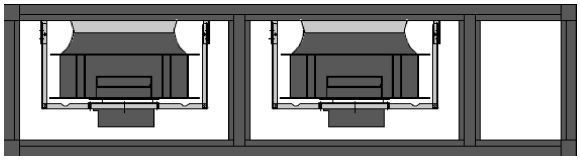
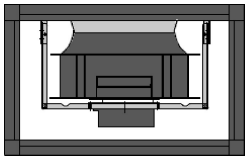
5 ADJUSTABLE AND VENTILATED PLINTHS (ACCESSORY)

When installing plinths it is advisable to place a layer of vibration damping material (rubber or equivalent material with a minimum thickness of 10 mm) between them and the floor to avoid transmitting vibrations to the structure of the building.

The interposition of vibration damping material also enables the recovery of a slight lack of flatness of the floor and to contain the noise level of installation.

It is also advisable to place a seal (rubber or equivalent material with minimum 5 mm thickness) between them and the unit so as to guarantee the air-tightness of the element.

Below are the various types of plenums and plinths:

Adjustable and ventilated plinths		
Type	**Front View**	**Right/Left side view**
Adjustable plinths		
Ventilated plinths (G Series)		

5.1 PLINTH DIMENSIONS

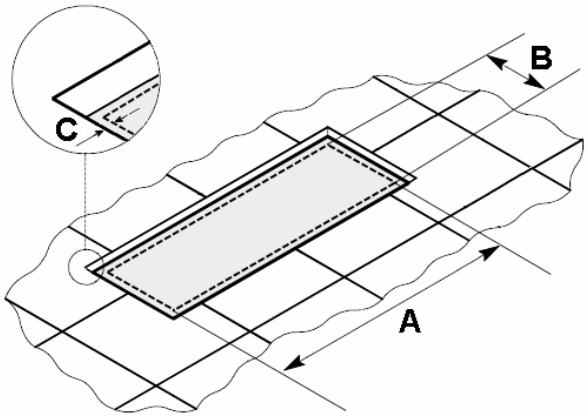
The dimensions of the plinths are found in the order confirmation or in the following tables for standard models (identified by the code number sequence).

Adjustable and ventilated plinth dimensions			
Standard models	**Plan dimensions - Standard model dimensions (mm)**		
	Length	**Depth**	**Minimum/Maximum height**
P Series			
071 – 141 – 10 – 20	750	580	300/600
211 – 251 – 30 – 50	860	850	
301 – 302	1410		
361 – 461 – 422 – 512 – 80 – 110	1750		
662 – 852	2300		
932 – 160	2640		
220	3495		
G Series			
70	1320	900	550 (set height) 1000 (set height)
461 - 612	1490		
150	2220		
932	2390		
230	3120		
300	4020		

5.1.1 SIZING THE HOLE FOR THE INSTALLATION OF THE PLINTHS IN THE FINISHED FLOOR SURFACE

To permit correct installation of the bases a hole must be made in the floor tiles. The dimensions of the plinths are found in the order confirmation or in the following tables for standard models (identified by the code number sequence).

Raised floor hole size



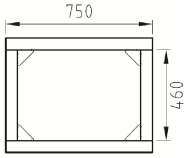
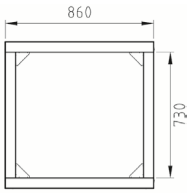
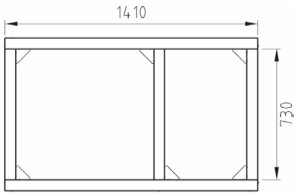
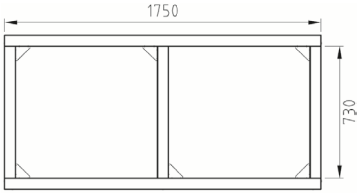
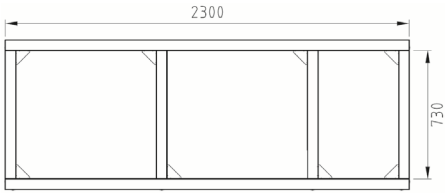
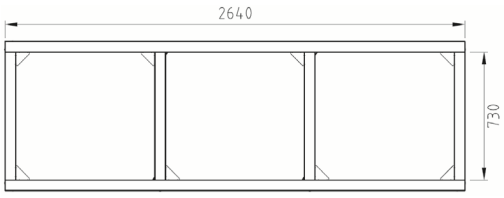
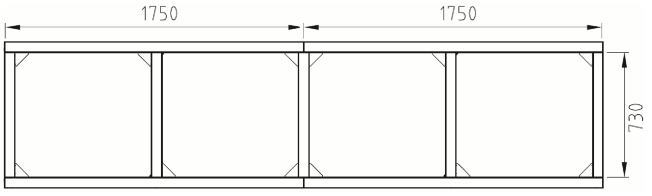
Standard models	Dimensions (mm)		
	Length	Depth	Tolerance
	A	B	C
P Series			
071 – 141 – 10 – 20	750	580	10
211 – 251 – 30 – 50	860	850	
301 – 302	1410		
361 – 461 – 422 – 512 – 80 – 110	1750		
662 – 852	2300		
932 – 160	2640		
220	3495		
G Series			
70	1320	900	10
461 - 612	1490		
150	2220		
932	2390		
230	3120		
300	4020		

5.2 ADJUSTABLE PLINTH ASSEMBLY

Adjustable plinths come unassembled in a specific kit, accordingly it will be necessary to assemble them as explained in the chapters below.

5.2.1 POSITIONING SUPPORT PROFILES

Position the metal supporting profiles supplied with the assembly kit on a flat surface according to the diagram below.

Supporting tube placement	
Models	**Position**
071 – 141 **10 – 20**	
211 – 251 **30 – 50**	
301 – 302	
361 – 461 – 422 – 512 **80 – 110**	
662 – 852	
932 **160**	
220	

5.2.2 90° BRACKET AND THREADED TUBULAR SUPPORT INSTALLATION

WARNING!

Join the tubular elements so that they form a perfect right angle

To install 90° brackets, supporting profiles and threaded tubular supports, do the following:

1) Take the 90° brackets.

2) Place the 90° brackets in the corners of the supporting profiles, lined up with the respective clamping holes.

3) Attach the 90° brackets with the self-drilling screws provided with the kit, using a battery-powered screw gun.

4) Take the threaded tubular supports.

5) Position the threaded tubular supports between two supporting profiles so that the outer edge of the support is flush with the outer surface of the supporting profiles.

6) Secure the threaded tubular supports between two supporting profiles by the self-drilling screws provided with the kit (use the holes and slots provided on the threaded tubular supports), using a screw gun.

5.3 ADJUSTABLE PLINTH HEIGHT DEFINITION AND ADJUSTMENT

The adjustable plinth support system is composed of two parts:

- One drilled tubular supporting foot.
- One threaded tubular support.

The height must be adjusted as instructed in the next chapters.

5.3.1 ADJUSTABLE PLINTH HEIGHT DEFINITION

The threaded tubular support allows heights to be manually adjusted between 600 and 530 mm with the bolt on the support.

For heights below 530 mm it is necessary to cut the tubular supporting feet to adapt them to the required measurement. The rule that needs to be followed to calculate the measurement of the tubular supporting foot is:

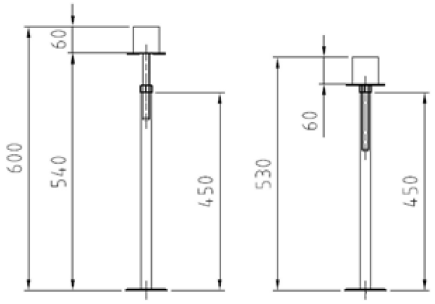
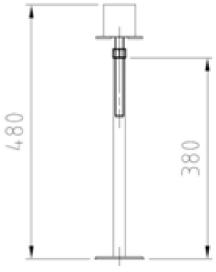
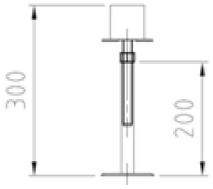
Tubular supporting feet height = Plinth height in mm – 100 mm

5.3.2 ADJUSTABLE PLINTH HEIGHT ADJUSTMENT

ATTENTION! DANGER! DANGEROUS HANDLING!

Maximum permitted range of the threaded tubular support is 90 mm!

Greater ranges can cause damage to the supporting feet and a risk of the units falling!

Examples of adjusting the tubular supporting feet	
Adjustment from 600 mm to 530 mm The height is adjusted from the hex nut on the threaded tubular support which is screwed in to reduce the height of the plinth.	
Plinth height 480 mm Cut the 450 mm cylindrical tube to 380 mm (480-100). Adjust the height for the last time by turning the hex nut.	
Plinth height 300 mm Cut the 450 mm cylindrical tube to 200 mm (300-100). Adjust the height for the last time by turning the hex nut.	

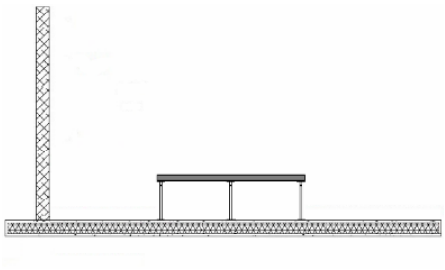
5.4 INSTALLATION OF ADJUSTABLE AND VENTILATED PLINTHS ON FINISHED FLOOR SURFACE

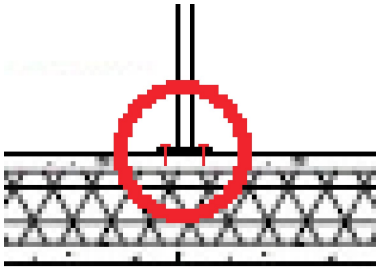
ATTENTION! DANGER! DANGEROUS HANDLING!

Placing the unit on the plinth before fixing the feet to the slab and positioning the raised floor can cause damage to the supporting feet and a risk of the units falling!

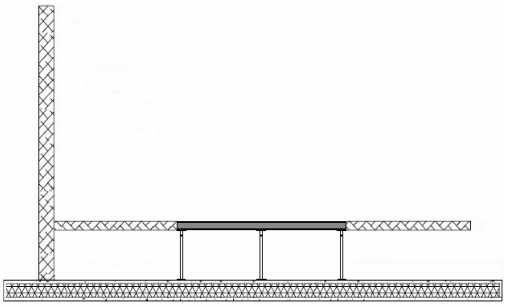
The plinths are installed in the finished floor surface as follows:

1) Place the plinth on the slab. With adjusted plinths, attach the feet to the slab with suitable plugs.

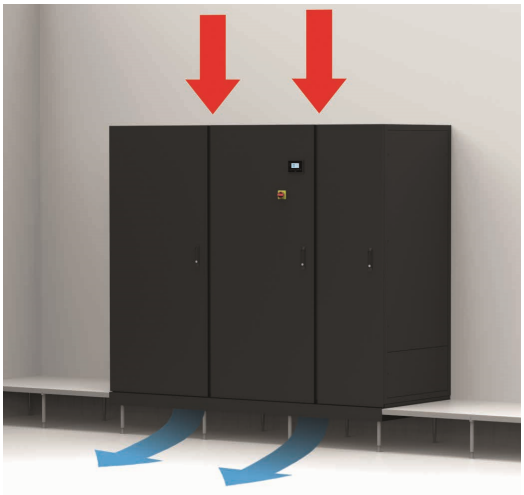




2) Adjust the feet to ensure that the plinth is flush with the upper edge of the finished floor surface and perfectly level.



3) Place a seal on the plinth profiles.
4) Position the unit on the plinth, making sure that the aluminium sections are properly aligned with each other.



Example of installation with plinth

6 TMC AIR-COOLED CONDENSER PLACEMENT AND INSTALLATION

6.1 DIMENSIONS FOR INSTALLATION AND CLEARANCES

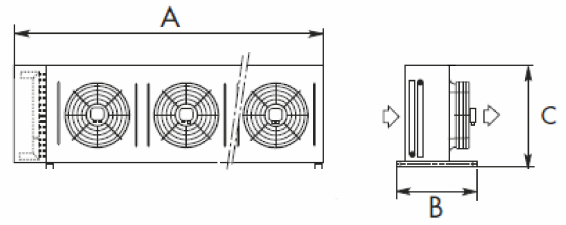
The figure below shows the dimensions to be taken into account during installation of the TMC air-cooled condensers. For the exact values referring to the dimensions indicated in the figure, refer to the following table and, in any case, to the drawings supplied with the order confirmation.

The units must be positioned differently based on the type of unit, and always following the design and manufacturing requirements of the unit.

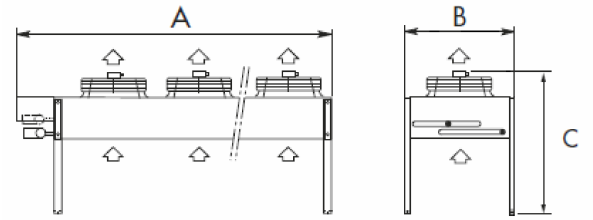
During installation the required spaces for optimal operation must be complied with, as set out in the following table for standard models (identified by the code number sequence).

TMC condenser dimensions

Vertical Installation (V)



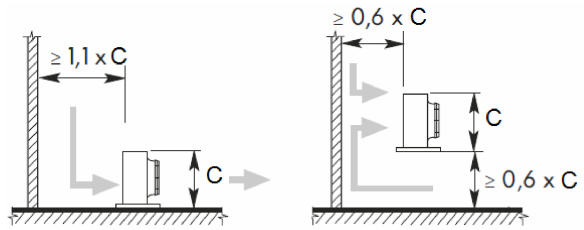
Horizontal Installation (H)



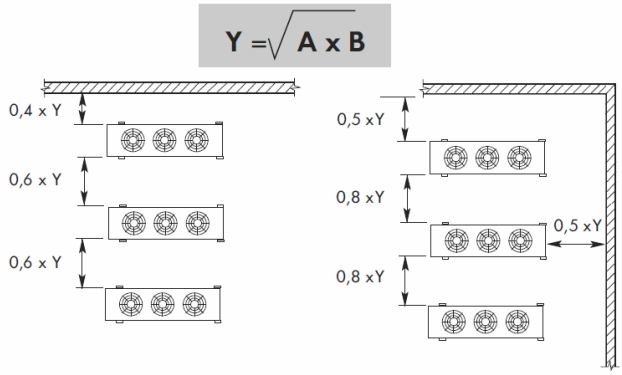
Standard models	Length (A)	Depth (B)		Height (C)		Fixing holes Ø	Weight
		V	H	V	H		
	mm	mm		mm		mm	kg
11	882	480	550	510	818	10	27
19	1582						44
31	1225	570	900	830	1050	13	67
35							71
40	2225						104
49							112
55							112
63							120
84	3225						157
92							170

Clearance space calculation

Vertical Installation (V)



Horizontal Installation (H)



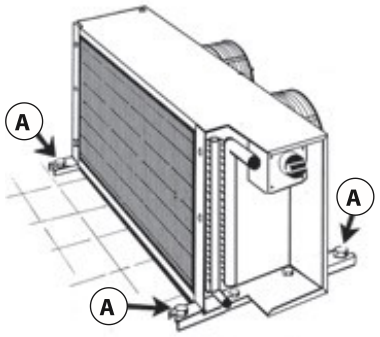
6.2 TMC AIR-COOLED CONDENSER INSTALLATION

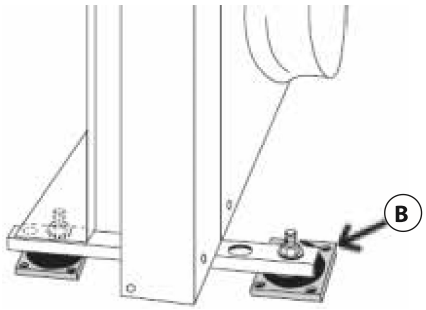
DANGEROUS HANDLING! HEAVY LOADS!

Always use suitable equipment to move the unit!

6.2.1 VERTICAL INSTALLATION (V)

TMC air-cooled condensers must be installed according to the following instructions:





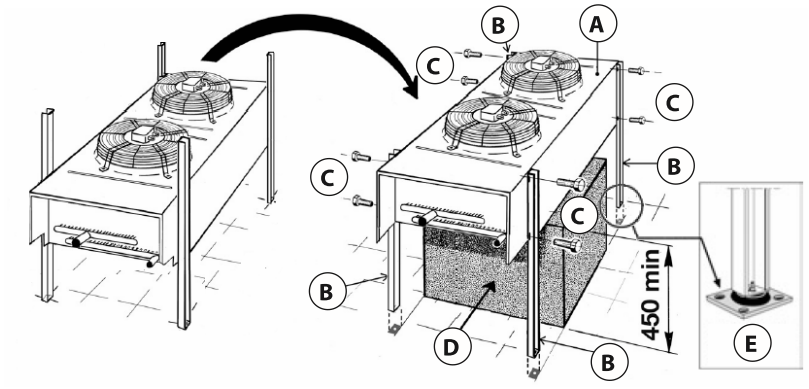
A Brackets
B Vibration damping supports (accessory)

Vertical installation (V)

1) Remove the condenser from the packaging.
2) Place the condenser in a vertical position.
3) Attach the brackets using the screws or install the supplied vibration damping supports (accessory).

6.2.2 HORIZONTAL INSTALLATION (H)

TMC air-cooled condensers must be installed according to the following instructions:



A TMC Condenser
B Feet for horizontal installation (H)
C Screws for securing the feet
D Support
E Vibration dampers (accessory)

Horizontal installation (H)

1) Remove the TMC condenser from the packaging.
2) Position the condenser on a support.
3) Remove the feet from the transport position.
4) Fasten the feet in the final position with the screws previously removed.
5) Install the supplied vibration damping (accessory).

7 CONNECTION OF CONDENSATE DISCHARGE AND HUMIDIFIER

7.1 CONNECTION OF CONDENSATE DISCHARGE AND HUMIDIFIER

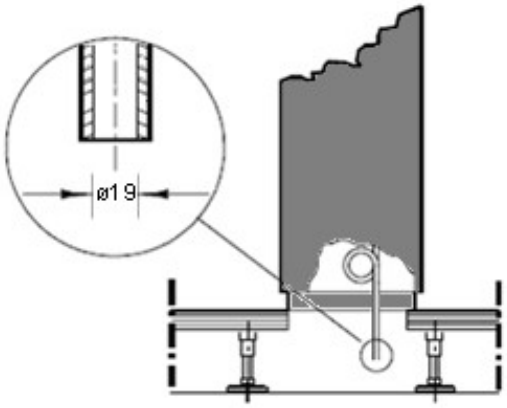
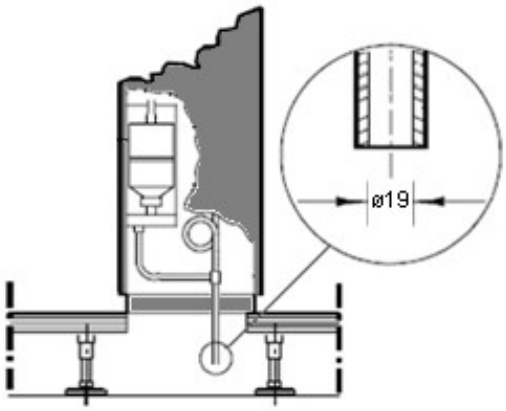
RISK OF BURNS!

The drainage water of the humidifier may reach temperatures of 100 °C!

All air conditioners, whether direct expansion or water chilled coils, require a condensate discharge connection, and the humidifier discharge of the building waste drainage system.

The trap, essential for draining condensate as the bowl is located in a point of negative pressure, is supplied already installed on the unit and should be connected when the unit is placed in position by the installer. The discharge pipe is Retiflex type with external diameter of 25 mm (internal 19 mm).

The humidifier discharge, which does not require a trap, is supplied ready connected to the termination of the condensate discharge.

Connection of condensate discharge and humidifier discharge	
	
Condensate discharge	**Condensate discharge with humidifier**
Hose	
Connection diameter Ø (mm)	
External	**Internal**
25	19

WARNING!

The condensate discharge is supplied with a trap!

Do not remove the trap supplied with the unit!

In order to avoid drainage problems do not add siphons to the drainage line and plan on a funnel type fitting!

7.2 CONDENSATE BOOSTER PUMP CONNECTION (ACCESSORY)

RISK OF BURNS!

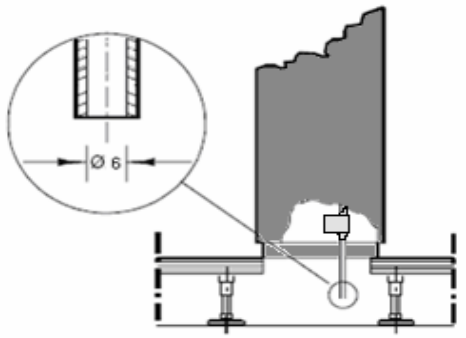
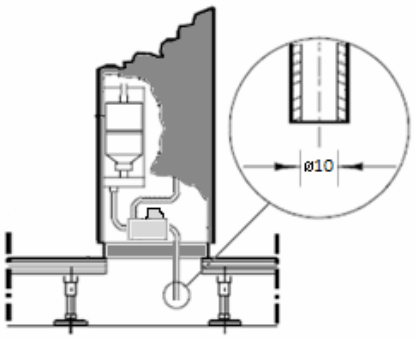
The drainage water of the humidifier may reach temperatures of 100 °C!

All conditioners, both direct expansion and chilled water, can be supplied with a condensation pumping trap (accessory).


Condensation booster pump

When the unit is installed the drain pipe must be connected to the building's sewage network by the installer. The drainage pipe is flexible and transparent, with an external diameter of 9 mm (internal 6 mm).

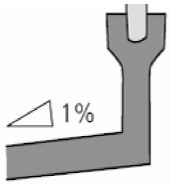
In case the unit is fitted with submerged electrode humidifier (accessory), it will be connected to the pump.

Connection of condensate discharge pump and humidifier discharge pump			
			
Condensate discharge		**Condensate discharge with humidifier**	
Hose			
Connection diameter Ø (mm)			
External	**Internal**	**External**	**Internal**
9	6	14	10

Condensate booster pump specifications				
Values		**Pump model**		
		SI33	**SI1830**	**SI82**
Maximum flow rate	l/h	30	400	500
Maximum line difference	m	5		
Maximum line length	m	30		

WARNING!

In order to avoid drainage problems do not add siphons to the drainage line and plan on a funnel type fitting!



8 WATER CIRCUIT CONNECTIONS

8.1 CHILLED WATER CIRCUITS CONNECTION

WARNING!

If the chilled water unit is used with Free Cooling plenum, it is essential to use glycol if outdoor temperatures below 5°C are expected!

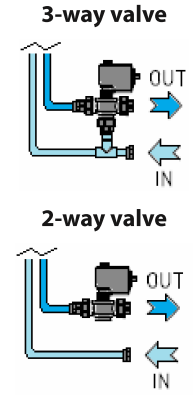
It will be necessary to install water inlet and outlet pipes for machines with chilled water coils. The inlet and outlet fittings are identified in the order confirmation or in the following tables for standard models (identified by the code number sequence).

Water connections				
Standard models	Fitting diameter Ø		Threading	Water circuit volume
	Inches	DN	ISO 7/1	dm^3
P Series				
10	3/4″	20	Female	3.5
20	1″	25		7
30	1-1/4″	32		10
50				16
80	1-1/2″	40		22
110				38.5
160	2″	50		56
220				76.5
G Series				
70	1-1/2″	40	Female	26.5
150	2″	50		59.5
230	2-1/2″	65		79.5
300				118
R Series				
20	1″	25	Female	11.5
40	1-1/4″	32		17.5

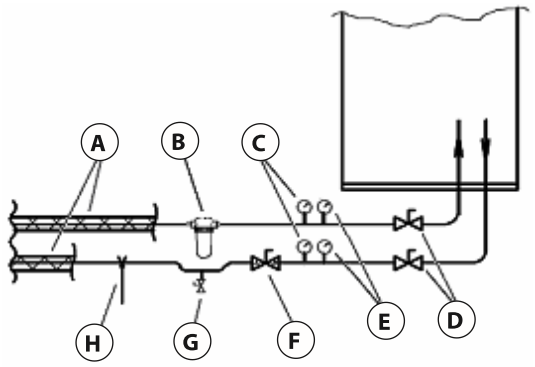
The maximum pressure of the water supply to the coils is 16 bar (1.6 MPa). The maximum pressure difference between the water inlet pipe to the valve and the outlet pipe is 2.5 bar (250 kPa), as at pressure differences greater than this value the return spring would not be able to shut off the water flow. In the event of greater pressure differences, it will be necessary to install pressure reducing valves upstream of the valve.

8.1.1 SETTING UP THE CHILLED WATER CIRCUITS

The positions of the water inlet and outlet connections are indicated in the figure below. The connections can also be identified by the adhesive labels applied on the pipes of the unit near the connections.



Water connections



Water circuit supply line

A Armaflex insulation
B Mechanical filter
C Thermometer
D Shut-off valve
E Pressure gauge
F Balancing valve
G Discharge
H Supports

To ensure that circuit pipes are installed correctly, we recommend you follow the instructions below:

- Use piping suited to the circuit pressure (copper, steel or plastic).
- Secure pipes with suitable brackets.
- Insulate both pipes with Armaflex type insulation.
- Install shut-off valves to facilitate maintenance.
- Install a Thermometer and Pressure gauge on the inlet and outlet.
- Install a discharge outlet at the lowest part of the circuit.
- Install a 50 µ mechanical filter on the supply line.
- Install a balance valve on the return line.
- Use water and glycol where necessary.

8.1.2 POWER VALVE - WATER FLOW ADJUSTMENT SYSTEM (ACCESSORY)

This accessory entails installation of a measuring device to control the instantaneous water flow of the system. The maximum admissible water flow set-point for the unit may be adjusted within the SURVEY^{EVO} electronic control. Should this threshold be exceeded, SURVEY^{EVO} will restrict valve opening to maintain water flow rate below it, resuming normal operation as soon as the system goes back to normal.

It is also possible to install probes on the water circuit to detect the water temperature on inlet and outlet, which make it possible to calculate the units' instantaneous cooling power, as well as its temperature delta.

Water flow measuring device

8.2 CHILLED WATER CIRCUITS CONNECTION - TWO SOURCES DESIGN

It will be necessary to install water inlet and outlet pipes for Two Sources units as it was for machines with chilled water coils. The inlet and outlet fittings are identified in the order confirmation or in the following tables for standard models (identified by the code number sequence).

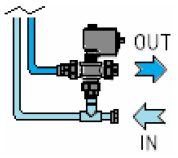
Water connections				
Standard models	Fitting diameter Ø		Threading	Water circuit volume
	Inches	DN	ISO 7/1	dm^3
P Series				
50	3/4″	20	Female	5
211	1″	25		5.5
301 – 302	1-1/4″	32		13.5
110				22
662 – 852	1-1/2″	40		27.5
160				28.5
R Series				
231	1″	25	Female	15.5
40	1-1/4″	32		22.5

The maximum pressure of the water supply to the coils is 16 bar (1.6 MPa). The maximum pressure difference between the water inlet pipe to the valve and the outlet pipe is 2.5 bar (250 kPa), as at pressure differences greater than this value the return spring would not be able to shut off the water flow. In the event of greater pressure differences, it will be necessary to install pressure reducing valves upstream of the valve.

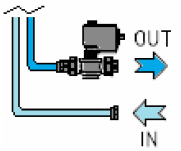
8.2.1 SETTING UP THE CHILLED WATER CIRCUITS - TWO SOURCES DESIGN

The positions of the water inlet and outlet connections are indicated in the figure below. The connections can also be identified by the adhesive labels applied on the pipes of the unit near the connections.

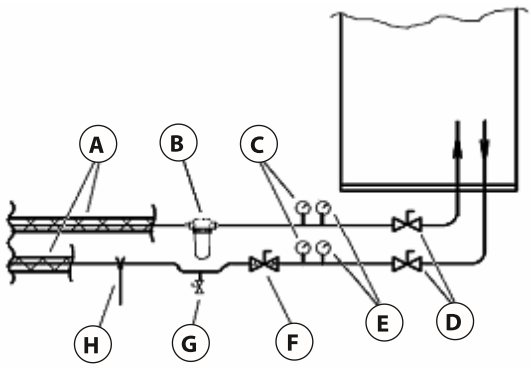
3-way valve



2-way valve



Water connections



Water circuit supply line

A Armaflex insulation
B Mechanical filter
C Thermometer
D Shut-off valve
E Pressure gauge
F Balancing valve
G Discharge
H Supports

To ensure that circuit pipes are installed correctly, we recommend you follow the instructions below:

- Use piping suited to the circuit pressure (copper, steel or plastic).
- Secure pipes with suitable brackets.
- Insulate both pipes with Armaflex type insulation.
- Install shut-off valves to facilitate maintenance.
- Install a Thermometer and Pressure gauge on the inlet and outlet.
- Install a discharge outlet at the lowest part of the circuit.
- Install a 50 µ mechanical filter on the supply line.
- Install a balance valve on the return line.
- Use water and glycol where necessary.

8.3 CHILLED WATER CIRCUITS CONNECTION - FREE COOLING DESIGN

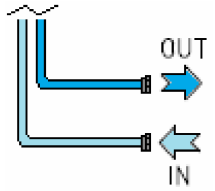
Machines in Free Cooling execution are supplied with water circuits connected to the pre-set valve and water condenser. Accordingly it will be necessary to set up the circuit water supply and discharge lines. The diameters of the pipes and the inlet and outlet fittings are identified in the order confirmation or in the following tables for standard models (identified by the code number sequence).

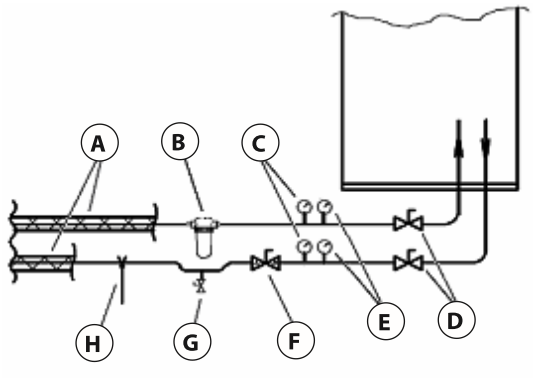
Water connections				
Standard models	Fitting diameter Ø		Threading	Water circuit volume
	Inches	DN	ISO 7/1	dm³
P Series				
301 – 302	1-1/4″	32	Female	13.5
662 – 852	1-1/2″	40		27.5
R Series				
231	1″	25	Female	15.5
40	1-1/4″	32		22.5

The maximum pressure of the water supply to the coils is 16 bar (1.6 MPa). The maximum pressure difference between the water inlet pipe to the valve and the outlet pipe is 2.5 bar (250 kPa), as at pressure differences greater than this value the return spring would not be able to shut off the water flow. In the event of greater pressure differences, it will be necessary to install pressure reducing valves upstream of the valve.

8.3.1 SETTING UP THE CHILLED WATER CIRCUITS - FREE COOLING DESIGN

The positions of the water inlet and outlet connections are indicated in the figure below. The connections can also be identified by the adhesive labels applied on the pipes of the unit near the connections.





A Armaflex insulation
B Mechanical filter
C Thermometer
D Shut-off valve
E Pressure gauge
F Balancing valve
G Discharge
H Supports

Water connections **Water circuit supply line**

To ensure that circuit pipes are installed correctly, we recommend you follow the instructions below:

- Use piping suited to the circuit pressure (copper, steel or plastic).
- Secure pipes with suitable brackets.
- Insulate both pipes with Armaflex type insulation.
- Install shut-off valves to facilitate maintenance.
- Install a Thermometer and Pressure gauge on the inlet and outlet.
- Install a discharge outlet at the lowest part of the circuit.
- Install a 50 µ mechanical filter on the supply line.
- Install a balance valve on the return line.
- Use water and glycol where necessary.

8.4 WATER-COOLED CONDENSER WATER CIRCUITS CONNECTION (ACCESSORY)

For machines with incorporated water-cooling condenser it is necessary to set up the condenser supply and discharge lines. The diameters of the pipes and the inlet and outlet fittings are identified in the order confirmation or in the following tables for standard models (identified by the code number sequence).

Water connections							
Standard models	Plate condenser			Adjustment valve			Water circuit volume
	Fitting diameter Ø		Threading	Fitting diameter Ø		Threading	
	Inches	DN	ISO 7/1	Inches	DN	ISO 7/1	dm^3
P Series							
071 - 141	3/4″	20	Male	1″	25	Female	0.7
211							1.5
251				1-1/4″	32		1.6
301	1-1/4″	32					2
361							2.5
461							3
302 - 422	3/4″	20		1″	25		1.2
512				1-1/4″	32		1.6
662	1-1/4″	32					2
852							2.5
932							3
G Series							
612	3/4	20	Male	1-1/4″	32	Female	1.6
461 - 932	1-1/4″	32					3
R Series							
121	3/4	20	Male	1″	25	Female	0.7
231							1.2
361	1-1/4″	32		1-1/4″	32		2
For models with several circuits the figures are intended per circuit							

If the water supply is obtained from a well or river, two filters of suitable characteristics for the type of water must be installed in parallel, (one as backup for the other) to prevent the condenser from becoming dirty from impurities in the water.

The maximum pressure of the water supply to the water-cooled condensers is 16 bar (1.6 MPa), the minimum is 1 bar (1 MPa). The maximum pressure difference between the water inlet pipe to the valve and the outlet pipe is 2.5 bar (250 kPa), as at pressure differences greater than this value the return spring would not be able to shut off the water flow. In the event of greater pressure differences, it will be necessary to install pressure reducing valves upstream of the valve.

8.4.1 CONDENSATION PRESSURE ADJUSTMENT MODULATING VALVE (ACCESSORY)

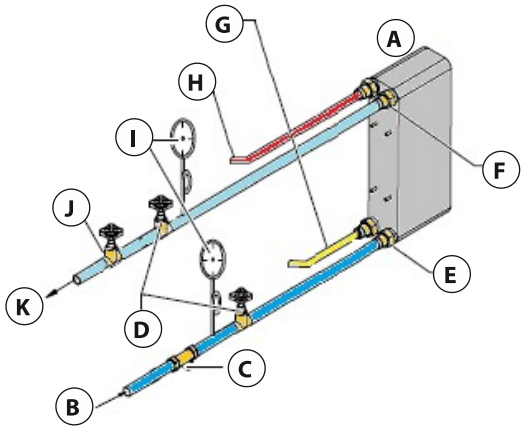
The condensation pressure adjustment modulating valve is indispensable in case of well, river, mains water supply and in all cases where water temperature might drop during the winter time at such low temperatures (below 15°C) that the machine's condensation temperature is excessively lowered. The valve is factory-installed on the condenser water outlet.

The positions of the water inlet and outlet connections are indicated in the figure below. The connections can also be identified by the adhesive labels applied on the panel of the unit near the connections. The maximum pressure of the water supply to the water-cooled condensers is 16 bar (1.6 MPa), the minimum is 1 bar (1 MPa).

The maximum pressure difference between the water inlet pipe and the outlet pipe is 2.5 bar (250 kPa), as at pressure differences greater than this value the return spring would not be able to shut off the water flow. In the event of greater pressure differences, it will be necessary to install pressure reducing valves upstream of the valve.

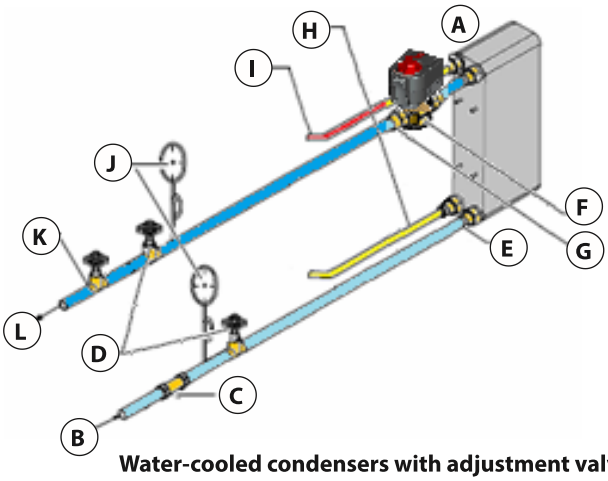
8.4.2 SETTING UP THE WATER-COOLED CONDENSER WATER CIRCUITS

The positions of the water inlet and outlet connections are indicated in the figure below. The connections can also be identified by the adhesive labels applied on the pipes of the unit near the connections.



A Plate condenser
B Condenser water inlet
C Water discharge
D Shut-off valve
E Inlet fitting
F Outlet fitting
G Liquid line
H Hot gas line
I Thermometers and pressure gauges
J Balancing valve
K Condenser water outlet

Non-regulated water-cooled condensers water circuit supply line



A Plate condenser
B Condenser water inlet
C Water discharge
D Shut-off valve
E Inlet fitting
F Condensation pressure adjustment modulating valve (accessory)
G Outlet fitting
H Liquid line
I Hot gas line
J Thermometers and pressure gauges
K Balancing valve
L Condenser water outlet

Water-cooled condensers with adjustment valve water circuit supply line

To ensure that circuit pipes are installed correctly, we recommend you follow the instructions below:

- Use piping suited to the circuit pressure (copper, steel or plastic).
- Secure pipes with suitable brackets.
- Insulate both pipes with Armaflex type insulation.
- Install shut-off valves to facilitate maintenance.
- Install a Thermometer and Pressure gauge on the inlet and outlet.
- Install a discharge outlet at the lowest part of the circuit.
- Install a 50 µ mechanical filter on the supply line.
- Install a balance valve on the return line.
- Use water and glycol where necessary.

8.5 CONNECTION OF THE INTERNAL SUBMERGED ELECTRODE HUMIDIFIER (ACCESSORY)

The units may be fitted with a submerged electrode humidifier to control environmental humidification.

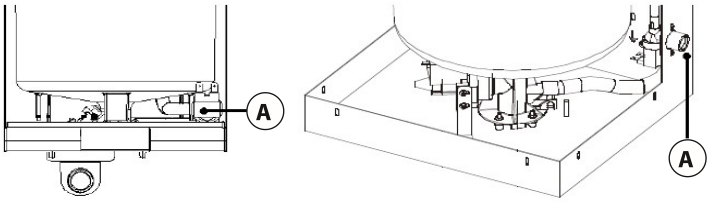
This type of humidifier exploits the conductivity of the water in the cylinder to produce steam. Applying voltage to the electrodes in the cylinder, current will flow between the electrodes that will heat the water until it reaches boiling point.

The humidifier is adjusted with the electronic board installed in the electric panel. The humidifier's work conditions may be checked with the display on the machine.

Submerged electrode humidifier

8.5.1 WATER CONNECTIONS OF THE SUBMERGED ELECTRODE HUMIDIFIER

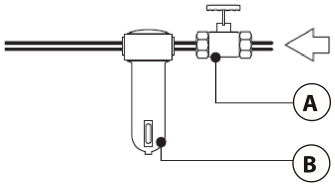
During installation of the unit, you are required to connect the supply piping of the internal humidifier to the water line of the system. The following table shows the type of water connection fitting.

<table>
<tr><th colspan="5">Water connections</th></tr>
<tr><td colspan="4"> 
</td><td>A Water charging valve and connection</td></tr>
<tr><th colspan="2">Hose</th><th colspan="2">Threaded fitting</th><td></td></tr>
<tr><th colspan="2">Connection diameter Ø (mm)</th><th colspan="2">Connection diameter Ø</th><th>Threading</th></tr>
<tr><th>External</th><th>Internal</th><th>Inches</th><th>DN</th><th>ISO 7/1</th></tr>
<tr><td>8</td><td>6</td><td>3/4</td><td>20</td><td>Male</td></tr>
</table>

Submerged electrode humidifier cylinder specifications				
Values		**Humidifier model**		
		3 kg/h	**8 kg/h**	**15 kg/h**
Steam production	kg/h	0.6 - 3.2	1.0 - 8.0	2.0 - 15.0
Cylinder volume	dm^3	1.1 - 3.3	0.9 - 5.4	2.2 - 9.8
Instantaneous supply flow rate	l/h	0.6	0.6	1.2
Instantaneous discharge flow rate	l/h	~ 4.0		

8.5.2 SETTING UP THE SUBMERGED ELECTRODE HUMIDIFIER WATER CIRCUITS

The submerged electrode humidifier's supply line shall have the features set out in the table below:



A Shut-off cock
B Mechanical filter

Humidifier water supply line

To ensure that circuit pipes are installed correctly, we recommend you follow the instructions below:

- A shut-off cock must be installed on the water supply pipe (A).
- A 50 µ mechanical filter must be installed on the supply line (B).
- The water pressure must range between 1-8 bar (100 and 800 kPa).
- The water temperature must range between 1 and 40 °C.
- The instantaneous water flow rate must not be lower than the nominal flow rate of the supply solenoid valve (0.6 - 1.2 l/min)
- Do not treat with softeners or demineralisation plants.

Once installation is complete, bleed the supply pipe for approximately 30 minutes, channelling the water directly to the drain pipe without letting it enter the humidifier. This will eliminate any waste or processing substances that could block the filling valve and/or create foam during boiling.

8.5.3 CHEMICAL/PHYSICAL CHARACTERISTICS OF THE WATER SUPPLY

Proper operation of the humidifier mainly derives from the chemical/physical characteristics of the water supply. The following table shows the limit values for proper operation. There is no reliable ratio between water hardness and conductivity and between cylinder conductivity and production!

Limit values for supply water with AVERAGE conductivity			
Values		**Minimum**	**Maximum**
Hydrogen ion activity	pH	7	8.5
Specific conductivity at 20 °C	$\sigma_{R\ 20\ °C}$ - µS/cm	350	750
Total dissolved solids	TDS - mg/l	320	700
Fixed residue at 180 °C	R_{180} - mg/l	220	490
Total hardness	mg/l $CaCO_3$	100	400
Temporary hardness	mg/l $CaCO_3$	60	300
Iron + Manganese	mg/l Fe + Mn	0	0.2
Chlorides	ppm C1	0	30
Silica	mg/l SiO_2	0	20
Residual chloride	mg/l C1	0	0.2
Calcium Sulphate	mg/l CaSO4	0	100
Metallic impurities, solvents, thinners, soaps, lubricants	mg/l	0	0
Do not treat with softeners or demineralisation plants!			

Should the features of the humidifier's supply water not comply with the figures set out in the previous table, it may be possible to assess feasibility of replacing the standard cylinder with special cylinders suited to the following conditions:

1) Cylinders for **LOW** conductivity: Suitable for water with a specific conductivity at 20 °C between **125 and 350 µS/cm.**
2) Cylinders for **HIGH** conductivity: Suitable for water with a specific conductivity at 20 °C between **750 and 1250 µS/cm.**

Should the features of the humidifier's supply water not comply with the features of the special cylinders, alternative systems will need to be assessed that cannot be integrated inside the unit, such as resistor or ultrasound humidifiers.

9 COOLING CONNECTIONS

9.1 ROUTING OF THE COOLING CIRCUIT PIPES

WARNING!

Correct pipe routing is crucial for good conditioner operation. It is necessary to be particularly careful in the choice and set-up of the supply and liquid pipes, especially with very long lines.

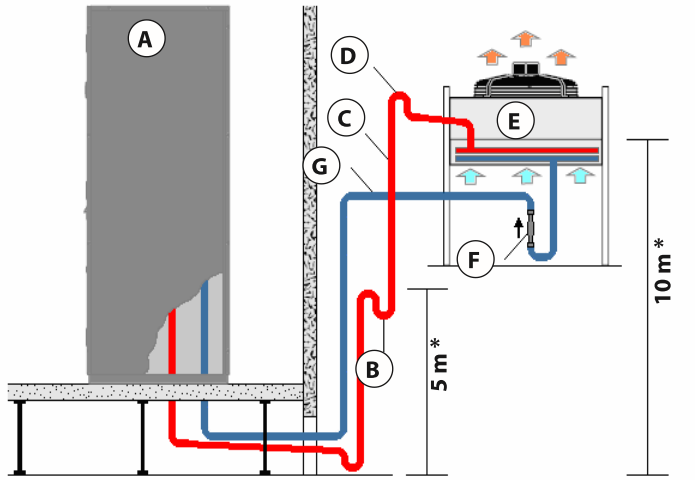
It is important to remember that the pipes should be SHORT AND WITH THE LEAST BENDS POSSIBLE since the cooling capacity of the circuit can be reduced exponentially by its length.

WARNING!

Pay attention when setting up the oil traps.

9.1.1 COMMON EXAMPLES OF COOLING CIRCUITS

Installation with condenser above

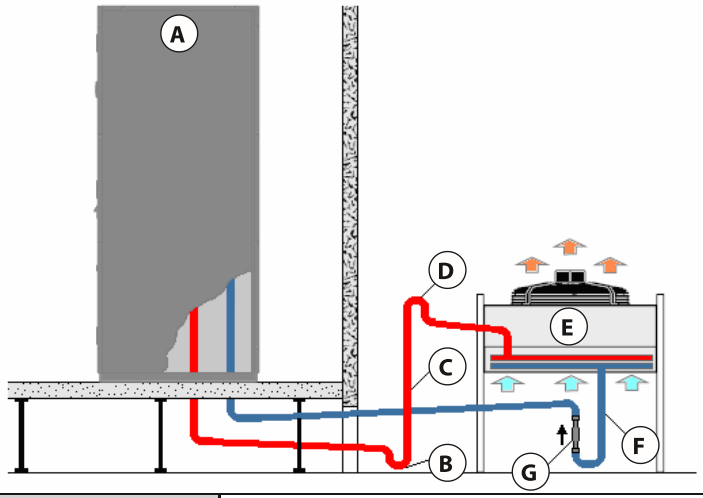


A Unit
B Oil traps
C Supply line
D Inverted curves (counter-trap) above the condenser coil
E Air-cooled condenser
F Check valve
G Liquid line

***Maximum height differences**

Maximum height difference	10 m	**Precautions**	Set up oil traps on the supply piping for every 5 m in level difference
			Set up a 1% slope on the horizontal sections of the supply pipe
Insulation	**Supply**	**Internal**	Required
		External	Only for aesthetic reasons
	Liquid	**Internal**	Only for aesthetic reasons
		External	Only if exposed to the sun and/or for aesthetic reasons

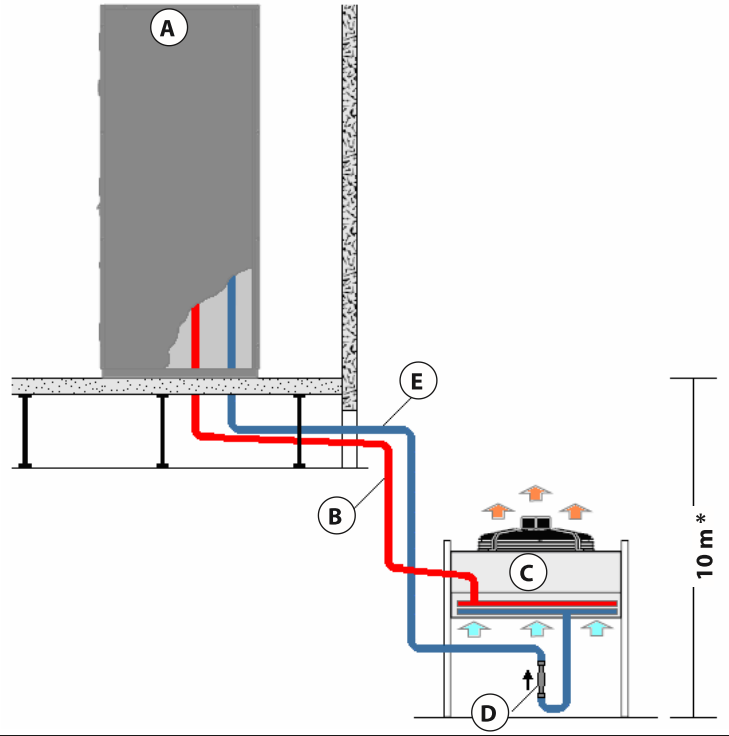
Installation with condenser on a level



A Unit
B Oil trap
C Supply line
D Inverted curves (counter-trap) above the condenser coil
E Air-cooled condenser
F Liquid line
G Check valve

Precautions			Set up oil traps on the supply piping
			Set up a 1% slope on the horizontal sections of the supply pipe
Insulation	**Supply**	**Internal**	Required
		External	Only for aesthetic reasons
	Liquid	**Internal**	Only for aesthetic reasons
		External	Only if exposed to the sun and/or for aesthetic reasons

Installation with condenser below



A Unit
B Supply line
C Air-cooled condenser
D Check valve
E Liquid line

***Maximum height differences**

Maximum height difference	10 m	**Precautions**	Set up a 1% slope on the horizontal sections of the supply pipe
Insulation	**Supply**	**Internal**	Required
		External	Only for aesthetic reasons
	Liquid	**Internal**	Only for aesthetic reasons
		External	Only if exposed to the sun or for aesthetic reasons

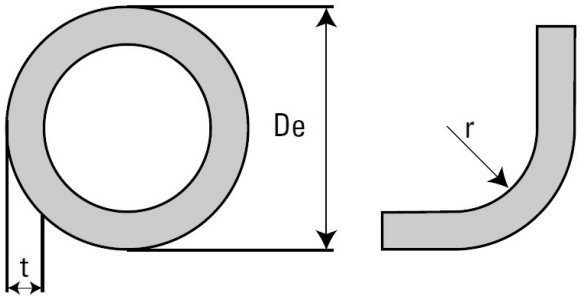
9.2 COOLING CIRCUIT SIZING

9.2.1 TYPES OF PIPING TO BE USED

The pipes must be made of copper that is suitable for direct expansion cooling circuits as required by standard EN 12735-1. Annealed copper coils may be used (diameters up to 7/8"), as well as hard-drawn copper bars.

In conformity with the EN14276-1 and EN14276-2 standards, the minimum recommend thickness for gas supply line piping, in particular where there are curves, for air condensed units using R410a refrigerant, it must be equal to values present in the table attached here below.

Copper pipe specifications



External diameter Ø		Minimum pipe thickness	Minimum curvature radius
De		t	r
Inches	mm	mm	mm
3/8"	10	0.8	20
1/2"	12	0.8	20
5/8"	16	1	26
3/4"	18	1	27
7/8"	22	1	66
1-1/8”	28	1.2	100

9.2.2 CALCULATION OF THE EQUIVALENT PIPE LENGTH

For correctly sizing the unit cooling lines it is necessary to calculate the equivalent length of refrigerant piping. When referring to equivalent length it means the linear length of the pipes coupled to the equivalent lengths of additional elements of the circuit, such as curves, therefore, the formula for calculation is as follows:

Total Equivalent Length (m) = Σ linear lengths of the pipe sections (m) + Σ equivalent lengths of the circuit components (m)

The following table includes equivalent length of the most common components of a cooling line:

Equivalent lengths of the cooling circuit components						
External diameter Ø		Curve 45°	Curve 90°	Elbow 90°	Curve 180°	T-fitting
Inches	mm	m				
3/8"	9.52	0.24	0.26	0.39	0.50	0.56
1/2"	12.70	0.26	0.28	0.43	0.54	0.61
5/8"	15.88	0.27	0.31	0.46	0.62	0.76
3/4"	19.05	0.30	0.40	0.58	0.80	0.92
7/8"	22.22	0.35	0.46	0.70	0.92	1.10
1-1/8”	28.57	0.45	0.55	0.82	1.10	1.38

9.2.3 DIAMETERS OF COOLING CIRCUIT CONNECTION PIPES

The diameters of the supply, liquid and suction pipes are identified in the order confirmation or in the following tables for standard models (identified by the code number sequence).

The diameters provided in the table were sized considering the characteristics set forth in the following table:

Cooling line sizing criteria		
Specifications	**Supply pipes**	**Liquid pipes**
Equivalent Length (per section)	40 m	
Vertical height difference	10 m	
Cooling capacity	Nominal specifications as per catalogue	
Evaporation Temperature	9 °C	
Condensation temperature	45°C	
Liquid refrigerant temperature	43 °C	
Refrigerant speed	Greater than 7 m/s	Less than 1.5 m/s
Head loss	Less than 1 Bar	Less than 2 Bar

Cooling line sizing				
Standard models	**Supply pipe Ø**		**Liquid pipe Ø**	
	Inches	**mm**	**Inches**	**mm**
P Series				
071	1/2"	12.70	3/8"	9.52
141 **302**	5/8"	15.88	1/2"	12.70
211 **422**	3/4"	19.05	5/8"	15.88
251 - 301 - 361 **512 - 662**	7/8"	22.22	5/8"	15.88
461 **852 - 932**	1 1/8"	28.57	3/4"	19.05
G Series				
612	7/8"	22.22	5/8"	15.88
461 **932**	1 1/8"	28.57	3/4"	19.05
R Series				
121	1/2"	12.70	3/8"	9.52
231	3/4"	19.05	5/8"	15.88
361	7/8"	22.22	5/8"	15.88
For models with several circuits the figures are intended per circuit				

9.3 COOLING CIRCUIT INSTALLATION

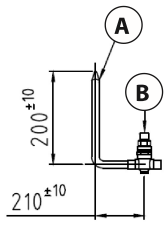
9.3.1 COOLING CIRCUIT INSTALLATION PRECAUTIONS

In order to correctly implement the cooling circuit, the following precautions need to be complied with:

- **Do not leave the circuit outdoors for an extended time, to prevent excessive formation of humidity.**
- **To prevent copper dust or swarf from getting into the system, the pipes should be cut using a pipe cutter rather than a hacksaw.**
- **It is necessary to carefully clean the pipe endings using the specific pipe reamer.**
- **If the ends are to be soldered, they should be cleaned with grade 00 sandpaper to eliminate all oxidisation and dirt.**
- **To avoid the curvature radius being too narrow or flattening the piping, bend the pipes with a suitable pipe bender of sufficient diameter.**
- **Prepare the end part of the piping to house the part to be fitted, widen the diameter with a suitable expander for copper pipes of sufficient diameter.**
- **Welding must be carried out through capillary brazing with oxyacetylene welding torch. The welding alloy must be copper or a copper-silver alloy.**
- **Protect the components with a damp cloth to prevent overheating.**

9.4 UNIT COOLING PIPE CONNECTION

The refrigerant inlet and outlet connections on the air-cooled condenser can be identified by their adhesive labels. To facilitate connection inside the unit, there is a section of pipe approximately 200 mm long, with relative cock, crimped and welded shut on the free end.



A Cooling line fitting
B Cock

9.4.1 COOLING CIRCUIT FITTING SIZES

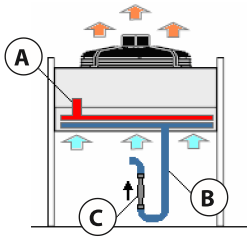
The diameters of the units' cooling connections for supply and liquid pipes (depending on the size of standard models identified by the code number sequence) are indicated in the order confirmation or in the following table:

Cooling circuit fitting sizes		
Standard models	**Supply pipe fittings Ø**	**Liquid pipe fittings Ø**
	mm	**mm**
P Series		
071	12	12
141 - 302 - 211 - 422	16	12
251 - 301 - 361 - 461 - 512 - 662 - 852 - 932	22	16
G Series		
461 - 612 - 932	22	16
R Series		
121	SAE male 1/2" flare	SAE male 1/2" flare
231	16	12
361	22	16

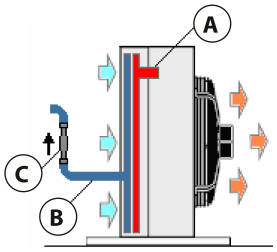
9.5 AIR-COOLED CONDENSER CONNECTION

The refrigerant inlet and outlet connections on the air-cooled condenser can be identified by their adhesive labels. To facilitate the connection there is a section of pipe approximately 100 mm long, crimped and welded shut on the free end.

A check valve (not supplied) has to be installed on the liquid pipe. When installing the valve, make sure the direction of the arrow matches the direction of flow. It is advisable to install the check valve with vertical axis and the arrow facing upwards; installations with inclined or horizontal longitudinal axes are tolerable.



Horizontal installation



Vertical installation

A Liquid line fitting
B Liquid line fitting
C Check valve

9.5.1 TMC CONDENSER CONNECTION DIMENSIONS

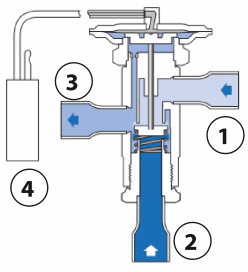
The diameters of the TMC condensers' cooling connections for supply and liquid pipes (depending on the size of standard models identified by the code number sequence) are indicated in the order confirmation or in the following table:

TMC condenser connection dimensions					
Standard models	Supply pipe fittings Ø	Liquid pipe fittings Ø	Standard models	Supply pipe fittings Ø	Liquid pipe fittings Ø
	mm	mm		mm	mm
11	16	16	**49**	28	28
19	16	16	**55**	28	28
31	22	22	**63**	28	28
35	28	28	**84**	35	28
40	28	28	**92**	42	35

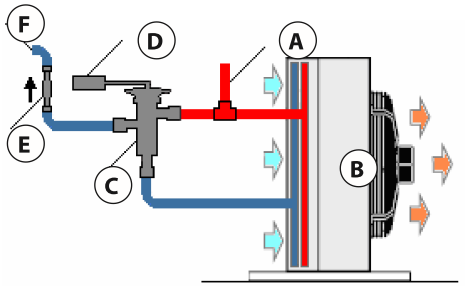
9.5.2 LAC (LOW AMBIENT CONTROL) VALVE CONNECTION (ACCESSORY)

The purpose of the LAC (Low Ambient Control) valve is to by-pass the condenser, injecting hot gas into the liquid pipe, to keep the pressure of the liquid refrigerant stable below 20 BarG. It is recommended to use the LAC valve in very cold climates, in the case of inverter compressors and in the case of condensers that are oversized compared to the actual needs of the units.

The LAC valve (included with the supply) must be installed on the air-cooled condenser's cooling connections as shown in the figure. The temperature probe needs to be left free to read the ambient temperature. Moreover, a check valve (not supplied) has to be installed on the liquid pipe. When installing the valve, make sure the direction of the arrow matches the direction of flow. It is advisable to install the check valve with vertical axis and the arrow facing upwards; installations with inclined or horizontal longitudinal axes are tolerable.



LAC valve



LAC valve connection

1 Hot gas connection (D)
2 Condenser outlet connection (C)
3 Liquid line connection (R)
4 Temperature probe

A Hot gas line
B Air-cooled condenser
C LAC (Low Ambient Control) valve
D Temperature probe
E Check valve
F Liquid line

9.5.3 PRECAUTIONS FOR BRAZING

RISK OF BURNS!

Burn hazard during cooling circuit brazing procedures!

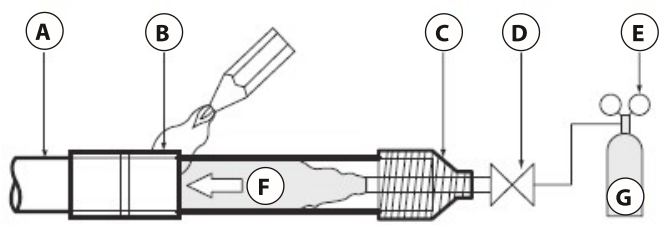
WARNING!

Check the nitrogen flow during brazing. If brazing is performed without using nitrogen, a strong layer of rust will develop inside the pipes, which may damage the valves and compressor and hinder the unit from operating correctly.

When performing brazing while feeding nitrogen into the pipe, the nitrogen must be regulated with a pressure reduction valve at 0.2 Bar (20 kPa) (just sufficient to be felt on the skin).

Use a suitable nitrogen pressurisation brazing kit and proceed as follows:

1) Connect the kit to the circuit as shown in the picture below.
2) Open the nitrogen feed cocks.
3) Ensure the nitrogen feeding pressure does not exceed 0.2 Bar (20 kPa).
4) If necessary protect the components with a damp cloth to prevent overheating.
5) Proceed with heating the pipe section with an oxyacetylene welding torch.
6) Add welding material until weld is completed by capillarity.



A Cooling lines
B Spot requiring brazing
C Insulating tape
D Manual valve
E Pressure reduction valve
F Nitrogen
G Nitrogen cylinder

9.5.4 SEAL TEST OF THE COOLING CIRCUIT WITH NITROGEN PRESSURISATION

Once the cooling circuit is completed, a verification of soldered joints and union fittings by way of nitrogen pressurisation is recommended.

Use a suitable nitrogen pressurisation circuit test kit and proceed as follows:

1) Connect the kit to the circuit.
2) Open any cocks and/or solenoid valves on the circuit.
3) Ensure no circuit sections can remain isolated.
4) Open the nitrogen delivery valve.
5) Reach test pressure for R410a systems, shown on the suitable kit pressure gauge. The recommended pressure is between 40 and 42 Bar (4 - 4.2 MPa):
   A) If the pressure does not reach this value, this means that there is a leak in the circuit.
   B) If it reaches the recommended pressure, maintain it for at least one hour. The test is considered a success if, in such a period of time, there is no decrease in pressure. Otherwise, it means there is a leak in the circuit.
3) Should a leak be found, proceed with the repair and repeat the previous operations, otherwise proceed with vacuum drying operations of the cooling line (see the next chapter).

Kit for nitrogen pressurisation test

9.6 COOLING CIRCUIT VACUUM DRYING OPERATIONS

WARNING!

Remote condenser air conditioners are shipped pressurised with nitrogen.

Air-cooled condensers are shipped pressurised with nitrogen.

Air conditioners with internal water-cooled condensers are supplied FULLY CHARGED with refrigerant.

After all connections and seal test operations, included in the previous chapters, have been completed for the cooling circuit, it is necessary the vacuum drying operation of the cooling circuit.

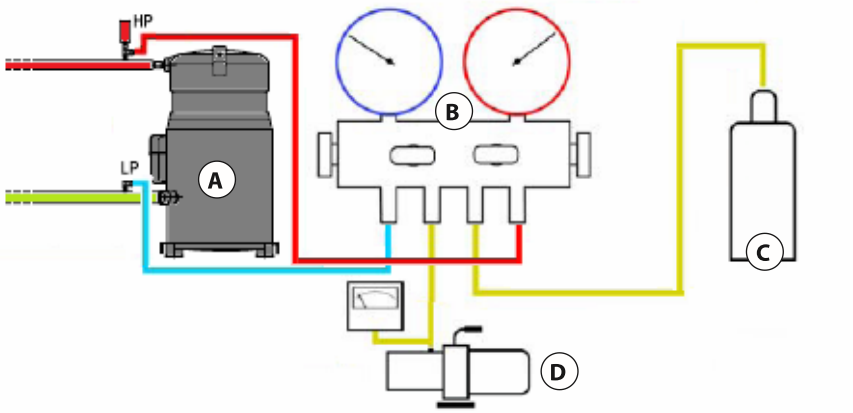
The vacuum drying operation of the cooling circuit is necessary to remove any residue of the technical gasses used for soldering and seal tests, atmospheric air and the water vapour that is part of it. By creating a vacuum inside the cooling line by means of a vacuum pump, the boiling point of water (100 °C at atmospheric pressure) is lowered to the point that, once it reaches a value lower than the temperature of the environment, humidity in the pipes turns into vapour and can, therefore, be ejected. **Vacuum pumps** are necessary to perform this operations suited to the cooling circuits (flow rate of 50 litres/minute).

The procedure for carrying out vacuum in the circuit is the following:

1) Connect the pressure gauges to the cooling circuit as shown in the next picture.
2) Connect the vacuum pump and refrigerant tank to the pressure gauges.
3) Power the machine (but not the compressors) to heat the possible crankcase oil heater.
4) Verify that all circuit cocks are open.
5) Bring the pressure gauges in position for operation in vacuum phase (carry out the vacuum simultaneously from both the liquid side and the gas side).
6) Start the vacuum pump.
7) The correct vacuum that can be achieved on the installation site is approximately **- 1 BarG (1 mBarA**).
8) Let the pump operate for a few hours (min. 2 hours):

- If, within two hours, the pump is unable to reach approximately **- 1 BarG (1 mBarA)**, this means that there are still traces of humidity or there is a leak.
- If a vacuum of approximately **- 1 BarG (1 mBarA)** is reached, maintain it for at least one hour. The test is considered a success if, in such a period of time, there is no increase in pressure. If otherwise, it means that there is still humidity inside the pipes, or there is a leak.

9) Should there be a leak, proceed with repairing it and repeat the previous operation, otherwise:
10) Close the pressure gauges and switch off the pump.
11) Disconnect the pump and move on to refrigerant charging operations.



A Compressor
B Pressure gauges
C Refrigerant
D Vacuum pump

9.7 CHARGING THE COOLING CIRCUIT

9.8 PRECAUTIONS

WARNING!

This equipment is exclusively meant for professionally prepared operators that know the fundamentals of cooling, cooling systems, cooling gasses and the possible damages that pressured equipment may cause.

The compressor must exclusively operate with refrigerants indicated by the manufacturer. Oxygen must never be allowed to enter the inside of the compressor. Do not start-up the compressor when there are significant vacuum conditions inside of it.

The units are designed to operate with R410a refrigerant. Do not dispose of R410a refrigerant as household waste as it is a fluorinated greenhouse gas subject to the Kyoto Protocol, with a Global Warming Potential (GWP_{100}) of 2088. The refrigerant must be disposed of in accordance with the legislation in force in the country where the units are installed.

Do not tamper or modify the calibration of the safety and control systems. It is recommended to wear suitable protection such as glasses and gloves; some unit components can cause physical injuries to the operator.

9.8.1 CALCULATION FOR THE QUANTITY OF REFRIGERANT IN THE CIRCUIT

WARNING!

The weights set forth in the tables are theoretical and may change when there are accessories and special configurations!

Refrigerant charging must be carried out as shown in the subsequent chapters!

The indicative quantity of refrigerant in the circuit is determined by the amount of refrigerant contained in each single element of the circuit, according to the following formulas:

1) Refrigerant content of the units with remote condenser:

Total refrigerant content (kg) = Unit content (kg) + Accessory content (kg)+ Supply pipe content (kg) + Liquid pipe content (kg) + Remote condenser content (kg)+ LT kit content (kg)

2) Refrigerant content of the units with integrated water-cooled condenser:

Total refrigerant content (kg) = Unit content (kg) + Accessory content (kg) + Water-cooled condenser content (kg)

The values of the individual circuit elements are given in the following tables.

Cooling line refrigerant content			
External diameter Ø		Weight of refrigerant per metre of pipe (kg/m)	
Inches	mm	Liquid	Supply
3/8"	**9.52**	0.05	0.007
1/2"	**12.70**	0.10	0.013
5/8"	**15.88**	0.16	0.022
3/4"	**19.05**	0.23	0.031
7/8"	**22.22**	0.32	0.043
1 1/8"	**28.57**	0.56	0.075

Unit refrigerant content							
Standard models	Unit	Oil separator	Water-cooled condenser	Standard models	Unit	Oil separator	Water-cooled condenser
	kg				kg		
P Series							
071	1.75	0.15	0.25	**302**	2.40	0.20	0.40
141	2.40	0.20	0.25	**422**	2.70	0.20	0.40
211	2.60	0.20	0.40	**512**	4.40	0.20	0.55
251	4.15	0.20	0.55	**662**	4.90	0.20	0.70
301	4.40	0.20	0.70	**852**	4.90	0.20	0.90
361	5.15	0.20	0.90	**932**	7.70	0.20	1.10
461	5.15	0.20	1.10				
Free Cooling and Two Sources P Series							
211	2.80	0.20	0.40	**302**	2.25	0.20	0.40
301	4.10	0.20	0.70	**662**	4.40	0.20	0.70
				852	4.40	0.20	0.90
G Series							
461	7.60	0.20	1.10	**612**	4.70	0.20	0.55
				932	7.40	0.20	1.10
R Series							
121	2.10	0.15	0.25	**361**	6.00	0.20	0.70
231	3.30	0.20	0.40				
Free Cooling and Two Sources R Series							
231	3.20	0.20	0.40				
For models with several circuits the figures are intended per circuit							

TMC condenser refrigerant content					
Standard models	Condenser	LAC valve	Standard models	Condenser	LAC valve
	kg			kg	
11	0.45	0.30	**49**	2.05	1.40
19	0.55	0.40	**55**	2.05	1.40
31	1.10	0.75	**63**	2.65	1.75
35	1.55	1.00	**84**	3.05	2.00
40	1.55	1.00	**92**	4.10	2.70
Non-TMC condenser refrigerant content					
For non TMC condensers, the refrigerant content, expressed in kg, is provided by the following expression:					
Coil volume (dm^3) x Kref = Refrigerant content (kg)					
Standard condensers			**Condensers with LAC valve**		
Kref			**Kref**		
0.37			0.61		

9.9 VERIFYING THAT THE LUBRICATING OIL CHARGE AND ANY TOP-UP IN THE CIRCUIT IS CORRECT

WARNING!

Units with inverter compressor contain an oil separator

Therefore the circuit does not need topping up with oil.

Correct lubricant oil charging is crucial for good operation of the direct expansion circuit, in fact, having no lubricant oil causes problems to the circuit, such as mechanical breakage of the compressor.

Accordingly it is necessary to assess whether refrigerant oil needs to be added to the circuit. The amount of refrigerant oil depends on the total refrigerant load and type of plant. To assess whether the cooling circuit needs to be topped up with lubricant oil, proceed as follows:

Oil to be topped up (l) = (Oil content in circuit (l) + Oil content in traps (l)) - Initial compressor content (l)

Calculation example of a system with 21 model unit:

- Initial content of lubricant oil: 1.7 l
- Total load of refrigerant: 12 kg R410a; Oil content requested in the circuit: 12 ÷ 6 = 2 l
- Number of oil traps: 2 x 3/4"; Oil content in traps: 2 x 0.018 = 0.036 l
- **Required top-up: (2+0.036) - 1.7 = 0.34 l**

9.9.1 TYPE AND INITIAL CONTENT OF LUBRICANT OIL IN THE UNITS

Standard lubricant oil specifications			
Type	Polyester oil	**Viscosity Index**	100
Viscosity @ 40°C	68 cSt	**Flash Point**	260 °C
Viscosity @ 100°C	8.7 cSt	**Freezing Point**	-39 °C

Initial content of lubricant oil in the units							
Standard models	**Compressor ON/OFF**	**Inverter Compressor**	**Oil separator**	**Standard models**	**Compressor ON/OFF**	**Inverter Compressor**	**Oil separator**
	Litres				**Litres**		
P Series							
071	0.6	0.4	0.3	**251 - 301 - 361 512 - 662**	2.8	1.7	0.3
141 - 211 302 - 422	1.7	1.7	0.3	**461 852 - 932**	3.5	1.7	0.3
G Series							
612	2.8	1.7	0.3	**461 - 932**	3.5	1.7	0.3
R Series							
121	-	0.4	0.3	**361**	-	1.7	0.3
231	-	1.7	0.3				
For models with several circuits the figures are intended per circuit							

9.9.2 CONTENT OF LUBRICATING OIL IN THE CIRCUIT

$$\frac{\text{Total load of refrigerant (kg)}}{6} = \text{Oil content requested in the circuit (l)}$$

9.9.3 CONTENT OF LUBRICATING OIL IN THE OIL TRAPS

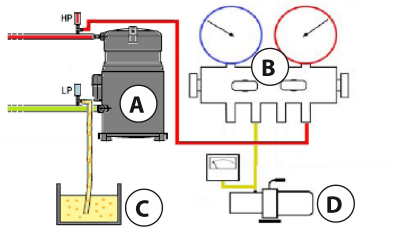
Content of lubricating oil in the oil traps		
External diameter Ø		Oil volume
Inches	mm	Litres
1/2"	12.70	0.006
5/8"	15.88	0.012
3/4"	19.05	0.018
7/8"	22.22	0.027
1-1/8"	28.57	0.054

9.9.4 LUBRICATING OIL TOP-UP IN THE CIRCUIT

If the lubricating oil in the compressor must be topped up, there are 2 charging types that can be used:

- **OIL TOP-UP DURING THE VACUUM PHASE:**

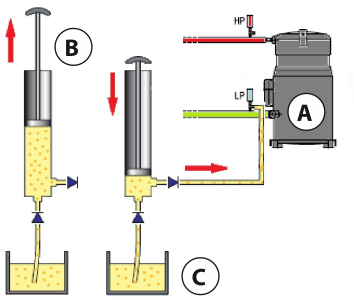
1) Connect a capillary to the low pressure side.
2) Submerge the capillary in a container.
3) Fill the container with the amount of oil needed.
4) Connect the pressure gauge unit from the high pressure side.
5) Proceed with the vacuum operations from the high pressure side.
6) The oil will be drawn into the circuit.
7) Once charging is complete, proceed with the vacuum operations.



A Compressor
B Pressure gauges
C Oil
D Vacuum pump

- **OIL TOP-UP WITH REFRIGERANT CHARGING CIRCUIT:**

1) For topping-up use a specific pump
2) Connect the pump to the circuit by the relative safety valve.
3) Connect the specific capillary to the intake valve.
4) Submerge the capillary in a container.
5) Fill the container with the amount of oil needed.
6) Activate the pump for the oil to enter the circuit.



A Compressor
B Oil pump
C Oil

9.9.5 CHARGING THE CIRCUIT WITH REFRIGERANT

WARNING!

Cooling circuit recharging operations need to be carried out with the unit running. Make sure that the electrical connections are correct.

Always charge the refrigerant in its liquid state. Make sure that the connections between pipes and cylinder are always set up correctly.

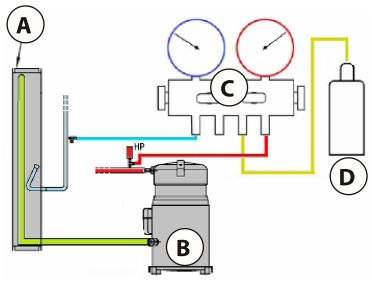
RISK OF BURNS!

Some parts of the cooling circuit may be hot!

It is recommended to perform refrigerant charge operations with ambient temperature within the unit's operating limits. A lower or higher temperature may compromise the actual circuit charge.

In order to charge completely proceed as follows (keeping in mind that the refrigerant must always be charged in liquid phase):

1) Make sure that circuit cocks are completely opened.
2) Check that the pressure gauges are compatible with the pressure of the refrigerant used (R410a).
3) Connect the pressure gauges to the cooling circuit as shown in the picture.
4) Check that the refrigerant tank is the type of refrigerant used (R410a).
5) Place the refrigerant tank on the calibrated scales.
6) Connect the refrigerant tank to the pressure gauge unit.
7) Place the pressure gauge in "Charge" position.
8) Open the HIGH PRESSURE SIDE filling valve to insert refrigerant until it approximately reaches 2/3 of the calculated quantity.
9) Open the recharging valve on the LOW PRESSURE SIDE, adding enough refrigerant to eliminate the empty condition.
10) Load any amount of top up oil through the provided valve placed on the compressor.
11) Feed the unit and wait for a few minutes.
12) Place the unit on ON, starting up the fans.
13) Start the compressor, being especially careful with double circuit units.
14) Verify overheating and operational parameters in order to evaluate the charge.
15) Calibrate the remote condenser speed variator to the temperature of required condensation.
16) Open the recharge valve on the LOW PRESSURE SIDE to integrate small amounts of refrigerant to fulfil the correct operating values.



A Coil
B Compressor
C Pressure gauges
D Refrigerant

9.10 TMC CONDENSER PRESSURE REGULATOR (ACCESSORY)

As accessories, speed regulation systems are available, installed inside the unit, for the remote condenser fans. Two different types of regulation are available, depending on what type of condenser is used.

9.10.1 ELECTRONIC CUT-OFF (AC) FAN SPEED REGULATORS

Electronic cut-off speed regulators are normally used to proportionally and continuously vary the speed of condensers with AC fans, with 230 Vac power supply, suitable for cut-off control.

They work as simple voltage variators where the control signal is provided by the unit's Survey^{EVO} regulator through a 0-10 V signal.

They are controlled by specific Survey^{EVO} regulator parameters, accordingly you need to refer to the relative user manual for their adjustment.

Electronic cut-off fan speed regulators

9.10.2 (EC) ELECTRONIC FAN SPEED CONTROL 0-10V SIGNAL

The 0-10V speed control signal is normally used to proportionally and continuously vary the speed of condensers with EC electronic fans, or condensers with built-in control.

The 0-10 V control signal is provided by the unit's Survey^{EVO} regulator.

The signal is regulated by specific Survey^{EVO} regulator parameters, accordingly you need to refer to the relative user manual for their adjustment.

9.11 CHECKING THE REFRIGERANT CHARGE AND COOLING CIRCUIT OPERATION

WARNING!

The compressor needs to be started up a few minutes prior to running the checks!

Correct plant operation, which depends on the choice of fundamental components and the dosage of the refrigerant load, can be checked from the cooling circuit operating values.

A correctly-installed unit that operates within the limits provided in this manual, will present values according to the following table:

Operating values of cooling circuits	
Evaporation pressure	Between **8 BarG** and **12 BarG**
Evaporation temperature	Between **4 °C** and **15 °C**
Suction temperature	Between **10 °C** and **21 °C**
Overheating	Stable at **6 K**
Compression ratio	Greater than **1.6**
Discharge temperature	Between **55 °C** and **80 °C**
Condensation pressure	Between **20 BarG** and **38 BarG**
Condensation temperature	Between **35 °C** and **60 °C**
Desuperheating	Between **20 K** and **30 K**
Liquid temperature	Between **25 °C** and **50 °C**
Sub-cooling	Between **2 K** and **10 K**

For units with two cooling circuits, the operating values will be checked with both circuits running.

Values differing from those provided in the table can mean that there is an incorrect refrigerant charge or operating conditions that do not comply with the limits set forth herein.

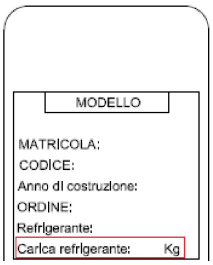
9.11.1 VERIFY THE REFRIGERANT CHARGE WITH THE DC INVERTER COMPRESSOR

During cooling capacity throttling stages, the operating values may appear satisfactory, however, they may no longer be correct at higher compressor speeds.

It is therefore essential that the compressor works at maximum speed before proceeding with the verification of the operating values of the circuit.

WARNING!

Once the charging operations of the cooling circuit are complete, it is mandatory to log the full amount of refrigerant introduced in the circuit on the CE marking found in the unit.



9.12 PRECAUTIONS AGAINST REFRIGERANT LEAKS

The direct expansion units operate on R410a refrigerant. R410a refrigerant is completely safe, non-toxic and non-flammable. Nonetheless it is a fluorinated greenhouse gas subject to the Kyoto Protocol, with a Global Warming Potential (GWP_{100}) = 2088.

According to REGULATION (EC) n. 842/2006, if the system contains more than 3 kg of refrigerant, the installer (or qualified staff appointed to operate the system) is required to draw up the SYSTEM LOG BOOK, where the following information will be reported:

- **The installed quantity and type of fluorinated greenhouse gas.**
- **Any quantities of gas added to amounts that were recovered during maintenance, repair and definitive disposal operations.**
- **All pertinent information, including details of the company or technician who performed the maintenance or repair work, as well as the dates and results of tests carried out and all information on the construction, operation and maintenance of the cooling system.**

It is compulsory for qualified personnel appointed to system operation to perform periodic checks in search of leaks, with the following frequency:

- **Applications containing from 3 kilogrammes to 30 kilogrammes of fluorinated greenhouse gases must be checked for leaks at least once every 12 (twelve) months (1 year).**
- **Applications containing 30 kilogrammes or more of fluorinated greenhouse gases must be checked for leaks at least once every 6 (six) months.**

9.13 CHECKING THE MAXIMUM CONCENTRATION OF REFRIGERANT

The direct expansion units operate on R410a refrigerant. R410a refrigerant is completely safe, non-toxic and non-flammable. Nonetheless, as it contains different chemical compounds than those found in the air, it poses the risk of suffocation if its concentration exceeds the maximum level for the environment where the unit is installed.

Accordingly, when a direct expansion air conditioner is installed, it is necessary to make sure that even in the case of a refrigerant leak, the density does not exceed the maximum risk level for the operators.

The unit of measurement used for the concentration is kg/m^3, i.e. the weight of refrigerant in 1 m^3 of air.

Based on current European standards, the maximum level of concentration for environments frequented by humans is 0.44 kg/m^3 for R410a refrigerant.

The concentration of refrigerant can be calculated as follows:

$$\frac{\text{TOTAL QUANTITY OF REFRIGERANT (kg)}}{\text{MINIMUM INTERNAL VOLUME WHERE THE AIR CONDITIONER IS TO BE INSTALLED } (m^3)} \leq 0.44\ kg/m^3$$

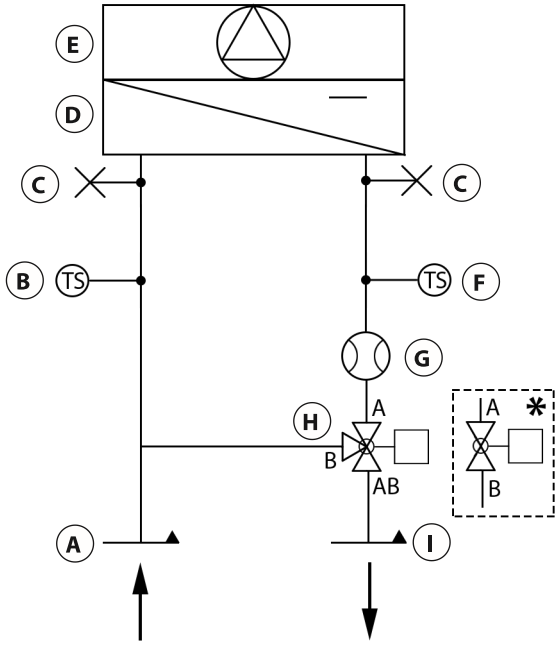
If the concentration of the refrigerant exceeds the maximum level, it will be necessary to implement adequate safety measures, such as openings to adjacent rooms or an overridden extraction system controlled by a leak detector.

If the concentration of refrigerant exceeds the maximum level, it will also be necessary to provide a conveying pipe, to be connected to the safety valve installed on the liquid receiver, in order to ensure the discharge of refrigerant to the outside of the room in case of intervention of the same.

10 EXAMPLES OF WATER AND COOLING CIRCUITS

10.1 EXAMPLE OF CHILLED WATER CIRCUIT

The following image represents the water circuit of chilled water units.

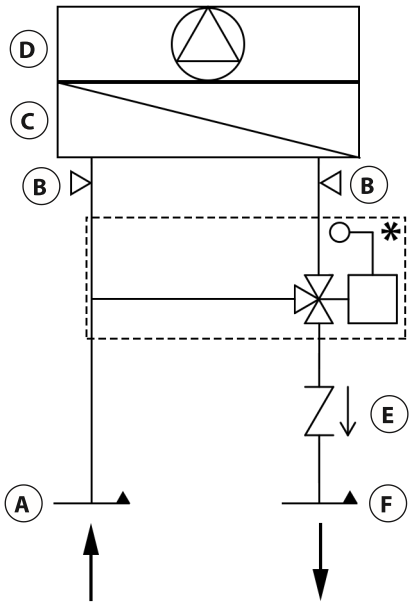


A Water inlet
B Inlet water temperature (accessory)
C Manual air vent valves
D Chilled water coil
E Fan
F Outlet water temperature (accessory)
G Water flow measuring device (accessory)
H 3-way ball valve
I Water outlet

*** 2-way ball valve (accessory)**

10.2 TMC AIR-COOLED CONDENSER COOLING CIRCUIT

The following image represents the cooling circuit of a TMC air-cooled condenser.



Hot gas line (HP gas: PS 41 Bar - TS 64 °C):

A Hot gas line
B Pressure intake SAE 1/4" male flare
C Air-cooled condenser
D Fan

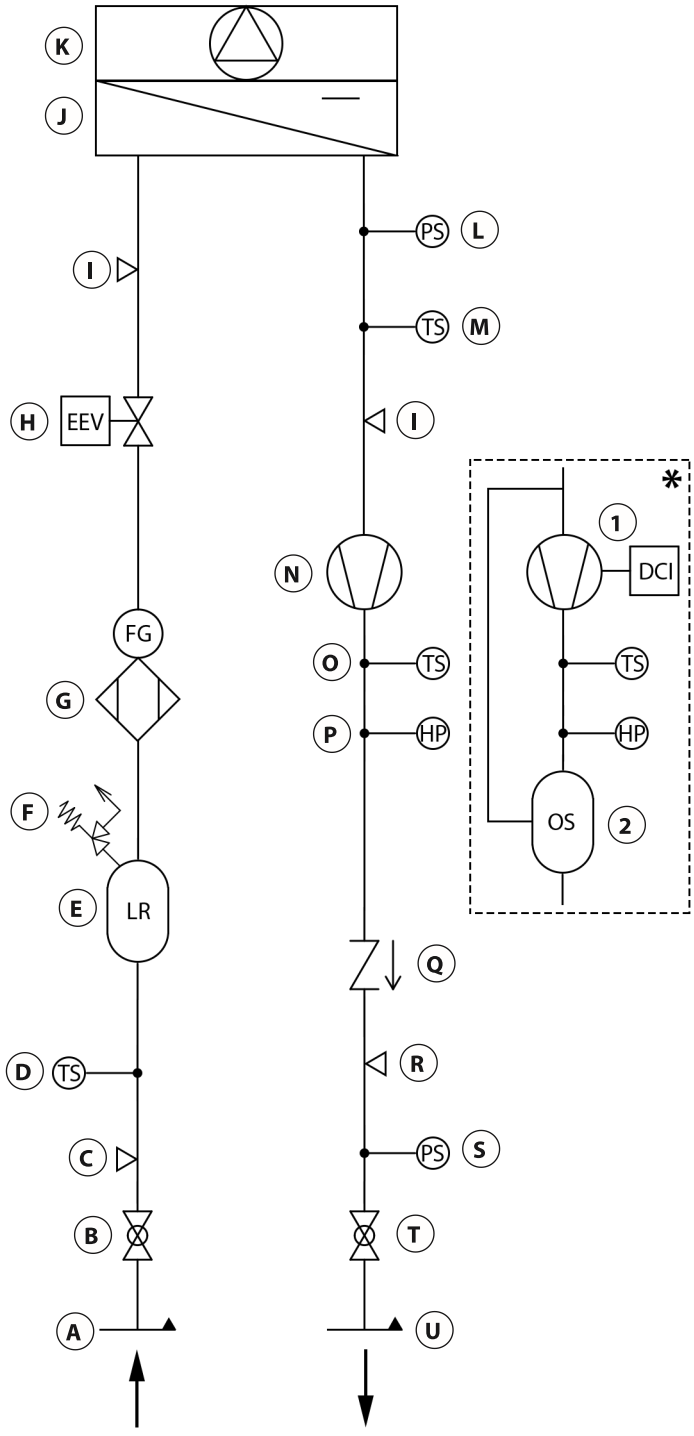
Liquid line (HP liq: PS 45 Bar - TS 68 °C):

E Liquid line check valve
F Liquid line

*** LAC (Low Ambient Control) Valve (Accessory)**

10.3 COOLING CIRCUIT WITH SINGLE COMPRESSOR AND REMOTE CONDENSER

The following image represents the cooling circuit in units with single compressor and remote condenser.



Liquid line (HP liq: PS 45 Bar - TS 68 °C):

A Liquid line
B Liquid line cock
C Pressure intake SAE 5/16" male flare
D Liquid temperature probe
E Liquid receiver
F Safety valve (44 Bar)
G Dehydrator filter with liquid sight glass
H Electronic expansion valve

Suction line (LP: PS 22 Bar - TS 38 °C):

I Pressure intake SAE 5/16" male flare (for refrigerant charging)
J Direct expansion coil
K Fan
L Evaporation pressure probe
M Suction temperature probe

Hot gas line (HP gas: PS 41 Bar - TS 64 °C):

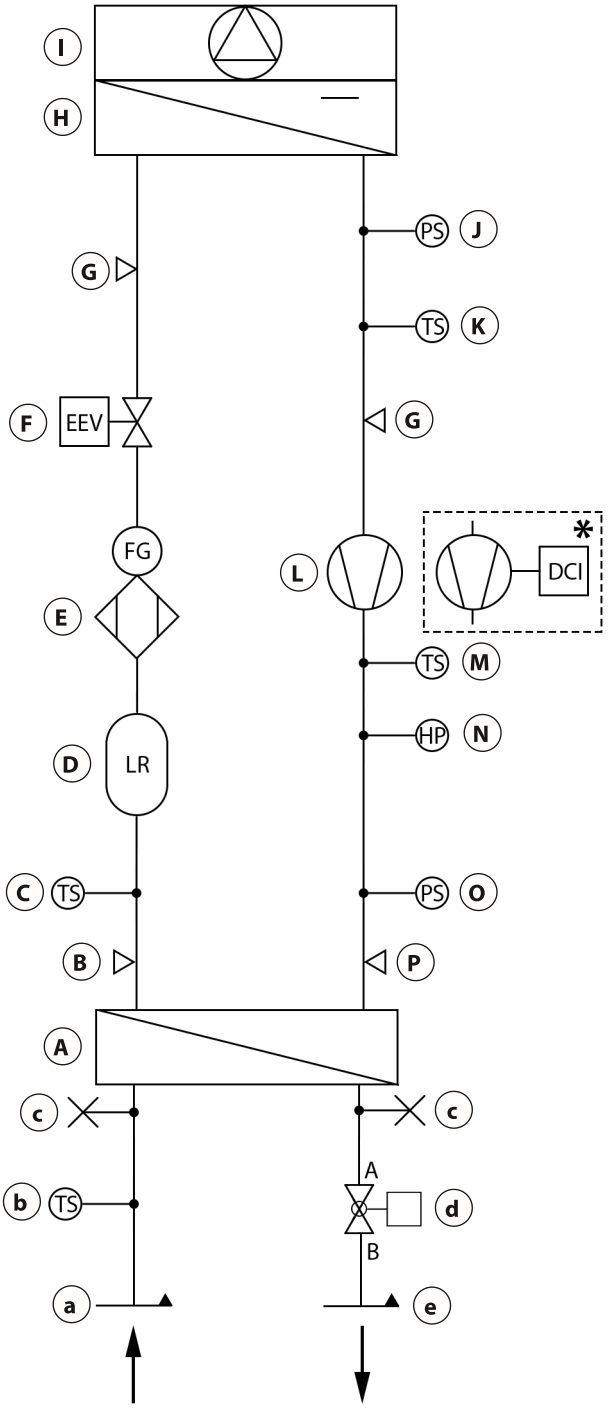
N Compressor
O Discharge temperature probe
P High pressure switch with manual reset (41 Bar)
Q Hot gas line check valve
R Pressure intake SAE 5/16" male flare
S Condensation pressure probe
T Hot gas line cock
U Hot gas line

*** DC inverter compressor (accessory):**

1 DC inverter compressor
2 Oil separator

10.4 COOLING CIRCUIT WITH SINGLE COMPRESSOR AND WATER-COOLED CONDENSER

The following image represents the cooling circuit in units with single compressor and air-cooled condenser.



Cooling circuit:

Liquid line (HP: PS 41 Bar - TS 64 °C):

A Water-cooled condenser
B Pressure intake SAE 5/16" male flare
C Liquid temperature probe
D Liquid receiver
E Dehydrator filter with liquid sight glass
F Electronic expansion valve

Suction line (LP: PS 22 Bar - TS 38 °C):

G Pressure intake SAE 5/16" male flare (for refrigerant charging)
H Direct expansion coil
I Fan
J Evaporation pressure probe
K Suction temperature probe

Hot gas line (HP: PS 41 Bar - TS 64 °C):

L Compressor
M Discharge temperature probe
N High pressure switch with manual reset (41 Bar)
O Condensation pressure probe
P Pressure intake SAE 5/16" male flare

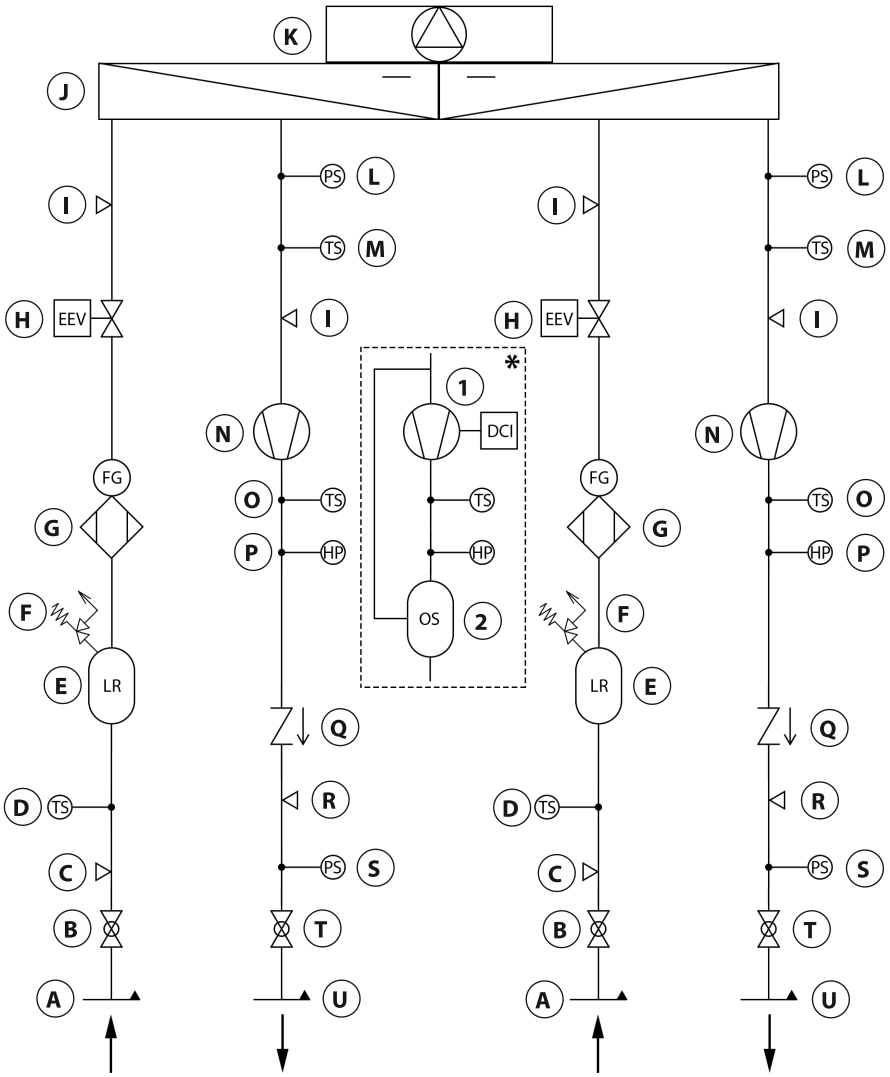
*** DC inverter compressor (accessory)**

Water circuit:

a Water inlet
b Inlet water temperature for dry cooler regulation (accessory)
c Manual air vent valves
d Adjustment valve of water-cooled condenser (accessory)
e Water outlet

10.5 COOLING CIRCUIT WITH DOUBLE COMPRESSOR AND REMOTE CONDENSER

The following image represents the cooling circuit in units with double compressor and remote condenser.



Liquid line (HP liq: PS 45 Bar - TS 68 °C):

A Liquid line
B Liquid line cock
C Pressure intake SAE 5/16" male flare
D Liquid temperature probe
E Liquid receiver
F Safety valve (44 Bar)
G Dehydrator filter with liquid sight glass
H Electronic expansion valve

Suction line (LP: PS 22 Bar - TS 38 °C):

I Pressure intake SAE 5/16" male flare (for refrigerant charging)
J Direct expansion coil
K Fan
L Evaporation pressure probe
M Suction temperature probe

Hot gas line (HP gas: PS 41 Bar - TS 64 °C):

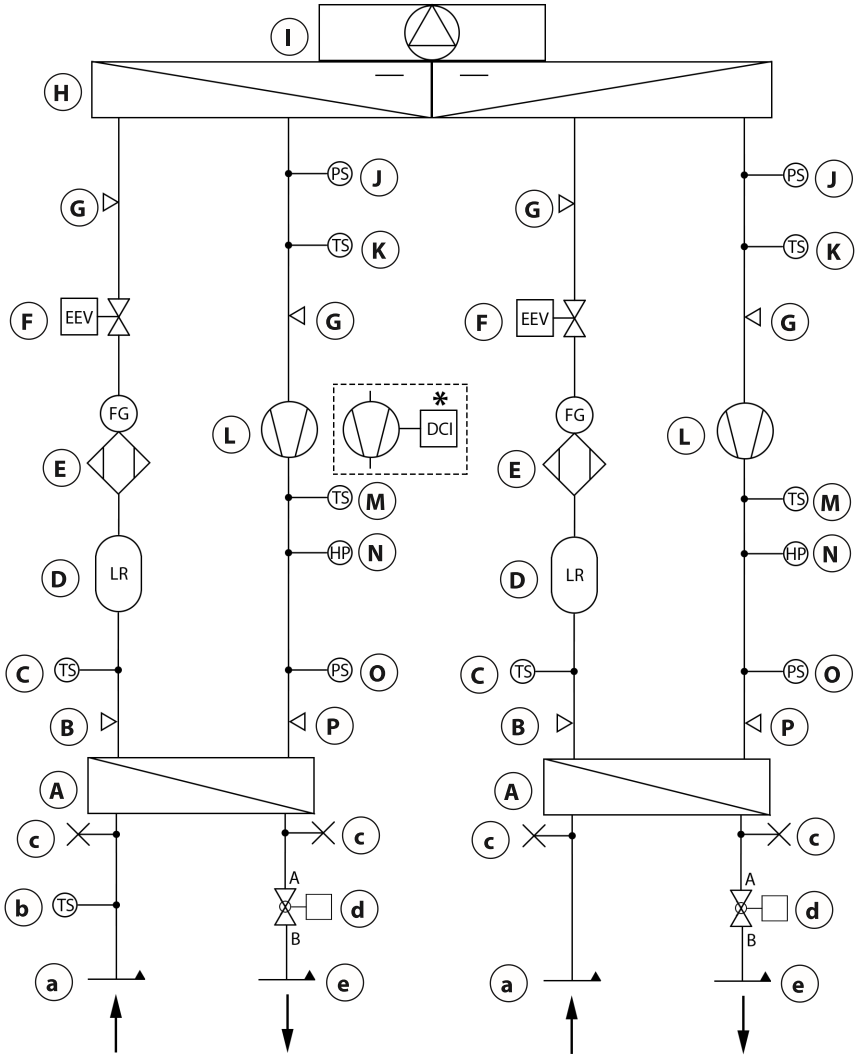
N Compressor
O Discharge temperature probe
P High pressure switch with manual reset (41 Bar)
Q Hot gas line check valve
R Pressure intake SAE 5/16" male flare
S Condensation pressure probe
T Hot gas line cock
U Hot gas line

*** DC inverter compressor (accessory):**

1 DC inverter compressor
2 Oil separator

10.6 COOLING CIRCUIT WITH DOUBLE COMPRESSOR AND WATER-COOLED CONDENSER

The following image represents the cooling circuit in units with double compressor and water-cooling condenser.



Cooling circuit:

Liquid line (HP: PS 41 Bar - TS 64 °C):

- **A** Water-cooled condenser
- **B** Pressure intake SAE 5/16" male flare
- **C** Liquid temperature probe
- **D** Liquid receiver
- **E** Dehydrator filter with liquid sight glass
- **F** Electronic expansion valve

Suction line (LP: PS 22 Bar - TS 38 °C):

- **G** Pressure intake SAE 5/16" male flare (for refrigerant charging)
- **H** Direct expansion coil
- **I** Fan
- **J** Evaporation pressure probe
- **K** Suction temperature probe

Hot gas line (HP: PS 41 Bar - TS 64 °C):

- **L** Compressor
- **M** Discharge temperature probe
- **N** High pressure switch with manual reset (41 Bar)
- **O** Condensation pressure probe
- **P** Pressure intake SAE 5/16" male flare

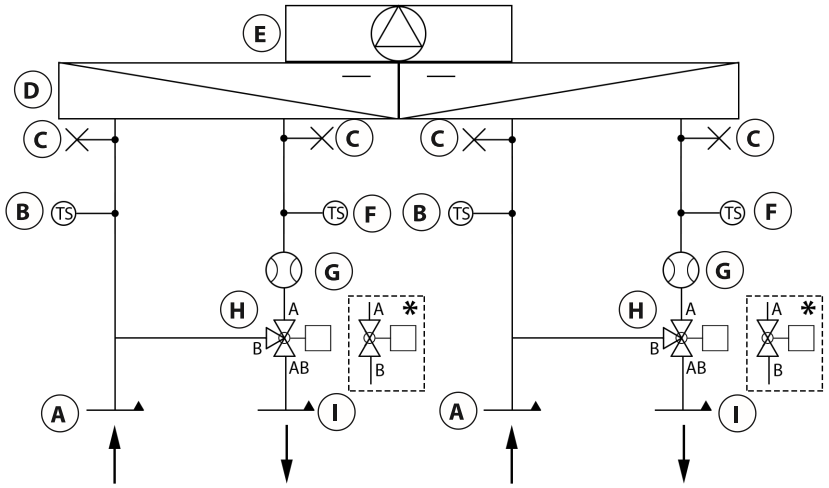
*** DC inverter compressor (accessory)**

Water circuit:

- **a** Water inlet
- **b** Inlet water temperature for dry cooler regulation (accessory)
- **c** Manual air vent valves
- **d** Adjustment valve of water-cooled condenser (accessory)
- **e** Water outlet

10.7 TWO SOURCES WATER CIRCUIT WITH CHILLED WATER CIRCUITS

The following image represents the water circuit of chilled water two sources units.

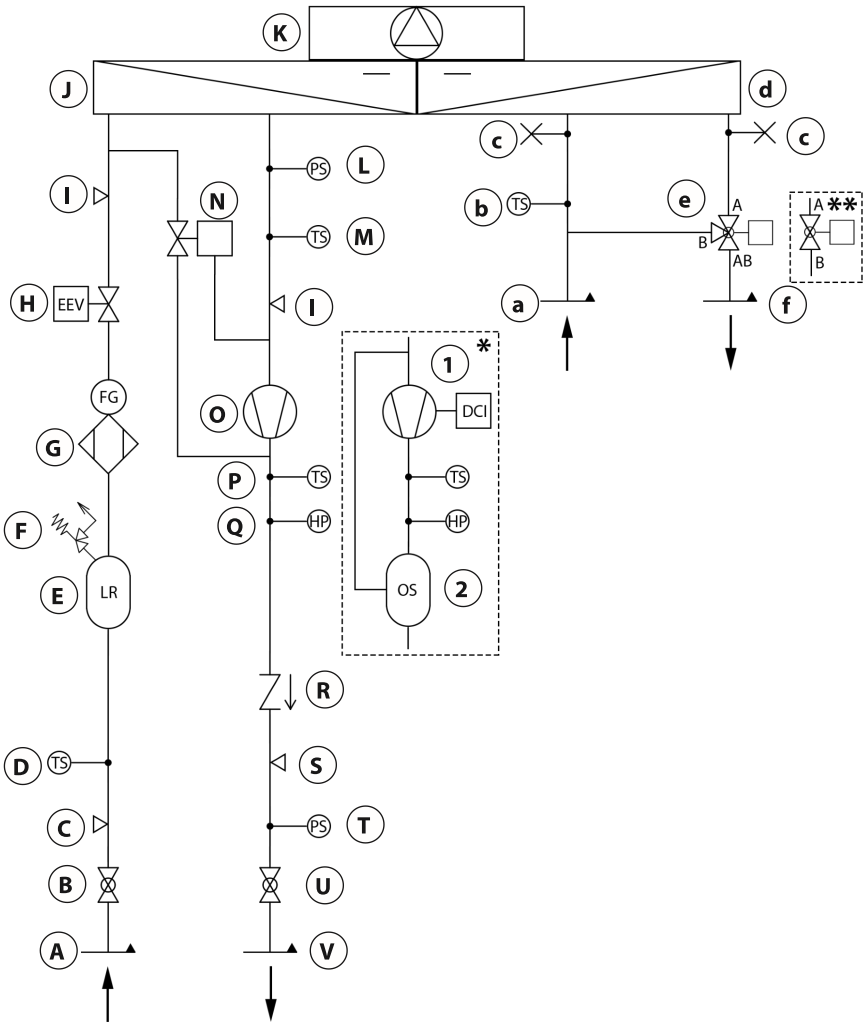


A Water inlet
B Inlet water temperature (accessory)
C Manual air vent valves
D Chilled water coil
E Fan
F Outlet water temperature (accessory)
G Water flow measuring device (accessory)
H 3-way ball valve
I Water outlet

*** 2-way ball valve (accessory)**

10.8 TWO SOURCES COOLING CIRCUIT WITH SINGLE COMPRESSOR AND REMOTE CONDENSER

The following image represents the cooling circuit in two sources units with single compressor and remote condenser.



Cooling circuit:

Liquid line (HP liq: PS 45 Bar - TS 68 °C):

- **A** Liquid line
- **B** Liquid line cock
- **C** Pressure intake SAE 5/16" male flare
- **D** Liquid temperature probe
- **E** Liquid receiver
- **F** Safety valve (44 Bar)
- **G** Dehydrator filter with liquid sight glass
- **H** Electronic expansion valve

Suction line (LP: PS 22 Bar - TS 38 °C):

- **I** Pressure intake SAE 5/16" male flare (for refrigerant charging)
- **J** Direct expansion coil
- **K** Fan
- **L** Evaporation pressure probe
- **M** Suction temperature probe
- **N** Antifreeze hot gas injection valve

Hot gas line (HP gas: PS 41 Bar - TS 64 °C):

- **O** Compressor
- **P** Discharge temperature probe
- **Q** High pressure switch with manual reset (41 Bar)
- **R** Hot gas line check valve
- **S** Pressure intake SAE 5/16" male flare
- **T** Condensation pressure probe
- **U** Hot gas line cock
- **V** Hot gas line

*** DC inverter compressor (accessory):**

- **1** DC inverter compressor
- **2** Oil separator

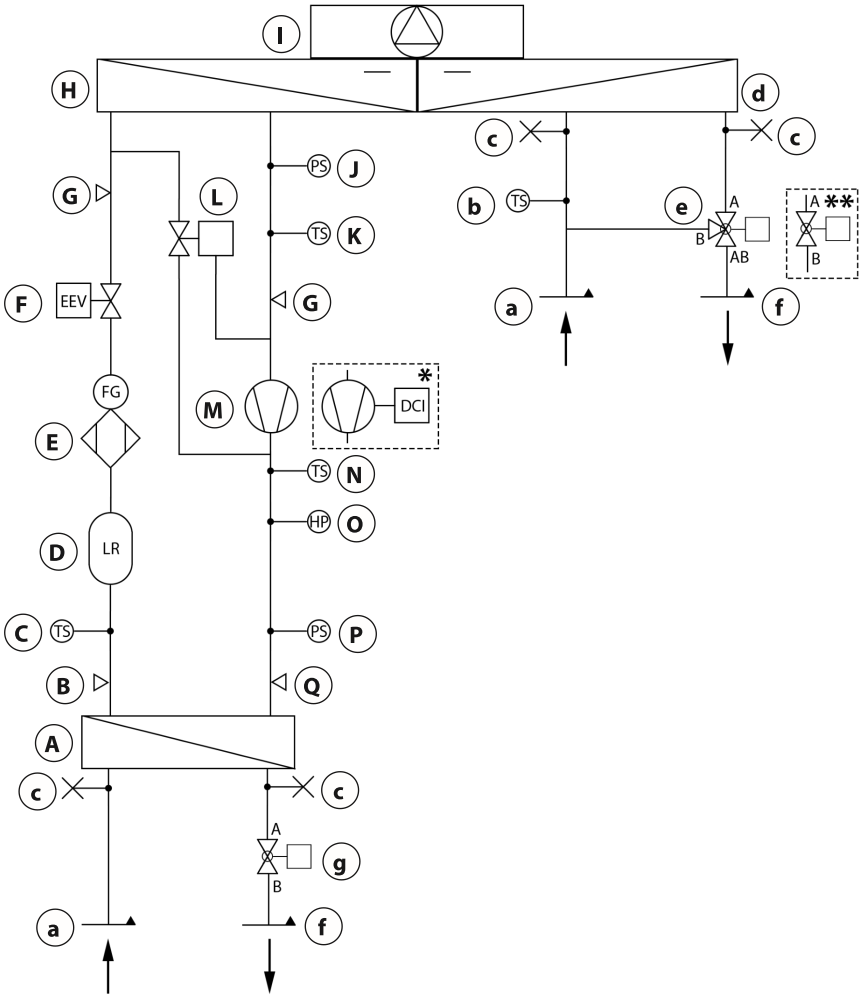
Water circuit:

- **a** Water inlet
- **b** Inlet water temperature
- **c** Manual air vent valves
- **d** Chilled water coil
- **e** 3-way ball valve
- **f** Water outlet

**** 2-way ball valve (accessory)**

10.9 TWO SOURCES COOLING CIRCUIT WITH SINGLE COMPRESSOR AND WATER-COOLED CONDENSER

The following image represents the cooling circuit in two sources units with single compressor and water-cooling condenser.



Cooling circuit:

Liquid line (HP: PS 41 Bar - TS 64 °C):

- **A** Water-cooled condenser
- **B** Pressure intake SAE 5/16" male flare
- **C** Liquid temperature probe
- **D** Liquid receiver
- **E** Dehydrator filter with liquid sight glass
- **F** Electronic expansion valve

Suction line (LP: PS 22 Bar - TS 38 °C):

- **G** Pressure intake SAE 5/16" male flare (for refrigerant charging)
- **H** Direct expansion coil
- **I** Fan
- **J** Evaporation pressure probe
- **K** Suction temperature probe
- **L** Antifreeze hot gas injection valve

Hot gas line (HP: PS 41 Bar - TS 64 °C):

- **M** Compressor
- **N** Discharge temperature probe
- **O** High pressure switch with manual reset (41 Bar)
- **P** Condensation pressure probe
- **Q** Pressure intake SAE 5/16" male flare

*** DC inverter compressor (accessory)**

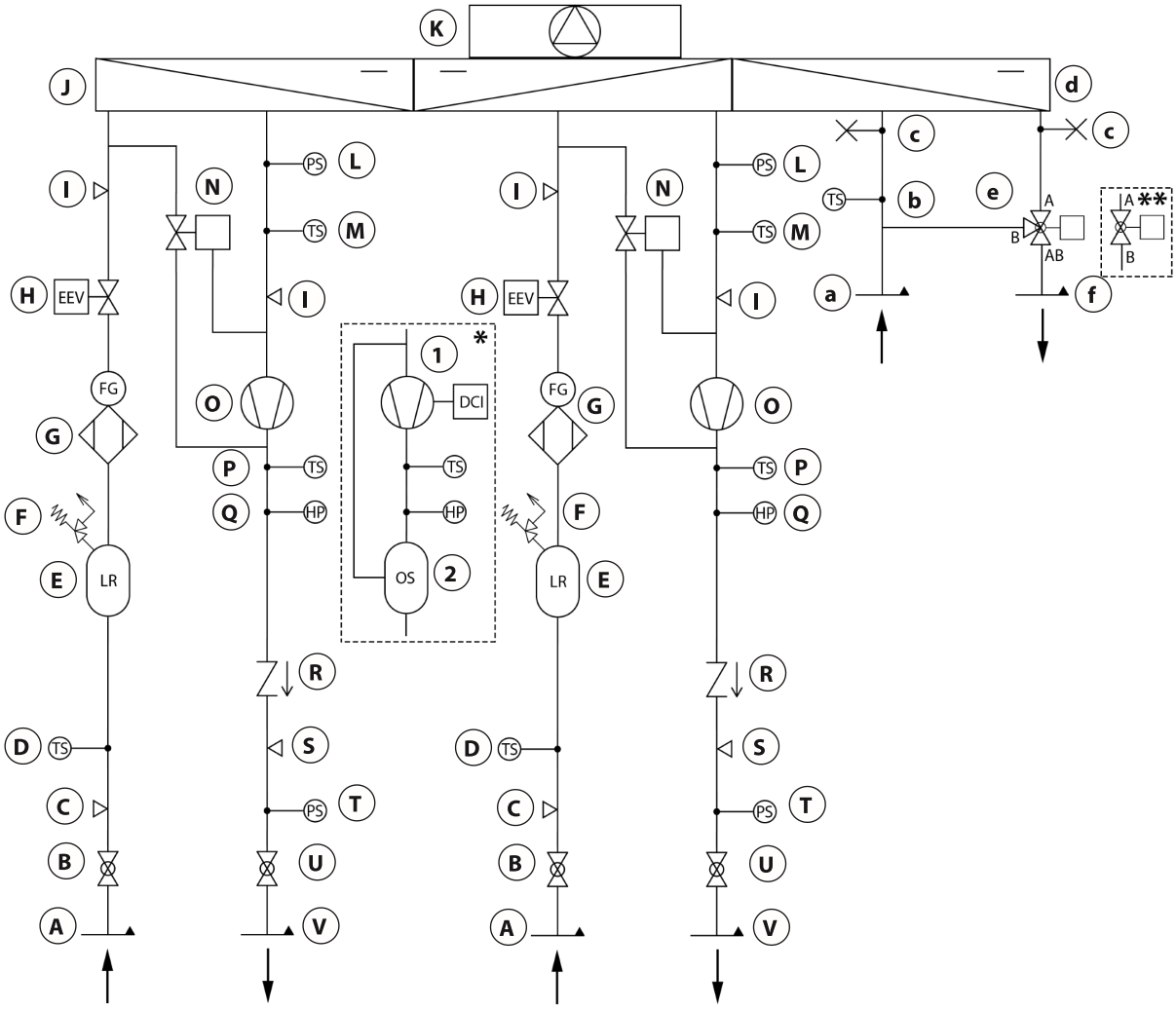
Water circuit:

- **a** Water inlet
- **b** Inlet water temperature
- **c** Manual air vent valves
- **d** Chilled water coil
- **e** 3-way ball valve
- **f** Water outlet
- **g** Adjustment valve of water-cooled condenser (accessory)

**** 2-way ball valve (accessory)**

10.10 TWO SOURCES COOLING CIRCUIT WITH DOUBLE COMPRESSOR AND REMOTE CONDENSER

The following image represents the cooling circuit in two sources units with double compressor and remote condenser.



Cooling circuit:

Liquid line (HP liq: PS 45 Bar - TS 68 °C):

- **A** Liquid line
- **B** Liquid line cock
- **C** Pressure intake SAE 5/16" male flare
- **D** Liquid temperature probe
- **E** Liquid receiver
- **F** Safety valve (44 Bar)
- **G** Dehydrator filter with liquid sight glass
- **H** Electronic expansion valve

Suction line (LP: PS 22 Bar - TS 38 °C):

- **I** Pressure intake SAE 5/16" male flare (for refrigerant charging)
- **J** Direct expansion coil
- **K** Fan
- **L** Evaporation pressure probe
- **M** Suction temperature probe
- **N** Antifreeze hot gas injection valve

Hot gas line (HP gas: PS 41 Bar - TS 64 °C):

- **O** Compressor
- **P** Discharge temperature probe
- **Q** High pressure switch with manual reset (41 Bar)
- **R** Hot gas line check valve
- **S** Pressure intake SAE 5/16" male flare
- **T** Condensation pressure probe
- **U** Hot gas line cock
- **V** Hot gas line

*** DC inverter compressor (accessory):**

- **1** DC inverter compressor
- **2** Oil separator

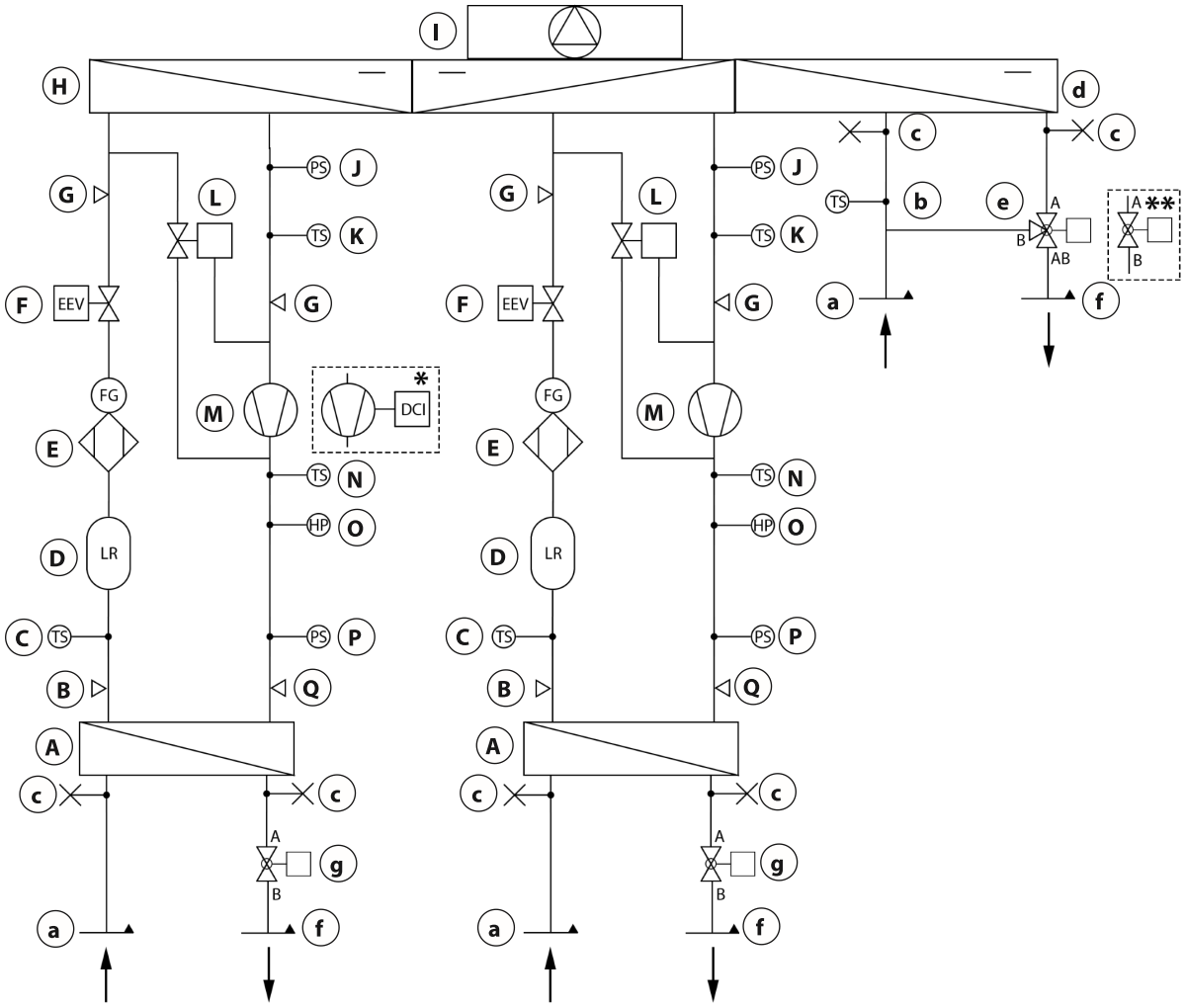
Water circuit:

- **a** Water inlet
- **b** Inlet water temperature
- **c** Manual air vent valves
- **d** Chilled water coil
- **e** 3-way ball valve
- **f** Water outlet

**** 2-way ball valve (accessory)**

10.11 TWO SOURCES COOLING CIRCUIT WITH DOUBLE COMPRESSOR AND WATER-COOLED CONDENSER

The following image represents the cooling circuit in two sources units with double compressor and water-cooling condenser.



Cooling circuit:

Liquid line (HP: PS 41 Bar - TS 64 °C):

- **A** Water-cooled condenser
- **B** Pressure intake SAE 5/16" male flare
- **C** Liquid temperature probe
- **D** Liquid receiver
- **E** Dehydrator filter with liquid sight glass
- **F** Electronic expansion valve

Suction line (LP: PS 22 Bar - TS 38 °C):

- **G** Pressure intake SAE 5/16" male flare (for refrigerant charging)
- **H** Direct expansion coil
- **I** Fan
- **J** Evaporation pressure probe
- **K** Suction temperature probe
- **L** Antifreeze hot gas injection valve

Hot gas line (HP: PS 41 Bar - TS 64 °C):

- **M** Compressor
- **N** Discharge temperature probe
- **O** High pressure switch with manual reset (41 Bar)
- **P** Condensation pressure probe
- **Q** Pressure intake SAE 5/16" male flare

*** DC inverter compressor (accessory)**

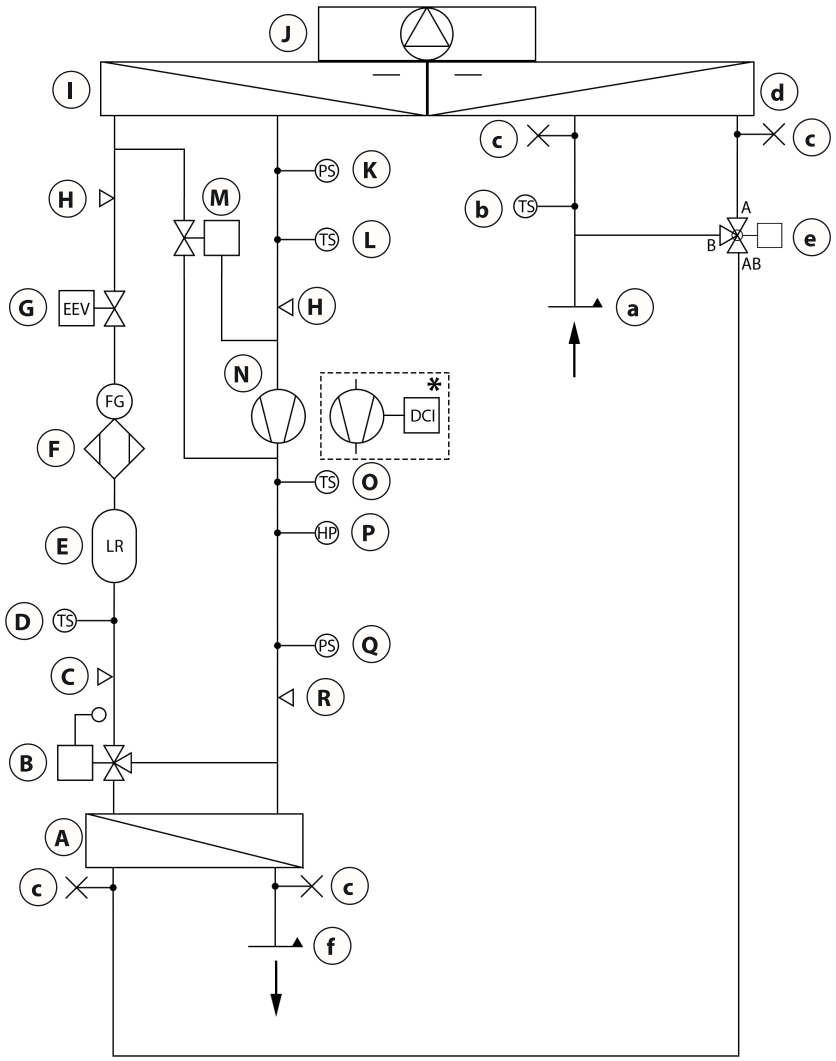
Water circuit:

- **a** Water inlet
- **b** Inlet water temperature
- **c** Manual air vent valves
- **d** Chilled water coil
- **e** 3-way ball valve
- **f** Water outlet
- **g** Adjustment valve of water-cooled condenser (accessory)

**** 2-way ball valve (accessory)**

10.12 COOLING CIRCUIT WITH FREE COOLING AND SINGLE COMPRESSOR

The following image represents the cooling circuit of the free cooling units with single compressor.



Cooling circuit:

Liquid line (HP: PS 41 Bar - TS 64 °C):

- **A** Water-cooled condenser
- **B** LAC valve for controlling condensation pressure
- **C** Pressure intake SAE 5/16" male flare
- **D** Liquid temperature probe
- **E** Liquid receiver
- **F** Dehydrator filter with liquid sight glass
- **G** Electronic expansion valve

Suction line (LP: PS 22 Bar - TS 38 °C):

- **H** Pressure intake SAE 5/16" male flare (for refrigerant charging)
- **I** Direct expansion coil
- **J** Fan
- **K** Evaporation pressure probe
- **L** Suction temperature probe
- **M** Antifreeze hot gas injection valve

Hot gas line (HP: PS 41 Bar - TS 64 °C):

- **N** Compressor
- **O** Discharge temperature probe
- **P** High pressure switch with manual reset (41 Bar)
- **Q** Condensation pressure probe
- **R** Pressure intake SAE 5/16" male flare

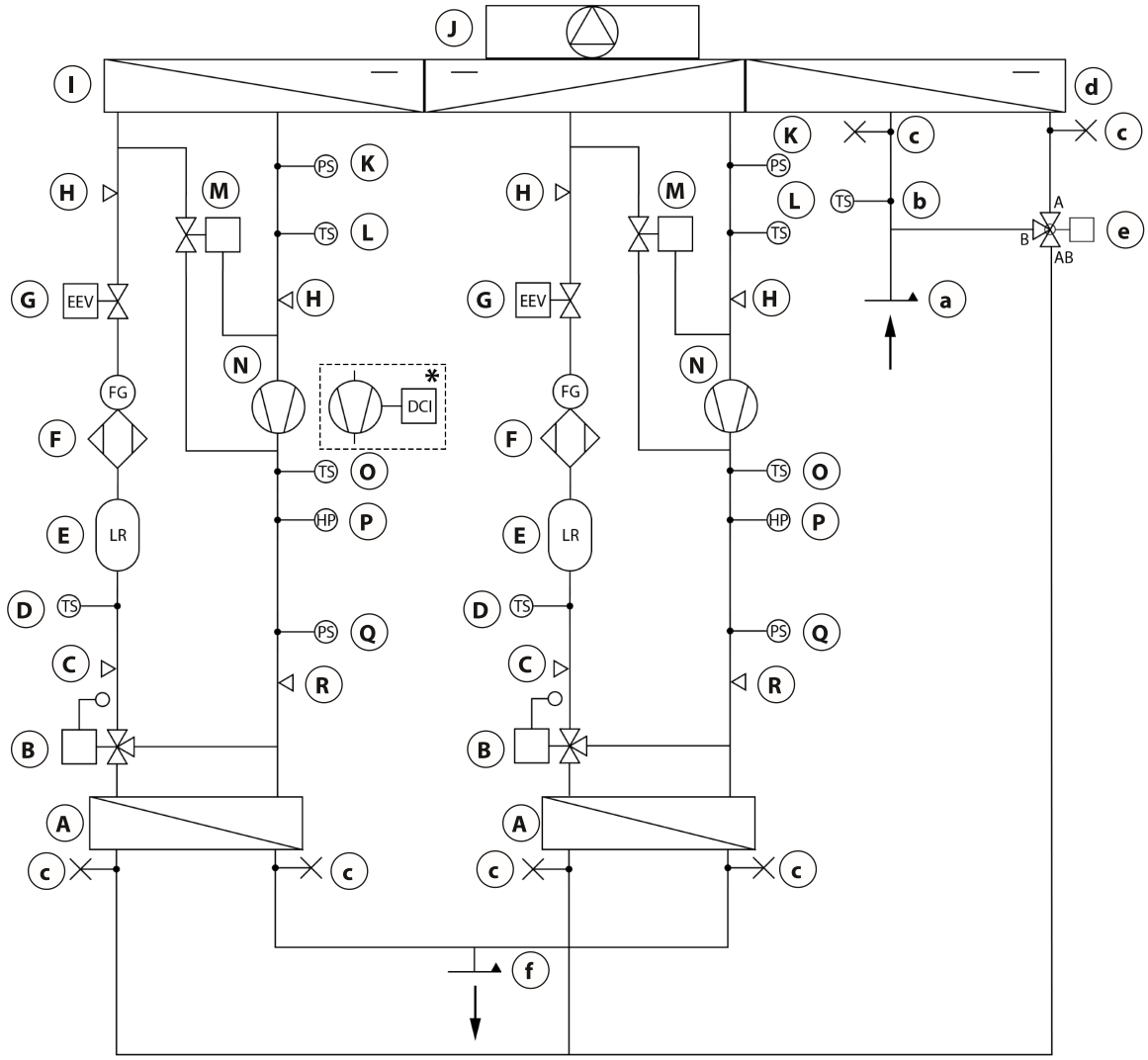
*** DC inverter compressor (accessory)**

Water circuit:

- **a** Water inlet
- **b** Inlet water temperature
- **c** Manual air vent valves
- **d** Chilled water coil
- **e** 3-way ball valve
- **f** Water outlet

10.13 COOLING CIRCUIT WITH FREE COOLING AND DOUBLE COMPRESSOR

The following image represents the cooling circuit of the free cooling units with double compressor.



Cooling circuit:

Liquid line (HP: PS 41 Bar - TS 64 °C):

- **A** Water-cooled condenser
- **B** LAC valve for controlling condensation pressure
- **C** Pressure intake SAE 5/16" male flare
- **D** Liquid temperature probe
- **E** Liquid receiver
- **F** Dehydrator filter with liquid sight glass
- **G** Electronic expansion valve

Suction line (LP: PS 22 Bar - TS 38 °C):

- **H** Pressure intake SAE 5/16" male flare (for refrigerant charging)
- **I** Direct expansion coil
- **J** Fan
- **K** Evaporation pressure probe
- **L** Suction temperature probe
- **M** Antifreeze hot gas injection valve

Hot gas line (HP: PS 41 Bar - TS 64 °C):

- **N** Compressor
- **O** Discharge temperature probe
- **P** High pressure switch with manual reset (41 Bar)
- **Q** Condensation pressure probe
- **R** Pressure intake SAE 5/16" male flare

*** DC inverter compressor (accessory)**

Water circuit:

- **a** Water inlet
- **b** Inlet water temperature
- **c** Manual air vent valves
- **d** Chilled water coil
- **e** 3-way ball valve
- **f** Water outlet

11 ELECTRICAL CONNECTIONS

WARNING!

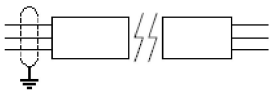
It is necessary to always refer to the electrical diagram supplied with the unit.

The electrical wiring diagram suggests dimension values for the electricity line and the corresponding protective devices.

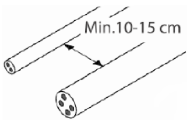
WARNING!

Avoid splicing

For signal cables:
Connect one end only of shielding to earth



Do not install with power cables



The electrical connections of the air conditioner must satisfy the following prescriptions:

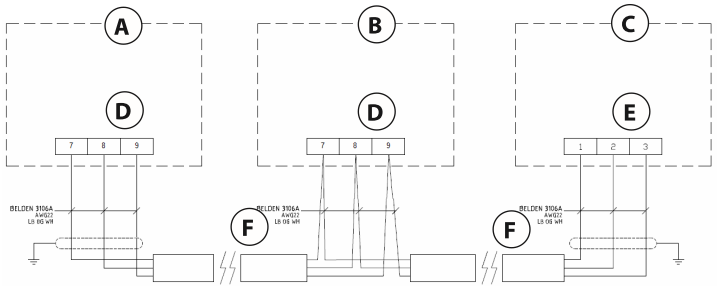
- The sizing of the power supply line, to be carried out by the installer, must comply with the indications provided in the technical documentation and the regulations of the country where the installation is carried out. The Manufacturer is not liable for any damage resulting from incorrect sizing.
- The electronic devices inside the unit are not compatible with IT distribution systems (Neutral insulated from the earth) as they could be damaged.
- To avoid potential damage to electrical and electronic equipment caused by voltage surges in the electricity supply line, the Manufacturer recommends evaluating the necessity of installing SPDs (Surge Protection Devices) appropriately rated for the type of installation and the frequency of direct lightning strikes on the electricity supply line (EN 62305/1-4).
- To prevent operating problems with the system, it is necessary that no other loads, even those that are part of the same system, are connected downstream of the main switch for the air conditioner, unless explicit permission is granted by the Manufacturer.
- The electronic devices inside the unit require that the differential protection is calibrated from 30 to 300 mA, in order to prevent untimely interventions.
- The electrical power supply line must have the following characteristics in compliance with EN 60654-2 & EN 61000-4-11 standards, in order to prevent possible malfunction of the installed components:

Characteristics of the standard unit electrical supply line				
Type	**Nominal values**	**Permissible tolerance**		
		%	**Minimum**	**Maximum**
400 V – 3 phases – 50 Hz				
Voltage	400 V	**± 15%**	340 V	460 V
Difference of voltage between the phases	0 V	**± 2%**	- 8 V	+ 8 V
Frequency	50 Hz	**± 2%**	49 Hz	51 Hz
460 V – 3 phases – 60 Hz				
Voltage	460 V	**± 15%**	391 V	529 V
Difference of voltage between the phases	0 V	**± 2%**	- 8 V	+ 8 V
Frequency	60 Hz	**± 2%**	58.8 Hz	61.2 Hz
380 V – 3 phases – 60 Hz				
Voltage	380 V	**± 15%**	323 V	437 V
Difference of voltage between the phases	0 V	**± 2%**	- 7.6 V	+ 7.6 V
Frequency	60 Hz	**± 2%**	58.8 Hz	61.2 Hz

11.1 MODBUS RTU RS485 SERIAL COMMUNICATION BOARD CONNECTION

SURVEY^{EVO} microprocessors may be connected to a supervision system and/or BMS (Building Management System) that adopts the standard Modbus® RS485 through an RS485 serial circuit board. From this circuit board it is also possible to connect the gateways required to interface SURVEY^{EVO} with networks that use different protocols.

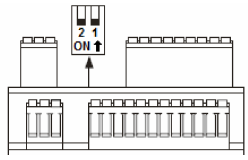
To create a connection to the Modbus system, simply connect the units by the terminals on it (see wiring diagram for further information):



A **Unit 1**
B **Unit 2**
C **BMS / Supervision system/ Gateway**
D **Modbus network output terminals**
E **Modbus network input terminals**
F **Modbus network connection cable**

In order to assure correct serial communication between the units connected in a Modbus network, it might be required to insert a network terminating resistor.

SURVEY^{EVO} microprocessors fitted with suitable micro switches for activating suitable 120 Ω terminating resistors if set to ON.



Set micro switch 1 to ON to activate the 120 Ω terminating resistor.

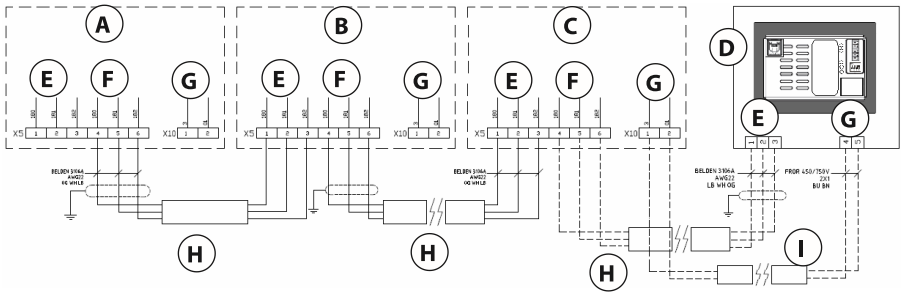
The type of cable to be used for the connection must have the following features:

Main features of serial communication cable		
Type	Data transmission cable for RS485, Modbus or CANbus interfaces	
Shielding	Tinned copper braid - Cover at least 65%	
Cross-section and number of conductors	3 x 0.34 mm^2 - AWG 22	
Stranding	Twisted pairs	
Nominal loss (1 MHz)	dB/100m	1.64
Maximum DC resistance for conductor at 20°C	Ω/km	49
Insulation resistance at 20°C	MΩ*km	5000
Mutual capacitance c-c / c-s	nF/km	40 - 70
Inductance	mH/km	0.7
Impedance	Ohm	120 +/- 0.12
Maximum length	m	100
Example		

11.2 CANBUS LAN CONNECTION (ACCESSORY)

SURVEY^{EVO} microprocessors can be interconnected in a CANbus LAN (Accessory) that allows several units to run so as to optimise the setting of the air-conditioned rooms.

To create a LAN, simply connect the units from the terminals on it (see wiring diagram for further information). Refer to the next chapter for connecting the remote terminal.



A Unit 1
B Unit 2
C Terminal unit (max. 12)
D Remote Terminal (accessory)
E CANbus network input terminals
F CANbus network output terminals
G Remote terminal power supply terminals (accessory)
H CANbus network connection cable
I Remote terminal power supply cable

The connection cable is supplied together with the units. If a change is required, the type of cable to be used for the connection must have the following features:

Main features of serial communication cable		
Type	Data transmission cable for RS485, Modbus or CANbus interfaces	
Shielding	Tinned copper braid - Cover at least 65%	
Cross-section and number of conductors	3 x 0.34 mm^2 - AWG 22	
Stranding	Twisted pairs	
Nominal loss (1 MHz)	dB/100m	1.64
Maximum DC resistance for conductor at 20°C	Ω/km	49
Insulation resistance at 20°C	MΩ*km	5000
Mutual capacitance c-c / c-s	nF/km	40 - 70
Inductance	mH/km	0.7
Impedance	Ohm	120 +/- 0.12
Maximum length	m	100
Example		

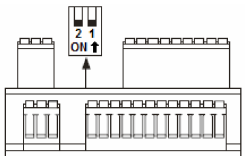
11.2.1 CANBUS LOCAL NETWORK TERMINATING RESISTORS

WARNING!

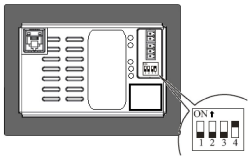
Set micro switches to ON to activate 120 Ω terminating resistor IN THE FIRST (Unit 1) and LAST UNIT OF THE LOCAL NETWORK.

In order to assure correct serial communication between the units connected in a CANbus network, the network must have terminating resistors at both ends.

SURVEY^{EVO} microprocessors and user terminals are fitted with suitable micro switches for activating suitable 120 Ω terminating resistors if set to ON.



Set micro switch 2 to ON to activate the 120 Ω terminating resistor.

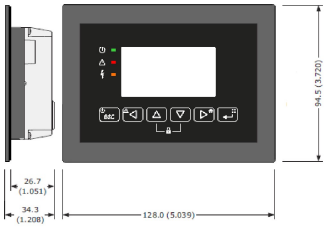


Set micro switch 4 to ON to activate the 120 Ω terminating resistor.

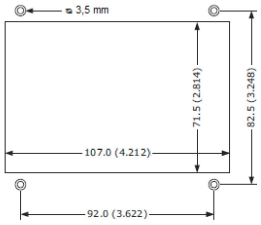
11.3 REMOTE CONTROL TERMINAL CONNECTION (ACCESSORY)

If the terminal is to be panel or recess-mounted, the maximum thickness of the panel must be 6 mm; if the terminal is to be recess-mounted in a wall, it is necessary a square recess-mounted resin box for 6 (3+3) modules (506E BTicino type).

The dimensions and drilling template are as follows:

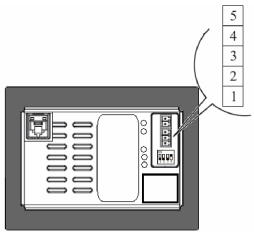


Remote terminal dimensions



Drilling template

The connections must be made as indicated in the electrical wiring diagram supplied with the unit. The terminal board for connecting the remote terminal is shown in the figure below.

Connection of the remote terminal		
Rear view of the terminal	**Pin**	**Meaning**
	**1**	CAN GND
	2	CAN L (-)
	3	CAN H (+)
	4	- Power supply (24 VAC or 20 ... 40 VDC)
	5	+ Power supply (24 VAC or 20 ... 40 VDC)

The type of cable to be used for the connection must have the following features:

Main features of serial communication cable		
Type	Data transmission cable for RS485, Modbus or CANbus interfaces	
Shielding	Tinned copper braid - Cover at least 65%	
Cross-section and number of conductors	3 x 0.34 mm² - AWG 22	
Stranding	Twisted pairs	
Nominal loss (1 MHz)	dB/100m	1.64
Maximum DC resistance for conductor at 20°C	Ω/km	49
Insulation resistance at 20°C	MΩ*km	5000
Mutual capacitance c-c / c-s	nF/km	40 - 70
Inductance	mH/km	0.7
Impedance	Ohm	120 +/- 0.12
Maximum length	m	100
Example		

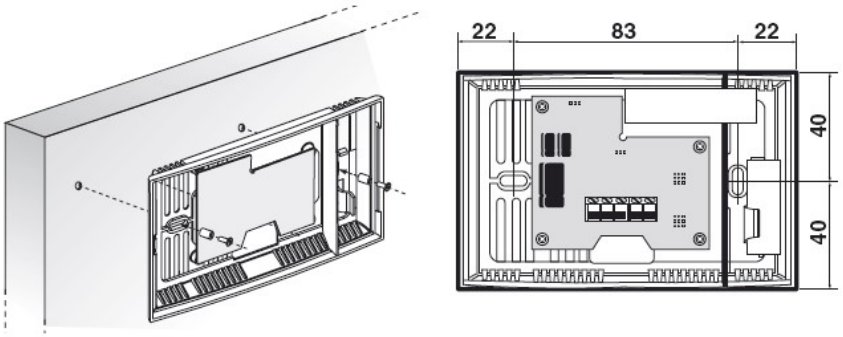
Main features of the power supply cable		
Type	Fror 450/750 V cable	
Shielding	Not required	
Cross-section and number of conductors	2 x 1 mm²	
Maximum length	m	100
Example		

11.4 CONNECTION OF THE SUPPLIED TEMPERATURE AND HUMIDITY SENSOR (ACCESSORY)

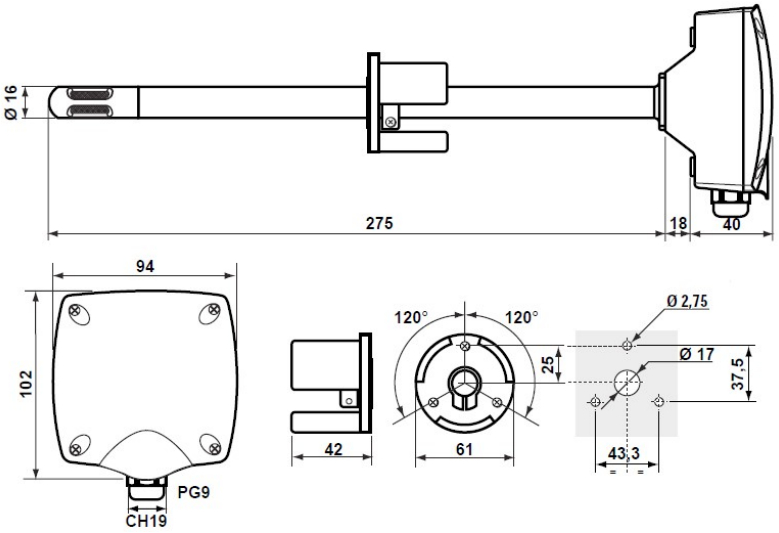
The supplied temperature and humidity probe allows managing the room temperature and humidity detection in systems where return detection is not real or satisfying like, for example, systems with partial outside air introduction in the return.

The supplied probe is of wall installation type. It is advised to install the probe at a minimum height of 1600 mm from the floor.

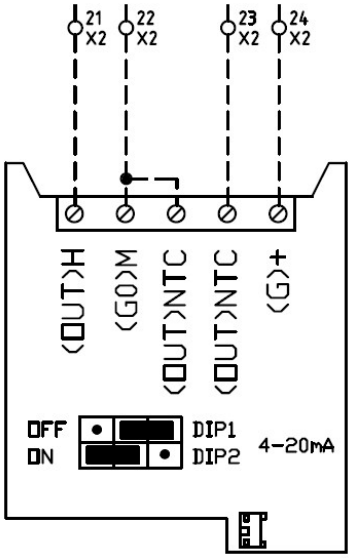
The connections must be made as indicated in the electrical wiring diagram supplied with the unit. The figure below shows the probe's connection terminal board and the position of the jumpers for correct operation of said probe.



Drilling template for wall installation



Drilling template for duct installation



Probe connection and jumpers positioning

The type of cable to be used for the connection must have the following features:

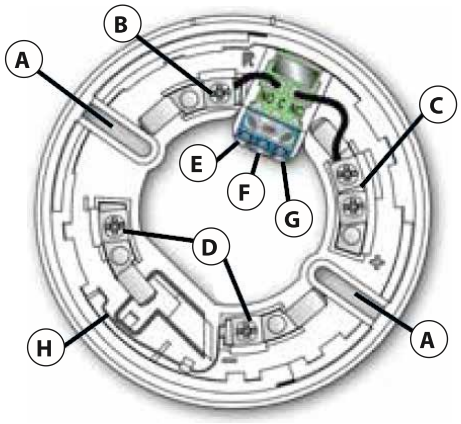
Main features of the connection cable		
Type	Signal transmission cable	
Shielding	Tinned copper braid - Cover at least 65%	
Cross-section and number of conductors	4 x 0.35 mm²	
Maximum length	m	100
Example		

11.5 CONNECTION OF THE SMOKE AND FLAME DETECTORS SUPPLIED (ACCESSORY)

The smoke and flame detectors supplied detect the presence of smoke or flames in the environment.

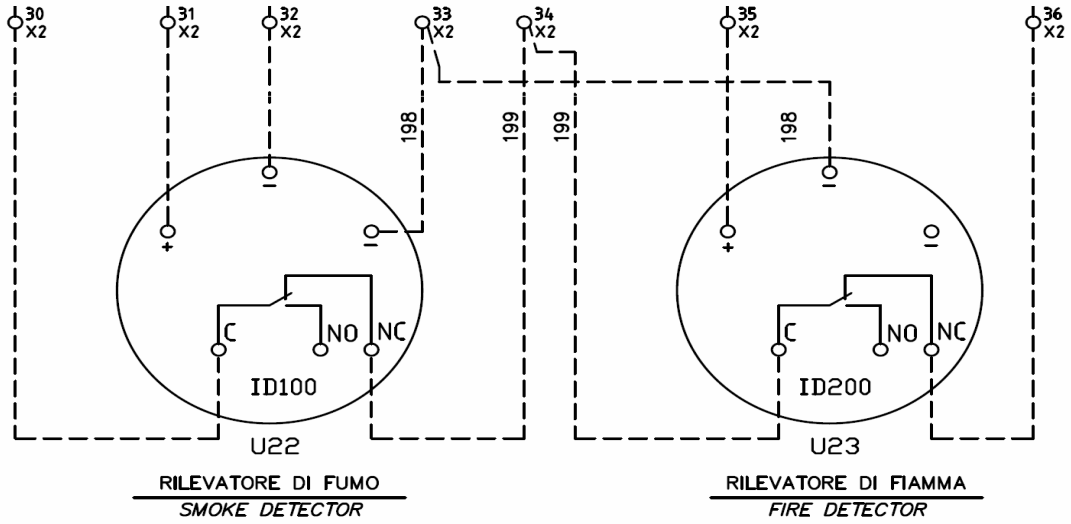
The supplied probe is of wall installation type. The connections must be made as indicated in the electrical wiring diagram supplied with the unit. The terminal board for connecting the sensor is shown in the figure below.

Smoke and flame sensors



A Anchor holes
B "R" terminal
C "+" terminal
D "-" terminal
E "NO" relay terminal
F "C" relay terminal
G "NC" relay terminal
H Blade for short circuit

Anchor base and connection



Connection of the smoke and flame sensors

The type of cable to be used for the connection must have the following features:

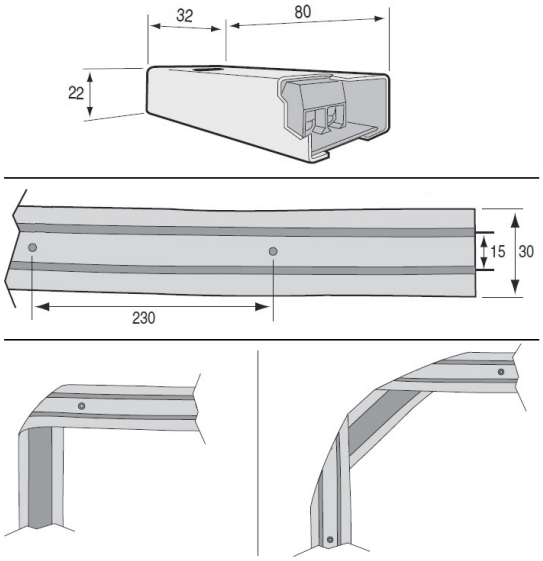
Main features of the connection cable		
Type	Fror 450/750 V cable	
Shielding	Not required	
Cross-section and number of conductors	7 x 1 mm^2	
Maximum length	m	100
Example		

11.6 CONNECTION OF THE WATER DETECTION PROBE (ACCESSORY)

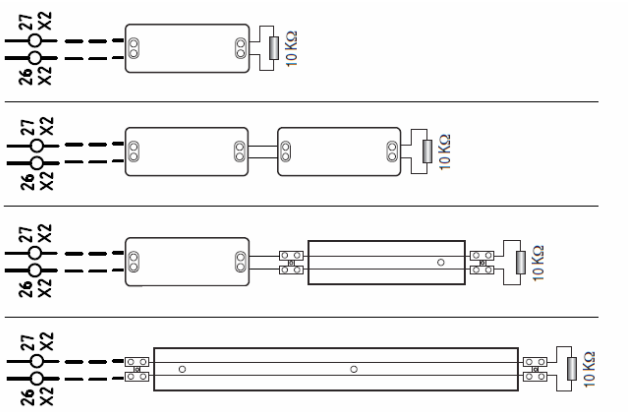
The accessory for detecting water provides an alarm if the probe, supplied with the device, is even partially covered with water.

The probes are comprised of an anti-corrosive metal container (local probe) or a fabric belt (belt probe). Inside the probes there are two stainless steel metal electrodes to read the alarm condition.

The probe must be positioned in the area being controlled and connected as shown on the wiring diagram supplied with the unit, being careful to ensure that the detection section is positioned correctly. It is possible to connect multiple probes in series to control a wider area. The following figure shows an example of connection.



Probe dimensions



Probe connection

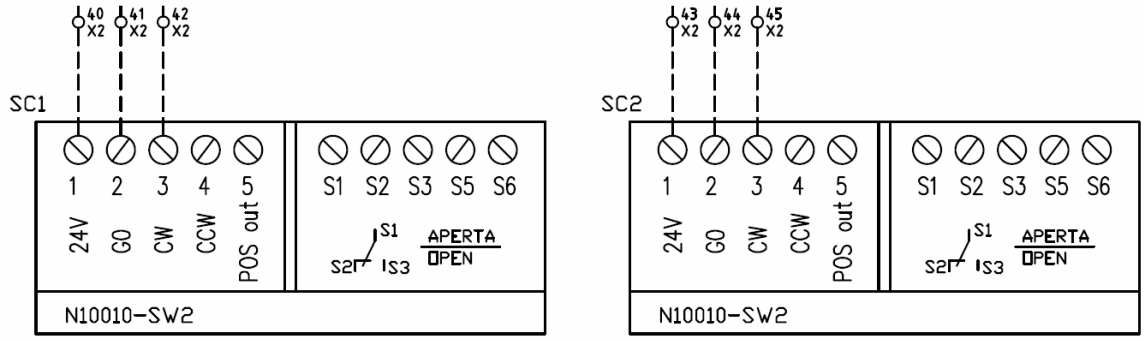
The type of cable to be used for the connection must have the following features:

Main features of the connection cable		
Type	Fror 450/750 V cable	
Shielding	Not required	
Cross-section and number of conductors	2 x 1 mm²	
Maximum length	m	100
Example		

11.7 CONNECTION OF FREE COOLING PLENUM MOTORISED DAMPER ACTUATORS (ACCESSORY)

The Free Cooling plenum accessory has two motorised dampers controlled by the regulator via a 0-10 V signal.

The damper actuators are supplied mounted on the dampers, and equipped with 3 metres of pre-wired cable in the actuators. The actuator cables have to be connected inside the unit's electrical panel, as shown in the figure:



Connection of the damper actuators

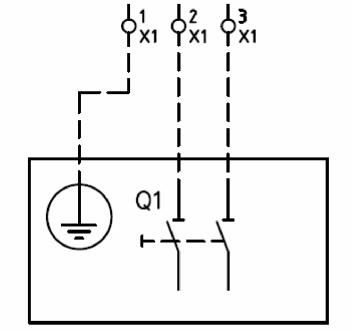
The type of cable to be used for the connection must have the following features:

Main features of the connection cable		
Type	Signal transmission cable	
Shielding	Not required	
Cross-section and number of conductors	3 x 0.5 mm²	
Maximum length	m	100
Example		

11.8 CONNECTION OF AC AIR-COOLED CONDENSERS WITH CUT-OFF REGULATOR (ACCESSORY)

As accessories, speed regulators, installed inside the unit, are available for the remote condenser fans.

When installing the unit, the power supply line of the air-cooled condensers must be set-up as shown in the figure below.



Remote condenser connection

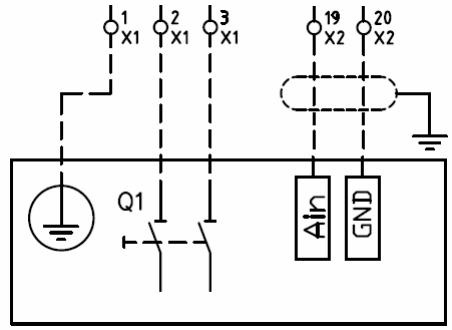
The type of cable to be used for the connection must have the following features:

Main features of the connection cable		
Type	Fror 450/750 V cable	
Shielding	Not required	
Cross-section and number of conductors	8 A variator	3 x 1.5 mm^2
	12 A variator	3 x 2.5 mm^2
Maximum length	m	100
Example		

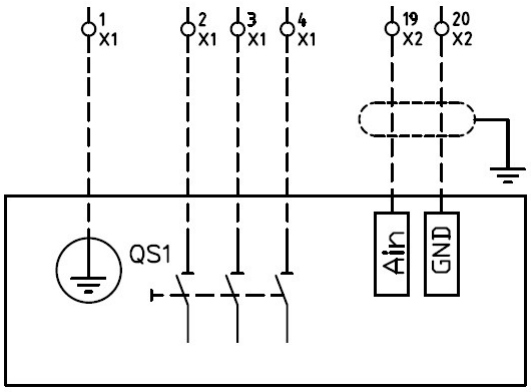
11.9 CONNECTION OF EC AIR-COOLED CONDENSER WITH 0-10 V SIGNAL (ACCESSORY)

As an accessory, a 230 V or 400 V protected line (depending on the type of condenser) and a 0-10 V signal line for regulating the condensers.

When installing the unit, the power supply line of the air-cooled condensers must be set-up as shown in the figure below.

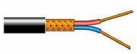


230 V remote condenser connection



400 V remote condenser connection

The type of cable to be used for the connection must have the following features:

Main features of the connection cable		
230 V supply line		
Type	Fror 450/750 V cable	
Shielding	Not required	
Cross-section and number of conductors	Up to 10 A	3 x 1.5 mm^2
	From 12 to 20 A	3 x 2.5 mm^2
Maximum length	m	100
Example		
400 V supply line		
Type	Fror 450/750 V cable	
Shielding	Not required	
Cross-section and number of conductors	Up to 10 A	4 x 1.5 mm^2
	From 12 to 20 A	4 x 2.5 mm^2
Maximum length	m	100
Example		
0-10 V control signal line		
Type	Signal transmission cable	
Shielding	Tinned copper braid - Cover at least 65%	
Cross-section and number of conductors	2 x 0.35 mm^2	
Maximum length	m	100
Example		

12 ROUTINE AND SPECIAL MAINTENANCE

WARNING!

Maintenance operations must be carried out by professionally trained technicians

Routine and special maintenance checks					
	Routine maintenance to be carried out by the user				
	Special maintenance to be carried out by the maintenance service or service centre				
Components		**Check at least every**			
		1 Week	**1 Month**	**3 Months**	**6 Months**
Control microprocessor	Make sure the system works properly	X			
	Check for any alarms	X			
	Check the mother board connections				X
	Check the control boards and displays				X
	Make sure that the sensor readings on the unit are correct				X
Air filters	Check filters for clogging		X		
	Check filter status: Fastening, any damage			X	
	Check operation and calibration of differential pressure sensors				X
Internal humidifier	Check the condition of the cylinder		X		
	Carry out the automatic cylinder washing procedure		X		
	Check the condition of the charging and discharge valves			X	
	Inspect the gaskets/seals			X	
	Replace the cylinder if necessary			X	
Fans	Verify the general condition: corrosion, mounting and cleanliness			X	
	Verify the noise of the motor			X	
	Verify the impeller: vibration, imbalance			X	
	Verify the absorbed current				X
	Clean the impeller and the motor				X
Electrical panel and electrical components	Clean the components with compressed air			X	
	Check the unit's power supply				X
	Check the correct tightening of the clamps				X
	Check the power consumption of electrical components				X
	Test safety devices				X
Water circuits	Check operation of the 3-way valves			X	
	Check circuits for leaks			X	
	Bleed air from circuits			X	
	Check circuit temperatures and pressures			X	
	Check the amount of glycol in the circuit				X
	Make sure the water circulates properly				X
Cooling circuits	Check the operating temperatures and pressures			X	
	Check the condition of the compressor			X	
	Check the condition of the liquid sight glass filter			X	
	Check operation of the safety devices				X
	Check the amount of refrigerant in the circuit				X
Condensers	Check the condition of the remote condenser			X	
	Check the calibration of the remote condenser regulator			X	
	Check that the remote condenser is receiving power correctly				X
	Check the adjustment valve of the water cooled condenser				X
	Verify the circulation of water/air in the condenser				X

12.1 ROUTINE MAINTENANCE

12.1.1 CONTROL MICROPROCESSOR MAINTENANCE

For further and more detailed information concerning regulation, see the MICROPROCESSOR OPERATING MANUAL.

The microprocessor requires periodical checks to verify operational statuses and the presence of possible alarms in components that may compromise proper unit operation.

For further information concerning alarms and operations, see the installed microprocessor operating manual.

12.1.2 MAINTENANCE ON THE AIR FILTERS

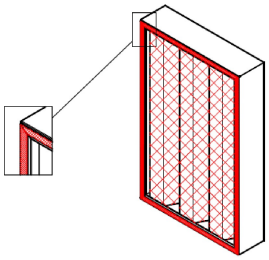
WARNING!

The filters are non-regenerable.

It is advisable to replace with original pieces only. Filters that do not conform to the original filters may not be compatible with the unit performance and cause operating problems.

The Manufacturer's air conditioners are equipped with, on all installed filters, differential pressure sensors in order to monitor pressure loss of the dirty filter. The microprocessor signals when the measured pressure difference exceeds the set value. To change the trip setting of a differential pressure switch, simply unscrew the cover and turn the setting dial to the desired pressure drop value.

FILTER TYPE	POSITION	VALUE [Pa]
G4 Filter	Return	250
M5 filter (Accessory)	Return	250



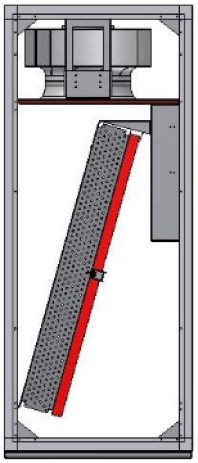
WARNING!

To guarantee the efficiency of the filters, it is necessary to install a 15 x 3 mm seal.

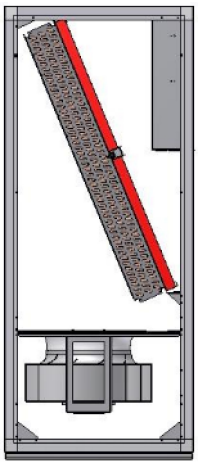
12.1.3 AIR FILTER REPLACEMENT

To replace the air filters the following instructions must be observed, as well as full compliance with safety obligations regarding use of the equipment:

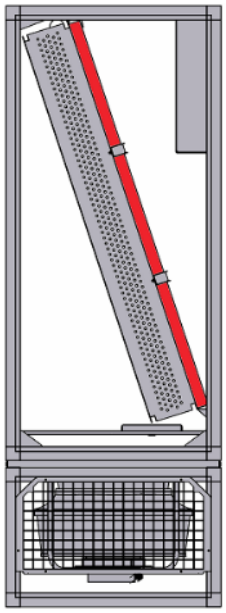
1) Set the main switch to "0".
2) Open the panels via the relevant safety locks.
3) Remove the filter support by turning the screws.
4) Replace the dirty filters with clean ones.
5) Position the support and secure it with the screws.
6) Close the panels and return the main switch to "I".



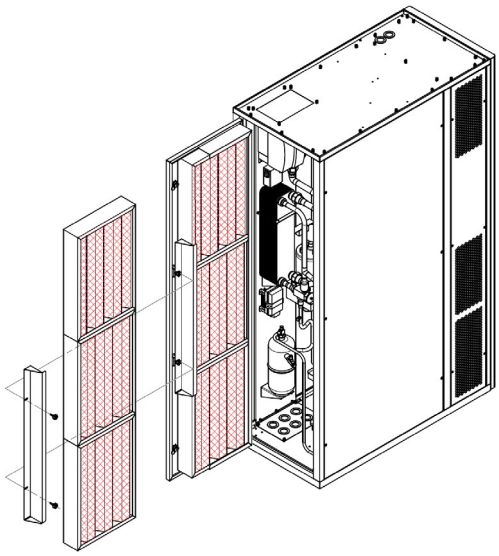
Position P unit air filters with air supply facing upwards

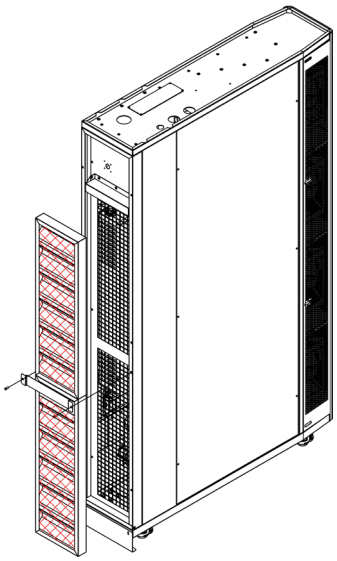


Position P unit air filters with air supply facing downwards



Position G unit air filters





Position R unit air filters

12.1.4 MAINTENANCE OF INTERNAL HUMIDIFIER

RISK OF BURNS!

The cylinder may be hot!

Let cool before handling or use protective gloves

RISK OF ELECTRIC SHOCK!

Set the main switch to "0" before every activity

The life span of the humidifying cylinder depends on various factors, which include: correct sizing and operation, supply water within the nominal values, hours of use and correct maintenance. After a variable period of time, the cylinder will inevitably need to be replaced. To meet the above requirements, follow the instructions below.

The humidifier requires periodic checks to ensure correct operation and extended cylinder lifetime. These checks should be performed as follows:

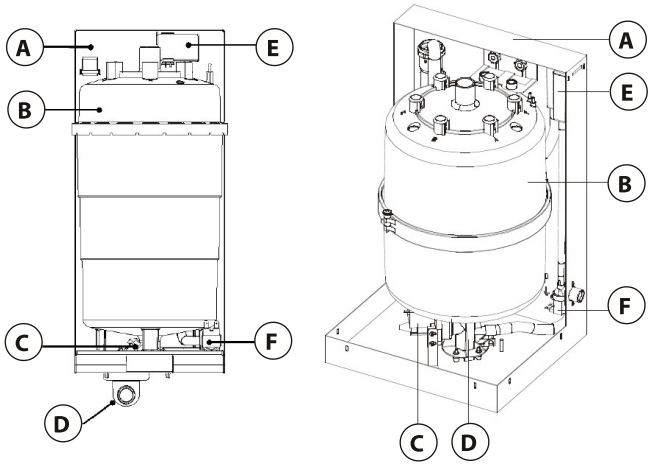
- **No later than the first 300 hours of operation:** Check operation, make sure there are no significant leaks of water, and check the general condition of the housing. Make sure that no sparks or arcs between electrodes are formed during operation.
- **Quarterly and never less frequently than every 1000 hours of operation:** Check operation, make sure there are no significant leaks of water, and replace the cylinder if necessary.
- **Annually and never less frequently than every 2500 hours of operation:** Proceed with changing the cylinder

After prolonged use, and above all in the event of water with a high salt content, solid deposits may cover the electrodes completely and adhere to the side walls. In some cases the heat produced may deform the cylinder and, in more serious cases, may create holes in the plastic wall with resulting leaks of water into the tray. To prevent this problem, increase the frequency of checks, halving the intervals between maintenance procedures.

12.1.5 CYLINDER REPLACEMENT

To replace the humidifier cylinder the following instructions must be observed, as well as full compliance with safety obligations regarding use of the equipment:

1) Drain all water from the cylinder using the relative function.
2) Set the main switch to "0".
3) Open the panels via the relevant safety locks.
4) Slide out the cylinder steam tube.
5) Detach the electrical connections from the top of the cylinder.
6) Release the cylinder from its fixture and lift to remove.
7) Connect the new cylinder and secure to the support.
8) Close the panels and return the main switch to "I".



A Load bearing frame
B Cylinder
C Drain solenoid valve/pump
D Drain fitting
E Filling tank + conductivity meter
F Feed solenoid valve

Internal humidifier components

12.2 SPECIAL MAINTENANCE

	**RISK OF ELECTRIC SHOCK!** **Set the main switch to "0" before every activity**
	**RISK OF BURNS!** **Some parts of the cooling circuit may be hot!**
	**RISK OF CUTS!** **Sharp parts!**

12.2.1 REPLACING THE CONTROL MICROPROCESSOR

To replace the control microprocessor the following instructions must be observed, as well as full compliance with safety obligations regarding use of the equipment:

1) Set the main switch to "0".
2) Open the panels via the relevant safety locks.
3) Disconnect all connectors on the board.
4) Remove the microprocessor from the DIN guide.
5) Replace with the scheduled original spare part.
6) Close the panels and return the main switch to "I".
7) Proceed with configuration, as specified in the SURVEY^{EVO} microprocessor technical manual.

12.2.2 FAN MAINTENANCE

For fans maintenance the following instructions must be observed, as well as full compliance with safety obligations regarding use of the equipment:

1) Verify the general condition: corrosion, mounting and cleanliness.
2) Verify the noise of the motor.
3) Verify the impeller: vibration, imbalance.
4) Verify the absorbed current.
5) Clean the impeller and the motor.

12.2.3 REPLACING THE FANS

To replace the fans the following instructions must be observed, as well as full compliance with safety obligations regarding use of the equipment:

1) Set the main switch to "0".
2) Open the panels via the relevant safety locks.
3) Disconnect the electrical connections from the terminal block of the fan.
4) Remove the fan from its seat.
5) Replace with an original spare.
6) Carry out electrical connections from the terminal board of the fan as specified in the wiring diagram.
7) Close the panels and return the main switch to "I".

12.2.4 MAINTENANCE OF THE ELECTRICAL CONTROL PANEL AND ELECTRICAL COMPONENTS

For the electrical control panel and electrical components maintenance the following instructions must be observed, as well as full compliance with safety obligations regarding use of the equipment:

1) Check the unit's power supply.
2) Check the electrical connections and make sure the terminals are properly tightened.
3) Check the power consumption of electrical components.
4) Test safety devices.
5) Change protection fuses, if required.
6) Clean the components with compressed air jets from a minimum distance of 30 cm (to avoid damaging plastic parts), paying particular attention to the cooling fans and heat sinks.

12.2.5 MAINTENANCE OF WATER CIRCUITS

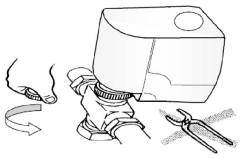
For the water circuit maintenance the following instructions must be observed, as well as full compliance with safety obligations regarding use of the equipment:

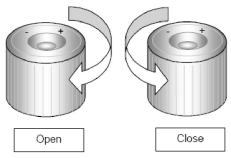
1) Check circuits for leaks.
2) Bleed air from circuits.
3) Check circuit temperatures and pressures.
4) Check operation of the 3-way valves.
5) Check the amount of glycol in the circuit.
6) Make sure the water circulates properly.

12.2.6 MANUAL WATER VALVE OPENING AND CLOSING WITH ACTUATOR WITH RING NUT CONNECTION

To manually open the water valves the following instructions must be observed, as well as full compliance with safety obligations regarding use of the equipment:

1) Open the panels via the relevant safety locks.
2) Remove the actuator by means of the ring nut. Do not use equipment.
3) Apply the suitable opening cap supplied with the unit.
4) Move the cap clockwise to open and anticlockwise to close.
5) Completely unscrew the cap to close the valve.
6) Close the front panels.





12.2.7 REPLACEMENT OF WATER VALVE ACTUATORS WITH RING NUT CONNECTION

To replace the actuators of the water valves, proceed as follows:

1) Set the main switch to "0".
2) Open the side panels by unlocking the relevant safety locks.
3) Disconnect all electrical connections from the terminal board of the compressor.
4) Remove the actuator from its seat.
5) Replace with an original spare.
6) Carry out electrical connections from the terminal board of the actuator as specified in the wiring diagram.
7) Close the front panels and return the main switch to “I”.

12.2.8 MANUAL WATER VALVE OPENING AND CLOSING WITH ACTUATOR WITH PLUG CONNECTION

To manually open the water valves the following instructions must be observed, as well as full compliance with safety obligations regarding use of the equipment:

1) Open the panels via the relevant safety locks.
2) Press the valve's position indicator located at the top of the actuator.
3) Move the position indicator into the desired position (Open or Closed).
4) Press the position indicator again to go back to automatic operation.
5) Close the front panels.

12.2.9 REPLACEMENT OF WATER VALVE ACTUATORS WITH PLUG CONNECTION

To replace the actuators of the water valves the following instructions must be observed, as well as full compliance with safety obligations regarding use of the equipment:

1) Set the main switch to "0".
2) Open the panels via the relevant safety locks.
3) Disconnect all electrical connections from the terminal board of the compressor.
4) Remove the actuator from its seat using the suitable release switch.
5) Replace with an original spare.
6) Carry out electrical connections from the terminal board of the actuator as specified in the wiring diagram.
7) Close the panels and return the main switch to “I”.

12.2.10 REPLACEMENT OF MAIN COMPONENTS OF THE WATER CIRCUITS

To replace the components of the circuits (pumps, coils, valves, etc.) the following instructions must be observed, as well as full compliance with safety obligations regarding use of the equipment:

1) Set the main switch to "0".
2) Open the panels via the relevant safety locks.
3) Close the shut-off valves placed on the water circuit upstream of the valve.
4) Manually open the valve, as specified in the previous chapters.
5) Open the vents placed next to the coil and the cock on the circuit and drain the water.
6) Remove the component from its seat.
7) Replace with an original spare.
8) Open the water circuit paying close attention to vent the air.
9) Check for any leaks.
10) Restore the regulation valve
11) Close the panels and return the main switch to “I”.

12.2.11 COOLING CIRCUIT MAINTENANCE

For the cooling circuit maintenance the following instructions must be observed, as well as full compliance with safety obligations regarding use of the equipment:

1) Check the work pressures and temperatures from the screen of the Survey^{EVO} controller microprocessor.
2) Check overheating, sub-cooling and desuperheating from the screen of the Survey^{EVO} controller microprocessor.
3) Check the condition of the liquid sight glass filter.
4) Check operation of the safety devices.
5) Check the calibration and operation of the regulation components.
6) Check the refrigerant charge level and make sure there are no circuit leaks.
7) Check the condition of the cooling coil. Any cleaning needs to be carried out with hot water and soap, using a brush with long, soft bristles. It is also possible to use compressed air as long as it is oil-free.

12.2.12 REPLACEMENT OF THE MAIN COMPONENTS OF THE COOLING CIRCUIT

ATTENTION! DANGER!

Neither the circuit nor the compressor must be left in open air for more than 15 minutes to avoid humidity contaminating the oil.

To replace the main components of the cooling circuit (valves, sight glass filter, coils etc.) the following instructions must be complied with, without prejudice to full compliance with safety obligations arising from use of the equipment:

1) Set the main switch to "0".
2) Open the panels via the relevant safety locks.
3) Collect all refrigerant (with the special recovery pump, pressure gauges and rechargeable tank). This gas may be re-used.
4) Open the cooling circuit by unscrewing the service needle valves with the provided key.
5) Disconnect any electrical connections of the components in question.
6) Remove the component by cutting the pipes next to it and install the new component.
7) Braze everything as indicated in the previous chapters.
8) Close the cooling circuit by re-applying the service needle valves using the appropriate spanner.
9) Perform a test using pressurised Nitrogen to verify that the system is airtight, as specified in the previous chapter.
10) With soap lather, check all new soldering has been carried out and leave under pressure for at least 24 hours.
11) After the required time, perform a pressure check with the provided pressure gauges.
12) When the test has been completed, empty out all of the nitrogen and proceed to the vacuum phase.
13) Vacuum the cooling circuit, as specified in the previous chapters.
14) Close the panels and return the main switch to "I".
15) Charge with new Freon, as specified in the previous chapters.
16) Check the operating conditions of the cooling circuit, as specified in the previous chapters.

12.2.13 COMPRESSOR REPLACEMENT

ATTENTION! DANGER!

Neither the circuit nor the compressor must be left in open air for more than 15 minutes to avoid humidity contaminating the oil.

To replace the compressor the following instructions must be observed, as well as full compliance with safety obligations regarding use of the equipment:

1) Set the main switch to "0".
2) Open the panels via the relevant safety locks.
3) Collect all refrigerant (with the special recovery pump, pressure gauges and rechargeable tank). This gas cannot be re-used and must be regenerated.
4) Open the cooling circuit by unscrewing the service needle valves with the provided key.
5) Disconnect all electrical connections from the terminal board of the compressor.
6) Cut the suction and supply pipes next to the compressor.
7) Remove the fixing screws and extract the compressor, always keeping it vertical.
8) Check for any remaining oil in the cooling circuit and perform an acidity test (Virginia Parker ETK TEST KIT or similar).
9) Should the system be extremely contaminated with carbon or from decomposition of oil products due to burning of the compressor, it is necessary to eliminate all this contamination by cleaning up all cooling components (pipes, evaporation coils, condenser, liquid receiver) with special clean-up fluid that is easily evaporated (Parker ParFlush Kit or similar).
10) Blow NITROGEN into the whole cooling circuit to eliminate all clean-up fluid.
11) Install a filter-drier and de-acidifier on the suction line of the compressor (Parker SLD Series or similar).
12) Replace the inspection filter on the liquid line with one that is a filter-drier and de-acidifier Sporlan Parker WSG Series or similar).
13) Install a new compressor, always keeping it vertical.
14) Weld everything as indicated in the previous chapters.
15) Close the cooling circuit by re-applying the service needle valves using the appropriate spanner.
16) Perform a test using pressurised Nitrogen to verify that the system is airtight, as specified in the previous chapter.
17) With soap lather, check all new soldering has been carried out and leave under pressure for at least 24 hours.
18) After the required time, perform a pressure check with the provided pressure gauges.
19) When the test has been completed, empty out all of the nitrogen and proceed to the vacuum phase.
20) Vacuum the cooling circuit, as specified in the previous chapters.
21) Close the panels and return the main switch to “I”.
22) Charge with new refrigerant, as specified in the previous chapters.
23) Check the operating conditions of the cooling circuit, as specified in the previous chapters.

12.3 MAINTENANCE OF TMC AIR-COOLED CONDENSERS

12.3.1 MAINTENANCE OF TMC AIR-COOLED CONDENSER FANS

For air-cooled condenser fans maintenance the following instructions must be observed, as well as full compliance with safety obligations regarding use of the equipment:

1) Verify the general condition: corrosion, mounting and cleanliness.
2) Verify the noise of the motor.
3) Verify the impeller: vibration, imbalance.
4) Verify the absorbed current.
5) Clean the impeller and the motor.

12.3.2 REPLACING THE TMC AIR-COOLED CONDENSER FANS

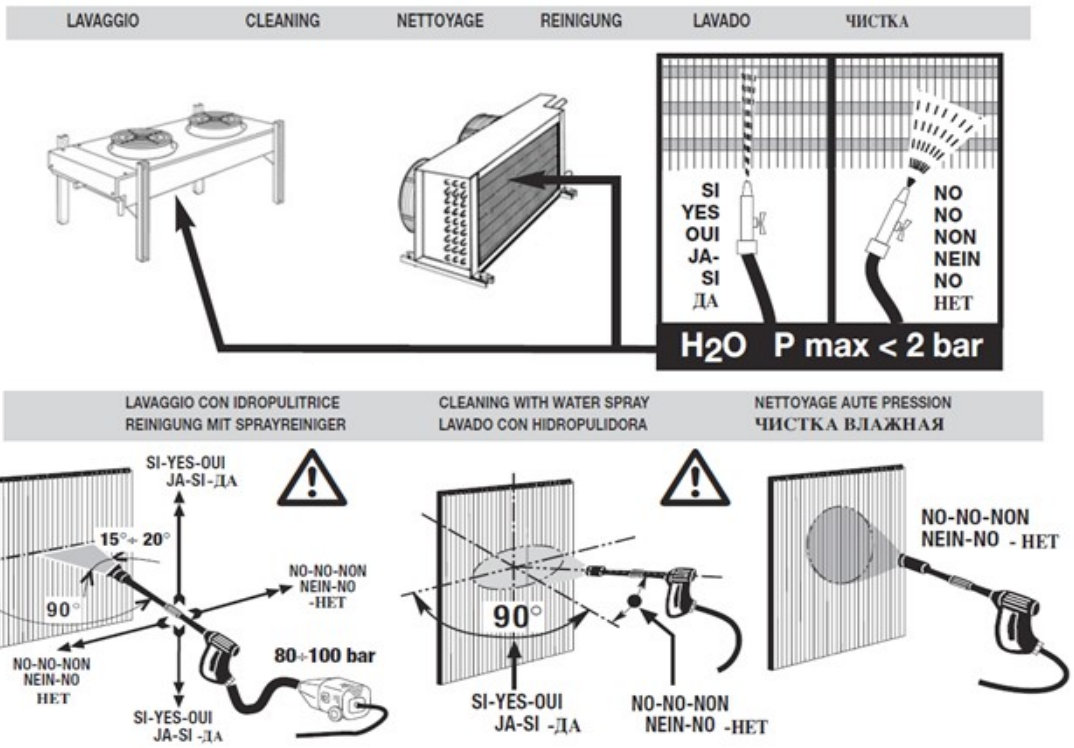
To replace the air-cooled condenser fans the following instructions must be observed, as well as full compliance with safety obligations regarding use of the equipment:

1) Set the main switch to "0".
2) Disconnect the electrical connections from the terminal block of the fan.
3) Remove the fan from its seat.
4) Replace with an original spare.
5) Connect the electrical connections from the terminal block of the fan.
6) Bring the main switch back to the "I" position.

12.3.3 CLEANING THE COILS OF THE TMC AIR-COOLED CONDENSERS

Notes for correct cleaning:

1) Use a flat or "fan-shaped" spray nozzle.
2) Maximum water pressure: < 2 bar with tap water and 80÷100 bar with pressure washer.
3) Keep the water spray at right angles to the fin edge both vertically and horizontally.



13 DEACTIVATION, DISASSEMBLY AND SCRAPPING

WARNING!

Deactivation, disassembly and scrapping operations must be carried out by professionally trained technicians

The Manufacturer's air conditioners must only be dismantled by specialised technical personnel. For the unit deactivation, disassembly and scrapping, it must be kept in mind that:

- This equipment may contain dangerous substances: The units must be disassembled by specialised technicians. Improper use or incorrect disposal may have an adverse effect on human health and the environment;
- Public or private waste collection systems are to be used for disposal, as defined by local laws and regulations.
- The units are made mostly of recyclable materials. It is therefore recommended to carry out a separate collection of these materials;

13.1 LIST OF THE MATERIALS CONTAINED IN THE UNITS

The following table lists the materials used, **upon shipment**, to produce the units.

P series - G series - R series units			
Material	**Composition**	**Weight**	**CAS n° or Alloy**
Galvanised sheet metal	Steel/Zinc	70%	DX51D + Z150
Aluminium	-	13%	91728-14-2
Copper	-	12%	65357-62-2
Plastic	ABS	2%	97048-04-09
Plastic	PE	2%	9002-88-4
Paint	Epoxy/Polyester	0.2%	-
Other materials	Miscellaneous	0.8%	-

TMC Series Unit			
Material	**Composition**	**Weight**	**CAS n° or Alloy**
Galvanised sheet metal	Steel/Zinc	52%	DX51D + Z150
Aluminium	-	24%	91728-14-2
Copper	-	23%	65357-62-2
Plastic	ABS	0.5%	97048-04-09
Plastic	PE	0.3%	9002-88-4
Paint	Epoxy/Polyester	0.2%	-

14 APPENDIX 1: RECOMMENDED EQUIPMENT

The table below lists the equipment required to perform unit installation, start-up and maintenance.

Heavy duty American type pipe wrench

Set of flathead screwdrivers

Adjustable wrench

Set of Phillips screwdrivers

Reversible ratchet wrench

Set of Torx® screwdrivers

Cordless drill

Grinder or saw

Pipe-bending device for copper pipes

Expander for copper pipes

Pipe cutter for copper pipes

Pipe reamer for copper pipes

Oxygen/propane soldering kit

Nitrogen pressurisation kit

4-way manometric unit with hoses (R410a)

High performance vacuum pump

Electronic scale

Refrigerant suitable for the unit (R410a)

Digital multimeter with current clamp

Electronic leak detector

15 APPENDIX 2: PRELIMINARY CHECKS AND FIRST START-UP

WARNING!

Maintenance operations must be carried out by professionally trained technicians

15.1 PRELIMINARY CHECKS

15.1.1 VERIFICATION OF POSITION AND INSTALLATION

	Description	Positive	Negative
1	Check that the units received comply with the order and transport documents.		
2	Check for any damage due to transport or positioning of the unit.		
3	Check that the packaging of the unit is completely removed.		
4	Check that the unit is placed flat and sufficiently insulated from the floor and walls (if necessary).		
5	Verification of compliance with the space for routine maintenance.		
6	Check for obstructions on the supply and return air vents and the front of the machine.		
7	Verify that the environmental conditions are favourable so as to enable the start-up and there is no hazard.		

15.1.2 VERIFYING THE DISCHARGE CONNECTIONS

	Description	Positive	Negative
1	Verify that the condensate and humidifier discharges are connected properly to the discharge line.		
2	Verify that the trap in the unit has not been removed.		
3	Make sure the drain line has no counter slopes or traps that may prevent the regular flow of water.		

15.1.3 WATER CIRCUIT CHECKS

	Description	Positive	Negative
1	Check that the inlet and outlet of the hot and cold water supplies conform with the arrows marked on the fittings.		
2	Check that all liquid supply pipes have manual shutoff taps just outside the machine, and that these taps are open.		
3	Check that the humidifier supply fitting is connected to the mains drinking water supply and that it is provided with a manual shut-off valve just outside the machine.		
4	Verify that the hydraulic circuits have been adequately cleaned.		
5	Verify that there is no air in the hydraulic circuits.		
6	Verify that there is water in the circuit and that the pressures are within the operating limits.		
7	Verify that the water temperature entering the circuit is consistent with that indicated in the project and is within the operating limits.		
8	Verify any presence and concentration of glycol in the circuit and that it is consistent with that indicated in the project.		

15.1.4 CHECKS ON THE WATER CONDENSED DIRECT EXPANSION CIRCUIT

	Description	Positive	Negative
1	Make sure the cooling circuit valves are open.		
2	Verifying the water circuit connections.		
3	Check that all liquid supply pipes have manual shutoff taps just outside the machine, and that these taps are open.		
4	Verify that the hydraulic circuits have been adequately cleaned.		
5	Verify that there is no air in the hydraulic circuits.		
6	Verify that there is water in the circuit and that the pressures are within the operating limits.		
7	Verify that the water temperature entering the circuit is consistent with that indicated in the project and is within the operating limits.		
8	Verify any presence and concentration of glycol in the circuit and that it is consistent with that indicated in the project.		

15.1.5 CHECKS ON THE AIR CONDENSED DIRECT EXPANSION CIRCUIT

	Description	Positive	Negative
1	Diagram of cooling circuit		
2	Check that the supply and liquid pipe diameter fulfils the indications in the installation manual.		
3	Check that the horizontal sections of the supply and liquid pipes have a gradient of at least 1% in the direction of refrigerant flow.		
4	Make sure there are oil traps at the base of each rising pipe and every 5 m rising pipe section (raised condenser).		
5	Make sure the check valve is installed as near as possible to the compressor with the aperture in the direction of refrigerant flow (raised condenser).		
6	Make sure the check valve is installed as near as possible to the compressor with the aperture in the direction of refrigerant flow (lowered condenser).		
7	Check that the supply pipe is insulated in the sections where accidental operator contact is possible (Pipe temperature in operation approx. 70/80 °C).		
8	Check that support brackets are installed on the supply and liquid pipe are not too tight, so as to allow expansion of the pipe.		
9	Check that cooling circuit pipe connections of the condenser with the evaporator are opposite the flow direction of the air flow.		
10	Check that the condenser is positioned correctly, to prevent air recirculation that would otherwise impair performance.		

15.1.6 CHECKS OF THE VACUUM OF THE AIR CONDENSED DIRECT EXPANSION CIRCUIT

	Description	Positive	Negative
1	Make sure the cooling circuit valves are open.		
2	Check opening of the solenoid valve (if present on circuit).		
3	Check the seal of the cooling circuit.		
4	Check the high and low side pressure gauges connection in VACUUM position.		
5	Check the vacuum level of the cooling circuit.		

15.1.7 REFRIGERANT CHARGE OF THE AIR CONDENSED DIRECT EXPANSION CIRCUIT

	Description	Positive	Negative
1	Check the high and low side pressure gauges connection in CHARGING position.		
2	Check the correspondence of refrigerant with that used by the unit (R410a)		
3	Check HIGH PRESSURE side introduction of an amount of refrigerant equal to 2/3 of the total calculated content.		
4	Check final refrigerant charge by filling in through the suitable fitting downstream of the expansion valve.		

15.1.8 ELECTRICAL POWER SUPPLY CHECK

	Description	Positive	Negative
1	Check the connection of the three phases, neutral and earth.		
2	Verify that the characteristics of the electrical supply line fall within the operating limits and comply with that indicated in the wiring diagram.		
3	Verify that the electrical connections with the condenser isolator fall within the operating limits and comply with that indicated in the wiring diagram.		

15.1.9 VERIFY CONNECTIONS TO ROOM PROBE, REMOTE TERMINALS, LAN AND RS485 SERIAL BOARD (IF PRESENT)

	Description	Positive	Negative
1	Make sure the RS485 board is wired as indicated on the wiring diagram and in the installation manual.		
2	Check the activation of the terminating resistance of the RS485 network.		
3	Check connection of LAN cable as indicated in the electrical wiring diagram and the installation manual.		
4	Check the activation of the opening and terminating resistance of the LAN.		
5	Check the positioning of the remote terminal as described in the installation manual.		
6	Check that the electrical connection between the remote terminal and the electrical panel is as indicated in the wiring diagram and the installation manual.		
7	Check the positioning of the room probes as described in the installation manual.		
8	Check that electrical connection between the sensors and the electrical panel is as indicated in the electrical wiring diagram and the installation manual.		
9	Check the positioning of the smoke and flame detectors as described in the installation manual.		
10	Check the electrical connection between the smoke and flame sensors, as indicated in the electrical wiring diagram and the installation manual.		
11	Check the positioning of the water detection probes as described in the installation manual.		
12	Check that the electrical connection between the water detection sensors and the electrical panel is as indicated in the electrical wiring diagram and the installation manual.		
13	Check the wiring of the closing resistance of the water detection sensors.		

15.2 FIRST START-UP

ATTENTION! DANGER!

Starting up or checking machines with cooling circuit requires the units to be powered on for at least two hours prior to the arrival of the technician, in order to allow the compressor's crankcase oil heater to reach working temperature and allow evaporation of any refrigerant deposited in it and guarantee correct compressor operation.

The crankcase heaters switch on automatically when the machine is powered on.

15.2.1 UNIT SUPPLY

	Description	Positive	Negative
1	Make sure the disconnecting switch is ON (unit powered).		
2	Make sure the disconnecting switch of the condenser is ON (condenser powered on).		
3	Make sure the phase sequencer is working properly (direct expansion unit).		
4	Make sure all electrical utilities of the unit are correctly powered.		

15.2.2 TURNING THE UNIT ON

	Description	Positive	Negative
1	Check the setting of the unit Set-point.		
2	Check the settings of the microprocessor user parameters.		
3	Check unit switch-on with the ON/OFF key.		

15.2.3 REFRIGERANT CHARGE OF THE AIR CONDENSED DIRECT EXPANSION CIRCUIT

	Description	Positive	Negative
1	Check the high and low side pressure gauges connection.		
2	Make sure the compressor switch is on.		
3	Check the evaporation pressure.		
4	Check the condensation pressure.		
5	Check the overheating of the refrigerant aspirated by the compressor.		
6	Check the sub-cooling of the liquid refrigerant.		
7	Check that the liquid line filter is not clogged.		
8	Check the correct calibration of the condenser speed regulator.		

15.2.4 QUANTITY OF REFRIGERANT IN THE CIRCUIT

	Description	Type	Kg
1	Charging refrigerant during the start-up phase.		
2	Adding refrigerant on site.		

15.2.5 CHECKING COOLING CIRCUIT OPERATION

	Description	Value	Positive	Negative
1	Evaporation pressure			
2	Evaporation temperature			
3	Suction temperature			
4	Overheating			
5	Compression ratio			
6	Discharge temperature			
7	Condensation pressure			
8	Condensation temperature			
9	Desuperheating			
10	Liquid temperature			
11	Sub-cooling			

15.2.6 CHECKING CORRECT COMPONENT OPERATION

	Description	Value	Positive	Negative
	Fans			
1	Check fan current consumption.			
2	Check flow sensor operation.			
3	Check reading of the differential pressure probe (if present).			
	Compressors			
1	Check the current absorbed by the compressor.			
2	Check operation of the high pressure probe.			
3	Check operation of the low pressure probe.			
4	Check correct operation of the electronic expansion valve.			
5	Check the water-cooled condenser condensation regulation.			

Water circuit				
1	Make sure the valves open.			
2	Check the position of the valves.			
3	Check the flow and temperature of the water entering and exiting the unit.			
Electric coils				
1	Check the current consumption of the electric coil.			
2	Check correct operation of the electric coil.			
Humidification				
1	Check the current absorbed by the humidifier.			
2	Check correct operation of the humidifier.			
3	Make sure the water charges correctly.			
4	Make sure the water discharges correctly.			
Local network				
1	Check correct operation of the LAN.			
2	Check rotation of the unit in LAN.			
Miscellaneous				
1	Check correct operation of the dirty filter alarm.			
2	Check correct operation of the water alarm.			
3	Check correct operation of the smoke and flame detectors.			
4	Ensure that the remote OFF is working.			
5	Carry out a general check of the unit's electrical components.			

15.2.7 MAKE SURE THE UNIT IS OPERATING CORRECTLY

	Description	Positive	Negative
1	Ensure that the set temperature is reached.		
2	Ensure that the set humidity is reached.		
3	Check correct general operation of the unit.		

15.2.8 NOTES ON ANOMALIES ENCOUNTERED DURING CHECKS

16 APPENDIX 3: FAULT DIAGNOSIS

WARNING!

Maintenance operations must be carried out by professionally trained technicians

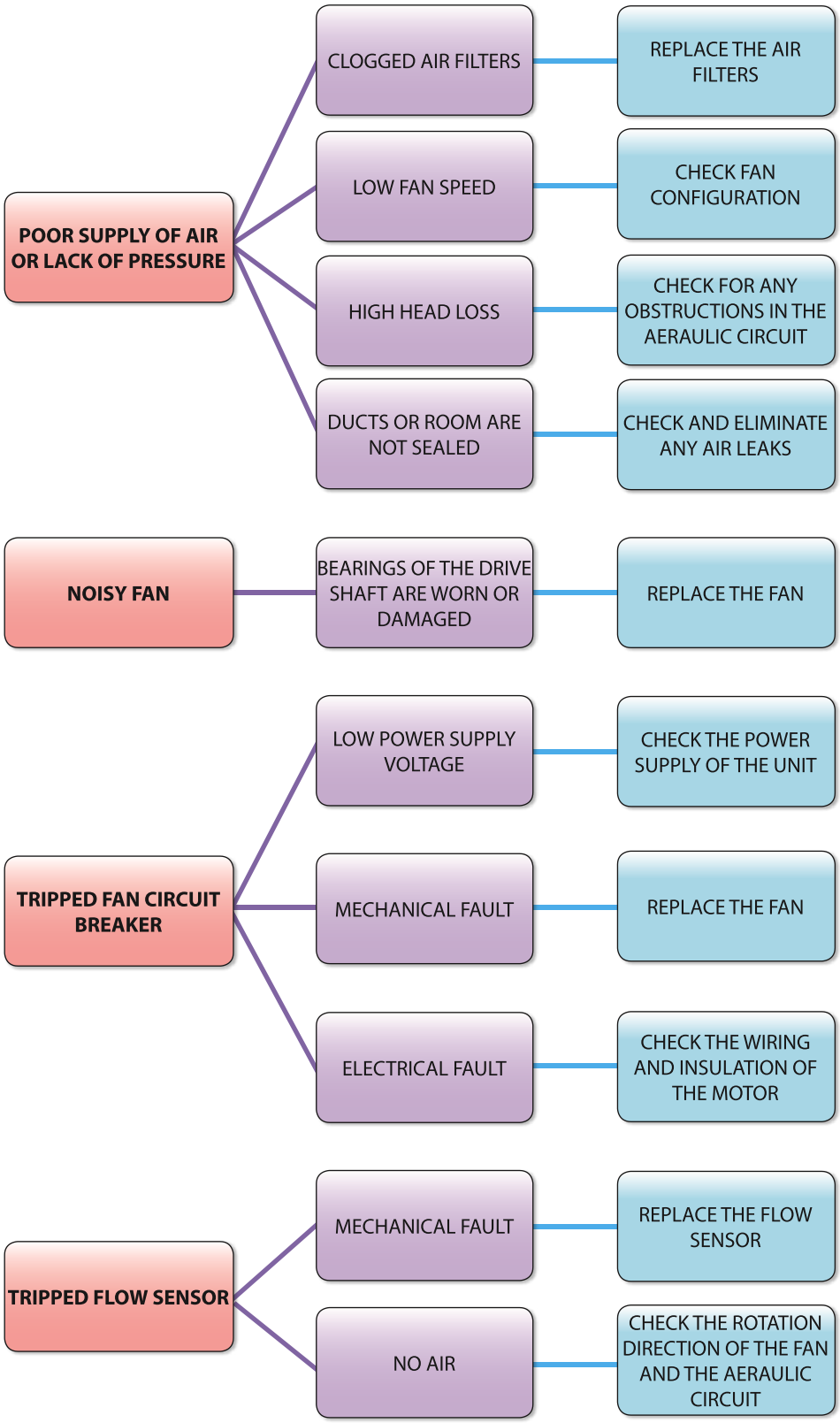
This chapter contains information to assist the operator in tracing any faults that may arise with the machine. Starting with a description of the nature of the problem, we provide indications on the probable causes and possible solutions. The causes described are generic and therefore also apply to the most complete versions of the machine; it is the task of the operator to determine which part of the information provided applies to the machine in question.

All servicing and repairs of the machine must be carried out by qualified personnel only.

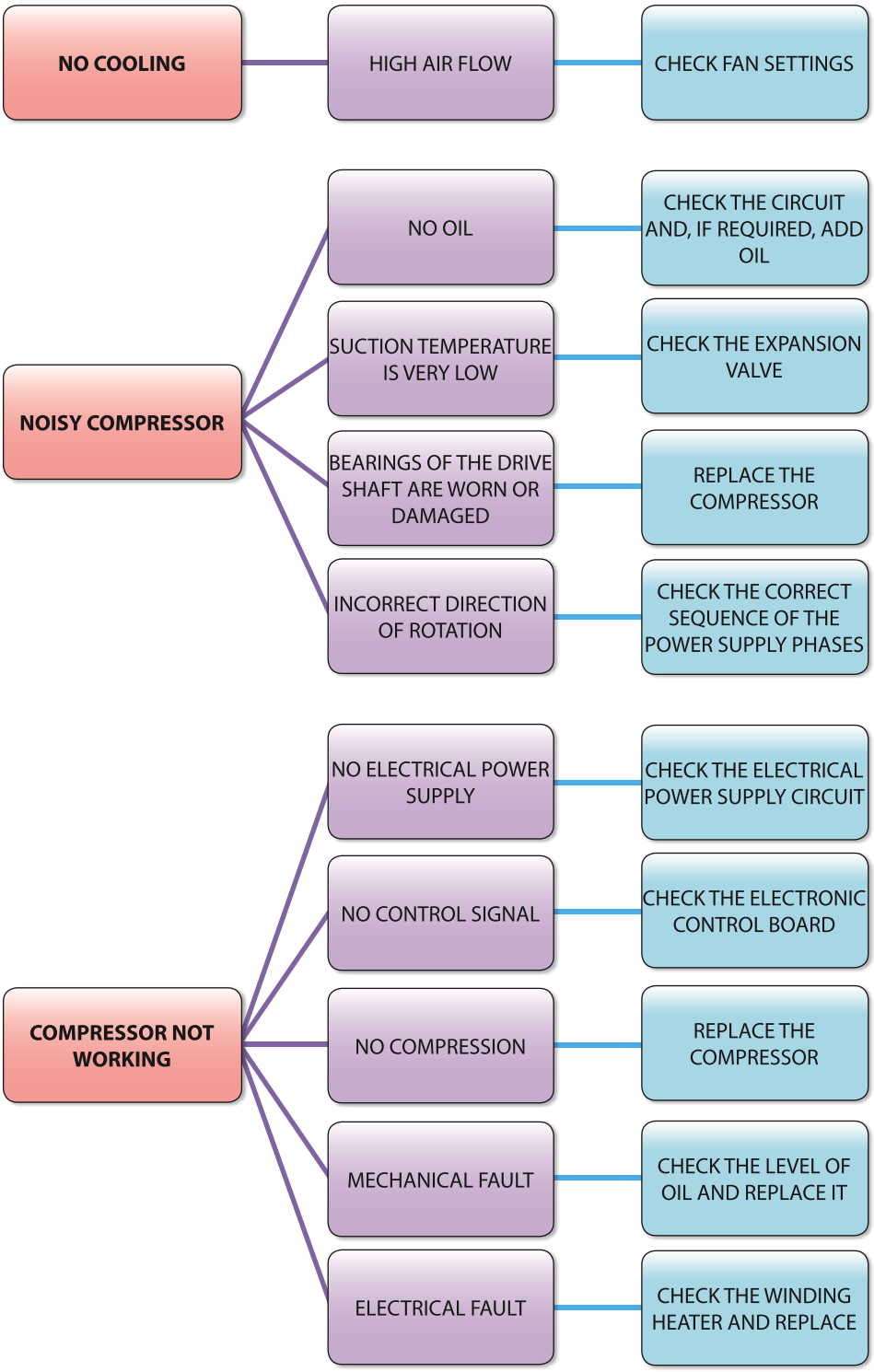
We strongly recommend that you do not attempt any procedures on the machine unless you have a good understanding of its operating principles.

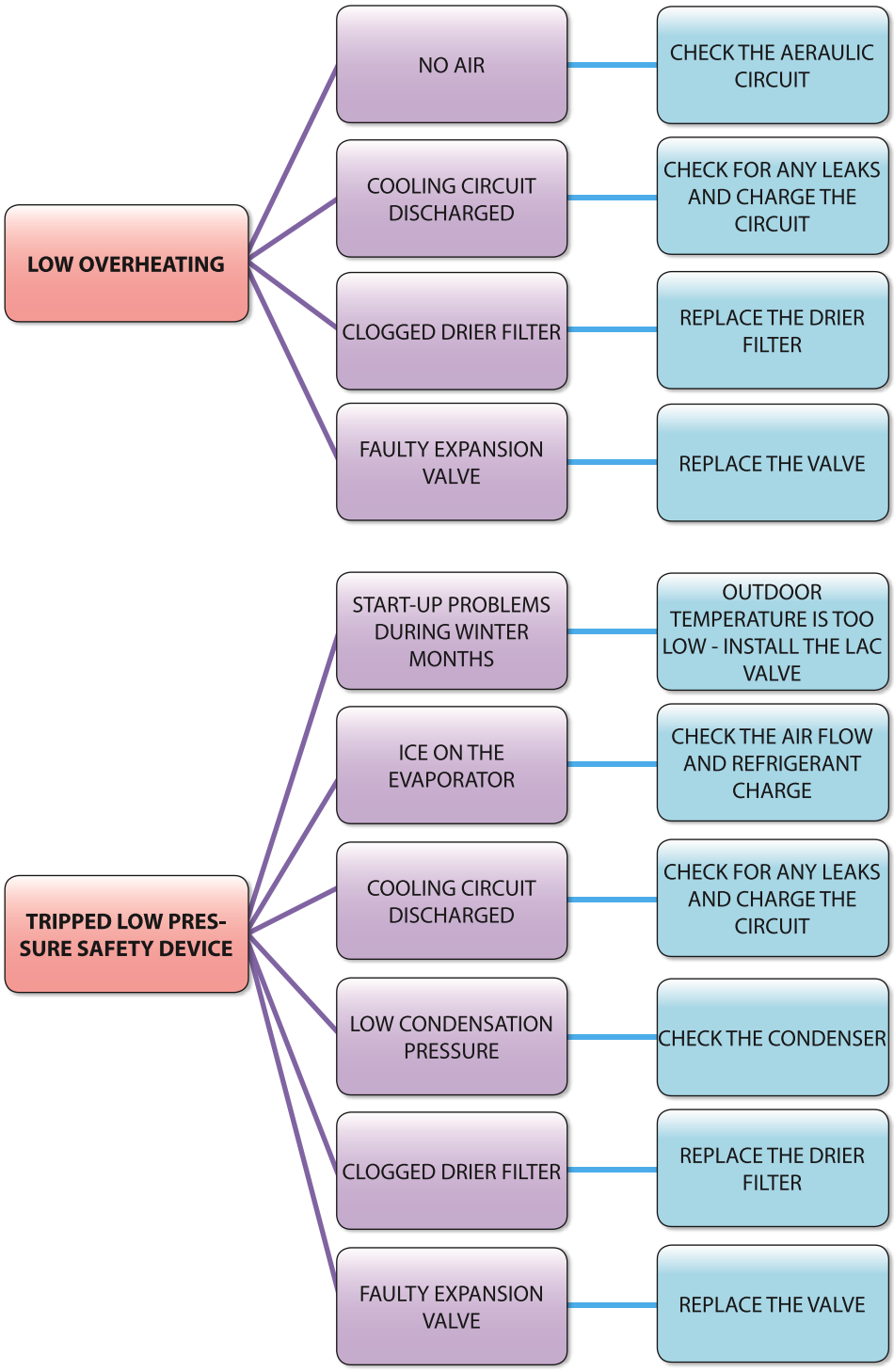
Key:

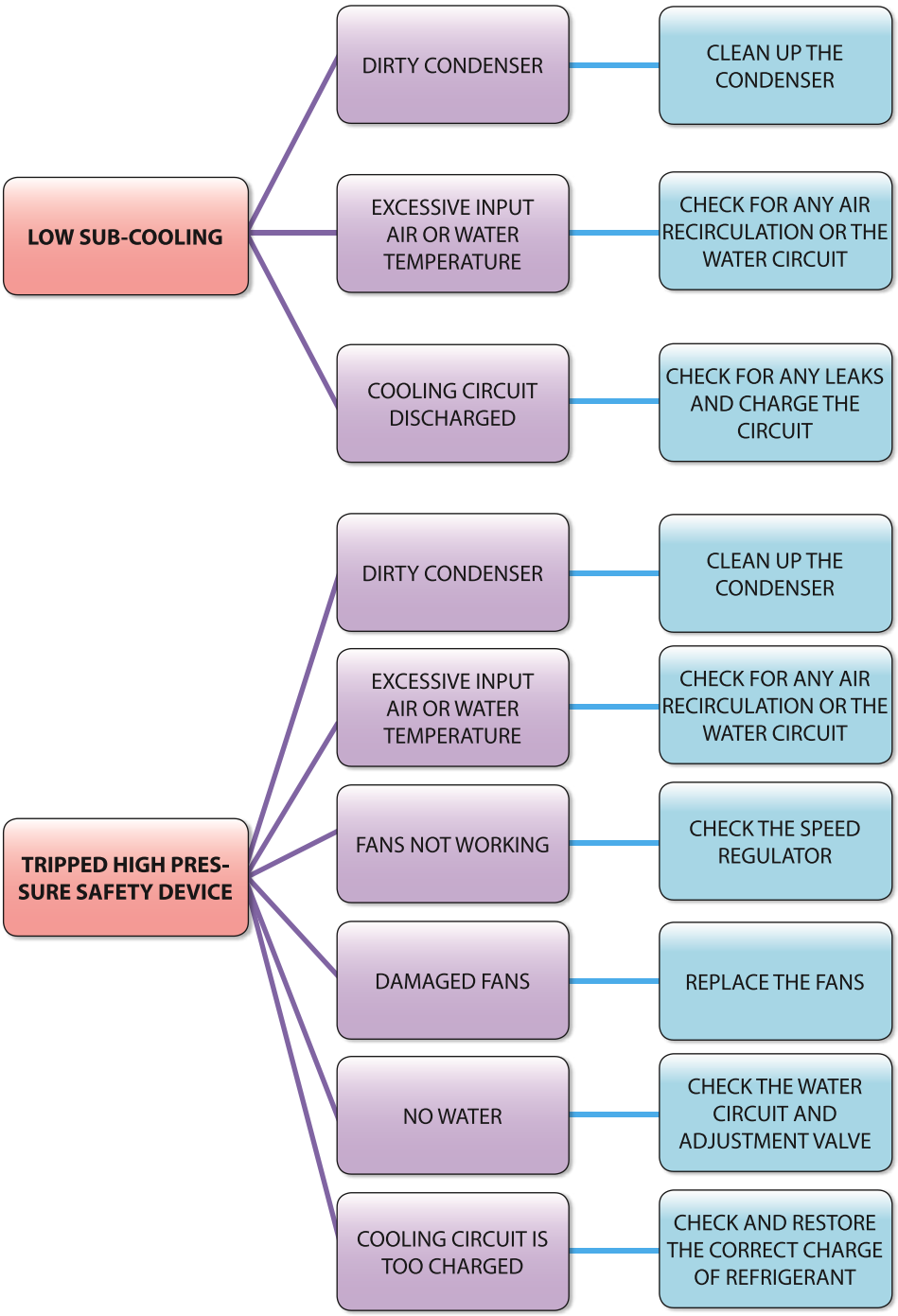
16.1 VENTILATION PROBLEMS



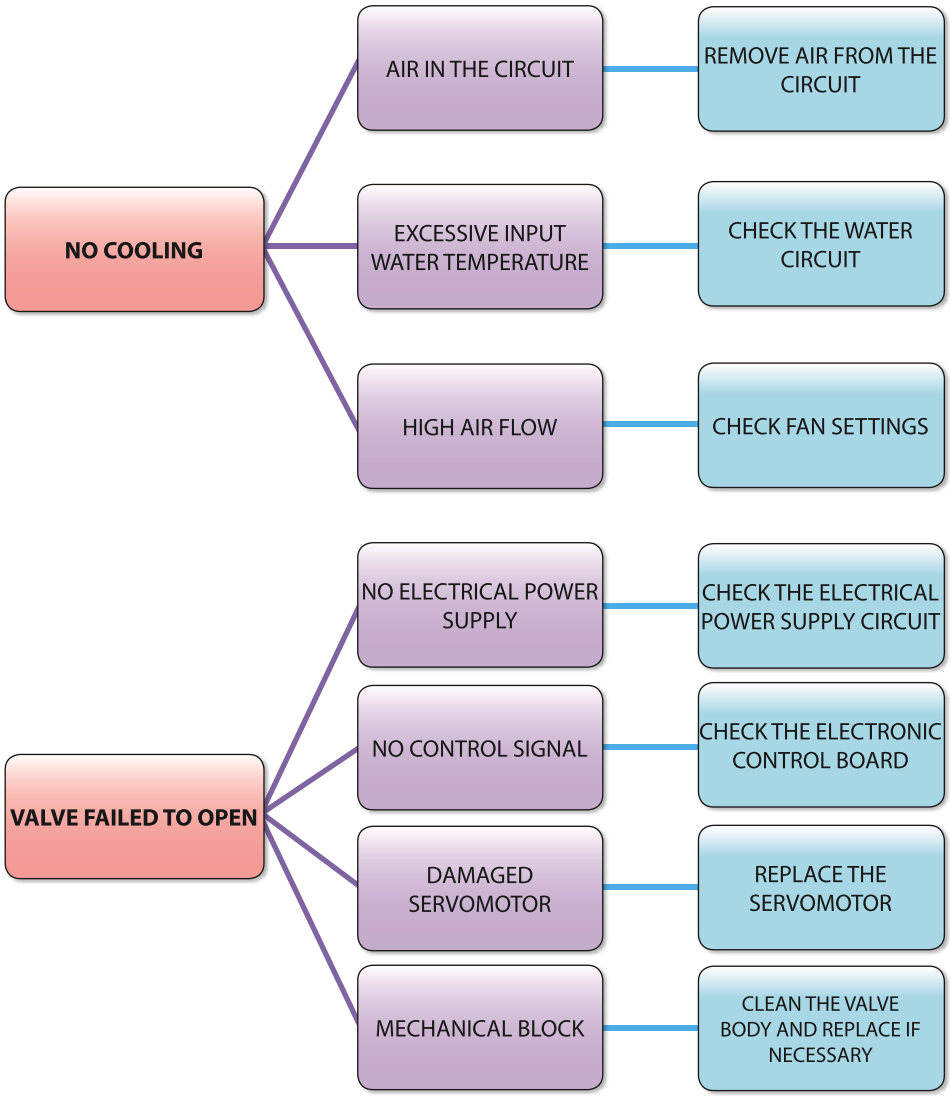
16.2 PROBLEMS WITH THE DIRECT EXPANSION COOLING CIRCUIT



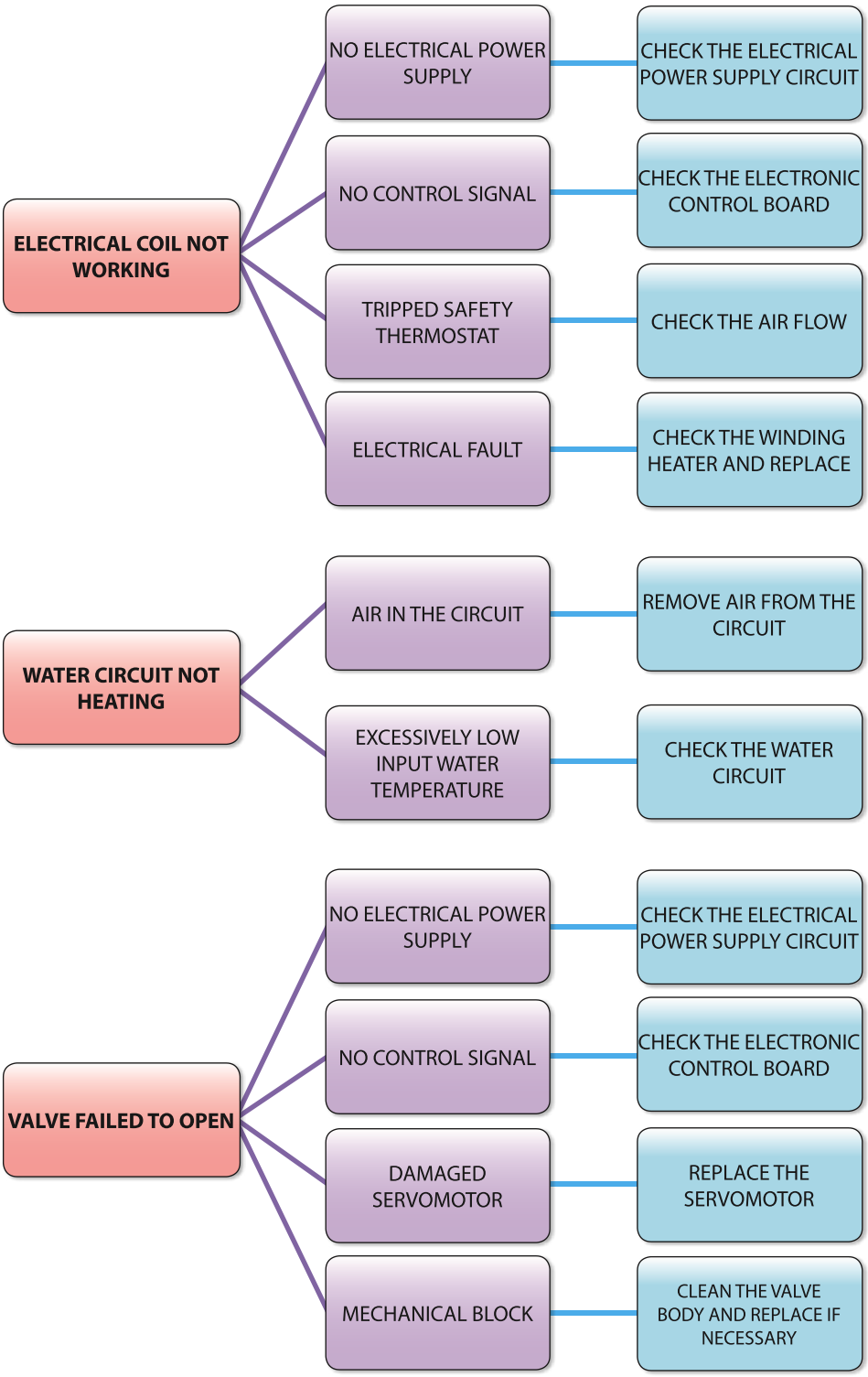

LOW OVERHEATING
NO AIR
CHECK THE AERAULIC CIRCUIT
COOLING CIRCUIT DISCHARGED
CHECK FOR ANY LEAKS AND CHARGE THE CIRCUIT
CLOGGED DRIER FILTER
REPLACE THE DRIER FILTER
FAULTY EXPANSION VALVE
REPLACE THE VALVE
TRIPPED LOW PRES-SURE SAFETY DEVICE
START-UP PROBLEMS DURING WINTER MONTHS
OUTDOOR TEMPERATURE IS TOO LOW - INSTALL THE LAC VALVE
ICE ON THE EVAPORATOR
CHECK THE AIR FLOW AND REFRIGERANT CHARGE
COOLING CIRCUIT DISCHARGED
CHECK FOR ANY LEAKS AND CHARGE THE CIRCUIT
LOW CONDENSATION PRESSURE
CHECK THE CONDENSER
CLOGGED DRIER FILTER
REPLACE THE DRIER FILTER
FAULTY EXPANSION VALVE
REPLACE THE VALVE


LOW SUB-COOLING
DIRTY CONDENSER
CLEAN UP THE CONDENSER
EXCESSIVE INPUT AIR OR WATER TEMPERATURE
CHECK FOR ANY AIR RECIRCULATION OR THE WATER CIRCUIT
COOLING CIRCUIT DISCHARGED
CHECK FOR ANY LEAKS AND CHARGE THE CIRCUIT
TRIPPED HIGH PRES-SURE SAFETY DEVICE
DIRTY CONDENSER
CLEAN UP THE CONDENSER
EXCESSIVE INPUT AIR OR WATER TEMPERATURE
CHECK FOR ANY AIR RECIRCULATION OR THE WATER CIRCUIT
FANS NOT WORKING
CHECK THE SPEED REGULATOR
DAMAGED FANS
REPLACE THE FANS
NO WATER
CHECK THE WATER CIRCUIT AND ADJUSTMENT VALVE
COOLING CIRCUIT IS TOO CHARGED
CHECK AND RESTORE THE CORRECT CHARGE OF REFRIGERANT

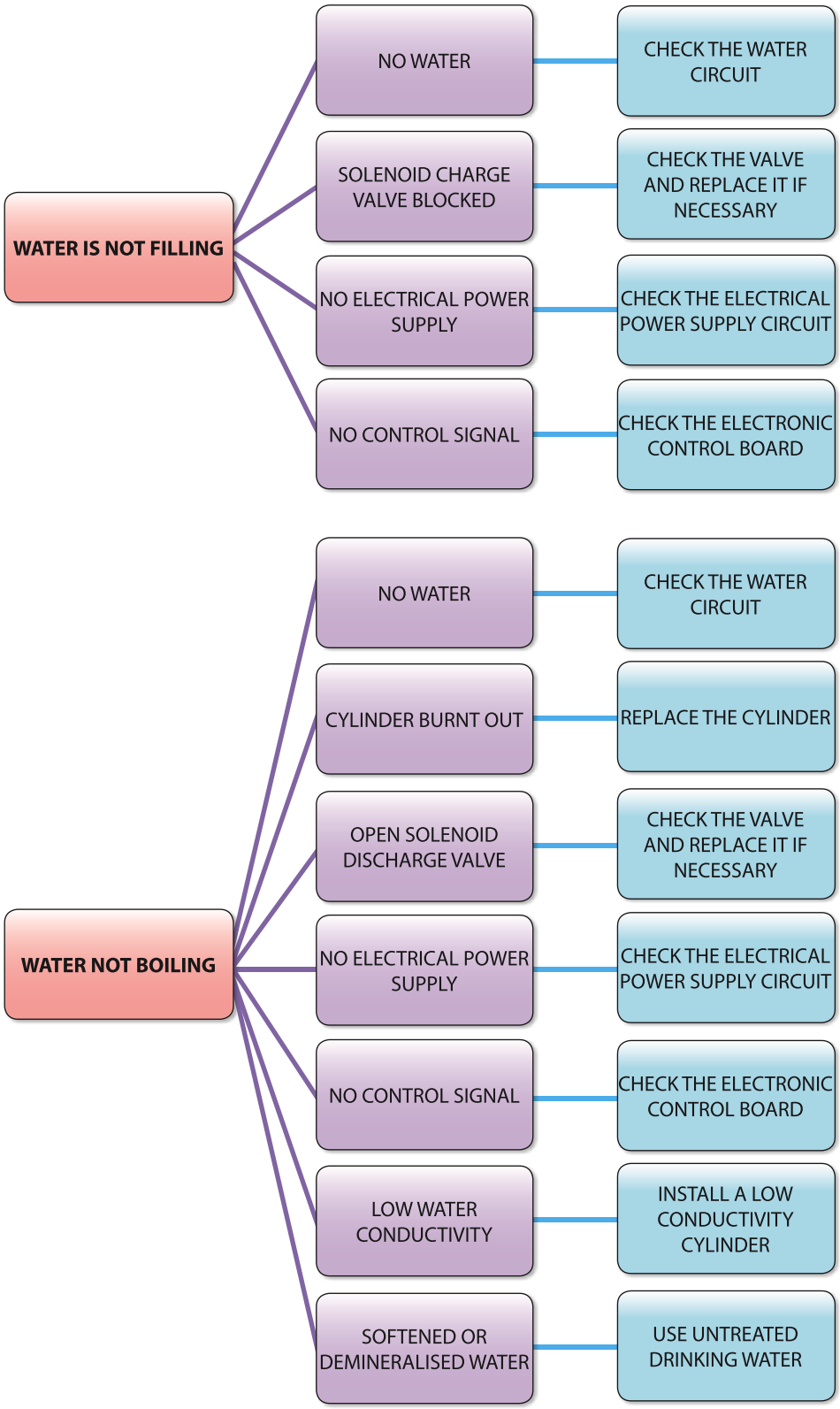
16.3 PROBLEMS WITH THE CHILLED WATER HYDRAULIC CIRCUIT

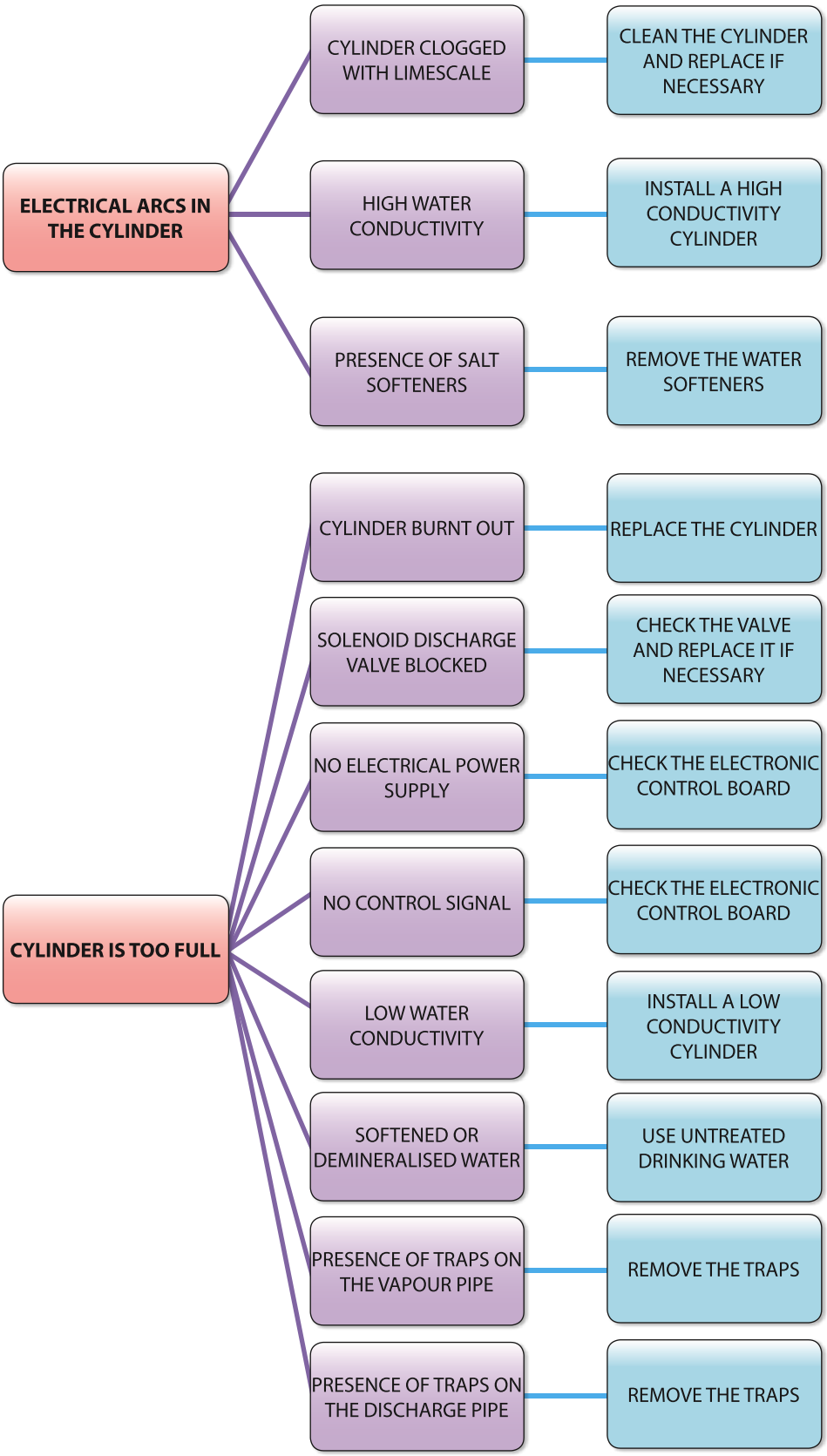


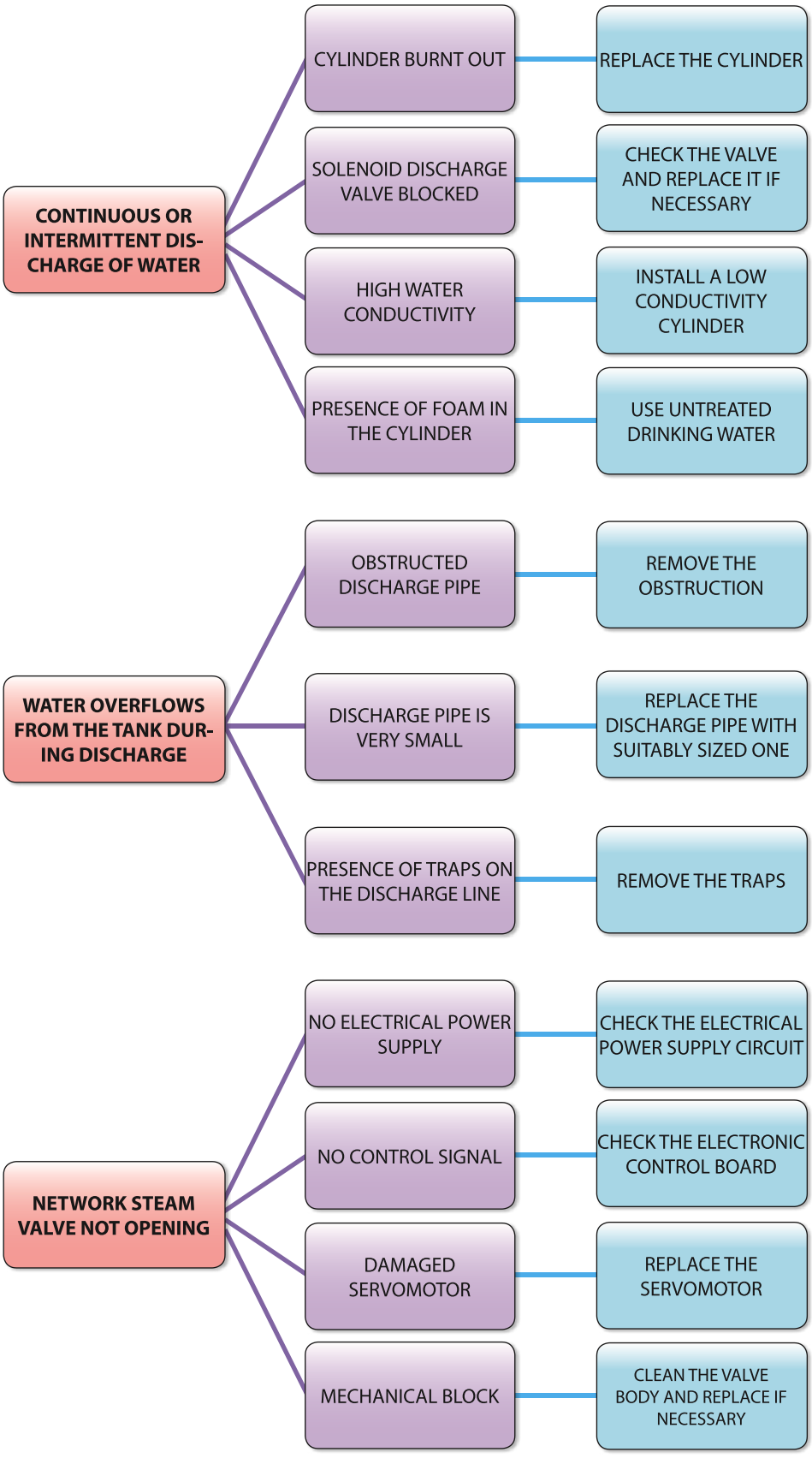
16.4 HEATING SECTION PROBLEMS



16.5 HUMIDIFICATION PROBLEMS




ELECTRICAL ARCS IN THE CYLINDER
CYLINDER CLOGGED WITH LIMESCALE
CLEAN THE CYLINDER AND REPLACE IF NECESSARY
HIGH WATER CONDUCTIVITY
INSTALL A HIGH CONDUCTIVITY CYLINDER
PRESENCE OF SALT SOFTENERS
REMOVE THE WATER SOFTENERS
CYLINDER IS TOO FULL
CYLINDER BURNT OUT
REPLACE THE CYLINDER
SOLENOID DISCHARGE VALVE BLOCKED
CHECK THE VALVE AND REPLACE IT IF NECESSARY
NO ELECTRICAL POWER SUPPLY
CHECK THE ELECTRONIC CONTROL BOARD
NO CONTROL SIGNAL
CHECK THE ELECTRONIC CONTROL BOARD
LOW WATER CONDUCTIVITY
INSTALL A LOW CONDUCTIVITY CYLINDER
SOFTENED OR DEMINERALISED WATER
USE UNTREATED DRINKING WATER
PRESENCE OF TRAPS ON THE VAPOUR PIPE
REMOVE THE TRAPS
PRESENCE OF TRAPS ON THE DISCHARGE PIPE
REMOVE THE TRAPS


CONTINUOUS OR INTERMITTENT DISCHARGE OF WATER
CYLINDER BURNT OUT
REPLACE THE CYLINDER
SOLENOID DISCHARGE VALVE BLOCKED
CHECK THE VALVE AND REPLACE IT IF NECESSARY
HIGH WATER CONDUCTIVITY
INSTALL A LOW CONDUCTIVITY CYLINDER
PRESENCE OF FOAM IN THE CYLINDER
USE UNTREATED DRINKING WATER
WATER OVERFLOWS FROM THE TANK DURING DISCHARGE
OBSTRUCTED DISCHARGE PIPE
REMOVE THE OBSTRUCTION
DISCHARGE PIPE IS VERY SMALL
REPLACE THE DISCHARGE PIPE WITH SUITABLY SIZED ONE
PRESENCE OF TRAPS ON THE DISCHARGE LINE
REMOVE THE TRAPS
NETWORK STEAM VALVE NOT OPENING
NO ELECTRICAL POWER SUPPLY
CHECK THE ELECTRICAL POWER SUPPLY CIRCUIT
NO CONTROL SIGNAL
CHECK THE ELECTRONIC CONTROL BOARD
DAMAGED SERVOMOTOR
REPLACE THE SERVOMOTOR
MECHANICAL BLOCK
CLEAN THE VALVE BODY AND REPLACE IF NECESSARY

17 NOTES

EC DECLARATION OF CONFORMITY

The manufacturer declares, under his own responsibility, that the devices that this manual refers to:

- Are intended to be installed in plants for air conditioning. It is forbidden to commission these devices before the plant is declared compliant with the provisions of the applicable Directives.
- Are compliant with the following harmonised regulations:

EN ISO 14120:2015	Safety of machinery - Guards - General requirements for the design and construction of fixed and movable guards
EN ISO 13849-2:2012	Safety of machinery - Safety-related parts of control systems - Part 2: Validation
EN ISO 13850:2015	Safety of machinery - Emergency stop - Principles for design
EN ISO 12100:2010	Safety of machinery - General principles for design - Risk assessment and reduction
EN 1037:1995 + A1:2008	Safety of machinery - Prevention of unexpected start-up
EN 60204-1:2006	Safety of machinery - Electrical equipment of machines - Part 1: General rules
EN 61000-6-2:2005	Electromagnetic compatibility (EMC) – Part 6-2: Generic standards - Immunity standard for industrial environments
EN 61000-6-4:2007	Electromagnetic compatibility (EMC) – Part 6-4: Generic standards - Emission for industrial environments
EN 378-2:2016	Refrigerating systems and heat pumps - Safety and environmental requirements - part 2: Design, construction, testing, marking and documentation

- Are compliant with the contents of the following directives:

2006/42/EC	Directive relative to machinery and that amends directive 95/16/EC (recast)
2014/30/EU	Directive concerning the harmonisation of the laws of the EU member states related to electromagnetic compatibility (recast)
2014/68/EU	Directive concerning the harmonization of the laws of the EU member states related to making available on the market of pressure equipment

The pressure equipment that this manual refers to complies with the contents of Directive 2014/68/EU as follows:

- Chilled water unit: compliant according to Art. 4 par. 3.
- Direct expansion unit with liquid receivers with a volume of less than 4.8 l: compliant with category PED I.
- Direct expansion unit with liquid receivers with a volume greater than 4.8 l: compliant with category PED II.
- Assessment form: A2 / Certificate Nr.. Z-IS-TAK-MUC-13-10-2086600-106

  Notified Body Nr. 0036: TÜV SÜD Industrie Service GmbH, Ridlerstrasse 65, 80339 Munich - Germany

TESTING ATTESTATION

The manufacturer declares, under his own responsibility, that the devices that this manual refers to have passed the functional and electrical safety tests according to the procedures of the quality management system, certified ISO 9001:2008 Vision.

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